ABOUT THIS MANUAL

Purpose

This manual describes the assembly, installation, operation and troubleshooting of this unit. Please read this manual carefully before installations and operations. Keep this manual for future reference.

Scope

This manual provides safety and installation guidelines as well as information on tools and wiring.

SAFETY INSTRUCTIONS

 **WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.**

1. Before using the unit, read all instructions and cautionary markings on the unit, the batteries and all appropriate sections of this manual.
2. **CAUTION** --To reduce risk of injury, charge only deep-cycle lead acid type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.
3. Do not disassemble the unit. Take it to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
4. To reduce risk of electric shock, disconnect all wirings before attempting any maintenance or cleaning. Turning off the unit will not reduce this risk.
5. **CAUTION** – Only qualified personnel can install this device with battery.
6. **NEVER** charge a frozen battery.
7. For optimum operation of this inverter/charger, please follow required spec to select appropriate cable size. It's very important to correctly operate this inverter/charger.
8. Be very cautious when working with metal tools on or around batteries. A potential risk exists to drop a tool to spark or short circuit batteries or other electrical parts and could cause an explosion.
9. Please strictly follow installation procedure when you want to disconnect AC or DC terminals. Please refer to INSTALLATION section of this manual for the details.
10. Fuses (3 pieces of 40A, 32VDC for 1KW, 4 pieces of 40A, 32VDC for 2KW and 6 pieces for 3KW, 1 piece of 200A, 58VDC for 4KW and 5KW) are provided as over-current protection for the battery supply.
11. GROUNDING INSTRUCTIONS -This inverter/charger should be connected to a permanent grounded wiring system. Be sure to comply with local requirements and regulation to install this inverter.
12. NEVER cause AC output and DC input short circuited. Do NOT connect to the mains when DC input short circuits.
13. **Warning!!** Only qualified service persons are able to service this device. If errors still persist after following troubleshooting table, please send this inverter/charger back to local dealer or service center for maintenance.

INTRODUCTION

This is a multi-function inverter/charger, combining functions of inverter, MPPT solar charger and battery charger to offer uninterruptible power support with portable size. Its comprehensive LCD display offers user-configurable and easy-accessible button operation such as battery charging current, AC/solar charger priority, and acceptable input voltage based on different applications.

Features

Pure sine wave inverter

Built-in MPPT solar charge controller

Configurable input voltage range for home appliances and personal computers via LCD setting Configurable battery charging current based on applications via LCD setting

Configurable AC/Solar Charger priority via LCD setting

Compatible to mains voltage or generator power

Auto restart while AC is recovering

Overload/ Over temperature/ short circuit protection

Smart battery charger design for optimized battery performance

Cold start function

Basic System Architecture

The following illustration shows basic application for this inverter/charger. It also includes following devices to have a complete running system:

Generator or Utility.

PV modules (option)

Consult with your system integrator 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 tube light, fan, refrigerator and air conditioner.

