PV Grid-connected Inverter

EA1KLPV/EA1K5LPV/EA2KLPV

User's Manual

Contents

1. Manual Instruction

1.1 Symbols used in this manual

This manual contains important instructions for safety and operation which must be understood and carefully followed during installation and maintenance of the equipment. In order to reduce the risk of electric shock and to be sure that the equipment is correctly installed and ready to operate, special safety symbols are used in the manual to highlight potential safety risks or useful information. The symbols are the following:

	**DANGER!**
	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	**WARNING!**
	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	**CAUTION!**
	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	**NOTICE**
	NOTICE indicates a situation which, if not avoided, could result in property damage.
	**Information**
	Information provides tips that are valuable for the optimal installation and operation of your product.

1.2 User group

This manual is for electrically skilled persons. The tasks described in this manual may only be performed by electrically skilled persons.

1.3 Validity

This manual applies to EA1KLPV/EA1K5LPV/EA2KLPV grid-connected inverter and describes the mounting, installation, commissioning, maintenance and troubleshooting procedures.
Keep this manual in a convenient place for future reference.

2. Safety Instructions

2.1 Intended use

EA1KLPV/EA1K5LPV/EA2KLPV is a PV inverter, which converts the direct current of the PV array to grid-compliant alternating current and feeds it into the power distribution grid. PV grid-connected system consists of PV modules, grid-connected inverters, metering device and power distribution system (Figure 1).

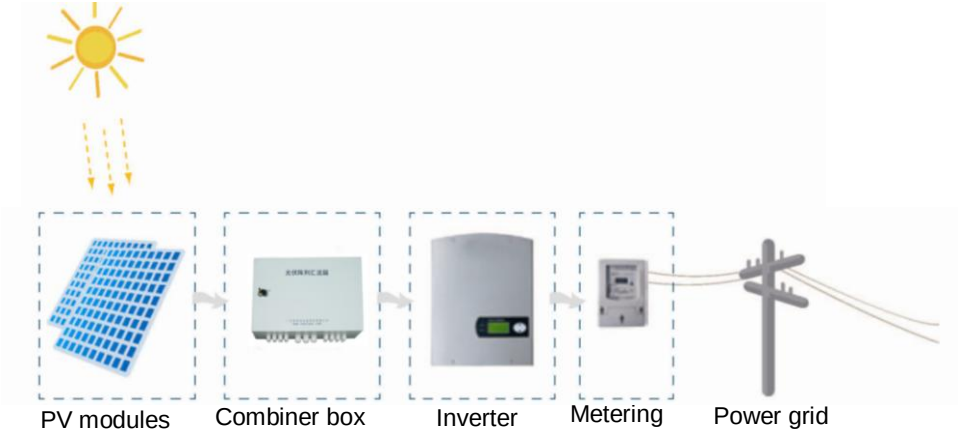


Figure 1 PV grid-connected system

The EA1KLPV/EA1K5LPV/EA2KLPV series inverter is suitable for indoor and outdoor use and may only be operated with PV arrays (PV modules and cabling) of protection class II... Do not connect any sources of energy other than PV modules to the inverter. Any other use can result in personal injury or property damage.

2.2 Safety instructions

	**DANGER!** **Danger to life due to high voltages in the inverter!**
	High voltages that can result in electrical shocks are present in the conductive component parts of the inverter. All work on the inverter may be carried out by qualified personnel only.

	**DANGER!** **Danger of burn injuries due to hot enclosure parts.**
	Do not touch enclosure during operation. Only touch the lid during operation.

	**DANGER!**
	Before opening the housing, the inverter must be disconnected from the grid and PV generator; while you must wait at least 5 minutes to let the energy storage capacitors fully discharged after disconnecting from the power sources.

	**WARNING!**
	The installation must be performed in full compliance with national and local standards and regulations.

	**WARNING!** Grounding the PV Generator
	Be sure that the PV generator frame and inverter connect to the ground in order to achieve maximum protection of the system and personnel

3. Unpacking

3.1 Scope of delivery

Check the delivery for completeness and for any visible external damage. Contact your dealer if anything is damaged or missing.

Object	Description	Quantity
A	EAST EA1KLPV/EA1K5LPV/EA2KLPV inverter	1
B	DC plug connectors (1 x positive/1 x negative)	1 pair
C	AC plug assembly	1
D	Wall plug	4
E	Mounting screws	4
F	Mating connector for RS485 terminal block	2
G	User manual	1

3.2 Identifying the Inverter

You can identify the inverter by the type label. The type label is on the right side of the enclosure. The serial number (Serial No.) and the type (Type / Model) of the product, as well as device-specific characteristics are specified on the type label.

4. Mounting the Device

4.1 Security

	**DANGER!** **Danger to life due to fire or explosion!**
	• Despite careful construction, electrical devices can cause fires. • Do not mount the inverter on flammable construction materials. • Do not install the inverter in areas where highly flammable materials are stored. • Do not install inverters in areas with a risk of explosion.

