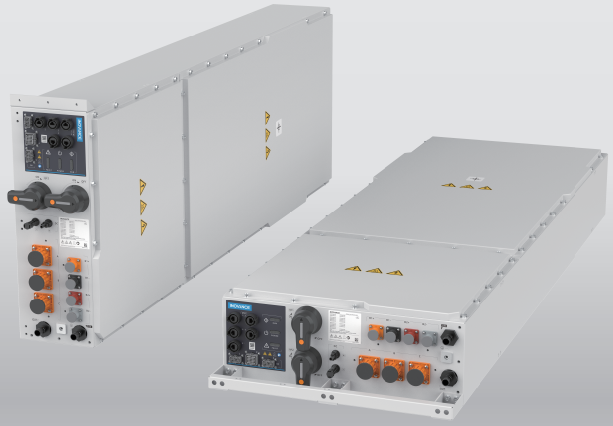
INOVANCE

Advancing industrial technology,
for a better world



IES630 Series
String PCS for Integrated ESS

User Guide (European Standard)

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

Data code PS00021821A00

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

The IES630 series string PCS is developed for integrated ESS cabinet applications. It is designed to enable energy exchange between the storage battery, the grid, and the loads, as well as to control and manage battery charging and discharging. 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	Description
March 2026	A00	Initial release.

Access to the Guide

This guide is not in the scope of delivery. If necessary, you can download the PDF file 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 user guides.

Warranty Disclaimer

If your product becomes defective under normal use conditions, we will offer guaranteed repair services within the warranty period. Maintenance will be charged after the warranty period expires.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (such as natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

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1 Fundamental Safety Instructions

1.1 Safety Instructions

Safety Disclaimer

- This chapter presents essential safety precautions for proper use of the product. Before use, read through the user guide and comprehend all the safety precautions. Failure to observe the safety instructions may result in equipment damage, physical injuries, or even death.
- "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 product in an environment that complies with the design specifications. Malfunction or component damage caused by improper use is not covered by warranty.
- Inovance is not legally responsible for any personal safety accidents or property losses caused by improper operations of this equipment or violation to instructions in this guide.

Safety Levels and Definitions



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



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



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

Safety Warning Signs



To prevent misuse or accidents caused by approach of unrelated personnel during installation, daily maintenance, or inspection of the PCS, observe the following:

- Place clear signs at the switches upstream and downstream the PCS, to prevent accidents caused by accidental brake closing.
- Set up a warning sign or safety belt near the operating area.
- Remove the cabinet door key and keep it properly after maintenance and inspection.

Requirements for Escape Routes

DANGER

- During maintenance, inspection, or other operations of the PCS, ensure that the escape routes are clear.
- Never place obstacles in the escape routes or occupy the escape routes in any form.

Safety Instructions

- Some drawings in this guide show the equipment without covers or protective guards to display more details. Remember to install the covers and protective guards before using the equipment and operate it in accordance with the instructions.
- Drawings in the user guide are for illustration only and may be different from the equipment you purchased.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking

WARNING

- Do not install the product when you find that the product and its accessories have any damage or corrosion or they have been used.
- Do not install the product when there is water inside the product or any of its parts is missing or damaged.
- Do not install the product when the product name is inconsistent with that in the packing list.

CAUTION

- Before unpacking, check the package for any damage, water seepage, dampness, or deformation.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surfaces of the equipment and accessories for any damage, rust, and scratches.
- Check the equipment, accessories, and materials in the package against the packing list.

Storage and Transportation

WARNING

- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in physical injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may disconnect and result in physical injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted.
- 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 physical injuries or equipment damage.

CAUTION

- Handle the equipment with care during transportation and mind your steps to prevent physical injuries or equipment damage.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Store and transport the product in environments free from water splashes, rain exposure, direct sunlight, strong electric and magnetic fields, and excessive vibration.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- Package the product strictly before transporting it, and use an enclosed container for long-distance transportation.
- Never transport the product with other equipment or materials that may harm or have negative impacts on the product.

Installation

DANGER

- Installation must be carried out by technicians who have received relevant training on electrical equipment and have sufficient electrical expertise. Non-professionals are not allowed to operate the equipment.



- Read through the user guide and safety precautions before installation.
- Do not install the product in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- 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 fire accidents.
- Do not modify the product.
- Do not fiddle with the bolts used to fix parts and components or the bolts marked in red.
- When installing the product in a cabinet or final assembly, make sure that the enclosure of the cabinet or final assembly provides adequate fire prevention, electrical protection, and mechanical protection conforming to relevant IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the product on an incombustible object, such as metal, and do not touch or attach the product to combustibles. Failure to comply may result in fire accidents.



- Cover the air inlet and outlet 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 installation, remove the cloth or paper on top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.

Wiring



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Before wiring, cut off all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the DC voltage of the main circuit and make sure that it is below the safety voltage. 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 device is reliably grounded. Failure to comply will result in an electric shock.

WARNING

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even fire.
- 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 fire accidents.
- 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 an electric shock or equipment damage.

CAUTION

- 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.

Power-on

DANGER

- Before power-on, make sure that the product is installed properly with reliable wiring.
- 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.

WARNING

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical 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 fire accidents.

Operation

DANGER

- The equipment must be operated only by professionals. Failure to comply will result in physical injuries or even death.
- 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.

WARNING

- 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 fire accidents or equipment damage.

Maintenance



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Do not maintain the equipment with power on. 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.
- During maintenance, completely disconnect the PCS from the energy storage battery.



- Carry out daily and periodic inspection and maintenance on the equipment according to maintenance requirements and retain a maintenance record.

Repair



- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Do not repair the equipment with power on. Failure to comply can result in an electric shock.
- Before inspection or repair, cut off the equipment power supply and wait for at least the time designated on the equipment warning label, and use a multimeter to check that the energy storage capacitor has no voltage.
- During maintenance, completely disconnect the PCS from the energy storage battery.



- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, cut off all equipment power supplies, wait for at least the time designated on the equipment warning label before power-on or further operations. Before power-on, check for short circuits before power-on or further operations. Failure to comply may result in equipment damage, physical injuries, or even death.
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment in according with the replacement instructions.
- Do not perform operations on damaged equipment. Failure to comply may result in death, physical injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal



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

Safety Labels

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the safety labels.

Safety Label	Description
	Risk of electric shock. Do not touch the heatsink after power-on. Failure to comply can result in burns.
	• Be careful. Do not operate the equipment by non-professionals. • 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 an interface to connect to the network and transmit data through the network interface. To protect factories, systems, machines, and networks from cyber attacks. A proper industrial information security protection mechanism must be implemented to ensure safe operation of factories, systems, machines, and networks.

The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer network or any other network to prevent unauthorized access to its factories, systems, machines, and networks. The system and device can be connected to the corporate network or Internet only when they are connected securely with appropriate security measures taken (for example, anti-virus software and fire wall installation).

Inovance is committed to continuous development and improvement of the products and solutions to improve the level of safety. It is strongly recommended to update the product promptly and always use the latest version.



Tampering with software (such as viruses, Trojans, and Worms) can lead to unsafe drive state, 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 longer supported or the latest version of the program is not applied, customers are at increased risk of cyber-attacks.
- Take proper protection measures (including but not limited to deploying anti-virus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the mobile storage device from being damaged by malware and protect products, networks, systems, and interfaces from unauthorized access, disturbance, intrusion, data disclosure, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

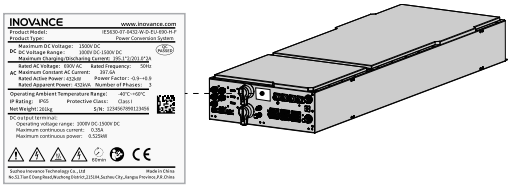
2.1 Model and Nameplate

Model

IES 6 30 - 07 - 0432 - W - S - EU - 690 - H -F
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪

①	**Product family** IES: Inovance energy storage product	⑤	**Power rating** 0432: 432 kW 0210: 210 kW	⑨	**AC side rated voltage** 400: 400 VAC 690: 690 VAC
②	**Product series** 6: Modular	⑥	**Cooling method** None: Forced-air cooling C: Air and water cooling W: Water cooling	⑩	**Installation** H: Horizontal V: Vertical
③	**Generation** 30: Third generation	⑦	**Wiring** S: Single DC input D: Dual DC inputs	⑪	**With high-voltage box** F: Yes None: No
④	**Maximum DC voltage** 07: 1500 VDC	⑧	**Compliance** EU: European standard		

Nameplate



2.2 Working Principle

The AC side of the IES630 series string PCS adopts a three-phase three-wire connection. The PCS provides two battery connection configurations:

- Single battery: Integrated high-voltage (HV) box is optional.
- Dual batteries: Integrated HV box is required as standard.

See the following table for detailed configurations.

Model		AC Side		Battery Side Inputs	Integrated HV Box	Installation
		Connection	Rated Voltage			
PCS without HV box	IES630-07-0210-W-S-EU-400-V	Three-phase three-wire	400 VAC	1	No	Vertical
	IES630-07-0432-W-S-EU-690-H	Three-phase three-wire	690 VAC	1	No	Horizontal
	IES630-07-0432-W-S-EU-690-V					Vertical
Single-DC-input PCS with HV box	IES630-07-0210-W-S-EU-400-V-F	Three-phase three-wire	400 VAC	1	Yes	Vertical
	IES630-07-0432-W-S-EU-690-H-F	Three-phase three-wire	690 VAC	1	Yes	Horizontal
	IES630-07-0432-W-S-EU-690-V-F					Vertical
Dual-DC-input PCS with HV box	IES630-07-0210-W-D-EU-400-V-F	Three-phase three-wire	400 VAC	2	Yes	Vertical
	IES630-07-0432-W-D-EU-690-H-F	Three-phase three-wire	690 VAC	2	Yes	Horizontal
	IES630-07-0432-W-D-EU-690-V-F					Vertical

See the following figures for the PCS power topology.

