

Grid-Hybrid Inverter
SPH 8K-10K TL-HU-US/(B)
User Manual

About This Document

This document introduces Grid-Hybrid Inverter SPH 8K-10K TL-HU-US/(B) in terms of its installation, electrical connection, operation, commission, maintenance, and troubleshooting. Before installing and operating Grid-Hybrid Inverter ensure that you are familiar with the product features, functions, and safety precautions provided in this document.

Symbol	Description
 DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation, if not avoided, could result in serious injury or death.
 NOTICE	Is used to address practices which are not safety relevant.

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1 Information on this Manual

1.1 Overview

This manual is intended to introduce the SPH 8K-10K TL-HU-US/(B) Inverters manufactured by Growatt USA, Inc.(hereinafter referred to as Growatt) in terms of the installation, operation, commissioning, maintenance and troubleshooting. Please read this manual carefully before using the product, and keep it in a place that is easily accessible to installation, operation and maintenance personnel. The content is continually reviewed and amended as necessary. Growatt reserves the right to make changes to the materiaI at any time and without notice.

1.2 Intended Audience

Only qualified electrical technicians are allowed to install SPH 8K-10K TL-HU-US/(B) Inverters. Reading through this manual and observing all the precautions, qualified electrical technicians will be able to properly install, troubleshoot and configure the SPH 8K-10K TL-HU-US/(B) Inverters. If any questions arise during installation, you can visit us.growatt.com and leave a message.

1.3 Safety Instructions

1. Please read this manual carefully before installation. Damages caused by failure to follow the instructions in the manual are beyond the warranty scope.
2. Only qualified and trained electrical technicians are allowed to perform operations on the Storage Inverter.
3. During installation, please do not touch other parts inside the equipment except wiring terminals.
4. Ensure that all electrical connections comply with local electrical standards.
5. For maintenance, please contact designated local installation and maintenance personnel.
6. Before operating the inverter in the on-grid mode, ensure that you have obtained any permission needed from the local electricity grid network operator.

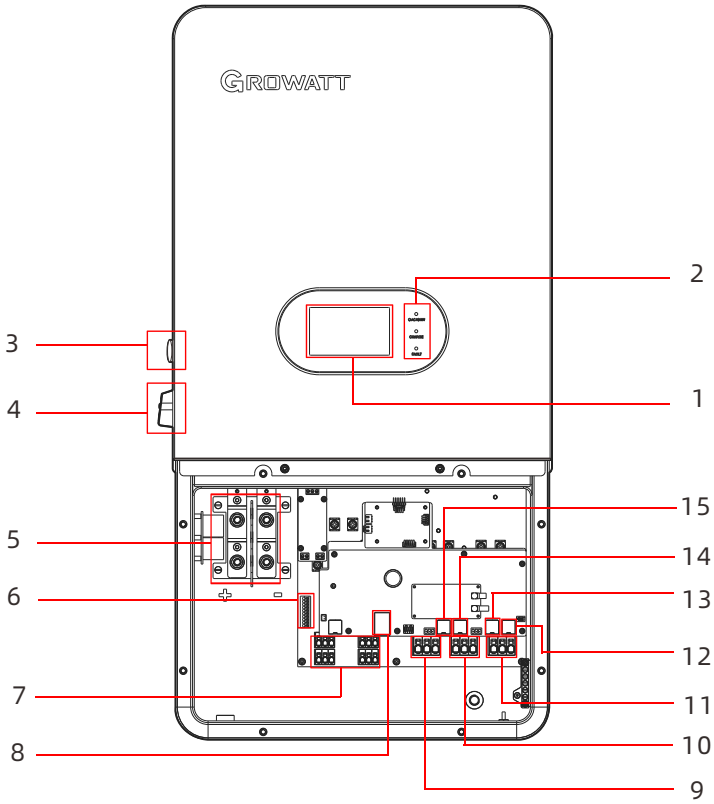
 **DANGER**	a. Electrical installation, repairs and conversions may only be carried out by electrically qualified persons. b. DO NOT connect the grid to the Load Output Breaker. c. DO NOT reverse the polarity of batteries. Damage WILL occur. d. The components in the inverter are live. Touching live components can result in serious injury or death. e. Non professional, please do not open the inverter. f. Beware of high PV voltage. Please turn-off the DC switch of PV Panel output before and during the installation to avoid electric shock.

	g. Beware of high grid voltage. Please turn-off the AC switch at the grid connection before and during the installation to avoid electric shock. h. Beware of large current of the battery output. Please turn-off the battery module before and during the installation to avoid electric shock.
 **WARNING**	a. Make all electrical connections (e.g. conductor termination, fuses, PE, connection, etc.) in accordance with prevailing regulations. When working with the inverter powered on, adhere to all prevailing safety regulations to minimize risk of accidents. b. Systems with inverters typically require additional control (e.g. switches, disconnects) or protective devices (e.g. fusing circuit breakers) depending upon the prevailing safety rules. c. ALL terminals/breakers including battery, MPPT, and AC breaker inputs should only have one conductor connecting to them. d. Anytime the inverter has been disconnected from the power network, use extreme caution as some components can retain charge sufficient to create a shock hazard; to minimize occurrence of such conditions, comply with all corresponding safety symbols and markings present on the unit and in this manual. e. Ensure all covers and doors are closed and secure during operation. All operations regarding transport, installation and start-up, including maintenance must be operated by qualified, trained personnel and in compliance with all prevailing codes and regulations. f. Although designed to meet all safety requirements, some parts and surfaces of Inverter are still hot during operation. To reduce the risk of injury, do not touch the heat sink at the back of the PV-Inverter or nearby surfaces while Inverter is operating.
 **NOTICE**	a. Please carefully read this manual before any work is carried out on this inverter, the installation, please keep this manual carefully stored and easy to access at any time. b. The qualified personnel should have had training in the installation and commissioning of the electrical system as well as dealing with hazards, also they should have the knowledge of the manual and other related documents. As the installer or operator they are required to be familiar with local regulations and directives.

2 Product Introduction

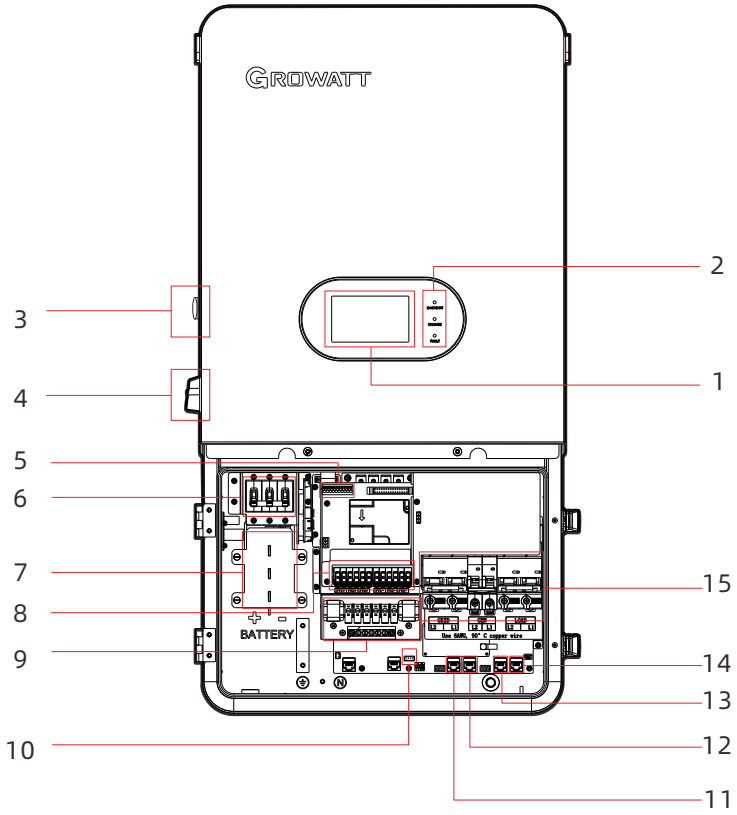
2.1 Product Overview

SPH 10000 TL-HU-US



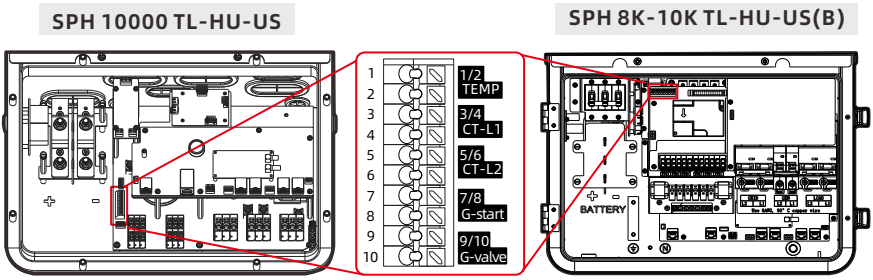
1: LCD Display
2: Inverter Status LEDs
3: Power ON/OFF button
4: PV Disconnect
5: Battery Input
6: Function Port
7: PV Input
8: Upgrading Port(USB)
9: Grid Port
10: Generator Input
11: Load Port
12: Parallel-A Port
13: Parallel-B Port
14: Host Computer Port
15:BMS Port

SPH 8K-10K TL-HU-US(B)



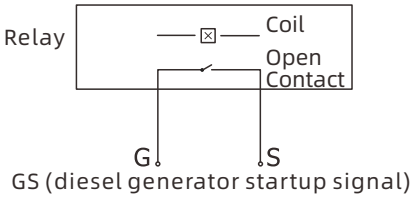
1: LCD Display
2: Inverter Status LEDs
3: Power ON/OFF button
4: PV Disconnect
5: Function Port
6: 250A Battery Breaker
7: Battery Input
8: PV Input
9: Neutral /Ground Bus Bar
10: Upgrading Port(USB)
11: BMS Port
12: Host Computer Port
13: Parallel-B Port
14: Parallel-A Port
15: AC Breaker
(Grid 100A/Gen 63A/Load 100A)

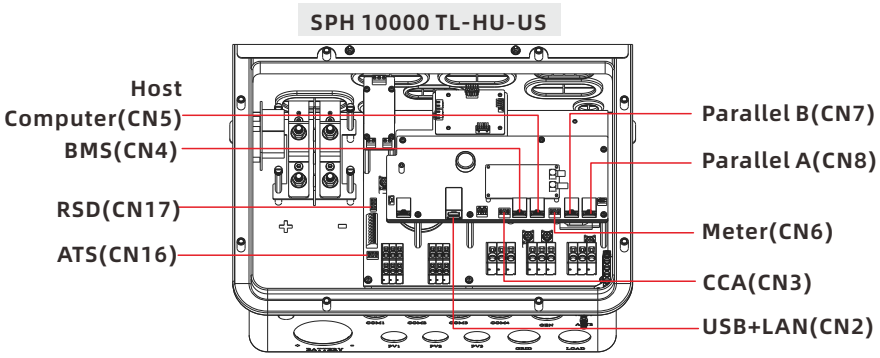
2.2 Function Port Definition



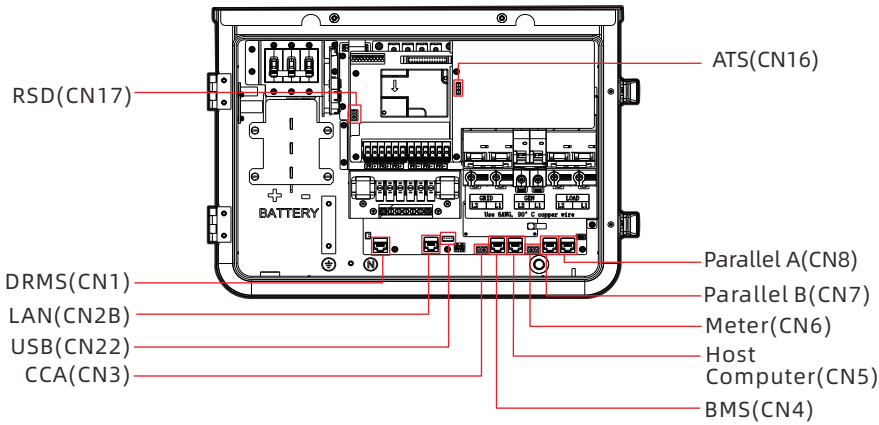
TEMP (1,2): Battery temperature sensor for lead acid battery.
CT-L1 (3,4): Current transformer (CT1) for"Export Limit to Home Load mode"mode clamps on L1 when in split phase system.
CT-L2 (5,6): Current transformer (CT2) for "Export Limit to Home Load mod" mode clamps on L2 when in split phase system.
G-start (7,8): Generator start signal should be connected to the CON board CN9 terminal 7/8 position, G-startnominal open circuit. If the user wants to start the generator, G-start nominally closes the port.
G-valve (9,10): Reserved.

2.3 Other Port Function





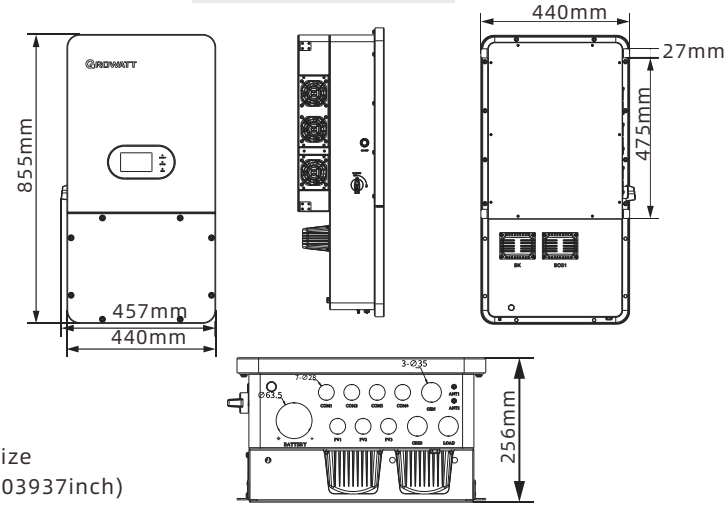
SPH 8K-10K TL-HU-US(B)



RSD (CN17): Provide 12Vdc output when inverter is on.
ATS (CN16): 240V output port when inverter is on.
BMS (CN4): RS 485 (1B,2A),CAN (4H,5L) port for battery communication.
Parallel A (CN8): Parallel communication port 1 (CAN interface).
Parallel B (CN7): Parallel communication port 2 (CAN interface).
Meter (CN6): For energy meter communication. Some hard ware versions don't have this port.
USB(CN22): USB port.
Host Computer (CN5): Upper Computer Port

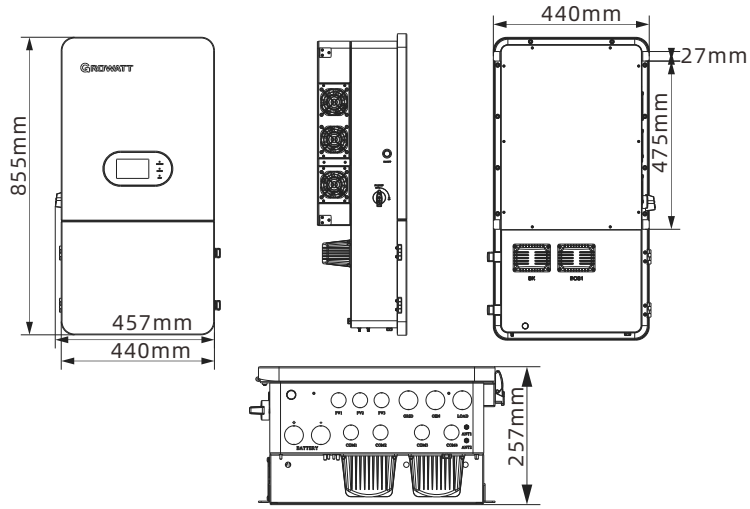
2.4 Product Size

SPH 10000 TL-HU-US



Inverter Size
(1mm=0.03937inch)

SPH 8K-10K TL-HU-US(B)



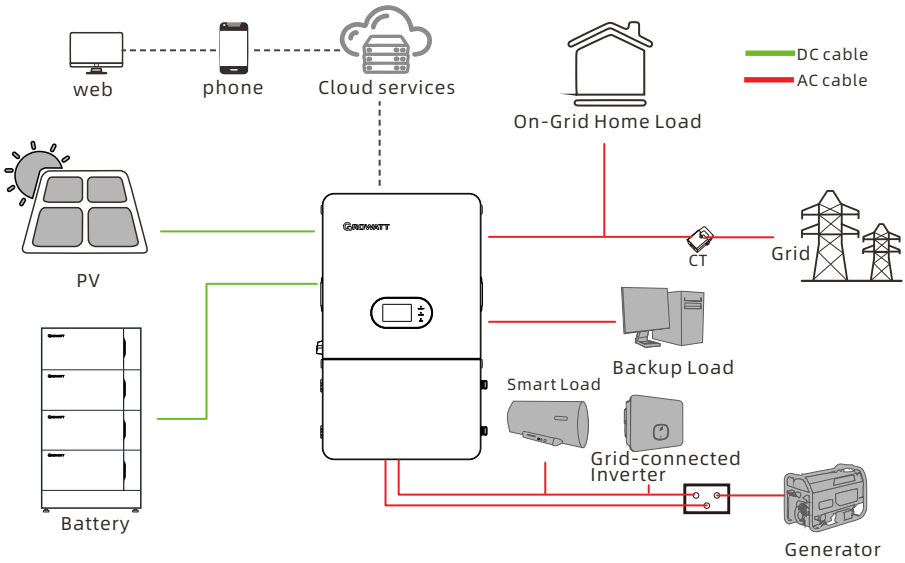
Inverter Size (1mm=0.03937inch)

2.5 Product Features

-Supports Split phase 120/240Vac, Three-phase 120/208Vac system.
-Configurable battery charging current/voltage based by touchscreen setting.
-Configurable AC/Solar/Generator Charger priority by touch screen setting.
-Compatible with grid voltage or generator power.
-Can be started by photovoltaic, grid or battery.
-Time of use function. Smart battery charger design for optimized battery performance.
-Supporting WiFi/ 4G/ Bluetooth monitoring.
-Smart settable three stages MPPT charging for optimized battery performance
-Overload/Over temperature/Short circuit protection.
-Programmable supply priority for battery or grid.
-Grid bypass current maximum value can reach 62.5A.AC port has a 90A relay, and the software will trigger protection. when the maximum bypass current is reached.
-Programmable multiple operation modes: On Grid Mode, Export Limit to Backup Load, Export Limit to Home Load.

2.6 System Architecture

The following illustration shows basic application of this inverter.
It also includes following devices to have a complete running system.
-Generator or Utility
-PV modules
-Battery
Consult with your installer or Growatt engineer for other possible system architectures depending on your requirements This inverter can power all kinds of appliances in home or office environment, including motor type appliances such as refrigerator and air conditioner.