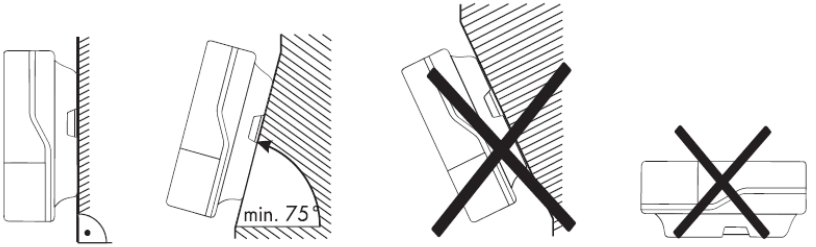
	**CAUTION!** **Risk of injury due to the heavy weight of the inverter.**
	• Take the weight of the inverter into account for transport. • Select a suitable mounting location and mounting surface.

	**CAUTION!** **Danger of burn injuries due to hot enclosure parts!**
	Mount the inverter in such a way that it cannot be touched inadvertently.

4.2 Selecting the mounting location

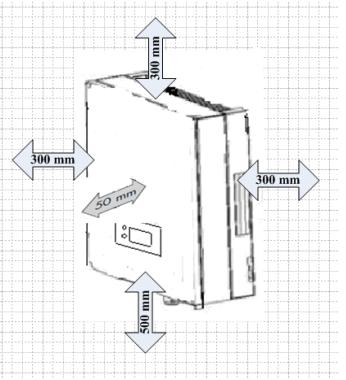
Consider the following requirements when selecting the mounting location:

- The mounting method and location must be suitable for the inverter's weight and dimensions (see section 11 "Technical Data" (page 80)).
- Mount on a solid surface.
- The mounting location must at all times be clear and safely accessible.
- Mount vertically or tilted backwards by max. 15°.



- The connection area must point downward.
- Never mount the device with a forward tilt...
- Never install the device with a sideways tilt.
- Do not mount horizontally...
- Mount at eye level to allow operating states to be read at all times.
- The ambient temperature should be below 40°C to ensure optimum operation.
- Do not expose the inverter to direct sunlight as this can cause excessive heating and thus power reduction.
- In living areas, do not mount the unit on plasterboard walls or similar to avoid audible vibrations. When in use, the inverter emits noises which may be perceived as a nuisance in a living area.
- Observe the following minimum clearances to walls, other devices or objects to guarantee sufficient heat dissipation and enough space for pulling the Electronic Solar Switch handle.

Direction	Minimum clearance
Sides	300 mm
Above	300 mm
Below	500 mm
Front	50 mm

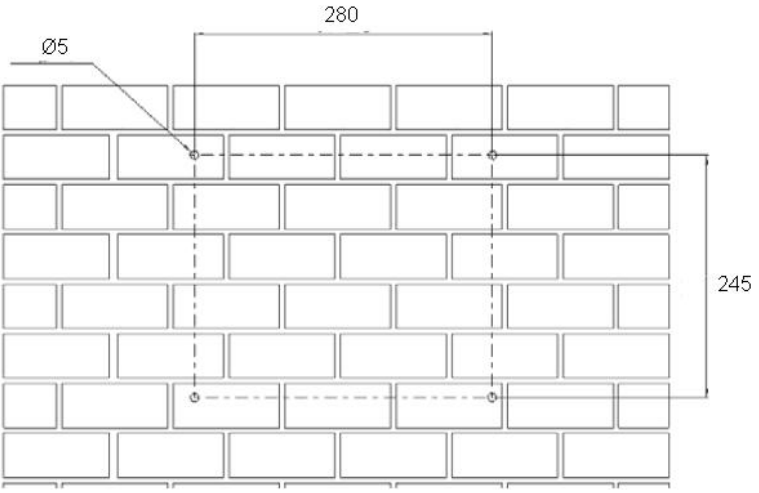


4.3 Mounting instructions

Mounting procedures:

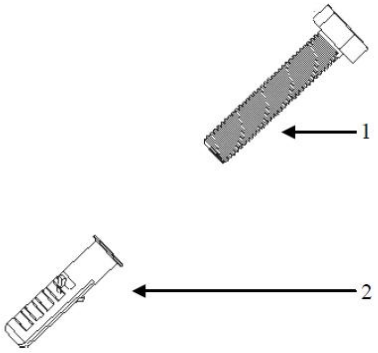
a) Drilling holes:

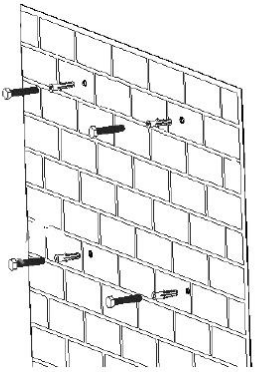
There are holes on the mounting template in the accessory, which is for help of orientation. Drill four holes for the screws at the selected installation position. The space between every two holes is shown in the figure below. Keep drilling vertical to the wall and don't shake the drill to avoid holes tilting. The depth of the holes must be the same and 55mm～60mm. After removing the dust in the four holes, measure the net depth of the holes. If the depth is deeper than 60 mm or less than 55 mm, the wall plugs wouldn't be installed and tightened.



