STATIC TRANSFER SWITCH

USER MANUAL

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Contents

1. Preface

This document primarily introduces product information, installation wiring, configuration and commissioning, troubleshooting, and maintenance of the Static Transfer Switch. Before installing or using this product, please carefully read this manual to understand the product's safety information and familiarize yourself with its functions and features. This document may be updated periodically, so please visit the official website for the latest version and more product information.

1.1 Applicable Products

This document applies to the Static Transfer Switch, referred to as STS model: S1-A-STS series.

1.2 Intended Personnel

Only qualified professionals who are familiar with local regulations and electrical systems, have undergone professional training, and are knowledgeable about this product should use it.

1.3 Definition of Symbols

sinformation. Please carefully read the symbols and their explanations.

Danger
Indicates a high potential danger that, if not avoided, will result in death or serious injury.
Waring
Indicates a moderate potential danger that, if not avoided, could result in death or serious injury.
Caution
Indicates a low potential danger that, if not avoided, may result in moderate or minor injury.
Note
Highlights or supplements information and may also provide tips to optimize product usage, helping to solve a problem or save time.

2. Safety Precautions

The safety precautions in this document must be followed at all times when operating the equipment.

Warning
The equipment has been designed and tested in compliance with safety regulations, but improper operation may result in serious injury or property damage. Always follow the safety instructions before operating the equipment.

2.1 General Safety

Note
· The document may be updated periodically due to product upgrades or other reasons. Unless otherwise specified, this document does not replace the safety precautions on the product labels. All descriptions in the document are for guidance purposes only. · Please carefully read this document before installing the equipment to understand the product and its precautions. · All operations on the equipment must be performed by professional and qualified electrical technicians who are familiar with local standards and safety regulations. · When operating the equipment, use insulated tools and wear personal protective equipment to ensure personal safety. Wear anti-static gloves, wristbands, and clothing when handling electronic components to protect the equipment from static damage. · The manufacturer is not responsible for any equipment damage or personal injury resulting from failure to install or use the equipment according to this document or the corresponding user manual.

2.2 Equipment Safety

Warning
· Ensure that the voltage and frequency at the equipment's grid connection point comply with the equipment's grid specifications. · It is strictly forbidden to place flammable materials near the STS equipment or to install the equipment in an environment containing explosive gases. · All installation, wiring, or routine maintenance must be performed with the power off. · When maintaining the product, be sure to disconnect the main circuit and wait at least 15 minutes to ensure that the equipment voltage drops to 0V and the internal capacitors are fully discharged. · Do not install or maintain the STS equipment in damp locations. If working in such conditions is unavoidable, stand on a dry rubber mat or wooden board, use insulated gloves, keep clothing dry, and work with a companion. · After installation, the labels and warning signs on the cabinet must remain clearly visible. Do not cover, alter, or damage them.

2.3 Personnel Requirements

Note
· Personnel responsible for installing and maintaining the equipment must undergo strict training, understand all safety precautions, and master the correct operation methods. · Only qualified professionals or trained personnel are allowed to install, operate, maintain, or replace the equipment or its components.

3. Product Introduction

3.1 Product Overview

Function Overview

The static transfer switch is an automatic switching system that selects one of two power sources. It transfers the power supply between two independent AC sources. When one source fails, the STS automatically switches to the other source to supply power to the load. The active switching and off-grid time is 0ms, while the passive switching time is 20ms (typical).

This product adopts a “break-before-make” switching method and can be used with our PCS products to achieve seamless switching between different power inputs.

Product Advantages	Product Features
High Efficiency & Intelligence	Dual power switching control between the grid and energy storage inverter.
	Maximum discharge efficiency of up to 99%.
	Intelligent, fast separation of grid and microgrid, switching power circuits (≤20ms).
	Smart operation with CAN, 485, Ethernet communication interfaces.
Safety & Reliability	High protection level
	Comprehensive fault protection functions
	High reliability to ensure uninterrupted power supply to critical loads.

Model Description

This document applies to the stransfer switch model: S1-A-STS500-3.

