TECLOMAN

C&I PV+Battery Energy Storage System

User manual

Rev. 1.0

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Catalogue

Chapter I General Safety Rules

Thankyou for choosing the energy storage products of Chengdu Tecloman Energy Storage Technology Co., Ltd. This manual is applicable to the following types of energy storage systems.

THESS-30-63	THESS-60-114	THESS-90-229	THESS-120-229	THESS-150-344
THESS-30-114	THESS-60-129	THESS-90-258	THESS-120-258	THESS-150-387
THESS-30-129	THESS-60-143	THESS-90-286	THESS-120-286	THESS-150-430
THESS-30-143	THESS-60-157	THESS-90-325	THESS-120-315	THESS-150-473
THESS-30-157				

This manual mainly introduces the working principle, installation, use, operation, maintenance and management of the C&I PV+Battery Energy Storage System. Industrial and commercial energy storage battery system and related supporting facilities. In order to facilitate your better use and maintenance of this system, please read this user's manual carefully before using this system. Please keep all the random materials properly after reading them for future reference.

1. Statement

When installing, using and maintaining this product, users must know to read this manual and operate according to the safety precautions required in this manual. Our company shall not be responsible for any injury or loss caused by illegal operation.

Without the written permission of Chengdu Tecloman Energy Storage Technology Co., Ltd., no unit or individual may extract or copy part or all of the contents of this document without authorization, and may not spread it in any form. Due to product version upgrade or other reasons, the contents of the manual will be constantly updated and revised, and there may be discrepancies or errors with the real products. Users should take the final real products as the standard.

2. Trademark

TECLOMAN® and other Tecloman trademarks are trademarks of Chengdu Tecloman Technology Co., Ltd. All other trademarks or registered trademarks mentioned in this document are owned by their respective owners.

3. Symbol description

3.1 Symbols in the manual

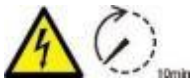
The safety symbols quoted in this manual are shown in the following table. These symbols are used to remind the reader of the safety precautions to be followed when installing, operating, and maintaining the device.

	**Danger**	If not avoided, it will lead to a dangerous situation of serious injury or death.
	**Warn**	If not avoided, it may lead to a dangerous situation of moderate injury.
	**Attention**	There are potential risks. If it is not avoided, it may lead to equipment failure or property loss.
	**Explain**	"Description" is additional information in the manual, which emphasizes and supplements the content, and may also provide tips or tricks for optimizing the use of products, which can help you solve a problem or save you time.

3.2 Product identification

Product surface safety and description marks, which are used to remind users of the safety measures to be taken during equipment installation, operation and maintenance.

Identification	Paraphrase
	This sign indicates that there is high voltage inside the body, and touching it may lead to electric shock danger.
	Before carrying out maintenance operation on the equipment, all external power connections must be disconnected!
	This symbol indicates that the temperature here is higher than the acceptable range of human body. Please do not touch it at will to avoid personal injury.

	Maintenance, overhaul and other operations can only be carried out after the system is powered off for 10 minutes.
	Noise may occur during the operation of the equipment, so it is recommended to wear mute earplugs.
	This symbol indicates that this is a protective grounding (PE) terminal, which needs to be firmly grounded to ensure the safety of operators.

4. Safety instructions

Reading instructions

Please read this manual carefully before installation and operation, and pay attention to various warning signs and statements on the equipment. Blind operation may cause damage to the equipment and even threaten personal safety. It is forbidden to disassemble any equipment by professional maintenance personnel who are not authorized by our company.

This manual contains important information such as transportation, installation, operation and maintenance of the main equipment of the energy storage system. Please read the relevant contents of this manual carefully before. performing various operations, and please keep this manual properly after the equipment acceptance.

Electric shock

Touching the contacts and terminals connected to the power grid or equipment may lead to electric shock death!

- Do not touch the terminals or conductors connected to the power grid circuit.
- Pay attention to all instructions or safety documents about connecting to the power grid.

Equipment damage

Damaged equipment or system failure may cause electric shock or fire!

- Visually inspect the equipment for damage or other hazards before operation.
- Check whether other external devices or circuit connections are safe.
- Make sure this equipment is in a safe state before you can operate it.

Related standards

The installation and operation of the equipment must conform to the relevant standards and specifications of the country/region where the project is located.

4.1 Applicable object

- Only professional electricians or qualified personnel can operate this product.
- Operators should be fully familiar with the composition and working principle of energy storage integrated system.
- Operators should be fully familiar with the relevant standards and specifications of the country/region where the project is located.
- Operators should be fully familiar with the product manuals of modular hybrid power system(Which include modular PCS with PV input and BESS for C&I) and internal electrical equipment of industrial and commercial energy storage battery system.

4.2 Battery protection

For large power stations, the voltage between the positive and negative electrodes of the battery pack is very high. If accidentally touched, there will be electric shock and even life-threatening.

△

Battery high voltage

Fatal high voltage exists between the positive and negative electrodes of the battery pack!

- When maintaining the equipment, ensure that the connection between the modular hybrid power system and the battery pack is completely disconnected.
- Set up warning signs at the disconnection point to ensure that there will be no accidental reconnection.

4.3 Ground fault protection

Ground fault protection

When the integrated energy storage system has a ground fault, there may be a fatal high voltage in the originally uncharged part. If accidentally touched, it is very dangerous! Before operation, please make sure that there is no grounding fault in the system, and at the same time, you need to take relevant protective measures.

4.4 Measure

When the integrated energy storage system is electrically connected and commissioned, it is necessary to use relevant electrical measuring equipment to ensure that all electrical parameters meet the requirements.

Live line measurement

There is high voltage in the equipment in the integrated energy storage system, and accidental touch may lead to fatal electric shock danger. Therefore, during live measurement, you should:

- Do a good job of protection (such as wearing insulating gloves, etc.).
- There must be an escort to ensure personal safety.

Use of measuring equipment

- Select high-quality measuring equipment whose measuring range and usable conditions meet the site requirements.
- Ensure that the measurement equipment is connected and used correctly and in a standard manner to avoid hazards such as electric arcs.
- If the measurement is live, take protective measures (for example, wear insulation gloves).

4.5 Power failure maintenance

Only under the condition of ensuring that all equipment and systems in the integrated energy storage system are completely uncharged can all operations be performed on them.

- Ensure that devices that have been powered off will not be accidentally powered on again.
- Use a multi-meter to ensure that there is no electricity inside the equipment.
- Implement necessary grounding.
- Use insulating materials to insulate and cover the possible live parts near the operation part.
- During the whole operation, it is necessary to ensure the smooth escape route.
- After the energy storage integrated system is completely out of operation, be sure to wait at least 20 minutes before operating the energy storage integrated system.
- Ensure that the integrated energy storage system is completely dead.

4.6 Arc protection

Arc protection

In order to avoid unnecessary casualties and equipment damage, this product must be operated in strict accordance with the description in this manual. If it is not handled properly, it may cause arc danger, and may even cause other risks such as fire and explosion. TECLOMAN will not take any responsibility for accidents such as arc, fire and explosion caused by failure to operate according to the machine logo or product manual.

The following improper operation may cause arc, fire, explosion and other dangers inside the machine. And always remember that once an accident occurs, it must be handled by qualified professionals. Improper operation of existing accidents may cause a wider range of failures or accidents.

- Plug and unplug DC-side high-voltage fuses of various devices.
- Touch the end of the cable that may be charged without insulation treatment.
- Touch the wiring copper bars, terminals or other parts inside the machine that may be charged.
- Loose connection of power cable.
- Parts such as screws accidentally fall into the power module.
- Incorrect operation of untrained unqualified operators, etc.

Before operating the equipment, it is necessary to evaluate whether there is arc risk in the operating area in advance. If there is an arc risk, you need to:

- Operators must have received relevant safety training in advance.
- Try to assess the area where electric shock may occur.
- Before operating in the possible electric shock area, you must wear protective clothing that meets the requirements.

4.7 Electrostatic protection

Electrostatic protection

Contact with printed circuit boards or other electrostatic sensitive components or improper operation will lead to device damage.

- Avoid unnecessary circuit board contact.
- Observe the electrostatic protection regulations, such as wearing an antistatic bracelet.

4.8 HMI parameter setting

Some settable parameters in liquid crystal are closely related to the operation of energy storage integrated system and its internal equipment. These parameters can only be modified and set after reliable analysis and evaluation of the system operation.

HMI parameter setting

Improper parameter setting may affect the normal function realization of internal equipment.

Only authorized professionals can set the parameters.

4.9 Sandstorm and moisture protection

In case of sandstorm, thunderstorm, gale, hail and other bad weather, or when the relative humidity of the surrounding environment is greater than 95%, do not open the cupboard door of the energy storage integrated system.

4.10 Body warning and identification protection

The warning signs on the body of the energy storage system and internal electrical equipment contain important information for safe operation of the energy storage system and internal equipment. No man-made tearing or damage!

Engine body warning sign

- Ensure that the warning signs of the engine body are legible at all times.
- Once the warning sign of the machine body is damaged or blurred, it must be replaced immediately.

4.11 Transport

After receiving the energy storage system, first check whether the received equipment is complete according to the delivery list, and check whether there is any damage during transportation. If you find any damage, please contact the transportation company or Tecloman Energy Storage Technology Co., Ltd. immediately, and please provide photos of the damage, so as to provide you with the fastest and best service.

Transportation

Incorrect mode of transportation may lead to equipment damage or casualties. Equipment shall be transported or moved in strict accordance with the operation procedures of transportation equipment.

4.12 Installation and commissioning

The installation and operation environment of energy storage system is outdoor, and its installation position and foundation must meet the requirements. In addition, the entire process of electrical connection must be operated in strict accordance with the regulations.

Trial operation

When the electrical equipment in the integrated system is electrically connected and commissioned, it is necessary to use relevant electrical measuring equipment to ensure that the electrical parameters meet the requirements.

- Select high-quality measuring equipment whose measuring range and usable conditions meet the site requirements.
- Ensure that the connection and use of measuring equipment are correct and standardized, so as not to cause danger such as electric arc.

4.13 Daily operation and maintenance

In the daily operation of the integrated system, it is necessary to ensure that the door is closed and locked to avoid the internal equipment being attacked by animals. Inspect and maintain the equipment regularly.

Insulation protection

If relevant operations are carried out while the equipment is live, insulation protection must be done, and at least two workers should be on site at the same time.

4.14 Product scrapping

When the whole energy storage integrated system or individual equipment in it needs to be discarded, it cannot be treated as conventional waste. Some components of internal machines can be recycled, and at the same time, some components will pollute the environment.

Please contact the local authorized professional recycling agency to properly dispose of the products and internal components.

5. Manual description

Manual preservation

Keep this manual and other related documents close to the device. To be ready for installation, operation, maintenance, overhaul at any time.

Technical support

This manual cannot cover all possible situations during installation, operation, maintenance, overhaul, etc. If you encounter a situation that is not explained in the manual, please promptly contact Tecloman Energy Storage Technology Co., LTD.

6. Delivery instructions

The documents supplied with the product are as follows:

- 1 certificate of conformity
- 1 copy of instruction manual (i.e. this manual).
- 1 copy of equipment installation construction drawing
- 1 ex-factory test report
- 1 electrical schematic diagram

Chapter II Energy Storage System

1. System Introduction

This energy storage integration system produced by TECLOMAN is mainly used in a variety of application scenarios such as industry and commerce, emergency power protection, modular hybrid power system and intelligent integration. The integrated energy storage system can be divided into outdoor or indoor structures.

The energy storage integrated system is composed of industrial and commercial energy storage battery system and modular hybrid power system. The industrial and commercial energy storage battery system is internally integrated with batteries, high-voltage boxes, air conditioners and reserved fire system interfaces. The modular hybrid power system integrates the energy storage converter, MPPT module and system power distribution part. The industrial and commercial energy storage battery system and the modular hybrid power system have a protection level of IP54, and are suitable for outdoor or indoor installation environments.

The system application diagram is shown in the figure below.

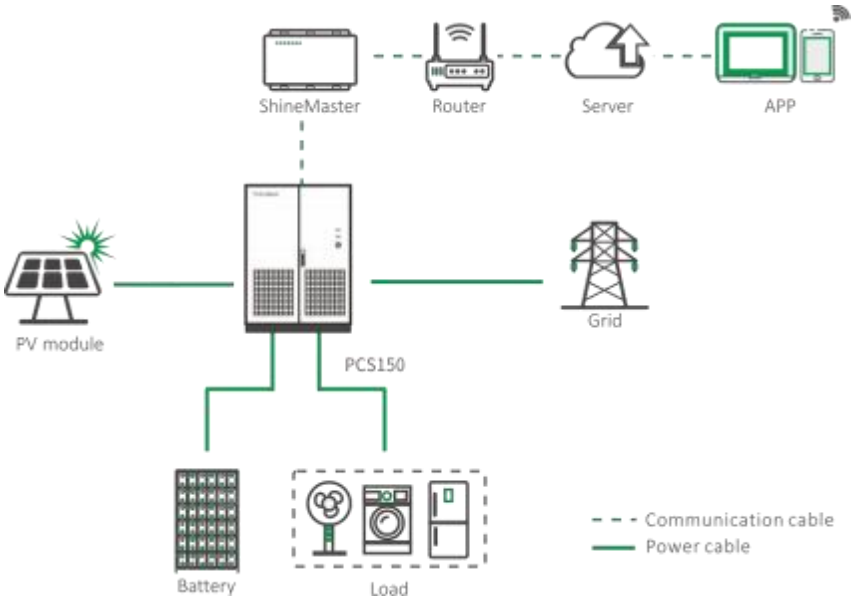


Figure 2.1 Commercial modular hybrid power system scheme

The commercial modular hybrid power system consists of two parts:

Modular hybrid power system: It has grid connected charging and discharging power control capability and off grid voltage stabilization function. The system can be connected to photovoltaic. Photovoltaic and energy storage adopt DC coupling mode, which can maximize the use of photovoltaic power generation. The modular hybrid power system has two models with 5 or 10 module installation positions, which can realize the installation of 10 energy storage inverters or MPPT modules at most.

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Industrial and commercial energy storage battery system: the form of energy storage industrial and commercial energy storage battery system is adopted. 3.2V/280Ah cells are used. 1P16S is composed of 51.2V/280Ah, 14.336kWh. The battery system can be configured with a maximum of 11 battery modules and a high-voltage control box to form a 563.2V/280Ah, 157.696kWh battery system. According to the project requirements, one to three industrial and commercial energy storage battery systems can be connected in parallel.

2. Standard modular hybrid power system configuration

Model	THESS-30-63 THESS-30-114 THESS-30-129 THESS-30-143 THESS-30-157	THESS-60-114 THESS-60-129 THESS-60-143 THESS-60-157	THESS-90-229 THESS-90-258 THESS-90-286 THESS-90-315	THESS-120-229 THESS-120-258 THESS-120-286 THESS-120-315	THESS-150-344 THESS-150-387 THESS-150-430 THESS-150-473
Communication (parallel)					
Apparent power	33kVA	66kVA	100kV	132kVA	165kVA
Rated power	30kW	60kW	90kW	120kW	150kW
Rated voltage	400V				
Rated current	43A	87A	130A	173A	217A
Voltage range	360V~440V				
Rated frequency	50/60Hz				
THDI	＜3%				
Power factor	0.8 lead~0.8 lag				
AC system	3/N/PE				
AC input	33kVA	66kVA	100kV	132kVA	165kVA
AC (off network)					

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Apparent power	33kVA	66kVA	100kVA	132kVA	165kVA
Rated power	30kW	60kW	90kW	120kW	150kW
Rated voltage	400V				
Rated current	43A	87A	130A	173A	217A
THDU	⩽2%				
Rated frequency	50/60Hz				
Overload capacity	110% 10 minutes 120% for 1 minute				
DC (battery and photovoltaic)					
Maximum photovoltaic open circuit voltage	1000V DC				
Rated photovoltaic power	30kWp	60kWp	90kWp	120kWp	150kWp
Maximum photovoltaic power	1.1~1.4 times rated				
Photovoltaic voltage range	400V~750V DC			500V~750V DC	
Maximum photovoltaic current	100A	200A	200A×2	200A*2	200A×3
Battery voltage range	352V~600V				
Optional battery configuration	63.36kWh 114.69kWh 129.02kWh 143.36kWh	114.69kWh 129.02kWh 143.36kWh 157.70kWh	229.38kWh 258.05kWh 286.72kWh 315.39kWh	229.38kWh 258.05kWh 286.72kWh 315.39kWh	344.06kWh 387.07kWh 430.08kWh 473.09kWh

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	157.70kWh				
Maximum charging power	33kW	66kW	100kW	132kW	165kW
Maximum discharge power	33kW	66kW	100kW	132kW	165kW
Maximum charging current	100A	200A	300A	400A	500A
Maximum discharge current	100A	200A	300A	400A	500A
Basic information					
Noise	<75dB(A)@1m				
Operating temperature	-25℃~+55℃				
Cooling mode	Forced air cooling+intelligent air conditioning				
Relative humidity	0~95%, no condensation				
Highest elevation	⩽3000m (frequency reduction over 3000m)				
On-grid and off-grid switching time	Automatic ⩽10ms				
Communication					
Man-machine interface	Touch screen				
Communication interface	RS485/CAN/LAN				

If you need to increase the photovoltaic MPPT loop, please consult the manufacturer;

For other power or power configurations, contact the manufacturer.

3. Appearance and size

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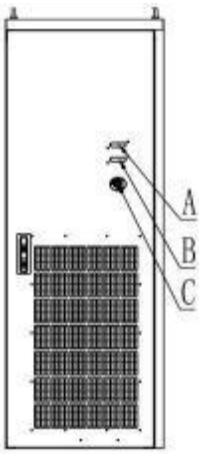
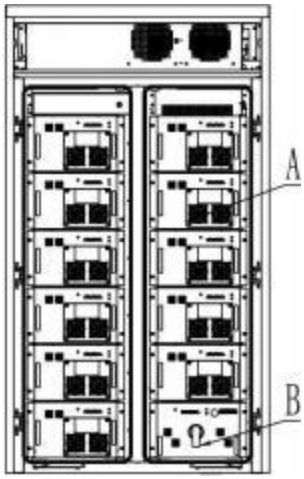
THESS-30-63 configuration	
Appearance of 30kW modular hybrid power system	**Explain**
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 635mm*1000mm*2190mm
Appearance of 63kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Battery module B:High voltage box Size(W*D*H) 1150mm*1000mm*2190mm
Configuration of THESS-60-157	
Appearance of 60kW modular hybrid power system	**Explain**

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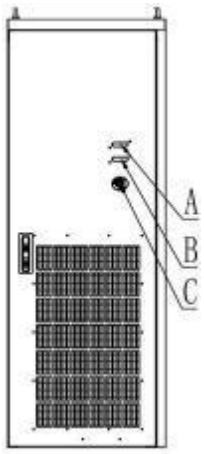
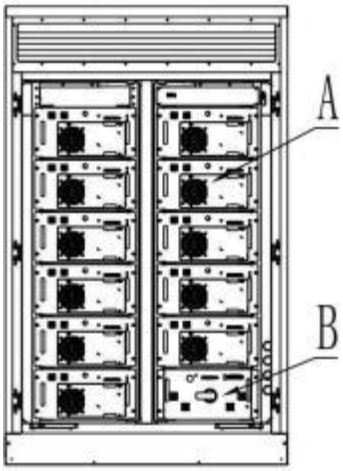
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 635mm*1000mm*2190mm
Appearance of 157kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Battery module B:High voltage box Size(W*D*H) 1350mm*1000mm*2190mm
Configuration of THESS-90-315	
Appearance of 90kW modular hybrid power system	**Explain**

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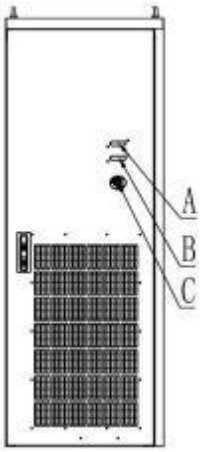
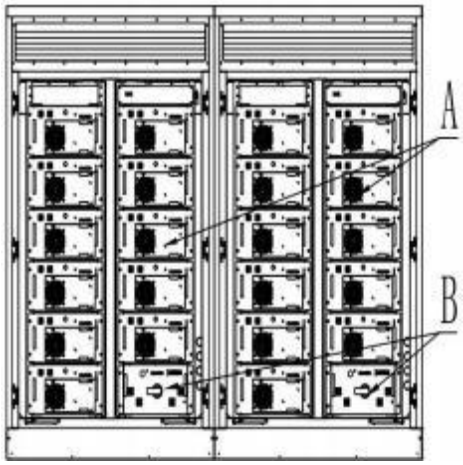
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 635mm*1000mm*2190mm
Appearance of 315kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Battery module B:High voltage box Size(W*D*H) 2700mm*1000mm*2190mm
Configuration of THESS-120-315	
Appearance of 120kW modular hybrid power system	**Explain**

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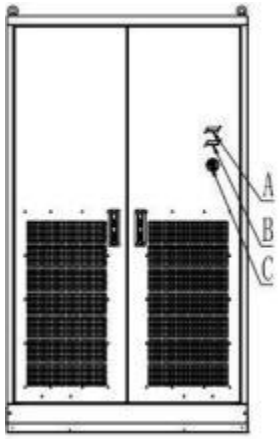
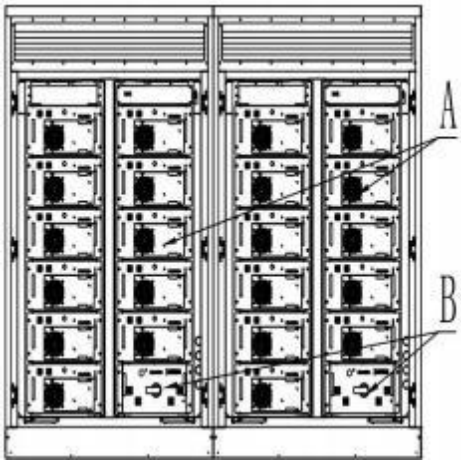
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W* D* H) 1264mm*1000mm*2190mm
Appearance of 315kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Battery module B:High voltage box Size(W* D* H) 2700mm*1000mm*2190mm
Configuration of THESS-150-473	
Appearance of 150kW modular hybrid power system	**Explain**

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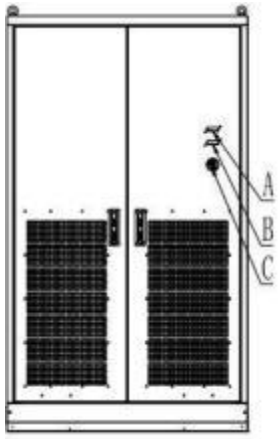
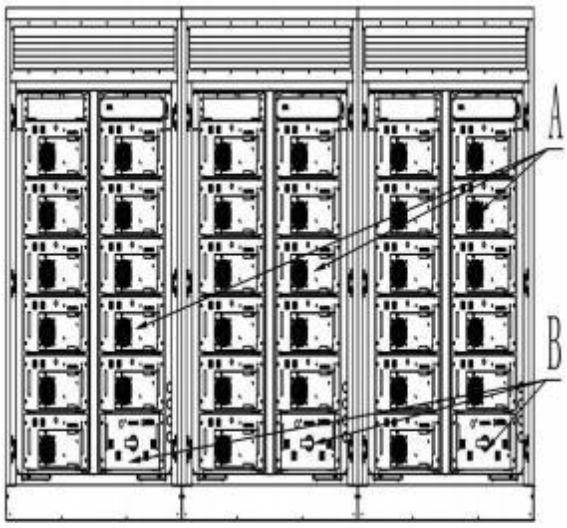
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 1264mm*1000mm*2190mm
Appearance of 473kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Battery module B:High voltage box Size(W*D*H) 4050mm*1000mm*2190mm

On the door panel of the modular hybrid power system, two LED lights are installed to display the main status of the equipment, namely "System Running" and "System Fault".