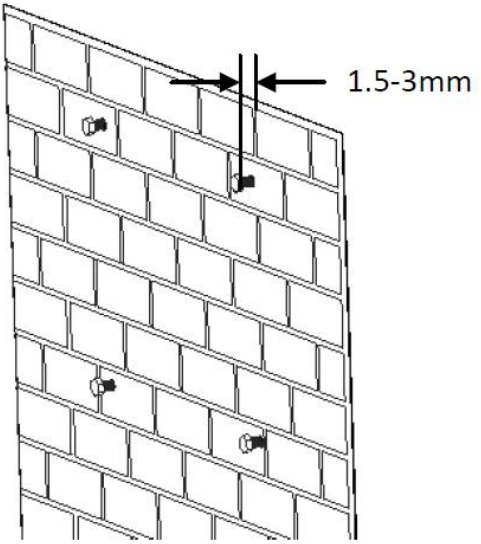
b) Wiring the screws

After drilling holes in the wall, place four wall plugs (object2 shown in the left drawing below) in the holes using a rubber hammer. Then, wiring four screws (object1) into the wall plugs.

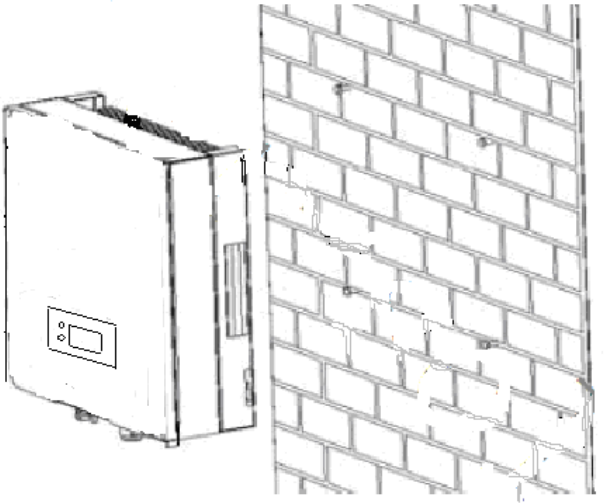




	NOTICE
	Before inserting wall plugs, measure the depth of every hole and the distance between every two holes. If the measured values do not meet the installing requirements, re-drill holes in the wall.



c) Attach the inverter to the screws downwards slightly.



5. Electrical Connection

5.1 Connection Area Overview

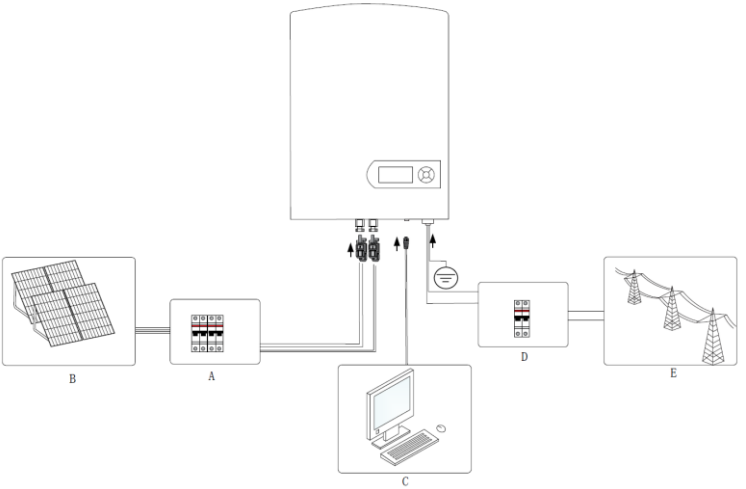
The following figure shows the assignment of the individual connection areas on the bottom of the inverter.

A **B** **C**

Object	Description
A	DC input: Plug-in connectors for connecting the PV strings
B	Communication connection area: PV inverters are configured via RS485 interface.
C	AC output: Socket for grid connection

5.2 System Diagram

The typical connection diagram for the entire PV system is shown in the following figure.



Object	Item	Description
A	DC circuit breaker	Used as a protective device during electrical connection. User must equips this device according to the maximum input voltage and current. You must choose the external DC circuit breaker whose rated current is 20A and the max breaking capacity can reach more than 1kA.
B	PV arrays	Provide DC power to the inverter. The allowable maximum open-circuit voltage of the PV arrays is 550V and maximum short-circuit currents 13.5A for EA1KLPV/14.5A for EA1K5LPV / 15.5A for EA2KLPV.

C	Remote PC	User equips this device to monitor the state of the inverter.
D	AC circuit breaker	Used as a protective device during electrical connection. You must choose the external AC circuit breaker whose rated current is 20A and the max breaking capacity can reach more than 2kA. The PE cable should be connected reliably to the earth.
E	Grid	Rated voltage of the utility grid is 230V.

5.3 Cable Sizing

All cables for PV power system are equipped with water-proof direct plug-in connectors. You'll find these connectors in the package

For electrical connection in the PV system described above, the cross section of all cables used should not be smaller than the following requirements.

