SINEXCEL
iSUNA

User Manual

Split-phase hybrid inverter

Isuna U5K-U20K

Shenzhen Sinexcel Isuna
Energy Technology Co.,LTD

v1.2

Catalogue

1.Overview

This document describes the product information, installation, electrical connection, configuration and commissioning, troubleshooting and maintenance, and technical specifications of the split-phase hybrid inverter. Before installing and using the product, read this manual carefully to familiarize yourself with the safety information and functions and features of the product. Manuals may be updated from time to time, please obtain the latest version from the official website for more product information.

1.1 Scope of Application

This manual is applicable to the following inverters:

Model	Rated output power	Rated output Voltage
Isuna U5K-PH	5kW	240V/120V L1-L2，L1/L2-N
Isuna U6K-PH	6kW	
Isuna U8K-PH	8kW	
Isuna U10K-PH	10kW	
Isuna U12K-PH	12kW	
Isuna U15K-PH	15kW	
Isuna U20K-PH	20kW	

Note: The product will be derated for overload protection above 40°C ring temperature.

1.2 Applicable Personnel

This document is intended for only professional and technical personnel who are familiar with local regulations, standards, and electrical systems, and have professional training and knowledge about this product.

1.3 Symbol Definition

In order to ensure the personal and property safety of users when using split -phase hybrid inverters, as well as the efficient use of this product, the manual provides relevant safe operation information and uses corresponding symbols to highlight. To avoid personal injury and property damage, please fully understand and absolutely comply with these stressed information. The symbols used in this manual are listed

below.

Danger
Indicates a highly hazardous situation which, if not avoided, will result in death or serious injury.
Warning
Indicates a hazard with a medium level of risk that could result in death or serious injury if not avoided.
Caution
Indicates a hazard with a low level of potential that, if not avoided, could result in moderate or minor injury.
Attenion
Indicates a potentially hazardous situation that, if not avoided, may cause equipment failure or property damage.

2. Safety Precautions

The safety precautions contained in this document must be followed when operating the device.

⚠ Attenion
➢ The inverter has been designed in strict accordance with safety regulations and has passed the tests. However, as an electrical device, you must comply with relevant safety instructions before performing any operation on the device. Improper operation may result in serious injury or property damage.

IMPORTANT SAFETY INSTRUCTIONS

To reduce the risk of fire, do not connect to an ac load center (circuit breaker panel) havin g multiwire branch circuits connected.

SAVE THESE INSTRUCTIONS

2.1 Operation Safety

⚠ Attenion
➢ Read this manual carefully before installing the device to understand the products and precautions. ➢ All operations on the equipment must be carried out by professional electrical technicians who are familiar with the local standards and safety regulations. ➢ When operating inverters, use insulation tools and wear personal protective equipment. Wear ESD gloves, an ESD wrist strap, and an ESD suit when touching electronic components to prevent damage caused by static electricity. ➢ The manufacturer shall not be liable for inverter damage or personal injury caused by failure to install, use, or configure the equipment in accordance with the requirements of this manual.

2.2 PV String Safety

⚠ Danger

- Use the DC wiring terminal delivered with the chassis to connect the DC cables of the inverter. Use of other types of DC terminals may cause serious consequences. Therefore, the manufacturer is not responsible for the damage to the device.

Warning

- Ensure that the assembly frame is properly grounded to the support system.
- After connecting DC cables, ensure that the cables are securely connected.
- Use a multimeter to check whether the positive and negative DC wiring terminals of the battery are connected correctly and the voltage is within the allowable range.
- Do not connect the same PV series to multiple inverters; otherwise, the inverters will be damaged.

2.3 Battery Safety

Warning

- Read the battery safety contents in the user manual carefully before installing the device, and strictly follow the instructions in the user manual.
- The battery current may be affected by external environment, such as temperature and humidity, which may cause battery current limiting and affect battery on-load performance.
- If the battery does not start, contact the after-sales service center as soon as possible. Otherwise, the battery may be permanently damaged.
- Use a multimeter to check whether the positive and negative DC wiring terminals of the battery are connected properly and the voltage is within the allowable range.
- Do not connect the same battery string to multiple inverters. Otherwise, the inverters may be damaged.

2.4 Inverter Safety

Warning

- A protection device, such as a circuit breaker or fuse, is recommended for the AC side of the inverter. Ensure that the protection device is greater than 1.25 times the maximum AC output current of the inverter.
- The GND cable for the inverters must be securely connected. When multiple inverters are combined, ensure that the protection ground points on all inverters' chassis shells are equipotential connected.
- If the battery is not configured in the photovoltaic system, it is not recommended to use the off-grid function, and the resulting system electricity risk will not be covered by the equipment manufacturer's warranty.

2.5 Personnel Requirements

Attenion

- When the inverter is running, some components may be charged or hot. Improper use, incorrect installation, or operation may result in serious injury to person or property. Transportation, loading, unloading, installation, starting and maintenance operations must be performed by qualified electrical engineers.

2.6 Description of Symbols

There are some safety-related labels on the split -phase hybrid inverter. Please read and fully understand these labels before installing the product.

Symbol	Symbol name	Symbol meaning
	It indicates the danger of residual voltage in the inverter.	Please wait for 5 minutes until the capacitor is completely discharged after the DC side of the inverter has been disconnected with power for a period of time.
	It indicates the danger of high voltage.	High voltage exists during inverter operation. If you need to operate the inverter, please make sure the inverter is disconnected.