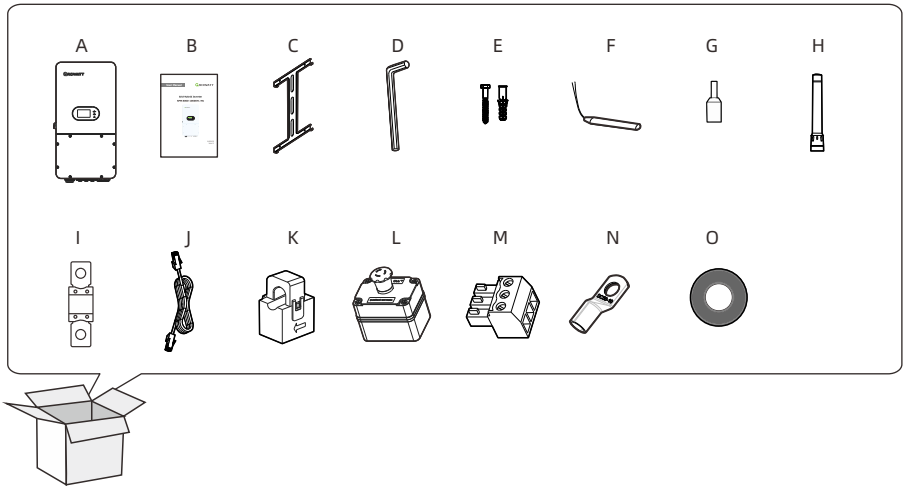


3 Installation

3.1 Parts List

Check the equipment before installation. Please make sure nothing is damaged in the package.
You should have received the items in the following package:

Item	Description	Qty	Item	Description	Qty
A	Hybrid inverter	1	I	Spare Fuse except for (B)	1
B	User manual	1	J	Parallel communication cable	2
C	Wall Bracket	1	K	Current Transformers(CT*2)	2
D	L-type Hexagon wrench	1	L	RSD Emergency Stop Switch	1
E	Stainless steel anti-collision bolt	4	M	ATS terminal	2
F	Battery temperature sensor	1	N	Battery terminal	2
G	Tubular terminal:6AWG,10AWG	9+12	O	Magnetic ring	1
H	Rod antenna	2			



3.2 Mounting Instructions

Installation Precaution

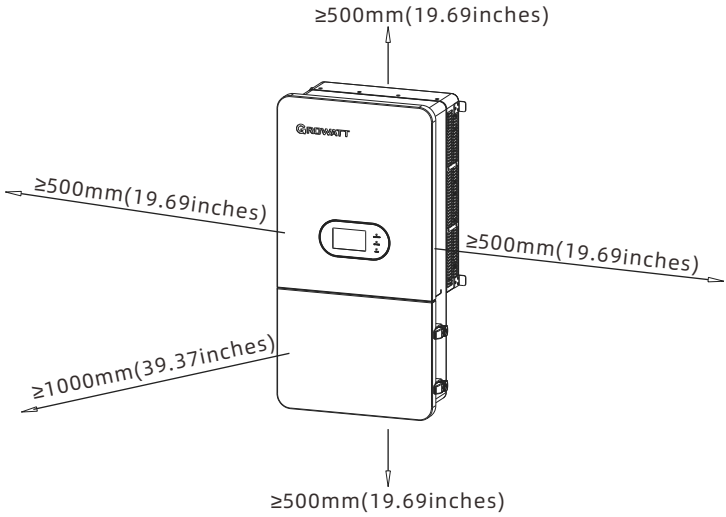
This Hybrid inverter is designed for outdoor use(IP65), Please make sure the installation site meets below conditions:

-Not in direct sunlight.
-Not in areas where highly flammable materials are stored.
-Not in potential explosive areas.
-Not in the cool air directly.

-Not near the television Antenna or antenna cable.
-Not higher than altitude of about 2000 meters above sea level.
-Not in environment of precipitation or humidity(>95%).

Considering the following before selecting where to install:

-Please select a vertical wall with load-bearing capacity for installation, suitable for installation on concrete or other non-flammable surfaces, installation is shown below.
-Install this inverter at eye level in order to allow touch screen display to be read at all times.
-The ambient temperature should be between -25~60°C to ensure optimal operation.
-Keep the inverter at a distance from other objects and surfaces as shown below.

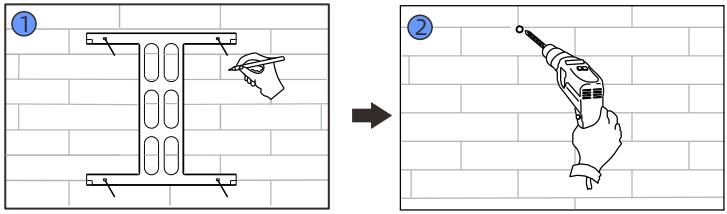


-For proper air circulation to dissipate heat, allow a clearance of approx.50cm to the side and approx.50cm above and below the unit. And 1000mm to the front.
-If using CTs included in the package plan accordingly considering the length restriction. CTs included in the package are 10m(32.8feet)long.

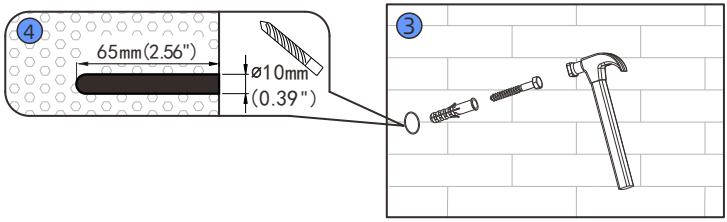
Mounting the inverter

Remember that this inverter is heavy! Caution when lifting out from the package.

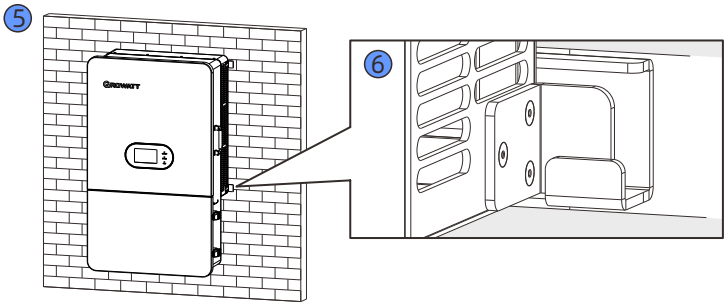
1.Please Make sure that the thickness of the wall for inverter installation is more than 70mm.
2.Please Place the template horizontally on the wall and confirm the level by level.



3.Please mark the holes in the 4 mounting holes of hole pattern.
4. Drill a hole with a depth of 65mm at the mark with a drill of 12mm.



5.Please knock the expansion screw rubber sleeve into the hole on the wall, and then screw on the expansion screw.
6.Please hang the inverter on the expansion screws, and then tighten the expansion screws.



3.3 Battery Connection

For safe operation and compliance, a separate DC over-current protector or disconnect device is required between the battery and the inverter. A 250A breaker is installed in the inverter of version (B) on the battery side In some applications, disconnect switch may not be required but over-current protectors are still required.

Model	Wire Size
SPH 8K-10KTL-HU-US/(B)	2AWG

WARNING	**All wiring must be performed by a professional person. Connecting the battery with a suitable cable is important for safe and efficient operation of the system. To reduce the risk of injury, refer to chart for recommended cables. Installers are reminded that adherence to local electrical codes and regulations is mandatory. Installers are encouraged to exercise caution, seek professional advice when necessary, and undertake installations with due diligence and in accordance with established electrical standards and regulations.**

SPH 8K-10K TL-HU-US/(B) has two battery input ports, so you could choose to choose to connect one battery clusters to it.

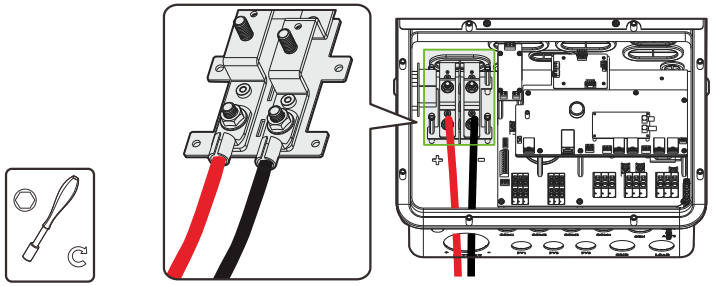
Please follow below steps to implement battery connection:

1.Please choose a suitable battery cable with correct connector which fits into the battery terminals.

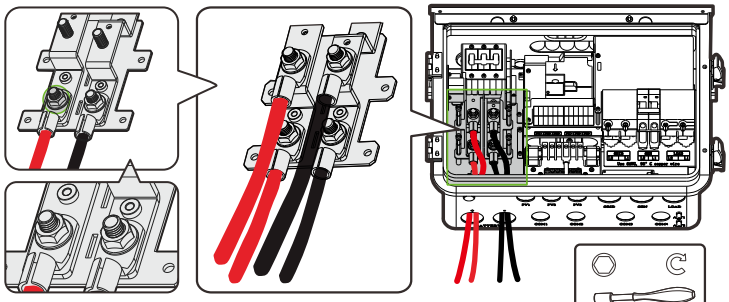
2. Use a Sleeve to unscrew the bolts and fit the battery connectors in, then fasten the bolt by the screwdriver, make sure the bolts are tightened in clockwise direction

3.Make sure polarity at both the battery and inverter is correctly connected

SPH 10000 TL-HU-US



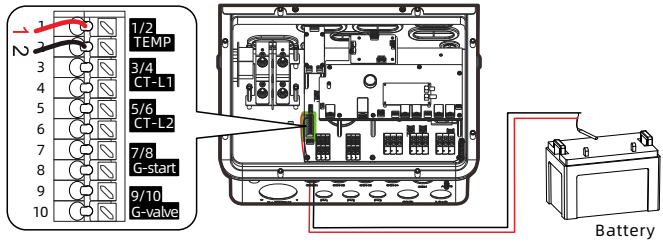
SPH 8K-10K TL-HU-US(B)



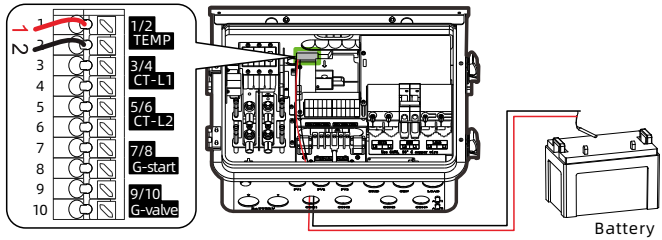
Torque: 12N.m/106.21in.lbs

Temperature sensor connection for lead-acid battery

SPH 10000 TL-HU-US



SPH 8K-10K TL-HU-US(B)



3.4 Grid Connection and Backup Load Connection

Before connecting to grid, please install a separate AC breaker between inverter and grid. Also, it is recommended to install an AC breaker between backup load and inverter. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current. The recommended of AC breaker is 80A for 10kw.There are three terminal blocks with "Grid" "Load" and "GEN" markings. Please do not misunderstand input and output connectors.

WARNING	**All wiring must be performed by a qualified personnel. It is very important for system safety and efficient operation to use appropriate cable fo AC input connection. To reduce risk of injury, please use the proper recommended cable as below.**

Model	Wire Size
SPH 8K-10K TL-HU-US/(B)	6AWG

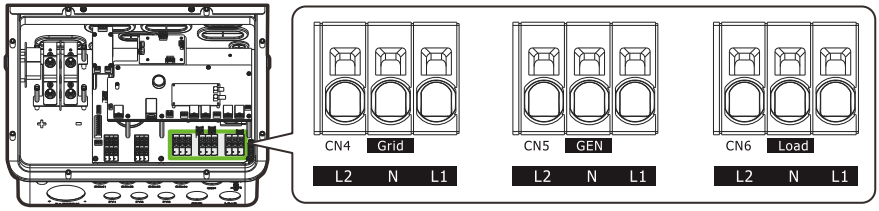
Please follow below steps to implement AC input/output connection:

1. Before making Grid, load and Gen port connection, be sure to turn off AC breaker first.
2. Remove insulation sleeve 10 mm for positive and negative conductors
3. Use crimping pliers to press the 6AWG cable onto the attached tubular terminal to form a square.

4. Install the AC conduit to the AC grid output opening (Grid, Gen, Load). Use appropriate conduit fittings and bond where necessary.
5. Terminate the AC conductors to the appropriate terminal.

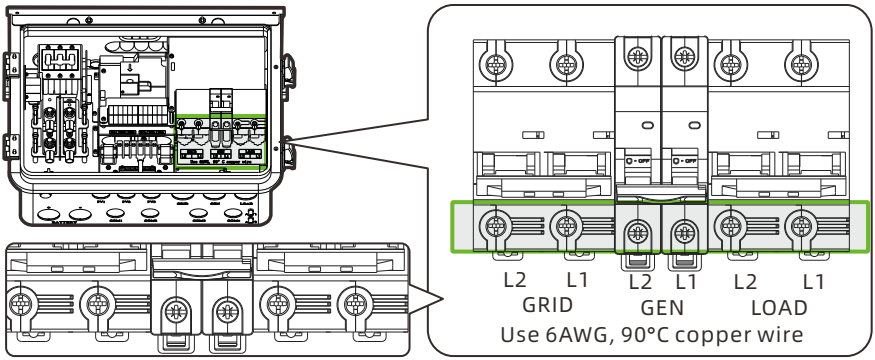
SPH 10000 TL-HU-US

L2	N	L1	L2	N	L1	L2	N	L1
Grid			GEN			Load		
CN4			CN5			CN6		



SPH 8K-10K TL-HU-US(B)

L2	L1	L2	L1	L2	L1
Grid		GEN		Load	



Grid, Load Connection: 3.5 N.m /31in.lbsGen Connection: 2 N.m/18in.lbs

NOTICE	**Be sure that AC power source is disconnected before attempting to wire it to the unit.**

Appliances such as air conditioner are required at least 2-3 minutes to restart because it is required to have enough time to balance refrigerant gas inside of circuit. If a power shortage occurs and recovers in short time, it will cause damage to your connected appliances. To prevent this kind of damage, please check manufacturer of air conditioner if it is equipped with time-delay function before installation. Otherwise, this inverter will trigger overload fault and cutoff output to protect your appliance but sometimes it still causes internal damage to the air conditioner.

3.5 PV Connection

Before connecting to PV modules, please install a separate DC circuit breaker between inverter and PV modules. It is very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.
SPH 8K-10K TL-HU-US/(B) comes with an integrated Tigo/Aps RSD transmitter. No need to install/connect or do anything with the integrated RSD transmitter. Only need to wire PV (+) and (-) in PV port on inverter (The inverter extends the wires from each PV strings connected to pass them through the transmitter core and transmit the keep alive signal completing the rapid shutdown. PS.RSD functionality is not available in Mexico and Colombia.)

Model	Wire Size
SPH 8K-10K TL-HU-US/(B)	10AWG

WARNING	**To avoid any malfunction, do not connect any PV modules with possible current leakage to the inverter. For example, grounded PV modules will cause current leakage to the inverter. When using PV modules, please be sure NO grounding. It is requested to use PV junction box with surge protection. Otherwise, it will cause damage on inverter when lightning occurs on PV modules.**

3.5.1 PV Module Selection

When selecting proper PV modules, please be sure to consider below parameters
1.Open circuit Voltage (Voc) of PV modules should not exceed max PV array open circuit voltage of inverter.
2.Open circuit Voltage (Voc) of PV modules should be higher than min start voltage.

Inverter Model	SPH 10000TL-HU-US	SPH 8000TL-HU-US(B)	SPH 10000TL-HU-US(B)
PV Input Voltage	370V(130V-525V)		
PV Array MPPT Voltage Range	150V-450V		
No. of MPPT Trackers	3		
No. of Strings per MPP Tracker	2+2+2		

3.5.2 PV Module Wire Connection

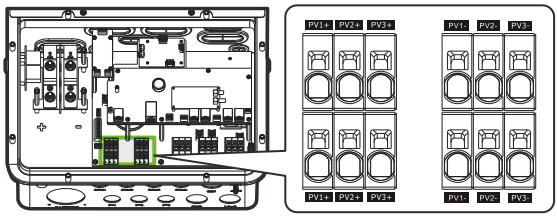
Please follow below steps to implement PV module connection:

1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Use crimping pliers to press the 10AWG cable onto the attached tubular terminal to form a square.
3. Check correct polarity of wire connection from PV modules and PV input connectors. Then, connect positive pole(+) of connection wire to positive pole (+) of PV input connector. Connect negative pole (-) of connection wire to negative pole (-) of PV input connector. Close the switch and make sure the wires are tightly fixed.
4. Parallel strings per MPPT must be the same Voltage.
    a. PV1 A/B must be the same voltage if using both strings.
    b. Panels on the same MPPT CAN face different directions.
5. Terminate the PV strings to the appropriate terminal.

NOTICE	**Make sure the wire is tight and secure.**

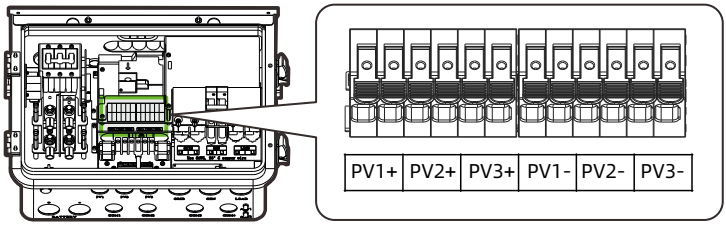
SPH 10000 TL-HU-US

1	2	3	4	5	6
PV1+	PV2+	PV3+	PV1-	PV2-	PV3-
PV1+	PV2+	PV3+	PV1-	PV2-	Pv3-



SPH 8K-10K TL-HU-US(B)

1	2	3	4	5	6	7	8	9	10	11	12
PV1+		PV2+		PV3+		PV1-		PV2-		PV3-	



3.5.3 Rapid Shutdown

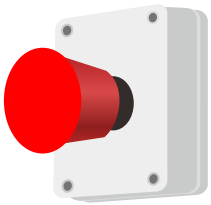
The inverter includes a rapid shutdown system that complies with 2017 and 2020 NEC 690.12 requirements. In case of emergency, press the rapid shutdown button that cut off the RSD power supply, thus stopping the inverter AC output, and the PV conductors voltage will be reduced to less than 30V within 30 seconds

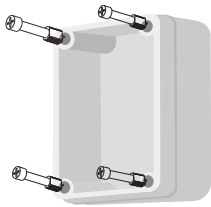
1.Mounting the RSD initiation switch

a. Using a Philips head screwdriver, unscrew the 4 plastic screws of the assembled RSD initiation switch to open the enclosure.

b. Use the base of the enclosure to mark 4 holes on thee wall and drill the holes out. Insert the wall anchors into the holes.

C. Align the holes of the RSD initiation switch base with the holes in the wall. Using a Philips screwdriver, screw the self tapping screws through the enclosure base into the wall anchors.





2.Wiring the RSD initiation switch

a. Install RSD switch wire to the COM input ,use appropriate conduit fittings and bond where necessary. Run the signal wire.