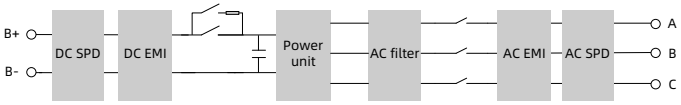


Figure 2-1 Power topology of PCS without HV box

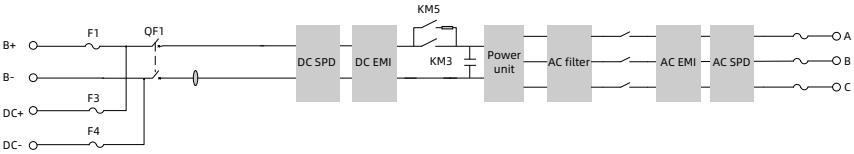


Figure 2-2 Power topology of single-DC-input PCS with HV box

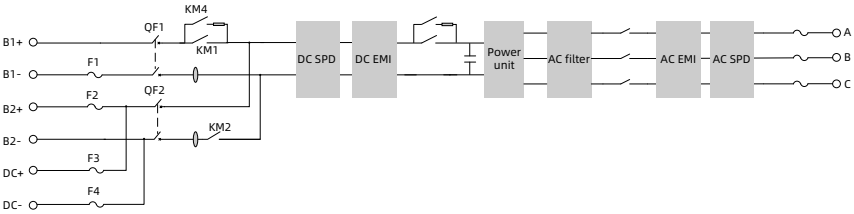


Figure 2-3 Power topology of dual-DC-input PCS with HV box

2.3 Specifications

Item		IES630-07-0210-W-****			IES630-07-0432-W-****		
		S-EU-400-V	S-EU-400-V-F	D-EU-400-V-F	S-EU-690-H S-EU-690-V	S-EU-690-H-F S-EU-690-V-F	D-EU-690-H-F D-EU-690-V-F
DC side	Maximum continuous charging current (A)	186.7	186.7	93.4x2	390.1	390.1	195.1x2
	Maximum continuous discharging current (A)	198.5	198.5	99.3x2	402.0	402.0	201.0x2
	Maximum continuous charging power (kW)	224.1	224.1	112.1x2	468.1	468.1	234.1x2
	Maximum continuous discharging power (kW)	238.1	238.1	119.1x2	482.4	482.4	241.2x2
	Maximum DC bus voltage (VDC)	1500					
	Operating DC voltage range (VDC)	1000 to 1500; rated 1330					
	DC voltage range (rated load) (VDC)	1100 to 1500					
	DC current control accuracy	< 2%					
	DC current ripple coefficient	< 2%					
	DC voltage control accuracy	< 1%					
	DC voltage ripple coefficient	< 2%					

Item		IES630-07-0210-W-****			IES630-07-0432-W-****		
		S-EU-400-V	S-EU-400-V-F	D-EU-400-V-F	S-EU-690-H S-EU-690-V	S-EU-690-H-F S-EU-690-V-F	D-EU-690-H-F D-EU-690-V-F
DC port	DC voltage range (VDC)	-	1000 to 1500		-	1000 to 1500	
	Maximum continuous current (A)	-	0.35		-	0.35	
	Maximum continuous power (kW)	-	0.525		-	0.525	
AC (on-grid)	Rated power (kW)	210			432		
	Maximum output power (kW)	231			475.2		
	Rated output current (A)	303.1			361.5		
	Maximum output current (A)	333.4			397.6		
	Reactive power range (kvar)	-220.5 to +220.5			-453.6 to +453.6		
	AC connection	Three-phase three-wire					
	Isolation	No isolation					
	Rated grid voltage (VAC)	400			690		
	Allowable grid voltage (%)	-15 to +10 (586 VAC to 759 VAC/340 VAC to 440 VAC)					
	Rated grid frequency (Hz)	50					
	Allowable grid frequency (Hz)	±5					
	Current harmonic distortion rate (rated power)	< 5%			< 3%		
	On-grid current DC component	< 0.5%I_n					
	Charge/ Discharge switching time (ms)	< 30					

Item		IES630-07-0210-W-****			IES630-07-0432-W-****		
		S-EU-400-V	S-EU-400-V-F	D-EU-400-V-F	S-EU-690-H S-EU-690-V	S-EU-690-H-F S-EU-690-V-F	D-EU-690-H-F D-EU-690-V-F
AC (off-grid)	Line voltage adjustable range for independent inverter output (V)	340 to 440 Configurable			586.5 to 759 Configurable		
	Rated output power (kW)	210			432		
	Voltage variation (%)	< 2%U_N (linear balanced load)					
	Degree of voltage imbalance (%)	< 2% for long term and ≤ 4% for short term					
	Total voltage harmonic distortion rate (%)	< 3% (linear load)					
	Rated output frequency (Hz)	50					
	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		IES630-07-0210-W-****			IES630-07-0432-W-****		
		S-EU-400-V	S-EU-400-V-F	D-EU-400-V-F	S-EU-690-H S-EU-690-V	S-EU-690-H-F S-EU-690-V-F	D-EU-690-H-F D-EU-690-V-F
System	Installation	V: Vertical			H: Horizontal V: Vertical		
	Cable inlet/ outlet	Front-in front-out					
	Overload capacity	1.1x long-term @ 45℃, 1.2x ≥ 1 min					
	Ambient temperature for operation (℃)	-40 to +60 (derating required above 50℃)					
	Relative humidity for operation (% RH)	0 to 100					
	Ambient temperature for storage (℃)	-40 to +70					
	Relative humidity for storage (% RH)	0 to 95					
	Noise (dB (A))	≤ 75 @ ambient temperature 30℃					
	Mass (kg)	162	175	201	162	175	201
	Overvoltage class	III (Grid side), II (DC side)					
	Corrosion-proof class	C4L (C5 optional for seaside applications)					
	Pollution degree	3					
	IP rating	IP65					
	Cooling mode	Water cooling					
	Number of parallel units	16 PCSs operating in parallel on AC side					
	Circulating current in parallel mode	< 5% of the average current of parallel operation (satisfied when load > 20%)					
Communication and display	Communication interface	RS485, CAN, Ethernet, and DI/DO					
	HMI	LED lamp					
	Communication protocol	Modbus RTU, CAN 2.0B, EtherCAT, and Modbus TCP					

2.4 Components

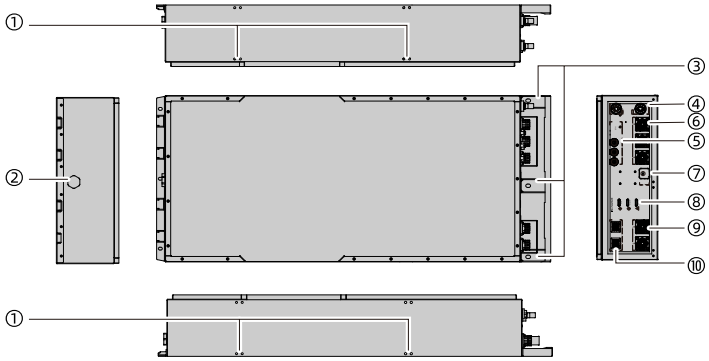


Figure 2-4 Components of PCS without HV box

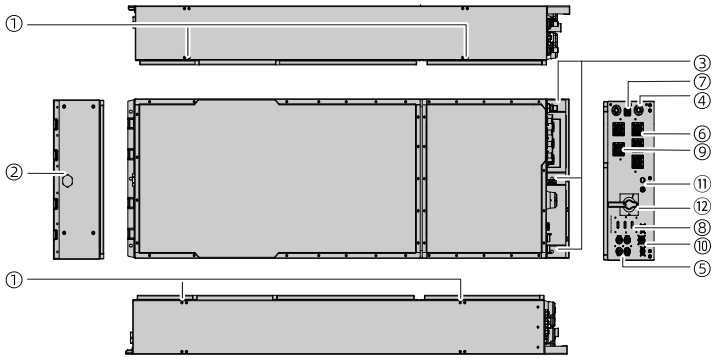


Figure 2-5 Components of single-DC-input PCS with HV box

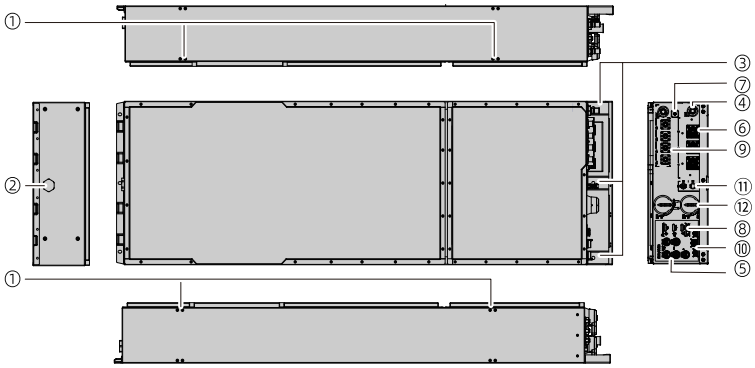


Figure 2-6 Components of dual-DC-input PCS with HV box

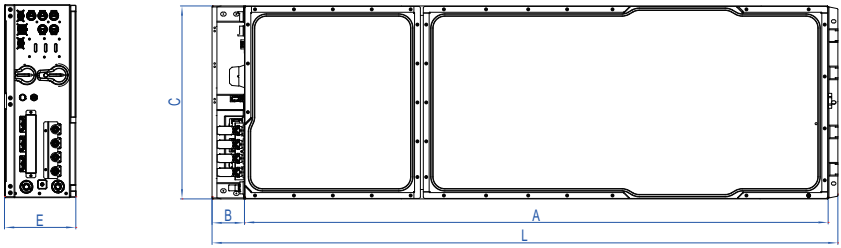
No.	Component	Description
①	Lifting eyebolt	Used for lifting the PCS; screw hole: M8.
②	Pressure relief vent	Automatically opens when pressure exceeds the set threshold to quickly release internal high-pressure gas.
③	Handle	Used for handling the equipment.
④	Coolant inlet/outlet	Coolant inlet and outlet ports of the PCS.
⑤	Parallel connection terminal and commissioning terminal	Wiring terminals for parallel operation and commissioning.
⑥	AC terminal	Wiring terminals for AC side phases A, B, and C.
⑦	Grounding point	Grounding terminal for PCS as a whole unit.
⑧	LED indicator area	• RUN: Operation indicator (green). ■ On when the PCS is operating normally. ■ Off in all other states. • POWER: Power indicator (white). ■ On when both the DC side (> 750 VDC) and the AC side (average of three-phase power > 630 VAC) are powered. ■ Flashes at 1s intervals when either the DC side or AC side is not powered. ■ Off when neither the DC side nor AC side is powered. • FAULT: Fault indicator (red). ■ On when the PCS shuts down due to a fault. ■ Flashes at 1s intervals when an alarm is triggered. ■ Off when no fault or alarm is present.
⑨	Battery terminal	Connects to the external battery: BAT+ and BAT-.
⑩	Communication terminal	Communication terminal for BMS, BMU, BCU, or EMS. • PCS without HV box: BMS, EMS • Single/Dual-DC-input PCS with HV box: BMU, BCU, EMS
⑪	DC terminal	Connects to the DC side: DC+ and DC-.
⑫	DC side switch	Manual switch on the DC side.

2.5 Dimensions

Note

The following figure shows the dimensions of a single-DC-input PCS with HV box for reference.

Horizontal



Vertical

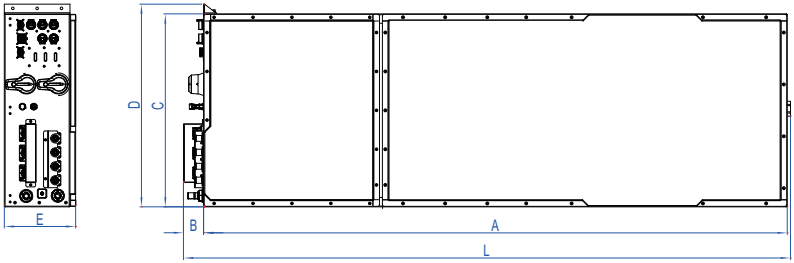


Figure 2-7 Product dimensions

Model	L	A	B	C	D	E
	Unit: mm					
IES630-07-0210-W-S-EU-400-V	1387	1250	107	595	625	220
IES630-07-0432-W-S-EU-690-V						
IES630-07-0432-W-S-EU-690-H						
IES630-07-0210-W-S-EU-400-V-F	1872	1800	62			
IES630-07-0210-W-D-EU-400-V-F						
IES630-07-0432-W-S-EU-690-V-F						
IES630-07-0432-W-D-EU-690-V-F						
IES630-07-0432-W-S-EU-690-H-F	1930		100		/	
IES630-07-0432-W-D-EU-690-H-F						

2.6 System Connection

System connection of PCS without HV box

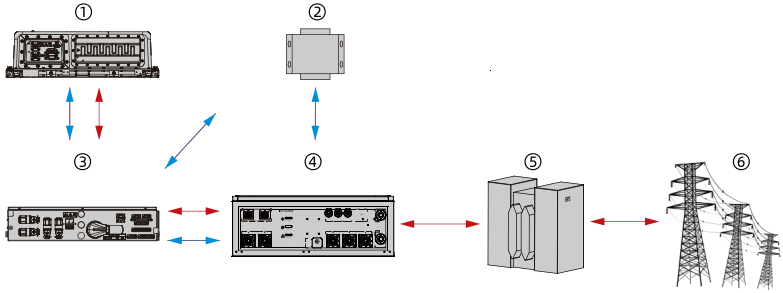


Figure 2-8 Diagram of the power conversion system

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	Lithium battery	Lithium battery of any type.
②	EMS	Energy management system, which schedules and monitors energy of the overall system.
③	High-voltage box, BMS	• The high-voltage box ensures safe and stable operation of the energy storage system. • The battery management system manages, protects, and monitors the battery.
④	PCS	Power conversion system, which exchanges energy between the battery and the grid.
⑤	Isolation transformer	Optional, which can be selected by the users based on their system demands.
⑥	Grid	When the PCS operates in on-grid mode, the AC side must be connected to the power grid.

