

ES-BOX1 (5120WH)

ALL-IN-ONE SOLAR ESS USER MANUAL

**3.2KVA INVERTER
5KWH LFP BATTERY**



CONTENT

1. ABOUT THIS MANUAL.....	
1.1 CATALOG.....	
1.2 SCOPE.....	
1.3 SAFETY DESCRIPTIONS	
2. INTRODUCTION.....	
2.1 FUNCTION.....	
2.2 BASIC SYSTEM STRUCTURE.....	
3. WIFI CONNECTIVITY	
4. INSTALLATION.....	
4.1 UNPACKING AND INSPECTION.....	
4.2 PREPARE.....	
4.3 INSTALL UNIT.....	
4.4 AC INPUT/OUTPUT CONNECTION.....	
4.5 PV CONNECTION.....	
4.6 FINAL ASSEMBLY.....	
5. OPERATION.....	
5.1 POWER SWITCH.....	
5.2 OPERATION AND DISPLAY PANEL.....	
5.3 LCD DISPLAY ICONS.....	
5.4 LCD SETTING.....	
5.5 FAULT REFERENCE CODE.....	
5.6 WARNING INDICATOR.....	
6. TROUBLE SHOOTING.....	
7. SPECIFICATION.....	
TABLE 1 SOLAR MODE SPECIFICATIONS.....	
TABLE 2 LINE MODE SPECIFICATIONS.....	
TABLE 3 CHARGE MODE SPECIFICATIONS.....	
TABLE 4 BATTERY SPECIFICATIONS.....	
TABLE 5 INVERTER MODE SPECIFICATIONS.....	

1. ABOUT THIS MANUAL

1.1 CATALOG

This manual describes how to assemble, install, operate the units and how to troubleshoot of this unit. Please read this manual carefully before installation and operation. Keep this manual for future reference.

1.2 SCOPE

This manual provides safety guidelines of installation, and the information on tools and wiring.

1.3 SAFETY INSTRUCTION

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

1. Read and follow all installation, operation, and maintenance information carefully before using the product.
2. Do not disassemble the unit personally. Take it to a qualified service center to repair.
3. Disconnecting all power supply before any maintaining or cleaning, please noted that if you only turn off the unit are not safe enough.
4. **WARNING!!:** Only qualified service persons are allowed to operate this product. If fault not solved after following troubleshooting table, please send this system back to local dealer or service center for maintenance.
5. **WARNING:** Because this system is non-isolated, only three types of PV modules are adaptable: mono crystalline, poly crystalline with class A - rated and CIGS modules. To avoid any malfunction, do not connect any PV modules which likely with current leakage flow to the system. For example, grounded PV modules may cause current leakage flow to the system. When using CIGS modules, please be sure of NO grounding.
6. **CAUTION:** It's requested to use PV junction box with surge protection. Otherwise, it may cause damage on system.

2. INTRODUCTION

This is a multi - function system, combining varies function of inverter, solar charger and battery charger, supply uninterruptible electricity energy to loads. Its easy - accessible comprehensive LCD touch screen display allowed user setting the varies date according to user's requirements, such as battery charging current, AC/solar charger priority, and setting different input voltage based on different applications.

2.1 FEATURES

1. Hybrid solar inverter(on/off grid inverter).
2. Output power factor PF=1.0.

3. On - grid with energy storage.
4. Configurable AC/Solar Charger priority via LCD setting.
5. Smart battery charger design for optimized battery performance.
6. Compatible to mains voltage or generator power.
7. Overload, over temperature, short circuit protection, fault record, history record.
8. External WIFI devices.

2.2 BASIC SYSTEM ARCHITECTURE.

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

Generator or AC. PV modules .

Consult with the integrator who provide you system about architectures as you request.
This inverter can supply power to all kinds of appliances in home or office, including motor - Type such as tube light, fan, refrigerator, air-conditioner and so on.