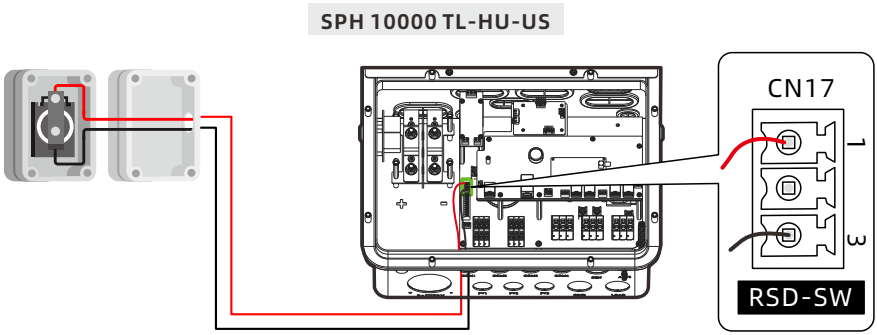
b. Connect the wire to the RSD switch as shown.

c. Reinstall the RSD initiation switch cover and tighten the plastic screws to secured.

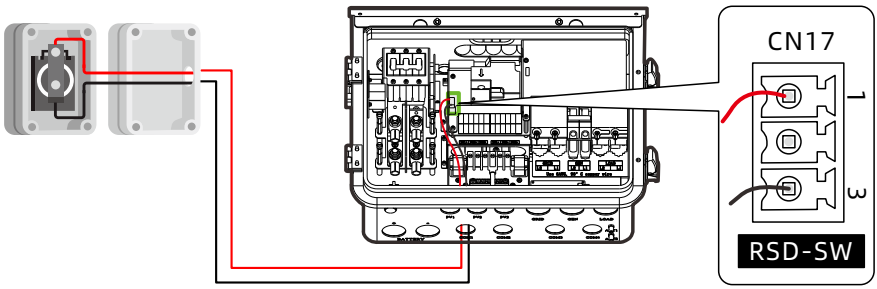
d. Remove the 3-pin connector from terminal CN17 and remove the jumper across the pins.

e. Insert the wire in the 3-pin conductor's positions 1 and 3, as shown.

f. Replace the connector in the terminal CN17 and replace the inverter wire box cover.



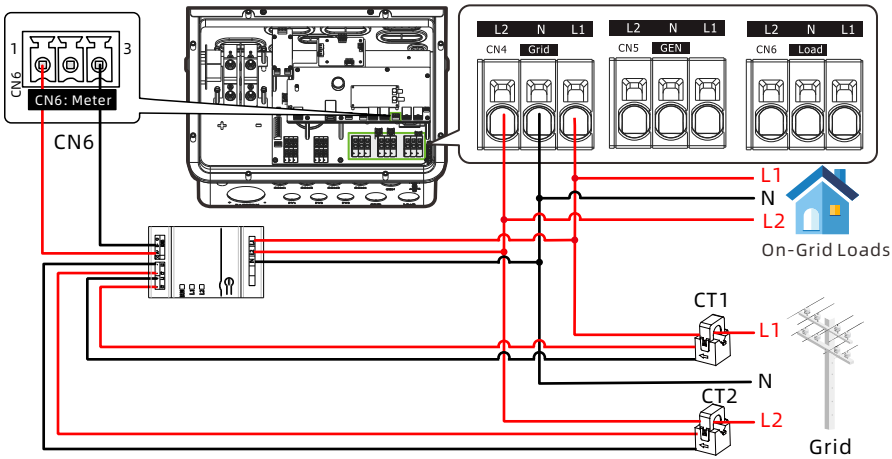
SPH 8K-10K TL-HU-US(B)



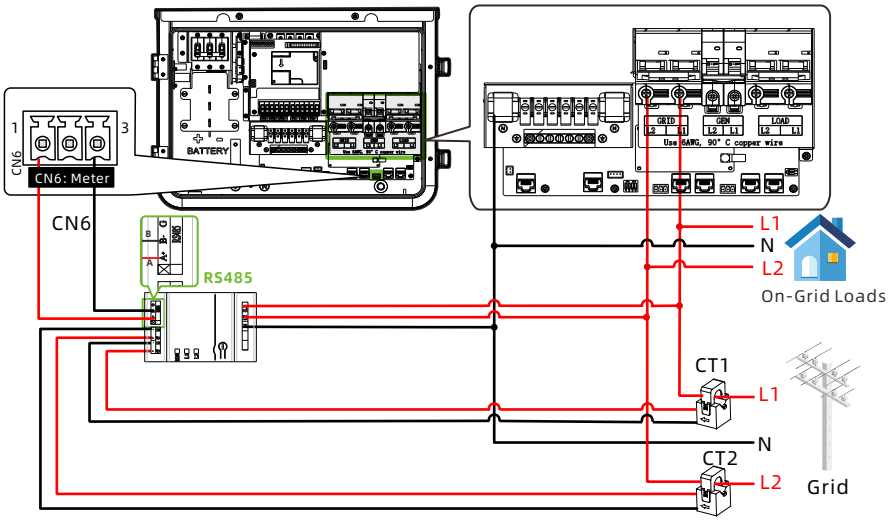
3.6 Meter or CT Connection

Cable	Meter	Inverter	Type	Conductor cross-sectional area range
AC wire-L1	ΦL1	n/a	solid or stranded wire but not fine stranded wire	6AWG
AC wire-L2	ΦL2			
AC wire-N	N			
Ground	PE symbol			
CT-ΦL1	L1 CT +/-	n/a	n/a	n/a
CT-ΦL2	L2 CT +/-			
Communications cable	RS485 A+		Min. 3-wire shielded	0.2-1mm²/24-18AWG
	RS485 B-			

SPH 10000 TL-HU-US

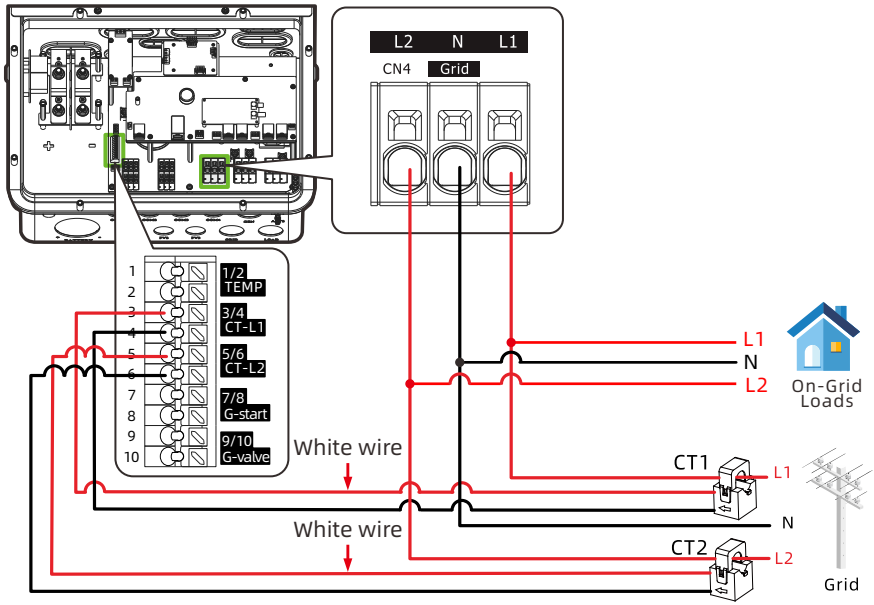


SPH 8K-10K TL-HU-US(B)

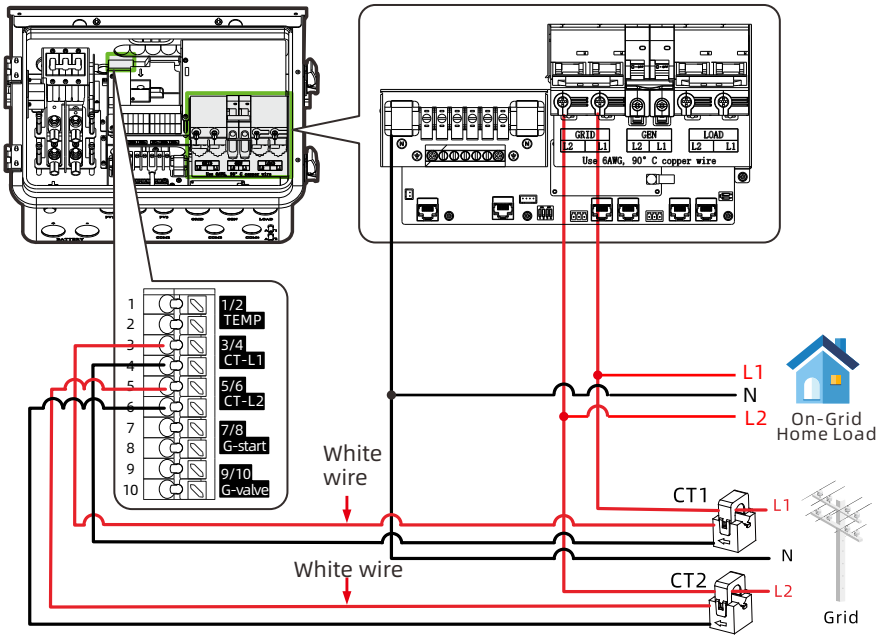


CT Connection(How to set CT, please refer to 7.9)

SPH 10000 TL-HU-US



SPH 8K-10K TL-HU-US(B)



3.7 Earth Connection(Mandatory)

Ground cable shall be connected to ground plate on grid side this prevents electric shock.

Model	Wire Size
SPH 8K-10K TL-HU-US/(B)	12AWG

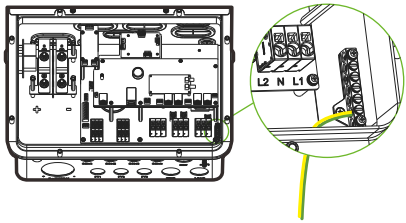
If the original protective conductor fails. Please follow below steps to plement Ground cable connection:

Please follow below steps to implement Ground cable connection:

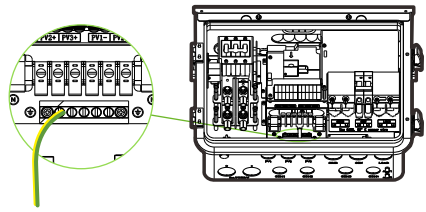
1.Remove insulation sleeve 10 mm for wire.

2.Loosen the screw, insert the ground wire and then tighten thee screw. Please make sure that the ground cable is firmly connected to the ground bar.

SPH 10000 TL-HU-US



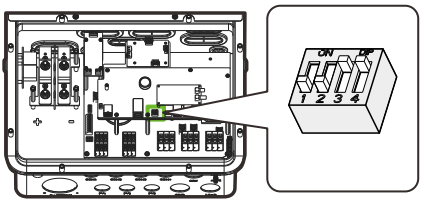
SPH 8K-10K TL-HU-US(B)



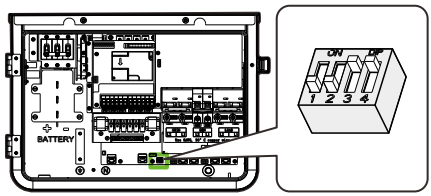
3.8 Dip Switch Status

Working condition	Switch status
Local upgrade （USB flash drive upgrade)	1/2:ON;3/4-OFF 
Connect to the build-in datalogger (Default)	1/2:OFF;3/4→ON 

SPH 10000 TL-HU-US



SPH 8K-10K TL-HU-US(B)

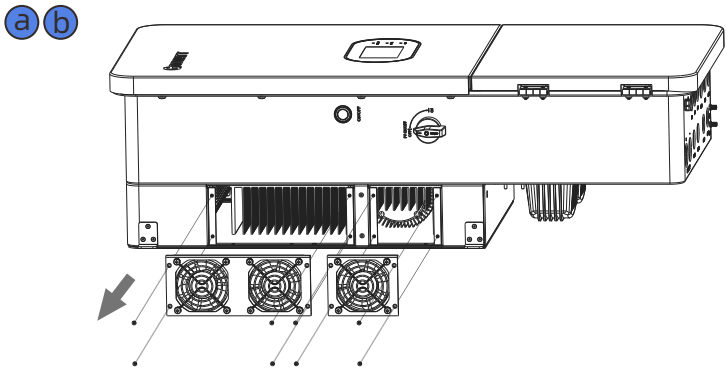


3.9 Fan Replacement

Please check and clean the fans regularly. The recommended period is 6 months Please replace the fan following up the below diagram if there is problem with the fans. Turn off the system and wait for more than 5 minutes before disassembling the machine.

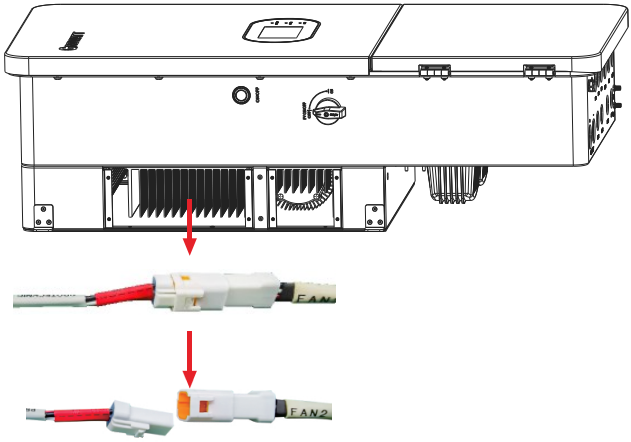
a. Loosen the screws and remove them.

b. Remove the fan fixing.



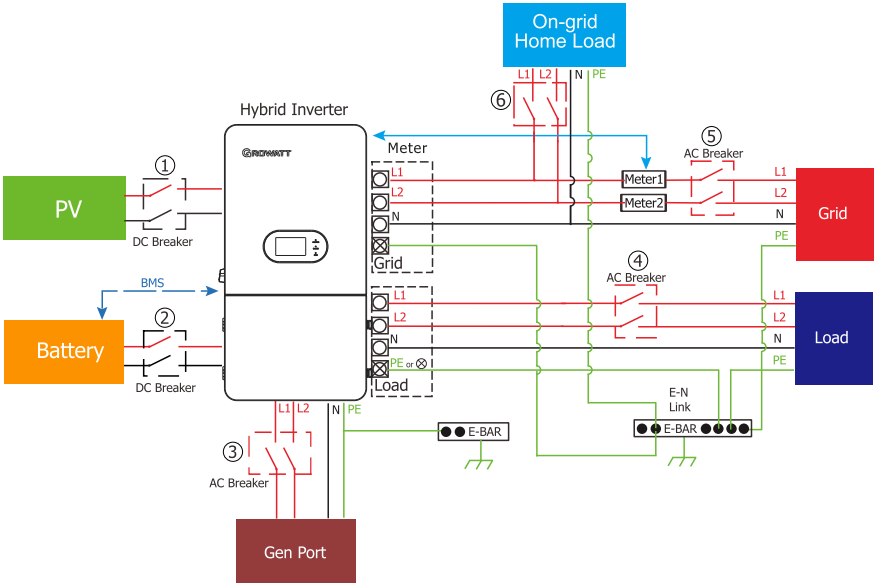
c. If you want to replace the broken fan, Then you need to press the snap-fit of the fan, untie the snap-fit of the fan, and then replace it. As the picture shows. Pull out the fan bracket completely, and use a soft brush to clean the fans or replace the damaged fan.

C



d. Remove the fan and replace it.
e. After the fan is installed, follow the steps just now to push back and assemble it back.

3.10 Wiring System for Inverter



In the SPH TL-HU-US(B)version series models. The external circuit breakers on the backup load side, generator side, grid side and battery side are optional. The inverter already has these breakers internally. The specifications are given below.

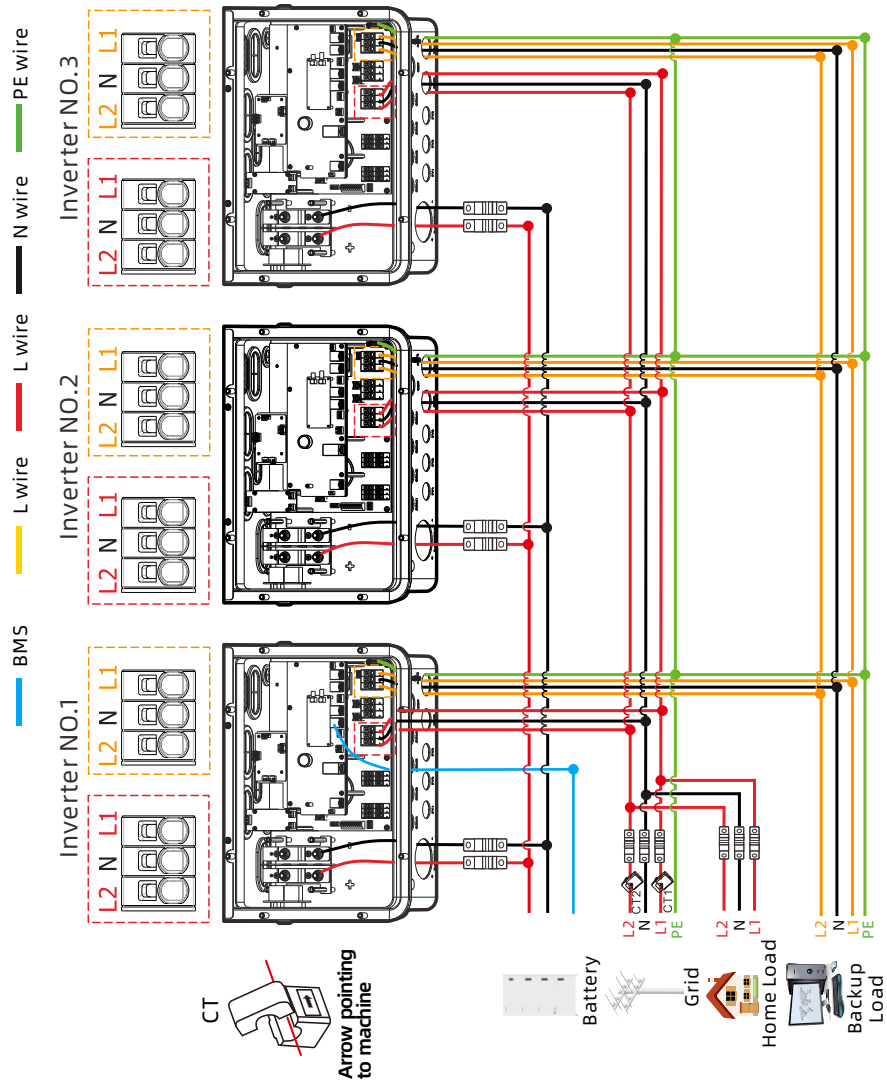
Inverter Model	SPH 10000TL-HU-US/(B)	SPH 8000TL-HU-US(B)
PV Breakers(①)	600V/30A	
Battery Breaker(②)	80V/250A	
Generator breaker(③)	240V/63A	240V/50A
Load Breaker(④)	240V/63A	240V/50A
AC Breaker(⑤)	240V/100A	
On-Grid Home Load Breaker(⑥)	240V/100A	