System connection of single/dual-DC-input PCS with HV box

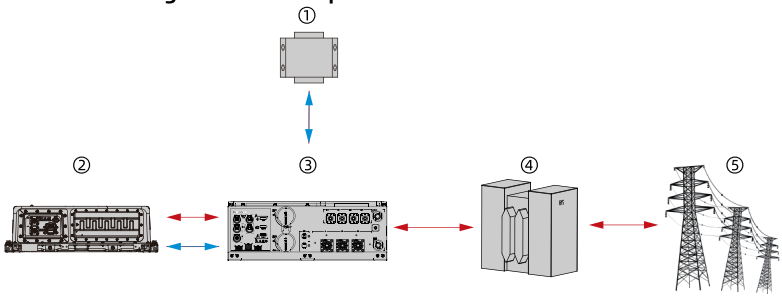


Figure 2-9 Diagram of the power conversion system (dual-DC-input PCS with HV box)

Note

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

Table 2–2 Description of the power conversion system

No.	Name	Description
①	EMS	Energy management system, which schedules and monitors energy of the overall system.
②	Lithium battery	Lithium battery of any type.
③	PCS	Power conversion system, which exchanges energy between the battery and the grid.
④	Isolation transformer	Optional, which can be selected by the users based on their system demands.
⑤	Grid	When the PCS operates in on-grid mode, the AC side must be connected to the power grid.

3 Unpacking, Storage, and Handling

3.1 Unpacking

3.1.1 Precautions for Unpacking



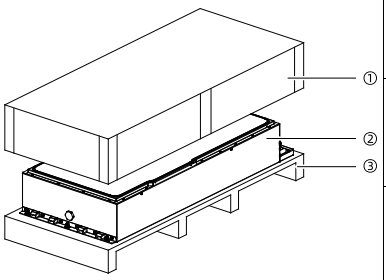
- Do not remove the packaging of the PCS during storage. Only remove the packaging before installation.
- After receiving the equipment, inspect it carefully.
- Check every item received against the delivery list. In case of any missing components or damage, notify the forwarder immediately.

3.1.2 Unpacking Procedure

1. Use a claw bar to pry open the wooden crate along the nailing gap in the door plank. Remove the top cover.
2. Remove filler materials.
3. Take out the PCS and accessories, and check the accessories to ensure nothing is missing.
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. Pay attention during the whole process to prevent personal injury caused by iron nails.
- 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	PCS
	③	Pallet

3.1.3 Check After Unpacking

Check the following items after unpacking.

Table 3–1 Post-unpacking checklist

No.	Check 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

Item	Storage Requirement
Package	The power conversion system must be stored with package.
Location	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	Protect the power conversion system during storage to prevent collision.

Item	Storage Requirement
Time	• 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.
Storage temperature	-40°C to +70°C
Storage humidity	0% RH to 95% RH, non-condensing

3.3 Handling

3.3.1 Precautions for Handling

Handling with a forklift

CAUTION

- Perform trial forking and adjust the forks as necessary. Then, lift the PCS and transport it to the designated position.
- Ensure that the tilting angle of the PCS is lower than 10° during handling and the relief height is as low as possible.
- Never transport the PCS on a hydraulic vehicle for a long distance or on a slope. Failure to comply may result in damage to the hydraulic vehicle.
- Handle the equipment slowly and steadily during lifting or landing to avoid shock or oscillation. Mind your feet when the forklift is lowered down.
- Arrange some people to hold the PCS when moving it. Move the cabinet on a flat ground.
- The PCS is high and may block the driver's sight, and thus the driver should be guided if necessary.

Handling with a hoist

CAUTION

- Lift the PCS once for trial to ensure that the straps can bear the weight of the PCS and the PCS is not tilted.
- The hook must be at the center of gravity.
- Ensure that the PCS inclines less than 10° after being lifted.
- Before handling, ensure that the front door of the cabinet has been locked. Opening of the door during handling may result in physical injury.
- Handle the equipment slowly and steadily during lifting or landing to avoid shock or oscillation.

3.3.2 Handling Before Unpacking

An unpacked PCS 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. Insert the forks to the position shown in the following figure.

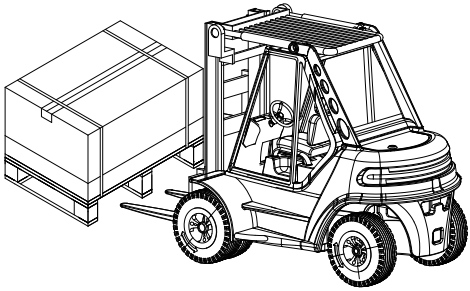


Figure 3-1 Handling with a forklift

3.3.3 Handling After Unpacking

Handling method

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

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. Insert the forks to the position shown in the following figure.

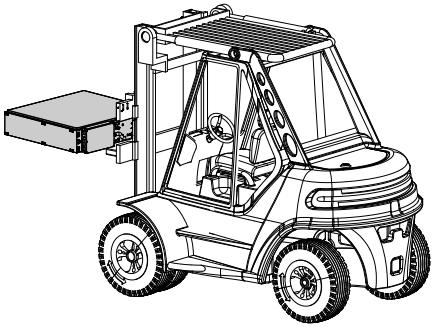
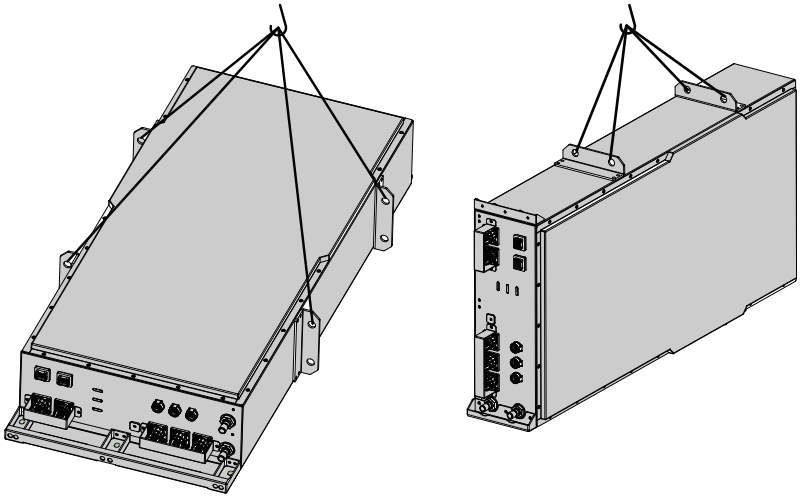


Figure 3-2 Handling with a forklift

Steps for handling with a hoist

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



Horizontal Vertical

Figure 3-3 Handling with a hoist



- The distance from the hook to the top of the cabinet must be greater than 1.5 m.
- During lifting, the tilt angle between the cabinet and the ground must be less than 10°.

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

Item	Environment Requirement
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 *"4.2.3 Installation Clearance" on page 33*.
Altitude	Maximum 3000 m
IP rating	IP65
Pollution degree	3
Corrosion-proof class	C4L
Ambient temperature for operation	-40°C to +60°C
Ambient humidity for operation	0% RH to 100% RH



Moisture intrusion may damage the PCS. To ensure normal operation of the PCS:

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

4.2.3 Installation Clearance

Reserve sufficient clearance around the PCS for the purpose of installation, maintenance, dissipation, and evacuation.

Horizontal installation clearance of PCS without HV box and dual-DC-input PCS with HV box

The horizontal installation clearance requirements for PCS without HV box and dual-DC-input PCS with HV box are the same. The following description uses the PCS without HV box as an example.

Horizontal PCSs can be installed individually or in parallel with multiple units. See the following figure for the installation clearance requirements.

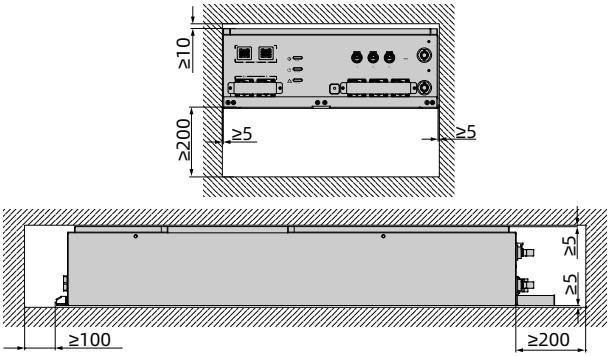


Figure 4-1 Installation clearance for single unit (unit: mm)

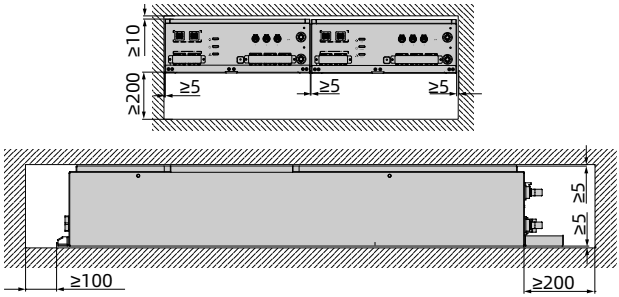


Figure 4-2 Installation clearance for multiple units (unit: mm)

Vertical installation clearance of PCS without HV box and dual-DC-input PCS with HV box

The vertical installation clearance requirements for PCS without HV box and dual-DC-input PCS with HV box are the same. The following description uses the dual-DC-input PCS with HV box as an example.

Vertical PCSs are used in energy storage systems for industry and business. Only one PCS is installed per cabinet. See the following figure for the installation clearance requirements.

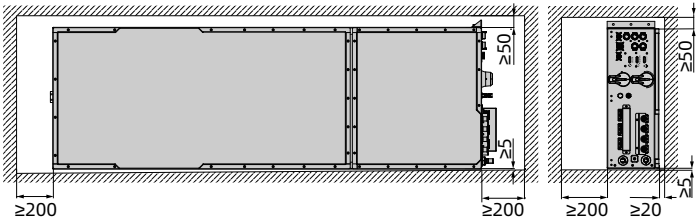


Figure 4-3 Installation clearance (unit: mm)

Horizontal installation clearance of single-DC-input PCS with HV box

Horizontal PCSs can be installed individually or in parallel with multiple units. See the following figure for the installation clearance requirements.