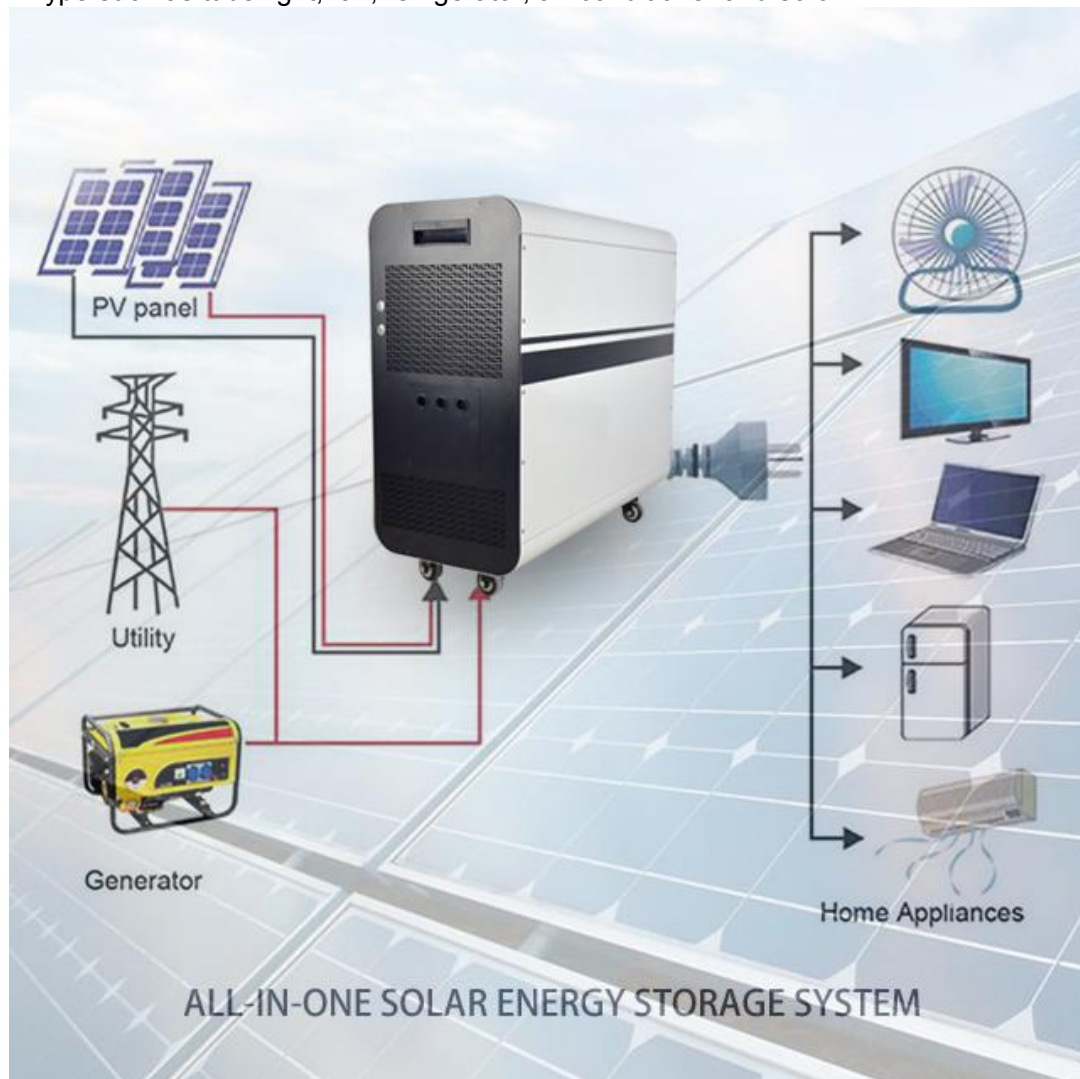


Figure 1 Hybrid Power System

2.3 Product Overview



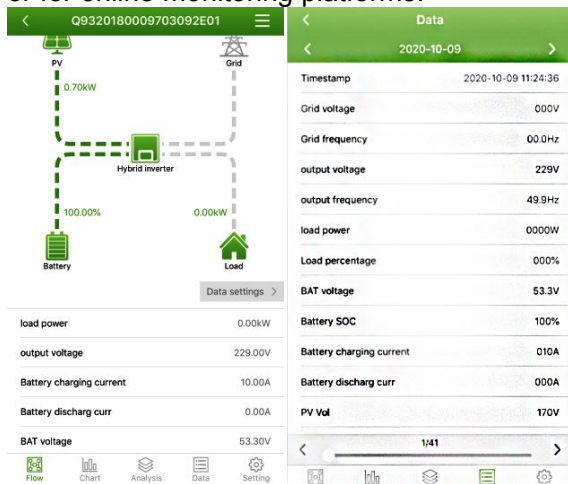
- ① Carrying handle
- ② Inverter System Button
- ③ Battery BMS Button
- ④ AC Charge Input Port
- ⑤ AC Discharge Output Port
- ⑥ PV Charge Input Port
- ⑦ Movable Wheels
- ⑧ LCD Touch Operation Display Screen

1. Carry Handle	2. Device switch	3. Battery BMS switch	4. AC Charge Input Port
5. AC Output Port	6. PV Charge Input Port	7. Movable wheels	8. LCD operate touch display screen

3. WIFI Connectivity (Optional)



This system come equipped with integrated Wi-Fi capability which makes it very easy to integrate into a home network. This makes it ideal for local monitoring via the inverter's own wireless home network or for online monitoring platforms.



4. INSTALLATION

4.1 UNPACKING AND INSPECTION

Before installation, please inspect the unit. Be sure that everything in the package is not damaged. The following items inside of package would be received.

01.All-in-one solar system 02.User manual

4.2 PREPARATION.

Please remove the two screws on the back cover of the device before opening it.

4.3 INSTALLATION SITES SELECTION.

Consider the below points before selecting where to install:

- 1.Do not mount the system on the surface of flammable construction materials.
- 2.Mount on the surface of solid material.
- 3.Install this system at a visible place in order to allow the LCD display to be read at all times.
- 4.For proper air circulation and heat dissipate, make sure there is 20cm distance from the two side, 50cm distance from bottom of the unit.
- 5.The ambient temperature should be between 0°C and 55°C to ensure optimal operation.
6. The recommended installation position is to be adhered to the wall vertically.
7. Be sure to keep other objects and surfaces as shown in the diagram to guarantee sufficient heat dissipation and to have enough space for collecting wires.

4.4 AC INPUT/OUTPUT CONNECTION

CAUTION! Before connecting to AC input power source, please install a separate AC breaker between system and AC input power source. This will ensure the system can be securely disconnected during maintenance and fully protected from over current of AC input.