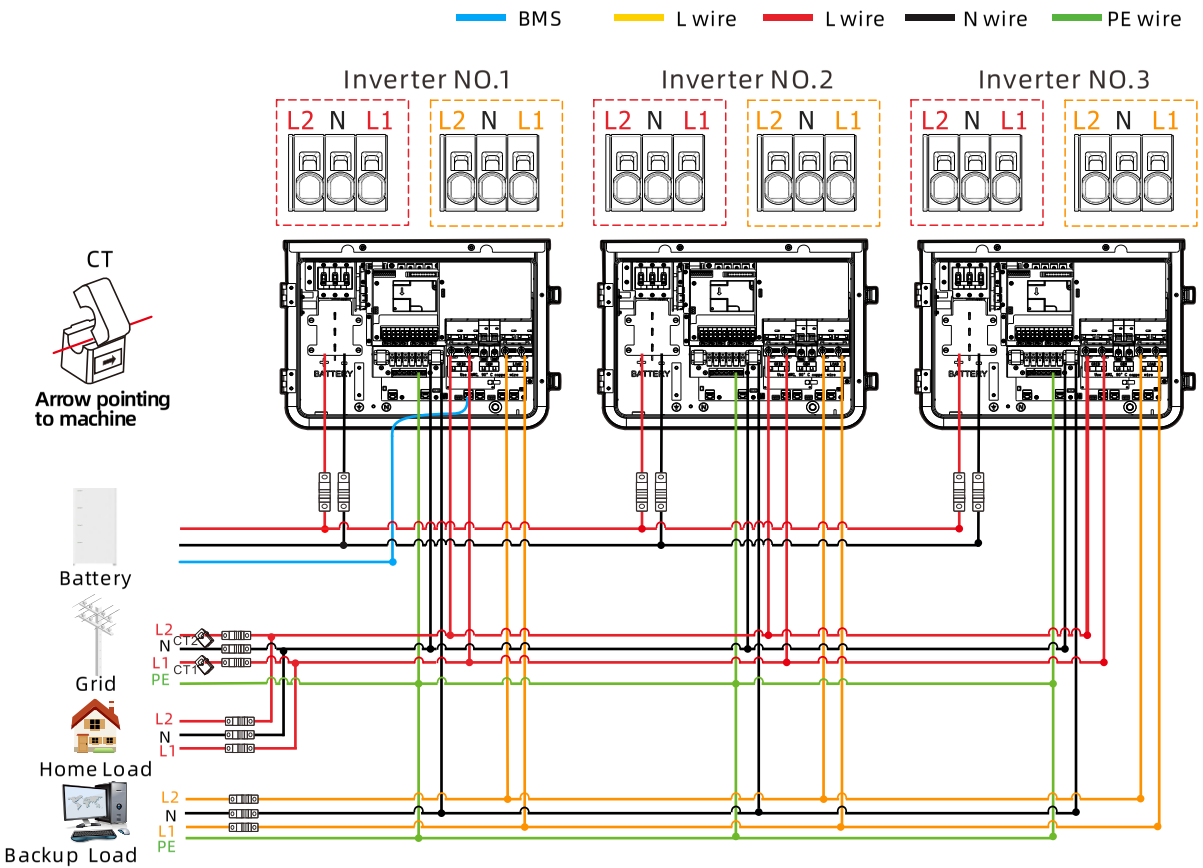
3.11 Split Phase(120/240Vac) Parallel Connection

For additional details on how to parallel multiple SPH/SPM systems, please refer to: Parallel Solutions technical white paper available at:
community.growatt.com/white-paper

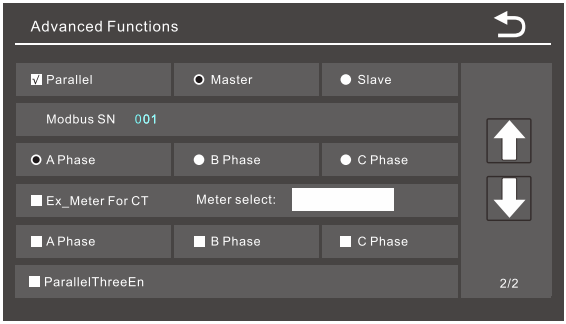
Three inverters in parallel:
Power Connection

SPH 10000 TL-HU-US

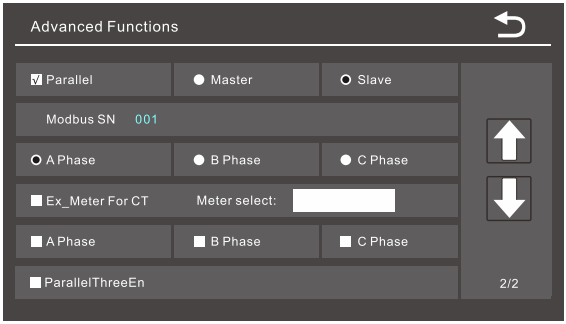



BMS
L wire
L wire
N wire
PE wire
Inverter NO.1
Inverter NO.2
Inverter NO.3
L2 N L1
CT
Arrow pointing to machine
Battery
Grid
Home Load
Backup Load
CT2
CT1
L2
N
L1
PE

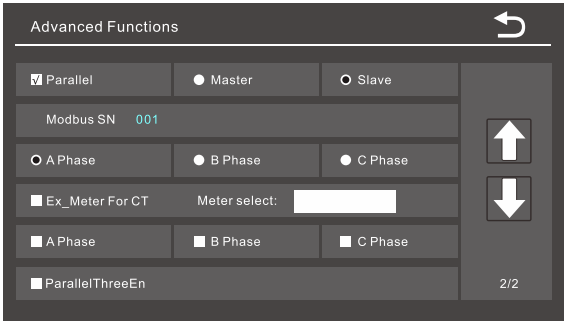
Inverter NO.1



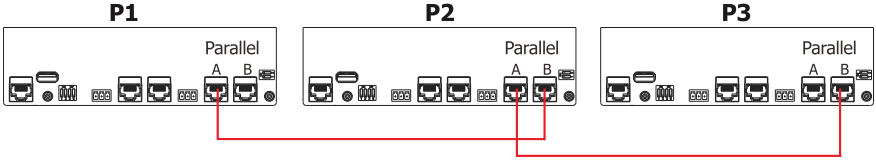
Inverter NO.2



Inverter NO.3



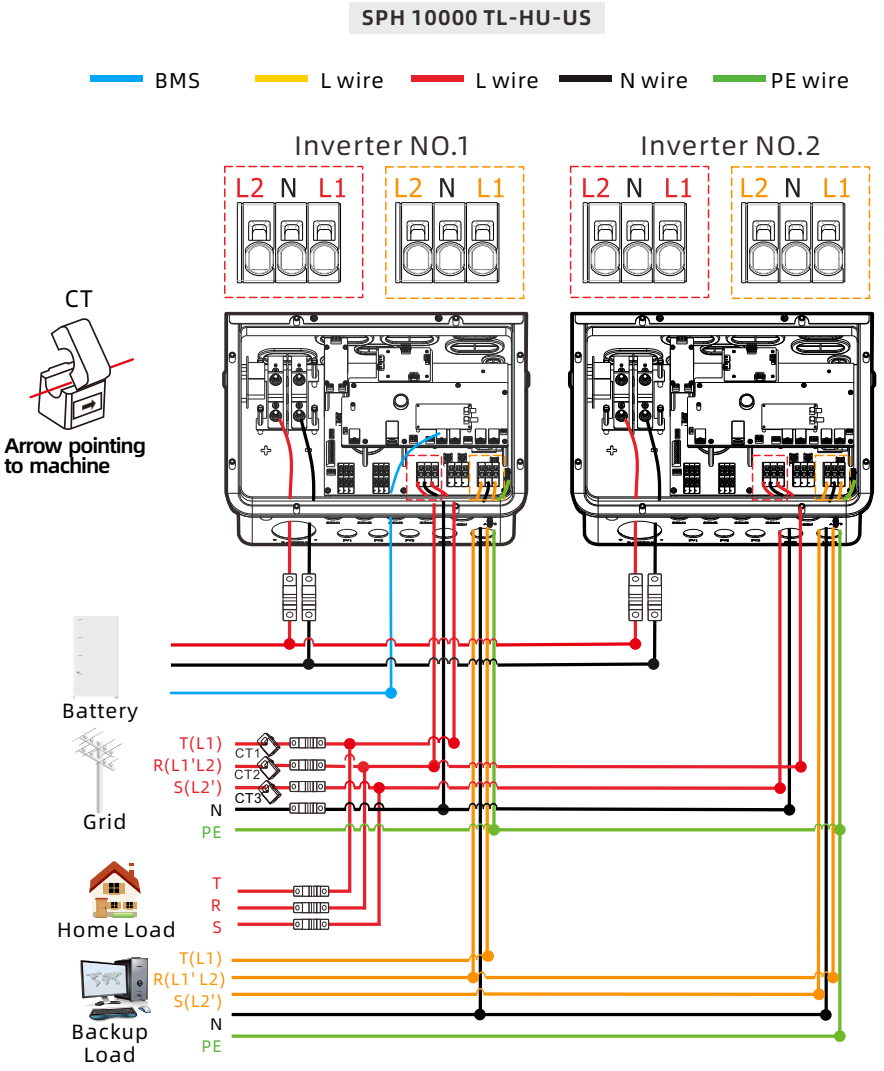
Communication Connection



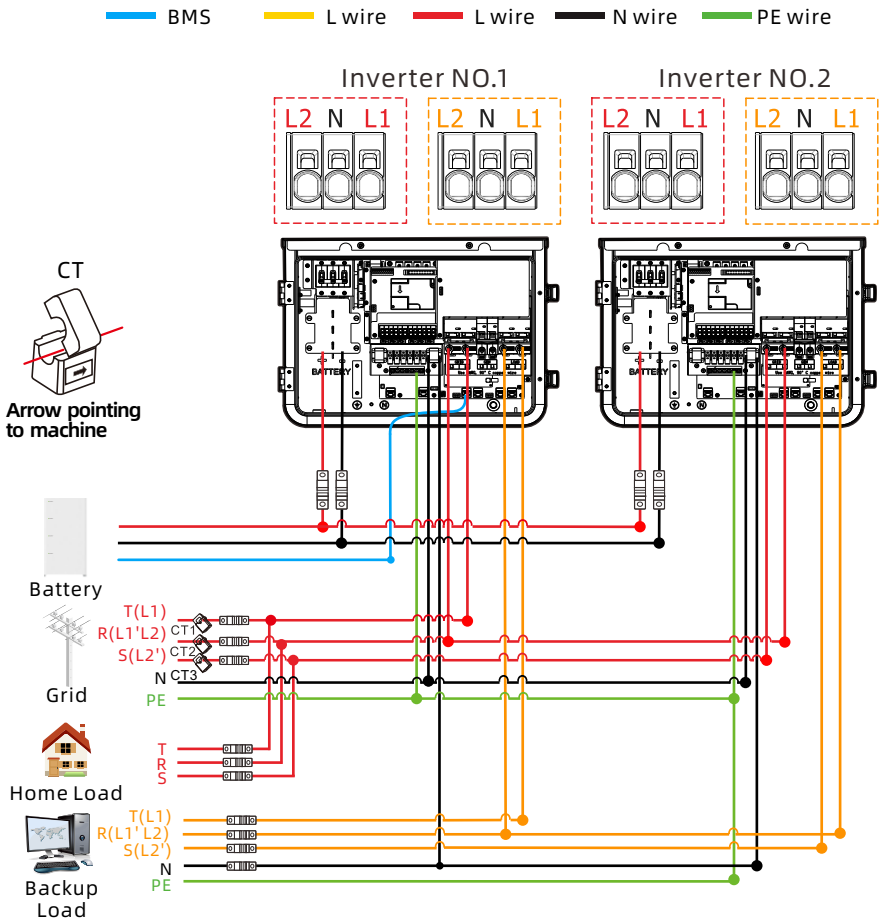
Modbus SN: This feature is currently not being used.
The status of the Dip Switch needs to be fully turned on.
CT1: Connect pins 3 and 4 of L1 (Inverter NO.1).
CT2: Connect pins 5 and 6 of L2 (Inverter NO.1).
Allow for 6 machines to be combined.

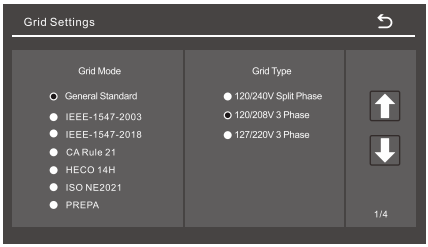
3.12 2Pcs Parallel Connection for 120/208 Three Phase（Unbalanced）

Two inverters in parallel:
Power Connection

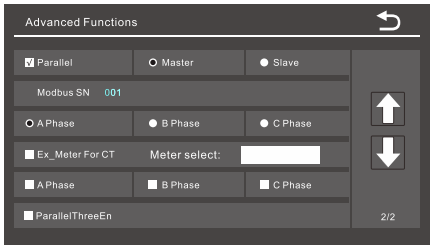


SPH 8K-10K TL-HU-US(B)

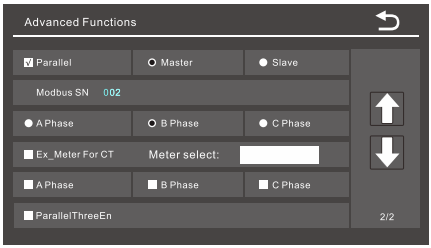




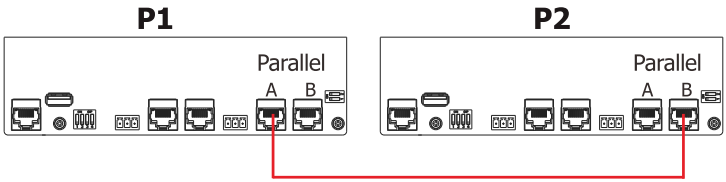
Inverter NO.1



Inverter NO.2



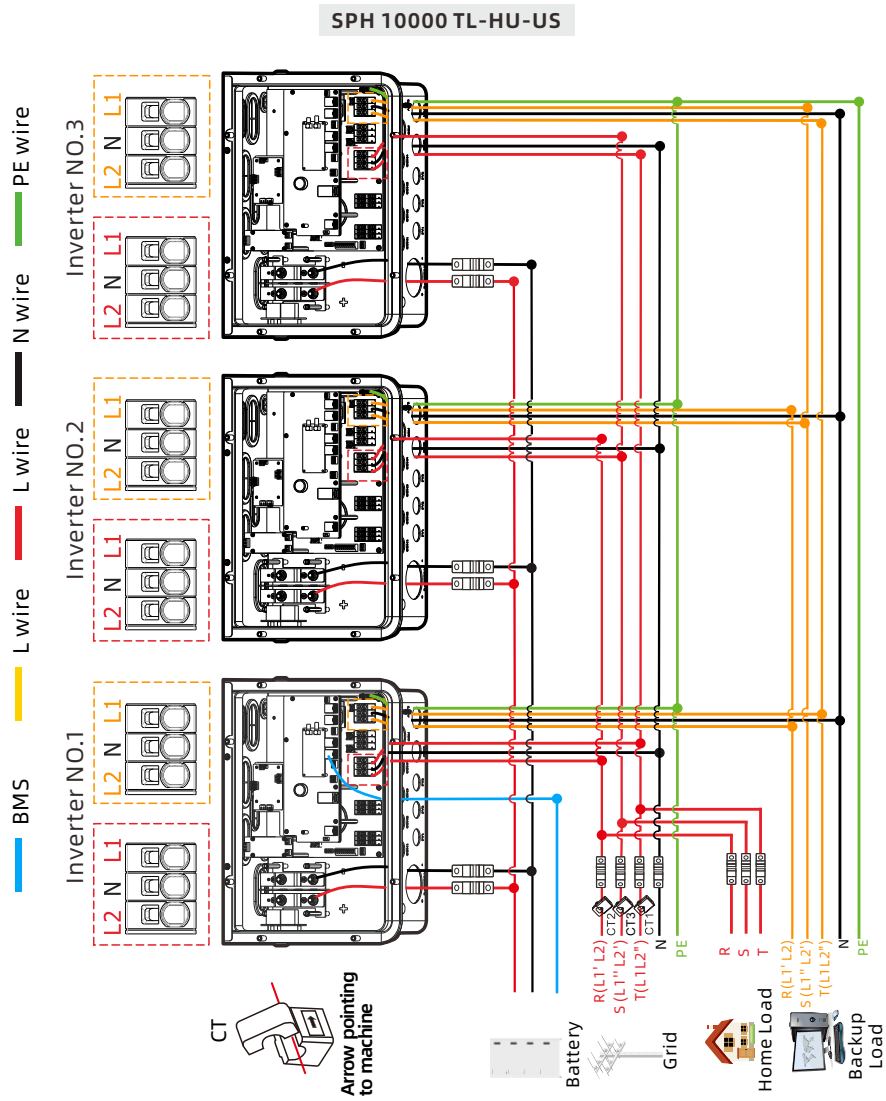
Communication Connection



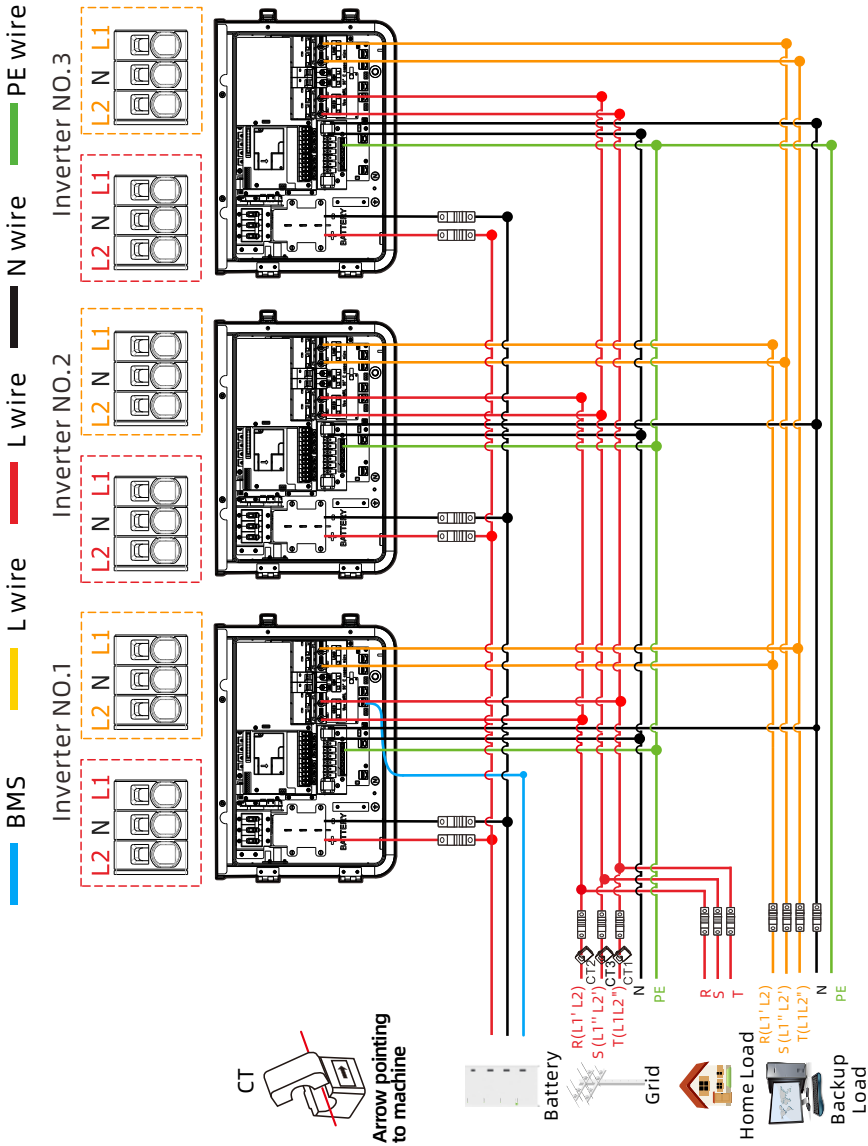
Modbus SN: This feature is currently not being used.
The status of the Dip Switch needs to be fully turned on.
CT1: Connect pins 3 and 4 of L1 (Inverter NO.1).
CT2: Connect pins 5 and 6 of L2 (Inverter NO.1).
CT3: Connect pins 3 and 4 of L2'(Inverter NO.2).
This situation can only be set to phase A and B.

