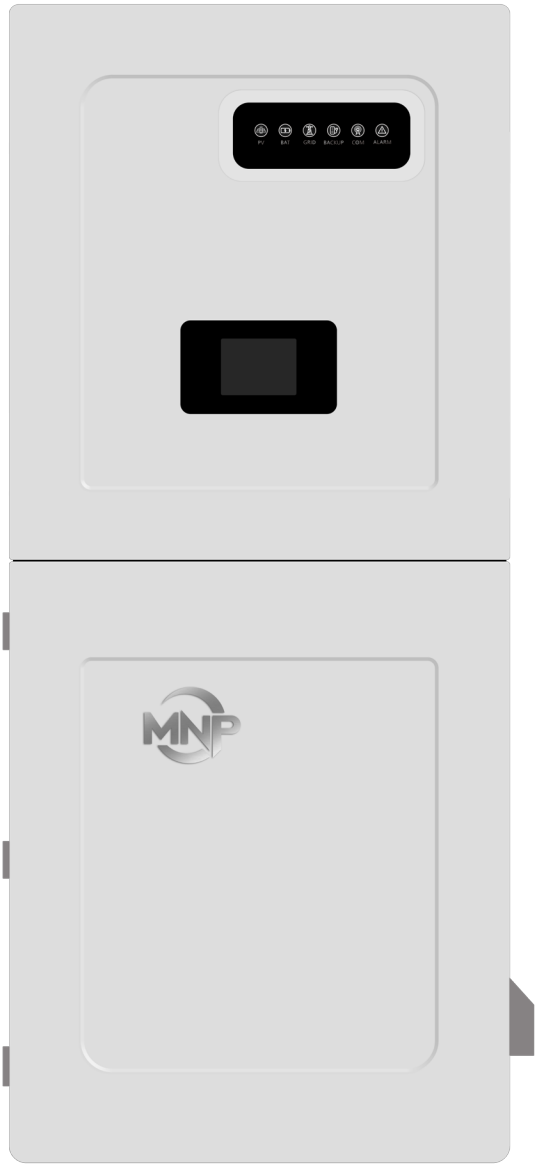
Version: 1.3

MN 15-12KW-AIO
All in one Inverter/Charger System



INSTALLATION GUIDE
AND USER MANUAL

READ THE INSTRUCTIONS COMPLETELY BEFORE OPERATING THE EQUIPMENT

Check the utility voltage before turning ON the unit if connected.

Verify the inverter's programmed grid type before connecting to the utility.

The unit will be programmed in 120/240V Split-Phase at 60Hz by default.

Disregarding these instructions could result in permanent damages to the unit

DISCLAIMER

UNLESS SPECIFICALLY AGREED TO IN WRITING, MIDNITE POWER:

(A) DOES NOT WARRANT THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

(B) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR ANY LOSS OR DAMAGES, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL, OR INCIDENTAL, ARISING OUT OF THE USE OF SUCH INFORMATION. USE OF SUCH INFORMATION SHALL BE ENTIRELY AT THE USER'S RISK.

MidNite Power is not responsible for system failure, damage or injury resulting from improper installation of its products.

Information in this manual is subject to change without notice.

This manual is only focused on the inverter labeled as: MN 15-12KW-AIO.

Contact

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Email: support@midnitepower.com

Website: www.midnitepower.com

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IMPORTANT SAFETY INSTRUCTIONS

SYMBOLS THAT APPEAR IN THIS DOCUMENT

WARNING: This symbol indicates information that, if ignored, could cause serious injury, equipment damage, or death.

CAUTION: This symbol indicates information that, if ignored, could result in minor injury or equipment damage.

NOTE: This symbol indicates relevant information that is not related to hazardous situations.

WARNINGS

Read this entire document before installing or using the MNPower MN 15-12KW-AIO inverter. Failure to follow any of the instructions or warnings in this document can result in electrical shock, serious injury, or death. Damage to the inverter is also possible, potentially rendering it inoperable.

High Risk due to fire or electrocution – ONLY qualified persons should install the MNPower inverter.

The system must have Ground connections and Neutral connections.

Solar PV+/PV- are UNGROUNDED. Note, you may ground PV Racking/Mounts, but doing so directly to the MNPower will likely result in damage in the case of a direct lightning strike to the PV array. Ground the PV racking directly to earth ground.

DO NOT connect the grid to the “AC OUT” output terminal.

DO NOT reverse the polarity of batteries. **Damage WILL occur**.

DO NOT exceed **600 V DC** on any MPPT on the MNPower inverter.

DO NOT turn off the battery breaker if there is current flowing in or out of the battery in any amount.

DO NOT use impact drivers to tighten any fasteners on the MNPower inverter.

Use conduit for AC and DC wires entering/exiting the wiring compartment to meet NEC and CSA code.

ALL terminals/breakers, including battery, MPPT, and AC Terminal Blocks should have only one conductor connected to each terminal. Pig tailing is an acceptable method to legally connect two wires to one circuit.

1. MNPower: At a First Glance

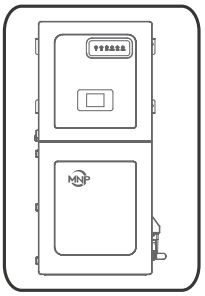
INSPECT SHIPMENT

The box should include all items shown in the component guide. If there is damage or missing parts, immediately call the phone number (USA) (877)-600-6688.

COMPONENT GUIDE

The MNPower MN 15-12KW-AIO system includes the following components:

A



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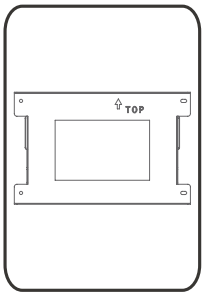

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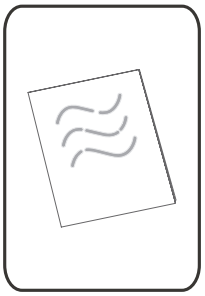

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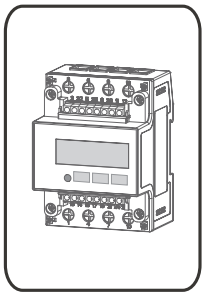

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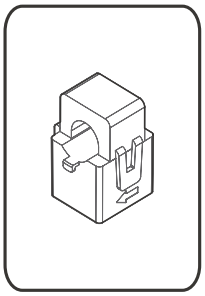

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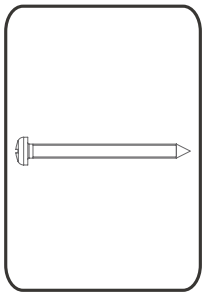

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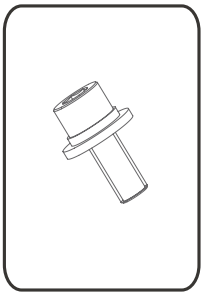

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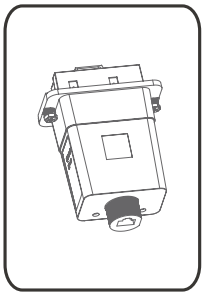

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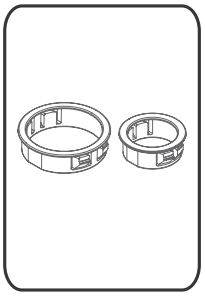

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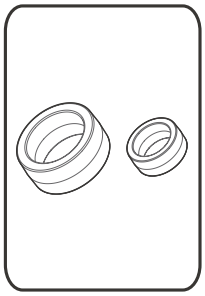

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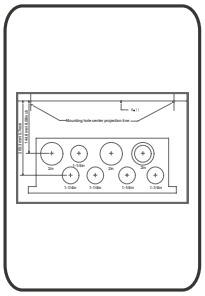

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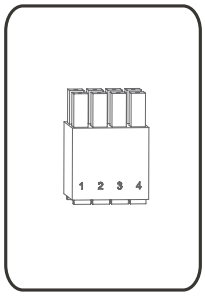
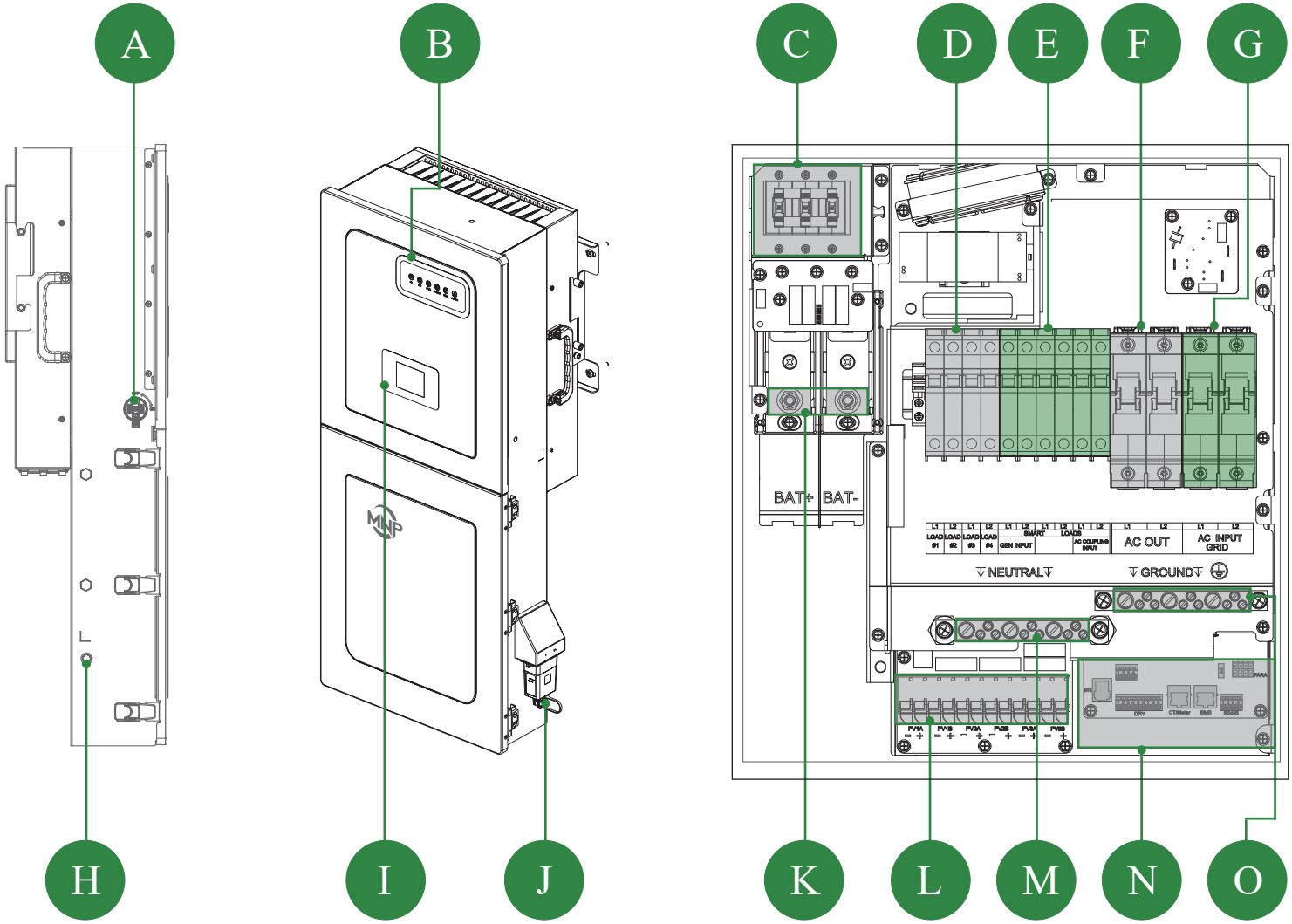


Component	Description	Quantity
A	Inverter	1
B	Mounting Bracket	1
C	File Package	1
D	Meter (Optional)	1
E	CT	2
F	M6 Self-tapping Screw	4
G	M6 Security Screw	1
H	Wi-Fi / Ethernet Dongle	1
I	Bushing Ring (φ: 67.5 mm & φ: 49 mm)	3 (φ: 67.5 mm) 6 (φ: 49 mm)
J	Toroid (φ: 5 mm for battery & φ: 30 mm for ground of grid)	2
K	Gutter Template	1
L	PARA Plug	1

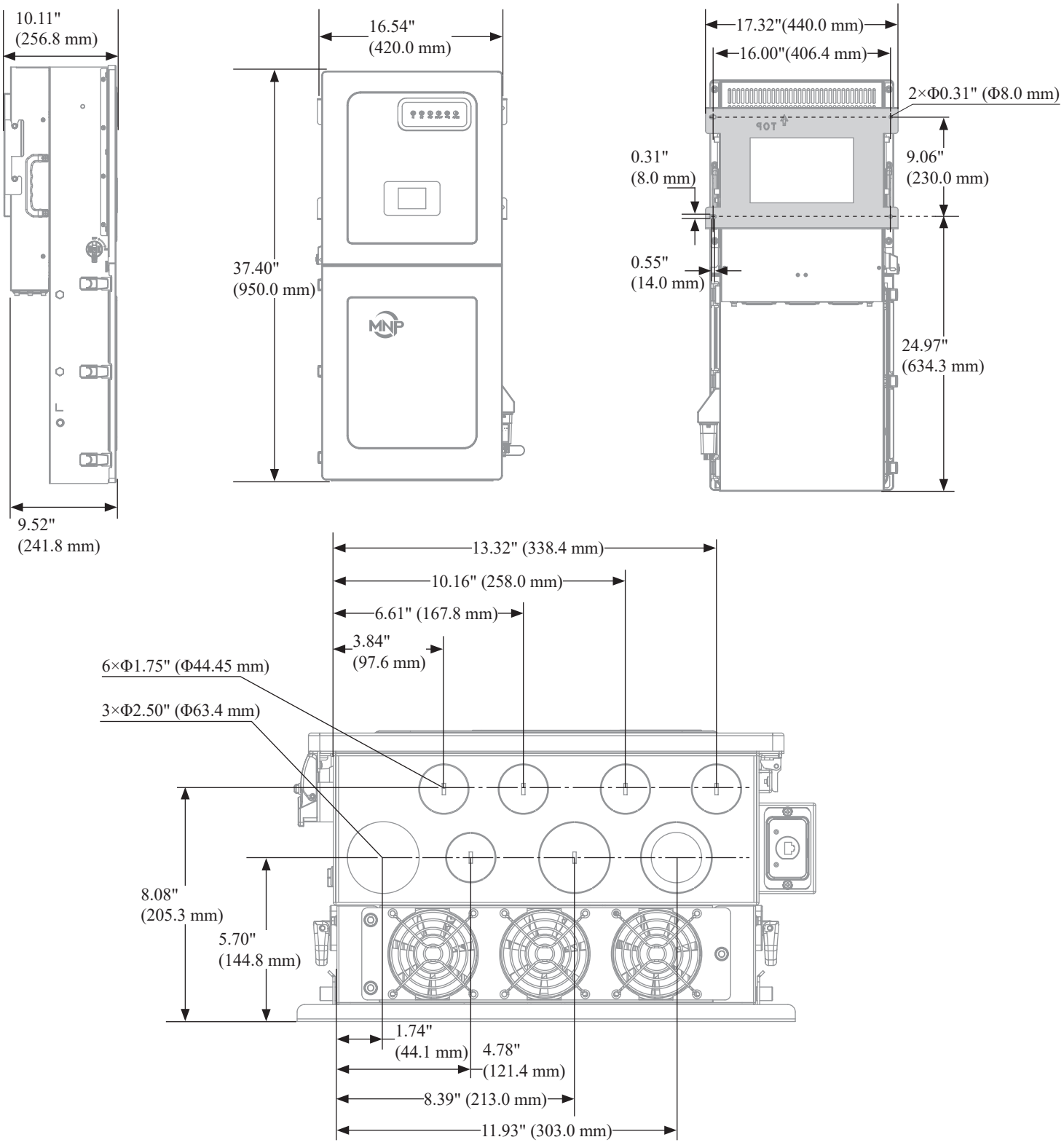
1.1 General Description



Component	Description
A	PV switch
B	LED screen
C	300 amp Hydraulic/magnetic Bat. breaker
D	Two 15 A & two 20 A / 240 V AC Load brkrs
E	120/240 V AC Smart load brkrs 60+30+50 A **OR** 60 A Gen input+ 30 A Smart Load+50 A AC coupling--Use each dual breaker as a load or input and program accordingly
F	100 A / 120/240V AC **OR** 120/208 V AC AC OUT
G	100A / 120/240 V AC **OR** 120/208V AC AC IN
H	ON/OFF Button
I	LCD screen

Component	Description
J	Wi-Fi / Ethernet dongle
K	5/16-18UNC Battery connection terminals
L	PV connection terminal block
M	Neutral Busbar
N	Communication connection ports (RS485, BMS, DRM, CT, DRY, RSD, PARA)
O	Groud Busbar

1.2 Specifications



Terminal	Torque [lb-in]	Torque [N·m]
LOAD (#1/#2/#3/#4)	20 lb-in	2.5 N·m
Smart loads breaker/Gen input/AC coupling	20 lb-in	2.5 N·m
AC out	35 lb-in	4 N·m
Neutral / Ground (Busbar)	50 lb-in (7/16-20 UNF) / 26 lb-in (1/4-28 UNF)	5.6 N·m (7/16-20 UNF) / 2.9 N·m (1/4-28 UNF)
AC Input Grid	35 lb-in	4 N·m
Battery Connection	126 lb-in	15 N·m

North America: MN 15-12KW-AIO

Datasheet

UL: MN 15-12KW-AIO

Input Data (PV)	
Max. Allowed PV Power (STC)	15,000 W
Nominal Voltage Range (V DC)	70 V DC to 550 V DC
Startup Voltage	70 V
Max. Input Voltage	600 V
Max. Input Current per MPPT	PV A: 30 A; PV B/C: 22 A
No. of MPP Trackers	3
No. of PV Strings per MPPT	2
Max. AC Coupled Input	10,000 W
Output Data (AC)	
Nominal AC Voltage	120/240 V, 120/208 V
Grid Frequency	50/60 Hz
Real Power, max continuous	11,400 W
Max. Output Current	47.5 A
Real Power, max continuous (batteries only, no PV)	10,000 W (41.7 A @240 V)
Peak Apparent Power (60 s, off-grid)	14,000 VA @240 V
Peak Apparent Power (1 s, off-grid)	> 15,000 VA @240 V
Max. Grid Passthrough Current	100 A
Power Factor Output Range	+/- 0.8 adjustable
Backup Transfer Time	Typical: 10 ms; Max: 20 ms
Design (DC to AC)	Transformer DC
Stackable	Up to 9 in parallel
Battery Input Data (DC)	
Battery Technologies	Lithium/Lead Acid
Nominal DC Voltage	48 V
Operating Voltage Range	40 V to 64 V
Max. Battery Charge / Discharge Current	210 A
Charging Controller	3-Stage with Equalization
Grid to Battery Charging Efficiency	Max: 93.4%
External Battery Temperature Sensor	Not Included
Current Shunt for Accurate % SOC	Integrated
Automatic Generator Start	Integrated
Communication to Lithium	CANBus & RS485
General Data	
Dimensions (H × W × D)	950 mm × 420 mm × 241.8 mm (37.40 in × 16.54 in × 9.52 in)
Net Weight / Package Weight	46.2 kg (101.85 lb) / 53.9 kg (118.83 lb)
Enclosure	NEMA 3R
Ambient Temperature	-25 °C to +60 °C, > 45°C Derating
Noise (No Load)	< 40 dB
Idle consumption - No Load	85 W
Wi-Fi & LAN Communication	Included
Standard Warranty	10 Years
Protection and Certifications	
Electronics Certified Safety by SGS Labs to NEC & UL Specs	Yes
Grid Sell Back — UL1741 3rd 2021, IEEE1547a 2018/2020, FCC 15 Class B, UL1741SB, CA Rule	Yes
Hawaiian Electric Companies, IEEE 1547.1-2020 Source Requirements Document Version 2.0 ("SRD V2.0"), effective on July 1st, 2020	Yes
PV DC Disconnect Switch — UL 508	Integrated
Ground Fault Detection — UL 1741 CRD	Integrated
PV Rapid Shutdown Control — UL1741 SECTION 92 TO SECTION 99	Integrated
PV Arc Fault Detection — UL 1699B	Integrated
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
300A × 1 Battery Breaker / Disconnect	Integrated
Surge Protection	DC Type II / AC Type II

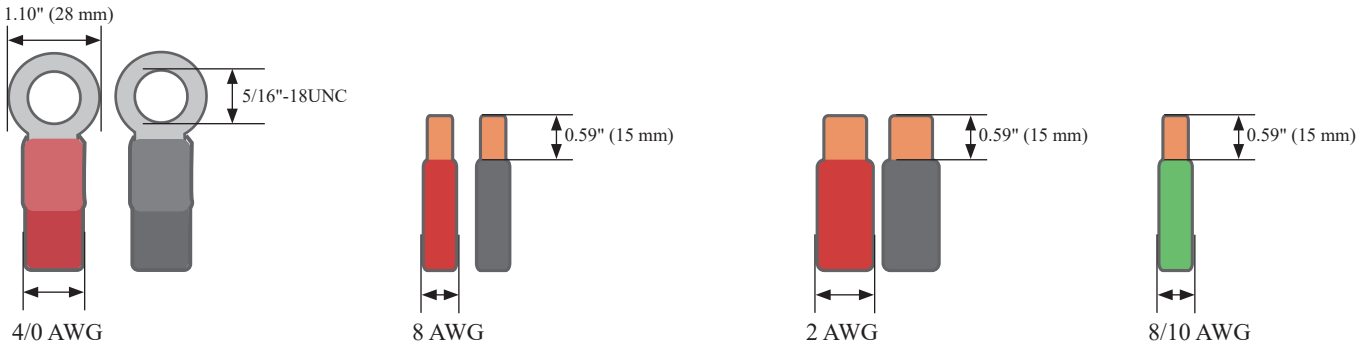
1.3 Wire Gauge Guide

1. **AC Input/Outputs:**
   - "AC INPUT GRID" Terminal 100 A MAX passthrough, 2 AWG conductor.
   - "AC OUTPUT" Terminal 100 A MAX passthrough, 2 AWG conductor.
   - Backed up Sub-panel may have more than 100 amps of load circuits although the utility pass through current is limited to 100 amps continuous per leg. Inverter output current when inverting is limited to 47.5 amps is continuous per leg.

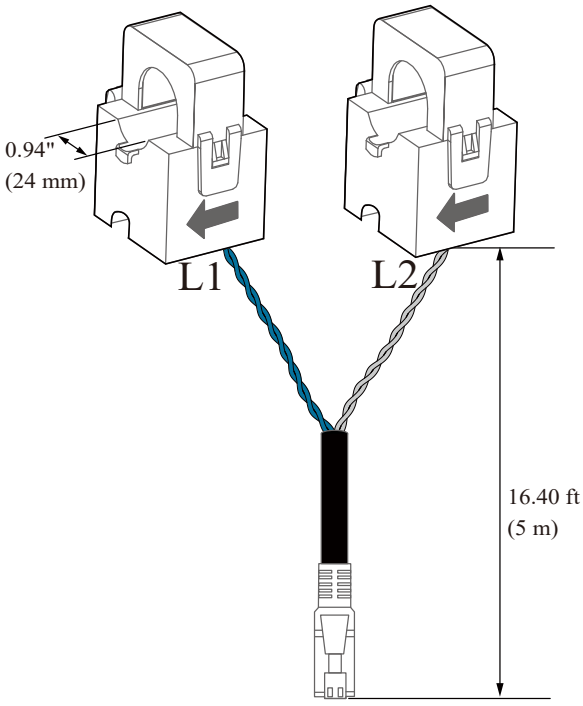
⚠ Wire gauge should be selected in compliance with your local electrical code.

2. **SENSORS CT:** 16.40 ft [5 m] included.
3. **BATTERY CABLES:** 4/0 AWG THHN / Max Charge and Discharge limited to 260 A.

Batteries | **PV Conductors** | **AC Conductors** | **Ground**

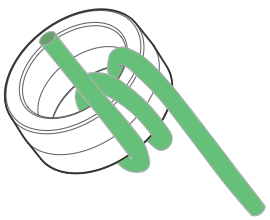


CT Sensors (Included)



Ground Toroid (φ 30 mm)

The ground cable of the Grid needs to be wrapped around the toroid twice, as shown below.



2. Installation

AC Out Backed up Circuits

A. The sub panel powered by the “AC OUT" circuit breaker terminals will be considered the Critical or Essential Loads Panel.

B. You may want to keep the essential loads panel within the limitations of the unit, however this panel is protected by 100 A breakers.

- Grid Tie → 24 kW = 100 A continuous @ 240 V (passthrough). 100 amps per 120 V AC leg.
- Off-Grid → 11.4 kW = 47.5 A @ 240 V (PV & battery) | 10 kW = 41.6 A @ 240 V (batteries only).

C. You can design for only continuous loads on the essential loads panel, however it is common to add more since loads are not normally continuous and fully consuming each breaker rating. You may add more loads than what can be powered, but the maximum continuous is stated above.

Single System Install

A. INVERTER AC IN and OUT:

- A 2-pole 125 A disconnect/breaker must be installed in the main utility distribution panel (2 AWG) to feed the MN 15-12KW-AIO to protect the conductors.

> Normal stab in breakers are normally thermal and can only be used at 80% of their rating. MidNite Power uses hydraulic/magnetic breakers that can be continuously used at 100% of their rating. Size cables for 125 A.

- Connect the inverter 100 A "AC OUT" breaker to the Essential Loads Panel using 2 AWG conductors.

B. SMART LOADS:

- There are three 120/240 V AC smart load breakers. Each smart load breaker has a programmable relay in series with the breaker.
- 60 A as an input is for generator hookup. 60 A as an output would be for a heavy load like EV charging.
- 50 A as an input can be for AC coupling. 50 A as an output can be for an electric range/oven.
- 30 A does not allow an input. 30 A as an output can be for an electric dryer, hot water heater, air conditioner, or other uses.

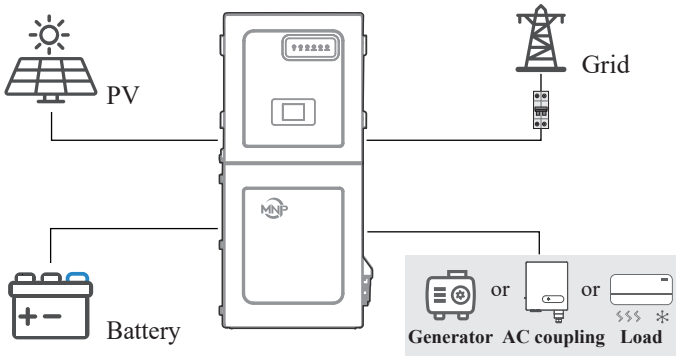


Figure 1: Single system install

2.1 Mounting the MN 15-12KW-AIO

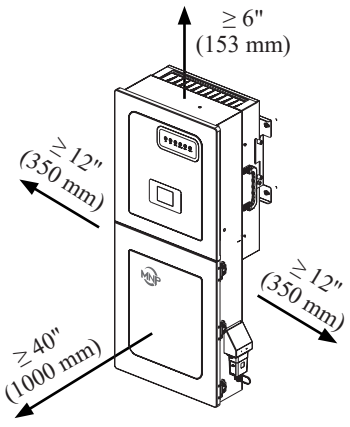


Figure 2: Mounting clearances

A. The system weight is 101.85 lb. (46.2 kg).

B. Considering the dimensions of the inverter, find a suitable location for the system(s). There must be at least 6 in [15 cm] of vertical clearance for proper heat dissipation.

> Heat transfer and cooling are done from bottom to top at a rate of 525 W/hr.

C. The MNPower MN 15-12KW-AIO has a NEMA 3R enclosure that is rated for outdoor installation but can also be installed indoors.

D. ⚠ PROTECT THE LCD SCREEN from direct exposure to UV light.

E. Mount the MNPower inverter and ensure the unit is leveled and properly seated.

F. Securely attach the inverter to the mounting surface. You may need expansion plugs or anchors for concrete. In case a different anchorage is required, calculate the support needed to properly hold the weight of the equipment.

G. Remove the sticker on the bottom of the equipment before mounting. Use gutter template to mark the installation location on the wire guard.