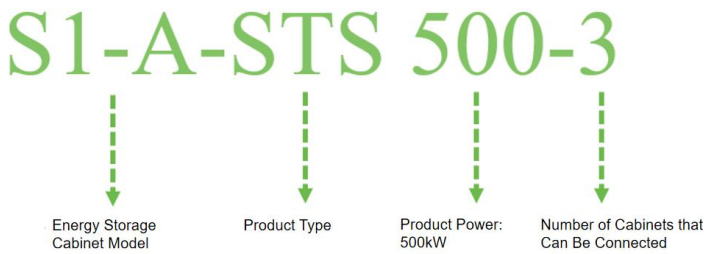

Figure 3.1 Explanation of STS Naming Rules

3.2 External Description

Figure 3.2 STS Appearance Diagram

3.2.1 Cabinet

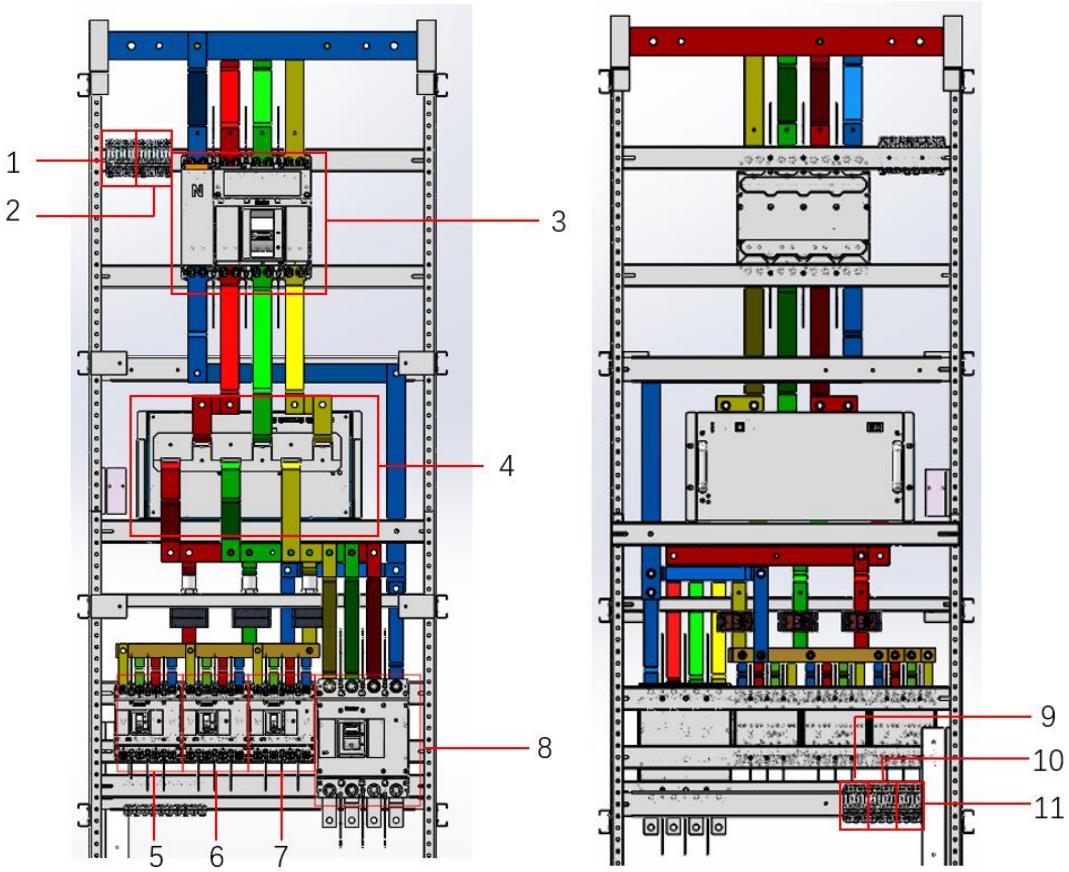

Figure 3.3 Front and Rear View of the Static Transfer Switch with Doors Open

Position	Description
1	Surge Protector
2	Miniature Circuit Breaker

3	Molded Case Circuit Breaker
4	STS Module (available in 200kW and 500kW options)
5/6/7	Molded Case Circuit Breakers
8	Molded Case Circuit Breakers
9/10/11	Miniature Circuit Breakers

3.2.2 STS Module

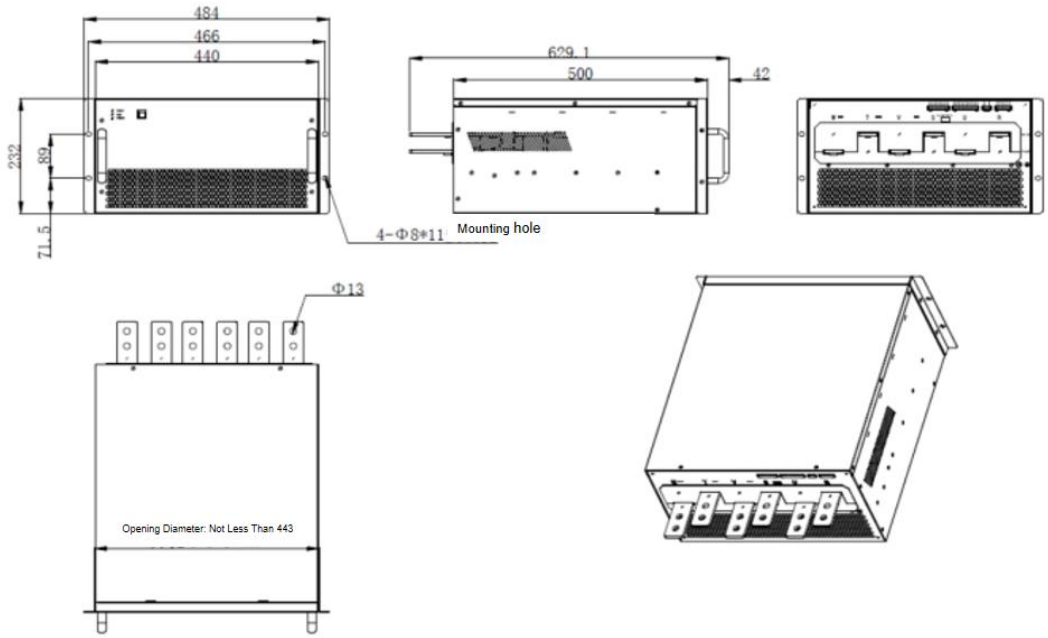

Figure 3.4 STS Module Dimension Diagram

3.3 Logical Block Diagram

The STS static transfer switch is placed between the grid and the battery system, ensuring that the system can quickly disconnect the grid from the energy storage system when the grid power is lost. It also sends a signal to switch the battery system to off-grid mode, completing the entire response process within 20ms, thereby ensuring uninterrupted power to critical AC loads.