The recommended spec of AC breaker is 3.2KVA 32A. There are two terminal blocks with “IN” and “OUT” markings. Please do NOT connect input and output connectors wrong.

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

Model	Gauge	Cable (mm ²)	Torque Value
3.2KVA	10AWG	6	1.2 Nm

4.5 PV CONNECTION PV

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

WARNING! It's very important for system safety and efficient operation to use appropriate cable for PV module connection. To reduce risk of injury, please use the proper recommended cable size as below.

Model	Gauge	Cable (mm2)	Torque Value
3.2KVA	8AWG	8	1.2 Nm

WARNING: Because this system is non-isolated, only three types of PV modules are acceptable: single-crystalline, poly crystalline with class A - rated and CIGS modules. To avoid any malfunction, do not connect any PV modules with possible current leakage to the system. For example, grounded PV modules will cause current leakage to the system. When using CIGS modules, please be sure NO grounding.

CAUTION: It's requested to use PV junction box with surge protection. Otherwise, it will cause damage on system when lightning occurs on PV modules.

PV Module Selection:

When selecting proper PV modules, please be sure to consider below parameters

1. Open circuit Voltage (Voc) of PV modules not exceeds maximum PV array open circuit voltage of system.
2. Open circuit Voltage (Voc) of PV modules should be higher than minimum battery voltage.

INVERTER MODEL	3.2KVA
Max. PV Array Open Circuit Voltage	450Vdc
PV Array MPPT Voltage Range	120Vdc~450Vdc

Application Example:

Solar Panel Spec: 250Wp Best working voltage: 30.1Vdc Best working current: 8.3A Open circuit voltage(Voc): 37.7Vdc Short circuit current(Isc): 84A	SOLAR INPUT	Qty of Panels	Total input Power
	(Min in serial: 6 pcs, max. in serial: 10pcs)		
	6pcs in serial	6pcs	1500W
	8pcs in serial	8pcs	2000W
	10pcs in serial	10pcs	2500W

PV Module Wire Connection

Please follow below steps to implement PV module connection:

1. Remove insulation sleeve 10 mm for positive and negative conductors.
2. Suggest to put bootlace ferrules on the end of positive and negative wires with a proper crimping tool.
3. Fix PV wire cover to the system with supplied screws as shown in below chart.