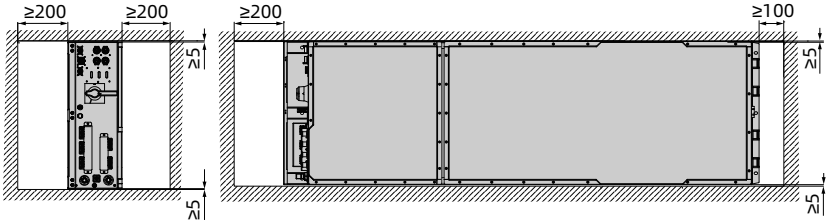


Figure 4-4 Installation clearance for single unit (unit: mm)

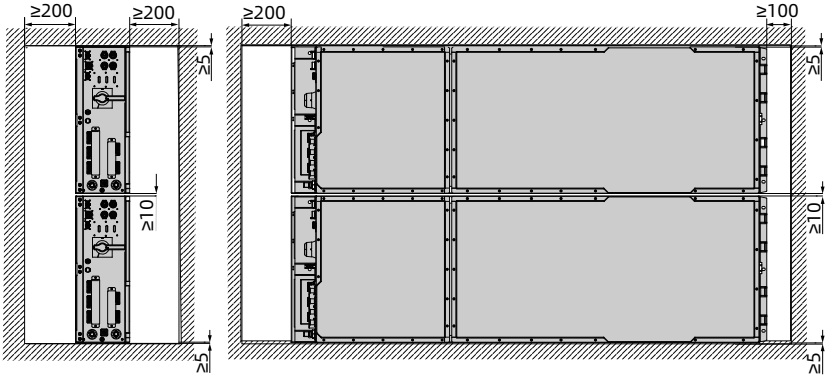


Figure 4-5 Installation clearance for multiple units (unit: mm)

Vertical installation clearance of single-DC-input PCS with HV box

Vertical PCSs are used in energy storage systems for industry and business. Only one PCS is installed per cabinet. See the following figure for the installation clearance requirements.

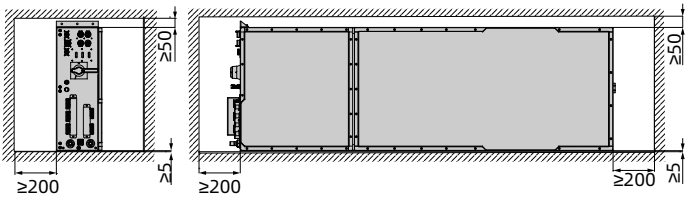


Figure 4-6 Installation clearance (unit: mm)

4.2.4 Installation Tools

No.	Tool	Quantity	Instructions for use
1	Crane/forklift/ stacker/PLC lifting tooling	1 piece	The load capacity shall be above 200 kg (PCS weight: 175 kg), depending on the number of units on site.
2	Ties	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

Screw/Bolt	Strength Grade	Max. 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 Orientation

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

4.5 Inspection Before Installation

Before installation, check the following items listed in the table below and tick the checked items in the "Checked" column.

No.	Item	Checked
1	The packing box is intact and free of damage and damp.	☐
2	After unpacking, the PCS module housing is intact without distortion, peeling, or crack, and there is no water stain.	☐
3	All ordered accessories and options are delivered.	☐

4.6 PCS Installation

Note

- The PCS is heavy. It is recommended that at least two people operate the PCS at the same time. Do not stand under PCS during the process. Failure to comply may result in personal injury.
- Do not operate in extreme weathers such as strong wind, sand, rain, and snow.

PCS without HV box

Horizontal installation

1. Ensure all the power supplies are disconnected.
2. Use a forklift to load the PCS onto the guide rails.
3. Secure the four M8 SEMS screws at the front bottom of PCS.

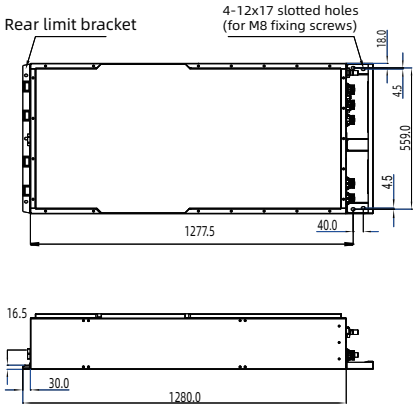


Figure 4-7 Fixing holes for horizontal installation

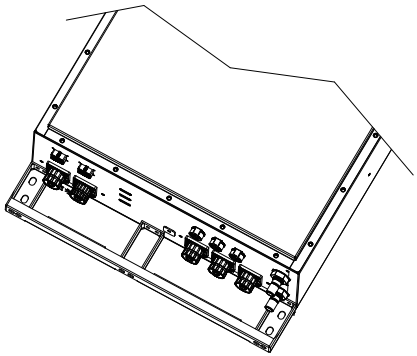


Figure 4-8 Positions of fixing screws

Vertical installation

1. Ensure all the power supplies are disconnected.
2. Lift the PCS and place it onto the fixture. Use the fixture to push the PCS into the corresponding position in the cabinet.
3. Secure the four M8 SEMS screws on the rear, three M8 SEMS screws on the front, and two M8x20 slotted-hole screws at the front bottom of the PCS.

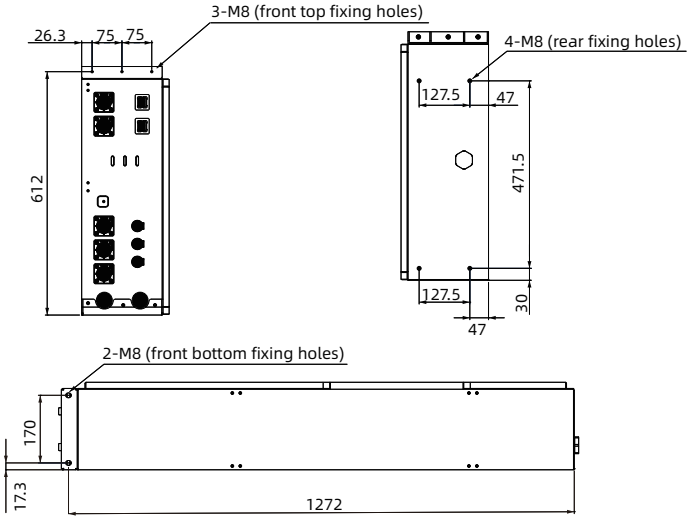


Figure 4-9 Fixing holes for vertical installation

Single/Dual-DC-input PCS with HV box

The installation method is the same for single-DC-input PCS with HV box and dual-DC-input PCS with HV box. The following uses dual-DC-input PCS with HV box as an example.

Horizontal installation

1. Ensure all the power supplies are disconnected.
2. Use a forklift to load the PCS onto the guide rails.
3. Secure the four M8 SEMS screws at the front bottom of PCS.

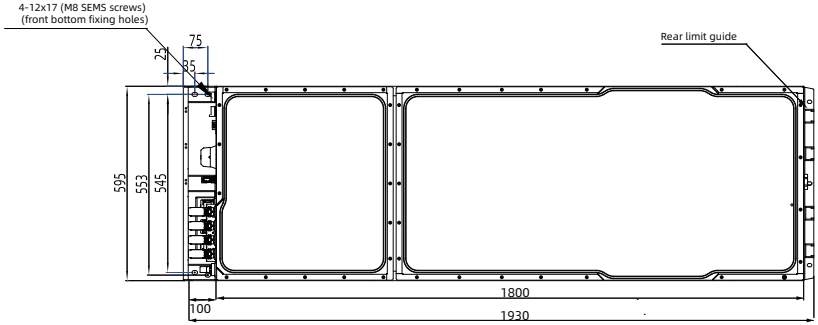


Figure 4-10 Fixing holes for horizontal installation

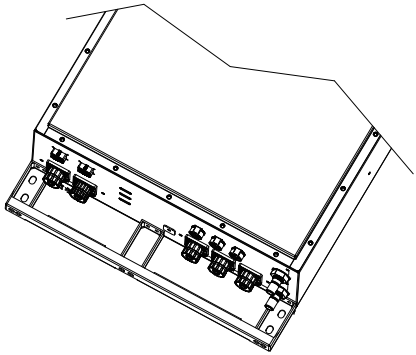


Figure 4-11 Positions of fixing screws

Vertical installation

1. Ensure all the power supplies are disconnected.
2. Lift the PCS and place it onto the fixture. Use the fixture to push the PCS into the corresponding position in the cabinet.
3. Secure the four M8 SEMS screws on the rear, three M8 SEMS screws on the front, and three M8x20 slotted-hole screws at the front bottom of the PCS.

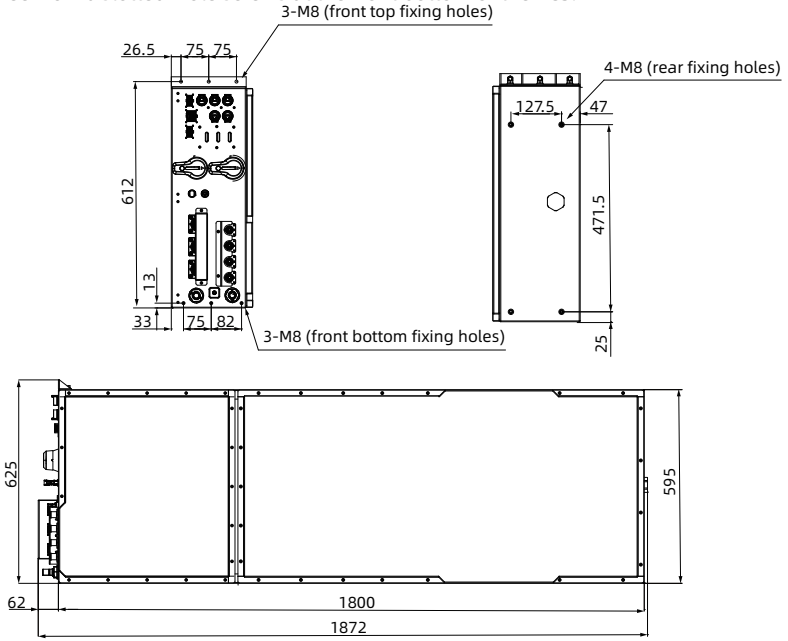


Figure 4-12 Fixing holes for vertical installation

4.7 Inspection After Installation

After installation, check the following items listed in the table below and tick the checked items in the "Checked" column.

Table 4–2 Post-installation checklist

No.	Item	Solution	Checked
1	The fasteners are tightened.	If any fastener is loose, tighten the screws again.	□
2	The installation clearance meets the requirements.	If the installation clearance is insufficient, redesign the cabinet and install it again.	□
3	The air filter is not blocked and has no foreign objects.	Clear foreign objects if any and locate the cause if the air filter is blocked.	□

5 Electrical Installation

5.1 Safety Precautions

Note

Take necessary safety protection measures during electrical installation to protect the safety of installation personnel. Observe the following requirements 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.
- Use insulating materials to isolate live parts to prevent physical injuries.
- 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.
- Before wiring, make sure that QF1 and QF2 are switched off.

Note

The wiring diagrams and descriptions in this chapter are based on the horizontal model. The wiring principles for the vertical model are the same; refer to this chapter for specific operations, noting the differences in installation orientation.

5.2 Preparation Before Wiring

5.2.1 Wiring Personnel Requirements

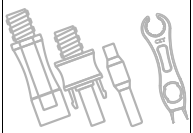
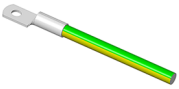
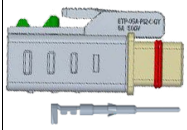
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- Taken specialized training.
- Read this guide completely and master the safety precautions related to operation.
- Be familiar with local standards and safety regulations of electrical systems.

5.2.2 Tools for Wiring

No.	Tool	Quantity	Instructions for use
1	Wire stripper (Automatic wire stripping machine)	1 set	Used for cable making.
2	Crimping tool	1	Used for cable making.
3	Clamp meter	1	Used to measure the current and voltage on the input and output sides.
4	Phillips screwdriver	1	Used to tighten M8 screws.