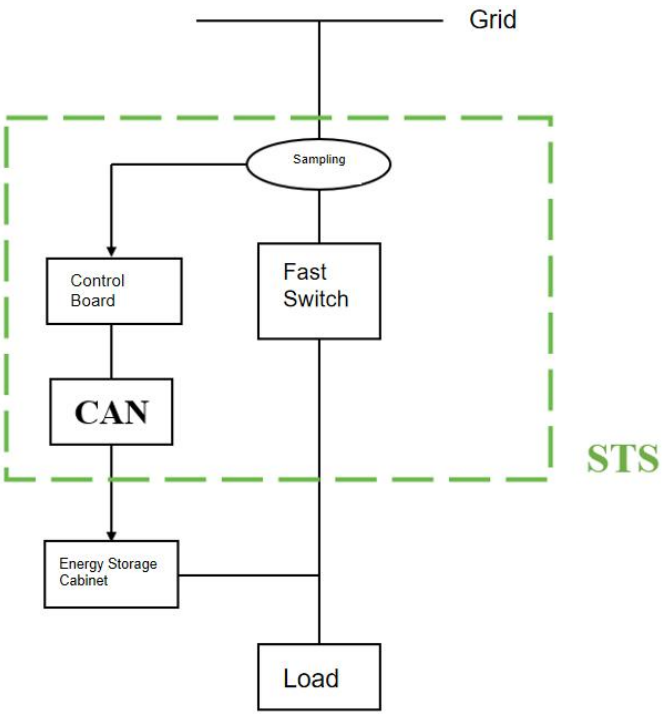

Figure 3.5 Logical Block Diagram of the Static Transfer Switch

(1) Passive Switching

① Typical Switching: The sampling board continuously samples grid-side data and sends it to the control board. When a voltage drop is detected, the control board analyzes for half a cycle to confirm a grid outage. At this point, the fast switch disconnects and simultaneously issues an off-grid switching signal to the energy storage cabinet. The entire process is completed within 20ms.

② Guaranteed Power Supply Switching: The sampling board continuously samples grid-side data and sends it to the control board. When a voltage drop is detected, the control board analyzes the grid voltage waveform and detects any abnormalities. The fast switch disconnects, and an off-grid switching signal is sent to the energy storage cabinet. This process is completed within 0-15ms.

(2) Active Switching

The monitoring system sends an off-grid command, and after the energy storage cabinet receives the command, it switches to off-grid operation, while the STS disconnects the fast switch. This process is a seamless switch.

(3) Synchronized Grid Connection:

The monitoring system sends a grid connection command, and after receiving the command, the STS begins detecting the grid voltage and adjusts the phase and amplitude of the energy storage cabinet output until it matches the grid. This process is a seamless switch.

3.4 Equipment Parameters

Product Model	S1-A-STS200-1	S1-A-STS500-2	S1-A-STS500-3

Power Parameters			
Grid Port Power (kW)	200	500	
Max Grid Port Current (A)	318	794	
Load Port Power (kW)	200	500	
Max Critical Load Power (kW)	100	200	300
Note: The sum of the critical load power and PCS-side power must be ≤ the product's maximum power.			
Rated Voltage (Vac)	400		
Grid Voltage Range (Vac)	400±15%		
Rated Frequency (Hz)	50/60		
Long-Term Overload Capacity	110%		
Grid-to-Off-Grid Switching Time (ms)	≤20		
Max Efficiency	> 99.5%		
System Parameters			
Product Dimensions (mm)	800×800×2400		
Weight (kg)	270±13	310±15	320±16
Operating Temperature (°C)	-25~55(derated above 45°C)		
Storage Temperature (°C)	-45~70		
Relative Humidity	0%RH~95%RH, non-condensing		
Cooling Method	Intelligent Air Cooling		
Protection Level	IP55		
Wiring Method	Three-phase, four-wire		
Altitude (m)	4000(derated above 2000m)		

4. Equipment Inspection and Storage

4.1 Pre-Signature Inspection

Before signing for the product, please check the following:

1. Check if the outer packaging is damaged, such as deformation, holes, cracks, or any other signs that may indicate damage to the equipment inside. If there is damage, do not open the packaging and promptly contact the carrier or our company.
2. Check if the static transfer switch model is correct. If there is a discrepancy, do not open the packaging and promptly contact the carrier or our company.
3. Verify the type and quantity of delivered items, and check for any appearance damage. If there is damage, promptly contact the carrier or our company.

4.2 Equipment Storage

If the static transfer switch is not immediately put into use, please store it as follows:

1. Before storage, ensure that the cabinet door is locked.
2. Ensure the storage environment is clean, with suitable temperature and humidity, and free from condensation.
3. After long-term storage, the static transfer switch must be inspected by professionals before use.

4.3 Delivered Items

The list of delivered items is as follows:

The list of delivered items is as follows:	Quantity
Static Transfer Switch	1

5. Installation Requirements

5.1 Environmental Requirements

Note
· **Site Requirements:** The equipment protection level is suitable for both indoor and outdoor installations. For outdoor installations, the site must not be in a low-lying area prone to flooding. The installation surface should be higher than the region's historical maximum water level, and the location should be away from flammable, explosive materials, and corrosive substances. Avoid installing in dusty, foggy, or corrosive environments. If unavoidable, install the equipment upwind of such areas. · **Foundation Requirements:** The foundation should provide sufficient load-bearing support for the equipment. The foundation height should be higher than the historical maximum flood level. The foundation must have a lifespan of more than 20 years and a level tolerance of 3mm/m². The cabinet should be elevated to prevent rainwater exposure, with the installation base suggested to be 300mm to 500mm above the ground. Drainage measures should be implemented based on local geological conditions. · **Space Requirements:** The final installed system must maintain good ventilation.

