

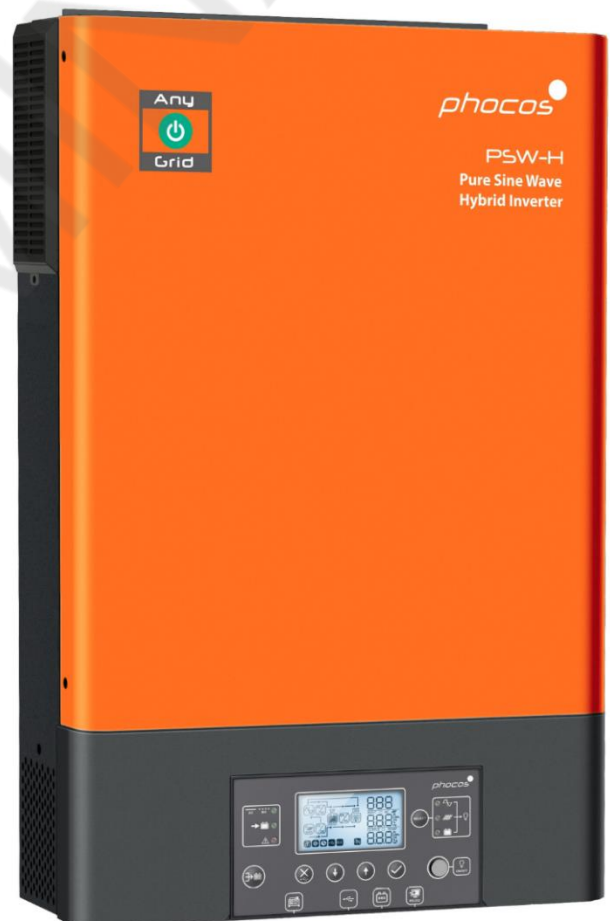


Phocos Any-Grid™ series

PSW-H-5kW-230/48V

Pure Sine Wave Hybrid Inverter Charger with
MPPT Solar Charge Controller

User and Installation Manual



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Introduction

Dear customer, thank you for choosing this quality Phocos product. The Any-Grid™ pure sine wave hybrid inverter / charger series has numerous outstanding features and use-cases such as:

- Function as purely Off-Grid inverter for applications with no AC power source
- Function as solar enabled (optional) uninterruptible power supply (UPS) functionality for intermittent or unstable AC sources
- Function as grid-connected or AC-generator-connected inverter to reduce energy demand from the AC source by prioritizing solar and/or battery power, thus saving energy costs
- Grid injection of excess energy possible where it is legal, with or without a connected battery. Accidental injection is prevented by requirement of a PIN code for activation. When used with a battery and with disabled grid injection, the unit cannot physically inject into the grid. This is because when the integrated inverter is supplying power, both neutral (N) and live (L) wires of the AC input are automatically disconnected (break-before-make relays) from the inverter output.
- High-voltage MPPT solar charge controller allows the connection of more solar panels in series (compared to other Off-Grid solar charge controllers), reducing or eliminating the need for expensive combiner boxes
- Battery charging from an AC source such as the public power grid or a genset
- Compatibility with multiple battery types including lead-acid (gel, AGM and liquid electrolyte) and lithium-based batteries such as LiFePO4
- Battery-free mode: if an AC source is available, photovoltaic (PV / solar) power will be used as priority, even with no battery attached
- Removable wired display unit can be installed in a different room (up to 20m cable can be used)
- All-in-one hybrid unit allows simple and fast installation, and easy configuration
- Monitor the unit in real-time with the PhocosLink App

This manual describes the assembly, installation, operation and troubleshooting of this unit.

Important Safety Instructions

SAVE THESE INSTRUCTIONS: This manual and chapter contains important safety and operating instructions. Read and save this manual for future reference.

WARNING: The installation of this unit may only be undertaken by qualified personnel with appropriate training. High voltages in and around the unit can cause serious injury or death. This unit must be installed in accordance with rules and regulations at the site of installation.

CAUTION: A battery can present a risk of electrical shock, burn from high short-circuit current, fire or explosion from vented gasses. Observe proper precautions.

WARNING: This unit must be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulations when installing this unit.

WARNING - EXPLOSION HAZARD: Do not disconnect while circuit is live or unless area is free of ignitable concentrations.

WARNING - EXPLOSION HAZARD: Do not connect or disconnect when energized.

BATTERY TYPE: Suitable for use with lead-acid (gel, AGM and liquid electrolyte) and lithium-based batteries such as LiFePO4. Nominal voltage 48 Vdc.

OVERCURRENT PROTECTION FOR BATTERY: Install a fuse with a minimum of 1000A interrupt rating as close as possible to the battery terminal. Select a device rated for 1.5 times the nominal current rating of the controller (see table). An overcurrent protection device must be purchased separately.

Any-Grid™ model	PSW-H-5KW-230/48V
Fuse rating	200 Adc, min. 66 Vdc

1. Before using the unit, read all instructions and cautionary markings on this unit, the batteries, the solar modules, any connected loads.
2. Please do not disassemble or attempt to repair Phocos products. This unit does not contain user serviceable parts. Damage to the warranty seal will lead to a loss of warranty of the product and can lead to injury.
3. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Switching off the unit is not sufficient, turn off and / or disconnect all connections to the unit.
4. For safe operation of this unit, please adhere to appropriate cable size requirements in this manual.
5. Be very cautious when working with uninsulated metal tools on or around batteries. The can short-circuit batteries or other electrical parts and could cause an explosion and / or injury.
6. Strictly follow the installation procedure when connecting or disconnecting AC or DC terminals. Please refer to the **Installation** section of this manual for details.
7. Appropriate fuses or breakers are required near the battery supply and AC input and AC output of this unit.
8. Never allow any AC or DC connections to be short-circuited. Do not connect to the mains when the battery input is short-circuited.
9. Only qualified service persons may service this device. If errors persist after following the **Troubleshooting** section in this manual, please send this unit back to a local Phocos dealer or service center for maintenance.
10. **WARNING:** Because this inverter (AC output) is not isolated from the PV input, only three types of PV modules are acceptable for use: monocrystalline, polycrystalline and CIGS modules. To avoid any malfunction, do not connect any PV modules with possible current leakage to the inverter. For example, positive- or negative-grounded PV modules will cause current leakage to the inverter. When using CIGS modules, please be sure that neither the positive nor negative PV cables are grounded. Grounding of the PV module frame is permitted and frequently required by local law.
The battery is isolated from the inverter and PV input, therefore the battery positive or negative terminal may be grounded if required.
11. **CAUTION:** It is highly recommended to use a surge arrester, also named surge protective device (SPD) near the PV input terminals of this unit. This is to prevent damage to the unit from lightning, thunderstorms or other voltage surges on the PV cables. The max. DC operating voltage of the SPD must be between 450 and 480 Vdc.
For example the *Citel DS240-350DC* is suitable.
12. **CAUTION:** It is highly recommended to use a surge arrester, also named surge protective device (SPD) near the AC input terminals of this unit, if the AC input is used. This is to prevent damage to the unit from lightning, thunderstorms or other voltage surges on the AC input conductors (for example coming from the public grid).
The max. AC operating voltage of the SPD must be between 275 and 300 Vac.
For example the *Citel DS41S-230* (for most public grids or generators, higher protection) or *Citel DS41S-320* (for public grids with large voltage swings, lower protection) is suitable.

Regulatory Information

This product is CE and RoHS (Restriction of Hazardous Substances) compliant. Please find the CE declaration at www.phocos.com.

This product is manufactured in an ISO 9001 (quality management) and ISO 14001 (environmental management) certified facility.



This equipment is suitable for use in non-hazardous locations only.

This is a class A device: in a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Overview

Functional Overview

This pure sine wave hybrid inverter charger with solar charge controller (MPPT) can provide power to connected loads by utilizing PV power, AC power and battery power. Most connections are optional, but there must be at least one power source (AC or PV):

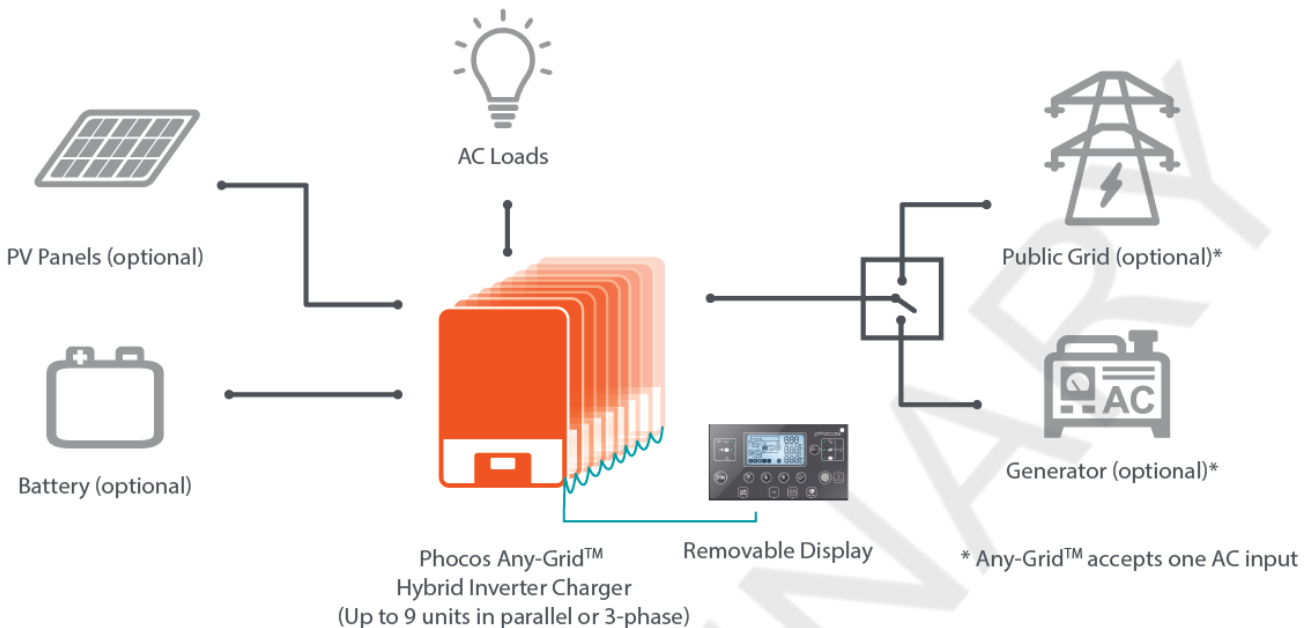


Fig. 1: System Overview

This unit has one each of the following power connections: battery, PV, AC input, AC output. The unit is designed to provide continuous power from PV / battery or an AC source, depending on the set priority. Independently, the priority for charging the battery can be set (the battery can only be charged from AC when the unit is not working in Off-Grid mode). The switching time between Grid (also valid when an AC generator is used) and Off-Grid modes is only 10 milliseconds (typical). Timers can be used to change the priorities based on time slots, this is useful for areas where night and day grid power have differing costs. The integrated maximum power point tracking (MPPT) solar charge controller can handle particularly high PV voltages, allowing for simpler installation and lower costs than most Off-Grid solar charge controllers. Typically, no combiner boxes or string fuses / diodes are required.

The pure sine wave AC output and the peak power capability (twice the continuous power rating) assure all types of AC loads can be powered. Ensure that the peak power requirement of the loads is below the peak power capability of this inverter.

Two special functions allow even more flexibility: Battery-Free mode and Grid Injection.

In Battery-Free mode, no battery is connected to the unit and an AC source must be present. The unit will then provide as much power from PV as is available to supply loads, adding any missing power from the AC source. If there is more PV power available than can be utilized by the loads, then the PV power is reduced to ensure no power feed-in into the grid.

The Grid Injection functionality allows feeding any excess power into the grid. If there is excess PV power beyond what is utilized by the load and for battery charging, this power can be fed into the public grid to take advantage of net metering or feed-in tariffs. In this way all of the PV power can be used even if the battery is full and the loads do not require all of the available PV power. Feeding into the grid may be prohibited in some areas so this function is locked by a PIN code to avoid accidental grid injection.