Terminal / Wire Size / AWG / Model	AC Output			DC Input	
	L	N	PE	+	-
EA1KLPV	14	14	14	12	12
EA1K5LPV	13	13	13	12	12
EA2KLPV	12	12	12	11	11

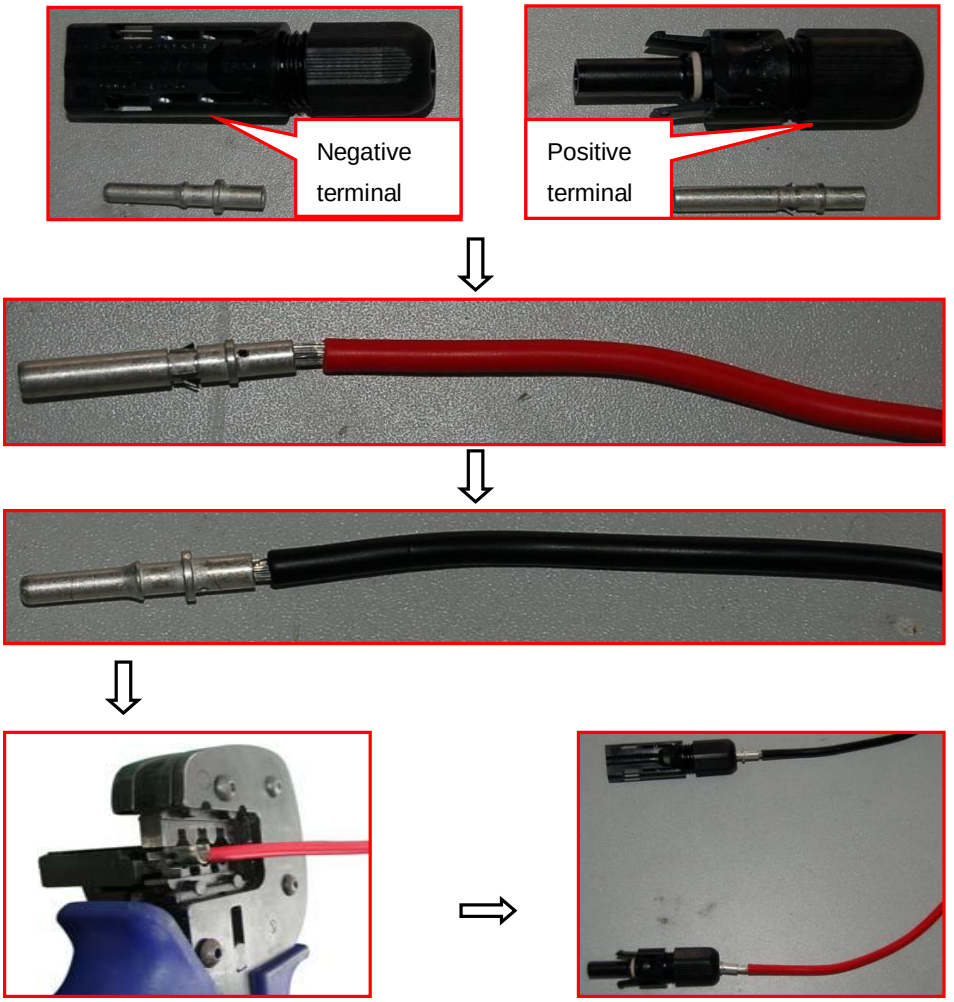
There is only one channel of DC input which can connect one PV string. The red is "+", and the black is "-". There is one channel of AC output, the red is L phase, the black is N phase，and the yellow-green is PE.

NOTICE

The grid impedance of the AC cable must not exceed 1 Ohm. Otherwise, the inverter will disconnect at full feed capacity due to excessive voltage at the feed-in point.

5.4 Connection of the PV generator (DC)

5.4.1 DC input wiring



5.4.2 DC connection Procedure

Step 1: Assemble DC cable to connector at the inverter side. See “5.4.1 DC Input Wiring”.

Step 2: Disconnect DC and AC circuit breakers.

Step 3: Check connection cable of one PV array string for correct polarity and that the maximum input open circuit voltage does not exceed 450V.

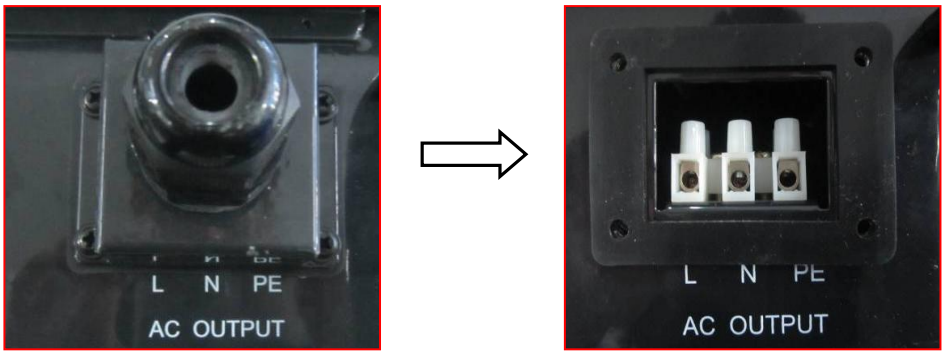
Step 4: Measure DC voltage between positive terminal of the PV string and Earth and DC voltage between negative terminal of the PV string and Earth. If the two voltages are constant and not zero, there is an insulation failure somewhere in this PV string.

Step 5: Plug DC positive and negative connector into corresponding terminals. If it makes a click sound, it means DC connector has attached to terminals.