5.2.3 Cable Selection

Name		Terminal	Cable Type	Cable Specification	Cable Outer Diameter	Connector Diagram	Connector Source
Main circuit cable	DC cable	DC+, DC-	Outdoor cables that meet the 1500 VDC standard	4.0 mm^2	5.9 mm		Prepared by user
	AC cable	A, B, C	It is recommended to use outdoor single-conductor cables.	Copper cable: 150 mm^2	22 mm to 24 mm		Prepared by user
	Battery cable	B+/B1+/B2+ B-/B1-/B2-	Outdoor cables that meet the 1500 VDC standard	Copper cable: 150 mm^2	22 mm to 24 mm		Prepared by user
	Grounding cable	PE	Single-conductor yellow-green cable	Copper cable: 70 mm^2	-		Prepared by user[1]
Control circuit cable	Communication cable	CN1/CN2/ CN3	Outdoor shielded twisted pair that meets the local regulations.	0.5 mm^2 to 1 mm^2	-		Provided by the manufacturer
	Cable for parallel connection and communication	ETH1, ETH2 ETH3, ETH4, ETH5	Cat 5e network cable	CAT5E/UTP-24AW	-		Prepared by user

Note

[1]: The exposed metal part of the crimped section must be protected with heat-shrink tubing.

5.3 Check Before Wiring

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

Table 5–1 Safety inspection list

No.	Check 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 *"5.2.3 Cable Selection" on page 44*.	☐
5	The operator has done relevant protective work.	☐

5.4 Grounding Cable Connection

5.4.1 Layout and Description of the Grounding Terminal

See the following figure for the grounding terminal of the PCS as a whole.

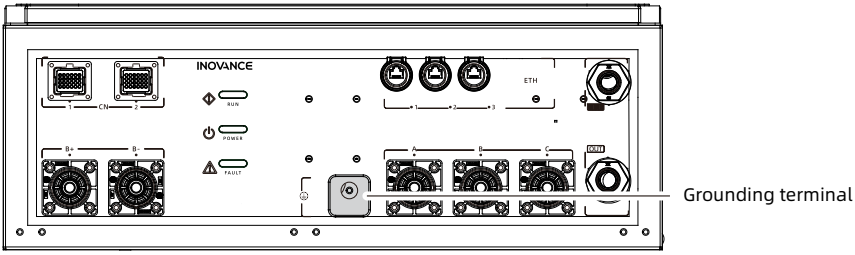


Figure 5-1 Grounding terminal (PCS without HV box)

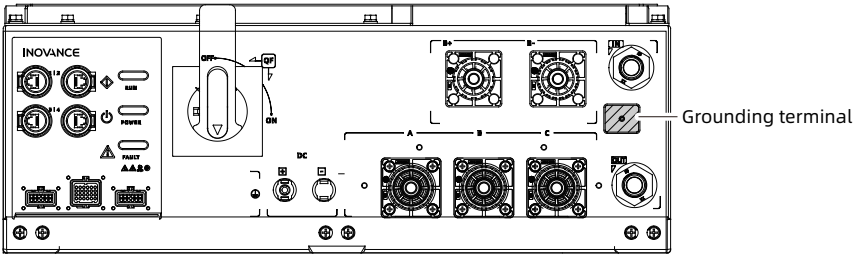


Figure 5-2 Grounding terminal (single-DC-input PCS with HV box)

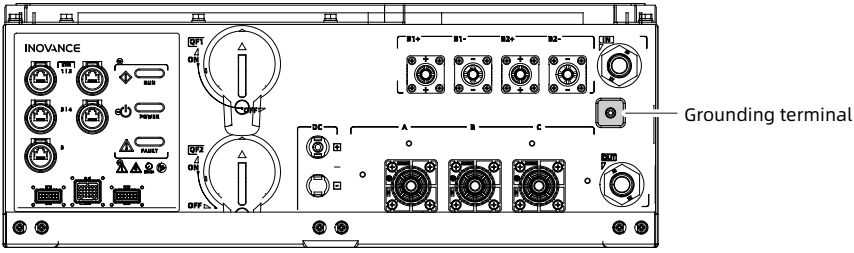


Figure 5-3 Grounding terminal (dual-DC-input PCS with HV box)

5.4.2 Wiring Procedure

The product housing includes M8 threaded grounding posts. It is recommended to use 70 mm^2 yellow-green cable to crimp the OT terminal and M8 screw. The recommended tightening torque of M8 screws is 4.8 N m.

5.5 Wiring of AC/DC Terminals

5.5.1 Layout and Description of AC/DC Terminals

CAUTION

- Before wiring, make sure that QF1 and QF2 are switched off.
- Ensure that the phase sequences at the AC side, the DC side, and the battery side are consistent with the phase sequences at the power grid, the PV system, and the battery, respectively.

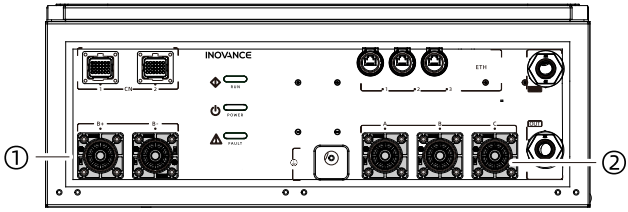


Figure 5-4 Layout of AC/DC terminals (PCS without HV box)

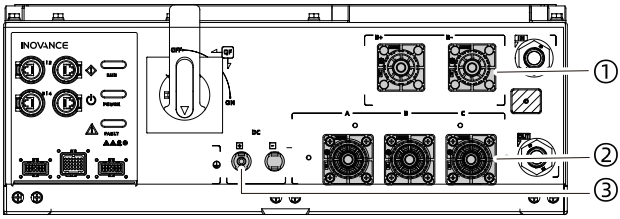


Figure 5-5 Layout of AC/DC terminals (single-DC-input PCS with HV box)

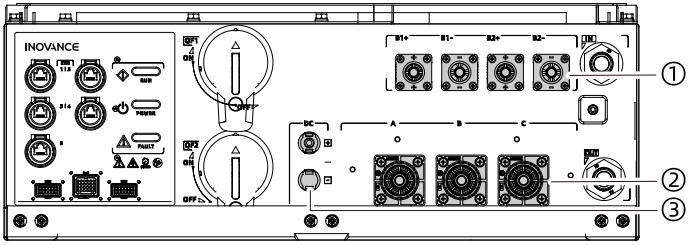


Figure 5-6 Layout of AC/DC terminals (dual-DC-input PCS with HV box)

Table 5–2 Description of AC/DC terminals

No.	Name	Mark	Description
①	Battery terminal	B+/B1+/B2+	Battery positive terminal
		B-/B1-/B2-	Battery negative terminal
②	AC terminal	A	AC phase-A terminal
		B	AC phase-B terminal
		C	AC phase-C terminal
③	DC terminal	DC+	DC positive terminal
		DC-	DC negative terminal

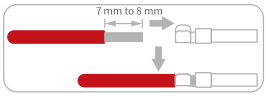
5.5.2 Wiring Procedure

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

Preparing the DC cables

1. Prepare the DC+ cable.

a. Strip the insulation of the DC+ cable 7 mm to 8 mm and assemble the cable end with crimping pliers.



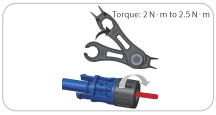
b. Loosen the DC+ connector cap by turning it counterclockwise.



c. Route the cable through the connector cap and insert the crimp contact into the insulator until the snap-fit joint is in place. Pull the cable back slightly to ensure that it is connected securely.

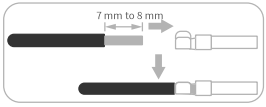


d. Use a wrench to tighten the connector cap and insulator clockwise with the torque of 2 N·m to 2.5 N·m.



2. Prepare the DC- cable.

a. Strip the insulation of the DC- cable 7 mm to 8 mm and assemble the cable end with crimping pliers.



b. Loosen the DC- connector cap by turning it counterclockwise.



c. Route the cable through the connector cap and insert the crimp contact into the insulator until the snap-fit joint is in place. Pull the cable back slightly to ensure that it is connected securely.



d. Use a wrench to tighten the connector cap and insulator clockwise with the torque of 2 N·m to 2.5 N·m.



Connecting the cables

1. Ensure that the PCS and the cables are de-energized.
2. Check that the DC switch of the PCS is set to the OFF position.

3. Identify and mark the cables for phases A, B, C, battery positive (B+/B1+/B2+), battery negative (B-/B1-/B2-), DC+, and DC-.
4. Insert the DC cables into the corresponding ports until a "click" sound is heard.
5. Connect the power cable plug to the power terminal in the proper phase sequence.

5.6 Wiring of Parallel Connection and Commissioning Terminals

5.6.1 Layout and Description of Parallel Connection and Commissioning Terminals

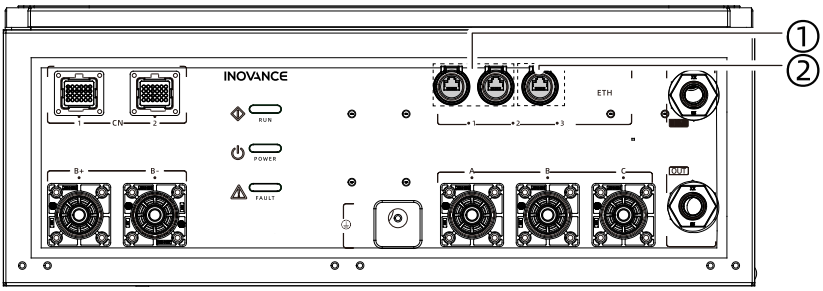


Figure 5-7 Layout of parallel connection and commissioning terminals (PCS without HV box)

Table 5–3 Description of parallel connection and commissioning terminals (PCS without HV box)

No.	Name	Mark	Description
①	Parallel connection terminal	ETH1	Carrier synchronization signal terminal for parallel communication
		ETH2	
②	PCS communication terminal	ETH3	Communication terminal of the PCS

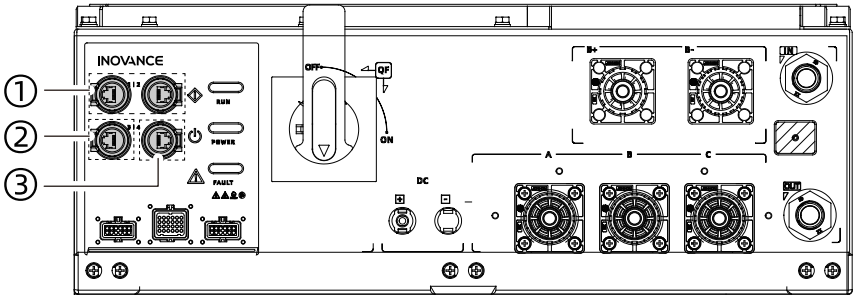


Figure 5-8 Layout of parallel connection and commissioning terminals (single-DC-input PCS with HV box)

Table 5–4 Description of parallel connection and commissioning terminals (single-DC-input PCS with HV box)

No.	Name	Mark	Description
①	Parallel connection terminal	ETH1	Carrier synchronization signal terminal for parallel communication
		ETH2	
②	BCU communication terminal	ETH3	BCU communication terminal
③	PCS communication terminal	ETH4	PCS communication terminal

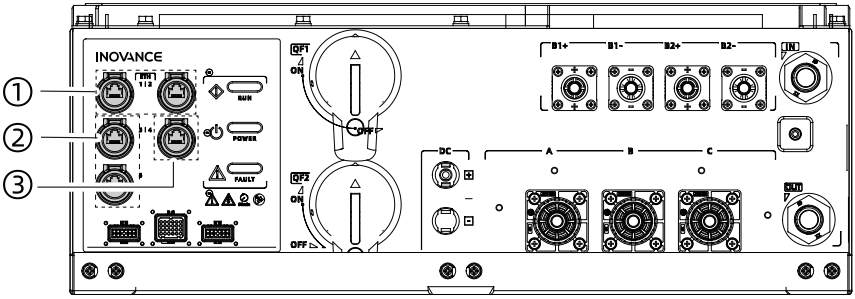


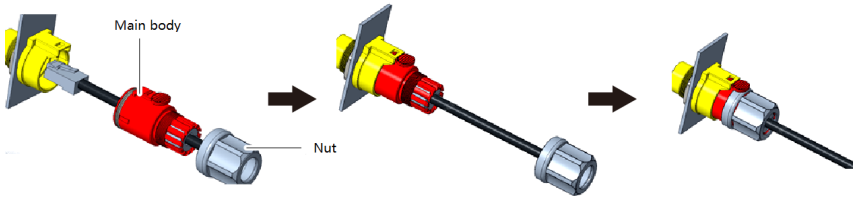
Figure 5-9 Layout of parallel connection and commissioning terminals (dual-DC-input PCS with HV box)

Table 5–5 Description of parallel connection and commissioning terminals (dual-DC-input PCS with HV box)

No.	Name	Mark	Description
①	Parallel connection terminal	ETH1	Carrier synchronization signal terminal for parallel communication
		ETH2	
②	BCU communication terminal	ETH3 ETH5	BCU communication terminal
③	PCS communication terminal	ETH4	PCS communication terminal

5.6.2 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.