4.6 FINAL ASSEMBLY

After connecting all wires, please put bottom cover back by screwing screws.

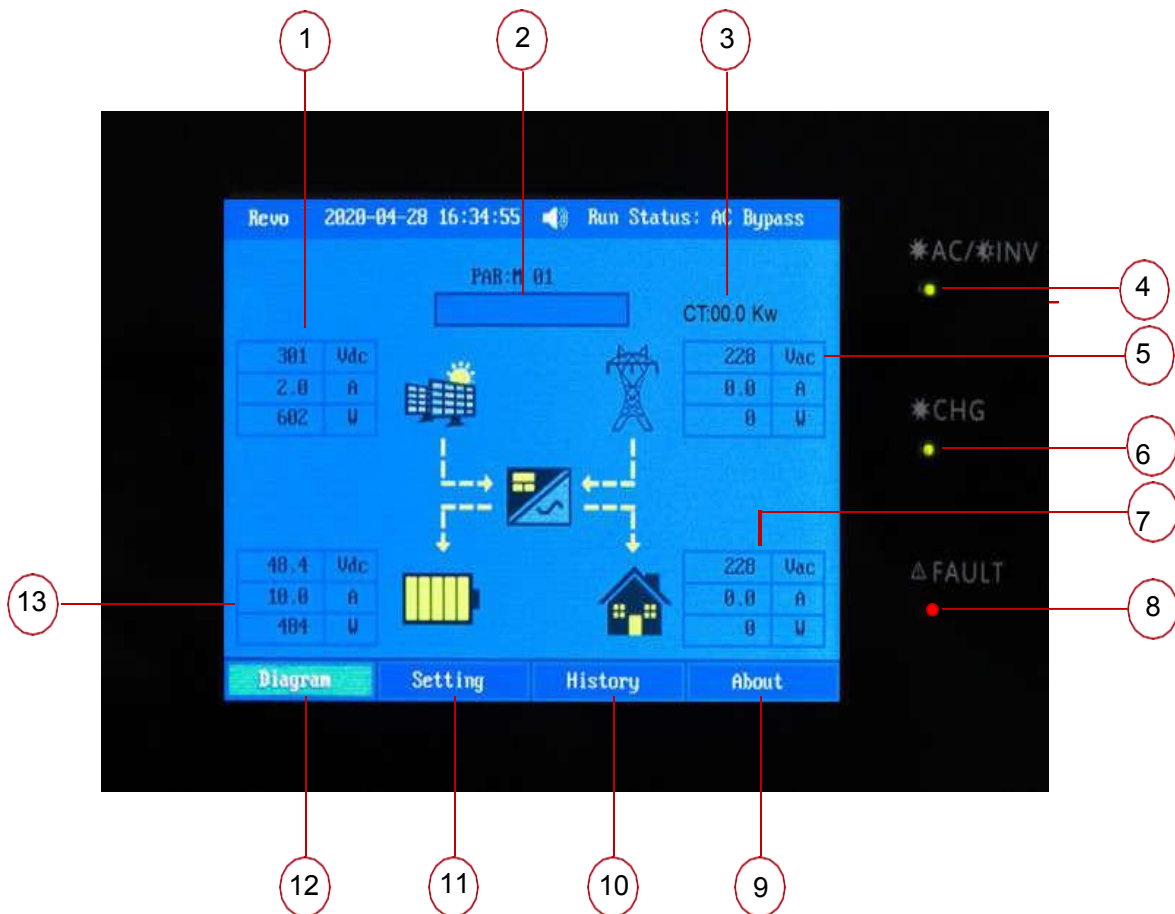
5. OPERATION

5.1 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.