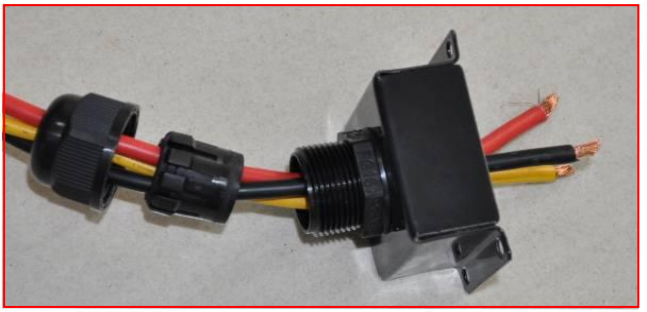
5.5 Connecting the inverter to the grid

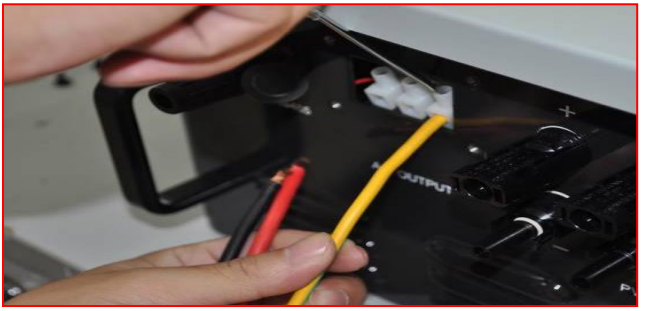
5.5.1 AC output wiring

Step 1: Unscrew AC output cover at the downside of the machine.



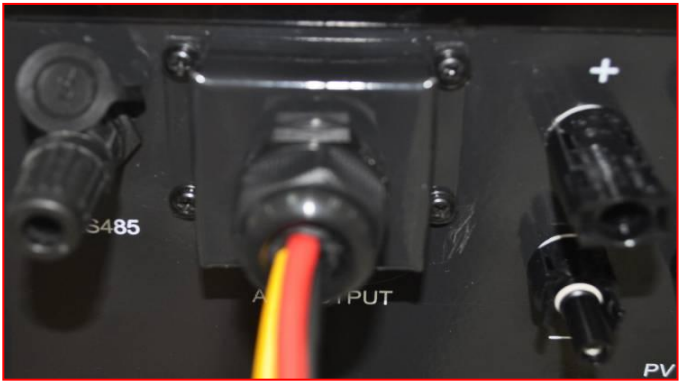
Step 2: Insert stripped AC cables of appropriate size into the cable glands. Fix the phase cables into corresponding terminals with screwdriver according to marks. Fix ground cable into the ground terminal.





Step 3: Screw the AC output cover.

Step 4: Tighten the cable gland in clockwise direction.



5.5.2 AC connection Procedure

Step 1: Assembling AC cables to connector supplied. See “5.5.1 AC Output Wring”.

Step 2: Make sure that AC and DC circuit breaker are disconnected.

Step 3: Connect L, N to AC circuit breaker.

- Plug AC connector to corresponding AC terminals.
- Screw AC cables to AC circuit breaker.

Step 4: Connect PE to the ground.

Step 5: Connect AC circuit breaker to utility grid.

Step 6: Make sure that all AC cables are firmly installed.

	NOTICE
	Assignment of AC cables should be paid attention to, especially “PE/GND” wire.

5.6 Connecting communication cable

5.6.1 Assembling the RS485 plug connector

Step 1: Make the communication cable through the waterproof ring, and then connect the cables to the terminal.

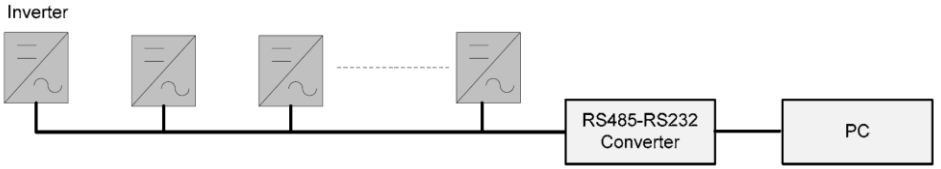
1	Blank	
2	B	
3	A	
4	GND	

2. Fasten the waterproof ring and case.

3. Finally, match the finished terminal to the RS485 communication port on the inverter’s case，then it is ready for communication.

5.6.2 Monitor system connection

The inverter provides RS485 interface to communicate with remote PC. User can monitor the state of the inverter and observe current running information and history record via this interface. Below is the method to install the monitoring system.



6. Switch on and off

6.1 Switch on

1. Finish the installation of the PV array, AC grid and the inverter according to the introduction before.
2. Before switch on, checking whether AC voltage and DC voltage can meet the requirement of the inverter
3. Switch on the DC breaker at first.
4. Then switch on the AC breaker.
5. When the environment conditions allow the inverter to work, the inverter will automatically start up and connect the grid to generate power.
6. After the inverter works normally on grid, it can be left working itself without human control. It can shut down when fault occurs and it can start automatically after the fault is gone.