5.7 Wiring of Communication Terminals

5.7.1 Layout and Description of Communication Terminals

Communication terminals on PCS without HV box

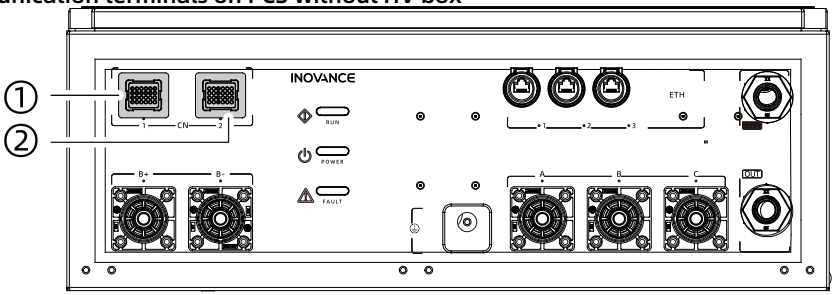


Figure 5-10 Layout of communication terminals (PCS without HV box)

Table 5–6 Description of communication terminals (PCS without HV box)

No.	Name	Mark	Description
①	BMS communication terminal	CN1	Supports RS485, CAN, and DI/DO communication for BMS
②	EMS communication terminal	CN2	Supports RS485 communication, scheduling signals, emergency stop and status feedback signals, and hard parallel connection for EMS

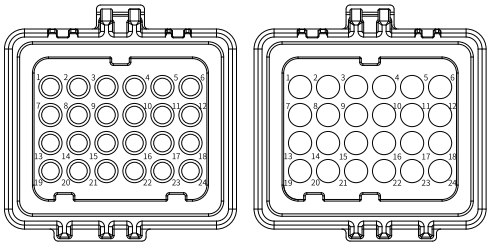


Figure 5-11 Layout of terminal pins (PCS without HV box)

Table 5–7 Description of terminal pins (PCS without HV box)

No.	BMS Pin Assignment	EMS Pin Assignment
1	GND	PC-485+
2	BMS_DO+	PC-485-
3	BMS_NO_DI+	M_AGC_DI
4	BMS_NC_DI+	EPO-DI
5	BMS_CANH	Reserved
6	BMS_485+	Reserved
7	PE	PC_485-
8	BMS_DO-	PC_485-
9	BMS_NO_DI-	M_AGC_COM
10	BMS_NC_DI-	EPO_COM
11	BMS_CANL	Reserved
12	BMS_485-	PE
13	PWM	NTC-
14	FB	NTC+
15	FAN24V+	Reserved
16	COM	Reserved
17	BMS_DO+	Reserved
18	PE	Reserved
19	USER24V-1	Reserved
20	COM	Reserved
21	USER24V	Reserved
22	DOUT1-NO	Reserved
23	BMS_DO-	Reserved
24	PE	Reserved

Communication terminals on single/dual-DC-input PCS with HV box

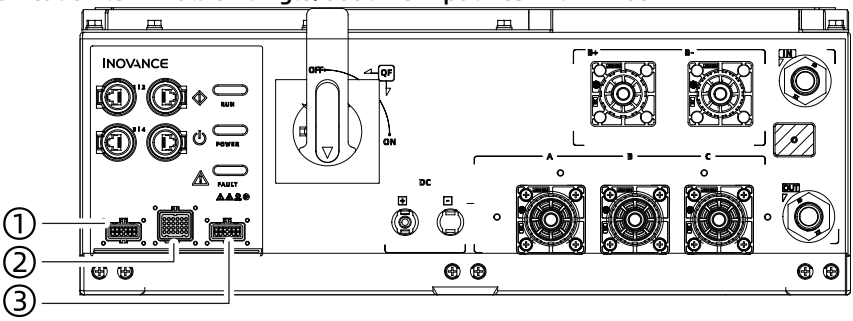


Figure 5-12 Layout of communication terminals (single-DC-input PCS with HV box)

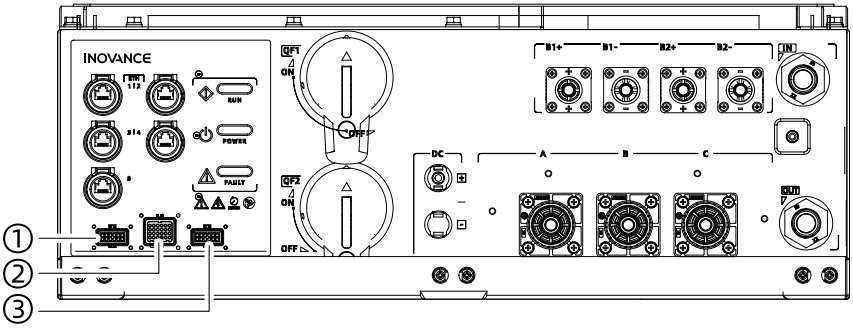


Figure 5-13 Layout of communication terminals (dual-DC-input PCS with HV box)

Table 5–8 Description of communication terminals (single/dual-DC-input PCS with HV box)

No.	Name	Mark	Description
①	Communication terminal 1	CN1	Communication port between BCU and BMU, supporting daisy-chain communication and RS485 communication
②	Communication terminal 2	CN2	Communication port between BCU and various devices, supporting CAN communication, RS485 communication, DI/DO, and BCU power supply
③	Communication terminal 3	CN3	Commissioning and reserved communication port, supporting CAN communication, RS485 communication, and DI/DO

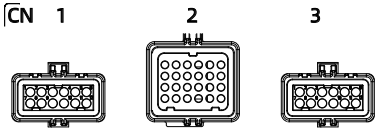


Figure 5-14 Layout of terminal pins (single/dual-DC-input PCS with HV box)

Table 5–9 Description of communication terminal-1 pins (single/dual-DC-input PCS with HV box)

No.	Assignment	Description
1	IP1	Cluster 1 daisy-chain communication
2	IM1	
3	IP2	Cluster 2 daisy-chain communication
4	IM2	
5	485_A	Cluster 1 RS485 communication
6	485_B	

No.	Assignment	Description
7	485_A	Cluster 2 RS485 communication
8	485_B	
9	Reserved	Reserved
10	Reserved	-
11	Reserved	-
12	PE	Shield ground (external grounding point routed internally)

Table 5–10 Description of communication terminal-2 pins (single/dual-DC-input PCS with HV box)

No.	Assignment	Assignment
1	485_A	Local controller communication
2	485_B	
3	CAN_H	BCU power supply
4	CAN_L	
5	BCU_24V	
6	COM	
7	BCU_24V	
8	COM	
9	HSD+	Operation indicator
10	HSD+	Fault indicator
11	HSD+	Alarm indicator
12	HSD+	Power circuit AC MCCB shunt trip
13	HSD+	Fan control
14	DIO	Water immersion transmitter feedback
15	DIO	Surge protection device feedback
16	DIO	Travel switch access
17	DIO	Power circuit AC MCCB feedback
18	DIO	Battery compartment aerosol
19	DIO	Electrical compartment aerosol
20	DIO	Fire smoke/heat detector feedback
21	DIO	Fan feedback
22	DIO	-
23	DIO	-
24	PE	Shield ground (external grounding point routed internally)

Table 5–11 Description of communication terminal-3 pins (single/dual-DC-input PCS with HV box)

No.	Assignment	Description
1	PC-485+	PCS commissioning RS485
2	M_AGC_DI	Power scheduling DI
3	EPO_DI	PCS emergency stop DI
4	PC-485-	PCS commissioning RS485
5	M_AGC_COM	Power scheduling DI
6	EPO_COM	PCS emergency stop DI
7	Reserved	Reserved
8	CAN_H	BCU1 commissioning communication
9	CAN_L	
10	CAN_H	BCU2 commissioning communication
11	CAN_L	
12	PE	Shield ground (external grounding point routed internally)

5.7.2 Wiring Procedure

1. Ensure that the PCS and the cables are de-energized.
2. Mark the communication cables.
3. Connect the communication cable plug to the corresponding socket, and hear a "click" to ensure that the cable is connected properly.

5.8 Check After Wiring

After wiring, check the following items listed in the table below and tick the checked items in the "Checked" column.

Table 5–12 Post-wiring checklist

No.	Check 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.	□

No.	Check Item	Checked
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 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.

6.2 Commissioning Tool List

No.	Name	Specification	Quantity	Remarks
1	HMI	IT7100E	1	Used to control a single PCS and display the running data of the PCS in real time
2	HMI commissioning cable	-	1	Used to connect the ESGU communication port and the 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.

6.3 Check Before Running

No.	Check Item	Checked
1	For the installation and operation environments, 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	The cables are not damaged or scratched, and the filter screen of the air vent is in good condition.	☐
8	The entire path of the battery connected to the DC input side of the PCS is detected through insulation test to ensure that there is no ground fault.	☐
9	The EMS is designed with a daily time synchronization program for the PCS [1].	☐

Note

[1] The time synchronization procedure for the PCS is as follows:

1. When the EMS determines that the time is 00:00, it executes the time synchronization procedure.
2. The EMS writes 1 to parameter FE.38 (communication address 0x0E26) to enable time synchronization.

   The EMS writes time parameters (communication addresses) – year: FE.39 (0x0E27); month and day: FE.40 (0x0E28); hour and minute: FE.41 (0x0E29); second: FE.42 (0x0E2A).
3. When the EMS reads that parameter FE.38 (communication address 0x0E26) of the PCS is 0, it reads the PCS time. If the read time matches the written time, the synchronization is successful.

   The EMS reads time parameters (communication addresses) – year: F1.27 (0x011B); month and day: F1.28 (0x011C); hour and minute: F1.29 (0x011D); second: F1.30 (0x011E).

