



SolBank3.0

Commissioning Manual

V1.7.1
CSI Energy Storage Co., Ltd.

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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 SolBank3.0 series (referring to all application models mentioned in Section 1.2, unless specifically stated otherwise, this will not be reiterated in the following text.) Energy Storage System (ESS). 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 SolBank3.0 series 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 SolBank3.0 series operation.

Should any questions arise, please contact e-STORAGE support:

- By telephone at +1-519-837-1881

1.2 Applicable Models

This manual covers the following models only:

- CSI-SolBank-S-5016-2h-NA
- CSI -SolBank-S-5016-4h-NA
- CSI-SolBank-S-5016-2h-EU
- CSI-SolBank-S-5016-4h-EU
- CSI-SolBank-S-5016-2h-AUS
- CSI-SolBank-S-5016-4h-AUS
- CSI-SolBank-S-PL-5016-2h-NA
- CSI-SolBank-S-PL-5016-4h-NA
- CSI-SolBank-S-PL-5016-2h-EU
- CSI-SolBank-S-PL-5016-4h-EU
- CSI-SolBank-S-PL-5016-2h-AUS
- CSI-SolBank-S-PL-5016-4h-AUS

1.3 Reference Documents

The SolBank3.0 series User Manual exists as part of library of product specific documents. Please consult the following documents to ensure a comprehensive understanding of SolBank3.0 series attributes.

- *SolBank3.0 Installation Manual*
- *SolBank3.0 User Manual*

- *SolBank3.0 safety Manual*
- *SolBank3.0 Maintenance Manual*
- *SolBank3.0 Commissioning Manual*
- *SolBank3.0 Transportation Instruction Document*

1.4 Version Control

This is the initial release of the SolBank3.0 series Commissioning Manual. As part of e-STORAGE's continuous improvement process, e-STORAGE reserves the right to make technology and document changes. Please contact e-STORAGE support to verify this manual reflects the most recent release or to report omissions or inaccuracies.

Version	Description	Date of Issuance
Commissioning_Manual_1.0	Initial publication date	2024.4.12
Commissioning_Manual_1.1	The nameplate energy is confirmed at 5016 kWh	2024.6.24
Commissioning_Manual_1.2	1.Updated Applicable Models 2.Added specifications with String PCS in Table 3	2024.8.9
Commissioning_Manual_1.3	Optimized the installation content in the static debugging flowchart in Chapter 5	2024.11.8
Commissioning_Manual_1.4	Added Section 5.8, system temperature check	2024.11.27
Commissioning_Manual_1.5	Added a note at the end of section 5.8; Added content related to powering on and checking air conditioning and dehumidifiers	2025.1.3
Commissioning_Manual_1.6	1. Fire protection system debugging update In chapter 5.6.1(2 horn-strobe) 2. Annex 6 has been updated with the addition of a horn-strobe, and add EU and AUS version 3. Updated IP settings content in chapter 5.6.4 4. Added applicable models in chapter 1.2	2025.3.12
Commissioning_Manual_1.6.1	Updated Fire Safety System Debugging (for AUS version) in Annex 6	2025.3.28
Commissioning_Manual_1.6.2	1.Model designation updated to CSI-SolBank-S-PL-5016-xx-xx 2. Replace "SolBank3.0&SolBank3.0 PL" to "SolBank3.0 series" 3. Added three new labels in chapter 1.5 4. Updated product specifications in chapter 3.3	2025.4.24
Commissioning_Manual_1.7	Added parameter setting table in chapter 5.6	2025.7.14
Commissioning_Manual_1.7.1	1.Optimized annex 6 FFSD table (NA version, heat detector will trigger ventilation) 2. Changed the 'Usable energy' in Table 3 to 'Rated DC capacity' in chapter 3.3 3. Updated the flowchart content in chapter 5.	2025.9.3

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 SolBank3.0 series 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
	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
	Consult instructions for use
	Noise source
	cTUVus certification

1.6 Product Certification and Compliance

The SolBank3.0 series is compliant with the standards, regulations, and requirements identified in Table 1.

Table 1: SolBank3.0 series Standard and Compliance

Classification		Regions	Standards
System	Design regulations	ALL	NEC – National Electrical Code® 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 NFPA 855 – Installation of Energy Storage Systems NFPA 70E® – Standard for Electrical Safety in the Workplace® NFPA 72 – National Fire Alarm and Signaling Code IEC62933-5-2 – Safety requirements for grid-integrated EES systems - Electrochemical-based systems AS3000 - Electrical installations “Wiring Rules”
	Product certification	NA	IEC 60529 – Degrees of protection provided by enclosure UL 60730-1 – Standard for safety: Automatic Electrical Controls – Part 1:General Requirements 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

			UL1973 – Standard for safety: Batteries For Use In Stationary And Motive Auxiliary Power Applications UL9540 – Standard For safety: Energy Storage Systems And Equipment UN38.3 – Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria
	Product certification	EU	IEC62619 – Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications IEC63056 – Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems IEC/EN 62477-1 – Safety requirements for power electronic converter systems and equipment - Part 1: General IEC/EN 61000 – Electromagnetic compatibility (EMC)
Fire Protection and Safety	Design regulation	NA	NFPA 2001 – Standard on Clean Agent Fire Extinguishing Systems NFPA 15 – Standard for Water Spray Fixed System for Fire Protection NFPA 2-2023 – Hydrogen technologies code
		EU	BS 5839-1 – Fire detection and fire alarm systems for buildings BS 7273 -1 – Code of practice for the operation of fire protection measures BS EN 54 Pt1- 21 – series for equipment BS EN 15004-1:-2019 – Fixed firefighting systems. Gas extinguishing systems. Design, installation and maintenance. BS EN 15004-2:2020 – Fixed Firefighting Systems-Gas Extinguishing Systems FK-5-1-12 BS 6266:2011 – Fire protection for electronic

			equipment installations– Code of practice BS EN 12094-1:2003 – Fixed firefighting systems. Components for gas extinguishing systems Requirements and test methods for electrical automatic control and delay devices
		AUS	AS 4487-2013 – Condensed aerosol fire extinguishing systems – Requirements for system design, installation and commissioning and test methods for components AS 7240– Fire Detection and Alarm Systems AS1670 – Fire detection, warning, control and intercom systems – System design, installation and commissioning AS 1851-2012 – Routine service of fire protection systems and equipment

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 SolBank3.0 series system supplied by e-STORAGE. The SolBank3.0 series 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 SolBank3.0 series apart from other ESS products.

The SolBank3.0 series is fully factory integrated and tested at e-STORAGE'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 SolBank3.0 series 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 SolBank3.0 series layout and key features is shown in Figure 1 and further described in Table 2.

