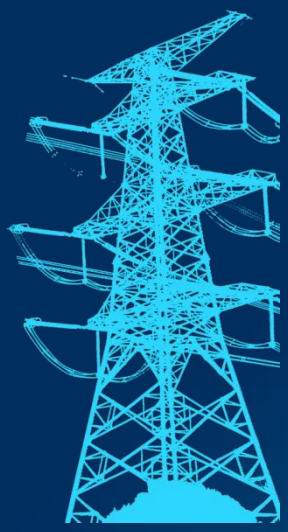
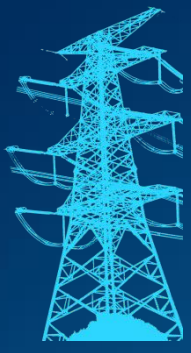
Static Transfer Switch

User manual

V2.2

2024.03.23





Contents

Foreword

In order to help you better use the product and protect your safety and the safety of the product, please carefully read and understand the relevant safety information and information about the equipment and user manual before operating the product.

Disclaimer

Following the contents of the user manual is a prerequisite for safe operation, as well as achieving the performance characteristics and product functions described;

Our company does not assume the responsibility for material loss, economic loss and personal injury caused by ignoring product information;

Copyright Notice

Technical changes

Please carefully read and understand the information related to the product;

Please keep this manual during the service life of the product to avoid unnecessary use;

As the product is constantly updated and upgraded, the place of upgrading is not subject to prior notice;

Warranty service

In the shelf life of the product, due to product quality problems can enjoy free after-sales service;

Do not attempt to disassemble, repair, modify or upgrade the equipment, otherwise all warranty services will be invalid.

Safety

These instructions are very important for the installation and use of static toggle switches (STS). Ignoring these instructions may cause bodily injury or even death to you. The following safety information Outlines the safety measures required for the operation of the equipment and its components. Please follow the safety tips and safety information to ensure your personal safety and avoid material and economic losses.

1.Symbols

Safety information is marked with symbols, and according to the danger level, the danger level is shown as follows:

 Attention	Always be aware of dangerous situations that may arise, which may result in minor injuries if left unattended.
 Careful	Always be aware of dangerous situations that may arise, which may result in moderate injury if left unattended.
 Warnings	Always be aware of possible dangerous situations that could result in serious injury if left unattended.
 Danger	Please always beware of electrical hazards.

2.Precautions

When operating electrical equipment, some parts of STS equipment inevitably produce dangerous voltages. Serious physical injury or equipment damage can occur if not handled properly.

- STS equipment is suitable for 0.4KV power supply system, it is strictly prohibited to connect to the power grid without knowing it, so as to avoid equipment damage and personal safety harm!
- Improper use will damage the static switching switch and connected equipment;
- All system installation or routine maintenance must be carried out under the condition of power failure;
- It is strictly prohibited to place combustible materials near STS equipment or install them in an environment containing explosive gas, otherwise fire or even explosion may occur.
- Ensure that the input power supply is completely disconnected before installation and wiring operation, otherwise there is risk of electric shock; Do not touch other parts of STS equipment after power is

turned on.

- Exposed cables, power terminal connectors, and ungrounded live equipment may result in electric shock. Ask an electrical engineer or professional technician to verify that the STS equipment is adequately grounded and to identify live parts of the connectors and components; Use appropriate safety protective clothing and test tools when operating, and follow the safety practice;
- Do not maintain STS equipment in working condition;
- When performing maintenance on the product, be sure to cut off the main circuit and wait at least 15 minutes to ensure that the voltage of the equipment drops to 0V and the internal capacitance is fully discharged;
- In wet conditions, the resistance of the human body will decrease and dangerous high current may pass through the human body, so do not maintain or install STS in wet areas. When it is impossible to avoid working in these conditions, stand on a dry rubber pad or dry board and use insulating gloves to keep your clothes dry and work with a companion.

3.Installation personnel

To avoid personal injury and material damage, only persons with professional electrical qualifications are allowed to operate work on the STS equipment and its components, assemblies, systems, and current circuits, and they must have knowledge :

- National and international Regulations for the Prevention of Electrical Safety Accidents;
- National standards for power supply technical standards of safety prevention system and low-voltage electrical safety technical specifications;
- Installation, commissioning, operation, disconnection, grounding and marking of electrical equipment;
- Basic requirements regarding personal protection.

Chapter 1 Arrival Inspection and Storage

1.1 Transportation

Each set of Static Transfer Switch (STS) is usually transported through carton packing (carton by default, wooden case can be selected), the carton is placed with buffer foam cotton and other protective items, but during the transportation and handling process can not be inverted or tilted, so as to ensure that the filter is not damaged in the process of moving.

1.2 Receive & Check

The STS equipment has been professionally tested and inspected before leaving the factory, and prepared for transportation according to the requirements of safe transportation. However, during long distance transportation, the fixed parts on the STS equipment may become loose due to vibration and turbulence, etc. Therefore, after receiving the equipment, please check as follows:

- After the equipment is shipped to the site, check the goods according to the delivery list. If there are any anomalies, such as broken packaging, obvious deformation of equipment, equipment quantity not consistent with the shipping list, have the carrier sign for confirmation and contact the manufacturer immediately;
- When removing equipment packaging, take care to avoid violent removal. When you use scissors, pliers, etc., to remove the packaging, please do so carefully to avoid scratching and damaging the equipment;
- Check the equipment for external damage, such as scratches on the panel, peeling paint, dents, etc., and observe the equipment for fallen components and loose wiring. If there is damage in transportation, logistics claims should be requested. If you need assistance in the claim process, please contact the company;
- Check specifications and models. Our STS equipment enclosures have prominent nameplate tags that clearly describe the device model number, rated capacity, etc. Please double check that the invoice, goods received are consistent with the delivery list.

1.3 Packing

Module packaging is divided into cartons and wooden cases, which are generally cartons by default. If wooden case packing is required, please make remarks in advance.

1.4 Storage

- STS equipment should be packaged to avoid long-term storage. After 6 months of storage (from the date of delivery), the equipment should be inspected and tested by professional personnel before being put into use.
- If the STS equipment is not installed and used immediately, the STS equipment should be placed in a dry, ventilated warehouse free of dust and corrosive substances, and free from strong mechanical vibration and magnetic field.
- Storage temperature: (-45℃~70℃), air relative humidity: (5%~95%) (lower than 25℃);
- If long-term storage is required, please check the packaging of the equipment regularly for mildew, damage and other conditions.

Chapter 2 Product overview

2.1 Product overview

Static Transfer Switch (STS) is an automatic switching system with dual power supply. It switches power between two independent AC power supplies. When the first power supply fails, the STS automatically switches to the second power supply to the load. Unlike the traditional ATS, STS provides rapid load switching to ensure the continuous operation of sophisticated electronics. The load transfer back to the main input power supply is virtually instantaneous (≤10ms) and can be used for a variety of digital equipment, control equipment, or other electrical equipment that requires very high continuity of power supply.

This product adopts the "first off then on" switching mode, can realize the uninterrupted switching between different input power supply, for single power supply load to provide double bus power supply, such as: N+1 redundancy of non-parallel UPS system, N+1 redundancy of different capacity UPS system, N+1 redundancy of different models of UPS system, redundancy of different mains, redundancy of mains and generator. It can be said that our products to achieve the so-called "distributed power supply" program of favorable tools, can greatly improve the reliability of the power supply system of equipment room, PLC, precision instruments and other equipment.

