



User Manual

Energy Storage Inverter

Virgo Series
3K-S~6K-S

HEIWIT

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Note

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Introduction

This manual provides detailed instructions on the installation, electrical connection, commissioning, maintenance, and troubleshooting of the Virgo series energy storage inverters (3K-S to 6K-S). Please read this manual carefully before installing or using the inverter to understand the safety information and familiarize yourself with its functions and features. The contents of this manual may be updated periodically. For the latest version and more product information, please visit our official website.

Applicable Product Models

This document applies to the following inverter models:

- ◆ Virgo 3K-S (3000)
- ◆ Virgo 3K6-S (3680)
- ◆ Virgo 4K-S (4000)
- ◆ Virgo 4K6-S (4600)
- ◆ Virgo 5K-S (5000)
- ◆ Virgo 6K-S (6000)

Target Group

This document is intended for:

- ◆ Users,
- ◆ Installation and maintenance personnel,
- ◆ Professionals who are familiar with local regulations and standards, have received professional training, and possess relevant product knowledge.

Symbol Definitions

The following symbols are used in this manual to highlight important information. Please read the symbols and descriptions carefully.

 Danger
Indicates a high potential hazard which, if not avoided, will result in death or serious injury.
 Warning
Indicates a medium potential hazard which, if not avoided, could result in death or serious injury.
 Caution
Indicates a low potential hazard which, if not avoided, could result in moderate or minor injury.
Note
Highlights important supplementary information or tips for optimizing product use, solving problems, or saving time. "Note" does not indicate safety warnings and does not involve injury to personnel, equipment, or the environment.

Version Recor

The latest version of this manual includes updates from all previous versions.

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Chapter 1

Safety Precautions

- 1.1 General Safety
- 1.2 AC and DC Cable Operation and Wiring Safety
- 1.3 Inverter Safety
- 1.4 Battery Safety
- 1.5 Personnel Requirements

Operators of this equipment system must always adhere to all safety precautions outlined in this document.

 Danger

- ✧ The equipment must be used within the specified design conditions. Failure to do so may lead to equipment malfunction, resulting in abnormal equipment function, component damage, personal injury, or property loss, which are not covered under the equipment quality warranty.
- ✧ Under no circumstances should the inverter be installed/operated while it is powered.
- ✧ Do not install, use, or operate outdoor equipment and cables (including but not limited to handling equipment, operating equipment and cables, plugging/unplugging signal interfaces connected to the outdoors, high-altitude work, and outdoor installation) during adverse weather conditions such as lightning, rain, snow, or strong winds (above level 6).
- ✧ In the event of a fire, evacuate the premises immediately, trigger the fire alarm, or call the fire department. Do not re-enter a burning building under any circumstances.
- ✧ The inverter is designed and tested according to safety regulations, but as an electrical device, all safety instructions must be followed to prevent serious injury or property damage.
- ✧ Any paint scratches that occur during transportation or installation must be promptly repaired to prevent prolonged exposure to outdoor environments.
- ✧ Do not tamper with, damage, or obscure the labels and nameplates on the equipment. Do not open the main panel of the inverter.
- ✧ The "Note," "Warning," and "Danger" indications in this manual are not exhaustive of all required safety measures. they serve as additional safety reminders. NOVOAGE accepts no liability for any consequences arising from non-compliance with general safety operation requirements or breaches of safety standards in the design, production, and use of the equipment.

The "Note," "Warning," and "Danger" indications in this manual are not exhaustive of all required safety measures. they serve as additional safety reminders. NOVOAGE accepts no liability for any consequences arising

from non-compliance with general safety operation requirements or breaches of safety standards in the design, production, and use of the equipment.

1.1 General Safety

Note

- ✧ The content of this document is subject to periodic updates due to product upgrades or other reasons. Unless otherwise specified, this document does not replace the safety instructions on product labels or in the user manual. All descriptions herein are intended for guidance only.
- ✧ All operations on the equipment must be performed by professional, qualified electrical technicians who are familiar with relevant standards and safety regulations in the project location.
- ✧ Fully understand the composition and working principles of the entire photovoltaic grid-connected power generation system, as well as the relevant standards in the country/region where the project is located.
- ✧ When operating the inverter, use insulated tools and wear personal protective equipment to ensure personal safety. When handling electronic components, wear anti-static gloves, wristbands, and clothing to protect the inverter from electrostatic damage.
- ✧ Do not perform reverse engineering, decompilation, disassembly, modification, embedding, or any other derivative operations on the equipment software. It is prohibited to study the internal implementation of the equipment, obtain the software source code, steal intellectual property, or disclose any performance test results of the equipment software.
- ✧ During equipment operation, if any faults that could lead to personal injury or equipment damage are detected, immediately cease operation, report to the responsible person, and take effective protective measures.
- ✧ Before using tools, ensure you are familiar with their correct usage to prevent injury and equipment damage.
- ✧ The equipment casing may become hot during operation, posing a risk of burns. Avoid direct contact.
- ✧ Read this document carefully before installing the equipment.

When installing, operating, or maintaining the equipment, follow local laws and regulations. The safety precautions in this manual are only supplementary to local laws and regulations. NOVOAGE assumes no responsibility for any of the following situations:

1	Operating the product under conditions not specified in this manual or not following the operational instructions and safety warnings provided in the product and documentation.
2	Installation and usage environments that exceed the standards specified in relevant international or national regulations.
3	Damage caused by transportation conducted by the customer.
4	Unauthorized disassembly of internal components, alteration of the product, or modification of software code, leading to equipment damage or personal injury.
5	Damage caused by abnormal natural environments (force majeure such as earthquakes, fires, storms, etc.).
6	Damage caused by storage conditions not meeting the requirements specified in the product documentation.

1.2 AC and DC Cable Operation and Wiring Safety



- ✧ Use only the DC terminal connectors provided with the inverter to connect the DC cables. Using other types of DC connectors may result in serious consequences, and any equipment damage or personal injury caused by this is not covered by the manufacturer's liability.
- ✧ Use only the DC terminal connectors provided with the inverter to connect the DC cables. Using other types of DC connectors may result in serious consequences, and any equipment damage or personal injury caused by this is not covered by the manufacturer's liability.

 Warning

- ✧ Before connecting power cables, verify the labels on the power cables are correct.
- ✧ Ensure that the component frames and mounting systems are properly earthed.
- ✧ Before making electrical connections, if there is a possibility of coming into contact with live parts, disconnect the appropriate upstream breakers.
- ✧ Ensure that the DC cable connections are secure and tight with no looseness.
- ✧ Use a multimeter to measure the polarity of the DC cables, ensuring correct polarity and that the voltage is within the allowable range.
- ✧ Do not connect the same PV string to multiple inverters, as this may cause damage to the inverter.
- ✧ If the equipment has multiple inputs, disconnect all inputs and wait until the equipment is fully powered off before operating.
- ✧ PV modules used with the inverter must meet the IEC61730 Class A standard.

Cables used in high-temperature environments may suffer insulation aging and damage. Maintain a distance of at least 4 cm between cables and heating components or heat sources. Similar types of cables should be bundled together, while different types of cables should be separated by at least 4 cm. Avoid intertwining or crossing different types of cables.

Ensure that cables used in photovoltaic grid-tied power systems are securely connected, well-insulated, and of appropriate specifications.

1.3 Inverter Safety

Warning

- ✧ Ensure the grid voltage and frequency at the connection point meet the inverter's grid connection specifications.
- ✧ The protective earthing conductor of the inverter must be securely connected. It is recommended to add a circuit breaker or fuse on the AC side of the inverter for additional protection. The protection device should be rated at 1.25 times the inverter's rated output AC current.
- ✧ If the same fault occurs five times within 24 hours, the inverter will remain in fault mode awaiting inspection. In other cases, the inverter will automatically restart and self-check after a fault.
- ✧ If the photovoltaic system is not equipped with a battery, it is not recommended to use the BACK-UP function. Any risks associated with the use of the BACK-UP function without a battery will not be covered by the manufacturer's warranty.

Danger

- ✧ After installing the inverter, ensure that the labels and warning signs on the equipment enclosure are clear and visible. Do not cover, alter, or damage them:

	The equipment casing may become hot during operation, posing a risk of burns. Avoid direct contact.		After powering off the equipment, wait at least 10 minutes to ensure the equipment is fully discharged.
	Read the product manual thoroughly before operating the equipment.		Potential risks exist after the equipment is running. Please take proper precautions during operation.
	The equipment should not be disposed of as household waste. Follow local laws and regulations for disposal or return the equipment to the manufacturer.		Ensure the protective earthing points are securely connected.

1.4 Battery Safety



Warning

- ✧ The batteries used with the inverter must be approved by the inverter manufacturer. The approved battery list can be obtained from the official website.
- ✧ Before installing the equipment, carefully read the corresponding user manual for the battery to understand the product and safety precautions. Follow the battery user manual strictly.
- ✧ If the battery is fully discharged, please charge it according to the instructions in the corresponding battery user manual.
- ✧ The battery current may be affected by factors such as temperature, humidity, and weather conditions, which can lead to battery limitations and affect its load capacity.
- ✧ If the battery cannot be activated, please contact the after-sales service center promptly. Otherwise, the battery may be permanently damaged.
- ✧ Use a multimeter to measure the DC cables' positive and negative poles, ensuring the polarity is correct and the voltage is within the allowable range.
Connecting the same battery pack to multiple inverters is prohibited as it may lead to inverter damage.

1.5 Personnel Requirements

Note

- ✧ Personnel responsible for the installation and maintenance of the equipment must undergo rigorous training to understand various safety precautions and master the correct operating methods. Replacement of equipment or components (including software) must be performed by professional personnel or authorized individuals
- ✧ Installation, operation, maintenance, and replacement of equipment or components are only to be carried out by qualified professionals or trained personnel. These professionals should have the special operational qualifications required by the local country, such as high-voltage operations and special equipment operation certifications.

Chapter 2

Product Introduction

- 2.1 Overview
 - 2.1.1 Nameing Rules
 - 2.1.2 Supported Grid Type
- 2.2 Application Scenario
- 2.3 Operation Mode
 - 2.3.1 System Operation Mode
 - 2.3.2 Inverter Operation Mode
- 2.4 Functional Characteristics
- 2.5 Apperances
 - 2.5.1 Instruction
 - 2.5.2 Dimensions
 - 2.5.3 LCD Display
- 2.6 Name Plate

2.1 Overview

Function

The energy storage inverter in the photovoltaic system controls and optimizes the energy flow through an integrated energy management system. It can supply the generated electrical energy from the photovoltaic system to the load, store it in the battery, or output it to the grid.

Model

This document applies to the following inverter models :

- ◆ Virgo 3K-S (3000)
- ◆ Virgo 3K6-S (3680)
- ◆ Virgo 4K-S (4000)
- ◆ Virgo 4K6-S (4600)
- ◆ Virgo 5K-S (5000)
- ◆ Virgo 6K-S (6000)

2.1.1 Nameing Rules:

Virgo 5K – S

1 2 3

1) Product Series Name:

No.	Product Type	Series Name
1	Household Energy Storage Hybrid Inverter	Virgo

2) Power or Capacity:

No.	Code	Output Power
1	3K	3000W
2	3K6	3680W
3	4K	4000W
4	4K6	4600W
5	5K	5000W
6	6K	6000W

3) Phase Type:

No.	Code	Meaning
1	S	Single-phase S
2	D	Split-phase D
3	T	Three-phase T

2.1.2 Supported Grid Type

For grid forms with N wires, the N to PE voltage needs to be less than 10V.

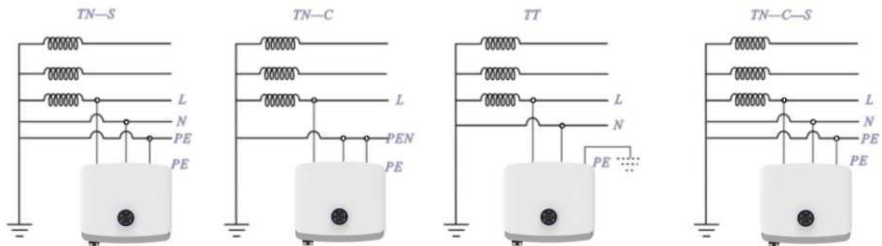


Figure 2.1.2-1 Supported Grid Types

2.2 Application Scenario



Warning

- ✧ If the photovoltaic system is not equipped with a battery, it is not recommended to use the BACK-UP function. Any risks associated with the use of the BACK-UP function without a battery will not be covered by the manufacturer's warranty.
- ✧ The battery current may be affected by factors such as temperature, humidity, and weather conditions, which can lead to battery limitations and affect its load capacity.
- ✧ When the grid is disconnected, if the load capacity exceeds the rated power of the inverter, the off-grid function of the inverter will automatically shut down. If an automatic startup is required, ensure that the load power is less than the rated power of the inverter.
- ✧ The photovoltaic system is not suitable for connecting equipment that requires reliable and stable power supply, such as life support devices.
- ✧ The BACK-UP output port of the inverter has overload capability and UPS function (switching time < 10ms), and can supply power to household loads during grid power failure. To ensure UPS switching and load power supply stability, avoid using loads with high startup currents, such as high-power water pumps. Supported load sizes are as follows: Virgo 3K-S, Virgo 3K6-S, Virgo 4K-S, Virgo 4K6-S, Virgo 5K-S, Virgo 6K-S, with total inductive and capacitive load power $\leq$ rated output power of the inverter.
- ✧ A warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE.

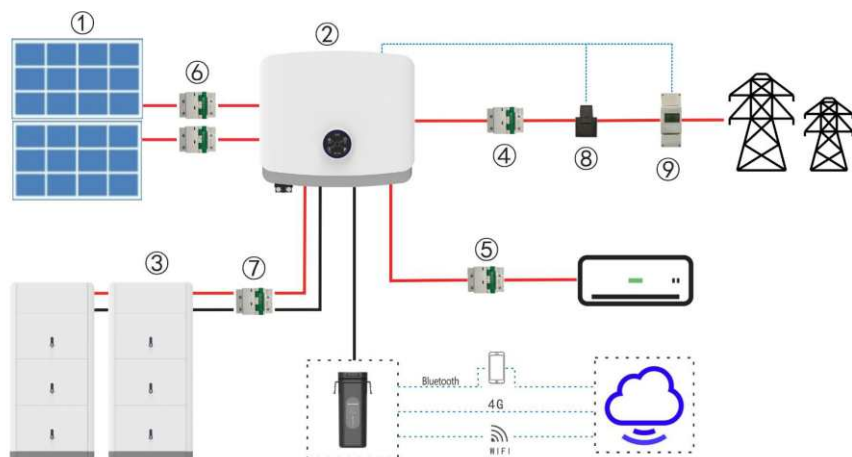


Figure 2.2-1 Application Scenarios

No.	Component	Description
1	PV Modules	PPV modules are combined to form a PV array.
2	Inverter	Virgo series inverter.
3	Battery	Selected according to the inverter and battery series list.
4	AC Breaker	Selected based on the rated power of the inverter: rated current $\geq 45\text{A}$, rated voltage $\geq 230\text{V}$
5	Load Breaker	Based on actual load requirements.
6	PV Breaker	Single channel rated current $\geq 20\text{A}$, rated voltage $\geq 600\text{V}$
7	Battery Breaker	rated current $\geq 120\text{A}$, rated voltage $\geq 60\text{V}$
8	CT	Supplied with the inverter or purchased from the inverter supplier.
9	Smart Meter	Supplied with the inverter or purchased from the inverter supplier (optional).