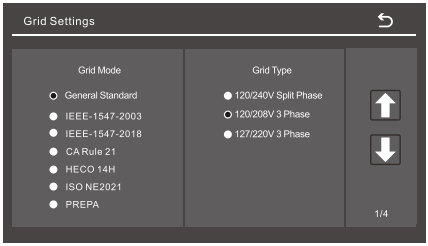
3.13 3Pcs Parallel Connection for 120/208 Three Phase

Three inverters in parallel:
Power Connection

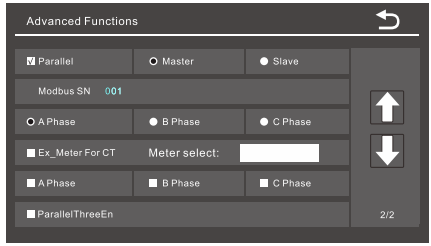


SPH 8K-10K TL-HU-US(B)

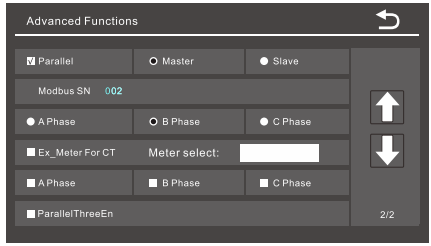




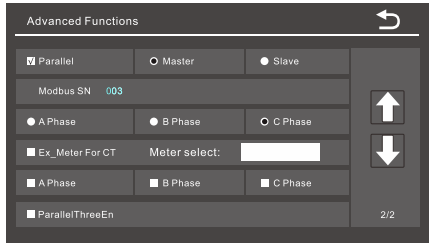
Inverter NO.1



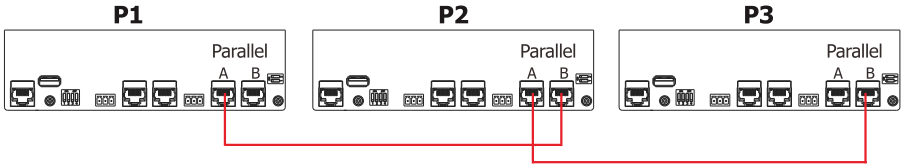
Inverter NO.2



Inverter NO.3



Communication Connection



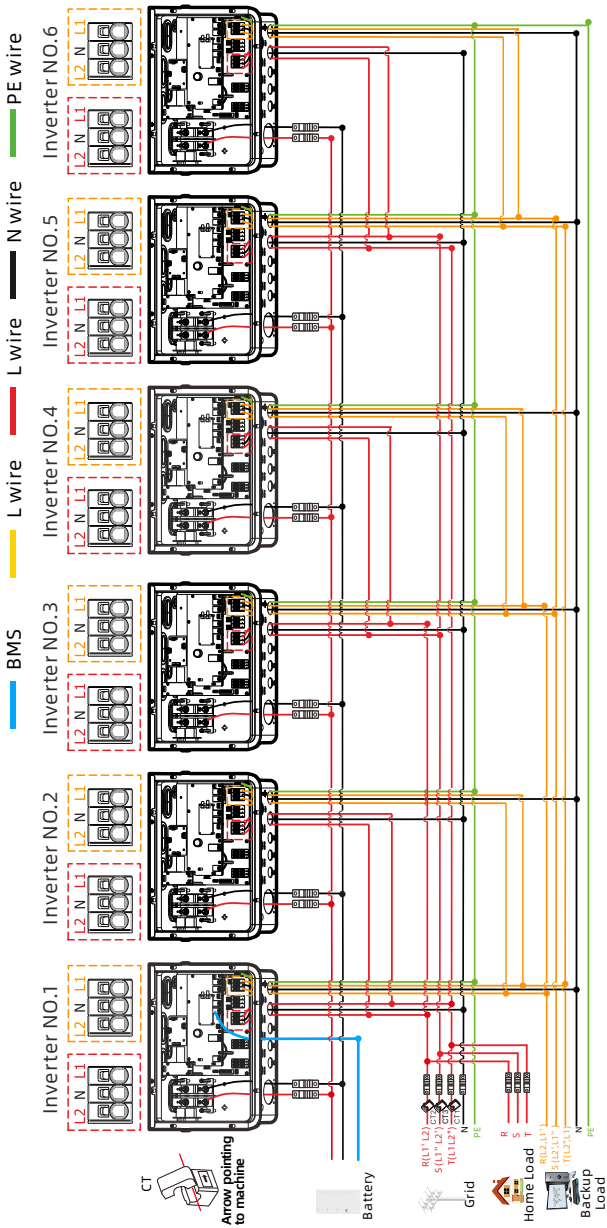
Modbus SN: This feature is currently not being used.
The status of the Dip switch needs to be fully turned on.
CT1: Connect pins 3 and 4 of L1 (Inverter NO.1)
CT2: Connect pins 5 and 6 of L2 (Inverter NO.1)
Ct3: Connect pins 3 and 4 of L1"(Inverter NO.3).

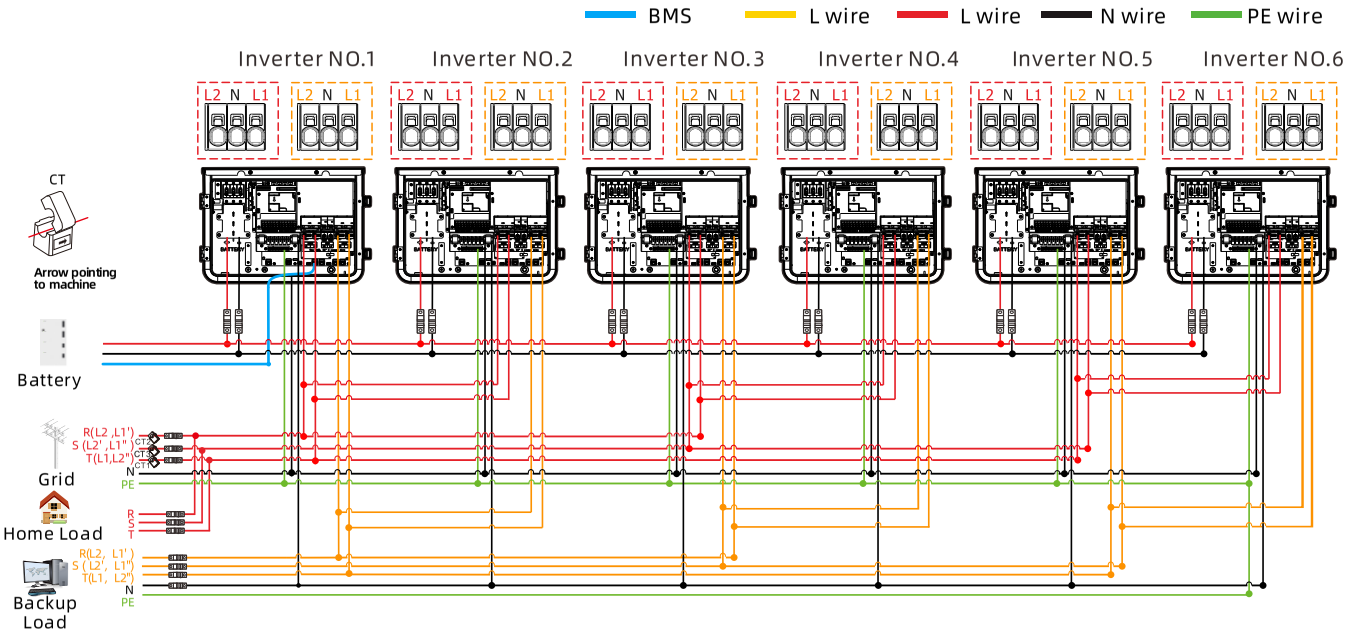
3.14 6Pcs Parallel Connection for 120/208 Three Phasse

Six inverters in parallel:

Power Connection

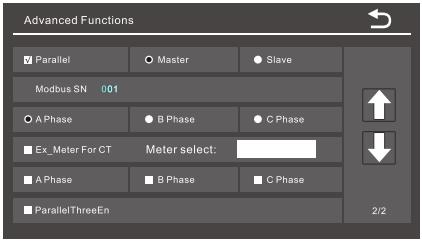
SPH 10000 TL-HU-US



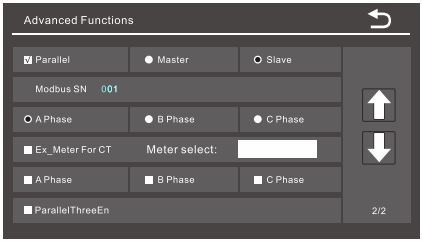


SPH 8K-10K TL-HU-US(B)

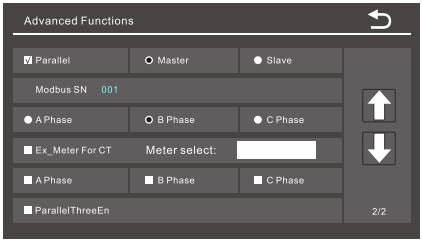
Inverter NO.1



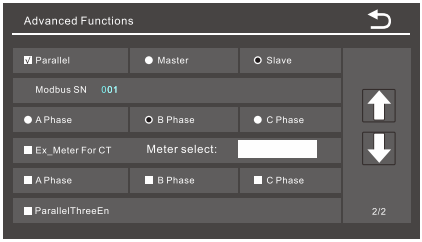
Inverter NO.2



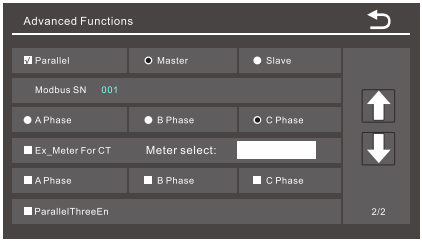
Inverter NO.3



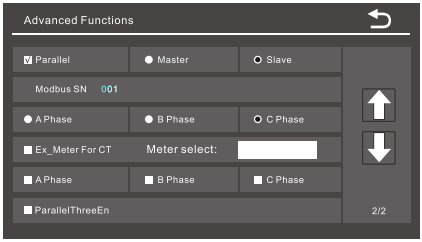
Inverter NO.4



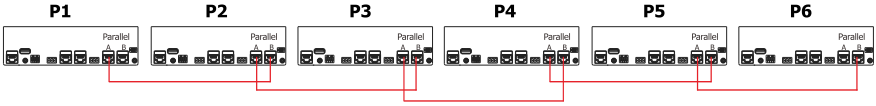
Inverter NO.5



Inverter NO.6



Communication Connection



Modbus SN: This feature is currently not being used.
The status of the Dip switch needs to be fully turned on.
CT1: Connect pins 3 and 4 of L1 (Inverter NO.1).
CT2: Connect pins 5 and 6 of L2 (Inverter NO.1).
CT3: Connect pins 3 and 4 of L1"(Inverter NO.5).

Operation 4

4.1 Power ON/OFF

Once the unit has been properly installed and the batteries are connected well, simply press On/Off button(located on the left side of the case) to turn on the unit. When one of the grid or PV is connected the screen will still light up even if the battery is not connected. In the off-grid state, if this button is not pressed, the inverter will not carry off-grid loads. If it is grid-connected, this button will not affect the power supply of the backup loads. If there is no battery, you can carry off-grid loads after selecting the No Battery Mode.

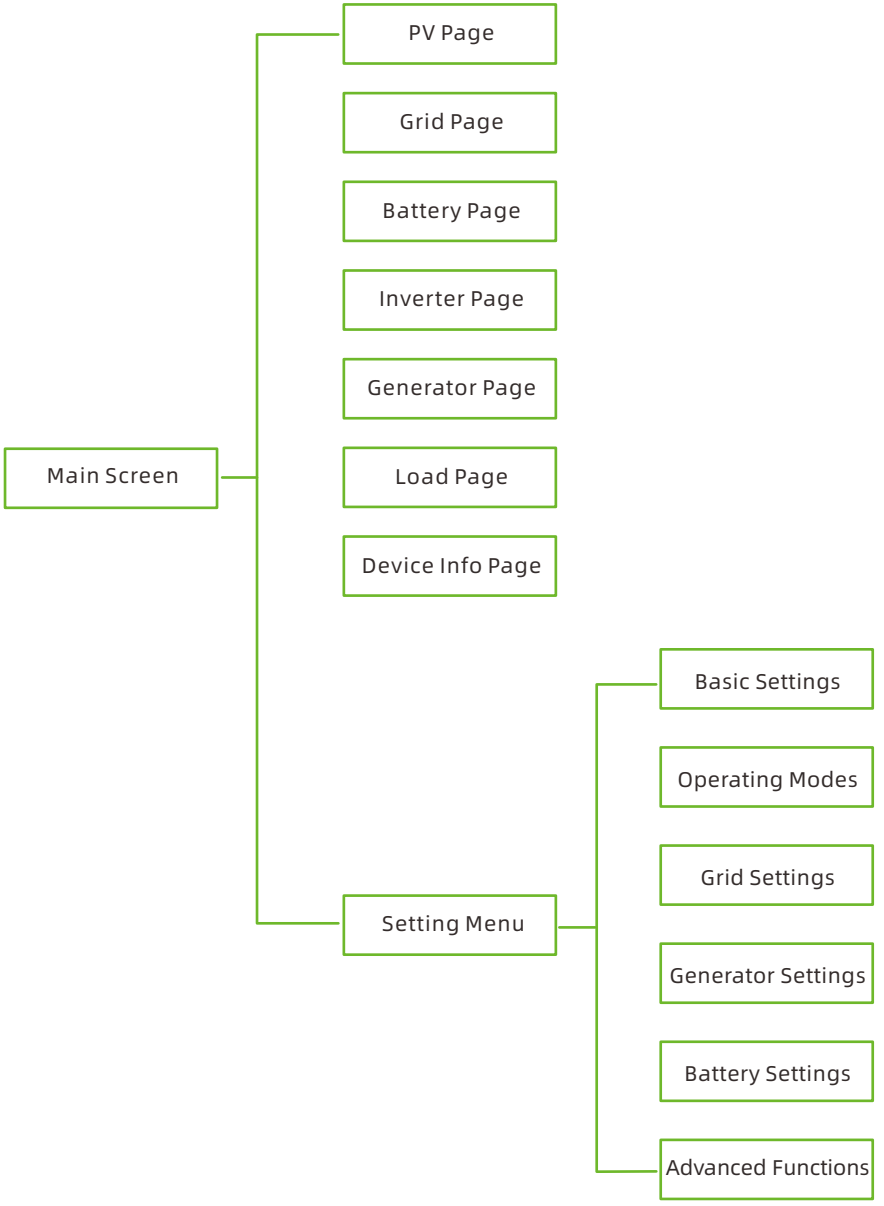
4.2 Operation and Display Panel

The operation and display panel, shown in below chart, is on the front panel of the inverter. It includes three indicators and a touch screen display, indicating the operating status and input/output power information.

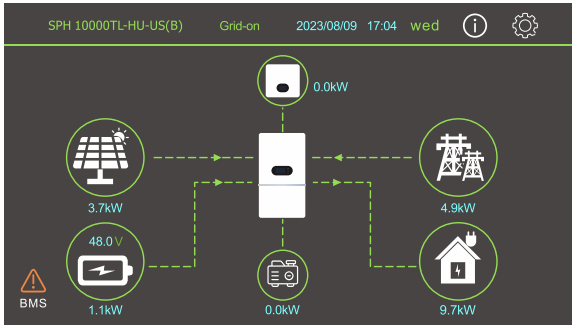
LED Indicator			Messages
AC/INV	GREEN	Light	Powered by AC
		Twinkle	Powered by DC
CHARGE	GREEN	Light	Full battery
		Twinkle	Charging
FAULT	RED	Light	Error
		Twinkle	Warning

5 Main Screen

5.1 Touchscreen Operation Flow Chart



5.2 Main Screen



Icon	Description
	PV
48.0V	Battery: Battery Power, Charge(negative), Discharge(positive)
	Inverter
	Generator
	Setting Menu
	Grid: Grid Power , Export(negative), Import(positive)
	Load
BMS	BMS communication error

1.The "Grid-on" in the above of the home screen indicates that the system is Normal operation. If "Fault: F17-64 or Alarm: W01-W96" appears in the upper left corner of the screen, a communication error or other error has occurred in the inverter. F17-F64 faults and W01-W96 alarms, detailed information can be found in the exclamation mark in the upper right corner of the main screen.

2.At the top of the screen is the time.

3.System Setup Icon, press this set button, you can enter into the system setup screen which including Basic Settings, Operating Modes, Grid Settings, Generator Settings, Battery Settings and Advanced Functions

4.The main screen showing the info including Solar, Grid, Load and Battery. Its also displaying the energy flow direction by arrow.

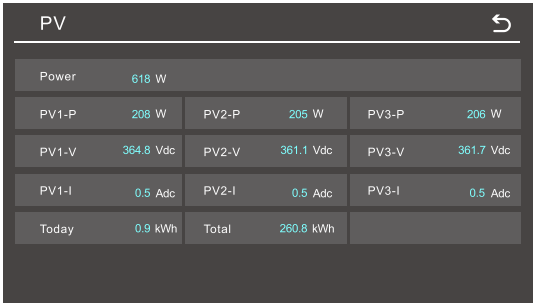
-PV power and Load power always keep positive.

-Grid power negative means sell to grid, positive means get from grid.

-Battery power negative means charge, positive means discharge.

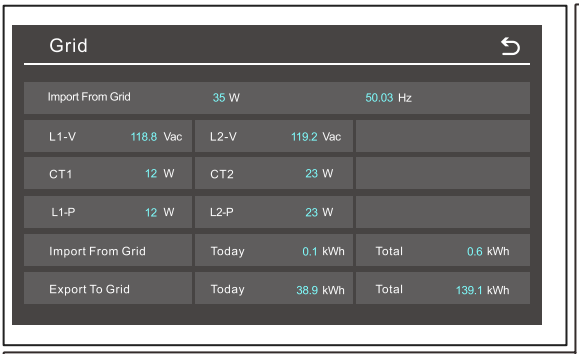
5. When there is an abnormal BMS communication, a BMS alarm icon will appear in the bottom left corner of the screen. After this alarm occurs, the lithium battery automatically switches to lead-acid battery, but cannot be charged.