Name	Colour	Explain
System Running	Green	Regular service
System Fault	Red	A fault has occurred and has not been cleared. If the fault is cleared, the indicator light will go out automatically.

4. Layout of main components

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The industrial and commercial energy storage battery system and modular hybrid power system constitute the whole integrated system, and all power distribution units, power module units, battery modules, industrial air conditioners and fire fighting systems are placed in independent cabinets; Among them, the industrial and commercial energy storage battery system can be configured according to the actual demand. The maximum capacity of the battery system that users can configure is 473.09kWh, and the battery modules are installed in three industrial and commercial energy storage battery systems. Its internal layout is shown in the following figure.

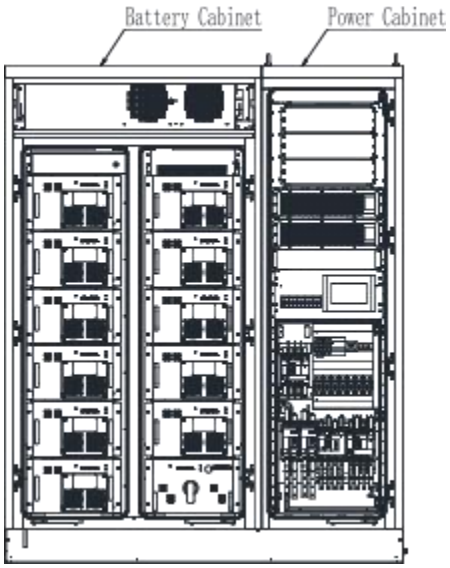

Figure 2.4.1 THESS-30-63 system diagram

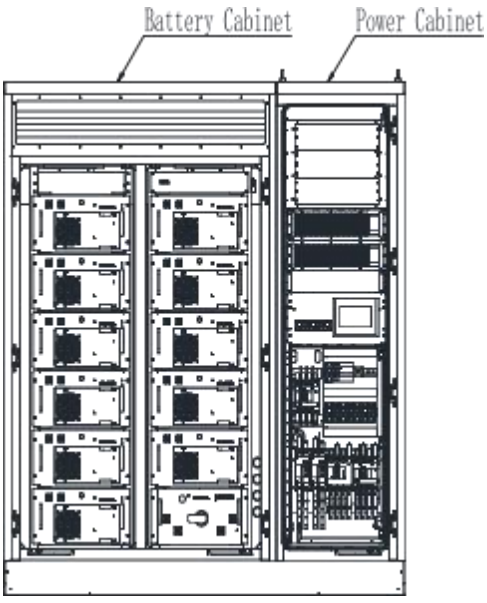

Figure 2.4.2 THESS-60-157 system diagram

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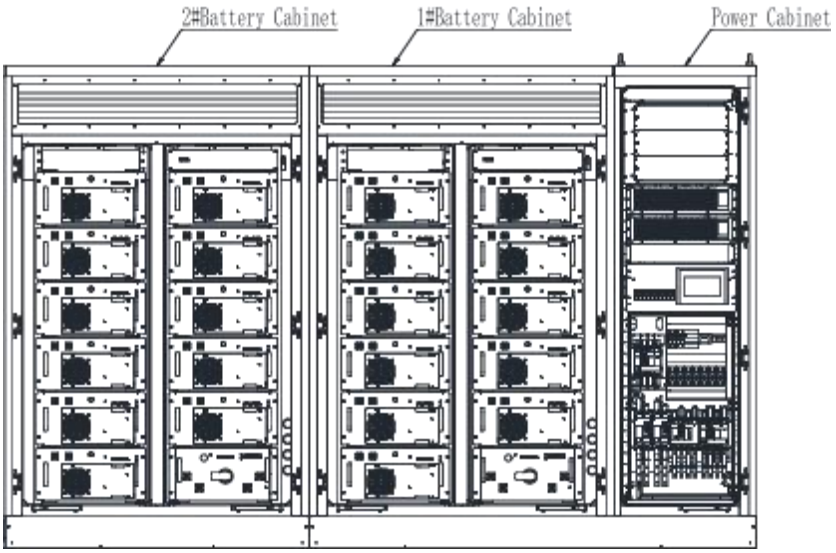

Figure 2.4.3 Overall Diagram of THESS-90-315 System

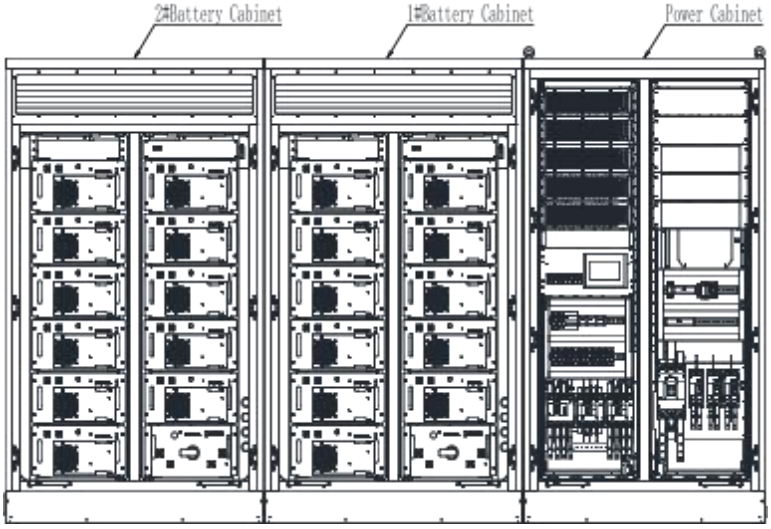

Figure 2.4.4 Overall Diagram of THESS-120-315 System

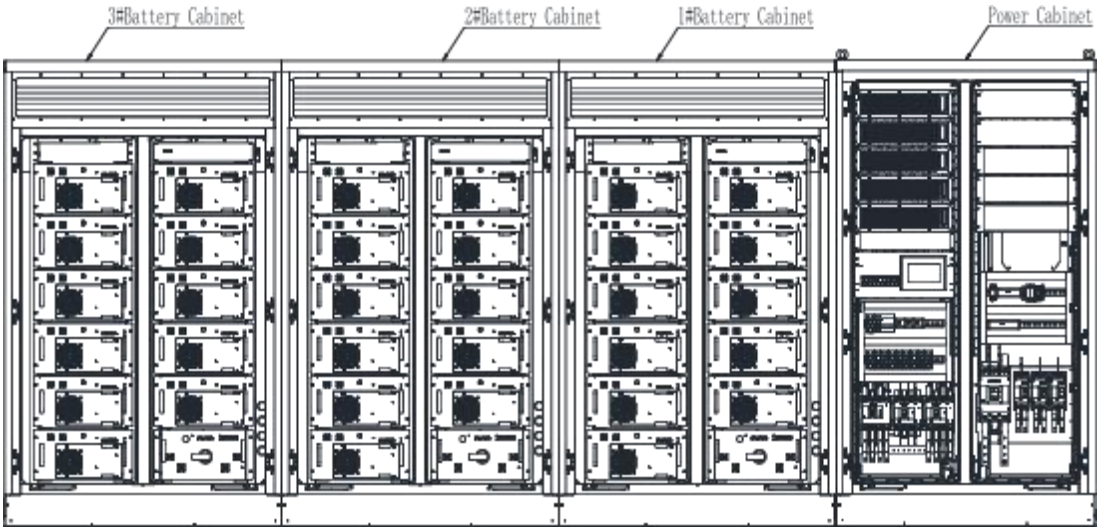

Figure 2.4.5 Overall Drawing of THESS-150-473 System

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The C&I PV+Battery Energy Storage System consists of a modular hybrid power system and an industrial and commercial energy storage battery system. See the following table for the specific components.

System unit	Explain
Industrial and commercial energy storage battery system	Battery module
	Pressure tank
	Temperature control system: each battery system is equipped with an intelligent temperature control system.
	Fire protection system:Each battery system is equipped with a set of fire protection system (Heptafluoropropane is standard); Please inform the manufacturer if you have any special requirements!
Modular hybrid power system	EMS energy management system
	Power part: PCS module and MPPT module.
	UPS and communication equipment
	Control box and power distribution part

5. Operation strategy

5.1 Local scheduling

In local scheduling mode, users can only set power instructions to the operating system through local terminals. Alternating current power or direct current power can be selected, and the user can manually set the power command, and set "positive power" to represent the system's outward discharge power; Set "negative power" to represent the charging power of the system.

5.2 Load priority

When the PV power is greater than the load power, PV gives priority to the load power supply, and the remaining power is charged to the battery;

When the PV power does not meet the load, the battery automatically discharges. If the battery is discharged to the undervoltage protection point, PV and the power grid will be given to the load together. Power supply, in order to protect the battery, the battery will be charged by trickle with low power energy, and the power supply can be restored when the battery is charged to a certain extent.

5.3 Battery priority

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When the PV power is greater than the charging power, the battery is charged first, and the remaining power is supplied to the load.

When the PV power is less than the charging power, the battery should be charged first, and the power grid should supply the load and charge the battery at the same time.

If the grid-connected backup mode is not discharged or switched to other modes, in order to maintain the electrochemical activity of the battery, the battery will be discharged after one week of current-limiting charging, and the battery discharge power is 20% of the rated output power.

5.4 External ammeter

1.When the photovoltaic power is greater than the sum of the critical load, the non-critical load and the battery charging power, the photovoltaic power supplies power to the critical load and the non-critical load, and the remaining power is charged to the battery:

a.Anti-backflow enable is activated, and excess photovoltaic power cannot be sent to the power grid.

b.Anti-backflow can be turned off, and excess photovoltaic power can be fed into the power grid (the feed power can be set).

2.When photovoltaic is greater than critical load and non-critical load, but less than the sum of critical load, non-critical load and battery charging power, photovoltaic supplies power to critical load and non-critical load, and the remaining power is charged to the battery.

3. Photovoltaic is greater than critical load, but less than critical load and non-critical load. Photovoltaic supplies power to critical load and non-critical load:

A. The battery sends power to the electricity meter to enable activation, and the battery and photovoltaic jointly supply power to non-critical loads; B. The enabling of the battery to send electricity to the electricity meter is not activated, and photovoltaic and power grid jointly supply power to non-critical loads. 4. Photovoltaic is smaller than the critical load, and photovoltaic and battery jointly supply power to the critical load:

A. The battery sends power to the electricity meter to enable activation, and the battery or the battery and the power grid jointly supply power to non-critical loads; B. The battery power supply to the electricity meter is not activated, and the power grid supplies power to non-critical loads;

5.5 Oil engine mode

Oil engine access function (dry node control)

In off-grid mode, when the battery is discharged to "discharge cut-off voltage" or "SOC lower limit", the modular hybrid power system sends a relay signal to start the oil engine and enter the oil engine mode, at this time, the oil engine supplies power to the load; At the same time, PV stops supplying power to the load and only charges the battery.

1. When the PV power is greater than the charging power, the PV power is only used to charge the battery;

/

The oil engine only supplies loads.

2. When the PV power is less than the charging power, the battery should be charged first; The oil engine supplies power to the load, and optionally charges the battery (PV and grid simultaneous charging are enabled).

3. When the battery is charged to the "SOC upper limit" or "float charging current limit point setting", the modular hybrid power system signals to stop the oil engine and turn off-grid mode.

4. When there is no power grid in the energy storage system, the oil engine can be directly connected to the power grid end of the modular hybrid power system; When there are both power grid and oil engine, it needs to be used with ATS.

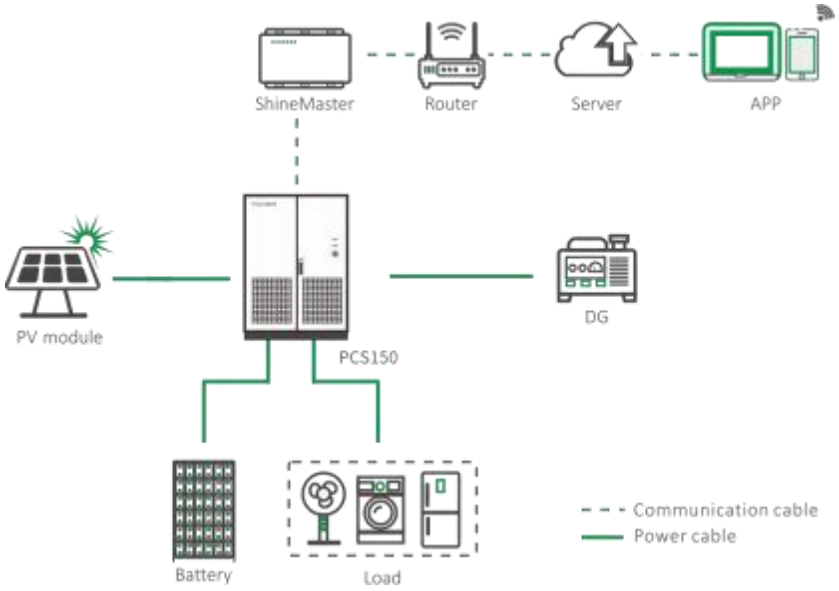

Figure 2.5.5.1 system diagram

6. Transport

6.1 Nameplate

Users can identify the equipment through the nameplate. The information contained in the nameplate includes: equipment model, serial number, main technical parameters and origin, etc.

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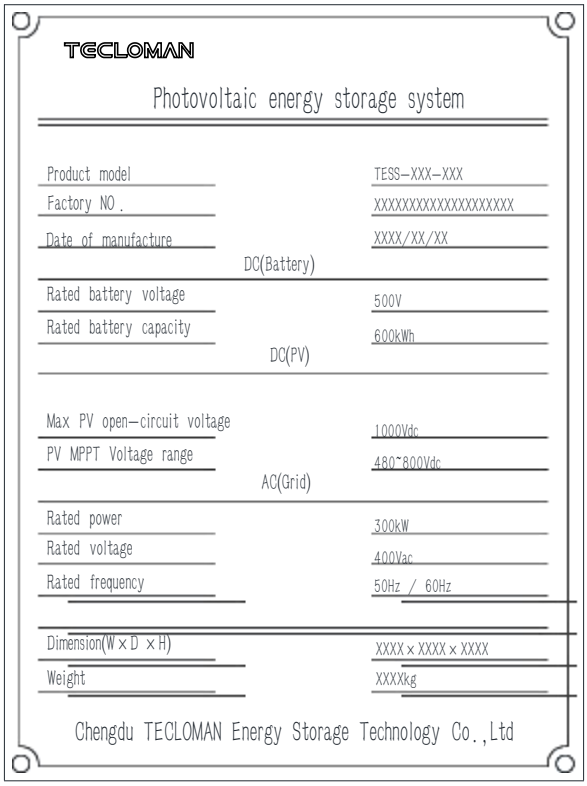

Figure. Schematic diagram of 2.6.1.1 nameplate

Nameplate

The nameplate contains important parameter information related to the equipment, which should be protected during transportation, installation, maintenance and overhaul. It is forbidden to destroy or dismantle!

6.2 Check integrity

Before leaving the factory, the integrated energy storage system has been carefully inspected by our staff and packed firmly. Nevertheless, it is still possible that the equipment may collide or even be damaged during transportation.

After receiving the equipment, it is first necessary to check the integrity and completeness of transportation. At least the following items should be carefully checked:

- Check whether all delivery components are complete.
- Confirm that the models of the received integrated energy storage system and internal equipment are the same as those you ordered before.

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- Carefully check the integrated energy storage system and internal equipment to see if there is any damage during transportation. In the process of inspection, if you find any problems or questions, please contact the forwarder or our company in time.

Integrality

Only a complete and non-damaging energy storage integrated system can be installed and tested! Before the installation begins, ensure that:

- The integrated energy storage system itself is intact and without any damage.
- All devices in the integrated energy storage system are intact and without any damage.

6.3 Forklift transportation

If the installation site is flat, the forklift can be used to move the industrial and commercial energy storage battery system and the modular hybrid power system. The bottom of industrial and commercial energy storage battery system and modular hybrid power system are equipped with fork holes specially used for forklift transportation. Mobile industrial and commercial energy storage battery system and modular hybrid power system through the front fork hole. If the forklift transportation method is used, the following requirements shall be met:

- Forklift trucks shall be equipped with sufficient bearing capacity (at least 5 tons)
- The length of pins should be at least 1100mm.
- The pin should be inserted into the fork jack at the bottom of the workstation (see the figure below for the location of the fork jack). The depth of the pin inserted into the pile number should be the depth of the pile number, that is, 1100mm.
- The transportation, moving and laying down of industrial and commercial energy storage battery system and modular hybrid power system should be slow and stable.
- Only the industrial and commercial energy storage battery system and modular hybrid power system can be placed in a stable place. The place should be well drained without any obstacles or bulges. The industrial and commercial energy storage battery system and modular hybrid power system should be fixed by four bottom corner pieces.

Fork transport

- Mobile industrial and commercial energy storage battery system and modular hybrid power system

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through bottom front fork pocket

☞ Under no circumstances can the industrial and commercial energy storage battery system and modular hybrid power system be moved by inserting the pins into other positions than the fork holes.

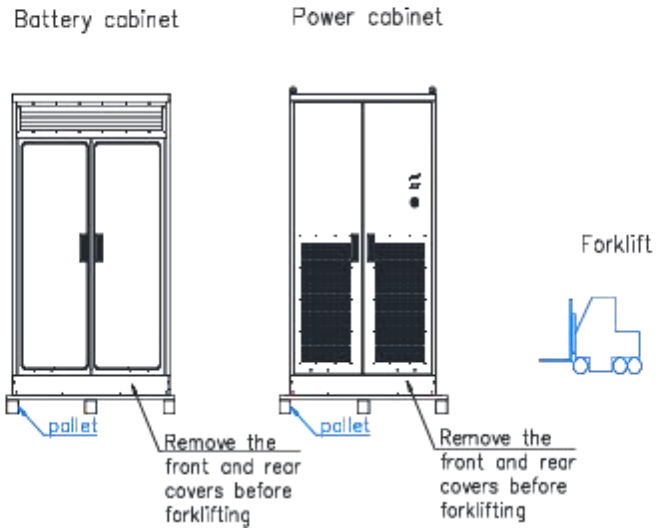

Figure. Schematic diagram of 2.6.3.1 fork transportation.

