



Three Phase BBox PVA 13kW
USER MANUAL

April 2021

To secure the full 10-years battery product warranty, be sure to install the Nelumbo three phase bbox PVA 13kW by qualified installers.

Warning:

Read this entire document before installing or using Nelumbo three phase bbox PVA 13kW. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death, or can damage Nelumbo three phase bbox PVA 13kW, potentially rendering it inoperable.

PRODUCT SPECIFICATIONS

All specifications and descriptions contained in this document are verified to be accurate at the time of printing. However, because continuous improvement is a goal at Nelumbo, we reserve the right to make product modifications at any time.

The images provided in this document are for demonstration purposes only. Depending on product version and market region, details may appear slightly different.

ERRORS OR OMISSIONS

To communicate any inaccuracies or omissions in this manual, please send an email to: nelumbo(@)nelumbo.cz

ELECTRONIC DEVICE: DO NOT THROW AWAY

Proper disposal of batteries is required. Refer to your local codes for disposal requirements.



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CONTENTS

1. Important Safety Instructions	4
2. Inverter Introduction	8
2.1 Basic features	8
2.2 Appearance Introduction	12
2.3 Display Interface	14
2.4 Specifications	15
2.5 Standard Packing List	17
3. Battery Introduction	18
3.1 Appearance Introduction	18
3.2 Specifications	21
3.3 Standard Packing List	22
4. Mechanical Installation	23
4.1 Selection of Installation Location	23
4.2 General installation steps	24
4.3 Cables Connection	27
5. Inverter Cables Connection	28
5.1 Electrical Connection	28
5.2 Communication Connection	39
5.3 Monitoring Device Installation	43
6. System Start and Stop	44
7. General Operation	45
7.1 Display Operation	45
7.2 Auto-Test	46
7.2 Monitoring and Configuration	46
8. Troubleshooting	47
8.1 Fault Messages	47
8.2 Maintenance	48






1. Important Safety Instructions

Save these important safety instructions.






Nelumbo three phase bbox PVA 13kW installation and repair instructions assume knowledge of high voltage electricity and should only be performed by nelumbo Certified Installers. Nelumbo assumes no liability for injury or property damage due to repairs attempted by unqualified individuals or a failure to properly follow these instructions. These warnings and cautions must be followed when using our product.

Symbols in this document





This manual uses the following symbols to highlight important information:

	Danger	Used to warn of urgent dangerous situations, if not avoided, it could result in death or serious personal injury.
	Warning	Indicates a hazardous situation which, if not avoided, could result in injury or death.
	Caution	Indicates a hazardous situation which, if not avoided, could result in damage to the equipment.
	Attention	Used to transmit the safety warning information about equipment or environment, if not avoided, it may cause equipment damage, data loss, equipment performance degradation or other unpredictable results. "Attention" does not involve personal injury.
	Note	Indicates an important step or tip that leads to best results, but is not safety or damage related.









Symbols on the Hybrid Inverter

	Power indicator.
	Grid status indicator.
	Inverter status indicator.
	Battery SOC and status indicator.
	Grounding symbol, the inverter casing needs to be properly grounded.
















Symbols on the Packing box







	Handle with care.
	This side up.
	Keep dry.
	Stacked layers.

Symbols on the Inverter nameplate





	The inverter cannot be disposed of with household waste.
	Please read the instructions carefully before installation.
	Do not touch any internal parts of the inverter until 5 min after being disconnected from the mains and PV input.
	CE mark, the inverter complies with the requirements of the applicable CE guidelines.
	TUV certification.
	Danger. Risk of electric shock!
	The surface is hot during operation and no touch is allowed.
	Electric shock hazard, it is strictly forbidden to use the person to disassemble the inverter casing.

GENERAL INFORMATION

-  Warning: Read this entire document before installing or using Nelumbo three phase bbox PVA 13kW. Failure to do so or to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death, or can damage Nelumbo LFP Battery, potentially rendering it inoperable.
-  Warning: A battery can present a risk of electrical shock, fire, or explosion from vented gases. Observe proper precautions.
-  Warning: Nelumbo three phase bbox PVA 13kW installation must be carried out only by nelumbo Certified Installers, who have been trained in dealing with high voltage electricity.
-  Warning: The product is heavy and challenging to lift.
-  Warning: Use nelumbo LFP Battery only as directed.
-  Warning: Do not use nelumbo LFP Battery if it is defective, appears cracked, broken, or otherwise damaged, or fails to operate.
-  Warning: Before beginning the wiring portion of the installation, first power off the inverter and then open the AC and DC disconnect switches (if applicable for the installation).
-  Warning: Do not attempt to open, disassemble, repair, tamper with, or modify nelumbo LFP Battery. Nelumbo LFP Battery is not user serviceable. LFP Cells in nelumbo Battery are not replaceable. Contact the nelumbo Authorized Reseller who sold the nelumbo LFP Battery for any repairs.
-  Warning: Do not connect nelumbo LFP Battery to alternating current carrying conductors. Nelumbo All-in-one storage system including battery and inverter must be wired to either an inverter or a DC combiner panel that is then wired to an inverter. No other wiring configuration may be used.
-  Warning: Nelumbo LFP Battery contains components, such as switches and relays, that can produce arcs or sparks.
-  Warning: To protect nelumbo LFP Battery and its components from damage when transporting, handle with care. Do not impact, pull, drag, or step on nelumbo LFP Battery. Do not subject nelumbo LFP Battery to any strong force. To help prevent damage, leave nelumbo LFP Battery in its shipping packaging until it is ready to be installed.
-  Warning: Do not insert foreign objects into any part of nelumbo LFP Battery.
-  Warning: Do not expose nelumbo LFP Battery or its components to direct flame.
-  Warning: Do not install nelumbo LFP Battery near heating equipment.
-  Warning: Do not immerse nelumbo LFP Battery or its components in water or other fluids.

-  Caution: Do not use cleaning solvents to clean nelumbo LFP Battery, or expose nelumbo LFP Battery to flammable or harsh chemicals or vapors.
-  Caution: Do not use fluids, parts, or accessories other than those specified in this manual, including use of non-genuine nelumbo parts or accessories, or parts or accessories not purchased directly from nelumbo or a nelumbo-certified party.
-  Caution: Do not place nelumbo LFP Battery in a storage condition for more than one (1) month, or permit the electrical feed on the nelumbo LFP Battery to be severed for more than one (1) month, without placing nelumbo LFP Battery into a storage condition in accordance with nelumbo's storage specifications.
-  Caution: Do not paint any part of nelumbo LFP Battery, including any internal or external components such as the exterior shell or casing.
-  Caution: Do not connect nelumbo LFP Battery directly to photovoltaic (PV) solar wiring.
-  Caution: When installing nelumbo LFP Battery in a garage or near vehicles, keep it out of the driving path. If possible, install the nelumbo LFP Battery on a side wall and/or above the height of vehicle bumpers.

ENVIRONMENTAL CONDITIONS

-  Warning: Install nelumbo LFP Battery at a height that prevents damage from flooding.
-  Warning: Operating or storing nelumbo LFP Battery in temperatures outside its specified range might cause damage to nelumbo LFP Battery.
-  Warning: Do not expose the nelumbo LFP Battery to ambient temperatures above 60°C (140°F) or below -30°C (-22°F).
-  Caution: Ensure that no water sources are above or near nelumbo LFP Battery, including downspouts, sprinklers, or faucets.

2. Inverter Introduction

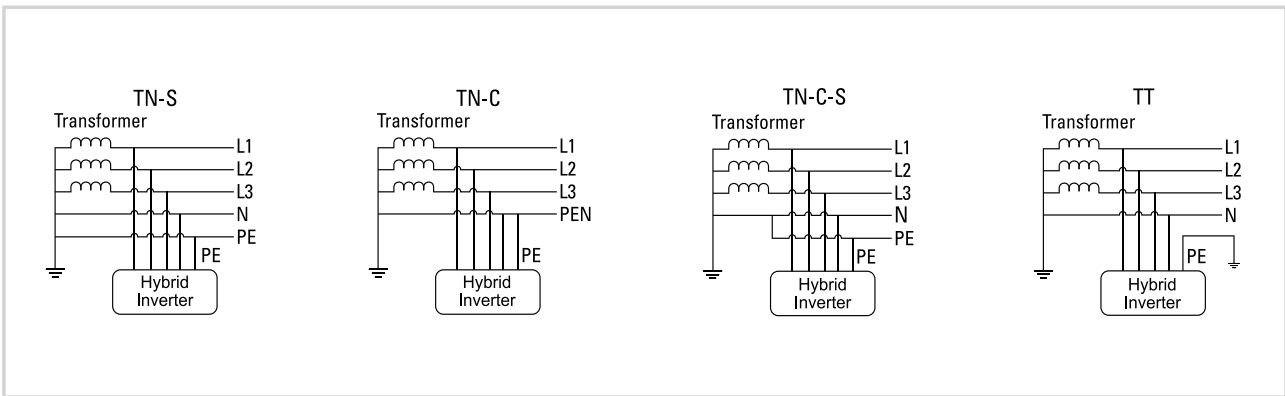
2.1 Basic features

Function

Nelumbo 10kW inverter is also known as hybrid inverter or storage inverter, which is mainly used to combine the PV array, lithium battery, loads and power grid to realize intelligent power management and dispatching.

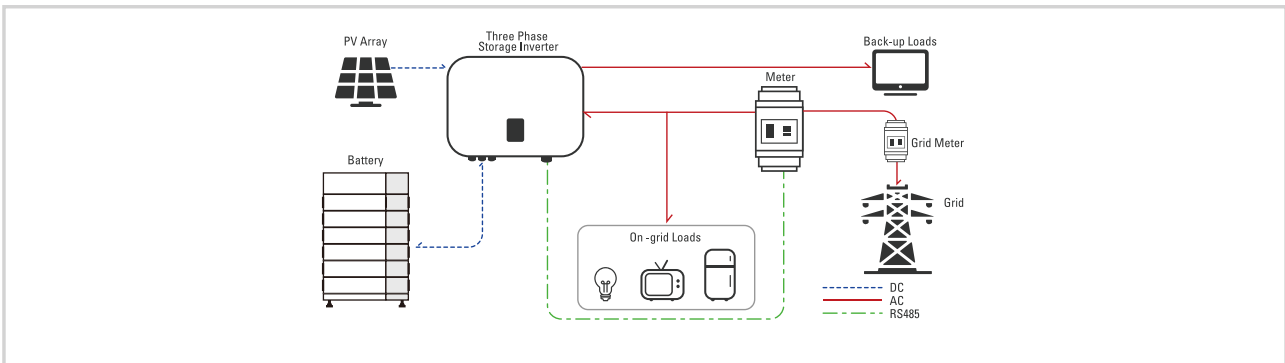
Applicable Grid Type

The applicable grid types of the nelumbo 10kW are TN-S, TN-C, TN-C-S and TT. When applied to the TT grid, the voltage of N to PE should be less than 30V.



Schematic Diagram of Hybrid System

The hybrid solar system is usually composed of the PV array, hybrid inverter, lithium battery, loads and power grid.



Operation Modes

Nelumbo Hybrid inverter has the following basic operation modes and you can configure the operation mode as per your preference in the App.

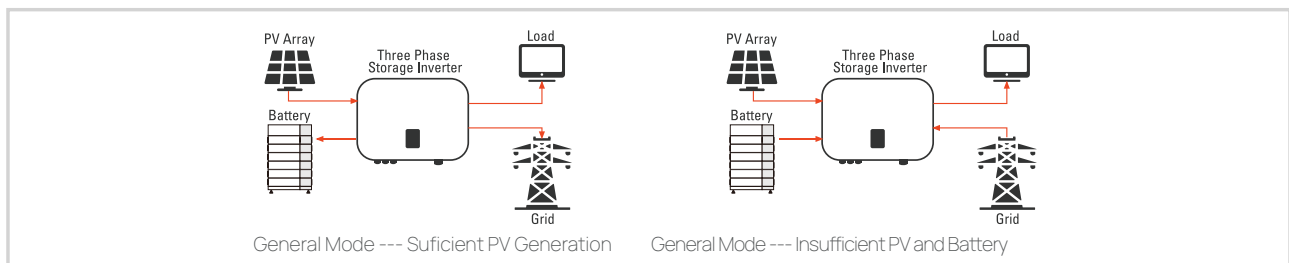
1/5 Maximun Solor Self-consumption

In this working mode, when the power from the PV array is sufficient, PV power will supply the loads, battery, and grid by the following sequence:

Loads > Battery > Grid.

PV power will supply the loads with priority, and secondly charge the battery if exceed PV energy, and then feed to the grid. (You can set the power to the grid to 0W if the local grid doesn't allow through APP or inverter display).

When the PV power is insufficient, the battery will discharge to supply loads, and the grid will join in if the battery power is not enough.

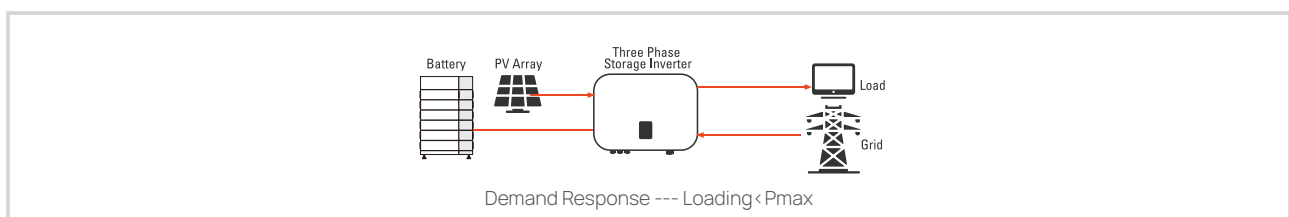


2/5 Demand Response

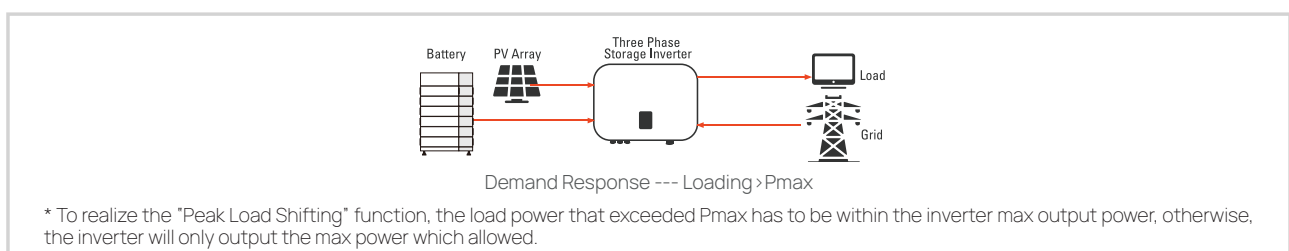
Setting Step: General Mode- → Pmax.

In this working mode, the customer can set the maximum allowable power from grid ("Pmax") through App or inverter display.

When the loads consumption less than the Pmax, loads are supplied by the PV array and grid together.



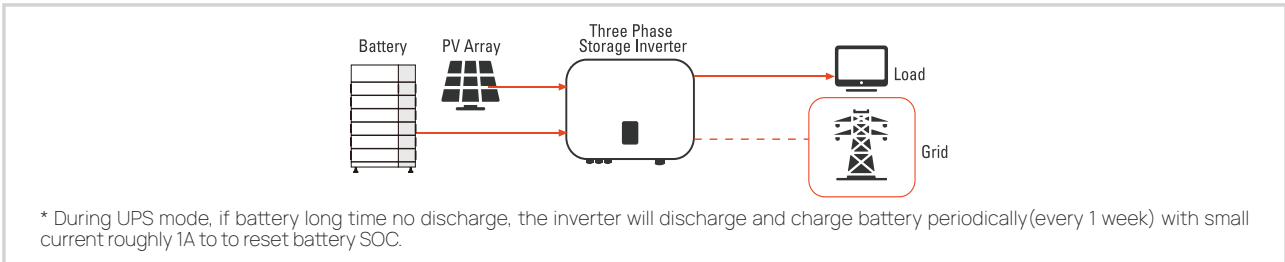
When the loads consumption more than the Pmax, the power exceeded Pmax (cannot be higher than the inverter max output power) will be supplied by the inverter. PV power will take the priority to supply loads and if not enough, the battery will support the real-time loading immediately.