2.3 Operation Mode

2.3.1 System Operation Mode

Zero Output Mode

Note
✧ Excess generated power from the photovoltaic system is stored in the battery. When solar power is insufficient or absent at night, the battery discharges to supply the load, improving self-consumption and household energy self-sufficiency, thereby saving on electricity bills.
✧ When the battery is fully charged and the PV's maximum power exceeds the load power, PV power output is limited to prevent energy from flowing into the grid.
✧ This mode is suitable for areas with high electricity prices and for regions where solar power cannot be fed back into the grid.
✧ The system defaults to a charge cut-off capacity of 96% and a discharge cut-off capacity of 5%. To modify these capacities, enter the application scenario settings.

● Daytime:

When PV's maximum power is sufficient, the generated electricity prioritizes household load supply. Excess power charges the battery, and any remaining power is prevented from flowing into the grid.

When PV's maximum power is insufficient, the battery power is used to supply the load first. If the battery power is insufficient, the grid supplies power to the load.

● Nighttime:

If the battery power is sufficient, it supplies the load. If the battery power is insufficient, the grid supplies power to the load.

Self-Consumption Mode

Note
✧ Excess generated power from the photovoltaic system is stored in the battery. When solar power is insufficient or absent at night, the battery discharges to supply the load, improving self-consumption and household energy self-sufficiency, thereby saving on electricity bills.
✧ This mode is suitable for areas with high electricity prices and for regions where the feed-in tariff for solar power is low or non-existent.
✧ The system defaults to a charge cut-off capacity of 96% and a discharge cut-off capacity of 5%. To modify these capacities, enter the application scenario settings.

● Daytime:

When the generated power from the PV system is sufficient, it prioritizes household load supply. Excess power charges the battery, and any remaining power is sold to the grid. The maximum feed-in power can be set from 0 to the maximum power, depending on the regulations of different countries.

When PV's maximum power is insufficient, the battery power is used to supply the load first. If the battery power is insufficient, the grid supplies power to the load.

● Nighttime:

If the battery power is sufficient, it supplies the load. If the battery power is insufficient, the grid supplies power to the load.

Self-Consumption Example:

(1) When irradiation is sufficient, PV output power is 9kW, load consumption is 4kW, and battery charges 5kW.

(2) When the battery is nearly full, the charge power reduces to 3kW, and the remaining 2kW is fed into the grid.

(3) When irradiation decreases, PV output power is 2kW, load consumption is 4kW, and Battery discharges 2kW to the load.

(4) When there is no irradiation, the battery supplies 4kW to the load.

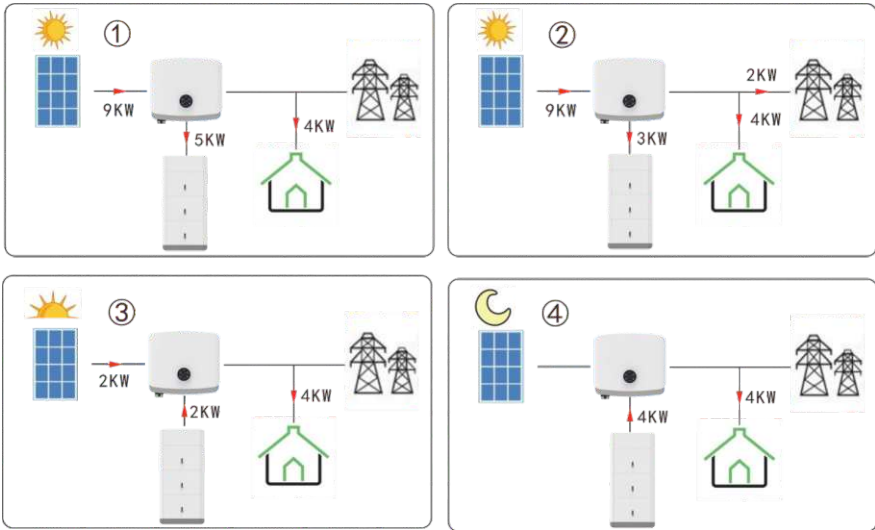


Figure 2.3-1 Self-Consumption Mode

TOU Mode

Note

- ✧ TOU mode can only be selected in compliance with local laws and regulations, such as whether grid charging of batteries is permitted. If not allowed, do not use this mode.
- ✧ Recommended for scenarios with significant differences between peak and off-peak electricity prices.
- ✧ This mode allows manual setting of charge and discharge time periods. For example, set the low electricity price period at night as the charge time, and the system will charge the battery during this period. Set the high electricity price period as the discharge time, and the battery will only discharge during this period to save household electricity costs. Up to two charge and two discharge periods can be set.

TOU Mode Settings

Setting	Description	Range
PV Excess Energy Priority	Charge Priority: When PV generation exceeds the load demand, excess energy charges the battery. After reaching the maximum charge rate or full battery capacity, the remaining energy is fed into the grid. Feed-in Priority: When PV generation exceeds the load demand, excess energy is fed into the grid. After the inverter output reaches the maximum value, the remaining energy charges the battery. This setting is typically used in scenarios where the FIT electricity price is higher than the grid electricity price, and the battery is only used as a backup.	Charge Priority Feed-in Priority
Grid Permissible Charging Power (W)	Specifies the maximum permissible charging power from the grid, determined by the local power company. If unspecified, the default is the storage system's maximum permissible charging power.	[0, Maximum Grid Charging Power]
Grid Charging Cut-off SOC	Sets the SOC at which grid charging stops.	[20%, 100%]

Application Examples:

- (1) Set 18:00 to 23:00 as the discharge period during peak electricity demand, where the battery discharges to supply the load.
- (2) Set 01:00 to 05:00 as the charge period during off-peak electricity demand,

where the battery charges from the grid at the set charge power.

(3) During other periods, if PV generation is set to charge priority, PV power charges the battery first, with remaining power fed into the grid.

(4) If PV generation is set to feed-in priority, PV power is fed into the grid first, with remaining power charging the battery. During this period, if PV power is insufficient for the load, power is drawn from the grid, and the battery does not discharge.

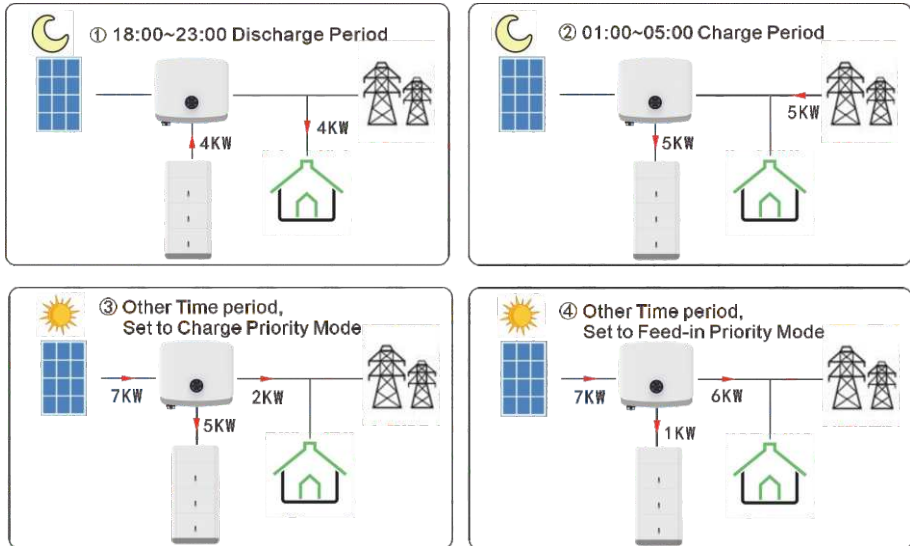


Figure 2.3-2 TOU Mode

Full Grid Feed-In Mode

Note

- ✧ Suitable for grid-tied scenarios with full feed-in mode.
Maximize solar power feed-in during the day. When PV generation exceeds the inverter's maximum output capacity, the excess energy charges the battery.
- ✧ When PV generation is less than the inverter's maximum output capacity, the battery discharges to ensure the inverter maximizes energy feed-in to the grid.

Application Example:

- (1) When PV generation is 9kW, a 6kW inverter feeds in at maximum output (6kW), and battery charges at 3kW.

- (2) When irradiance weakens and PV generation is 2kW, battery supplements 4kW to feed in at 6kW.

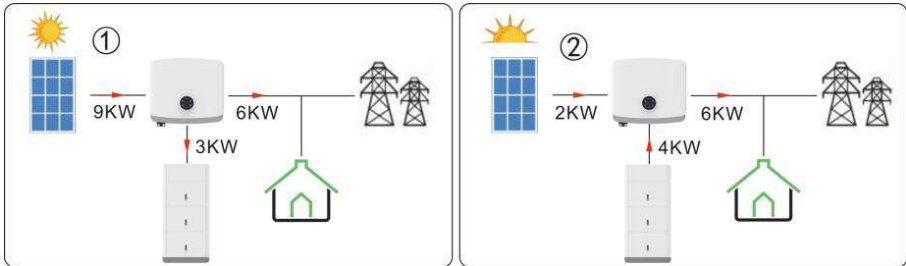


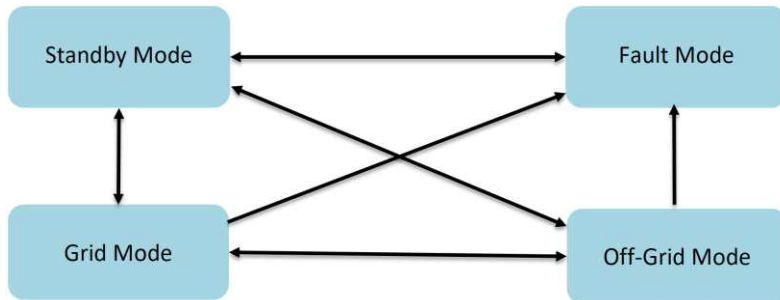
Figure 2.3-3 Full Grid Feed-In

Remote Control Mode

Note

- ✧ This mode is used for remote dispatch by the grid.

2.3.2 Inverter Operating Modes



No.	Mode	Description
1	Standby Mode	1) The machine enters standby mode upon power-on, determining whether the startup conditions are met. 2) If the conditions are met, the machine performs self-check and initialization. If the grid is normal, it enters grid-tied mode; otherwise, it operates in off-grid mode. 3) If self-check or initialization fails, it enters fault mode. If a shutdown command is received during self-check or initialization, it remains in standby mode.

2	Grid Mode	1) If grid abnormalities are detected, the machine switches to off-grid mode. 2) If a fault is detected, it enters fault mode. 3) If a shutdown command is received, it immediately enters standby mode.
3	Off-Grid Mode	1) The Inverter operates in off-grid mode until the grid returns to normal. The BACK-UP port continuously supplies power to the load. 2) If grid conditions meet the requirements for grid-tied operation and persist for a period, it switches to grid-connected mode. 3) If a fault is detected, it enters fault mode. 4) If a shutdown command is received, it immediately enters standby mode.
4	Fault Mode	1) If a fault is detected, the inverter enters fault mode. Once the fault is solved, it enters standby mode.

2.4 Functional Characteristics

Power Derating

To ensure the safe operation of the inverter, the inverter will automatically reduce output power when operating conditions are not optimal. The following factors may cause power derating; please avoid them during use as much as possible:

- Unfavorable environmental conditions, such as high temperatures.
- The output power percentage of the inverter has been preset.
- Over-frequency derating.
- High input voltage.
- High input current.

AFCI

The inverter is equipped with optional AFCI functionality.

Communication

The inverter supports communication via WiFi and Bluetooth for local configuration. Through WiFi, it can connect to the cloud, monitor the inverter's operational status, check power generation status, set inverter operating parameters, perform remote diagnostics, and

upgrade inverter firmware.

- Bluetooth: Complies with Bluetooth 4.2 standards.
- WiFi: WiFi: Supports 2.4GHz frequency, requiring the router to be set to 2.4GHz mode.
- The router's SSID should not exceed 40 characters.
- WiFi Signal Strength: Can be checked using the NovoSolar app. When the signal strength is below -60dB, it is recommended to move the router closer to the inverter or remove any obstructions to improve signal strength.
- 4G: Supports communication through 4G to connect to the cloud, supporting LTE UE-Cat. 4, LTE FDD, LTE TDD, WCDMA, and GSM. The specific type depends on the SIM card and the local operator.

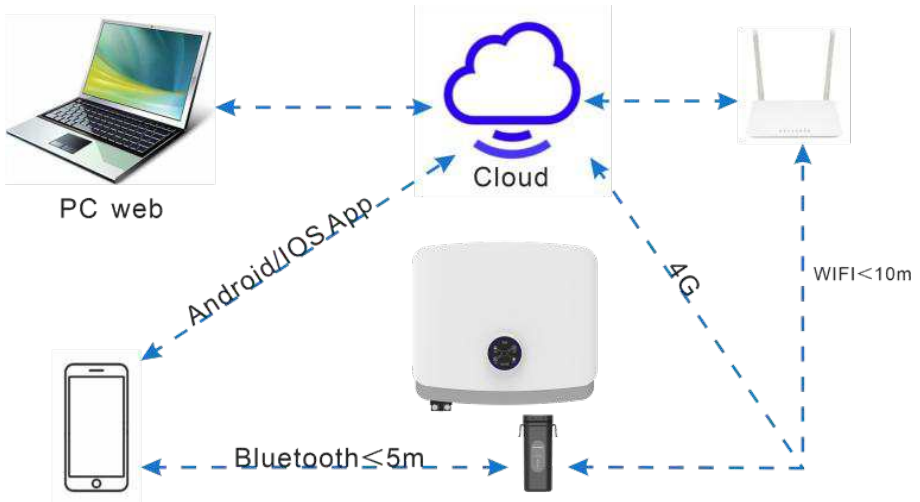
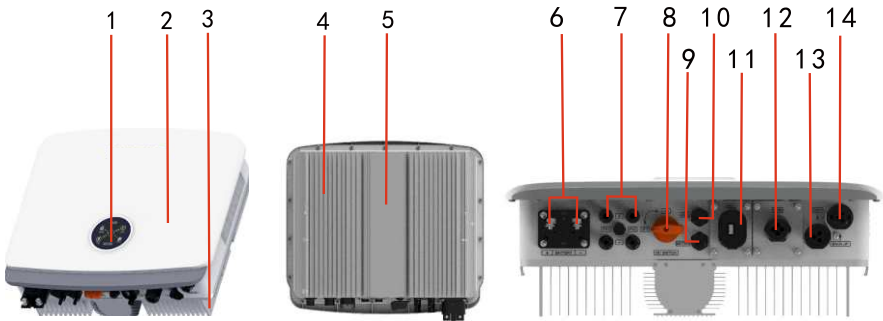


Figure2.4-1 InverterCommunicationMethods

2.5 Apperances

2.5.1 Instruction



- | | |
|----------------------------------|-------------------------------------|
| 1. Display Screen | 8. PV Switch |
| 2. Front Panel | 9. Meter |
| 3. Grounding Point | 10. Battery Management System (BMS) |
| 4. Heat Sink | 11. WiFi Data Collector Port |
| 5. Inductive Components | 12. Communication Port (COM) |
| 6. Battery Terminals (BAT+/BAT-) | 13. GRID Terminals |
| 7. PV Terminals (PV1/PV2) | 14. BACK-UP Terminals |

Figure 2.5-1 Instruction

2.5.2 Dimensions



Figure 2.5.2-1 Dimensions

2.5.3 LCD Display

A: Visual Diagram



Figure 2.5.3-1 LCD Display

B: Explanation of Display Symbols:

No.	Icon	Function Description
1	888	Operating Status Code
2	88:88	Time Display
3	↔↔↔ ↔↔↔	Power Flow Indicator
4	Blue Ring Light	Operating Status Indicator
5	↻	DC/AC Conversion
6		PV Panel Status Top Row 8888W: PV1 power Bottom Row 8888W: PV2 power
7		Grid Status With Circle: Meter/CT Connected Without Circle: Meter/CT Disconnected
8		Load Status 8888W: Load Power
9		Battery Status With Circle: BMS Connected Without Circle: BMS Disconnected

Figure 2.5.3-2 Explanation of Display Symbols

2.5.3.1 Mode

The top row of the display screen shows the mode code“-0-”, indicating the current operating mode set for the inverter. The following are the modes:



Mode Code	Mode
0	Zero Output Mode
1	Self-Consumption Mode
2	Time Mode
3	UPS Mode
4	Full Grid Feed-In Mode
5	EMS Mode

Figure 2.5.3-3 Mode Code

2.5.3.2 Fault Status



Figure 2.5.3-4 Fault Status Display

When a fault occurs in the inverter, the top row of the display will show a fault code. For example, code "E10" indicates a bus overvoltage fault. The fault codes are as follows:

Fault Code	Fault Reason	Fault Code	Fault Reason	Fault Code	Fault Reason
E10	Bus Overvoltage	E1C	BuckBoost Fault	E28	Inverter Current Sampling Fault
E11	Bus Undervoltage	E1D	DAB Fault	E29	Load Current Sampling Fault
E12	Boost1 Overcurrent	E1E	Boost1 Fault	E2A	Battery Current Sampling Fault
E13	Boost2 Overcurrent	E1F	Boost2 Fault	E2B	BuckBoost Current Sampling Fault
E14	Inverter Overcurrent	E20	Battery Voltage Too High	E2C	Leakage Current Sensor Fault
E15	BuckBoost Overcurrent	E21	Inverter Side Overtemperature	E2D	Excessive Leakage Current
E16	Transformer Overcurrent	E22	PV1 Overvoltage	E2E	Grid Relay Sticking
E17	Battery Overcurrent	E23	PV2 Overvoltage	E2F	Grid Relay Failure to Close
E18	Output Short Circuit	E24	PV1 Reverse Connection	E30	Low Positive Insulation Impedance
E19	Load Power Overload	E25	PV2 Reverse Connection	E31	Low Negative Insulation Impedance
E1A	Excessive DC Component	E26	Boost1 Current Sampling Fault	E32	Excessive Inverter Power
E1B	Inverter Fault	E27	Boost2 Current Sampling Fault	E33	Inverter Soft Start Fault

2.5.3.3 Parallel Status



Figure 2.5.3-5 Parallel Status

When parallel operation is needed in off-grid mode, connect the parallel communication line. The top row of the display will show "P-", indicating successful parallel communication. After shutting down, connect the wires from the Backup terminals accordingly to enable parallel output.

2.6 Namepla

HEIWIT		}	Company Logo, Product Type, and Model
Model:	Virgo 6K-S-HW		
Name:	Hybrid Inverter	}	Technical Specifications
PV INPUT			
Max. Input Voltage:	600 Vd.c.		
MPPT Voltage Range:	100~550 Vd.c.		
Max Continuous Input Power:	9000 W		
Max Continuous Input Current:	16 Ad.c.x2		
Isc PV:	20 Ad.c.x2		
BATTERY			
Battery Type:	Sodium-ion		
Battery Voltage Range:	32~60 Vd.c.		
Nominal Battery Voltage:	48 Vd.c.		
Max. Continuous Charging&Discharging Current:	100 Ad.c.		
Max. Continuous Charging&Discharging Power:	5000 W		
GRID			
Max. Continuous Output Apparent Power:	6000 VA		
Registered Capacity:	6000 W		
Nominal Input&Output Voltage:	230 Va.c.		
Max. Continuous Input Power:	10000 W		
Max. Continuous Input&Output Current:	43.5/26.1 Aa.c.		
Nominal Grid Frequency:	50/60Hz		
Power Factor:	0.8 leading to 0.8 lagging		
BACK UP			
Max. Continuous AC Output Power:	5000 W		
Nominal AC Output Voltage:	230 Va.c.		
Nominal AC Output Current:	21.7 Aa.c.		
Max. Continuous Output Current:	21.7 Aa.c.		
Nominal AC Output Frequency:	50/60Hz		
Power Factor:	0.8 leading to 0.8 lagging		
OTHERS			
Ambient Temperature Range:	-25℃~+60℃		
Over Voltage Category:	DCIII/ACIII		
Ingress Protection:	IP66		
Protective Class:	Class I		
Standard:	CEI0-21:2022; VDE-AR-N 4105; VDE 0124-100:2020; G99 1-9&G100-1/2; C10111; EN 50549-1; IEC 62109-1/2; EN IEC61000-6-1/3; EN 62920:2017/A1; AS/NZS 4777.2		
		}	Safety Symbols and Certification Marks
Serial No.:			
		}	Manufacturer, Serial Number Information
中国制造		}	
MADE IN CHINA			
深圳市朗沃时代能源科技有限公司		}	
SHENZHEN NOVOAGE ENERGY TECHNOLOGY CO.,LTD			

Figure 2.6-1 Nameplate

Chapter 3

Equipment Inspection and Storage

3.1 Pre-Receipt Inspection

3.2 Delivery Item List

3.3 Equipment Storage

3.1 Pre-Receipt Inspection

Before accepting the product, please thoroughly check the following:

1. Inspect the outer packaging for any damage, such as deformation, holes, tears, or any other signs of damage that might indicate harm to the equipment inside. If any damage is found, do not open the packaging and contact your distributor immediately.
2. Check the inverter model number to ensure it is correct. If it does not match, do not open the packaging and contact your distributor immediately.
3. Verify that the types and quantities of delivery items are correct and that their appearance is undamaged. If there is any damage, contact your distributor immediately.

3.2 Delivered Items List



Warning

- ✧ When making electrical connections, please use the terminal connectors provided with the shipment. Damage to the equipment caused by incompatible connectors will not be covered under warranty.
- ✧ Items marked with * are optional accessories.

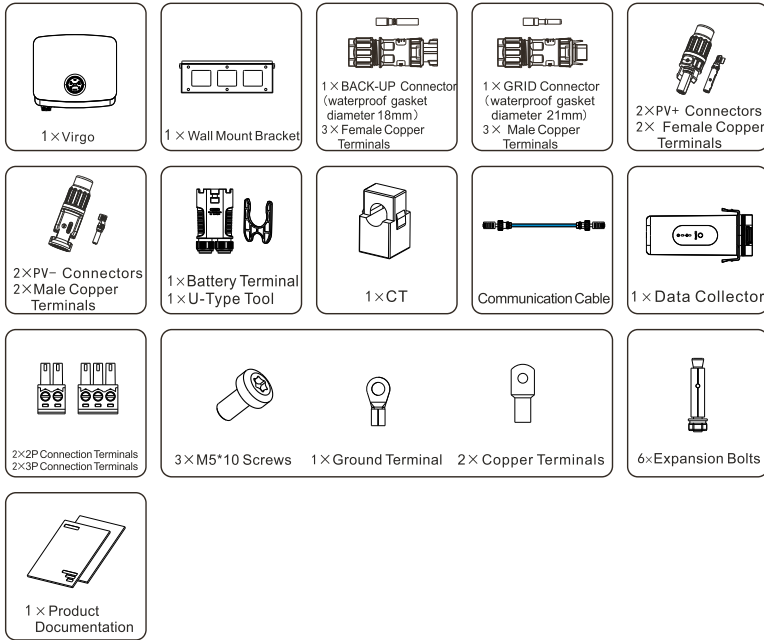


Figure 3.2-1 Delivered Items List

3.3 Equipment Storage

If the inverter cannot be put into use immediately, please adhere to the following storage conditions:

1. Do not open the outer packaging and ensure the desiccant inside the box remains intact.
2. Ensure the storage environment is clean and dry to prevent dust and moisture intrusion. It is recommended to inspect the packaging every three months. If any damage is found, replace the packaging materials promptly.
3. Maintain storage temperatures between -40°C and $+70^{\circ}\text{C}$, and relative humidity between 5% RH and 95% RH, without condensation.
4. Ensure the stacking height and direction of the inverters conform to the label requirements on the packaging to avoid tipping hazards and potential equipment damage.
5. If the inverter is stored for more than two years, it must be inspected and tested by

Chapter 4

Installation

4.1 Installation Requirements

4.2 How to Install

4.2.1 Transporting the Equipment

4.2.2 Installation Procedure

4.1 Installation Requirements

Environmental Requirements

1. The equipment must not be installed in environments prone to flammable, explosive, or corrosive conditions.
2. Avoid installing the equipment in areas that are easily accessible or where it can be easily touched. This is to prevent accidental contact with hot surfaces during operation, which could cause burns.
3. When drilling, ensure the location is free from pipes and electrical wiring to avoid potential hazards.
4. The inverter should be installed in a location protected from direct sunlight, rain, snow, and other extreme weather conditions. If necessary, build a protective canopy.
5. The installation space must allow for adequate ventilation and ease of maintenance, ensuring the equipment operates safely.
6. The Ingress protection level of the equipment is suitable for both indoor and outdoor installation. Ensure that the environmental temperature and humidity are within the specified range.
7. The equipment should be installed in a way that allows easy access for maintenance and inspection. All labels should be easily visible, and terminal connections should be easily accessible.
8. The inverter should be installed at an altitude lower than the maximum working altitude of 3,000 meters.
9. Please make sure the installation environment is well ventilated.
10. Do not obstruct the ventilation openings or the cooling system during operation to prevent overheating and fire hazards.
11. Keep the equipment away from environments with flammable or explosive gases or fumes and avoid operating the equipment in such environments.
12. Maintain a distance from strong magnetic fields to avoid electromagnetic interference. If there are radio stations or wireless communication devices operating below 30MHz nearby, install the equipment according to the following requirements:

- ◆ Add ferrite magnetic cores with multiple turns at the DC input or AC output lines of the inverter, or add low-pass EMI filters.
- ◆ Ensure a distance of over 30 meter between the inverter and devices that generate electromagnetic interference.

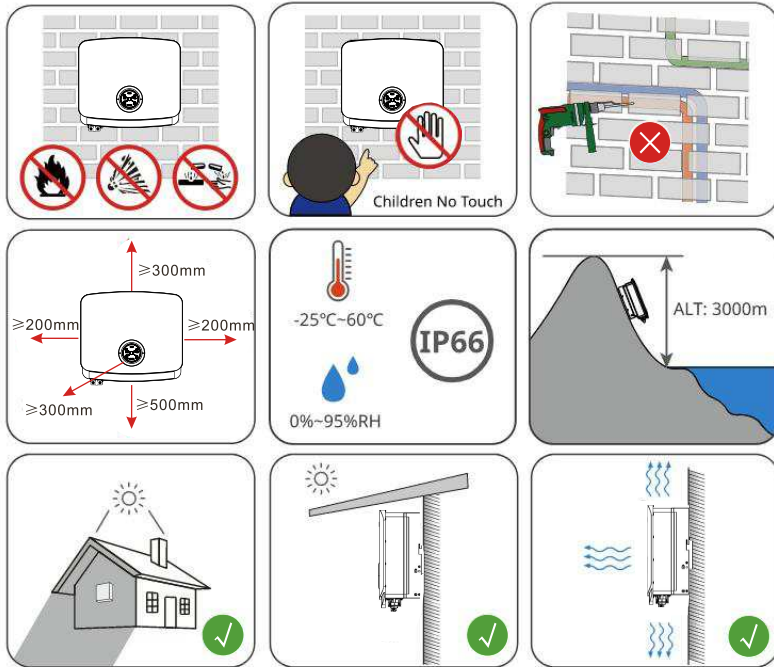


Figure 4.1-1 Installation Requirements

Carrier Requirements for Installation:

- The installation carrier should not be made of flammable materials and must have fire-resistant properties.
- Ensure the carrier is sturdy and reliable, capable of bearing the weight of the inverter.
- The equipment generates vibrations during operation, please avoid installing it on carriers with poor sound insulation to prevent noise disturbance to residential areas.

Installation Angle Requirements

- Recommended installation angle for the inverter: vertical or tilted backward by $\leq 15^\circ$.
- Do not install the inverter upside down, tilted forward, tilted backward beyond the recommended angle.

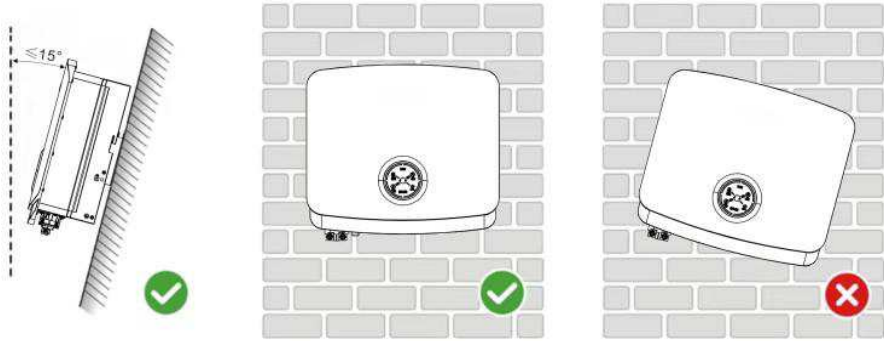


Figure4.1-2 Installation Angle

Installation Tools Requirements

When installing, it is recommended to use the following installation tools. If necessary, other auxiliary tools can be used on-site.

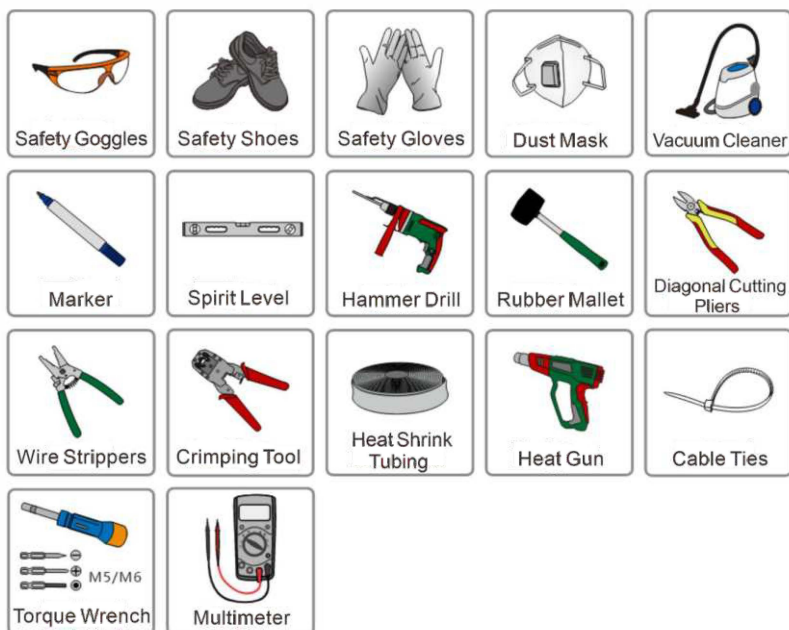


Figure 4.1-3 Installation Tools

4.2 How To Install

4.2.1 Transporting the Equipment

⚠ Caution

- ✧ During transportation, handling, and installation, comply with the relevant laws, regulations, and standards of the country or region.
- ✧ Transport the inverter to the designated installation site. During transportation, adhere to the following guidelines to prevent personal injury and equipment damage:
- ✧ Ensure the appropriate number of personnel is assigned based on the equipment's weight to avoid injuries from lifting beyond safe limits.
- ✧ It is highly recommended that personnel wear safety gloves during transportation to avoid injuries.

Maintain balance during transportation to prevent the equipment from falling.