6.4 Lifting transportation

In the process of lifting the cabinet or container, each operation link shall be carried out according to the following requirements:

☞ The cabinet should be lifted vertically, and it should not be dragged on the ground or the top of the lower cabinet, and it should not be dragged on any surface.

☞ After the cabinet is hoisted 300mm away from the supporting surface, it should be suspended, and the connection between the spreader and the cabinet should be inspected. Only after the connection is firm can lifting be carried out.

☞ After the cabinet is in place, it should be put down gently and landed smoothly. It is forbidden to place the cabinet outside the vertical landing by shaking the spreader.

☞ The place where the cabinet is placed should be solid and flat, with good drainage and no obstacles or protrusions; On the site, the cabinet should be fixed by four bottom corner pieces.

☞ Limited to the site conditions, please use non-vertical force to lift the cabinet from the four rings.

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Figure. Schematic diagram of 2.6.4.1 hoisting

7. Site operation

Foundation requirements

The integrated energy storage system is heavy as a whole. Before building the foundation, the conditions of the installation site (mainly geological conditions and environmental climate conditions) should be investigated in detail. Only on this basis can the design and construction of foundation be started.

The installation foundation of the energy storage integrated system must be designed and constructed in accordance with certain standards in advance to meet the requirements of mechanical support, cable routing, and later maintenance and overhaul. Therefore, at least the following requirements should be met during foundation construction:

- The bottom of the foundation pit where the foundation is built must be tamped and filled.
- The foundation should be sufficient to provide effective load-bearing support for the energy storage integrated system.
- Raise the integrated energy storage system to prevent rainwater from eroding the base and interior of the integrated energy storage system. It is suggested that the foundation should be about 300mm higher than the horizontal ground of the installation site.
- It is necessary to construct corresponding drainage measures in combination with local geological conditions.

/

Build a cement foundation with sufficient cross-sectional area and height. The foundation height is determined by the constructor according to the site geology.

Cable routing should be considered when building the foundation.

Dregs dug out during foundation construction should be cleaned up immediately, so as not to affect the subsequent hoisting of the integrated energy storage system.

The maintenance platform is built around the foundation, which brings convenience for later maintenance.

According to the position and size of cable inlet and outlet on industrial and commercial energy storage battery system and modular hybrid power system, sufficient space should be reserved for AC/DC side cable trough in foundation construction, and cable conduit should be embedded in advance.

Determine the specifications and quantity of perforating tubes according to the cable model and the number of incoming and outgoing lines.

Both ends of all embedded pipes are temporarily sealed to prevent impurities from entering, otherwise it is inconvenient to wire later.

After all cables are connected, the inlet and outlet of cables and connectors are sealed with refractory mud or other suitable materials to prevent rodents from entering.

According to different cabinet models, there will be different on-site construction methods. Please refer to the on-site construction drawing attached with the product for operation. The following is only the on-site construction process of 473kWh energy storage system for reference.

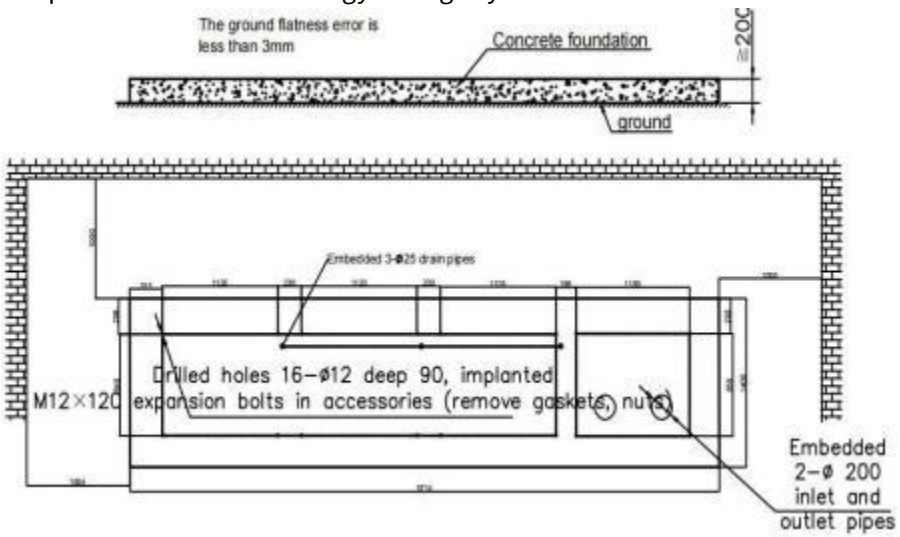

Figure 2.7.1 Foundation Construction 473kWh Energy Storage System

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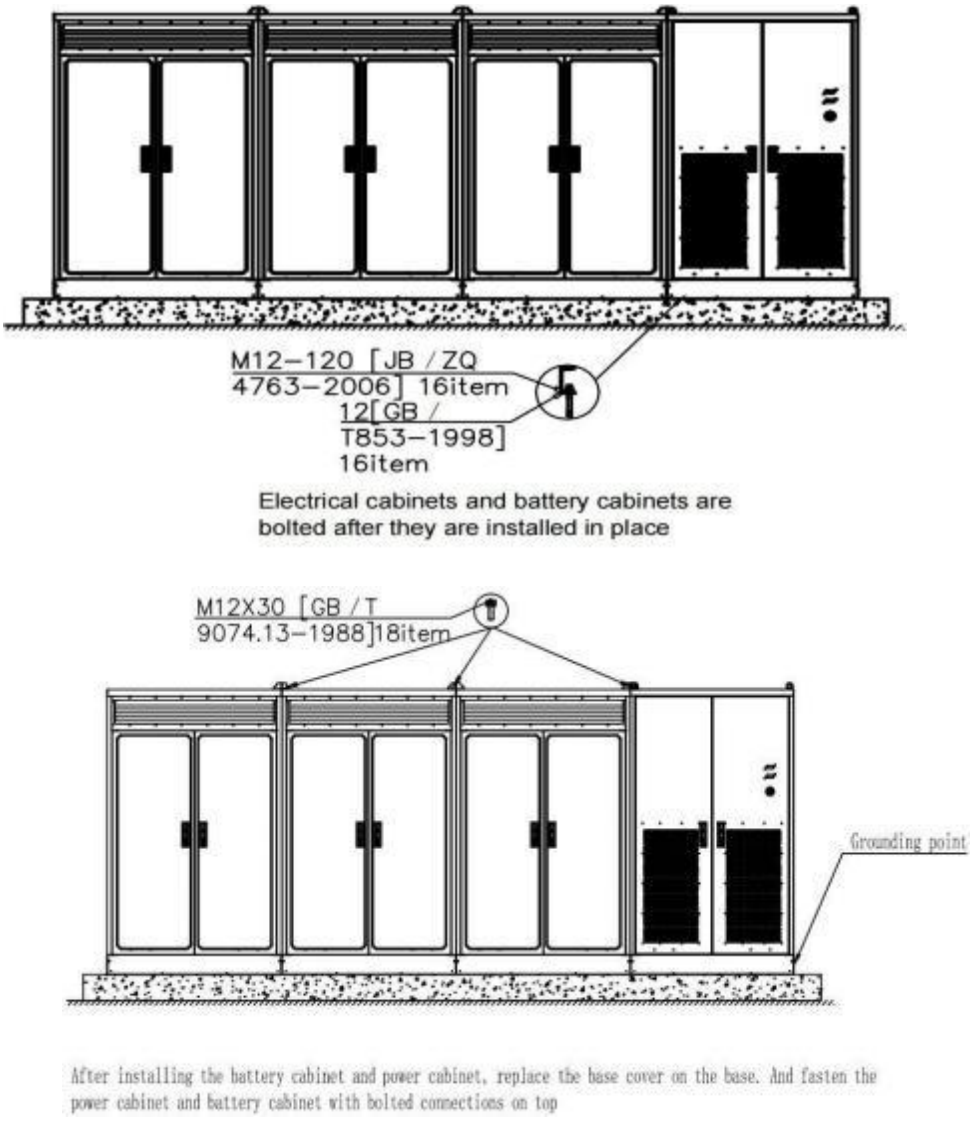

Fig. 2.7.2 Installation 473kWh energy storage system

8. Electrical wiring

The system includes modular hybrid power system unit and industrial and commercial energy storage battery system.

System internal connections:

A single connection between the battery system and the power system

Secondary connection between battery system and power system

Continuous outside the system:

Grid connection

Load connection

Photovoltaic connection

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Communication network connection diagram.

Electrical wiring

- Before electrical wiring, make sure that all circuit breakers of the equipment and corresponding grid load switches are off.
- Before wiring, the polarity of all input cables must be checked to ensure that each input polarity is correct.
- In the process of electrical installation, do not pull the cable or wire hard to avoid damaging its insulation performance.
- All cables and wires shall have a certain bending space.
- Take necessary auxiliary measures to reduce the stress on cables or wires.
- After each step of wiring operation, it is necessary to check carefully to ensure that the wiring is correct and firm.

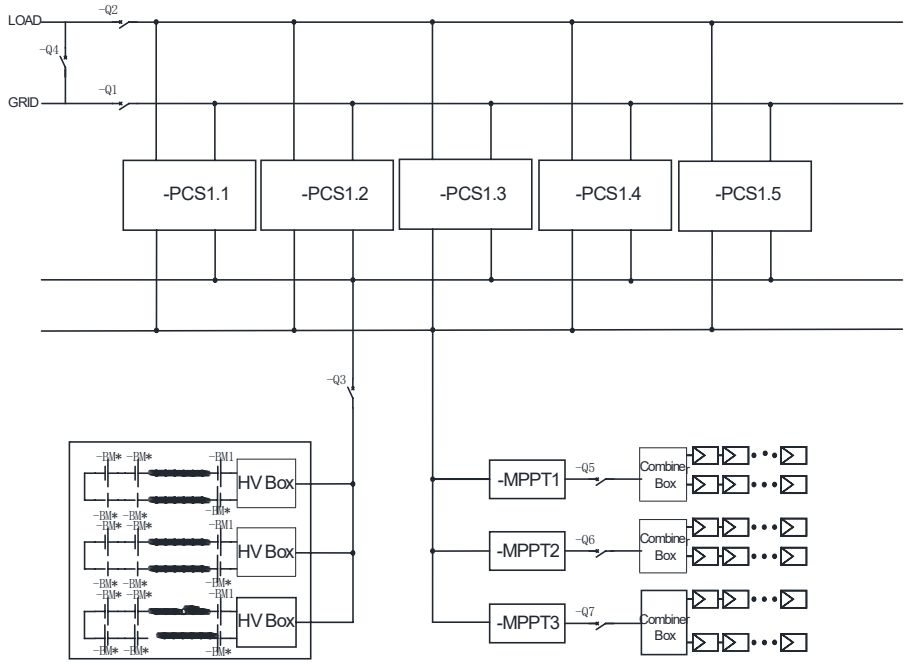

Figure 2.8.1 Primary Circuit Diagram of Energy Storage System

For the external electric meter mode, the energy storage system will be equipped with additional electric meters and current transformers. The watt-hour meter collects voltage, current, power and other data in the loop, and then transmits the data to the main control EMS through the 485 interface. Please pay attention to the positive direction of current transformer during installation.

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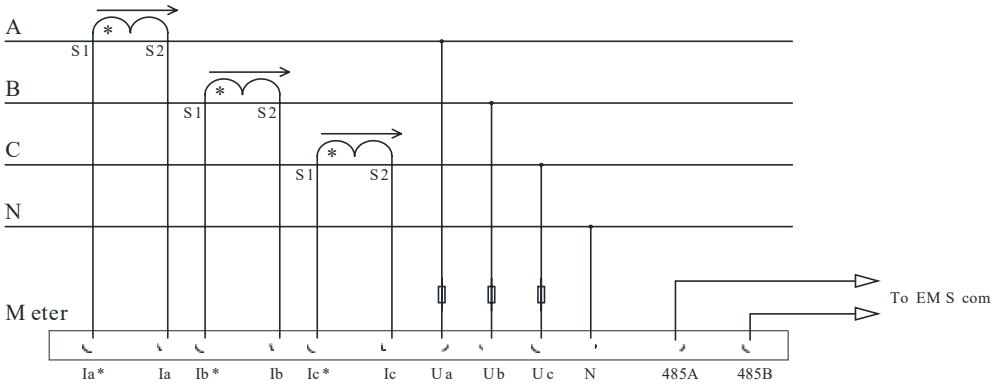

Figure 2.8.2 External current acquisition

Each battery module is connected end to end to form a battery cluster, and the total positive electrode and the total negative electrode of the battery cluster are connected to the power unit through a high-voltage box. For details of battery system, please refer to the chapter "Industrial and Commercial Energy Storage Battery System".

DC connection

Before wiring the battery system, make sure that all high-voltage boxes and battery modules are in an inactive state, and the main switch of the high-voltage box is in the OFF position.

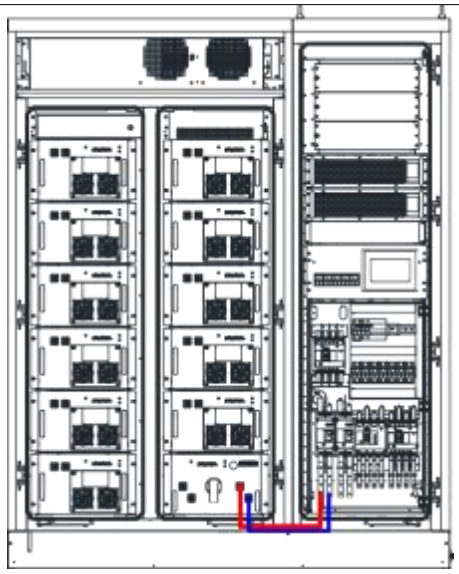

Figure 2.8.3 THESS-30-63 DC wiring diagram

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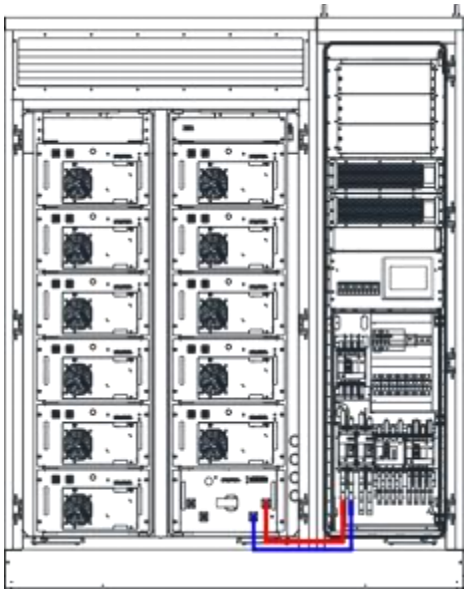

Figure 2.8.4 THESS-60-157 DC wiring diagram

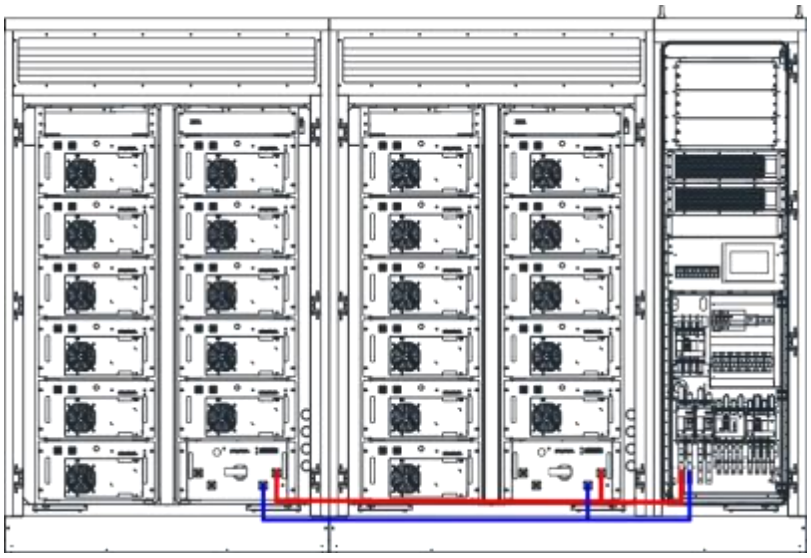

Figure 2.8.5 THESS-90-315 DC wiring diagram

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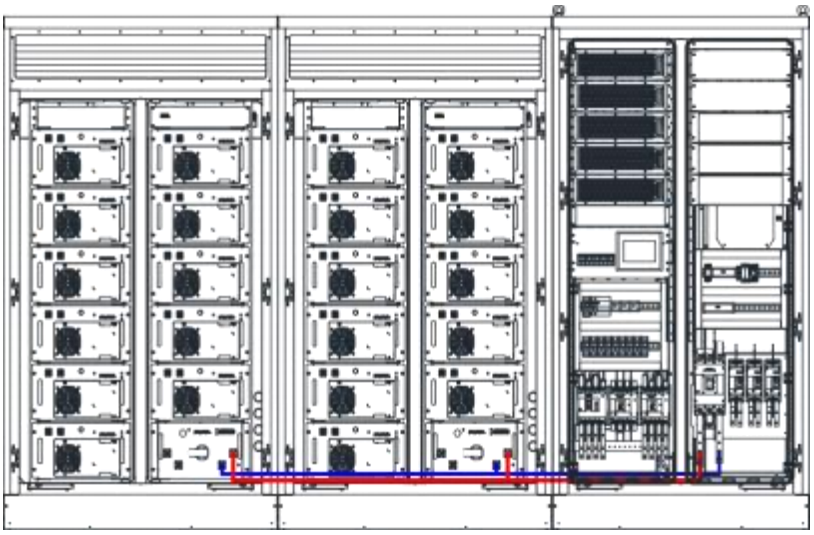

Figure 2.8.6 THESS-120-315 DC wiring diagram

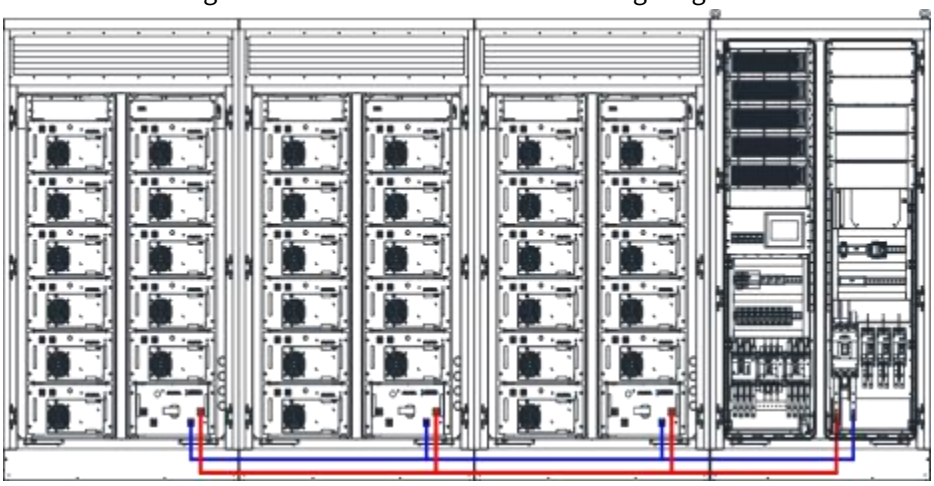

Figure 2.8.7 THESS-150-473 DC wiring diagram

The secondary connection between the battery system and the power supply system can be connected through a heavy-duty connector.