3/5 UPS Power Back-up

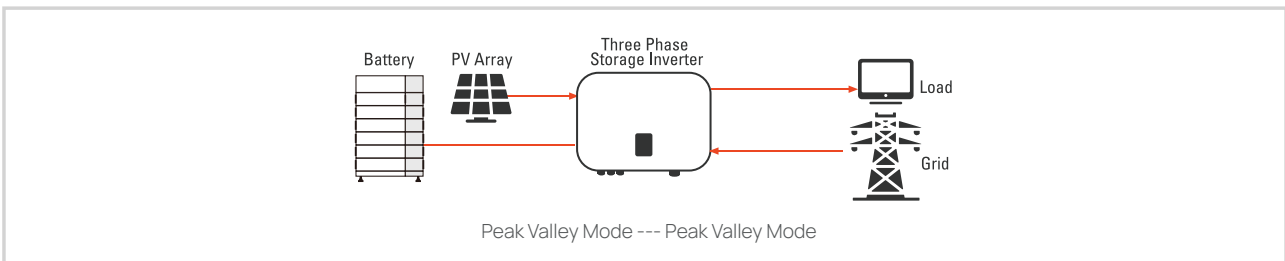
In this working mode, the inverter will use the power from PV or grid (Set by App) to charge the battery with full power and top priority until it is fully charged, and as long as the grid is there, the battery won't discharge.

When the grid is cut off, power from PV and battery will supply real-time loading connected to inverter back-up port immediately within 10ms.

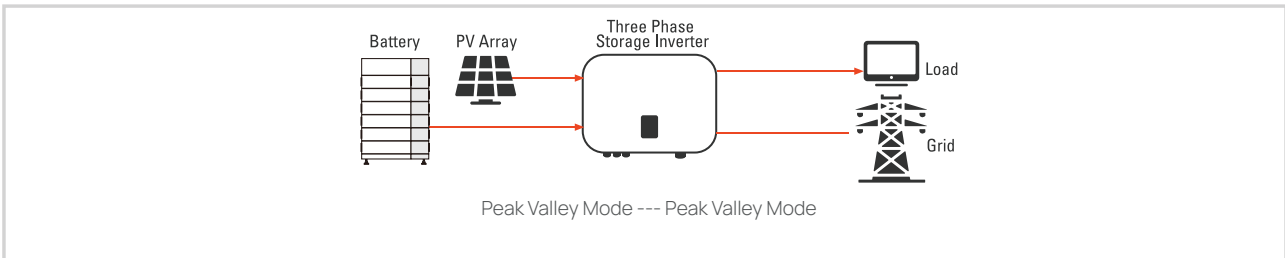


4/5 Peak Valley Mode

In this working mode, the customer can set time-based scheduled charge and discharge by App, inverter will use the power from PV or grid(selectable by APP) to charge the battery in the scheduled period.

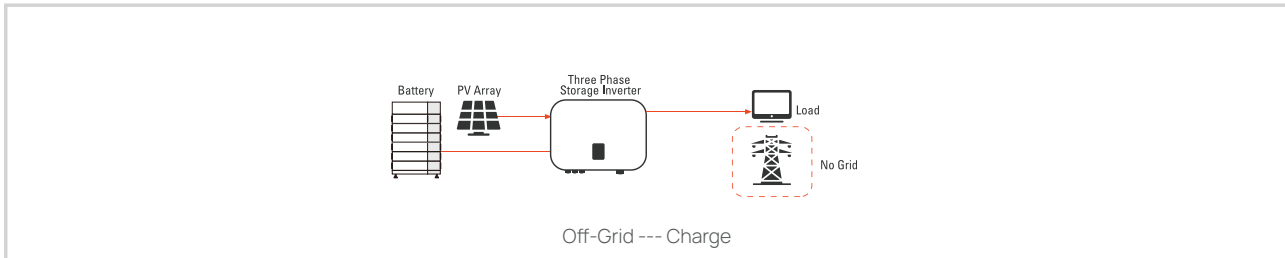


Inverter will use power from PV and battery to supply loads in the scheduled period and the insufficient part will be supplied by the grid.

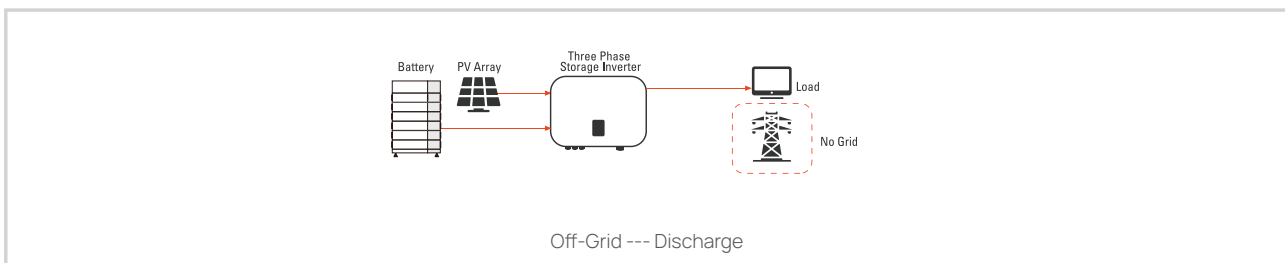


5/5 Smart Micro Grid Solution(Off-grid)

In the purely off-grid mode, power from PV will supply the back-up loads firstly and then charge the battery if there is surplus PV generation.



When the power from PV is weak, the battery will discharge to supply back-up loads together with or without PV.



Off-grid peak load capability

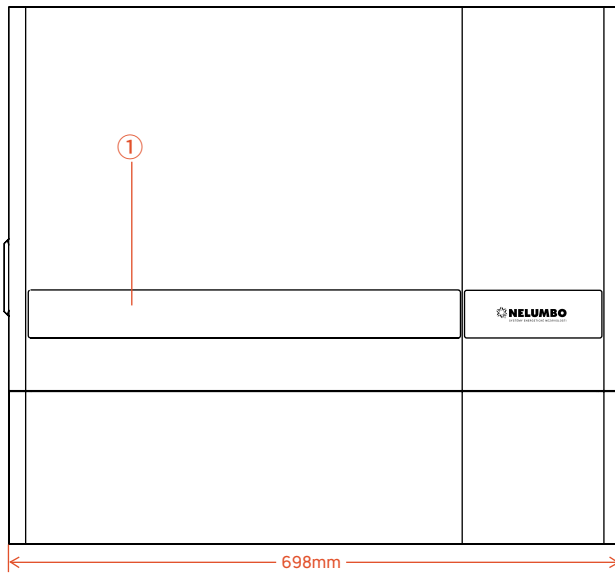
Nelumbo hybrid inverter supports max 2 times off-grid instantaneous overload of rated output power, and each phase support 1.25 times continuous overload of rated output power but only one of them can reach 1.25 times output power at the same time.

Storage conditions

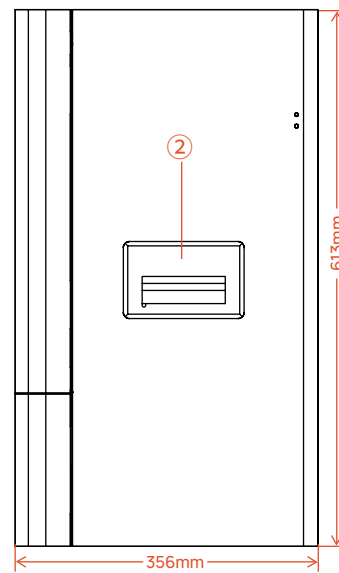
- 1) Inverter must be stored in its original packaging.
- 2) The storage temperature should be in the range of -30°C and $+60^{\circ}\text{C}$, and the relative humidity stored is less than 90%.
- 3) If a batch of inverters needs to be stored, the height of each pile should be no more than 6 levels.

2.2 Appearance Introduction

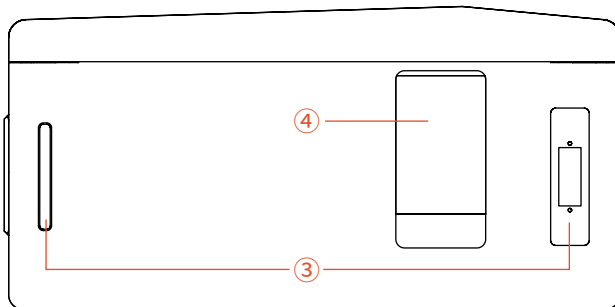
Front



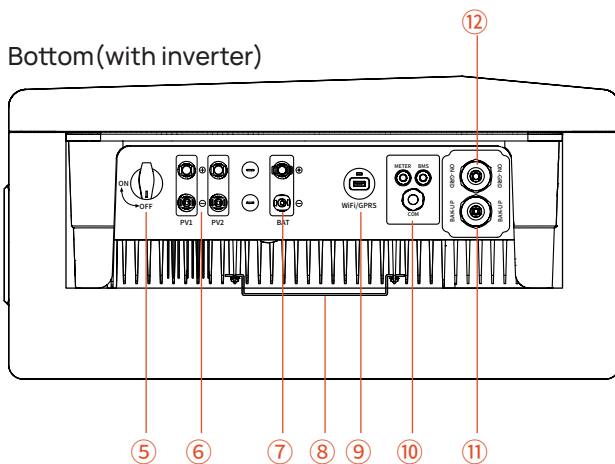
Right side



Bottom



Bottom (with inverter)

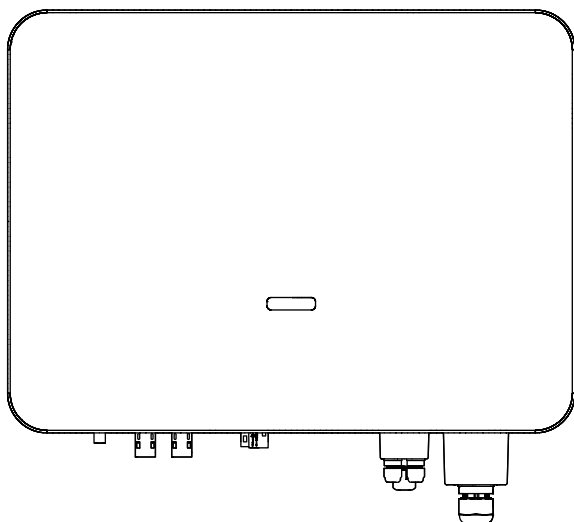


Inverter in all-in-one kit

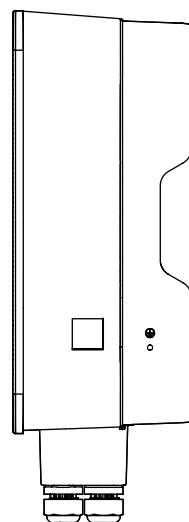
- ① Display
- ② Handle
- ③ Inverter positioner
- ④ Reserved connection hole
- ⑤ DC Switch (PV)
- ⑥ DC Input Terminal (PV)
- ⑦ Battery Input Terminal
- ⑧ Back Rail
- ⑨ WIFI/LAN Port
- ⑩ Com Port
- ⑪ Back-up Output Terminal
- ⑫ On-grid Output Terminal

Inverter

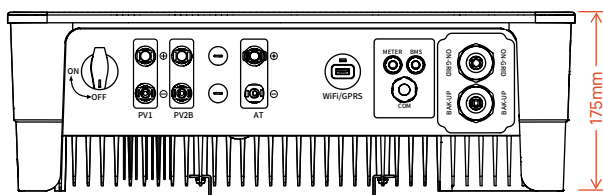
Front



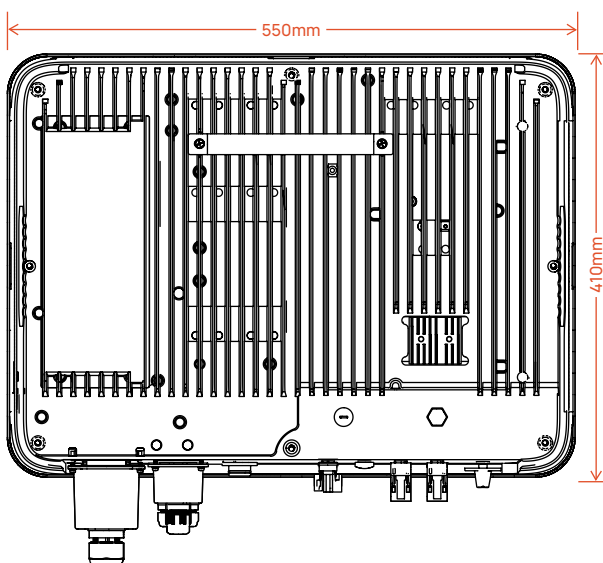
Right side



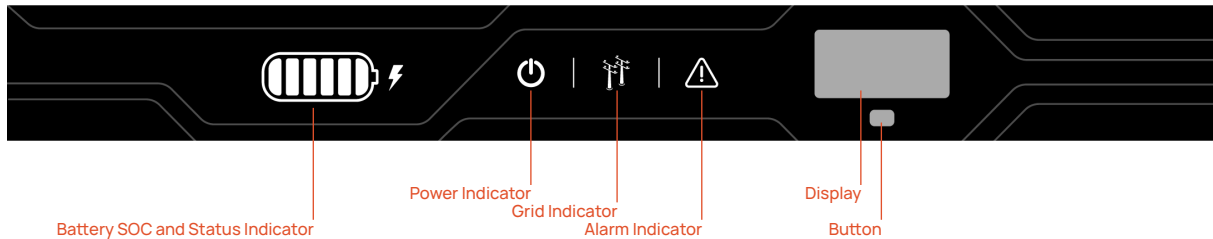
Bottom



Back



2.3 Display Interface



Item	Indicator	Status	Description
1	Battery SOC and Status Indicator	Off	Battery not connected or communication fault.
		Always on	Battery is discharging or waiting, indicator shows battery SOC.
		Single indicator flash	Battery is charging, indicator shows battery SOC.
2	Power Indicator	Off	Inverter no AC output.
		Quick flashing	Inverter entered self-test status.
		Always on	Inverter works normal.
3	Grid Indicator	Off	Disconnected with grid.
		Slow flashing	Inverter detected grid but not running in on-grid mode.
		Always on	Inverter works in on-grid mode.
4	Alarm Indicator	Off	The inverter is running normally.
		Slow flashing	The monitoring device is not connected to the router or is not connected to the base station.
		Quick flashing	The monitoring device is connected to the router or connected to the base station but not connected to the server.
		Orange	A warning is detected but inverter still working, view the warning info on the display.
		Red	An alarm or fault is detected, view the fault info on the display.
5	Display	On	Display the inverter operation information.
		Off	Display off to save power, press the button to wake up the display.
6	Button	Physical button	Switch display information and set parameters by short press or long press.