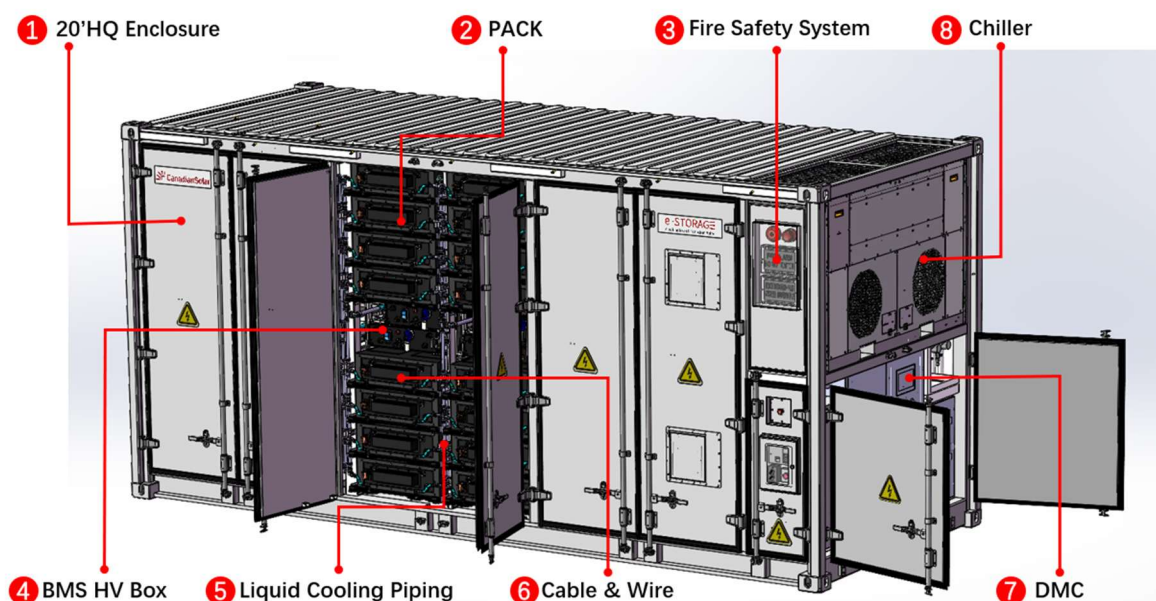


Figure 1: Layout and features of the SolBank3.0 series

Table 2: Key System Features

NO.	Name	Remarks
1	Standard Enclosure and Rack	All models of the SolBank3.0 series utilize a standard IP55 rated 20'ft HC container and battery rack design allowing for enhanced system modularity.

2	Pack	The SolBank3.0 series PL contains 48 Lithium Iron Phosphate (LFP) battery packs, each consisting of 104 series wired battery cells.
3	Fire Protection System	The SolBank3.0 series combines heat, smoke and gas detection with an explosion-proof ventilation system.
4	BMS Box	The SolBank3.0 series contains 12 BMS boxes. These are easily accessed for installation and maintenance within the middle line of the container. The BMS ensure optimal battery functionality and safety.
5	Liquid Cooling piping	The liquid-cooled piping connecting the chiller to the packs.
6	Cable & Wire	High-voltage connection and low-voltage communication power cable.
7	DMC	The Distribution and Control Cabinet houses all aux power distribution equipment including 2-hour backup UPS; system communication, control, and monitoring hardware including network switch, and Local EMS, and all required customer communication, signal, and aux power interfaces.
	Junction Box	The DC Junction box contains all primary DC busbar, fusing, Surge Protection Devices (SPD), and power monitoring required to safely exchanged power between the SolBank and PCS.
8	Chiller	The liquid cooling/heating system facilitates improved battery temperature management efficiency relative 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.
9	Air-cooled HVAC(Optional)	The SolBank air-cooled HVAC is used to control the temperature of the DMC within the 25°C(±3) range.

10	Dehumidifier (Optional)	The SolBank dehumidifier is used to control the humidity of battery compartment.
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3.3 System Specifications

The SolBank3.0 series system has two models, as shown in Table 3 below. Each model has varying P-rate, power, and energy characteristics. Battery string size, nominal voltages, form factor, and physical dimensions remain consistent across all models.

Table 3: SolBank3.0 series Specifications.

SYSTEM MODEL NUMBER	CSI-SolBank-S-5016-4h CSI-SolBank-S-PL-5016-4h	CSI-SolBank-S-5016-2h CSI-SolBank-S-PL-5016-2h
Discharge Duration (hour)	4	2
Charge/Discharge C-rate (P)	0.25	0.5
BOL Cell Energy (kWh)	5016	5016
Rated DC capacity (kWh)	4800 (For String PCS) / 4800 (For centralize PCS)	4800 (For String PCS) / 4700 (For centralize PCS)
Voltage Range (VDC)	1164.8V~1497.6V	
Recommended Discharge Power (kW)	1200 (For String PCS) /1200 (For centralize PCS)	2400 (For String PCS) /2350 (For centralize PCS)
# of LFP Battery Rack	12	12
# of BMS boxes	12	

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 SolBank3.0 series 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 SolBank3.0 series operation until system is fully commissioned and inspected by e-STORAGE field engineers, or until all required periodic maintenance is performed.



Do not modify or alter the SolBank3.0 series without written permission from e-STORAGE

4.2 Basic work

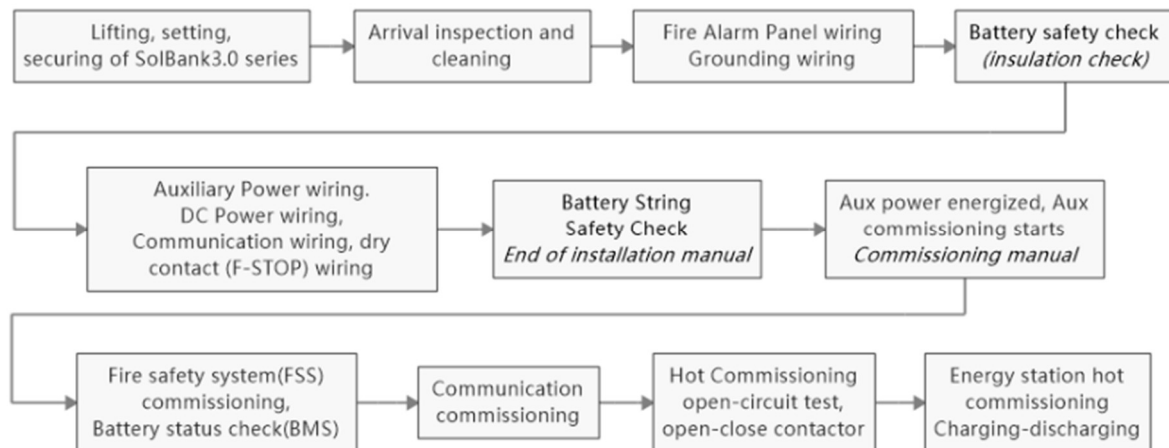
Before commissioning, SolBank3.0 series enclosure shall be installed and fixed properly. DC cables between SolBank and PCS shall be connected and tested. Communication harness between SolBank and PCS shall be connected, auxiliary power supply of SolBank has been connected, and conditions for power on 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 SolBank3.0 series and integrate it into an ESS project site. Figure below provides an overview of the SolBank3.0 series debugging process. These steps must be completed sequentially by qualified personnel.

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

Before the Battery Cables are connected to the corresponding BMS, Insulation Resistance testing needs to be performed on each battery string.