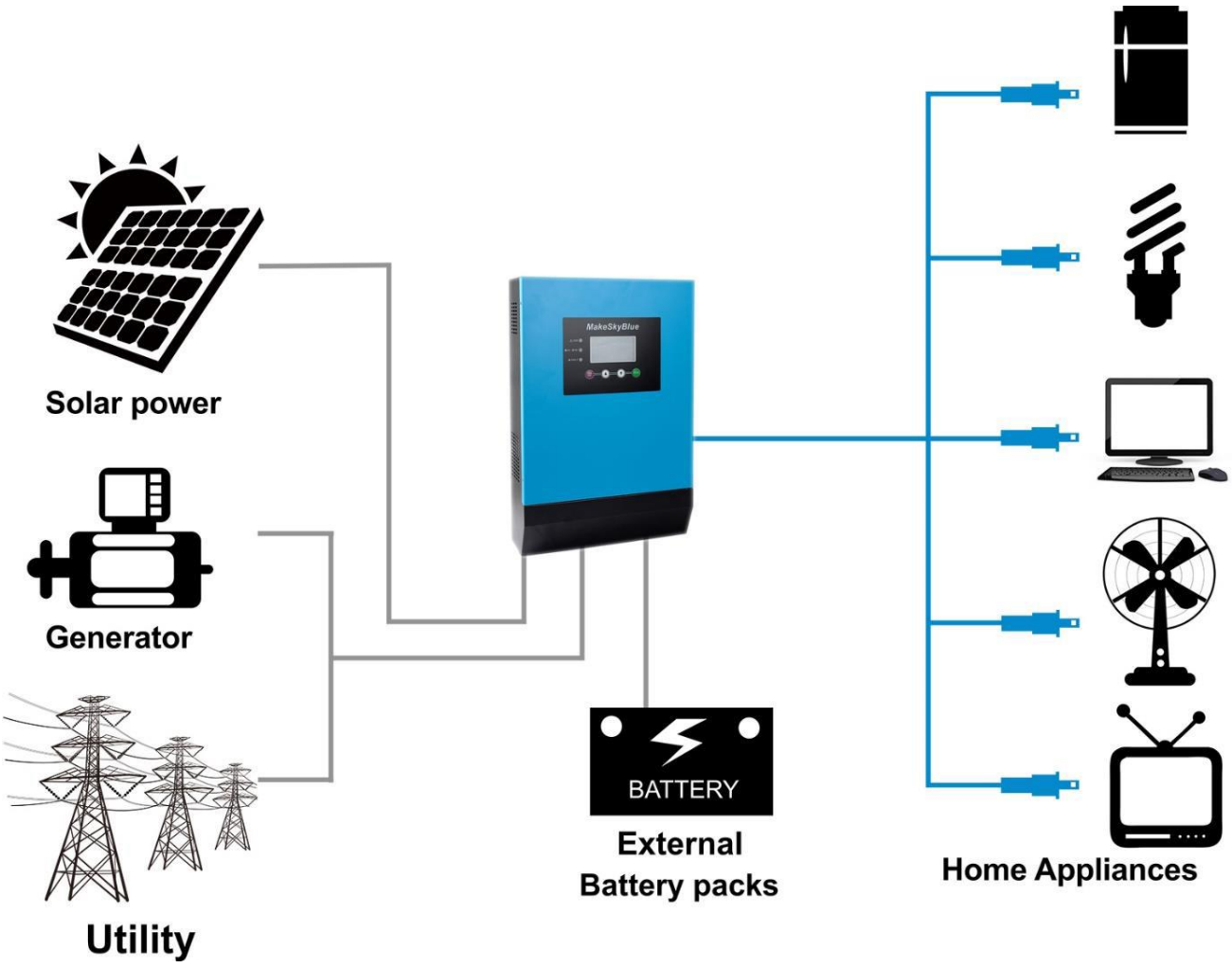
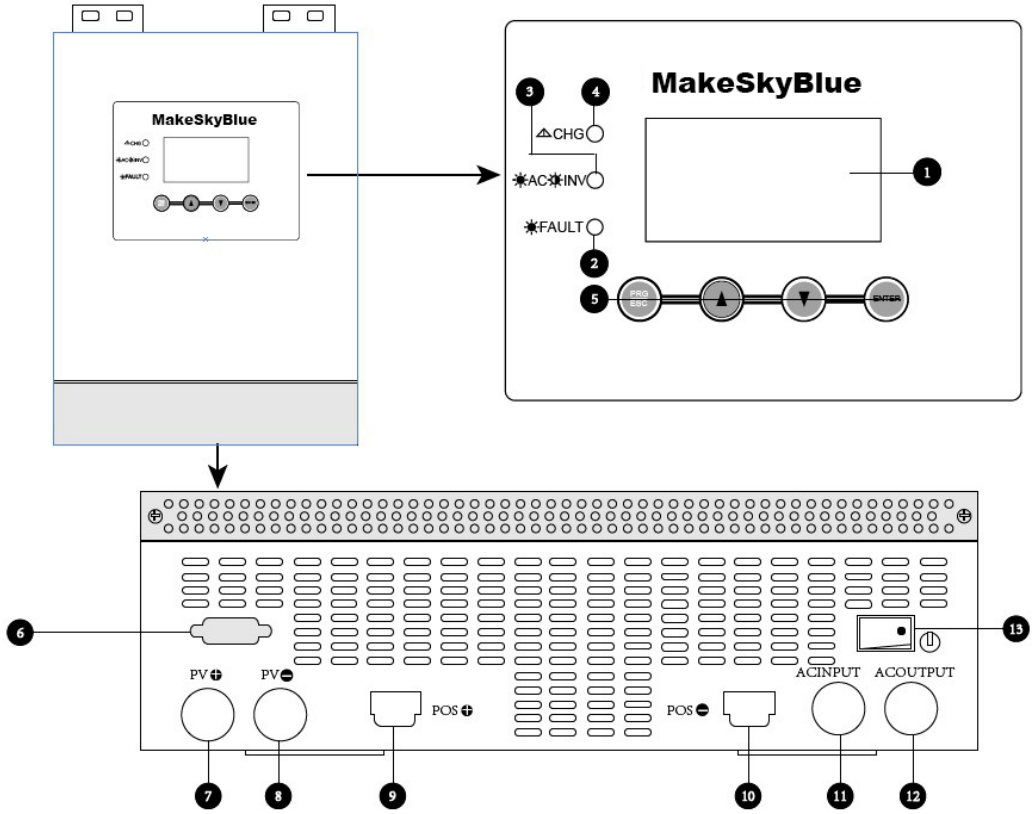


Figure 1 Hybrid Power System

Product Overview



1. LCD display 2. Fault/Alarm indicator
3. Status indicator 4. Charging indicator
5. Function buttons 6. NC
7. PV+ Input 8. PV- Input
9. Battery + Input 10. Battery - Input
11. GRID AC input 12. AC output
13. Power on/off switch

INSTALLATION

Unpacking and Inspection

Before installation, please inspect the unit. Be sure that nothing inside the package is damaged. You should have received the following items inside of package:

The unit x 1

User manual x 1

Battery cable x 2

Fixed plax 2

Mounting the Unit

Consider the following points before selecting where to install:

Do not mount the inverter on flammable construction materials.