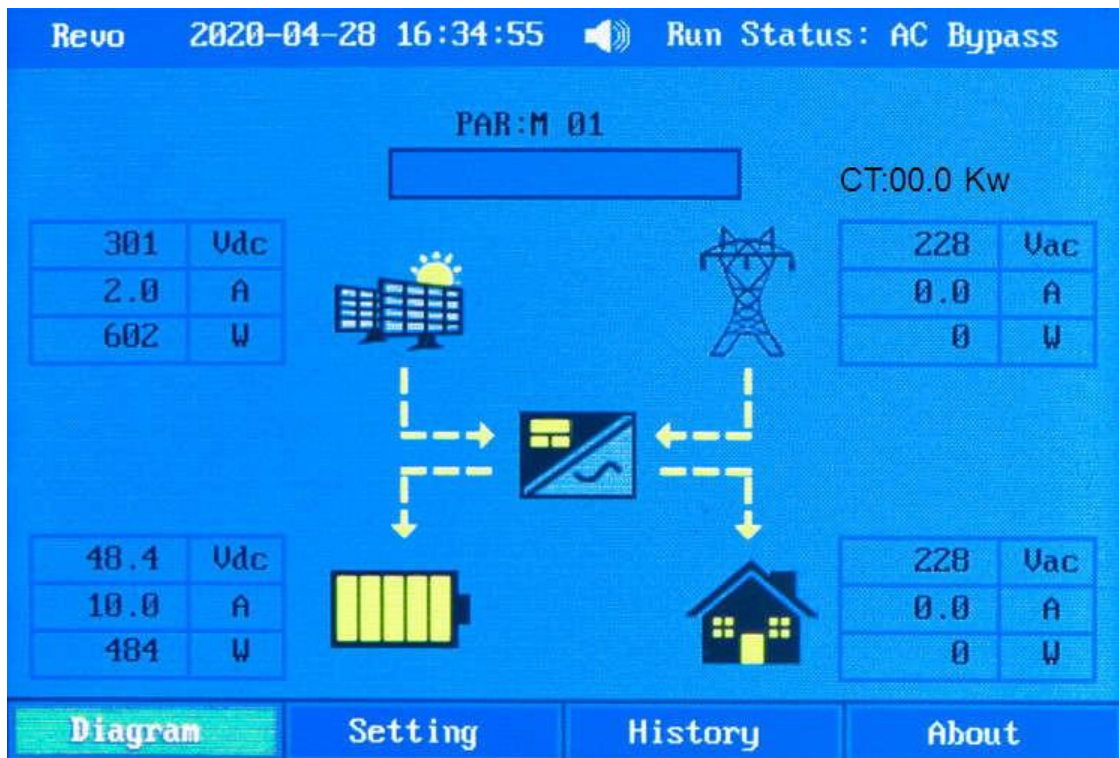
5.2 OPERATION AND DISPLAY PANEL

The operation and display panel, shown in below chart, it is on the front panel of the system. It includes three indicators, four function keys and a LCD display, indicating the operating status and input/output power information.




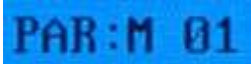









1. PV input information
2. Operation information
3. CT power
4. AC/INV indicator
5. AC Input /Grid power information
6. Charging indicator
7. AC Output information
8. Fault indicator
9. About button
10. History button
11. Setting button
12. Diagram button
13. Battery information

5.3 LCD DISPLAY ICONS



Icon	Description
	Product model and operation time
	Operation information include fault and warning code
	Input voltage, current and power information
	Output voltage, current and power information

	PV voltage ,current and power
	Battery voltage and current information
	Indicates the DC/AC inverter circuit is working
	Parallel status
	Inverter working status
	Volume icon
	CT Power
	This button includes LCD, inverter, MPPT version, inverter model
	This button includes generation, event, help
	The setting button include language, working mode, input, output, battery, charge, PV, parallel, date and time, Grid, peak valley, and other function settings
	Work state diagram