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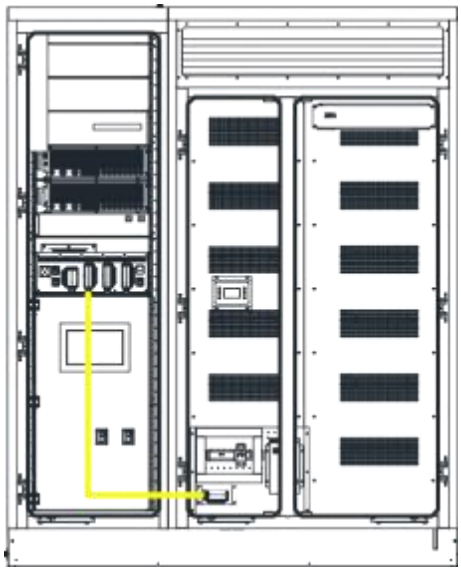

Figure 2.8.8 THESS-30-63 Secondary Wiring Diagram

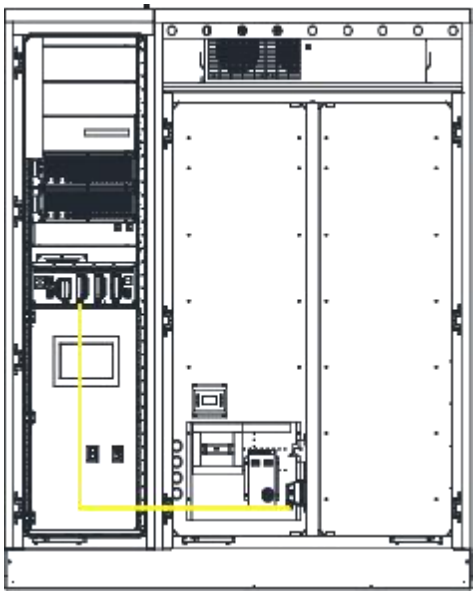

Figure 2.8.9 THESS-60- 157 Secondary Wiring Diagram

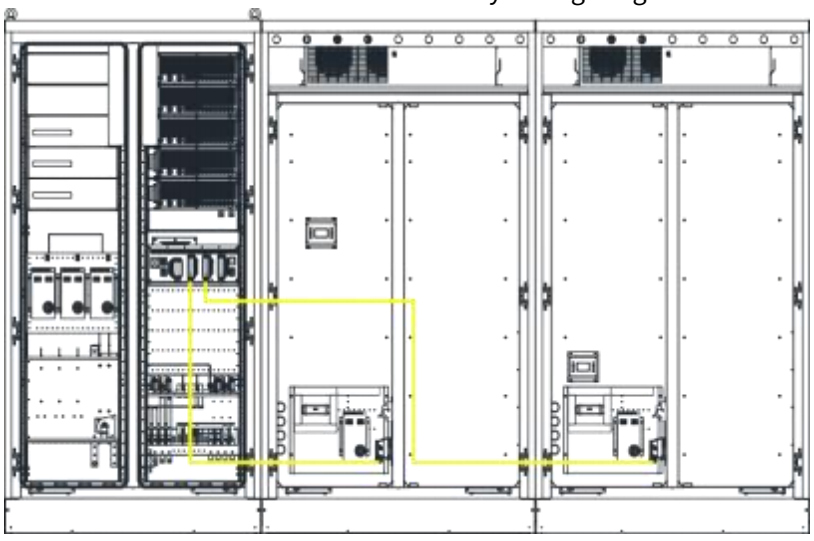

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Figure 2.8. 11 THESS- 120-315 Secondary Wiring Diagram

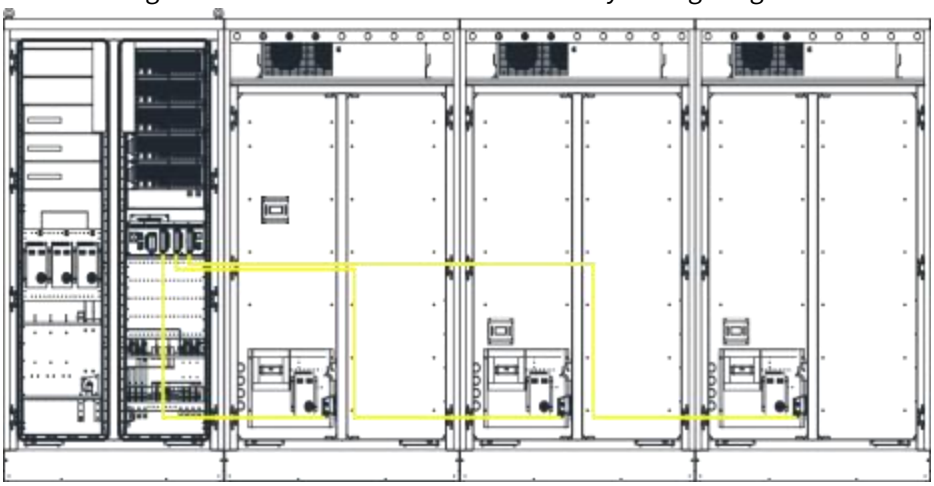

Figure 2.8. 12 THESS- 150-473 Secondary Wiring Diagram

Circuit breakers outside the system include photovoltaic circuit breakers, power grid circuit breakers and load circuit breakers, which are connected by users themselves.

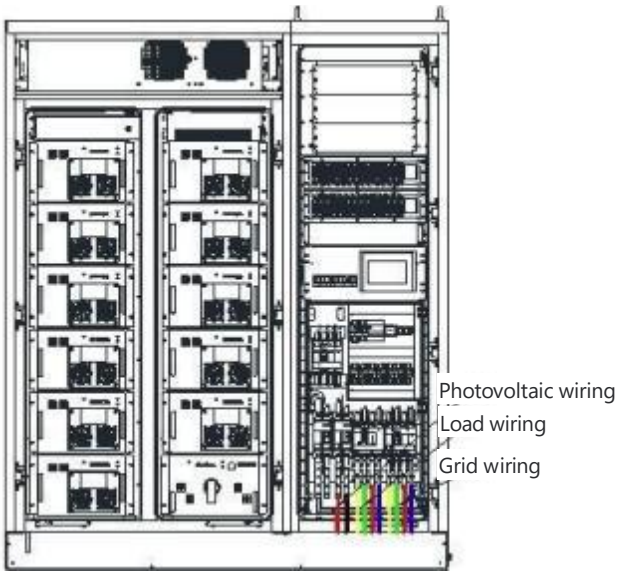

Figure 2.8. 13 THESS-30-63 External Wiring Diagram

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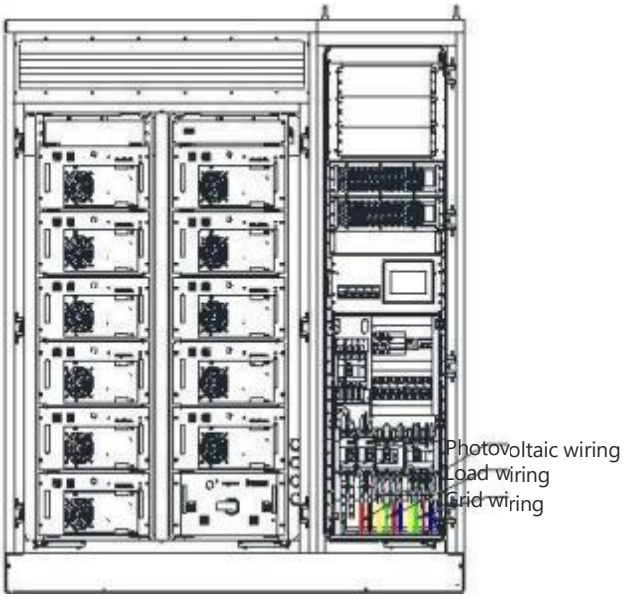

Figure 2.8.14 THESS-60-157 External Wiring Diagram

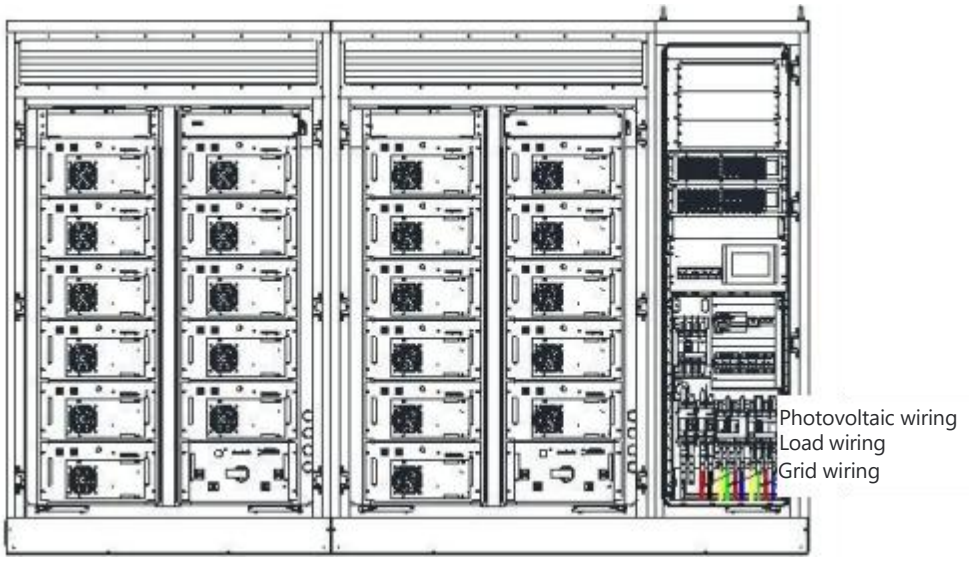

Figure 2.8.15 THESS-90-315 External Wiring Diagram

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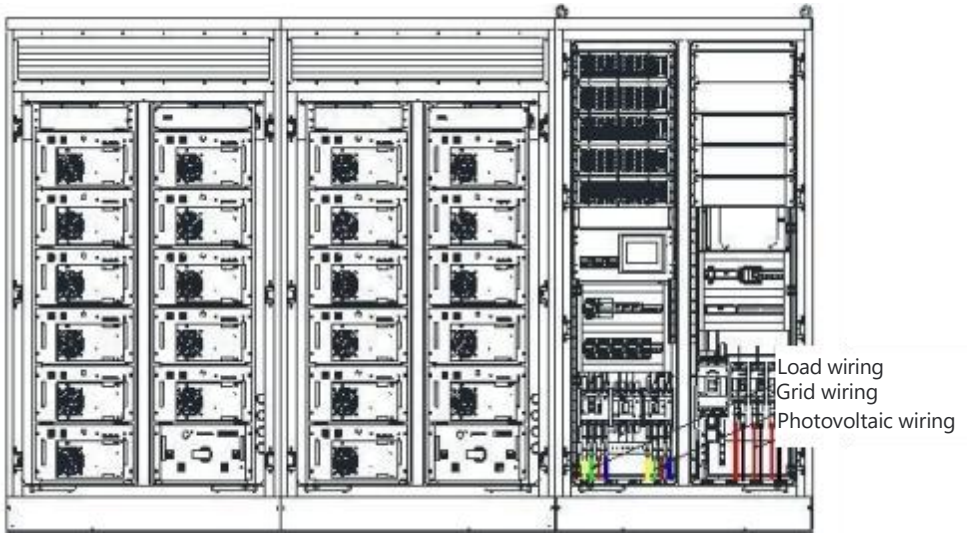

Figure 2.8.16 THESS-120-315 External Wiring Diagram

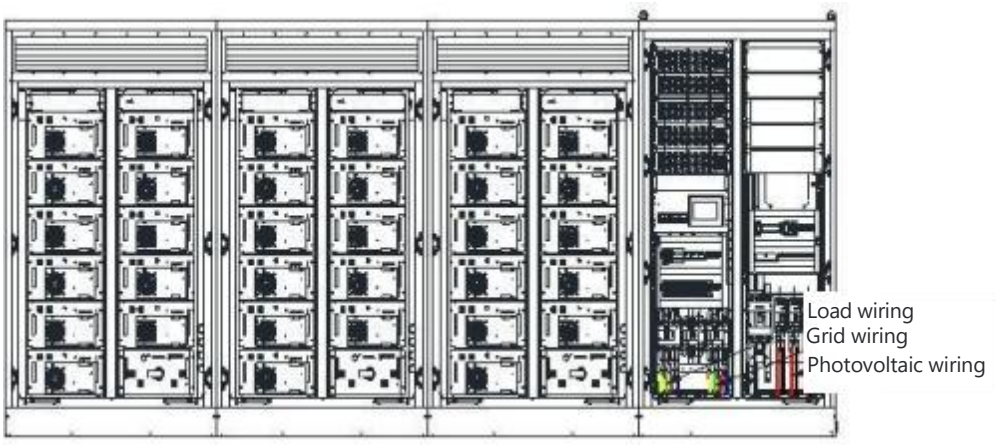

Figure 2.8.17 THESS-150-473 External Wiring Diagram

The system communication network connection diagram is as follows:

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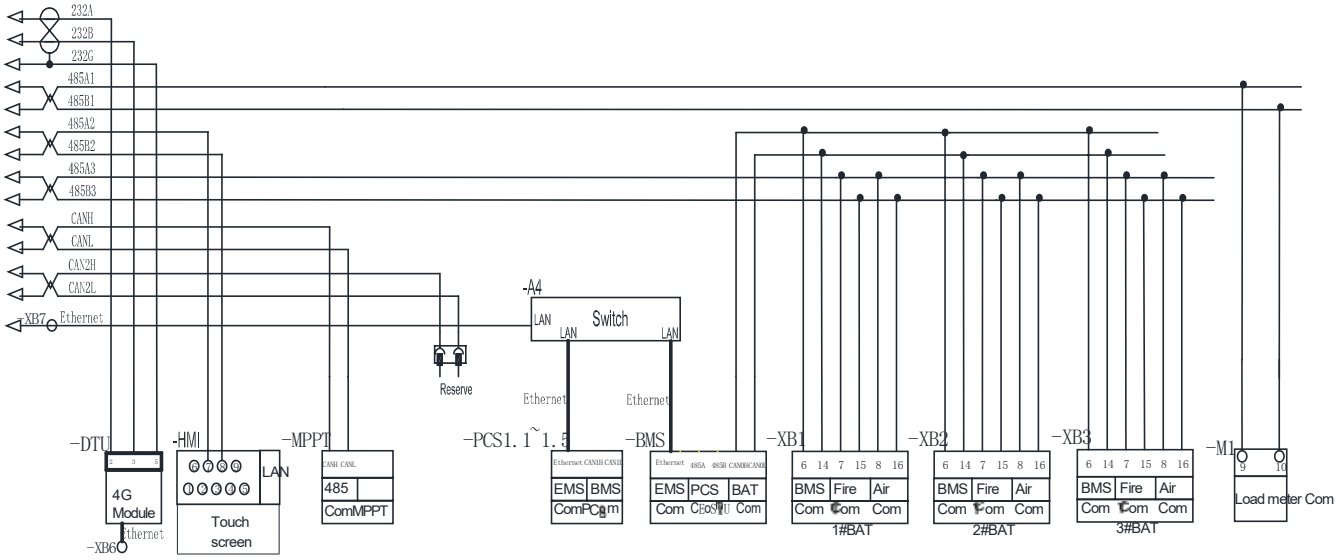

Figure 2.8.18 Communication Network Diagram

The energy storage system includes internal grounding and external grounding. The grounding of equipment inside the energy storage system cabinet has been completed. The following figure shows the location of the external ground point. The user only needs to select one point to be grounded nearby, and do not repeat the grounding.

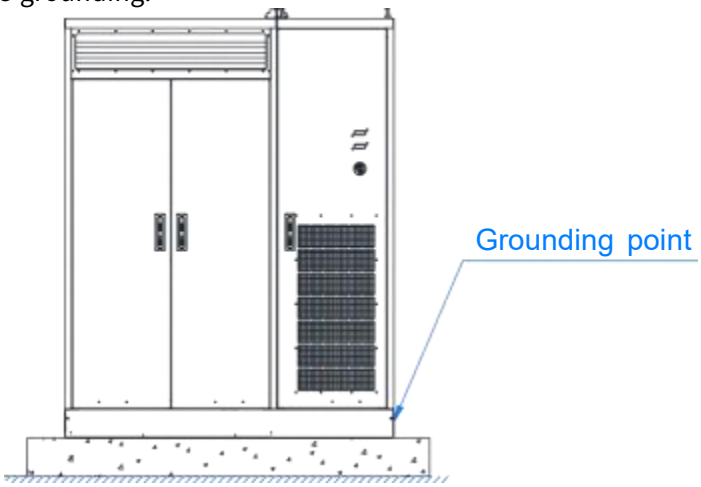

Figure 2.8.19 External Grounding Diagram of 157kWh Cabinet

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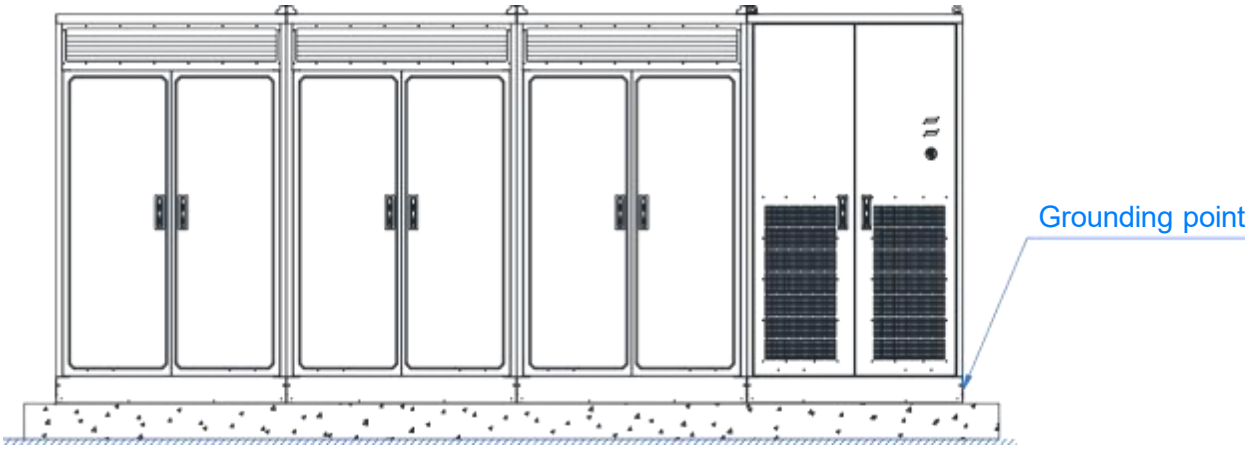

Figure 2.8.20 473kWh Cabinet External Grounding Diagram

Grounding

Ensure that the ground cable is in good condition and the ground point is reliable and not loose. The grounding connection must comply with the grounding standards and regulations of the country/region where the project is located.

If there is no special requirement, EV-HLCI 50mm ^{2} cable shall be used as the power line of the battery system, and the cable connecting PV to MPPT module shall be configured by the user. All communication cables are 22AWG insulated twisted pair shielded wires. For the cables of the modular hybrid power system, please refer to the following table.

Rated power	30kW	60kW	90kW	120kW	150kW
Power grids	4AWG	2AWG	0AWG	0AWG	2/0AWG
Load	4AWG	2AWG	0AWG	0AWG	2/0AWG
landing	4AWG	4AWG	2AWG	2AWG	0AWG
Communication network cable	CAT5E	CAT5E	CAT5E	CAT5E	CAT5E
Electric meter communication line	2*22AWG	2*22AWG	2*22AWG	2*22AWG	2*22AWG

9. Power on/off operation

9.1 Initial power on

Confirm that the power line, communication line and control line of the battery system have been connected reliably before power on. Confirm that the wiring of the modular hybrid power system

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and the energy storage battery system is secure. Confirm that the cabinet has been reliably grounded. Verify that all circuit breakers are open.

Check the short circuit of the system and send the power supply to the power grid interface. Close the power grid switch, close the control power switch of the electrical box, close the air conditioning switch, close the power supply switch of the auxiliary circuit, and check whether the power supply is normal.

Start the UPS and close the high-voltage box switch on the industrial and commercial energy storage battery system.

In the battery system, turn the main switch of the high-voltage box to "ON", press the power button on the high-voltage box, and the operation indicator of the high-voltage box and all battery modules in the cluster will always be on. In this way, start all battery clusters. If all battery clusters are not started within the startup time limit of BMS self-test, it is necessary to disconnect all main switches of high-voltage box and restart this step. After confirming that the battery voltage is normal, proceed to the next step.

Close the PCS DC circuit breaker and the PCS screen lights up. After PCS is in normal standby, proceed to the next step.

After confirming the photovoltaic connection to the MPPT module, close the photovoltaic circuit breaker of the modular hybrid power system, and confirm the photovoltaic voltage and power.

Close the load circuit breaker of the modular hybrid power system step by step.

9.2 Power failure maintenance

Step by step disconnect the load circuit breaker of the modular hybrid power system.

Disconnect the photovoltaic circuit breaker of the modular hybrid power system.

Disconnect all switches in the modular hybrid power system integrated cabinet, and disconnect the circuit breaker of the modular hybrid power system electromechanical network.

Disconnect the DC circuit breaker of the modular hybrid power system.

Disconnect and turn the main switch of high-voltage box of all battery clusters to "OFF".

Turn off the UPS.

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Chapter 3 modular hybrid power system

1. Introduction to modular hybrid power system

The main function of the modular hybrid power system is to distribute the photovoltaic DC power to the energy storage battery or inverter output through the DC bus, and can realize fast switching in and out of the grid to ensure uninterrupted load supply.

