Power Conversion System

INPPCS-100/0.4-W-C1-OS Series

User Manual

Beijing IN-Power Electric Co., Ltd.

Statement

Trademark statement


and other IN-Power trademarks are trademarks of IN-Power Electric Co., Ltd.

Note

The products, services or features you purchase are subject to IN-Power Electric's commercial contracts and terms, and all or part of the products, services or features described in this document may not be within the scope of your purchase or use. Unless otherwise agreed in the contract, IN-Power Electric Co., Ltd. makes no express or implied representations or warranties regarding the contents of this document.

The content of this document will be updated from time to time due to product version upgrade or other reasons. Unless otherwise agreed, this document is used only for guidance, and all statements, information and suggestions in this document do not constitute any express or implied warranty.

Beijing IN-Power Electric Co., Ltd.

Address:	No. 118, 1st Floor Podium, No. 69 Zizhuyuan Road, Haidian District, Beijing
Company website:	http://www.IN-Power.net/
E-MAIL:	info@IN-Power.net
Customer service center hotline:	+086-010-63805588
Tel:	+086-010-63805588
Fax:	+086-010-82600608

Forewords

Notes

Thank you for purchasing IN-Power Electric's Power Conversion System (hereinafter referred to as "converter") products!

This manual introduces the appearance, main features and working principle of the converter, and provides installation instructions, electrical connection instructions, use and operation instructions, maintenance management, transportation and storage, etc.

Please keep all attached information properly for future reference after reading.

The illustrations in this manual are for illustration only. Please refer to the physical objects received for specific products.

Applicable model

- INPPCS-100/0.4-W-14-C1-OS
- INPPCS-100/0.4-W-24-C1-OS

Product standard

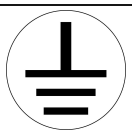
- IEC 62477
- IEC 61000

Table of Contents

1. Safety Instructions

1.1 Symbolic description

Table 1-1 Symbols, Terms and Names Used

	Danger! Hazard at high risk level, which will lead to death or serious injury if it is not avoided. Follow the manual requirements to prevent serious accidents and fatal injuries.
	Warning! Hazard at medium risk level, which will likely lead to death or serious injury if it is not avoided. Only qualified professionals can carry out installation and maintenance.
	There are AC and DC Power terminals in the equipment. After each Power supply is disconnected separately, wait at least 60 minutes before maintenance can be carried out.
	PE grounding This is the protective grounding (PE) terminal, which shall be firmly grounded during installation to ensure personnel safety.
	Comply with CE certification mark
	Read the instructions before performing any operation on the inverter.
	PCS shall not be treated as domestic garbage.

1.2 Safety precautions

Before installing and debugging the equipment, be sure to read these precautions and some safety precautions to be observed when operating and maintaining the converter. For specific safety instructions in use and maintenance, please refer to the safety instructions in corresponding chapters.

Note

Before operation, please carefully read the notes and precautions in this part to avoid accidents.

"Dangers", "warnings" and "precautions" in the manual do not represent all safety precautions to be observed, but only serve as a supplement to safety precautions in various operations.

Notes

IN-Power Electric is not liable for any violation of general safe operation requirements or safety standards for the design, production and use of equipment.

Instructions for safe use

Danger

Do not touch any terminals or conductors connected to the Power grid circuit, otherwise it may lead to fatal danger!

Danger

There are no user-operated parts inside the equipment, so please do not open the machine shell without authorization, otherwise there will be the danger of electric shock, and the resulting equipment failure is not covered by the warranty.

Danger

After disconnecting the input and output of the converter, the energy remaining in the energy storage capacitor of the converter may still cause electric shock. Ensure that all Power supplies are turned off for 30 minutes before maintenance can be carried out.

Warning

Do not put your fingers or tools into the running fan, so as not to endanger personal safety or damage equipment.

Warning

The surface temperature of the converter may reach 75°C. Please avoid contact with its surface when it is working, otherwise it may cause scalding.

Note

Do not allow liquid or other foreign objects to enter the machine, otherwise it may cause damage to the machine.

Warning

In case of fire, please use dry powder fire extinguisher. If you use liquid fire extinguisher, you will be in danger of electric shock.

Energy storage battery protection

There is a fatal high voltage between the positive and negative electrodes of the energy storage battery pack, which may lead to electric shock danger and even endanger life safety.

Danger

During equipment maintenance, ensure that the connection between the converter and the energy storage battery pack is completely disconnected, and set a warning sign at the disconnection to ensure that it will not be accidentally reconnected.

Electrostatic protection

Note

Electrostatic electricity generated by human body may cause damage to sensitive devices on printed boards. Before touching sensitive components, wear an anti-static bracelet and ground the other end of the bracelet well.

Grounding requirements

Warning

High leakage danger! Before electrical connection, grounding must be ensured. The grounding terminal must be connected to the earth. Otherwise, there may be electric shock danger when touching the machine.

- When installing equipment, it must be grounded first; and when dismantling the equipment, the ground wire must be dismantled finally;
- It is forbidden to destroy the grounding conductor;
- The equipment shall have permanent grounding protection.
- Before operating the equipment, check the electrical connection of the equipment to ensure that the equipment is reliably grounded.

Moisture protection

Note

Moisture invasion may cause converter damage!

In order to ensure the normal use of the converter, please follow the following instructions:

- When the air humidity is >95%, please do not open the cover plate of the converter;
- Under rainy or humid weather conditions, avoid opening the converter door panel for maintenance or overhaul.

Safety warning sign setting

In order to avoid accidents caused by irrelevant personnel approaching or misoperating the converter, please comply with the following relevant specifications during installation and daily maintenance and overhaul of the converter.

- Set warning signs at the front and rear switches of the converter to prevent accidents caused by wrong closing.
- Set warning signs or safety warning belts in the operation area to avoid personnel injury or equipment damage caused by irrelevant personnel entering.

Electrical connection

Electrical connection must be carried out in strict accordance with the description and electrical wiring schematic diagram in this manual.

Warning

Technical parameters such as battery configuration, Power grid grade and frequency must meet the technical parameters of converter. Grid-connected operation shall be allowed by the local Power supply department and professionals shall be invited to carry out relevant operations.

All electrical connections must meet the electrical installation standards of the country/region where the project is located.

Live line measurement

Note

Dangerous high pressure exists in the equipment, and accidental touch may lead to fatal electric shock risk. Therefore, during live line measurement, we must well implement protection (such as wearing insulating gloves).

The measuring equipment must meet the following requirements:

- The measuring range and usable conditions of the measuring equipment shall meet

the field requirements;

- The connection of measuring equipment shall be correct and standardized, so as not to cause danger such as arc.

