INOVANCE

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IES600 Series 400 kW String Power Conversion System

User Guide (European Standard)

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code PS00018460A02

Legal Information

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Disclaimer of Liability

Due to continuous updates and improvements of products and technologies, the content of this documentation may not fully match the actual products. In the event of any discrepancies, the actual products shall prevail.

The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

IES600 series string power conversion system (PCS, 1500 V/400 kW) exchanges energy between the storage battery and the grid to charge and discharge the storage battery in a controlled and intelligent way. In an on-grid system, the power conversion system mainly operates in P/Q mode to allow peak clipping, valley filling, active power reserve, and reactive power support. The power conversion system also supports multiple charge and discharge modes, such as constant voltage, constant current and constant power charge/discharge mode.

This guide describes the product basic information, installation, wiring, commissioning, and troubleshooting.

Revision history

Date	Version	Revision
March 2026	A02	• Updated the labels on the terminal page of the power conversion system. • Updated the cable selection table.
January 2026	A01	**Changed**: • Updated *"4.6 Installing the PCS" on page 36*. • Updated *"5.3.3 Cable Selection" on page 42*. • Updated *"8.3.4 Replace the PCS" on page 72*.
March 2025	A00	Initial release.

Access to the guide

This guide is not delivered with the product. You can download the PDF version in the following ways:

- Visit **https://www.inovance.com/global**, and choose Service&Support> Support > Documentation Download.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install **My Inovance app**, where you can search for and download the guide.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance will be charged after the warranty expires.

Even within the warranty period, maintenance can be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Secondary damage caused by force majeure (natural disaster, earthquake, lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For details, see the Warranty Card.

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1 General Safety Rules

1.1 Fundamental Safety Instructions

Safety Disclaimer

- This section describes the safety precautions that help you use this product correctly. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to observe the safety precautions may result in serious injuries or death of personnel or device damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

Safety Levels and Definitions



Indicates that failure to comply with the notice will result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety Precautions

- Product illustrations in the user guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- Product illustrations in this guide are for reference only. Actual products may vary.
- Personnel must take mechanical precautions to protect personal safety. Wear necessary protective safety gear, such as anti-smashing shoes, clothing, glasses, gloves, and sleeves.

Unpacking



- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.



- Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.
- Unpack the package by following the unpacking sequence. Do not hit the package with force.
- Check whether there is damage, rust, or injuries on the surface of the equipment or equipment accessories.
- Check the materials and ensure all items are included.

Storage and transportation



- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Take appropriate protective measures as required when operating the equipment.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws, and the cabinet doors are locked. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is lifted by hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.
- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.



- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Do not store or transport the drive in environments with strong electric field, strong magnetic field, and strong vibration.
- Do not store or transport the indoor equipment in environments with water splash, rain, and direct sunlight.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take necessary inspection.
- Pack the equipment strictly before transportation.
- Never transport the drive with other equipment or materials that may harm or have negative impacts on the drive.
- The product nameplate contains important parameter information of the equipment. Do not tear or damage the nameplate.

Installation



- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- During installation, set up a visible sign near the equipment switch to prevent accidents caused by inadvertent switch-on. Set up a warning sign or safety belt near the operating area.
- Since the installation area is usually far away from urban areas, appropriate emergency care facilities should be prepared for use as needed.



- Read through the guide and safety instructions before installation.
- Install the product away from heat or fire sources, such as fireworks, heaters, or other heating devices, which may cause overheating or fire.
- Do not install the equipment in an environment with metal dust and magnetic dust, and keep the equipment away from vibration sources.
- Do not install the product in places with strong electric or magnetic fields.
- Before installation, ensure that the installation position has sufficient mechanical strength to support the weight of the device. Failure to comply will result in a mechanical danger.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.

Installation
• When this product is installed in a cabinet or terminal equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations. • Install the equipment onto flame retardant materials, such as metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire. • Do not drill holes on the equipment.
 CAUTION • Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After the installation is completed, remove the protective guard. Failure to comply will block the vent and affect heat dissipation, causing overheat of the product. • During foundation selection, meet the ventilation requirements of the equipment; otherwise, the equipment will become overheating. • Tighten the screws according to the required torque. Too small torque will cause loose connection, and too large torque may damage the screws.
Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- Before wiring, disconnect all the power supplies of the equipment. and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Make sure that the equipment is reliably grounded. Failure to comply will result in an electric shock.
- To ensure that the electrical requirements are met, make sure that the selected measurement equipment meets the field requirements and is used correctly and in a standardized manner. Failure to comply will result in an electric shock.
- For large power stations, the voltage between the positive and negative poles of the energy storage battery pack is very high. Do not touch. The Electric shock or even death may occur if the electrodes are touched accidentally.
- Do not directly short-circuit the positive and negative polarities of the battery; otherwise, the battery will be short-circuited, resulting in fire or explosion.

WARNING

- Ensure that the input and output power cables are connected correctly and the phase sequence is correct, and the cable terminals are properly insulated. Otherwise, the equipment may be damaged or a fire may occur.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at both ends.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.
- Do not drill holes on the equipment.

Wiring



- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply can result in equipment malfunction.
- Do not route cables on the air duct and inlet and outlet of the equipment; otherwise, the product ventilation will be blocked.
- Do not loop or twist cables. Do not connect or weld power cables.
- Ensure that the trench is free of sharp edges and protect the cable when routing the cable through pipes or holes; otherwise, the cable may be damaged.
- Tighten the screws according to the required torque. Too small torque will cause loose connection, and too large torque may damage the screws.
- Use cable bracket and cable clamps to fix buried cables. Cables in the backfilled area need to fit the ground, otherwise the cables will be deformed or damaged by pressure.
- Since the PCS is equipped with anti-surge device, disconnect the PCS from the test circuit during the insulation withstand voltage test, otherwise the test will fail or the PCS will be damaged.

Power-on



- Non-professionals are not allowed to power on the equipment.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- Before power-on, check that the equipment is installed and wired properly without damage and ensure that the equipment will not cause danger. Failure to comply will cause personal injury or death.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire accident.
- Do not open the cabinet door or protective cover of the product, touch any wiring terminal of the product, or remove any part of the product with power on. Failure to comply can result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.



- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire.
- Do not touch the terminals and conductors connected to the power grid circuit or other live terminals or conductors with power-on. Otherwise, electric shock will occur.

Operation state



- The equipment must be operated only by professionals. Failure to comply can result in death or personal injury.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply can result in an electric shock.
- Before operation, check that the equipment is installed and wired properly without damage and ensure that the equipment will not cause danger. Failure to comply will cause personal injury or death.
- Before operation, check that the equipment is grounded properly. Failure to comply will result in an electric shock.
- Always pull out the key to the cabinet door after inspection is done.



- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.
- During operation, do not touch the terminals and conductors connected to the power grid circuit or other live terminals or conductors with power ON. Otherwise, electric shock will occur.



- Before on-grid, obtain the permission of the power department of the country and region.

Maintenance

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- Ensure that at least two personnel are present during maintenance.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the AC voltage and DC voltage in the main circuit to ensure the voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Before maintenance, set up a visible sign near the equipment and the switch to prevent accidents caused by inadvertent switch-on. Set up a warning sign or safety belt near the operating area. Failure to comply may result in personal injuries or death.
- Always pull out the key to the cabinet door after maintenance is done.

WARNING

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.
- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- During maintenance, ensure that the evacuation passage is completely unblocked. Do not place obstacles in the evacuation passage or occupy the evacuation passage in any form.
- Do not clean electrical parts of the product with water, alcohol, or oil.
- Do not open the cabinet door for maintenance when the air humidity exceeds 95% RH, or during rainy, sandy, or hail conditions.

Repair

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Operators should be fully familiar with the relevant standards and operating safety regulations of the country/region and follow the relevant regulations.
- Take appropriate protective measures as required when operating the equipment.
- Ensure that at least two personnel are present during maintenance.
- Make sure that the equipment is reliably grounded. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the AC voltage and DC voltage in the main circuit to ensure the voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- During maintenance, set up a visible sign near the equipment switch to prevent accidents caused by inadvertent switch-on. Set up a warning sign or safety belt near the operating area. Failure to comply may result in personal injuries or death.
- Do not maintain the equipment with power ON to avoid fire or explosion caused by battery short circuit.
- For large power stations, the voltage between the positive and negative poles of the energy storage battery pack is very high. Do not touch. The Electric shock or even death may occur if the electrodes are touched accidentally.
- During maintenance, do not directly short-circuit the positive and negative polarities of the battery; otherwise, the battery will be short-circuited, resulting in fire or explosion.
- Always pull out the key to the cabinet door after maintenance is done.



- Require for repair services in accordance with the product warranty agreement.
- When the fuse is blown or the circuit breaker trips, wait for at least the time designated on the equipment warning label and troubleshoot the fault before power-on or further operations. Failure to comply may result in death, personal injury or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment in according with the replacement instructions.
- Do not operate damaged equipment. Failure to comply may result in worse damage.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- During maintenance, ensure that the evacuation passage is completely unblocked. Do not place obstacles in the evacuation passage or occupy the evacuation passage in any form.
- Do not open the cabinet door for maintenance when the air humidity exceeds 95% RH or during rainy, sandy, or hail conditions.
- Maintain the fan when the fan stops running and has no power.
- Do not drill holes on the equipment.

Unforeseen circumstance



- In case of a fire, evacuate immediately and press the fire alarm bell, or call the fire alarm number.
- Under no circumstances should you enter the burning area.

Disposal

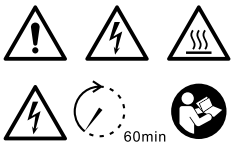


- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

To ensure safe operations, comply with safety signs on the device, and do not damage or remove the safety labels. The following table describes the safety signs.

Safety Label	Description
	Risk of electric shock.

	Ear protection must be worn.
	• Be careful. Operations by non-professionals are prohibited. • Do not touch with power ON to prevent the risk of burn. • Do not touch terminals within 60 minutes after disconnecting the power supply to prevent the risk of electric shock. • Before using the product, read the guide and safety instructions carefully.

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyber attacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.



Tampering with software (such as viruses, Trojans, and Worms) can lead to unsafe drivestate, which can put the device in an unsafe operation state. This may result in death,serious injury, and property damage. Observe the following strictly.

- Always use the latest software version. If the product version is no longersupported or the latest version of the program is not applied, customers are atincreased risk of cyber-attacks.
- Take proper protection measures (including but not limited to deploying antivirussoftware, firewall, WAF, IPS/IDS, situational awareness system, IDverification, and data encryption) to prevent files in the mobile storage devicefrom being damaged by malware and protect products, networks, systems, andinterfaces from unauthorized access, disturbance, intrusion, data disclosure, orinformation theft.
- Check all safety-related interfaces and settings after commissioning.

2 产品信息

2.1 Working Principle

The system includes one input (BAT) on the battery side and three-phase three-wire output on the output side. The schematic for the main power is shown below.

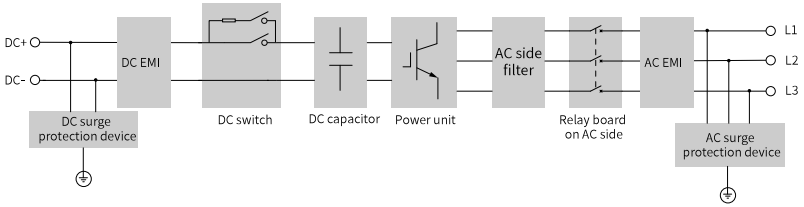


Figure 2-1 Power topology

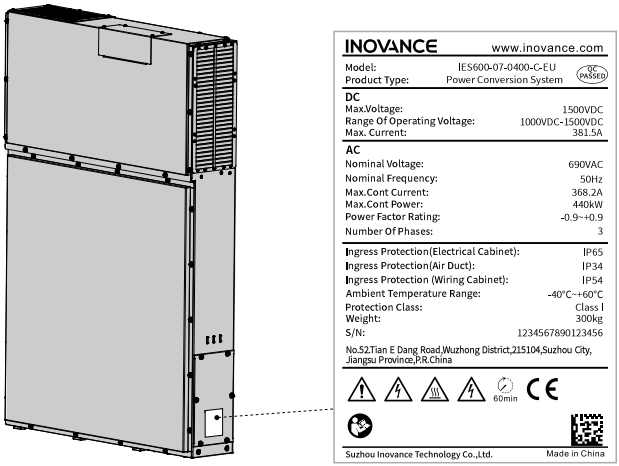
2.2 Model and Nameplate

Model description

IES 6 00 - 07 - 0400 - C _ - EU
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① **Product Family** IES: Inovance energy storage product	④ **Maximum DC voltage** 07: 1,500 V	⑥ **Ventilation method** None: Forced-air cooling C: Air and water cooling W: Water cooling
② **Product series** 6: Modular	⑤ **Power Class** 0366: 366 kW 0376: 376 kW 0400: 400 kW 0415: 415 kW 0420: 420 kW	⑦ **Wiring method** None: Three-phase three-wire N: Three-phase four-wire
③ **Generation** 00: First generation		⑧ **Safety regulations** EU: Europe