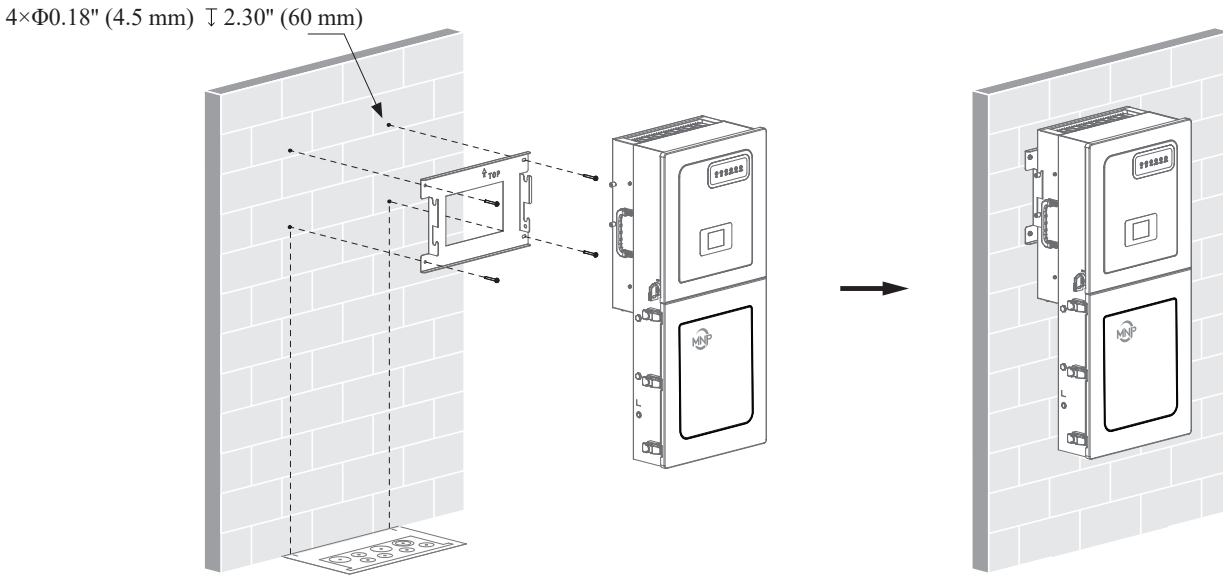


Figure 3: Wall mount

⚠ Damage to the LCD Screen due to direct sunlight exposure will not be covered by warranty.

H. Use the bushing rings as needed.

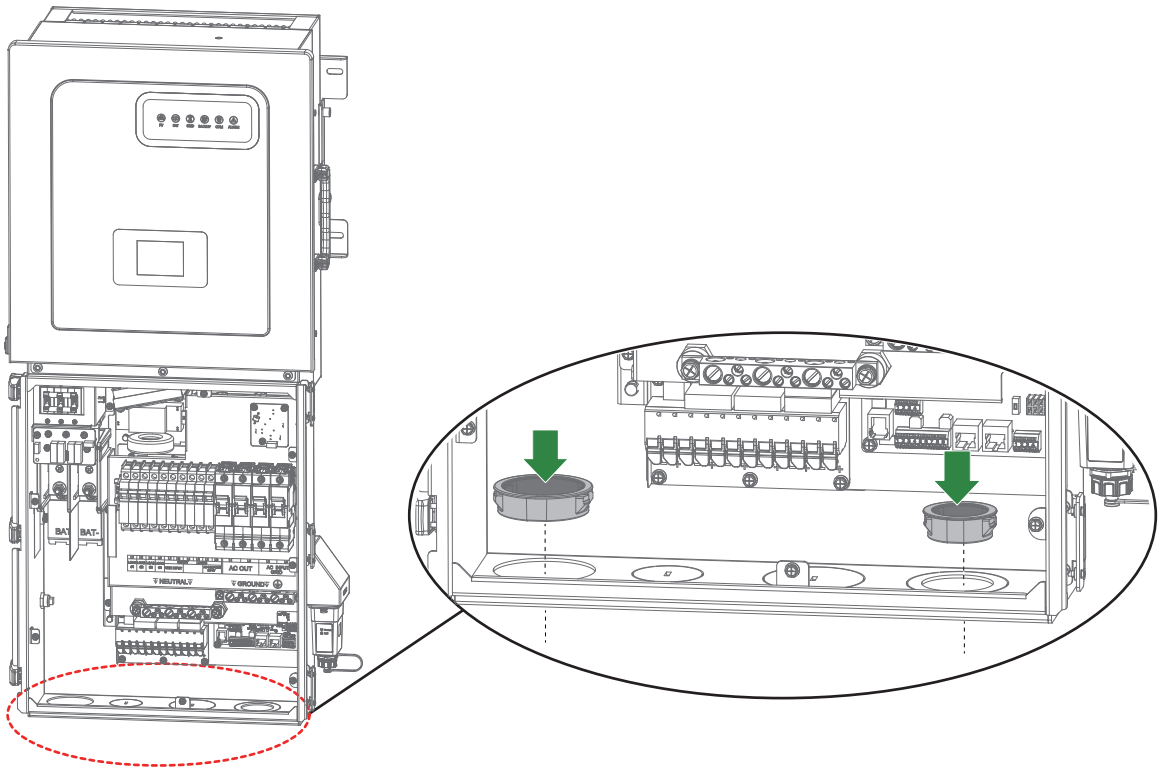


Figure 4: Bushing ring installation

I. Mount the inverter in a permitted position, as shown below.

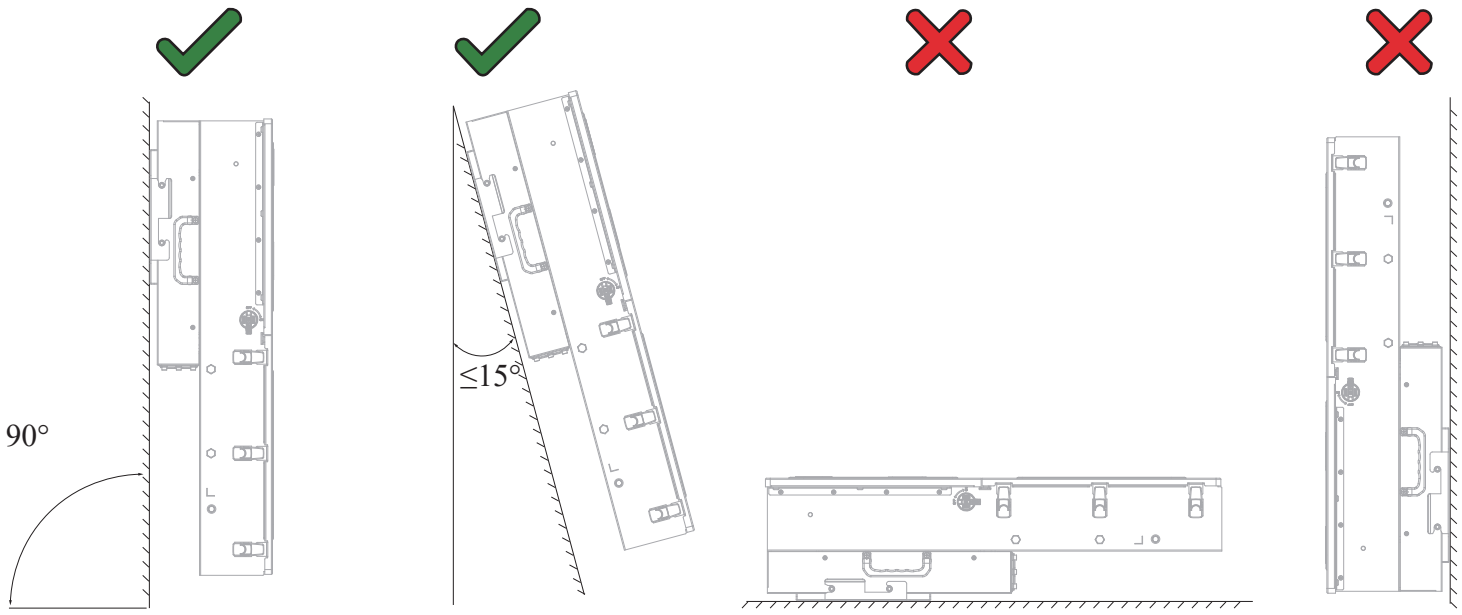


Figure 5: Permitted and prohibited mounting positions

2.2 Removing Insulation Cover

Before electrical connections, remove the grounding cable and insulation cover from the wiring area temporarily, as shown in figure below.

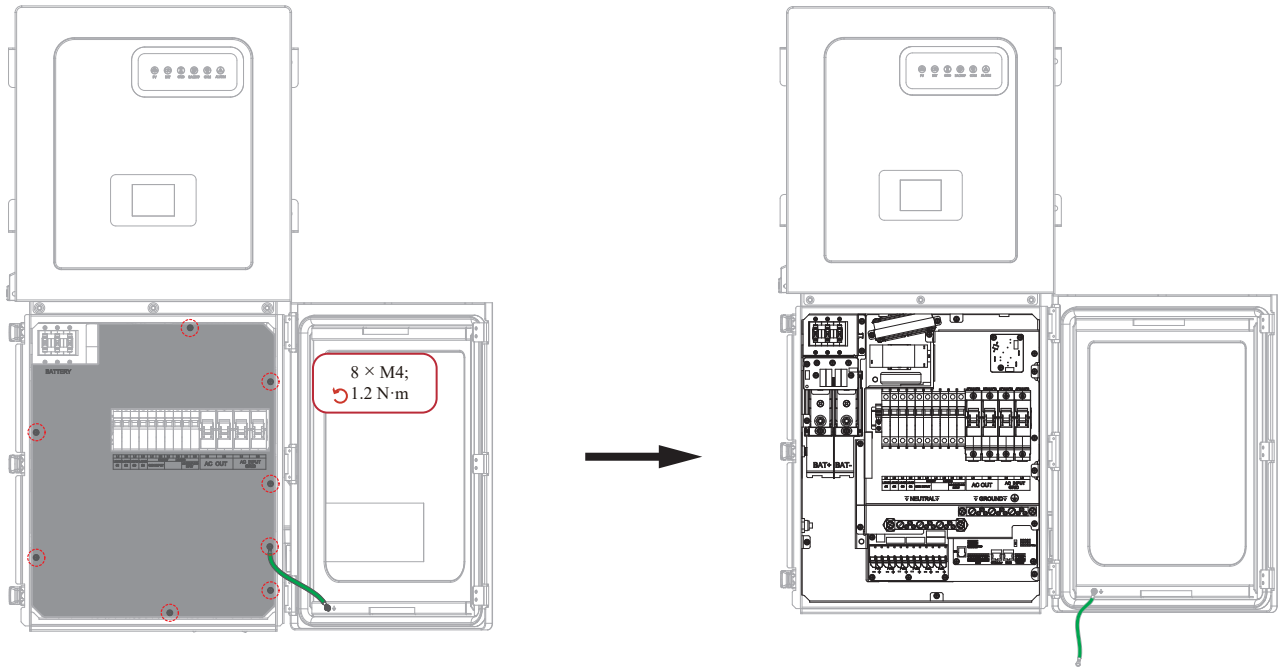


Figure 6: Removing insulation cover and grounding cable

After the electrical connections are complete, if no other connections are made in the wiring area, replace the insulation cover and ensure the grouding cable is well-connected again.

2.3 Connecting PV Modules

The inverter has 3 independent MPPTs and each can handle up to 2 PV strings. Each MPPT can operate at a current of 30 A / 22 A / 22 A (self-limiting) and a MAX Voc of 600 V.

A. Max DC solar input = 15 kW (± 5%) | Max input power of MPPT1 = 10 kW | Max input voltage per MPPT = 600 Voc | Max input current per MPPT = 30 A / 22 A / 22 A (self-limiting).

B. **There will be damage if Voc > 600 V.**

C. Strings in parallel on the same MPPT must have the same designed open-circuit voltage (Voc), otherwise the system will be limited to the lowest string voltage. Shading on one of the two strings will result in averaging the maximum power voltage.

i. PV1 A/B must have the same Voc.

ii. If the solar panels are oriented in different directions and connected in the same MPPT, there will be a loss in PV efficiency.

D. It is required per code in the US and Canada to ground the mounting frame from the PV array to an **external grounding system**.

E. Design for a max input current of 30 A MPPT1. The inverter will self-limit beyond 30 A. If current exceeds 40 A Isc limit, damage will occur.

F. Connect the solar panel strings using either of the following configurations:

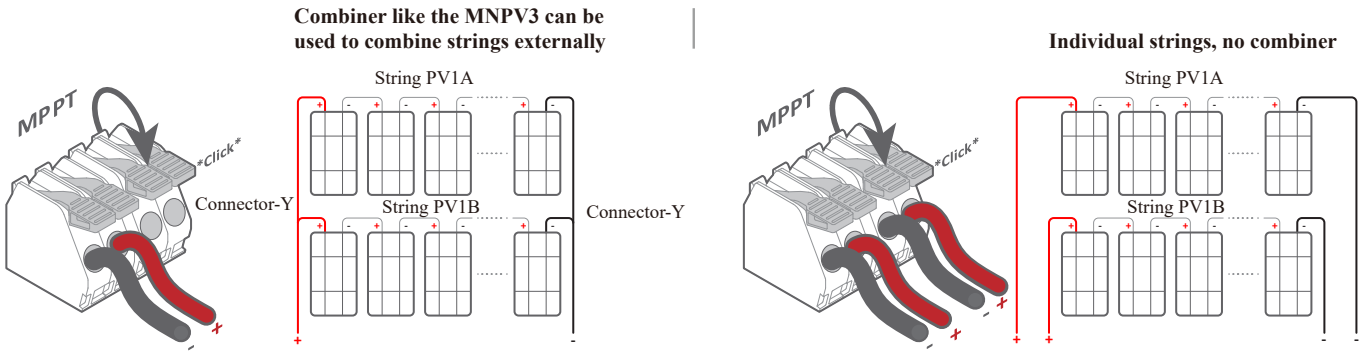


Figure 7: MPPT wiring and PV configurations

2.4 Integrating Batteries

A. ⚠ MNPower MN 15-12KW-AIO must be OFF while the batteries are being connected.

B. Depending on the battery voltage, wire up the battery bank in the possible configurations shown in figures.

C. Battery breakers must be OFF when wiring. If your battery bank does not have internal breakers, maintain the necessary safety measures when handling.

D. The inverter/charger reaches a max battery charge/discharge of 210 A.

⚠ MNPower MN 15-12KW-AIO is a **48 V nominal system**. **DO NOT** connect the inverter to any other battery configuration. If you use 12 V batteries, you **MUST NOT** exceed four (4) batteries in series, as shown in Figure 8b. The inverter can work with any battery chemistry as long as it remains within the range of **40 V DC to 64 V DC**.

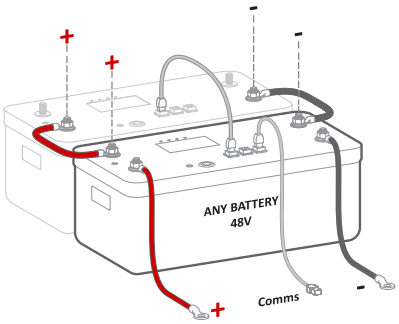


Figure 8a: 48 V DC batteries in parallel connection

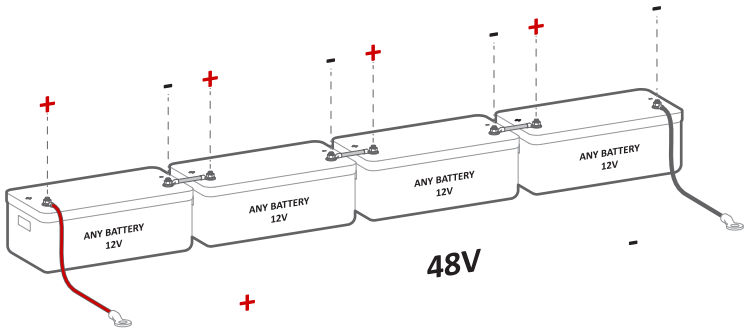


Figure 8b: 12 V DC batteries in series connection

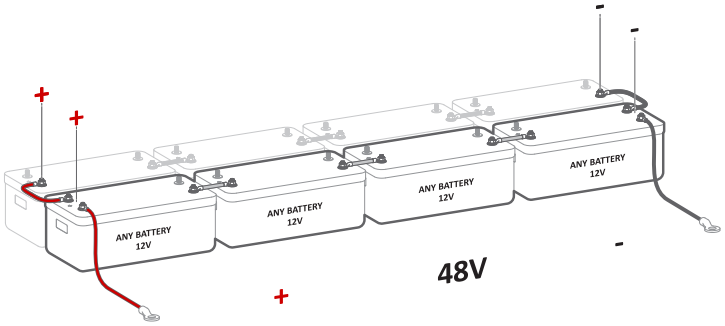
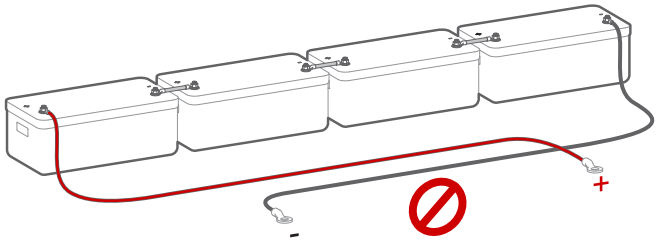


Figure 8c: Series and parallel connections for complete 48 V DC batteries bank



⚠ DO NOT reverse polarity. The system will be damaged, and warranty will be voided!

Battery Toroid

Install the battery toroid (provided) on battery input wires, as shown in the following figure. Battery (+) and (-) cables must go through the toroid simultaneously. These toroids are for EMI suppression.

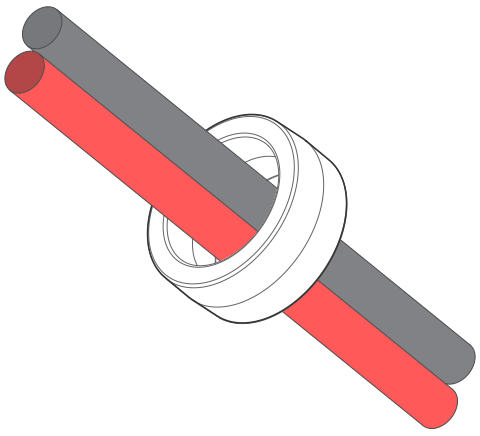


Figure 9: Battery toroid

Multi-Terminal Installation

The two battery input terminals of the MN 15-12KW-AIO will parallel batteries internally to ensure a common connection between battery banks and simplify battery installations. If a charge/discharge rate of 210 A is needed, the batteries must be connected to both input terminals. If applying 3 or more batteries, use external busbars or a MidNite Power battery combiner for (+) and (-) connections.

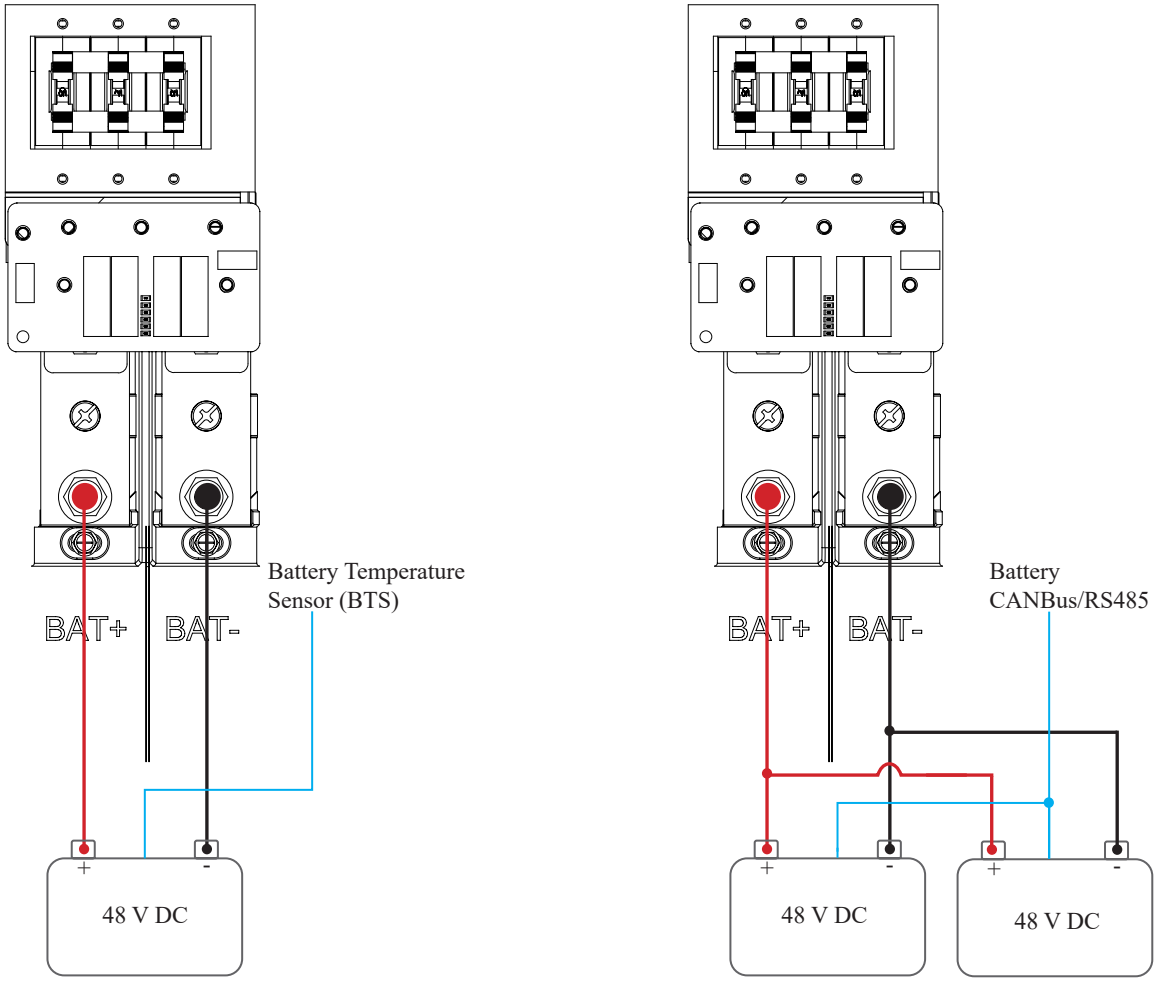


Figure 10: Multi-terminal installation

2.5 Integrating the Generator/Smart Loads/AC Coupling

Generators Smaller than 10 kW → On “GEN INPUT” Terminal

1. Supports 120/240 V generators.
2. Connect the generator output to the “GEN INPUT” breaker terminal in the wiring compartment. You must select the correct grid type before connecting the generator.
3. A THD (Total Harmonic Distortion) of less than 15% is preferred.
4. History tells us the biggest problem in renewable energy systems has the word "generator" involved. It is highly advised to use a generator intended for unattended operation. These generators are called "Prime Power Generators". Problems typically occur from portable generators that were never designed for this application. They can be identified easily. They have wheels and handles and don't cost much. Fortunately the charger in this inverter has shown to be very tolerant of portable generators.

Smart Load→ On “SMART LOADS” Terminal

The MNPower MN 15-12KW-AIO is a system that supports the addition of smart load.

AC Coupling→ On “AC COUPLING INPUT” Terminal

The MNPower MN 15-12KW-AIO is a system that supports the addition of AC coupled solar panels. The max solar input power can be expanded by coupling micro or string inverters into the “AC COUPLING INPUT” terminal. A full AC coupled solar system is not recommended as power control and monitoring is limited.

AC coupling on “AC COUPLING INPUT”

1. Can produce power during a grid outage or Off-Grid systems.
2. Can monitor solar production.

Max combined solar input AC = 12 kW

In Off-Grid systems, MNPower inverter uses Frequency Shift technology to shut down AC coupled solutions when the battery is full. Grid-Tied AC coupled solutions will always sell excess solar power back to the grid. “Limited to Load” will NOT limit production when AC coupled.

2.6 Automatic Generator Start

1. To charge the battery from the “GEN INPUT” source, the generator must be connected to the “GEN” input.
2. “Generator start SOC (%)” and “Generator end SOC (%)” or “Generator start Bat. Volt (V)” and “Generator start Bat. Volt (V)” are the set-point/condition that must be fulfilled to automatically start the generator.
3. (Default) Batteries will charge from a generator until the battery bank accepts 50% of its programmed capacity in Amperes-hours (Ah). This is equivalent to around 50% of the state of charge (SOC). These settings are fully adjustable on your App.

2.7 Integrating Sensors and Accessories

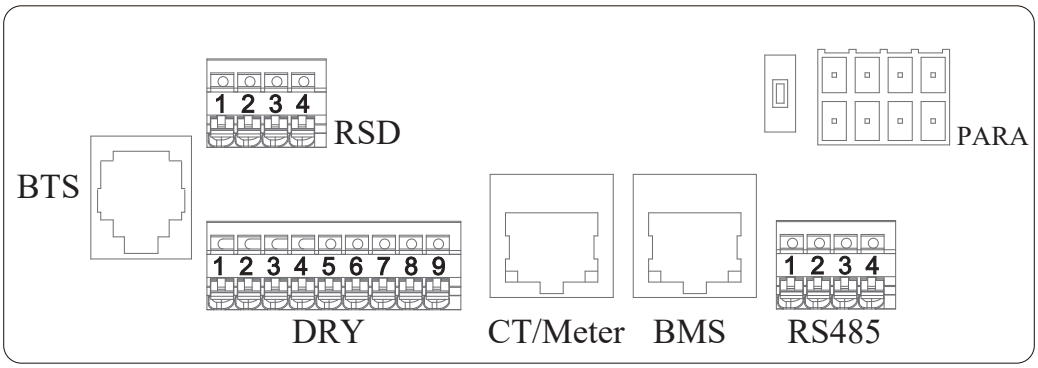


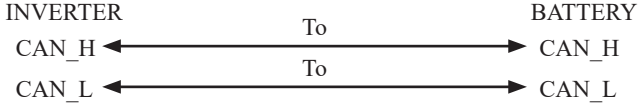
Figure 11: Communication wiring area

- **BTS:** Battery temperature sensor, not polarity sensitive. Used for voltage compensation for Lead Acid batteries.
- **RSD**: Rapid shutdown control.
  - (Pin 3, 4): For Pin 4 (Remote off) and Pin 3 (GND), normally open dry contact for EPO (emergency power off button).
  - (Pin 1, 2): For Pin 1 (12 Vdc) and Pin 2 (GND), 12 Vdc power supply (100 mA max, 12 Vdc, 1.2 W) for RSD transmitters. The built-in transmitter is SunSpec compatible.
- **DRY:** Generator control, Remote off control, DI/DO control.
  - (Pin 1, 2): Normally open relay for generator two-wire start. Applied voltage/current signal must be less than 30 Vdc / 1 A.
  - (Pin 7): Remote off control. Used for inverter Remote off switch connection.
  - (Pin 8, +9): Temperature sensor terminal of lead-acid battery.
  - (Pin 3, 4, 5, 6): Not in use.
- **CT/METER:** Meter communication or Grid current sensor.
- **BMS:** Lithium battery communication interface.
- **PARA:** Parallel communication. A matched resistance switch for parallel communication.
- **RS485:** RS485 communication.

⚠ Please ensure that the inverter is used strictly in accordance with the electrical specifications defined above; failure to do so may result in damage to the inverter.

BMS Port (CAN/RS485, Only for Lithium Battery)

- CAN BUS communication principle: CAN_H to CAN_H, CAN_L to CAN_L.
- Prepare RJ45 terminals and strip appropriate length of COM cables.
- Always face the flat side of the terminal, and count the pin slots from left to right from 1 to 8. Read the pin definitions of both the battery and inverter carefully.
- According to pin definitions and cable order, assemble the RJ45 terminals and crimp communication wires. Then label the RJ45 terminals (BAT or INV) to avoid confusion.
- After finishing wire-making, use a multimeter or other specific tool to determine if your cable is good, bad, or wired incorrectly.
- Insert the well-prepared communication cable into the correct inverter port and battery port respectively.
- CAN BUS connection principle:



This manual ONLY illustrates the pinout sequence of BMS at INVERTER SIDE. For details about the pinout sequence at battery side, see the user manual of the battery you use, and the following pinout diagram of battery side is only for illustration.