1.3 Requirements for operators

Note

The operation and wiring of the converter shall be performed by qualified personnel to ensure that all electrical installations comply with electrical installation standards.

Professional and technical personnel shall meet the following requirements:

- After strict training, understand all kinds of safety precautions and master the correct operation methods;
- Be fully familiar with the composition and working principle of the whole energy storage system;
- Be familiar with the relevant standards of the country and region where the project is located.

1.4 Matters needing attention during maintenance or overhaul

Warning

After the AC and DC sides of the Power Conversion System are disconnected, it is necessary to wait for at least 60 minutes before maintenance or overhaul.

After the Power Conversion System is shut down, it has been out of operation. When maintaining or overhauling it, pay attention to the following matters:

- Ensure that the converter is not accidentally rePowered.
- Measure with multimeter to ensure that the inside of the converter is completely electrically neutral.
- Implement necessary grounding connection.
- Use insulating material to cover the parts that may be electrified near the operating parts.
- In the whole process of maintenance and overhaul, it is necessary to ensure that the escape route is completely unblocked.

1.5 Other matters needing attention

Warning

All operations on the converter must meet the relevant standards of the country/region where the project is located.

Warning

When the equipment is electrified, it is strictly forbidden to carry out maintenance or overhaul operations!

During maintenance or overhaul, at least two personnel must be present. Maintenance operation can be carried out only after the equipment is completely Powered off and discharged.

In addition, the following protective or emergency measures shall be taken according to the needs of the site:

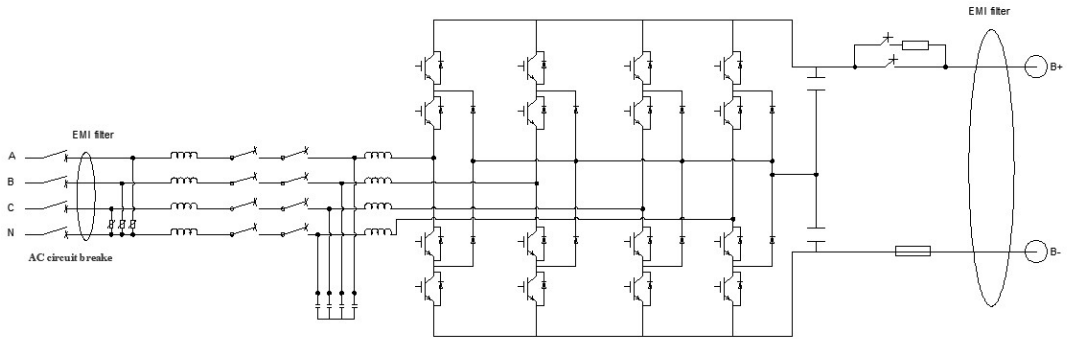
- Operators shall take appropriate protective measures as needed, such as wearing anti-noise earplugs, anti-scalding gloves and insulated shoes.
- Power Conversion Systems are usually installed far away from urban areas, and corresponding emergency rescue facilities shall be prepared as needed for use when necessary.
- Adopt all necessary auxiliary measures to ensure the safety of personnel and equipment.

2. Product Introduction

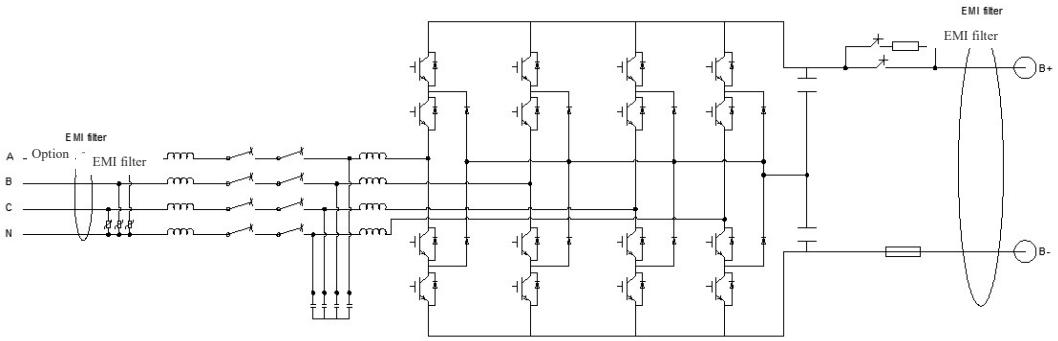
The main function of INPPCS series products produced by IN-Power Electric is to charge and discharge battery components, invert DC into sine wave alternating current that meets the requirements of Power grid, and transmit it directly to Power grid through transformer. It can also charge the excess electricity of the Power grid into the battery, so it is an important part of the energy storage system.

2.1 Product principle

The INPPCS converter is the main executive mechanism and core component of the energy storage system, which can realize the AC/DC conversion between the Power grid and the batteries and complete the two-way energy flow between them. The charge and discharge management of battery system, charge and discharge Power control of battery energy storage system, grid-connection/grid-disconnection operation modes and mode switching function are realized with advanced control strategies. It has perfect protection functions, such as island protection, DC overvoltage protection and AC overvoltage/undervoltage protection, etc., to meet the grid-connection/grid-disconnection requirements.



INPPCS-100/0.4-W-14-C1-OS



INPPCS-100/0.4-W-24-C1-OS

Figure 2-1 Main Circuit Diagram

2.2 Technical features

- Single-stage structure, with high conversion efficiency
- Support multiple battery types, a perfect converter, and a battery protection function
- Wide DC voltage range
- Support multi-machine parallel connections with good scalability
- Support active and reactive Power regulation
- Support RS485/CAN/Ethernet communication