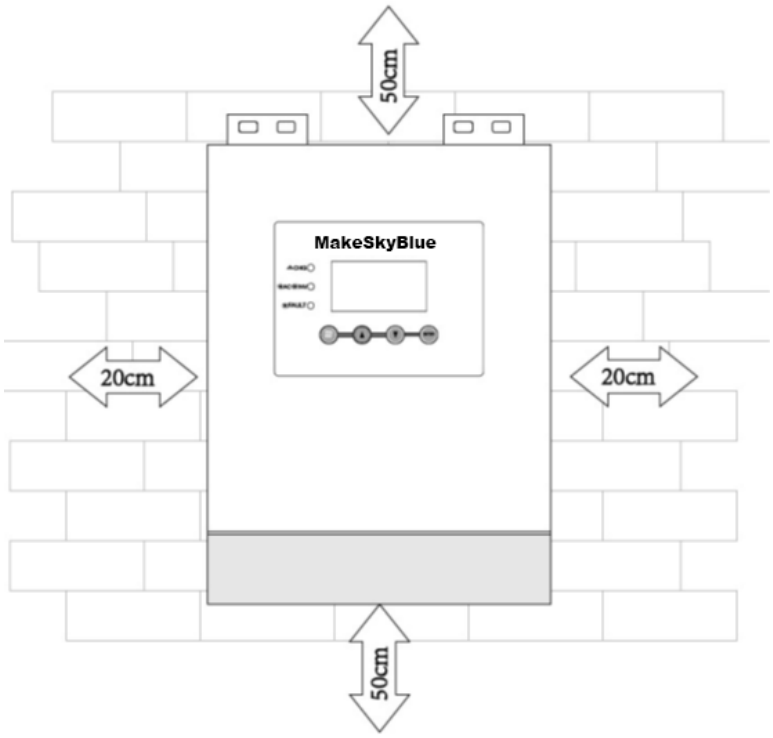
Mount on a solid surface

Install this inverter at eye level in order to allow the LCD display to be read at all times.

The ambient temperature should be between 0°C and 55°C to ensure optimal operation.

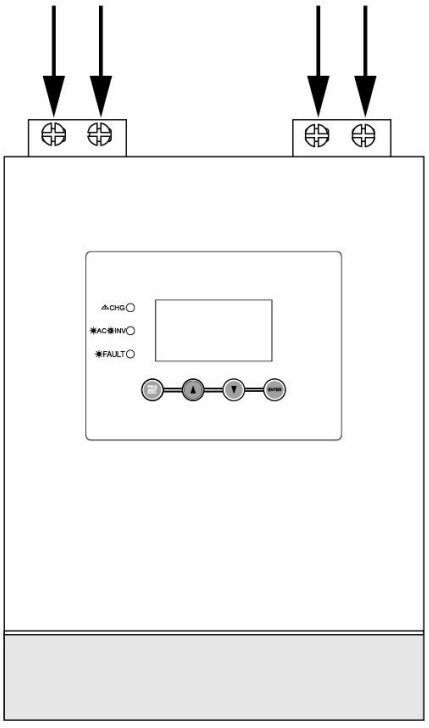
The recommended installation position is to be adhered to the wall vertically.

Be sure to keep other objects and surfaces as shown in the right diagram to guarantee sufficient heat dissipation and to have enough space for removing wires.



⚠**SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY.**

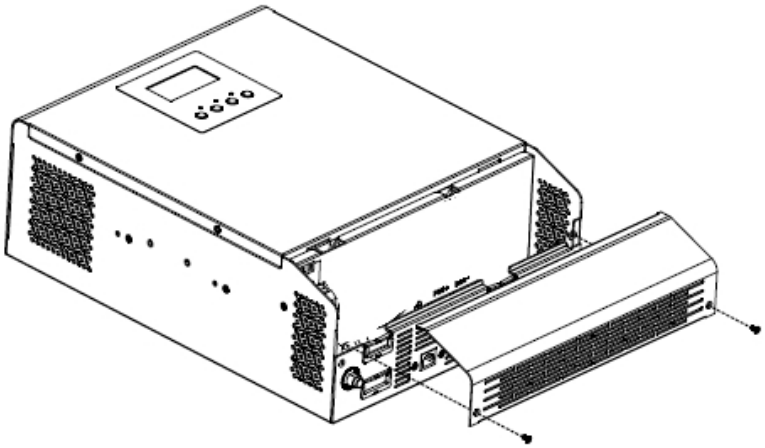
Install the unit by screwing three screws. It's recommended to use M4 or M5 screws.