2.4 Specifications

Model	10KW-3P
Efficiency	
Max. Input Power (W)	13,000
Start-up Voltage (V)	180
Max. DC Input Voltage (V)	1000
Rated DC Input Voltage (V)	620
MPPT Voltage Range (V)	200-850
No. of MPP Trackers	2
No. of PV Inputs	1/1
Max. Input Current (A)	13/13
Max. Short-circuit Current (A)	18/18
Battery	
Battery Type	Lithium Battery (with BMS)
Battery Communication Mode	CAN / RS485
Battery Voltage Range (V)	180-750
Max. Charge/Discharge Current (A)	25/25
Rated Current of Built-in Fuse (A)	63
Output (Grid)	
Rated Output Power (kW)	10
Max. Output Power (kW)	11
Max. Apparent Power (kVA)	11
Max. Input Apparent Power (kVA)	16.5 ^①
Max. Charging Power of Battery (kW)	10
Rated Output Voltage (V)	3 / N / PE, 230(400)
Rated AC Frequency (Hz)	50/60Hz 45-55Hz/55-65Hz
Max. Output Current (A)	16.5
Power Factor	0.8 leading ...0.8 lagging
Max. Total Harmonic Distortion	< 3% @Rated Output Power
DCI	< 0.5%In
Output (Back-up)	
UPS Switching Time	< 10ms
Rated Output Voltage (V)	3/N/PE, 230(400)
Rated AC Frequency (Hz)	50/60Hz 45-55Hz/55-65Hz
Max. Apparent Output Power (kVA)	
Peak Overload Apparent Power (kVA)	20 ^② , 60s
Single-phase Peak Output Power (kVA)	4 ^③
Voltage Harmonic Distortion	< 3% @Linear Load

① Max apparent power from the grid means the maximum power imported from the utility grid used to satisfy the backup loads and charge the battery.

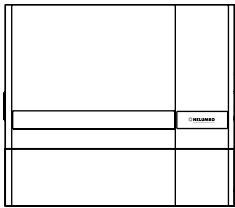
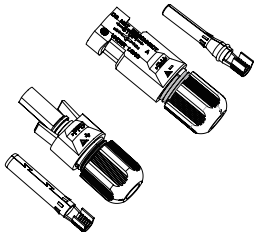
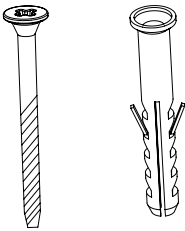
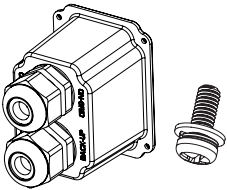

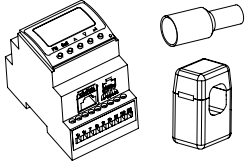
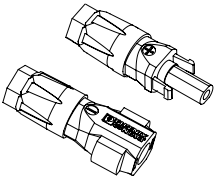
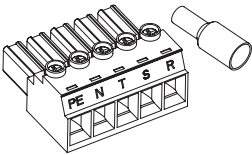
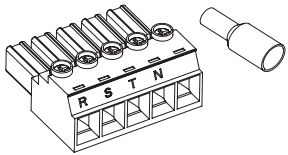
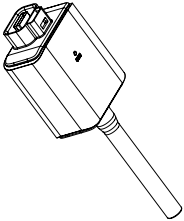
② The output power will exceed the rated value only when the power in the PV array is sufficient, and the duration of the overload is relating to the overload power.

③ Single-phase peak output power is the single-phase max output that won't trigger overload protection, only 1 phase can reach peak output power at the same time.

Model	10KW-3P
Efficiency	
Max. Efficiency	98.2%
European Efficiency	97.4%
Max. Battery Charging Conversion Efficiency	97.3%
Max. Battery Discharge Conversion Efficiency	97.3%
Protection	
DC Reverse Polarity Protection	Integrated
Battery Input Reverse Connection Protection	Integrated
Insulation Resistance Protection	Integrated
DC Switch	Optional
Surge Protection	Integrated (Type II)
Over-temperature Protection	Integrated
Residual Current Protection	Integrated
Islanding Protection	Frequency Shift, Integrated
AC Over-voltage Protection	Integrated
Overload Protection	Integrated
AC Short-circuit Protection	Integrated
General Data	
Over Voltage Category	PV: II ; Main: III
Dimensions (mm)	550W*410H*175D
Weight (KG)	28
Protection Degree	IP65
Self-consumption at Night (W)	<15
Topology	Transformer-less
Operating Temperature Range (°C)	-30~60
Relative Humidity	0~100%
Operating Altitude (m)	3000
Cooling	Natural Convection
Noise Level (dB)	<25
Display	OLED & LED
Communication	WiFi / LAN(Optional)
Compliance	IEC62109, IEC62116, VDE4105, VDE0126, AS4777, RD1699, NBR16149, IEC61727, IEC60068, IEC61683, EN50549, EN61000

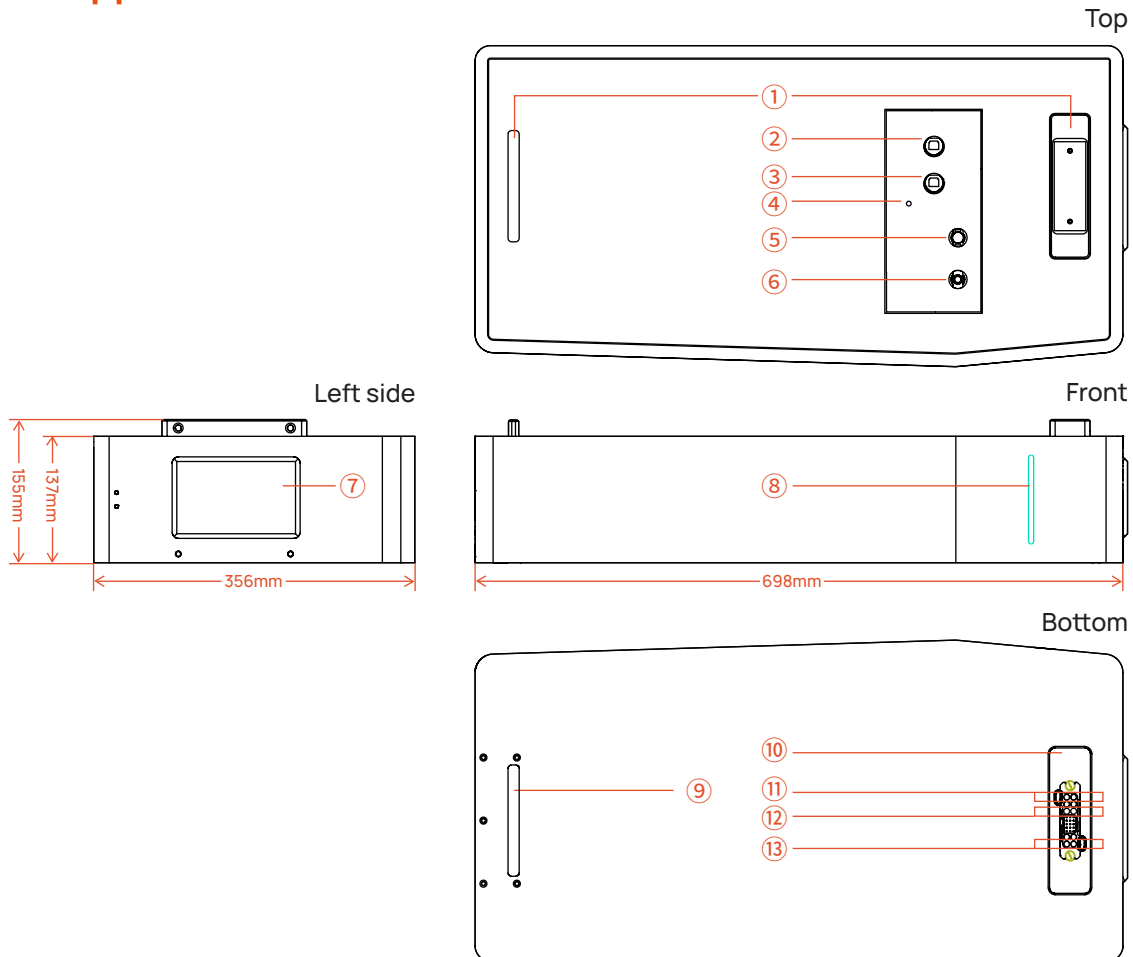
2.5 Standard Packing List

The package of the inverter includes the following accessories. Please check whether the accessories in the packing box are complete at the first time when receiving the goods.

 <p>Inverter in all-in-one kit×1</p>	 <p>PV Terminal</p>	 <p>Expansion Bolt</p>
 <p>AC Cover, Screw</p>	 <p>PE Terminal</p>	 <p>Nelumbo Meter with 3 CTs Cord End Terminal</p>
 <p>BAT Plug</p>	 <p>On Grid AC Terminal Cord End Terminal</p>	 <p>Back Up AC Terminal Cord End Terminal</p>
 <p>Monitoring Device (optional)</p>		

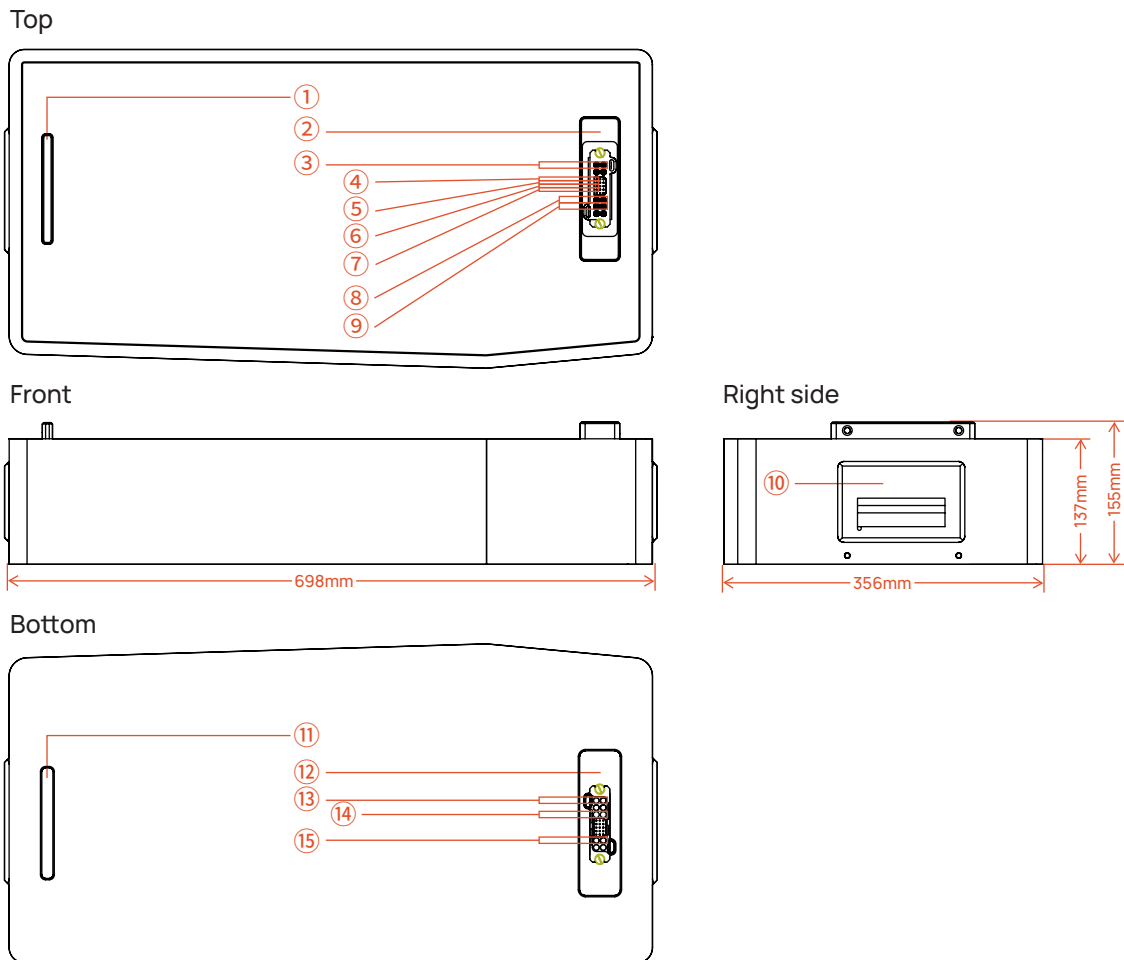
3. Battery Introduction

3.1 Appearance Introduction



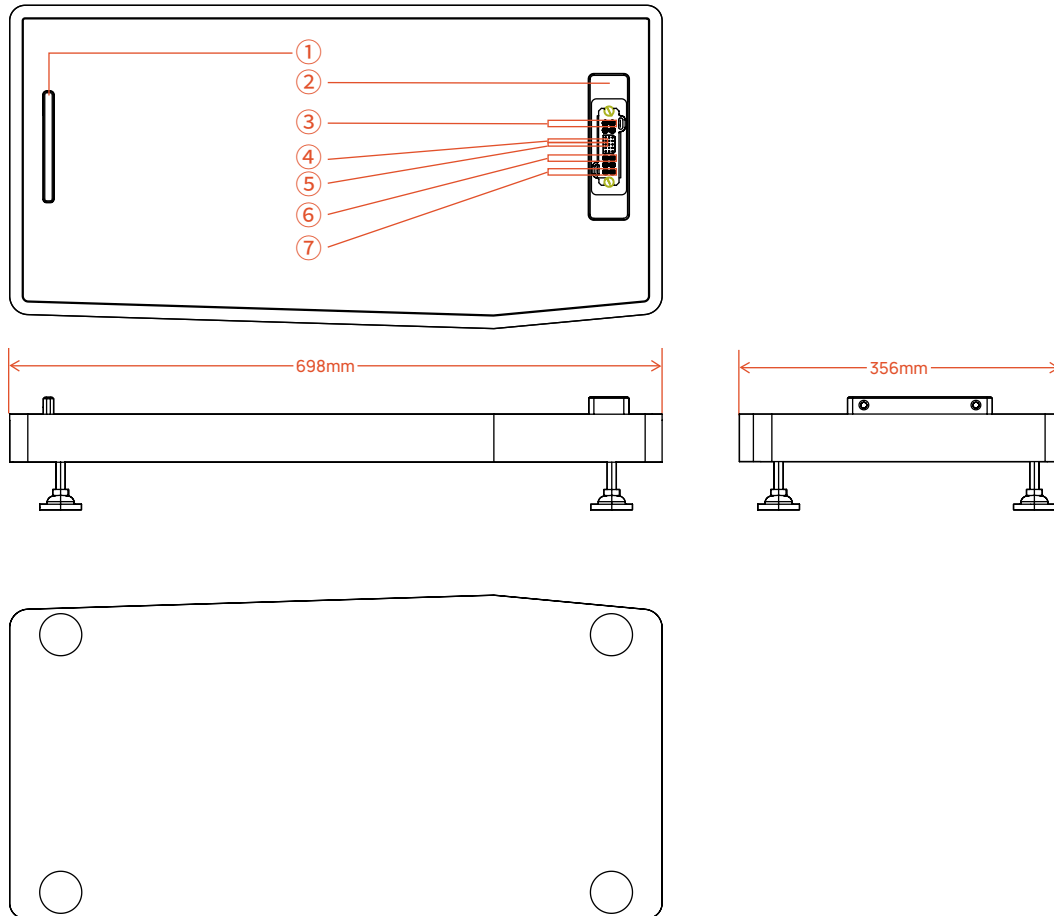
Sub-Master BMS

①	Inverter positioner
②	Inverter COM
③	Service COM
④	Earth point
⑤	Battery DC Output +
⑥	Battery DC Output -
⑦	DC Isolator
⑧	Indicator light
⑨	Battery positioner socket
⑩	Terminal positioner socket
⑪	Battery Negative B-
⑫	Battery Negative B+
⑬	Earth cable



Battery module

①	Battery positioner plug
②	Terminal positioner plug
③	Earth cable
④	BMU Power Supply -
⑤	BMU Power Supply +
⑥	CAN-L
⑦	CAN-H
⑧	Battery Positive B+
⑨	Negative pole
⑩	Handle
⑪	Battery positioner socket
⑫	Positive pole
⑬	Battery Positive B+
⑬	Earth cable
⑬	Terminal positioner socket



Base module

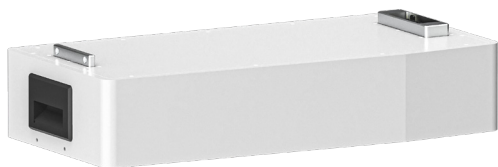
①	Battery positioner plug
②	Terminal positioner plug
③	Earth cable
④	CAN COM Resistor (Pre-installed)
⑤	CAN COM Resistor (Pre-installed)
⑥	Battery Positive B+
⑦	Battery Positive B+

3.2 Specifications



Sub-Master BMS

Operation Voltage [Vdc]	100~800
Max. Charge/Discharge Current [A]	50
Recommend Charge/Discharge Current [A]	25
Functions	Pre-charge, Over-Less Voltage/ /Over-Less Temperature Protection, Cells Balancing/SOC-SOH calculation etc.
Communication Protocol/Connector Type	CAN/RS485 ModBus, TCP/IP/ RJ45
Power Connection Type	Hard Connection with Positioner
User Interface	LCD Display (Optional, need to be confirmed upon order)
Dimension [W*H*D(mm)]	698*356*137
Weight	11kg
Operating Temperature [°C]	-20~55
Ingress Protection	IP21 (Optional IP65, need to be confirmed upon order)
Installation Method	Stackable
Warranty	10 years



Battery Module




Nominal Voltage/Capacity per Module	86.4/2.6KWH
Expand Capability	Up to 8 Modules series at 691.2V/20.7KWH
DOD Recommended	90%
Max. Charge/Discharge Current [A]	50A Continual
Recommend Charge/Discharge Current [A]	25A Continual
Communication Protocol/Connector Type	CAN/ RJ45
Power Connection Type	Hard Connection with Positioner
Dimension [W*H*D(mm)]	698*356*137 per module
Weight	30kg
Charge Temperature Range [°C]	0~45
Discharge Temperature Range [°C]	-20~55
Ingress Protection	IP21 (Optional IP65, need be confirmed upon order)
Installation Method	Stackable
Cables Connection Method	Hard Connection with Positioner
Warranty	8000 Cycles within 10 Years Guarantee

*Battery System Configuration Options: 259.2V/7.8kWh, 345.6V/10.4kWh, 432.0V/13.0kWh, 518.4V/15.6kWh, 604.8V/18.1kWh, 691.2V/20.7kWh.