Product advantages	Product features
Efficient and intelligent	Realize dual switching control of power grid and energy storage converter
	The maximum discharge efficiency can reach 99%
	Smart and fast separation of power grid and micro grid, switching power supply loop (≤20ms)
	Intelligent operation, with CAN, 485, Ethernet and other communication interfaces
Convenient operation and maintenance	Lightweight design, easy to install
	Before maintenance design, easy operation and maintenance
Safe and reliable	High level of protection
	Complete fail-safe features
	High reliable backup design (fast switch and bypass switch in parallel design), ensure that important load is not interrupted

2.2 Product naming

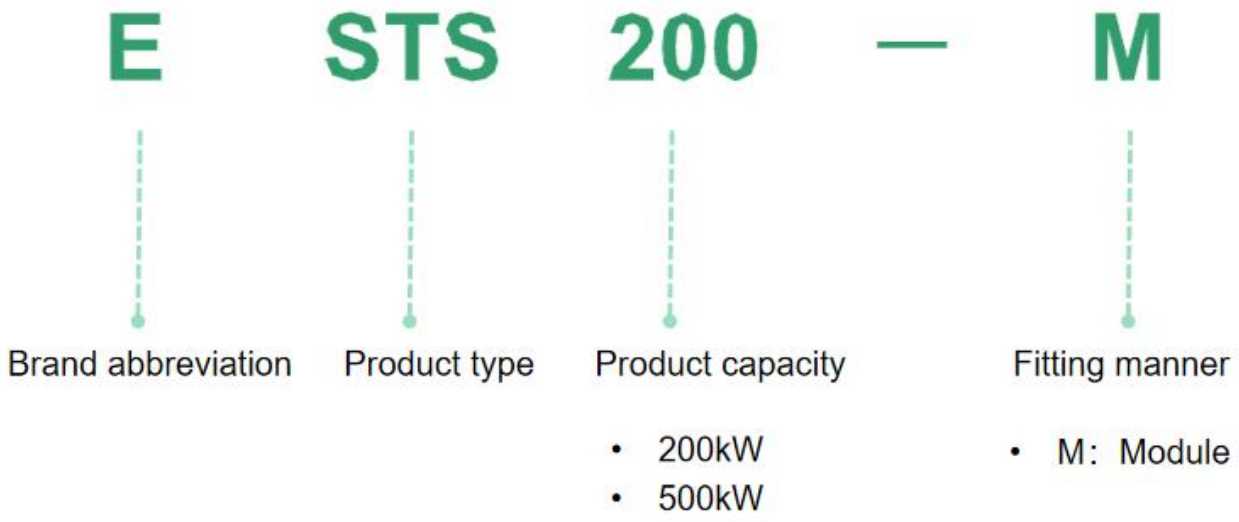


Figure 2-1 Naming rule

2.3 Operating principle

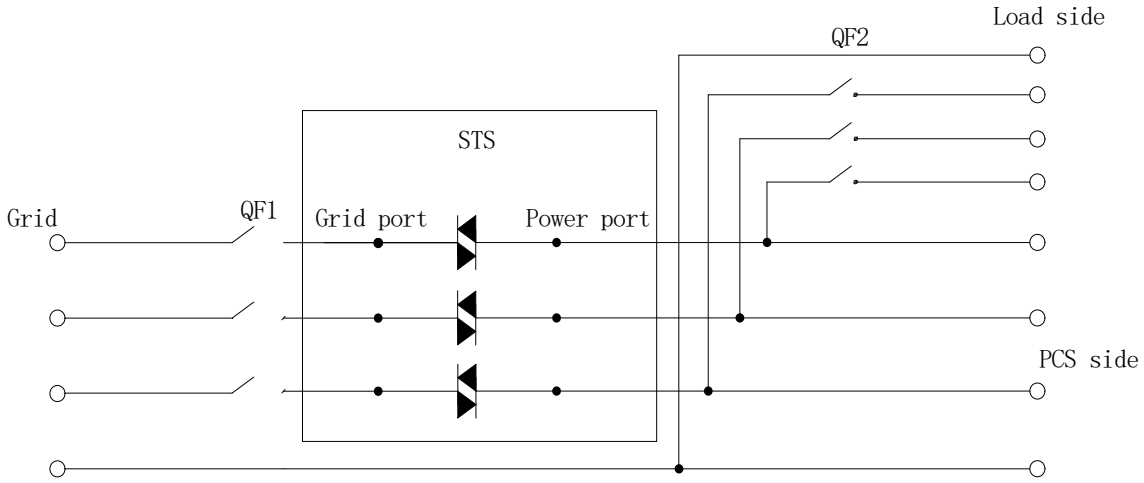


Figure 2-2 Topology view of STS

Note: QF1: mains switch; QF2: load switch

(1) grid-connected mode

STS is closed, and the mains is connected to the load and PCS through STS. Our STS "open first and then close", when using with PCS, it needs to run in PCS "off-grid mode", after STS closing, PCS will turn into "grid-connected mode", and the system will enter the grid-connected state.

(2) grid-connected to off-grid mode

When the static switching cabinet detects power loss from the power grid, the STS is disconnected, and the PCS is ordered to switch to off-grid mode to supply power to the load.

(3) Off-grid mode

At this time, STS disconnects and isolates the power grid from the system. STS continuously detects the power grid data to determine whether the power grid is restored.

(4) Off-grid to grid-connected mode

When STS detects that the power grid is restored, PCS is phase locked, and STS is closed after the phase lock is completed. At the same time, PCS changes from off-grid mode to grid-connected mode.