	It indicates to be careful of high temperature surface.	The temperature of inverter housing is high during operation, so do not touch it, otherwise it may cause burns.
	It indicates grounding terminal.	Connect the inverter to ground for grounding protection purpose.
	It indicates reading the manual.	Please read and understand this manual carefully before installing the inverter.

3.Equipment Inspection and Storage

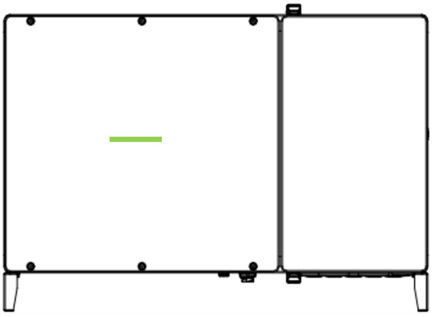
3.1 Pre-signing Inspection

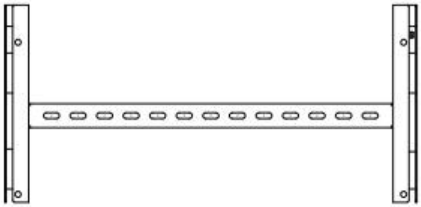
Before signing for the product, please check the following:

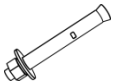
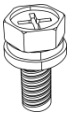
- Check the outer packing for holes, distortions, cracks, or other signs that may cause damage to the equipment in the packing case. If so, do not open the packing and contact your distributor.
- Check whether the inverter type is correct. If not, do not open the package and contact your dealer.
- Check whether the type and quantity of the delivered package are correct and whether the appearance is damaged. If damaged, please contact your dealer.

3.2 Packing List

After the inverter is unpacked, check whether the delivered package are complete. If any components are found missing or incomplete, contact the dealer in time.

序号	图片	描述	数量
1		inverter	1PCS

2		Wall mounted backsplash hangers	1PCS
3		CT	2PCS
4		WIFI module	1PCS
5		parallel communication line	1PCS
6		BMS communication lines	1PCS

7		M8*80 expansion bolts	4PCS
8		Cross recessed pan head combination screws M5x10	4PCS
9		user manual	1PCS
10		warranty card	1PCS
11		desiccant	2PCS
12		key	2pcs

3.3 Equipment Storage

If the inverter is not put into use immediately, store it according to the following

requirements:

- Ensure that the outer packing case is not removed and the desiccant is not lost.
- Ensure that the storage environment is clean and within appropriate temperature and humidity ranges.
- Ensure that inverters are placed in the height and direction according to the labels on the packing cases.
- Ensure that there is no tilt and fall risk after inverters are stacked.
- After the inverter is stored for a long time, check and confirm the inverter before it can be used.

4.Product Description

4.1 Product Overview

split -phase hybrid inverter is a photovoltaic off-grid inverter and battery energy storage as one, with a variety of built-in working modes to suit the diversified needs of users. In the period of rising energy costs such as oil and coal, the continuous decline of energy subsidies for photovoltaic grid-connected systems, mountain areas or base stations without grid, uninterrupted power supply and emergency power supply needs, split -phase hybrid inverters can provide a complete solution.

4.2 Application Scenario

⚠ Warning

- The photovoltaic system is not suitable for devices that rely on stable power supply, such as life-sustaining medical devices. Ensure that no personal injury is caused when the system is powered off.
- Do not use a load with a high starting current in the photovoltaic system. Otherwise, the off-grid output may fail due to excessive instantaneous power.
- When the inverter overload protection occurs for a split time, the inverter can automatically restart; If it happens several times, the inverter will stop, and after the fault is rectified, the inverter can be restarted immediately through the App.
- If the load capacity exceeds the rated power of the inverter during power failure, the off-grid function of the inverter automatically shuts down. To start, turn off the large load and ensure that the load power is smaller than the rated power of the inverter.
- When the inverter is in off-grid mode, it can be used normally for ordinary household load.
- Overload capability: Supports 1.1x long term overload, 1.6x 10s. overload output needs to include sufficient PV output.

4.3 Appearance Description

4.3.1 Appearance Description

Please carefully inspect the packaging and accessories of the product before installation.

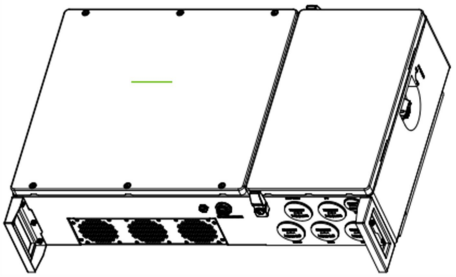


Figure 4.1 Appearance of the inverter

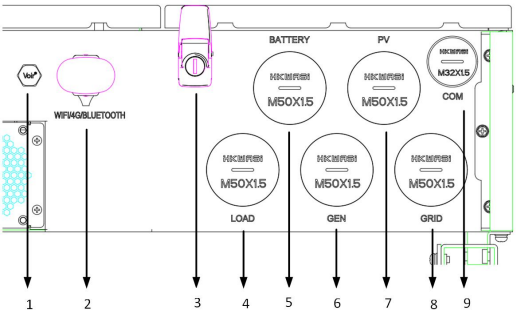


Table 4-1 Appearance of the inverter

1	relief valve	6	Generator Knockout Hole (Ø50mm)
2	WIFI_USB interface	7	Photovoltaic knockout holes (Ø50mm)
3	safety lock	8	Grid knockout hole (Ø50mm)
4	Load knockout hole (Ø50mm)	9	communications port (Ø34.5mm)
5	Battery knockout hole (Ø50mm)		

Table 4-2 Inverter external wire diameter range

1	PV cable	UL10269 12 AWG
2	BAT cable	UL10269 6 AWG
3	GEN	UL10269 4/0AWG
4	LOAD	UL10269 4/0AWG
5	GRID	UL10269 4/0AWG
6	PE	UL10269 6 AWG

Note: Recommended cable sizes are for cables connected to the inverter terminals.Specific cable diameters are selected according to your usage.