5.4 LCD SETTING

After press function button, the unit will enter setting mode. Set password:1155

Button	Function	Illustrate
Diagram	Main Display Interface	Return to the default display screen
Set up	Language	Chinese: Chinese display English: English Display
	Working mode	AC: (default) AC will provide power to the load as the first priority,solar charging the battery. When solar energy is insufficient,AC and solar energy charge the battery at the same time. When AC is unavailable it will be powered by solar energy or batteries.
		Solar: Solar energy provides power to the loads as the first priority. When the solar energy is sufficient,the extra energy will charges the battery. When solar energy is insufficient for load,batteries and solar will supply power at the same time. When solar energy and batteries are insufficient or solar energy is unavailable,AC power supply power to the load.
		Battery: Battery provides power to the loads as the first priority. AC provides power to the loads when battery voltage drop to low-level warning voltage or setting point,and the AC power will charge the battery. When the battery is fully charged,battery provides power to the load again.
		Solar + AC: Solar energy provides power to the load as the first priority. If solar energy is not sufficient to power all load,AC energy will supply power the load at the same time

Set up	Input	AC Width Range: (Default) 120-280Vac AC narrow range: 170-280Vac		
	Output	Output Voltage: (Default) 230Vac、 220Vac 、 240Vac Output frequency: (Default)50Hz 、 60Hz		
	Battery	Battery Type: Lithium battery		
		User	Bulk charging voltage: 48v mode:56.0vdc(default) setting range:48V to 60V Floating charge voltage:48v mode:54.0vdc(default) setting range:48V to 60V setting increase or decrease of 0.1V	
		Cut off vol	Low Vol Disconnect: 48v mode :44.0vdc(default) Setting range:36v to 50v setting increase or decrease of 0.1V.	
			Shutdown Vol: 48v mode :42.0vdc(default) Setting range:36v to 50v setting increase or decrease of 0.1V.	
	High Vol Reconnect: 48V model: 54.0Vdc(default) setting range :40V to 58V setting increase or decrease of 0.1V. NOTE: Setting voltage point to battery mode When selecting “Solar priority” or “Battery priority” in program			
Lithium Battery	After the lithium battery pack and the inverter are connected through the CAN port, you can view the lithium battery BMS management information, including battery voltage, charging current, discharging current, discharging voltage, battery temperature.			

	Charge current	<p>Total Charge: (default 10A) setting range is 10A to 90A,the increment or decrement is 10A per click.</p> <p>Note: Total Charge=Solar Charging Current+Utility Charging current</p> <p>AC Charge: (default 10A) setting range is 0A to 60A,the increment or decrement is 10A per click.</p> <p>Note: when the AC charging current is set to '0A', if PV, battery and Utility exist at the same time, the PV will only charge the battery and the load is powered by utility, and the grid-tie function is not available.</p>
	PV	<p>PV CAP: (Default 3k) According to the actual capacity of the solar panel, users fill in and set the rang of 1kva-8kva,the increment or decrement is 0.1k per click.</p>
Set up	Parallel setting	This version of the all in one solar system does not support grid connection.
	Date & Time setting	You can set the local date and time in your country.
	Grid	<p>Select "On Grid" in Grid setting: when in On Grid mode solar will power loads first, then extra power feed back to utility; When Solar power is not enough, the utility will assist it to power loads.</p> <p>Note: if the utility charging is selected to be"0A",the grid connection function will not be available.</p>
	Peak and Valley	<p>No charge1: optional</p> <p>No charge2: optional</p> <p>NOTE: when peak valley no charging, utility will stop charging. If pv, battery and utility exist at the same time, the PV will only charge the battery and the load is powered by utility and the grid-tie function is not available</p>
	Other	<p>Beep: Optional buzzer sound</p> <p>Factory: Optional factory reset</p> <p>CT sensor: CT power calibration, set the range of 500-3000,the increment or decrement is 1 per click.</p> <p>Choose the AC+PV mode first, then choose the "Out Side CT" (in output side, when your loads power is big, PV will give more power to supplement it, but the biggest power it can supplied is PV output rate power)</p> <p>Please note: The direction of the CT must be right. (CT is connected in input side)</p>
History	Generation	Generated energy diagram display for per Day/Month/Year
	Event	History record for faulty date or others
	Help	Some solutions to failures and warnings
About	Version data	Version data display for LCD/inverter control board/MPPT program and machine model