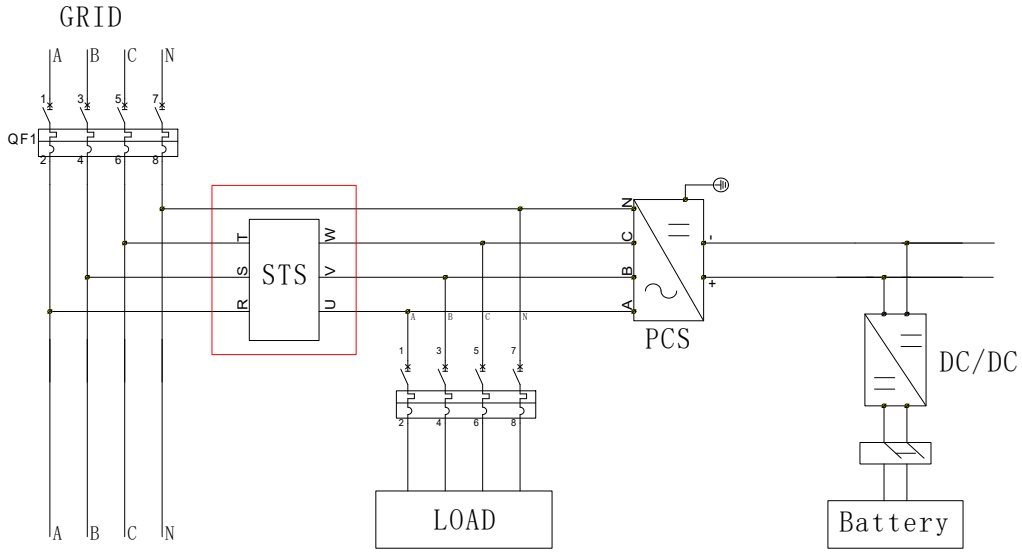
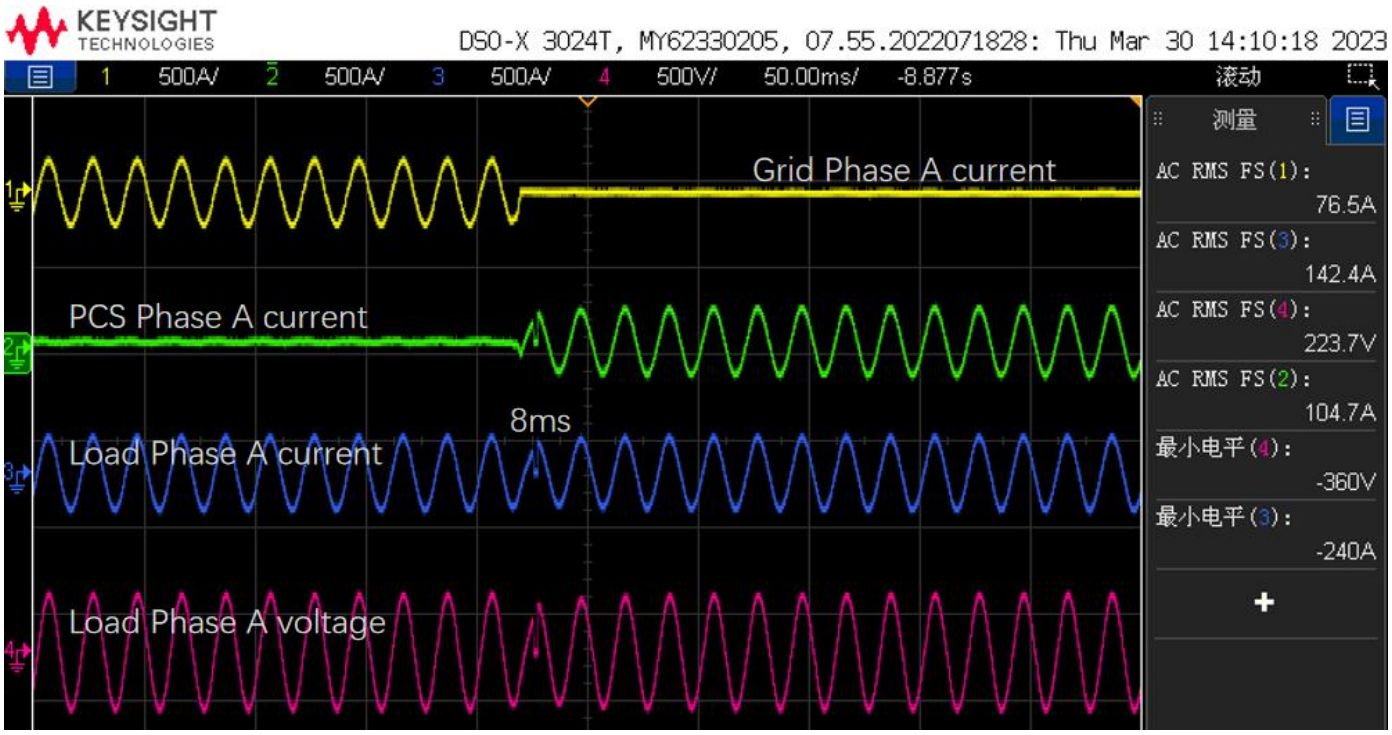


Figure 2-3 Electrical diagram

2.4 Oscillograph waveform of on-grid to off-grid



The response time from x1 to x2 is about 8ms.

Chapter 3 Product Specifications

ESTS200-M series products are currently mounted in rack, and the module supports 400V voltage class.

Name	Model number
Static switching module STS	ESTS200-M-24V power supply
	ESTS500-M-24V power supply
	ESTS200-M-220V power supply
	ESTS500-M-220V power supply

3.1 Product appearance

Figure 3-1 Front view of the STS

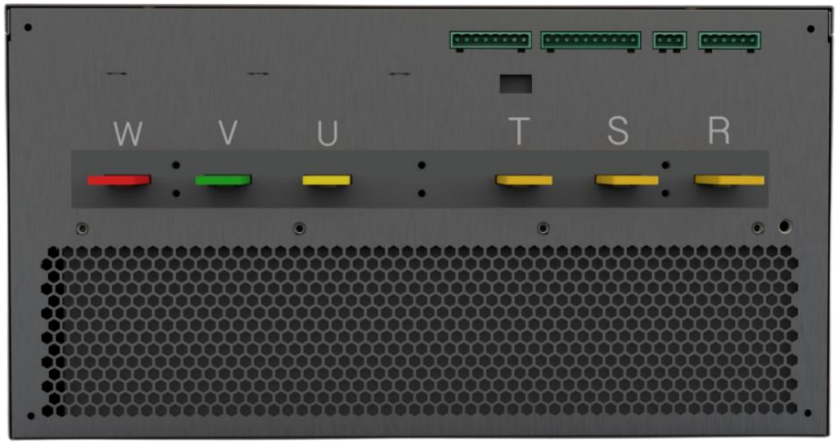


Figure 3-2 Rear view of the STS

Note: The picture is for reference only, the specific object shall prevail!

3.2 Product size

STS has four shapes according to power supply mode and capacity. The figure below shows the dimensions.