Pin	RS485	CAN
1	RS485_ A	--
2	RS485_B	--
3	GND_S	GND_S
4	--	CAN_H
5	--	CAN_L
6	GND_S	GND_S
7	GND_S	GND_S
8	GND_S	GND_S

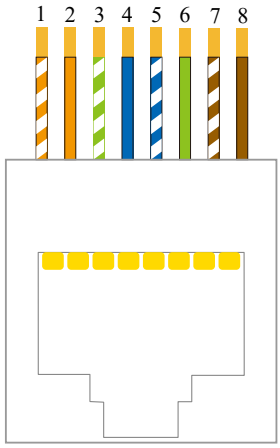


Figure 12: BMS pinouts configuration

Wi-Fi / Ethernet Dongle (Antenna)

Remote monitoring and software updates require an internet connection through the Wi-Fi/Ethernet Antenna (Dongle). Compatible with Wi-Fi or Ethernet connections.

A. Unscrew the cover. (Figure 13a)

B. Insert Wi-Fi/Ethernet dongle into the port firmly. (Figure 13b)

C. Secure the Wi-Fi/Ethernet dongle. (Figure 13c)

D. Take the waterproof connector out of the package and prepare the network cable with network. Insert the network cable. (Figure 13d)

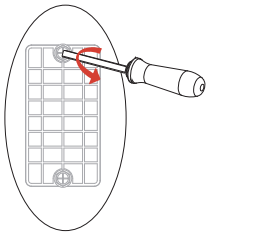


Figure 13a: Unscrew the cover

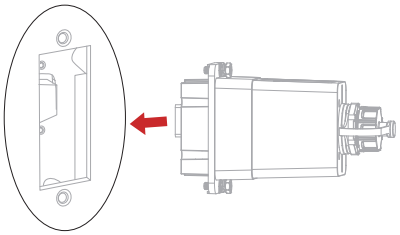


Figure 13b: Insert the Wi-Fi/Ethernet dongle

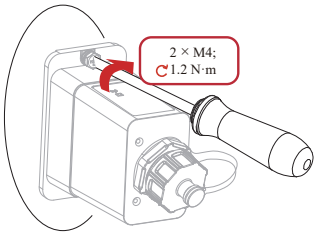


Figure 13c: Secure the Wi-Fi/Ethernet dongle

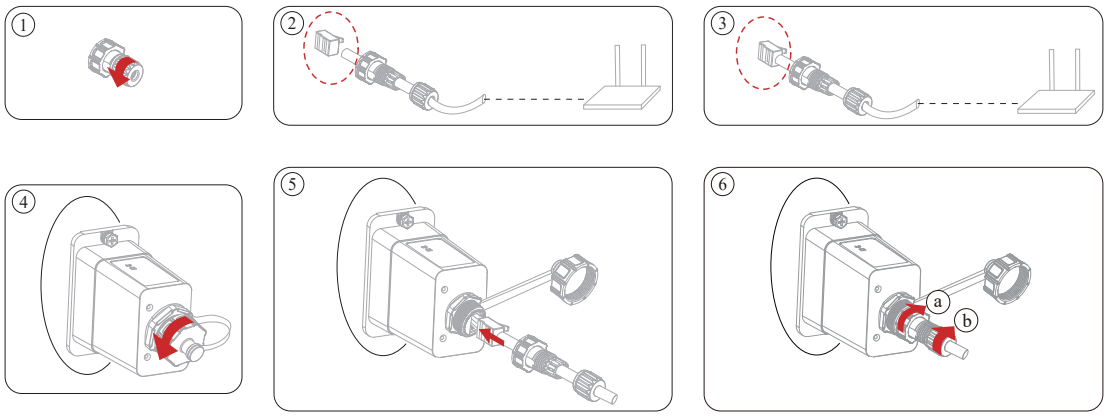


Figure 13d: Insert the network cable

2.8 Dry

The 9-pin dry terminal services as an Generator control, Remote off control, and DI/DO control.

GEN Start Signal (Two-wire start)

The signal comes from a normally open relay that closes when the generator “Start” condition is met.

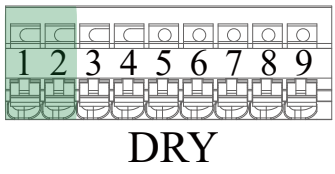


Figure 14: DRY pinout configuration for Gen

Remote off Control

The inverter can be remotely managed through a dry contact connection.

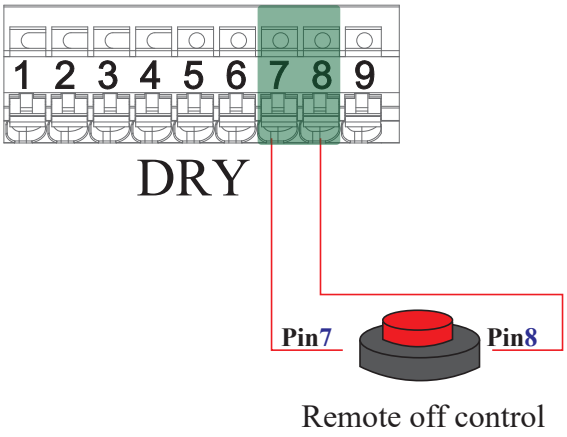


Figure 15: DRY pinout configuration foor remote off control

2.9 Limit Sensors (CT/Meter)

The CT/Meter will measure and calculate the demand in the Main Service Panel which the MNPower MN 15-12KW-AIO will then use to accurately supply and offset all home loads.

CT/Meter Installation

- Install sensors on incoming electrical service wires on L1, L2 and L3 if system is 3-phase.
- Embossed arrows on the sensors must point toward the grid/inverter.
- To ensure proper fit, check incoming wire diameters (grid or generator). If the sensors are too small, bigger CTs can be purchased by calling sales: 1-877-600-6688 or contacting support@midnitepower.com
- See section “Work mode” for more information about the different work modes.
- See section “Wiring diagrams” for more information on CT/Meter installation.

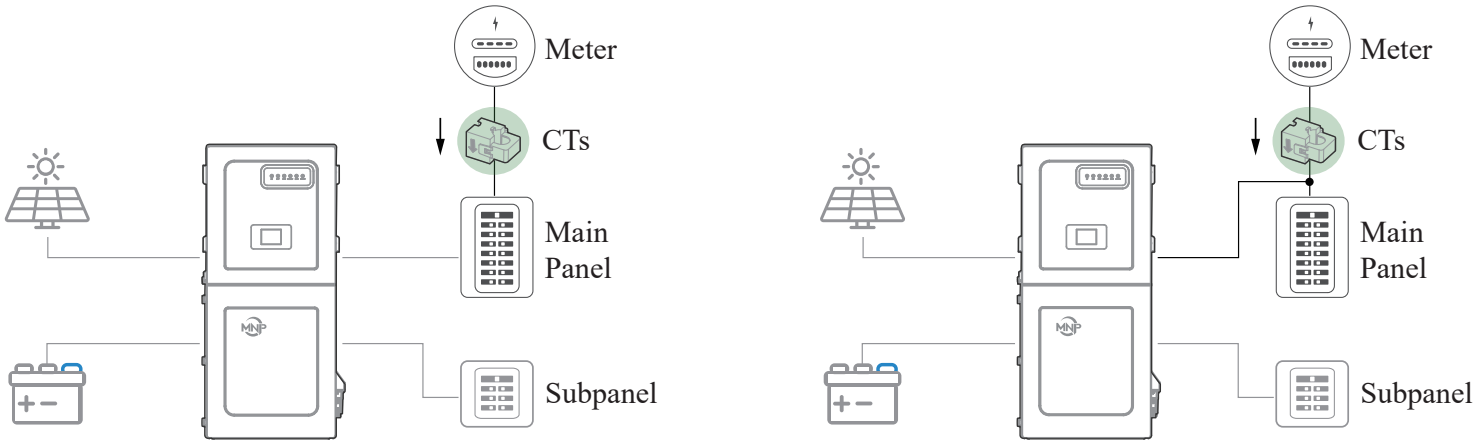


Figure 16: CT/Meter installation

CT Sensor Size

- MNPower inverter includes two 0.94" (24 mm) CT sensors (150 A, 3000:1).
- MNP offers one 0.94" (24 mm) CT sensor (500 A, 100:1) and one meter (DTSU666) upon request. •

Default CT ratio is 3000:1.

⚠ Unless authorized, DO NOT change CT Ratio or warranty will be voided.

Wire gauge is the only metric used to determine size of CTs. Contact sales at 1-877-600-6688 to purchase bigger CT sensors.

Wiring the CT sensor

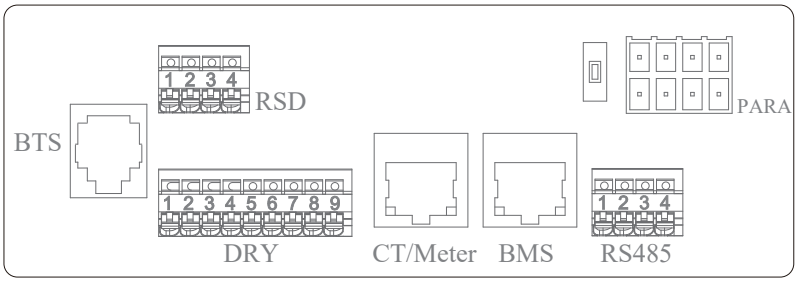


Figure 17: CT/Meter wiring area

CT Sensors for Stand-alone application

Each inverter will include two CT.

• Connect CT1 from phase L1 to pin 7 (White-Brown), 8 (Brown).

• Connect CT2 from phase L2 to pin 6 (Green), 5 (White-Blue).

Pin	Function Description
1	--
2	--
3	RS485_ A
4	RS485_B
5	CT2-
6	CT2+
7	CT1+
8	CT1-

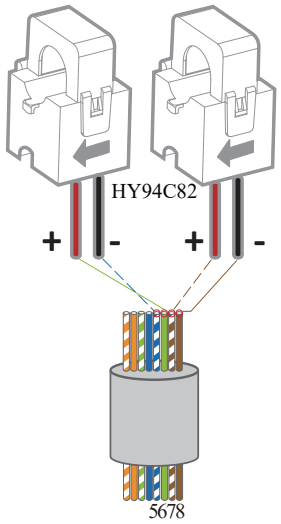


Figure 18: CT sensors for stand-alone application

CT+Meter for Parallel Systems

• CT+meter sensors are essential for stacking, which is highly recommended for multi-system installs.

• Please contact sales at 1-877-600-6688 to purchase the meter and bigger CT.

Pin	Function Description
1	--
2	--
3	RS485_ A
4	RS485_B
5	--
6	--
7	--
8	--

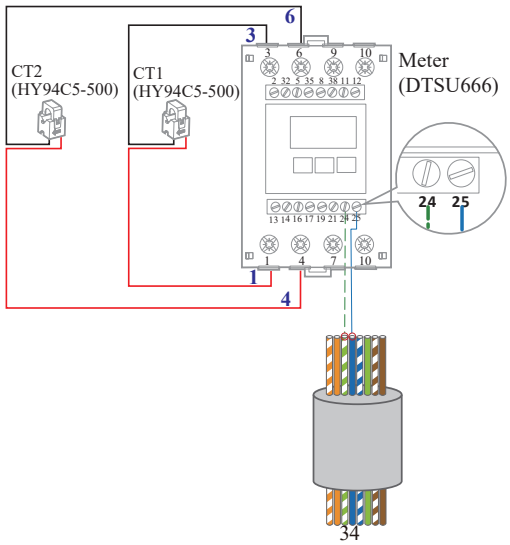


Figure 19: CT+meter for parallel systems

CT+Meter for Parallel Systems 120/208 V 3-Phase

- The three-phase system requires three CTs and 1 meter.
- Please contact sales at 1-877-600-6688 to purchase the meter and bigger CT.

Pin	Function Description
1	--
2	--
3	RS485_ A
4	RS485_B
5	--
6	--
7	--
8	--

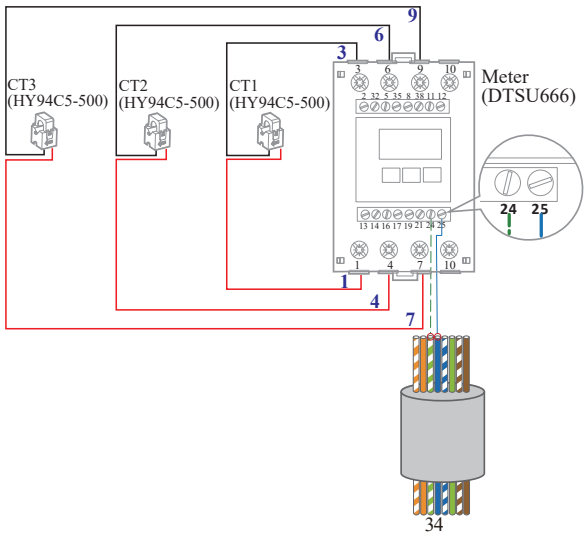


Figure 20: CT+meter for parallel systems 120V/208V three-phase

2.10 RS485

4-Pin interface for RS485 communication:

Pin	Function Description
1	RS485_A
2	RS485_B
3	--
4	--

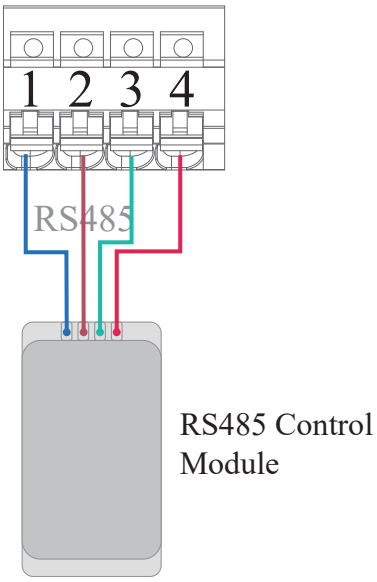


Figure 21: RS485 pinouts configuration

2.11 Parallel Communication

It is necessary to turn the matched resistance switch of inverter No. 1 (i.e., inverter 1 in figure below) and inverter No. N (i.e., inverter N) to “ON” and others to "1" in parallel connection mode. See Section 5 "Diagram 02" for more information on parallel wiring.

Pin	Function Description
1	GND_S
2	PARA_SYNC
3	CAN_L
4	CAN_H

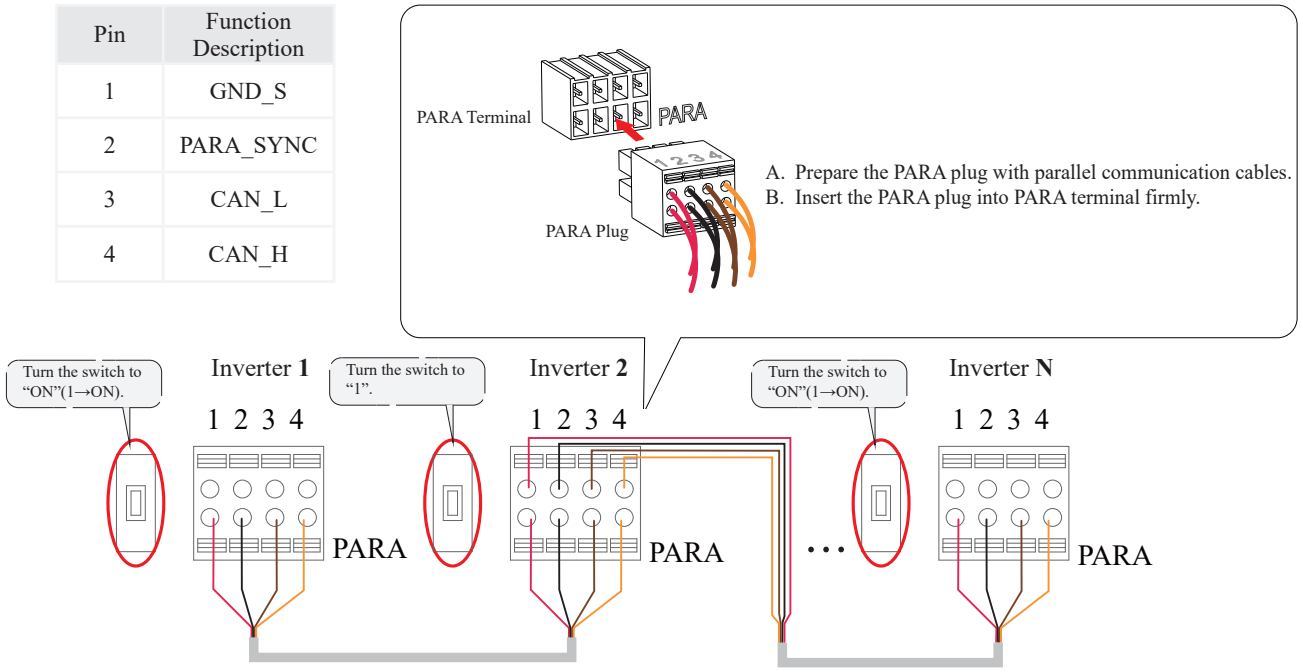


Figure 22: Parallel communication pinouts configuration

2.12 Emergency Stop and Rapid Shutdown

The (3,4) emergency stop pins of the MNPower MN 15-12KW-AIO are a normally open contact that triggers rapid shutdown (RSD) when closed. RSD will cut all power including the MNPower inverter's internal power supply and stop all AC outputs. The MNPower inverter will disconnect any RSD transmitter that will then shutdown all solar panels when the emergency stop button is pressed.

- Emergency stop button connects to (3, 4) pins. A momentary switch will suffice. A shutdown and restart will be required after an RSD event.
- For parallel systems: the emergency stop should be connected to the inverter designated as “Inverter 1” and it will initiate rapid shutdown on all paralleled inverters.
- Pins 1 & 2 are already wired to the SunSpec transmitter.

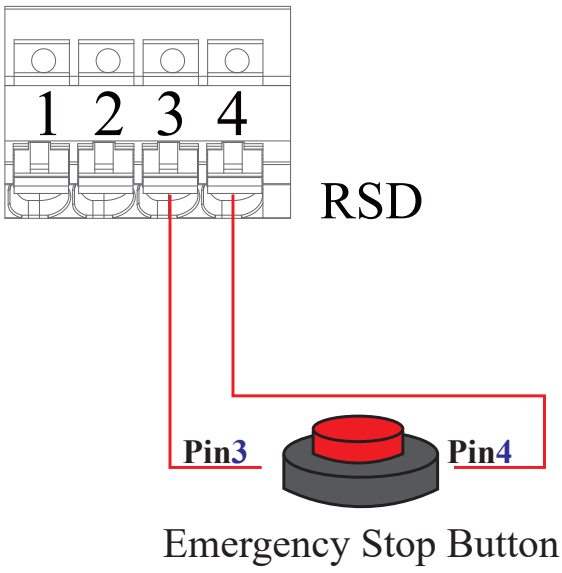


Figure 23: Emergency stop pinouts configuration

2.13 Powering-up and Testing the MNPower inverter

1. Check the voltage of the battery bank

A. ⚠ The voltage of the battery must be from 40 V DC to 64 V DC.
B. If applicable, turn **ON** internal switches of the batteries. Measure individual voltages.
C. Verify that the voltage of the battery bank at the battery terminals is adequate.

2. Check the voltage of each PV input circuit

A. ⚠ Input voltage must not exceed 600 V DC. Damage to the inverter will result.
B. Input voltage must be above the startup voltage of 90 V DC.
C. ⚠ Do not ground PV+ or PV-. Damage to the inverter will result.
D. ⚠ Verify polarity in each PV string. Reverse polarity will measure 0 V DC by the inverter and will cause long term damage.
E. PV input will only turn on the LCD screen. Inverter requires **grid power** or **batteries** to start inverting.
F. PV switch on the side of the inverter will turn the PV ON or OFF.

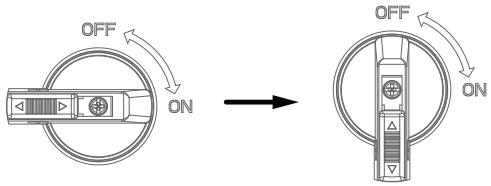


Figure 24: Check PV switch

3. Check AC INPUT GRID input voltage with breakers off

A. Use the breaker terminal lugs to measure AC voltages with a multimeter.
B. Measure line (L) to neutral (N) voltages on **"AC INPUT GRID"** terminal. Ensure 120 V AC on both legs.
C. Measure line (L1) to line (L2) voltage on **"AC INPUT GRID"** terminals. Ensure 240 V AC or 208 V AC. (If voltage reading is close to 220 V or 210 V, verify if grid is single-phase or three-phase instead).
D. Verify that voltage between neutral and ground is 0 V AC. Stray parasitic capacitance in wiring may show low voltages present.
E. Verify that voltage between **"AC INPUT GRID" L1** and **"AC OUT" L1** is 0 V. Do the same for L2.

4. Power ON MNPower MN 15-12KW-AIO

A. Power on the PV.
B. Power on the battery from the battery breaker and any external battery switches or breakers.
C. Power on the AC INPUT GRID breaker.
D. Connect the cell phone App via Bluetooth and click the Power ON in the App for the first time. Or you can hold the ON/OFF button on the side of the inverter for 5 s in this step when performing subsequent startup. Cell phone app instructions are on the side of the inverter & on the quick start guide.
E. Power on the AC OUT breaker.
F. Power on the SMART LOAD breakers.
G. **Please wait 5 minutes for the inverter to start as it makes systems checks.**
H. **When changing modes or changing smart load settings, you must put the inverter in standby and wait 5 minutes to restart.**
I. **If an error is identified, you must clear the error to recover and wait 5 minutes to restart.**

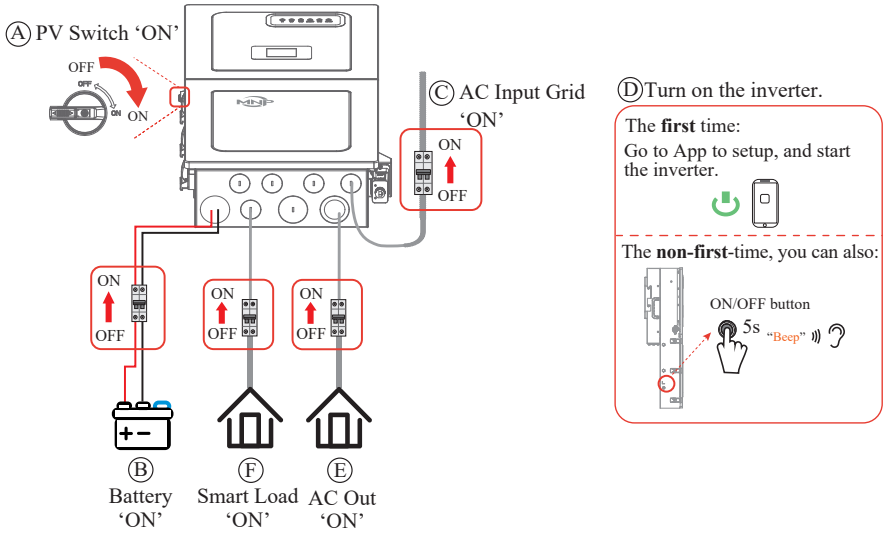


Figure 25: Power-on procedure

2.14 Power Off Sequence

A. Power off the AC OUT breaker.
B. Power off the SMART LOAD breakers
C. Connect the cell phone App via Bluetooth and click the Power OFF on the App. Or you can hold the ON/OFF button on the side of the inverter for 5 seconds in this step when performing subsequent shutdown.
D. Power off the AC INPUT GRID breaker.
E. Power off the battery from the battery breaker and any external battery switches or breakers.
F. Power off the PV.
G. To disconnect the inverter cables, please wait at least **5 minutes** before touching them.

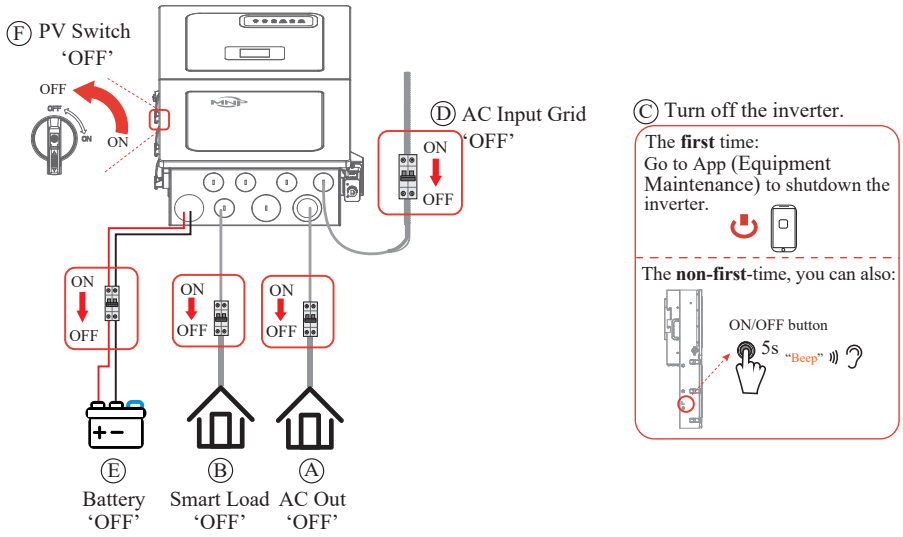


Figure 26: Power-off procedure

2.15 LED Indicators

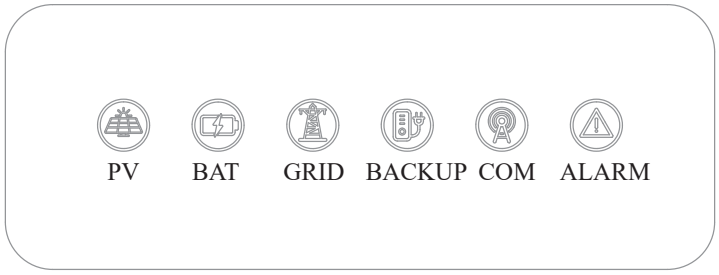


Figure 27: LED indicators

PV	BAT	GRID	COM	BACKUP	ALARM
On →PV input is normal.	On →Battery is charging.	On →GRID is available and normal.	-	On →BACKUP power is available.	On →Fault has occurred and inverter shuts down.
Blink →PV input is abnormal.	Blink →Battery is discharging. Battery is abnormal.	Blink →GRID is available but abnormal.	Blink →Data are communicating.	Blink →BACKUP output is abnormal.	Blink →Alarms have occurred but inverter doesn't shut down.
Off →PV is unavailable.	Off →Battery unavailable or battery type not selected.	Off →GRID is unavailable or set to off grid mode.	Off →No data transmission.	Off →BACKUP power is unavailable.	Off →No fault.

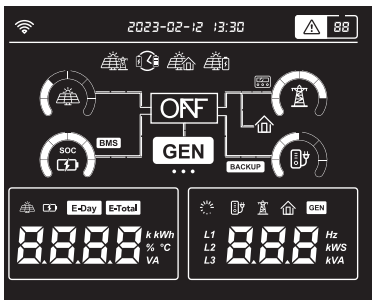
*Fully energizing the unit constitutes at least: a) DC Solar panels AND Grid or b) Just batteries.

2.16 LCD Screen

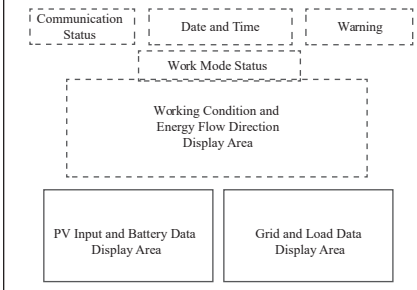
LCD screen is optional for this series of inverters. If you choose a LCD screen, the following introduction will help you understand the function of each icon displayed.

> LCD screen will be automatically turned off if there is no operation within 10 mins (which cannot be changed by default). You can press the ON/OFF button on the side of inverter to wake up the LCD screen.