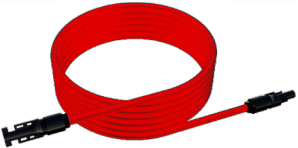



*Nelumbo reserves the right to modify the technical datasheet and appearance of the product in the manual without prior advice to the users.

3.3 Standard Packing List

Main units

 <p>Sub-Master BMS for 3.84KWH</p>	 <p>3.84KWH Li-HV LFP Battery Modules (Stackable)</p>
 <p>Base for Stackable Li-HV all-in-one system</p>	

Standard Accessories

 <p>300MM Communication Cables from Battery to Inverter</p>	 <p>Grounding Wire 300mm from Battery to Inverter</p>
 <p>300MM Positive Power Cables from Battery to Inverter</p>	 <p>300MM Negative Power Cables from Battery to Inverter</p>
 <p>Kit for Wall Mounted</p>	 <p>M6 Plastic Expansion Pipe and Self-tapping Screw</p>

4. Mechanical Installation

4.1 Selection of Installation Location

- The nelumbo 10kW is designed with IP65 protection for indoor and outdoor installations. When selecting an inverter installation location, the following factors should be considered:
- The wall on which the inverter is mounted must be strong and can withstand the weight of the inverter for a long time.
- The inverter needs to be installed in a well-ventilated environment.
- Do not expose the inverter directly to strong sunlight to prevent the power derating due to excessive temperature.
- The inverter should be installed in a place with shelter to prevent direct exposure to sunlight and rain.
- Install the inverter at the eye level for easy inspection of screen data and further maintenance.
- The ambient temperature of the inverter installation location should be between -30 °C and 60 °C.
- The surface temperature of the inverter may reach up to 75 °C. To avoid risk of burns, do not touch the inverter while it's operating and inverter must be installed out of reaching of children.
- The area is completely water proof.
- The floor is flat and level.
- There are no flammable or explosive materials.
- The ambient temperature is within the range from 0 to 50.
- The temperature and humidity is maintained at a constant level.
- There is minimal dust and dirt in the area.
- The distance from heat source is more than 2 meters.
- The distance from air outlet of whole system is more than 0.5 meters.
- Do not cover or wrap the battery case or cabinet.
- Do not place at a children or pet touchable area.
- The installation area shall avoid of direct sunlight.
- There is no mandatory ventilation requirements for battery module, but please avoid of installation in confined area(minimum 300mm to top/left/right/front).
- The aeration shall avoid of high salinity, humidity or temperature.

4.2 General Installation Procedure

Installation procedure summary

1. Install the base;
2. Install the battery module and Sub-Master BMS;
3. Install the inverter;
4. Cables connection;
5. Install the cables cover and wall mounting support.

System component



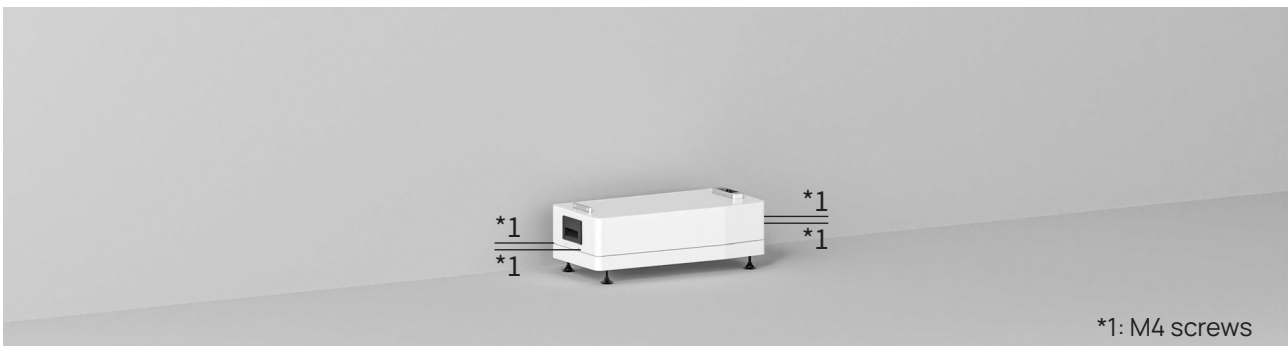
Step1. Install the base

Check the installation environment to ensure ground level. Place the base on the ground, and make sure it is level and stable.



Step2. Install the battery module and Sub-Master BMS

After the base is installed, the remaining battery and Sub-Master BMS are then placed in turn. Once each battery or Sub-Master BMS is in place, tighten it with four m4 screws on the left and right side.



Step3. Install the inverter

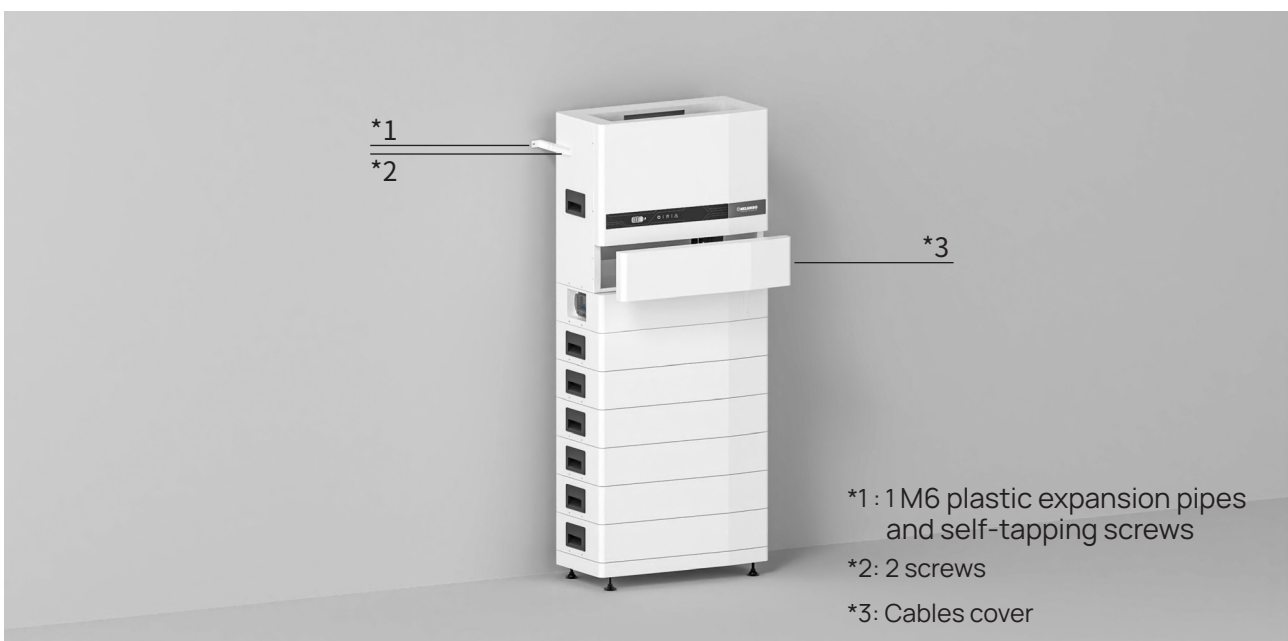
After the inverter is installed to the All-in-One Kit, put the All-in-One Kit to the stacked battery and Sub-Master BMS.



Step4. Install the kit for wall mounted and cables cover

Monuting the kit for wall mounted, and tighten them with M6 plastic expansion pipes and self-tapping screws and screws.

Connet the cables between inverter and Sub-Master BMS as is shown in page24 and then monting the cables cover.

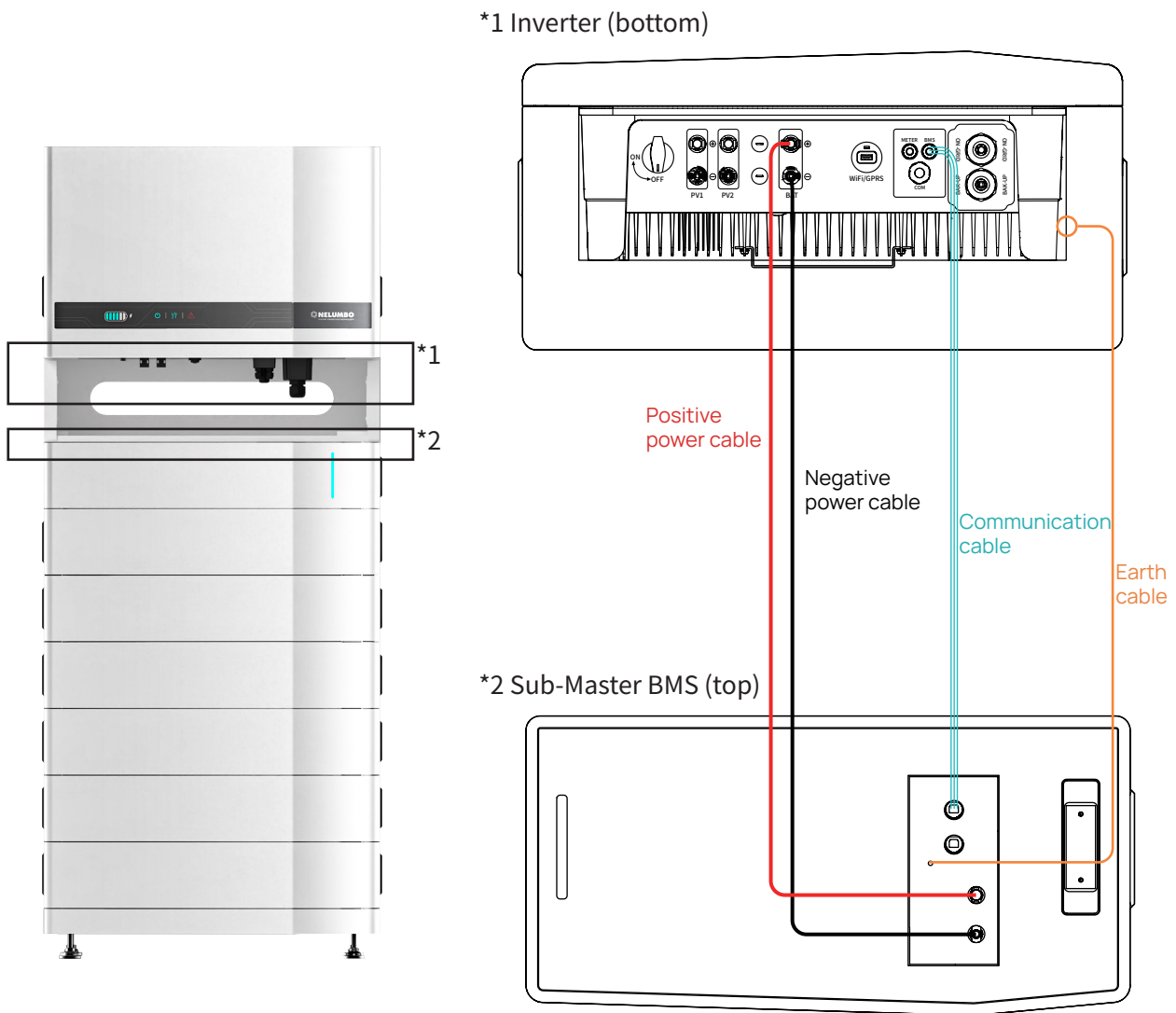


4.3 Cables Connection

After mechanical installation is finished, there are positive power line, negative power line, communication cable and earth cable between inverter and Sub-Master BMS need to be connected. The picture on this page shows the cables connection. Please follow the instruction and make sure all the cables are connected correctly.

! Warning:






Please make sure the main switch at OFF position during installation to guarantee high voltage protection.



5. Inverter Cables Connection

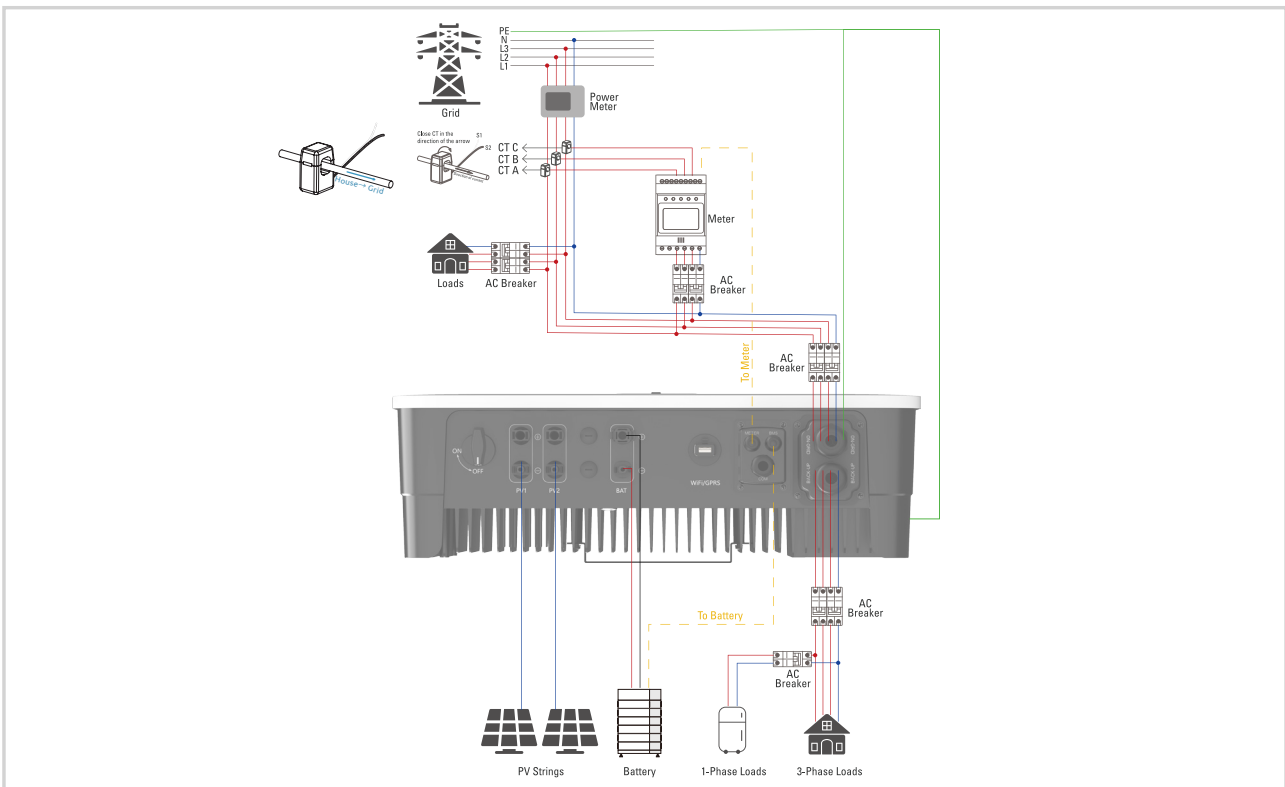
5.1 Electrical Connection

Danger hint

-  **Danger:** A high voltage in the conductive part of the inverter may cause an electric shock. When performing any installation on the inverter, make sure that the AC and DC sides of the inverter are completely de-energized.
-  **Warning:** Do not ground the positive or negative pole of the PV string, otherwise it will cause serious damage to the inverter.
-  **Warning:** Static may cause damage to the electronic components of the inverter. Anti-static measures should be taken during the repairing or installation.
-  **Attention:** Do not use other brands or other types of PV terminals other than the PV terminal in the accessory package. Nelumbo has the right to refuse all damages caused by the mixed-use of terminals.
-  **Attention:** Moisture and dust can damage the inverter, ensure the cable gland is securely tightened during installation. The warranty claim will be invalidated if the inverter damaged by the cable connector not well installed.