Table 4-3 Recommended Catheter Sizes

NUM	Knockout hole size(mm)	Trade size of conduit(inch)	Quantity
1	50	1-1/2	5pcs
2	34.5	1	1pcs

Note: The conduit and inverter are fixed by fireproof mud, and the length can be configured according to your installation needs.

4.3.2 Size Description

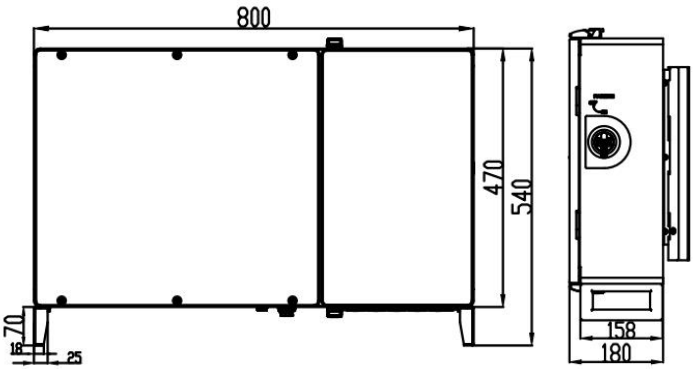


Figure 4.2 Overall size of inverter

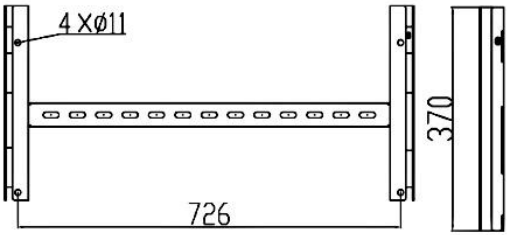


Figure 4.3 Dimensions of wall mount

5 Installation

5.1 Installation Requirements

5.1.1 Installation Environment Requirements

1) The equipment must not be installed in flammable, explosive, corrosive and other environments.

2) The installation position should be away from water pipes and cables in the wall to avoid danger during drilling.

3) The installation position should be out of the reach of children, and avoid installation in a position that is easy to touch. There may be high temperature on the surface of the equipment during operation to prevent burns.

4) The inverter should avoid the installation environment such as sun, rain, snow, etc. It is recommended to install it in a sheltered installation position. If necessary, an awning can be built.

5) The installation space must meet the requirements of ventilation, heat dissipation and operation space.

6) The protection level of the equipment complies with the requirements for indoor and outdoor installation, and the installation environment temperature and humidity must be within the appropriate range.

7) Make sure that the inverter indicator light and all labels are easy to view and that the terminal is easy to operate.

8) The inverter installation altitude should lower than the maximum working altitude 4000m.

9) Stay away from strong magnetic field environment to avoid electromagnetic interference. If

a radio station or a wireless communication device below 30MHz is located near the installation location, install the device according to the following requirements:

- Add a ferrite core with multi-turn winding at the inverter DC input line or AC output line, or add a low-pass EMI filter.
- The distance between the inverter and the wireless electromagnetic interference device exceeds 30m.

5.1.2 Mounting Carrier Requirements

1) The installation carrier must not be flammable material and must have fire resistance.

2) Please ensure that the installation carrier is solid and reliable, and can carry the weight of the inverter.

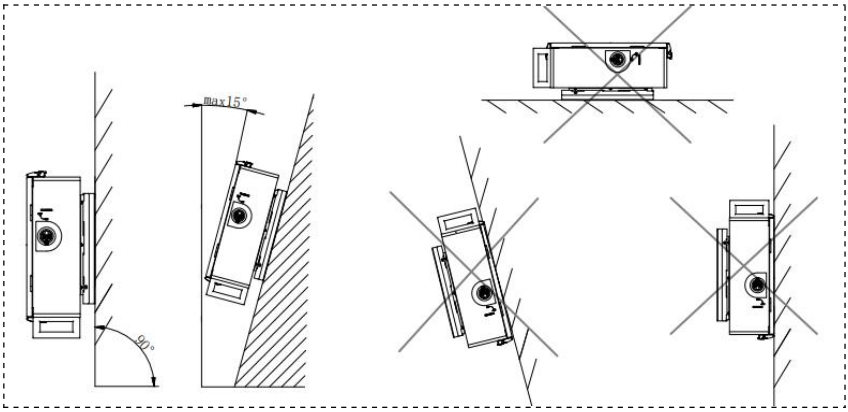
3) When the equipment is running, it will make noise. Do not install it on the carrier with poor sound insulation, so as to avoid the noise emitted by the equipment when it is working, which will cause trouble to residents in the living area.

5.1.3 Mounting Angle Requirements

1) Recommended inverter installation Angle: vertical or backward ≤15°.