Product Overview

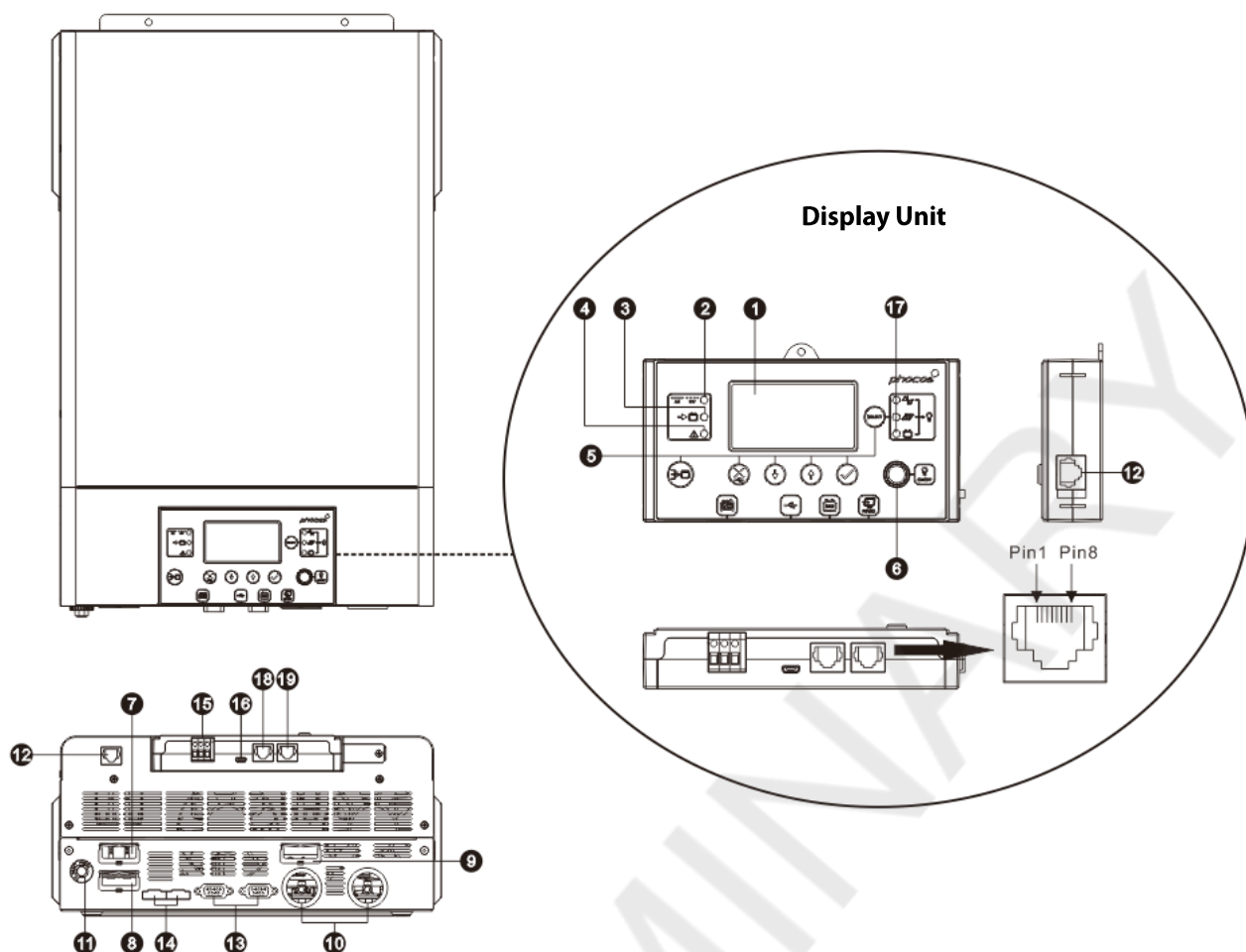


Fig. 2: Product Overview

1. LC-display
2. Inverter status indicator
3. Charging indicator
4. Fault indicator
5. Function buttons
6. AC output on/off switch (solar charging still functions when the AC output is powered off)
7. AC input terminals (public grid or AC generator connection)
8. AC output terminals (load connection)
9. PV terminals
10. Battery terminals
11. Resettable circuit breaker
12. Remote display unit communication port
13. Parallel communication port (for inter-connecting multiple Any-Grid™ units)
14. Current sharing port (for inter-connecting multiple Any-Grid™ units)
15. Relay contact
16. USB-OTG communication port
17. Output source indicators and USB function indicators
18. Battery Management System (BMS) communication port: CAN, RS-485 and RS-232
19. RS-232 communication port

Installation

Package Contents

Before installation, please inspect the unit to ensure nothing inside the package is damaged. Package contents:

- Any-Grid™ unit
- This manual
- RS-232 cable (SUB-D to RJ-45)
- Parallel communication cable (gray connectors)
- Current sharing cable (green connectors)
- 3 pcs. ring terminals for battery connection

Mounting the Unit

Before connecting all wirings, please take off bottom cover by removing two screws as shown below and sliding the cover down.

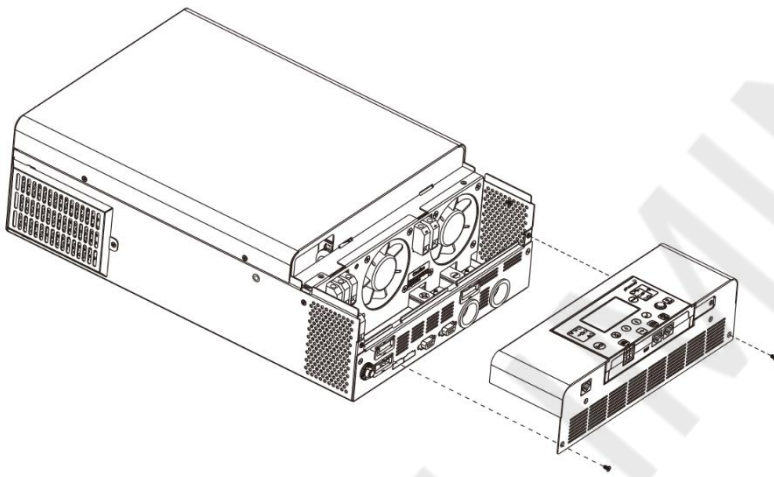


Fig. 3: Removal of bottom cover

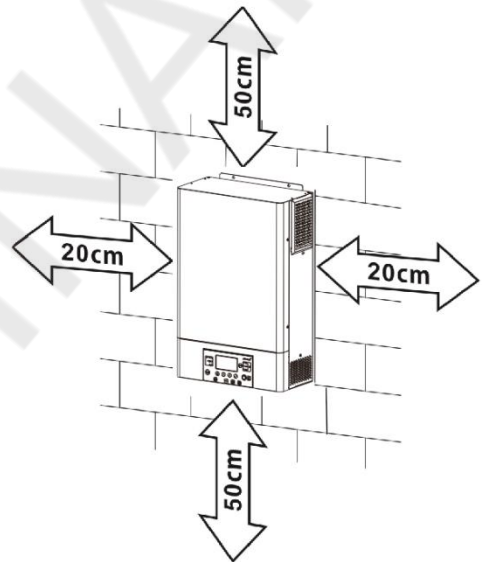


Fig. 4: Minimum distance to other objects

Guidelines for choosing the installation location:

- **WARNING: Only mount this unit on concrete or another solid non-combustible surface capable of securely holding the weight of the unit.**
- Install this inverter at eye level to ensure legibility of the display
- Ensure the ambient temperature is between -10°C and 50°C, 14 °F and 122 °F at all times
- Avoid excessively dusty environments
- The unit is designed for vertical installation on a solid wall
- Ensure a minimum distance to other objects and surfaces as shown in **Fig. 4** guarantee sufficient heat dissipation and to have enough space for removing wires.

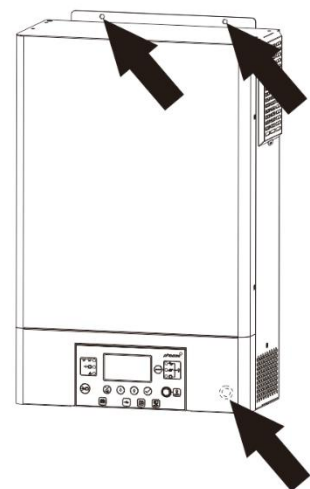


Fig. 5: Mounting holes

Install the unit by using three M4 or M5 screws (**Fig. 5**) appropriate for the weight of the unit and wall material, use wall plugs. The bottom screw hole is only accessible after removal of the bottom cover (**Fig. 3**). This bottom cover must remain removed for the rest of the **Installation** chapter until instructed otherwise.

Battery Connection

WARNING: The installation of this unit may only be undertaken by qualified personnel with appropriate training. High voltages in and around the battery and unit can cause serious injury or death. This unit must be installed in accordance with rules and regulations at the site of installation.

WARNING: Choose a suitable battery fuse as outlined in the chapter “Important Safety Instructions”, section “OVERCURRENT PROTECTION FOR BATTERY”.

WARNING: Ensure the battery cables are sized according to the table below. Inadequate battery cables can cause excessive heat or fire during operation.

Recommended battery cable cross-section, battery size and fuse / DC circuit breaker rating:

Any-Grid™ model	PSW-H-5KW-230/48V
Battery cable cross-section	35 ~ 50 mm ² , AWG 2 ~ AWG 0
Min. battery capacity (lead-based)	48V/200 Ah
Battery current capability	140 Adc continuous, 280 Adc peak (5s)
Fuse / breaker rating	200 Adc, min. 66 Vdc

Steps to connect the battery:

- WARNING: Ensure the battery cables are not yet connected to the battery.**
CAUTION: Ensure none of the cable insulation is jammed in the ring terminal before crimping.
 Crimp one battery ring terminal (included) to each the positive and negative battery lead (unit side). If choosing ring terminals other than the included ones, make sure they have an inside ring diameter of 6.4 mm, 0.25 in to fit the M6 battery terminal bolts of the Any-Grid™ securely.
- Remove the pre-installed nuts from the battery terminal bolts. Insert the ring terminal of the battery cables through the casing holes and flat onto the corresponding battery terminal (**Fig. 6**). Screw down the previously removed nuts with a torque of 2 ~ 3 Nm (1.5 ~ 2.2 lbf.ft). Ensure the ring terminals sit flush on the connectors.
CAUTION: Do not apply any anti-oxidant substances to the battery terminals of the unit before they are adequately fastened.
CAUTION: Over-tightening the terminal nuts can cause damage to the terminal, under-tightening can cause a loose connection and excessive heat during operation, make sure to use the prescribed torque.
- Install the fuse holder or breaker in the positive battery cable (or negative, if the battery must be positive-grounded).
WARNING: Ensure the fuse is not yet installed or make sure the circuit breaker is secured in the open position for the rest of the installation procedure until instructed to do otherwise.
- Connect the other end of the battery cables to the battery. Ensure the polarity of the battery terminals on the Any-Grid™ match the battery polarity.
CAUTION: Reverse polarity connection to the battery may damage the unit.