Nameplate


INOVANCE
www.inovance.com
Model: IES600-07-0400-C-EU
Product Type: Power Conversion System
DC PASSED
DC
Max.Voltage: 1500VDC
Range Of Operating Voltage: 1000VDC-1500VDC
Max. Current: 381.5A
AC
Nominal Voltage: 690VAC
Nominal Frequency: 50Hz
Max.Cont Current: 368.2A
Max.Cont Power: 440kW
Power Factor Rating: -0.9~+0.9
Number Of Phases: 3
Ingress Protection(Electrical Cabinet): IP65
Ingress Protection(Air Duct): IP34
Ingress Protection (Wiring Cabinet): IP54
Ambient Temperature Range: -40°C~+60°C
Protection Class: Class I
Weight: 300kg
S/N: 1234567890123456
No.52,Tian E Dang Road,Wuzhong District,215104,Suzhou City, Jiangsu Province,P.R.China
60min
Suzhou Inovance Technology Co.,Ltd.
Made in China

2.3 Product Specifications

Item		IES600-07-****-C-EU				
		0366	0376	0400	0415	0420
DC side	Maximum DC power (kW)	410.8	422	449	465.8	471
	Maximum current on the DC side (A)	381.1	358.6	381.5	395.8	400
	Maximum DC bus voltage (VDC)	1500				
	DC voltage operating range (VDC)	950 to 1500	1000 to 1500			
	DC current control accuracy	< 2 %				
	DC current ripple coefficient	< 2 %				
	DC voltage control accuracy	< 1 %				
	DC voltage ripple coefficient	< 2 %				

Item		IES600-07-****-C-EU				
		0366	0376	0400	0415	0420
AC side (on-grid)	Rated power (kW)	366	376	400	415	420
	Max. output power (kW)	402.6	413.6	440	456.5	462
	Rated output current (A)	335.4	314.6	334.7	347.3	351.4
	Maximum output current (A)	369.0	346.1	368.2	382.0	386.6
	Reactive power range (kvar)	-384 to +384	-395 to +395	-420 to +420	-436 to +436	-441 to +441
	AC connection mode	Three-phase three-wire				
	Isolation mode	No isolation				
	Rated grid voltage (VAC)	630	690			
	Allowable grid voltage (%)	- 15 to +10 (536 VAC to 693 VAC)	-15 to +10 (586 VAC to 759 VAC)			
	Rated grid frequency (Hz)	50				
	Allowable grid frequency (Hz)	±5				
	Current harmonic distortion	Total harmonic distortion rate < 3% (rated power)				
	On-grid current DC component	< 0.5%In				
	Charge/Discharge switching time (ms)	< 30				
AC side (off-grid)	Rated output voltage (VAC)	630	690			
	Rated output power (kW)	366	376	400	415	420
	Output overload capacity	1.1 times for long term or 1.2 times for no less than 1 min				
	Rated output frequency (Hz)	50				
	Voltage variation	<1% U_N (linear load balance)				
	Voltage unbalance degree	<2% for long term and <4% for short term				
AC side (off-grid)	Voltage total harmonic distortion rate	• < 3% (linear load) • Each harmonic limit meets the requirements of EN 50549-2.				
	Dynamic voltage transient range	Under the condition of resistive load (load balancing), when the load increases from 20% to 100% or decreases from 100% to 20%, the output transient voltage is lower than 10%.				

Item		IES600-07-****-C-EU				
		0366	0376	0400	0415	0420
System	Cable inlet mode	Bottom inlet/outlet hole				
	Maximum efficiency	99 %				
	Overload capacity	1.1 times for long term or 1.2 times for over 1 min				
	Ambient temperature (℃)	-40 to +60				
	Operation relative humidity (% RH)	0 to 100				
	Ambient temperature for storage (℃)	-40℃ to +70℃				
	Relative humidity for storage (% RH)	0 to 95				
	Rated operation altitude (m)	Maximum 3000				
	Noise (dB (A))	≤75 when the ambient temperature of air inlet is 30℃				
	Dimensions (mm)	W x D x H: 224 x 1015 x 1515				
	Mass (kg)	300				
System	Overvoltage class	III (Grid side), II (DC side)				
	Corrosion-proof class	C4H				
	Pollution degree	3				
	IP rating	Power cavity: IP65/Air duct: IP34/Wiring cavity: IP54				
	Cooling method	Intelligent air/water cooling, liquid cooling				
	Number of devices connected in parallel	16 PCSs operating in parallel on AC side				
	Circulating current in parallel mode	< 5% of the average current of parallel operation (satisfied when the load is greater than 20%)				
Communication and display	Communication port	RS485/CAN/Ethernet				
	HMI	LED Display				
	Communication protocol	● EMS: Modbus-RTU /EtherCAT ● BMS: Modbus-RTU /CAN2.0B				
Certification		EN 55011:2016/A11:2020, EN 55011:2016/A2:2021, EN IEC 61000-6-4:2019, EN IEC 61000-6-2:2019, EN 62477-1:2012/A12:2021, EN 50549-2:2019/A1:2023, EN 50549-10:2022				

2.4 Description

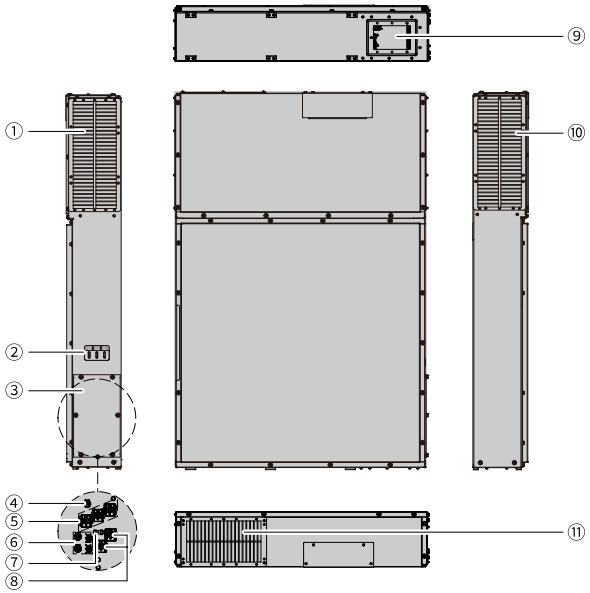


Figure 2-2 Components

No.	Component	Description
①	Air inlet	Air inlet of PCS
②	LED display area	• RUN: Running indicator, green. It becomes steady ON when the AC drive is running normally. It flashes at a frequency of 1s during AC drive startup. It flashes at a frequency of 1s when AC drive is standing by, and turns off during AC drive standby. • POWER: Power indicator, white. It becomes ON after power-on on the DC side and AC side of the PCS. It flashes at a frequency of 1s when the AC side is not powered on and DC side is powered on. When the DC side is not powered on and AC side is powered on, the indicator blinks at a frequency of 3s. No power-on on both sides, the indicator becomes OFF. • FAULT: Fault indicator, red, ON when the PCS stops at alarm; flashing at 1s frequency when the PCS reports an alarm; OFF when the PCS runs normally.
③	Cover	Open the cover to connect and maintain AC/DC cables.
④	Commissioning port	HMI commissioning terminal (reserved)

No.	Component	Description
⑤	Wiring terminals on AC side	L1, L2, L3 phase wiring terminals on AC side.
⑥	Communication port	BMS/EMS communication port, Link Port0/Link Port1 parallel port
⑦	Grounding point	Grounding terminal for PCS whole unit
⑧	Wiring terminals on DC side	BAT+, BAT-, positive/negative wiring terminals on DC side.
⑨	Bottom cable hole	Cable hole for DC/AC/communcation cables
⑩	Rear air outlet	Air outlet of PCS
⑪	Top air outlet	

2.5 Dimensions

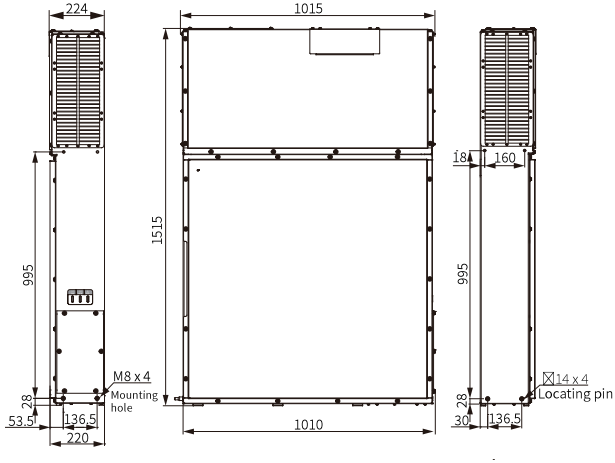


Figure 2-3 Product dimensions (in mm)

2.6 System Connection

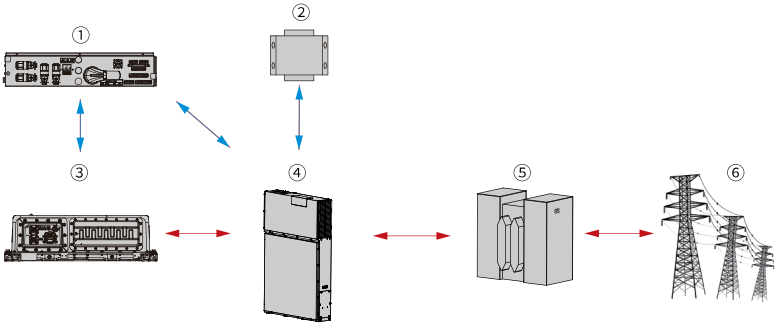


Figure 2-4 Diagram of the power conversion system

Note

The red cable is the power cable and the blue cable is the communication monitoring cable.

Table 2–1 Description of the power conversion system

No.	Name	Description
①	BMS	Battery management system, which is used to manage, protect and monitor the storage battery
②	EMS	Energy management system, which is used for energy dispatching and monitoring of the entire system
③	Lithium battery	All types of lithium batteries
④	PCS	Power conversion system, used for energy exchange between the battery and power grid.
⑤	Isolation transformer	You can configure based on actual system needs.
⑥	Power grid	When the PCS operates in on-grid mode, the AC side must be connected to the power grid and the DC side can be connected to the lithium battery.

3 Unpacking, Storage, and Handling

3.1 Unpacking

3.1.1 Precautions for Unpacking



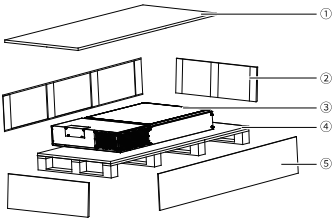
- Do not unpack the power conversion system before installation.
- After receiving the equipment, perform necessary inspection on the equipment received.
- Check every item received against the delivery list. Notify the shipping company immediately of any missing or damaged items.

3.1.2 Unpacking Procedure

1. Use a claw bar to pry off the crate body along the nailing gap in the door plank. Then pry off the top board, side board, rear board, and end board in sequence.
2. Remove filler materials.
3. Take out the PCS.
4. Remove the plastic packaging of the PCS.
5. Check that its surface shows no signs of damage.
6. Check that the model on the nameplate of PCS is the same as the one ordered.
7. Dispose of or recycle the packing material according to local regulations.



- During unpacking, put the crowbar into the crate as short as possible to prevent damaging the equipment.
- When removing the packing materials such as plastic film, do not use sharp tool to avoid scratching the equipment.

Packing list diagram	No.	Name
	①	Cover
	②	End plate
	③	PCS
	④	Pallet
	⑤	Side plate

3.1.3 Check After Unpacking

Check the following items after unpacking.

Table 3–1 Post-unpacking checklist

No.	Item	Checked
1	There is no sign of damage, scratching, and bumping on the surface of the product.	☐
2	Options ordered for the product are complete.	☐
3	The nameplate is consistent with the ordered product model.	☐
4	There is no sign of damage, scratch, and blur on the warning labels.	☐

3.2 Storage

Table 3–2 Storage requirements

Items	Storage Requirements
Package requirements	The power conversion system must be stored with package.
Location requirements	The system must be stored on a level and stable floor.
	The floor must be stable without shaking and capable of bearing the weight of the system.
Clearance requirements	Protect the power conversion system during storage to prevent collision.
Time requirements	• Long-term storage degrades the electrolytic capacitor. Thus, the unit must be energized once every 2 years, each time lasting at least 5 hours. The input voltage must be increased slowly to the rated value with the regulator. • Do not expose the device to moisture, high temperature, or outdoor direct sunlight for a long time. • Replace the desiccant every six months.

Items	Storage Requirements
Storage temperature	-40℃ to +70℃
Storage humidity	0 to 95% RH (non-condensing)

3.3 Handling

3.3.1 Precautions for Transportation

Handling with a forklift



- Check whether the forklift is appropriate before handling. If not, adjust the position of the feet of the forklift. If the fork is appropriate, lift the power conversion system and move it to a suitable position.
- The power conversion system tilt angle must be less than 10° during handling. When transporting the PCS, minimize its height fluctuations.
- Long-distance transportation or transportation on slops is prohibited on hydraulic forklift. Failure to comply may damage the hydraulic forklift.
- Handle with care and stability when lifting or landing and avoid shocks or oscillation. Avoid crushing injury when lowering the forklift.
- The left and right sides of the equipment must be held by mounting personnel during moving. Move the cabinet on a flat ground.
- Because the equipment is high and may block the driver’s sight, the driver must be guided.

Handling with a hoist

CAUTION

- Perform trial lifting to check that the ties can bear the weight of the power conversion system and the system is kept upright during lifting.
- The crane hook must be at the center of gravity.
- Ensure that the IPV800 inclines less than 10° after the IPV800 is lifted.
- Before transportation, check that the front door of the cabinet is locked to avoid personal injury caused by sudden door open.
- Handle with care and stability when lifting or landing and avoid shocks or oscillation.

3.3.2 Handling Before Unpacking

An unpacked power conversion system can be handled with a forklift. Adjust the feet width of the forklift to let the center of gravity of the PCS fall in the middle of the forklift feet. Place the fork to the position shown in the following figure.