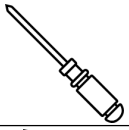
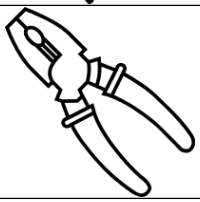
2) Do not invert, tilt forward, tilt back beyond the Angle, horizontal installation.

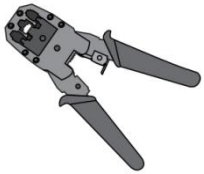
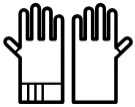
3) At least 1.2m from the ground below the inverter, about at least 30m.



5.2 Mounting Tools

Table 5-1 List of installation tools

Series No.	Tools	Description	Function
1		Percussion drill Recommended 10mm drill	Wall drilling
2		6mm cross-head screwdriver	Removing, installing screws and wiring
3		4mm cross-head screwdriver	Removing and installing load terminal screws
4		Removal tool	Removal of PV, BAT line end terminals
5		Wire strippers	Stripping wire
6		Crimping pliers	Crimping PV and BAT cables

7		Crimping pliers	Pressure welding grid, load end cable
8		6mm hex wrench	Fasten the grid terminal to the cable
9		Multimeter	Check whether the cable wiring is correct, the positive and negative battery terminals are correct and voltage, and grounding is reliable
10		Marking pen	Drilling mark
11		Tape	Measurement distance
12		Protective gloves	Wear when setting up the inverter
13		Goggles	Wear when drilling holes
14		Dust mask	Wear when drilling holes

5.3 Inverter Transportation

Remove the inverter from the outer packaging and carry it horizontally to the designated mounting position. Open the outer packaging box and the two operators need carry the inverter out of the outer packaging box and carry it to the designated mounting position.

Caution

- When carrying out the transportation, turnover, and installation, you must comply with the laws, regulations and related standards of the country or region where you are located.
- The inverter is heavy. Please keep it balanced during handling to prevent the inverter from falling and injuring the operator.
- The power cable and signal cable ports at the bottom of the inverter cannot bear any weight. Do not touch wiring terminals directly. Place the inverter horizontally.
- When the inverter is placed on the ground, put foam or paper under it to avoid damage to the shell.

5.4 Wall Mounted

Attenion

- When drilling holes, ensure that the holes are drilled away from water pipes and cables in the wall to avoid dangers.
- When drilling holes, wear goggles and a dust mask to prevent dust from inhaling into the respiratory tract or falling into the eyes.

Step 1: Please choose a wall with sufficient load-bearing capacity, according to the wall bracket on the level will be wall bracket level to the installation wall, with a marker pen on the wall to mark the fixed wall bracket to be drilled position, and then use the impact drill to drill holes in the wall, drilling to keep the impact drill perpendicular to the wall, do not shake, so as to avoid damage to the wall, if the holes drilling error is large need to be re-positioned;

Step 2: Insert the M8*80 expansion screws vertically into the holes, pay attention to the depth of the expansion bolts should not be too shallow;

Step 3: Place the wall bracket against the hole, and fix the wall bracket on the wall with

the nut;

Note: The machine must not be installed at a height of less than 1m.

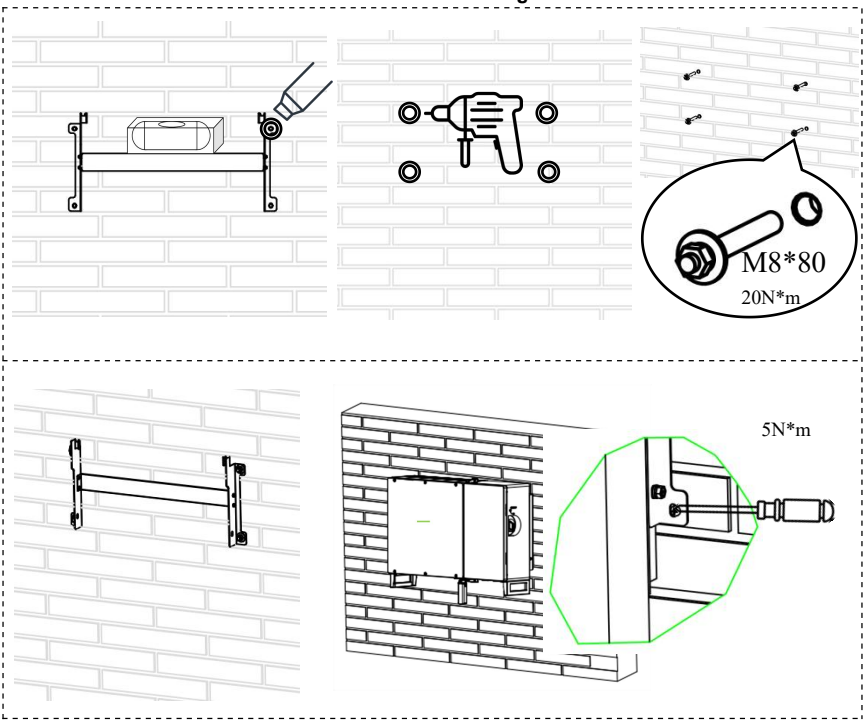


Figure 5.1 Illustrative diagram for installation of wall hangings

6. Electrical Connection

Before installation and maintenance, ensure that the AC/DC side is not powered on. The capacitors are still powered on for a period of time after the inverter is powered off. Therefore, wait at least five minutes to ensure that the capacitors are fully discharged. split -phase hybrid inverters are used in battery energy storage photovoltaic systems. Equipment can be damaged if not used as intended.