2.3 Model description

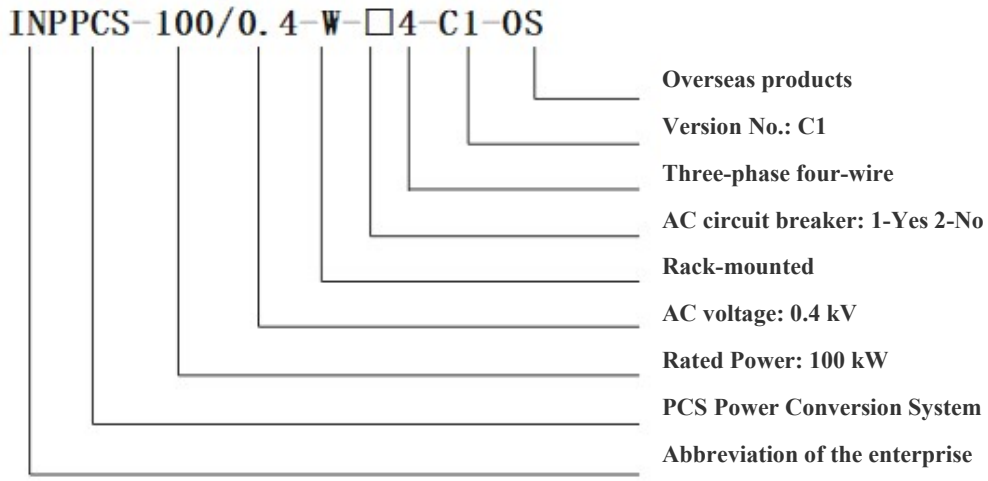


Figure 2-2 Description of Specification and Model

2.4 Product type

Table 2-1 Product Selection

No.	Model	Discrepancy Description
1	INPPCS-100/0.4-W-14-C1-OS	AC circuit breaker
2	INPPCS-100/0.4-W-24-C1-OS	NO AC circuit breaker

Note: If customers need products with other capacity specifications, they can consult Beijing IN-Power Electric Co., Ltd.

2.5 Grid-connected operating conditions

Unless otherwise specified, IN-Power Electric INPPCS can operate normally under the following Power grid conditions:

1) Harmonic voltage of Power grid shall not exceed the requirements of local national and Power grid standards and regulations;

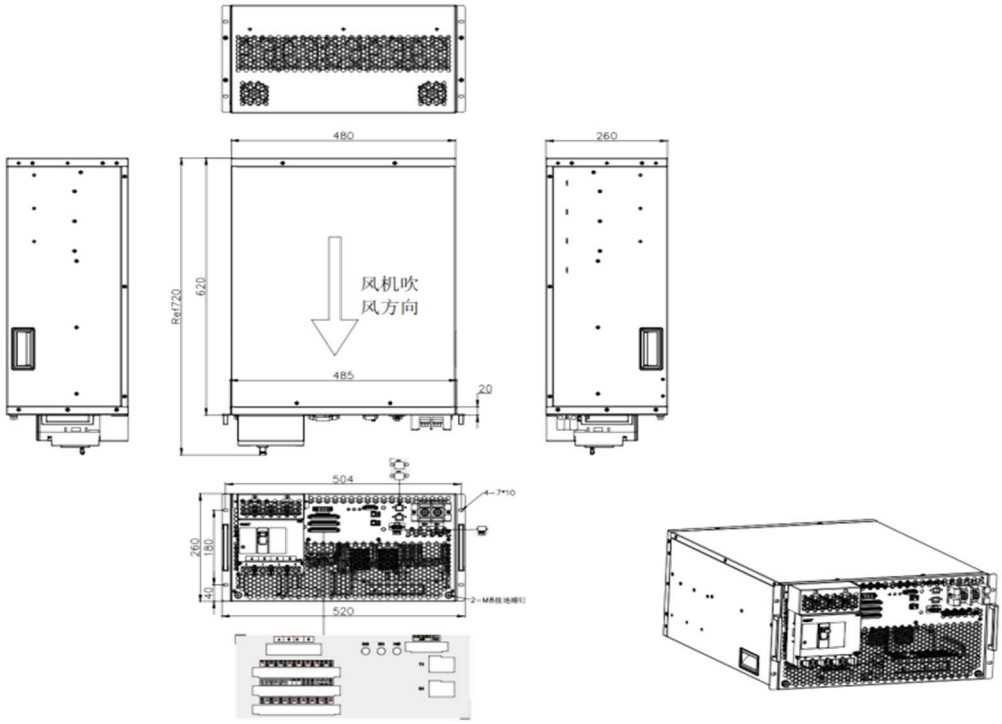
2) The three-phase voltage imbalance of AC output terminal shall not exceed the requirements of local national and Power grid standards and regulations;

3) The allowable deviation of grid voltage shall meet the requirements of local national and Power grid standards and regulations;

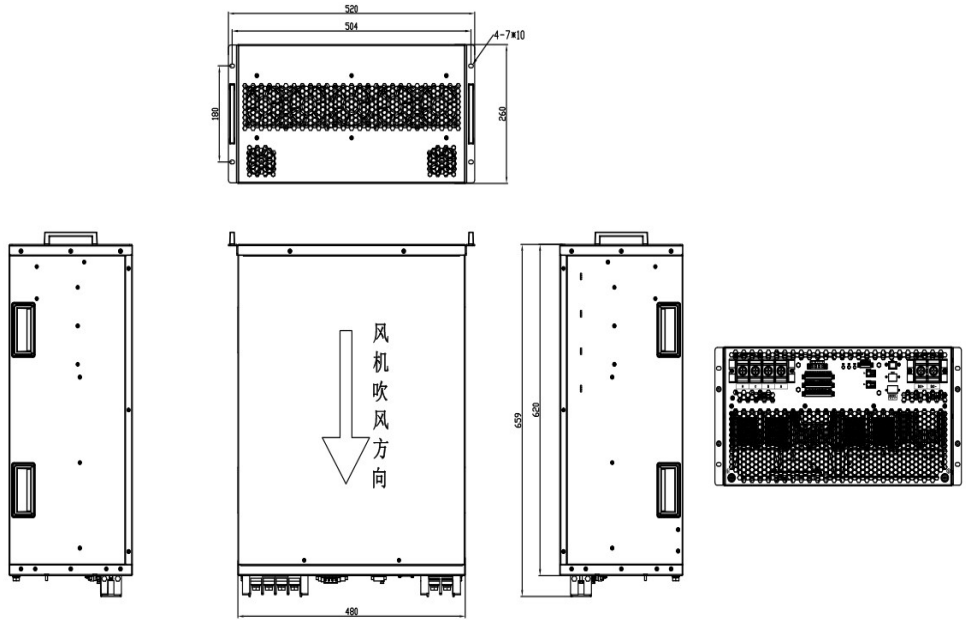
4) The allowable deviation of grid frequency shall meet the requirements of local national and Power grid standards and regulations.

2.6 Layout of main parts

The main external components of INPPCS include: Communication interface, IO control interface, Power input and output interface and so on.



INPPCS-100/0.4-W-14-C1-OS



INPPCS-100/0.4-W-24-C1-OS

Figure 2-3 Outline Diagram of Module

INPPCS has intelligent design. There are three LED lights showing the running status of the equipment at the middle and upper ends of the Power Conversion System. The current working status of INPPCS can be determined by the on/off of LED indicator lights.