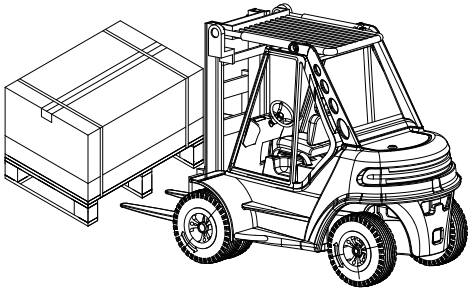


Figure 3-1 Transportation with a forklift

3.3.3 Handling After Unpacking

Handling method

An unpacked power conversion system can be handled with a forklift or a crane.

Steps for handling with a forklift

Adjust the feet width of the forklift to let the center of gravity of the PCS fall in the middle of the forklift feet. Place the fork to the position shown in the following figure.

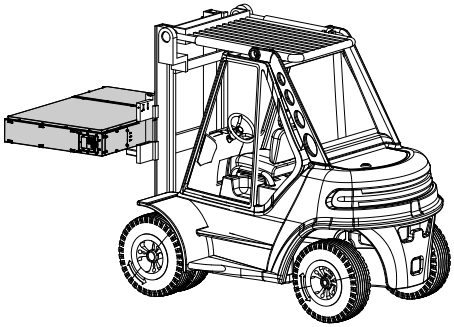


Figure 3-2 Handling with a forklift

Steps for handling with a crane

1. Install four M8 lifting holes to the PCS.
2. Use lifting slings or straps to pull the lifting lugs and protect the PCS with cushion material to avoid damage.

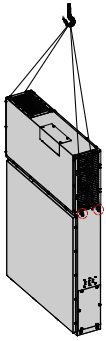


Figure 3-3 Handling with a crane

CAUTION

The distance between the hook and cabinet top must be over 1.5 m, and the angle between the cabinet and the floor must be less than 10° during lifting.

4 Mechanical Installation

4.1 Safety Precautions

Neglect of the following precautions during installation may result in equipment damage, personal injury, or severe death. Observe the following precautions strictly.

Note

- The installation of the whole machine must be performed by qualified personnel.
- Do not install or fix the product by non-professionals. Ensure that the welding is secure after fixing the equipment.
- To avoid the risk of electric shock, power off the system before installation.
- Before installation, the operator must read this section carefully.
- The installation personnel must take safety precautions according to industry standards.



- The cabinet frame must be strong enough to withstand the weight of the components, control circuits and other equipment installed in it.
- The cabinet must meet the requirements for dust and humidity.
- For ease of installation and maintenance, reserve sufficient space around the equipment.

4.2 Preparations Before Installation

4.2.1 Requirements on Installation Personnel

All installation operations must be performed only by qualified technicians, who must meet the following requirements:

- Taken specialized training.
- Read this guide completely and master the safety precautions related to operation.
- Be familiar with local standards and safety regulations of electrical systems.

4.2.2 Installation Environment

Items	Environment Requirement
Requirements on the installation site	• A well ventilated indoor or outdoor environment to prevent affecting performance caused by poor heat dissipation. • Ensure that the air inlet and air outlet are clear and unobstructed. • Have necessary fireproof, waterproof, and rodent-proof measures. • During operation, the temperature of the machine surface (especially the heatsink) is high. Install the machine in a non-easily accessible position, away from children and vulnerable populations. • Keep away from combustible and explosive objects and avoid high-voltage interference. • The mounting bracket or wall must have fire protection. • Avoid installation in office or residential areas that are sensitive to noise.
Clearance	Maintain sufficient clearances around the system for the purpose of ventilation, maintenance, and evacuation. For details, see *"4.2.4 Installation Clearance" on page 33*.
Altitude	Max. 3000 m
IP rating	Power cavity: IP65/Air duct: IP34/Wiring cavity: IP54
Pollution degree	3
Corrosion-proof class	C4H
Ambient temperature	-40℃ to 60℃
Ambient humidity	0 to 100% RH



The PCS may be damaged due to moisture intrusion. To ensure normal use of PCS:

- Do not turn on the PCS when the relative humidity exceeds 95%.
- Do not turn on the PCS for maintenance or inspection in rainy or wet weather conditions.

4.2.3 Ventilation Requirements

The system generates a large amount of heat during operation, which may lead to overtemperature and damage the system. To allow proper heat dissipation, install the system in a environment that meets the following requirements.

- Installation only in well-ventilated environments.
- Plenty of fresh air is required at air inlet.
- The ventilation system of the system is separated from other ventilation systems in the control room.

If overtemperature occurs on the system, check whether the ventilation hole is blocked.

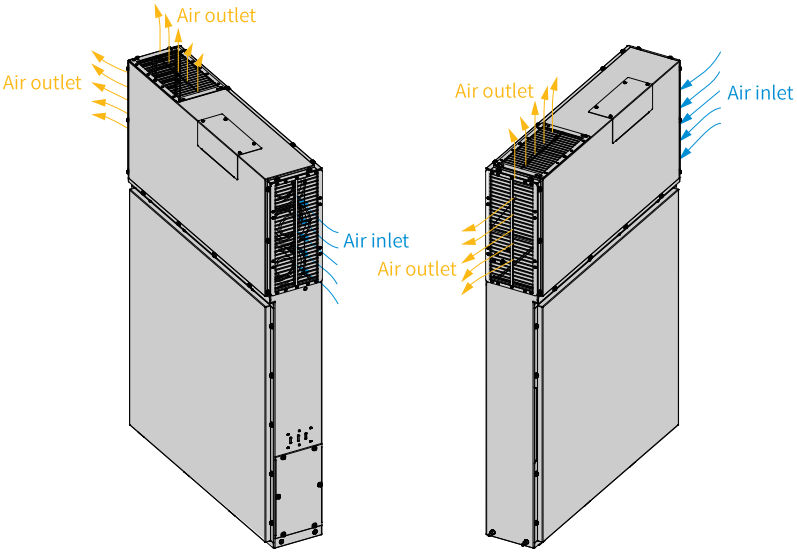


Figure 4-1 Airflow direction of the power conversion system

4.2.4 Installation Clearance

Reserve sufficient clearance around the system for the purpose of installation, maintenance, dissipation, and evacuation. For the parallel installation of multiple devices in a cabinet, install air guide plate. For clearance requirements, see *"Figure 4-2 " on page 34* and *"Figure 4-3 " on page 34* .

Single-row installation

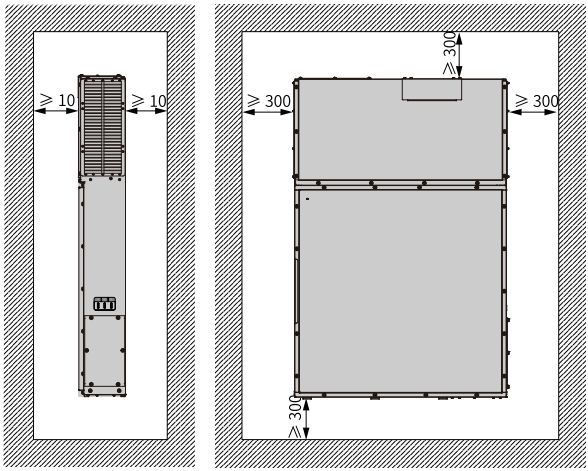


Figure 4-2 Installation clearance for single unit (unit: mm)

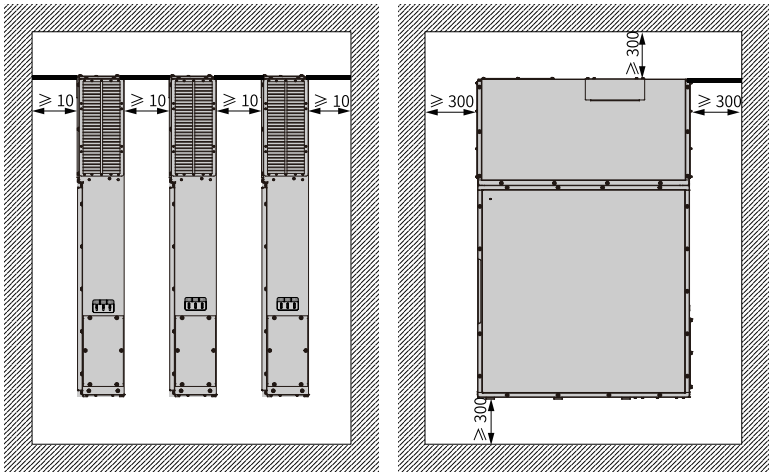


Figure 4-3 Installation clearance for multiple units (unit: mm)

4.2.5 Installation Tool Preparations

No.	Tool	Quantity	Instructions for Use
1	Crane/forklift/ stacker/PLC lifting tooling	1 set	The load capacity shall be above 300 kg (PCS weight: 300 kg), depending on the number of units on site.
2	Strap	4 m	Soft strap, steel rope or strap are required for crane lifting.
3	Wrenches and sockets	1 set	Used for fixing with maximum torque of more than 70 N·m.
4	Phillips screwdriver	1	Used to tighten M8 screws.

4.3 Tightening Torque of Common Screws and Bolts

Table 4–1 Tightening torque of common screws and bolts

Screw/Bolt	Strength Grade	Recommended Torque (N·m)
M3	4.8	0.5
M4	4.8	1.2
M5	4.8	2.8
M6	4.8	4.8
M8	8.8	20
M10	8.8	40
M12	8.8	70
M16	8.8	180

4.4 Installation Method

The PCS can be installed in a vertical mode for applications in different scenarios.

4.5 Checklist Before Installation

Before the installation, inspect the items in the following table and tick compliant items.

No.	Item	Checked
1	The packing box is intact and dry.	☐
2	The enclosure of the unpacked PCS is free of deformation, paint loss, rupture, or water stain.	☐
3	All accessories and options ordered are delivered.	☐

4.6 Installing the PCS

Note

- The PCS is heavy (≈ 300 kg). It is recommended to operate it with at least two people at the same time. Do not stand under the PCS during lifting. Failure to comply may result in personal injury.
- Do not operate in extreme weathers such as strong wind, sand, rain, and snow.
- Check whether the rope is worn during the use of the tooling. If damaged, stop the operation immediately until the rope is replaced.

Note

This section provides the installation of the PCS tooling. You can also use the hydraulic lifting platform with the lifting function to perform auxiliary operations.

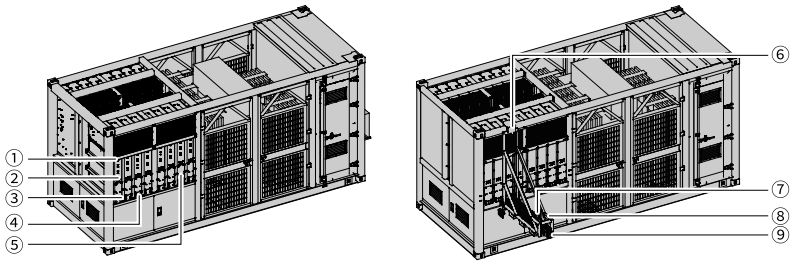


Figure 4-4 Diagram of rack and tooling fixing

No.	Name	No.	Name	No.	Name
①	Upper fixed mounting plate	④	Lower fixed mounting plate	⑦	Push-pull baffle plate
②	PCS	⑤	Junction box cover	⑧	Intermediate support part
③	Insulation barrier	⑥	Top mounting bracket	⑨	Lead screw

1. **Installing tooling**

   a. Insert the forklift tines into the tooling slot.

   b. Lift the tooling and hang it on the crossbeam at the top of the integrated device rack.

   c. Fine-tune the jig position, and use two M10 screws (one on each side) to secure the anti-sway bracket to the intermediate crossbeam of the rack.

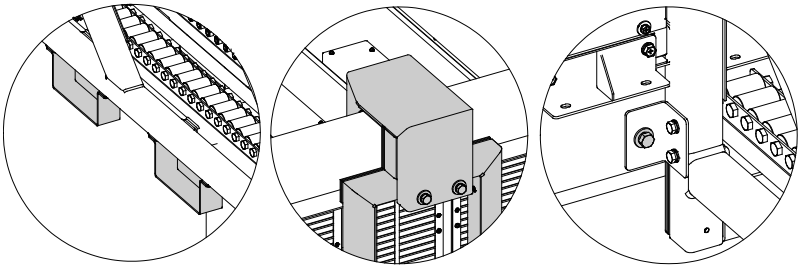


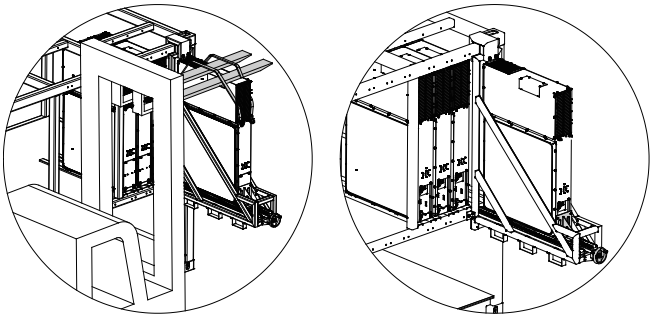
Figure 4-5 Installing tooling

2. **Installing the PCS**

   a. Install the spring buckles, M8 eyebolts, and lifting slings into the four ϕ8 fixing holes of the PCS.

   b. Insert the forklift tines into the lifting slings, slowly lift the PCS, transfer it onto the support frame, and remove the spring clip, M8 eyebolts, and lifting sling.
   The PCS should not touch the rack during lifting to avoid scratching the paint surface. If the paint surface is scratched carefully, perform maintenance according to *"8.2.3 Instructions for Painting " on page 68*.

   c. Connect the push-pull baffle plate to the screw holes of the PCS, rotate the lead screw winch to pull the PCS into the rack.