Menu Structure Overview

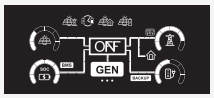


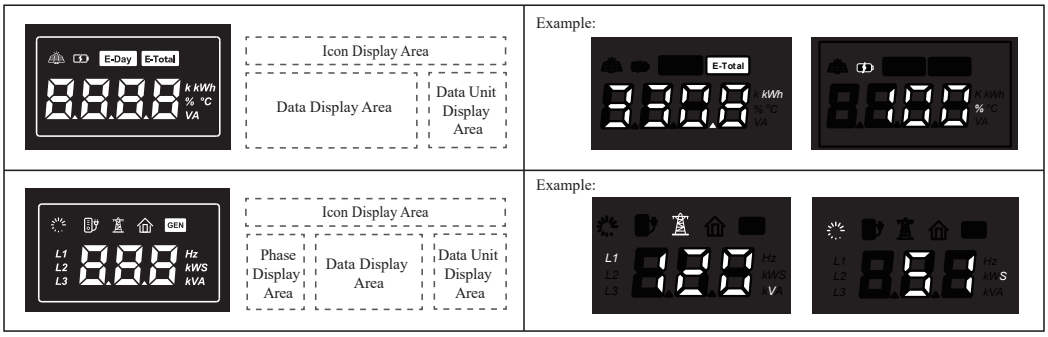
Actual LCD Screen



Function Overview

Icon Introduction-1

	This icon indicates **WIFI** connection status.
	The **date and time** display information about year, month, day, and hour. The ':' between hour and minute flashes once a second.
	The **warning icon** only displays when an error occurs. For the specific warning code explanation, please refer to the chapter Troubleshooting Guide.
	These four icons show **different operating statuses**. Please refer to section Work Mode for detailed introduction.  **Grid Feed in priority (Sell to grid)**  **Self Consumption**  **TimeBase Control Function**  **Off Grid**
	This area shows the **working conditions and energy flow directions**. Please refer to table Icon Status Description for a detailed introduction to each icon displayed.
	The **Energy Bars** indicate the direction of energy flow. Each bar lights up one by one, then turns off when all bars light and repeats this cycle again.
	The **Energy Ring** indicates the battery SOC or the current power percentage. Each Energy Ring definition is as follows.  PV Input Power  ***On-Grid Mode***: Grid Output Power ***Non On-Grid Mode:*** Bypass load consumption power + Backup consumption power  Battery SOC  Backup  Grid undervoltage Energy ring flashes  Grid overvoltage Energy ring flashes



Icon Introduction-2

	The **PV icon** represents the power of PV.
	The **Battery icon** represents the current battery charge percentage or the voltage of battery.
E-Day	The **E-Today icon** represents the electricity energy generated today.
E-Total	The **E-Total icon** represents the electricity energy generated in total.
	When the **Loading icon** is on, it indicates that the device is starting, and the start timer countdown is displayed. The icon lights up a cluster of lights every second until all lights are on, and then it repeats the whole process again.
	The **Back-Up icon** represents the relevant power, frequency or voltage of backup.
	The **Grid icon** represents the relevant power, frequency or voltage of the Grid.
	The **Load icon** represents the power consumption.
GEN	The **GEN icon** represents the voltage or power of generator.
L1 L2 L3	The **L1 icon** represents L1 phase of Grid/Backup/Generator. The **L2 icon** represents L2 phase of Grid/Backup/Generator. The **L3 icon** represents L3 phase of Grid/Backup/Generator.
	These two areas will display corresponding data of each lit icon mentioned above.

Icon Status Description

Icon Status Description			
Icon	**Name**	**Light**	**Description**
	PV	ON	Any PV voltage exists (it should be higher than the Min. PV Startup voltage).
		OFF	PV voltage is lower than the Min. PV Startup voltage.
	Grid	ON	Grid voltage and frequency are normal.
		OFF	Grid overvoltage / undervoltage / overfrequency / underfrequency occurs.
	Battery	ON	Battery voltage is higher than the Rated Min. Battery voltage.
		OFF	Battery voltage is lower than the Rated Min. Battery voltage.
	Backup Load	ON	Backup relay is on.
		OFF	Backup relay is off.
	BMS	ON	Battery is set to BMS Type and its communication is normal.
		Blink	BMS communication is abnormal. (The icon indicator on for one second, off for one second.)
		OFF	1. Battery is not set to BMS Type.
			2. Battery voltage is lower than Rated Min. voltage.
	BACKUP	ON/OFF	Lights up/off with Backup Load icon simultaneously.
	Meter/CT	ON	Power Limit in the App is set to Meter or CT, and the Meter/CT communication is normal the Grid side is running well.
		Blink	When Meter/CT communication is lost, Meter/CT icon on for one second, off for one second.
		OFF	1. Power Limit is not set to CT or Meter.
			2. The voltage or frequency of grid side is abnormal.
	Load	ON/OFF	Lights up/off with Grid icon simultaneously.
	ON	ON	1. Backup relay is on.
			2. The inverter works under On-Grid mode.
			3. The inverter works under Off-Grid mode.
	OFF	OFF	Non-on working mode.
	Generator / Smart Load	From left to right, when the two dots light up, each represents different meanings.	
		When GEN communication is lost, GEN icon will go off.	
	GEN	ON	Generator relay is on.
		OFF	Generator relay is off.
	Generator dot	ON	In App, the "Smart Load 1(GEN)" parameters are set to "Generator" and the generator relay is powered on.
		OFF	App parameter is set to Non "Generator".
	Smart Load dot	ON	In App, the "Smart Load 1(GEN)" parameters are set to "Smart load" and the generator relay is powered on.
		OFF	APP parameter set to Non 'Smart load'.

2.17 Quick Setup

1. Download App

• Scan the QR code to download the App **MidNite Pro**.

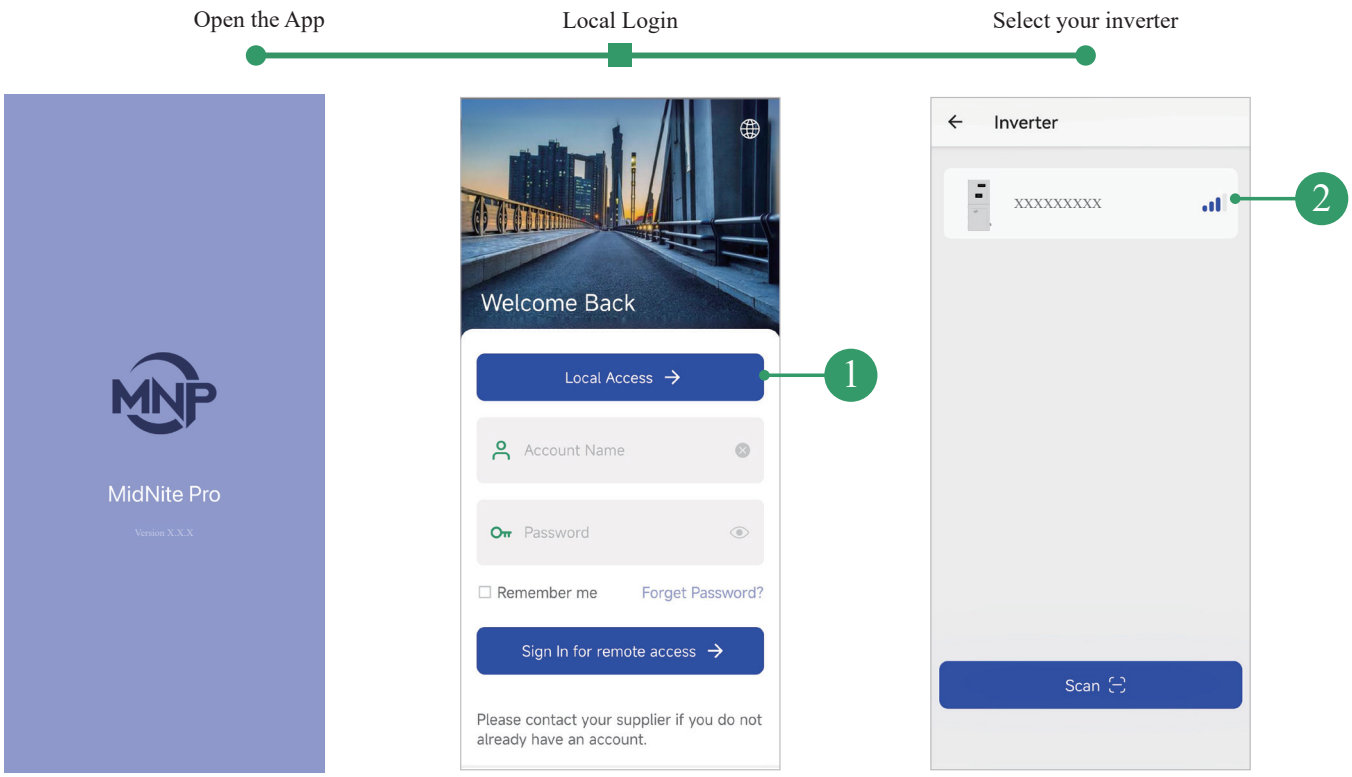
Figure 28: MidNite Pro QR Code

• Download the App from the App Store or Google Play

Before using the local setting, the App should access some permissions. (You can allow them when you install the App or grant permissions in your own phone setting.) When the App asks for permission, please click Allow.

2. Local Login

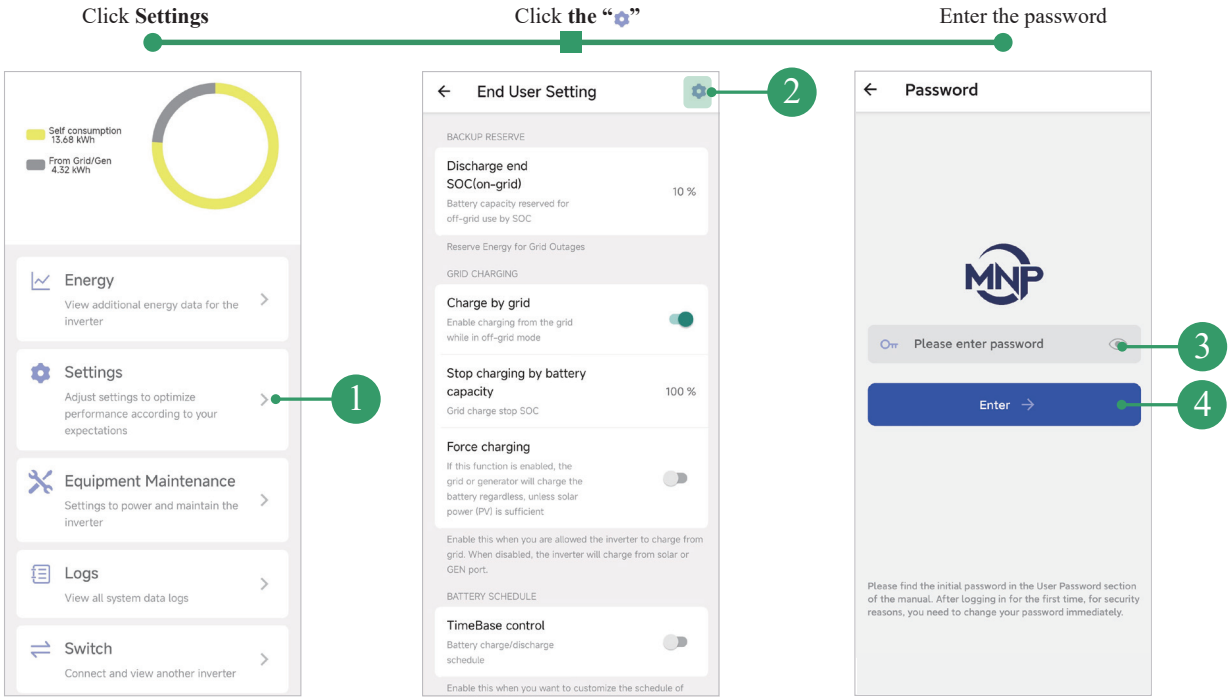
Enable the Bluetooth on your own phone and the App, then do as shown in the following diagram.



3. Administrator Setting

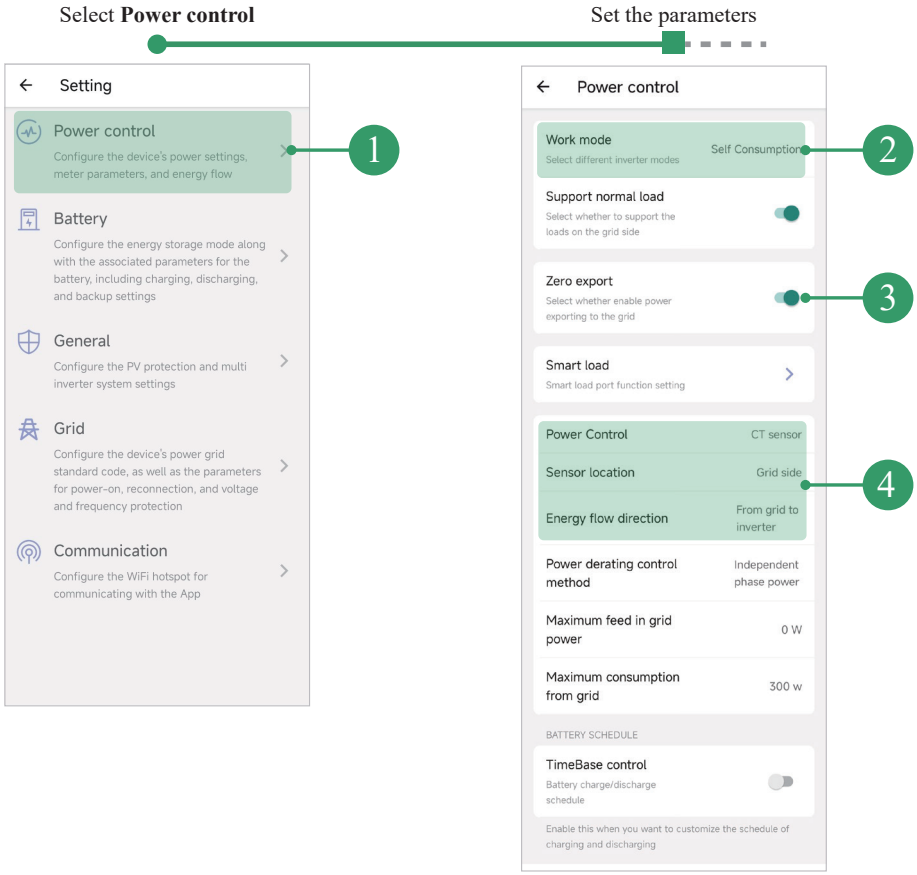
From the **Home** page, navigate to "**Settings**" menu. Change your access level to set more parameters.

> The initial password is '**superadmin**'.
> After logging in for the first time, for security reasons, you need to change your password immediately.

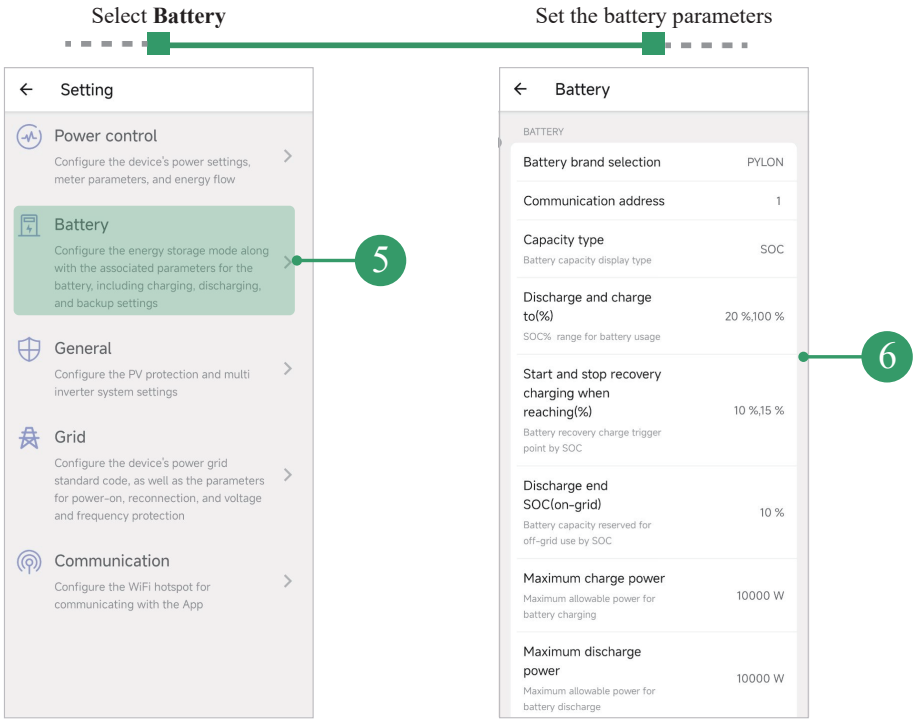


4. Set the Parameters

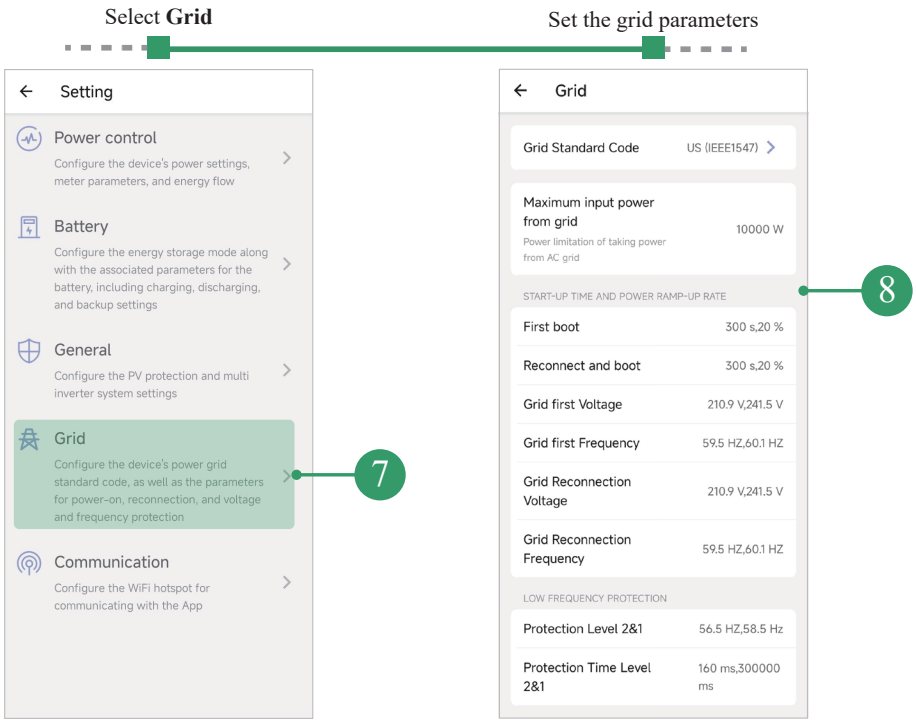
A. In the **Setting** page, follow the diagram below to configure the work mode and power control settings. If you intend to sell surplus energy back to the grid, make sure to disable the Zero Export feature; otherwise, keep it enabled.



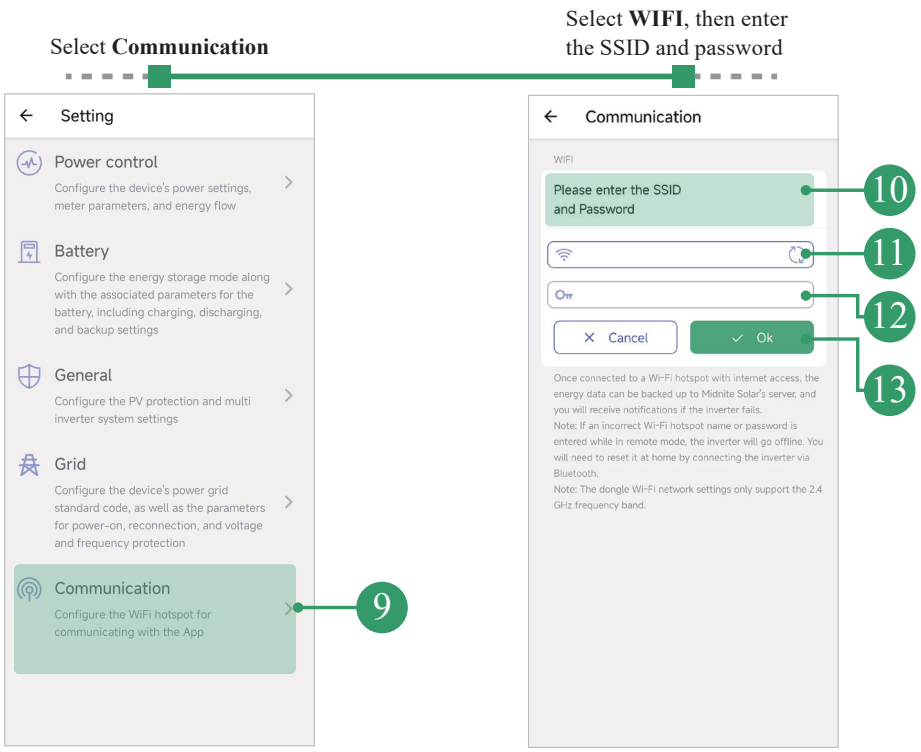
B. Go back to the **Setting** page and follow the diagram below to configure the battery parameters.



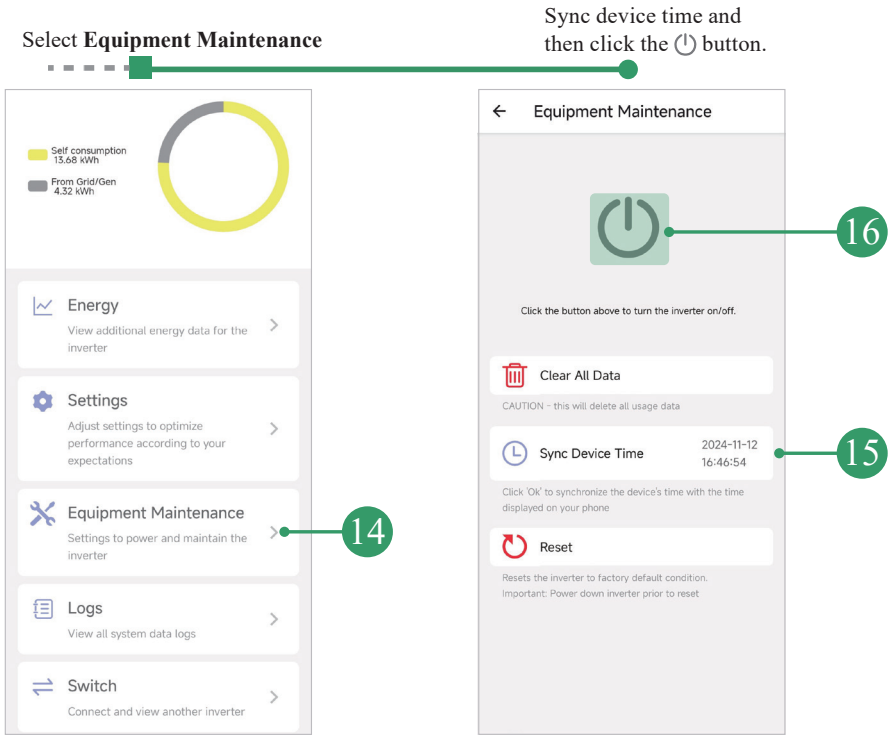
C. Go back to the **Setting** page and follow the diagram below to configure the grid parameters.



D. Go back to the **Setting** page and follow the diagram below to connect to a Wi-Fi hotspot with internet access.



E. Go back to the **Home** page and follow the diagram below to sync device time, then turn on the inverter.



3. User Interface

Download App

• Scan the QR code to download the App **MidNite Pro**.

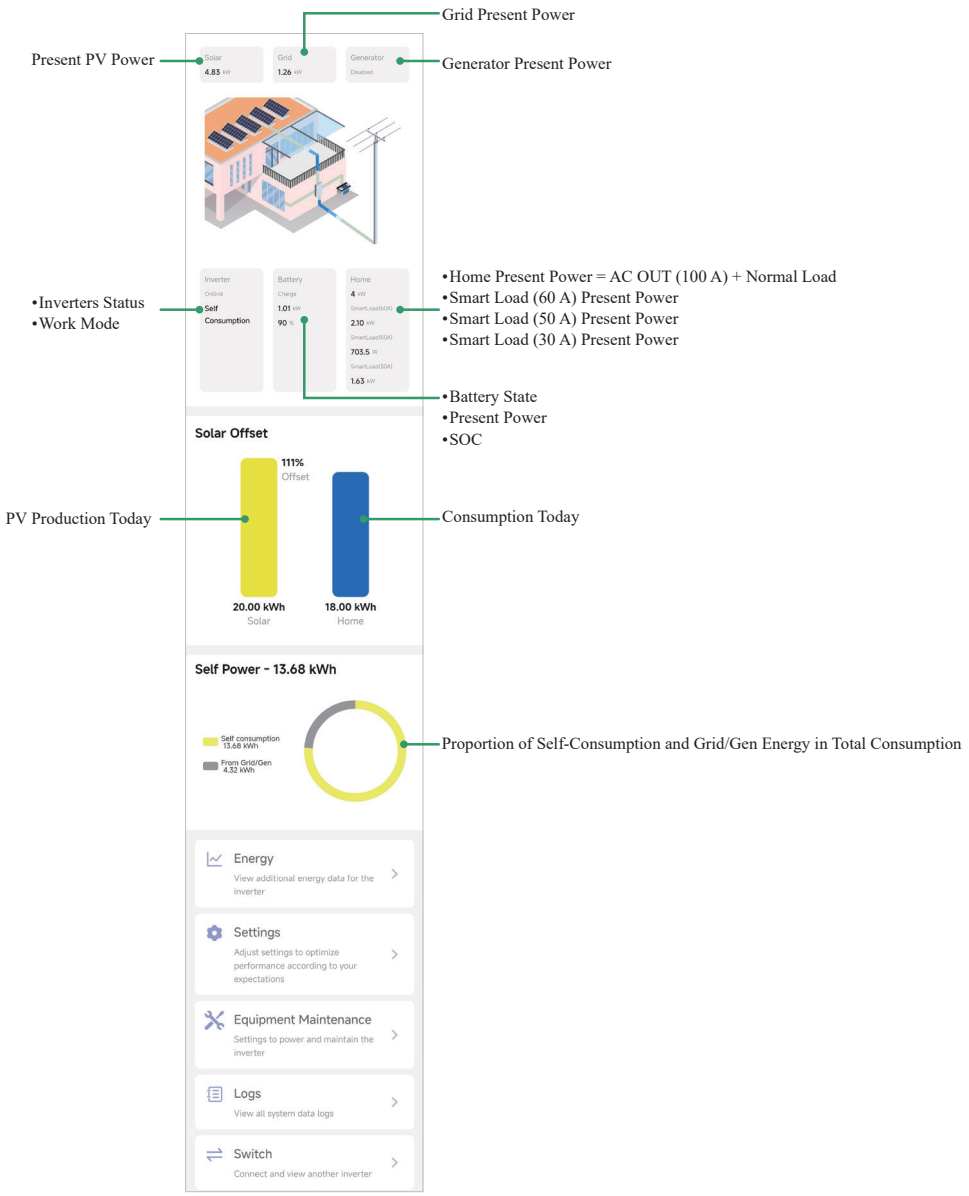
Figure 29: MidNite Pro QR Code

• Download the App from the App Store or Google Play

> Before using the local setting, the App should access some permissions. (You can allow them when you install the App or grant permissions in your own phone setting.) When the App asks for permission, please click Allow.

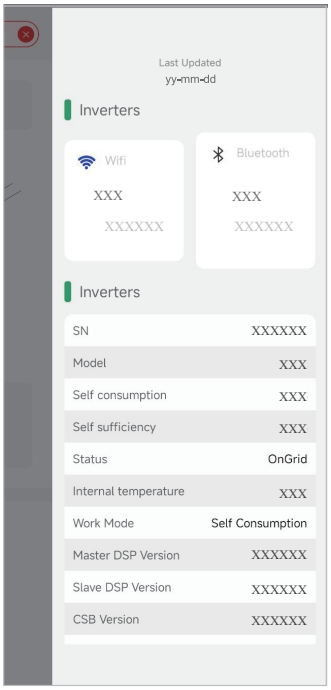
3.1 Home

In **Home** page, you can view the basic information of your energy system.