PV Detail Page

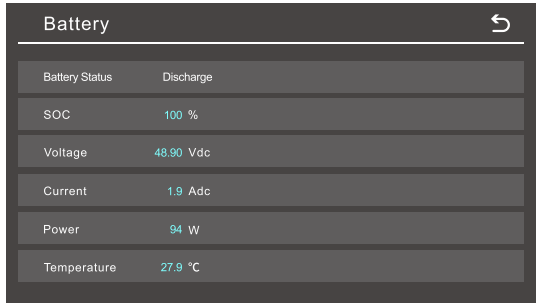


Solar Panel Generation.
Power, Voltage, Current for each MPPT.
Solar panel energy for Day and Total.

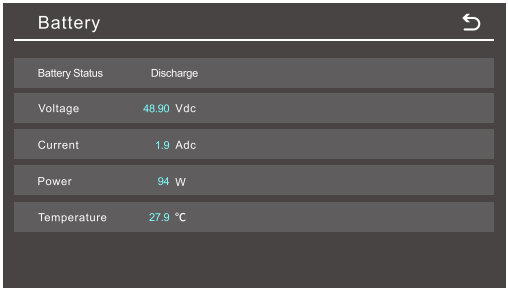
Grid Detail Page



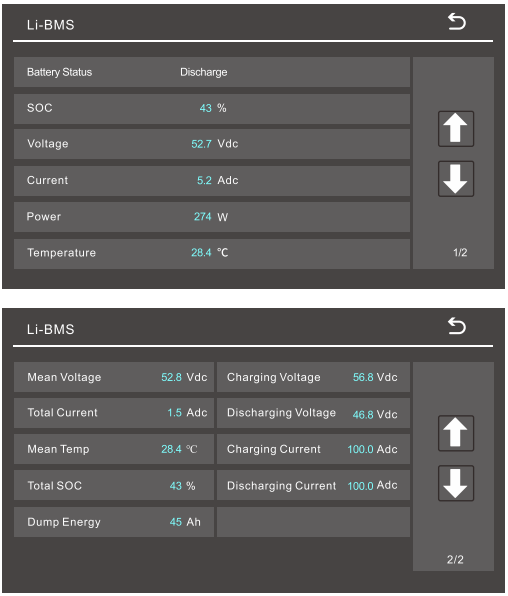
By clicking on the Grid icon, you can access the grid details screen. In this screen, you can see the current status of the grid(Stand-by, Import From Grid and Export To Grid), which includes power and frequency.
L1-V&L2-V: Grid voltage.
CT1&CT2: External current sensor grid power.
L-P: Internal current sensor grid power.
Import From Grid: Today and total grid output power.
Export To Grid: Grid power sold today and in total.



The image on the left shows the display screen when using % to measure the remaining power of the battery and make settings.

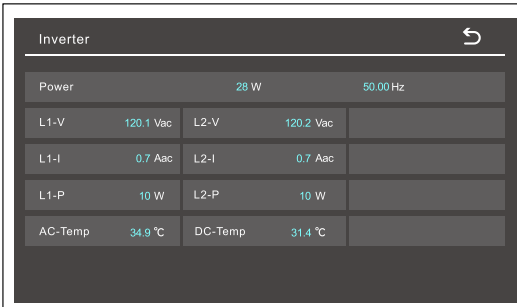


The image on the left shows the display screen when using voltage to measure the remaining power of the battery and make settings.



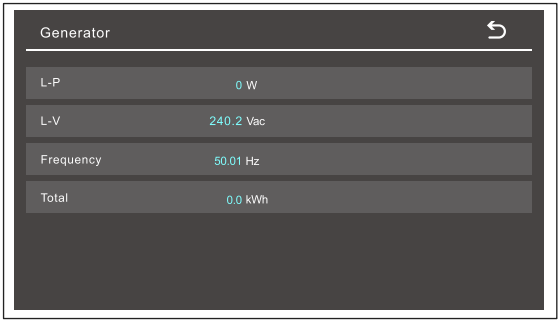
If you use Lithium Battery, you can enter 1-2 page.

Inverter Detail Page



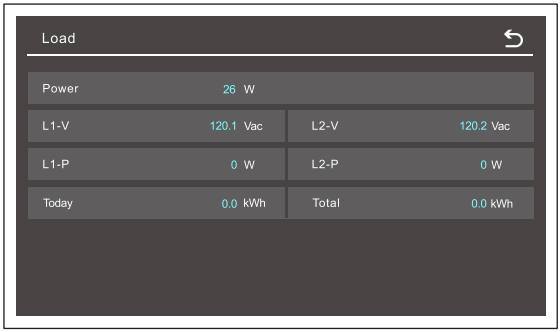
Inverter Generation Power and Frequency. Voltage, Current, Power fo reach phase.
AC-Tem: Temperature of Heat-sink.
DC-Temp: Temperature of DC-DCmodule.

Generator Detail Page



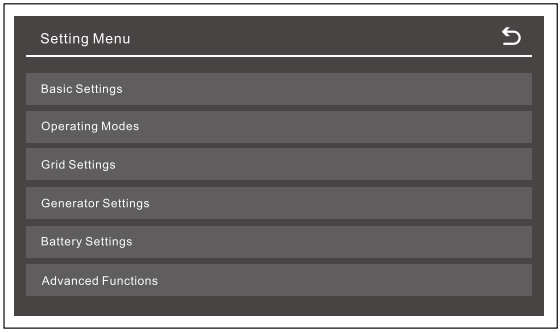
Generator Power, Voltage and Frequency.
Generator exportation for Total.

Load Detail Page



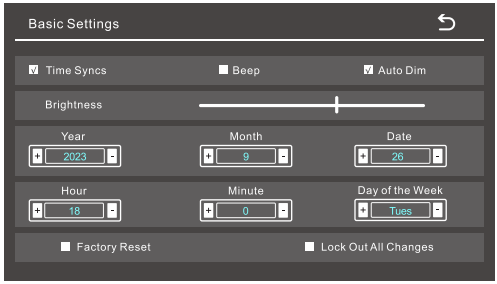
In this screen, you can see the voltage, power, daily consumption and total consumption of the load.

5.3 Setting Menu



This is Setting menu detail page.

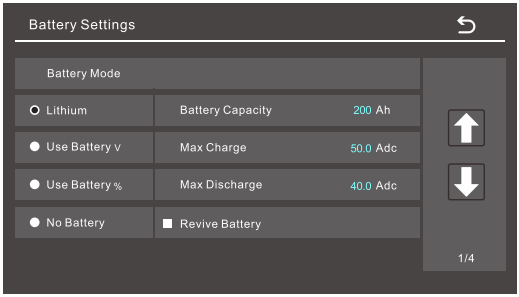
5.4 Basic Settings



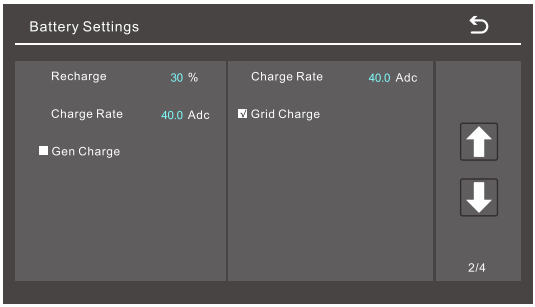


Factory Reset: Reset all parameters of the Inverter.
Lock Out All Changes: Enable this function, the setting will be fixed and can not be changed until this item is disabled.
The password for factory reset and lockout all changes are both 9999

5.5 Battery Settings

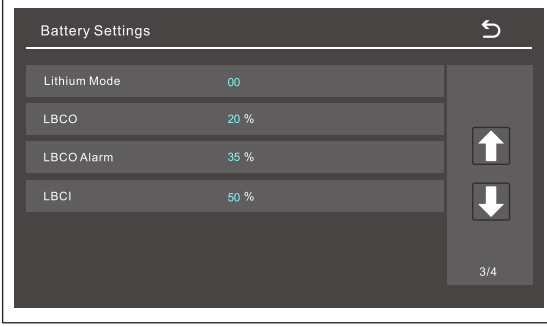


Lithium: Choose Lithium for Battery Mode if lithium battery is used.
Battery Capacity: Enter the size of the battery bank connected to the system.
Use Battery V: When using lead-acidbattery, choose Use Battery V if you want to use voltage as the unit of actual battery capacity and do the setup.
Use Battery %: When using lead-acidbattery, choose Use Battery %, if you want to use percentage as the unit of actual battery capacity and do the setup
Max Charge/Discharge: Set the max charge/discharge rate for the batteries.
No Battery: Tick this item if no battery is connected to the system.
Revive Battery: If lithium battery is used but the inverter and the battery are incompatible in communication, please enable the Revive Battery function to wake up the battery. If the lithium battery is compatible with the inverter in communication, then the inverter is able to wake the lithium battery when PV or grid is connected whether the Revive Battery function is enabled or not.

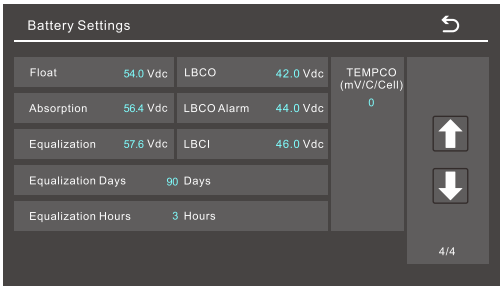


Recharge (Left): When Automatic Start for generator is enabled and the actual battery capacity is lower than the recharge value, the generator will automatically start and charge the battery.
Charge Rate=40 Adc(left): The maximum generator charging current is 40A.

Gen Charge: Enable this to allow generator to charge the battery.
Charge Rate = 40 Adc (right):The maximum grid charging current is 40A.
Grid Charge: Enable this to allow grid to charge the battery.



Lithium Mode: The communication protocol used between the inverter and lithium battery. Please set this according to the Appendix I at the end of user manual.
LBCO: Low Battery Cut Off. The default value is 20%.The minimum value that can be set is 5%.The set value must match LBCO< LBCO alarm< LBCI, otherwise the setting will not be successful. The inverter will shut off its AC output if the actual battery capacity is lower than this value. The backup load can still be powered by the grid.
LBCO Alarm: Low Battery Cut Off Alarm, the inverter will send alarm if the actual battery value reaches this value. The default value is 35%. The minimum value can be set is 10%. The set value must match LBCO< LBCO alarm<LBCI, otherwise the setting will not be successful.
LBCI: Low Battery Cut In. The inverter AC output will resume if actual battery capacity reaches this value. The default value is 50%. The minimum value can be set is 29%. The set value must match LBCO<LBCO alarm<LBCI, otherwise the setting will not be successful.

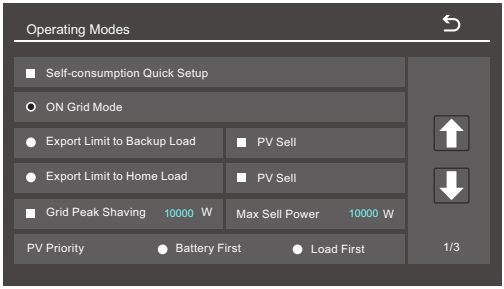


Float, Absorption, Equalization are three stages of charging the battery.
LBCO 42Vdc: The inverter will shutdown if the voltage below this value.
LBCO Alarm 44Vdc: The inverter will alarm if the voltage below this value.
LBCI 46Vdc: After the battery low voltage alarm, the alarm information above 46V is cleared.
This is for professional installers, you can keep it if you do not know Recommended battery settings:

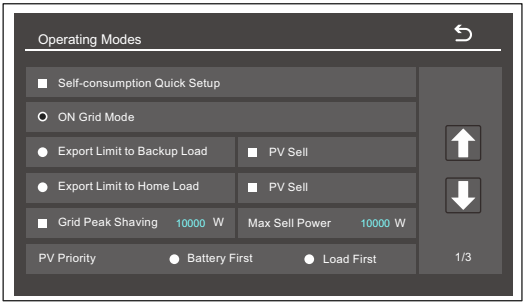
Battery Type	Absorption	Float	Equalization
AGM(or PCC)	14.4V(57.6V)	13.5V(53.6V)	14.4(57.6V)
Gel	14.1V(56.4V)	13.5V(54.0V)	
Wet	14.7V(59.0V)	13.7V(55.0V)	14.7(59.0V)
Lithium	Follow its BMS voltage parameters		

5.6 Operating Modes

Please reference technical white paper SPH ESS operating modes for more details on how to set operating modes https://community.growatt.com/white-paper?page=3



Self-consumption Quick Setup: after the setting, the mode is automatically set to Export Limit to Home Load mode→ Enable PV Sell →PV Priority (Load First)→ enable Time of Use Time period (24 hours a day)→Check all the week selection parts of the TOU function→ battery discharge power (equal to the rated power of the inverter)→ SOC21%→Grid Charge to make sure maximize solar power self-consumption, the battery will discharge to power the load before importing the grid power if PV power is insufficient.



On Grid Mode: The inverter will sell any excess power produced by the solar panels back to the grid. If you enables the"time of use" function, the battery energy can also be sold into grid. The PV energy will be used to power the load and charge the battery and then excess energy will flow to grid.

The backup loads and on-grid loads have different priorities. If load first is enabled, the PV will power the backup load first, then charge the battery. If there is excess power being exported to the grid, the on-grid home loads will be powered during this process. Power source priority for the load is as follows:

1.Solar Panels.

2.Grid.

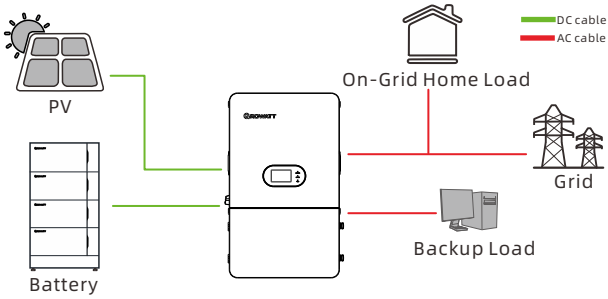
3.Battery.

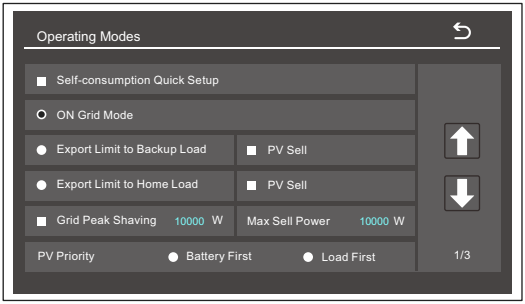
General description:

a. The inverter will measure all power from the "GRID" terminal as sell power

b. External CT/Meter is not required for this mode. Even if the CT/Meter is connected, the inverter will not use its data.

c. Enable "ON Grid Mode" function - and set the "Max Sell Power"(KW)





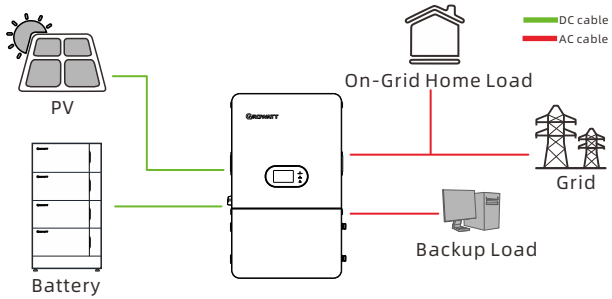
Export Limit to Backup Load: Hybrid inverter will only provide power to the backup load connected. The hybrid inverter will neither provide power to the home load nor sell power to grid. The built-in meter will detect power flowing back to the grid and will reduce the power of the inverter only to supply the local load and charge the battery. Enable "PV Sell",it can sell electricity to the power grid.

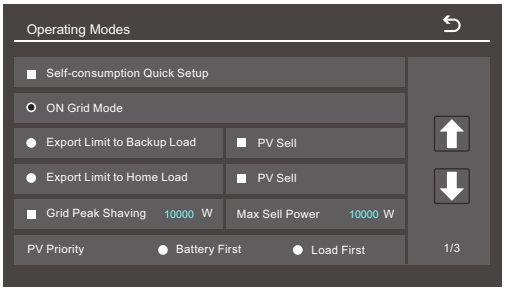
General description not select "PV Sell":

a. The inverter will only cover the loads connected to the "Backup LOAD" terminal.

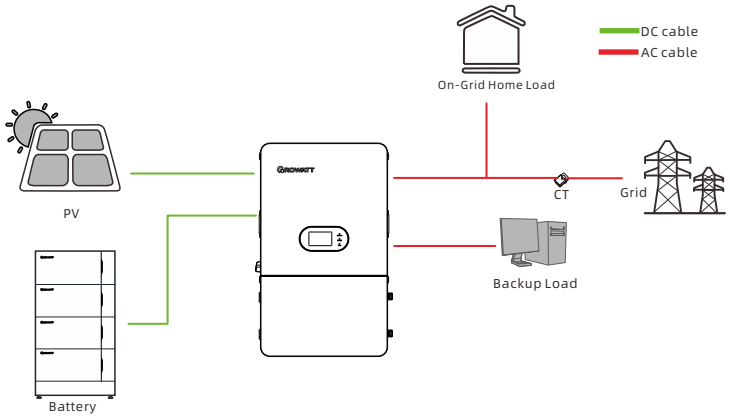
b. This work mode will not provide power to the "GRID" terminal.

C. This system work mode is recommended for off-grid applications.



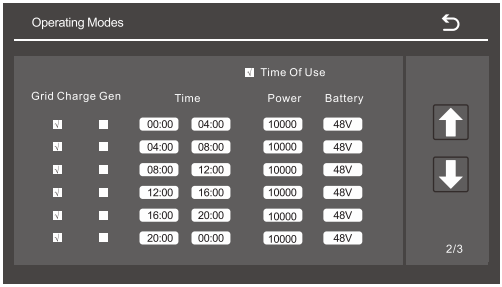


Export Limit to Home Load: Hybrid inverter will not only provide power to the backup load connected but also provide to the home load connected. The backup loads and on-grid home loads shares the same priority. If PV power is insufficient, it will take grid energy as supplement unless TOU or grid peak shaving is set. The hybrid inverter will not sell power to grid. In this mode, a meter/CT is needed. The installation method of the meter please refer to chapter3.6 Meter or CT connection, The external meter will detect power fowing back to the arid and will reduce the power of the inverter only to supply the local load, charge battery and home load.
Enable "PV Sell" it can sell electricity to the power grid. General description "PV sell" disabled:
a. Power is delivered to the whole home without selling the excess solar back to the grid.
b. External CT sensor required for this system work mode. (How to install CT and set CT, please refer to 3.6 and 5.9)
c. Enable "Grid Peak-Shaving" and set "Peak-shaving power(KW)"which is used to set the maximum power that the inverter will draw from its grid power.

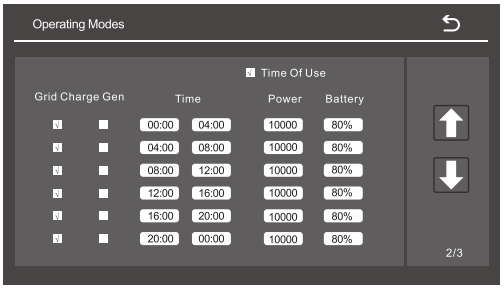


PV Sell: "PV sell" is for Export limit to backup load mode or Export limit to home load mode: When this item is selected, the surplus energy can be sold back to grid. PV Power source priority usage is as follows: load consumption and charge battery and feed into grid.
Max Sell Power: Allowed the maximum output power to flow to grid.