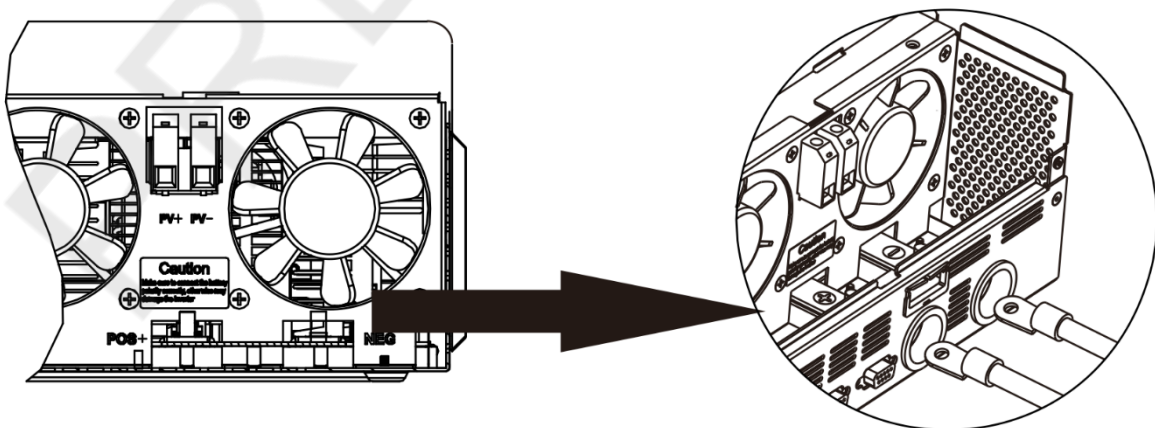


Fig. 6: Battery connection

AC Input and AC Output Connection

WARNING: Before connecting an AC source to the AC input of the Any-Grid™, install an AC circuit breaker between the Any-Grid™ and AC input power source. This will ensure the inverter can be securely disconnected during maintenance and fully protected from over current of AC input. Make sure the breaker is open / off for the rest of the installation procedure until instructed otherwise.

WARNING: Ensure that the installation has adequate grounding and connect the protective earth (PE) terminals to this ground as instructed below. Failure to do so can cause serious injury or death once the unit is powered up or the AC source is activated via its breaker.

WARNING: Ensure the AC cables are sized according to the table below. Inadequate AC cables can cause excessive heat or fire during operation.

CAUTION: Do not connect an AC source to the “AC OUTPUT” labelled terminal of the unit as this will destroy the unit. Only connect it to the “AC INPUT” labeled terminal.

Recommended AC cable cross-section and AC circuit breaker rating:

Any-Grid™ model	PSW-H-5KW-230/48V
AC input and output cable cross-section	4 ~ 10 mm ² , AWG 11 ~ AWG 7
Circuit breaker rating	40 Aac, min. 280 Vac

Steps to connect the AC source and AC loads:

1. **WARNING: Ensure the battery cable fuse is removed or breaker is secured in the open position.**
WARNING: Ensure the AC source breaker is secured in the open position and there is no voltage on the conductors before continuing.
2. Remove 10 mm / 0.4 in of insulation for the six AC conductors (neutral “N”, live “L” and protective earth “PE” for the AC source and loads).
3. Insert the three AC source wires through the rectangular casing hole marked “AC INPUT”. Insert the “PE” protective conductor \oplus first into the corresponding AC input terminal and tighten that terminal screw with a torque of 1.4 ~ 1.6 Nm (1.0 ~ 1.2 lbf-ft). Repeat for the neutral “N” and live “L” conductors.

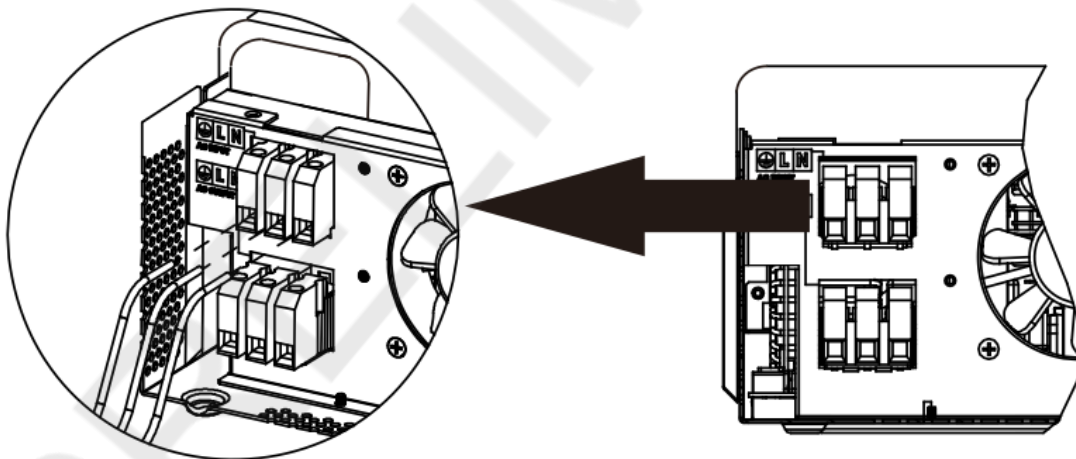


Fig. 7: AC input connection

4. Insert the three AC load wires through the rectangular casing hole marked “AC OUTPUT”. Insert the “PE” protective conductor \oplus first into the corresponding AC output terminal and tighten that terminal screw with a torque of 1.4 ~ 1.6 Nm (1.0 ~ 1.2 lbf-ft). Repeat for the neutral “N” and live “L” conductors.

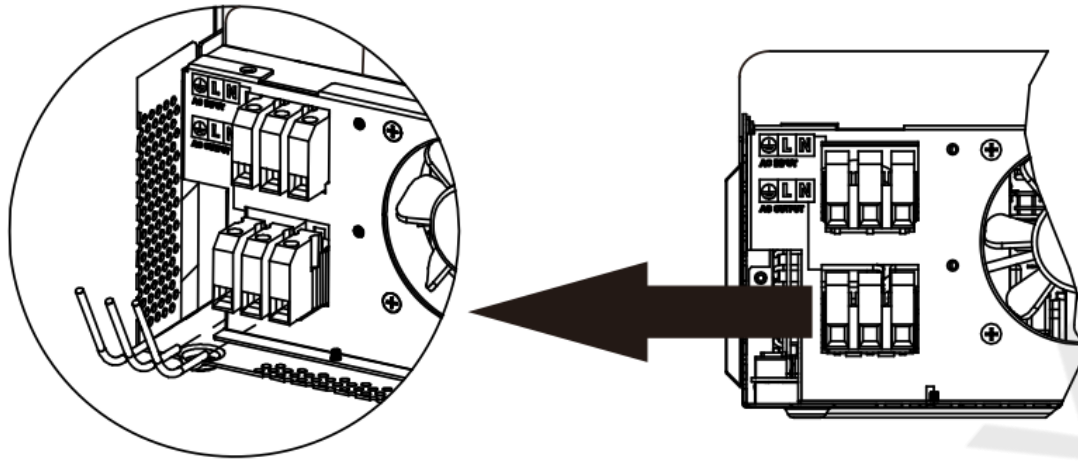


Fig. 8: AC Output connection

5. Make sure the six wires are securely connected.

CAUTION: Over-tightening the terminal screws can cause damage to the terminal, under-tightening can cause a loose connection and excessive heat during operation, make sure to use the prescribed torque. Ensure none of the conductor insulation is jammed between the terminal contacts.

CAUTION: Ensure the polarity is correct on all wires. Failure to do so may cause a short-circuit at the AC source when several units are working in parallel operation.

PV Connection

WARNING: Before connecting the PV module array to the PV input of the Any-Grid™, install a DC circuit breaker between the Any-Grid™ and PV modules. This will ensure the inverter can be securely disconnected during maintenance and is fully protected from over current of the PV modules. PV modules produce a dangerous voltage even with little light. Make sure the breaker is open / off for the rest of the installation procedure until instructed otherwise.

WARNING: Ensure the PV cables are sized according to the table below. Inadequate PV cables can cause excessive heat or fire during operation.

Recommended battery cable cross-section and DC circuit breaker rating:

Any-Grid™ model	PSW-H-5KW-230/48V
PV cable cross-section	2.5 ~ 16 mm ² , AWG 13 ~ AWG 5
Circuit breaker rating	20 Adc, min. 450 Vdc

PV Module Selection:

For selecting the correct PV module configuration, please consider the following points:

- The total open circuit voltage (Uoc / Voc) of the PV module array may never exceed the values in the table below. Consider the coldest possible temperatures at the location of installation together with the temperature coefficient of the PV modules used.
- The total maximum power point voltage (Umpp / Vmpp) of the PV module array must be above the minimum values in the table below. Consider the warmest PV module temperatures at the location of installation.
- The total maximum power point current (Impp / Ampp) of the PV module array may not exceed the value in the table below.

Any-Grid™ model	PSW-H-5KW-230/48V
Max. PV voltage (Uoc)	450 Vdc
Min. PV mpp voltage (Umpp)	120 Vdc
Max. mpp current (Impp)	22.5 Adc (up to 18 Adc actually usable)

Steps to connect the AC source and AC loads:

1. Remove 10 mm / 0.4 in of insulation from the positive and negative PV cables.
2. Insert the two PV wires through the rectangular casing hole marked "PV input".
3. Insert the positive PV cable into the "PV+" terminal and the negative PV cable into the "PV-" terminal.
CAUTION: Ensure correct polarity.

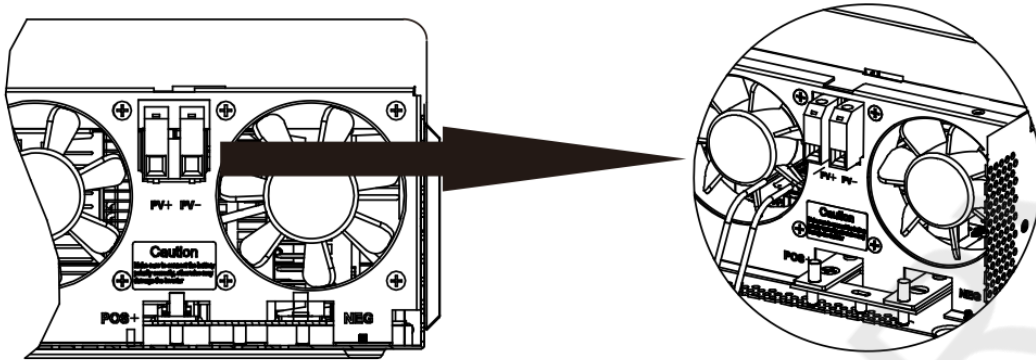


Fig. 9: PV connection

4. Tighten both terminal screws with a torque of 1.4 ~ 1.6 Nm (1.0 ~ 1.2 lbf·ft) and make sure the two wires are securely connected.
CAUTION: Over-tightening the terminal screws can cause damage to the terminal, under-tightening can cause a loose connection and excessive heat during operation, make sure to use the prescribed torque. Ensure none of the cable insulation is jammed between the terminal contacts.

Final Assembly

After Battery, PV and AC wiring is completed, please slide the bottom cover back up on the unit and secure it by fastening the two screws as shown below.

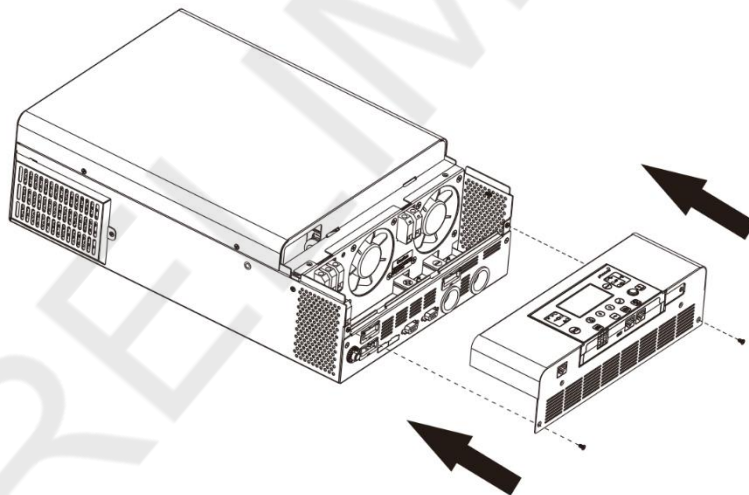


Fig. 10: Re-applying bottom cover

Remote Display Panel Installation

The display module can optionally be removed and installed in a remote location with an optional communication cable. Please take the follow steps to implement this remote panel installation. Use a standard straight Ethernet patch cable (Cat5 or higher) with male RJ45 connectors on both sides (not included). A maximum cable length of 20 meters is recommended. Follow the steps below to remove the display module and install it away from the inverter unit.