6.1 External wiring diagram of the distribution warehouse section

The right side of the whole inverter is the power distribution bin part, the main function is responsible for the connection of external cables, open the security lock and the lower side of the power distribution cover will see the part shown in the picture below.

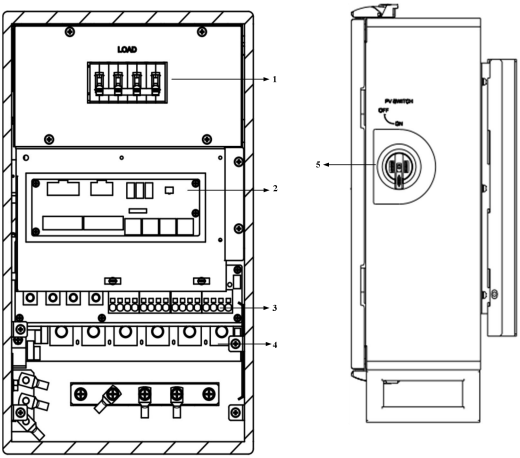


Figure 6.1 Schematic diagram of the whole inverter distribution bin section

Table 6-1: Functional table of the whole inverter distribution bin section

number	Terminal Name	number	Terminal Name
1	Grid AC Switch	4	Load/Generator/Grid Interface
2	External communication	5	PV Switch

	interfaces		
3	Battery and Photovoltaic Interface		

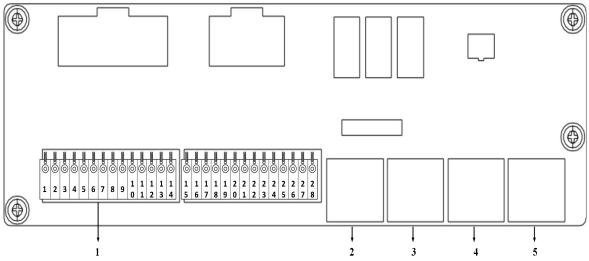


Figure 6.2 External Communication Interface Board Schematic Diagram

Table 6-2: External Communication Interface Board Function Table

number		functionality
1	**(1-,2+)**	**CT_L1_in:**Current transformer used in L1 in grid-connected mode for backcurrent detection and power distribution.
	(3-,4+)	**CT_L2_in:**Current transformer used in L2 in grid-connected mode for backcurrent detection and power distribution.
	(5,6)	**Gen_On_Relay:**Genset start signal, no polarity
	(7,8)	**Gen_Start_Relay:**Genset ready signal, no polarity
	(9+,10-)	**Temp_Bat1_in:**Battery 1 temperature sensor; for voltage correction when using lead-acid batteries
	(11+,12-)	**Temp_Bat2_in:**Battery 2 temperature sensor; for voltage correction when using lead-acid batteries
	(13+,14-)	**RSD_input:13,14:**RSD Emergency Stop Switch
	(15+,16-)	**RSD_12V_out:**RSD output voltage 12V, power 3W
	(17A,18B)	**485_Meter:**Meter signals
	(19H,20L)	**Res_CAN:**Reserved CAN signals, not currently used
	(21A,22B)	**Res_485:**Reserved 485 signals, not currently used
	(23H,24L)	**CANA:**not currently used

	(25H,26L)	**CANA:**not currently used			
2	BMS1/BMS2	**PIN**	**Definition**	**functionality**	**Fuction**
		1	/	/	Communication with Li-ion battery BMS, CAN and RS485 communication for Li-ion battery can be adapted.
		2	/	/	
		3	/	/	
		4	CAN_A_H	CAN high level data	
		5	CAN_A_L	CAN low level data	
		6	/	/	
		7	RS485_A_BMS	RS485 differential signal A	
		8	RS485_B_BMS	RS485 differential signal B	
		Note: Communication with lithium batteries requires attention to the battery's communication port sequence and pin definition.			

3	LINK1/LIN2	**PIN**	**LINK1**	**LINK2**
		1	CON2_AO	CON1_AO
		2	CON2_BO	CON1_BO
		3	CON2_AI	CON1_AI
		4	CON2_BI	CON1_BI
		5-6	/	/
		7	CON_SyncH	CON_SyncH
		8	CON_SyncL	CON_SyncL

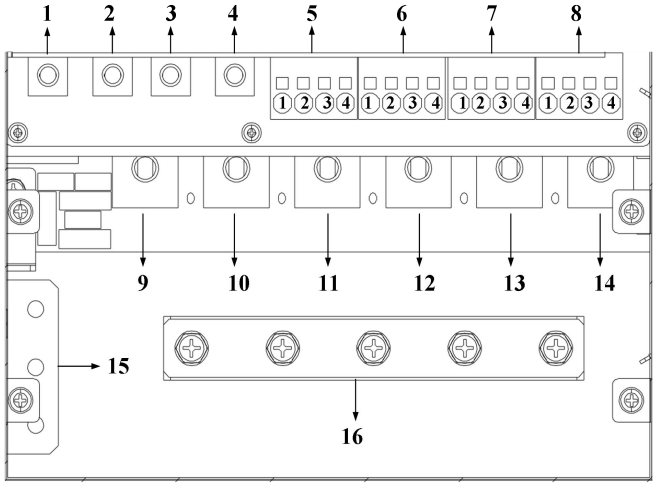


Figure 6.3 Schematic diagram of distribution bin strong terminals

Table 6-3 Distribution bin strong terminals function table

number	functionality	number	functionality
1	Battery 1 positive +	9	Load L2 terminal
2	Battery 1 negative-	10	Load L1 terminal
3	Battery 2 negative-	11	Generator L2 terminal
4	Battery 2 positive +	12	Generator L1 terminal
5	PV1(1&2positive+;3&4 negative-)	13	Grid L2 terminal
6	PV2(1&2negative-;3&4positive +)	14	Grid L1 terminal
7	PV3 (1&2 positive +; 3&4 negative -)	15	N-row terminal
8	PV4 (1&2 negative -; 3&4 positive +)	16	PE terminal