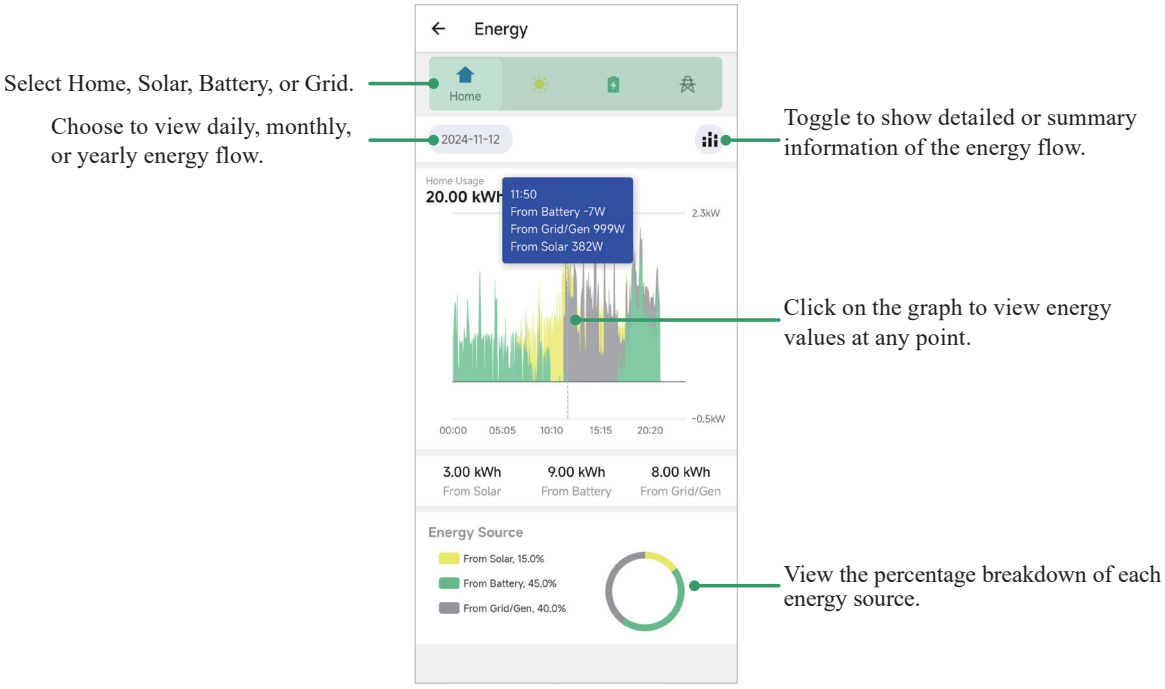
Swipe left on the **Home** screen to view the basic information of the inverter.

For Wi-Fi signal, when the value ranges from 80 dBm to 100 dBm, it means the signal is strong.
For Bluetooth signal, when the value ranges from -80 dBm to 0 dBm, it means the signal is strong.



3.2 Energy

From the **Home** page, navigate to "**Energy**" menu. Here, you can examine the graphical representation of energy production or consumption for your home, solar panels, battery, and the grid over various timeframes such as daily, monthly, or yearly. Please note that the data curves provided in the illustrations are for example purposes only. You can click on any point of the graph to obtain the energy value for that specific time.

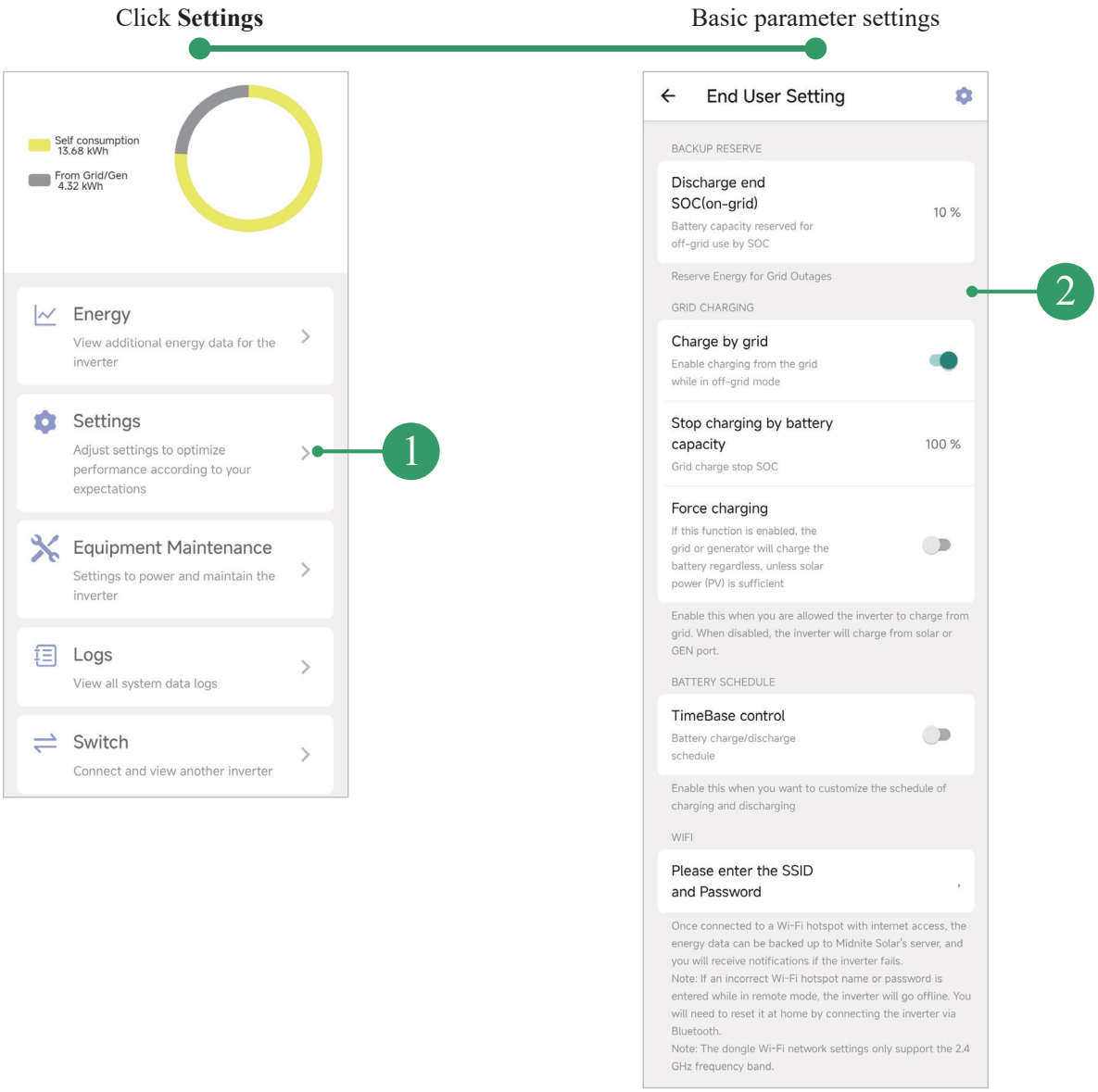


3.3 Settings

In this page, you can select an administrator account or an end user to set or modify the parameters.

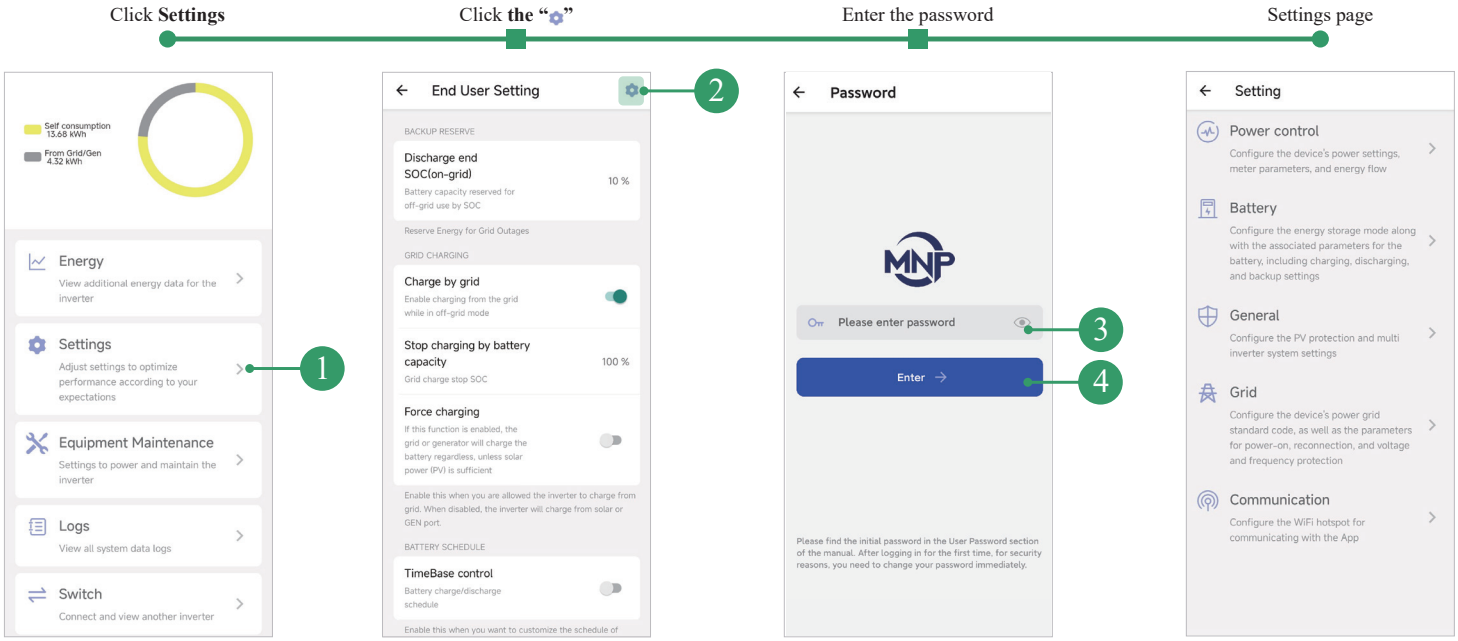
End User Setting

From the **Home** page, navigate to "**Settings**" menu. An end user account can configure some basic parameters including BACKUP RESERVE, GRID CHARGING, BATTERY SCHEDULE, and WIFI.



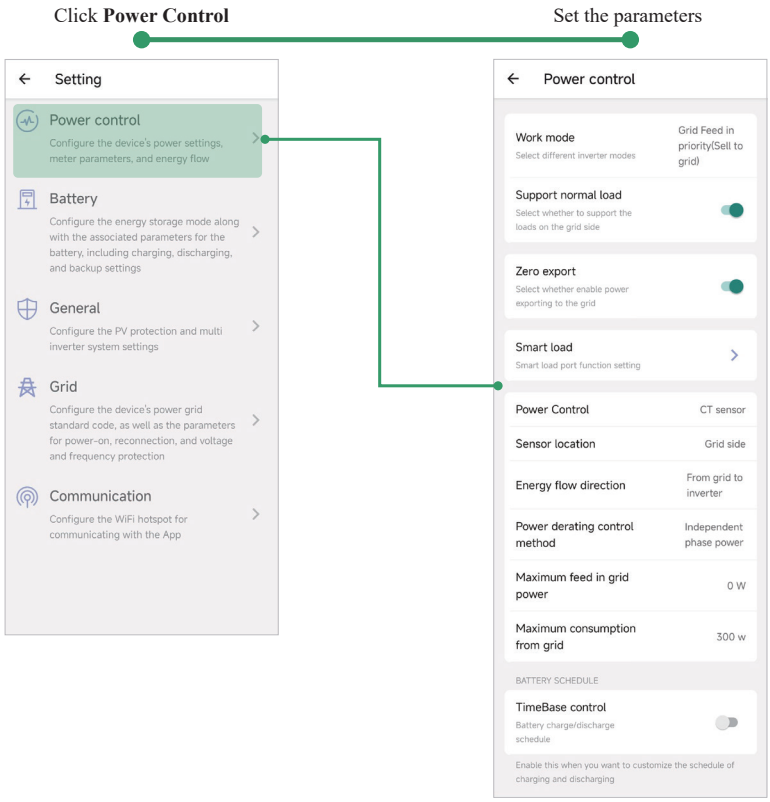
Administrator Setting

In **End User Setting** page, you can change your access level to an administrator account for advanced parameter settings.



3.3.1 Power Control

In **Power control** menu, you can configure the device's power settings, such as inverter work modes and energy export management, energy meter settings, energy flows, and battery work timesets.

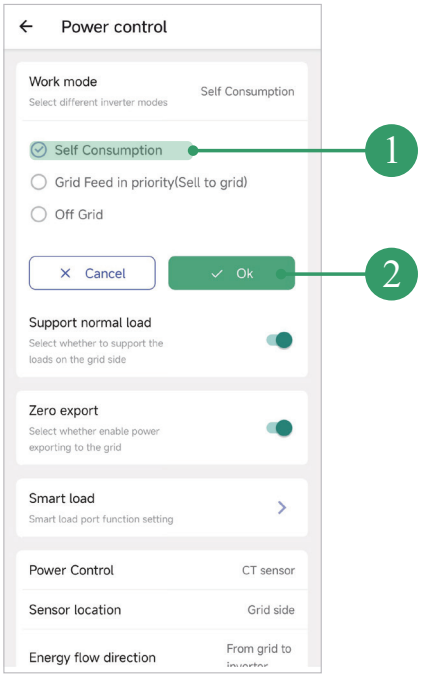


Support Normal Load: If the user intends to support normal load, please enable the button.
Zero Export: If the user intends to sell surplus energy back to the grid, make sure to disable the Zero Export feature; otherwise, keep it enabled.

► Power Control--Work Mode

Self Consumption

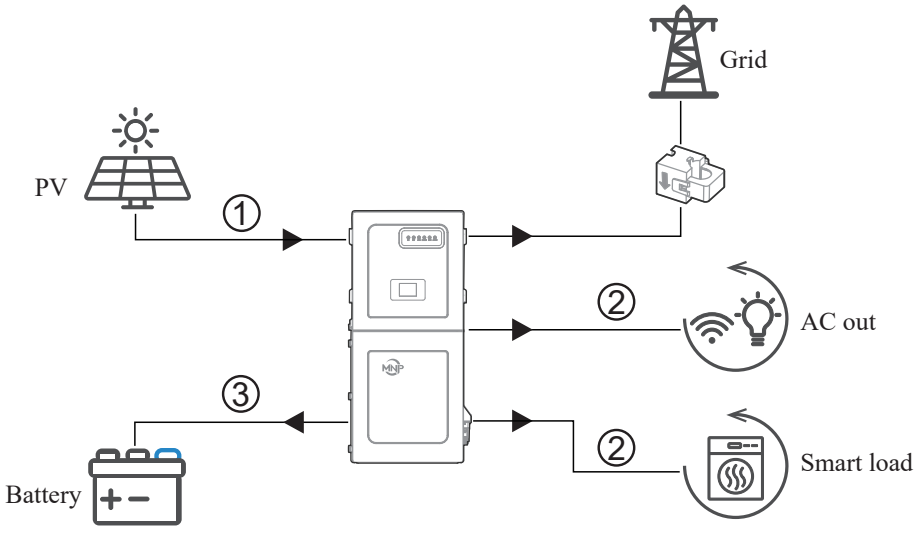
In Self Consumption mode, the priority for using PV energy is as follows: first, to power local loads; second, to charge the battery; and third, to feed into the grid if the user has the permit to sell the excess energy back. This mode is designed to increase the self-consumption rate.



Based on the availability of PV energy, the working logic of Self Consumption mode is illustrated below.

a) Excess PV Energy

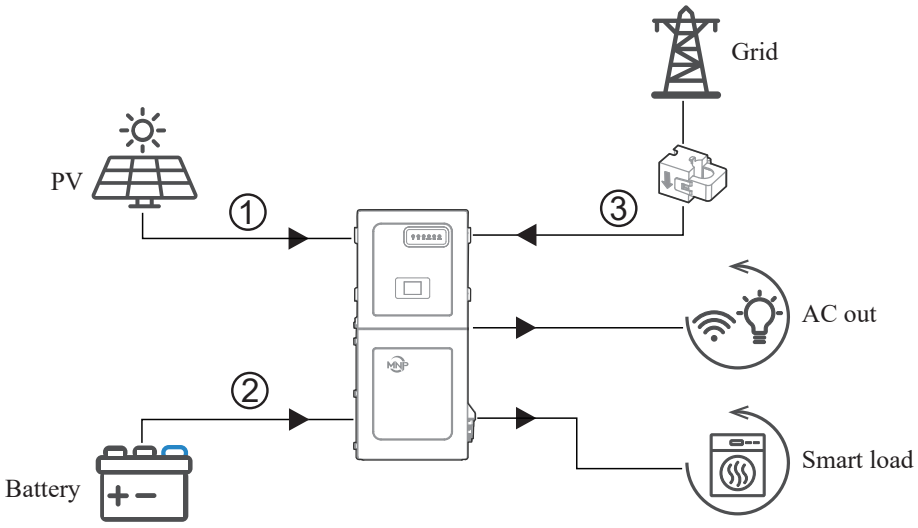
When PV energy is abundant, the PV energy is first consumed by the loads, the excess energy is used to charge the battery, and then the remaining energy is fed into the grid if the user has the permit to sell it back.



① ② ③ is the sequence of PV energy transmission.

b) Limited PV Energy

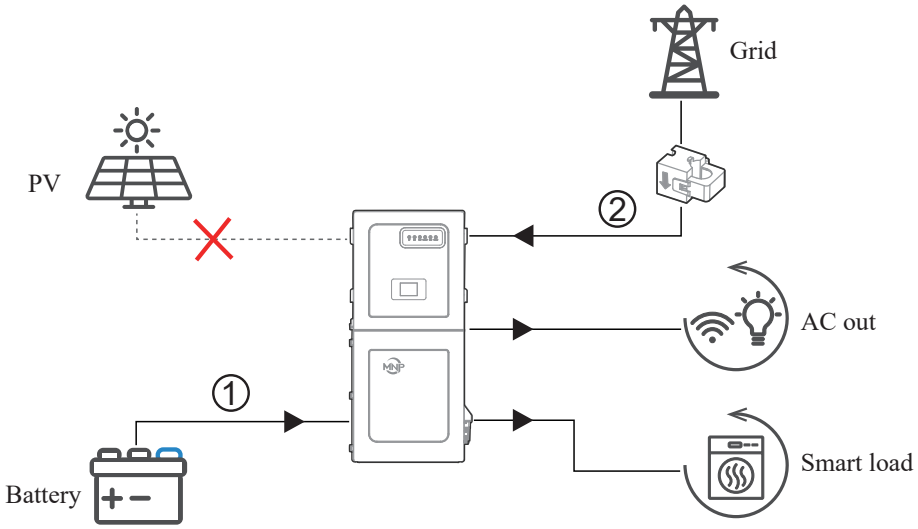
When the PV energy is not enough to cover all consumption, the PV energy will be entirely used by loads, and the insufficient part will be supplied by battery. Then still insufficient parts will be supplied by the grid.



① ② ③ is the sequence of loads consumption.

c) No PV Input

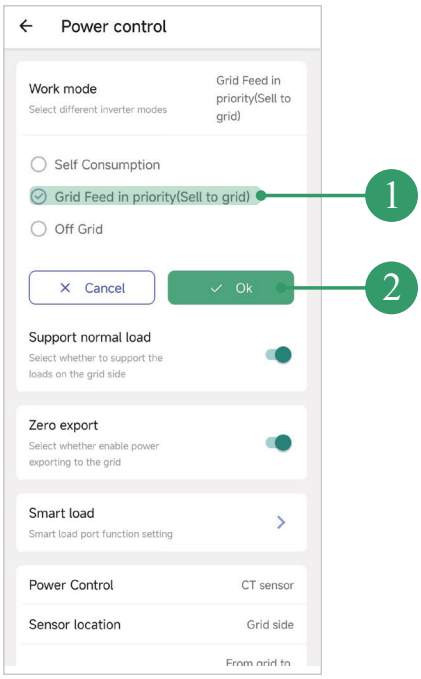
The inverter will first discharge the battery energy for home load consuming when no PV input (such as in the evening or some cloudy or rainy days). If the demand is not met, the loads will consume grid energy.



① ② is the sequence of loads consumption.

Grid Feed in Priority (Sell to Grid)

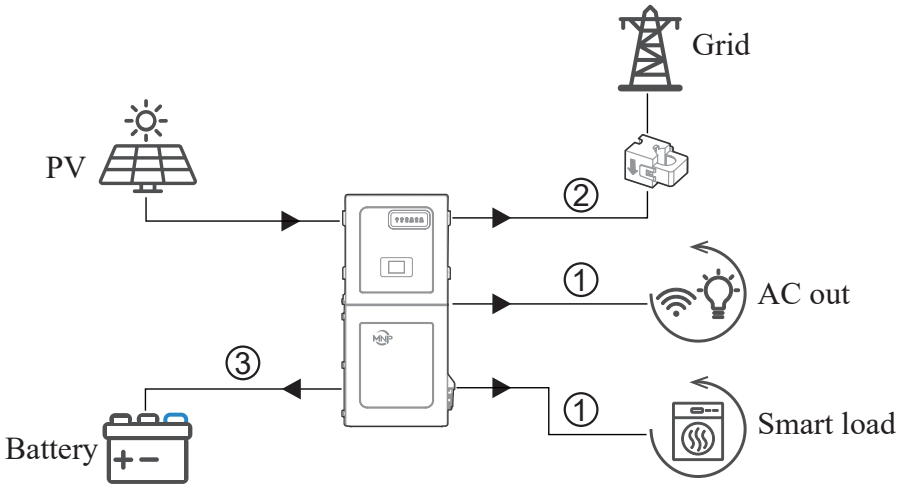
In Grid Feed in Priority (Sell to Grid) mode, the priority for using PV energy is as follows: first, to power local loads; second, to feed into the grid; and third, to charge the battery.



Based on the availability of PV energy, the working logic of Grid Feed in Priority (Sell to Grid) mode is illustrated below.

a) Excess PV Energy

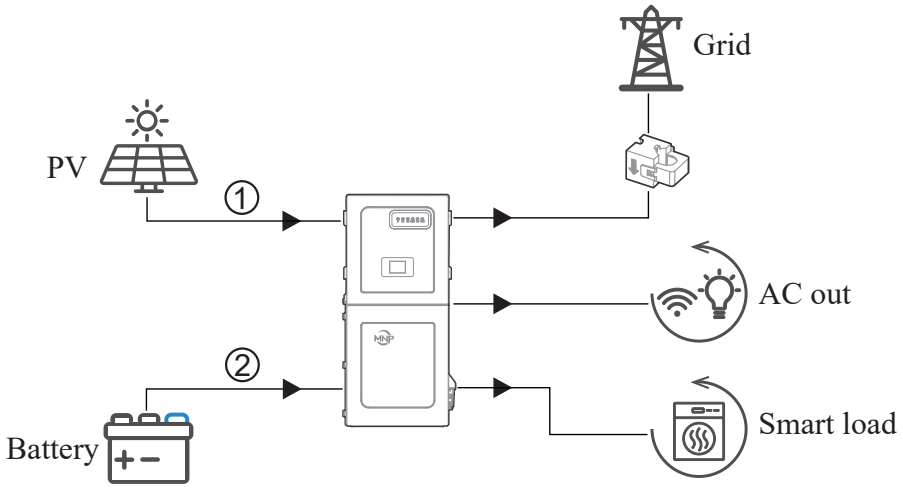
When PV energy is abundant, the PV energy will be first consumed by loads. If there is excess PV power, the power will be fed into grid. If there is still PV energy left after load consuming and grid feeding, then the remaining PV power will be used to charge the battery.



① ② ③ is the sequence of PV energy transmission.

b) Limited PV Energy

When PV energy is limited and cannot meet the feed-in grid power, the battery will discharge to meet it.

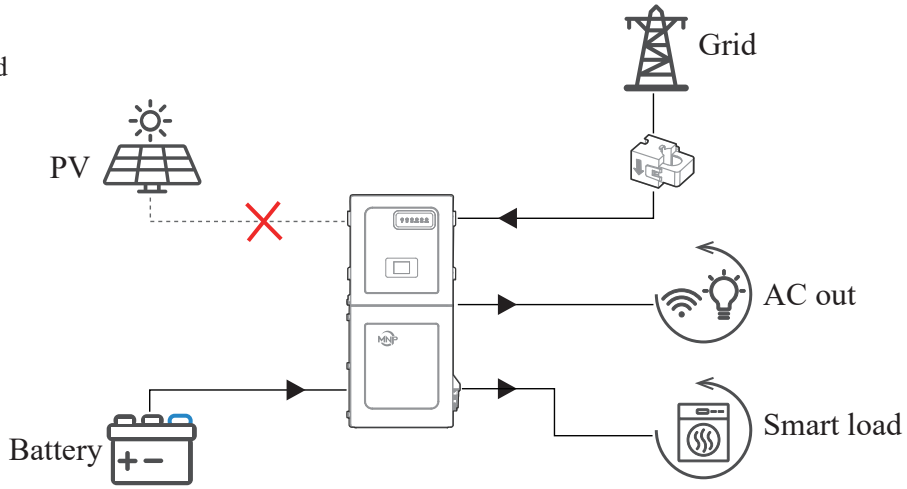


① ② is the sequence of grid feed-in energy.

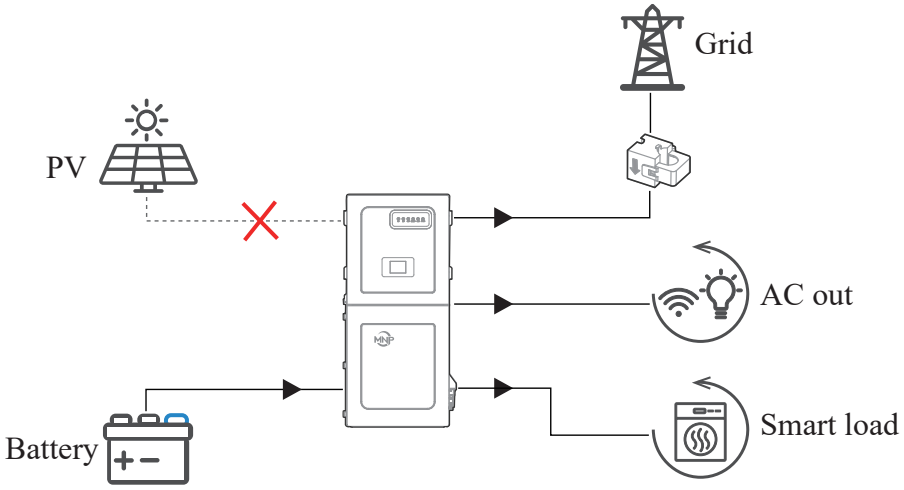
c) No PV Input

The inverter will first discharge the battery energy for home load consuming when no PV input (such as in the evening or some cloudy or rainy days). If the demand is not met, the loads will consume grid energy.

$P_{BAT} < P_{Load}$

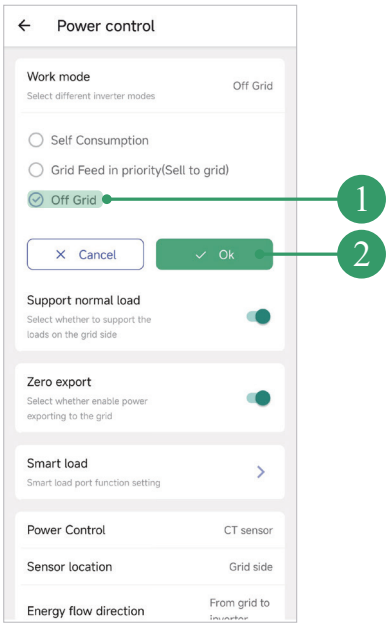


$P_{BAT} \geq P_{Load}$



Off Grid

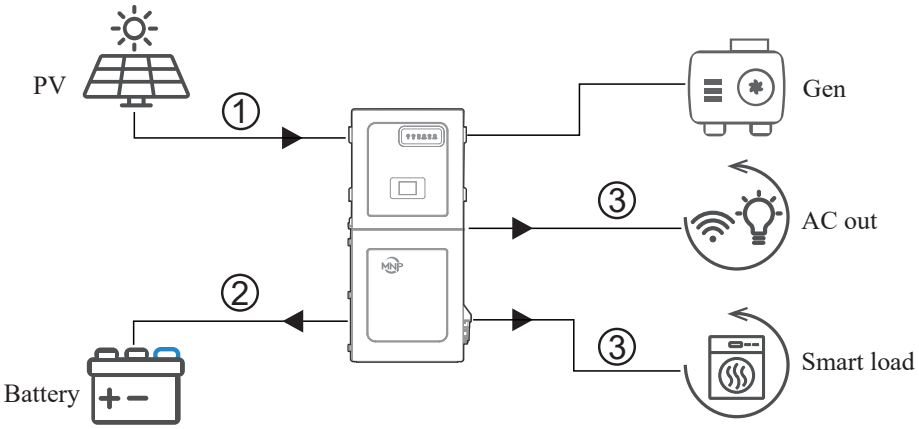
In Off Grid mode, the priority for using PV energy is as follows: first, to charge the battery; second, to power local loads.