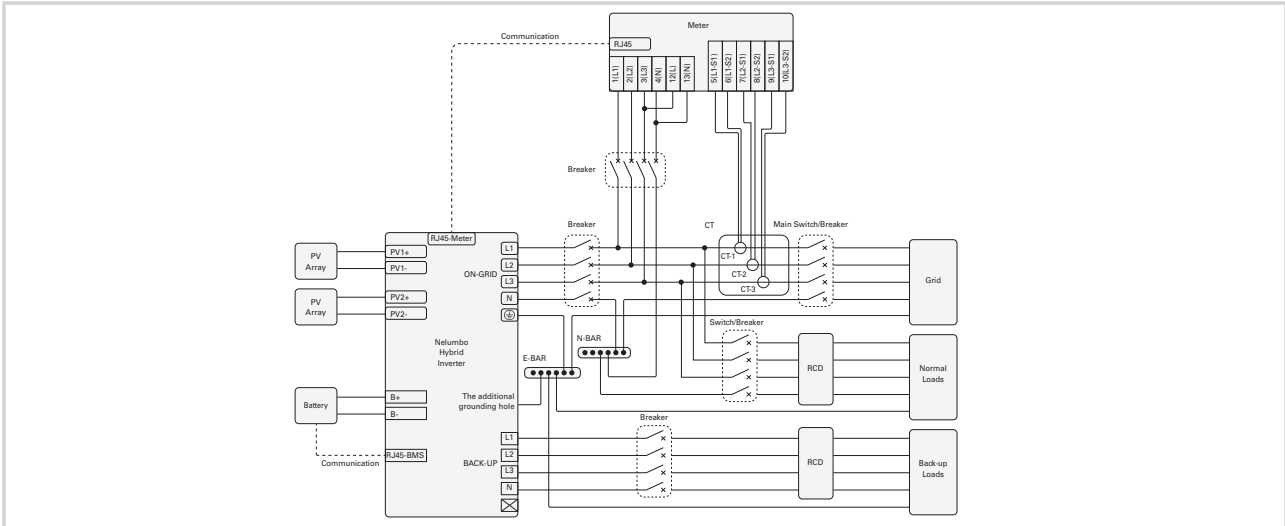
Nelumbo hybrid inverter electrical wiring diagram

This diagram shows nelumbo 10kW hybrid inverter wiring structure and composition, concerning the real project, the installation and wiring have to be in line with the local standards.

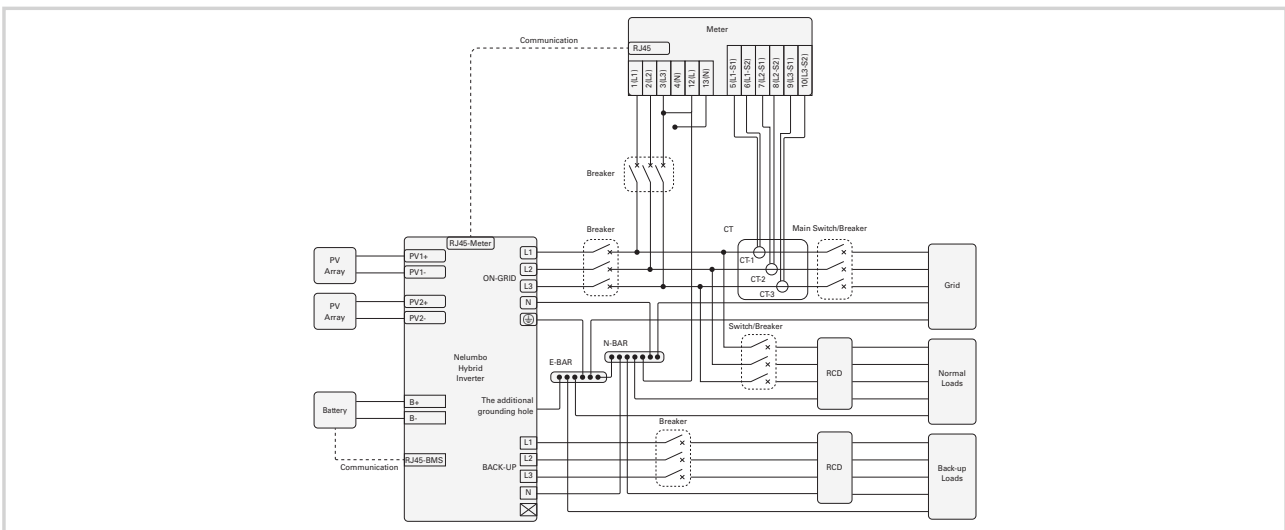


Single inverter wiring diagram

This diagram is an example without special requirement on electrical wiring connection. Neutral line of AC supply can be isolated or switched.



This diagram is an example for Australia and New Zealand. Neutral line of AC supply must not be isolated or switched.



External ground connection

Connect the inverter and ground bar through PE wire to achieve the purpose of grounding protection. Please always remember wiring the PE wire before wiring other wires.

- Danger:** Do not connect the N-wire as a protective ground wire to the inverter casing. Otherwise, it may cause electric shock.
- Attention:** Good grounding is good for resisting surge voltage shock and improving EMI performance. Inverters must be well-grounded.
For a system with only one inverter, just ground the PE cable.
For a multi-inverter system, all inverters PE wire need to be connected to the same grounding copper bar to ensure equipotential bonding.

Ground terminal connection steps:

- 1) The external grounding terminal is located in the lower right side of the inverter.
- 2) Fix the grounding terminal to the PE wire with a proper tool and lock the grounding terminal to the grounding hole in the lower right side of the inverter.

**Inverter PV string connection**

The following principles must be considered when making electrical connections to the inverter:

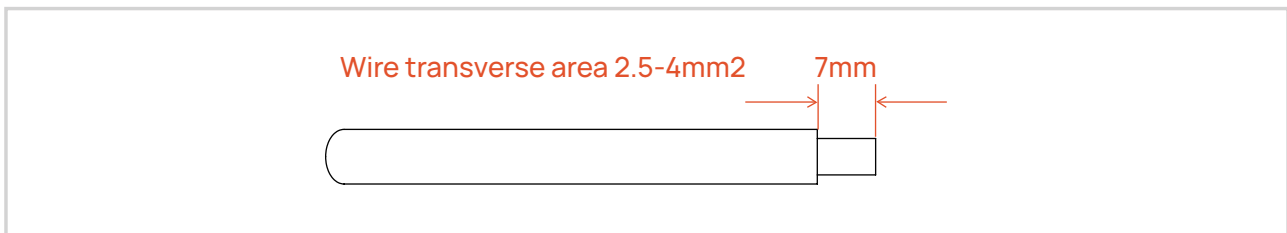
- 1) Disconnect the AC breaker on the grid side.
- 2) The DC switch of the inverter must be turned to the "OFF" position.
- 3) The number and type of the PV panels connected in the two strings of one MPPT must be same.
- 4) Make sure the maximum output voltage of each PV string does not exceed 1000V.

DC connector assembly procedures

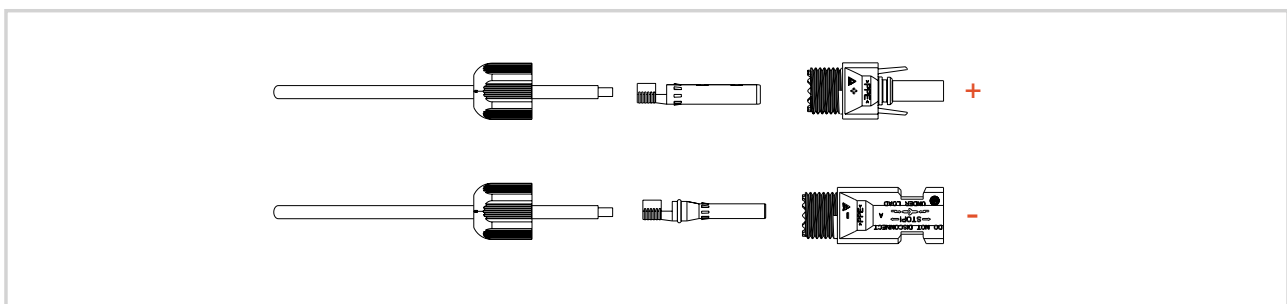
1) Select the appropriate photovoltaic cable:

Cable type	Conductor transverse area(mm ²)	
	Scope(mm ²)	Recommended value(mm ²)
General photovoltaic cable	2.5-4.0	4.0

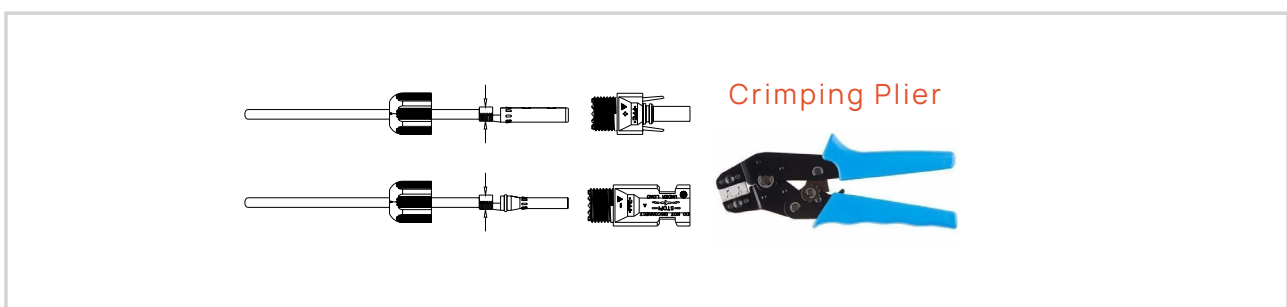
2) Peel off the DC cable insulation sleeve for 7 mm.



3) Disassemble the connector in the accessory bag.

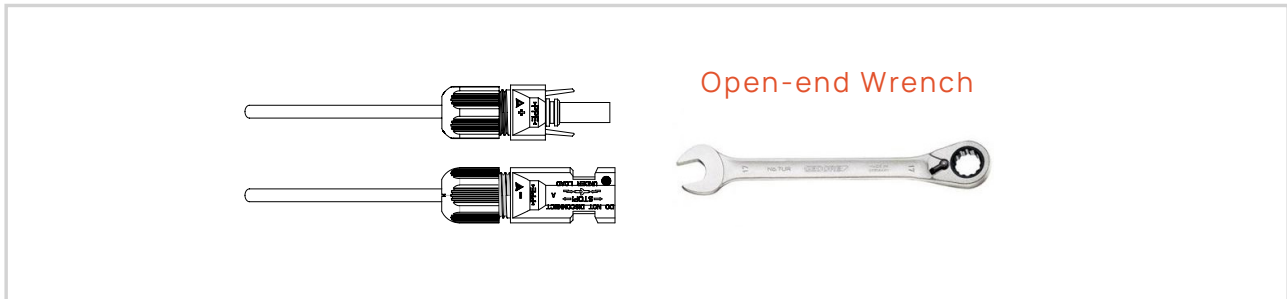


4) Insert the DC cable through the DC connector nut into the metal terminal and press the terminal with a professional crimping plier (pull back the cable with some power to check if it's tight enough).



5) Insert the positive and negative cables into the corresponding positive and negative connectors, pull back the cable to ensure that the terminal is tightly attached in the connector.

6) Use an open-end wrench to screw the nut to the end to ensure that the terminal is well sealed.

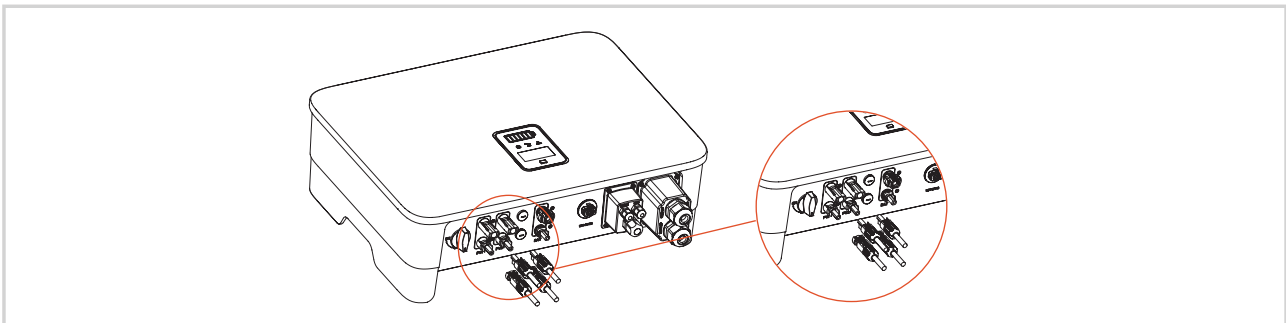


Warning 1. Before assembling the DC connector, make sure that the cable polarity is correct.



Warning 2. Use a multimeter to measure the voltage of the DC input string, verify the polarity of the DC input cable, and ensure that each string voltage is within 1000V.

7) Insert the positive and negative connectors into the inverter DC input terminals respectively, and a "click" sound represents the assembly in place.



Inverter battery connection

The following principles must be considered when making battery connection:

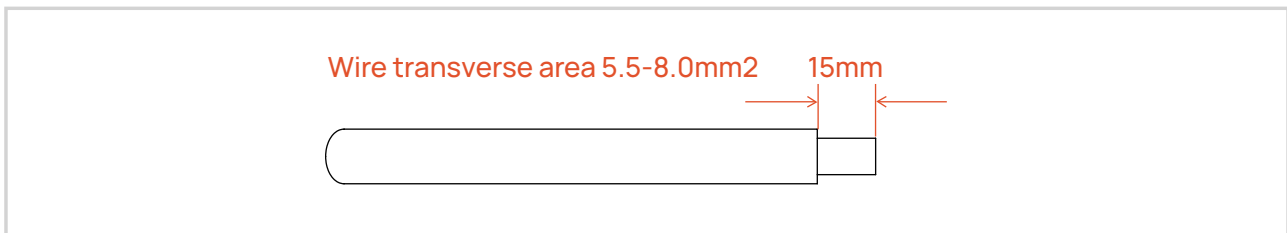
- 1) Disconnect the AC breaker on the grid side.
- 2) Disconnect the breaker on the battery side.
- 3) Turn the inverter DC switch to the "OFF" position.
- 4) Make sure the maximum input voltage of battery is within the inverter limitation (180~750V). For 2.3kWh LFP module, the operation voltage range of each battery module is 60V~87.6V, so usually suggested to series connected 3 to 8 modules.