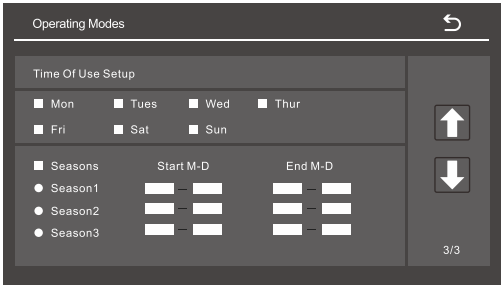
PV Priority: PV Power source priority.
Battery First: PV power is firstly used to charge the battery and then used to power the load. If PV power is insufficient, grid will make supplement for battery and load simultaneously.
Load First: PV power is firstly used to power the load and then used to charge the battery. If PV power is insufficient, grid will make supplement for battery and load simultaneously.
Grid Peak Shaving: when it is selected, grid output power will be limited within the set value. If the load power exceeds the allowed value, it will take PV energy and battery as supplement, If still can't meet the load requirement, grid power will increase to meet the load needs. Under this working condition, only "Load First" can be selected.(This function can only take effect in Export limit to home load mode):The minimum setting value is 1000W.



Time Of Use: It is used to program when to use grid or generator to charge the battery, and when to discharge the battery to power the load. Only tick "Time Of Use"then the follow items (Grid Charge, Gen Time, Power, Battery) will take effect. Using this mode, the inverter is allowed to discharge the battery to the grid or charge it to the battery within a specific time frame.
General description:
a. During the setting hours the system will discharge the batteries to deliver power charge the batteries from the external AC power. All time intervals are automatically enabled.
b. Enable "Time of Use" function and set the Forced discharge time to discharge the batteries to deliver power.
Note: when in ON Grid Mode and click time of use, the battery power can be sold into grid
Grid Charge: Utilize grid to charge the battery in a time period.
Gen: Utilize diesel generator to charge the battery in a time period.
Time: The time displayed on the inverter, range of 00:00-23:59.
Power: Max discharge power of battery allowed.
Battery(V or SOC %): Battery SOC % or voltage at when the action is to happen. The setting range is 41 to 54V or 21% to 100%. This setting needs to be greater than the LBCO alarm into the battery settings.
Gen: The generator does not currently support Time Of Use.

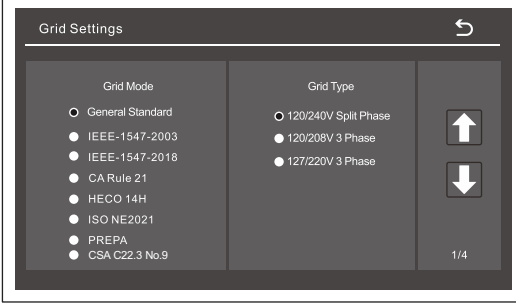


For example: During 09:00-18:00, when battery SOC is lower than 80% it will use grid to charge the battery until battery SOC reaches 80%.During 18:00-09:00,when battery SOC is higher than 80%,hybrid inverter will discharge the battery until the SOC reaches 80%.
Battery: The setting range is 21% to 100%.

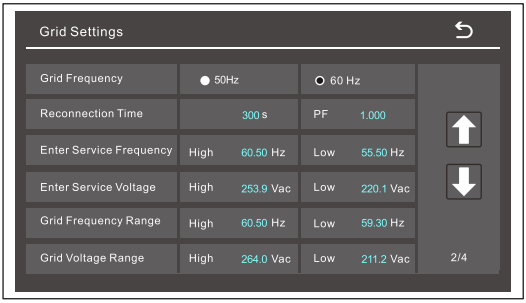


Week setting: The TOU function will only take effect after selecting the week.
Seasons: Enable Button(After selecting this option, Season 1,2,3 will only take effect.
Season1,2,3: Automatically select based on the current time period.
Start M-D: Time on.
End M-D: End Time.

5.7 Grid Settings

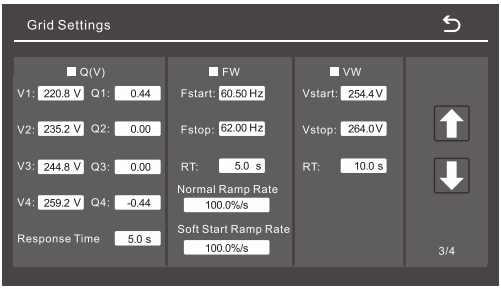


Grid Mode: Please follow the local grid code and then choose the corresponding grid standard.
Grid Type: Set the Grid Type.



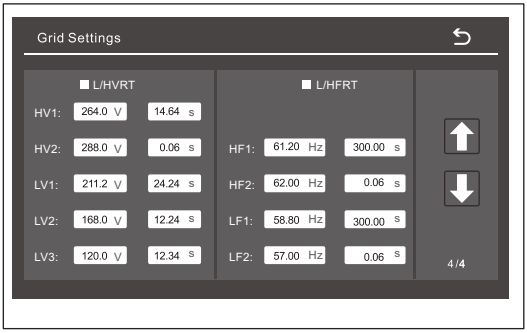
Grid Frequency: Set the grid frequency.
Reconnection time: The waiting time period for the inverter to connect the grid again.
PF: This is used to adjust the inverter's reactive power.

Enter Service Frequency/Voltage: Grid-connected voltage frequency range.
Grid Freqency/ Voltage Range: Grid voltage frequency protection range.



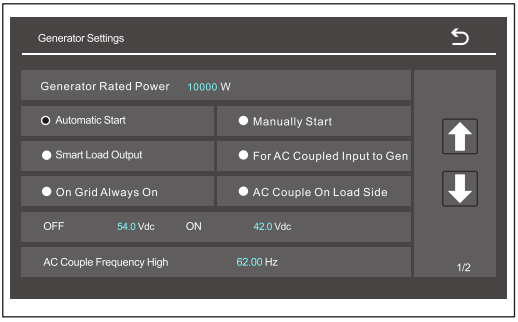
Q(V): It adjusts the inverter reactive power according to the set grid voltage. This function adjusts inverter output (active and reactive) power when grid voltage changes.
FW: This series inverter is able to adjust inverter output power according to grid frequency.

VW: It adjusts the inverter active power according to the set grrid voltage.



HV1: Level 1 overvoltage protection point.
HV2: Level 2 overvoltage protection point.
HV3: Untapped.
LV1: Level 1 undervoltage protection point.
LV2: Level 2 undervoltage protection point.
LV3: Untapped.
HF1: Level 1 over frequency protection point.
HF2: Level 2 over frequency protection point.
HF3: Untapped.
LF1: Level 1 under frequency protection point.
LF2: Level 2 under frequency protection point.
LF3: Untapped.
14.64s: Trip time.

5.8 Generator Settings



Generator Rated Power: Allowed Max. power from diesel generator.

Automatic Start : In this mode, the inverter will automatically turn on the generator when the Recharge value is lower than the Battery Settings-Page 2.When the grid is present or the Maximum Run Time set on the Generator Setting-Page 2 is reached, the generator will be turned off. When using this function, make sure that the generator has an automatic start (ATS) function.

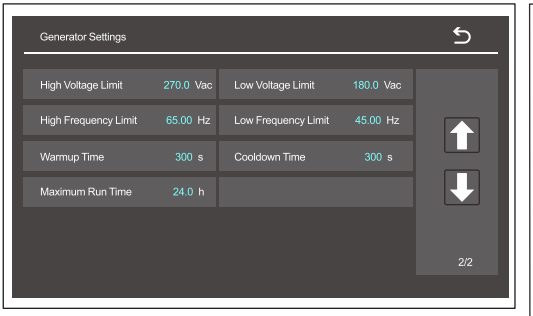
Manually Start : When this function is checked, the generator will be forced to start.When using this function, make sure that the generator has the automatic start (ATS) function.

Smart Load: Allows load to be connected to this port as Smart Load. The inverter will shut off the power supply of the smart load when the battery SOC/voltage drops to the OFF value, and the power supply will resume when the battery SOC/voltage reaches the ON value. If On Grid Always ON is enabled, the inverter will always provide power to the smart load if the grid is connected.

For AC Coupled Input to Gen: Allows other PV inverter to be connected to the generator port. In this mode, the OFF value represents the voltage/SOC when the AC Couple function is turned off, and the ON value represents the voltage/SOC when the AC Couple function is turned on

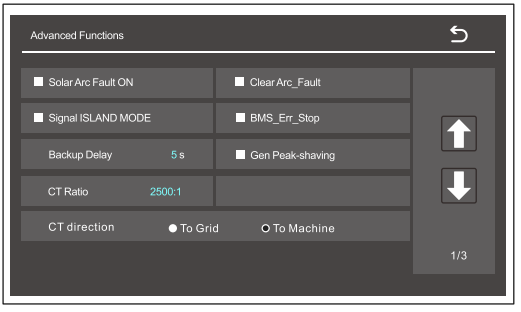
AC Couple Frequency high: represents the highest frequency that the inverter can increase when the AC Couple function is turned on. It is recommended to be the same as the first-order grid-off frequency specified in the current grid regulations.

AC Couple on Load Side: Reserved.



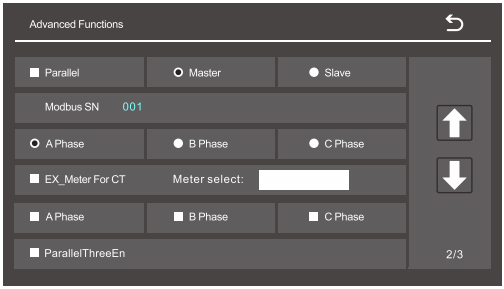
High/Low Voltage Limit: Generator-connected voltage range.
High/Low Frequency Limit: Generator-connected frequency range.
Warmup Time: After startup, the amount of time the generator runs(no-load) before the inverter is connected to the generator.
Cooldown Time: The amount of time the generator runs (no load after the shutdown command is issued before the generator is actually shut down.
Maximum Run Time: When automatically started, the cumulative time allowed for continuous operation of the generator within 24 hours. The generator can be operated manually for any length of time

5.9 Advanced Functions

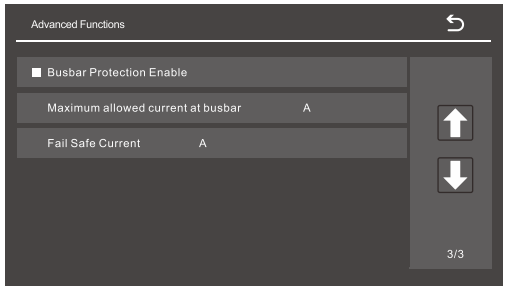


The password for entering this pages is 7777.
Solar Arc Fault ON: This is AFCI function.
BMS_Err_Stop: When the Battery Mode is Lithium
a) enable this function, the inverter will disconnect its output and send BMS error if the battery communication is abnormal. The output will be resumed after the communication is restored
b) disable this function, the Battery Mode will be changed to Use Batt V if the battery communication is abnormal, and the battery can only be discharged, not be charged.
Signal ISLAND MODE: when the inverter connects grid, the ATS port will output 240Vac and it is used to cuts off Earth-Neutral(load port N line) bond via connect external relay. When the inverter disconnects from the grid, ATS port voltage will be 0 and the Earth-Neutral bond keeps on, More details, please refer to above picture.
Clear Arc Fault: Clear AFCI error messages.
Backup Delay: Reserved.
Gen Peak-shaving: Reserved.
CT Ratio: The inverter support 6 ratios of CT clamp-1500: 1, 2000:1, 2500:1, 3000:1, 4000:1 and 7500:1, The CT Ratio of the CTs in the accessory bag in US

alone is 4000:1.The CT ratio used in parallel connection is set according to the actual CT used. For example, if 100A/50mA is marked on the CT, it means the CT ratio is 2000:1.
CT direction: Section of CT direction



Parallel: This is the inverter's parallel function interface setting.
Ex_Meter For CT: This is the CT setting for the inverter, please leave it unchecked.
ParallelThreeEn: This model enables the three-phase function of the group by setting specific grid regulations. This setting is useless
Modbus SN: To be developed.
Meter Select: Selection of electric meter.



Maximum allowed current at busbar: Maximum value of busbar protection current.
Fail Safe Current: Can set the fault safety current value.

5.10 Device Info.



Inverter ID: This is the ID of the inverter.
HMI/M1/M2 Ver: This is the software version number of the inverter.
LCD Ver: LCD Version.
Clear Record: Clear error alarm messages.

Error Information and Processing 6

Error codes are divided into Warning codes and fault codes.
Warning codes identify the current statues of the inverter(Max),it codes not affect the normal running of the inverter When a numeric warning appears on the Main Screen , it can usually be cleared through orderly shutdown/re-set or self-corrective action performed by the inverter. Fault codes identify the possible equipment failure. incorrect setting or configuration of the inverter, all attempts to clear the fault code must be performed by qualified personnel.
Typically, error codes can be cleared. Some of error code as table shows below.

Auditing routine	Error Code	Description	Solutions
About PV	W83	PV Volt Over Warning	1.Check whether the PV voltage is greater than 525V. 2.If alarm message still exists, contact manufacturer.
	W89	PV Over Load	1.Check whether the single-channel PV power exceeds 11 KW. 2.If alarm message still exists, contact manufacturer.
	F33	PV Current Over	1.Check the connection between the PV module and the battery module. 2.Reduce the number of load connections in off-grid mode. 3.If the fault persists, contact the manufacturer.
	F39	Self Check Fault	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F40	PV Voltage Over	1. Check whether the actual PV voltage is consistent with the Main Screen. 2.Check whether the PV string voltage (Voc) is higher than the maximum input voltage of the inverter. If yes, adjust the number of PV modules in series to reduce the PV series voltage. 3.If the fault persists, contact the manufacturer.
About Grid、Generator	W68	Grid Relay Warning	1.Restart the inverter. 2.If alarm message still exists, contact manufacturer.
	W71	Gen Overload warning	1.Check whether the generator power exceeds 10 kW. 2.If alarm message still exists, contact manufacturer.
	F26	Grid Type Fault	1.Restart the inverter. 2.If the fault persists,contact the manufacturer.

Auditing routine	Error Code	Description	Solutions
About inverter	W01	Fan lock warning	1. Check fan wiring after shutdown. 2.If alarm message still exists, contact manufacturer.
	W03	LCD Connect warning	1.Check LCD wiring after shutdown. 2.If alarm message still exists, contact manufacturer.
	W04	USB Connect warning	1.Check USB wiring after shutdown. 2.If alarm message still exists, contact manufacturer.
	W10	RSD Stop Press Alarm	1. Check if the emergency stop button is pressed. 2.If alarm message still exists, contact manufacturer
	W12	MDSP update alarm	1.Check if the machine is in the process of upgrading. 2.If alarm message still exists, contact manufacturer.
	W13	SDSP update alarm	
	W67	Inverter Relay Warning	1.Restart the inverter. 2.If alarm message still exists, contact manufacturer
	W70	GFCI Warning	1.Restart the inverter. 2.If alarm message still exists, contact manufacturer.
	W73	MDSP-METER Connect warning	1.Check meter wiring after shutdown 2.If alarm message still exists, contact manufacturer.
	W88	AFCI Curr Over Warning	1.Shut down and check for poor contact or tearing of PV component wires. 2.If the fault persists,contact the manufacturer.
	W90	Insulation Low	1.After shutdown,check if the panel shell is reliably grounded 2.If alarm message still exists, contact manufacturer
	W91	AFCI Communicati on fail	1.After shutdown, check if the AFCI line inside the machine has fallen off 2.If the fault still exists,please contact us for help.
	W92	AFCI selftest fail	1.Restart inverter. 2.If the fault persists, contact the manufacturer.

Auditing routine	Error Code	Description	Solutions
	F18	Inverter Over Curr Fault	1. Check if the load is within the power range. 2.Restart the inverter. 3.If the fault persists, contact the manufacturer.
	F19	MSDSP Connect Fault	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F24	Inverter Voltage Fault	1. Test if the actual output inverter voltage is consistent.1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F27	GFCI Fault	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F34	Bus Volt Over	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F35	Bus Volt Unbalance	
	F41	Heat Sink High Temperature Failure	1. Check that the inverter is not installed in a place where the sunshines, and ensure that the inverter is installed in a cool and ventilated place.
	F42	Transfer Temperature Over	2.Check whether the working temperature is too high, and make sure that the inverter is installed vertically 3.Turn off the inverter for 10 minutes, then restart the inverter 4.If the fault persists, contact the manufacturer
	F45	BUS Start Error	1. Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F49	M3MDSP Connect Fault	1.Shut down and check whether the communication line is firmly connected. 2. Restart the inverter 3.If the fault persists, contact the manufacturer.
	F53	Version Different	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
About Load	W65	Output Short Warning	1.Output is short circuit. 2.Shut down and restart to check whether the machine can work normally 3.If alarm message still exists, contact manufacturer.

Auditing routine	Error Code	Description	Solutions
	W66	Output Overload Warning	1.Check whether the output is short-circuited. 2.Shut down and restart to check whether the machine can work normally 3.If alarm message still exists, contact manufacturer.
	W76	Smart Load Warning	1. Check if the Gen port is connected to the load or generator If it is a generator, modify the machine settings to generator mode. If it is a load, please restart the machine. 2.If alarm message still exists, contact manufacturer.
	W77	Smart Load Over Load Warning	1.Check whether the output is short-circuited. 2.Shut down and restart to check whether the machine can work normally 3.If alarm message still exists, contact manufacturer.
	F21	Output Short	1. Check if the load is short circuited. 2. Restart the inverter. 3.If the fault persists, contact the manufacturer.
	F22	Output Over Load	1. Check if the load is within the power range.2.Restart the inverter.3.If the fault persists, contact the manufacturer.
	F23	Output Over Curr	1. Restart the inverter. 2.If the fault persists, contact the manufacturer.
About Battery	W14	BMS update alarm	1. Check if the machine is in the process of upgrading. 2.If alarm message still exists, contact manufacturer.
	W16	BMS update parameter alarm	1.Pleaseset the 'Lithium Mode' to 01 in the Battery Settings on the LCD, then proceed with the battery upgrade. 2.If alarm message still exists, contact manufacturer

Auditing routine	Error Code	Description	Solutions
	W69	Bat Energy Warning	1.Please charge for 10 minutes before inverter. 2.If alarm message still exists, contact manufacturer.
	W82	Bat Volt Low Warning	1. Check if the battery voltage is too low 2.If alarm message still exists, contact manufacturer.
	W87	Battery Missing Warning	1.There is no electric voltage at the input end of the machine battery. 2.After confirming that the battery voltage is normal, turn on the machine to check whether it can work normally. 3.If alarm message still exists, contact manufacturer.
	F36	Battery Voltage Over	1.Check whether the actual connected battery voltage is consistent with the display. 2.If the battery voltage is too low, use photovoltaic on commercial power to charge the battery. If the battery voltage is too high, please connect to a battery within the required range. 3.If the fault persists, contact the manufacturer.
	F37	Bat Charge Current Over	1. Check whether the actual battery current is consistent with the display. 2.Restart the inverter. 3.If the fault persists, contact the manufacturer.
	F38	Bat DisCharge Current Over	
	F51	M3BMS Connect Fault	1.Shut down and check whether the communication line is firmly connected. 2.Restart the invert. 3.If the fault persists, contact the manufacturer.
	F57	BMS Fault	1.Restart the inverter. 2.If the fault persists, contact the manufacturer.
	F58	Battery Mode Fault	
About Parallel	W05	Parallel Grid different	1.After shutting down the inverter, check if the grid power supply cables are correctly connected. 2.If the warn persists, contact the manufacturer.