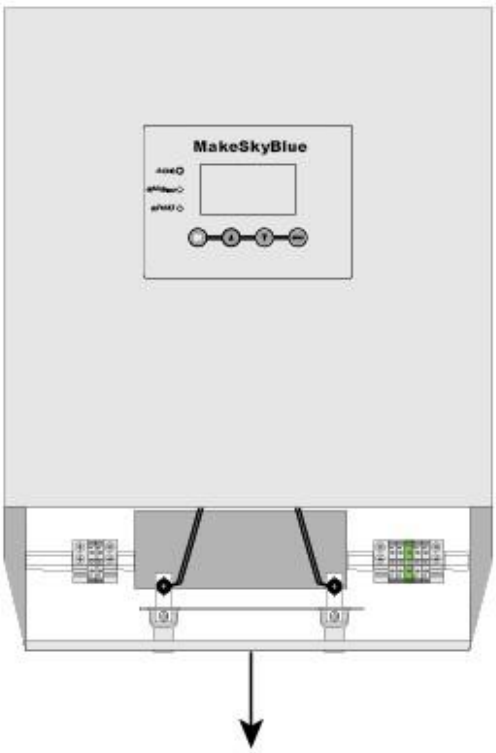


Connected and Operated

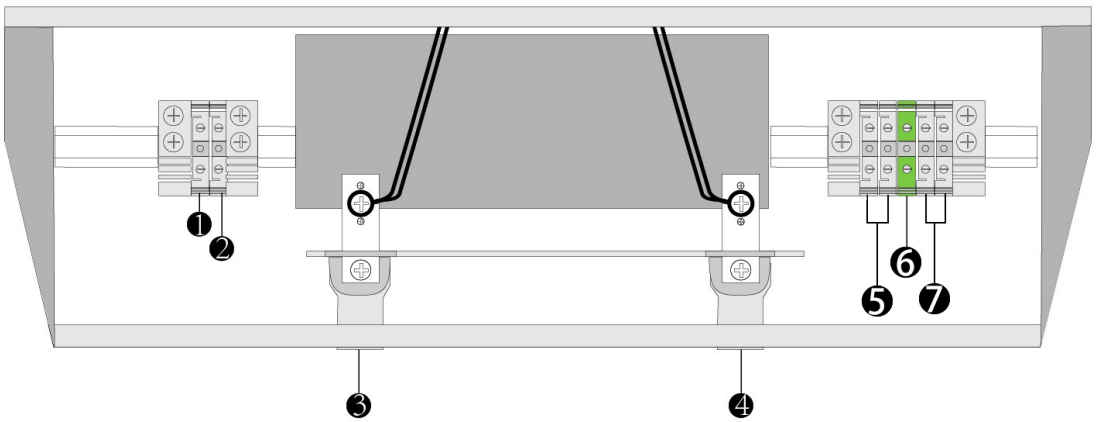
Preparation

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





Terminals named



1. PV+ Input
2. PV- Input
3. Battery + Input
4. Battery - Input
5. GRID AC L/N Input
6. Ground
7. AC L/N Input to load

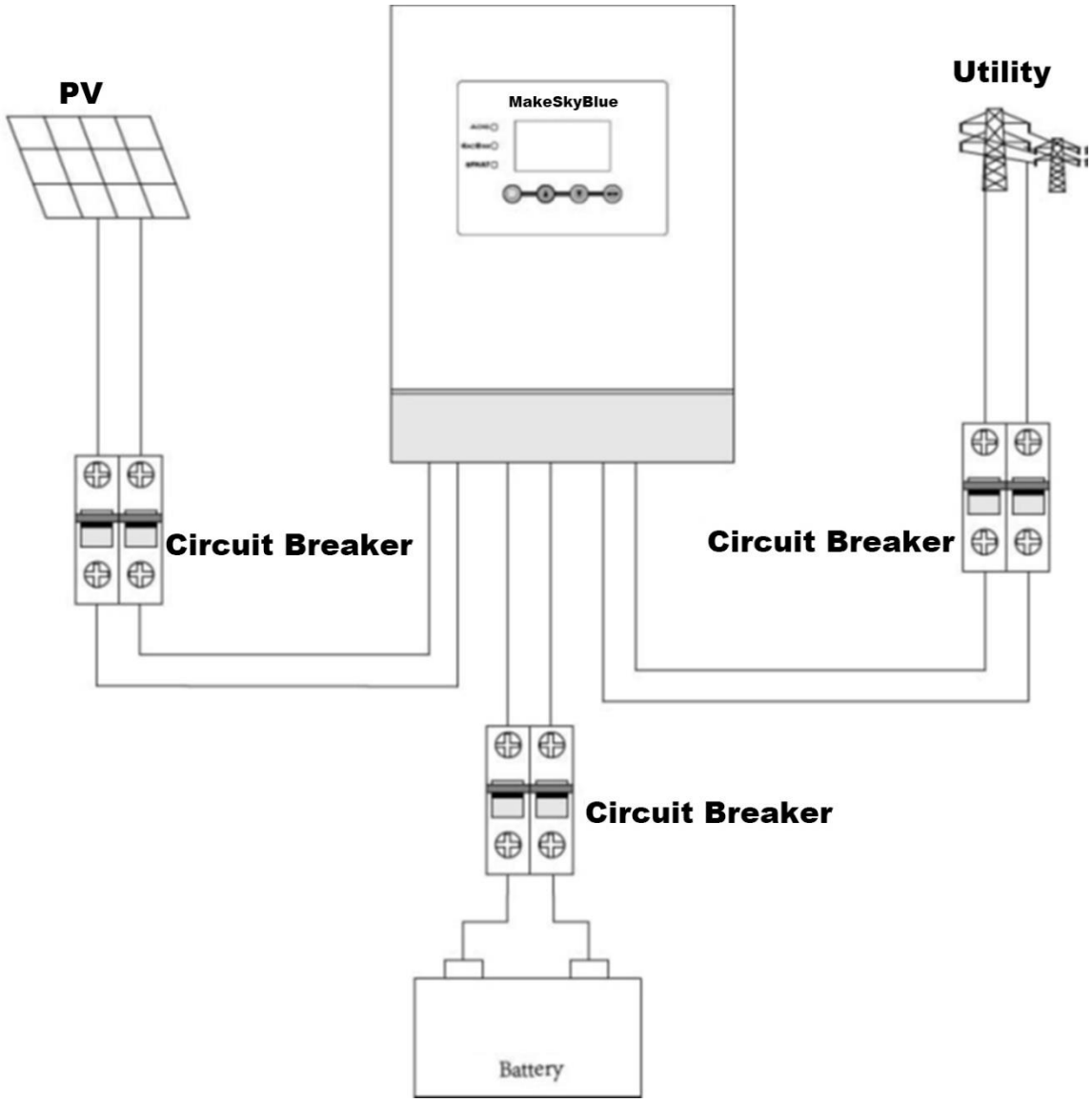
AC Input/Output Connection CAUTION!!