Figure 2-4 Outline Diagram of Indicator Light

No.	Indicator Light	Notes
1	POW	In normal operation, the indicator light is always on, and in standby status, the indicator light flashes
2	ERR	The indicator light is always on during failure
3	RUN	The indicator light is always on when DC is connected

2.7 Operation status

2.7.1 Standby status

Standby status refers to waiting to receive operation instructions after grid-connected INPPCS is turned on. When the operation instruction is a charging instruction (i.e., constant voltage charging voltage value, constant current charging current value and constant Power charging Power value, it is necessary to determine the charging mode

as constant voltage, constant current or constant Power before), that is, it enters the grid-connected charging status. When the operation instruction is set as the discharge instruction (i.e., the constant current discharge current value and the constant Power discharge Power value, it is necessary to determine the discharge mode as constant current or constant Power before), that is, it enters the grid-connected discharge status;

2.7.2 Grid-connected operating status

1) The DC input terminal of INPPCS is connected with the DC output of the battery component, and the AC output terminal is connected with the Power grid;

2) Confirm that INPPCS is in normal shutdown status (the panel fault indicator does not light up, the operation indicator flashes, and there is no fault display in the real-time fault information interface);

3) INPPCS will gradually close the switch and carry out “self-test” in front of AC and DC sides to enter the “grid-connected” status;

4) The Power response is fast, and the charge-discharge conversion time of INPPCS is less than 100 ms. When the Power grid is abnormal, it will be disconnected from the Power grid immediately and enter the fault status immediately.

5) In this mode, INPPCS can convert the direct current of the battery into alternating current and merge it into the Power grid; Alternating current from the Power grid can also be charged into the battery.

2.7.3 Grid-disconnected operation status

1) The DC input terminal of INPPCS is connected with the DC output of the battery component, and the AC output terminal is connected with the load line;

2) Confirm that INPPCS is in normal shutdown status (the panel fault indicator does not light up, the operation indicator flashes, and there is no fault display in the real-time fault information interface).

3) INPPCS will gradually close the switch and carry out “self-test” in front of AC and DC sides to enter the “grid-disconnected” status.

Note: Reliable connection between system N line and PE must be ensured during grid-disconnected operation.

2.7.4 Fault status

When INPPCS fails, the Power Conversion System will immediately disconnect the AC side circuit breaker and the DC side circuit breaker and enter the fault status, thus ensuring the safety of the system. INPPCS will continuously monitor whether the fault is eliminated or not, and if the fault is not eliminated, it will remain in a fault status.

2.8 Battery configuration

Battery is an important part of energy storage control system, which needs strict protection during the whole operation process. Protection parameters are set for INPPCS to ensure that the connected battery pack runs in a safe environment. Battery configuration parameters include: Capacity, charging current, discharging current, over-voltage protection, under-voltage protection, etc. Battery configuration parameters shall be configured by professional personnel. If the configuration parameters are improper, INPPCS will not work properly.

2.9 Functional protection

Overvoltage and undervoltage protection of the Power grid

High and low frequency protection of the Power grid

DC overvoltage/undervoltage protection

DC overcurrent protection

DC polarity reverse protection

AC overcurrent protection

Overtemperature protection

Phase loss protection

Anti-islanding protection

AC incoming phase sequence error protection

Communication fault protection

Protection according with IGBT

Cooling system protection

Have emergency stop protection function

Feedback the battery fault information protection based on BMS

2.10 Storage

After the completion of product acceptance, if the equipment cannot be installed and operated on site immediately and needs to be stored, the following points shall be paid attention to:

- Restore the packaging to its original status;
- Keep the desiccant in the package and do not abandon it;
- Pay attention to ventilation and moisture prevention when storing equipment, and avoid accumulated water in the storage environment;

- Storage temperature: -20℃-+70℃, storage humidity: 0-95% without condensation;
- Pay attention to the harsh environment around, such as quenching, sudden heat and collision, so as not to cause damage to INPPCS;
- It is recommended to carry out regular inspection once a week to check whether the package is intact and avoid insect bites. If the package is found to be damaged, it shall be replaced immediately;
- If the storage time exceeds half a year, the package shall be opened for inspection and then repackaged.

3. Product Installation

3.1 Requirements for installation conditions

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

a) The protection grade of INPPCS is IP20, and the product is electronic equipment, so it shall not be placed in wet places;

b) It installs indoors to avoid sunlight and rain;

c) The ventilation around the equipment is good;

d) The installation environment is clean;

e) The equipment will produce some noise during operation, so try to install it far away from residents' lives;

f) Ensure that the installation ground will not shake, and the support surface shall meet the load-bearing requirements of the Power Conversion System;

g) Ensure that the installation position is easy to maintain;

h) The ambient temperature is -20℃-+55℃;

i) Enough space shall be reserved for equipment to ensure ventilation and heat dissipation;

It is recommended to install INPPCS in the chassis of the whole machine. The space, air duct, ventilation equipment and various protective measures of the chassis shall be strictly designed to meet the following requirements:

Installation direction

When installing INPPCS, please install it horizontally in front and back or sideways, and do not install it upside down.

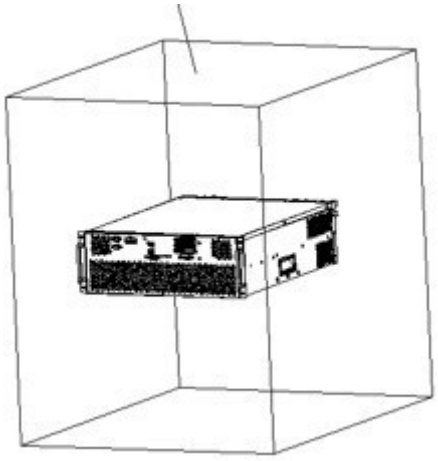


Figure 3-1 Schematic Diagram of Recommended Installation Direction

Installation in cabinet

Heat dissipation instructions: For the installation layout of INPPCS in the cabinet, it is necessary to consider the heat dissipation space, and the air inlet and outlet of the cabinet shall face the module.