6.2 Electrical System Connection Diagram

Attenion

- Connect the N and PE cables to the AC GRID and AC LOAD ports of the inverters in different regions according to local regulations. For details, see local regulations.
- If the AC LOAD AC port is powered on after the inverter is started, power off the inverter to maintain the backup load. Otherwise, electric shocks may occur.

- Inverter AC GRID and AC LOAD AC ports have built-in relays. When the inverter is in off-grid state, the built-in AC GRID relay is in disconnected state; When the inverter is in the AC GRID state, the built-in AC GRID relay is in the closed state.

split-phase hybrid inverter wiring system as following page: (structure schematic, non-electrical wiring standard).

Recommended safety wiring: battery side requires external fuse and circuit breaker; AC side requires circuit breaker; grid requires external fuse and circuit breaker.

Note: The specifications are selected according to the user's actual working conditions.

Recommended minimum circuit breaker specifications: Battery circuit breaker 100A; AC circuit breaker: 250A (of which the grid-side AC circuit breaker needs to be decided according to the actual power of the load used and local regulations).

Recommended minimum fuse size: 150A 600V for 2-way access bus on battery side, 80A 600V for split access; 250A fuse for power grid.

Note: During final installation, circuit breakers for external connections to the inverter shall comply with UL1741 certification requirements.

Note: The AC Load cannot be connected to the grid and the inverter at the same time.

6.2.1 Connection to the AC grid and AC loads

⚠ Warning

- Ensure that the AC cable matches the L1, N, and ground ports of the AC terminal properly. Incorrect connection may cause device damage.
- Ensure that the cable core is fully connected into the wiring hole of the terminal.
- Ensure that the insulation board at the AC terminal is tightly fastened.

Ensure that the cables are securely connected. Otherwise, the terminal may overheat and damage the device.

Recommended the external circuit breaker which connection on the grid side, generator side and load side is 250A.