Auditing routine	Error Code	Description	Solutions
	W06	Parallel Phase Error	1.After disconnecting the grid power supply from the inverter, check whether the grid connection phase sequence matches the parallel operation settings on the Main Screen. 2.Restart the inverter. 3.If the warn persists, contact the manufacturer.
	W07	Op Phase Loss Error	1. Check if the parallel operation parameters settings on the inverter's LCD interface are correct. 2.Restart the inverter. 3.If error message still exists, contact manufacturer.
	W08	Parallel version different	If the warn still exists, please contact us for help.
	F29	Parallel Setting Fault	1.Check if the master-slave settings in the parallel operation settings on the LCD interface of the inverter are correct. 2.Restart the inverter. 3.If error message still exists, contact manufacturer.
	F31	Parallel CN-AC Phase Order	1.Restart the inverter. 2.1f error message still exists, contact manufacturer.
	F54	Can Fault	1.After shutting down the inverter, check if the parallel communication cables are securely and correctly connected. 2. Restart the inverter. 3.If error message still exists, contact manufacturer
	F55	Host Loss	1.Restart the inverter. 2.If error message still exists, contact manufacturer.
	F59	Parallel BMS Connect Error	1.Connect the BMS communication cable to the 'Master Phase A port of the inverter. 2. Restart the inverter. 3.If error message still exists, contact manufacturer

Data Sheet 7

Model	SPH 8KTL-HU-US(B)	SPH 10KTL-HU-US	SPH 10K TL-HU-US(B)
PV Input Data			
Max Recommended PV Power	15000W		
DC/AC Ratio	1.875	1.5	1.5
PV Input Voltage(V)	370V(130V-525V)		
MPPT Range(V)	150V-450V		
Start-up Voltage(V)	130V		
PV Input Current(A)	22A+22A+22A		
Max. short-circuit current per MPP tracker	27A		
No. of MPPT Trackers	3		
No. of PV strings per MPPT trackers	2/2/2		
Battery Data			
Battery Type	Lead-acid or Li-Ion		
Nominal Voltage(V)	48V		
Battery Voltage Range(V)	40-60V		
Max. Charging Current(A)	190A	200A	200A
Max. Discharging Current(A)	190A	200A	200A
Output Data (On Grid)			
Rated Voltage	120/240Vac (split phase) 120/208Vac (three phase) 127/220Vac (three phase)		
Rated Power(W)	8000W	10000W	10000W
Rated Current(A)	33.4A	41.7A	41.7A
Maximum Grid Bypass Current	62.5A		
Power Factor	0.8 leading to 0.8 lagging		
Output Frequency	60Hz		
Grid Type	Split phase		
THDI	<3%		
Backup Power (Off Grid)			
Rated Voltage	120/240Vac (split phase) 120/208Vac (three phase) 127/220Vac (three phase)		
Rated Power(W)	8000W	10000W	10000W
Peak Power(grid off)	1.5 times of rated power, 5s		
Rated Current(A)	33.4A	41.7A	41.7A

Model	SPH 8KTL-HU-US(B)	SPH 10KTL-HU-US	SPH 10K TL-HU-US(B)
Output Frequency	60Hz		
Switch Time	<10ms		
Load Start Capability	101.5LRA Note：Load Start Capability may vary		
Efficiency			
Max. Efficiency	98.10%		
Euro Efficiency	97.60%		
MPPT Efficiency	99.90%		
Protection			
PV Switch	Yes		
BAT reverse protection	Yes		
Output over current protection	Yes		
AC short-circuit protection	Yes		
PV Input Lightning Protection	Yes		
Anti-islanding Protection	Yes		
PV String Input Reverse Polarity Protection	Yes		
Insulation Resistance Monitoring	Yes		
Residual Current Monitoring Unit	Yes		
AFCI protection	Yes		
Surge Protection	DC Type II / AC Type II		
Certifications and Standards			
Grid support regulation	General Standard、IEEE-1547-2003、IEEE-1547-2018、CA Rule 21、HECO 14H、ISO NE2021、PREPA、CSA 、C22.3 No.9		
Safety	IEC62109-1, IEC62109-2		
EMC	EN61000-6-1, EN61000-6-3, FCC Part 15		
General Data			
Operating Temperature Range(°C)	-25~60°C , >45°C Derating		
Cooling	Smart cooling		
Noise(dB)	<30 dB		
Communication with BMS	RS485: CAN		
Weight(kg)	42.5		
Size(mm)	457.2W*874H*255.6D		
Protection Level	IP65/NEMA 4		
Installation Style	Wall-mounted		
Warranty	10 years		

Parameter setting about Grid 8

	IEEE 1547-2003		IEEE-1547-2018	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Enter service delay (s)	10~610	300	10~610	300
Reconnection Time	10~610	300	10~610	300
Enter Service Voltage low	183~High Value-1	220.1	183~High Value-1	220.1
Enter Service Voltage high	low Value+1~277	253.9	low Value+1~277	252
Enter Service Frequency low	55~59.99	59.3	55~59.99	59.5
Enter Service Frequency high	60.01~66	60.5	60.01~66	60.1
Grid Voltage Range low	0~High Value-1	211.2	0~High Value-1	211.2
Grid Voltage Range high	low Value+1~300	264	low Value+1~300	264
Grid Frequency Range low	55~59.99	59.3	55~59.99	58.5
Grid Frequency Range high	60.01~66	60.5	60.01~66	61.2
PF		1		1
VW Enable	/	0	/	0
Vstart	0~Vstop	254.4	0~Vstop	254.4
Vstop	Vstart~280	264	Vstart~280	264
RT	1~60	10	1~60	10
FW Enable	/	0	/	1
Fstart	60~65	60.036	60~65	60.036
Fstop	62~62	62	62~62	62
Normal Ramp Rate	1~1000	1	1~1000	300
RT	1~10	5	1~10	5
Q(V) Enable	/	0	/	0
V1	0~V2	220.8	0~V2	220.8
V2	V1~V3	235.2	V1~V3	235.2
V3	V2~V4	244.8	V2~V4	244.8
V4	V3~280	259.2	V3~280	259.2
Q1	-0.6~0.6	44	-0.6~0.6	44

	IEEE 1547-2003		IEEE-1547-2018	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Q2	-0.6~0.6	0	-0.6~0.6	0
Q3	-0.6~0.6	0	-0.6~0.6	0
Q4	-0.6~0.6	-44	-0.6~0.6	-44
RT	1~90	5	1~90	5
L/HVRT Enable	/	0	/	0
HV1	0~300	264	0~300	264
HV1 Time	0~600	14.46	0~600	12.9
HV2	0~300	288	0~300	288
HV2 Time	0~600	0.02	0~600	0.1
HV3	0~300	288	0~300	288
HV3 Time	0~600	0.06	0~600	0.06
LV1	0~300	211.2	0~300	211.2
LV1 Time	0~600	24.24	0~600	20.9
LV2	0~300	168	0~300	168
LV2 Time	0~600	12.24	0~600	10.9
LV3	0~300	120	0~300	120
LV3 Time	0~600	12.34	0~600	1.9
L/HFRT Enable	/	1	/	1
HF1	60~65.99	61.2	60~65.99	61.2
HF1 Time	0~600	300	0~600	300
HF2	60~65.99	62	60~65.99	62
HF2 Time	0~600	0.06	0~600	0.06
LF1	55~59.99	58.8	55~59.99	58.8
LF1 Time	0~600	300	0~600	300
LF2	55~59.99	57	55~59.99	57
LF2 Time	0~600	0.06	0~600	0.06

	CA Rule 21		HECO 14H	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Enter service delay (s)	10~610	15	10~610	300
Reconnection Time	10~610	15	10~610	300
Enter Service Voltage low	183~High Value-1	211.9	183~High Value-1	211.2
Enter Service Voltage high	low Value+1~277	253.9	low Value+1~277	252
Enter Service Frequency low	55~59.99	58.5	55~59.99	59.5
Enter Service Frequency high	60.01~66	60.5	60.01~66	60.1
Grid Voltage Range low	0~High Value-1	211.2	0~High Value-1	211.2
Grid Voltage Range high	low Value+1~300	264	low Value+1~300	264
Grid Frequency Range low	55~59.99	58.5	55~59.99	57
Grid Frequency Range high	60.01~66	60.5	60.01~66	63
PF		1		1
VW Enable	/	1	/	0
Vstart	0~Vstop	254.4	0~Vstop	254.4
Vstop	Vstart~280	264	Vstart~280	264
RT	1~60	10	1~60	10
FW Enable	/	1	/	1
Fstart	60~65	60.036	60~65	60.036
Fstop	62~62	62	62~62	62
Normal Ramp Rate	1~1000	300	1~1000	300
RT	1~10	5	1~10	0.5
Q(V) Enable	/	0	/	0
V1	0~V2	220.8	0~V2	220.8
V2	V1~V3	235.2	V1~V3	235.2
V3	V2~V4	244.8	V2~V4	244.8
V4	V3~280	259.2	V3~280	259.2
Q1	-0.6~0.6	44	-0.6~0.6	60

	CA Rule 21		HECO 14H	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Q2	-0.6~0.6	0	-0.6~0.6	0
Q3	-0.6~0.6	0	-0.6~0.6	0
Q4	-0.6~0.6	-44	-0.6~0.6	-60
RT	1~90	5	1~90	5
L/HVRT Enable	/	0	/	0
HV1	0~300	264	0~300	264
HV1 Time	0~600	14.46	0~600	13
HV2	0~300	288	0~300	288
HV2 Time	0~600	0.02	0~600	0.16
HV3	0~300	288	0~300	288
HV3 Time	0~600	0.06	0~600	0.06
LV1	0~300	211.2	0~300	211,2
LV1 Time	0~600	24.24	0~600	21
LV2	0~300	168	0~300	168
LV2 Time	0~600	12.24	0~600	11
LV3	0~300	120	0~300	120
LV3 Time	0~600	12.34	0~600	2
L/HFRT Enable	/	1	/	1
HF1	60~65.99	61.2	60~65.99	61.2
HF1 Time	0~600	300	0~600	300
HF2	60~65.99	62	60~65.99	62
HF2 Time	0~600	0.06	0~600	0.06
LF1	55~59.99	58.8	55~59.99	58.8
LF1 Time	0~600	300	0~600	300
LF2	55~59.99	57	55~59.99	57
LF2 Time	0~600	0.06	0~600	0.06

	ISO NE2021		PREPA（LUMA）	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Enter service delay (s)	10~610	300	10~610	300
Reconnection Time	10~610	300	10~610	300
Enter Service Voltage low	183~High Value-1	220.1	183~High Value-1	211.2
Enter Service Voltage high	low Value+1~277	252	low Value+1~277	254.4
Enter Service Frequency low	55~59.99	59.5	55~59.99	59.5
Enter Service Frequency high	60.01~66	60.1	60.01~66	60.1
Grid Voltage Range low	0~High Value-1	211.2	0~High Value-1	211.2
Grid Voltage Range high	low Value+1~300	264	low Value+1~300	264
Grid Frequency Range low	55~59.99	58.5	55~59.99	58.5
Grid Frequency Range high	60.01~66	61.2	60.01~66	61.2
PF		1		1
VW Enable	/	0	/	0
Vstart	0~Vstop	254.4	0~Vstop	254.4
Vstop	low Value~280	264	low Value~280	264
RT	1~60	10	1~60	10
FW Enable	/	1	/	1
Fstart	60~65	60.036	60~65	60.036
Fstop	62~62	62	62~62	62
Normal Ramp Rate	1~1000	300	1~1000	50
RT	1~10	5	1~10	5
Q(V) Enable	/	0	/	0
V1	0~V2	220.8	0~V2	220.8
V2	V1~V3	235.2	V1~V3	235.2
V3	V2~V4	244.8	V2~V4	244.8
V4	V3~280	259.2	V3~280	259.2
Q1	-0.6~0.6	44	-0.6~0.6	44

	ISO NE2021		PREPA（LUMA）	
	Range of Adjustment	Default Value	Range of Adjustment	Default Value
Q2	-0.6~0.6	0	-0.6~0.6	0
Q3	-0.6~0.6	0	-0.6~0.6	0
Q4	-0.6~0.6	-44	-0.6~0.6	-44
RT	1~90	5	1~90	5
L/HVRT Enable	/	0	/	0
HV1	0~300	264	0~300	264
HV1 Time	0~600	13	0~600	13
HV2	0~300	288	0~300	288
HV2 Time	0~600	0.16	0~600	0.16
HV3	0~300	288	0~300	288
HV3 Time	0~600	0.06	0~600	0.06
LV1	0~300	211.2	0~300	211.2
LV1 Time	0~600	20.9	0~600	20.9
LV2	0~300	168	0~300	168
LV2 Time	0~600	10.9	0~600	10.9
LV3	0~300	120	0~300	120
LV3 Time	0~600	1.9	0~600	1.9
L/HFRT Enable	/	1	/	1
HF1	60~65.99	61.2	60~65.99	61.2
HF1 Time	0~600	300	0~600	300
HF2	60~65.99	62	60~65.99	62
HF2 Time	0~600	0.06	0~600	0.06
LF1	55~59.99	58.8	55~59.99	58.8
LF1 Time	0~600	300	0~600	300
LF2	55~59.99	57	55~59.99	57
LF2 Time	0~600	0.06	0~600	0.06

	CSA C22.3 No. 9			CSA C22.3 No. 9	
	Range of Adjustment	Default Value		Range of Adjustment	Default Value
Enter service delay (s)	10~610	300	Q2	-0.6~0.6	0
Reconnection Time	10~610	300	Q3	-0.6~0.6	0
Enter Service Voltage low	183~High Value-1	220.1	Q4	-0.6~0.6	-44
Enter Service Voltage high	low Value+1~277	252	RT	1~90	5
Enter Service Frequency low	55~59.99	59.5	L/HVRT Enable	/	0
Enter Service Frequency high	60.01~66	60.1	HV1	0~300	264
Grid Voltage Range low	0~High Value-1	211.2	HV1 Time	0~600	13
Grid Voltage Range high	low Value+1~300	264	HV2	0~300	288
Grid Frequency Range low	55~59.99	58.5	HV2 Time	0~600	0.16
Grid Frequency Range high	60.01~66	61.2	HV3	0~300	288
PF		1	HV3 Time	0~600	0.06
VW Enable	/	0	LV1	0~300	211.2
Vstart	0~Vstop	254.4	LV1 Time	0~600	20.9
Vstop	Vstart~280	264	LV2	0~300	168
RT	1~60	10	LV2 Time	0~600	10.9
FW Enable	/	1	LV3	0~300	120
Fstart	60~65	60.036	LV3 Time	0~600	1.9
Fstop	62~62	62	L/HFRT Enable	/	1
Normal Ramp Rate	1~1000	300	HF1	60~65.99	61.2
RT	1~10	5	HF1 Time	0~600	300
Q(V) Enable	/	0	HF2	60~65.99	62
V1	0~V2	220.8	HF2 Time	0~600	0.06
V2	V1~V3	235.2	LF1	55~59.99	58.8
V3	V2~V4	244.8	LF1 Time	0~600	300
V4	V3~280	259.2	LF2	55~59.99	57
Q1	-0.6~0.6	44	LF2 Time	0~600	0.06

9 Appendix I

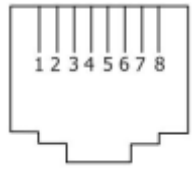
Approved battery brand from Growatt.

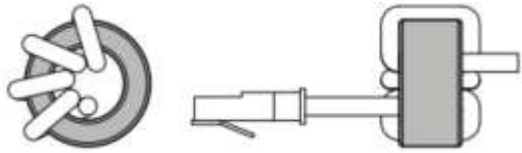
Brand	Model	RS485 or CAN	Inverter Setup
GROWATT	ALP 5.0L-E2-US	CAN	01
	AXE 5.0L-C1	CAN	05
	HOPE 5.5L-A1	RS485	00
		CAN	01
SACOLAR	STR 5.5-A1	RS485	00
		CAN	01
Enersys	OGHB 1548-Li	CAN	02
TOPBAND	TB48100F-T110AD	RS485	03
PYLON	Pylontech-US3000C	CAN	04
	US5000	CAN	04

Please check the complete battery matching list on the official website, official website link:
https://community.growatt.com/upload/file/Growatt_Approved_LV_Battery_List.pdfraw=Growatt_Approved_LV_Battery_List.pdf

10 Appendix II

NO.	BMS
1	RS485B
2	RS485A
3	/
4	CAN-H
5	CAN-L
6	GND
7	/
8	/





1. Pass the BMS communication cable through the magnetic ring and wrap it around the magnetic ring four times.
2. Please use the BMS communication cable provided by the corresponding battery manufacturer.
3. Ensure that the battery and machine are well grounded, and guaranteeing correct connection to the communication ground（NO.6）.

Appendix III 11

CT installation recommendation

CT model	CT ratio	CT aperture	Property	Recommendation system
250A	4000:1	37mm	Standard configuration	split-phase system 2PCS three-phase parallel systems 3 PCS three-phase parallel systems 2-3 PCS split-phase parallel system
500A	7500:1	37mm	Additional purchase	4-6PCS split-phase parallel systems 6PCS three-phase parallel systems

Appendix IV 12

Meter installation recommendation

Meter type	Property	Recommendation system
AGF-AE-D/200	Additional purchase	Split-phase system
SDM630MCT		
SDM630MCT	Additional purchase	2-6 PCS three-phase parallel systems 2-6 PCS split-phase parallel systems

Appendix V 13

FCC COMPLIANCE STATEMENT:
This device complies with part 15 of the FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures

Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.
Warning: Changes or modifications to this unit not expressly approved by the part responsible for compliance could
void the user's authority to operate the equipment.

FCC Radiation Exposure Statement
The device has been evaluated to meet general RF exposure requirement.
The device can be used in mobile(min20cm) exposure condition.

14 Appendix VI

Certificates
With the appropriate settings, the unit will comply with the requirements specified in the following standards and directives (dated: Aug./2024):

Model	
SPH 10000TL-HU-US	IEEE1547, CA RULE21, RULE14(HECO Compliant), UL1741, UL17741SA/SB, CSA C22.2, PREPA, UL1699B, UL1741 CRD, FCC Part15 Class B, Sunspec
SPH 8000-10000TL-HU-US(B)	IEEE1547, CA RULE21, RULE14(HECO Compliant), UL1741, UL1741SA/SB, CSA C22.2, PREPA, UL1699B, UL1741 CRD, FCC Part15 Class B, Sunspec

15 Shiner Configuration Guide

Download the configuration guide: **Shiner App User Manual EN (SPH).**

Datalogger	
Shiner App User Manual EN (SPH)	

Download
Manual

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