4.2.2 Installation Procedure

Note

- ✧ When drilling holes, ensure the drilling positions avoid water pipes and cables within the walls to prevent any potential danger.
- ✧ Ensure the inverter is securely installed to prevent it from falling and causing injury.
- ✧ When drilling into walls or floors, consider wearing safety goggles, gloves, and a dust mask to avoid inhaling dust or getting debris in your eyes. Also, shield the equipment to prevent debris from entering, and clean up any debris promptly after drilling.

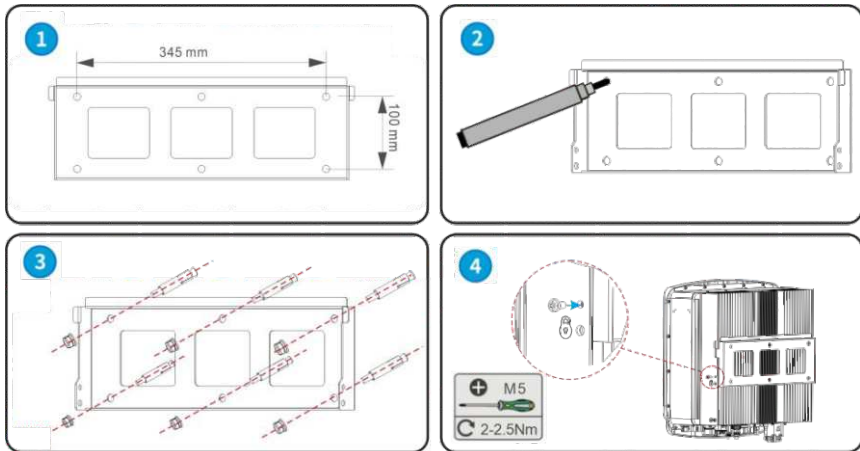


Figure 4.2.2-1 Installation Procedure

Step 1: Place the backplate horizontally against the wall and use a marker to indicate the positions for drilling.

Step 2: Use a drill bit with a diameter of 10mm (0.39 inches) to drill the holes, ensuring a depth of approximately 80mm (3.15 inches).

Step 3: Fix the backplate to the wall using expansion bolts.

Step 4: Hang the inverter onto the backplate,

Step 5: Ensure the inverter is firmly secured to the backplate to maintain stability.

Chapter 5

Electrical Connection

- 5.1 System Connection Diagram
- 5.2 Safety Precautions
- 5.3 Connecting the PE Wire
- 5.4 Connecting the AC Cable
- 5.5 Connecting the DC Input (PV) Cable
- 5.6 Connecting the Battery Cable
- 5.7 Communication Connection
 - 5.7.1 Communication Port Diagram
 - 5.7.2 Parallel Communication Connection
 - 5.7.3 Connecting the BMS and Meter Communication Cable
 - 5.7.4 Installing the CT/Meter
 - 5.7.5 Installing the Communication Module

5.1 System Connection Diagram

Note

- ✧ The connection methods for the N and PE lines of the inverter's GRID and BACK-UP ports vary according to regional regulations. Follow local regulations for specific requirements.
- ✧ The GRID and BACK-UP AC ports of the inverter have built-in relays. When the inverter is in off-grid mode, the internal GRID relay is open; when the inverter is in grid-connected mode, the internal GRID relay is closed.
- ✧ The BACK-UP AC port remains live when the inverter is powered on. If maintenance is required on the BACK-UP load, power off the inverter to avoid electric shock.

Ensure that the N and PE lines in the switching cabinet are connected separately.

Note

- ✧ Ensure that the BACK-UP protective earth wire is correctly and securely connected. Failure to do so may result in malfunction of the BACK-UP function during a grid fault. The following wiring method applies to regions other than Australia, New Zealand, South Africa, and similar areas.

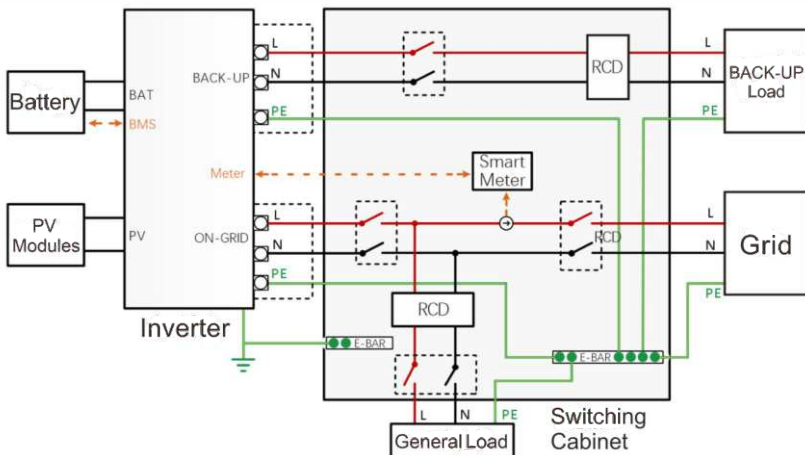


Figure 5.1-1 System Connection Diagram

5.2 Safety Precautions



Danger

- ✧ All operations during electrical connections, as well as the specifications of the cables and components used, must comply with local laws and regulations.
- ✧ Before making electrical connections, ensure that the DC switch, AC output switch, and all switches connected to the inverter are in the off position to prevent electric shock due to high voltage.
- ✧ Bind similar cables together and arrange them separately from different types of cables. Do not entangle or cross different types of cables.
- ✧ Excessive tension on the cables may lead to poor connections. Ensure that sufficient slack is left in the cables before terminating them at the inverter's terminals.
- ✧ When crimping terminal connectors, ensure that the conductive part of the cable makes full contact with the terminal. Do not crimp the cable insulation together with the terminal, as this may cause the device to malfunction or overheat, leading to terminal damage.

Note

- ✧ During electrical connections, wear personal protective equipment such as safety shoes, insulated gloves as required.
- ✧ Only qualified personnel are permitted to perform electrical connection operations. The cable colours shown in this document are for reference only. Specific cable specifications must comply with local regulations.

5.3 Connecting the PE Wire



Warning

- ✧ output port. Ensure both protective earth connections are reliable.
- ✧ For multiple inverters, ensure that the protective earth points of all inverter enclosures are equipotentially connected.
- ✧ According to IEC62109 requirements, to avoid unsafe application in case of damaged or disconnected earthing wires, properly connect the protective earth wire of the inverter, ensuring at least one of the following:
 - ✧ If the PE terminal in the AC connector is not connected, the enclosure's protective earthing must use a single-core outdoor copper wire with a cross-sectional area of $\geq 10\text{mm}^2$.
 - ✧ Use cables of the same diameter as the AC output cables to connect both the PE terminal in the AC connector and the grounding screw on the enclosure.
 - ✧ In some countries/regions, additional earth wire are required for inverters. In such cases, use cables of the same diameter as the AC output cables to connect both the PE terminal in the AC connector and the earthing screw on the enclosure.
 - ✧ To improve the corrosion resistance of the terminals, it is recommended to apply silicone or paint to the external earthing terminals after installation.
 - ✧ Prepare your own protective earth wire, recommended specifications: Type: single-core outdoor copper wire; Wire diameter: 8-10AWG ; Conductor cross-sectional area: $4\text{mm}^2 \leq S \leq 6\text{mm}^2$.

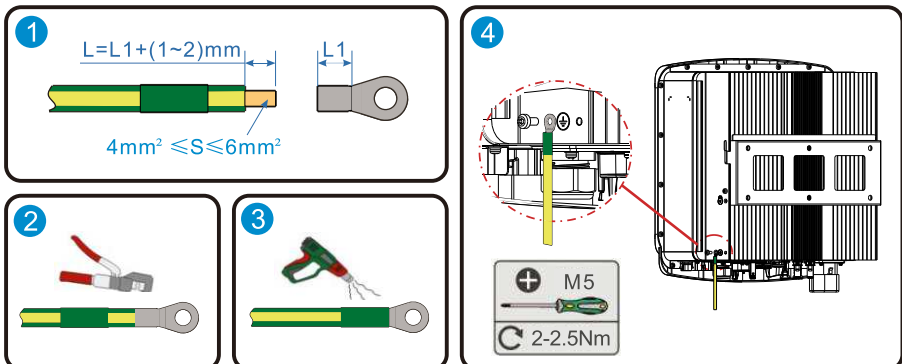


Figure 5.3-1 Earth Wire

5.4 Connecting the AC Cable



Warning

- ✧ An external AC switch must be configured on the AC side of the inverter to ensure safe disconnection from the grid. Do not connect loads between the inverter and the AC switch directly connected to the inverter.
 - ✧ The inverter integrates a Residual Current Monitoring Unit (RCMU). When the inverter detects a leakage current exceeding the permissible value, it will quickly disconnect from the grid.
 - ✧ The GRID and BACK-UP AC ports of the inverter have built-in relays. When the inverter is in off-grid mode, the internal GRID relay is open; when the inverter is in grid-connected mode, the internal GRID relay is closed.
 - ✧ The BACK-UP AC port remains live when the inverter is powered on. If maintenance is required on the BACK-UP load, power off the inverter to avoid electric shock.
 - ✧ If an oversized AC switch is used, not recommended by NOVOAGE or local standards and regulations, it may fail to disconnect safely in abnormal situations, causing serious faults.
 - ✧ Do not use knife switches as AC switches. Do not connect multiple inverters to a single AC switch. Each inverter requires an individual AC output switch.
- If the external AC switch has leakage protection, its rated leakage operating current should be $\geq 100\text{mA}$.

Based on local laws and regulations, select whether to connect an RCD device. The inverter can be externally connected to a Type A RCD (Residual Current Monitoring Device) for protection when the DC leakage current exceeds the limit. The following RCD specifications are for reference:

No.	Inverter Model	RCD Specification (GRID)	RCD Specification (BACK-UP)
1	Virgo 3K-S	300mA	30mA
2	Virgo 3K6-S	300mA	30mA

3	Virgo 4K-S	300mA	30mA
4	Virgo 4K6-S	300mA	30mA
5	Virgo 5K-S	300mA	30mA
6	Virgo 6K-S	300mA	30mA

AC terminal diagram:

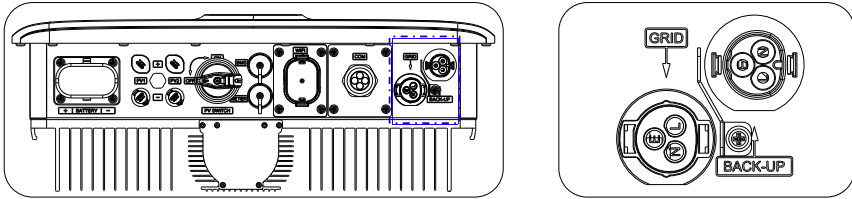


Figure 5.4-1 AC Input Terminal

AC terminal wiring diagram:

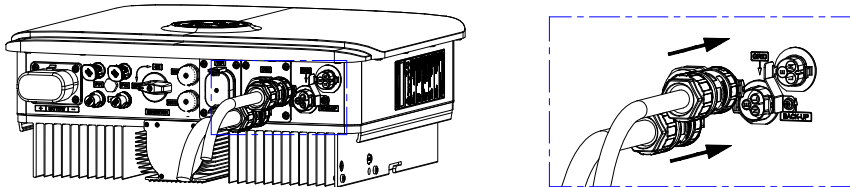


Figure 5.4-2 Connecting AC Input Wires

Warning

- ✧ Match the AC cable with the "L," "N," and "PE" ports of the AC terminal correctly. Incorrect wire connections can damage the equipment.
- ✧ Ensure that the wire cores are fully inserted into the terminal wiring holes without exposure.
- ✧ Tighten the wire connections securely to prevent overheating of the terminals during operation.

Before removing the AC connector, ensure that the DC switch at the bottom of the inverter and all switches connected to the inverter are in the off position.

AC Cable Crimping Diagram:

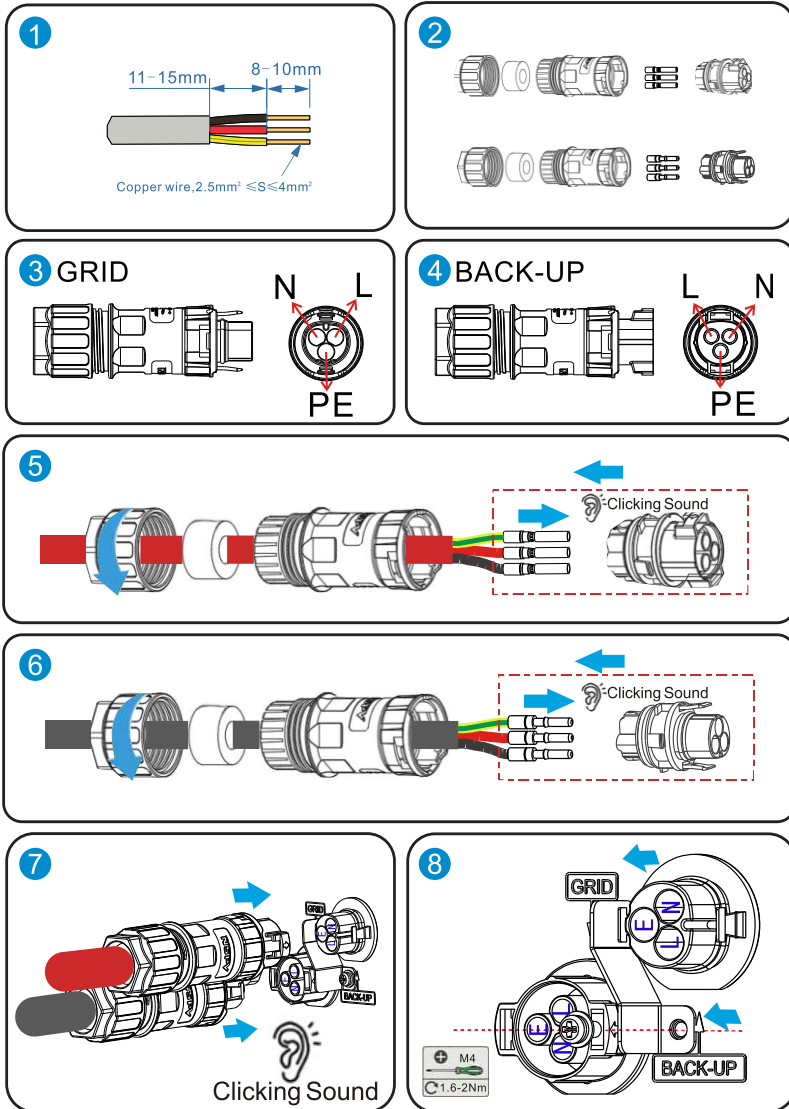


Figure 5.4-3 Steps for Installing and Connecting AC Cable

5.5 Connecting the DC Input (PV) Cable



Danger

- ✧ Do not remove the waterproof cover of the DC input terminal if the inverter's DC input terminal is not connected to the PV string, as this will affect the ingress protection level of equipment.
- ✧ Do not connect the same PV string to multiple inverters, as this can damage the inverter.
- ✧ Before connecting the DC input cable, ensure the DC side voltage is within the safe range ($\leq 60\text{V DC}$), and the inverter's DC switch is in the off position. Failure to do so could result in high voltage and electric shock hazards.
- ✧ Before connecting the PV array to the inverter, ensure that the maximum short-circuit current and maximum input voltage of each string are within the inverter's allowable range for each MPPT. Also, ensure the correct polarity of the PV array's positive and negative terminals matches the DC input terminals (PV+ and PV- respectively). Failure to do so could cause permanent damage to the inverter and, in severe cases, lead to fire, resulting in personal injury and property loss.
- ✧ If the DC input cable is mistakenly connected with reverse polarity, immediately turn off the DC switch and disconnect the PV positive and negative connectors. Wait until nighttime or cover the PV modules to reduce the PV array current to below 0.5A before reconnecting. Check and repair any polarity issues before reattempting connection.
- ✧ During inverter operation, do not perform maintenance on the DC input cables, such as inserting or removing a string or module component. This can result in electric shock hazards.