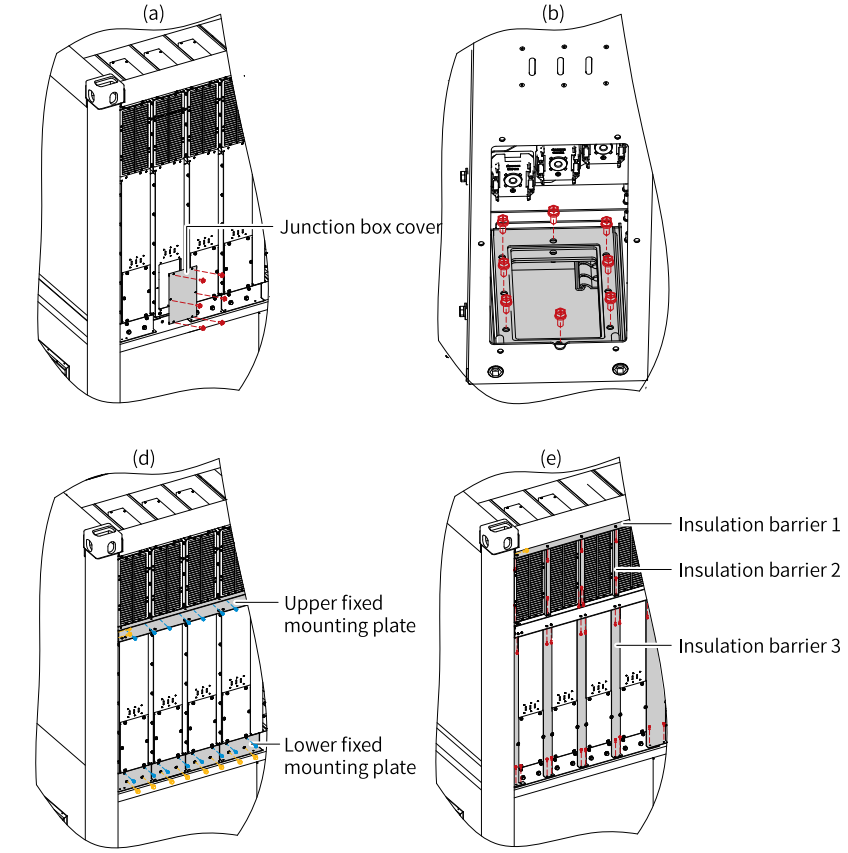
CAUTION

Use specialized lifting holes for the PCS. Failure to comply will result in the risk of not being locked

3. Remove tooling.
4. **Tighten the PCS and install the insulation barrier**. The procedure and recommended torque are as follows:

a. Remove the six M6 screws (in red) of the junction box cover of the PCSs.
b. Tighten the eight M6 screws (in red) attaching the bottom of the PCS wiring area to the support base of integrated device.
c. Tighten the six M6 screws (in red) of the junction box cover of the PCSs.
d. Use a screwdriver and wrench to tighten the eight M8 screws (in blue) and four M10 screws (in yellow) of the upper fixed mounting plate, and eight M8 screws (in blue) and eight M10 screws (in yellow) of the lower fixed mounting plate.
e. Use a screwdriver to tighten the two M10 screws (in yellow) of insulation barrier 1 and the 32 M6 screws (in red, including the 8 screws shared with the other 4 PCSs) of insulation barrier 2 and 3.

Screw/Bolt	Recommended Torque (N·m)
M6	4.8
M8	20
M10	40



4.7 Inspection After Installation

After the installation is completed, inspect the items in the following table and tick compliant items.

Table 4–2 Inspection checklist after installation

No.	Item	Solution	Checked
1	The fastener is tight.	If it is connected loosely, tighten the screws again.	□
2	The space environment meets the installation dimensions.	If the space is insufficient, it is recommended to design the installation site again before installation.	□
3	Check whether the air duct is free of foreign objects.	Clean up any foreign objects. If not, eliminate the fault.	□

5 Electrical Installation

5.1 Electrical wiring diagram

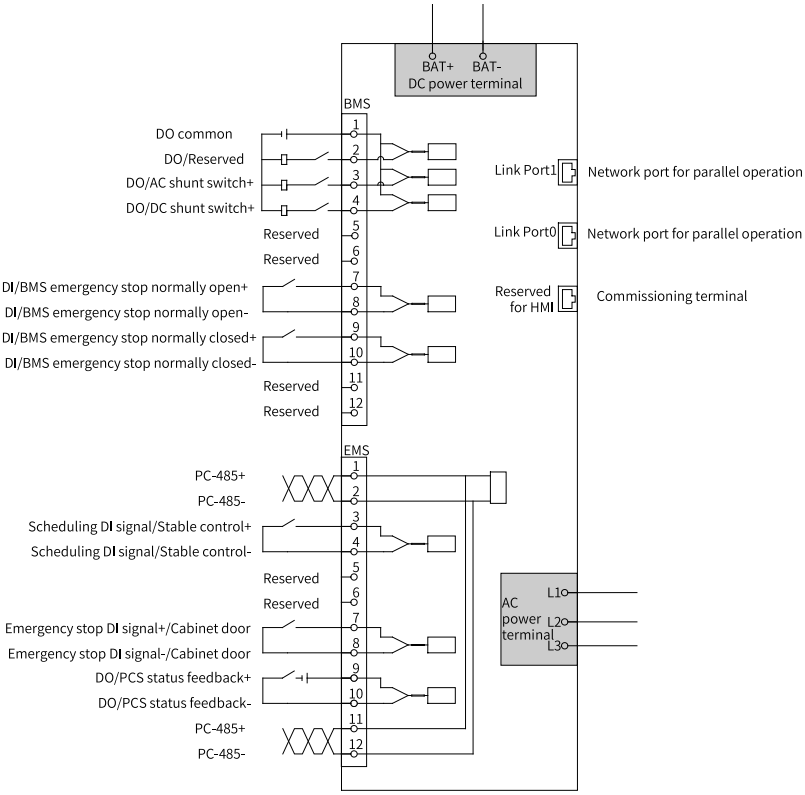


Figure 5-1 Electrical wiring diagram

5.2 Safety Precautions

Note

Take necessary safety protection measures during electrical installation to protect the safety of installation personnel. Observe the following rules during electrical installation.

- Disconnect the PCS from all power supplies and ensure that the PCS is de-energized.
- Place a warning sign at the disconnection part to prevent power-on during installation.
- Power off the power conversion system and wait for 60 minutes until the power conversion system is in discharged state.
- Perform necessary grounding and short circuit connections.
- Insulate live components with insulation materials to avoid personal injury.
- Installation can only be performed by professionals, with installation requirements specified in the manual strictly observed.
- During installation, the installation personnel must comply with local electrical operation regulations.

5.3 Preparations Before Installation

5.3.1 Requirements on Installation Personnel

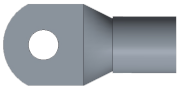
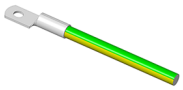
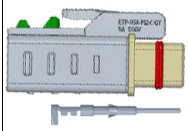
All wiring operations must be performed only by qualified technicians, who must meet the following requirements:

- Taken specialized training.
- Read this guide completely and master the safety precautions related to operation.
- Be familiar with local standards and safety regulations of electrical systems.

5.3.2 Installation Tool Preparations

No.	Tool	Quantity	Instructions for use
1	Wire stripper (Automatic wire stripping machine)	1 set	It is used for cable making.
2	Crimping tool	1	It is used for cable making.
3	Clamp meter	1	It is used to measure the current and voltage on both input and output sides.
4	Phillips screwdriver	1	Used to tighten M3 screws.

5.3.3 Cable Selection

Name		Terminal	Cable type	Cable specifications	Cable Outer Diameter	Display of connectors	Connector Resources
Main circuit cable	DC cable	BAT+ and BAT-	Outdoor cables that meet the 1500 VDC standard	Copper cable: 150 mm^2	22 mm to 24 mm		Prepared by user
	AC cable	L1, L2, L3	It is recommended to use outdoor single-conductor cables.	Copper cable: 150 mm^2	22 mm to 24 mm		
	Grounding cable	PE	Single-conductor yellow-green cable cable	Copper cable: 70mm^2	-		Prepared by user
Control circuit cable	BMS communication cable	BMS	Outdoor shielded twisted pair that meets the local regulations.	0.5 mm^2 to 1 mm^2	-		Provided by the manufacturer
	EMS communication cable	EMS					
	Cable for parallel connection	Link Port0, Link Port1	Cat 5e network cable	CAT5E/UTP-24AW	-		Prepared by user[1]

Note

[1]: The network cables for parallel connection shall be connected using RJ45 connectors without outer sheathing.

5.4 Inspection Before Wiring

Before wiring, check each item according to the following table.

Table 5–1 Safety inspection list

No.	Item	Checked
1	Switch off the power conversion system and all the external upstream switches to ensure all cables and the system are in the discharged state.	☐
2	Check that the cable duct at the bottom of the base is clear and not blocked.	☐
3	Check and inventory the wiring tool to prevent it from falling into the unit.	☐
4	The cable specifications meet the requirements in *"5.3.3 Cable Selection" on page 42*.	☐
5	The operator has done relevant protective work.	☐

5.5 Grounding Cable Connection

5.5.1 Layout and Description of Grounding Terminal

The grounding terminals for PCS whole unit are as follows.

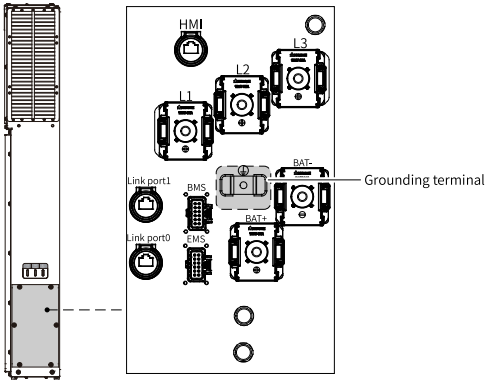


Figure 5-2 Layout of grounding terminal

5.5.2 Wiring Procedure

The product housing includes M6 threaded grounding posts. It is recommended to use 70mm^2 yellow-green cable to crimp the OT terminal and M6 screw. The recommended tightening torque of M6 screws is 4.8 N m.

5.6 Wiring of AC/DC Terminals

5.6.1 Layout and Description of AC/DC Terminals

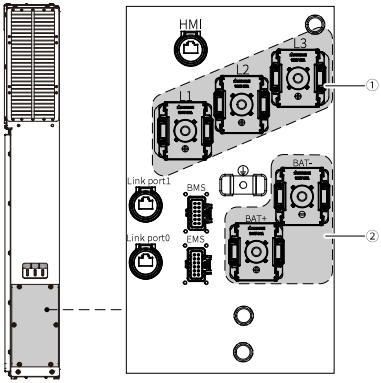


Figure 5-3 Layout of AC/DC terminals

Table 5–2 Description of AC/DC terminals

No.	Port Name	Mark	Description
①	Wiring terminals on AC side	L1	L1 phase wiring terminals on AC side.
		L2	L2 phase wiring terminals on AC side.
		L3	L3 phase wiring terminals on AC side.
②	Wiring terminals on DC side	BAT+	Positive electrode wiring terminals on DC side
		BAT-	Negative electrode wiring terminals on DC side

CAUTION

Ensure that the phase sequence of the AC and DC cables is consistent with the phase sequence of the power grid and battery.

5.6.2 Wiring procedure

The main power cable adopts bottom-in and bottom-out wiring mode. The terminals are all located on the lower side of the PCS.

1. Ensure that the PCS and the cables are de-energized.
2. Check L1, L2, L3, BAT+ and BAT- , and mark them clearly.

3. Connect the power cable plug to the power terminal in the corresponding phase sequence and tighten it with M8 bolts. The recommended torque is 13 N·m.

5.7 Cable connection of Commissioning and Parallel Terminals

5.7.1 Layout and Description of Commissioning and Parallel Terminals

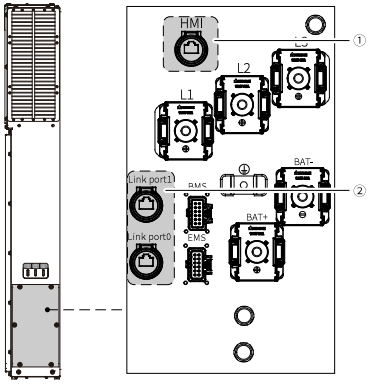


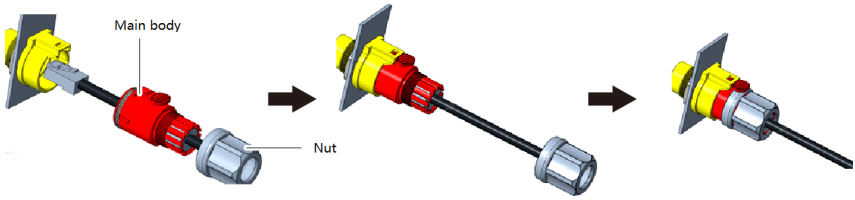
Figure 5-4 Layout of commissioning and parallel terminals

Table 5–3 Description of commissioning and parallel terminals

No.	Port Name	Mark	Description
①	Commissioning port	HMI	HMI commissioning terminal (reserved)
②	Parallel terminal	Link Port0	PCS multi-machine parallel connection port; the parallel network cable enters from Link Port0 (IN) and exits from Link Port1 (OUT).
		Link Port1	

5.7.2 Wiring Procedure

1. Loosen the nut and insert the registered jack to interlock the registered jack with the network port on the board end.
2. Install the plug body on the socket, with the snap-fit joint protected from retraction, enabling the second lock.
3. Tighten the nut, and then the plug is installed.