Lithium battery connector assembly procedures

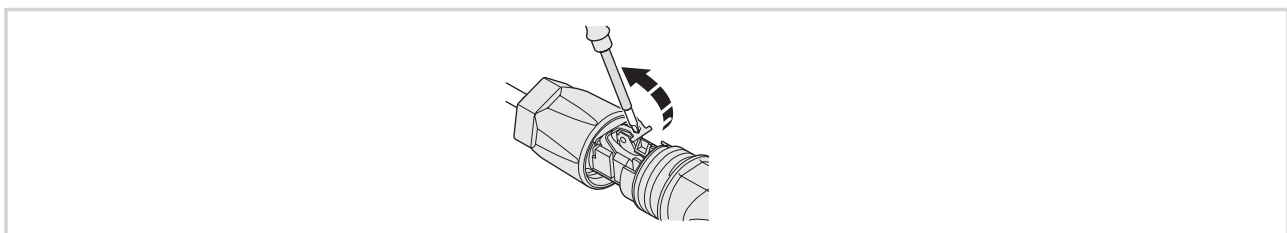
1) Select an appropriate DC cable.

Cable type	Conductor transverse area(mm ²)	
	Outside diameter (mm ²)	Conductor core section (mm ²)
AWG 10	5.5-8.0	4.0-6.0

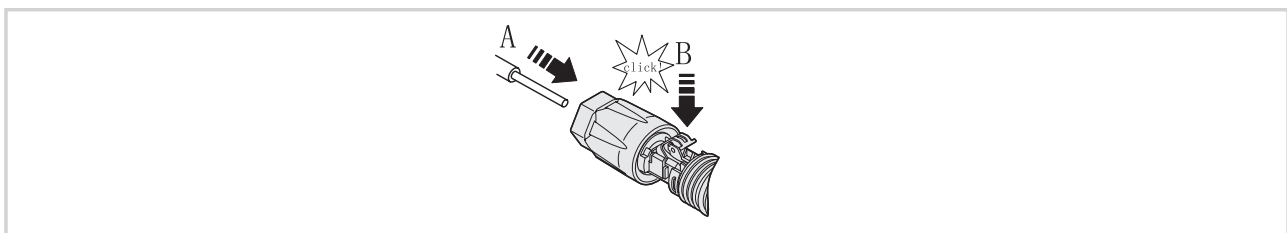
2) Peel off the DC cable insulation sleeve for 7 mm.



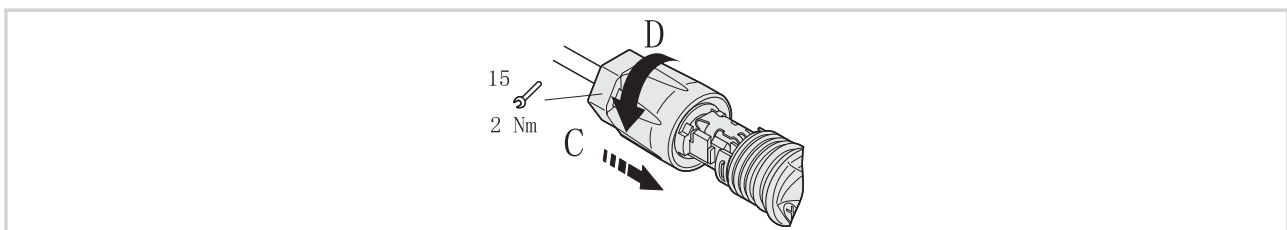
3) Use a flathead screwdriver to open the clamping bracket in the connector.





4) Insert the stripped DC cable to the battery connector deep enough and toggle the clamping bracket to make sure it is tightly locked with the stripped cable.

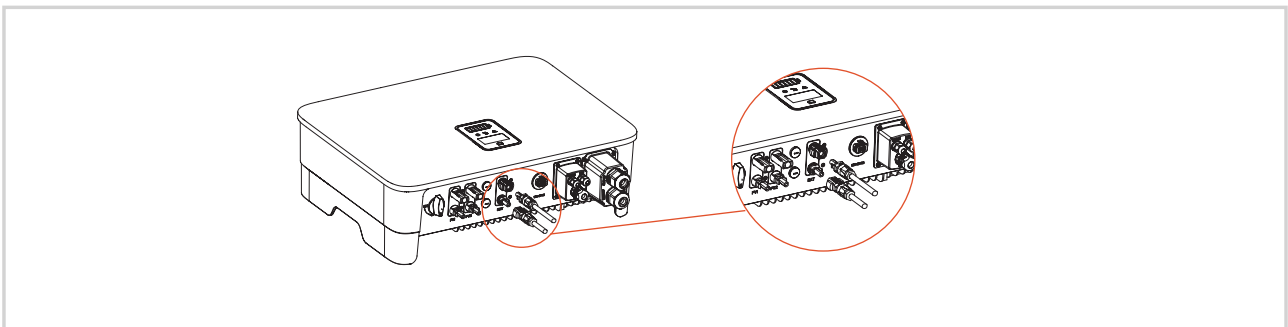


5) Push the battery connector to the thread joint, and use an open wrench to lock the connector in a torsion of 2Nm tightly.



-  Warning: Before making the battery connector, please make sure the polarity of the cable is correct.
-  Warning: Use a multimeter to measure the voltage of the battery pack and make sure the voltage is within the inverter limitation and the polarity is correct.

6) Insert the positive and negative connector into the inverter battery terminals respectively, and a "click" sound represents the assembly in place.



AC output connector connection

The following principles must be considered when making AC output connection.

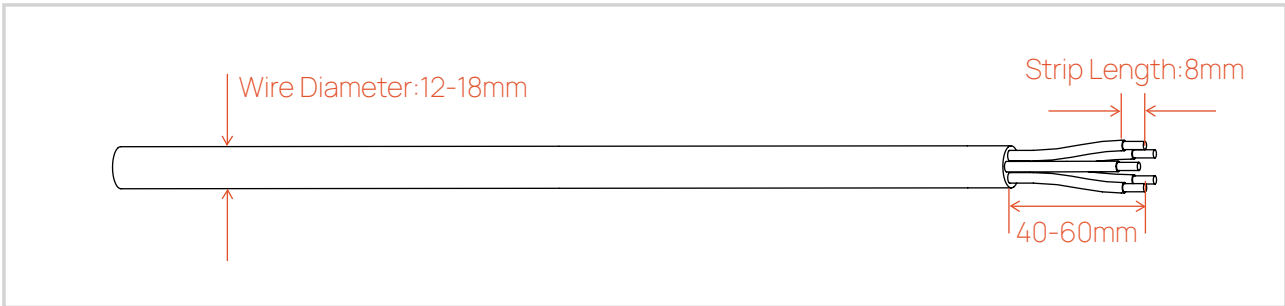
- 1) An independent AC breaker is required in both inverter on-grid and back-up output side, and any loads cannot be connected with inverter directly.
- 2) Before making the connection of AC cable, please confirm all DC & AC power source are disconnected from the inverter.
- 3) The nelumbo 10kW three-phase high voltage hybrid inverter applies to the three-phase power grid with a voltage of 230/400V and a frequency of 50/60Hz.

AC connector assembly procedures

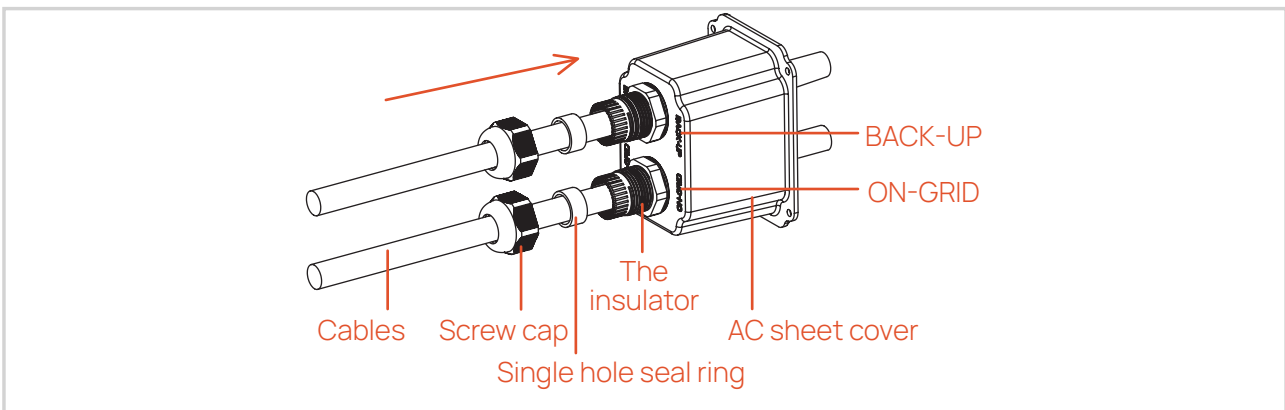
The recommended AC cable and AC breaker for nelumbo 10kW three-phase hybrid inverter are as shown in the table.

Model	10KW-3P
Outside diameter (mm)	12-18
Conductor core section (mm ²)	4-10
Breaker (A)	32

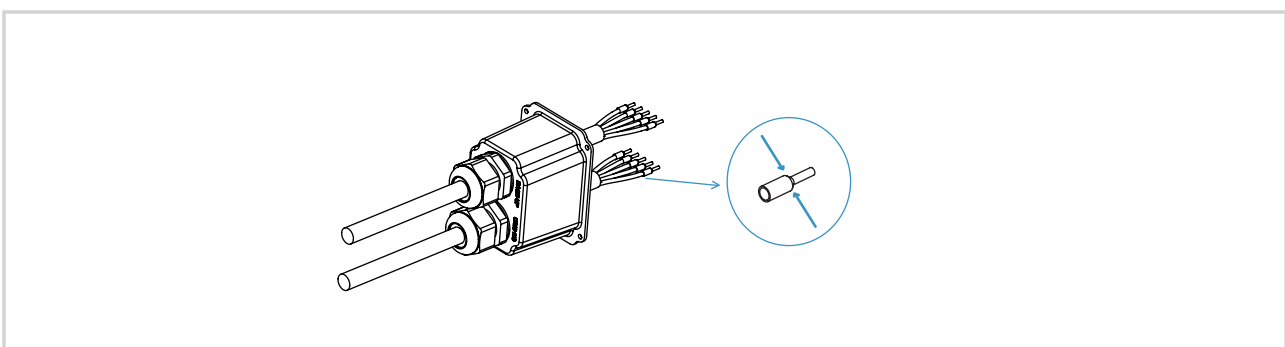
1) According to the table above, select an appropriate AC cable, peel off the insulation sleeve of AC cable for 40~60mm, and peel off the sleeve in the conductor core of 3L/PE/N wires for 8mm.



2) Insert the stripped AC cables through the AC connector cover in the sequence.

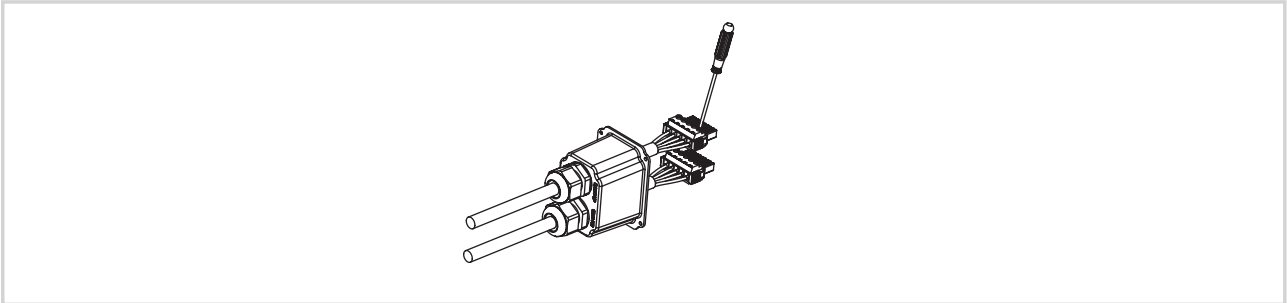


3) Put the cord end terminals on the stripped conductors one by one and press with some pressure to make it tightly locked with the conductors.

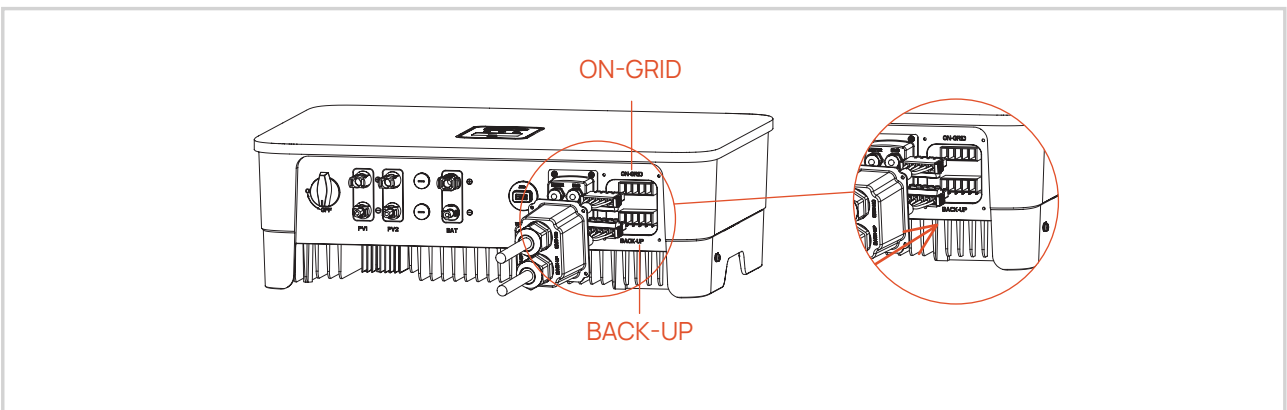


Caution: The cold-pressed terminals must be locked tightly, and make sure it won't be loose after a long period of use.

4) Lock the well-pressed cord end terminals into the AC connector in the accessory bag and make sure the cables sequence is in line with the mark on the connector.

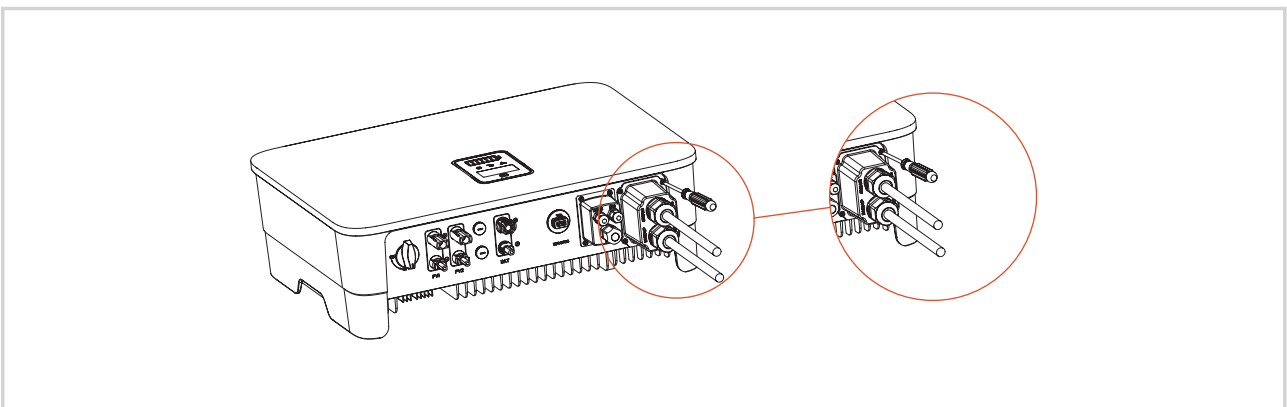


5) Insert the assembled AC connector to the corresponding AC port in the inverter.