6.2 Switch off

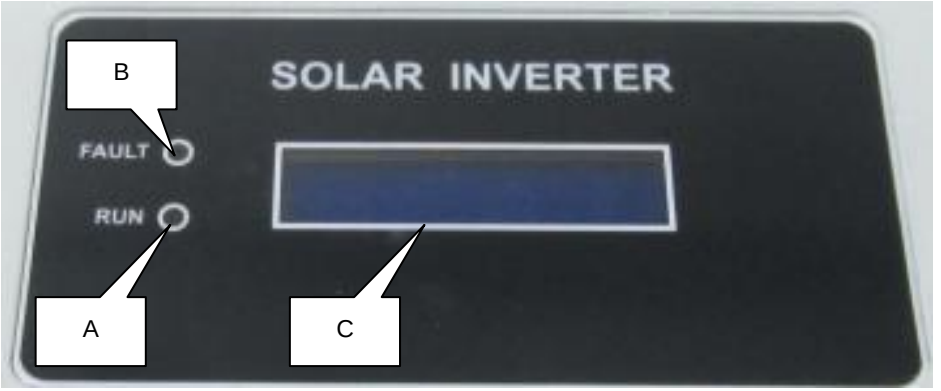
1. When solar power was not enough to generate the power, the inverter will shut down automatically.
2. If you need to shut down the inverter yourself, you can operate the inverter through the front panel screen.
3. The process of emergency shutdown.

If you need shut down the inverter in emergency, first turn off the AC breaker, then turn

off the DC breaker, otherwise it may lead to the damage of the DC breaker and danger to people. If any damage or loss occurs due to not following this requirement, we will not follow the warranty.

7. Operation

7.1 Display Overview



Object	Descriptions
A	GREEN LED (Working normally)
B	RED LED (Fault)
C	2 line LCD display

7.2 LED display

The PV inverter is equipped with two LEDS including “green” and “red” which indicate three different modes of operation.
Green LED: Normal mode

The green LED lighting indicates that the inverter is active and working normally.

Whenever the supplied power from PV panel is sufficient (voltage>120VDC), Inverter converts power to the grid. If the power is insufficient (voltage<90VDC), the inverter enters a “waiting” state.

Red LED: Fault mode

The red LED indicates that the inverter has stopped feeding power into the grid because of fault, and the corresponding fault information will display on the LCD at the same time.

All off: Shutdown mode

During periods of little or no sunlight, Inverter automatically stops running. In this mode, Inverter does not take any power from the PV panels. The display and LED’s on the front panel do not work.

7.3 LCD display

The LCD display consists of 16 characters and 2 lines. Once the PV power is sufficient, the inverter starts up automatically. The inverter displays information as shown in the flow chart as follow:

“Welcome” → “Model:EAxKLPV” → “Version :x.xx” →“Waiting: xxS” → “Normal State” → “Pac= xxx.x W”.

To save power, the LCD display’s backlight automatically turns off after feeding the grid 5 minutes. If there is a fault message appears, the LCD display’s backlight turns on all the time until the fault is solved.

Along with different working states of the inverter, the LCD display different information as follows:

The first line of LCD		
System State	LCD Display Content	Remark
System Initial	Welcome	System initial default display
Standby	Waiting	waiting
Connecting	Connecting **s	System checking
	Reconnecting **s	Again System checking
On Grid	Working	Inverter working
	Pac= xxxx W	Inverter watt at working
Key stop	Shutdown	Key off
Waiting key start	Waiting Start	Waiting key start
Fault	PV Over Voltage	Dc over voltage
	Island	Island or no grid
	AC Over Voltage	Ac over voltage

	AC Under Voltage	Ac under voltage
	AC Over Freq	Ac over frequency
	AC Under Freq	Ac under frequency
	High Temperature	Temperature abnormal
	AD Channel Fault	Adc channel abnormal
	High Iac Leakage	Ac leakage current over
	Over Current	abnormal current
	Insulation Fault	PV insulation fault
	No Utility	No grid
	High DC Component	Dc component over
	Relay Check Fail	Relay check fail
	Fault	fault clc

The second line of LCD			
System State	**Cycle Display Content**	**Display Time /s**	**Remark**
System Initial	EAxK TUV x.xx		Machine model, grid standards, software version
Standby	Null	2	Display null
Connecting	Company : XXXX	2	Manufacturer
	Model: EAxKLPV	2	Inverter model
	Version:x.xx	2	software version
	PV:xxx.xV xx.xxA	2	PV voltage and current
	BUS:xxx.xV	2	Bus voltage
	AC:xxx.xV xx.xxA	2	Grid voltage and current
	Freq:xx.xxHz	2	Grid frequency
On Grid	Etoday:xx.xxKWh	4	Energy today
	PV:xxx.xV xx.xxA	4	PV voltage and current
	BUS:xxx.xV	4	Bus voltage
	AC:xxx.xV xx.xxA	4	Grid voltage and current
	Freq:xx.xxHz	4	Grid frequency
Key stop	Null		Upper pc key stop, display until key start

Waiting key start	Null		Upper pc key start, display until entering standby
Fault	Info:xxx.xV xx		Dc over voltage fault value and fault code
	Info:xxx.xV xx		Ac over voltage fault value and fault code
	Info:xxx.xV xx		Ac under voltage fault value and fault code
	Info:xx.xxHz xx		Ac over frequency fault value and fault code
	Info:xx.xxHz xx		Ac under frequency fault value and fault code
	Info:xxx.xV xx		Relay check fail fault value and fault code
	Info:xxxx xx		Temperature abnormal value and fault code
	Waiting xxxs xx		Other fault display countdown and fault code