3.2.1 Size drawing of ESTS200-M (24V power supply type)

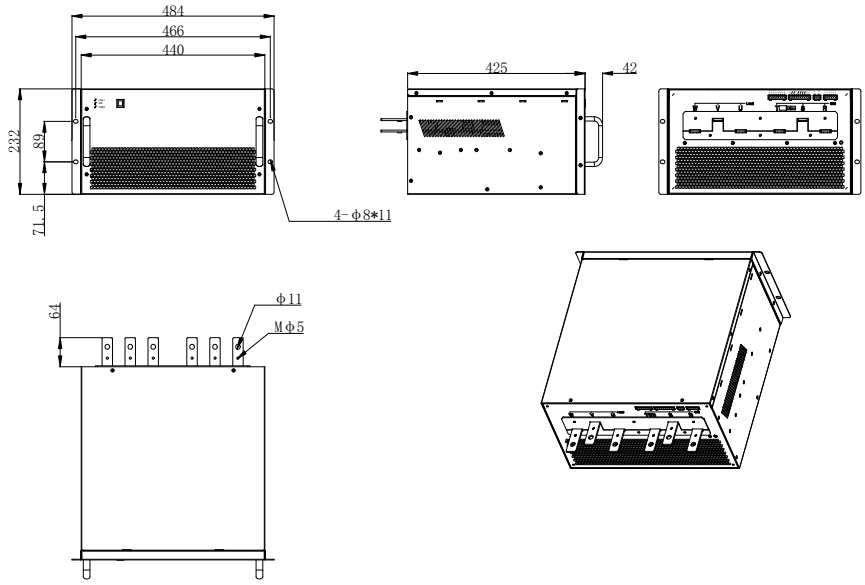


Figure 3-3 Dimensions of the ESTS200-M (24V) power supply

3.2.2 Size drawing of ESTS200-M (220V power supply type)

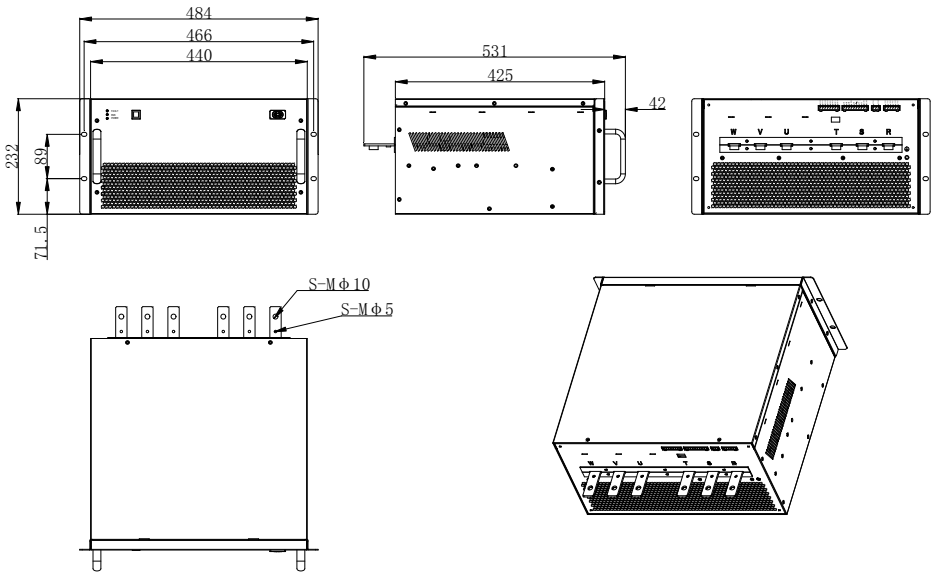


Figure 3-4 Dimensions of the ESTS200-M (220V) power supply

3.2.3 Size diagram of ESTS500-M (24V power supply type)

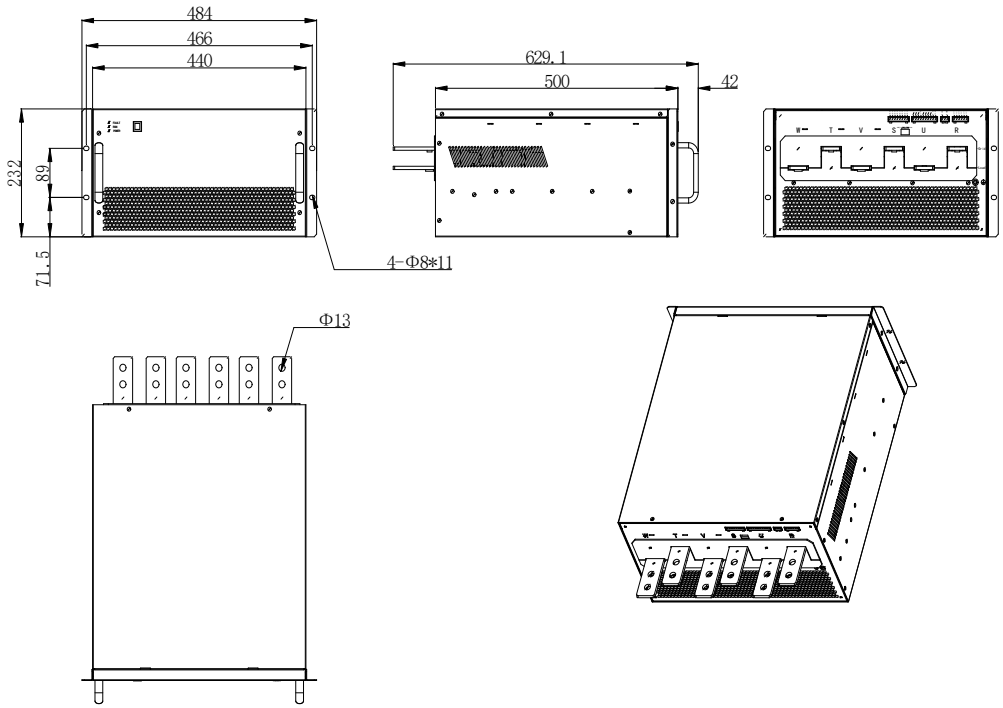


Figure 3-5 Dimensions of the ESTS500-M (24V) power supply

3.2.4 Size diagram of ESTS500-M (220V power supply type)

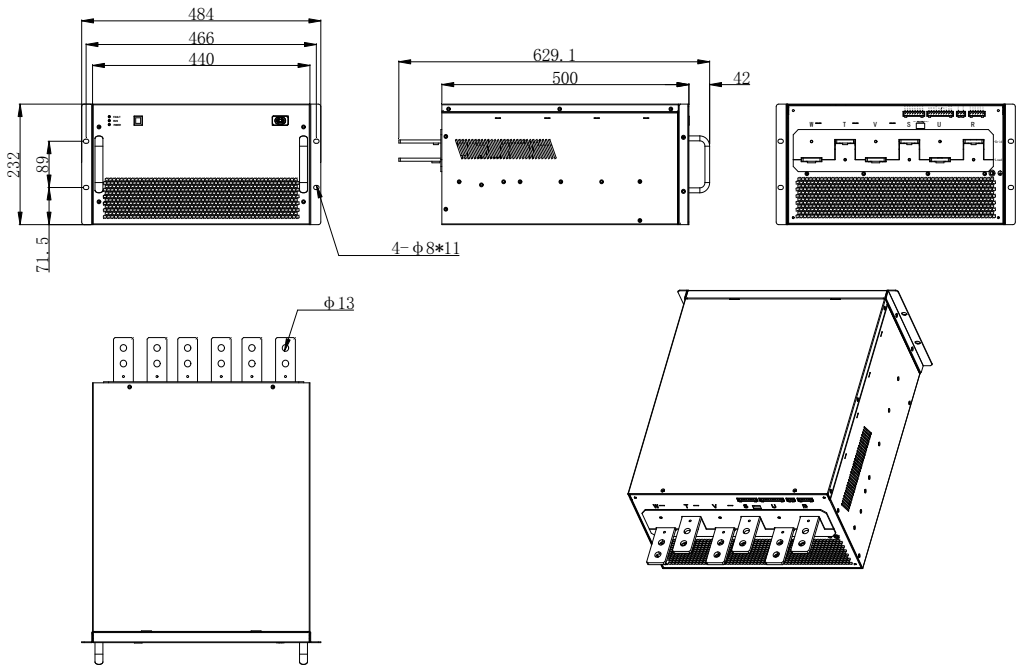


Figure 3-6 Dimensions of the ESTS500-M (220V power supply

3.3 Technical Specifications

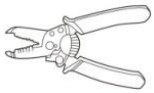
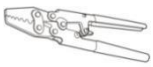
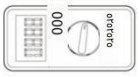
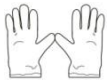
Product model	**EJ-STS200**	**EJ-STS500**
Grid port power (kW)	200	500
Maximum current at grid port (A)	318	794
Electric side port power (kW)	200	500
Maximum power (kW) for important loads	100	250
Power instructions	Major load power + PCS side power ≤ maximum product power	
Rated voltage (v)	400	
Grid end voltage range (vac)	400±15%	
Rated frequency (Hz)	50/60	
Frequency range (Hz)	45 ~ 60	
Long-term overload capacity	Long Term 110%	
And off-grid switching time (ms)	20	
Off-grid switching time (ms)	20	
Efficiency	99%	
Dimensions W*D*H (mm)	484 * 531 * 232	484*629.1*232
Weight (kg)	22	32
Communication port	RS485, CAN	
Communication protocol	ModBus TCP,CAN	
Operating temperature	- 25 ℃ ~ + 55 ℃	
Storage temperature	- 30 ℃ ~ + 70 ℃	
Relative humidity	5 ~ 95%	
Protection level	IP20	
Wiring method	Three phase three wire	
Altitude	2000m	
Power port	RST on the power grid side and UVW on the load side	