1. Remove the screw holding the bracket on the bottom of the display module (**Fig. 11** → ①) and push down the display unit from the case slightly while removing the metal bracket.
2. Keep pushing the display module down, taking care not to damage the connected cable (**Fig. 11** → ②).
3. Remove the cable connected to the display module (**Fig. 11** → ③).
4. Screw the bracket removed in **Fig. 11** → ① back in place (**Fig. 11** → ④).

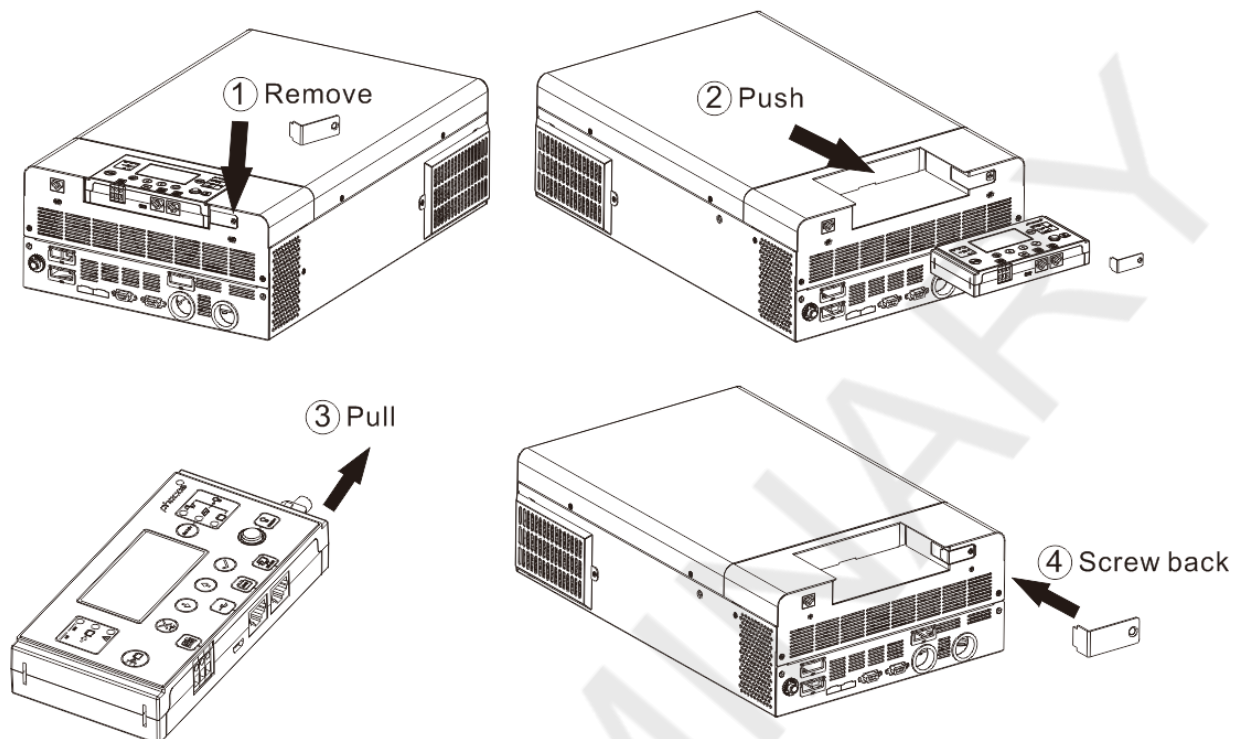


Fig. 11: Remote display removal

5. Drill the three mounting holes in the marked distances of 70 mm, 2.75 in to each other (**Fig. 12**, left). Use M3, size no. 4 diameter screws. The screw heads must be between 5 ~ 7 mm, 0.2 ~ 0.3 in. Screw the bottom two screws into the wall where the display module is to be mounted and let the screw heads protrude 2 mm, 0.08 in. from the wall. Slide the display down on the protruding screw heads. Now insert and tighten the third screw at the top (**Fig. 12**, right).

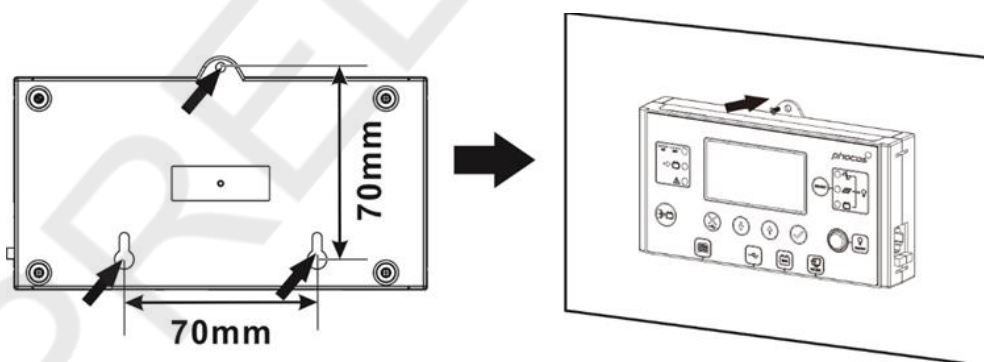


Fig. 12: Remote display mounting hole locations

6. Install one end of the Ethernet patch cable (not included) into socket ⑫ (**Fig. 2**) on the display module (right side). Install the other end of the Ethernet patch cable into socket ⑫ (**Fig. 2**) on the Any-Grid™ unit.
7. If using lithium batteries designed for battery management system (BMS) communication such as Pylontech batteries, please visit www.phocos.com for a current list of batteries supported with BMS communication. Connect the battery BMS cable to socket ⑮ (**Fig. 2**).

CAUTION: Ensure the battery and BMS is compatible with the Any-Grid™ and that the pin location is correct before connection. Damage to any communication port or the battery due to incorrect connection is not covered by warranty.


Pin (Fig. 2)	1	2	3	4	5	6	7	8
Function	RS-232 RX	RS-232 TX	RS-485 B	+12 Vdc	RS-485 A	CAN H	CAN L	GND

BLE Communication

This unit is equipped with wireless BLE functionality. Download the “PhocosLink” App from the Google Play™ store or Apple’s App Store® with an Android™ or iOS device, respectively. Once the App is installed, use it to connect to the Any-Grid™ unit with the password “123456”. The typical maximum communication distance is approximately 6 ~ 7 meters.

Relay Contact

There is one potential-free relay contact (3A / 250 Vac) available on the display module (Fig. 2 → 15). It may be used to signal an external device when battery voltage reaches a low level, such as a gasoline or diesel generator. The relay may be wired with normally closed (NC) or normally open (NO) logic. The table below indicates the relay states between the common (C) and NO, as well as between C and NC contacts.

Any-Grid™ Status	Condition		Relay terminals: 		
			NC & C	NO & C	
Powered Off or Battery-free mode	Unit is off and AC output is not powered.		Closed	Open	
Powered On	Output is powered from Battery power or Solar energy.	Program 01 set as Utility / AC input first	Battery voltage < Low DC warning voltage	Open	Closed
			Battery voltage > Settings menu 13 or battery charging reaches Floating phase	Closed	Open
		Program 01 is set as SBU or Solar / PV first	Battery voltage < Settings menu 12	Open	Closed
			Battery voltage > Settings menu 13 or battery charging reaches Floating phase	Closed	Open

Operation

Inverter Power ON/OFF

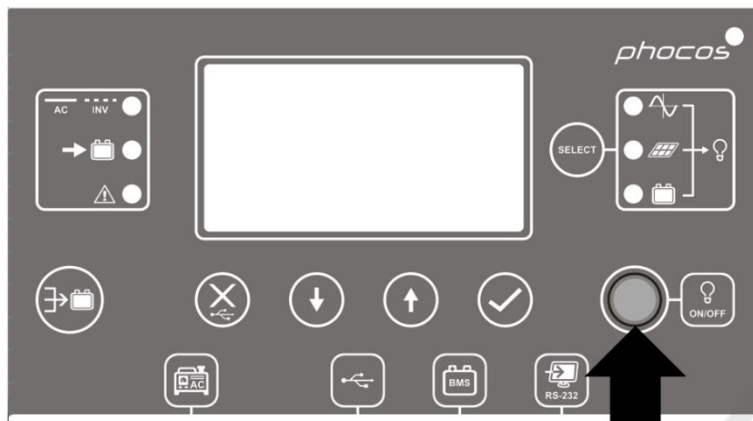


Fig. 13: Remote display mounting hole locations

Ensure the "ON/OFF" switch located on the display panel (**Fig. 13**) is in the "OFF" position after the initial installation (the button must not be depressed).

Now activate the circuit breakers or insert the fuses to energize the various inputs and outputs in the following order (skip any that are not connected):

1. Battery
2. AC input
3. PV input
4. AC output

Next, press the "ON/OFF" to turn on the AC output and thus and connected AC loads and the entire unit.

If the "ON/OFF" switch is in the "OFF" position, then the unit will be completely off when there is insufficient sunlight. If PV modules are connected and there is sufficient PV voltage, the unit will wake up automatically to charge the batteries during the day. Once the PV voltage drops below the threshold, the unit will again turn completely off to save energy during the night. **The AC output and thus the loads will remain off as long as the "ON/OFF" switch is in the "OFF" position.**

Display and Control Module

The display and control module, shown in **Fig. 14**, includes six LED indicators, six function buttons, an ON/OFF button and a LC-display, indicating the operating status and allowing the programming of settings parameters.

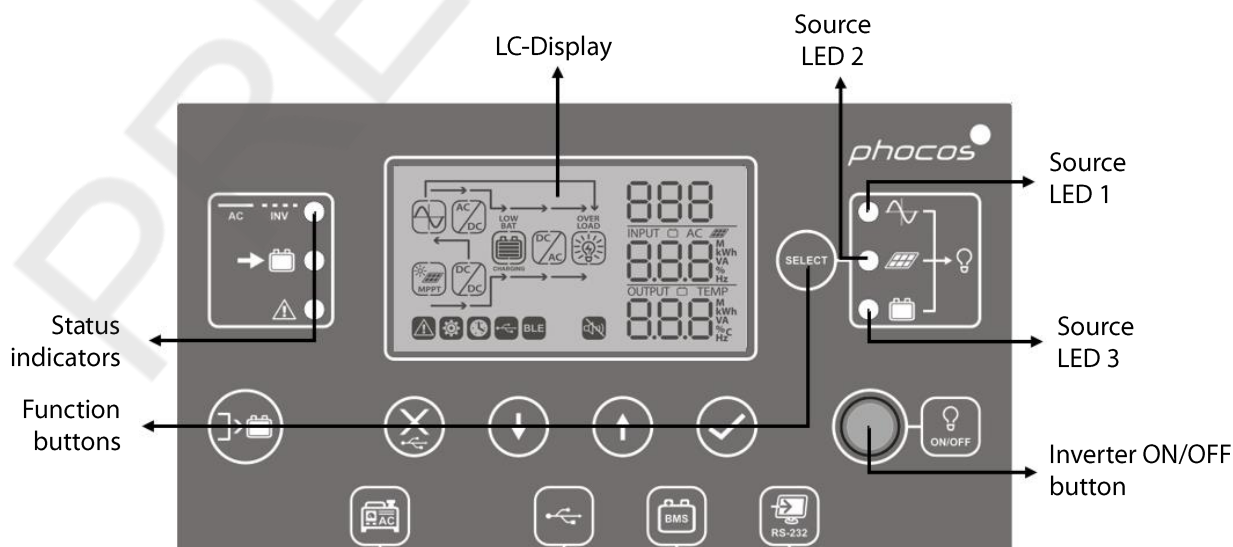











Fig. 14: Display module buttons and indicators

Indicator Description

LED Indicator	Color	Solid On / Flashing	Description	
Source LED 1	Green	Solid On	AC output powered by AC input	
Source LED 2	Green	Solid On	AC output powered by PV	
Source LED 3	Green	Solid On	AC output powered by battery	
Status indicators		Green	Solid On	AC output powered by AC input (Grid mode)
		Green	Flashing	AC output powered by integrated inverter (Off-Grid mode)
		Green	Solid On	Battery is fully charged
		Green	Flashing	Battery is charging
		Red	Solid On	Fault mode
		Red	Flashing	Warning mode