- **Inverter Standard Wiring Diagram**

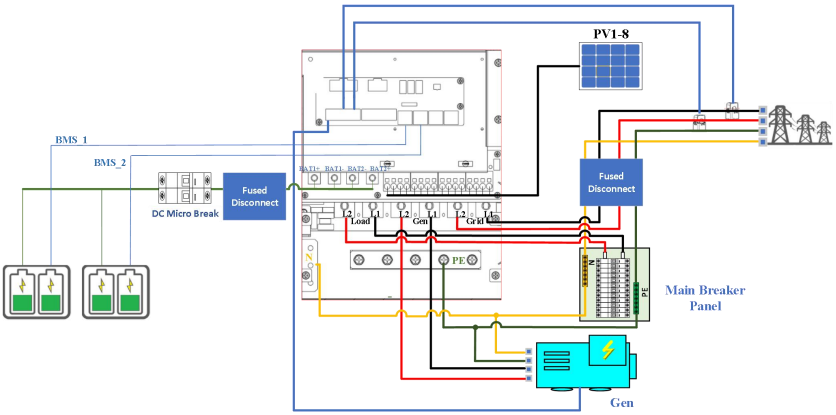


Figure 6.4 Isuna U20K Grid-Connected Standard Wiring Diagram 120V/240V

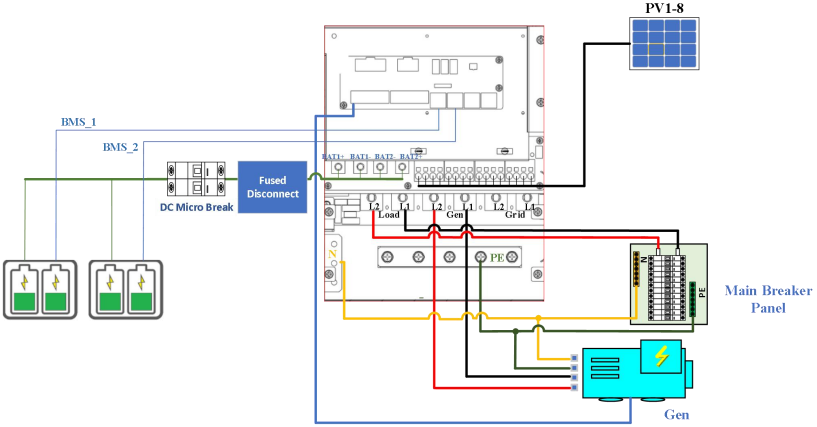


Figure 6.5 Isuna U20K Off-Grid Standard Wiring Diagram 120V/240V

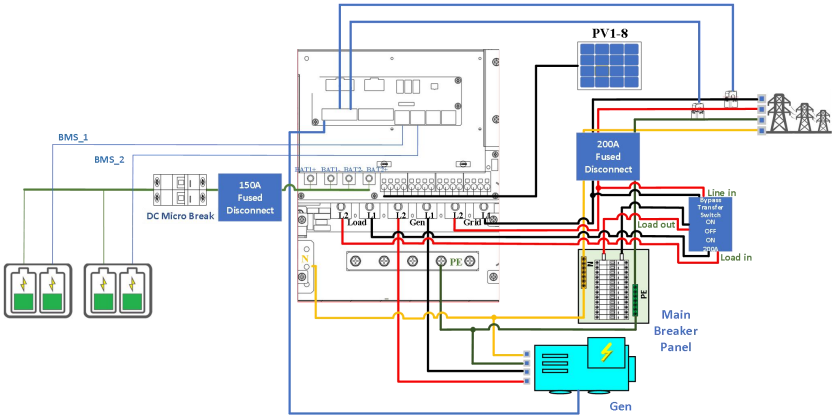


Figure 6.6 Isuna U20K Standard Manual Bypass Wiring Diagram 120V/240V

6.2.2 Connecting the Ground Cable (PE)

Attenion

- Since the inverter is a transformer-free type, it is required that the positive and negative electrodes of the photovoltaic array cannot be grounded, otherwise the inverter will fail. In the photovoltaic power generation system, all non-current-carrying metal components (such as brackets, distribution cabinet enclosures, inverter enclosures, etc.) should be connected to Inverter Grounding Blocks.

6.2.3 Connecting the PV and the Battery

Danger

PV series connection:

- Do not connect the same PV series to multiple inverters. Otherwise, the inverters may be damaged.
- Before connecting the PV series to the inverter, confirm the following information. Otherwise, the inverter may be permanently damaged or fire may occur, which may cause personal and property loss.
- Ensure that the maximum short circuit current and maximum input voltage of each PV are within the allowable range of the inverter.

- Ensure that the positive terminal of the PV string is connected to the PV+ of the inverter, and the negative terminal of the PV string is connected to the PV- of the inverter.

Battery cable connection:

- A battery short circuit may cause personal injury. However, a short circuit may release a large amount of energy, which may cause fire.
- Before connecting the battery cable, ensure that the inverter and battery are powered off, and the front and rear switches of the device are off.
- Do not connect or disconnect battery cables when the inverter is running. Improper operations may result in electric shock.
- Do not connect the same battery string to multiple inverters. Otherwise, the inverters may be damaged.
- Do not connect loads between the inverter and the battery.
- When connecting battery cables, use insulation tools to prevent accidental electric shock or battery short circuit.
- Ensure that the open circuit battery voltage is within the allowable range of the inverter.

⚠ Warning

PV series connection:

- The PV string output does not support grounding. Before connecting the PV string to the inverter, ensure that the minimum insulation resistance to the ground of the PV string meets the minimum insulation impedance requirement.

Battery cable connection:

- When connecting cables, the battery cable matches BAT+ and BAT- on the battery terminal.
- Ensure that the cable core is fully connected into the wiring hole of the terminal.
- Ensure that the cables are securely connected. Otherwise, the terminal may overheat and damage the device.

Note: Before crimping the PV and BAT cables, check and make sure that the PV knob switch is set to the 'OFF' position and that the battery is disconnected.

Note: In the internal wiring of the split-phase photovoltaic storage integrated inverter,

the inverter silkscreen is PV1-PV4, i.e. MPPT1-MPPT4, and the actual wiring is PV1-PV8, and the inverter internal PV1 and PV2 are connected in parallel as a group of MPPTs (PV3/4, PV5/6, PV7/8 are also the same), and due to the electrical relationship and the limitations of the silkscreen, the inverters are referred to by the name of PV1-PV4.

Note:When you reconnect the PV cable to the invert each time, you must make sure the control of invert has the power form the Grid or batter. Or you can think you need turn on the switch of Grid or batter and make sure the invert has the power and then switch on the PV's knob switch.

Photovoltaic wiring as shown in the figure below, there are four groups of MPPT where each group of MPPT is composed of two-way PV in parallel, as shown in Figure ① PV1 that is, MPPT1 is composed of PV1, PV2 in parallel. MPPT supports a voltage range of 80 ~ 500V, the maximum current of 36A, a split power of 7.5kW, a total of four groups of power 30kW. MPPT wiring supports one MPPT access and two MPPT parallel access.The general wiring diagram shows only one wiring mode.

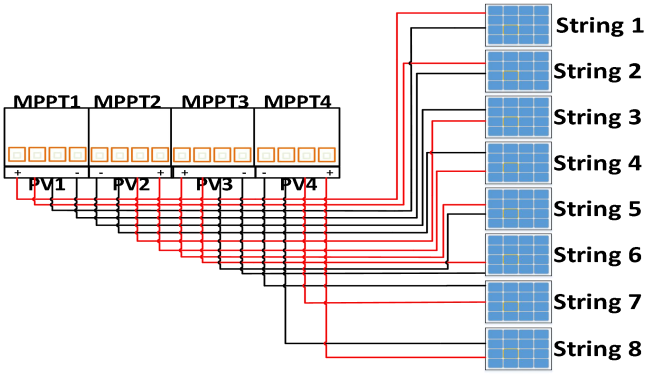


Figure 6.7 Schematic diagram of PV wiring

If you need two MPPTs in parallel, the wiring is as follows

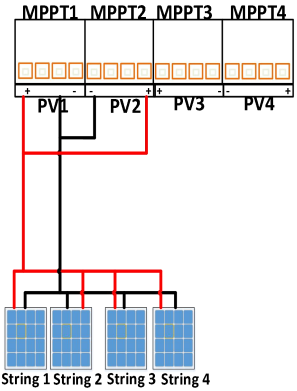


Figure 6.8 2-channel MPPT parallel connection diagram

Battery wiring as shown below, battery support voltage range 80V~480V, rated charge/discharge current is 50A.The power of split circuit is 10kW, the total power of two circuits is 20kW. the general wiring diagram only shows one kind of wiring method.