2. System configuration

Product model	TPSC-30	TPSC-60	TPSC-90	TPSC-120	TPSC-150
AC (grid connection)					
Apparent power	33kVA	66kVA	100kVA	132kVA	165kVA
Rated power	30kW	60kW	90kW	120kW	150kW
Rated voltage	400V	400V	400V	400V	400V
Rated current	43A	87A	130A	173A	217A
Voltage range	360V~440V	360V~440V	360V~440V	360V~440V	360V~440V
Rated frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz
THDI	＜5%	＜5%	＜5%	＜5%	＜5%
power factor	0.8 lead~0.8 lag	0.8 lead~0.8 lag	0.8 lead~0.8 lag	0.8 lead~0.8 lag	0.8 lead~0.8 lag
AC system	3/N/PE	3/N/PE	3/N/PE	3/N/PE	3/N/PE
AC input	60kVA	120kVA	180kVA	240kVA	240kVA
AC (off network)					
Apparent power	33kVA	66kVA	100kVA	132kVA	165kVA
Rated power	30kW	60kW	90kW	120kW	150kW
Rated voltage	400V	400V	400V	400V	400V
Rated current	43A	87A	130A	173A	217A
THDU	≤2%	≤2%	≤2%	≤2%	≤2%
Rated frequency	50/60Hz	50/60Hz	50/60Hz	50/60Hz	50/60Hz

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Overload capacity	110% 10 minutes 120% for 1 minute	110% 10 minutes 120% for 1 minute	110% 10 minutes 120% for 1 minute	110% 10 minutes 120% for 1 minute	110% 10 minutes 120% for 1 minute
DC (battery and photovoltaic)					
Maximum photovoltaic open circuit voltage	1000V DC	1000V DC	1000V DC	1000V DC	1000V DC
Rated photovoltaic power	30kWp	60kWp	90kWp	120kWp	150kWp
Maximum photovoltaic power (Reference for PV recommended configuration)	1.1~1.4 times rated	1.1~1.4 times rated	1.1~1.4 times rated	1.1~1.4 times rated	1.1~1.4 times rated
PV MPPT voltage range	400V~800V DC	400V~800V DC	500V~800V DC	500V~800V DC	500V~800V DC
Maximum photovoltaic current	100A	200A	200A×2	200A×2	200A×3
Number of PV MPPT	1	1/2	2/3	2/4	3/5
Battery voltage range	352V~600V	352V~600V	352V~600V	352V~600V	352V~600V
BMS three-level display and control	have	have	have	have	have
Maximum charging power	33kW	66kW	100kW	132kW	165kW
Maximum discharge power	33kW	66kW	100kW	132kW	165kW
Maximum charging current	100A	200A	300A	400A	500A
maximum discharge current	100A	200A	300A	400A	500A
Basic information					
noise	<65dB(A)@1m	<65dB(A)@1m	<65dB(A)@1m	<65dB(A)@1m	<65dB(A)@1m
operating temperature	-25℃~+55℃	-25℃~+55℃	-25℃~+55℃	-25℃~+55℃	-25℃~+55℃

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Cooling mode	air blast cooling	air blast cooling	air blast cooling	air blast cooling	air blast cooling
relative humidity	0~95% without condensation	0~95% without condensation	0~95% without condensation	0~95% without condensation	0~95% without condensation
Highest elevation	3000m(The frequency drops above 3000m)	3000m(The frequency drops above 3000m)	3000m(The frequency drops above 3000m)	3000m(The frequency drops above 3000m)	3000m(The frequency drops above 3000m)
Parallel and off-grid switching time	Automatic ≤10ms	Automatic ≤10ms	Automatic ≤10ms	Automatic ≤10ms	Automatic ≤10ms
Communication					
show	Touch screen	Touch screen	Touch screen	Touch screen	Touch screen
communication interface	RS485/CAN/LA N	RS485/CAN/LAN	RS485/CAN/LAN	RS485/CAN/LAN	RS485/CAN/LAN
Equipment size (W×D×H)	635mm×1000mm×2140mm			1264mm×1000mm×2040mm	
Equipment weight	300kg	350kg	375kg	640kg	690kg

If you need to add photovoltaic MPPT loop, please consult the manufacturer.

For other power or power configurations, contact the manufacturer.

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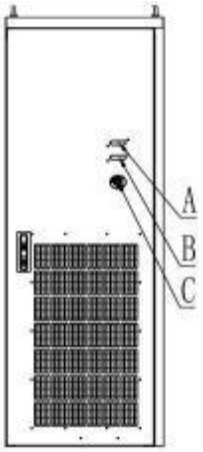
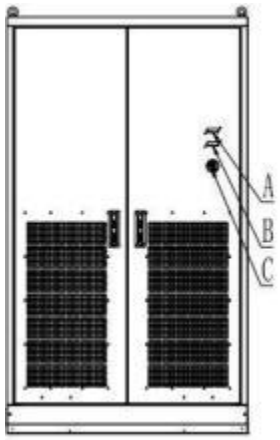
3. Appearance and size

Appearance of 30kW modular hybrid power system	Explain
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 635mm*1000mm*2190mm
Appearance of 150kW modular hybrid power system	**Explain**
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 1264mm*1000mm*2190mm

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4. Layout of main components

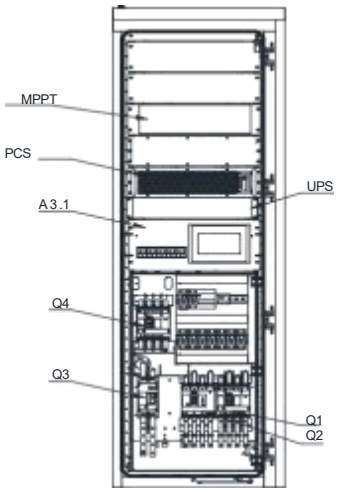

Figure 3.4.1 Layout of 30kW modular hybrid power system

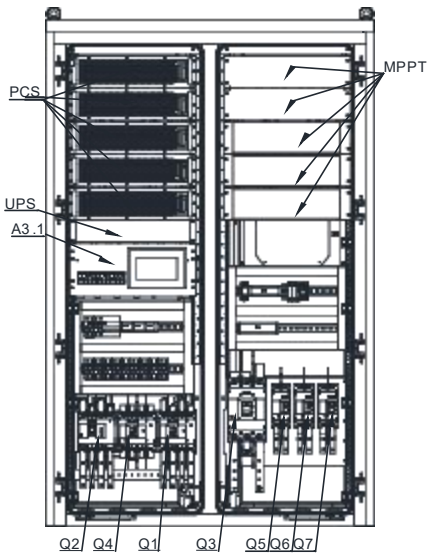

Figure 3.4.2 Layout of 150 kW modular hybrid power system

The main components of modular hybrid power system are shown in the table below.

Code name	Name
PCS	Power conversion system
UPS	Uninterruptible power supply
A3.1	Control box

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MPPT	Photovoltaic module
Q1	Grid circuit breaker
Q2	Load circuit breaker
Q3	DC circuit breaker
Q4	Bypass circuit breaker
Q5、Q6、Q7	Photovoltaic circuit breaker

5. External interface configuration

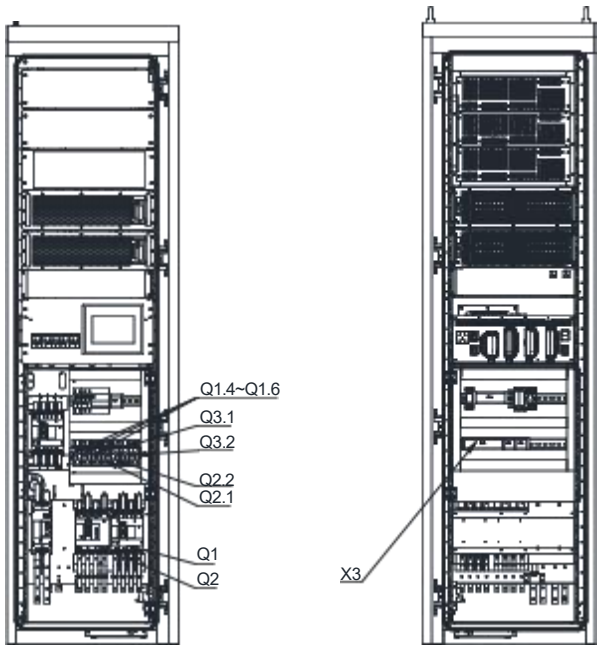

Figure 3.5.1 External Interface of 30kW modular hybrid power system

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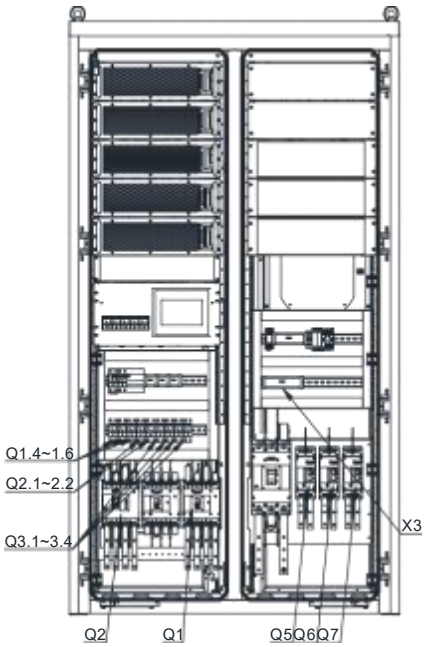

Figure 3.5.2 External Interface of 150 kW modular hybrid power system

See the table below for the description of the external interface of the modular hybrid power system.

Code name	Name	Explain
Q1	Grid circuit breaker	Power grid access circuit breaker
Q2	Load circuit breaker	Load access circuit breaker
Q5、Q6、Q7	Photovoltaic circuit breaker	Photovoltaic access circuit breaker
Q1.4~Q1.6	miniature circuit breaker	Q1.4 and Q1.5: standby circuit breaker Q1.6: Cooling Fan Circuit Breaker
Q2.1~Q2.2	miniature circuit breaker	Q2.1: Emergency Light Circuit Breaker Q2.2: Fire AC Circuit Breaker
Q3.1~Q3.4	miniature circuit breaker	Q3.1, Q3.3, Q3.4: Fire DC Circuit Breaker Q3.2: standby DC circuit breaker
X3	External terminal	1, 2 and 3: standby 1 AC220V power supply terminal. 4, 5 and 6: standby 2 AC220V power supply

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		terminal.
		7, 8 and 9: Power supply terminal of cooling fan 10, 11: Emergency lamp power supply terminal 12 and 13: AC220V power supply terminal for fire fighting. 14, 15: Fire 1 DC24V power supply terminal 16, 17: Fire 2 DC24V power supply terminal 18 and 19: Fire-fighting 3 DC24V power supply terminal 20, 21: spare 3 DC24V power supply terminal 22, 23: Emergency stop normally closed reserved terminal

6. Installation and use

6.1 Installation condition requirements

In order to ensure the normal operation of the machine, the installation environment and requirements are as follows:

The protection level of the modular hybrid power system is IP54, and the product is an electronic device, so it should not be placed in a humid place. Good ventilation around the machine;

Clean installation environment;

The equipment will produce some noise during operation, so try to install it far away from residents' lives; Install the ground to ensure that it will not shake, and the supporting surface should meet the load-bearing requirements of the modular hybrid power system; The installation location should ensure easy maintenance;

The machine should reserve enough space to ensure ventilation and heat dissipation.

All protective measures for the installation of modular hybrid power system need to be strictly designed and meet the following requirements:

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- Foundation requirements:

Modular hybrid power system needs to be installed on the flat ground or channel steel supporting structure with flame retardant material on the surface, and the ground is forbidden to be sunken or inclined. The foundation must be solid, safe and reliable. The foundation must have the bearing capacity to bear the weight of the modular hybrid power system.

- Space requirements:

When installing a modular optical storage unit, a proper distance from walls or other equipment must be maintained to meet the requirements of the narrowest maintenance path, escape route, and ventilation.

The front of the installation position of the modular hybrid power system should ensure a space of more than 0.8m, the back should ensure a space of more than 0.8m, and the top should ensure a space of more than 0.8m to facilitate installation, heat dissipation and maintenance.

- Cable trench design:

The cable connection of the modular hybrid power system adopts the way of down-incoming and down-outgoing. It is suggested that the cables connected to the outside of the modular hybrid power system should be routed through the cable trench, which is convenient for installation and maintenance.

- Wiring specification:

The cables used in the system can generally be divided into power cables and communication cables. When laying communication cables, it is necessary to stay away from power cables, and the cables should be at right angles at intersections. When laying, make the cable length as short as possible and keep a distance from the power cable. It is suggested that the insulation impedance of DC terminal BAT+ and BAT- to-ground should be greater than 1 mω. Power cables and communication cables should be placed in different cable trenches, so as to avoid long-distance parallel running of power cables and communication cables and reduce electromagnetic interference caused by output voltage transients. The distance between power cables and communication cables should be greater than 0.2m. When the wires are distributed crosswise, the crossing angle should be 90 degrees, and the distance can be reduced appropriately.

- Ventilation requirements:

When the modular hybrid power system is running, it will generate a lot of heat, which will affect the electrical performance of the equipment and even damage the equipment when the environmental temperature is too high. Therefore, it is necessary to fully consider the release of these heat when designing the control room to ensure the normal and efficient operation of the equipment.

- Ventilation environment:

In order to meet the ventilation requirements of modular hybrid power system, the installation environment should meet the following conditions:

1. modular hybrid power system should avoid being installed in places with poor ventilation and low air

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flow;

2. The air inlet should be supplemented with sufficient air.

㊣ Ventilation equipment:

In order to ensure the safe, reliable and efficient operation of the equipment, the ambient temperature of the equipment must be in the range of -25℃~55℃, so it is necessary to provide appropriate ventilation devices to dissipate the heat generated by the equipment;

1. There must be ventilation facilities in the distribution room to ensure that the waste heat energy generated by the modular hybrid power system is discharged from the equipment to meet the maximum allowable ambient temperature. It can be realized by installing exhaust devices (such as fans and ventilation pipes);

2. In order to ensure the pressure balance, a fan for exhausting air can be added at the outlet of the air outlet pipe;

3. The direction of the air outlet should be selected according to the actual situation of the local wind direction;

4. Pay attention to the dust-proof measures and rain-proof design of air inlet and air outlet;

5. If it is necessary to add ventilation pipes, the size of ventilation pipes should be based on the size of air output and should be set by professionals.

㊣ 1. Other protection:

The protection grade of modular hybrid power system is IP54, which is suitable for installation in dry and clean environment. At the same time, attention should be paid to avoid the damage of modular hybrid power system caused by water leakage in the house. According to EMC requirements and noise level, modular hybrid power system should be installed in industrial environment.

6.2 Installation of required tools and spare parts

Tools and parts required for installation are as follows:

Lifting crane, forklift or fork automatic loading and unloading truck (with the capacity to carry the weight of modular light storage unit);

Torque wrench;

Screwdriver;

Wire stripper;

Terminal press machine;

Hot hair dryer;

Megohm meters and multimeters.

6.3 AC side wiring

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The output voltage of the AC side of the modular hybrid power system is 400V, which is connected to the power grid through a transformer. The connection method between AC side and power grid side of modular hybrid power system is as follows:

Step 1: Turn off the power grid side circuit breaker, turn off the AC side circuit breaker of the modular hybrid power system, and measure with a multimeter to confirm that the terminal has been cut off.

Step 2: Determine the phase sequence of AC connection cables.

Step 3: Peel off the insulation at the end of the cable.

Step 4: Crimp the copper nose of the wiring.

1. Put the exposed copper core part of the stripped wire end into the wire pressing hole of the wiring copper nose.

2. Use a terminal press to press the copper nose of the wiring, and the number of crimping should be more than two.

Step 5: Install the heat shrink sleeve.

1. Select the heat shrinkable sleeve which is in line with the cable size, and the length is about 5cm.

2. Sleeve the heat shrinkable sleeve on the copper nose of the wiring, so as to completely cover the wire pressing hole of the copper nose of the wiring.

3. Use a hot air blower to shrink the heat-shrinkable sleeve.

Step 6: Connect the "L1" cable to the "L1" phase A(U) of the AC distribution cabinet. Select bolts that match the copper nose of the wiring.

Step 7: Connect the "L2" of the AC output to the "L2" of the AC distribution cabinet according to the method of step 6, that is, phase B(V); The "L3" connected to the AC output is connected to the "L3" of the AC distribution cabinet, that is, the C(W) phase; Connect the N line and connect it to the N row of equipment.

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Chapter IV Industrial and Commercial Energy Storage Battery System

1. Brief introduction of battery system

The battery module is mainly composed of high-safety, long-life, environmental-friendly and pollution-free LiFePO4 batteries produced by our company and a battery management unit that fits the characteristics of LiFePO4 batteries efficiently, and adopts standard modular design, which can be flexibly assembled according to the actual needs of users, with good maintainability and later expansibility.

2. Battery system configuration

2.1 Operating principle

The battery modules are connected in series to form a high-voltage unit, and the battery management system inside the high-voltage control module (PDU) and the main circuit switches, contactors, fuses and other components are used to collect, analyze and protect the data of the battery units, and all the modules are integrated on the steel bracket through structural parts to form a battery cluster. The working schematic diagram is as follows:

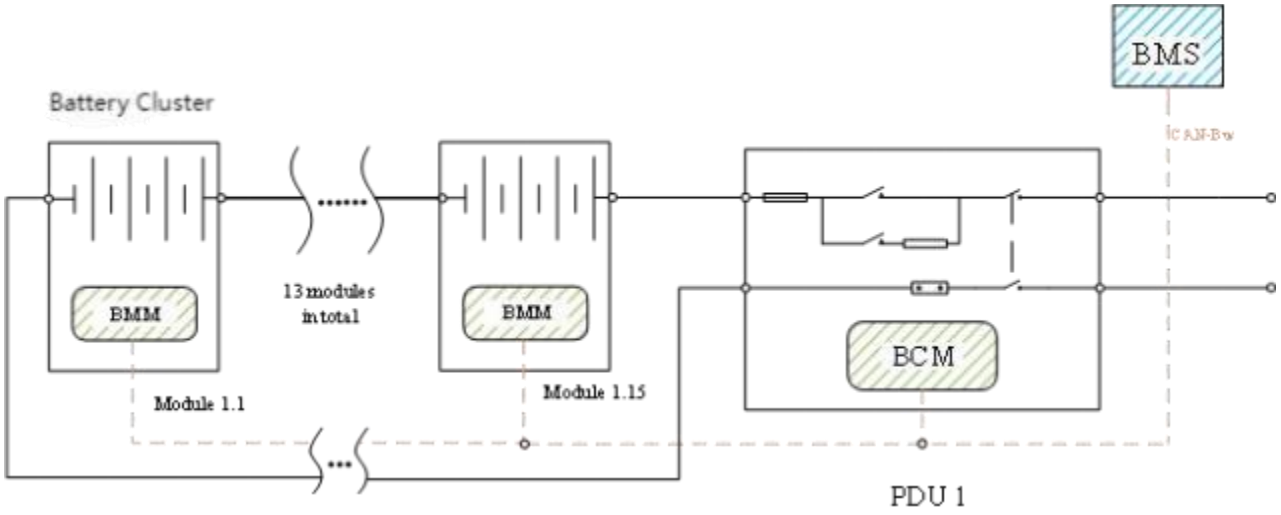

Figure 4.2.1 Working Principle Diagram of Battery System

2.2 Basic parameter

The lithium iron phosphate battery module is mainly composed of batteries connected in series and parallel, and has the functions of voltage and temperature acquisition and balanced control for each battery cell. It is designed with a special chip for battery management, receives control commands through daisy-chain communication, and reports the collected data.

The high-voltage box includes fuse, relay and battery cluster management unit (BCMU), which mainly monitors the whole battery cluster.