Function Buttons

Function Button	Description	
	Escape / close	Exit settings without confirming
	USB function setting	Select USB OTG functions
	Timer setting for AC output source priority	Setup timer for prioritizing AC output source
	Timer setting for the battery charger source priority	Setup timer for prioritizing battery charger source
	Up	To last selection
	Down	To next selection
	Enter	To confirm/enter the selection in setting mode

Display Symbols

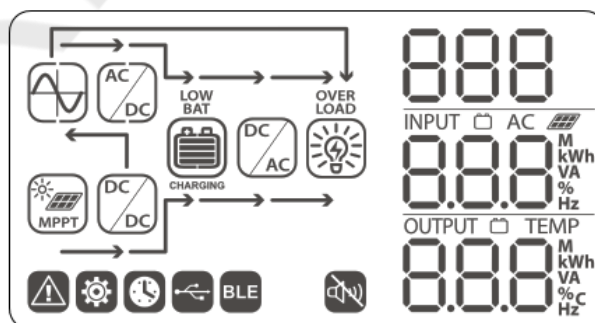


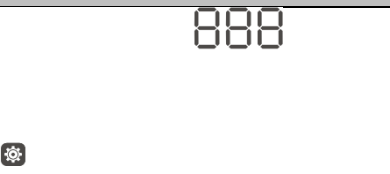


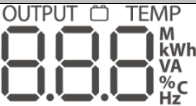
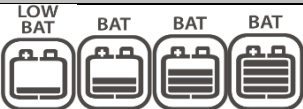



















Fig. 15: LC-Display symbols

Symbol	Description	
Input Information		
AC	Indicates AC input	
	Indicates PV input	
	Indicates input voltage, input frequency, PV voltage, charging current, charging power, battery voltage.	
Settings menu and Fault Information		
	Indicates the setting menus	
	<p>Indicates warning and fault codes.</p> <p>Warning:  flashing with warning code.</p> <p>Fault: F88 shown with fault code.</p>	
Output Information		
	Indicates output voltage, output frequency, load in % of nominal power, load in VA, load in Watt and discharging current.	
Battery Information		
	Indicates battery level in 0 ~ 24%, 25 ~ 49%, 50 ~ 74% and 75 ~ 100% (left to right) increments.	
While the battery is charging, the battery indicator shows the following:		
Status	Battery voltage (x6 cells per 12V nominal battery voltage)	LCD Display
All battery charging modes except Floating phase	< 2V/cell	4 bars flash in turns
	2 ~ 2.083V/cell	Bottom bar constantly on and other three bars flash in turns
	2.083 ~ 2.167V/cell	Bottom two bars constantly on and other two bars flash in turns
	> 2.167 V/cell	Bottom three bars constantly on and top bar flashes
Floating phase. Batteries are fully charged.		4 bars constantly on
While the battery is discharging, the battery indicator shows the following:		
Load Percentage	Battery voltage (x6 cells per 12V nominal battery voltage)	LC-Display
Load >50%	< 1.85V/cell	0 ~ 24%
	1.85V/cell ~ 1.933V/cell	25 ~ 49%
	1.933V/cell ~ 2.017V/cell	50 ~ 74%
	> 2.017V/cell	75 ~ 100%
Load < 50%	< 1.892V/cell	0 ~ 24%







	1.892V/cell ~ 1.975V/cell	25 ~ 49%
	1.975V/cell ~ 2.058V/cell	50 ~ 74%
	> 2.058V/cell	75 ~ 100%
Load Information		
	Indicates overload	
	Indicates load level by 0 ~ 24%, 25 ~ 49%, 50 ~ 74% and 75 ~ 100% (left to right) increments.	
Mode Operation Information		
	Constantly on: AC source valid Blinking: AC source present but rejected	
	PV input valid	
	Load supplied by AC input	
	AC source charger circuit is active	
	PV charger circuit is active	
	DC to AC inverter circuit is active	
	Alarm disabled	
	BLE is ready to connect	
	USB disk connected	
	Timer setting or time display	

Device Operation Settings

General Settings

Press  for 3 seconds to enter settings mode. Press  or  to select between settings menus. Once selected, press  to confirm the selection or  to exit without confirmation.

Settings menus

Menu no.	Description	Selectable Option and Notes	
00	Exit setting mode	Escape 00  ESC	
01	AC output source priority: Configure the priority of which power sources supply the AC output load	Utility / AC input first (Default) "USB" for: Utility → Solar → Battery 01  USB	AC input / utility will provide power to the loads as first priority. Solar and battery will provide power to the loads only when AC input power is not available.
		Solar / PV first "SUB" for: Solar → Utility → Battery 01  SUB	Solar provides power to the loads as first priority. If solar power is not sufficient to power all connected loads, battery energy will supply power the loads simultaneously. If no solar power is available (ex. At night), AC input / utility power is used exclusively.
		SBU priority "SBU" for: Solar → Battery → Utility 01  SBU	Solar energy provides power to the loads as first priority. If solar energy is not sufficient to power all connected loads, battery energy will supply power to the loads at the same time. Utility provides power to the loads only when battery voltage drops to either low-level warning voltage or the setting point in program 12.
02	Maximum total battery charging current of AC and solar charging combined: Max. total charging current = AC input charging current + solar charging current This setting is important to limit charging current for some battery types.	10A 02  10 ^A	80A (Default) 02  80 ^A
		Can be set from 10 ~ 80 Adc in 10 Adc increments. This is the battery-side DC charging current.	

03	AC input voltage range	Appliances 03 * APL	Accepted AC input voltage range from 90 ~ 280 Vac.
		UPS (Default) 03 * UPS	Accepted AC input voltage range from 170 ~ 280 Vac.
05	Battery type Settings menus 26, 27 and 29 can only be modified if "User-defined" is selected here	AGM (Default) 05 * AGn	Flooded 05 * FLd
		User-defined 05 * USE	Battery charging voltages and low voltage disconnect (LVD) can be manually defined in settings menu 26, 27 and 29.
		Pylontech battery 05 * PYL	For use with Pylontech lithium batteries. Ensure the battery management system communication is connected (chapter Remote Display Panel Installation). Settings menus 02, 26, 27 and 29 will be automatically set up and cannot be changed. Further batteries may be added in the future. Please visit www.phocos.com for a current list of batteries supported with BMS communication.
06	Automatic restart if an AC output overload occurs	Restart disabled (Default) 06 * Lfd	Restart enabled 06 * LfE
07	Automatic restart when over-temperature occurs	Restart disabled (Default) 07 * tfd	Restart enabled 07 * tFE
08	Solar power feed-in into grid A PIN code is required to change this setting. Grid feed-in / injection may not be legal at the site of installation. Contact your dealer for more details.	Disabled (Default) 08 * Gfd	Enabled 08 * GfE



09	AC output frequency Only relevant for Off-Grid mode	50 Hz (Default) 09 50 _{Hz}	60 Hz 09 60 _{Hz}
10	AC output voltage Only relevant for Off-Grid mode	230 Vac (Default) 10 230 _V	From 220 ~ 240 Vac in 10 Vac increments.
11	Maximum AC source charging current (battery side) If settings menu 02 is smaller than this value, charging will be limited by the value in settings menu 02.	30 Adc (Default) 11 061 30 _A	Available values: 2 Adc and 10 ~ 80 Adc in 10 Adc increments.
12	Voltage set-point to switch from Off-Grid mode to Grid mode when "SBU priority" or "Solar / PV first" is selected in settings menu 01	48 Vdc (Default) 12 48 _V	Available values: 44 ~ 57 Vdc in 1 Vdc increments.
13	Voltage set-point to switch from Grid mode to Off-Grid mode when selecting "SBU priority" or "Solar / PV first" in program 01.	Battery fully charged 13 FUL _V	54 Vdc (Default) 13 54 _V
		Available values: "FULL" and 48 ~ 64 Vdc in 1 Vdc increments. The battery is considered fully charged when the float charging phase is reached.	
16	Battery charger source priority Configure the priority of which power sources are used to charge the battery. The AC source can only charge the battery if in Grid, Stand-By or Fault modes. In Off-grid mode only solar / PV power can charge the battery. It is recommended not to choose "Only Solar" if an AC source is available because the self-consumption of the Any-Grid™ unit is supplied from the battery (if connected). If there are long periods without sunshine (ex. snow), the unit may shut down due to low battery voltage. Instead, select "Solar first" here and 2 Adc in settings menu 11 to compensate for the self-consumption with some safety margin.	Solar first 16 CS0	Solar power will charge battery as first priority. Utility will charge battery only when solar energy is not available and the unit is in Grid mode.
		Solar and Utility (Default) 16 SNU	Solar power and AC input power will charge battery at the same time if the unit is in Grid mode.
		Only Solar 16 0S0	Solar power will be the only battery charging source regardless of the operating mode.

18	General alarm control	Alarm on (Default) 18 * 607	Alarm off 18 * 60F
19	Automatic return to default overview display screen	Return to default display view (Default) 19 * ESP	The display will return to the default overview (input voltage / output voltage) if no button is pressed for 1 minute.
		Remain at last view 19 * 1EP	The display will remain at the selected view indefinitely, until another view is selected.
20	Display backlight control	Backlight on (Default) 20 * L07	Backlight off 20 * L0F
22	Beeps while primary source is interrupted	Alarm on (Default) 22 * A07	Alarm off 22 * A0F
23	Overload by-pass: When enabled, the unit will quickly switch to Grid mode if an AC output overload occurs in Off-Grid mode. It will return back to Off-Grid mode once the load power has normalized.	By-pass disabled (Default) 23 * bYd	Bypass enabled 23 * bYE
25	Record fault codes to internal datalogger	Record enabled (Default) 25 * FEN	Record disabled 25 * FdS
26	Boost battery charging voltage	57.6 Vdc (Default) 26 * 57.6 ^v	If "User-defined" is selected in settings menu 05, this value can be changed. Available values: 48.0 ~ 64.0 Vdc in 0.1 Vdc increments.
27	Floating battery charging voltage	55.2 Vdc (Default) 27 * 55.2 ^v	If "User-defined" is selected in settings menu 05, this value can be changed. Available values: 48.0 ~ 64.0 Vdc in 0.1 Vdc increments.

28	AC output mode This value can only be changed if the inverter is in Stand-By mode (AC output turned off). See the chapter "Multi-Any-Grid™ Systems" for detailed instructions.	Single: This unit is used alone in a single-phase application 28 * S1 0	Parallel: This unit is one of several units in a single-phase application 28 * PAR
		Phase L1: This unit is one of several units and on phase 1 in a three-phase application 28 * 3P 1	Phase L2: This unit is one of several units and on phase 2 in a three-phase application 28 * 3P 2
		Phase L3: This unit is one of several units and on phase 3 in a three-phase application 28 * 3P 3	
29	Low voltage disconnect The AC output is turned off when the battery reaches this voltage level to protect the battery from deep discharge.	44.0 Vdc (Default) 29 COV 44.0 *	If "User-defined" is selected in settings menu 05, this value can be changed. Available values: 40.0 ~ 54.0 Vdc in 0.1 Vdc increments. This voltage is fixed and independent from the load power level.
32	Boost battery charging duration The duration for which the boost voltage from settings menu 26 is held before the Floating phase is reached.	Automatic 32 * AUT	120 min (Default) 32 * 120
		If "User-defined" is selected in settings menu 05, this value can be changed. Available values: "Automatic" and 5 ~ 900 minutes in 5 min. increments.	
33	Battery equalization Battery equalization helps prevent sulfation of lead-acid batteries and is beneficial for bringing all cells to the same voltage. Consult your battery manual to make sure the battery can withstand the higher voltages required for this purpose. This is typically the case for flooded lead-acid batteries.	Battery equalization enabled 33 * EEN	Battery equalization disabled (Default) 33 * EDS
		If "User-defined" or "Flooded" is selected in settings menu 05, this value can be changed.	
34	Battery equalization voltage	59.2 Vdc (Default) 34 EV 59.2V *	Available values: 48.0 ~ 64.0 Vdc in 0.1 Vdc increments.