Before connecting to AC input power source, please install a **separate** AC breaker between inverter 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. The recommended spec of AC breaker is 10A for 1KVA, 20A for 2KVA, 32A for 3KVA, 40A for 4KVA and 50A for 5KVA. **CAUTION!!** There are two terminal blocks with "IN" and "OUT" markings. Please do NOT mis-connect input and output connectors.

Battery Connection CAUTION: For safety operation and regulation compliance, it's requested to install a separate DC over-current protector or disconnect device between battery and inverter. It may not be requested to have a disconnect device in some applications, however, it's still requested to have over-current protection installed. Please refer to typical amperage in below table as required fuse or breaker size.

Then, insert AC output wires according to polarities indicated on terminal block and tighten terminal screws. Be sure to connect PE protective conductor (yellow-green**)** first.

PV Connection CAUTION: Before connecting to PV modules, please install **separately** a DC circuit breaker between inverter and PV modules.



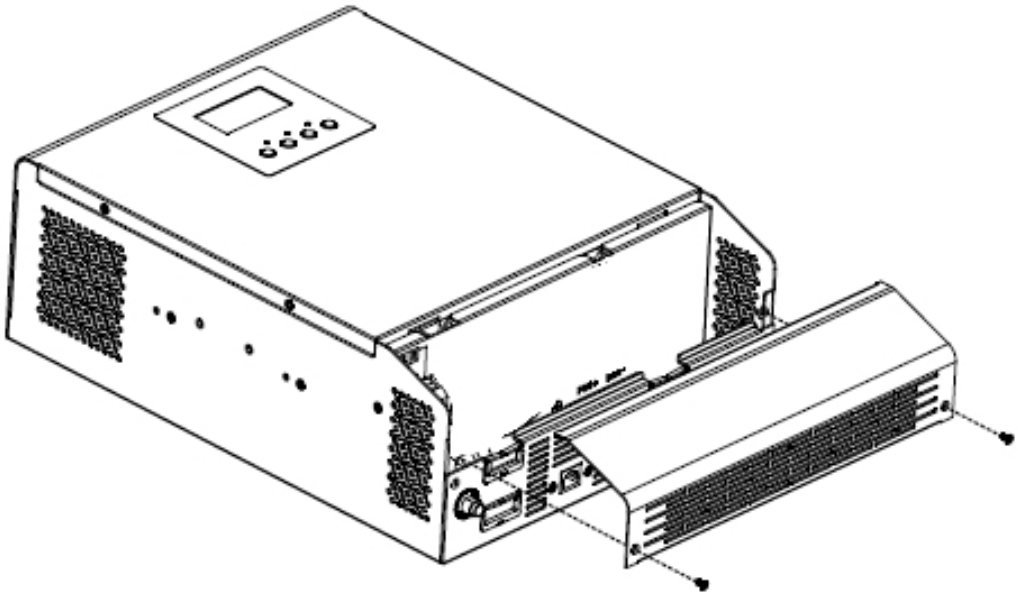
Utility AC, battery, solar panel input will require the installation of circuit breaker, circuit breaker Specifications are as follows:

Circuit breaker 1	PV input circuit breaker	1KW-4KW@40A
		5KW@60A
Circuit breaker 2	Battery input circuit breaker	1KW-2KW@63A 3KW-4KW@100A