5.8 Wiring of Communication Terminals

5.8.1 Communication Port Layout and Description

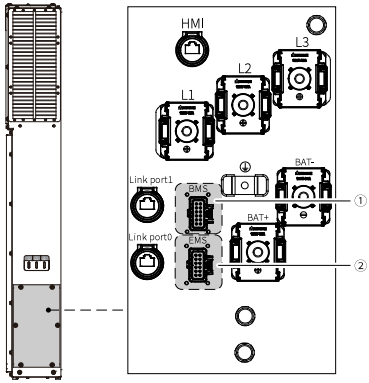


Figure 5-5 Communication port layout diagram

Table 5–4 Communication port layout description

No.	Port Name	Mark	Description
①	BMS communication port	BMS	Includes signal ports such as 485 communication, CAN communication, and emergency stop signal of BMS as well as PCS state output.
②	EMS communication port	EMS	Includes the 485. communication, scheduling signal, emergency stop, and status feedback signal ports of the EMS

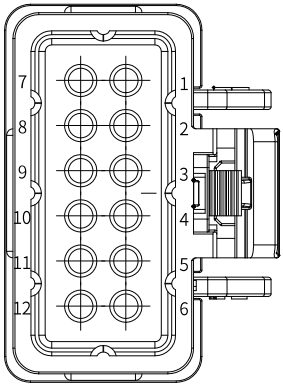


Figure 5-6 Port pin layout

Table 5–5 Port pin layout description

Pin No.	BMS pins	EMS pins
1	DO common terminal	PC-485+
2	-	PC-485-
3	DO/AC shunt switch+	Scheduling DI signal/Stable control+
4	DO/ DC shunt switch+	Scheduling DI signal/Stable control-
5	Reserved	Reserved
6	Reserved	Reserved
7	DI/BMS emergency stop normally open+	Emergency stop DI signal+/Cabinet door
8	DI/BMS emergency stop normally open-	Emergency stop DI signal-/Cabinet door
9	DI/BMS emergency stop normally closed+	DO/ PCS status feedback+
10	DI/BMS emergency stop normally closed-	DO/ PCS status feedback-
11	Reserved	PC-485+
12	Reserved	PC-485-

5.8.2 Wiring Procedure

1. Ensure that the power conversion system and the cable are in the discharged state.
2. Mark the EMS and BMS communication cables.
3. Connect the communication cable plug to the corresponding socket, and hear a "click" to ensure that the cable is connected properly.

5.9 Inspection After Installation

After wiring, check and measure the following items to avoid equipment damage and property loss.

Table 5–6 Post-wiring checklist

No.	Item	Checked
1	Before check, disconnect the breakers on the battery side and grid side to ensure the DC side and AC side of the power conversion system are in discharged state.	□
2	Check that the battery and the power conversion system are connected properly and the AC phase sequence is correct. Measure the resistance between the three phases, which should be at MΩ level. If the resistance measured is at kΩ level or lower, check the circuit.	□
3	The external control cable, grounding cable, and communication cable are secured.	□
4	The resistance of the grounding cable is lower than 0.1 Ω. Cables are intact without signs of damage or cracking.	□
5	The installation area is free of tools or foreign matters.	□

6 Trial Run

6.1 Commissioning Tool List

No.	Name	Specifications	Quantity	Notes
1	HMI	IT7100E	1	Control a string PCS (400 kW) unit and view the running data in real time.
2	HMI commissioning cable	/	1	Connect ESGU communication port and HMI.

Note

The above requirements are for the use of a single PCS by one person. The actual quantity is determined based on the site requirements.

6.2 Safety Precautions

Note

- Read and comply with the safety instructions provided in this guide.
- Only qualified professionals are allowed to operate the equipment.
- The equipment is typically used in industrial applications with high voltage. Its parts become live during operation. Therefore, unauthorized removal of required covers, improper use or operation, or poor maintenance can lead to property loss, severe physical injury, or even death.
- Ensure that the all-in-one equipment and other components are installed and connected in accordance with the national technical rules and other applicable regional regulations.
- Ensure that the equipment is properly grounded.
- Cover or isolate the adjacent components that are still live.
- If the fuse in a branch circuit trips, the fault current may have been disconnected. To reduce the risk of fire or electric shock, check the conductive parts and other components and replace the damaged parts. After a safety device trips, identify and rectify the cause of the tripping.

6.3 Check Before Running

No.	Item	Checked
1	The power conversion system is installed in a place that meets the installation and operating environment requirements. For details, see the requirements on the installation environment and site.	☐
2	The power conversion system is fixed to the rack properly.	☐
3	The power conversion system is grounded properly.	☐
4	The grounding busbar, DC positive/negative busbar, and busbar on the AC side are connected properly.	☐
5	The voltage on the both ends of the battery is lower than 1500 VDC and in the range of the corresponding model specifications. The positive and negative polarities are connected correctly.	☐
6	The voltage on the AC side is in the range of model technical specifications.	☐
7	There is no sign of damage or scratching on the cable. The air filter of the air vent is intact.	☐
8	Perform insulation test on the circuit between the battery components to the DC input side of the power conversion system to ensure no grounding fault exists.	☐

6.4 Power-on



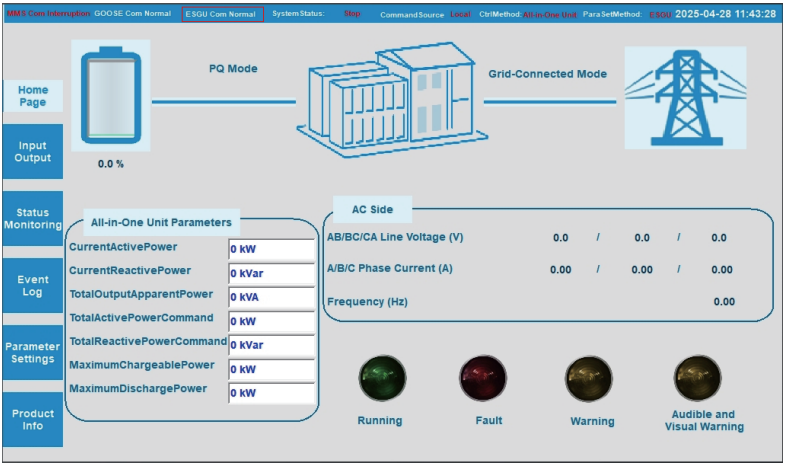
Start the device by strictly following the procedure. Failure to comply can result in damage or malfunction of the device.

Note

For parameter commissioning, this part takes the ESGU to connect the AC drive as an example.

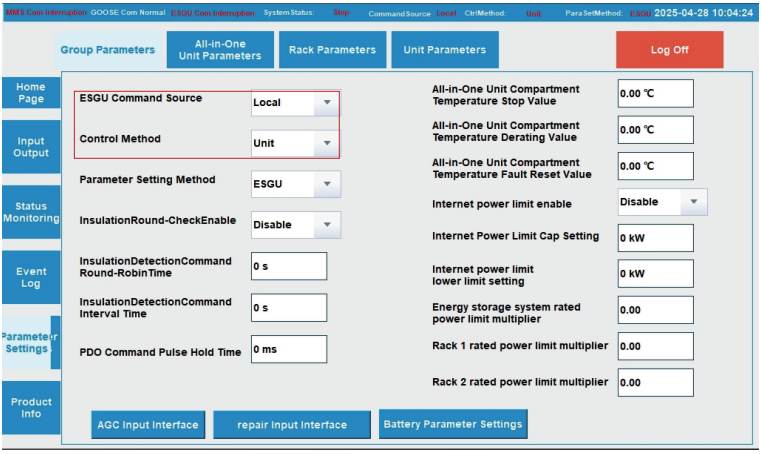
1. Check that the AC and DC sides of the PCS are connected properly (AC side: 690 VAC power supply or grid; DC side: Battery power supply).

2. Power on the AC and DC side, and the PCS is powered on. The power indicator of the PCS is steady ON to indicate that power-on is successful. The system is in the stop state by default upon power-on, with the main switch on the DC/AC side disconnected.
3. Connect the ESGU and check the communication status in the upper left corner of the HMI interface corresponding to the ESGU. Confirm that the communication between the HMI and ESGU is normal.

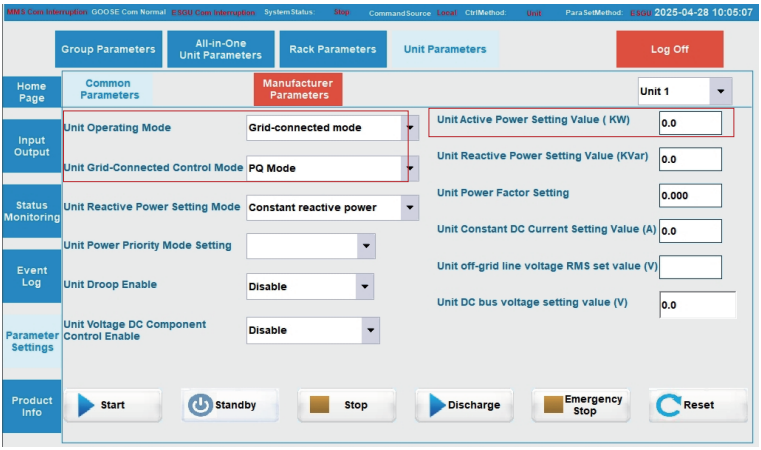


6.5 Trial Run

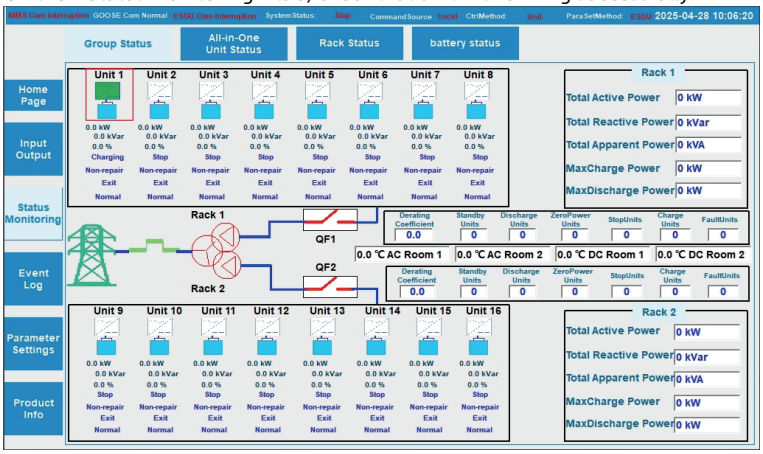
1. Click "Parameter Settings" in the lower left corner of the HMI interface, set the user name to operator and enter the password to enter the user mode.
2. In the Group Parameters tab, set the **ESGU Command Source** to "Local " and the **Control Method** to "Unit" .



3. Click the “Unit Parameters” tab.
   - Set the **Unit Operating Mode** to grid-connected mode.
   - Set **Unit Grid-Connected Control Mode** to PQ mode.
   - Set **Unit Active Power Setting Value (kW)** to 0.



4. Click the **Start** button in the lower left corner to enable on-grid operation of unit 1.
5. On the “Status Monitoring” tab, check that unit 1 is running successfully.



6. On the “Unit Parameters” tab, set the **Unit Active Power Setting Value (kW)** to be incremented from 0 to 10.
7. Run for 10 minutes. If no fault occurs, the trial run is completed.

6.6 Stop

On the left side of the HMI, click the Home page and click the **Stop** button.

If the PCS is powered by an external power supply, disconnect the external power supply.

7 Troubleshooting

According to severity, the PCS will encounter faults or alarms. After a fault or an alarm occurs, the LED states of the PCS are as follows:

- When an alarm occurs, the fault indicator flashes red at a frequency of 1s.
- When a fault occurs, the fault indicator is steady red and the PCS stops.