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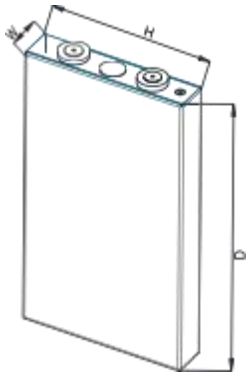
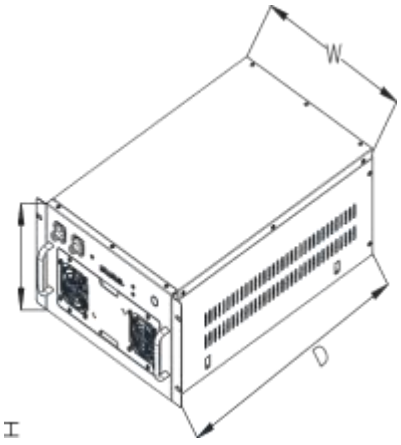
63kWh industrial and commercial energy storage battery system is mainly composed of battery modules, high-voltage boxes, etc. Its parameters are as follows:

75Ah Cell	Parameter name	Parameter value
	Size (depth * width * height)	215mm*29mm*135mm
	Weight	1.75±0.05KG
	Rated capacity	75Ah
	Rated energy	240W
	Rated voltage	3.2V
	Voltage range	2.8V~3.65V
Battery module	**Parameter name**	**Parameter value**
	Model	TEM-38-150-A
	Size (W*D*H)	360*573*242
	Discharge rate	0.5C
	Cell type	75Ah
	Compound mode	2P12S
	Weight	66±1kg
High-voltage box	**Parameter name**	**Parameter value**

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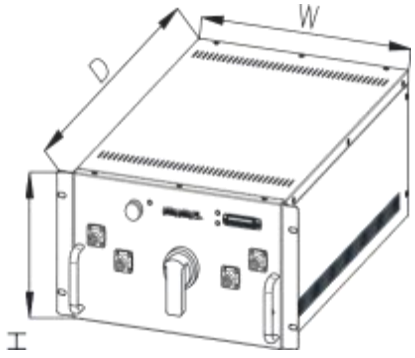
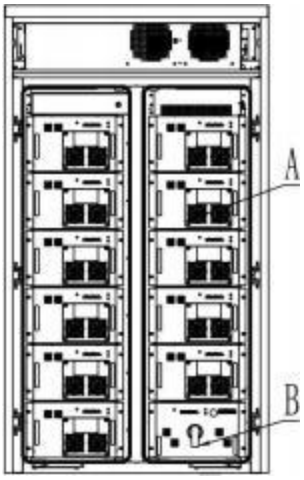
	Model	PDU-800-200BLS
	Size (W*D*H)	360*573*242
	Rated current	150A
	Rated voltage	1000V
	Weight	25±1kg
Industrial and commercial energy storage battery system	**Parameter name**	**Parameter value**
	Quantity of electricity	63kWh
	Size (W*D*H)	1150*1000*2190
	Rated power	63.36kWh
	Rated voltage	422.4V
	Voltage range	369.6~475.2V

157kWh industrial and commercial energy storage battery system is mainly composed of battery core, battery module, high-voltage box, etc. Its parameters are as follows:

280Ah Cell	**Parameter name**	**Parameter value**
	Size (depth * width * height)	215mm*29mm*135mm
	Weight	5.42±0.30KG

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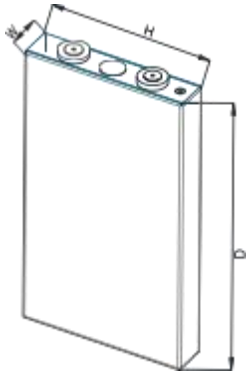
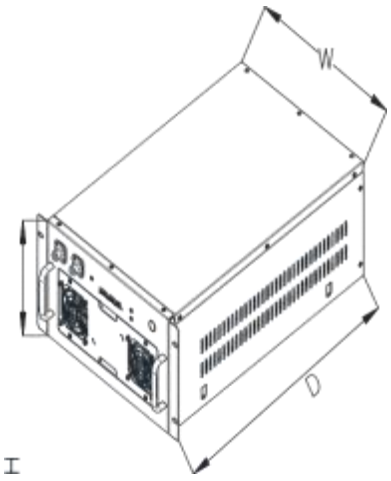
	Rated capacity	280Ah
	Rated energy	240W
	Rated voltage	3.2V
	Voltage range	2.8V~3.65V
Battery module	**Parameter name**	**Parameter value**
	Model	TEM-51.2-280-J
	Size (W*D*H)	420*790*242
	Discharge rate	0.5C
	Cell type	280Ah
	Compound mode	1P16S
	Weight	115±1kg
High voltage box	**Parameter name**	**Parameter value**
	Model	PDU-800-200-280-J
	Size (W*D*H)	420*790*242
	Rated current	280A
	Rated voltage	1500V

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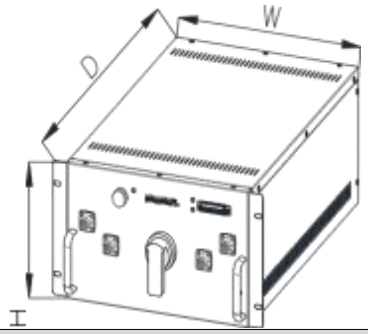
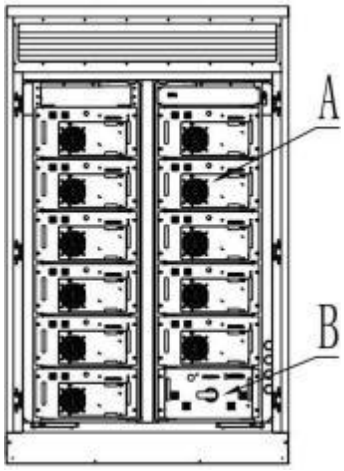
	Weight	30±1kg
Industrial and commercial energy storage battery system	**Parameter name**	**Parameter value**
	Quantity of electricity	157kWh
	Size (W*D*H)	1350*1000*2190
	Rated power	157.6kWh
	Rated voltage	563.2V
	Voltage range	492.3~633.6V

3. Appearance and size

63kWh industrial and commercial energy storage battery system	
Appearance of 63kWh industrial and commercial energy storage battery system	**Explain**

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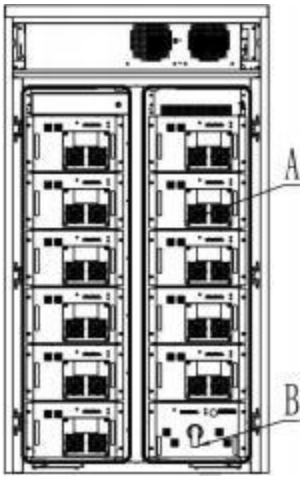
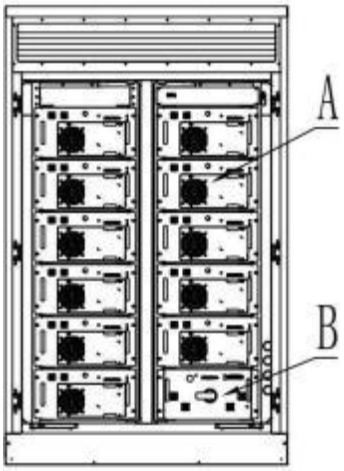
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 1150mm*1000mm*2190mm
157kWh industrial and commercial energy storage battery system	
Appearance of 157kWh industrial and commercial energy storage battery system	**Explain**
	Front view A: Operation indicator B:Fault indicator C:Emergency stop button Size(W*D*H) 1350mm*1000mm*2190mm

4. Auxiliary system configuration

4.1 Fire fighting（optional according to actual needs)

4.1.1 Fire fighting shape and description

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Figure 4.4.1.1.1 Fire fighting outline drawing

Intelligent fire extinguishing device is equipped with LCD panel and built-in control unit module, which has the functions of pressure indication, spraying indication, under-voltage alarm, acousto-optic alarm, emergency start, constant temperature start and electric control start. When a fire occurs, the control unit receives the signals from the external smoke and temperature detectors, and audible and visual alarm acts. After reaching the preset delay time, the fire extinguishing device is started to put out the fire. The intelligent type is also equipped with a temperature control starting device. When the temperature in the cabinet reaches 68℃, the fire extinguishing device can also start automatically and spray fire extinguishing agent to put out the fire. Intelligent double protection makes fire fighting more reliable. The intelligent control unit has 485 communication interface, and the fire main engine can detect and control the state of each cabinet and fire extinguishing device in realtime.

4.1.2 Intelligent working principle flow chart

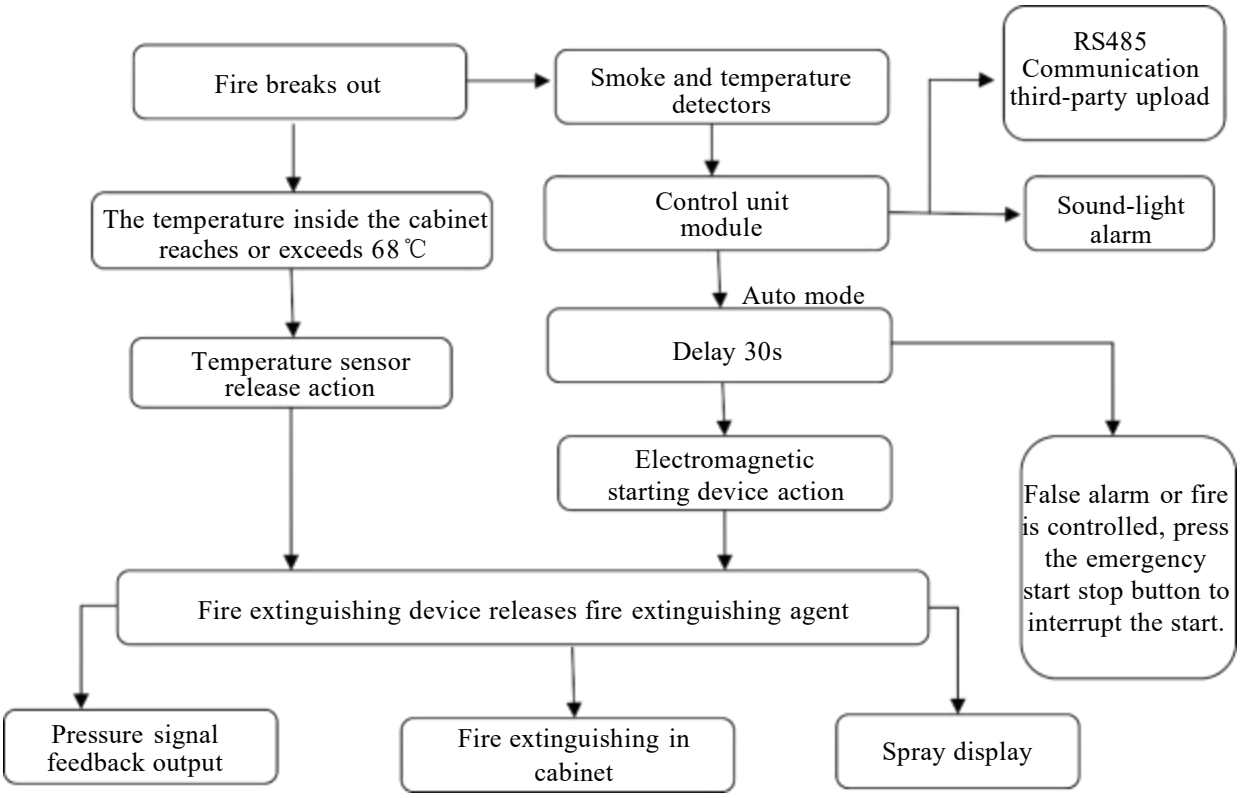

Figure 4.4.1.2.1 Flowchart of Fire Control Work

4.1.3 Product technical parameters

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Technical parameter	JJQR-*-W-1.5×2/1.2-ZHTAJJQR-*-C-1.5×2/1.2-ZHTAJJQR-*-W/C-1.5×2/1.2-ZHTAJJQR-*-Z-1.5×2/1.2-ZHTA		JJQR-*-W-6/1.2-ZHTA JJQR-*-C-6/1.2-ZHTA JJQR-*-W/C-6/1.2-ZHTA JJQR-*-Z-6/1.2-ZHTA	
Storage capacity of chemicals (Kg)	3		6	
Storage pressure (MPa)	1.2		1.2	
Protection space (m^3)	4		8	
Injection time (s)	≤10		≤10	
Overall dimension mm (length × width × height)	530*480*88/ Intelligent: 560*480*88		530*480*176/ Intelligent: 560*480*88	
Operating ambient temperature	0℃~50℃		0℃~50℃	
Model classification				
Classify	Temperature control type	Electric control type	Thermoelectric double control type	Intelligent
Starting condition	+68℃	DC24V	+68℃ or DC24V	+68℃ or smoke temperature signal
Delay	Without	Without	Without	Settings (0~30S)
Pressure display	Pressure gage	Pressure gage	Pressure gage	LCD display
External equipment	Without	Without	Without	Smoke, temperature, sound and light
External communication	Without	Without	Without	RS485 communication
Signal feedback	Have	Have	Have	Have
Temperature-sensitive releaser	Have	Without	Have	Have
Electromagnetic drive device	Without	Have	Have	Have

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Power Supply	Not required	Not required	Not required	AC220V

4.2 Air conditioner

4.2.1 Performance parameter table

In order to consider the application scenarios of the energy storage system, air conditioning design is added to the battery area to ensure that the system can be used normally at -40℃~45℃. See the table below for specific parameters.

Model	Complete machine			LZXD-3.5GE
Complete machine	Rated cooling capacity		kW	3.0
	Rated heat production			4.0
	Refrigeration input power			1.7
	Heating input power			4.1
	Refrigerating fluid	Model		R410A
		Charge	g	750
	Operating environment		℃	-40～45
	Overall dimensions (see attachment)	W	mm	945
		D	mm	655
		H	mm	260.2
	Colour			RAL7035
	Weight（Single）		kg	68
	Power supply			1Φ~220V/50HZ

5. Installation and use

5.1 Safety instructions

The battery system has extremely high voltage, and improper operation may cause electric shock or short circuit danger. It must be installed by qualified personnel, and protective equipment must be worn during work.

High voltage and current

- Pay attention to the high voltage of the battery, and it is forbidden to directly contact the metal part of the product when it is charged.
- Pay attention to the high current output of the battery, and it is forbidden to use any conductor to short the

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positive and negative poles of the battery.

- Do not insert or remove cables when the system is running.
- Ensure that the product is reliably grounded and that the operator has professional and reasonable protective equipment, such as insulation gloves.
- During the installation, check whether cables between modules are properly connected to prevent device damage or personal injury.

Personnel misoperation and improper use

- Do not tear or cover the nameplate or other warning signs on the surface of the product to prevent children or non-professionals from entering the equipment work area.
- The installation and operation must be carried out by specially trained personnel and all operation procedures must comply with local laws, regulations or national standards.
- Special lifting equipment should be used to ensure that it is properly fixed to the battery rack. The installation personnel should wear anti-smashing gloves, anti-smashing shoes and other protective equipment.

5.2 Installation step

5.2.1 Module installation

a) Use the elevator equipped with the system to place all battery modules in the corresponding positions of the battery rack according to the code;

b) Use bolts to fix all battery modules;

c) Install and fix the PDU module to the designated position of the battery rack and fix it;

5.2.2 Power line connection

a) Power lines between modules are connected in series, and the positive and negative poles of battery modules and power lines should be distinguished.

b) Starting from the battery module numbered "1", plug the positive plug of the power line numbered "1" with the positive terminal of the module;

c) Before connecting the next battery module, use a multimeter to confirm that the voltage between the output end of the previous battery module and the shell and battery rack of the next battery module is less than 500mV;

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d) Plug the negative plug of the power line with the negative terminal of the next module;

e) Repeat steps b)~d), and connect all the modules according to the module number from low to high.

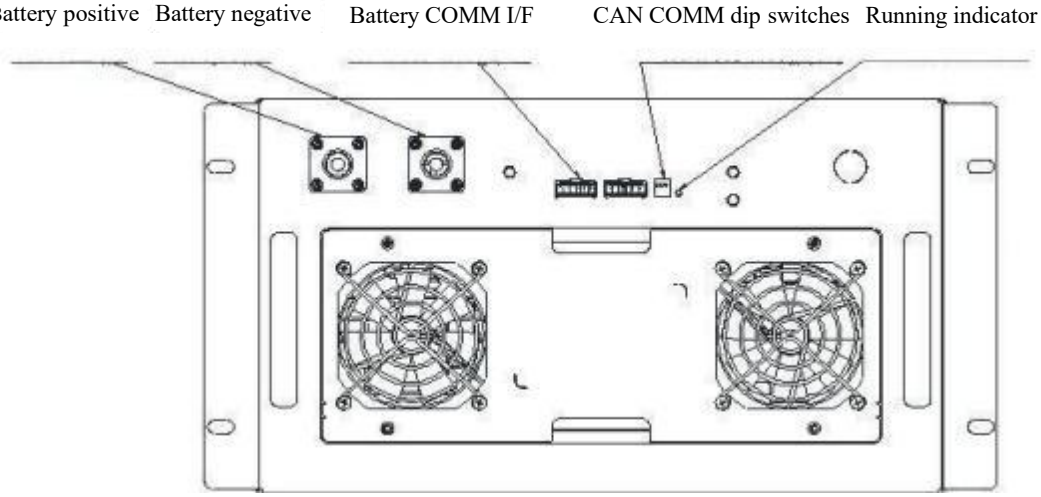

Figure 4.5.2.2.1 Schematic diagram of battery module interface

5.2.3 Communication line connection

a) Starting from the battery module numbered "1", plug one end of the communication line numbered "1" with the "POWER IN" interface of the battery module;

b) Plug the other end of the communication line numbered "1" with the "POWER OUT" interface of the next battery module;

c) Repeat steps a)~b), and connect all module communication lines in order of numbers from low to high;

d) After the connection is completed, the DIP switch ADD of the last battery box should be turned up.

5.3 Power on test

a) Use an insulation internal resistance meter to measure the insulation values between the battery pack output terminal and each port of PDU module and the battery rack respectively. The insulation resistance of each part shall be no less than 500 kω/V according to the nominal voltage, and the test voltage level shall refer to the following table:

Nominal voltage of battery system Ue/V	Voltage level of measuring instrument /V
Ue<500	500
500≤Ue<1000	1000

b) Confirm that the insulation resistance meets the requirements, and confirm that the main circuit breaker of PDU module is in the off state;

/

c) Connect that power line at the output end of the battery cluster with the input end of the PDU module;

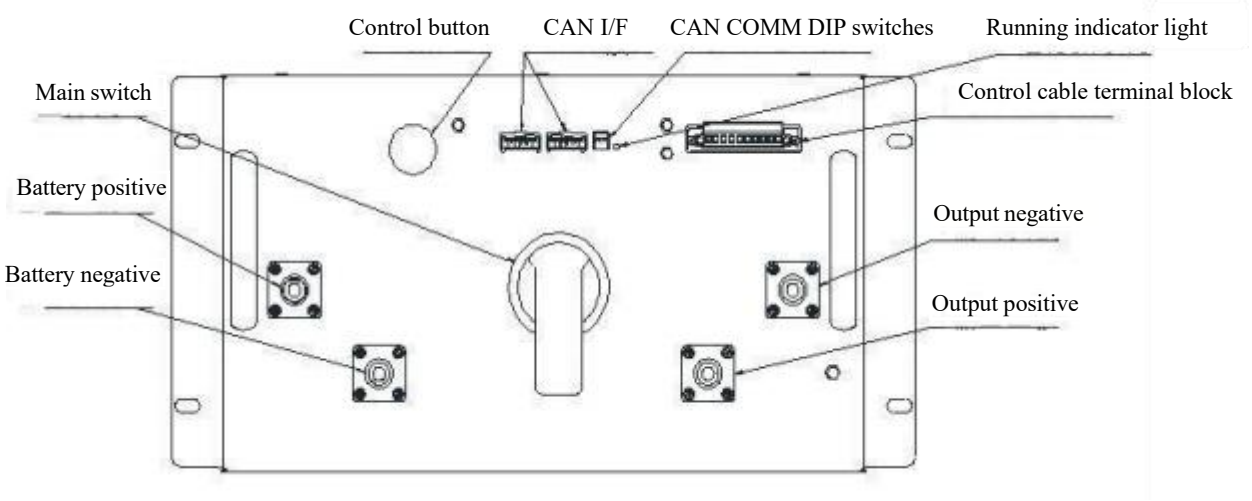

Fig. Schematic diagram of front panel of 4.5.3.1 PDU module

d) Connect the "POWER OUT" interface of battery module numbered "1" with the communication interface of PDU module by communication line;

e) The PDU module is powered by single-phase alternating current provided by UPS, and the power plug is plugged into the power interface. After confirming that UPS is started, press the power button of PDU module to start the battery system;

f) Close the main circuit breaker, and confirm the relay closing and battery voltage on the BMS level 3 management display panel. There is no obvious difference between the battery voltage and the measured value of multi-meter, which indicates that the battery module is started normally.

g) If there is any abnormality, please immediately disconnect the main circuit breaker and close the PDU module, and notify the professionals to check.