35	Battery equalization duration The duration for which the equalization voltage from settings menu 34 is held before the Floating phase is reached.	120 min. (Default) 35 * 120	Available values: 5 ~ 900 minutes in 5 min. increments.
36	Battery equalization timeout If the equalization voltage from settings menu 34 cannot be reached within the duration from settings menu 35, once this timeout is reached, equalization is ended and the charger returns to Floating phase.	180 min. (Default) 36 * 180	Available values: 5 ~ 900 minutes in 5 min. increments.
37	Equalization interval	30 days (Default) 37 * 30d	Available values: 0 ~ 90 days in 1-day increments.
39	Equalization phase: forced start	Enabled 39 * EN	Disabled (Default) 39 * DS
		If the battery equalization function is enabled in settings menu 33, this function can be enabled. If "Enabled" is selected in this menu, battery equalization is immediately force-started and the display main view will show EQ (EQ). If "Disabled" is selected, it will cancel the forced equalization function until the next scheduled equalization interval as defined in settings menu 37. EQ will no longer be shown in LCD main page.	
40	Reset PV and Load energy datalogger storage	Not reset (Default) 40 * nrt	Reset 40 * rst
41	Maximum discharging current This setting is important to limit discharging current for some battery types.	Disabled (Default) 41 * dds	120 A 41 * 120



		<p>Depending on the used battery type, its maximum discharge current may be lower than what the Any-Grid™ unit requires to deliver its full power to AC loads. If set to “Disabled” the unit will draw as much current from the battery as necessary to supply the loads. If overloaded by too much load power, settings menu 23 determines if the unit may switch to the AC input by-pass to deliver more power or protect itself by turning off permanently (until manual restart) or temporarily (depends on settings menu 06).</p> <p>If this setting is not “Disabled” then the unit will allow a maximum of the set discharge current. If this limit is surpassed, the unit will switch to the AC input by-pass temporarily to provide more power to the loads. If no AC source is available, then the unit will shut down for 5 minutes.</p> <p>Available values: Disabled and 30 ~ 120 Adc in 10 Adc increments.</p>	
93	Erase / erase all datalogger contents	<p>No reset (Default)</p> <p>93</p> <p>✱ nrt</p>	<p>Reset</p> <p>93</p> <p>✱ rSt</p>
94	Datalogger storage period	<p>10 days (Default)</p> <p>94</p> <p>✱ 10</p>	<p>The Any-Grid™ unit can store measurement data with the following frequency:</p> <p>3 days: 20 entries per day 5 days: 12 entries per day 10 days: 6 entries per day 20 days: 3 entries per day 30 days: 2 entries per day 60 days: 1 entry per day</p> <p>Once the memory is full, entries are over-written.</p> <p>Available values: 3, 5, 10, 20, 30 and 60 days.</p> <p>Irrespective of this setting the unit stores the last 100 error / warning event codes.</p>
95	Time setting: minute	<p>95</p> <p>ni n</p> <p>✱🕒 00</p>	<p>Allows setting the current time in minutes.</p> <p>Available values: 00 ~ 59 minutes.</p>
96	Time setting: hour	<p>96</p> <p>HOU</p> <p>✱🕒 00</p>	<p>Allows setting the current time in hours (24h notation).</p> <p>Available values: 00 ~ 23 hours.</p>
97	Date setting: day of month	<p>97</p> <p>dAY</p> <p>✱🕒 01</p>	<p>Allows setting the current day of the month.</p> <p>Available values: day 01 ~ 31.</p>

98	Date setting: month		Allows setting the current month. Available values: month 01 ~ 12.
99	Date setting: year		Allows setting the current year (last two digits: ex. 2019 = 19). Available values: year 17 ~ 99.

USB and Timer Settings


There are three function keys on the display module to implement functions such as USB OTG, timer settings for the output source priority and timer settings for the battery charger source priority.

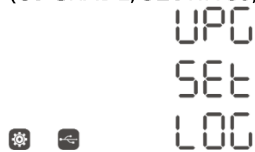
USB Functionality




Insert a USB OTG storage device (disk) or a USB disk with a USB OTG microUSB adaptor into the USB port  (see **Fig. 2**). Press  for 3 seconds to enter USB function mode. These functions including the unit firmware upgrade, data log export and internal parameters re-write from the USB disk.








Note: If no button is pressed within 1 minute of starting this procedure, the screen it will automatically return to the default main view.




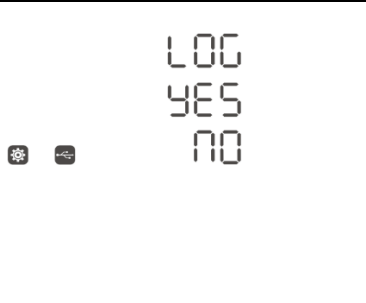
Follow these steps to select the various USB functions:

1. Press  for 3 seconds to enter USB function mode. The three available functions are shown on the display (**UPGRADE, SETTINGS, LOGGER**):



2. Press either ,  or  to enter one of the three selectable settings programs (detailed description in step 3).
3. Please select the desired function by following the procedure as shown in the table below:

Function	Description	Screen View
 Upgrade firmware	Upgrade the Any-Grid™ firmware it necessary with a file from the USB disk.	
 Re-write internal parameters	Over-write all parameter settings with a settings file stored on the USB disk. Settings files may be available from your Phocos dealer.	
 Export data log	1. By pressing  the unit prepares to export the internal data log to a connected USB disk. Once the function is ready, the screen will display  . Press the  button to confirm the selection.	

	<ol style="list-style-type: none"> Press  to select "YES" or  to return to the main screen without any changed. If "YES" was selected, Source LED 1 (see Fig. 14) will flash once every second during the process. Once the data log copy to the USB disk is complete, the screen will show: LOG and all LEDs will be lit. Now press  to return to main screen. 	
--	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------

Possible error messages for USB functions:

Error Code	Description
U01	No USB disk is detected
U02	USB disk is write-protected
U03	File read from the USB disk has an incorrect format


If any error occurs, the error code will be displayed for three seconds. After three seconds, the screen returns to the default main view.

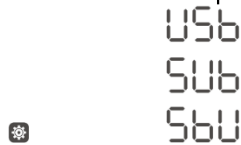
Timer Override Setting for AC Output Source Priority







This timer setting is to set up the daily AC output source priority.

Note: If no button is pressed within 1 minute of starting this procedure, the screen it will automatically return to the default main view.

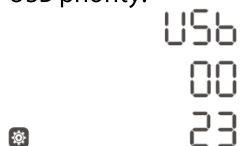
To define a daily time period in which a specific AC output source priority is to be temporarily activated, follow the steps below:










- Press and hold  for 3 seconds to enter the timer setting for the AC output source priority. The three available priority orders are shown on the display (see Chapter **Device Operation Settings** → "Settings menu 01" for an explanation):



- From top to bottom the priorities shown in the screen represent:
 - Utility / AC input first ("USB" for Utility → Solar → Battery)
 - Solar / PV first ("SUB" for Solar → Utility → Battery)
 - SBU priority ("SBU" for Solar → Battery → Utility)
- Press either ,  or  to enter one of the three selectable priorities:
 -  = USB
 -  = SUB
 -  = SBU

- The selected priority order (USB, SUB or SBU) is shown at the top of the screen. The middle shows the starting time and the bottom shows the stopping time in full hours (24h notation). As an example for the USB priority:




5. Press  to select the starting time (middle of screen), it will flash. Now press  or  to change the starting time in 1-hour steps. Then, press  to confirm the starting time, it will stop flashing.
6. Press  to select the ending time (bottom of screen), it will flash. Now press  or  to change the ending time in 1-hour steps. Then, press  to confirm the ending time, it will stop flashing.
7. Now press  to return to main screen.

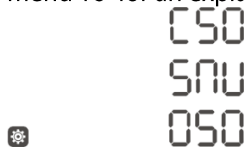
Timer Override Setting for Battery Charger Source Priority







This timer setting is to set up the daily battery charger source priority.

Note: If no button is pressed within 1 minute of starting this procedure, the screen it will automatically return to the default main view.

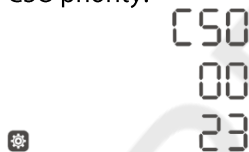
To define a daily time period in which a specific battery charging source priority is to be temporarily activated, follow the steps below:










1. Press and hold  for 3 seconds to enter the timer setting for the battery charger source priority. The three available priority orders are shown on the display (see Chapter **Device Operation Settings** → “Settings menu 16” for an explanation):



2. From top to bottom the priorities shown in the screen represent:
 - a. Solar first (“CSO” for Charger Solar)
 - b. Solar and Utility (“SNU” for Solar and Utility)
 - c. Only Solar (“OSO”)
3. Press either ,  or  to enter one of the three selectable priorities:
 - a.  = CSO
 - b.  = SNU
 - c.  = OSO

4. The selected priority order (CSO, SNU or OSO) is shown at the top of the screen. The middle shows the starting time and the bottom shows the stopping time in full hours (24h notation). As an example for the CSO priority:

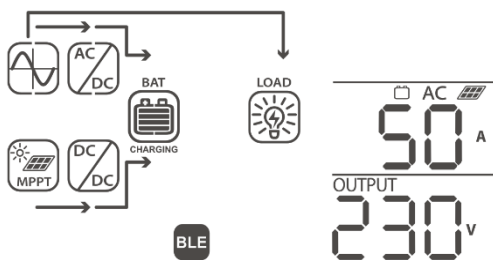
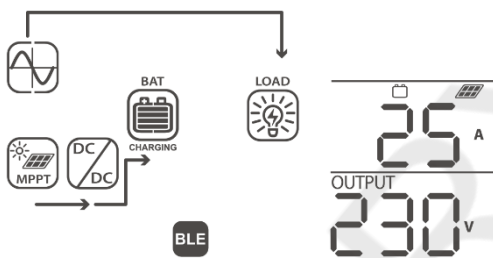
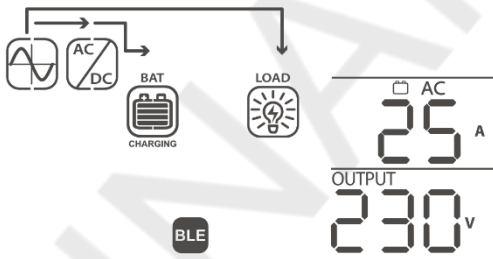
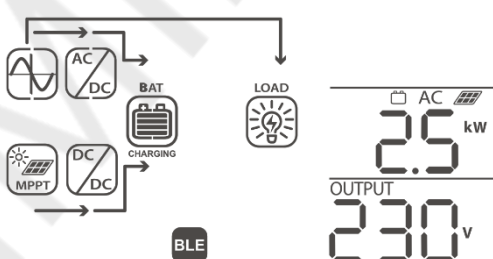
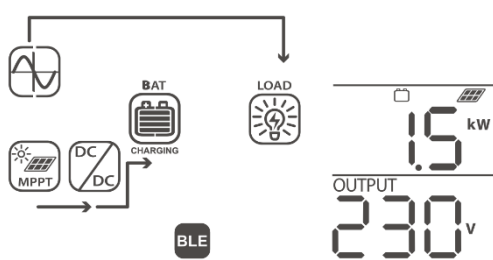
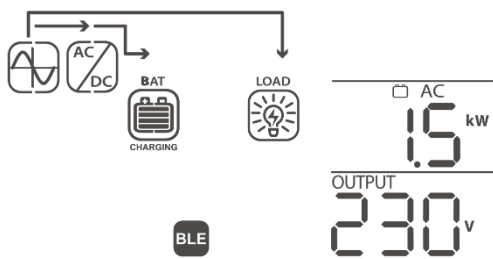