In this mode, the battery can be charged by both PV energy and generator. The primary goal is to rapidly charge the battery, and you have the option to decide if the generator should contribute to this charging process. Based on the availability of PV energy, the working logic of Off Grid mode is illustrated below.

a) Excess PV Energy

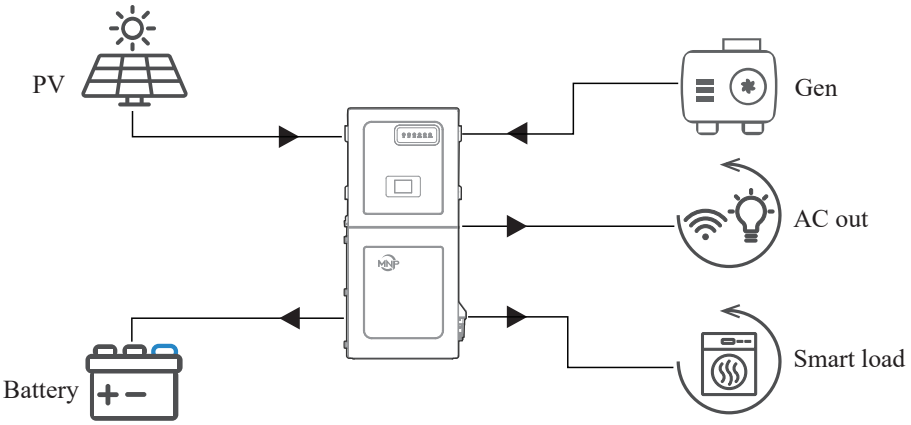
When PV energy is abundant, PV charges the battery first, then meets the loads.



①②③ is the sequence of PV energy transmission.

b) Limited PV Energy

When the PV energy is not enough to charge the battery, the generator will charge the battery and feed the loads as supplement.



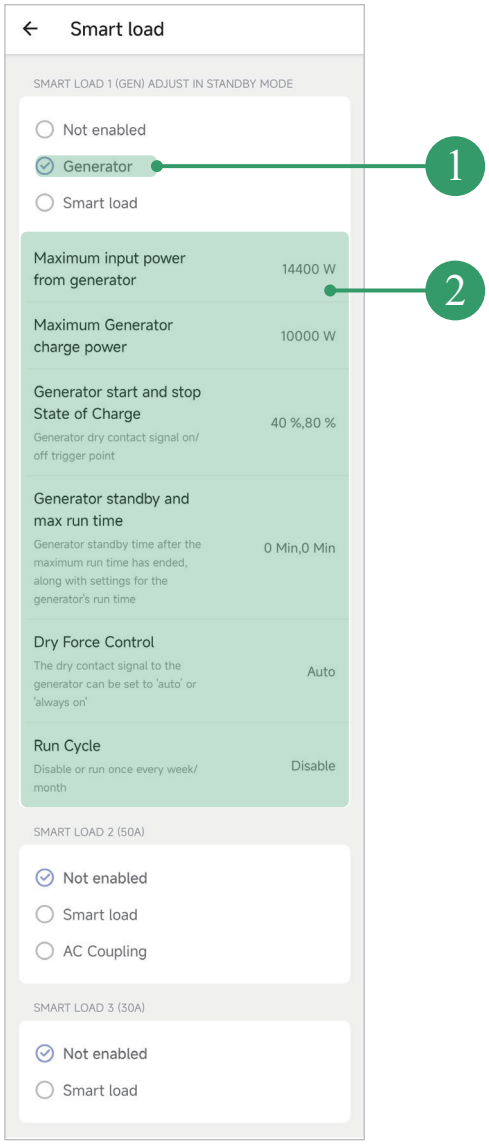
► Power Control--Smart Load

Generator

Maximum Input power from Generator: Forbid generator power larger than the setting value.
Maximum Generator charge power: Maximum battery charge power from generator.
Generator start and stop by battery SOC: When the battery SOC exceeds/falls below the value, the generator starts/stops.
Generator start and stop by battery voltage: When the battery voltage exceeds/falls below the value, the generator starts/stops.
Generator standby and MaxRun time:

- **MaxRun Time:** When the generator's running time reaches the maxrun time setting value, the inverter will disconnect the input from generator. But the generator will keep working for a while defined by standby time.
- **Standby Time:** When the inverter disconnects the input from generator, the generator will keep working for a while defined by the standby time setting value.
  - For generator that switches on and off by dry contact, it will stop working automatically when the generator working time reaches the standby time setting value.
  - For generator that is manually switched on and off, it will stop working by manual regardless of the standby time setting value.

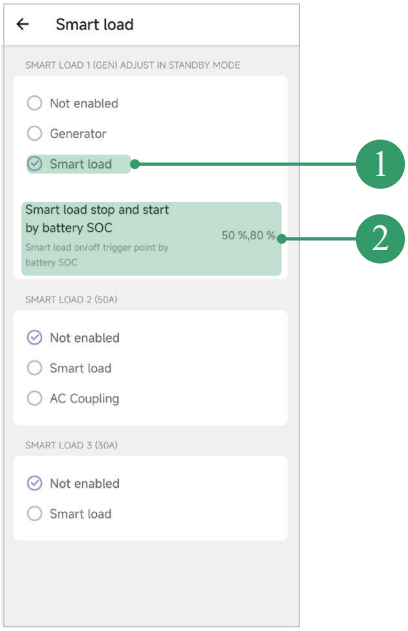
Dry Force: When the grid power is abnormal, the generator is forced to be turned on.
Run Cycle: Generator Cycle running mode. You can set the generator running cycle as Weekly or Monthly.



Select a battery operating mode through **Battery > Capacity type** (also see Battery Setting section), in which you can determine the start and stop of the generator by battery SOC or battery voltage. This procedure does not affect the generator's operating logic you have configured above.

Smart Load

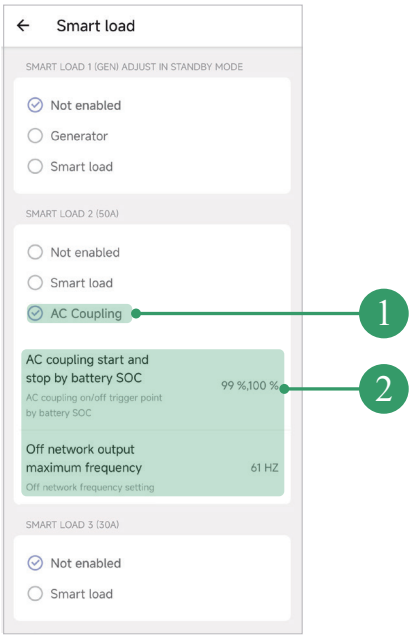
As three dual breakers can be used as smart load breakers, set parameters of "SMART LOAD 1/2/3" according to your actual use.
Smart load stop and start by battery SOC: When the battery SOC exceeds/falls below the value, the smart load starts/stops.
Smart load stop and start by battery voltage: When the battery voltage exceeds/falls below the value, the smart load starts/stops.



Select a battery operating mode through **Battery > Capacity type** (also see Battery Setting section), in which you can determine the start and stop of the smart load by battery SOC or battery voltage. This procedure does not affect the smart load's operating logic you have configured above.

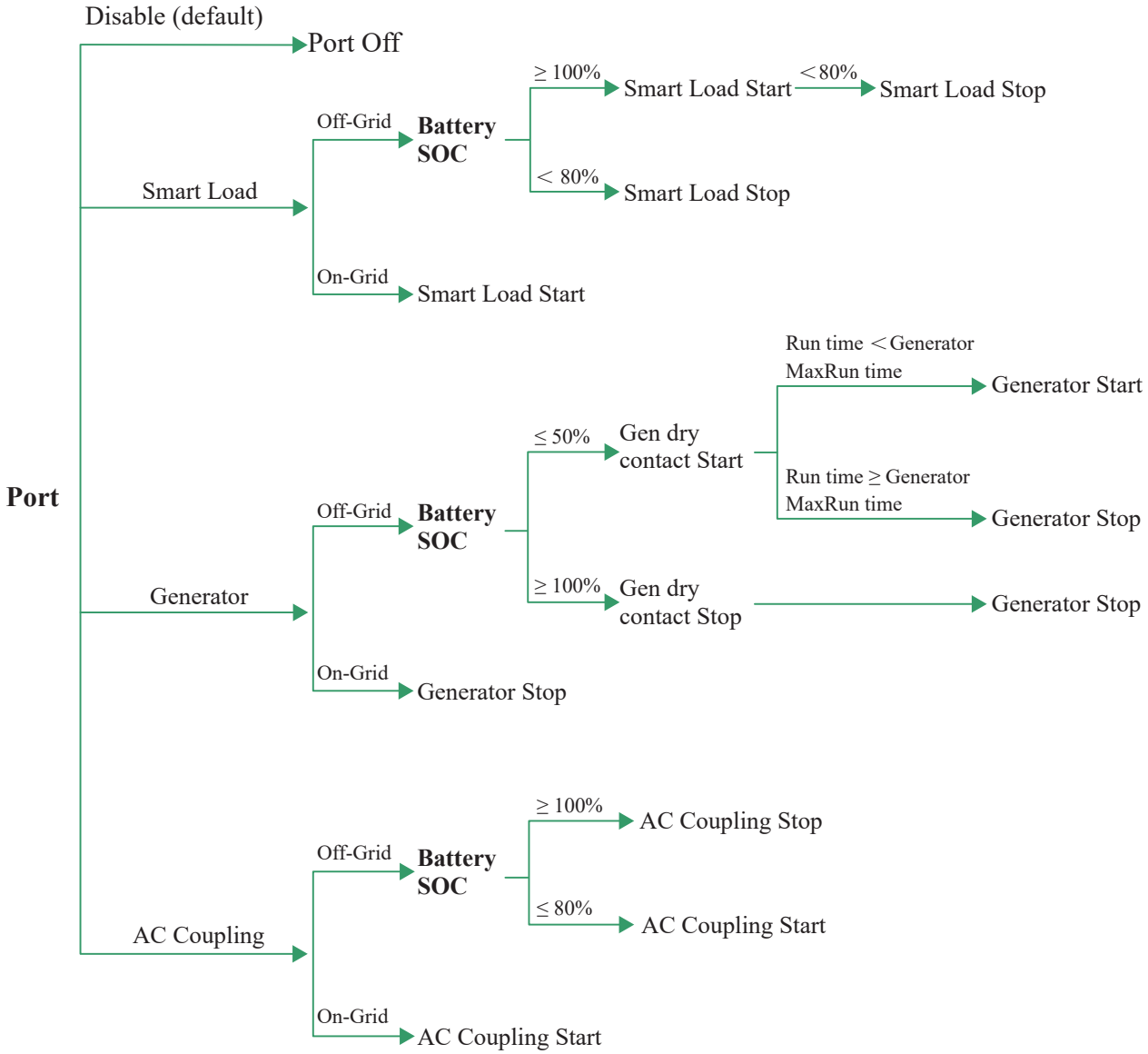
AC Coupling

AC Coupling start and stop by battery SOC: When the battery SOC exceeds/falls below the value, the AC coupling starts/stops.
AC Coupling start and stop by battery voltage: When the battery voltage exceeds/falls below the value, the AC coupling starts/stops.
Off-network output maximum frequency: This parameter is used to limit the output power of grid-tied inverter when the hybrid inverter works under off-grid. As the battery SOC gradually reaches the setting value (stop), during the process, the grid-tied inverter output power will decrease linearly. When the battery SOC equals to the setting value (stop), the system frequency will become the setting value (**off-network output maximum frequency**), and the grid-tied inverter will stop working.



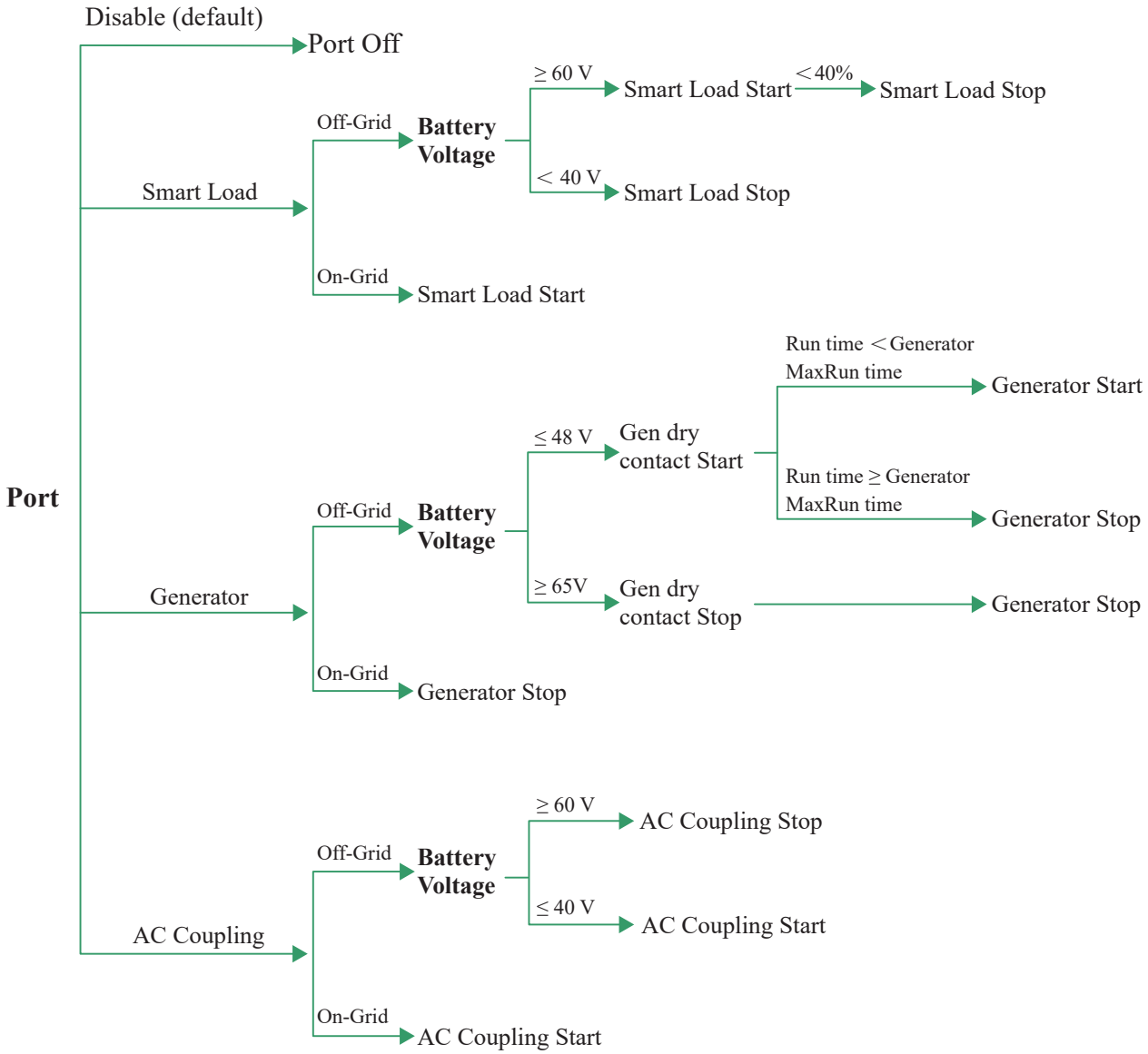
Select a battery operating mode through **Battery > Capacity type** (also see Battery Setting section), in which you can determine the start and stop of the AC coupling by battery SOC or battery voltage. This procedure does not affect the AC coupling's operating logic you have configured above.

Logic Diagram of Start/Stop Smart Load/Generator/AC Coupling Port Function (by Battery SOC)



- When the Capacity type was set to voltage, the Smart load/Generator/AC Coupling still follows the above logic.
- The data in the figure are illustrative.

Logic Diagram of Start/Stop Smart Load/Generator/AC Coupling Port Function (by Battery Voltage)



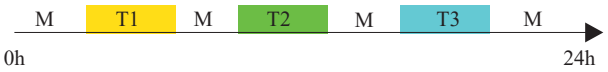
- When the Capacity type was set to SOC, the Smart load/Generator/AC Coupling still follows the above logic.
- The data in the figure are illustrative.

► Power Control--TimeBase Control

The TimeBase Control (Forced Charge/Discharge) function is designed to control the time setting of charging and discharging the inverter. According to the demands of application, the user can set the inverter to work on forced charge/discharge the battery in any working mode.

There are three time periods in which you can set this function. Outside of the set periods, the inverter returns to its original working mode. The forced charge/discharge function has the highest priority.

The relationship between the forced charge/discharge function and working mode shown as below.



M : Self Consumption Mode/Grid Feed in priority (Sell to grid) Mode/Off Grid Mode

T1: Time period 1 for forced charge/discharge parameter setting

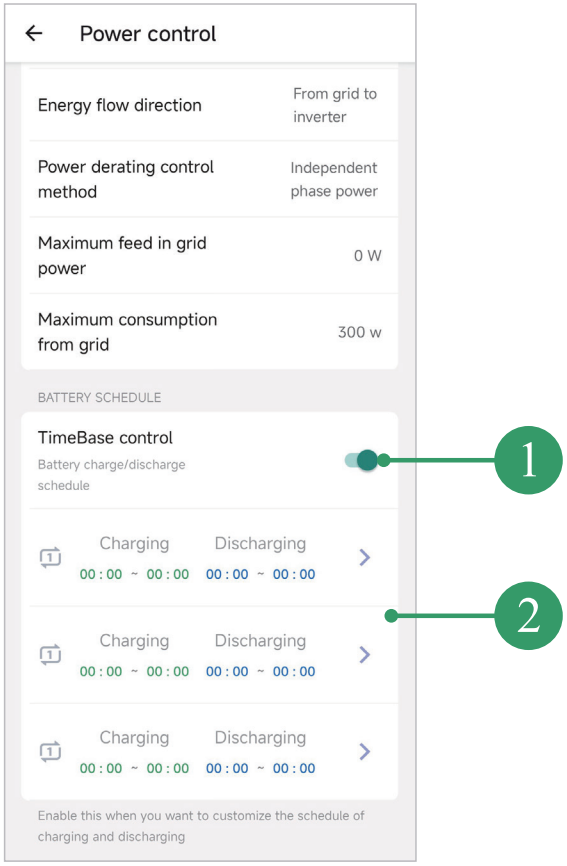
T2: Time period 2 for forced charge/discharge parameter setting

T3: Time period 3 for forced charge/discharge parameter setting

T1, T2, and T3 have priority over M.

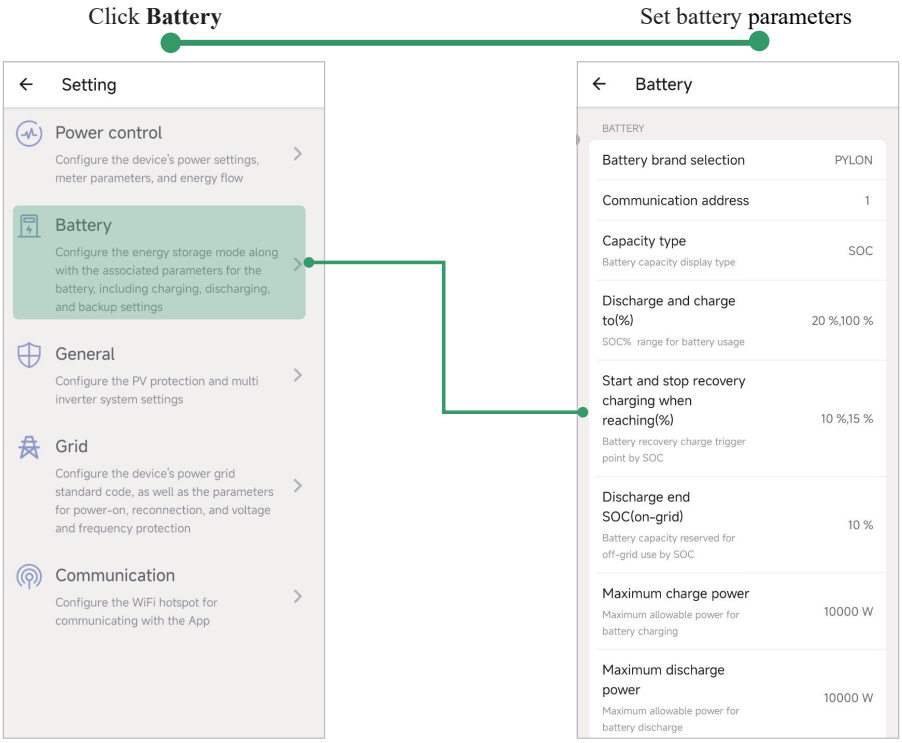
Charge and discharge frequency: one time or daily

- Charging start time: 0 to 24 hours
- Charging end time: 0 to 24 hours
- Discharge start time: 0 to 24 hours
- Discharge end time: 0 to 24 hours



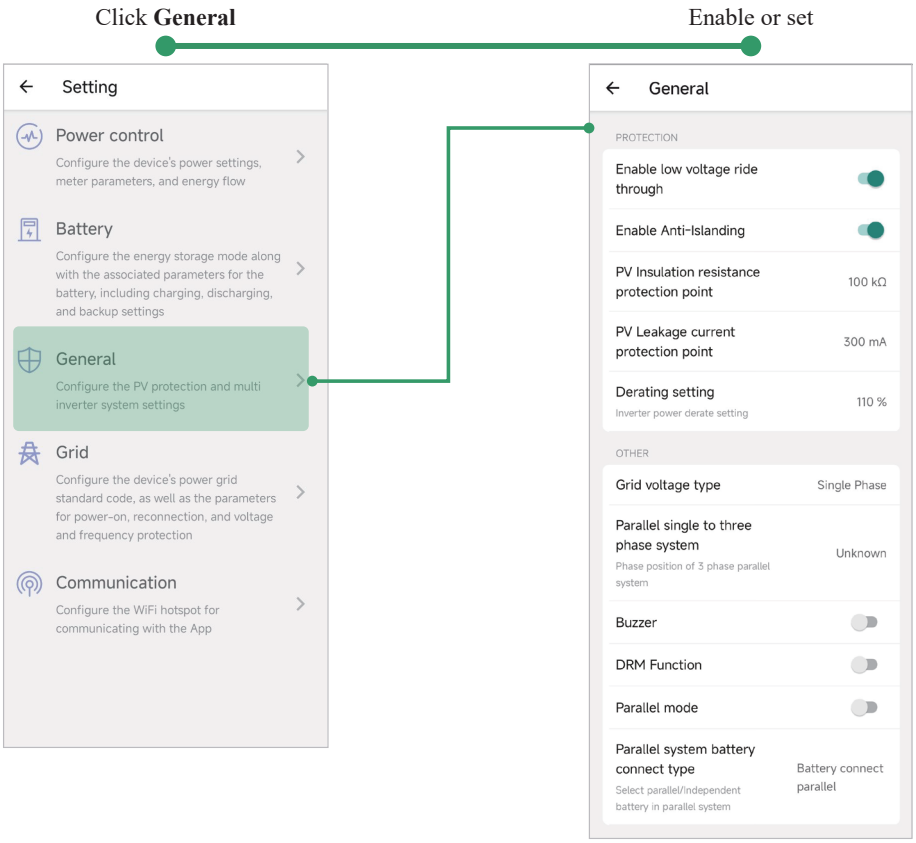
3.3.3 Battery

In this page, you can set or change the battery parameters.
In **Setting** page, click **Battery**.



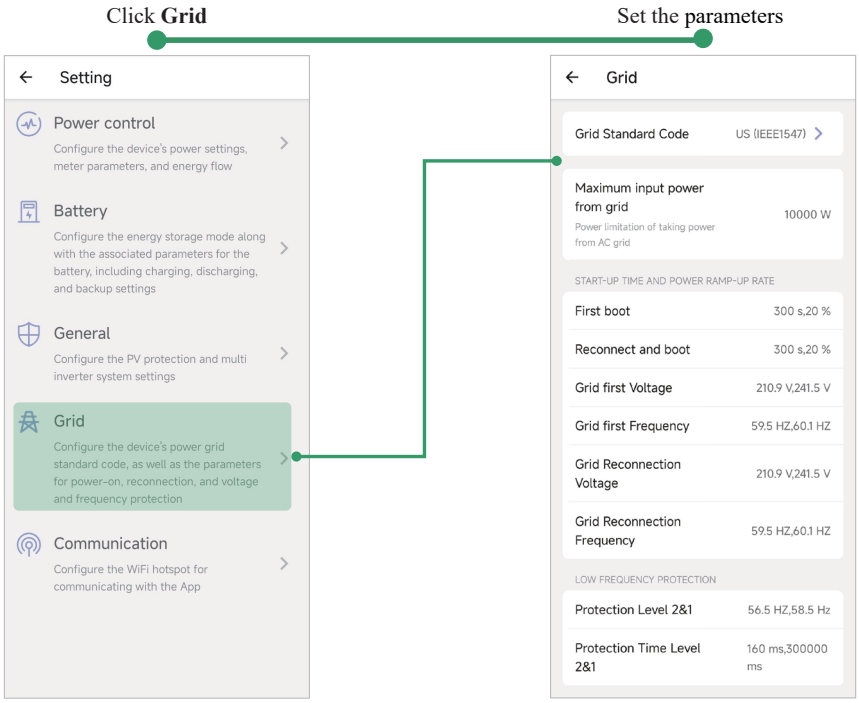
3.3.2 General

In this page, you can set or change the protection measures, and other options (including Grid voltage type, Buzzer, DRM Function, Parallel mode listed). Enable or set them when necessary.
In **Setting** page, click **General**.



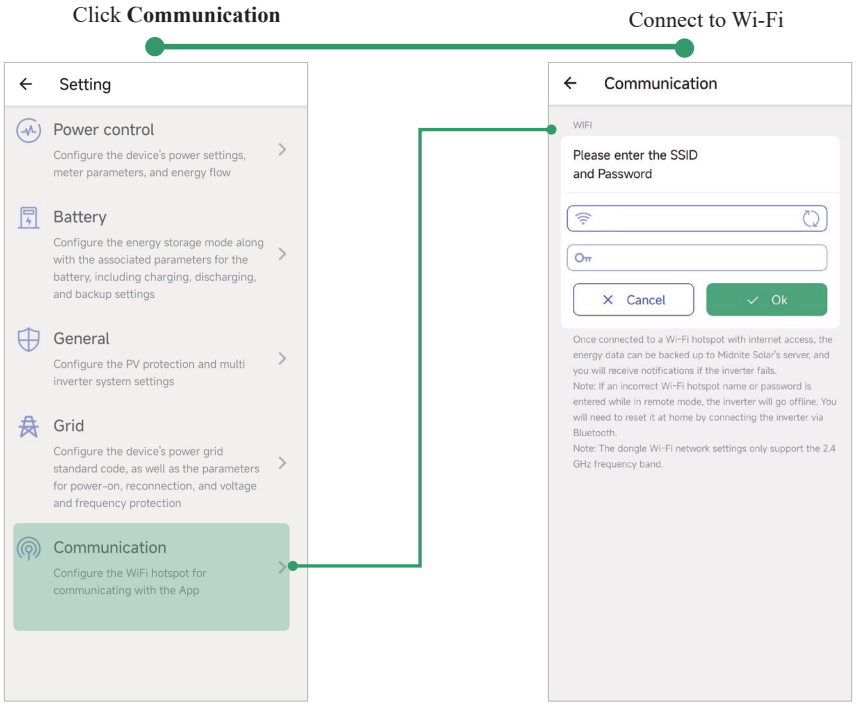
3.3.4 Grid

In this page, you can set or change the grid parameters.
In **Setting** page, click **Grid**.



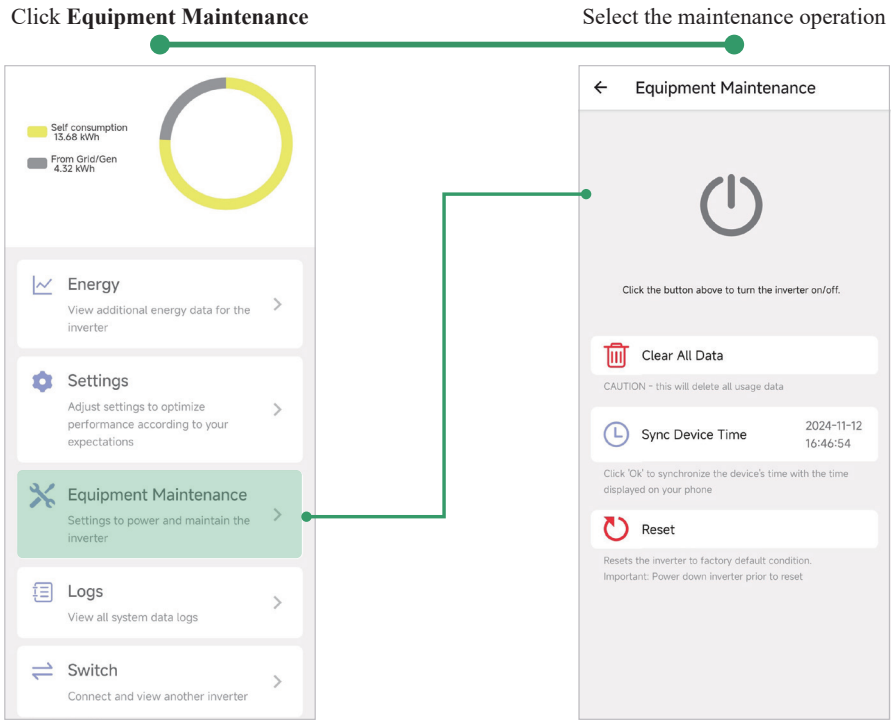
3.3.5 Communication

In this page, you can set or change the Wi-Fi hotspot.
In **Setting** page, click **Communication**.