⚠ Warning

- ❖ PV arrays do not support earthing. Before connecting the PV array to the inverter, ensure the PV array meets the minimum insulation resistance requirements ($R = \text{maximum input voltage} / 30\text{mA}$). If the insulation resistance is below this threshold, the inverter may trigger an insulation resistance alarm.

During the installation of PV arrays and the inverter, if improper wiring or failure to meet installation requirements causes short circuits between the PV array's positive and negative terminals or earthing, this can result in damage to the inverter or other severe consequences. Any such damage is not covered under the manufacturer's warranty

DC terminal diagram:

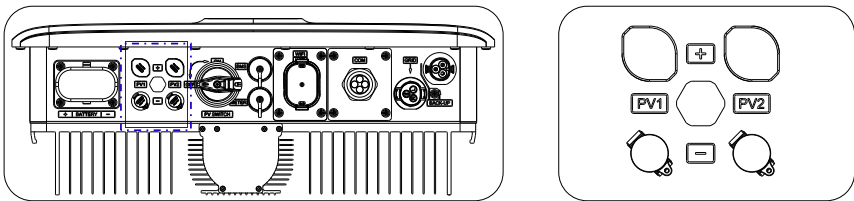


Figure 5.5-1 DC Input Terminals

DC terminal wiring diagram:

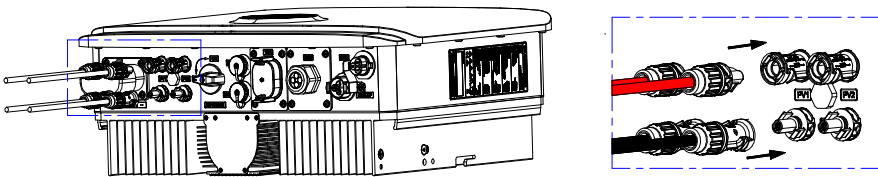


Figure 5.5-2 Connecting DC Input cable

DC Cable Crimping Diagram:

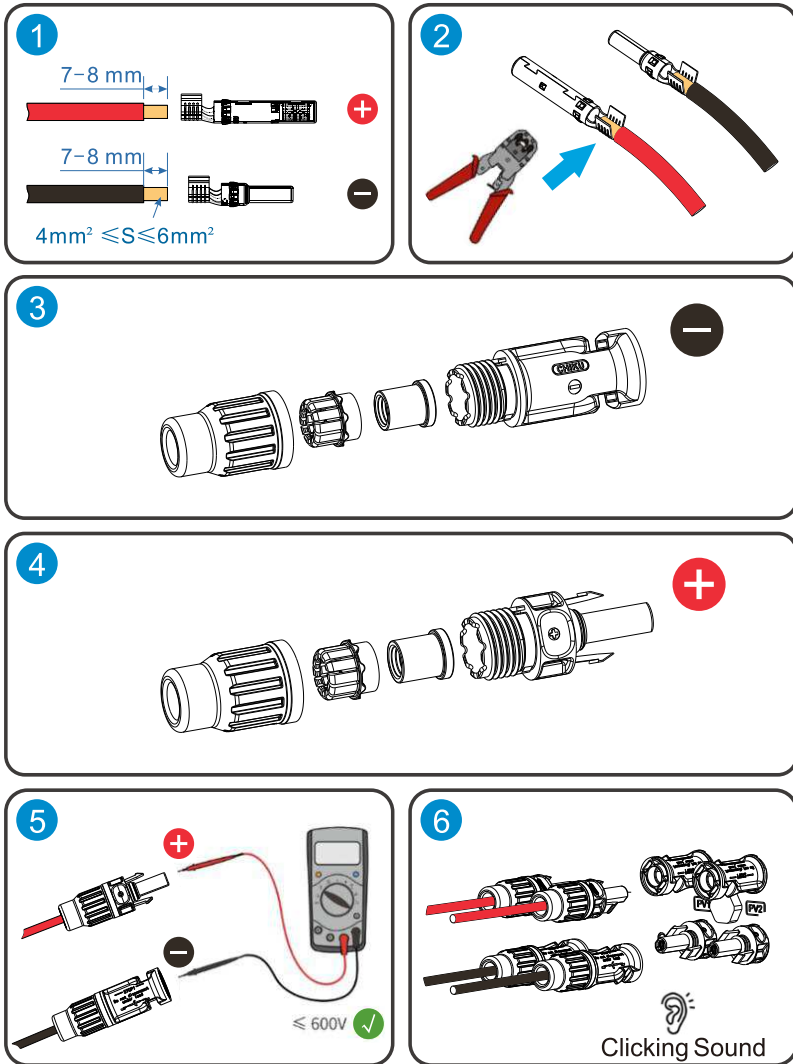


Figure 5.5-3 Steps for Installing and Connecting DC Cable

5.6 Connecting the Battery Cable



- ✧ Batteries used with the inverter must be approved by the inverter manufacturer. The approved battery list can be obtained from the official website.
- ✧ Take precautions to prevent battery short circuits, as short circuits may cause fires.
- ✧ Before connecting the battery cable, ensure the inverter and battery are powered off, and both the upstream and downstream switches are in the off position.
- ✧ Do not connect or disconnect the battery cable while the inverter is running, as improper operations may cause electric shock.
- ✧ Do not connect the same battery pack to multiple inverters, as this may damage the inverter.
- ✧ Do not connect loads between the inverter and the battery.
- ✧ Use insulated tools when connecting the battery cable to prevent accidental electric shock or short-circuiting of the battery.
- ✧ Ensure the open-circuit voltage of the battery is within the inverter's allowable range.
- ✧ A DC switch should be installed between the inverter and the battery to ensure safe disconnection of the energy storage equipment from the inverter.



- ✧ Ensure the correct polarity of the battery cable. When connecting, match the battery wires with the "BAT+," "BAT-," and earthing ports of the battery terminal correctly. Incorrect cable connections can damage the equipment. Ensure the wire cores are fully inserted into the terminal wiring holes without exposure.
- ✧ Tighten the cable connections securely to prevent overheating of the terminals during operation.

Note

- ✧ It is not recommended to use armored cables or other rigid cables for wires, as bending stress can cause poor terminal contact.
- ✧ During the installation of the energy storage battery and inverter, if the distribution cables are not installed or routed according to the requirements, causing a short circuit between the positive or negative pole of the energy storage equipment to the earth, it may result in a DC short circuit during the operation of the inverter, leading to equipment damage. Such damage caused by this issue is not covered under the equipment warranty.
The wiring distance between the energy storage battery and the inverter should be less than 5m.

Battery Terminal Diagrams:

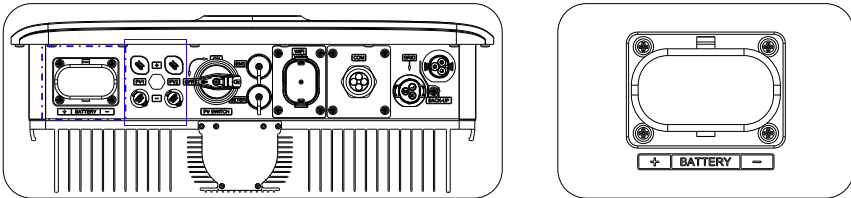


Figure 5.6-1 Battery Terminal

Battery terminal wiring diagram:

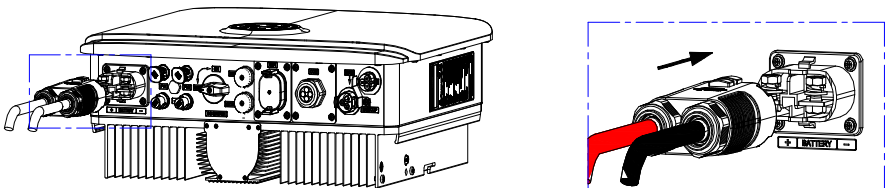


Figure 5.6-2 Connecting Battery Terminals

Battery cable crimping diagram:

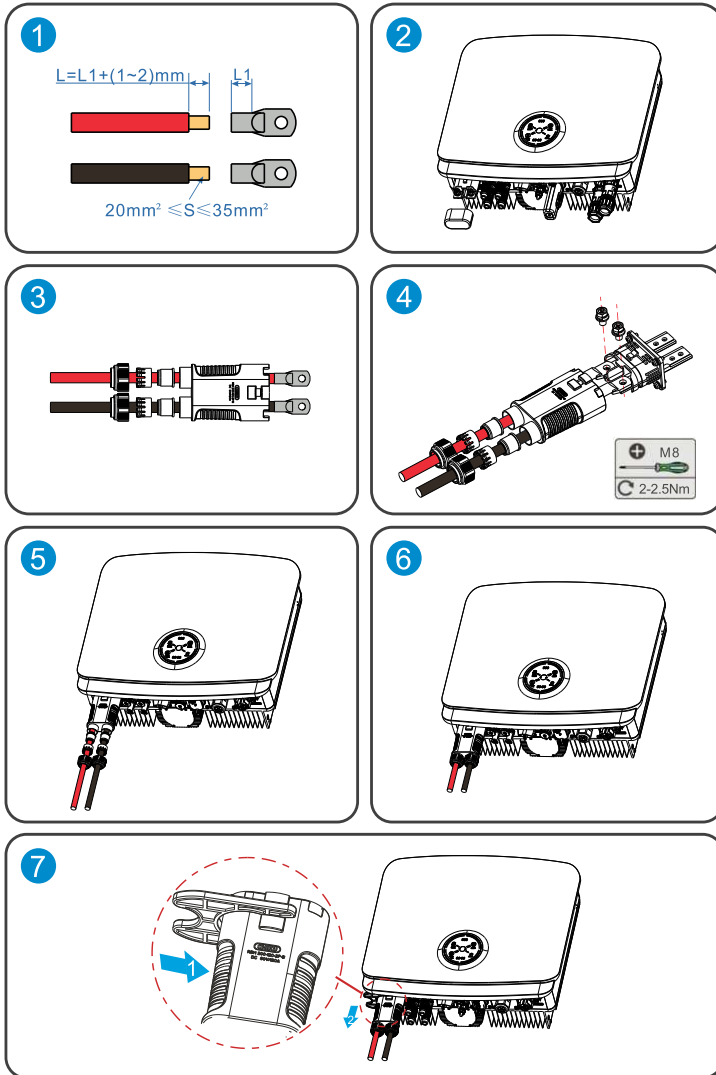


Figure 5.6-3 Steps for Installing and Connecting Battery Cable

Note: Step 7 is to remove the battery terminal, insert the U-shaped tool into the battery terminal and pull it out.

Battery pack connection diagram:

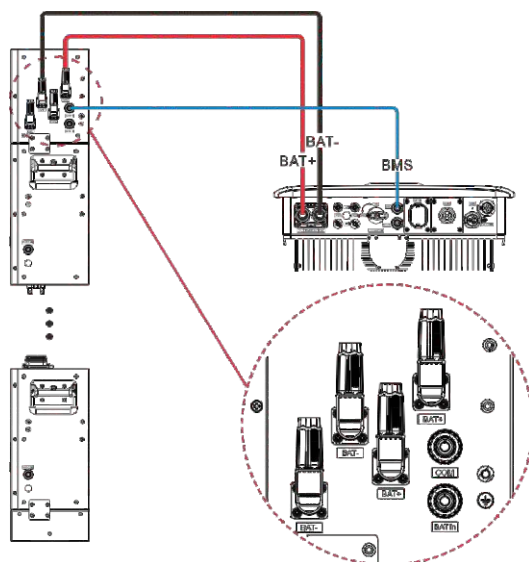


Figure 5.6-4 Single Battery Pack Connection Diagram

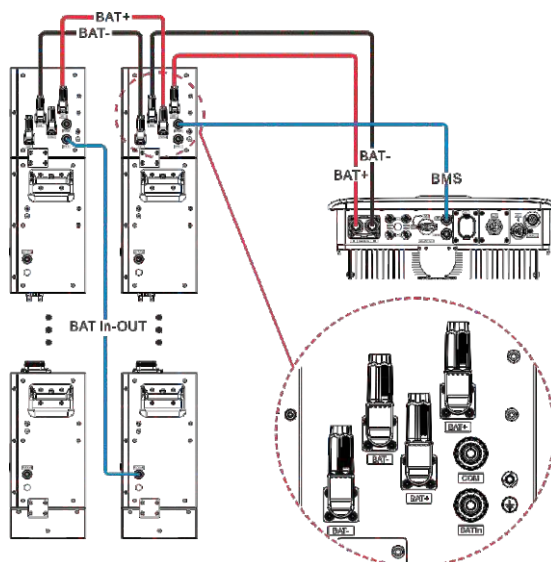


Figure 5.6-5 Dual Battery Pack Connection Diagram

5.7 Communication Connections

Note

- ✧ When connecting communication cables, ensure the terminal definitions match the equipment perfectly. The cable routing should avoid interference from power lines to prevent signal reception issues.

5.7.1 Communication Port Diagram

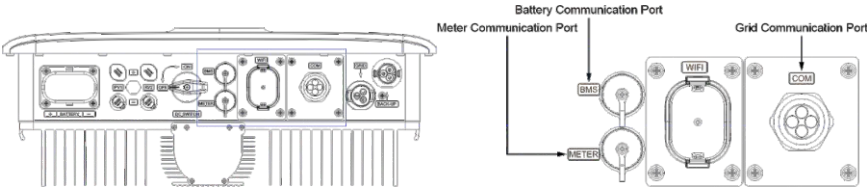


Figure 5.7-1 Communication Ports

5.7.2 Parallel Communication Connection

A. COM Port Function Diagram:

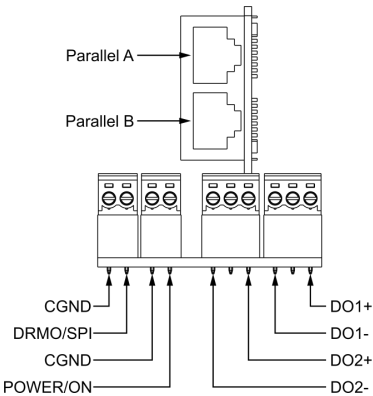
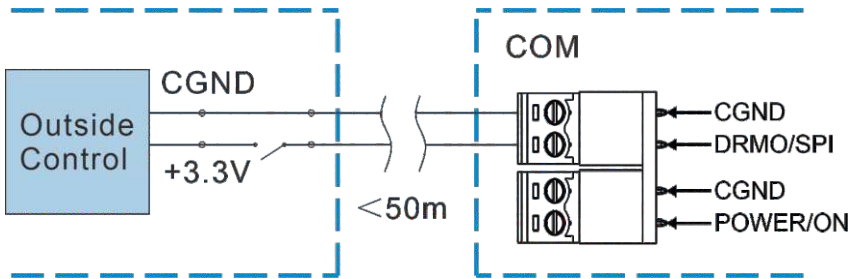


Figure 5.7.2-1 COM Port

No.	Terminal Name	Terminal Definition
1	Parallel A	Parallel Communication A
2	Parallel B	Parallel Communication B
3	CGND	DRMO/SPI Signal Ground
4	DRMO/SPI	DRMO/SPI Signal
5	CGND	POWER Signal Ground
6	POWER/ON	POWER Signal Positive
7	DO1+	Do1 Power Positive
8	DO1-	Do1 Power Negative
9	DO2+	Do2 Power Positive
10	DO2-	Do2 Power Negative

Figure 5.7.2-2 COM Terminal Definitions

B. Remote Control Instructions :



When a 3.3V voltage is applied between the CGND port and the DRMO/SPI port of the inverter's COM port for more than 1ms, the inverter will accept remote control commands.