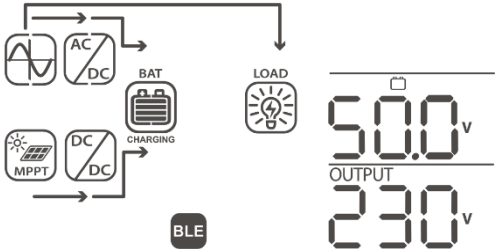
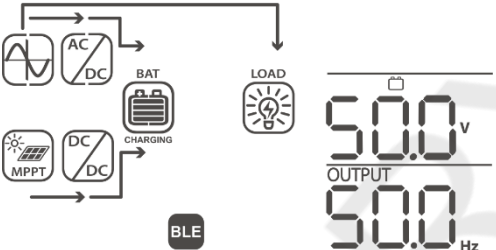
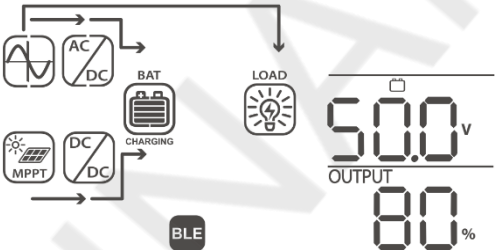
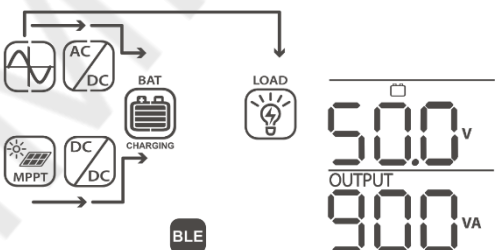
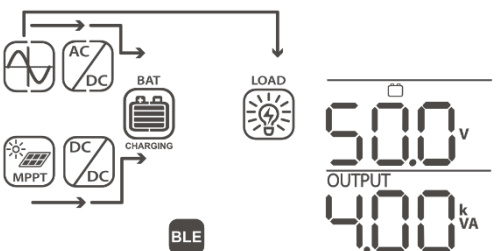
5. Press  to select the starting time (middle of screen), it will flash. Now press  or  to change the starting time in 1-hour steps. Then, press  to confirm the starting time, it will stop flashing.
6. Press  to select the ending time (bottom of screen), it will flash. Now press  or  to change the ending time in 1-hour steps. Then, press  to confirm the ending time, it will stop flashing.
7. Now press  to return to main screen.

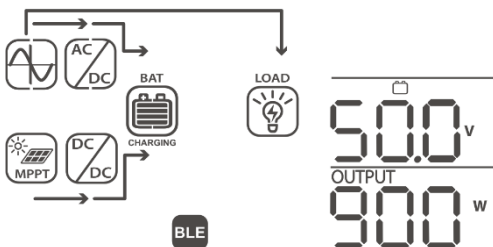
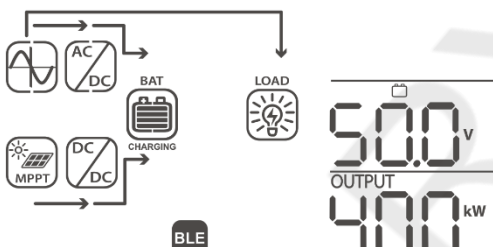
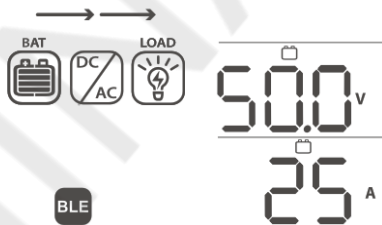
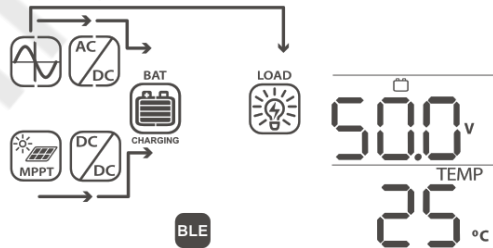
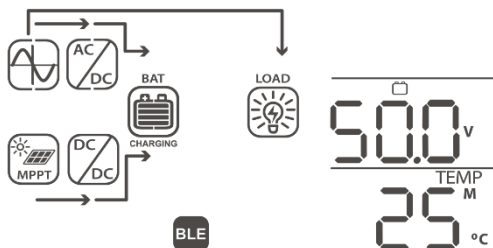
Screen Views of Current Values

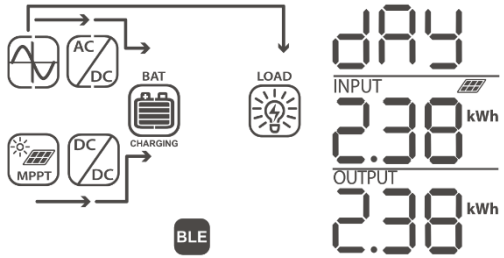
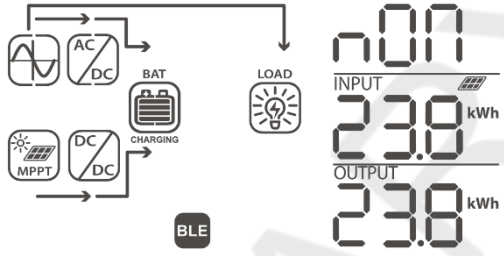
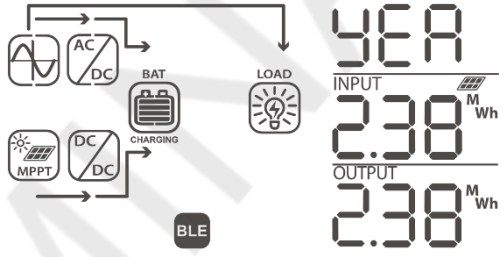
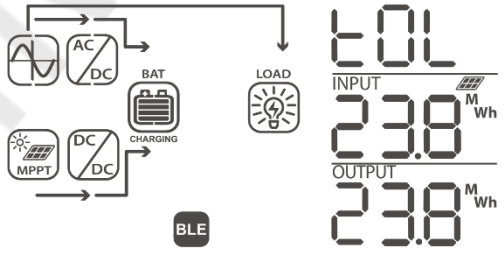
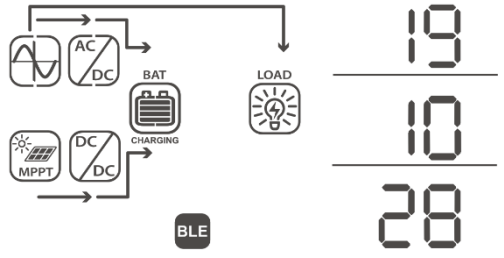
The screen views can be scrolled by pressing \uparrow or \downarrow to show current values in the following order:

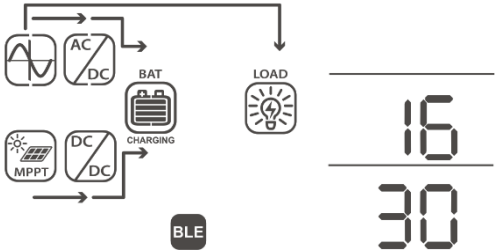
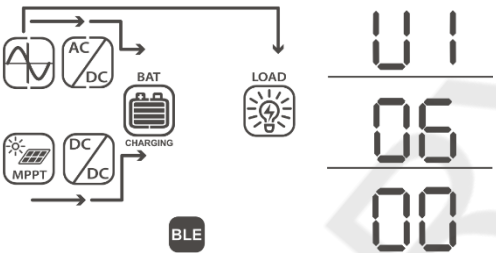
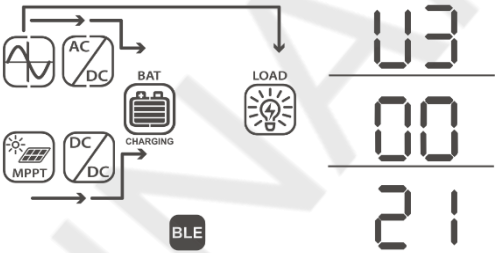
Measurement Values	Screen View Example
AC input voltage / AC output voltage (Default Display Screen)	<p>Input Voltage = 230 Vac, Output voltage = 230 Vac</p>
AC input frequency	<p>Input frequency = 50 Hz, Output voltage = 230 Vac</p>
PV voltage	<p>PV voltage = 260 Vdc</p>
PV current	<p>PV current = 2.5 Adc</p>
PV power	<p>PV power = 650 W</p>

<p>Charging current</p>	<p>AC and PV charging current (battery side) = 50 Adc</p>  <p>PV charging current = 25 Adc</p>  <p>AC charging current = 25 Adc</p> 
<p>Charging power</p>	<p>AC and PV charging power = 2.5 kW</p>  <p>PV charging power = 1.5 kW</p>  <p>AC charging power = 1.5 kW</p> 

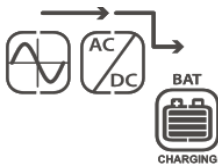
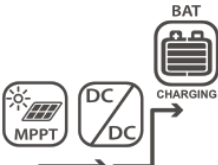
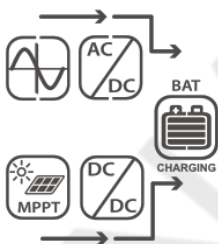

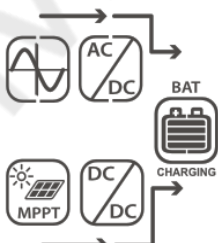
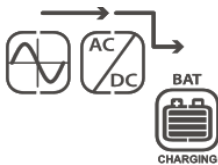
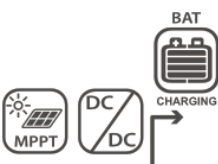

<p>Battery voltage and AC output voltage</p>	<p>Battery voltage = 50 Vdc, output voltage = 230 Vac</p> 
<p>AC output frequency</p>	<p>Output frequency = 50 Hz</p> 
<p>AC output percentage of nominal inverter power</p>	<p>Load percent = 80%</p> 
<p>AC output in VA (apparent power)</p>	<p>When load power is lower than 1 kVA, apparent power is shown in VA (ex. 900 VA)</p>  <p>When load power is higher than 1 kVA, apparent power is shown in kVA (ex. 4.00 kVA)</p> 

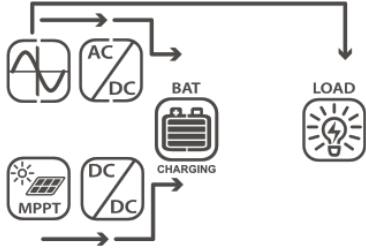
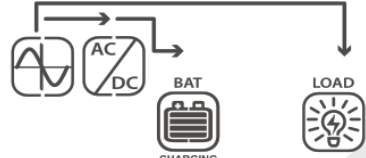
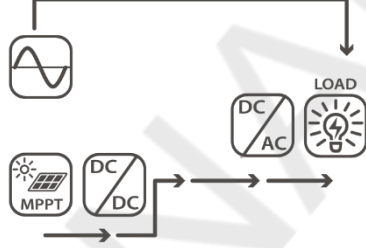

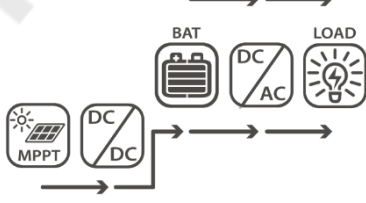
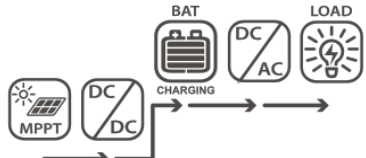

<p>Load in Watt (active power)</p>	<p>When load power is lower than 1 kW, active power is shown in W (ex. 900 W)</p>  <p>When load power is lower than 1 kW, active power is shown in kW (ex. 4.00 kW)</p> 
<p>Battery voltage / DC discharging current</p>	<p>Battery voltage = 50 Vdc, discharging current = 25 Adc</p> 
<p>Battery voltage / inside inverter temperature and inside solar charge controller temperature (Inverter temperature and solar charge controller temperature is displayed in turns)</p>	<p>Battery voltage = 50 Vdc, inverter temperature = 25 °C</p>  <p>Battery voltage = 50 Vdc, solar charge controller temperature = 25 °C</p> 