		5KW@150A
Circuit breaker 3	AC input circuit breaker	1KW-4KW@25A
		5KW@40A

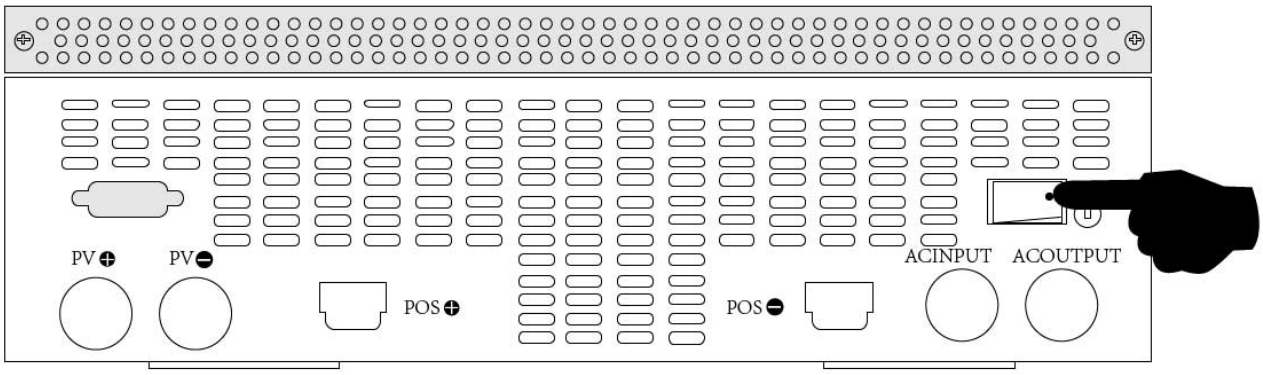
Final Assembly

After connecting all wirings, please put bottom cover back by screwing two screws as shown below.



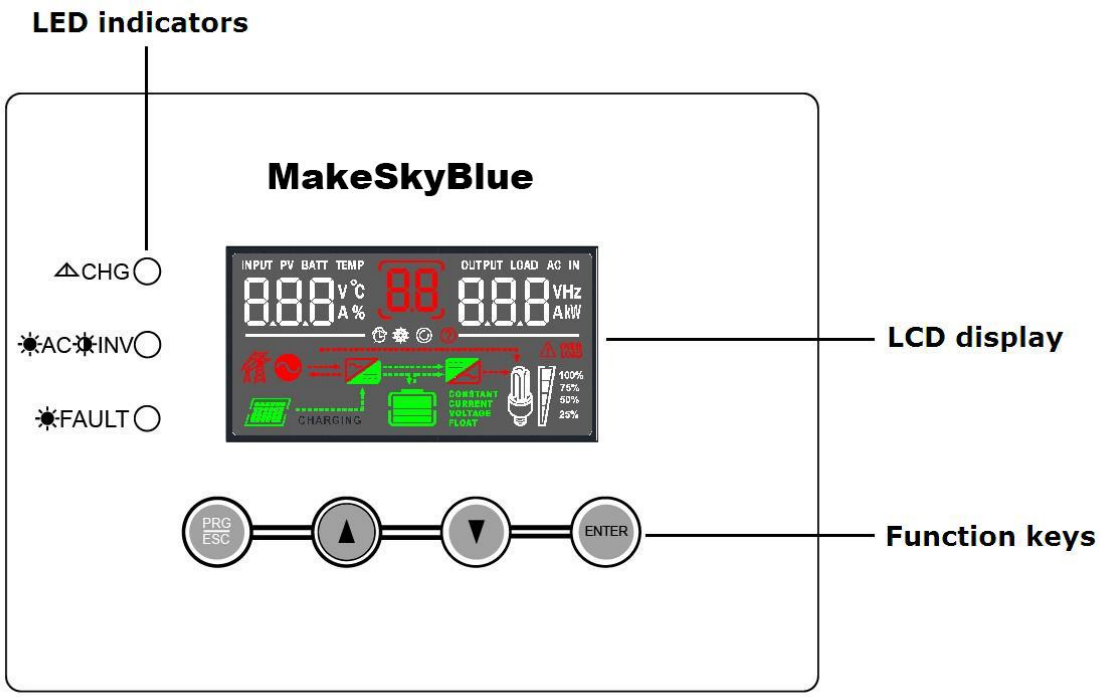
OPERATION

Power ON/OFF



Once the unit has been properly installed and the batteries are connected well, simply press On/Off switch (located on the button of the case) to turn on the unit.

Operation and Display Panel



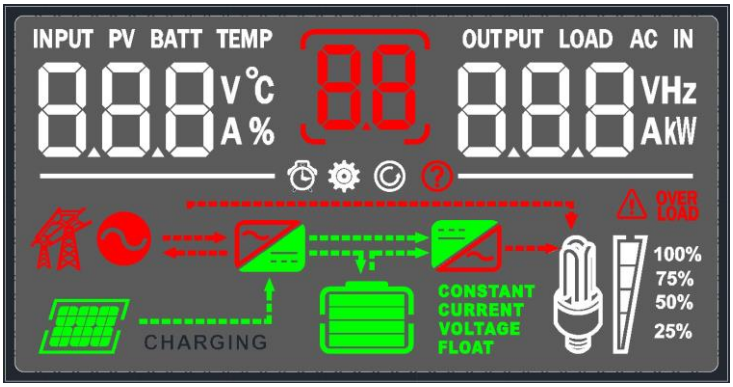
LED Indicator

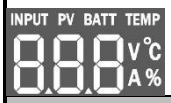
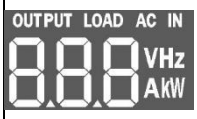
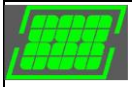
LED Indicator			Status Instruction
CHG	Green	Solid On	Battery is fully charged
		Flashing	Battery is charging
AC / INV	Red	Solid on	Output is powered by utility in Line mode
		Flashing	Output is powered by battery or PV in battery mode
FAULT	Yellow	Solid On	Fault occurs in the inverter
		Flashing	Warning condition occurs in the inverter