C. Cable Preparation:

- Parallel Communication A & B: Use standard 8-core network cables.
- Signal Cables: Use multi-core cables. Strip the outer insulation, then insert the cables into the green terminal and crimp them securely.

Cable processing diagram:

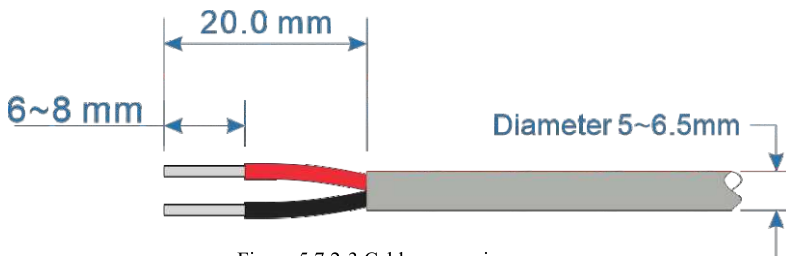


Figure 5.7.2-3 Cable processing

DO1/DO2 connection diagram: Torque: 0.18~0.2 N·m

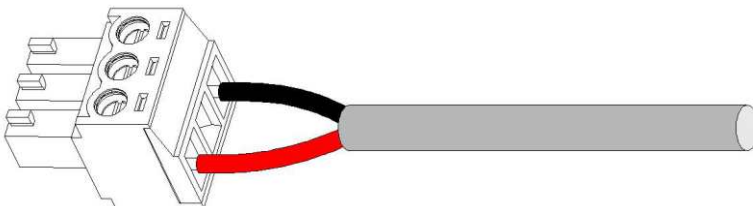


Figure 5.7.2-4 Connecting DO1/DO2 Cables

DRMO/POWER connection diagram: Torque: 0.18~0.2 N·m

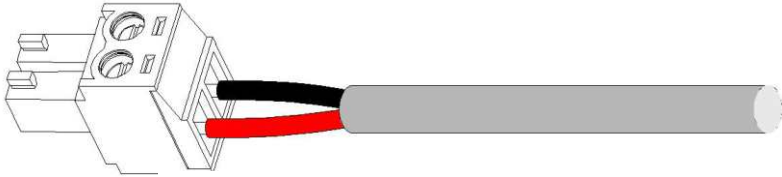


Figure 5.7.2-5 Connecting DRMO/POWER Cables

D. Cable Connection Steps:

- a. Remove the 4 screws from the COM port board and take off the entire port board.
- b. Loosen the locking nut of the M25 nylon waterproof connector counterclockwise, then remove the fastening ring and plug.
- c. Thread the wire through the locking nut→fastening ring→nylon waterproof connector body, then insert the fastening ring into the nylon waterproof connector body. Ensure to retain the required number of plugs based on the actual installation needs.
- d. Insert the wires into the corresponding terminal sockets and check for correct connections.
- e. Install the COM port board and tighten the 4 M4 stainless steel screws with a torque of 1.4~1.6 N·m. (Note: If the COM port board is not installed according to the specified torque, the company does not assume any responsibility for non-standard general safety operation.)
- f. Tighten the locking nut with a torque of 6.75~7.5 N·m.

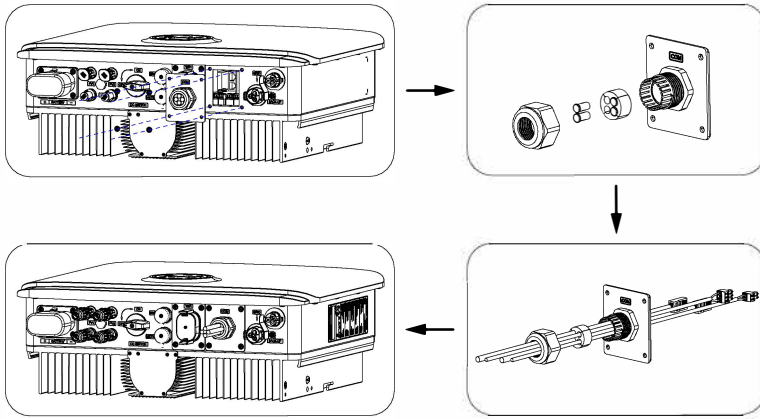


Figure 5.7.2-6 Parallel Communication Connection Cable Connection

5.7.3 Connecting the BMS and Meter Communication Cable

Note

- ✧ The inverter comes with BMS and Meter communication cables. The default length for the BMS communication cable is 3m; the default length for the Meter communication cable is 10m. Please install the meter and CT reasonably according to the actual situation.
- ✧ The meter and CT are shipped with the inverter, and the relevant parameters have been pre-set at the factory. Do not modify the parameters of the meter and CT. Each inverter should connect to a separate meter. Do not connect multiple inverters to the same meter.
- ✧ To ensure the normal use of the meter and CT, please ensure the following:
 1. Ensure the CT is connected correctly to the corresponding line. CT1 should be connected to L1.
- ✧ The BMS communication of the battery supports connection with a standard RJ45 crystal head. The terminal definitions are as follows.
- ✧ The meter communication supports connection with a standard RJ45 crystal head. The terminal definitions are as follows.

RJ45 Port Wiring Sequence:

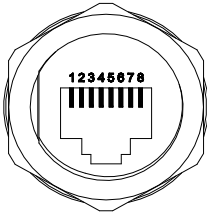


Figure 5.7.3-1

RJ45 Crystal Head Wiring Sequence:

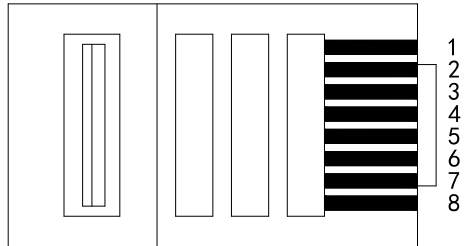


Figure 5.7.3-2

BMS/METER port function definitions:

No.	BMS Terminal Definition	METER Terminal Definition
1	-	485A-METER
2	-	485B-METER
3	-	-
4	CANH	-
5	CANL	CT-
6	-	CT+
7	485A-BMS	-
8	485B-BMS	-

Step:

1. Connect the communication Cable to the RJ45 crystal head.

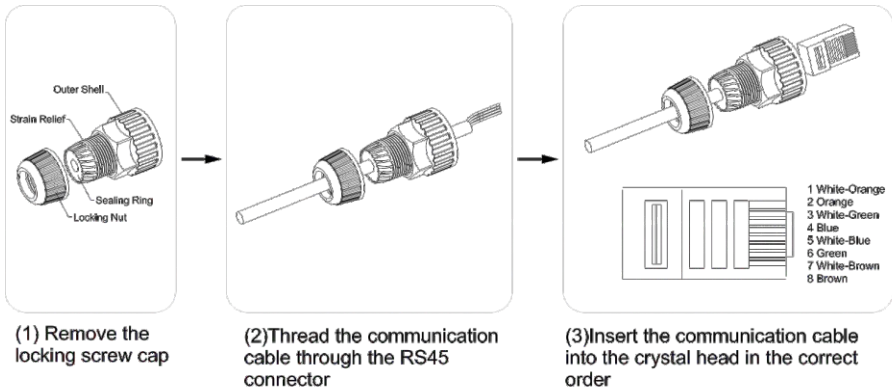


Figure 5.7.3-3 Assembling the RJ45 Connector

2. Connect the RJ45 connector to the corresponding RS45 port. Ensure the connection is secure and the ports match.

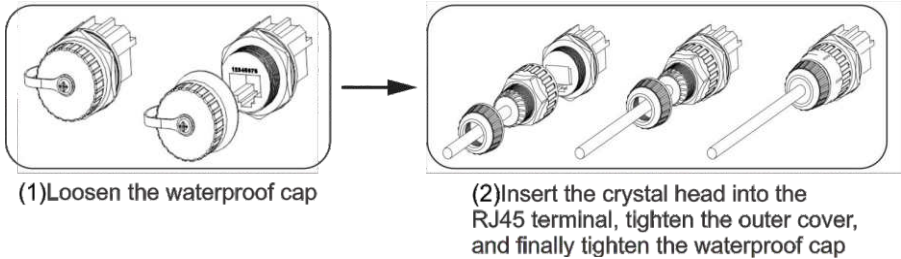


Figure 5.7.3-4 Installing the RJ45 Connector

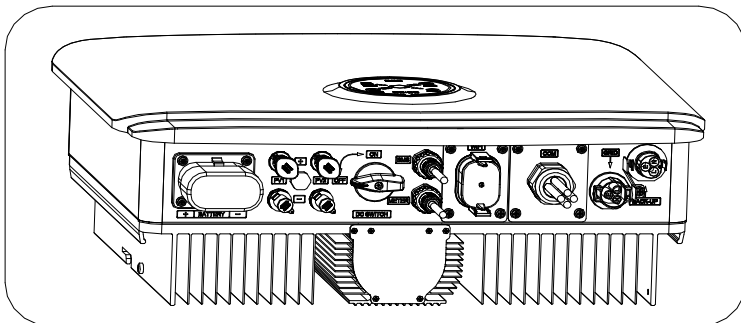


Figure 5.7.3-5 Complete Installation Diagram

5.7.4 Installing the CT/Meter

Note

✧ Meter/CT Installation Method and Steps.

- 1、Ensure that the inverter's PV switch, battery pack switch, and AC breaker are all in the off position before connecting the inverter.
- 2、Follow the diagram to connect the energy storage system cables, and connect the CT/Meter to the inverter's Meter terminal.
- 3、The CT/Meter should be installed at the grid connection point, close to the grid terminal. Ensure there is no load between the CT/Meter and the grid.
- 4、Keep the switches for the grid, PV, and battery in the off position, and wait for the inverter to power on.
- 5、Observe the status displayed on the screen of inverter.
- 6、If the CT/Meter is installed correctly, the power flow on the screen should show energy flowing from the grid to the load, as shown in Figure 5.7.3-6.
- 7、If you observe that the power is flowing from the inverter to the grid, it indicates that the CT/Meter is installed in the wrong direction. You need to loosen the CT and adjust its direction before securing it back to the power cable.



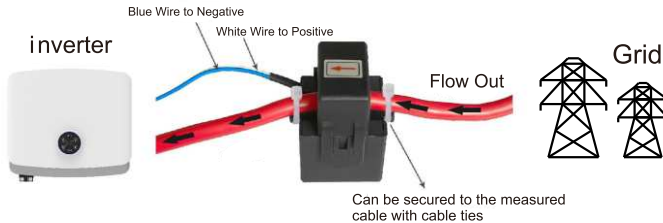
Figure 5.7.4-1 LCD Display

Operation Steps:

1、Install the CT(standard configuration)

- 1.1 CT can be directly stuck in a suitable position on the L line of the power grid, and can be fixed more firmly with zip ties; At the same time, pay attention to the direction of the current flow. The direction of the arrow is the outflow (as shown in Figure 5.7.4-2), and the other end of the crystal head is directly inserted into the meter on the inverter.

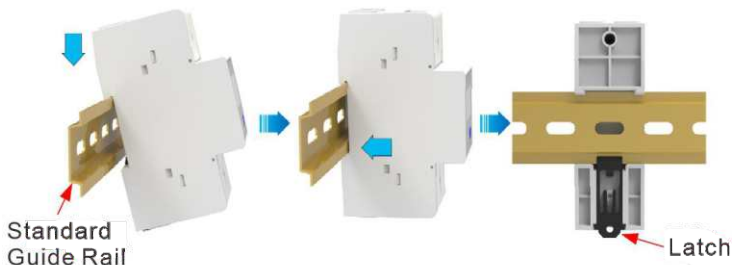
Figure 5.7.4-2 Install the CT



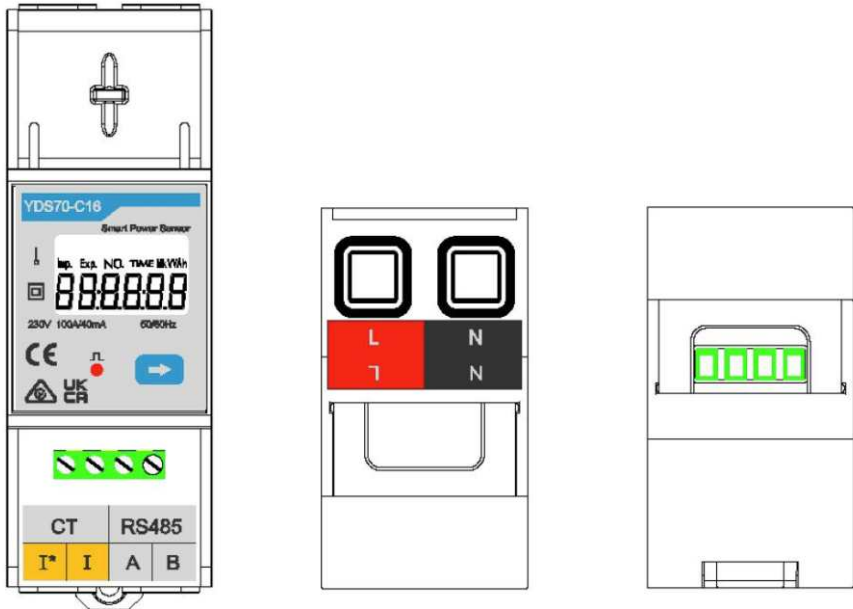
2、Install the Meter(Optional)

- 2.1、Install the smart meter onto the standard guide rail from top to bottom, and then push the meter into the guide rail from bottom to front.
- 2.2、When disassembling, please use a screwdriver to forcefully grip the flexible plug and then remove the smart meter.
- 2.3、CT can be directly stuck in a suitable position on the L line of the power grid, and can be fixed more firmly with zip ties; At the same time, pay attention to the direction of the current flow, with the arrow indicating outflow (as shown in Figure 5.7.4-3); The white wire output on the CT side is connected to meter I * (positive), and the white wire is connected to meter I (negative). The wiring diagram is as follows (note that this only provides CT wiring for our company, other CT products need to understand the corresponding positive and negative levels before connecting to the corresponding interface on the meter).