7.1 Fault List

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Battery fault	Energy storage battery inversely connected	The battery and PCS are connected inversely.	Check whether the battery is connected with wrong polarity.
	The battery voltage is too high.	The battery voltage is too high upon power-on.	Check whether the battery voltage is too high.
	The battery voltage is too low.	The battery voltage is too low upon power-on.	Check whether the battery voltage is too low.
DC bus voltage fault	Half-bus hardware overvoltage on the DC side	• The half-bus voltage is too high. • The bus voltage is not balanced between the positive half and the negative half of the bus.	Contact Inovance.
	Full-bus software overvoltage on the DC side	• Bus voltage too high • The battery voltage is too high.	• Check whether the battery voltage is within the proper range. • Check whether the grid voltage is normal.
	DC full bus software undervoltage	• The bus voltage is too low during running. • The battery voltage is too low.	• Check whether the battery voltage is within the proper range. • Check whether the grid voltage is normal.
	DC half-bus voltage deviation too large	• Deviation occurs between positive and negative half bus voltages • The bus capacitor is aged.	Contact Inovance.
Overcurrent on the AC side	Hardware overcurrent on the AC side	• The AC side is short-circuited. • Impact load occurs.	Contact Inovance.
	Software overcurrent on the AC side	• The AC side is short-circuited. • The AC load is too heavy.	Contact Inovance.
Overcurrent on the DC side	Hardware overcurrent on the DC side	• Short circuit occurs on the DC side. • Impact load occurs.	Contact Inovance.
	DC-side software overcurrent	• Short circuit occurs on the DC side. • Too heavy load on the DC side	Contact Inovance.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Hall sensor fault on the AC side	AC-side phase-A hall disconnected	Hall sensor disconnected on the AC side	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
	AC-side phase-B hall disconnected	Hall sensor disconnected on the AC side	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
	AC-side phase-C hall disconnected	Hall sensor disconnected on the AC side	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
Switch fault	Switch fault on the DC side	• Contact stuck of circuit breaker • The feedback signal cable of the circuit breaker is disconnected. • The control signal cable of the circuit breaker is disconnected.	• Check whether the switch contact gets stuck. • Check whether the control signal and feedback signal of the switch are connected properly.
	Switch fault on the AC side		
CBC overcurrent	CBC overcurrent	The current is excessive.	• Check whether short circuit occurs in the system. • Measure whether the current is too high with a clamp meter.
Device overload	Device overload	The PCS runs in overcurrent mode for too long.	Check that the operating power of the PCS is within the allowed range.
Grid fault	Grid AC overvoltage	The grid voltage is greater than the AC overvoltage threshold.	Check whether the grid voltage is normal.
	Grid AC undervoltage	The grid voltage is less than the AC undervoltage threshold.	Check whether the grid voltage is normal.
	Grid AC overfrequency	The grid frequency is greater than the overfrequency threshold.	Check whether the grid voltage is normal.
	Grid AC underfrequency	The grid frequency is less than the underfrequency threshold.	Check whether the grid voltage is normal.
	Output current phase loss	• The main circuit output cables are loose. • The main circuit output is short-circuited to ground.	Check whether the three-phase output wiring is normal.
	Grid voltage sequence incorrect	The grid wiring is reversed.	Exchange any two phases among the three phases.
	Phase lock error	A grid voltage phase lock error occurs.	Check whether the grid voltage is normal.
	Grid voltage unbalanced	• The amplitude of the three-phase grid voltage exceeds the allowed range. • Grid input phase loss occurs.	• Check whether the grid voltage is normal. • Check whether phase loss occurs on the grid voltage.
Off-grid fault	AC overvoltage in off-grid mode	The off-grid AC voltage is greater than the AC overvoltage threshold.	Contact Inovance.
	AC undervoltage in off-grid mode	The off-grid AC voltage is less than the AC undervoltage threshold.	Contact Inovance.
Islanding fault	Islanding fault	The load runs in isolation after disconnecting from the power grid.	Contact Inovance.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Large current control deviation	Large current control deviation	• The terminal is disconnected. • The control loop is saturated. • The main circuit voltage is abnormal.	Contact Inovance.
Bus soft start failed	Bus soft start failed	• The pre-charge contactor fails. • The air switch of the pre-charge circuit is open. • Bus undervoltage occurs. • The sampling cable is disconnected.	• Check whether the air switch of the pre-charge circuit is closed. • Check whether the pre-charge circuit contactor is normal. • Check the bus voltage. • Check the sampling cable.
DC component of AC current beyond limit	DC component of AC current beyond limit	• The DC component in the three-phase current is out of limit. • DC deviation occurs in current sampling.	Contact Inovance.
Soft start failed on the AC side	Incorrect voltage after AC switch closing	• The battery voltage does not match the grid voltage. • There is voltage from the grid in off-grid mode.	Contact Inovance.
	Soft start failure on the AC side	• Inverter voltage sampling is abnormal. • PCS pulsing abnormal.	Contact Inovance.
Large AD zero drift	Large AD zero drift	Current zero drift too large	Contact Inovance.
Insulation resistance fault	Low insulation resistance	The insulation resistance detected is too low.	• Check that the main circuit is not short-circuited to ground. • Contact Inovance.
Filter capacitor board temperature fault	Filter capacitor board overtemperature	• The temperature of filter capacitor board exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked.	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the ventilation duct is blocked.
	Filter capacitor board overtemperature alarm		
	Filter capacitor board temperature too low	• Temperature sampling of filter capacitor board is disconnected. • Actual ambient temperature is lower than the protection threshold.	• Check whether the temperature display is normal. • Contact Inovance.
Ambient temperature fault	Ambient temperature too high	The ambient temperature exceeds the protection threshold.	Check over-temperature protection threshold.
	Ambient temperature too high alarm		
	Ambient temperature too low	• Ambient temperature sampling disconnected • Actual ambient temperature is lower than the protection threshold.	• Check whether the temperature display is normal. • Contact Inovance.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
IGBT temperature abnormal	A-phase overtemperature fault in IGBT module	• The ambient temperature is too high. • The current is excessive.	• Check whether the fan operates properly. • Check whether the air duct is blocked. • Check whether the current is within the proper range. • Check whether the temperature sensor operates properly.
	B-phase overtemperature fault in IGBT module		
	C-phase overtemperature fault in IGBT module		
	A-phase overtemperature alarm in IGBT module		
	B-phase overtemperature alarm in IGBT module		
	C-phase overtemperature alarm in IGBT module		
	IGBT temperature sampling error	The NTC sampling failed.	Check whether the temperature sensor operates properly.
Surge protection device fault	Surge protection device fault	Surge protection device on AC side or DC side is damaged.	• Check that the surge protection device is wired properly. • Check that the surge protection device is damaged.
Parallel fault	Carrier synchronization failure	The carrier synchronization cable is disconnected.	Check the carrier synchronization wiring.
DC fan fault	Internal fan fault	• The fan is damaged • The fan drive circuit is abnormal.	• Check whether the fan works normally. • Contact Inovance.
	IGBT fan fault		
	IGBT fan alarm		
Internal communication fault	Communication fault between the control board and communication board	The cable is disconnected or the bus node is abnormal.	Check whether the communication cable between the control board and CAN unit is connected properly.
Internal chip fault	EEPROM fault	The EEPROM drive is abnormal or the EEPROM is damaged.	Contact Inovance.
	EEPROM alarm		
	Black box abnormal	FLASH error	Contact Inovance.
	FPGA data exchange error	The communication timing between FPGA and ARM is abnormal.	Contact Inovance.
	RTC abnormality	• The button battery voltage is low. • RTC abnormality	• Replace the button battery. • Contact Inovance.
	Main ARM junction temperature over-temperature	• Temperature read error. • The fan fails. • The ventilation duct is blocked.	• Check whether the fan operates properly. • Check whether the ventilation duct is blocked. • Check whether the temperature is within the proper range.
	Auxiliary ARM junction temperature over-temperature		
	FPGA junction temperature over-temperature		
Control power error	24 V power supply error	Control power error	Check that the power supply cable connection is normal.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Emergency stop fault	Local emergency stop fault	PCS DI signal is active.	Check whether PCS emergency stop is triggered.
	BMS_DI emergency stop fault	BMS DI signal is active.	Check whether BMS emergency stop is triggered.
Capacitor voltage resonance fault	Capacitor voltage resonance fault	Resonance at AC side	Contact Inovance.
EMS communication fault (board fault such as EtherCAT, ENET, IEC 61850)	EMS connection timeout 1(external bus)	Communication error between EtherCAT and ESGU	• Check whether the cable connection between EtherCAT and ESGU is reliable. • Contact Inovance.
	EMS connection timeout 2(internal communication)	Communication error between EtherCAT and communication board	• Check whether the cable connection between EtherCAT and communication board is reliable. • Contact Inovance.
Sampling disconnection fault on DC side	Sampling disconnection fault at midpoint on DC side	Sampling disconnected.	• Check the bus voltage. • Check the sampling cable.
	Voltage sampling disconnection fault on DC side		
Temperature of detection board	Overtemperature	• The detection board temperature exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked.	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the air duct is blocked.
	Alarm		
	Temperature too low	Detection board temperature sampling disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Temperature of relay board	Overtemperature	• The temperature of relay board exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked.	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the air duct is blocked.
	Alarm		
	Temperature too low	Temperature sampling of relay board is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Temperature of power supply board	Overtemperature	• The temperature of power supply board exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked.	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the air duct is blocked.
	Alarm		
	Temperature too low	Temperature sampling of power supply board is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.

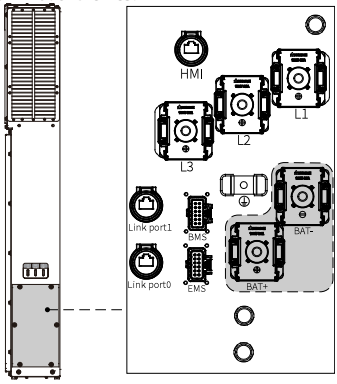
Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Temperature of heatsink coolant inlet	Overtemperature	• Temperature of heatsink coolant inlet exceeds exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked. • Water pump fault	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the air duct is blocked. • Check whether the water pump is normal.
	Alarm		
	Temperature too low	Temperature sampling of the heatsink coolant inlet is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Temperature of heatsink C-phase outer tube	Overtemperature	• Temperature of heatsink C-phase outer tube exceeds the protection threshold. • The fan fails. • The ventilation duct is blocked. • Water pump fault	• Check over-temperature protection threshold. • Check whether the fan works normally. • Check whether the air duct is blocked. • Check whether the water pump is normal.
	Alarm		
	Temperature too low	Temperature sampling of heatsink C-phase outer tube is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Water pump fault	Water pump fault	Water pump fault	Contact Inovance.
Liquid level detection fault	Liquid level detection fault	DI signal for liquid level detection is at high level.	Contact Inovance.
Filter capacitor current fault	Filter capacitor overcurrent	• High frequency resonance occurs in grid voltage. • Filter capacitor current sampling is abnormal.	• Check whether the total harmonics distortion of the grid voltage is normal. • Check whether the filter capacitor current display is normal. • Contact Inovance.
Liquid level detection fault	Liquid level detection fault	DI signal for liquid level detection is at high level.	Contact Inovance.

7.2 Common Faults and Solutions



When measuring the battery voltage, use a multimeter with a proper range.

Battery Reverse Connection Fault

Description	Possible Causes	Solution
The polarity of the battery is incorrect, resulting in a PCS failure.	The polarity of the battery input cable connector is reversely connected to the terminal on the PCS.	1. Disconnect the power supply. 2. After waiting for 10 minutes, unplug the battery cable from the battery connection terminal of the PCS.  Figure 7-1 Terminal layout of battery connection terminal 3. Measure the voltage on the battery input cable using the DC voltage range of the multimeter: Use the red lead (positive) of the multimeter to measure the positive input pole (BAT+). Use the black lead (negative) of the multimeter to measure the negative input pole (BAT-). If negative voltage is measured, the polarity of the connected battery cable is incorrect. In this case, connect the BAT+ cable to the BAT+ terminal and the BAT- cable to the BAT- terminal. And then connect the battery cables to the battery connection terminals of the PCS.

Battery fault

Description	Possible Causes	Solution
The battery voltage is too high or too low, which prevents the PCS from operating properly	The battery voltage exceeds the battery voltage range indicated on the PCS nameplate, which is higher than the overvoltage protection threshold or lower than the undervoltage protection threshold of the battery voltage.	1. Disconnect the power supply. 2. After waiting 10 min, refer to *"Figure 7-1 " on page 60* to unplug the battery cable from the battery connection terminal of the PCS. 3. Measure the voltage on the battery input cable using the DC voltage range of the multimeter. If the measured battery voltage exceeds the overvoltage protection threshold (1530 VDC) or lower than the undervoltage protection threshold (850 VDC) of the battery voltage, contact technical support engineers to replace the battery.

Bus Fault

Description	Possible Causes	Solution
The bus voltage is too low or too high; or there is large voltage deviation on half-bus.	The battery voltage input is too high or fluctuates, causing the bus voltage to exceed the undervoltage or overvoltage protection threshold.	1. Disconnect the power supply. 2. After waiting 10 min, refer to *"Figure 7-1 " on page 60* to unplug the battery cable from the battery connection terminal of the PCS. 3. Measure the voltage on the battery input cable using the DC voltage range of the multimeter. If the measured battery voltage exceeds the overvoltage protection threshold (1530 VDC) or lower than the undervoltage protection threshold (850 VDC) of the battery voltage, contact technical support engineers to replace the battery.
	Uneven load current causes large bus deviation.	1. Check the current on the grid side to determine whether one phase is overload and exceeds the current unbalance requirement in *"2.3 Product Specifications" on page 20*. 2. Contact the technical support personnel.

Bus Fault

Description	Possible Causes	Solution
The bus voltage is too low or too high; or there is large voltage deviation on half-bus.	The battery voltage input is too high or fluctuates, causing the bus voltage to exceed the undervoltage or overvoltage protection threshold.	1. Disconnect the power supply. 2. After waiting 10 min, refer to *"Figure 7-1 " on page 60* to unplug the battery cable from the battery connection terminal of the PCS. 3. Measure the voltage on the battery input cable using the DC voltage range of the multimeter. If the measured battery voltage exceeds the overvoltage protection threshold (1530 VDC) or lower than the undervoltage protection threshold (850 VDC) of the battery voltage, contact technical support engineers to replace the battery.
	Uneven load current causes large bus deviation.	1. Check the current on the grid side to determine whether one phase is overload and exceeds the current unbalance requirement in *"2.3 Product Specifications" on page 20*. 2. Contact the technical support personnel.