Note: The specifications of 24V power supply and 220V power supply are the same.

Chapter 4 System installation

 Warnings	As ignoring the installation instructions can easily cause equipment damage, which may endanger personal safety in serious cases, please strictly follow the following rules: ◆ Before starting work, please disconnect the isolation switch and make sure it cannot be closed by someone, and check that STS has been powered off! Temporarily cover adjacent live parts with insulation; ◆ In the process of operation and troubleshooting, please check in advance whether there is dangerous voltage in the environment, if necessary, please turn them off; ◆ When working on the electrical system, please wear protective clothing and equipment according to the applicable guidelines; Before connecting the equipment/parts, please keep the ground and ensure the equipment power off; Do not contact the energized bare or peeling wire, stranded wire should be equipped with wire sleeve; ◆ All parts of the circuit connected to the power supply/grid may have dangerous voltage; ◆ Use suitable line isolation switches/circuit breakers/fuses; ◆ Dangerous voltages may still exist in the equipment or components (capacitors) even when disconnected from the power supply/grid; Do not operate the equipment when the current transformer circuit is open; Do not exceed the equipment can bear the limit value; ◆ Please pay attention to the warning and safety mark of all documents related to the equipment; Please pay attention to all the warning and safety marks of the site environment.

4.1 Tools

Number	Tools	Description	Features
1		Flat-head screwdriver	Remove and install screws as well as wiring
2		Phillips screwdriver	Remove and install screws as well as wiring
3		Wire strippers	Wire stripper
4		Hex wrench	Holding module
5		Crimping pliers	Crimp communication and control terminal wiring And crimp CT extension cords
6		Multimeter	Check that the cable is wired correctly, Reliable grounding
7		Marker	Punch marks
8		Tape measure	Measuring distance
9		Insulation Protective gloves	Wear when installing the machine

Prepare the tools that may be used for installation and wiring in advance. Only some of the tools that may be used are listed here for reference only.

4.2 Installation Environment

Projects		Environmental requirements
Site requirements		This product is an in-cabinet installation (closed environment) product that needs to be installed for use in the final system
		The final installation system must be maintained in a well-ventilated environment
		The air inlet and outlet must be professionally treated against rain, dust and wind and sand
		Have the necessary fire, water and rat-proof treatments
		If there are serious dust and fly ash problems at the installation site, it is recommended to equip STS with special protective treatment to avoid equipment failure and reduced efficiency
		Do not install the equipment in a place interfered by strong electric field or electromagnetic wave
		When the device is to be installed in an environment with strong electromagnetic interference, such as a transformer, please install shielding protection devices to avoid misoperation of STS devices
Foundation requirement		The installation surface must be smooth and dry, and no water is allowed on the ground
		Make sure the ground is level and does not shake and that the plot is sturdy enough to bear the weight of the final installation system
Space requirements		This product is an in-cabinet installation product that needs to be installed for use in the final system
		STS equipment should be kept away from flammable, explosive and corrosive materials
Environmental Requirements	Altitude	It can run with full load when the altitude is below 2000m; When it is greater than 2000m, it can be derated
	Humidity requirements	95% Max, no condensation
	Operating temperature	-30℃ ~ +50℃

4.3 Mechanical Installation

When STS is installed, it can be fixed to the cabinet mounting point through the front mounting aperture on both sides of the module (figure below). **The handrails on the front panel of the module are held for auxiliary installation only and cannot be used for load bearing!**

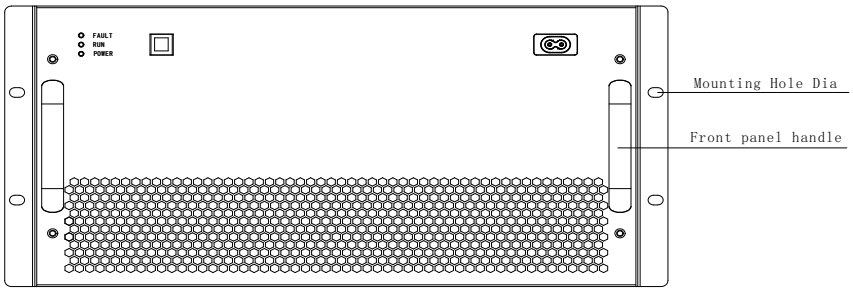


Figure 4-1 Front panel of STS

Take the 100kW optical Storage all-in-one (200 KW-STS) as an example:

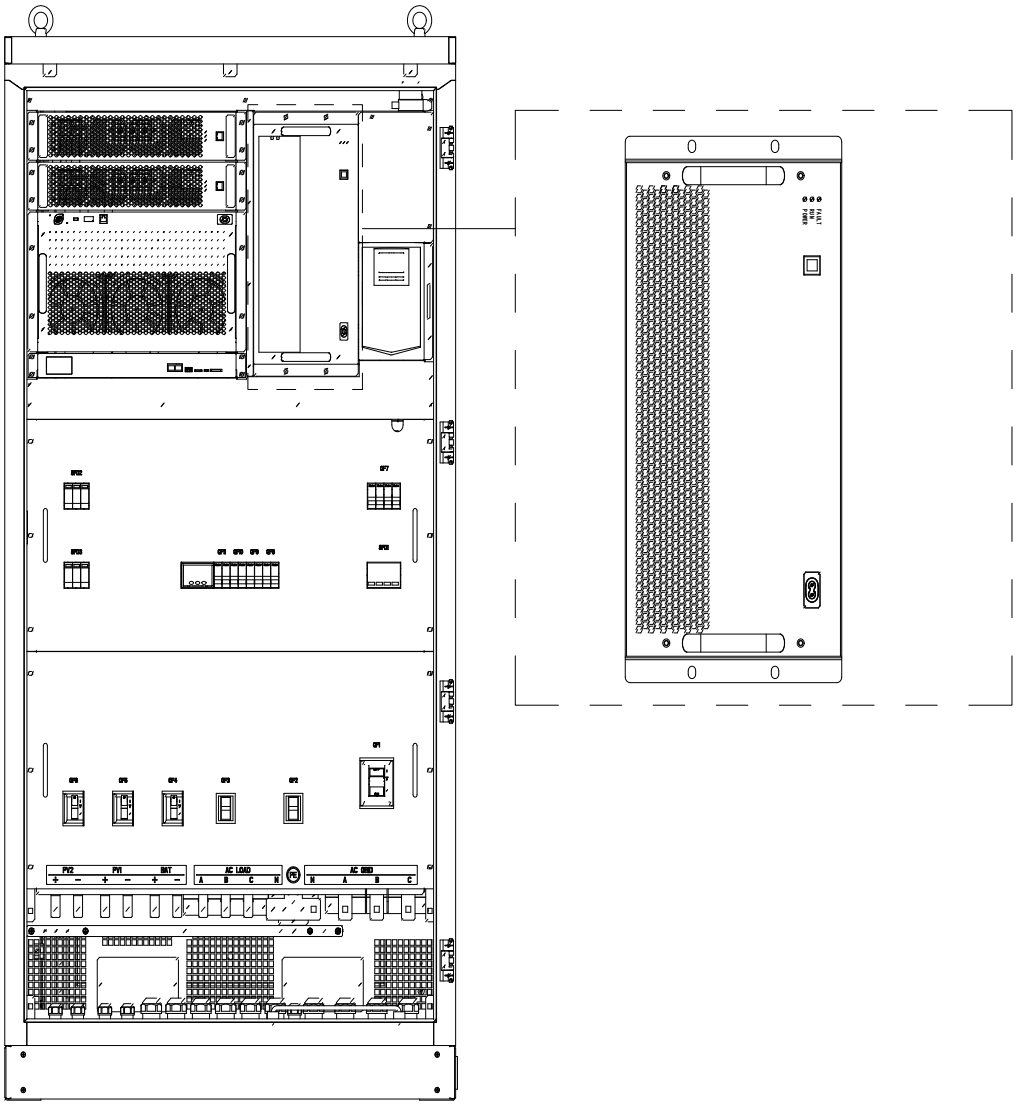


Figure 4-2 STS installation in an optical storage unit

4.4 Electrical Connections

4.4.1 Port overview

STS module ports are distributed on the front and back. The front ports are debug ports, and the back ports include power ports and control ports as well as dip switches. The rear appearance of 200kW is different of 500kW. The following figure shows the rear appearance in two pictures.