5.5 FAULT REFERENCE CODE

Fault code	Fault event
01	Bus voltage is too high
02	Inverter voltage is too high
03	Inverter voltage is too low
04	Bus soft start failure
05	Overload fault
06	Output short circuited or over temperature
07	Battery voltage is too low
08	Inverter soft start failure
09	Bus voltage is too low
10	Battery voltage is too high
11	Over temperature
12	Battery voltage is too high
13	A phase lost
14	B phase lost
15	C phase lost
16	Output different
23	PV is over current
24	PV over temperature
25	PV Overload
26	PV boost fault

5.6 WARNING INDICATOR

Warning code	Warning Event
01	Battery voltage is too low
02	Input voltage is too low
03	Input voltage is too high
04	Overload
05	Over temperature
06	Fan is locked when inverter is on
07	Battery voltage is too high
21	PV voltage is too low
22	PV voltage is too high

6. TROUBLE SHOOTING

Problem	LCD/LED/Buzzer LCD / LED	Possible cause	What to do
Unit shuts down automatically during start up process	LCD/LED and buzzer will be active then complete off	The battery voltage is too low	1. Re-charge battery 2. Replace battery
No response after power on	No indication	1. The battery voltage is too low. 2. Internal fuse tripped.	1. Contact repair center for replacing the fuse. 2. Re-charge battery. 3. Replace battery
Mains exist but the unit works in battery mode	Input voltage is displayed as '0' on the LCD and green LED is flashing	Input protector is triggered	Check if AC breaker is turned on and AC wiring is connected well.
When the unit is turned on, internal relay is switched on and off repeatedly	LED is flashing	Insufficient quality of AC power	1. Check if AC wires are too thin and/or too long. 2. Check if generator (if applied) is working well or if input voltage range setting is correct. (UPS Appliance) Change output source
When the unit is turned on, internal relay is switched on and off repeatedly	LCD display and LED flashing	Battery is disconnected	Check if battery wires are connected well

Buzzer beeps continuously and red LED is on	Warning code 06	Fan fault	Replace the fan
	Warning code 05	Internal temperature of inverter component is over 100°C	Check whether the environment around the equipment well ventilated
	Fault code 07	The battery voltage is too high	Check if spec and quantity of batteries are meet requirements
		Battery is over-charged	Return to repair center
	Fault code 10	Parallel fault	Please check if the connection between the inverters is loose
	Fault code 06	Output short circuited	Check if wiring is connected well and remove abnormal load
	Warning code 05	Overload error, the inverter is overload 100% and overload time reaches the upper limit	Reduce the connected load by switching off some equipment
	Fault code 22	If PV input voltage is higher than specification, the output power will be derated. At this time, if connected loads is higher than derated output power, it will cause overload	Reduce the number of PV modules in series or the connected load
	Fault code 02/03	Output abnormal (Inverter voltage below than 190Vac or is higher than 260Vac)	1. Reduce the connected load 2. Return to repair center
	Fault code 01/04/06/08	Internal components failed	Return to repair center
	Fault code 23	Over current or surge	Remove abnormal load or check PV input
	Fault code 01	Bus voltage is too high	Restart the unit if the error happens again please return to repair center
	Fault code 09	Bus voltage is too low	
	Fault code 02/03	Output voltage is unbalanced	
	Fault code 11	Internal temperature of inverter component is over 85°C	check whether the environment around the equipment well ventilated
	Fault code 12	The battery voltage is too high	Check if spec and quantity of batteries are meet requirements
		Battery is over-charged	Return to repair center
	Fault code 13/14/15	Phase loss	1. check whether three- phase power is connected. 2. check whether the inverter turns on three- phase parallel
	Fault code 16	Output different	Check whether the output voltage and frequency of each inverter are set the same

7. SPECIFICATIONS

Table 1 Solar Mode Specifications

MODEL	3.2KVA
Normal DC voltage	48vdc
Max PV array power	2500W
Rated output power	3200W
Max PV open circuit voltage	450VDC
PV operating voltage range	120-450VDC
PV normal operating voltage	280-360VDC
Normal output voltage	230VAC
Output voltage range	230 ± 5%VAC
Normal output current	14A
Power factor	1.0
Efficiency(DC/AC)	≥92%
Frequency	50/60HZ
Overload protection	MPPT will close immediately as long as the input power is greater than the maximum output power
Max input current	20A