Figure 5.7.4-3 Install the Meter



Terminal Definitions:



Label	Function	Description
	LCD Display	Shows basic data, visible window size: 24.1mmX14.2mm
	Button	Page turning, setting
	Pulse Indicator	Indicates energy pulses
L	AC Voltage Line	Connects to AC230V live wire
N	AC Voltage Neutra	Connects to AC230V neutral wire
I*	AC Current CT Positive Input	Connects to the positive terminal of the current transformer
I	AC Current CT Negative Input	Connects to the negative terminal of the current transformer
A	RS485 Communication+	RS485 communication output positive terminal
B	RS485 Communication-	RS485 communication output negative terminal

Figure 5.7.4-4 Terminal Definitions

Wiring Diagram :

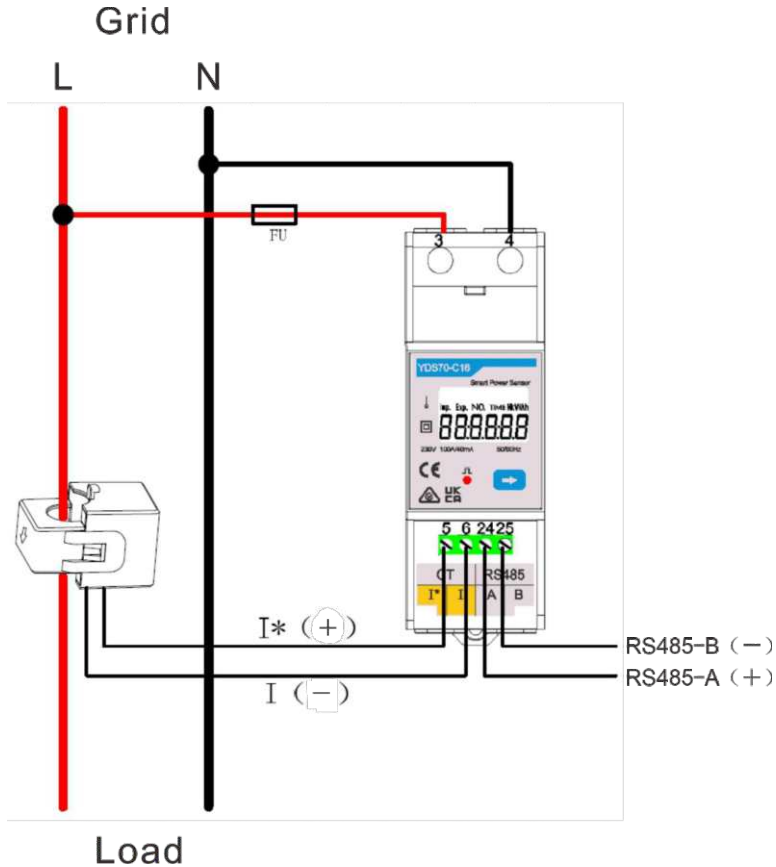


Figure 5.7.4-5 Wiring Diagram

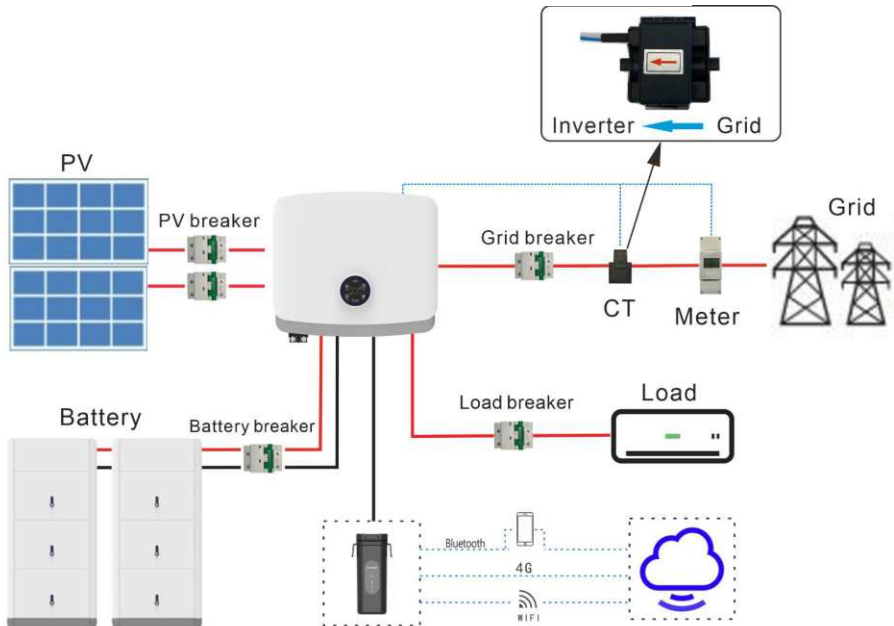
Notes:

- (1) It is recommended to add a fuse to the voltage input terminal to meet the safety requirements of relevant electrical standards. The fuse FU in the wiring diagram is recommended to be 2A.
- (2) This method is provided for connecting the meter/CT by our company. If you need to use other replacement meters/CTs, you must connect according to the terminal definitions.

Anti-Backflow Networking Solution (Single-Phase Scenario):

When using a single-phase load and Virgo series inverters for a self-consumption scenario, the anti-backflow function can be implemented with different brands of meters or CTs. The method for achieving anti-backflow with the photovoltaic grid-tied inverter depends on the specific inverter model being used. To ensure strict implementation of the anti-backflow function, there may be instances where the load's electricity consumption is sourced from the grid. The following networking wiring scheme is provided for reference only.

Figure 5.7.4-6 Anti-Backflow



Different brands of meters or CTs:

	YADA	CHNT	namin	bjstmck
meter	YDS70-C16	DDSU666		
CT	Matching CT CTF16TH		EICT-120K-T210C	HY33C1
CT wire colors	+:white -:blue		+:red -:black	+:red -:black

CT connection mode is positive: white (red) color, negative: blue (black) color.

5.7.5 Installing the Communication Module

Note

- ✧ The inverter supports setting parameters, connecting to cloud monitoring, and monitoring the operational status of the inverter through the WiFi Kit, Wi-Fi/LAN Kit, and 4G module.
- ✧ For detailed information on the communication module, refer to the documentation provided with the module or obtain more details from the official website.

Operating Steps:

Step 1: Remove the dust cover of the data collector and ensure to keep it safe.

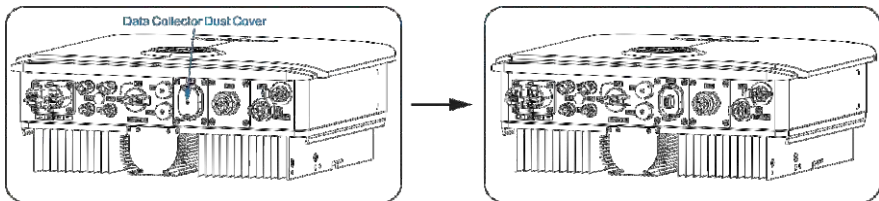


Figure 5.7.4-1 Removing the Data Collector Dust Cover

Step 2: Install the data collector.

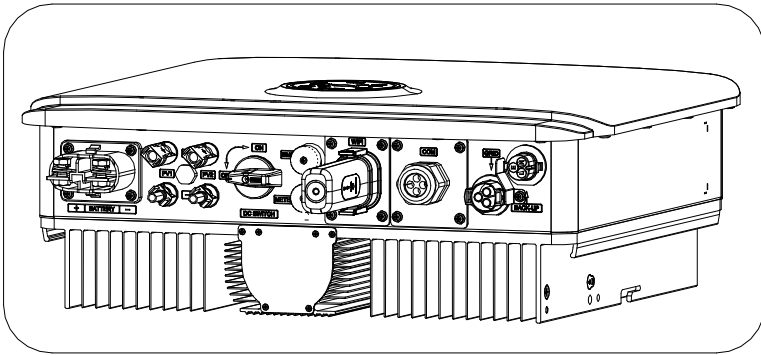
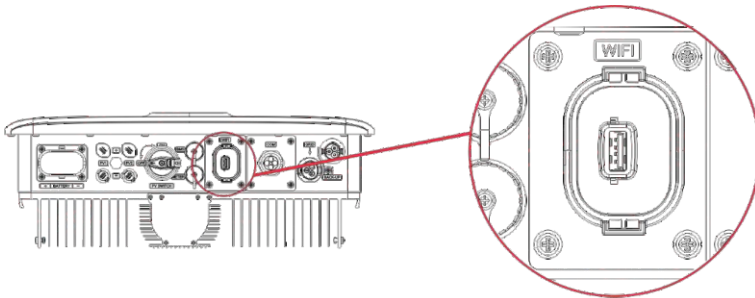


Figure 5.7.4-2 Installing the data collector



	1. 5V
	2. 485B
	3. 485A
	4. GND

Chapter 6

Inverter Commissioning

- 6.1 Pre-Power-Up Inspection
- 6.2 Powering Up the Inverter

6.1 Pre-Power-Up Inspection

No.	Inspection Items
1	Ensure the installation space for the inverter is reasonable, free of obstructions, and allows for easy operation and maintenance. The installation location should facilitate ventilation and heat dissipation, and the environment should be clean and tidy.
2	Ensure the protective earth, DC input cable, AC output cable, communication cable, and battery power cable are correctly and securely connected.
3	Ensure the wiring harness meets the routing requirements, is appropriately distributed, undamaged, and the cable ends are evenly wrapped. Verify that unused cable holes are sealed for waterproofing. Check that all cables passing through the cable holes are protected.
4	Ensure the earth wire connection is reliable. Ensure the DC switches are off and the inverter's switches are in the off position.
5	Verify that the voltage and frequency at the inverter's grid connection point meet the grid requirements.

6.2 Powering Up the Inverter

Note
✧ Before closing the DC switch of the inverter's photovoltaic components, use a multimeter to measure the DC voltage of the photovoltaic components to ensure it is within the allowable range. ✧ Before closing the AC switch between the inverter and the grid, use a multimeter to measure the AC voltage between the inverter and the grid to ensure it is within the allowable range.

Step 1: Close the GRID circuit breaker of the inverter.

Step 2: Close the BACK-UP circuit breaker of the inverter.

Step 3: Close the energy storage circuit breaker of the battery pack.

Step 4: Close the DC input circuit breaker of the inverter.

Chapter 7

System Configuration

- 7.1 Account registration
- 7.2 Connecting the Inverter to the Internet
- 7.3 Creating a Plant
- 7.4 Adding Equipment to a Plant

When powering on the equipment for the first time, ensure that a professional correctly sets the parameters. Incorrect settings may result in non-compliance with the certification requirements of the country/region where the equipment is located, affecting the normal operation of the equipment.

Use the NovoSolar APP to connect the equipment to the cloud monitoring platform.

Note

- ✧ To ensure proper operation and monitoring of the equipment, use the NovoSolar APP to complete the equipment parameter settings and connect to the cloud.

The **【NovoSolar】** APP is a mobile application that can interact with the inverter through Bluetooth, WiFi, or a 4G module. The main functions of the **【NovoSolar】** APP include:

- (1) Checking operational data, software versions, and alarm messages.
- (2) Checking graphical parameters, communication parameters, and setting information.

To install the **【NovoSolar】** APP:

Download from the app store **【iOS/Android】** .

Search for "NovoSolar" in the app store, download the **【NovoSolar】** application, and install it. After installation, select your language.

Note: If you have already installed the **【NovoSolar】** application, search for **【NovoSolar】** in the app store to check if the application version is up to date.

7.1 Account registration

Account registration can be via the login page of NovoSolar APP or web terminal, select "Account registration" to enter the registration page, select your role, and then fill in your registration information, after submission, the system will automatically send your account information to your registered email, please pay attention to check, if not, please check whether the email bin is intercepted. Or contact customer service.

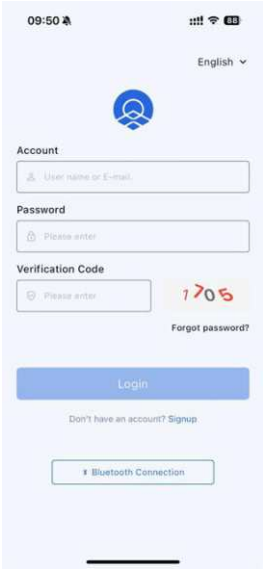


Figure 7.1-1 login page

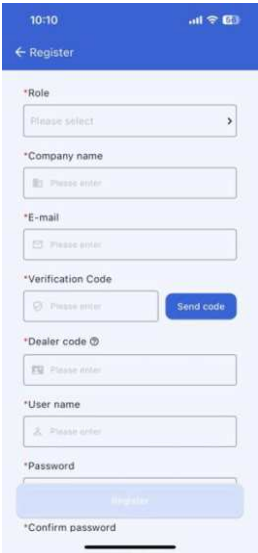


Figure 7.1-2 Account registration page

7.2 Connecting the Inverter to the Internet

The monitoring communication module on the equipment itself does not have communication capabilities, so it cannot directly transmit data after being powered on. To enable your communication module to have communication capabilities, you need to configure the network for the communication module. You need to download the NovoSolar APP for configuration. The configuration steps are as follows:

1. After powering on the equipment, the communication module will automatically power on. When the indicator light turns green  it indicates that the data collector is working properly.



Figure 7.2-1 Communication Module

2. Turn on Bluetooth and WiFi on your mobile phone, and run the APP to log in (if you do not have an account, please apply for one first).

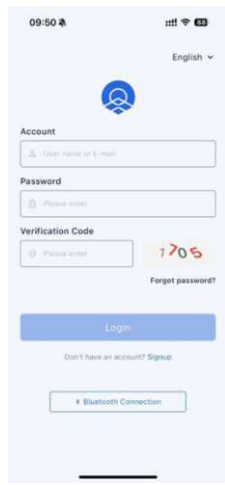


Figure 7.2-2 Mobile App Login Page

3. Select "Bluetooth Connection" on the login page. The APP searches for a list of nearby devices via Bluetooth. You can select the device you want to connect to and pair it (the pairing password is the last 4 digits of the device SN).

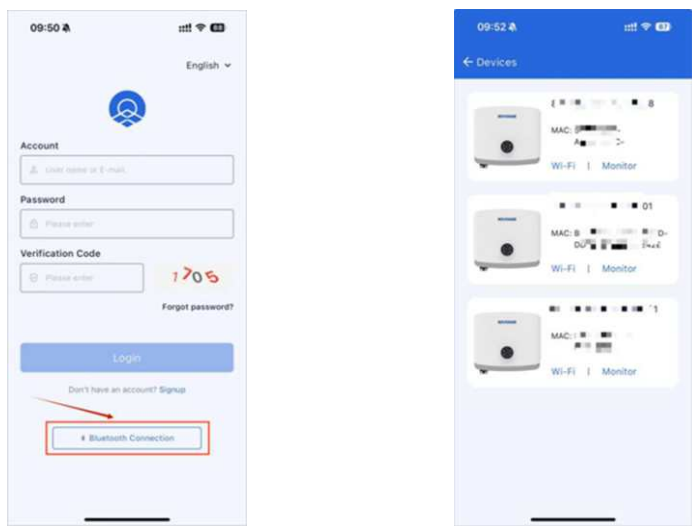


Figure 7.2-3 “Me”Page after login

Figure 7.2-4 Bluetooth Local Monitoring Page

4. On the device page, click "Wi-Fi" to configure the network. On the Android system, select the Wi-Fi to connect and enter the password. On the Apple system, you need to manually enter the Wi-Fi name and password; click "Monitor" to enter local monitoring.

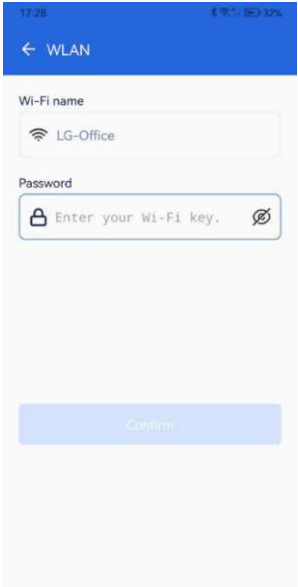


Figure 7.2-5 Enter Wi-Fi Password

5. After successfully connecting to the network, the indicator light on the data collector will turn solid green.



Figure 7.2-6 Network Connection Success

7.3 Creating a Plant

Login to your account

1. On the APP home page, click the  button at the bottom menu to "Add Plant".

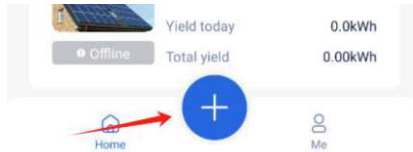


Figure 7.3-1 Add Plant Icon

2. On the Add Plant page, fill in the actual information of the plant. To facilitate the calculation and statistics of plant data, users need to complete the following information as accurately as possible:

- 1) Enter the name of the plant
- 2) Select the type of plant
- 3) Confirm the inverter capacity
- 4) Confirm the installation location of the plant
- 5) Fill in other information as required

For data accuracy, please complete as much information on the page as possible.