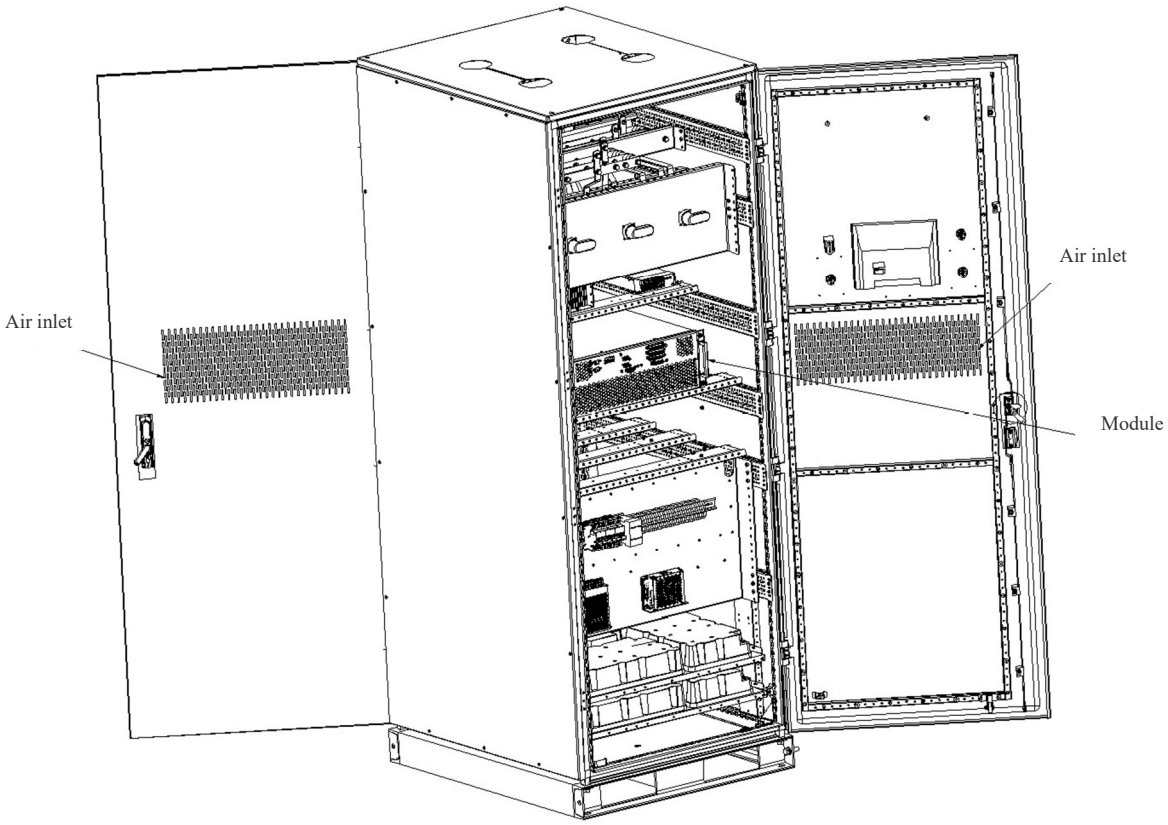


Figure 3-2 Schematic Diagram of Drawer Installation

Table 3-1 Table of Drawer Installation Cabinet Heat Dissipation Parameters

Model	The Number of Fans	Total air Volume at Working Point (CFM)	Actual Effective Area of Cabinet Facing INPPCS Air Inlet (mm^2)	Actual Effective Area of Cabinet Facing INPPCS Air Outlet (mm^2)
INPPCS-100/0.4-W-14-C1-OS	7	467	43,232	69,171
INPPCS-100/0.4-W-14-C1-OS	7	467	43,232	69,171

Notes:

1. CFM =0.0283 m^3/min
2. The above-mentioned “actual effective area” refers to the through-hole area
3. This parameter table is only for the air inlet and outlet area of a single INPPCS module, and the ventilation heat of other devices in the cabinet is not calculated
4. The bottom duct fans refer to Delta FFB0824EHE (5 fans).

Space requirements

When installing INPPCS, keep proper distance from other equipment to meet maintenance requirements.

Wiring specification

The cables used in the system can generally be divided into Power cables and communication cables. When laying communication cables, it is necessary to keep away from Power cables, and the cables shall be kept at right angles at intersections. When laying, try to keep the cable length as short as possible and keep a distance from the Power cable. It is advised that the insulation impedance of BT+ and BT- to ground at DC terminal should be greater than 10 MΩ.

Ventilation requirements

When INPPCS runs, it will generate a lot of heat. When the ambient temperature is too high, it will affect the electrical performance of the equipment and even damage the equipment. Therefore, it is necessary to fully consider the release of the heat when designing the chassis to ensure the normal and efficient operation of the equipment.

Ventilation environment

In order to meet the ventilation requirements of INPPCS, the installation environment of ventilation equipment shall meet the following conditions:

a) Power Conversion Systems shall not be installed in places with poor ventilation conditions and low air flow;

b) The air inlet shall be replenished with sufficient air;

c) It is necessary to ensure that the air inlet area is equivalent to the front panel area of INPPCS, and an exhaust fan is added to the air outlet;

d) Ensure that the air inlet and outlet of INPPCS are unobstructed and there is no return air;

In order to ensure the safe, reliable and efficient operation of the equipment, the ambient temperature of the equipment must be in the range of -25℃-+65℃, so it must be equipped with appropriate ventilation devices to dissipate the heat generated by the equipment;

Other protection

The protection grade of INPPCS is IP20, and INPPCS is suitable for installation in dry and clean Power station environment. At the same time, prevent water leakage from damaging INPPCS. According to EMC requirements and noise levels, INPPCS shall be installed in industrial environment.

3.2 Preparation of installation tools

The tools and parts needed for installation are as follows:

a) Torque wrench; M8 (torque 120 ± 1.5 kgf/cm)

b) Screwdriver;

c) Wire stripper;

d) Terminal pressing machine;

e) Megohmmeter and multimeter.

3.3 Mechanical installation

INPPCS is packed and transported in cartons, which can be lifted by two people from the bottom.

Note 1: INPPCS is a whole and must not be decomposed during transportation or installation. Faults caused by modification without IN-Power Electric's authorization are not covered by the warranty.

Note 2: Do not make the Power Conversion System tilt, shake violently or suddenly bear force during moving, such as suddenly lowering or lifting.

Note 3: Read the marked parameters carefully to select the appropriate means of transportation and storage location.

In order to ensure that INPPCS is in a better protective status during transportation, transport with packaging as much as possible, and transport according to various signs on the packaging. The illustration of packaging signs is as follows:

Table 3-2 Description of Packaging Signs

Icon	Sign
	Gravity center mark
	Face up: It is forbidden to lay, tilt or invert the Power Conversion System horizontally
	Handle with care, to avoid damage to the Power Conversion System caused by excessive collision and friction in transportation environment
	Guard against damp, to avoid rain or damp on the Power Conversion System

3.4 Electrical installation

3.4.1 Input and output requirements

Danger!

There is a high voltage electric shock hazard when INPPCS works, so only electricians with professional skills can operate INPPCS.