Function Keys

Keys	Instruction
PRG/ESC	To enter setting mode or exit setting mode
UP	To go to previous selection
DOWN	To go to next selection
ENTER	To confirm the selection in setting mode

LCD Display Icons



Icons	Description
Input Source Information	
PV	Indicates the PV input
	Indicates the AC input
	Indicate input voltage, input current, PV voltage, battery voltage and charger current
Configuration Program and Fault Information	
	Indicates the setting programs. Indicates the warning and fault codes
Output Information	
	Indicate output voltage, output frequency, load in Watt
Battery Information	
	Display battery level by 0-24%, 25-49%, 50-74% and 75-100% in battery mode and Charging status in line mode
Load Information	
	Indicates overload.
	Indicates the load
	Indicates unit connects to the PV panel
	Indicates the utility /MPPT charger circuit is working
	Indicates the DC/AC inverter circuit is working

LCD Setting

After pressing and holding PRG button for 3 seconds, the unit will enter setting mode. Press “UP” or “DOWN” button to select setting programs. And then, press “ENTER” button to confirm the selection or ESC button to exit.

Item	Description	Selectable option	
01	Output source priority : To configure load power source priority	SOL	Solar first
		UTI	Utility first
		SBU	Inverter first
02	AC Input Range Setting	UID	90Vac-280Vac(Wide)
		NOR	170Vac-280Vac(Normal)
03	Rated output voltage setting	208V	
		220V	Default
		230V	
		240V	
04	Rated output frequency setting	50Hz	Default
		60Hz	
05	Power saving mode Enable/Disable	OFF	Saver Mode OFF
		ON	Saver Mode ON
06	Charger source priority Prohibit user configuration	CSO	Solar first: Solar energy will charge battery as first priority. Utility will charge battery only when solar energy is not available.
		CUT	Utility first: Utility will charge battery as first priority. Solar energy will charge battery only when utility power is not available.
		SNU	Solar and Utility: Solar energy and utility will charge battery at the same time.
		OSO	Only solar: Solar energy will be the only charger source no matter utility is available or not.
07	Battery Type Setting	AGM	Default
		FLOOD	
		Lithium	14V for 12V battery 28V for 24V battery 56V for 48V battery (Voltage can’t be changed)
		Defined	Only factory to set it
08	Rated power setting	1K~5K	Prohibit user configuration
09	Battery Number setting	1~4	Prohibit user configuration
10	MPPT charger communication	OFF	Default value is OFF and protocol is modbus which can communication with the monitor software.
		ON	If MPPT comm enable, the protocol is changed.
11	Setting voltage point back to Utility Source when selecting "SBU priority" or "Solar first" in program 01.	1.85(cell) ①	Utility Source on line, The battery voltage is reduced to the following parameters, it will load switch to Utility Source, if there is no Utility Source, it will switch to the Inverter to continue. When selecting "SBU priority" or "Solar first" in program 01.
12	Setting voltage point back to Battery Mode when selecting "SBU priority" or "Solar first" in program 01.	2.25(cell) ①	Utility Source on line, The battery voltage up to this parameter, the load will switch to the Inverter to continue. When selecting "SBU priority" or "Solar first" in program 01.

13	Charge Current setting	Prohibit user configuration	AC Charge Current
14		Default is 30A	Solar Charge Current 1KW-2KW, can't be over 30A 3KW-5KW, can't be over 60A

Notes: LCD Setting

① 1.85(cell) AND 2.25(cell)

In fact, every 12V's lead acid battery is connected in 6 CELL series by 2V, then this parameter is representative of the battery voltage of each 2V/PC.

For example, a 24V battery system, program 09 parameter is 2; contains 2PCS - 12V batteries in series, then a total of 2V*6CELL battery,

If program 11 is set to 1.85V, then 2V*6CELL*1.85V=22.5V, which means that when the battery voltage is reduced to 22.5V, it is by-passed to the Utility Source. When there is no Utility Source, this parameter is ignored, the battery's Low DC Cut-off Voltage protection value is Table 2.

If program 12 is set to 2.25V, then 2V*6CELL*2.25V=27V, which means that when the battery voltage is charged to the 27V, it will continue to work from the Utility Source to the Inverter.

The above concept applies to lithium battery.

UTI:

Utility will provide power to the loads as first priority.

Solar and battery energy will provide power to the loads only when utility power is not available.

SOL:

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 the loads at the same time.

Utility provides power to the loads only when any one condition happens:

- Solar energy is not available
- Battery voltage drops to either

low-level warning voltage or the setting point in program 11.

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 11.