Test 1: Positive to Ground

Test 2: Negative to Ground

Red Test Lead = Battery Positive Cable

Red Test Lead = Battery Negative Cable

Black Test Lead = Container Ground

Test Voltage = 1500Vdc

Test Time = 1 minute

Passing Score = > 20MΩ

Black Test Lead = Container Ground

Test Voltage = 1500Vdc

Test Time = 1 minute

Passing Score = > 20MΩ



See Annex 3: Insulation Test Sheet

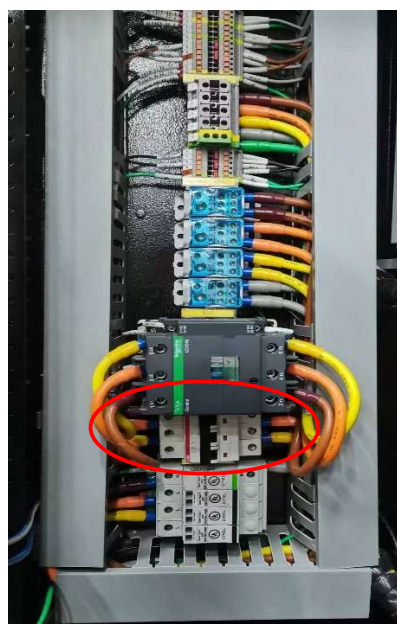
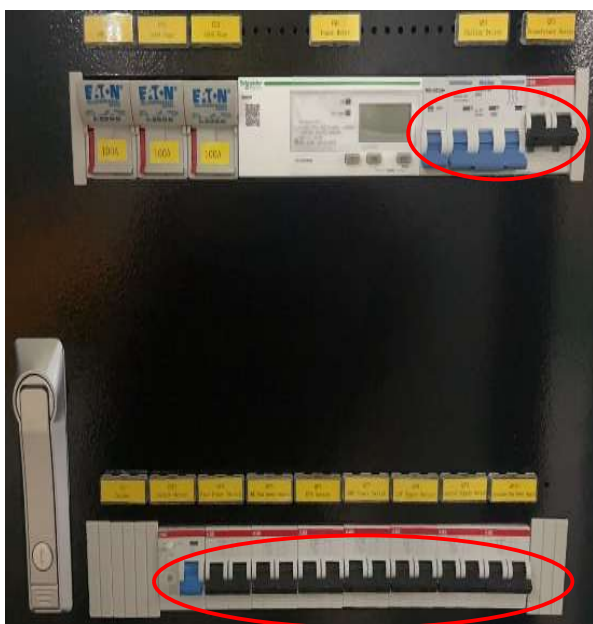
5.5 Power on the auxiliary power supply

While checking the battery pack voltage, ensure that the auxiliary power cable is normal and turn on the control switches of the liquid-cooled chillers, and UPS step by step. 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 1-12.
2. Power on the circuit breakers of SPD. Before powering up, measure the voltage value at the input separately with a multimeter.

3. Power on the circuit breaker of chiller and close the AC relay. 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.
4. Power on the circuit breaker of Transformer.
5. Power on the circuit breaker of Socket.
6. Power on the circuit breaker of Fire Safety System.
7. Power on the circuit breaker of Fan in DMC.
8. Power on the circuit breaker of UPS.
9. Power on the circuit breaker of air-cooled HVAC. (Optional)
10. Power on the circuit breaker of dehumidifier. (Optional)
11. Power on the circuit breaker of BMS boxes in DMC.
12. Power on the circuit breaker of 24V AC/DC module.
13. Power on the control supply switch .
14. Power on the circuit breaker Fan in Container .
15. 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.
16. 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 Safety system debugging

Operating Steps:

Activate the heat sensor with a heat source generator 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 heat detector with a heat source generator 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 horn-strobe is activated, the system stops, and the ventilation system operates.

Use combustible gas reagent to trigger the detector, when the combustible gas concentration $\geq 10\%$ LEL, the combustible gas detector is triggered, the alarm bell rings, the horn-strobe is activated, the system stops, and the ventilation system operates.

Annex 6: Fire debugging

2. The chiller ,air-cooled HVAC (Optional)and dehumidifier(Optional)

The chiller , air-cooled HVAC and dehumidifier will automatically start after power-on.

After the chiller is powered on, observe whether it operates normally through the interface of the chiller, 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.

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 powering on the dehumidifier, set different humidity values through the dehumidifier interface to verify the dehumidification effect.

The main control parameters are set as shown below.

System	device name	control mode	factory mode	control parameters
0.25P	Chiller (25kW)	Cell temperature	Automatic mode (local)	Refrigeration: Cell cooling setpoint during operation: 26°C Cell cooling stop point: 24°C Cell cooling setpoint at rest: 29°C Heating: Cell heating setpoint: 18°C Cell heating stop point: 20°C Self-circulation: Cell circulation temperature difference setpoint: 8°C

				Cell circulation temperature difference stop point: 5°C
		Outlet water temperature ☒		Refrigeration: Cooling target 22 °C, cooling deviation 3 °C; Heating: Heating target 18 °C, heating deviation 3 °C
		Return water temperature		
	HVAC (600W)	Return air temperature		Refrigeration: Cooling target 28 °C, cooling deviation 3 °C; Heating: Heating target 15 °C, heating deviation 3 °C
	dehumidifier (7L)	Hygrometer		Humidity: ≥50%, hysteresis 10%
0.5P	Chiller (60kW)	Cell temperature	Automatic mode (local)	Refrigeration: Cell cooling setpoint during operation: 26°C Cell cooling stop point: 24°C Cell cooling setpoint at rest: 29°C Heating: Cell heating setpoint: 18°C Cell heating stop point: 20°C Self-circulation: Cell circulation temperature difference setpoint: 8°C Cell circulation temperature difference stop point: 5°C
		Outlet water temperature ☒		Refrigeration: Cooling target 20 °C, cooling deviation 3 °C; Heating: Heating target 18 °C, heating deviation 3 °C
		Return water temperature		
	HVAC (600W)	Return air temperature		Refrigeration: Cooling target 28 °C, cooling deviation 3 °C; Heating: Heating target 15 °C, heating deviation 3 °C
	dehumidifier	Hygrometer		Humidity: ≥50%, hysteresis 10%

	(7L)			
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3. UPS

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

4. 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

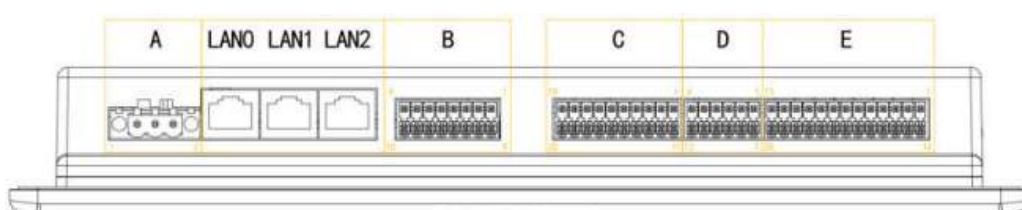
IP address settings:

Master Solbank3.0 series IP setup:

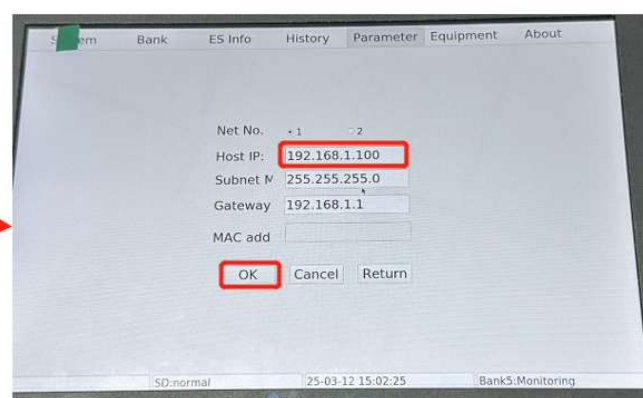
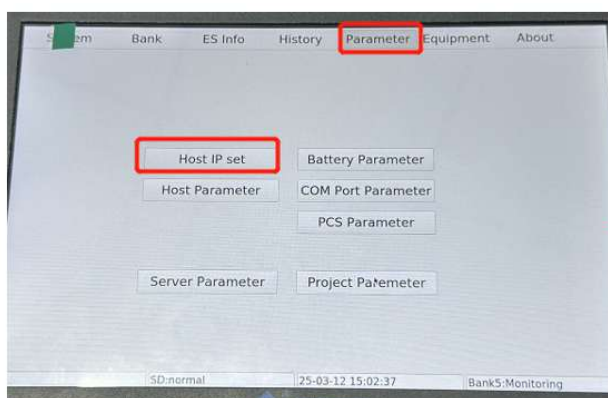
Step 1: Click “Parameter” button on the top of the master Solbank BMS screen, then click the “Host IP set” button.