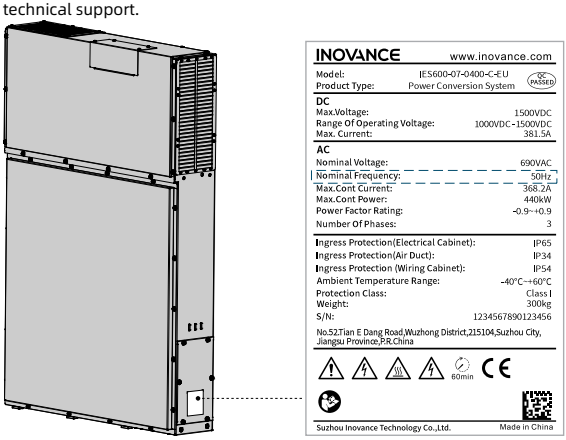
Device overload

Description	Possible Causes	Solution
The power conversion system operates in the overcurrent or overload state for an excessively long time.	The running power of the PCS exceeds the overload current or power specified in the technical specifications.	1. Check the current or the power on the grid side to determine whether the required overload current or power in *"2.3 Product Specifications" on page 20* is exceeded. 2. Contact the technical support personnel.

The grid voltage is abnormal.

Description	Possible Causes	Solution
Power grid overvoltage or undervoltage Grid voltage unbalance protection threshold	The grid voltage of the PCS is abnormal.	1. Disconnect the power supply and wait for 10 minutes. 2. Refer to *"5.6.1 Layout and Description of AC/DC Terminals" on page 44* and check that the grid wiring of the PCS is correct. a. Check whether the wiring sequence is correct. If not, exchange the phase sequence. b. Check whether the grid wiring terminal is in poor contact. If yes, tighten the terminal. 3. Use the AC voltage range of the multimeter to measure whether the grid voltage of the PCS is in the range of 621 VAC to 759 VAC: a. If the measured grid voltage is too high or too low, or exceeds the unbalance requirement in *"2.3 Product Specifications" on page 20*, the fault indicates the actual condition. b. If the measured grid voltage is within the normal range, contact Inovance for technical support.

Abnormal grid frequency

Description	Possible Causes	Solution
Power grid overfrequency or underfrequency	The grid voltage frequency of the PCS is abnormal.	Check whether the frequency of the local power grid matches the frequency indicated on the nameplate. If no, contact Inovance for technical support.  Figure 7-2 Frequency Information on Nameplate

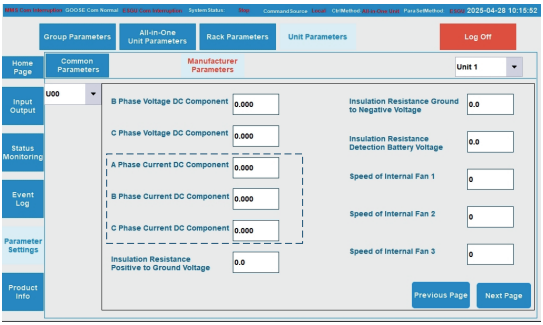
Grid voltage sequence incorrect

Description	Possible Causes	Solution
Grid voltage sequence incorrect	The grid wiring sequence of the PCS is incorrect.	1. Disconnect the power supply and wait for 10 minutes. 2. Refer to *"5.6.1 Layout and Description of AC/DC Terminals" on page 44* and check that the grid wiring of the PCS is correct. a. Check whether the wiring sequence is correct. If not, exchange the phase sequence. b. Check whether the grid wiring terminal is in poor contact. If yes, tighten the terminal.

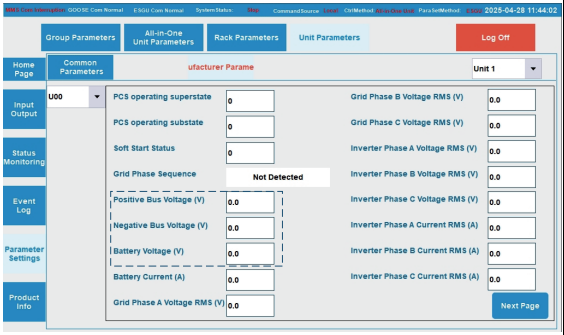
Off-grid fault

Description	Possible Causes	Solution
The output voltage on the AC side is too high or too low in the off-grid mode.	The inverter voltage sampling is abnormal, resulting in voltage control accuracy exceeding the threshold.	When the PCS starts in the off-grid mode, measure the line voltage of the AC terminal with a multimeter. Check whether the off-grid AC voltage is within the range of 587 VAC to 759 VAC. ● Contact technical support if within range. ● If not, contact technical support to check the load.
	The inverter voltage reference is set incorrectly. The setpoint exceeds the normal range of AC voltage.	

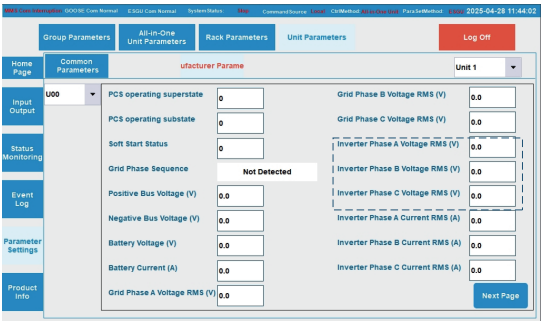
DC Component of AC-side Current Beyond Limit

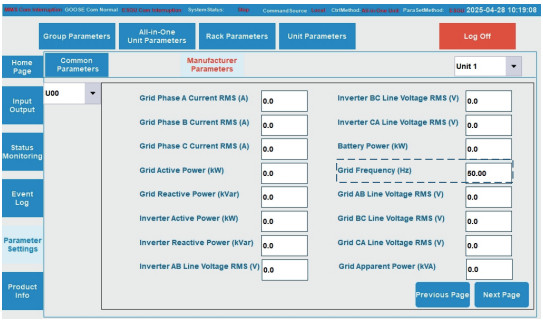
Description	Possible Causes	Solution
In on-grid mode, the DC component of AC-side current exceeds the protection threshold.	The sampling of AC-side current DC component is abnormal, resulting in the control accuracy of the DC component exceeding the protection threshold.	1. Check that the control of DC component of AC-side current is enabled. 2. Measure the AC terminal current with a current clamp meter. Check whether the measured value of the current clamp meter deviates by 0.5% from the DC component on the AC side of the monitoring interface.  If the DC component measured by the current clamp meter exceeds the protection point of 0.5% In (1.7 A@400 kW), contact technical support to recalibrate or replace the PCS.
	The control of DC component of AC-side current is disabled.	

Bus Soft Start Failed

Description	Possible Causes	Solution
After the soft-start relay is closed, the bus voltage is not established or the establishment time exceeds 10s	The hardware soft-start resistor is damaged.	Start the PCS as *"6.5 Trial Run" on page 51*. Monitor the battery voltage and bus voltage changes on the HMI monitoring interface. ● If the bus voltage does not change or the voltage increases slowly, contact technical support to replace the PCS. ● If the bus voltage changes but the battery voltage exceeds the bus voltage by more than 30 VDC, contact technical support to recalibrate the battery voltage and bus voltage. 
	The hardware soft-start relay is damaged.	
	Hardware battery voltage and bus voltage sampling error.	

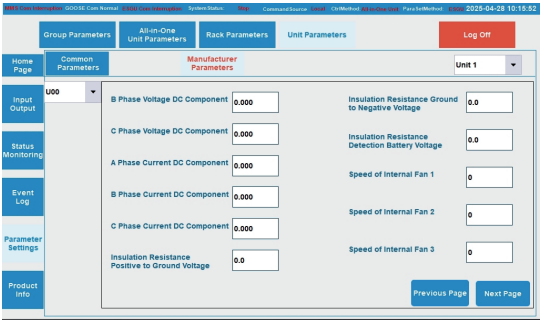
Soft Start Failed on AC Side

<table>
<tr><th>Description</th><th>Possible Causes</th><th>Solution</th></tr>
<tr><td rowspan="3">In on-grid mode, the AC side inverter voltage and the grid voltage do not meet the closing conditions.</td><td>The battery voltage exceeds the peak value of the grid voltage by more than 20 VDC.</td><td rowspan="3">1. Measure the battery voltage and grid voltage with a multimeter and check whether the battery voltage exceeds the peak grid voltage by more than 20 VDC.
2. When the PCS starts in the off-grid mode, measure the line voltage of the AC terminal with a multimeter. If the measured AC voltage deviates by more than 1% from the value displayed by the HMI, the sampling is abnormal. Contact technical support to replace the AC drive.


3. Check that the grid frequency on the HMI monitoring interface is consistent with the actual grid voltage frequency under normal three-phase grid voltage.


4. If the above items are normal, contact Inovance for technical support.</td></tr>
<tr><td>Hardware grid voltage and inverter voltage sampling error.</td></tr>
<tr><td>Phase lock failure happens to the mains voltage.</td></tr>
</table>

Fan fault

<table>
<tr><th>Description</th><th>Possible Causes</th><th>Solution</th></tr>
<tr><td rowspan="3">If the deviation between the set speed of the fan and the feedback value exceeds 13% of the rated speed, the fan is faulty.</td><td>The fan is damaged.</td><td rowspan="3">1. After the PCS starts, check whether the fan is stuck or locked. If yes, contact technical support.
2. Check the fan speed on the HMI monitoring interface. Check whether the fan speed is within ±600 rpm deviation range from the actual set speed of the PCS based on the fan speed regulation curve.


3. Check that the fan wiring is not damaged, short-circuited, or disconnected.
4. Contact Inovance for technical support.</td></tr>
<tr><td>The fan drive circuit is abnormal.</td></tr>
<tr><td>2. The air filter is blocked.</td></tr>
</table>

8 Maintenance and Repair

8.1 Safety Precautions

The influence of the ambient temperature, humidity, dust, and vibration will cause aging of components inside the PCS, which may result in potential faults or shorten the service life of the PCS. Therefore, the regular inspection and maintenance can monitor the status of the converter and improve its reliability.

Note

- Only allow qualified professionals to maintain the PCS.
- Before maintenance, take necessary personal protection measures because the AC and DC side of the converter are both high current.
- Before maintenance, disconnect the AC and DC power supplies.
- Strictly follow the correct operation procedure during maintenance.
- The converter is equipped with an energy storage capacitor. Before maintenance, power off the converter, wait for at least 60 min until the power conversion system is in discharged state.
- Put a warning sign after the power supplies are cut off to prompt other people not to power on the inverter during maintenance.
- Wear insulation protective clothing during maintenance to prevent accidents.

8.2 Inspection and Maintenance

8.2.1 Routine Maintenance

Check the following items during routine inspection.

No.	Daily Maintenance Items	Checked
1	Designate observers to monitor the input and output voltage and current and operation status of the PCS in real time, check the PCS at specified positions, and perform maintenance in time in case of PCS failure or voltage or current exception.	☐
2	The PCS does not make abnormal noise.	☐
3	The PCS does not produce odor.	☐
4	Measure the interior temperature of the PCS and ensure that the temperature is within the normal range.	☐
5	Check that the surface is free of damage. Clean dirt on the surface with water or alcohol, and repaint the surface in case of paint damage. For details, see *"8.2.3 Instructions for Painting " on page 68*.	☐

8.2.2 Regular Check Items

Perform regular inspection on the items that are difficult to check during operation.

Table 8-1 Regular checklist

No.	Regular checklist		Cycle	Checked
1	Heat sink	Check whether the heatsink is covered by objects or dust. Remove the fan to check and clean it if necessary.	Every six months	□
2	Fan	• Check whether the fan makes abnormal noise during running. • Check whether the fan blades are cracked. • Check whether the fan is blocked by foreign objects.	Every six months	□
3	Cable	• Check whether the AC and DC cables are connected reliably and whether they are damaged. • Check whether the cable gland is tightened. • Check whether the grounding cable is connected securely.	Every six months	□
4	Others	• Check that inside ventilation, surrounding ventilation, ambient temperature, humidity, and dust of the PCS meet the requirements. • Check that the PCS exterior is free of damage or rust. • Use a temperature detector to detect the interior temperature of the PCS and ensure that the temperature is normal.	Every one month	□

8.2.3 Instructions for Painting

- **Only when the external surface is dirty**
  Clean with a cloth dampened with water or 97% alcohol.
- **When the paint is damaged**
  1. Use sand paper to smooth the surface of the damaged parts.
  2. Clean the surface with 97% alcohol.
  3. After the surface is dry, make paint on the damaged parts. The paint is as uniform and aesthetically pleasing as possible.
- **When the paint surface is damaged and the substrate is leaked**
  1. Use sand paper to smooth the surface of the damaged parts.
  2. Clean the surface with 97% alcohol.
  3. After the surface is dry, apply a zinc-rich primer to the damaged parts.

4. After the primer is dry, apply top-up paint to ensure that the paint is as uniform and aesthetically pleasing as possible.

8.3 Part Replacement

8.3.1 List of Maintainable Parts

Table 8–2 List of maintainable parts

No.	Name
1	Fan
2	PCS whole unit

8.3.2 Maintenance Tools

Table 8–3 List of maintenance tools

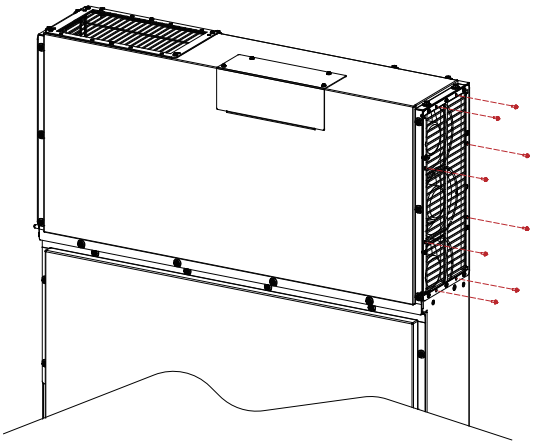
Tool	Quantity	Instructions for use
Wrenches and sockets	1 set	Used for fixing with maximum torque of more than 70 N·m.
Phillips screwdriver	1	Used to tighten M6/M4 screws.
Straight screwdriver	1	Used to tighten M3 screws.
Module lift fitting tooling	1 set	Used to hoist the module.