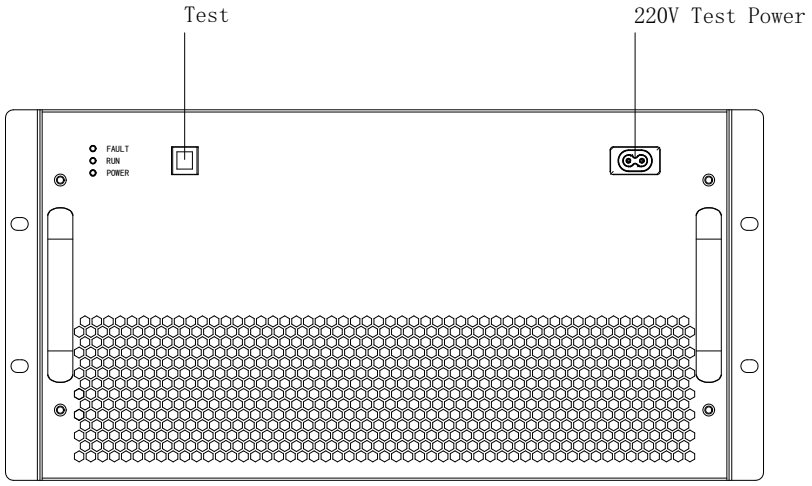


Figure 4-3 General view of the front

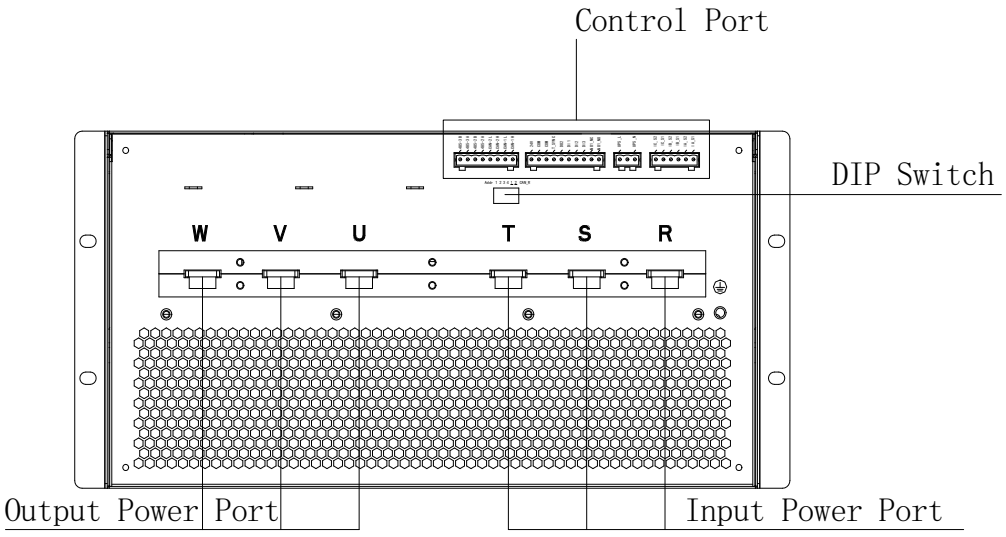


Figure 4-4 Back overview of 200 KW-STS

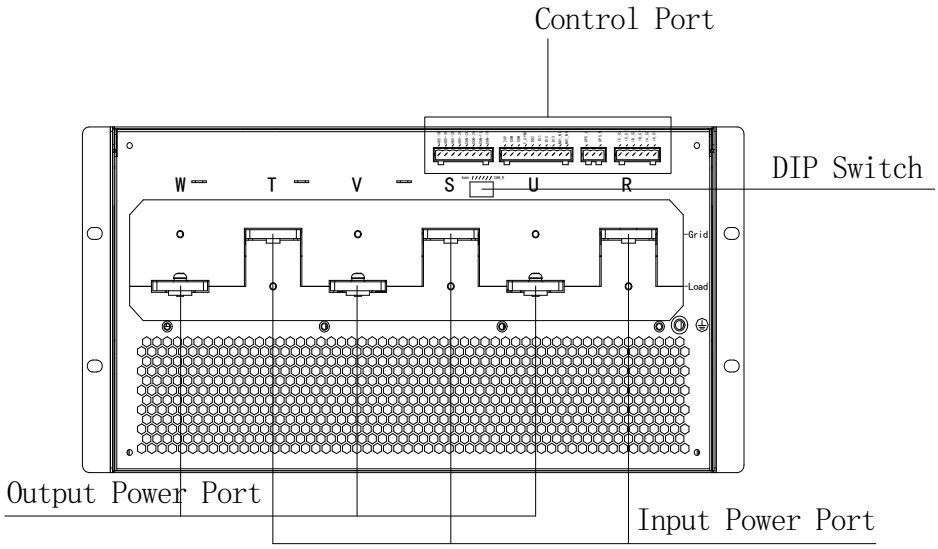


Figure 4-5 500 KW-STS Back overview

4.4.2 Debugging ports

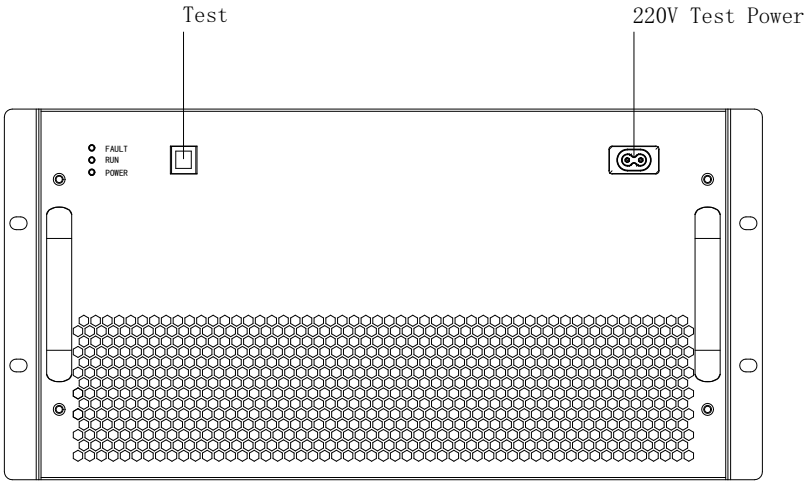


Figure 4-6 Commissioning port distribution

*** The front appearance of the STS product 500kw is the same as the figure above, which is not shown here.**

Test debugging communication port: The Test port is a special interface for professional and technical personnel of the manufacturer to debug and test the equipment before leaving the factory. If you want to conduct secondary debugging of some performance parameters of the equipment, please contact the manufacturer's after-sales personnel in time! Do not debug the Test port without the manufacturer's authorization! If you modify the parameters without authorization, it may cause equipment failure or even damage, the company will not be responsible for it!

220V commissioning power port: 220V port is a special interface for testing equipment by professional and technical personnel of the factory before leaving the factory. Please do not debug the 220V interface without authorization from the manufacturer! If you modify the parameters without authorization, it may cause equipment failure or even damage, the company will not be responsible!

4.4.3 Power Port

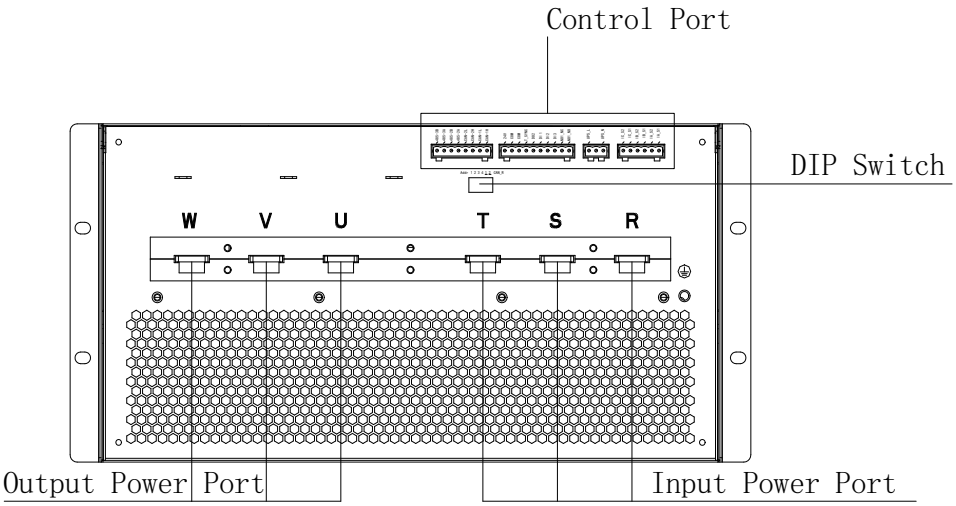


Figure 4-7 Power port distribution of the 200 KW-STS

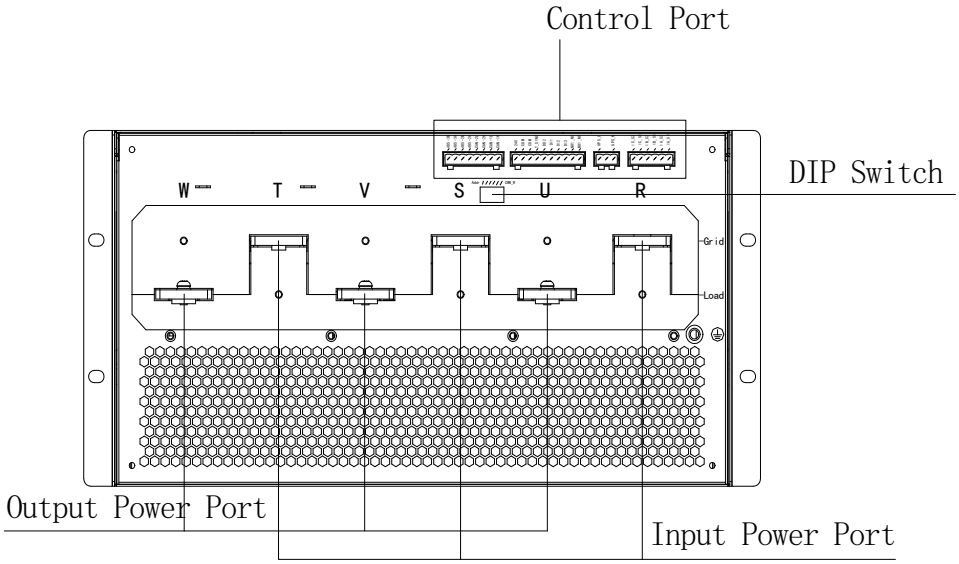


Figure 4-8 Power port distribution of the 500 KW-STS

Description of power port definition:

Terminal type	Terminal symbol	Terminal function description
Ac input	R	Input phase A in three-phase electricity
	S	Input phase B in three-phase electricity
	T	Input phase C in three-phase electricity
Ac output	U	Output the A phase in the three phase
	V	Output the B phase in the three phase
	W	C phase in the output three-phase electricity

Note: R S T indicates the power terminal on the power grid side, and U V W indicates the power terminal on the load side. Please be sure to identify carefully before wiring, so as to avoid equipment damage and other dangerous accidents caused by wiring errors!