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)

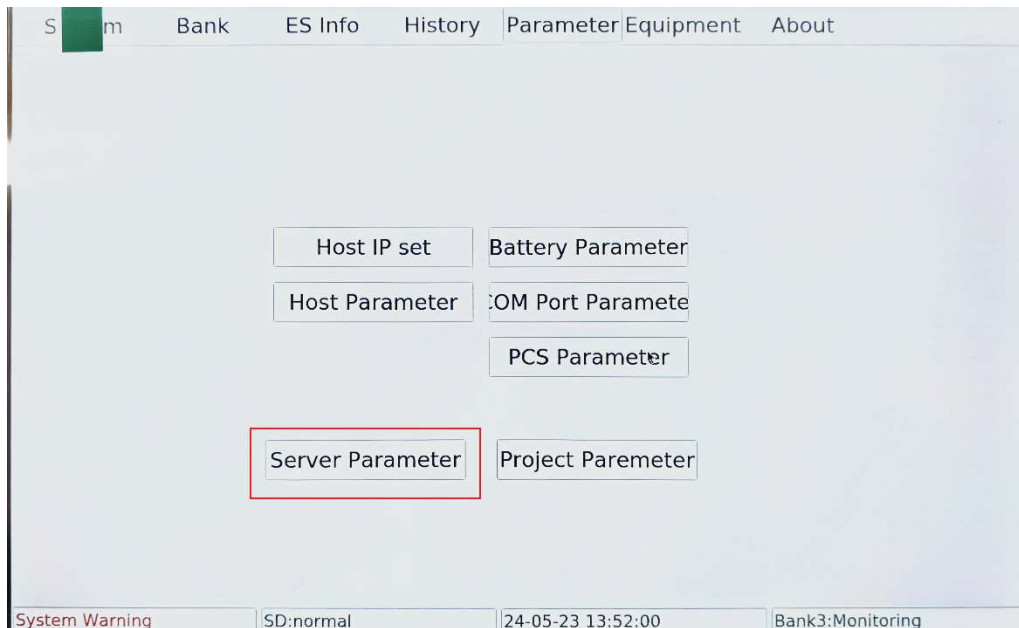


LAN0	100M/1000M 以太网
LAN1	100M/1000M 以太网
LAN2	10M/100M 以太网



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.

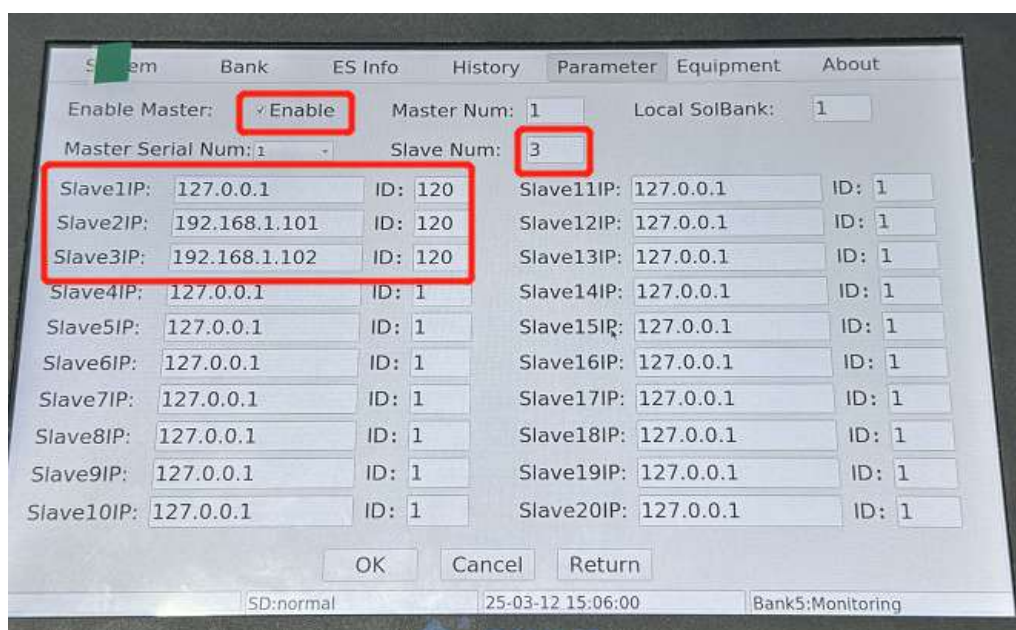
Step 4: Click on the “Server Parameter” button to set parameters of Master-Slave mode.



Step 5:

Single Bus System Master Configuration:

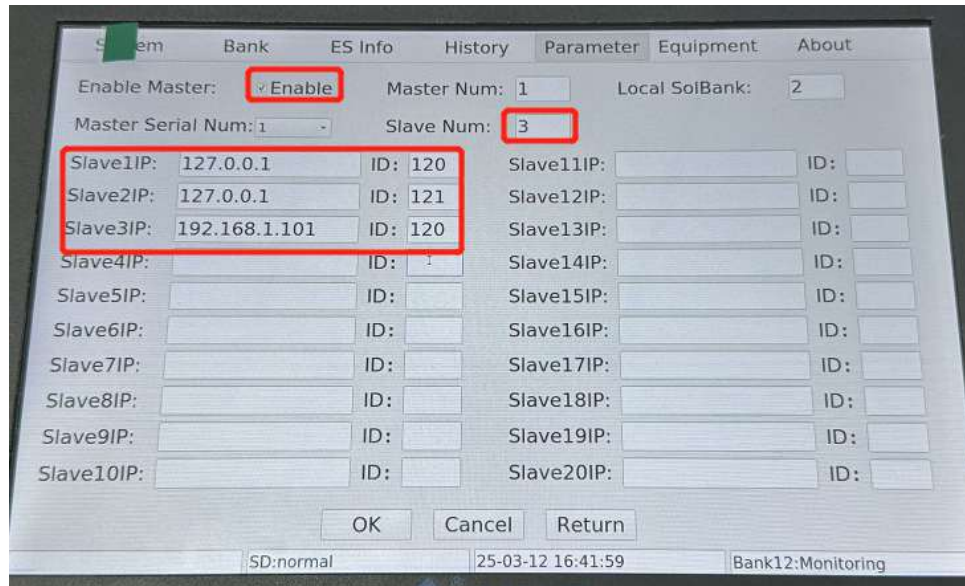
- Select to enable Master Mode
- Check and set the Slave1 IP and ID as default. Set Local Solbank as 1.
Slave1IP → 127.0.0.1 | ID=120 (Master Solbank)
- Add slave IP as the setting of host IP on Slave Solbanks' EMSU. Set ID as 120.
Example of 3 single bus Solbank parallel connection:
Slave2IP → 192.168.1.101 | ID=120 (ESMU Host IP of Slave Solbank#1)
Slave3IP → 192.168.1.102 | ID=120 (ESMU Host IP of Slave Solbank#2)
- Set the Slave Num according to actual Solbanks paralleled or total Slave IP number.
(includes Master itself)