LCD Display Setting

Press "UP" or "DOWN" button to select Display Operation parameters

Display Information		
Input voltage	**Fault code**	**Output voltage**
Input current	**Error code**	**Output current**
Battery voltage		**Output frequency**
Dc bus voltage		**Load in kW**
Battery current		**Output voltage**
PV voltage		**PV Charger current**
MPPT charge temperature		**MPPT KW**

If no fault or error happen, the Lcd will display "—

Fault Reference Code

Fault Code / Error code	Fault Event	Explanation / Possible cause	What to do
16	AC GRID Fault	The voltage or frequency of abnormal	Check the frequency in the specified range
20	Bypass voltage abnormal	Bypass voltage exceeds the scope of work	Check the voltage in the specified range
24	Bypass overload	Bypass work overload	Reduce the connected load by switching off some equipment.
28	AC GRID is too low	The grid is not connected	Check if GRID wires are connected well
30	Bypass Switching frequency overrun	Bypass/inverter switching frequency limit	Wait for the next hour after recovery
32	Output short circuited	Output short circuited	Check if wiring is connected well and remove abnormal load
34	Discharge end	Battery capacity is too low	Charge or change the batteries
38	The battery test failed	Low Battery	Charge or change the batteries
47	Rectifier fault	Bus overvoltage	Restart the unit, if the error happens again, please return to repair center.
		Bus voltage is too low	
49	Inverter fault	The inverter voltage is abnormal	Restart the unit, if the error happens again, please return to repair center
51	Over Temperature	Internal temperature of inverter component is over 85°C	Check whether the air flow of the unit is blocked or whether the ambient temperature is too high
55	Inverter output overload	Inverter output Over current or surge	Wait a minute after automatic recovery
57	Inverter overload timeout	Over current or surge	Please shut down now
65	Battery Low	The battery voltage is too low	Charge or change the batteries

Troubleshooting for MPPT

Code	Description	How to solve
18	Input PV voltage is low	Increase the PV voltage
60	Over-temperature protection	Fan will work and temperature reduction automatically
63	Battery voltage is high	Battery high voltage protection and wait for recovery
65	Battery voltage is low	Battery over-discharge and wait for recovery
71	Input PV voltage is high	Decrease the PV voltage
73	Over-charging current	Decrease the PV power

SPECIFICATIONS

Model	1KVA-12-230	1KVA-24-230	1KVA-48-230	2KVA-12-230	2KVA-24-230	2KVA-48-230	3KVA-24-230	3KVA-28-230	4KVA-48-230	5KVA-48-230
RATED POWER	1000VA /800W	1000VA /800W	1000VA /800W	2000VA/ 1600W	2000VA/ 1600W	2000VA/ 1600W	3000VA/ 2400W	3000VA/ 2400W	4000VA/ 3200W	5000VA/ 4000W

INPUT										
AC Voltage	120VAC / 230 VAC						230 VAC			
Selectable Voltage Range	90-280VAC									
Frequency Range	50 Hz / 60 Hz									
OUTPUT										
AC Voltage (Inverter. Mode)	120/230 VAC ± 3%						230VAC ± 3%			
Surge Power	2000W			4000W			6000W		8000W	10000W
Efficiency (Peak)	90%-92%			93%						
Transfer Time	<10ms									
Waveform	Pure sine wave									
BATTERY & AC CHARGER										
Battery Voltage	12VDC	24VDC	48VDC	12VDC	24VDC	48VDC	24VDC	48VDC		
Floating Charge Voltage	14VDC	28VDC	56VDC	14VDC	28VDC	56VDC	28VDC	56VDC		
Overcharge Protection	16VDC	31VDC	62VDC	16VDC	31VDC	62VDC	31VDC	62VDC	60VDC	
SOLAR CHARGER & AC CHARGER										
Maximum PV Array Power	400W	800W	1500W	600W	800W	1500W	1500W	3000W	3000W	
MPPT Range @ Operating Voltage	20~80VDC	37~100VDC	72~160VDC	20~80VDC	37~100VDC	72~160VDC	37~100VDC	72~160VDC	72~ 160VDC	
PV Over-voltage Protection (Open Circuit Voltage)	90VDC	105VDC	160VDC	90VDC	105VDC	160VDC	105VDC	160VDC	160VDC	
Maximum Solar Charge Current	30A	30A	30A	30A	30A	30A	60A	60A	60A	
Maximum AC Charge Current	/	/	/	/	/	/	10A / 20A	10A / 15A	20A	
Maximum Charge Current	/	/	/	/	/	/	70A	70A	80A	
Standby Power Consumption	11W									
Maximum Efficiency	98%									
PHYSICAL										
Dimension, D x W x H (mm)	370 x230 x 100						455 x 300 x 110			
Net Weight (kgs)	4.7	4.7	4.7	4.8	4.8	4.8	8.4	8.4	8.5	8.5
OPERATING ENVIRONMENT										
Humidity (Non-condensing)	5% to 95% Relative Humidity									
Operating Temperature	0°C - 55°C									
Storage Temperature	-15°C - 60°C									

MakeSkyBlue (Shenzhen) Technology Co., LTD

1402M, Bldg. C6, Hengfeng Industry Zone, Hezhou, Baoan

Shenzhen Guangdong 518101 China

Tel: 86 755 2331 3263

www.makeskyblue.com sales@makeskyblue.com

V1.6