Table 2 Line Mode Specifications

Input Voltage Waveform	Pure Sine wave (AC or generator)
Normal Input Voltage	230Vac
Low Loss Voltage	120Vac±7V(wide range) 170Vac±7V(narrow range)
Low Loss Return Voltage	130Vac±7V(wide range) 180Vac±7V(narrow range)
High Loss Voltage	280Vac±7V
High Loss Return Voltage	270Vac±7V
Max AC Input Voltage	300Vac
Normal Input Frequency	50Hz / 60Hz (Auto detection)
Low loss Frequency	40±1Hz
Low loss Return Frequency	42±1Hz
High loss Frequency	70±1Hz
High loss Return Frequency	69±1Hz
Output short circuit protection	Circuit Breaker
Max AC charge current	60A (Optional 10A to 60A)
Efficiency (Line Mode)	>95% (Rated R load, battery full charged)
Communication	WIFI
Humidity	0-90% RH(No-condensing)
Operation temperature	0-50°C

Table 3 Charge Mode Specifications

INVERTER MODEL	3.2KVA
Charging Algorithm	3-Step
Charging Mode	
Charging Current	10/20/30/40/50/60Ap (@V _{IP} =230Vac)
Bulk Charging Voltage	48.0-60.0vdc (Default:56 vdc)
Floating Charging Voltage	48.0-60.0vdc (Default:54vdc)
Charging Curve	
Max. charging current(Solar+AC)	60A
Over-charging voltage	60vdc

Table 4 Battery Specification

Type	LiFePO4	
Nominal Energy	5120Wh	
Rated Capacity(Ah)	100Ah	
Rated Voltage	51.2V	
Discharge characteristic	Continuous Current	100A
	Over current protection	120A
Charge characteristic	Charge Voltage	56V
	Charge Current	≅ 60A
Over-charge Protection	Single cell Cut-off voltage	3.65V
	Single cell Recovery Voltage	3.58V
Over-discharge Protection	Single cell Cut-off Voltage	2.5V
	Single cell Recovery Voltage	3.0V
Over-current Protection	Cut-off current	120A
	Release condition	Release load
Short Circuit Protection	Short Circuit Protection	Enable
	Recovery condition	Release load
Self-consumption current	Working mode power consumption	≤25mA
	Idle mode power consumption	≤200uA

Table 5 Inverter Mode Specifications

Battery system voltage	51.2V
Waveform	Pure Sine wave
Output Voltage Regulation	230Vac \pm 5%
Output Frequency	50/60Hz \pm 1Hz
Peak Efficiency	\geq 90%
Power factor	1.0
Overload Protection	20s@101%~120% load ,10s@121%~150% load, 3-6s@ \geq 150% load
Transfer time	\leq 10ms typical (UPS); 20ms typical (Appliances) \leq 10ms (UPS) ; 20ms Typical (device)
Protection features	Low voltage protection; High voltage protection Overload protection; Over-temperature protection Short circuit protection; Over-charge protection; Battery reverse protection
Dimension(WxDxH)mm	710*300*600 (Not include wheels size) 710*300*670mm (Include wheels size)
Weight (Kg)	81Kg

Warranty Card

Thank you very much for choosing the ES-BOX1 (5120WH). Our company provides you with 3 years warranty period which begins on the date of purchase Warranty: please present the warranty card and fill in the relevant information in detail when a warranty service is requested.

Warranty Coverage

1. The warranty provided covers any quality problem occurring in normal operation conditions.
2. The warranty provided not cover any damage or defects caused by owner's abuse, misuse or negligent acts.
3. The warranty provided not cover owner's modification or dismantling of the product.
4. The warranty will be void if the label of the product is removed or defaced.

For the products not covered by this warranty, our company provides maintenance service, but the maintenance cost incurred is charged to the customer.

Model Number		Serial Number	
Date Of Purchase		Date of Maintain	
Customer's Name		TEL	
Customer's Address			
Marketing Unit			
Description of the abnormal phenomena			