All connection to the device must be performed without voltage.

If the wrong input and output terminals are connected, INPPCS will be damaged! Failure to follow this warning may result in serious personal injury or significant property damage or even death.

1) Battery assembly

The positive and negative open circuit voltage of the battery assembly shall not exceed 900 V DC, otherwise the equipment will be in an overvoltage protection status and cannot work normally.

2) Three-phase grid

INPPCS will constantly check whether the Power grid meets the grid-connected conditions (the grid-connected requirements of different countries are different, and the protection parameters of INPPCS can be set by themselves. Please refer to the local grid-connected laws and regulations for detailed information), and the Power grid is a three-phase Power grid. Before installation and grid connection, it shall be allowed by the local Power department.

Considering the safety protection measures, INPPCS-100/0.4-W-14-C1-OS

Equipped with AC circuit breaker, it can be directly connected to the power grid. INPPCS-100/0.4-W-24-C1-OS need to add a current protection device, it is recommended to configure a circuit breaker, In200-250A.

3) Cable requirements

Table 3-3 Cable Requirements

Model	INPPCS100	
Mounting aperture	AC side M8 type wire pressing terminal, DC side M8 type wire pressing terminal, and M8 type wire pressing terminal for PE	
Battery assembly BT+	≥50 mm^2 * 1	BT+
Battery assembly BT-	≥50 mm^2 * 1	BT-
Power grid	≥50 mm^2 * 4	ABCN
PE grounding protection	≥25 mm^2 * 1	The cross-section of the PE wire should be of the same material as the ADCN wire and not less than 1/2 of the cross-sectional area of the phase conductor
Model	INPPCS100	
Secondary harness requirements		
Secondary signals (except IA+, IA-, IB+, IB-, IC+ and IC-)	≥28 AWG * N	Secondary signal harness
IA+, IA-, IB+, IB-, IC+, IC-	≥18 AWG * 6	STS current sensor

3.4.2 Preparation before electrical wiring

Before wiring, pay attention to the following:

1: Ensure that INPPCS is in a shutdown status, there is no voltage on the AC side and the DC side, and the panel indicator light is not on;

2. Ensure that the AC side incoming switch is in an open status;

3: Ensure that the battery side switch is open.

4: Perform wiring operation after the above confirmation.

3.4.3 DC side wiring

Danger!

The positive and negative poles of the output of the battery assembly shall not be connected inversely, and the positive and negative inputs of the corresponding INPPCS shall be connected after the polarity is measured and determined with a multimeter.

The DC side wiring method is as follows:

Step 1: Measure the open circuit voltage of the battery assembly with a multimeter to ensure that it is within the allowable range.

Step 2: Confirm the positive and negative poles of the voltage with a multimeter.

Step 3: Strip the insulation at the end of the cable.

Step 4: Crimp the wiring copper nose. Put the stripped copper core into the wire pressing hole of the wiring copper nose, and press the wiring copper nose tightly with tools. The number of crimping wires shall be more than two.

Step 5: Install the heat shrinkable sleeve, and select the heat shrinkable sleeve that is more consistent with the cable size, with a length of about 5 cm.

Sleeve the heat shrinkable sleeve on the wiring copper nose to completely cover the wire pressing hole of the wiring copper nose, tighten the heat shrinkable sleeve with a hot blower, and tighten the DC terminal assembly correctly.

Step 6: Connect the positive cable output from the battery assembly to the DC+ of the chassis.

Step 7: Connect the “DC-” terminal of the INPPCS to the negative output of the battery assembly as described in Step 6.

Step 8: Ensure that the wiring is firmly connected.

3.4.4 AC side wiring

Danger!

When connecting to AC Power grid, disconnect the circuit breaker of AC distribution cabinet to ensure that the AC wire connected to the terminal is not electrified.

The AC side output voltage of INPPCS is AC 400 V, and the connection method between AC side and Power grid side of INPPCS is as follows:

Step 1: Measure with multimeter to confirm that the connection terminal has been Powered off.

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

Step 3: Strip the insulation at the end of the cable.

Step 4: Crimp the wiring copper nose, and place the exposed copper core part of the stripped thread end into the wire pressing hole of the wiring copper nose. Use tools to press the wiring copper nose tightly, with the number of crimping times for no more than two.

Step 5: Install the heat shrinkable sleeve, and select the heat shrinkable sleeve that is more consistent with the cable size, with a length of about 5 cm.

Sleeve the heat shrinkable sleeve on the wiring copper nose to completely cover the wire pressing hole of the wiring copper nose, tighten the heat shrinkable sleeve with a hot blower.

Step 6: Connect the “L1”, “L2” and “L4” cables to the A (U), B (V), C (W) and N phases of the AC circuit breaker in the Power Conversion System to ensure the accuracy of the phase sequence.

3.4.5 Grounding connection

In order to ensure safety, all INPPCS shall be grounded through PE conductor. The PE copper bar in the INPPCS cabinet has been reliably connected with the shell of INPPCS in the cabinet. When PE connection is carried out, it is necessary to reliably connect the PE grounding copper bar with the equipotential connection device in the installation site or electrical control room. The grounding resistance shall not be higher than 1 Ω.

The grounding PE of INPPCS is shown below:

Figure 3-1 PE Grounding Point

Because individual devices in INPPCS need to be grounded, please do not change PE copper bar connection wire without permission, so as to avoid electric shock danger!

3.5 Communication mode

INPPCS can be reserved with one RS485, one Ethernet interface and one CAN for communication between INPPCS and battery components, user local station or remote upper computer, and has Ethernet interface with Power station monitoring system.

3.6 Installation inspection

In order to ensure the safe and reliable operation of INPPCS, please check its installation according to the items listed in the following table before putting into operation, to ensure the correctness of installation.