Example of writing and reading time (November 16, 2025, 10:36:10):

Parameter	Write (Address)	Read (Address)	Write/Read Value
Year	FE.39 (0x0E27)	F1.27 (0x011B)	2025
Month and day	FE.40 (0x0E28)	F1.28 (0x011C)	1116 (November 16)
Hour and minute	FE.41 (0x0E29)	F1.29 (0x011D)	1036 (10:36)
Second	FE.42 (0x0E2A)	F1.30 (0x011E)	10

6.4 Power-On

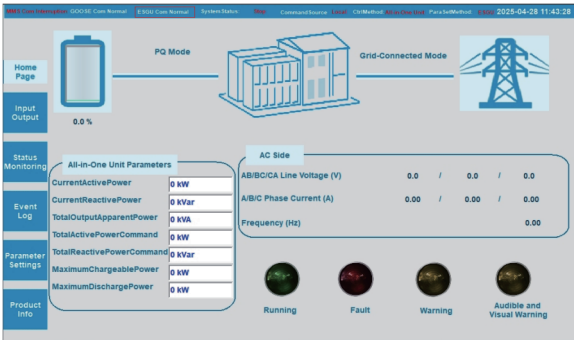


Start the device by strictly following the procedure. Failure to comply can result in damage or malfunction of the device.

Note

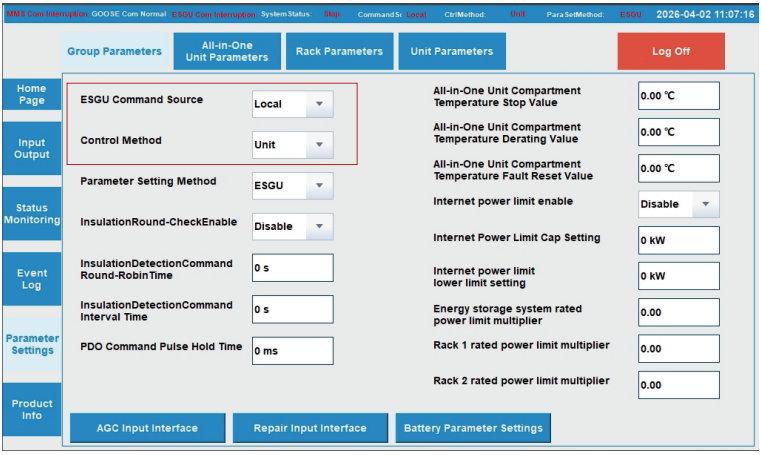
For parameter commissioning, this part takes the ESGU to connect the AC drive as an example.

1. Check connections on the AC side (690 VAC power supply or grid) and DC side (battery) of the PCS.
2. Power on the AC/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 AC/DC side disconnected.
3. Connect the ESGU and check the communication status in the upper left corner of the HMI corresponding to the ESGU. Confirm that the communication between the HMI and ESGU is normal.



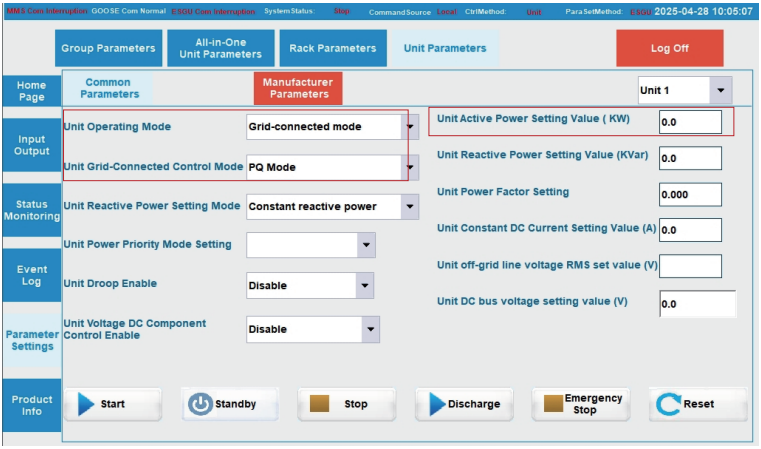
6.5 Trial Run

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

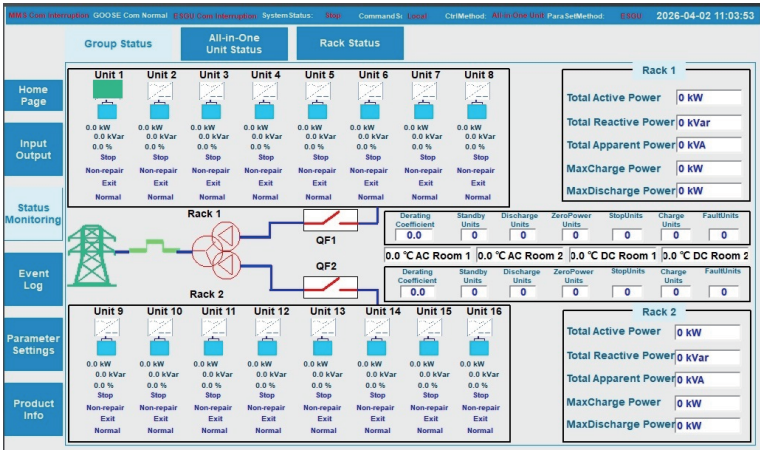


3. Click the "Unit Parameters" tab.

- 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 of PCS

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Battery fault	Storage battery polarity connected reversely	The battery is connected to the power conversion system with wrong polarity.	Check whether the battery is connected with wrong polarity.
	Storage battery voltage too high	The battery voltage is too high upon power-on.	Check whether the battery voltage is too high.
	Storage battery voltage too low	The battery voltage is too low upon power-on.	Check whether the battery voltage is too low.
DC side bus voltage fault	DC side half-bus hardware overvoltage	• 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.
	DC side full-bus software overvoltage	• The bus voltage is 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 side 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 side half-bus voltage variation too large	• Voltage variation occurs between positive and negative halves of the bus. • The bus capacitor is aged.	Contact Inovance.
	DC bus short circuit	The DC bus is short-circuited.	Contact Inovance.
AC side overcurrent	AC side hardware overcurrent	• The AC side is short-circuited. • Impact load occurs.	Contact Inovance.
DC side overcurrent	DC side hardware overcurrent	• The DC side is short-circuited. • Impact load occurs.	Contact Inovance.
	DC side software overcurrent	• The DC side is short-circuited. • Load on the DC side is heavy.	Contact Inovance.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
AC side Hall sensor fault	AC side phase-A Hall disconnected	Hall sensor on the AC side is disconnected.	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
	AC side phase-B Hall disconnected	Hall sensor on the AC side is disconnected.	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
	AC side phase-C Hall disconnected	Hall sensor on the AC side is disconnected.	• Check whether the current on the AC side is within the proper range. • Contact Inovance.
Detection board model mismatch	Detection board model mismatch	The voltage and the model do not match.	Contact Inovance.
Switch fault	DC side switch fault	• The contact of the circuit breaker is stuck. • 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.
	AC side switch fault		
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.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Grid error	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 imbalance	• 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.
	Fault ride-through count overlimit	The number of consecutive ride-through events exceeds the limit.	Check whether the grid voltage is normal.
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.
Current control deviation too large	Current control deviation too large	• 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.
AC side DC component out of limit	AC side DC component out of limit	• The DC component in the three-phase current is out of limit. • DC deviation occurs in current sampling.	Contact Inovance.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
AC side soft start failed	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.
	Pre-charge failure on the AC side	• Inverter voltage sampling is abnormal. • PCS pulsing abnormal.	Contact Inovance.
AD zero drift too large	AD zero drift too large	The current zero drift is 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 over-temperature	• 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 over-temperature 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 is 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 over-temperature fault in IGBT module	• The ambient temperature is too high. • The current is excessive.	• Check whether the fan operates properly. • Check whether the ventilation duct is blocked. • Check whether the current is within the proper range. • Check whether the temperature sensor operates properly.
	B-phase over-temperature fault in IGBT module		
	C-phase over-temperature fault in IGBT module		
	A-phase over-temperature alarm in IGBT module		
	B-phase over-temperature alarm in IGBT module		
	C-phase over-temperature alarm in IGBT module		
	IGBT temperature sampling error	The NTC sampling failed.	Check whether the temperature sensor operates properly.
SPD fault	SPD fault	The SPD on the AC side or DC side is damaged.	• Check whether the SPD is wired properly. • Check whether the SPD is damaged.
Parallel module fault	Parallel communication fault	The communication between the PCS and other PCSs fails.	Check whether the communication cable between the PCS and other PCSs is connected properly.
	Carrier synchronization fault	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.
	Inner cavity fan alarm		
Internal communication fault	CAN 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.

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Internal chip fault	EEPROM fault	The EEPROM drive is abnormal or the EEPROM is damaged.	Contact Inovance.
	EEPROM alarm		
	Black box error	FLASH error.	Contact Inovance.
	FPGA data exchange error	The communication timing between FPGA and ARM is abnormal.	Contact Inovance.
	RTC error	• The button battery voltage is low. • RTC error.	• Replace the button battery. • Contact Inovance.
	Primary ARM junction 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.
	Secondary ARM junction over-temperature		
	FPGA junction temperature over-temperature		
Control power error	Primary-side 24 V power supply error	Control power error.	Check that the power supply cable connection is normal.
Emergency stop fault	Remote E-Stop fault	The host controller has issued an emergency stop command.	Check whether host controller emergency stop is triggered.
Capacitor voltage resonance fault	Capacitor voltage resonance fault	Resonance at the AC side.	Contact Inovance.
EMS communication fault (board fault such as EtherCAT, Ethernet, IEC 61850)	EMS connection timeout 1 (external bus)	Communication between the Ethernet port and the EMS is abnormal.	• Check the connection cable between the Ethernet port and the EMS. • Contact Inovance.
	EMS connection timeout 1 (internal communication)	Communication between the Ethernet port and the communication board is abnormal.	• Check the connection cable between the Ethernet port and the communication board. • Contact Inovance.
	EMS connection timeout 2 (external bus)	Communication between EtherCAT and the ESGU is abnormal.	• Check whether the cable connection between EtherCAT and the ESGU is reliable. • Contact Inovance.
	EMS connection timeout 2 (internal communication)	Communication between EtherCAT and the communication board is abnormal.	• Check whether the cable connection between EtherCAT and the communication board is reliable. • Contact Inovance.
DC side sampling disconnected	DC side midpoint sampling disconnected	Sampling disconnected.	• Check the bus voltage. • Check the sampling cable.
	DC side voltage sampling disconnected		

Fault Name	Sub-fault Name	Possible Cause	Troubleshooting
Temperature of relay board	Over-temperature Alarm	• 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 ventilation duct is blocked.
	Temperature too low	Temperature sampling of relay board is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Temperature of power supply board	Over-temperature Alarm	• 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 ventilation duct is blocked.
	Temperature too low	Temperature sampling of power supply board is disconnected.	• Check whether the temperature display is normal. • Contact Inovance.
Zero sequence loop current too large	Zero sequence loop current too large	• Carrier synchronization error: master and slave pulsing inconsistent. • Inductor current sampling error.	• Check historical records for carrier synchronization faults. • Contact Inovance.
Water immersion fault	Internal liquid leakage	Liquid leakage inside PCS.	Check whether condensation has occurred inside the PCS or if the water cooling system is leaking.
	Junction box liquid leakage	Liquid leakage inside junction box.	Check whether condensation has occurred inside the junction box or if the water cooling system is leaking.
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.
Bus capacitor temperature fault	Over-temperature Alarm	• The bus capacitor 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 ventilation duct is blocked.
	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
Master-slave fault	Master and slave software version inconsistent	The software versions of the master and slave are inconsistent.	Check the software versions of the master and slave.
	Master and slave identification fault	• Hardware identification shows master-slave mismatch. • Hardware identification conflicts with communication settings. • Communication settings show master-slave consistency.	• Check the hardware identification level signal on the power board. • Check the optical fiber communication master-slave settings inside the cabinet.
	Master and slave power imbalance	The power output is unbalanced between the master and slave.	Contact Inovance.
Fault of parallel devices in cabinet	Fault of parallel devices in cabinet	• The master inside the cabinet reports that the slave is faulty. • The slave inside the cabinet reports that the master is faulty.	• Master: Check whether the slave has a fault. • Slave: Check whether the master has a fault.
Optical fiber communication fault	Optical fiber communication interrupted	The optical fiber communication between power boards is physically interrupted.	Contact Inovance.
	Optical fiber communication CRC fault	CRC check error in optical fiber communication between power boards.	Contact Inovance.
Control mode inconsistent	Control mode inconsistent	The control mode settings of the master and slave are inconsistent.	Check the PCS operation modes of the master and slave.