Multi-Bus System Master Configuration (1Master+0.5Slave Solbank):

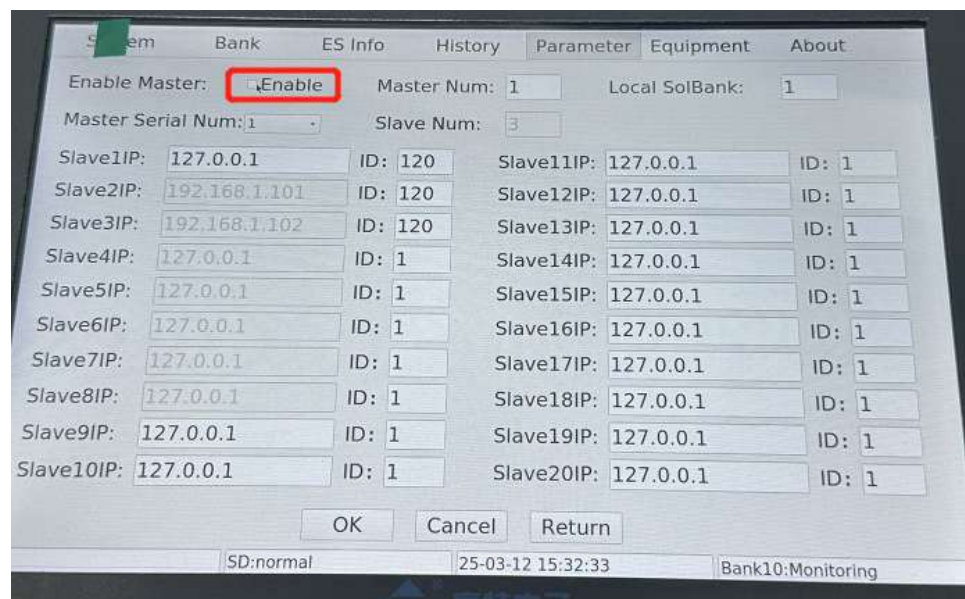
- Select to enable Master Mode

- b. Check and set the Slave1 IP and ID as default. Set Local Solbank as 2.
 Slave1 → 127.0.0.1 | ID=120 (String 1–6 of Master Solbank)
 Slave2 → 127.0.0.1 | ID=121 (String 7–12 of Master Solbank)
- c. Add slave IP as the setting of host IP on Slave Solbanks' EMSU. Set ID as 120 to add string 1-6 or 121 to add string 7-12.
 Example of 1Master+0.5Slave Solbank parallel connection:
 Slave3IP → 192.168.2.101 | ID=120 (ESMU Host IP of Slave Solbank)(String 1–6)
- d. Set the Slave Num according to actual Solbanks bus paralleled or total Slave IP number.
 (includes Master itself)



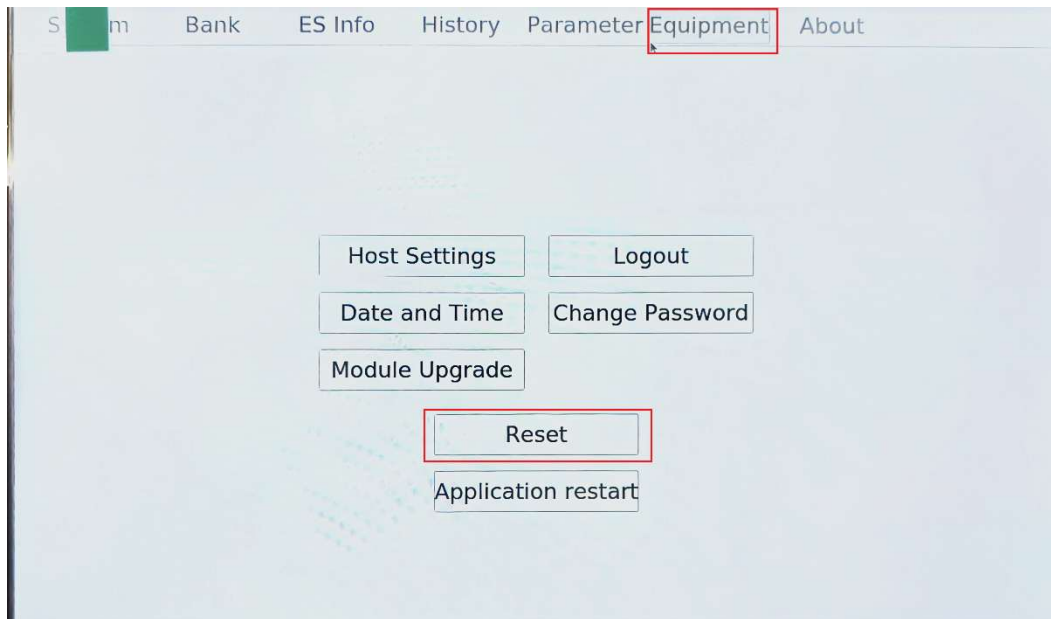
Slave Configuration:

- a. Uncheck Enable Master.



Click "OK" button after the parameter setting is completed.

Step 6: Click the "Equipment" button, and then click the "Reset" button. 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 Solbank can be reading through BCI Modbus.

DC voltage test:

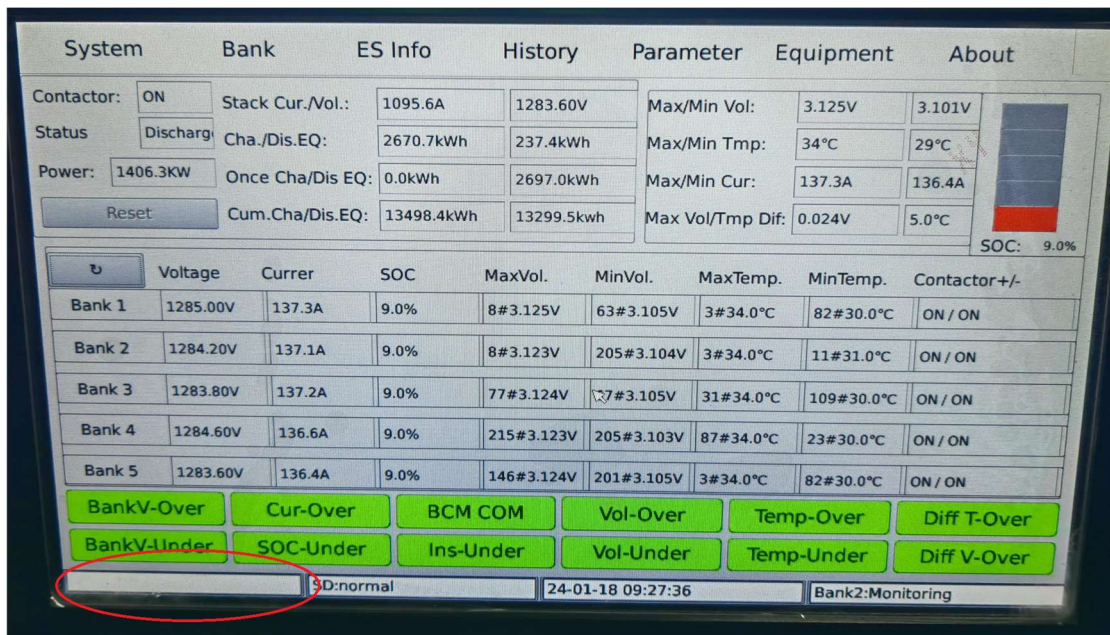
Step 1:

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

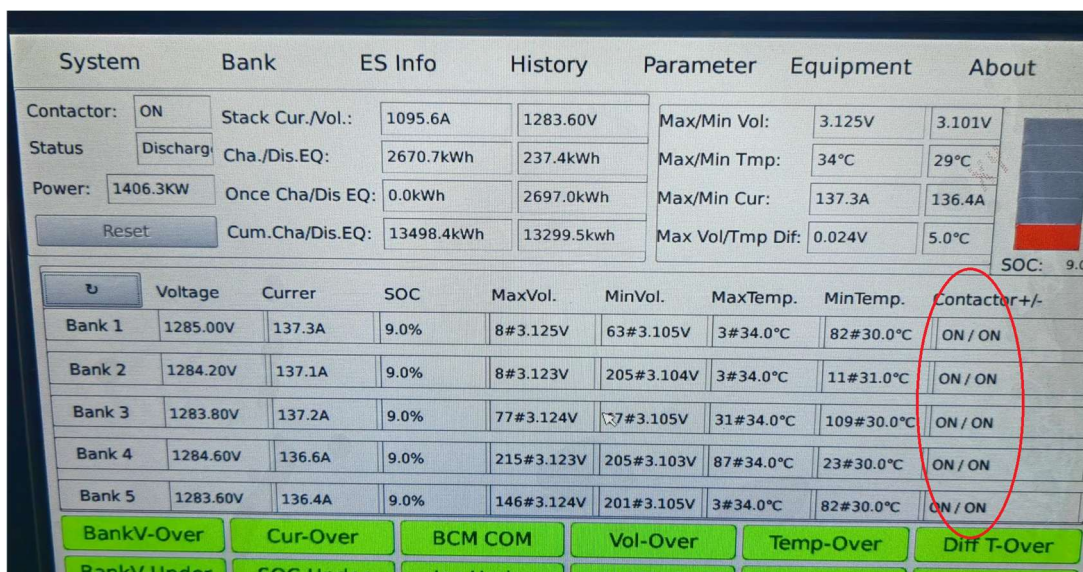


Step 3:

Through Modbus TCP to simulate the BCI and send a power-on command.

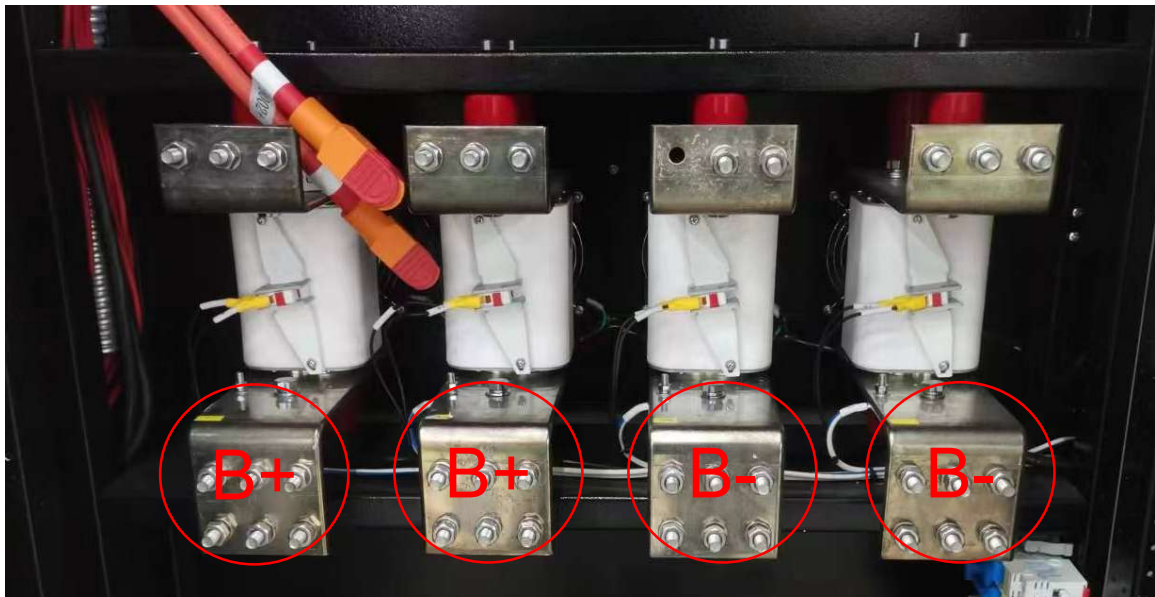
Step 4:

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 Master-Slave mode commissioning

Close the contactors in 1 master and 2 slaves mode:

Step 1:

Connect to the master SolBank by Modbus Poll or other Modbus tool.

Step 2:

Check "SolBanks with communication" register at function code 03 address 7. Each bit represents the communication state of one SolBank. If the register shows 3, it means communication between master and slave is successful. Otherwise, check the wiring and configuration of master and slave SolBanks.

	Alias	00000	Alias	00010
0	Heartbeat Register	455	System max charge power limit	0
1	Year	2024	System max discharge power limit	0
2	Month	5	System power on	0
3	Day	23	System power off	0
4	Hour	14	Enable maintenance mode	0
5	Minute	41	Maintenance rack mask (H)	0
6	Second	13	Maintenance rack mask (H)	0
7	SolBanks with communication	3	Maintenance rack mask (L)	0
8	SolBanks connected	0	Maintenance rack mask (L)	0
9	System fault reset	0	Maintenance start	0

Step 3:

Check the register "System Level 3 Alarm Summary" at function code 03 address 24. Each bit represents the level 3 summary of one SolBank. If it shows 0, that means there is no level 3 fault in master and slave SolBanks. Otherwise, check each SolBank and clear level 3 fault.

	Alias	00000
20	BCI Heartbeat	0
21	BCI Heartbeat enable	0
22	system Level 1 Alarm Summary	0
23	system Level 2 Alarm Summary	0
24	system Level 3 Alarm Summary	0
25	system charging prohibition	0
26	system discharge prohibition	0
27	system status	1
28	Duty	0
29	system current	0

Step 4:

Write 1 to register “System power on” at function code 03 address 12, to control the contactors of master and slave Solbanks to be closed.

	Alias	00000	Alias	00010
0	Heartbeat Register	455	System max charge power limit	0
1	Year	2024	System max discharge power limit	0
2	Month	5	System power on	0
3	Day	23	System power off	0
4	Hour	14	Enable maintenance mode	0
5	Minute	41	Maintenance rack mask (H)	0
6	Second	13	Maintenance rack mask (H)	0
7	SolBanks with communication	3	Maintenance rack mask (L)	0
8	SolBanks connected	0	Maintenance rack mask (L)	0
9	System fault reset	0	Maintenance start	0

Step 5:

Check register “Number of Online Racks” and “Racks connected status” at function code 03 address 38-42. “Number of Online Racks” register shows the number of racks with the contactors closed. Each bit of “Racks connected status” register represents contactor status of one rack. If number of online racks is 18 and racks connected status shows like the picture shown, that means all the contactors of racks of master and slave SolBanks are closed. If it doesn't work as expected, check the fault record for further information.