5.2 Equipment Handling

Forklift: For loading and transportation, simply insert the forklift prongs into the pallet base of the static transfer switch, lift it steadily, and load it into the transport vehicle.

Caution
· During transport, consider the weight and center of gravity of the static transfer switch. Ensure the forklift can bear the weight of the equipment. · The cabinet must always be transported upright, avoiding tilting risks during the process. · The cabinet should not experience severe vibrations, shocks, or be overturned during transportation.

6. Wiring Instructions

6.1 Safety Precautions

Danger
◆ All operations during the electrical connection process, as well as the specifications of cables and components used, must comply with local laws and regulations. ◆ Before any electrical connections, please disconnect all switches of the STS Cabinet to ensure that the equipment is powered off. Live operations is strictly prohibited, as it may pose dangers such as electric shock. ◆ Similar cables should be bundled together and separated from different types of cables in their layout, with no mutual entanglement or crossing allowed. ◆ If the cable is subjected to excessive tensile force, it may result in poor wiring connections. When wiring, please ensure to leave a certain length of cable before connecting it to the wiring terminal port of the smart switch system cabinet. ◆ When crimping the wiring terminals, please ensure that the conductor of the cable is in full contact with the wiring terminal. Do not crimp the cable insulation together with the wiring terminal, as this may cause the equipment to fail to operate, or lead to situations such as overheating due to unreliable connections, which may damage the terminal block of the STS Cabinet in operation.

PRECAUTIONS
◆ When conducting electrical connections, please wear personal protective equipment such as safety shoes, protective gloves, and insulating gloves as required. ◆ Only professionals are allowed to perform operations related to electrical connections. ◆ The cable colors shown in the graphics of this document are for reference only. The specific cable specifications must comply with local regulatory requirements.

6.2 System Schematic Diagram

The STS Cabinet is equipped with surge protectors, grid-side switches, breakers for energy storage cabinets, and breakers for critical loads. It can automatically complete on-grid and off-grid switching, as well as grid synchronization, with the on-grid and off-grid switching time within 20 milliseconds. The following is the topological diagram of its composition structure:

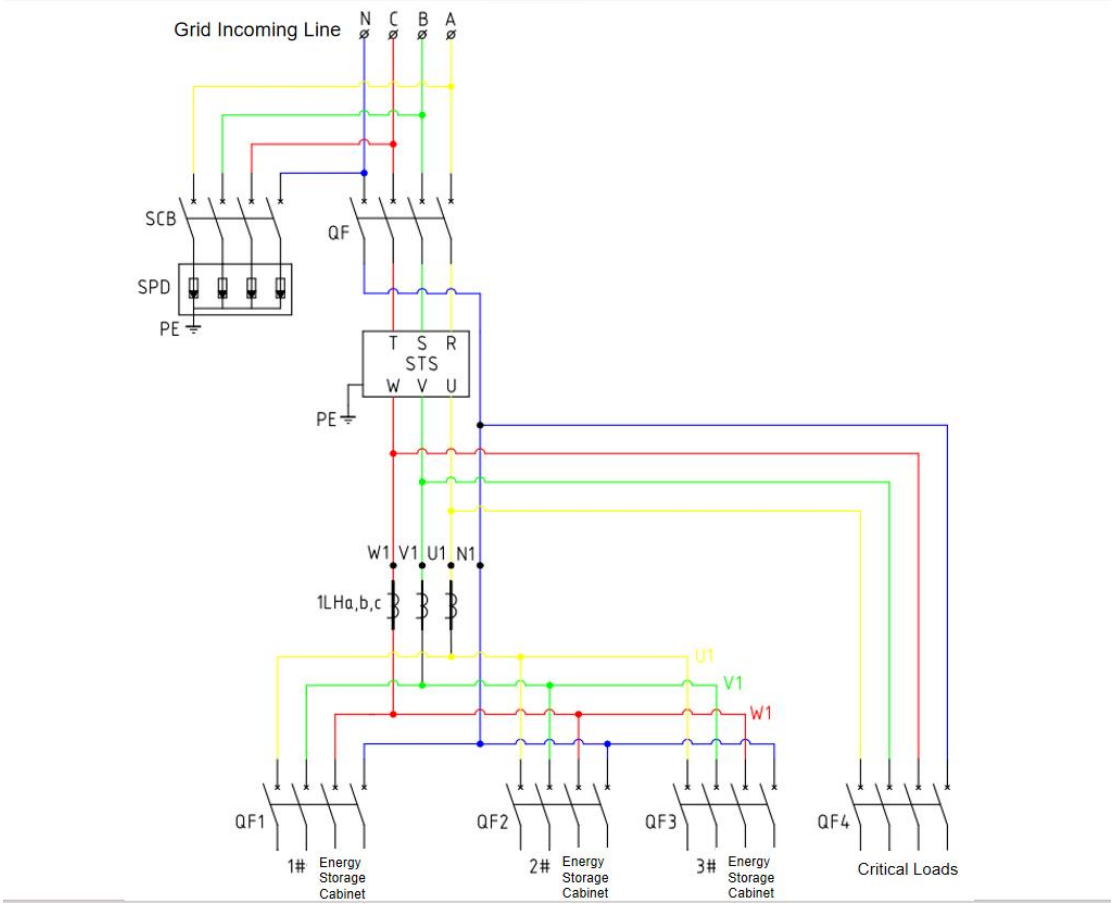

Figure 6.1 STS Cabinet Schematic Diagram

6.3 STS Cabinet Strong Current Wiring

The input of the main power grid is connected to the following wiring positions:：