Fault Messages	**Fault Code**	**Fault Descriptions**	**LCD displays**
Island	1	The slave DSP detects the grid fault, and communicates with the master DSP through the parallel port.	1.Island 2.NULL
	2	System start checks grid fault	1.Island 2.NULL
	3	Phase lock program detects zero signal for three continuous grid cycle	1.Island 2.NULL
	4	Active islanding program detects the grid fault	1.Island 2.NULL
	5	Grid voltage is under 20V	1.Island 2.NULL

Grid Over voltage	6	Grid voltage is over 300V	1.AC over voltage 2.voltage value,fault code
	7	Grid voltage is over the preset over voltage protection point	1.AC over voltage 2.voltage value,fault code
	8	While feeding grid, system detects grid transient voltage over bus voltage -15V.	1.AC over voltage 2.voltage value,fault code
Grid under voltage	9	Grid voltage is under the preset under voltage protection point	1.AC under oltage 2.voltage value, fault code
	10	Grid voltage is under 110V and over 20V,	1.AC under voltage 2.voltage value, fault code
Grid over frequency	11	Grid frequency is over the preset over frequency protection point	1.AC Over Freq 2.Freque value, fault code
Grid under frequency	12	Grid frequency is under the preset under frequency protection point	1.AC under Freq 2.Freque value, fault code
Bus over voltage	13	Bus transient voltage is over the preset bus voltage protection point	1.Bus over voltage 2.Bus voltage value, fault code
	14	Bus voltage is over the preset bus voltage protection point	1.Bus over voltage 2.Bus voltage value, fault code
PV isolation resistance check	15	PV isolation resistance check fails	1.Isolation Fault 2.NULL
Output DC Injection check	16	While feeding grid, system detects the dc current component injecting to the grid.	1.High DC omponent 2.NULL
Temperature check	17	Inverter inner ambient temperature is too high	1.High temperature 2.Temperature value, fault code
Leakage current check	18	Ac leakage current is over the preset protection value	1.High Iac Leakage 2.NULL

Relay check	19	Relay check phase 1 fails, when the first group relays are closed while the second group relays are opened	1.Relay Check Fail 2.fault value and fault code
	20	Relay check phase 2 fails, when the first group relays and the second group relays are closed	1.Relay Check Fail 2.fault value and fault code
	21	Relay check phase 3 fails, when the first group relays are opened while the second group relays are closed	1.Relay Check Fail 2.fault value and fault code
	22	Relay check phase 4 fails, when the first group and the second group relays are opened	1.Relay Check Fail 2.fault value and fault code

8. Troubleshooting

8.1 Display Message

It is important to understand all operational and error messages that could appear on the LCD display. The error messages that appear are especially important because service personnel will need this information reported in order to help them to define the failure and correct it.

a. Working Status Messages

Operation Condition	Messages	Descriptions
Power Off	No Display	1.Initial condition: Before system startup voltage (80V) 2.PV Inverter is totally shutdown, Vpv < 70V
Initialization and Waiting	Waiting	1.Initial condition: After PV voltage is higher than 120V, inverter is waiting for feeding to grid 2.After Startup: Input voltage range is at 80 ~ 120V

Check Grid	Connecting xxxS	When PV voltage > 150V, inverter is checking feeding conditions
Feeding Grid	Working	Inverter is feeding power to the grid

b. Monitoring Parameter Messages

Operation Condition	Messages	Descriptions
Instantaneous Output Power	Pac= xxxx.xW	The real time output power in xxxx.xW
Accumulated energy information	Energy= xxxxxxkWh	Total energy has been fed to the grid ince inverter was installed
Today's energy information	Etoday= xxx.xkWh	Total Energy that has been fed to the grid today.
Grid Voltage and Current	AC:xxx.xV xx.xxA	Grid Voltage in xxx.x VAC, feeding urrent in xx.xxA
Grid Frequency	Freq: xx.xxHz	Grid frequency in xx.xxHz
PV Array Voltage and Current	PV:xxx.xV xx.xxA	Input voltage and current from PV array,

c. System information Messages

Operation Condition	Messages	Descriptions
Model Display	EAxKLPV	Inverter Model
Software version	vx.xx	Software version
Waiting for reconnect to the grid	Reconnect in xxx S	The waiting time for reconnect to the grid

d. System Fault Messages

Operation Condition	Messages	Descriptions and corrective measure
Isolation Failure	Isolation Fault	The resistance between the PV + or PV – and grounding is outside the permissible range, <500K.

		Corrective measures ◆Check the insulation of the PV plant ◆Check the PV plant for ground faults and have the PV generator installation engineer to fix the ground fault before reconnect the string in question
Grid Voltage Fault	AC Over voltage AC Under voltage	The grid voltage is not within the permissible range. This fault can be caused by any of the following conditions: ◆Power distribution grid disconnected (miniature circuit-breaker, fuse) ◆The local grid condition is out of acceptable range. The inverter disconnects itself from the public grid for safety reasons.
		Corrective measures ◆Check the grid voltage and connection on the inverter. ◆I If the detected grid voltage is within permissible range, restart the PV Inverter and try again. If fault remains, contact the system installer to check the grid voltage and cable connections between PV Inverter and Utility system. ◆ If detected grid voltage is out of permissible range, contact the system installer to check the feed-in AC voltage and contact the utility operator for further action.
Grid Frequency Fault	AC Over Freq	The grid frequency is out of the permissible range.