	Alias	00000
36	Cause of power reduction	0
37	Cause of power dropping to 0	0
38	Number of Online Racks	18
39	Racks connected status (H)	0
40	Racks connected status (H)	0
41	Racks connected status (L)	0000 0000 0000 0011
42	Racks connected status (L)	1111 1111 1111 1111
43	Maximum cell voltage	0
44	Minimum cell voltage	0
45	Maximum cell temperature	0
46	Minimum cell temperature	0

Tips: Write 3 to register "System power off" at function code 03 address 13 to disconnect all the contactors of master and slave SolBank.

5.8 System temperature check

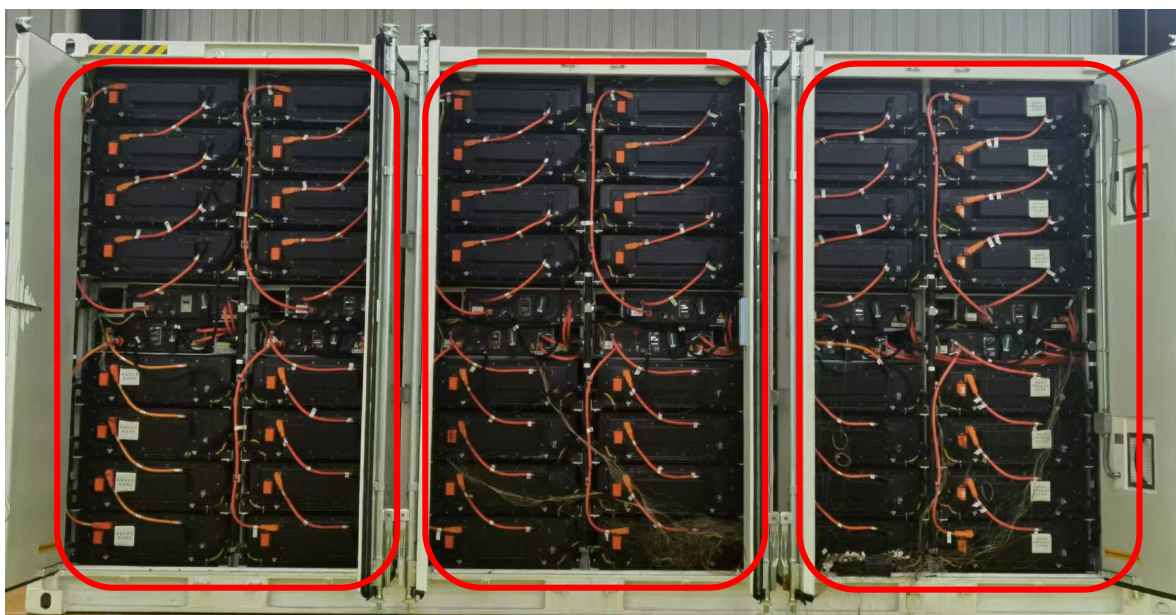
The temperature of the system needs to be checked immediately after the initial charge-discharge cycle test is completed.

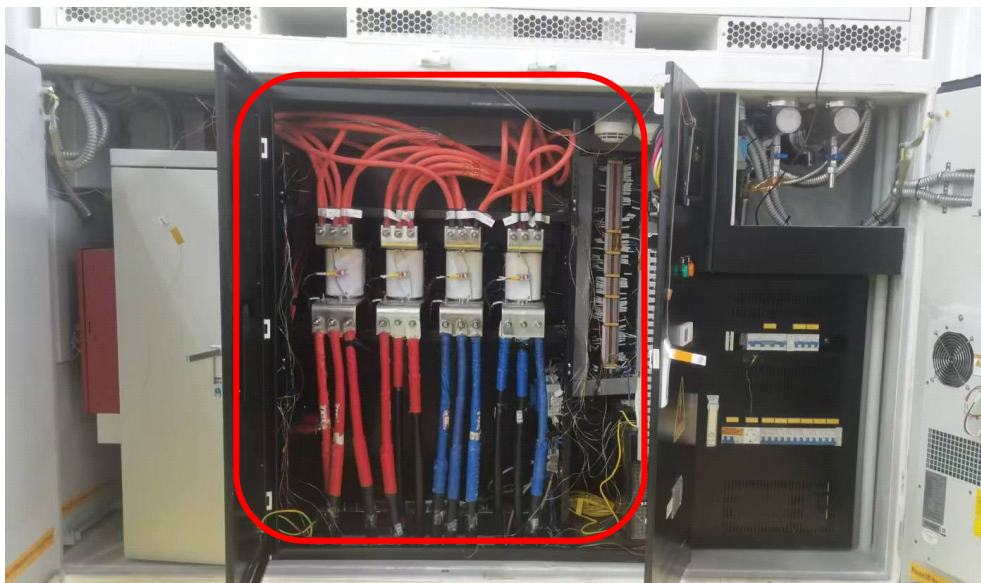
Step 1:

Open the battery doors and DMC door of the container.

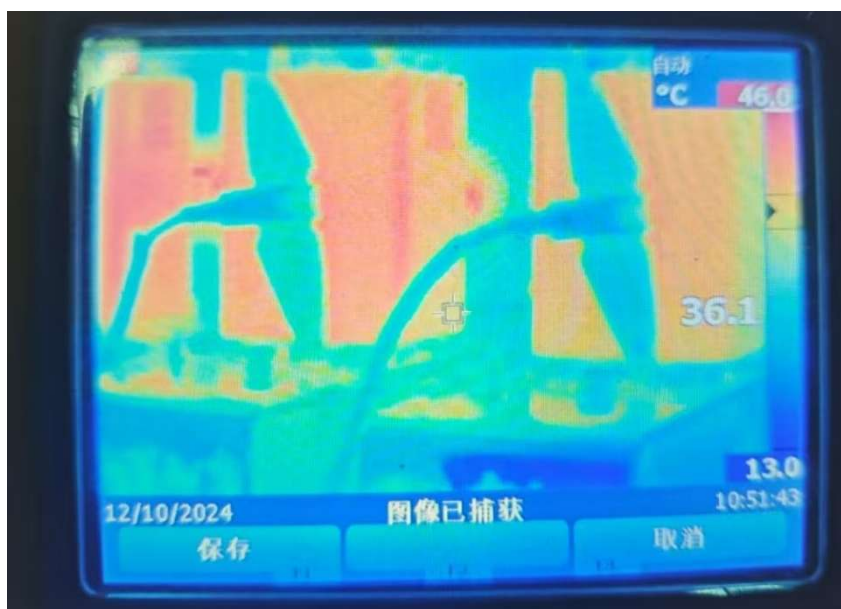
Step 2:

The infrared temperature sounder is used to measure the temperature inside enclosure. The measuring range is shown in the red box in the figure below. It is recommended that the measurement distance between the infrared temperature sounder and the container be more than 3 meters to cover a wider range. If necessary, it can be measured multiple times in different parts.





An example is shown in the following figure (DMC):



Step 3:

Check if the temperature rise is normal. The criteria are set as follows.

a) Battery compartment: Compared with the temperature difference between the heat sensor presented on BMS HMI and the value was detected by infrared temperature sounder, the temperature differential should not exceed 55 °C.

b) DMC cabinet: Compared with the temperature difference between the heat sensor presented on BMS HMI and the value was detected by infrared temperature sounder, the temperature differential should not exceed 60 °C.

If it's beyond the normal range, power off the system and check whether the abnormal heat source is securely connected.