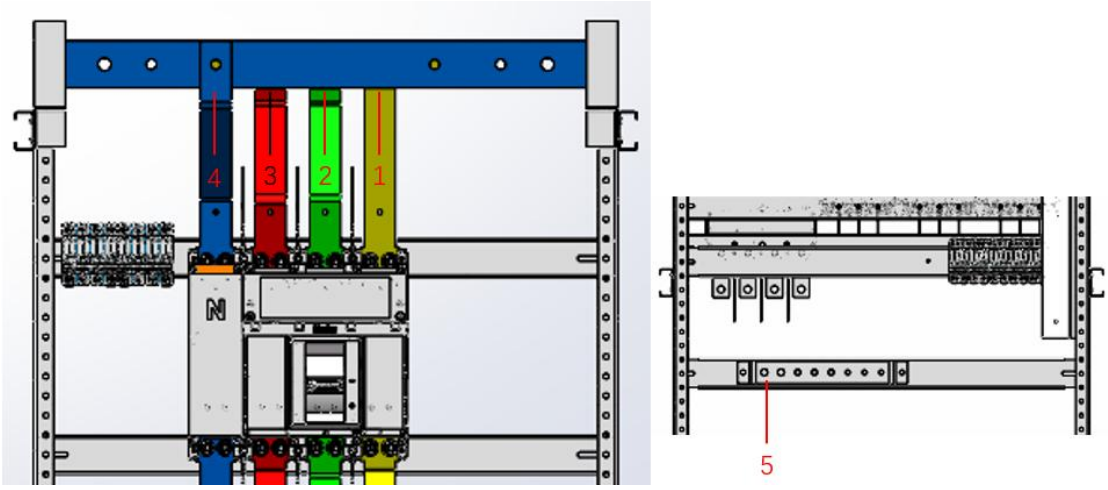

Figure 6.2 STS Cabinet Top and Bottom Copper Busbar

Position	Description	Quantity
1	A-phase to grid-side A-phase	1

2	B-phase to grid-side B-phase	1
3	C-phase to grid-side C-phase	1
4	N-phase to grid-side N-phase	1
5	PE to grid-side PE	1

Below is the S1-A-STS500-3 example to illustrate the wiring method for the battery system and loads, with three energy storage cabinets connected on the left side and critical loads connected on the right side:

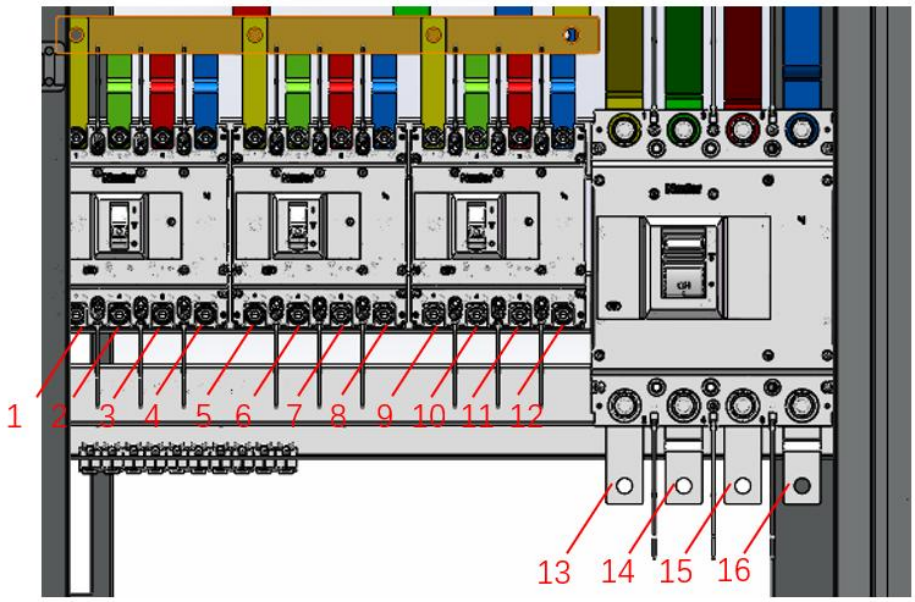

Figure 6.3 STS Cabinet Bottom Wiring Terminals

Position	Description	Quantity
1	A-phase to 1# ES Cabinet A-phase	1
2	B-phase to 1#ES Cabinet B-phase	1
3	C-phase to 1#ES Cabinet C-phase	1
4	N-phase to 1#ES Cabinet N-phase	1
5	A-phase to 2# ES Cabinet A-phase	1
6	B-phase to 2#ES Cabinet B-phase	1
7	C-phase to 2#ES Cabinet C-phase	1
8	N-phase to 2#ES Cabinet N-phase	1

9	A-phase to 3# ES Cabinet A-phase	1
10	B-phase to 3#ES Cabinet B-phase	1
11	C-phase to 3#ES Cabinet C-phase	1
12	N-phase to 3#ES Cabinet N-phase	1
13	A-phase to Load A-phase	1
14	B-phase to Load B-phase	1
15	C-phase to Load C-phase	1
16	N-phase to Load N-phase	1

6.4 STS Cabinet Communication Wiring

The STS Cabinet is equipped with CAN and RS485 communication ports, enabling communication with the PCS and allowing the upload of operational status and fault information to the EMS.