Table 3-4 Installation Checklist

Mechanical Inspection Items	
1	INPPCS has no deformation or damage
2	The fixation and support of INPPCS lug are stable and reliable
3	INPPCS has enough space around
4	The temperature, humidity and ventilation of the environment in which INPPCS is located meet the requirements
5	The cooling air circulates smoothly
6	The sealing protection of cabinet body is complete and reliable

Electrical Installation Inspection	
1	INPPCS grounding is complete and firm
2	The Power grid voltage matches with INPPCS rated output voltage
3	The phase sequence of Power grid connection is correct, and the fastening torque meets the requirements
4	The positive and negative poles of DC input are connected correctly, and the fastening torque meets the requirements
5	The communication wiring is correct and keeps a certain distance from other cables
6	Cable number is marked correctly and clearly
7	The insulation shield is complete and reliable, and the danger warning sign is clear

Other Inspections	
1	All useless conductive parts are tightened with insulating cable ties
2	There are no tools, parts, conductive dust or other foreign matters left behind in the interior
3	There is no condensation of moisture or ice inside

3.7 Terminal definition

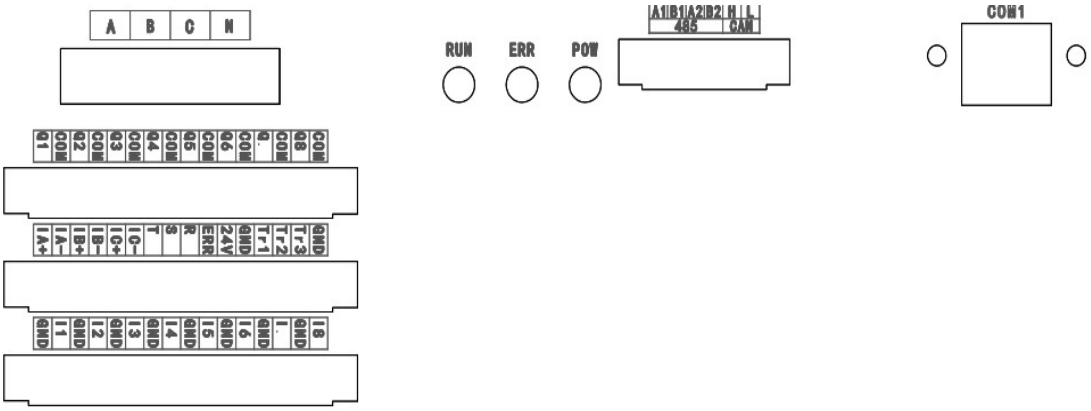


Figure 3-2 Schematic Diagram of Terminal Panel

The terminal definition is described as follows:

Where 4-8 are reserved STS interfaces

No.	Part Name	Notes
1	COM1	Network ports are reserved, and COM1 is used for debugging network port and EMS communication network port
2	CAN, 485-1/2	CAN port and 485-1 port are used for BMS communication, and 485-2 is used for communication between PCS module and DCDC module;
3	I1-8, Q1-8	Used for DI input detection port (the internal part is active, the external part only needs to be disconnected/shorted, DI1 and DI3-DI8 are normally open; and DI2 is normally open/normally closed, which can be set in the upper computer); See the following figure for the preset definition of DI port and DO port; Used for DO port (dry contact, only supporting external 24 V Power access)
4	IA+, IA-, IB+, IB- IC+, IC-	Current sampling signal for grid-connected and grid-disconnected switching requirements, grid-connected and grid-disconnected switching switches;
5	T, S, R,	Reserved terminals, no wiring;
6	ERR	The fault indicator signal for STS, which may not be connected;
7	Tr1, Tr2, Tr3, GND	GND: GND of trigger signal; Tr1, Tr2, Tr3: Trigger signals of STS, which can be connected with only one phase;
8	A/B/C/N	Voltage sampling on Power grid side is generally used with grid-connected and grid-disconnected switching cabinets

	1	2	3	4	5	6	7	8
Input	Emergency stop	BMS fault detection	STS overtemperature signal	Smoke sensation, fire sensation, temperatur	AC soft start detection	AC main contactor	Parallel high-speed synchronization (reserved)	Reserved

				e and humidity detection		detectio n		
Outpu t	Cabinet fan control	Fault output dry contact	Grid-connected and grid-disconnected contactors	Reserved	AC soft start contacto r	AC main contacto r	Parallel high-speed synchronizatio n (reserved)	Reserve d

4. Start-up and Shutdown Process

4.1 Relevant requirements

Before being put into operation, the installation of equipment shall be thoroughly checked, especially whether the DC and AC terminal voltages meet the requirements of INPPCS and whether the polarity is correct. Check whether the connections of the system have met the requirements of relevant standards and specifications. Check whether the system is well grounded.

4.2 Check

4.2.1 Check INPPCS

Before INPPCS is Powered on, please carry out a series of inspections according to the following steps:

Step 1: Check the installation and wiring of Power Conversion System according to Section 3.6;

Step 2: Ensure that all AC and DC circuit breakers are in an open status;

4.2.2 Check the voltage of Power grid

- Check whether the three-phase connection identification of INPPCS corresponds to the three-phase identification of Power grid one by one;
- Check whether the voltage of Power grid lines is within the predetermined range and record the voltage value;
- Check whether the voltage of Power grid frequency is within the predetermined range and record the frequency value;
- Measure THD (Total Harmonic Distortion) of Power grid voltage. If the distortion is serious, INPPCS may not operate.

4.2.3 Check DC side voltage

Connect the DC side from the bus box or DC distribution cabinet to the INPPCS.

- Ensure the DC input polarity is correct;
- Measure and record DC (open circuit) voltage, which does not exceed the maximum allowable DC voltage.

4.3 Start-up steps

INPPCS start-up steps are as follows:

Step 1: After confirming that there is no abnormality in all the above inspections, Power on the DC side and perform DC Power transmission once outside the cabinet; and Power on AC side and manually close AC side circuit breaker;

Step 2: After about 1 minute at this time, some electrical parameters on AC and DC sides can be seen through the upper computer software;

Step 3: Confirm whether the status of the device is normal: The fault warning lamp is not on, and the LCD main interface has no fault display;

Step 4: Enter the background software to set relevant operation parameters. If there is a touch screen, set relevant operation parameters according to 5.2.8 Start-up boot, and set the equipment to “start” after the parameter setting is completed;

Step 5: After for about 10 s, the equipment starts up, during which there will be a sound of contactor closing, which is a normal phenomenon. If the equipment is not operated for a long time, it will enter the grid-connected “standby” status;

Step 6: After INPPCS is running (the running indicator is on), check whether there is any abnormality in INPPCS. For example, if the noise is abnormal, and abnormal smell or smoke occurs, it is necessary to stop the machine immediately for inspection.

4.4 Shutdown steps

Normal shutdown steps:

A. When the background is set to the shutdown status, INPPCS enters the automatic shutdown process. After the Power IGBT is sealed, the equipment will automatically disconnect the contactors on the AC/DC side. At this time, there will be a sound of contactor disconnection. After about 10 s, the normal shutdown is completed (if the equipment is required be standby for a long time, the switches on the DC side and the AC side shall be disconnected in turn);

B. The Power of AC side is cut off, and the primary Power supply of the AC side outside the cabinet is disconnected;

B. The Power of DC side is cut off, and the primary Power supply of the DC side outside the cabinet is disconnected;

D. Open the cabinet door and use the electroscope to check the electricity (there is an energy storage device inside, so it is necessary to ensure that other operations are carried out after the discharge is completed). After the electricity is checked to be safe, the next step can be carried out after the grounding wire is hung;

E. Maintenance personnel carry out maintenance and overhaul operations.

5. Transportation

When transporting INPPCS, users are only allowed to use the transportation method described in the user manual. Please consider the weight of INPPCS and its non-centered center of gravity when transporting.