4.4.4 Control port

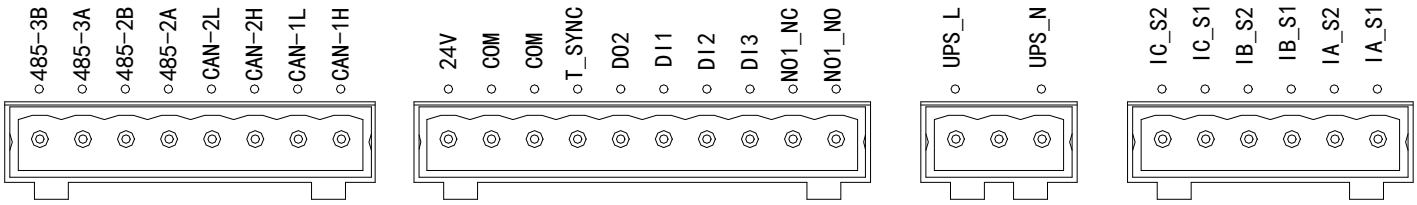


Figure 4-9 STS module control port

	Terminal symbol	Terminal instructions	Functions	
Communication	485_3B	Channel 3 485 negative end	485 communication is used for BMS/EMS	
	485_3A	Channel 3 485 positive end		
	485_2B	Negative end of channel 2 485	485 communication is used to communicate with HMI	
	485_2A	Channel 2 485 positive end		
	CAN-2L	Channel 2 CAN negative end	Reserved	
	CAN-2H	Channel 2 CAN positive end		
	CAN-1L	Channel 1 CAN negative end	CAN communication with PCS	
	CAN-1H	Channel 1 CAN positive end		
Number Input output	24V	Positive end of 24V power supply		24V output power supply
	COM	Common end 24V power supply negative end The common end synchronizes the control signal negative end	Digital input and output common terminal	
	COM			Synchronous control Signal input
	T_SYNC	Sync control signal positive end		
	DO2	DO2 Digital output	DO Digital output	
	DI1	DI1 digital input	Default EPO input	
	DI2	DI2 numeric input	One click start signal input	
	DI3	DI3 digital input	Reserved	
	NO1_NC	NO1 outputs the common end	NO output	
	NO1_NO	NO1 Output the usual beginning		
UPS	UPS_L	UPS-L power supply	UPS-220V power supply	
	UPS_N	UPS-N Power supply		
Transformer	IC-S2	Connect to the S2 end of C-phase CT	Load current sampling	
	IC-S1	Connect to the S1 end of C-phase CT		
	IB-S2	Connect the S2 end of B-phase CT		
	IB-S1	Connect the S1 end of B-phase CT		
	IA-S2	Connect the S2 end of the A-phase CT		
	IA-S1	Connect the S1 end of the		

		A-phase CT	

4.4.5 Dip Switch

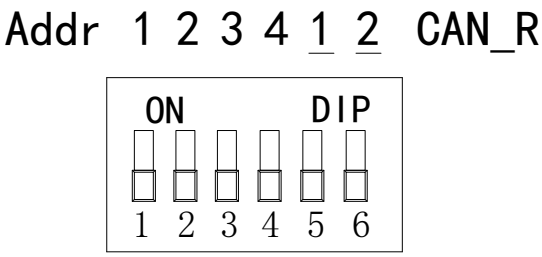


Figure 4-10 Dip switch diagram

Port signal description:

Symbols	Instructions	Notes
1 ~ 4	STS Module Address Setting (binary)	Follow the binary arithmetic principle, with the lower part on the left
5 ~ 6	Terminal resistance access	Symbol 5: CAN1 Terminal resistance position Symbol 6: CAN2 terminal resistance

Dip switch setup instructions:

Manually configure the STS communication address using the DIP switch. Bits 1 to 4 are used for address communication coding (binary, low on the left); Bit 5 is the CAN 1 terminal resistance bit; Bit 6 is the CAN 2 terminal resistance.

Dip bits 1 to 4 are turned ON downward as "ON" and are represented as "1"; When the dip is turned on by "OFF", it is turned off by "0"; The 5 - to 6-digit dip switch is turned ON by "ON" when it is turned on by "OFF" when it is turned off when it is turned off by "off".

Chapter 5 Device Operation

Static switching switch is applied in the energy storage system and off-grid switching application scenario, and its startup and operation need to cooperate with PCS and EMS of our company.

5.1 Check before power-on

Please double-check the following items before powering on for the first time:

(1) Whether the STS equipment is securely installed on the cabinet mounting column;

(2) Whether the power input wiring (R, S, T) and output wiring (U, V, W) are correct, whether there is leakage or mixed connection and other phenomena;

(3) Power input wiring (R, S, T) and output wiring (U, V, W) wiring whether there is reverse connection, mixed connection phenomenon;

(4) Power input wiring (R, S, T) and output wiring (U, V, W) wiring is firm, displacement or loosening does not occur with hand shaking, wiring are maintained path, no virtual connection does not leak;

(5) Need to maintain the distance between phases, phase spacing is not less than 14mm;

(6) Use A multimeter to detect whether there is short circuit between A, B, C and N pairs of equipment;

(7) Check whether the wiring of the control port is correct and whether the wiring at both ends of the terminal block is one-to-one corresponding;

(8) The STS installation environment conforms to the content described in Section 3.2;

Note: **The 220V power supply side of the 220V power supply type STS cannot have a leakage protection switch**

5.2 Turn on STS with power

After the above double check is correct, start the power-on operation.

The procedure is as follows:

(1) Fasten and connect the power and signal cables to the STS housing.

 Warnings	The STS output terminal may be live when performing the STS power-on step, if there is a PCS energy storage converter connected to the STS output side terminal, please confirm that the PCS is working properly.

(2) Close the switch between the mains and the STS intelligent static switching module.

 Note	Indicator light changes from top to bottom in the top left corner of the front panel of the module. If the STS device is powered on normally, the POWER indicator is on and on; If the STS device is faulty, the FAULT indicator light will show red, and the STS cannot operate normally.

(3) Check whether the startup data of STS is normal through the EMS energy management system.

5.3 Shutdown of STS

The STS can be shut down in one of two ways:

(1) The first way is to directly disconnect the switch between the STS equipment and the mains. This way is the complete shutdown mode, that is, after the shutdown, the system is not powered on and can be used for system maintenance.

(2) The second way is to shut down STS equipment controlled by EMS (energy management system).

 Warnings	This shutdown mode only shuts down the operation of the power components in the system, the machine is in standby state, and the output terminals are charged!

*** Do not directly power off the equipment in operation, this behavior will cause some damage to the equipment!**

Chapter 6 Care and Maintenance

In order to ensure the normal and safe operation of STS equipment, we recommend regular maintenance of the equipment.

6.1 Pay attention before maintenance

 Danger	◆ STS equipment is operated with strong electricity. For safety, maintenance personnel should not touch any live terminal of the equipment during operation, and ensure that the ground terminal of the equipment is grounded reliably; ◆ Since there is capacitance in the busbar of STS equipment, repair and maintenance work must be carried out 15 minutes after power failure. ◆ After the power is disconnected, a warning sign should be set at the disconnection place to prevent anyone from powering on during maintenance. ◆ To avoid accidental risks, maintenance personnel should wear insulation equipment during maintenance. ◆ Only professionally qualified personnel can maintain STS equipment.

6.2 Contents and cycle of routine maintenance

Time and content of routine maintenance

Maintenance items	Maintenance content	Recommended hours
Routine check	The input, output voltage, current and running state of STS equipment should be monitored in real time to observe whether they are within the normal range.	Every day
	Listen to the abnormal sound and smell when the STS device is running.	
	Read the internal temperature of STS equipment and observe whether it is in the normal range	
Status Check	Check the appearance of STS equipment for breakage and rust.	One month
	Check to see if the inlet and outlet are clear.	

	Check whether the ambient humidity, temperature, dust, and ventilation conditions of the device meet requirements.	
Checking Cables	Look for damage to cables, terminals.	Three months
	Whether the main loop wiring, ground wiring, communication wiring, etc. are connected reliably.	
	Check whether there are signs of aging and burning at the wiring bolts, and shake them with your hand to confirm whether they are tightened.	