The communication wiring diagram between the STS and the PCS in the battery system is shown below:

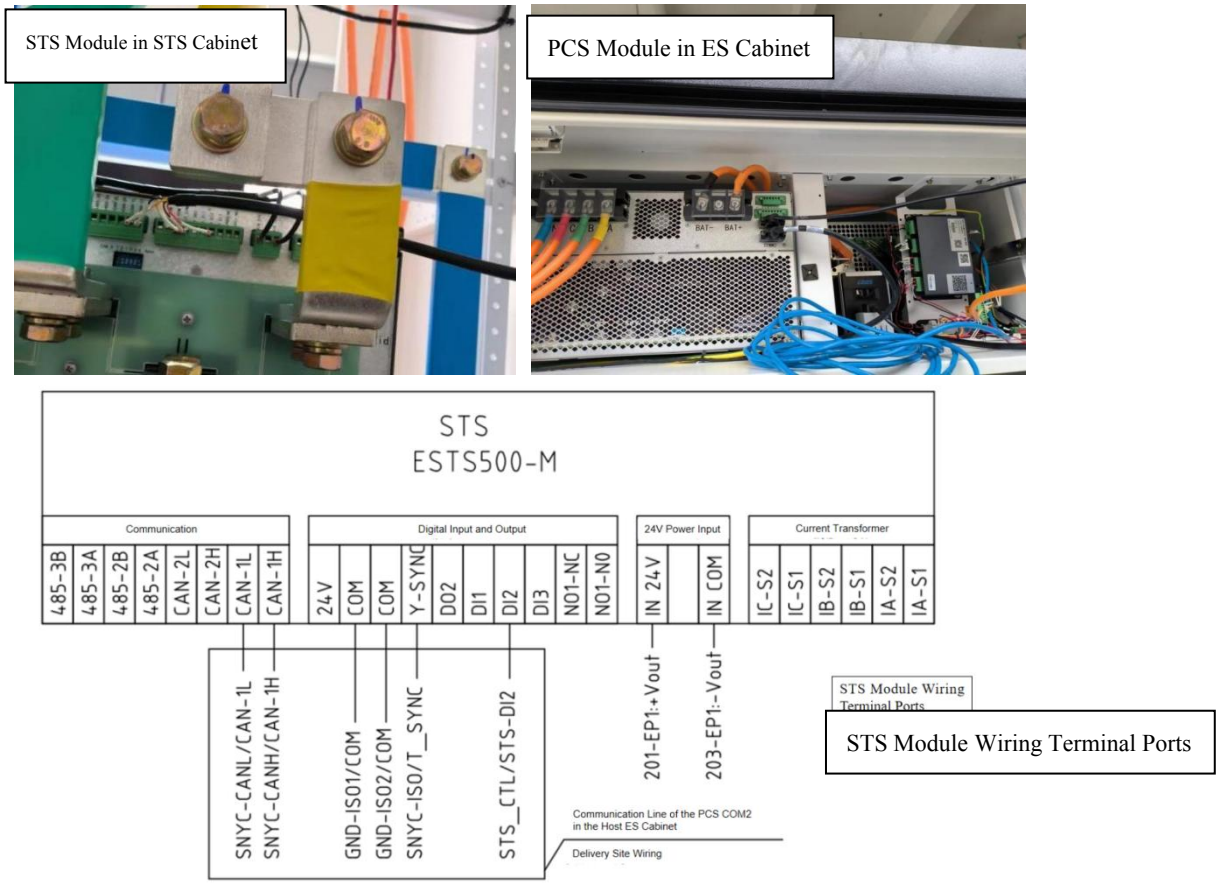

Figure 6.4 STS-PCS Communication Wiring Schematic Diagram

Below is the communication wiring between STS Cabinet and the EMS of the battery system:

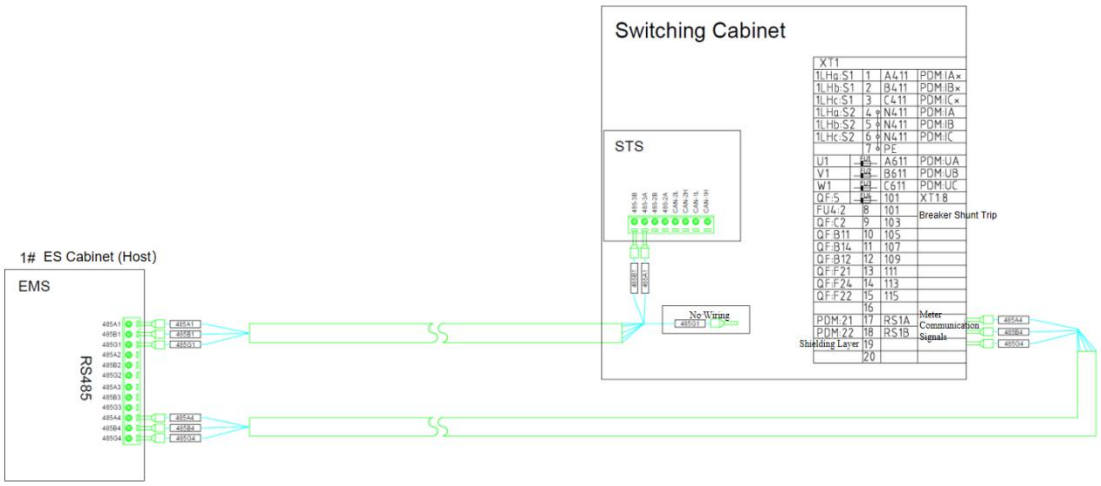

Figure 6.5 STS-EMS Communication Wiring Schematic Diagram

Because multiple battery systems are connected in parallel, the batteries in individual battery system also need to be connected in parallel. The parallel connection method is as follows:

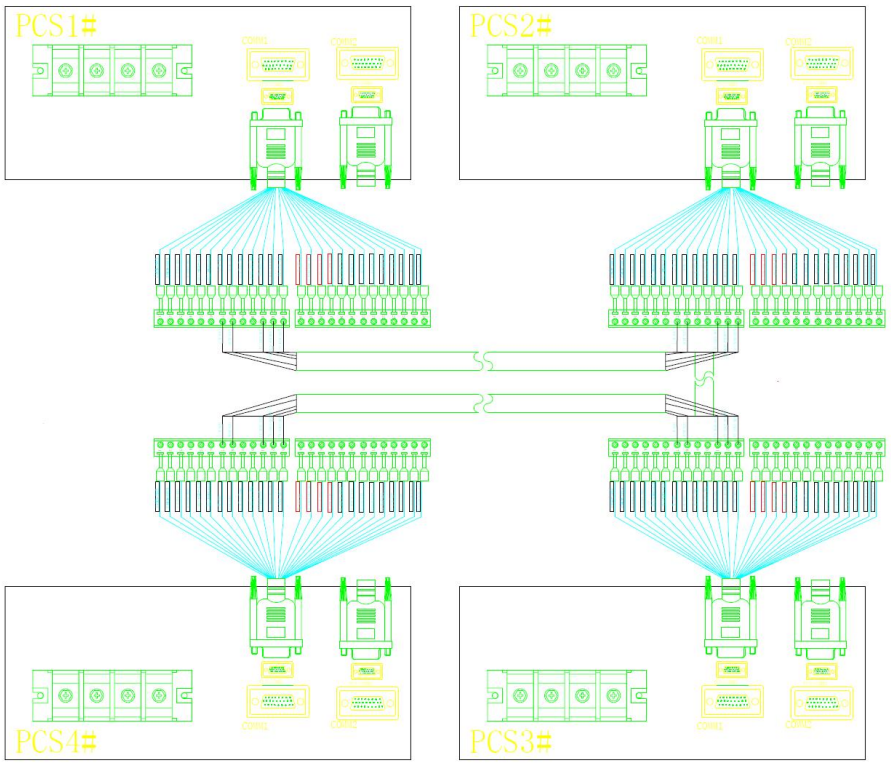

Figure 6.6 PCS-PCS Communication Wiring Schematic Diagram

6.5 STS Cabinet Power Distribution Wiring

The STS Cabinet needs to be connected to a 24Vdc power to supply power to the system. The power supply access position is shown in the following figure.:

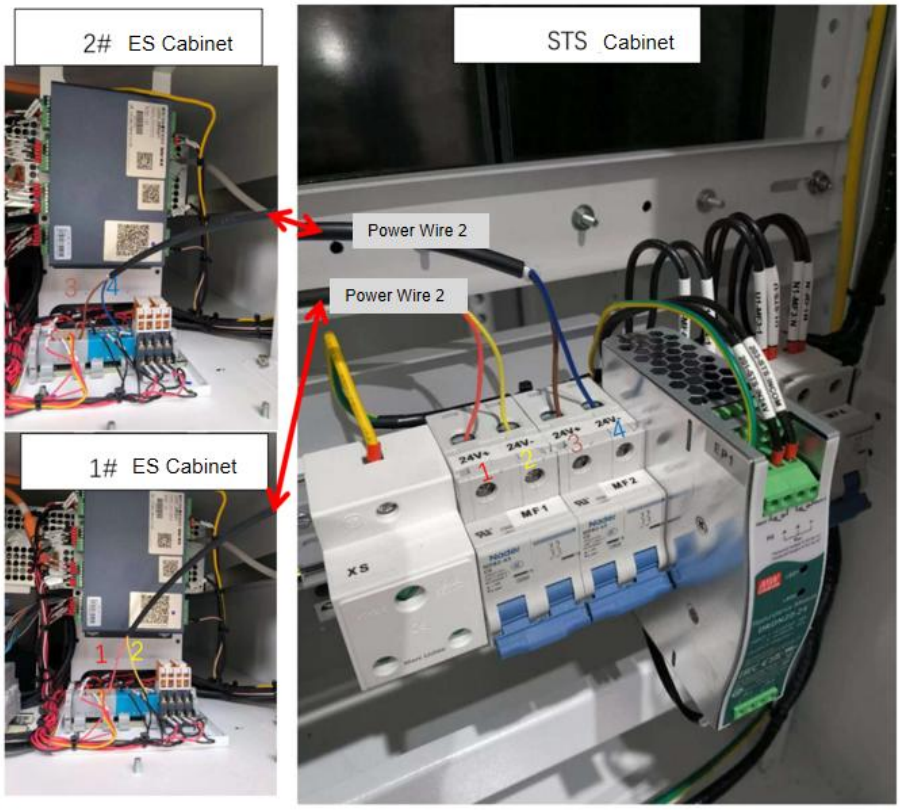

Figure 6.7 STS Cabinet-ES Cabinet Power Distribution Wiring Schematic Diagram

7. Equipment Running Trial

The STS cabinet is applied in the scenario of on-grid and off-grid switching in energy storage systems, and its startup and operation require coordination with our PCS and EMS.

7.1 Pre-Power-On Inspection

Before powering on, please carefully check the following items to guarantee their accuracy.