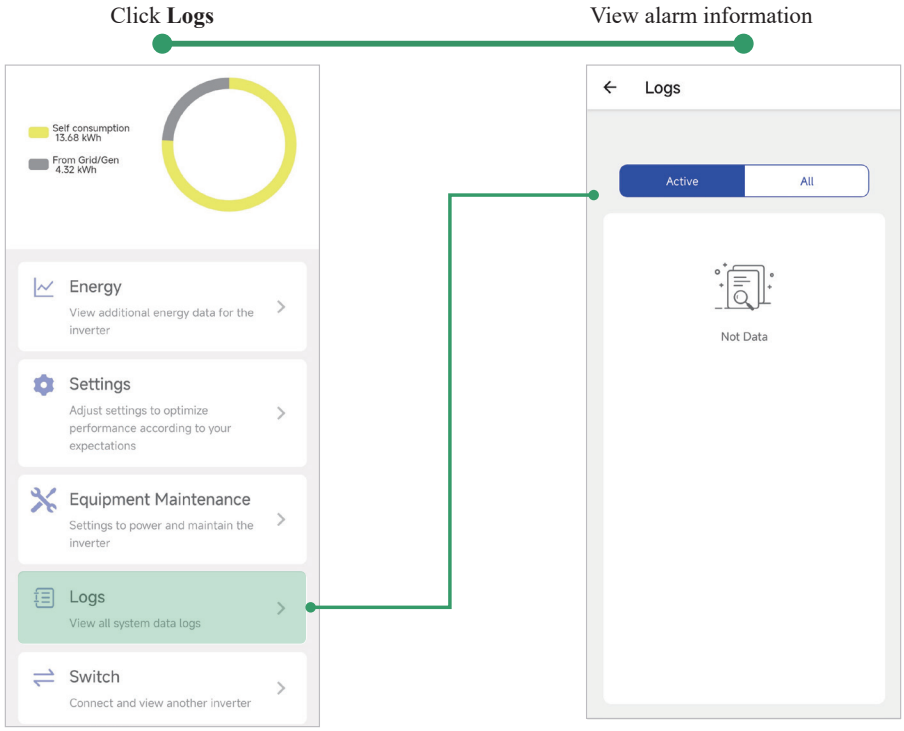
3.4 Equipment Maintenance

In this page, you can turn on/off the inverter, clear all data, sync device time and restore the device to factory condition.
Click **Equipment Maintenance**.



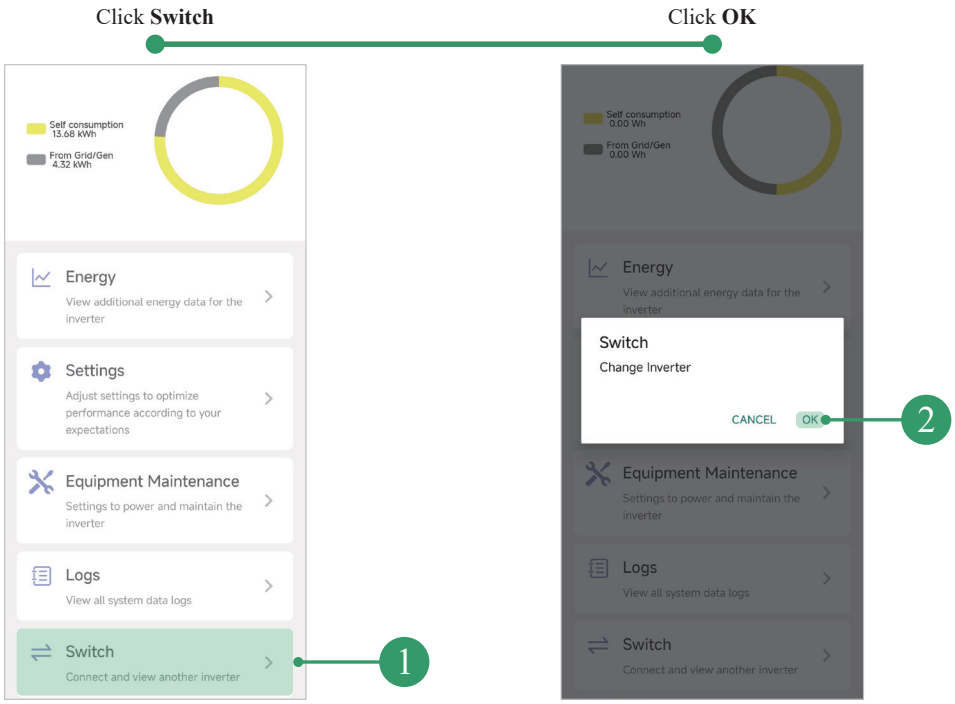
3.5 Logs

Click **Logs** at the bottom and then go to the history log page (as shown below). It contains all the logs for the inverter.



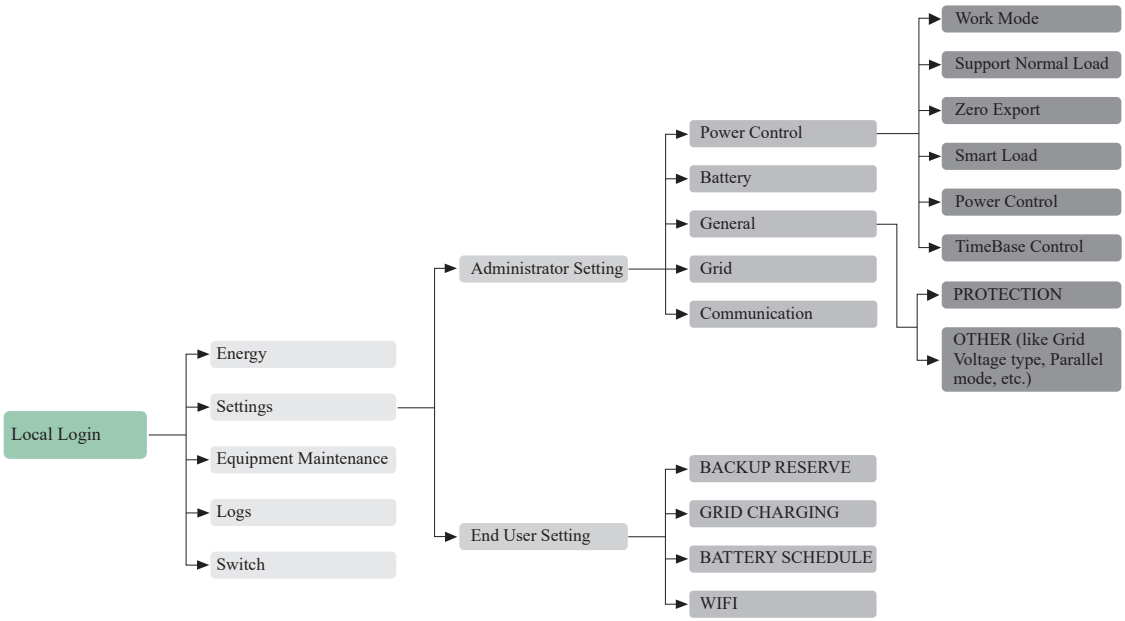
3.6 Switch

Click **Switch** at the bottom and then switch other inverters.



3.7 Programming Guide

The diagram below shows the most used parameters for programming the MNPower MN 15-12KW-AIO.



4. Parallel Systems

4.1 Before Enabling Parallel Operations

A. BMS communication connection is only for lithium battery.
   For shared lithium battery connection, please refer to Three-phase equipment connection diagram to connect the BMS communication cable.
   For standalone lithium battery connection, the BMS communication cable needs to be connected to each inverter.
B. It is necessary to additionally purchase suitable CT and meter according to the specific requirements in parallel connection. Meter+CT Ratio is 3000:1(optional).
C. It is necessary to turn the matched resistance switch of No. 1 inverter and No. N inverter to “ON” in parallel connection mode.
D. With parallel connection mode, it is necessary to connect App to one of the inverters and then go to **Settings** > **General** to enable parallel mode.
E. The internal DC/AC breakers are supplied with the inverter.
   DC Breaker (Battery side): 300 A / 80 V DC
   AC Breaker (GEN Input): 60 A / 480 V AC
   AC Breaker (Smart loads): 30 A / 480 V AC
   AC Breaker (AC Coupling): 50 A / 480 V AC
   AC Breaker (AC Input grid / AC out): 100 A / 240 V AC
   AC Breaker (Load 1 L1 / Load 2 L2): 15 A / 240 V AC
   AC Breaker (Load 3 L1 / Load 4 L2): 20 A / 240 V AC

⚠ Ensure that the inverter and all cables to be installed have been completely powered off during the whole process of installation and connection. Otherwise, high voltage may result in fatal injury.

DIP Switch Configuration for Parallel Systems

In parallel systems, set the “DIP Switch” shown in the following figure, according to the table below.

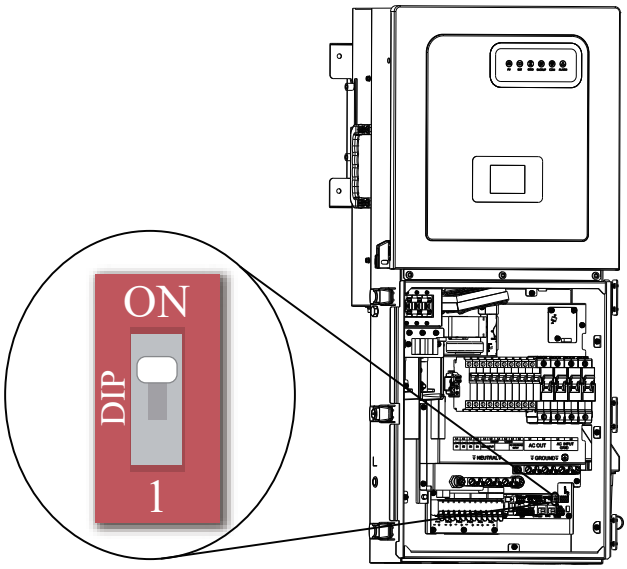


Figure 30: DIP switch configuration

Inverter 1	Inverter 2	Inverter 3	Inverter 4	Inverter 5	Inverter 6	Inverter 7	Inverter 8	Inverter 9
1								
ON	ON							
ON	1	ON						
ON	1	1	ON					
ON	1	1	1	ON				
ON	1	1	1	1	ON			
ON	1	1	1	1	1	ON		
ON	1	1	1	1	1	1	ON	

Parallel systems with 2 inverters must have their DIP switches on the ON position.

Parallel Systems MNPower MN 15-12KW-AIO (Split-Phase)

# of inverters in parallel	Continuous output power with PV (kW)	Continuous output power with batteries (kW)	Grid “Pass Through” (A)	Peak power 10 sec (kVA)
1	15	10	100	15
2	30	20	200	30
3	45	30	300	45
4	60	40	400	60
5	75	50	500	75
6	90	60	600	90
7	105	70	700	105
8	120	80	800	120
9	135	90	900	135

Parallel Systems MNPower MN 15-12KW-AIO @ 120/208V 3-Phase

# of inverters in parallel	Continuous output power with PV (kW)	Continuous output power with batteries (kW)	Grid “Pass Through” (A)	Peak power 10 sec (kVA)
1 (only 2 phases)	13	12	200	15
2 (all phases but unbalanced)	26	24	400	30
3	39	36	400	45

Ensure all inverters in parallel have the same firmware version by verifying the 'Master DSP', 'Slave DSP', and 'CSB' version numbers on App, as shown in Figure 30a. Before three-phase connection, it is recommended to reset the inverter to factory default to ensure the same parameter for each inverter, as shown in Figure 30b.

Verify version number: Swipe left on the **Home** screen.

Reset the inverter: Click the **Equipment maintenance** > turn off the inverter > Click the **Reset**.

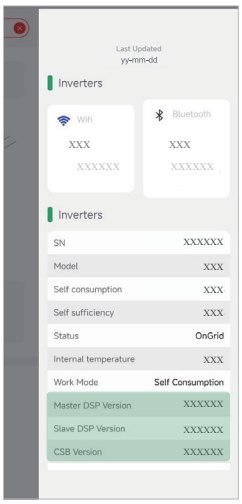


Figure 31a: Verify version number

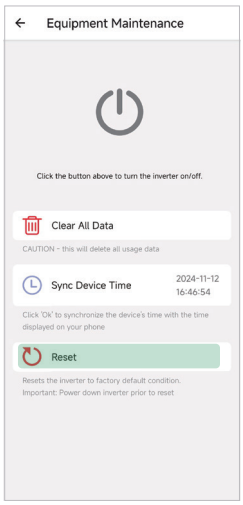


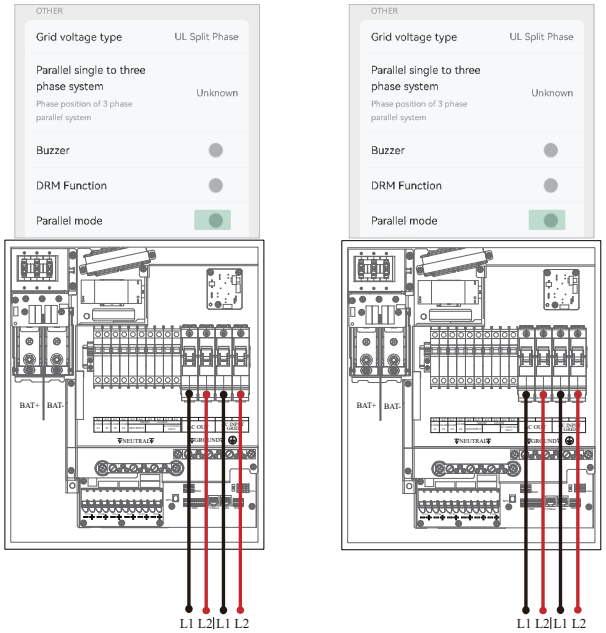
Figure 31b: Restore the firmware

4.2 Parallel Systems Programming Sequence

Parallel Systems MNPower MN 15-12KW-AIO (Split-Phase)

Under split phase parallel connection mode, it is necessary to connect the App to each inverter and set related parameters by following the steps below.

1. Login as an administrator.
2. Go to **Settings** > **General** to enable parallel mode. Notice that the value of the **Grid voltage type** should be set consistently for all inverters.



Parallel Systems MNPower MN 15-12KW-AIO @ 120/208 V 3-Phase

Under three-phase connection mode, it is necessary to connect the App to each inverter and set related parameters. The following is an example for three inverters.

1. Login as an administrator.
2. Go to **Settings** > **General** to enable parallel mode.
3. Set the grid voltage type: Go to **Settings** > **General** > **Grid voltage type** > **UL 2/3 Phase** > **Ok**. (Figure 31a)
4. Set the phase position accordingly: Go to **Setting** > **General** > **Parallel single to three phase system**. Notice that all three inverters should be set in this step. (Figure 31b-31d)
5. Set the battery connect type: Go to **Settings** > **General** > **Parallel system battery connect type** > Select parallel/independent battery > **Ok**. (Figure 31e)
6. Set power control: Go to **Settings** > **Power Control** > **Smart meter** > **Ok**. (Figure 31f)
7. Set power derating control method: Go to **Settings** > **Power Control** > **Power derating control method** > **Independent phase power** > **Ok**. (Figure 31g)
8. Set the other basic parameters of the inverter. Detailed setting process please refer to Quick Setup.

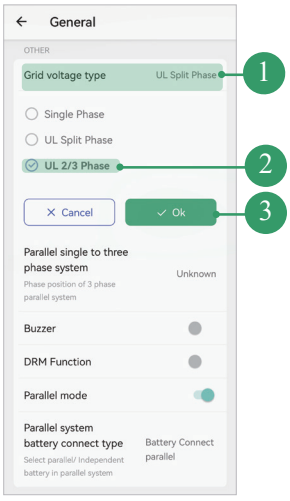


Figure 32a: Grid voltage type

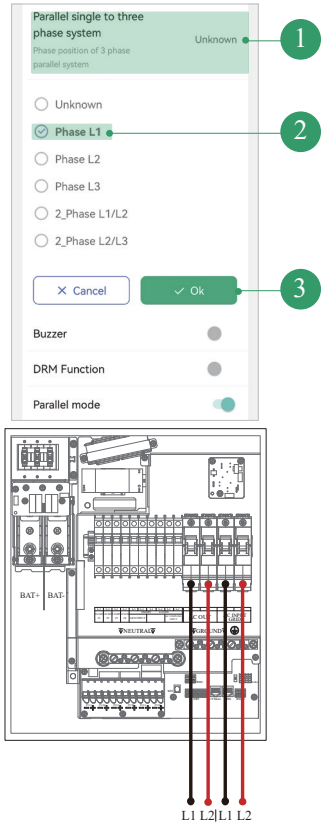


Figure 32b: Inverter 1-Phase L1

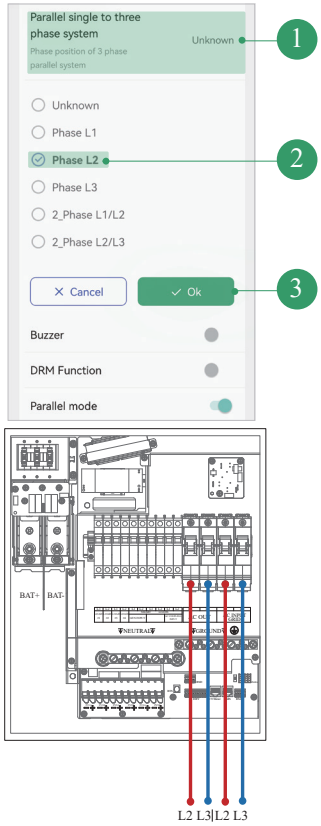


Figure 32c: Inverter 2-Phase L2

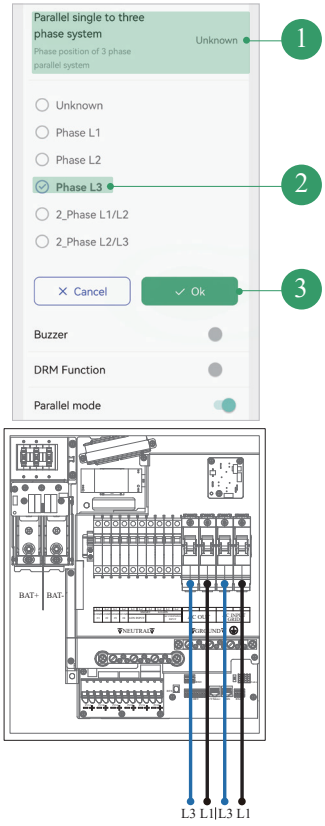


Figure 32d: Inverter 3-Phase L3

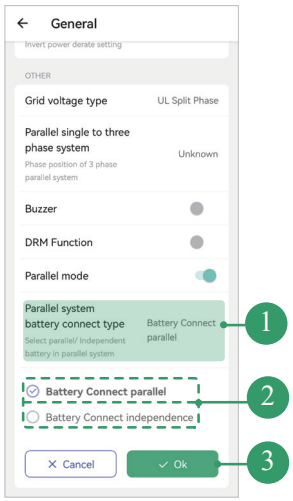


Figure 32e: Battery connect type

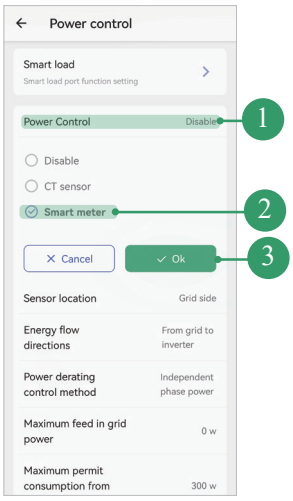


Figure 32f: Power control

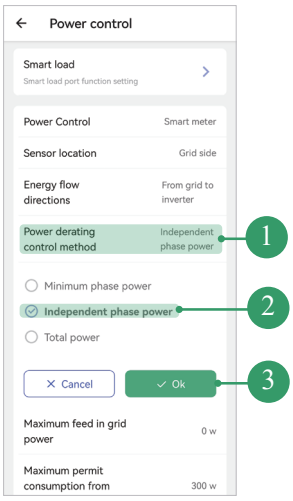
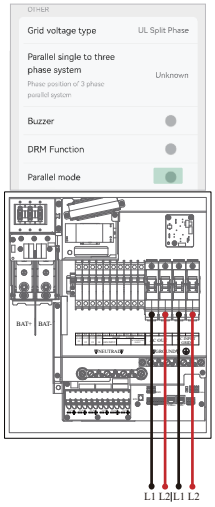


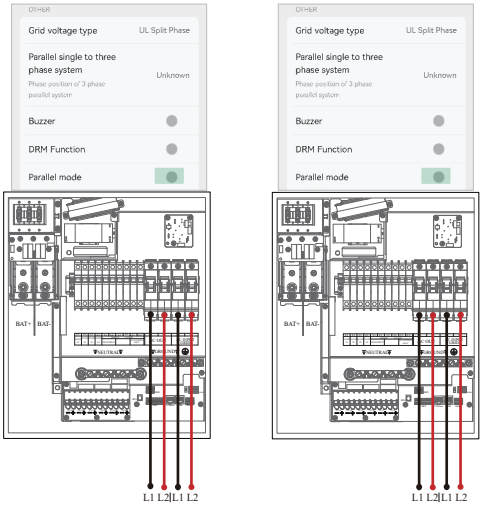
Figure 32g: Power derating control method

Examples of Wiring Diagram

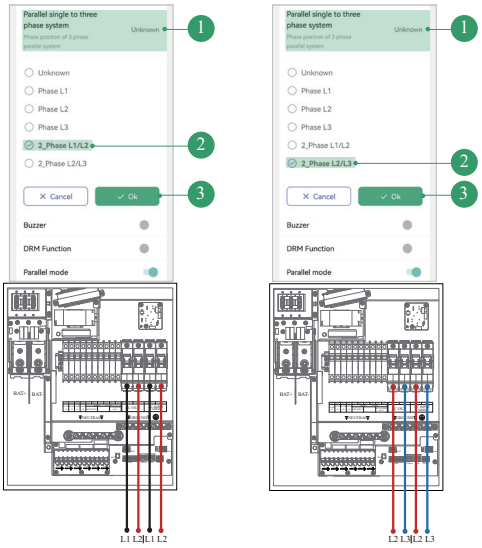
1 inverter @ 120/208V
Using 2 phases of 3



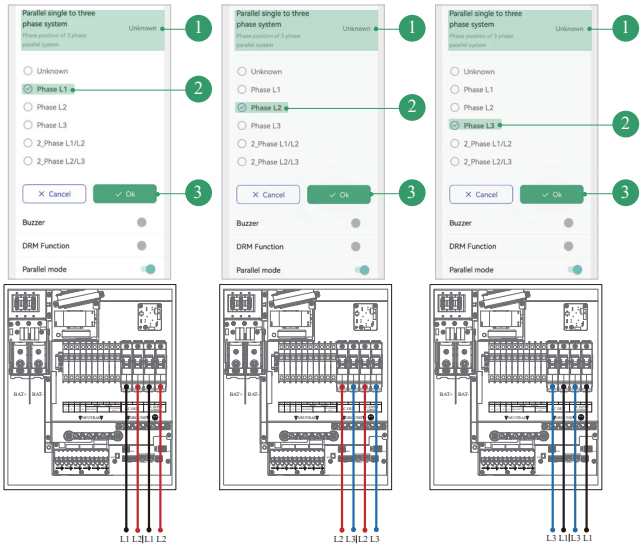
2 inverters @ 120/208V
Using 2 phases of 3



2 inverters @ 120/208V
Using 3 phases of 3 (Unbalanced)



3 inverters @ 120/208V
Using 3 phases of 3 (Balanced)



4.3 Three-Phase Systems: Programming and Troubleshooting

3-phase systems with multiple MNPower inverters must be programmed according to the table below:

# of inverters	Programming
2	Phase L1 01 | Phase L2 02
3	Phase L1 01 | Phase L2 02 | Phase L3 03

Examples of Wiring Diagram

⚠ If the history log page of your App shows the error shown below, ensure the phase sequence follows L1L2-L2L3-L3L1 convention. The message "Phase Sequence abnormal" is displayed when the inverter does not detect the correct phase rotation. This situation can cause overloads faults in the system even with the "AC OUT" disconnected and **WILL CAUSE DAMAGE** to the equipment if it is not corrected.

	Terminal: L1	Terminal: L2
Inverter 1	Phase: L1	Phase: L2
Inverter 2	Phase: L2	Phase: L3
Inverter 3	Phase: L3	Phase: L1

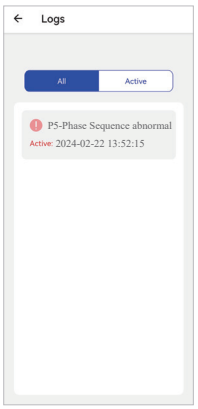


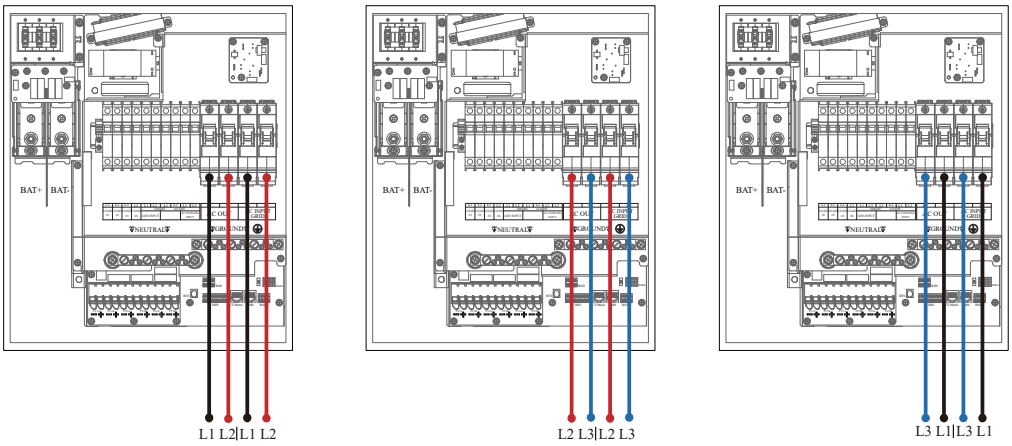
Figure 33: Phase abnormal warning

How to find an incorrect phase if prompted "Phase Sequence abnormal"?

- Measure L1 AC INPUT GRID of inverter 1 to L2 AC INPUT GRID of inverter 3. Should be 0 V AC.
- Measure L2 AC INPUT GRID of inverter 1 to L1 AC INPUT GRID of inverter 2. Should be 0 V AC.
- Measure L2 AC INPUT GRID of inverter 2 to L1 AC INPUT GRID of inverter 3. Should be 0 V AC.
- Same process should be done for LOAD side.
- Measuring voltage different than 0 V AC means the measured lines are not the same phase.
- **The MN 15-12KW-AIO can only receive direct rotation "↻" (clockwise).**

Be sure to check both, AC INPUT GRID and AC OUT terminal connections; both must be correct. If the error persists you will need to check your AC connection beyond the inverter and you will need to verify that the phases are correctly labeled from your meter.