Figure 7.3-2 Information Filling Page

Click "Confirm" to indicate that you have successfully created your plant. However, the plant will not have any data yet, as you have not added any equipment to this plant.

7.4 Adding device to a Plant

1. On the APP home page, first switch to the device list page, then click the “” button to add device.



Figure 7.4-1 Add Device Button

2. Scan the device serial number, then select the plant to which the device will be added.



Figure 7.4-2 Scan Page

3. Finish

After successfully adding your device, you can check the status of your equipment at any time via the APP.



Figure 7.4-3 Checking Test Equipment

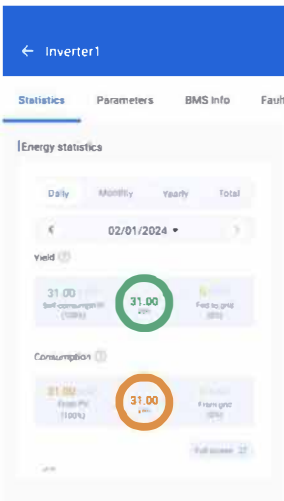
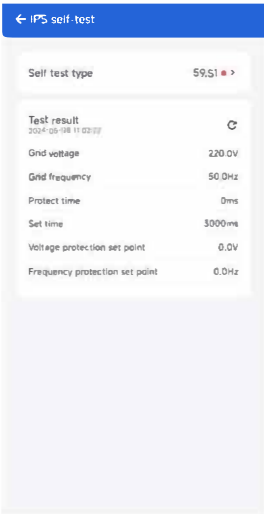
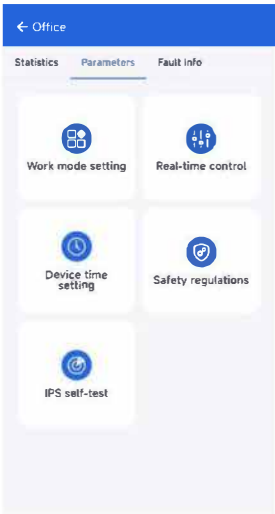


Figure 7.4-4 Checking Equipment Data

4. Self-Test of the Equipment

Enter the "Parameter Settings - Self-Test" page, select the self-test type, and confirm to complete the self-test.



(Note: If a password is required, please contact the distributor.)

5、Remote control

Enter the "Parameter Settings - Instant Control" page, click "Remote Power On/Off." The app transmits the power on/off signal to the data collector, which then transmits the signal to the inverter control board via the 2 and 3 PINs of CN5 to execute the power on/off action.

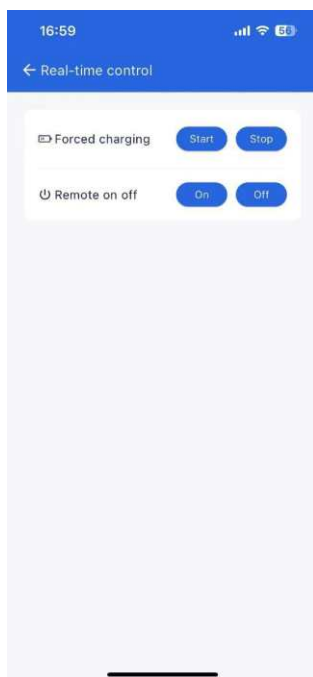


Figure 7.4-7 Instant contro

Chapter 8

System Maintenance

- 8.1 Powering-off the Inverter
- 8.2 Disassembling the Inverter
- 8.3 Decommissioning the Inverter
- 8.4 Troubleshooting
- 8.5 Routine Maintenance

When performing power on, power off, disassembly, decommissioning, or maintenance on the inverter, please follow the warnings and precautions listed below:

 Danger

- ✧ During the operation of the equipment, there may be high voltage present, which could result in electric shock, causing death, serious personal injury, or severe damage to the equipment. Therefore, before performing any maintenance work, the equipment must be powered off, and the operation must be performed according to the safety precautions and steps listed in this manual and related documents. Failure to do so may result in electric shock hazards due to incorrect operation.
- ✧ Even after the system is powered off, there may still be residual voltage in the machine, which could cause electric shock or injury. Therefore, wait at least 5 minutes after powering off the inverter system before performing any operations, and wear protective gloves during the operation.

Note

- ✧ Please ensure you are familiar with the contents of this manual and have the appropriate tools and testing equipment for the maintenance tasks.
- ✧ Before performing any maintenance work, power off the equipment and wait for the appropriate delay as indicated by the discharge labels to ensure the equipment is fully power off before proceeding.
- ✧ During maintenance, please prevent unauthorized personnel from entering the maintenance site, and clearly mark the area with warning signs or barriers.
- ✧ When maintaining the inverter's back stage electrical equipment or distribution equipment, the inverter's AC and DC switches need to be disconnected.
- ✧ If the equipment encounters a fault, please contact your distributor for resolution.
- ✧ The equipment can only be powered on after the fault is completely resolved; otherwise, the fault may worsen or cause equipment damage.

8.1 Powering off the Inverter

- Step 1: Turn off the inverter's GRID AC breaker.
- Step 2: Turn off the inverter's BACK-UP AC breaker.
- Step 3: Turn off the storage circuit breaker between the inverter and the battery.
- Step 4: Turn off the inverter's DC switch.

8.2 Disassembling the Inverter



Warning

- ✧ Ensure the inverter is powered off and maintenance personnel are equipped with personal protective equipment.

- Step 1: Perform the system power-off procedure by disconnecting all electrical connections of the inverter, including DC cables, AC cable.
- Step 2: Remove the inverter from the mounting bracket.
- Step 3: Dismantle the mounting bracket.
- Step 4: If you still have the original packaging of the inverter, place it in the original packaging and secure it with tape. If the original packaging is not available, use a sturdy cardboard box that matches the weight and dimensions of the inverter to secure it properly.
- Step 5: Store the inverter properly. If the inverter is to be used again in the future, ensure that the storage conditions meet the requirements.

8.3 Decommissioning the Inverter

When the inverter has reached the end of its service life and needs to be decommissioned, please dispose of it in accordance with the electronic waste disposal regulations of the country/region where the inverter is located.

8.4 Troubleshooting

Please follow the methods below for troubleshooting. If these methods do not help, please contact the after-sales service.

When contacting the after-sales service, please collect the following information to facilitate quick problem resolution:

1. Inverter information, such as: serial number, software version, installation date, fault occurrence time, fault frequency, etc.
2. Installation environment, such as: weather conditions, whether the components are shaded, presence of shadows, etc. It is recommended to provide photos, videos, or other files to assist in problem analysis.
3. Grid conditions.

No.	Fault Description	LCD Display	Fault Cause	Solution
1	Bus Overvoltage	E10	PV voltage too high, or internal BUS voltage of inverter too high	Check if the input voltage of PV is too high. If the PV voltage is within the normal range, wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
2	Bus Undervoltage	E11	Internal BUS voltage of inverter too low	Wait for the inverter to self-check.
3	Boost Overcurrent	E12	Module function abnormal, causing boost overcurrent	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
4	Boost2 Overcurrent	E13	Module function abnormal, causing boost2 overcurrent	
5	Inverter Overcurrent	E14	Module function abnormal, causing inverter overcurrent	
6	BuckBoost Overcurrent	E15	Module function abnormal, causing buck-boost overcurrent	
7	Overpressure Overcurrent	E16	Module function abnormal, causing overpressure overcurrent	
8	Battery Overcurrent	E17	Module function abnormal, causing battery overcurrent	
9	Output Short Circuit	E18	Backup terminal detected short circuit	Check if the backup terminal of the inverter is short-circuited or overloaded, and reduce the load if necessary.
10	Backup AC Overcurrent	E19	Backup terminal detected power exceeding rated capacity	Check if the backup terminal is short-circuited or overloaded, and reduce the load if necessary.
11	DC Component Overvoltage	E1A	Grid voltage detected excessive DC component	Check if the DC component of the grid voltage is too high. If the fault persists, please contact your distributor or after-sales service center.

12	Inverter Bridge Fault	E1B	Inverter bridge fault detected	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
13	BuckBoost Fault	E1C	Buck-boost fault detected	
14	DABB Fault	E1D	DABB fault detected during startup, possibly affecting operation	
15	Boost1 Fault	E1E	Boost1 fault detected	
16	Boost2 Fault	E1F	Boost2 fault detected	
17	Battery Overvoltage	E20	Battery pack voltage detected too high	Check if the air switch of the battery pack is turned off. If the fault persists, please contact your distributor or after-sales service center.
18	Inverter Overtemperature	E21	Inverter overtemperature detected	Check if the installation environment of the inverter is well-ventilated. Wait for the inverter to cool down.
19	PV1 Overvoltage	E22	PV input voltage of PV1 detected too high	Check if the input voltage of PV is too high. If the fault persists, please contact your distributor or after-sales service center.
20	PV2 Overvoltage	E23	PV input voltage of PV2 detected too high	Check if the input voltage of PV is too high. If the fault persists, please contact your distributor or after-sales service center.
21	PV1 Reverse Polarity	E24	PV input polarity of PV1 reversed	Check if the input polarity of PV is reversed.
22	PV2 Reverse Polarity	E25	PV input polarity of PV2 reversed	Check if the input polarity of PV is reversed.
23	Boost1 Current Sensor Fault	E26	Current sensor abnormal on the self-checking	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
24	Boost2 Current Sensor Fault	E27		
25	Inverter DC Leakage Current Fault	E28		
26	Inverter AC Leakage Current Fault	E29		
27	Battery Pack Leakage Current Fault	E2A		
28	BuckBoost Leakage Current Fault	E2B		
29	Leakage Current Sensor Fault	E2C		
30	Leakage Current Too High	E2D	Leakage current detected too high	Check if the grounding of the inverter is good. Check if the output line of the inverter is damaged or has aged.
31	Grid Connection Relay Abnormal	E2E	Grid connection relay abnormal detected	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
32	Grid Connection Relay Abnormal Self-check	E2F	Grid connection relay abnormal detected during self-check	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.

33	Insulation Resistance Too Low (Positive)	E30	Insulation resistance of PV+ to ground too low	Check if the grounding of the inverter is good. Check if the PV system is damaged.
34	Insulation Resistance Too Low (Negative)	E31	Insulation resistance of PV- to ground too low	Check if the grounding of the inverter is good. Check if the PV system is damaged.
35	Inverter Output Power Too High	E32	Inverter output power detected too high	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.
36	Inverter Fault	E33	Internal grid connection voltage detection fault	Wait for the inverter to self-check. If the fault persists, please contact your distributor or after-sales service center.

8.5 Routine Maintenance



Warning

- ✧ Ensure the inverter is powered off, and maintenance personnel must wear protective equipment.

Maintenance Item	How to Maintenance	Frequency
System Cleaning	1. Check the heat dissipation fins and the air inlets/outlets for any foreign objects or dust.	Once every 6 months to 1 year
System Operation Status	1. Observe if the appearance of the inverter shows any signs of damage or deformation. 2. Listen for any unusual noises during operation to see if there are any abnormalities. 3. Check if the operational parameters of the inverter match the set parameters.	Once every 6 months to 1 year
Electrical Connections	1. Check if the electrical connections show signs of loosening, corrosion, or if the insulation appears worn or cracked. Also check for any signs of overheating on the metal parts of the terminals and cables. 2. Ensure the electrical connections are secure and reliable. 3. Check if the earthing connection is secure. 4. Check the status of the DC terminal, storage terminal, COM interface, and other external monitoring components' covers. Ensure they are in proper condition and tightened.	Once every 6 months to 1 year
Sealing Integrity	Check if the sealing of the equipment's enclosure meets the required standards. If there are signs of large cracks or incomplete sealing, reseal as necessary.	Once every 6 months to 1 year

Chapter 9

Technical Data

Virgo Series Technical Data

Virgo Series Technical Data

Model	Virgo 3K-S	Virgo 3K6-S	Virgo 4K-S	Virgo 4K6-S	Virgo 5K-S	Virgo 6K-S
PV input quantities						
Vmax PV (absolute maximum) [d.c.V]	600					
Rated voltage [d.c.V]	360					
PV input operating voltage range [d.c.V]	100-550					
MPPT voltage range (full load) [d.c.V]	250-520					
Maximum operating PV input current [d.c.A]	16/16					
Isc PV (absolute maximum) [d.c.A]	20/20					
Max. inverter backfeed current to the array [d.c.mA]	√ 10					
MPPT tracker number	2					
Maximum input power [W]	8000	8600	9000			
Battery input/output terminal parameters:						
Battery type	Sodium-ion					
Maximum voltage [d.c.V]	60					
Voltage (nominal or range) [d.c.V]	32-60					
Nominal battery voltage [d.c.V]	48					
Current (maximum continuous) [d.c.A]	100					

Maximum charge power [W]	5000					
d.c. output quantities						
Battery type	Lithium-ion					
Maximum voltage [d.c.V]	60					
Voltage (nominal or range) [d.c.V]	42-60					
Nominal battery voltage [d.c.V]	51.2					
Current (maximum continuous) [d.c.A]	100					
Maximum discharge power [W]	5000					
Maximum charge power from grid to battery [W]	3000	3680	4000	4600	5000	5000
a.c. input quantities						
Rated input voltage [a.c.V]	1P+N+PE, 230					
Frequency (nominal or range) [Hz]	50/60					
Voltage (nominal or range) [a.c.V]	230					
Rated input current [a.c.A]	13	16	17.4	20	21.7	26.1
Current (maximum continuous) [a.c.A]	26.1	32	34.8	40	43.5	43.5
Current (inrush) [a.c.A]	36.9	45.3	49.2	56.6	61.5	61.5
Rated input power [W]	3000	3680	4000	4600	5000	6000
Maximum continuous input active power [W]	6000	7360	8000	9200	10000	10000
Maximum continuous input apparent power [VA]	6000	7360	8000	9200	10000	10000
a.c. output quantities						
Rated output voltage [a.c.V]	1P+N+PE, 230					
Frequency (nominal or range) [Hz]	50/60					
Voltage (nominal or range) [a.c.V]	230					
Rated output current [a.c.A]	13	16	17.4	20	21.7	26.1

Current (maximum continuous) [a.c.A]	13	16	17.4	20	21.7	26.1
Current (inrush) [a.c.A]	18.4	22.6	24.6	28.3	30.7	36.9
Rated output active power [W]	3000	3680	4000	4600	5000	6000
Maximum output active power [W]	3000	3680	4000	4600	5000	6000
Maximum output apparent power [VA]	3000	3680	4000	4600	5000	6000
Power (maximum continuous) [W]	3000	3680	4000	4600	5000	6000
Maximum output fault current [a.c.A]	19.5	24	26.1	30	32.6	39.2
Maximum output overcurrent protection [a.c.A]	15.6	19.2	20.9	24	26	31.3
Power factor range	0.8 leading to 0.8 lagging					
Back up terminal parameters						
Nominal AC Output Power[W]	3000	3680	4000	4600	5000	5000
Nominal AC Output Voltage [a.c.V]	230					
Nominal AC Output Current [a.c.A]	13	16	17.4	20	21.7	21.7
Max. Output Current [a.c.A]	13	16	17.4	20	21.7	21.7
Nominal AC Output Frequency [Hz]	50/60					
Power factor range	0.8 leading to 0.8 lagging					
General parameter						
Ingress protection (IP) rating	IP66					
Operation temperature range [°C]	-25 to +60					
Full power temperature range [°C]	-20 to +40					
Storage temperature range [°C]	-40 to +70					
Relative humidity [%RH]	0 to +100					
Protective class (I, II, or III)	Class I					
Pollution degree	PD3(Outdoor), PD2(Indoor)					
Overvoltage category	OVC II (PV, BAT), OVC III(Grid)					