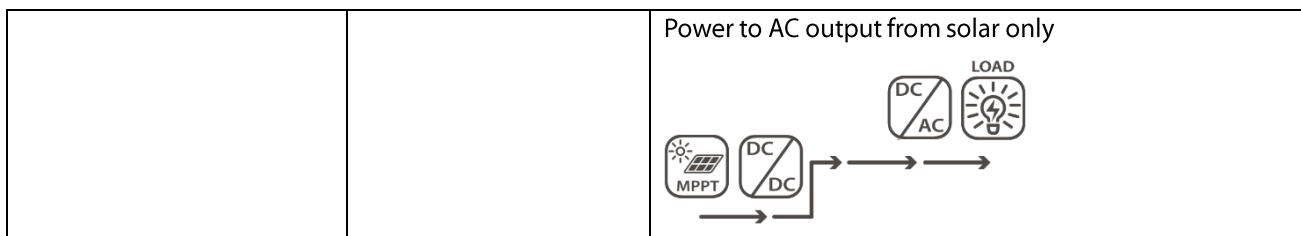
<p>PV energy generated today, and AC output energy consumed today</p>	<p>PV energy = 2.38 kWh, AC output energy = 2.38 kWh</p> 
<p>PV energy generated this month, and AC output energy consumed this month</p>	<p>PV energy = 23.8 kWh, AC output energy = 23.8 kWh</p> 
<p>PV energy generated this year, and AC output energy consumed this year</p>	<p>PV energy = 2.38 MWh, AC output energy = 2.38 MWh</p> 
<p>PV energy generated in total, and AC output energy consumed in total</p>	<p>PV energy = 23.8 MWh, AC output energy = 23.8 MWh</p> 
<p>Current date</p>	<p>October 28, 2019.</p> 

Current time (24h notation)	<p>16:30 hrs.</p> 
Main microcontroller version (V1)	<p>Version 06.00</p> 
BLE controller version (V3)	<p>Version 00.21</p> 

Operating Mode Description

Operating mode	Behaviors	LCD display
<p>Stand-By mode</p> <p>The AC output is not turned on, but the unit can charge the battery without AC output (for example if the inverter ON/OFF switch is set to the OFF position).</p>	<p>No AC output voltage is supplied by the unit, but it still can charge batteries</p>	<p>Battery is charged by an AC source</p> 
		<p>Battery is charged by solar power</p> 
		<p>Battery is charged by AC source and solar power</p> 
		<p>No charging</p> 
<p>Fault mode</p> <p>Errors are currently active (see chapter Fault Reference Codes for details)</p>	<p>Solar power and AC source can charge batteries</p>	<p>Battery is charged by AC source and solar power</p> 
		<p>Battery is charged by an AC source</p> 
		<p>Battery is charged by solar power</p> 
		<p>No charging</p> 












<p>Grid mode</p>	<p>AC output power is fully sourced from the AC input (by-pass), battery charging is available</p>	<p>Battery is charged by AC source and solar power</p>  <p>Battery is charged by an AC source</p> 
<p>Battery-free mode No battery is connected to the Any-Grid™</p>	<p>AC output power is fully sourced from the AC input (by-pass) and solar power</p>	<p>Solar power and the AC source provide power to the AC output</p>  <p>AC source provides power to the AC output</p> 
<p>Off-Grid mode</p>	<p>AC output power from battery and solar power</p>	<p>Battery and solar provide power to the AC output</p>  <p>Solar provides power to the AC output and charges battery at the same time, no AC source available</p>  <p>Power to AC output from battery only</p> 



Fault Reference Codes

Fault Code	Fault Event	Screen View
01	Fan is locked while inverter is off	F01
02	Over-temperature	F02
03	Battery voltage is too high	F03
04	Battery voltage is too low	F04
05	AC output is short circuited or over-temperature is detected by internal components	F05
06	AC output voltage is too high	F06
07	AC output overload timeout	F07
08	Internal DC bus voltage is too high	F08
09	Internal DC bus soft start failed	F09
10	Solar charge controller over-current	F10
11	Solar charge controller over-voltage	F11
12	DC-DC converter over-current	F12
51	Over-current or surge	F51
52	Internal DC bus voltage is too low	F52
53	Inverter soft-start failed	F53
55	DC voltage component in AC output too high	F55
57	Battery connection is open	F57
58	Current sensor failed	F58

Warning Codes

Warning Code	Warning Event	Audible Alarm	Screen view
01	Fan is locked while inverter is on	Beeps three times every second	01 
02	Over-temperature	None	02 
03	Battery is over-charged	Beeps once every second	03 
04	Low battery voltage	Beeps once every second	04 
07	AC output overload	Beeps once every 0.5 second	07  
10	AC output power de-rating	Beeps twice every 3 seconds	10 
32	Communication interrupted	None	32 
Eq	Battery equalization	None	Eq 
bP	Battery is not connected	None	bP  

Specifications

Grid Mode

Model	PSW-H-5KW-230/48V
AC Input Voltage Waveform	Pure Sine Wave (utility or generator)
Nominal AC Input Voltage	230 Vac
Low Loss AC Input Voltage	170 Vac \pm 7 Vac (UPS mode) 90 Vac \pm 7 Vac (Appliances mode) See chapter Device Operation Settings \rightarrow "Settings menu 03" for details.
Low Loss Return AC Input Voltage	180 Vac \pm 7 Vac (UPS mode) 100 Vac \pm 7 Vac (Appliances mode)
High Loss AC Input Voltage	280 Vac \pm 7 Vac
High Loss Return AC Input Voltage	270 Vac \pm 7 Vac
Maximum AC Input Voltage	300 Vac
Nominal AC Input Frequency	50 Hz / 60 Hz
Low Loss Frequency	40 Hz \pm 1 Hz
Low Loss Return AC Input Frequency	42 Hz \pm 1 Hz
High Loss AC Input Frequency	65 Hz \pm 1 Hz
High Loss Return AC Input Frequency	63 Hz \pm 1 Hz
Output Short Circuit Protection	Grid mode: Circuit Breaker (40 Aac, resettable) Off-Grid mode: Electronic Protection
Transfer Time between Grid mode and Off-Grid mode and vice versa	10 ms typical (UPS mode) 20 ms typical (Appliances mode) See chapter Device Operation Settings \rightarrow "Settings menu 03" for details.
AC Output Power De-Rating When AC input voltage falls under 170 Vac in Grid mode, the AC output power is de-rated	<p>The graph illustrates the AC output power de-rating characteristics. The vertical axis represents Output Power, with a horizontal dotted line for Rated Power and a lower horizontal dotted line for 50% Power. The horizontal axis represents Input Voltage, with markers at 90V, 170V, and 280V. The power curve starts at 50% of rated power at 90V, rises linearly to reach the full rated power at 170V, and then remains constant at the rated power level until the input voltage reaches 280V.</p>

Off-Grid Mode

Model	PSW-H-5KW-230/48V
Nominal AC Output Power	5000 VA / 5000 W
AC Output Voltage Waveform	Pure Sine Wave
AC Output Voltage Regulation	230 Vac \pm 5%
Total Harmonic Distortion of Voltage	< 5% for linear load, < 10% for non-linear load at nominal voltage
AC Output Frequency	50 Hz or 60 Hz (programmable)
Peak Efficiency	> 93%
AC Output Overload Protection	100 milliseconds @ \geq 205% nominal AC output power 5 seconds @ \geq 150% nominal AC output power 10 seconds @ 110% ~ 150% nominal AC output power
AC Output Surge Capacity	2x nominal power for 5 seconds
Nominal Battery Input Voltage	48 Vdc
Min. Battery Voltage for Inverter Start-up	46.0 Vdc Default \geq 2.0 Vdc. above "Low voltage disconnect" setting See chapter Device Operation Settings \rightarrow "Settings menu 29" for details.
Low Battery Warning Voltage	
load nominal power < 20%	44.0 Vdc
20% \leq load nominal power < 50%	42.8 Vdc
load nominal power \geq 50%	40.4 Vdc
Low Battery Warning Return Voltage	
load nominal power < 20%	46.0 Vdc
20% \leq load nominal power < 50%	44.8 Vdc
load nominal power \geq 50%	42.4 Vdc
Low Battery Voltage Disconnect	Programmable, see chapter Device Operation Settings \rightarrow "Settings menu 29" for details.
load nominal power < 20%	42.0Vdc
20% \leq load nominal power < 50%	40.8Vdc
load nominal power \geq 50%	38.4Vdc
High Battery Disconnect Voltage	66 Vdc
High Battery Return Voltage	64 Vdc
DC Voltage Accuracy	+/- 0.3%V at no load
DC Offset	\leq 100 mV

Battery Charging

Charging from AC Source		
Model	PSW-H-5KW-230/48V	
Max. Battery Charging Current at Nominal AC Input Voltage	80 Adc	
Boost Charging Voltage	Flooded Battery	58.4 Vdc
	AGM / Gel Battery	57.6 Vdc
Floating Charging Voltage	55.2 Vdc	
Overcharge Protection	66 Vdc	
Charging Algorithm	4-Step with Equalization	
Charging Curve Cell voltage x 6 per 12V nominal battery voltage		

Charging from MPPT Solar Charge Controller	
Model	PSW-H-5KW-230/48V
Max. Usable Solar Power	4800 W
Max. Solar Array Power	6000 W
Max. Solar Array Open Circuit Voltage	450 Vdc
Solar Array MPP Voltage Range	120 Vdc ~ 430 Vdc
Max. Usable Solar Input Current	18 Adc
Start-Up Voltage	110V +/- 10Vdc

General

Model	PSW-H-5KW-230/48V
Safety Certification	CE
Operating Temperature Range	-10 ~ 50 °C
Storage temperature	-15 ~ 60 °C
Humidity	5% to 95% Relative Humidity (Non-condensing)
Dimension (D x W x H), mm	142.5 x 308 x 467.5
Net Weight, kg	12

Troubleshooting

Problem	LCD / LED / Buzzer	Explanation / Possible cause	What to do
Unit shuts down automatically during start-up process.	LCD / LEDs and buzzer will be active for 3 seconds and then turn off.	The battery voltage is too low (<1.91V/Cell)	1. Re-charge battery 2. Replace battery
No response after power on.	No indication.	1. The battery voltage is far too low (<1.4V/Cell) 2. Battery polarity is connected in reverse	1. Check if batteries and the wiring are connected correctly, check battery polarity. 2. Re-charge battery. 3. Replace battery.
AC source exists but the unit works in battery mode.	Input voltage is displayed as 0 on the LCD and green LED is flashing.	Input circuit breaker is tripped	Check if AC circuit breaker is tripped and AC wiring is connected correctly.
	Green LED is flashing.	Insufficient quality of AC power (Grid or Generator)	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working correctly or if input voltage range setting is correct (try switching from UPS mode → Appliances mode), see chapter Device Operation Settings → "Settings menu 03" for details.
	Green LED is flashing.	"Solar / PV First" is set as the priority of the AC output source.	Change output source priority to "AC input / utility first", see chapter Device Operation Settings → "Settings menu 01" for details.
When the unit is turned on, internal relay is switched on and off repeatedly.	LCD display and LEDs are flashing	Battery is disconnected.	Check if battery wires are connected well.
Buzzer beeps continuously and red LED is on.	Fault code 07	Overload error. The inverter is overloaded $\geq 110\%$ for more than the allowed duration.	Reduce the connected load by switching off some equipment.
	Fault code 05	Output short circuited.	Check if wiring is connected well and remove abnormal loads.
		Temperature of internal converter component is over 120°C.	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high.
	Fault code 02	Internal temperature of inverter component is over 100°C.	
	Fault code 03	Battery is over-charged.	Return to repair center.
The battery voltage is too high.		Check if specifications and quantity of batteries meet requirements.	
Fault code 01	Fan fault	Replace the fan(s)	

	Fault code 06/58	Output abnormal (AC output voltage below 190Vac or higher than 260Vac)	1. Reduce the connected load. 2. Return to repair center
	Fault code 08/09/53/57	Internal components failed.	Return to repair center.
	Fault code 51	Over current or surge.	Restart the unit, if the error occurs again, please return to repair center.
	Fault code 52	Internal DC bus voltage too low.	
	Fault code 55	Output voltage is unbalanced.	
	Fault code 56	Battery is not connected correctly, or internal fuse has blown.	If the battery is connected correctly, please return to repair center.

PRELIMINARY