6. Maintenance and Repair

First, disconnect the INPPCS from the battery assembly and the Power grid. When it is confirmed that these Power supplies will not be connected again, wait for at least 20 minutes, and then perform all maintenance and repair operations on the INPPCS.

Disconnect the Power grid from the battery

First, disconnect the INPPCS from the AC Power grid and the INPPCS from the battery assembly to ensure that the INPPCS will not be accidentally reconnected. Then disconnect the INPPCS AC side upper circuit breaker and battery side circuit breaker switches, and test with a multimeter to ensure that the INPPCS equipment has been completely disconnected and has no voltage. Even if the INPPCS is disconnected from the Power grid/main Power supply and battery assembly, some components (such as capacitors) in the INPPCS still have residual voltage and generate electricity slowly. Therefore, please wait at least 20 minutes before continuing operation after disconnecting INPPCS from the Power grid and battery assembly.

Maintenance and modification

INPPCS can only be maintained and modified by personnel authorized by IN-Power Electric. For personal safety, please use the original accessories provided by the manufacturer. If non-original accessories are used, there will be no guarantee of compliance with relevant certification standards in terms of electrical safety and EMC.

Functional and safety parameters

Do not change INPPCS parameters without authorization from the local Power supply company and instructions from IN-Power Electric. Unauthorized changes to functional safety parameters may cause injury and damage to persons or INPPCS. In this case, IN-Power Electric will not provide warranty services.

7. Routine Maintenance

7.1 Regular maintenance

INPPCS must be maintained regularly to ensure its normal operation and service life. The recommended routine maintenance cycle and work contents are shown in the table.

Table 8-1 Work Contents of Routine Maintenance Cycle

Maintenance Item	Cycle
Clean the dust at the air inlet of the Power module	Every month
Check whether there is dust, moisture or condensed water vapor inside the box	Every month
Check whether the cable connection is loose and tighten the screws if necessary	Every month
Check warning signs and add or replace them if necessary	Every month
Manually check AC and DC breakers	Every six months
Check the stop function of LCD	Every month
Check whether there is abnormal noise during the operation of the equipment	Every month

Danger!

All maintenance operations must be carried out with all switches on the DC side, AC side, battery module and AC distribution cabinet of INPPCS disconnected. After the INPPCS AC/DC switch is disconnected, some components on the INPPCS still have residual voltage. Please wait at least 60 minutes before maintaining the INPPCS to prevent electric shock!

7.2 Waste disposal

INPPCS will not pollute the environment, and the materials and components of the products meet the environmental protection requirements. When the service life of INPPCS ends, users shall operate and dispose of it according to the relevant local laws and regulations, and shall not discard it at will.

8. Technical Parameter

INPPCS-100/0.4-W-14-C1-OS, INPPCS-100/0.4-W-24-C1-OS

DC Side		
Max. DC voltage	900 V	
Min. DC voltage	630 V	
DC voltage range	630 V-900 V	
Max. DC current	190 A	

Rated conditional short-circuit current	30kA	
AC Side (Grid)		
AC rated Input /Output Power	output 100 kW	Input 100 kW
Max. AC Input/Output current	output 173 A	Input 173A
Nominal AC voltage	3L/N/PE, 400 V	
AC voltage range	340-460 V	
Nominal frequency/Frequency range	50 Hz/60 Hz ± 2.5 Hz	
Harmonic (THDi)	≤5% (at nominal Power)	Linear load
Power factor	-0.99-+0.99	At nominal Power
Adjustable reactive Power range	-100%–100%	
AC access mode	3P4W	3L/N/PE
Overvoltage Category(OVC)	III	
AC Side (Off-Grid)		
Nominal AC voltage	400 V	
AC voltage range	AC 400 V ± 3%	
Harmonic THDu	≤3%	Linear load
DC voltage component	<0.5%	Linear load
Unbalance load capacity	100%	
Nominal frequency/Frequency range	50 Hz/60 Hz ± 2.5 Hz	
System Parameters		
Max. efficiency	>98%	
Communication	RS485, CAN, Ethernet	
Enclosure Dimensions (W * H * D)	480 mm × 260 mm × 620 mm	Cabinet size
Weight	70 kg	
Degree of protection	IP20	
Operating ambient temperature	-25℃-60℃ (>45℃ derating)	>45℃ derating
Allowable relative humidity	RH ≤95%	
Cooling method	Forced air cooling	
Max. operating altitude	3,000 m (>2,000 m derating)	
Pollution degree	I	

9. Quality Assurance

Warranty period

The warranty period of this product is one year. If otherwise stipulated in the contract, the contract shall prevail.

During the warranty period of IN-Power Electric products, customers should take the initiative to show the invoice and date of purchasing products to IN-Power Electric service personnel during maintenance. At the same time, the nameplate on the product shall be clearly visible, otherwise IN-Power Electric has the right to refuse repair.

Warranty conditions

IN-Power Electric will repair or replace the products that fail during the warranty period free of charge. The faulty equipment shall be owned by IN-Power Electric Co., Ltd. after replacement. The customer should reserve a certain time for IN-Power Electric Co., Ltd. to repair the faulty equipment.

Exemption from liability

Our company has the right not to provide warranty services under the following circumstances:

a) The product has no IN-Power Electric logo;

b) The product or components have exceeded the warranty period of IN-Power Electric;

c) Failure or damage (such as too high temperature, too low temperature, too wet or dry environment, too high altitude and unstable voltage or current) caused by failure to meet the requirements of the instruction manual, non-working environment specified by the product or wrong installation, storage and use;

d) Failure or damage caused by installation, repair, alteration or disassembly by non- IN-Power Electric after-sales service personnel, except those entrusted by IN-Power Electric after-sales service;

e) Failure or damage caused by the use of non- IN-Power Electric components;

f) Failure or damage caused by accident or man-made reasons (such as operation error, scratch, handling, bumping and inappropriate voltage connection), or transportation damage;

g) Failure or damage caused by force majeure such as natural disasters (such as earthquake, lightning strike and fire);

h) Other failures or damages not caused by quality problems of IN-Power Electric equipment (including components).