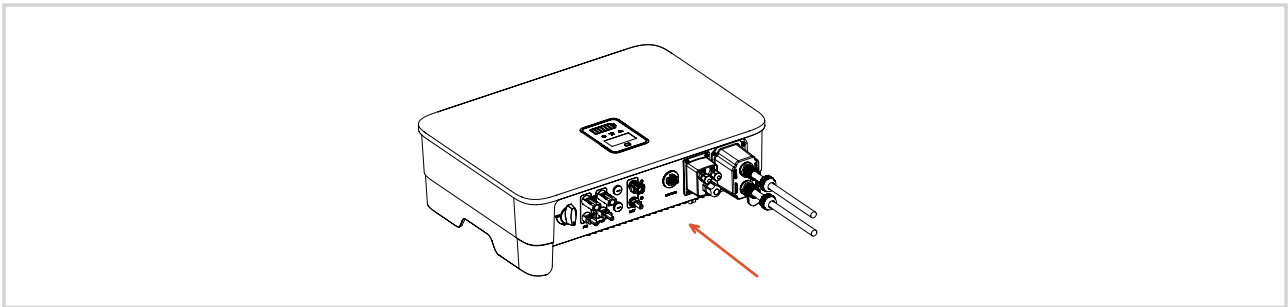


Caution: Please distinguish the on-grid and back-up port, and don't mix up the on-grid port and back-up port when making the connection.

6) Lock the AC connector cover to the inverter with screws.



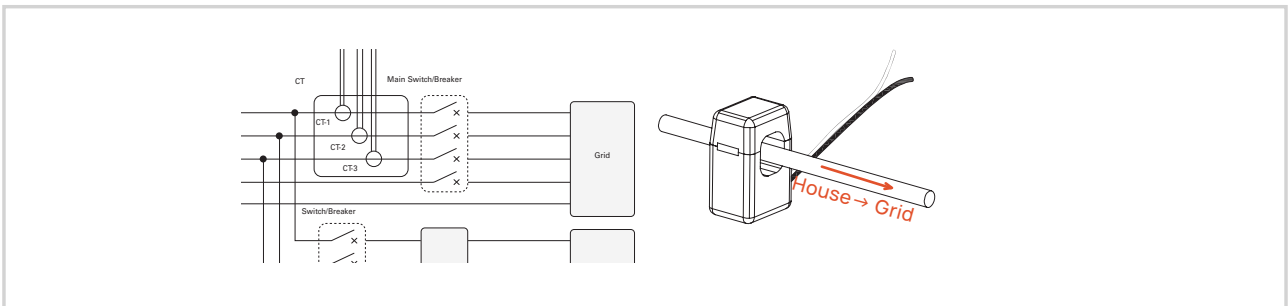
7) Screw up the rubber ring and anti-water cap to make sure the AC connector is well sealed.






Meter and CT connection

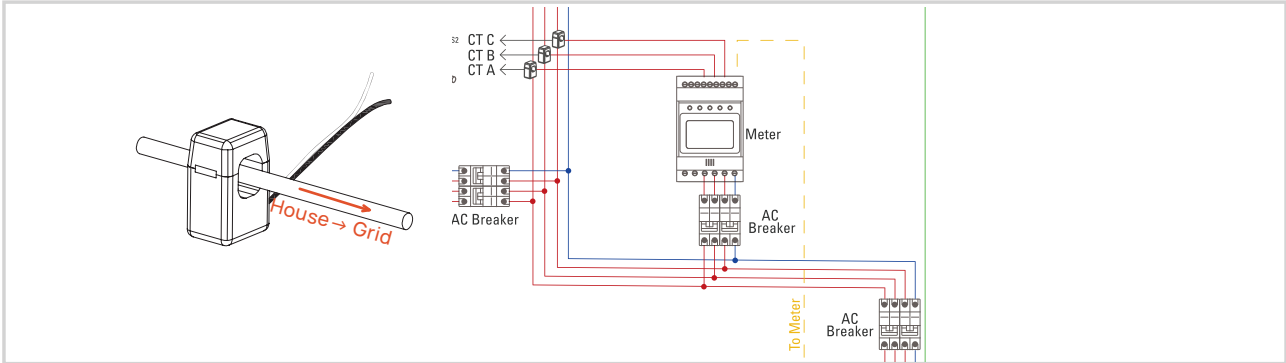
1) The current transducer, also called CT, is usually installed on the fire wires between the house loads and the power grid.

The Meter can install in the AC combiner box or other places that are unable to be touched by children. nelumbo CT integrated a cable with length of 2m and could be extended to 5m at max.

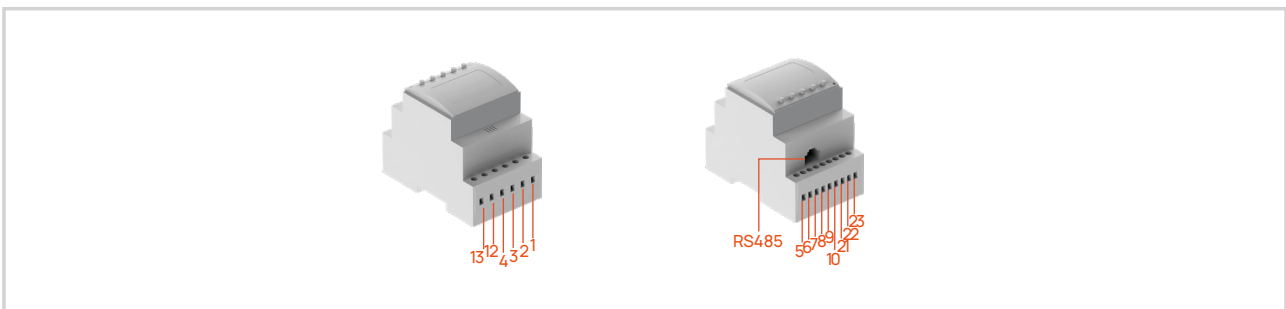


- 
Attention: CT installation direction and phase sequence should strictly follow the instruction in the user manual, otherwise, the inverter may not be working normally.
- 
Attention: The CT has to be corresponding with the port in the meter, and the connection between CT and Meter needs to be reliable, otherwise, the CT measurement accuracy may be affected.
- 
Note: The rated current of CT in the inverter accessory box is 80A, and the maximum allowed inserted cable diameter is 16mm. If the max current through the CT exceeds the rated current or the cable diameter wider than 16mm, please contact nelumbo for help.

2) The three CTs have already well-connected on the Meter while you received, and you just need to follow the wiring diagram in the Meter to connect CT.



Meter terminals definition

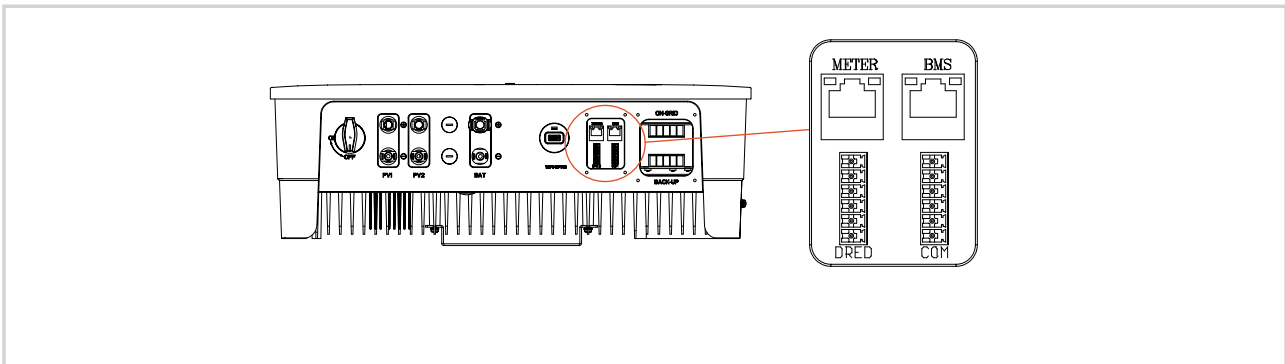
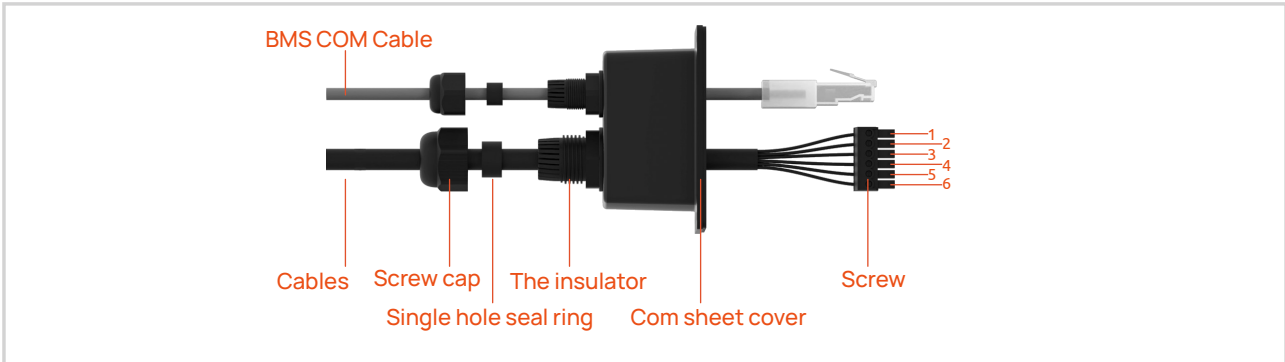


No.	Definition	Function
1	L1	L1/L2/L3/N connect to grid to detect power grid voltage
2	L2	
3	L3	
4	N	
5	L1-S1	Connect CT to detect current
6	L1-S2	
7	L2-S1	
8	L2-S2	
9	L3-S1	
10	L3-S2	
12	L	Power supplied from 220V grid
13	N	
RS485	RS485	Communicate with inverter

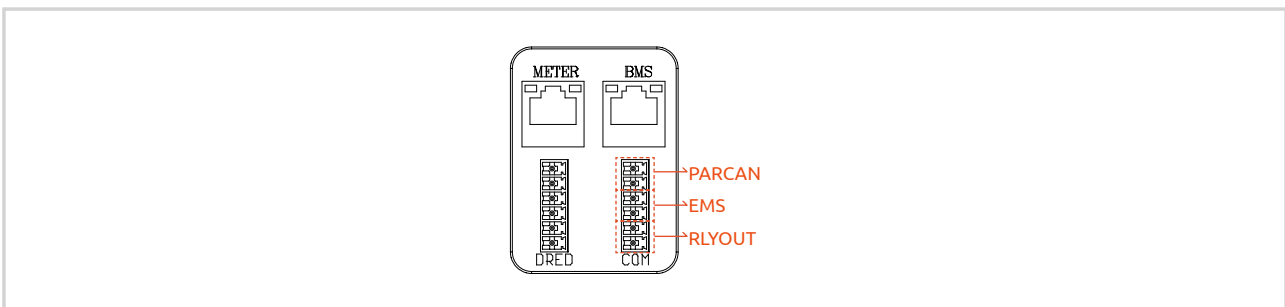
5.2 Communication Connection

Communication wiring illustration

All communication ports are hidden behind the communication terminal in the bottom of inverter which are include Meter port, CAN port, BMS port, EMS port, relay output port, DRED port.

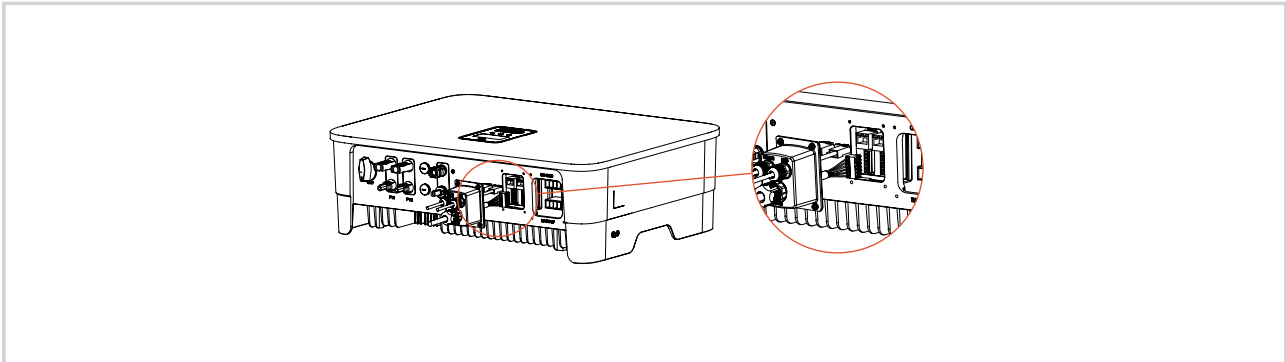


Inverter communication interface and definition.



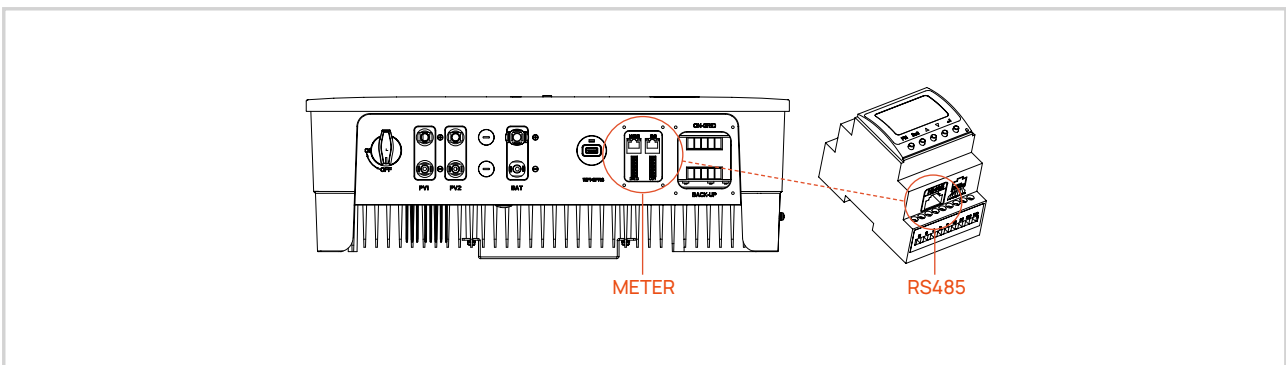
Type	Definition
METER	Communicate with Meter
BMS	Communicate with BMS
DRED	For Australia use/One key to shut off
PARCAN	Parallel CAN communication bus interface
EMS	EMS power dispatching interface
RLYOUT	Dry contact output, a group of normally open contact passive dry contact

Dismantle the cover of the communication ports with a screwdriver, and put all communication cables through the holes and follow the illustration below to make the connection of each communication cables, and when all cables have connected, put back the cover and screw up the anti-water cap of the holes.



Communication between inverter and meter

The communication between meter and inverter is an RJ45 interface cable. A 10M length meter communication cable is already attached to the inverter when you received it and this cable could be extended up to 100M. Insert the RJ45 heads into the meter RS485 port.



RJ45 terminal connection sequence and definition.