7.2 Common Faults and Solutions



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

Battery reverse connection fault

Fault Description	Possible cause	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. 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

Fault Description	Possible cause	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 for 10 minutes, 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

Fault Description	Possible cause	Solution
The bus voltage is too low or too high; there is large voltage deviation on half-bus; or the DC bus is short-circuited.	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 for 10 minutes, 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 overloaded and exceeds the current imbalance requirement in *"2.3 Specifications" on page 17*. 2. Contact technical support.
	DC bus short circuit	1. Check whether there is voltage on the DC bus and disconnect the power supply. 2. Wait 10 minutes, then use a multimeter to measure continuity between the DC bus terminals. If there is a short circuit, contact technical support.

Device overload

Fault Description	Possible cause	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 Specifications" on page 17* is exceeded. 2. Contact technical support.

Abnormal grid voltage

Fault Description	Possible cause	Solution
Power grid overvoltage or undervoltage	The grid voltage of the PCS is abnormal.	1. Disconnect the power supply and wait for 10 minutes. 2. Refer to the "Layout and Description of AC/DC Terminals" section 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 586 VAC to 759 VAC. a. If the measured grid voltage is too high or too low, or exceeds the imbalance requirement in *"2.3 Specifications" on page 17*, the fault indicates the actual condition. b. If the measured grid voltage is within the normal range, contact Inovance for technical support.
Grid voltage imbalance		

Abnormal grid frequency

Fault Description	Possible cause	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.

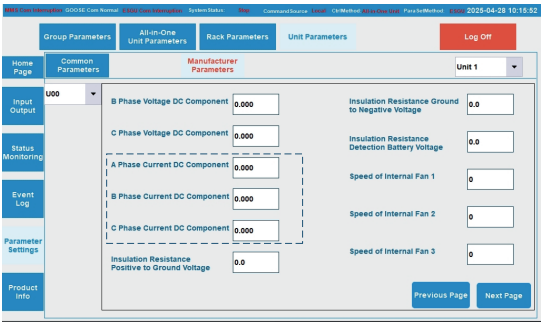
Grid voltage sequence incorrect

Fault Description	Possible cause	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 the "Layout and Description of AC/DC Terminals" section 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.

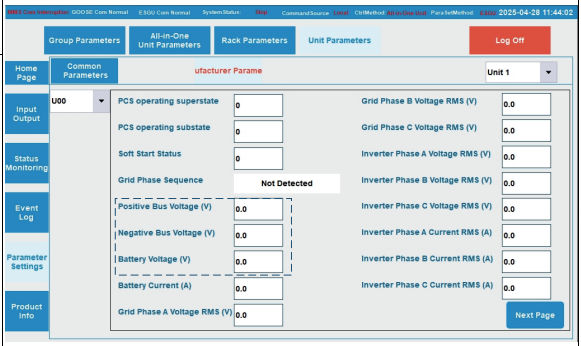
Off-grid fault

Fault Description	Possible cause	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.	

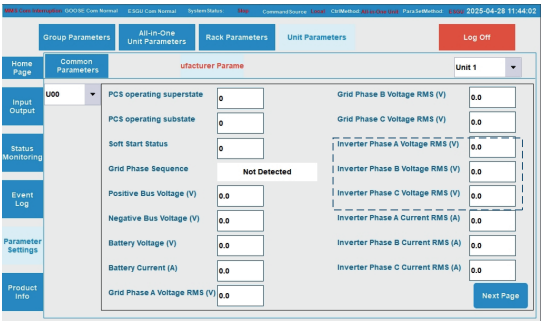
DC component of AC-side current beyond limit

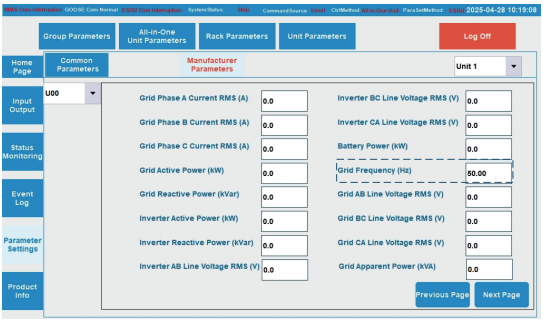
Fault Description	Possible cause	Solution
In on-grid mode, the DC component of AC-side current exceeds the protection threshold.	The sampling of AC-side current DC component is abnormal, resulting in the control accuracy of the DC component exceeding the protection threshold.	1. Check that the control 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 (1.8 A@430 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

Fault Description	Possible cause	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 described in the "Trial Run" section. Monitor the battery voltage and bus voltage changes on the HMI.  • 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 difference between the battery voltage and the bus voltage is less 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.	

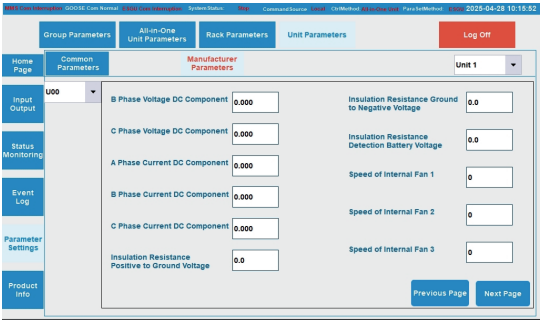
Soft start failed on AC side

<table>
<tr><th>Fault Description</th><th>Possible cause</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 PCS.


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 gird voltage.</td></tr>
</table>

Fan fault

<table>
<tr><th>Fault Description</th><th>Possible cause</th><th>Solution</th></tr>
<tr><td rowspan="3">If the deviation between the set speed of the fan and the feedback value exceeds 15% 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 ±900 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>The ventilation duct is blocked.</td></tr>
</table>

8 Repair and Maintenance

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 PCS and improve its reliability.

Note

- The power conversion system can be maintained by professionals only.
- Before maintenance, take necessary personal protection measures because the AC and DC sides of the PCS are both high-voltage.
- Ensure that all the power supplies on the DC and AC sides are disconnected before maintenance.
- Strictly follow the correct operation procedure during maintenance.
- The PCS is equipped with an energy storage capacitor. Before maintenance, power off the PCS, wait for at least 60 min until the PCS is de-energized.
- Put a warning sign after the power supplies are cut off to prompt other people not to power on the inverter during maintenance.
- During maintenance, the maintenance personnel must wear insulating protective equipment to prevent accidents.

8.2 Maintenance

8.2.1 Routine Maintenance Checklist

Perform routine inspection according to the following checklist.

No.	Routine Check Item	Checked
1	Monitor the input/output voltage/current and operating state of the power conversion system in real time and rectify errors detected.	☐
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 78*.	☐

8.2.2 Regular Inspection Checklist

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

Table 8–1 Regular inspection checklist

No.	Regular Inspection Item		Interval	Checked
1	Heat sink	Check that the heatsink is not covered by objects or dust. Remove the fan to check and clean it if necessary.	6 months	□
2	Fan	• Check that the fan makes no abnormal noise during running. • Check that the fan blades are intact. • Check that the fan is not blocked by foreign objects.	6 months	□
3	Cable	• Check that the AC and DC cables are connected reliably and intact. • Check that the cable gland is tightened. • Check that the grounding cable is connected securely.	6 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.	1 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	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. The maximum torque must be greater than 70 N·m.
Phillips screwdriver	1	Used for fixing the M8 and M6 screws.
Module lift fitting tooling	1 set	Used to hoist the module.

8.3.3 Replacing the PCS

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

Note

- The PCS is heavy. It is recommended that at least two people operate the PCS at the same time. Do not stand under PCS during the process. Failure to comply may result in personal injury.
- Do not operate in extreme weathers such as strong wind, sand, rain, and snow.

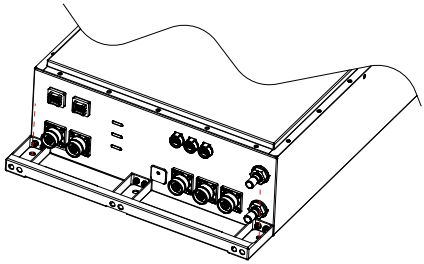
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1. Disconnect the power supply and ensure that the device is in the no-power state.
2. Unplug the AC/DC quick connectors on the panel.
3. Unplug the network cable and communication cable on the panel.
4. Unplug the inlet and outlet coolant pipes on the panel.

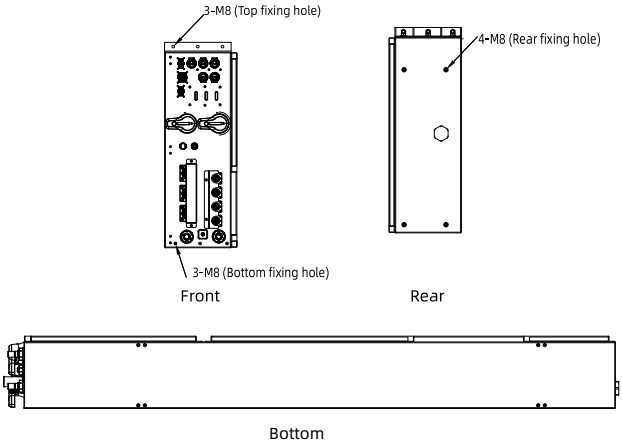
Note

- When there is no shut-off valve in the coolant pipe, the liquid must be drained in advance.
- To drain the liquid, use a water pump to extract the coolant from the PCS.

5. Loosen the screws securing the PCS.
   - Horizontal PCS: Four M8 SEMSs at the bottom of the front panel.



   - Vertical PCS: Three M8 SEMSs on the front, three M8x20 slotted-hole screws at the front bottom, and four M8 SEMSs on the rear.



6. Use the tooling fixture to move the PCS from inside the integrated cabinet to the outside. Then, remove the PCS with a hoist and place it in a safe location.
7. Install the new PCS in the reverse order of removal.

9 Appendix

9.1 Fuse and Circuit Breaker Models

The IES630 series PCS without HV box does not have a fuse or circuit breaker inside. For use, a fuse must be provided on the AC side and a circuit breaker must be provided on the DC side. The recommended fuse or circuit breaker is as follows.

AC Fuse		DC Molded Case Circuit Breaker	
Recommended Model	Quantity	Recommended Model	Quantity
ESH4037	3	ExMDY3HV E B TM 630 2P HC+ SHT22 MYHV DC24V	1

9.2 Terminology

Full Term	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 PCS 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.
Battery Management Unit	BMU	A core hardware component of the Battery Management System (BMS) and a key element of the monitoring layer. It forms a collaborative architecture with the BCU, where the BMU handles data acquisition and the BCU handles control execution.
Battery Control Unit	BCU	The hardware control center of the Battery Management System (BMS) and a core component of the execution layer (distinct from the monitoring-layer function of the BMU).
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.

Full Term	Abbreviation	Description
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.
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