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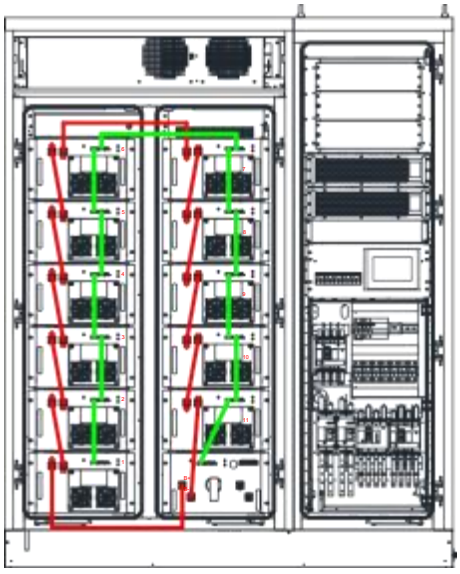

Figure 4.5.3.2 Battery Stacking and Wiring of 63kWh Energy Storage System

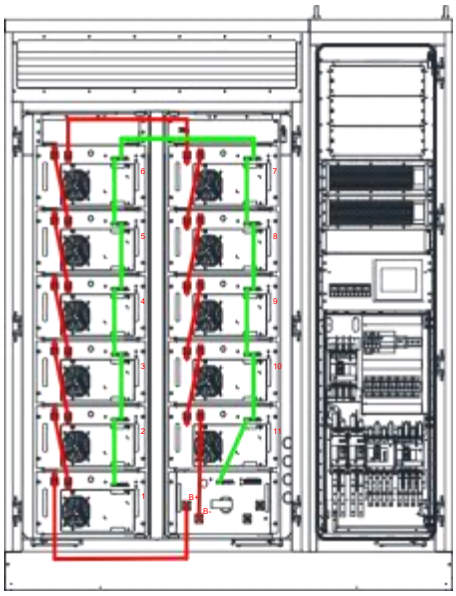

Figure 4.5.3.3 Battery Stacking and Wiring of 157kWh Energy Storage System

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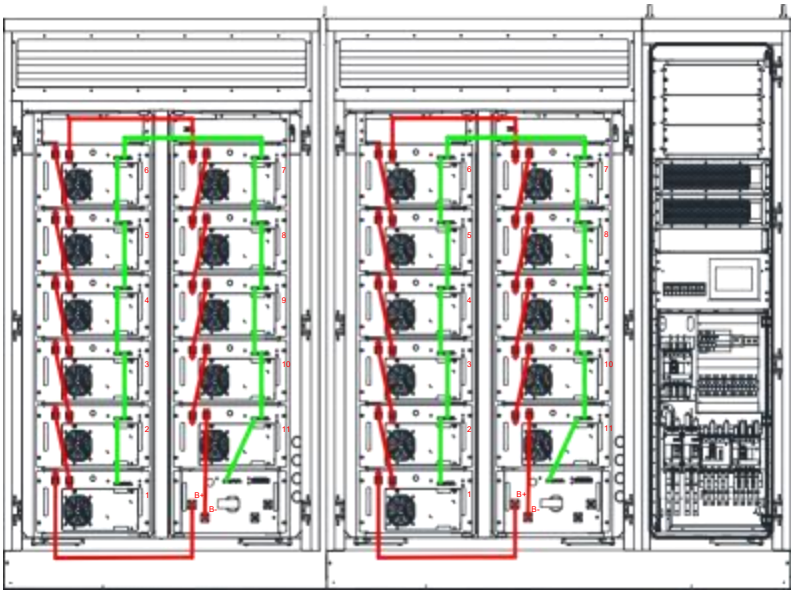

Figure 4.5.3.4 Battery Stacking and Wiring of 315kWh Energy Storage System

Figure 4.5.3.5 Battery Stacking and Wiring of 473kWh Energy Storage System

6. Product maintenance

All components of the battery system work under high current for a long time. After a certain period of operation, it is necessary to check the key components, so as to find the abnormality in time and deal with it accordingly, so as to ensure that the system runs in a good working state.

6.1 matters need attention

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Disassembly prohibited

- Non-professionals are prohibited to disassemble, if you need to replace parts or other necessary conditions, please contact the after-sales personnel to operate or seek the advice of our company.

Extreme temperature

- Do not allow the battery system to work at extreme temperatures for a long time. If the battery system is not suitable for a long time, power off the battery system at 60% to 80% SOC, and recharge it every six months.

/

Chapter V Man-Machine Interface

1. Main page

Click the [Home] button at the bottom of any other interface to enter this page.

In this page, there are mainly: operation data, parameter settings, historical data and other information. You can switch to other pages by using the common function keys below.

Figure 5.1.1 Main page of modular hybrid power system

2. On/off page

Click the [On/Off] button in any other interface to enter this page.

In this page, there are mainly: confirm button and cancel button. Used to select startup or shutdown operation.

/

Figure 5.2. 1 Switch interface

3. Operating data

Click Run Data at the bottom of any other interface to enter the sub-menu of Run Data. The sub-menu contains the operation data of PCS, BMS,MPPT and other equipment.

3.1 PCS operation data

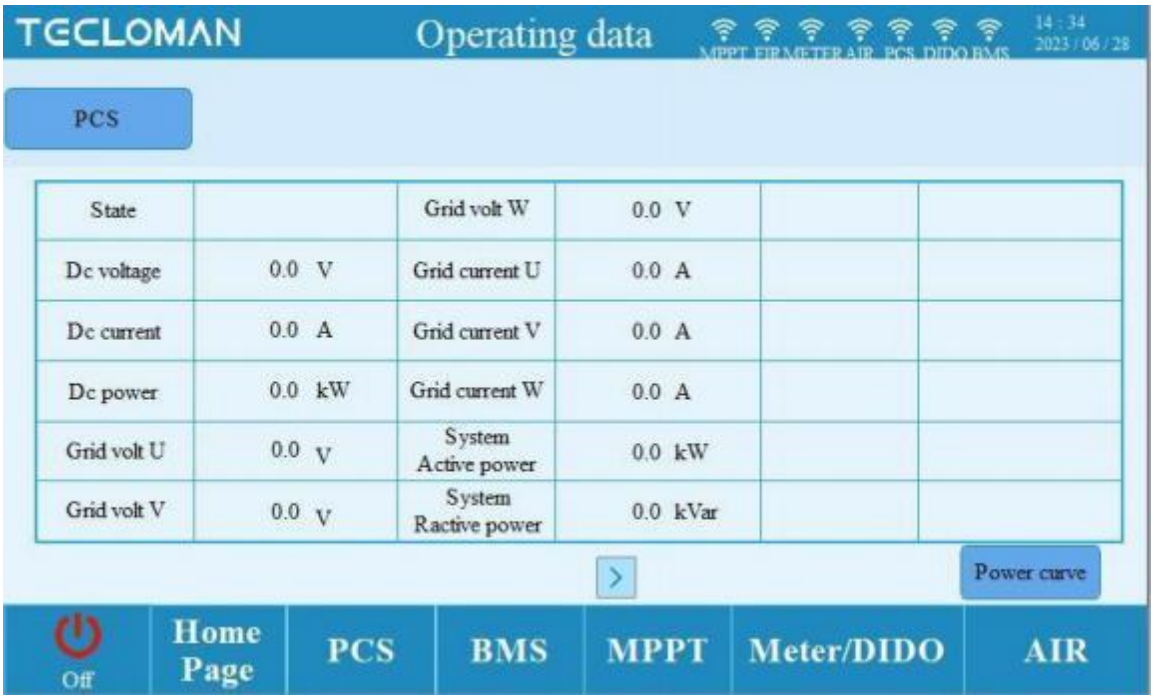

Figure 5.3. 1PCS Operation Data Interface

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3.1.1 Curve of output

Click the [Power Curve] button at the bottom of the PCS operation data interface to enter the "Power Curve" submenu. The submenu has power curves of battery charge and discharge, power grid and load.

Figure 5.3.2 Interface of Battery Charge and Discharge Power Curve

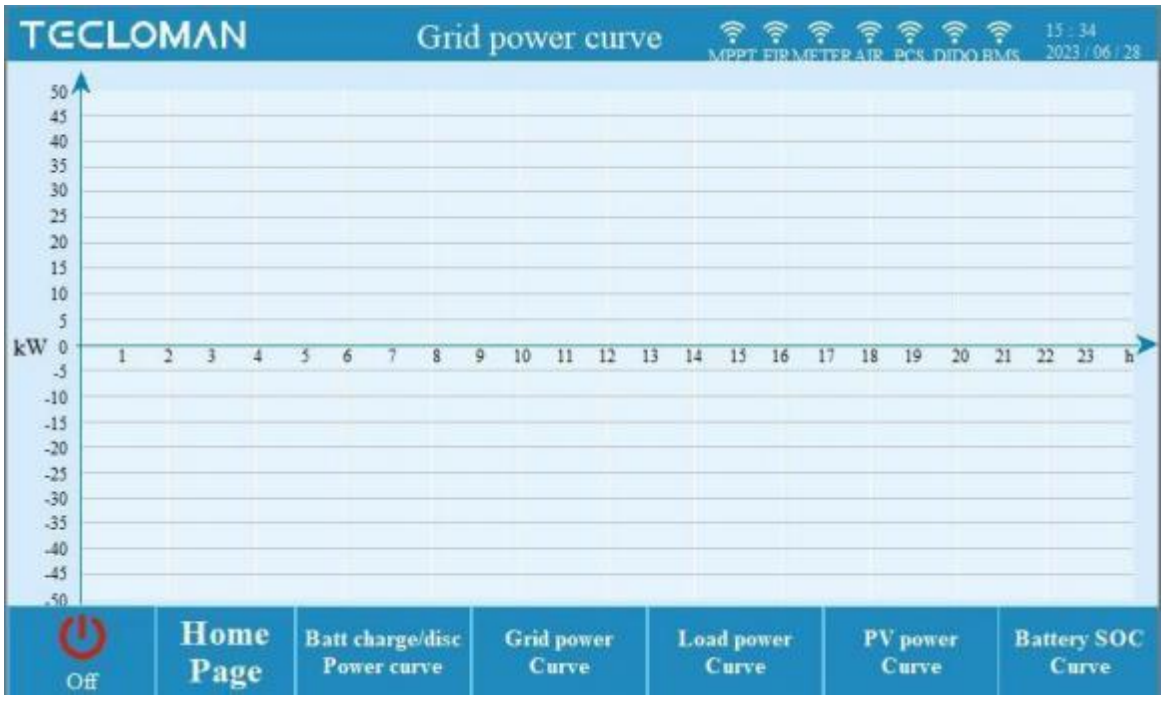

Figure 5.3.3 Interface of Power Curve of Power Grid

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Figure 5.3.4 Interface of Load Power Curve

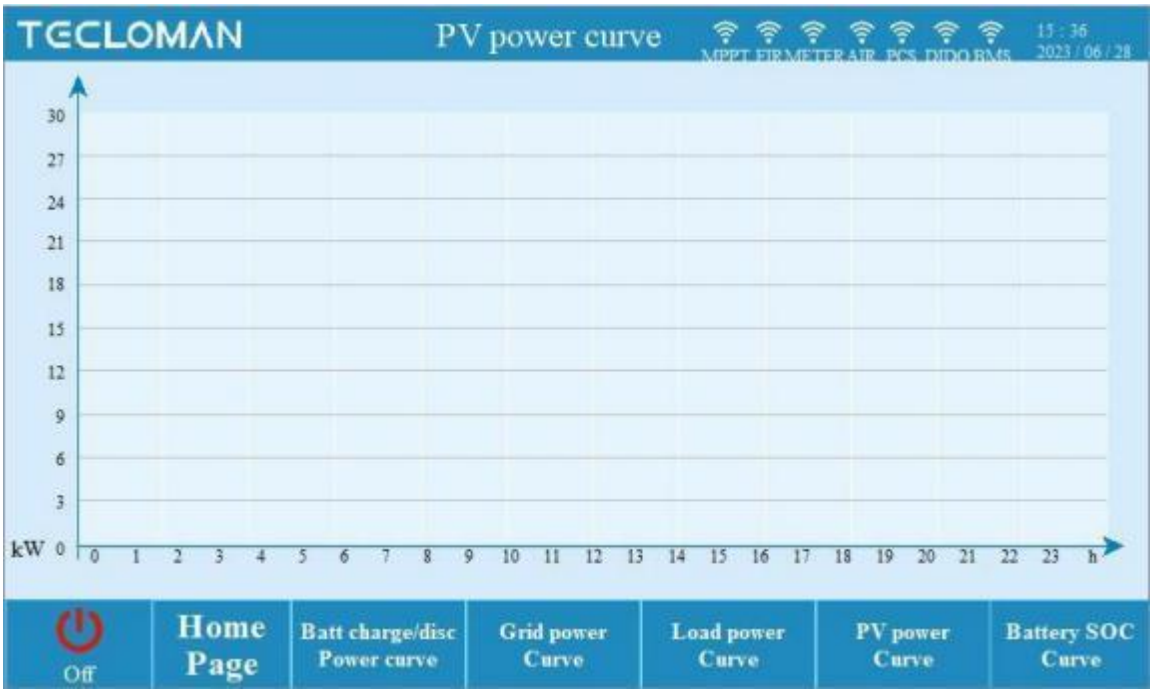

Figure 5.3.5 Photovoltaic Power Curve Interface

Figure 5.3.6 Battery SOC Curve Interface

3.2 BMS operation data

Figure 5.3.7 BMS Operation Data Interface

3.3 MPPT operation data

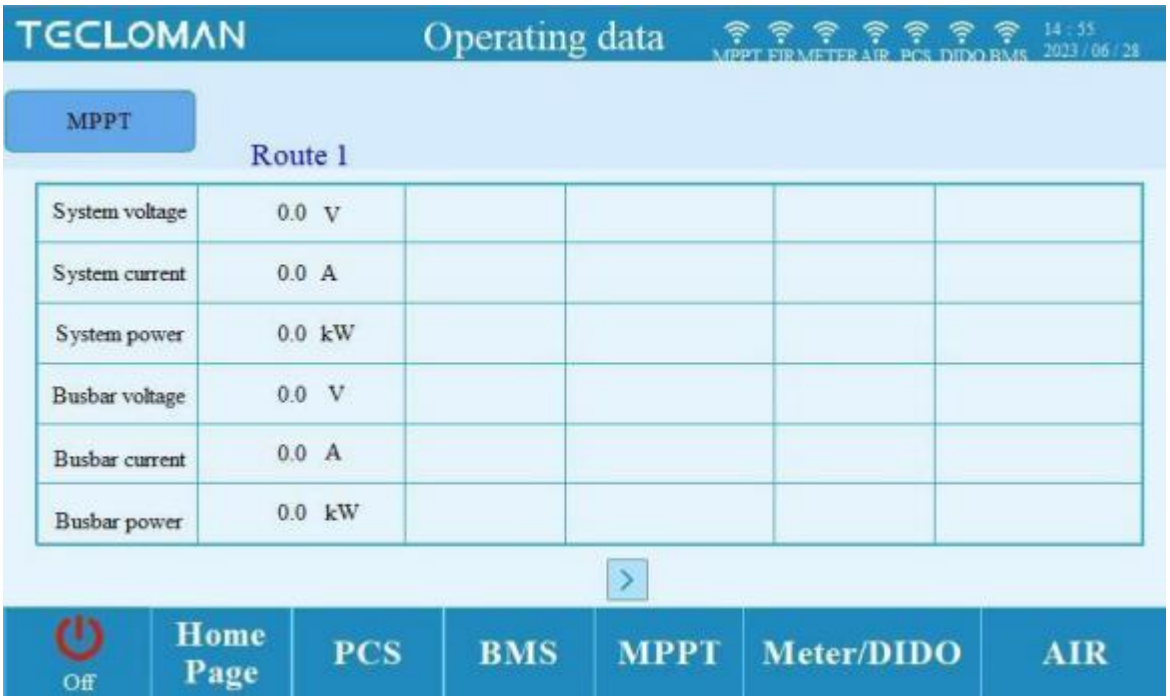

Figure 5.3.8 MPPT Operation Data Interface

3.4 Meter/DIDO running data

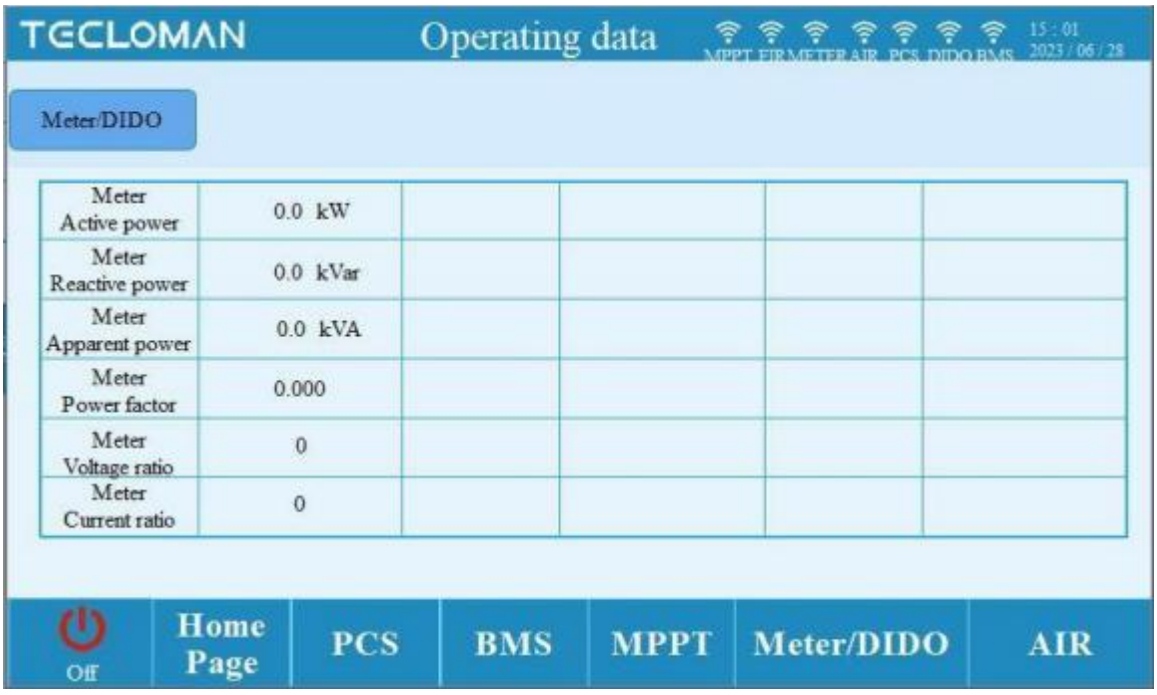

Figure 5.1.9 Operation Data Interface

3.5 AIR operation data

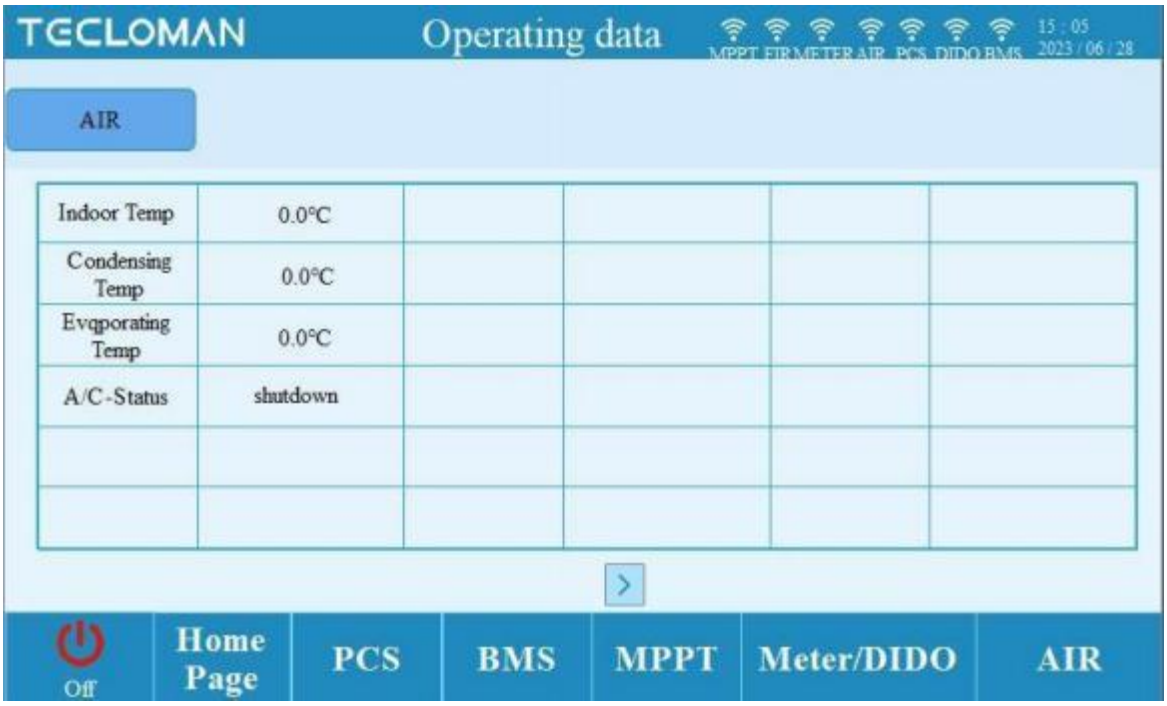

Figure 5.3. 10AIR Operation Data Interface

4. Parameter setting

Click Parameter Settings in any other interface to enter the sub-menu of Parameter Settings. The sub-menu includes: basic parameters, protection parameters, communication parameters and language/time.