No.	Color	Meter Side	Battery Side
1	Orange&White	/	RS485_A
2	Orange	/	RS485_B
3	Green&White	RS485_B	/
4	Blue	/	CAN_H
5	Blue&White	/	CAN_L
6	Green	RS485_A	/
7	Brown&White	RS485_B	/
8	Brown	RS485_A	/

Communication between inverter and battery

The communication between meter and inverter is an RJ45 interface cable. A 3M length battery communication cable is already attached to the inverter when you received it, and you just need to insert it to the BMS interface of the inverter and Sub-Master BMS.



Note: Before purchasing the battery, you have to make sure the battery you selected is in the battery approval list of nelumbo, otherwise, the system may not work properly. Please contact your installer or nelumbo service team for confirmation if you're not sure about it.

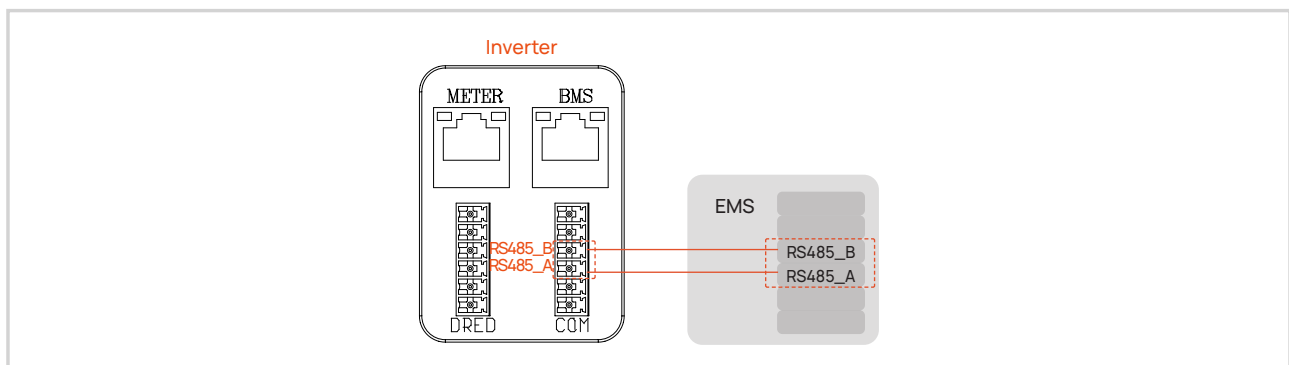
Multiple inverters parallel connection/EMS/Relay output dry contact

Multiple inverters parallel connection, EMS and relay output dry contact interfaces use the 6pin terminal on the right side, and you can use the matching 6pin terminal in the accessory box to make the connection.



No.	1	2	3	4	5	6
Definition	CAN PAR		EMS		RLY OUT	
	CAN_H	CAN_L	RS485_B	RS485_A	RLY_COM	RLY_NO

- 1) The EMS communication between inverter and battery should be connected through the RJ45 cable that is attached to the inverter when you need to control the work of the hybrid inverter.
- 2) Nelumbo 10kW hybrid inverter integrated a set of relay output dry contacts with the contact capacity 230Vac/1A or 30Vdc/1A that are very useful in some special circumstances, such as in the purely off-grid system, it can be used to trigger the backup generator. Please contact your installer or nelumbo service team to learn more detailed operation steps.



DRED Connection

DRED interface is special reserved for Australia and New Zealand according to their safety regulation, and nelumbo doesn't provide the DRED device for the customer.

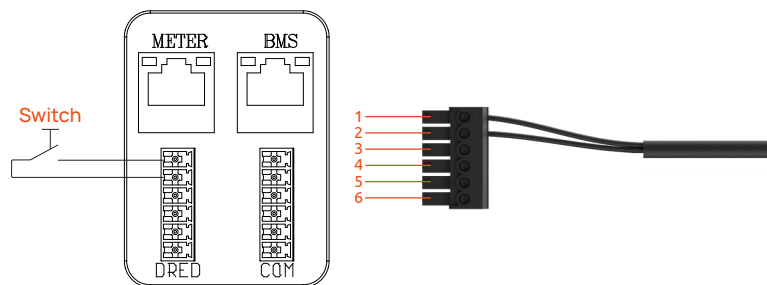
DRED connection uses the 6pin terminal on the left side, and you can use the matching 6pin terminal in the accessory box to make the connection.



No.	1	2	3	4	5	6
Definition	COM/DRMO	REFGEN	DRM4/8	DRM3/7	DRM 2/6	DRM1/5

One key to shut off

Nelumbo hybrid inverter comes with one key to shut off function, and you can use this function by connecting an external switch into the DRED interface if it requires in the installation place. The external switch doesn't include in our accessory box.

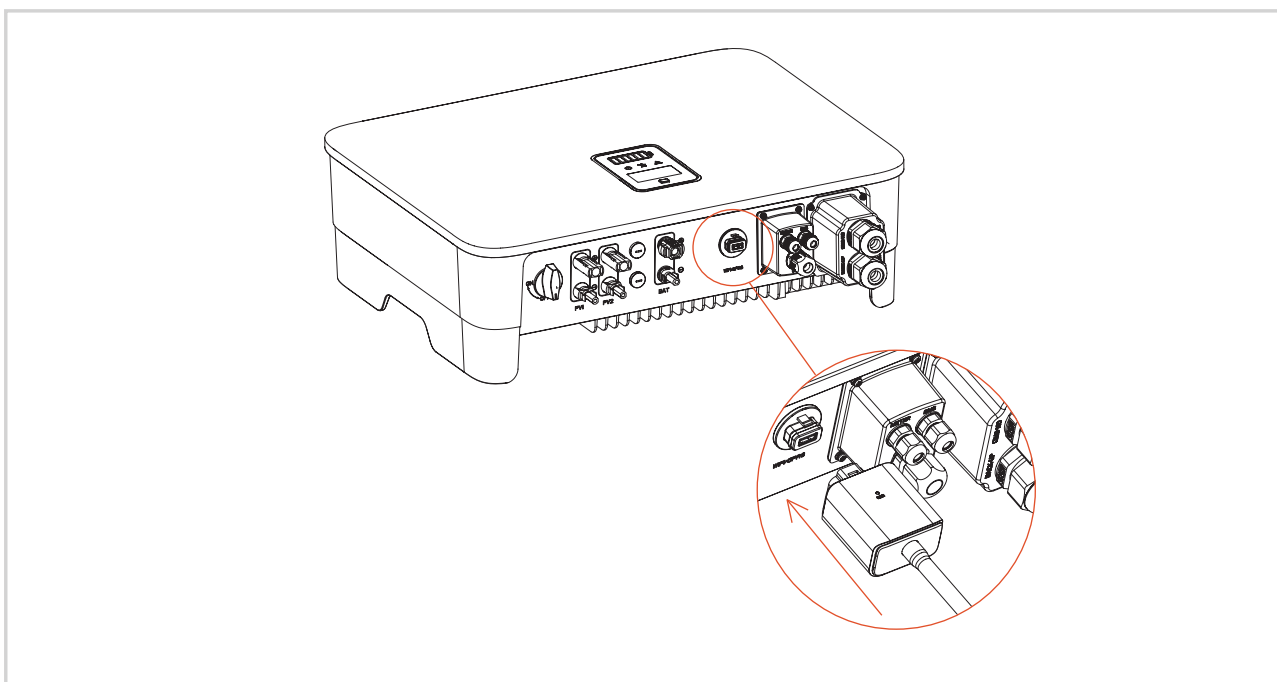


No.	1	2	3	4	5	6
Definition	COM/DRMO	REFGEN	/	/	/	/

5.3 Monitoring Device Installation

Nelumbo 10kW hybrid inverter can be monitored through either WiFi or LAN, and you can alternatively select according to your preference.

Plug the WiFi or LAN module into the WiFi/GPRS port in the bottom of inverter by following the direction the side with indicator is up. A slight "click" sound during the installation represents that the assembly is in place.



6. System Start and Stop

Start Inverter



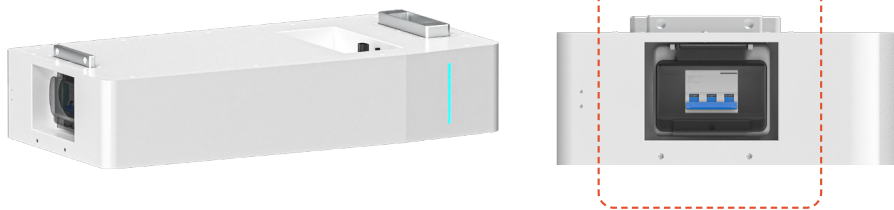
Please make sure all cables (PV/Battery/Grid/Back-up) are correctly connected according to above instructions before start up the inverter, or it will have high risk to damage inverter or batteries.

Before starting the inverter, follow these steps:

- 1) Turn the DC switch in the inverter bottom to the "ON" position.
- 2) Turn on the Sub-Master BMS DC Isolator.
- 3) Switch on the AC breaker.
- 4) The inverter will start to check the DC and AC input parameters and self-check, and if everything is normal, the inverter will start to work according to the work mode which you set on the App. The inverter display and indicators will show relative parameters and status.

Start Battery

Turn on the DC Switch on the Sub-Master BMS. When the indicator light on the Sub-Master BMS flashing 5 times with solid green or the display show correct system information with no error.



Stop Inverter

When turning off the inverter, please follow the steps below:

- 1) Shut off the inverter through the APP or the button on the display first.
- 2) Disconnect the breakers on the grid and load side.
- 3) Turn off the battery switch, and disconnect the DC breaker on the battery side (if any).
- 4) Wait 30 seconds and then turn the inverter DC switch to the "OFF" position. At this time, there is remaining power in the inverter capacitor. Wait for 5 minutes until the inverter is completely de-energized before operating.
- 5) Disconnect the AC and DC cables.

Stop Battery

Turn off the DC Switch on the Sub-Master BMS.

7. General Operation

7.1 Display Operation

When the inverter is turned on, the following interfaces will be displayed on the OLED display, and you can check the information and modify the parameters of the inverter by short or long pressing the button. Please refer to the following display operation flow for details.

Tip: After every setting completed, wait for 10 seconds and the inverter will automatically save your settings or modifications.



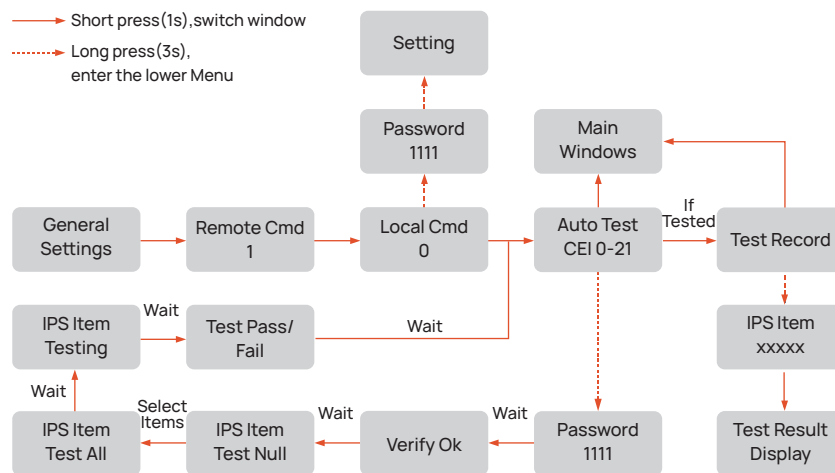
7.2 Auto-Test

This function is disabled by default, and only will be functional in the safety code of Italy. Short press the button several times until "Auto Test CEI 0-21" displays on the screen, press and hold the button 3 seconds to activate "Auto Test". After the auto test finished, short press the button several times until the screen displays "Auto Test Record", and hold the button 3 seconds to check the test result.

The auto test type will be chosen from "Remote" and "Local" before starting the auto test. "Remote" is set as 1 by default, which only can be modified to "0" by sending an external command and "Local" is set as 0 by default, which can be modified to 1 through operating the button on the inverter. According to the requirements of the standard, the test has been divided into three modes:

- 1) "Remote" set as 1, "Local" set as 0, then the test order is 59.S1, 59.S2, 27.S1, 81>.S2, 81<.S2;
- 2) "Remote" set as 1, "Local" set as 1, then the test order is 59.S1, 59.S2, 27.S1, 81>.S1, 81<.S1;
- 3) "Remote" set as 0, "Local" set as 1, then the test order is 59.S1, 59.S2, 27.S1, 81>.S2, 81<.S2.

Connect the AC cable, auto test will start after the inverter connected to the grid, see the operation steps below:



The auto test will start when the correct test item is selected, and the test result will be displayed on the screen when it finished. If the test success, it will display "Test Pass", otherwise will display "Test Fail". After each item tested, the inverter will reconnect to the grid and automatically start the next test item according to the requirements of CEI 0-21.

7.3 Monitoring and Configuration

Nelumbo inverter provides a monitoring port that can collect data from the inverter and transmit it to monitoring website via an external monitoring data collector WiFi or LAN module. Please check the WiFi user manual for more details.

8. Troubleshooting




8.1 Fault Messages






Nelumbo 10kW three-phase hybrid inverter is designed in accordance with grid operation standard, and conform to the requirements of the safety and EMC. The inverter had passed a series of rigorous tests to ensure it runs sustainably and reliably before shipment. When a fault occurs, the corresponding fault messages will display on the OLED display, and in this case, the inverter might stop feeding into grid.


The fault messages and their corresponding troubleshooting methods are listed below:

Error Message	Solution
Mains Lost	<ol style="list-style-type: none"> 1. Check whether the mains supply is lost. 2. Check whether the AC breaker and terminal are well connected.
Grid Voltage Fault	<ol style="list-style-type: none"> 1. Check whether the impedance of the AC cable is too high to lead the grid voltage increased. Change a thicker AC cable if it is. 2. Extend the voltage protection range if it is allowed by the electricity company.
Grid Frequency Fault	<ol style="list-style-type: none"> 1. Check whether the AC cable is correct and well connected. 2. Change to another country with wider protection range if it's allowed by the local electricity company.
DCI Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
ISO Over Limitation	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
GFCI Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
PV Over Voltage	Reduce the number of PV panels to make sure the open-circuit voltage of each string is lower than the inverter max allowed input voltage.
Bus Voltage Fault	<ol style="list-style-type: none"> 1. Check whether the input voltage is over the limitation. 2. Seek for help from the installer or manufacture.
Inverter Over Temperature	<ol style="list-style-type: none"> 1. Check whether the input voltage is over the limitation. 2. Seek for help from the installer or manufacture.
SCI Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
SPI Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
E2 Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
GFCI Device Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
AC Transducer Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
Relay Check Fail	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.
Flash Fault	<ol style="list-style-type: none"> 1. Restart the inverter. 2. Seek for help from the installer or manufacture.

8.2 Maintenance

-  **Danger:** Risk of inverter damage or personal injury due to incorrect service!
-  **Danger:** Always keep in mind that the inverter is powered by dual sources: PV strings and utility grid.
-  **Danger:** Before any service work, observe the following procedure.
 1. Disconnect the AC circuit breaker and then set the DC load-break switch of the inverter to OFF;
 2. Wait at least 5 minutes for inner capacitors to discharge completely;
 3. Verify that there is no voltage or current before pulling any connector.

-  **Caution:** Keep non-related persons away!
-  **Caution:** A temporary warning sign or barrier must be posted to keep non-related persons away while performing electrical connection and service work.
-  **Attention:** Restart the inverter only after removing the fault that impairs safety performance.
-  **Attention:** As the inverter contains no component parts that can be maintained, never arbitrarily replace any internal components.
-  **Attention:** For any maintenance need, please contact us. Otherwise, nelumbo shall not be held liable for any damage caused.

 **Note:** Servicing of the device in accordance with the manual should never be undertaken in the absence of proper tools, test equipment or the latest revision of the manual which has been clearly and thoroughly understood.

Items	Methods	Period
System clean	Check the temperature and dust of the inverter. Clean the inverter enclosure if necessary. Check if the air inlet and outlet are normal. Clean the air inlet and outlet if necessary.	Six months to a year (it depends on the dust contents in air.)



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