	AC Under Freq	Corrective measures ◆Check the grid connection and contact the distribution grid operator if necessary. ◆If the power frequency is within the tolerable range, but disturbances are still displayed, contact the EAST Service line.
No Utility	Island	Utility is not available. This can occur if the AC fuse is broken, No AC connections from utility system, or broken AC cables.
		Corrective measures ◆Check the Utility system and the AC connections of the PV Inverter ◆Check the AC fuses of the PV Inverter ◆If failure remains, disconnect the PV Inverter and contact the system installer.
Input Voltage too High	PV Over voltage	Input voltage higher than 450V. The inverter could be damaged.
		Corrective measures ◆Disconnected PV modules immediately. ◆Check the configuration of the strings for the PV modules in order to ensure the maximum input voltage is lower than 450V.
Leakage current Fault	High Iac Leakage	Leakage current on ground conductor is too high
		Corrective measures ◆Check the AC Cables Connections, especially the grounding cables. Ensure all the cables are connected properly. ◆Restart the PV Inverter. ◆If fault remains, disconnect the PV Inverter and contact the system installer.

e. Inverter Fault Messages

Operation Condition	Messages	Descriptions
Consistent Fault	Consistent Fault	The readings of 2 microprocessors are not Consistent. It could be caused by CPU and/or other circuit not functioning properly.
		Corrective measures ◆Restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line
Temperature too high	High Temperature	The internal temperature is higher than normally allowed value
		Corrective measures ◆Disconnect PV Inverter for a period (>30 minutes) and then restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the system installer. Select a new location for the installation when if it is necessary.
Output Relay Failure	Relay check fail	The relay between the inverter and grid is not functional
		Corrective measures ◆Restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line.

Output DC Injection too high	High DC Component	Output DC injection too high
		Corrective measures ◆Check the connection of the DC Input. ◆Restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line.

EEPROM Problem	EEPROM failure	EEPROM inside has data access problem
		Corrective measures ◆Restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line.
Communication failure between microprocessors	SCI failure	Communication between MCU inside is abnormal
		Corrective measures ◆Restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line.
DC bus voltage is too high	Bus Over voltage	The DC BUS inside is higher than expected
		Corrective measures ◆Check the DC voltage, if the DC voltage is above the maximum input voltage, contact the system installer. ◆If the DC voltage is under the maximum input voltage, restart the PV Inverter. ◆ If fault remains, disconnect the PV Inverter and contact the EAST Service line.

9. Technical data

	Specification/Type	EA1KLPV	EA1K5LPV	EA2KLPV
Input(DC)	Max. DC Power	1200W	1800W	2300W
	Max. DC voltage	450V	550V	550V
	MPP voltage range	90V-405V	125V-450V	150V-450V
	DC nominal voltage	360	360	400
	start voltage	150V		
	Shutdown Voltage	Typical 80V		
	Max. input current	13.5A	14.5A	15.5A
	Number of MPP-Trackers	1	1	1
	Number of strings	1	1	1
	DC switch	optional		
Output(AC)	Rated AC power	1000W	1500W	2000W
	Max. AC power	1100W	1650W	2200W
	Nominal AC voltage	230Vac		
	Grid voltage range	180 V … 265 V		
	Grid frequency range	44 Hz … 55 Hz		
	Nominal AC current	4.4A	6.5A	8.7A
	Max. AC current	5.6A	8.3A	11A
	Power factor	1		
	Harmonic distortion (THD) at rated output	＜3%		
	Number of grid phases	1		
	Night consumption	0W		
	Power consumption at standby	＜6W		
Efficiency	Max efficiency	96%	97%	97%
	Euro efficiency	94%	95%	96%

	MPPT adaptation efficiency	99.5%	99.5%	99.5%
Protection devices	DC reverse-polarity protection	Yes		
	DC Insulation monitoring	Yes		
	AC short circuit protection	Yes		
	Grid monitoring	Yes		
	Ground fault monitoring	Yes		
	DC current monitoring	Yes		
	Islanding protection	Active Frequency Disturbance		
General data	Dimensions(W×H×D)	330mm×425mm×142mm		
	Net Weight	13.5kg		
	Operating temperature range	–25 °C to +60 °C(up 45°C derating)		
	Relative humidity	0% to 100%, non-condensing		
	Site altitude	Up to 2000m without derating above sea level		
	IP protection type	IP65		
	Topology	transformerless		
	Cooling concept	Convection		
	Noise emission	＜40db(A)		
	LED display	3		
	LCD display	Backlight, 16×2 Character LCD		
	Data logger Data communication interfaces	RS485		
	Warranty	5 years		

10. Appendix

10.1 Exclusion of liability

The content of these documents is periodically checked and revised, when necessary, please call us for the latest information. However discrepancies cannot be excluded. No guarantee is made for the completeness of these documents. Please contact our company or distributors to get the latest version.

Guarantee or liability claims for damages of any kind are excluded if they are caused by one or more of the following:

- Improper or inappropriate use or install of the product
- Installing or operating the product in an unintended environment
- Installing or operating the product when ignoring relevant safety regulations in the deployment location
- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Installing or operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond allowed limit values.
- In case of unforeseen calamity or force majeure.