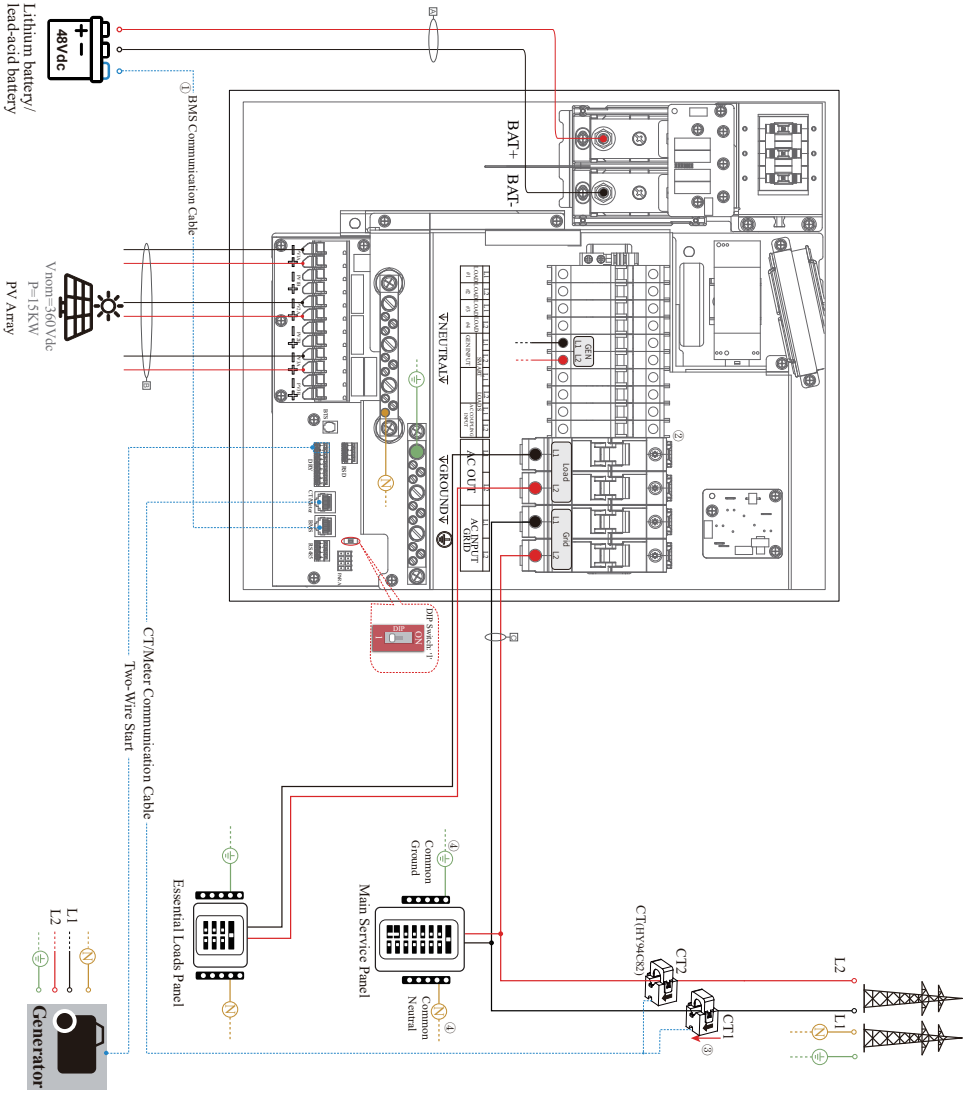
**** In 3 phase systems it is recommended to use a rotational tester (1-2-3, A-B-C).***



5. Wiring Diagrams

⚠ These wiring diagrams are examples of common use-cases for MNPower inverters. Diagrams must meet local electrical code and authorized jurisdiction requirements.

MNPower MN 15-12KW-AIO
Standard Wiring Diagram



(AC) L1
(DC) PV-
(DC) BAT -

(AC) L2
(DC) PV+
(DC) BAT +

NEUTRAL

GROUND

COM

① BMS is only for lithium battery. When applying standalone lithium battery connection, each inverter should be connected to BMS COM cable.
② The DC/AC breakers specification please refer to TABLE 1.
③ The arrow indicates the current in CT flows from the grid to the inverter.
④ Ⓝ ⏚ These symbols represent a common neutral/ground connection.

Diagram 01

TABLE 1
BREAKER SPECIFICATION

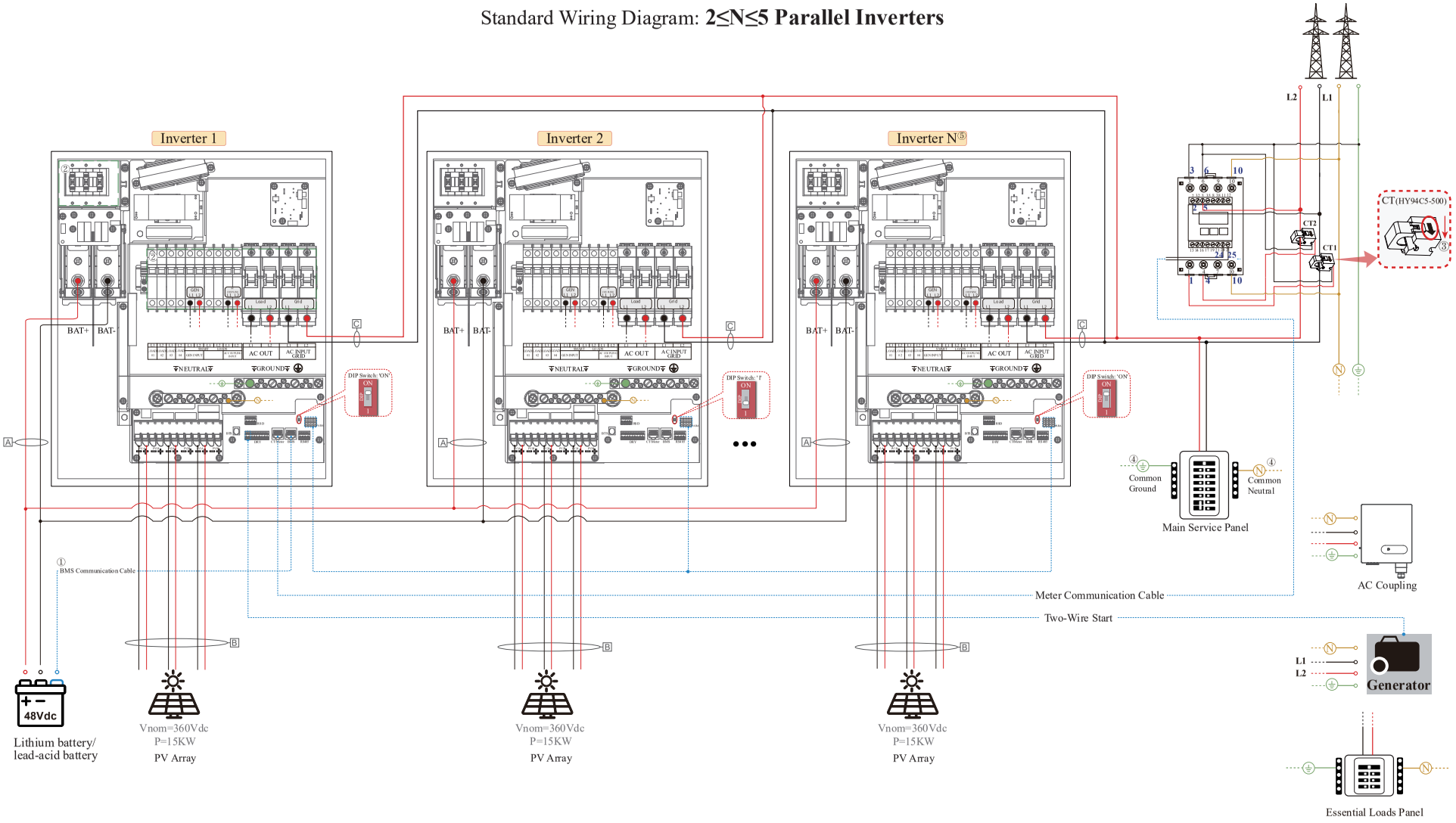
LOCATION	SPECIFICATION
Battery side(DC)	300A/80VDC
GEN side(AC)	60A/480VAC
Smart loads	30A/480VAC
AC Coupling	50A/480VAC
AC in Grid/AC out	100A/240VAC
Load 1 L1/Load 2 L2	15A/240VAC
Load 3 L1/Load 4 L2	20A/240VAC
Normal load side(AC)	Depends on rating of panel/through current and local code requirements

TABLE 2
WIRE GAUGE GUIDE (COPPER)

LABEL	CONDUCTOR
A	4/0 AWG
B	8 AWG
C	2 AWG

MNPower MN 15-12KW-AIO

Standard Wiring Diagram: **2≤N≤5 Parallel Inverters**



(AC) L1 (DC) PV- (DC) BAT -

(AC) L2 (DC) PV+ (DC) BAT +

NEUTRAL

GROUND

COM

① BMS is only for lithium battery. When applying standalone lithium battery connection, each inverter should be connected to BMS COM cable.
②The DC/AC breakers specification please refer to TABLE 1.
③The arrow indicates the current in CT flows from the grid to the inverter.
④Ⓝ ⏚ These symbols represent a common neutral/ground connection.
⑤ When there are only two inverters in the parallel system, refer to inverter 1 and inverter N for wiring and DIP switch settings.

TABLE 1
BREAKER SPECIFICATION

LOCATION	SPECIFICATION
Battery side (DC)	300 A / 80 V DC
GEN side (AC)	60 A / 480 V AC
Smart loads	30 A / 480 V AC
AC Coupling	50 A / 480 V AC
AC Input Grid/AC out	100 A / 240 V AC
Load 1 L1 / Load 2 L2	15 A / 240 V AC
Load 3 L1 / Load 4 L2	20 A / 240 V AC
Normal load side(AC)	Depends on required passthrough current and local code requirements.

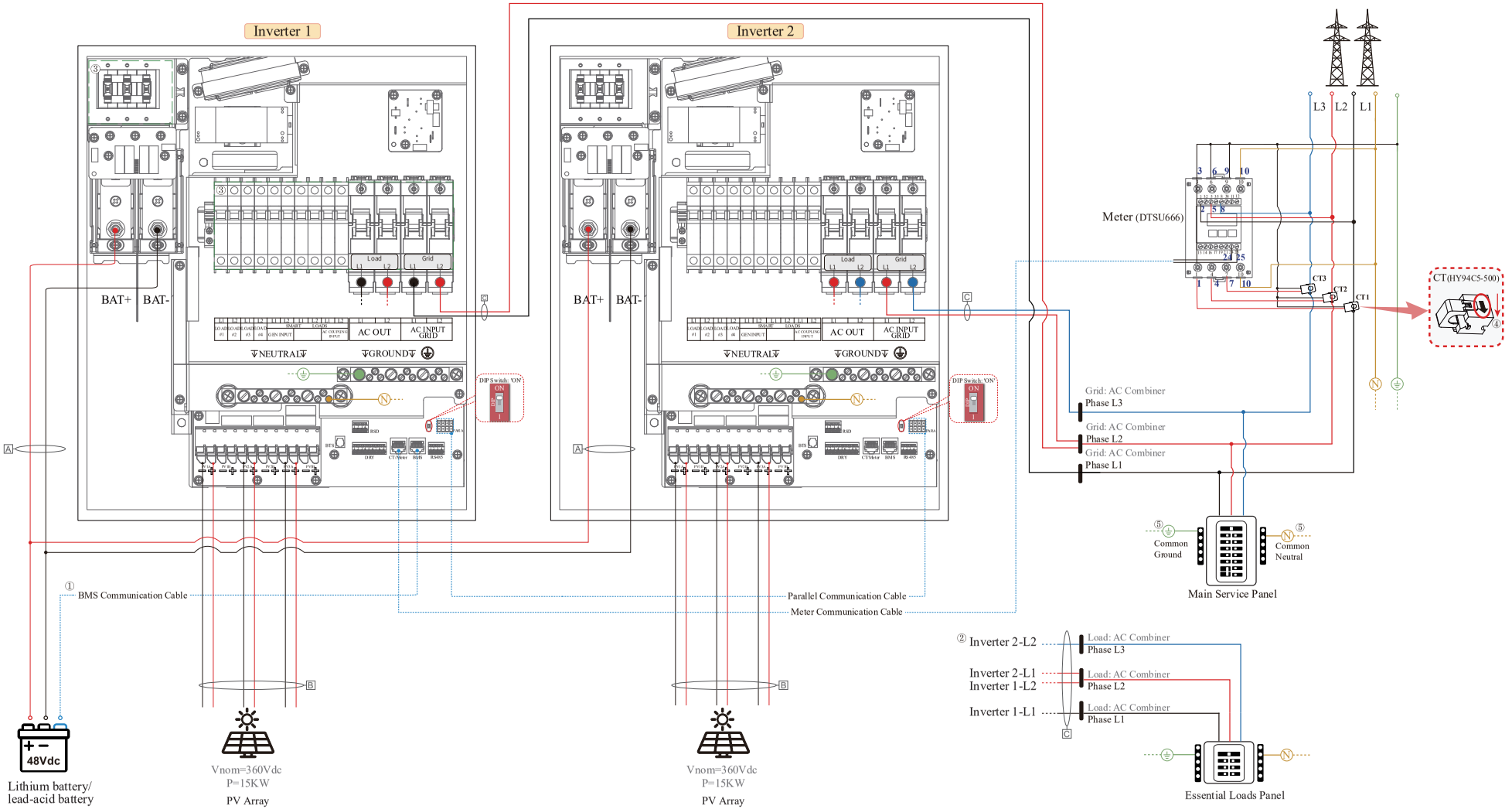
TABLE 2
WIRE GAUGE GUIDE (COPPER)

LABEL	CONDUCTOR
A	4/0 AWG
B	8 AWG
C	2 AWG

Diagram 02

MNPower MN 15-12KW-AIO

Standard Wiring Diagram: 2 Parallel Inverters | **120/208V** 3-Phase



(AC) L1 (DC) PV- (DC) BAT -
(AC) L2 (DC) PV+ (DC) BAT +
(AC) L3
NEUTRAL
GROUND
COM

① BMS is only for lithium battery. When applying standalone lithium battery connection, each inverter should be connected to BMS COM cable.
② The wiring method of GEN/critical load is as the same as that of the grid.
In 'Inverter N-L1', 'N' represents inverter serial number; 'L' represents the phase of live wire in GRID/GEN/BACKUP connection.
③ The DC/AC breakers specification please refer to TABLE 1.
④ The arrow indicates the current in CT flows from the grid to the inverter.
⑤ Ⓝ ⏚ These symbols represent a common neutral/ground connection.

TABLE 1
BREAKER SPECIFICATION

LOCATION	SPECIFICATION
Battery side(DC)	300 A / 80 V DC
GEN side(AC)	60 A / 480 V AC
Smart loads	30 A / 480 V AC
AC Coupling	50 A / 480 V AC
AC Input Grid /AC out	100 A / 240 V AC
Load 1 L1 / Load 2 L2	15 A / 240 V AC
Load 3 L1 / Load 4 L2	20 A / 240 V AC
Normal load side(AC)	Depends on required passthrough current and local code requirements.

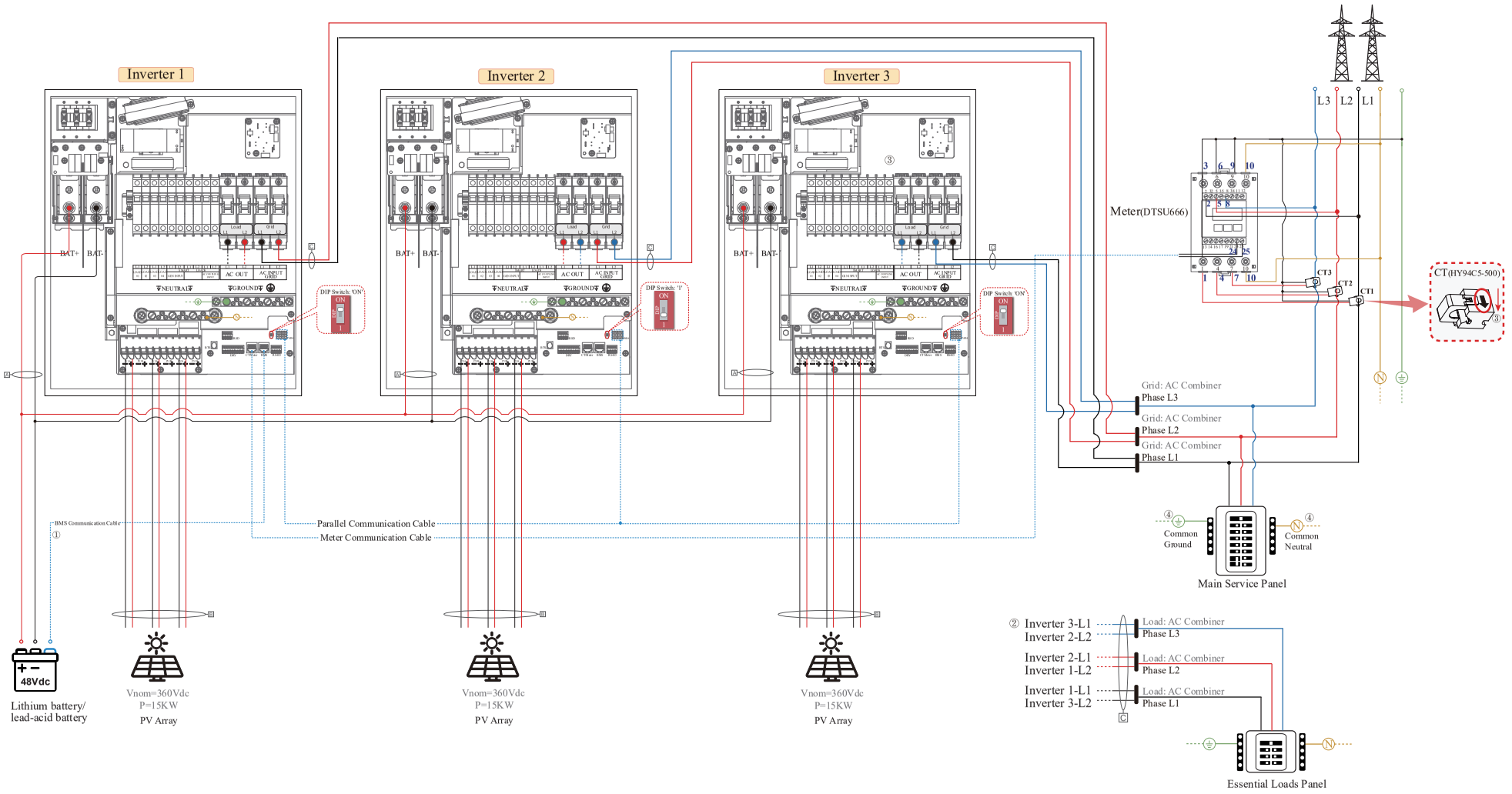
TABLE 2
WIRE GAUGE GUIDE (COPPER)

LABEL	CONDUCTOR
A	4/0 AWG
B	8 AWG
C	2 AWG

Diagram 03

MNPower MN 15-12KW-AIO

Standard Wiring Diagram: 3 Parallel Inverters | **120/208V** 3-Phase



(AC) L1 (DC) PV- (DC) BAT -
(AC) L2 (DC) PV+ (DC) BAT +
(AC) L3
NEUTRAL
GROUND
COM

① BMS is only for lithium battery. When applying standalone lithium battery connection, each inverter should be connected to BMS COM cable.
② The wiring method of GEN/critical load is as the same as that of the grid.
In 'Inverter N-L1', 'N' represents inverter serial number; 'L' represents the phase of live wire in GRID/GEN/BACKUP connection.
③ The DC/AC breakers specification please refer to TABLE 1.
④ The arrow indicates the current in CT flows from the grid to the inverter.
⑤ Ⓝ ⏚ These symbols represent a common neutral/ground connection.

TABLE 1
BREAKER SPECIFICATION

LOCATION	SPECIFICATION
Battery side(DC)	300 A / 80 V DC
GEN side(AC)	60 A / 480 V AC
Smart loads	30 A / 480 V AC
AC Coupling	50 A / 480 V AC
AC Input Grid /AC out	100 A / 240 V AC
Load 1 L1 / Load 2 L2	15 A / 240 V AC
Load 3 L1 / Load 4 L2	20 A / 240 V AC
Normal load side(AC)	Depends on required passthrough current and local code requirements.

TABLE 2
WIRE GAUGE GUIDE (COPPER)

LABEL	CONDUCTOR
A	4/0 AWG
B	8 AWG
C	2 AWG

Diagram 04

6. Troubleshooting Guide

6.1 MNPower Error Codes

FAULT	INSTRUCTION	COMMON CAUSE / REMEDY
A0	Grid over voltage	1. If the alarm occurs occasionally, possibly the power grid voltage is abnormal temporarily, and no action is required. 2. If the alarm occurs repeatedly, contact the local power station. After receiving approval of the local power bureau, revise the electrical protection parameter settings on the inverter through the App. 3. If the alarm persists for a long time, check whether the AC circuit breaker / AC terminals is disconnected, or if the grid has a power outage.
A1	Grid under voltage	
A3	Grid over frequency	
A4	Grid under frequency	
A2	Grid absent	Wait till power is restored.
B0	PV over voltage	Check whether the maximum input voltage of a single PV string exceeds the MPPT working voltage. If yes, modify the number of PV module connection strings.
B1	PV insulation abnormal	1. Check the insulation resistance against the ground for the PV strings. If a short circuit has occurred, rectify the fault. 2. If the insulation resistance against the ground is less than the default value in a rainy environment, set insulation resistance protection on the App.
B2	Leakage current abnormal	1. If the alarm occurs occasionally, the inverter can be automatically recovered to the normal operating status after the fault is rectified. 2. If the alarm occurs repeatedly, contact your dealer for technical support.
B4	PV under voltage	1. If the alarm occurs occasionally, possibly the external circuits are abnormal accidentally. The inverter automatically recovers to the normal operating status after the fault is rectified. 2. If the alarm occurs repeatedly or last a long time, check whether the insulation resistance against the ground of PV strings is too low.
B7	PV string reverse	Check and modify the positive and negative polarity of the input of the circuit string.
C0	Internal power supply abnormal	1. If the alarm occurs occasionally, the inverter can be automatically restored, and no action is required. 2. If the alarm occurs repeatedly, please contact customer service.
C2	Inverter over dc-bias current	1. If the alarm occurs occasionally, possibly the power grid voltage is abnormal temporarily, and no action is required. 2. If the alarm occurs repeatedly, and the inverter fails to generate power, contact customer service

FAULT	INSTRUCTION	COMMON CAUSE / REMEDY
C3	Inverter relay abnormal	1. If the alarm occurs occasionally, possibly the power grid voltage is abnormal temporarily, and no action is required. 2. If the alarm occurs repeatedly, please refer to the suggestions or measures of Grid over voltage. If the inverter fails to generate power, contact customer service. If there is no abnormality on the grid side, the machine fault can be determined. (If you open the cover and find traces of damage to the relay, it can be concluded that the machine is faulty.) Please contact customer service.
CN	Remote off	1. Local manual shutdown is performed in App. 2. The monitor executed the remote shutdown instruction. 3. Remove the communication module and confirm whether the alarm disappears. If yes, replace the communication module. Otherwise, please contact customer service.
C5	Inverter over temperature	1. If the alarm occurs occasionally, the inverter can be automatically recovered. No action is required. 2. If the alarm occurs repeatedly, please check whether the installation site has direct sunlight, bad ventilation, or high ambient temperature (such as installed on the parapet). If the ambient temperature is lower than 45° C and the heat dissipation and ventilation is good, please contact customer service.
C6	GFCI abnormal	1. If the alarm occurs occasionally, it could have been an occasional exception to the external wiring. The inverter can be automatically recovered. No action is required. 2. If it occurs repeatedly or cannot be recovered for a long time, please contact customer service.
C8	Fan abnormal	1. If the alarm occurs occasionally, please restart the inverter. 2. If it occurs repeatedly or cannot be recovered for a long time, check whether the external fan is blocked by foreign objects. Otherwise, contact customer service.
C9	DC link unbalance or under voltage	Batteries exceeded their current discharge limit.
CA	Dc-link over voltage	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CB	Internal communication error	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CC	Software incompatibility	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CD	Internal storage error	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.

FAULT	INSTRUCTION	COMMON CAUSE / REMEDY
CE	Data inconsistency	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CF	Inverter abnormal	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CG	Boost abnormal	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
CJ	Meter lost	1. Check the meter parameter Settings. 2. Local App checks that the communication address of the inverter is consistent with that of the electricity meter. 3. The communication line is connected incorrectly or in bad contact. 4. Electricity meter failure. 5. After excluding the above, if the alarm continues to occur, please contact customer service.
P1	Parallel ID warning	It is Parallel ID Alarm. Please check the parallel communication cable, and check whether any inverter joins or exits online. All inverters are powered off completely, check the line, and then power on the inverters again to ensure that the alarm is cleared.
P2	Parallel SYN signal warning	Parallel synchronization signal is abnormal. Check whether the parallel communication cable is properly connected.
P3	Parallel BAT abnormal	The parallel battery is abnormal. The battery of the inverter is reported low voltage or the battery is not connected.
P4	Parallel GRID abnormal	The parallel grid is abnormal. The grid of the inverter is abnormal.
P5	Phase Sequence abnormal	Ensure that the phase sequence of power grid is consistent with that of L1/L2/L3 on App. To clear phase sequence abnormal alarm: Option 1: Power off all inverters, correct the phase sequence of each inverter and then restart the inverters. Option 2: Under inverter standby mode, correct the phase sequence of each inverter on App, power off all inverters and then restart the inverters. If the alarm continues, please contact customer service.
D2	Battery over voltage	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. Check that the battery overvoltage protection value is improperly set. 3. The battery is abnormal. 4. After excluding the above, if the alarm continues to occur, please contact customer service.

FAULT	INSTRUCTION	COMMON CAUSE / REMEDY
D3	Battery under voltage	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. Check the communication line connection between BMS and inverter (lithium battery). 3. The battery is empty or the battery voltage is lower than the SOC cutoff voltage. 4. The battery undervoltage protection value is improperly set. 5. The battery is abnormal. 6. After excluding the above, if the alarm continues to occur, please contact customer service.
D4	Battery discharger over current	1. Check whether the battery parameters are correctly set. 2. Battery undervoltage. 3. Check whether a separate battery is loaded and the discharge current exceeds the battery specifications. 4. The battery is abnormal. 5. After excluding the above, if the alarm continues to occur, please contact customer service.
D5	Battery over temperature	1. If the alarm occurs repeatedly, please check whether the installation site is in direct sunlight and whether the ambient temperature is too high (such as in a closed room). 2. If the battery is abnormal, replace it with a new one. 3. After excluding the above, if the alarm continues to occur, please contact customer service.
D6	Battery under temperature	
D7	AC output voltage abnormal	1. Check whether the AC OUTPUT voltage and frequency Settings are within the specified range. 2. Check whether the AC OUTPUT circuit is overloaded. 3. When not connected to the power grid, check whether AC OUTPUT voltage is normal. 4. After excluding the above, if the alarm continues to occur, please contact customer service.
D8	Communication error (Inverter-BMS)	1. Check whether the battery is disconnected. 2. Check whether the battery is properly connected with the inverter. 3. Confirm that the battery is compatible with the inverter. It is recommended to use CAN communication. 4. Check whether the communication cable or port between the battery and the inverter is faulty. 5. After excluding the above, if the alarm continues to occur, please contact customer service.
D9	Internal communication loss(E-M)	1. Check whether the communication cables between AC OUTPUT, electricity meter and inverter are well connected and whether the wiring is correct (European units only). 2. Check whether the communication distance is within the specification range. 3. Disconnect the external communication and restart the electricity meter and inverter. 4. After excluding the above, if the alarm continues to occur, please contact customer service.
DA	Internal communication loss(M-D)	
CU	Dcdc abnormal	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, please: a) Check whether the MC4 terminal on the PV side is securely connected. b) Check whether the voltage at the PV side is open circuit, ground to ground, etc. After excluding the above, if the alarm continues to occur, please contact customer service.

FAULT	INSTRUCTION	COMMON CAUSE / REMEDY
CP	AC output over dc-bias voltage	1. If the alarm occurs occasionally, the inverter can be automatically recovered and no action is required. 2. If the alarm occurs repeatedly, the inverter cannot work properly. Please contact customer service.
DB	AC output short circuit	1. Check whether the live line and neutral line of AC OUTPUT are short-circuited. 2. If it is confirmed that the output is not short-circuited or an alarm, please contact customer service to report for repair. (After troubleshooting alarm problems, AC OUTPUT breaker needs to be manually turned on during normal use.)
Dr	AC output over load	1. Disconnect the AC OUTPUT breaker and check whether the alarm is cleared. 2. If the load is disconnected and the alarm is generated, please contact customer service. (After the alarm is cleared, the AC OUT breaker needs to be manually turned on for normal use.)

NOTE


MNP