NO.	Issues
1	To check if the wiring is correct.
2	To check and ensure there are no grounding faults.
3	To detect whether the voltage at the equipment connection points meets the startup conditions by using a multimeter and ensure there is no risk of overvoltage.
4	To check if the wiring of the control terminal ports is correct and if the wiring at both ends of the terminal block corresponds to each other one-to-one.
5	To check to ensure no tools or parts are left inside the equipment.
6	To check and ensure that all air inlets and outlets are not obstructed or blocked by any objects.

7.2 Equipment Startup (or Power-On)

After reconfirming that all the above are no problems, proceed with the power-on and startup operations. The steps are as follows:：

1.Tighten the cabinet and properly connect the power and signal cables and wires.

Warning
During the startup process of the STS cabinet, the output terminals may already be energized. If there is PCS connected to the output terminals of the STS cabinet, please ensure that the PCS is functioning correctly.

2.Close the switch between the Grid and the STS module.

PRECAUTIONS
The indicator lights on the top left corner of the STS module's front panel will change accordingly. If the STS equipment is properly powered on, the POWER indicator light will illuminate and remain steady. If there is a fault in the STS equipment, the FAULT indicator light will display in red, indicating that the STS cannot operate normally.

3.Check if the startup data of the STS is normal through the EMS.

7.3 Equipment Shutdown

There are two shutdown methods:

(1) Directly disconnect the switch between the STS Cabinet and the grid. This method is the complete shutdown mode, meaning that after shutdown, the system will be without power, allowing for related maintenance to be carried out on the system.

(2) The second method is to shut down the STS Cabinet through control by the EMS.

Warning
This shutdown mode only stops the operation of the power devices in the system, placing the machine in standby mode, and the output terminals remain live! Do not directly cut the power to the equipment that is currently running, as this may cause damage to the equipment!

7.4 STS Module Indicator Introduction

Indicator	State	Description
○ FAULT		In fault
		No faults
○ RUN		Running
		Standby mode
○ POWER		Power on
		Power off

8. System Maintenance

8.1 Equipment Power-off

Danger
◆ When performing operational maintenance on the equipment, please ensure the equipment is powered down, as operating with power may lead to equipment damage or electric shock. ◆ After powering down the equipment, the internal components will take some time to discharge. Please wait for at least 15 minutes until the equipment is fully discharged. ◆ To avoid accidental risks, maintenance personnel should wear insulating equipment during the maintenance. ◆ Only personnel with professional qualifications should perform maintenance on STS equipment.

8.2 Fault Handling

PRECAUTIONS
When an abnormal change occurs in the STS Cabinet, it is recommended to first conduct a preliminary troubleshooting according to the fault diagnosis and troubleshooting methods described in the user manual. If the problem cannot be solved or if there are still doubts even with the help of the user manual, please contact SAV Digital Energy. When consulting, it is recommended to provide the following information simultaneously: 1. Equipment mode 2. Fault information and a brief description 3. If possible, please provide photos of the fault scene

The following is a list of main faults:

Description	Suggested Handling Methods
Surge Protector Fault	Manually inspect the surge protector and handle it promptly.
Redundancy Power Loss	Manually inspect the redundancy power supply and handle it promptly.
Circuit Breaker Fault	Manually inspect the redundancy Circuit Breaker and handle it promptly.

8.3 Periodic Maintenance

Maintenance Content	Maintenance Method	Maintenance Cycle

System Status and Cleaning	Inspect the following items, and if they do not meet the requirements, please take immediate corrective actions: 1. Check if the cabinet and internal equipment are damaged or deformed. 2. Check if there are any abnormal noises during the operation of the internal equipment. 3. Check if the temperature inside the cabinet is excessively high. 4. Check if the humidity and dust level inside the cabinet are within the normal range, and clean if necessary. 5. Check if the air inlet and outlet are blocked, and clean if necessary.	Once every three months
Cabinet Interior and Exterior	Inspect the following items, and if they do not meet the requirements, please take immediate corrective actions: 1. Check whether there are flammable objects on the top of the cabinet. 2. Check whether the cabinet body and casing are damaged, have paint peeling off, oxidation, etc. 3. Check whether the cabinet door lock and others can be opened flexibly. 4. Check whether the sealing strip and others are fixed well. 5. Check whether there are fallen screws and other situations inside the cabinet.	Once every year
Electrical Connection	Make sure the equipment is completely powered off before starting the inspection! During the inspection, if any non-compliance is found, please take immediate corrective actions: 1. Check if the cable arrangement is standardized and if there are any short circuits. If any abnormalities, correct immediately. 2. Check if all the inlet and outlet wire holes in the STS cabinet are properly sealed. 3. Check for any water infiltration inside the STS cabinet. 4. Inspect if the power cables are loosely connected and tighten them according to the previously specified torque. 5. Examine if the power cables and control cables are damaged, especially for any cuts on the outer skin that is in contact with metal surfaces. 6. Check if the insulating tapes on the power cable wiring terminals have come off.	Once every three months

	7. Verify if the grounding connections are correct.	
Safety Function	1. Simulate power outage. 2. Check the warning signs on the machine body and other equipment signs. If any blurring or damage, replace them in time.	Once every six months or one year
Device Maintenance	1. Conduct regular inspections (every six months) on the rusting condition of all metal components. 2. Conduct annual inspections on contactors (auxiliary switches and microswitches) to ensure the mechanical operation is in good condition. 3. Check operating parameters (especially voltage and insulation, etc.).	Once every six months or one year