8.3.3 Replace the Fan

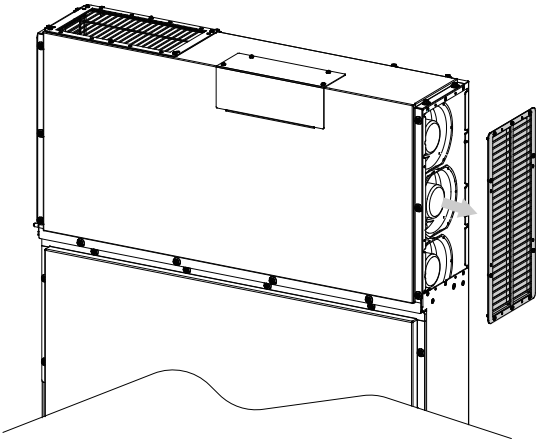
When the fan needs to be replaced, only the fan needs to be serviced without taking the PCS apart.

Replacement steps

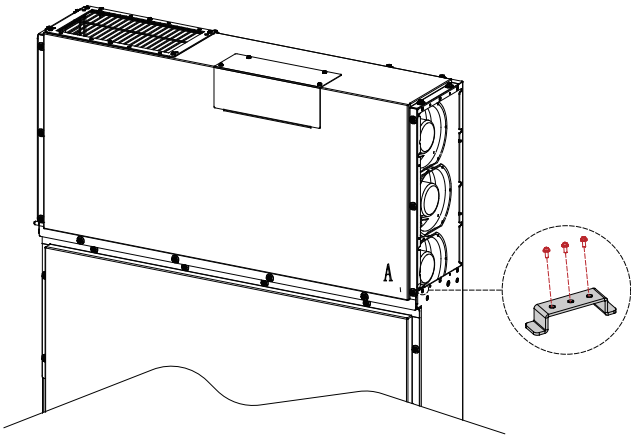
1. Disconnect the power supply and ensure that the device is in the no-power state.
2. Loosen the eight M4 screws of the air inlet protection plate.



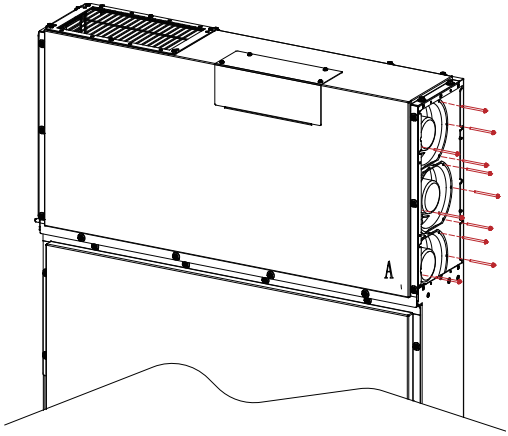
3. Remove the air inlet protection plate.



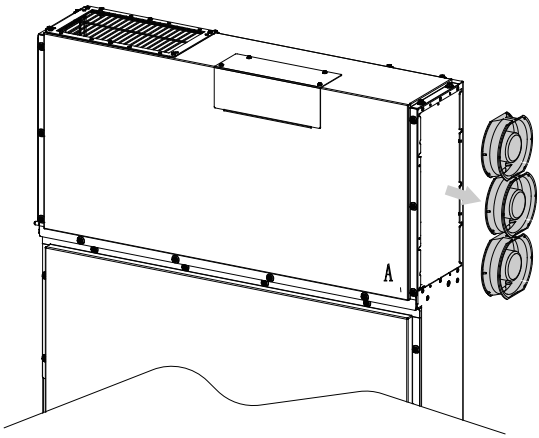
4. Remove the M4 grounding screws of the faulty fan.



5. Unplug the connection terminal between the fan cable and the PCS on the fan bracket.
6. Cut the cable ties on the fan bracket assembly.
7. Use a Phillips screwdriver to remove the M4 fastening screws of the faulty fan and the corresponding fan assembly.



8. Remove the faulty fan.



9. Replace the fan and re-install the fan according to the preceding sequence, but in the reverse order.
   - The fan cable outlet is located next to the cable clamp of the bracket. Tie the cable to the cable clamp.
   - The recommended tightening torque of M4×60 screws is 1.2 N·m.

8.3.4 Replace the PCS

When the internal components of the PCS need maintenance or the whole device need replacement, use a proper lifting device to remove the PCS from the rack to the bottom surface, and then replace the PCS after maintenance or new PCS to the original position.

Note

- The PCS is heavy (≈ 300 kg). It is recommended to operate it with at least two people at the same time. Do not stand under PCS during lifting. Failure to comply may result in personal injury.
- Do not operate in extreme weathers such as strong wind, sand, rain, and snow.
- Check whether the rope is worn during the use of the tooling. If damaged, stop the operation immediately until the rope is replaced.

Note

This section provides the disassembly method for the lifting tooling of the PCS. Other lifting devices can also be used for operation.

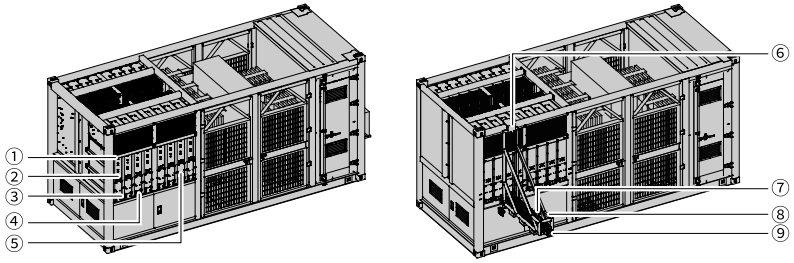


Figure 8-1 Diagram of rack and tooling fixing

No.	Name	No.	Name	No.	Name
①	Upper fixed mounting plate	④	Lower fixed mounting plate	⑦	Push-pull baffle plate
②	PCS	⑤	Junction box cover	⑧	Intermediate support part
③	Insulation barrier	⑥	Top mounting bracket	⑨	Screw

1. **Preparation before the replacement**

a. Ensure all the power supplies are disconnected.

b. Use a screwdriver to remove the two M10 screws (yellow) of insulation barrier 1 and the twelve M6 screws (red) of insulation barrier 2 and 3.

c. Use a screwdriver and wrench to remove the eight M8 screws (in blue) and two M10 screws (in yellow) of the upper fixed mounting plate, and two M8 screws (in blue) and two M10 screws (in yellow) of the lower fixed mounting plate.

d. Remove the six M6 screws (in red) of the junction box cover.

e. Remove the power and communication cables connected to the bottom of the PCS.

f. Remove the eight M6 screws (in red) attaching the bottom of the PCS wiring area to the support base of integrated device.

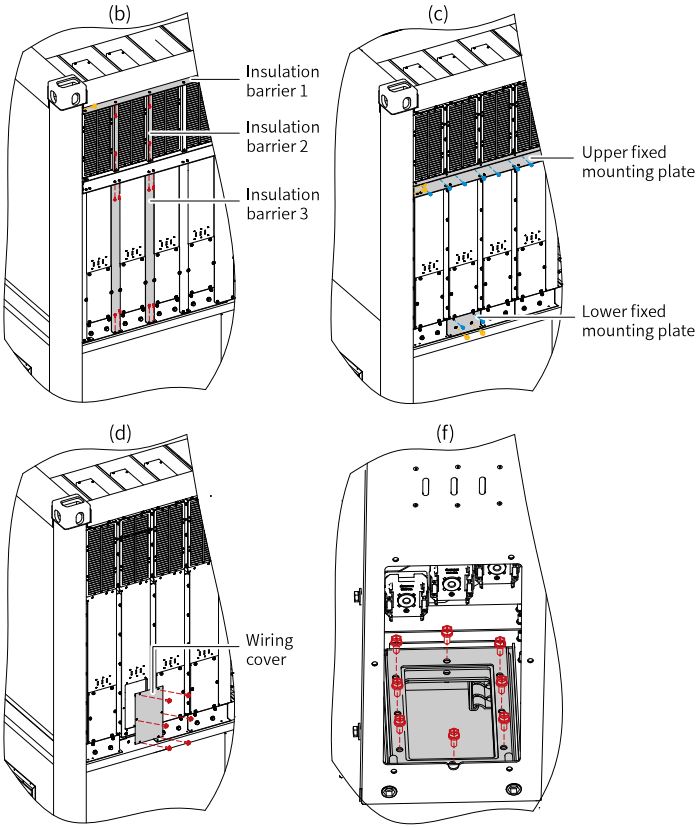


Figure 8-2 Preparation before the replacement

2. **Installing tooling**

a. Insert the forklift tines into the tooling slot.

b. Lift the tooling and hang it on the crossbeam at the top of the integrated device rack.

c. Fine-tune the jig position, and use two M10 screws (one on each side) to secure the anti-sway bracket to the intermediate crossbeam of the rack.

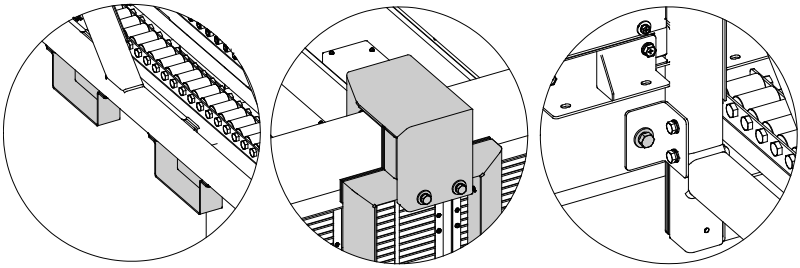


Figure 8-3 Installing the tooling

3. **Remove the PCS**

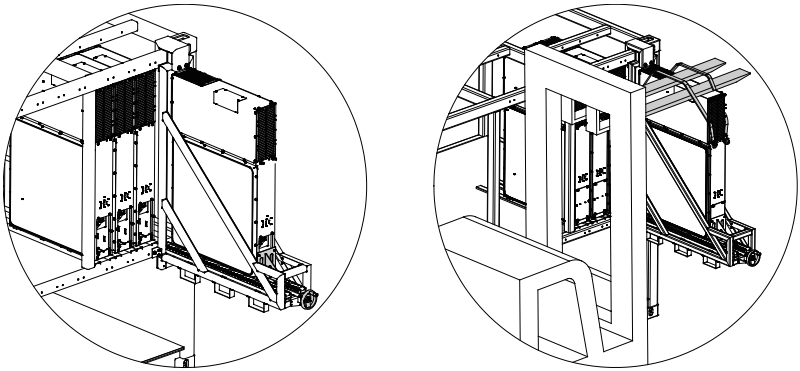
a. Connect the push-pull baffle plate to the screw holes of the PCS, rotate the lead screw winch to pull the PCS onto the support.

b. Remove the screws that connect the push-pull baffle plate to the PCS.

c. Install the spring buckles, M8 eyebolts, and lifting slings into the four Φ8 fixing holes of the PCS.

d. Slide the forklift tines into the lifting slings, slowly lift the PCS, and complete the transfer.

e. For maintenance and other operations, place the PCS horizontally on a pallet or a platform with cushion.



CAUTION

Use specialized lifting holes for the PCS. Failure to comply will result in the risk of not being locked

4. **Installing the PCS**

a. Use a forklift or crane to hoist the repaired or new PCS into the rack.

b. Fix the PCS to the push-pull baffle plate of the lead screw, and push the PCS into the integrated device rack.
c. Remove the tooling, and restore the PCS cables, terminal cover plate, and mounting plate in front of the cabinet.
d. Re-paste the relevant labels.

9 附录

9.1 Fuse and Circuit Breaker Selection

The PCS does not have a fuse or circuit breaker inside. For use, a circuit breaker must be provided on the DC side and a fuse must be provided on the AC side The recommended fuse or circuit breaker is as follows.

Name	Recommended model	Quantity
Fuse	EVM-B-630AF-N	2
Molded case circuit breaker	NDM3Z-630V/23500A AC220V shunt +CZ+ insulation bottom board	1

9.2 Terminology

Name	Abbreviation	Description
Power conversion system	PCS	With energy storage battery pack and connected to the battery pack and the grid, the system stores the power of the grid into the battery or feeds the energy of the battery into the grid. It is mainly composed of the converter and its control system.
Battery management system	BMS	It monitors the battery state (voltage, current, state of charge, etc.) and provides the communication interface and protection system for the battery.
Energy management system	EMS	Based on the application of computer, network, and communication technologies, EMS is a computer application system that realizes information collection, processing, monitoring and control of battery management system, power conversion system, and secondary power distribution equipment in the energy storage station. It can also enable the active and reactive power regulation of the energy storage station.
Power manager service	PMS	The PMS is located between the station level and the bay level. It performs coordination and control of the PCS and BMS and performs quick response tasks such as transient control.
Coordinated control unit	CCU	Samples the voltage, current, and frequency of the parallel devices, and controls multiple energy storage units through the real-time fast communication network. Performs first-time frequency modulation, dynamic voltage regulation, fast power reversal, grid connection of the unit voltage source, virtual synchronous generator, and black start.
Energy storage group unit	ESGU	It completes the information collection, monitoring, and control functions of the equipment in the unit through the communication network, as well as uploads information to the coordinated control unit and energy management system, and receives scheduling instructions. A device that achieves consistency and coordination of device control within a group.

10 Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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