4.1 Basic parameter

Figure 5.4.1 Basic Parameter Interface

4.2 Protection parameter

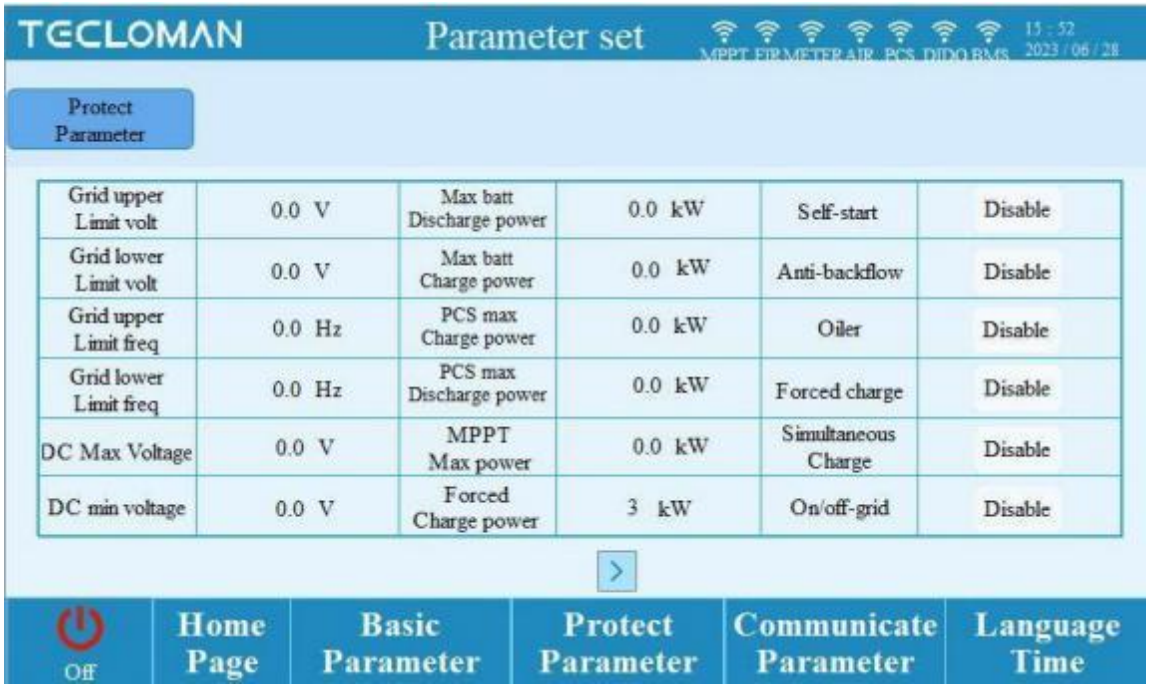

Figure 5.4.2 Protection Parameter Interface

4.3 Communication parameters

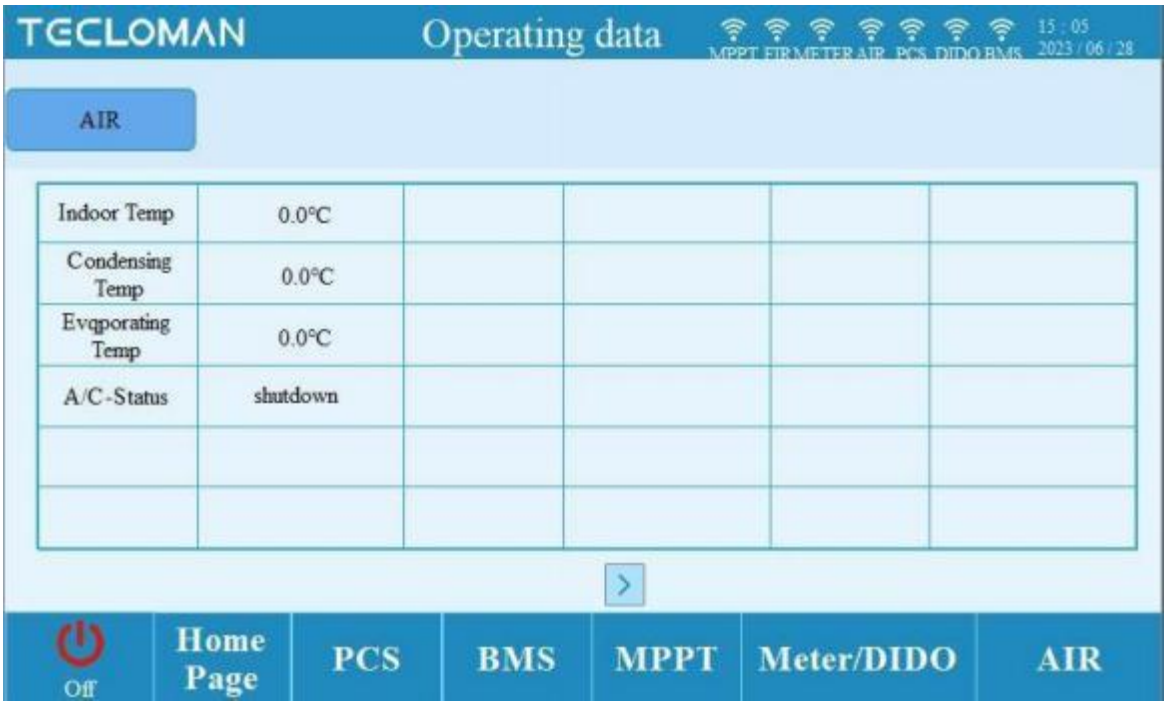

Figure 5.4.3 Communication parameter interface (unchanged)

4.4 Language/time

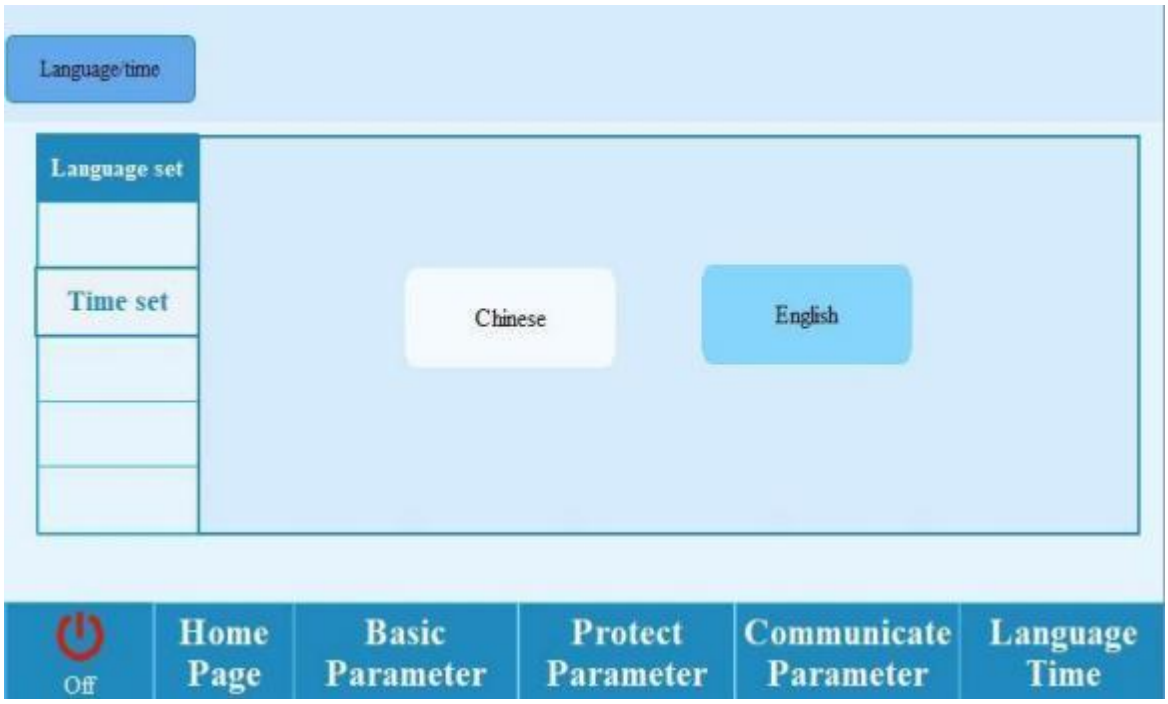

Figure 5.4.4 Language/Time Interface

5. History data

Click the "Historical Data" button at the bottom of any other interface to enter the "Historical Data" Sub-menu. The sub-menus are: alarm record, electricity statistics.

5.1 Alarm record

Figure 5.5.1 Alarm recording interface

5.2 Electricity statistics

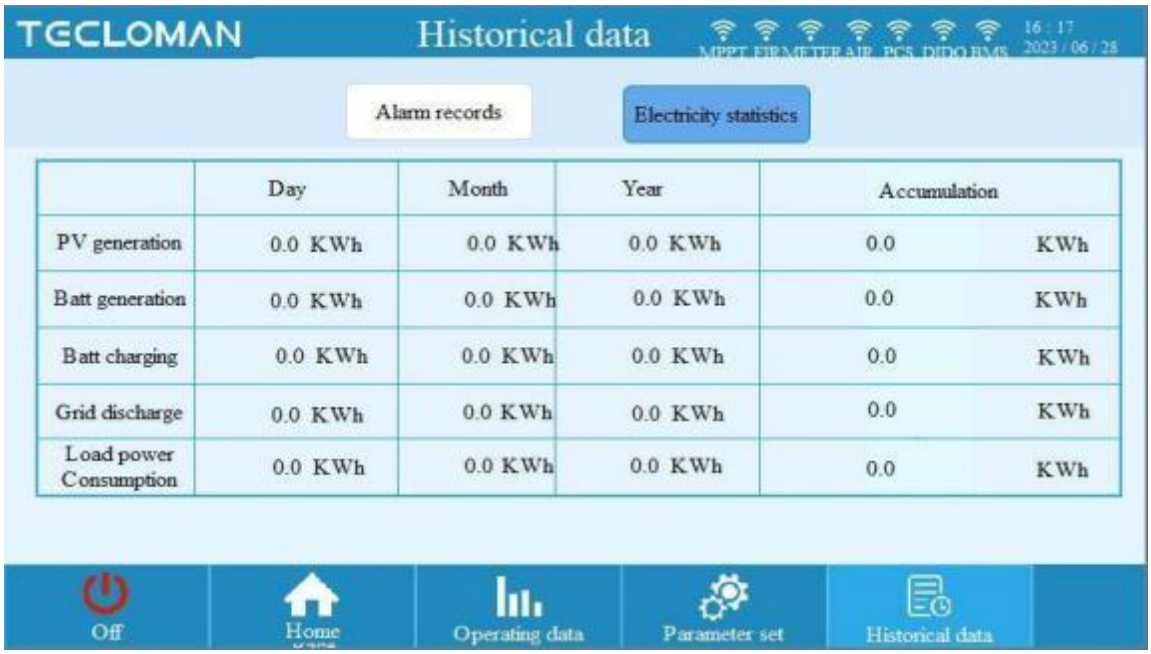

Figure 5.5.2 Electricity statistics interface

Chapter VI Daily Operation and Maintenance

1. Maintenance cycle

In order to ensure the good operation of each equipment in the energy storage integrated system, it should be maintained regularly.

The maintenance intervals given in this section are reference values. The actual maintenance period should be reasonably determined according to the actual environmental conditions of the project site. If the operation environment of energy storage integrated system is harsh, such as desert area, the corresponding maintenance cycle should be shortened. In particular, internal and external cleaning, anti-corrosion and anti-rust work should be more frequent.

Daily maintenance

Periodically check whether the cooling fans and fans in the energy storage integrated system run normally, and observe whether there is friction sound during operation. If yes, dust may enter the system. After stopping the energy storage integrated system, remove dust.

After the energy storage integrated system is completely powered off, wait at least 10 minutes for the internal capacitor to discharge. Before removing dust, use a multimeter to check that the inside of the machine is completely free of electricity to avoid electric shock.

The following work is recommended every two years.

Project list	Inspection method
System status and cleaning	Check the following items, and if they do not meet the requirements, please correct them immediately: ☞ Check whether the industrial and commercial energy storage battery system, modular hybrid power system and internal equipment are damaged or deformed. ☞ Check whether there is abnormal noise during the operation of internal equipment.

	☞ Check whether the temperature in the industrial and commercial energy storage battery system and modular hybrid power system is too high. ☞ Check whether the internal humidity and gray scale of industrial and commercial energy storage battery system and modular hybrid power system are within the normal range. Clean it if necessary. ☞ Check whether the air inlet and air outlet of industrial and commercial energy storage battery system and modular hybrid power system are blocked.
Warning sign	Check whether warning signs and labels are clearly visible and free from contamination. Replace it if necessary.
Cable shielding layer grounding	Check whether the cable shielding layer is in good contact with the insulating sleeve; Whether the grounding copper bar is fixed in place.
Corrosion situation	Check whether there is oxidation or corrosion in the integrated energy storage system.

The following work is recommended once a year.

Project list	**Inspection method**
Outside the cabinet	Check the following items, and if they do not meet the requirements, please correct them immediately: ☞ Check whether there are flammable objects on the top of industrial and commercial energy storage battery system and modular hybrid power system. ☞ Check whether the welding points between the industrial and commercial energy storage battery system and the modular hybrid power system and the foundation steel plate are firm and whether there is corrosion. ☞ Check whether the industrial and commercial energy storage battery system and modular hybrid power system casing are damaged, painted and

	oxidized. ☞ Check whether the door lock of the cupboard door can be opened flexibly. ☞ Check whether the sealing strip is fixed properly.
Inside the cabinet	Check whether there are foreign bodies, dust, dirt and condensed water in the industrial and commercial energy storage battery system and modular hybrid power system.
Air inlet and outlet	Check the radiator temperature and dust. If necessary, vacuum cleaner can be used to clean the cooling module. Wait for cleaning.
Wiring and cable arrangement	☞ Do not start the inspection until the industrial and commercial energy storage battery system and the internal equipment of the modular hybrid power system are completely powered off! During the inspection, please correct the nonconformities as soon as they are found. ☞ Check whether the cable layout is standard and whether there is a short circuit. If there is any abnormality, it needs to be corrected immediately. ☞ Check whether all inlet and outlet holes of industrial and commercial energy storage battery system and modular hybrid power system are well sealed. ☞ Check whether there is water seepage in the industrial and commercial energy

	storage battery system and modular hybrid power system, ☞ Check whether the power cable connection is loose, and then tighten it according to the previously specified torque. ☞ Check whether the power cable and control cable are damaged, especially whether the skin in contact with the metal surface is cut.

	Traces of. ☞ Check whether the insulation wrapping tape of the power cable terminal falls off.
Grounding and equipotential bonding	☞ Check whether the grounding connection is correct, and the grounding resistance shall not be greater than 4Ω. ☞ Check whether the equipotential connection inside the industrial and commercial energy storage battery system and the modular hybrid power system is correct.
fan	☞ Check the running status of the fan. ☞ Check whether the fan is blocked. ☞ Check whether there is abnormal noise when the fan is running.
screw	Check whether there are screws falling in the industrial and commercial energy storage battery system and modular hybrid power system.

The following work is recommended to be carried out once every six months.

Project list	**Inspection method**
Safety function	☞ Check the emergency stop button and the stop function of LCD to simulate the stop. ☞ Check the warning signs of the machine body and other equipment signs, and replace them in time if they are blurred or damaged.
Internal component inspection	☞ Check the cleanliness of circuit boards and components. ☞ Check the radiator temperature and dust. If necessary, a vacuum cleaner can be used to clean the heat dissipation module. If necessary, please replace the air filter. ☞ Attention! The ventilation of the air inlet must be checked. Otherwise, if the module cannot be cooled effectively, it will fail due to overheating.

Device maintenance	☞ Conduct routine inspection on the corrosion of all metal components (every six months). ☞ The contactor's annual inspection (auxiliary switch and microswitch) ensures its good mechanical operation. ☞ Check the operating parameters (especially voltage and insulation, etc.).

2. System cleaning

Cleaning around and inside industrial and commercial energy storage battery systems and modular light storage units is an important part of maintenance work.

Due to the influence of the temperature, humidity, dust and vibration of the internal equipment in the environment of the industrial and commercial energy storage battery system and the modular optical storage unit, dust will accumulate inside, blocking the inlet and outlet or entering the internal equipment, which will lead to potential failures of the internal equipment, shorten the service life of the equipment or reduce the power generation.

During the normal operation of the equipment, regular inspection and cleaning should be carried out to ensure that the internal equipment is in a better operating environment to a certain extent.

2.1 Cleaning cycle

The cleaning cycle of industrial and commercial energy storage battery system and modular hybrid power system should be reasonably determined according to their operating environment, such as climatic conditions, so as to ensure the good external and internal cleaning conditions of industrial and commercial energy storage battery system and modular hybrid power system. If the operating environment is harsh, such as desert areas, the maintenance cycle should be shortened.

2.2 Internal cleaning

For the dust in the energy storage integrated system, it is not recommended to clean it directly with a broom, otherwise it will easily cause dust, and it is recommended to use a vacuum cleaner to absorb the dust.

2.3 Internal cleaning of foundation

Users should regularly enter the interior of the foundation to check the cleanliness of the foundation. If necessary, please use a vacuum cleaner for cleaning.

2.4 Door lock and hinge inspection

After cleaning, check whether the locks and hinges of the integrated energy storage system can be used normally and in good condition. If necessary, properly lubricate lock holes and hinges.

2.5 Sealing strip inspection

The sealing strip in good condition is an important guarantee to effectively prevent the internal water seepage of the electrical and commercial energy storage battery system and the modular hybrid power system. It should be carefully inspected, and if it is damaged, please replace it immediately.

Chapter VII After-sales and Service

1. Return visit and warranty measures during the warranty period

① Provide customers with the Operation and Maintenance Manual related to this project, and provide training and disclosure to customers' on-site maintenance and operators, and actively cooperate with customers' operation and maintenance work after the project is handed over, until the daily management and maintenance work of customers is on the right track.

② Provide customers with the User Manual, so that customers can fully understand the relevant usage of the work, and supervise and inspect it; And provide maintenance records, and put the records in an appropriate place, so that customer staff can check the maintenance, replacement times, inspection and maintenance dates of relevant equipment at any time.

③ Carry out regular maintenance according to a certain time, including comprehensive inspection and test, and keep all installed equipment in the best operation level. At the same time, fill in the maintenance records, so that the customer staff can check the records of equipment maintenance and component replacement times at any time.

④ During the warranty period, full-time maintenance personnel shall be assigned to take care of the scene, replace or repair the components of the equipment as required to maintain the installed project in good condition, including the supply of materials, all consumables such as lubricants, cleaning materials, filters, etc. At the same time, they shall immediately respond to the accident call and provide 2-hour on-call emergency maintenance service. When receiving the emergency call during working hours and non-working hours, they shall respond effectively to the scene for emergency repair within two hours and six hours respectively.

⑤ The after-sales service department pays a return visit to the project once every quarter, communicates with users, understands users' opinions on imperfect use functions, existing problems and hidden dangers in building installation and use functions and safety, and handles quality problems that need to be solved urgently, so as to relieve users' comprehensive evaluation of the project and quality defects that appear later.

⑥ In the last month of the warranty period, the installation equipment shall be inspected and cleaned. All replacement parts except worn and damaged parts during the maintenance period shall be returned free of charge during inspection.

⑦ If the customer needs to adjust and transform some functions and logic of the equipment due to the needs of his own business development after the whole project is completed and delivered, our company will still actively cooperate with the owner, provide relevant rationalization suggestions to the customer and be a good staff officer of the owner.

2. Monitoring measures after warranty period

After the field equipment is in normal operation, our company's field service personnel will send the operation parameters of the acquisition system back to our company's monitoring platform, and our company will set up full-time personnel to check and analyze the on-site operation parameters of our products every day. If any abnormality is found, our company will analyze and judge the abnormal phenomenon at the first time.

① After the project debugging is completed, will our technical service personnel analyze and sort out the data of the equipment, and send the unnecessary data back to the company's server platform through the network? And jud and processing that correspond data. Make sure that the abnormal data of each project can be prompted and alarmed. Deal with it as soon as possible

② Our company has set up full-time personnel to analyze the operation data of field equipment every day. If any abnormality is found, the fault will be judged at the first time, and the problem points will be confirmed. At the same time, the field maintenance personnel will check and deal with some problems in time.

③ If the platform data analysis finds problems that can't be handled by on-site maintenance personnel, our company will immediately respond by deploying technical service personnel nearby to handle the problems on site. In case of emergency or accident, there is a risk of expansion, and the on-site maintenance personnel can be notified in time for necessary treatment or power failure.

In case of failure within the warranty period, Chengdu Tecloman Energy Storage Technology Co., Ltd.

will provide free maintenance or device replacement services! Name: Chengdu Tecloman Energy

Storage Technology Co., Ltd.

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