Important note: During debugging period, in order to avoid water vapor from entering the SolBank 3.0 enclosure leading to unfavorable results such as corrosion, the door and the cable entry opening should not remain opening for more than 1 day. The cable entry opening can use an interim cover.

5.9 SolBank3.0 series function verification

Artificial operation is used to simulate faults to test the normal protection function of all equipment in SolBank3.0 series enclosure.

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 sounder		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			
9		Battery string 9 voltage and positive and negative pole to ground voltage			
10		Battery string 10 voltage and positive and negative pole to ground voltage			
11		Battery string 11 voltage and positive and negative pole to ground voltage			
12		Battery string 12 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		Insulation between positive and negative poles of battery string 9 and ground				
10		Insulation between positive and negative poles of battery string 10 and ground				
11		Insulation between positive and negative poles of battery string 11 and ground				
12		Insulation between positive and negative poles of battery string 12 and ground				
9	DMC insulation measurement	Line insulation (closed contactor)				
10						

Annex 4: Input voltage values for auxiliary equipment

Input voltage values for auxiliary equipment			
S/N:		Site specific number:	Date:
No.	Circuit Description	Voltage	Remarks
1	Chiller switch	480Vac (US) 400Vac (EU/AUS)	
2	Lightning arrester switch	480Vac (US) 400Vac (EU/AUS)	
3	Socket switch	230Vac	
4	Transformer switch	230Vac	
5	Fire power switch	230Vac	
6	DMC fan power supply	230Vac	
7	UPS switch	230Vac	
8	BMS power switch	230Vac	
9	24V Switch power switch	230Vac	
10	Control supply switch	230Vac	
11	Container fan power supply	230 Vac	
12	Air-cooled HVAC switch(Optional)	230 Vac	
13	Dehumidifier switch(Optional)	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 chiller working properly?			
4	Is water immersion sensor status normal?			
5	Whether the fire protection system is normal?			
6	Is the local F-stop normal?			
7	Is the lighting normal?			
8	Is the Air-cooled HVAC working properly? (Optional)			
9	Is the Dehumidifier working properly? (Optional)			

Annex 6: Fire Fighting System Debugging

Fire Fighting System Debugging(for NA version)										
S/N:				Site specific number:					Date:	
Combustible gas level 1 alarm	Combustible gas level 2 alarm	Smoke detector alarm	Heat detector alarm	ventilation Fan	Alarm Bell	Horn-Strobe (fire)	Horn-Strobe (gas)	Aerosol Based Fire Suppression (Optional)	Running status of the energy storage system	Inspection results
×	×	×	×	Close	Close	Close	Close	Close	No fire alarm, the system runs normally	
√	×	×	×	Open	Open	Close	Open	Close	Combustible level 1 alarm, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
√	√	×	×	Open	Open	Close	Open	Close	Combustible level 2 alarm, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	

×	×	✓	×	Close	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
✓	×	✓	×	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	
✓	✓	✓	×	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	×	✓	Open	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	

✓	×	×	✓	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	
✓	✓	×	✓	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	✓	✓	Open	Open	Open	Close	Open	Fire alarm level 2, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	
✓	×	✓	✓	Open	Open	Open	Open	Open	Combustible level 1, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	

✓	✓	✓	✓	Open	Open	Open	Open	Open	Combustible level 2, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	
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	Fire Safety System Debugging(for EU version)									
	S/N:			Site specific number:					Date:	
Combustible gas level 1 alarm	Combustible gas level 2 alarm	Smoke detector alarm	Heat detector alarm	ventilation Fan	Alarm Bell	Horn-Strobe (fire)	Horn-Strobe (gas)	Aerosol Based Fire Suppression	Running status of the energy storage system	Inspection results
×	×	×	×	Close	Close	Close	Close	Close	No fire alarm, the system runs normally	
√	×	×	×	Open	Open	Close	Open	Close	Combustible level 1 alarm, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
√	√	×	×	Open	Open	Close	Open	Close	Combustible level 2 alarm, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	√	×	Close	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	

✓	×	✓	×	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	
✓	✓	✓	×	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	×	✓	Close	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
✓	×	×	✓	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	

✓	✓	×	✓	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	✓	✓	Close	Open	Open	Close	Open	Fire alarm level 2, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	
✓	×	✓	✓	Open	Open	Open	Open	Close	Combustible level 1, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	
✓	✓	✓	✓	Open	Open	Open	Open	Close	Combustible level 2, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	

	Fire Safety System Debugging(for AUS version)									
	S/N:			Site specific number:					Date:	
Combustible gas level 1 alarm	Combustible gas level 2 alarm	Smoke detector alarm	Heat detector alarm	ventilation Fan	Horn-Strobe (fire)	Horn-Strobe (release)	Horn-Strobe (gas)	Aerosol Based Fire Suppression	Running status of the energy storage system	Inspection results
×	×	×	×	Close	Close	Close	Close	Close	No fire alarm, the system runs normally	
√	×	×	×	Open	Close	Close	Open	Close	Combustible level 1 alarm, the system does not charge and	

									discharge, auxiliary AC switch and DC contactor are closed	
√	√	×	×	Open	Close	Close	Open	Close	Combustible level 2 alarm, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	√	×	Close	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
√	×	√	×	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	

√	√	√	×	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	×	√	Close	Open	Close	Close	Close	Fire alarm level 1, the system does not charge and discharge, auxiliary AC switch and DC contactor are closed	
√	×	×	√	Open	Open	Close	Open	Close	Combustible, fire alarm level 1, the system is prohibited to charge and discharge, auxiliary AC switch and DC contactor are closed	

√	√	×	√	Open	Open	Close	Open	Close	Combustible alarm level 2, fire alarm level 1, the system is forbidden to charge and discharge, auxiliary AC switch and DC contactor are disconnected	
×	×	√	√	Close	Open	Open	Close	Open	Fire alarm level 2, the system does not charge and discharge, auxiliary AC switch and DC contactor are disconnected	
√	×	√	√	Open	Open	Close	Open	Close	Combustible level 1, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	

√	√	√	√	Open	Open	Close	Open	Close	Combustible level 2, fire level 2 alarm, the system forbid charging and discharging, auxiliary AC switch and DC contactor are disconnected	
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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	3.65V									
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 (°C)	Level 1	40									
	Level 2	45									
	Level 3	50									
Low battery charging and discharging temperature (°C)	Level 1	10									
	Level 2	5									
	Level 3	0									
Battery temperature Large difference (°C)	Level 1	10									
	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*416									
High	Level 2	3.6*416									
	Level 3	3.65*416									
Total voltage overvoltage	Level 1	2.9*416									
Low	Level 2	2.8*416									
	Level 3	2.55*416									
Power plug-in temperature over temperature alarm (°C)	Level 1	90									
	Level 2	95									
	Level 3	100									
Charging overcurrent (A)	Level 1	195									
	Level 2	200									
	Level 3	205									
	Level 1	195									

Discharge overcurrent (A)	Level 2	200									
	Level 3	205									
Low insulation (KΩ)	Level 1	2000									
	Level 2	1500									
	Level 3	750									
ESMUI communication fault	Level 2	/									
BMU communication failure	Level 3	/									
ESMU: fire protection	Level 3	/									
Fault/Emergency Stop											
Signal/electrical operation/fuse disconnection											
Individual voltage Collection fault	Level 3	/									
Monomer temperature Collection fault	Level 3	Number of invalid temperatures ≥ 4 or number of invalid temperature slaves ≥ 3									
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	/									