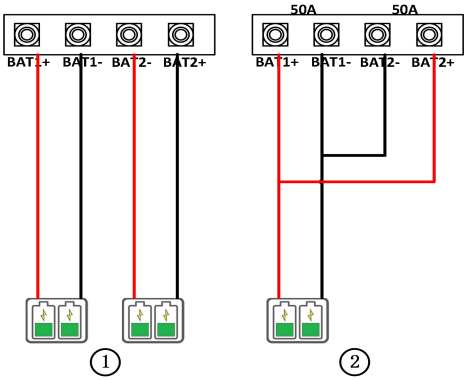


Figure 6.9 Battery Wiring Diagram

6.2.4 Wiring of CT current transformer

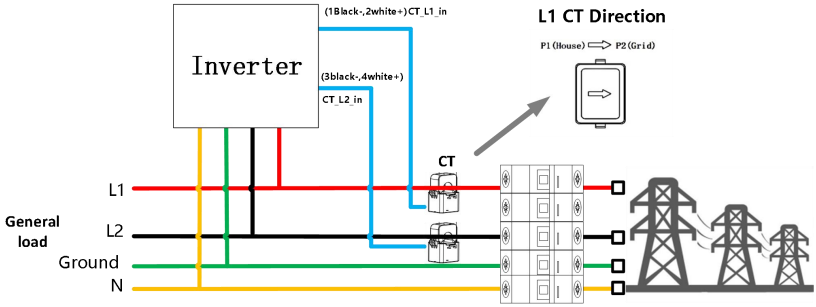


Figure 6.10 CT Wiring Schematics

The snap direction of the L1 current transformer is an arrow pointing towards the grid as shown in the figure below, and the L2 snap direction is same to L1.

- **Wiring of Smart Meters**

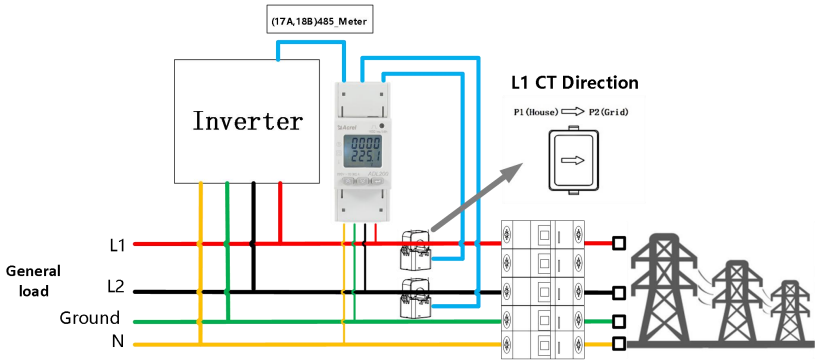


Figure 6.11 Meter Wiring Indication Diagram

Note:You can just choose one between the CT current transformer and the meter to connect Detailed wiring diagram of the meter is shown in the instruction manual of the meter.to the inverter.

6.2.5 RSD emergency stop switch wiring

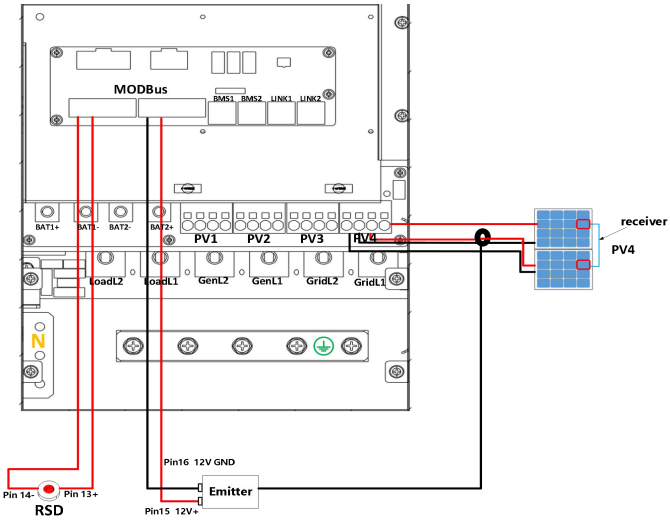


Figure 6.12 RSD Wiring Diagram

RSD (Rapid Shutdown) Compatible Models: TIGO TS4-A-O | TIGO TS4-A-F | TIGO TS4-O | TIGO TS4-O-DUO | APsmart RSD S-PLC / RSD-D.

Photovoltaic systems: the emergency stop shall be connected to the master PV board at address 01 and shall be activated by a split button for all parallel systems.

6.2.6 Arc detection protection

Function Description

Arcing may occur when the inverter's PV modules or cables are poorly connected or damaged. The arc may cause a fire. The inverter is equipped with an arc fault detection function module, which meets the requirements of UL1699B-2018 standard and shuts down the inverter and cuts off the PV when an arc is detected. Provide protection for user's life and property safety.

This function default: enable, the inverter automatically performs arc fault detection. If you want to disable this function, you can set “AFCI” in the App.Set “AFCI” as disabled.

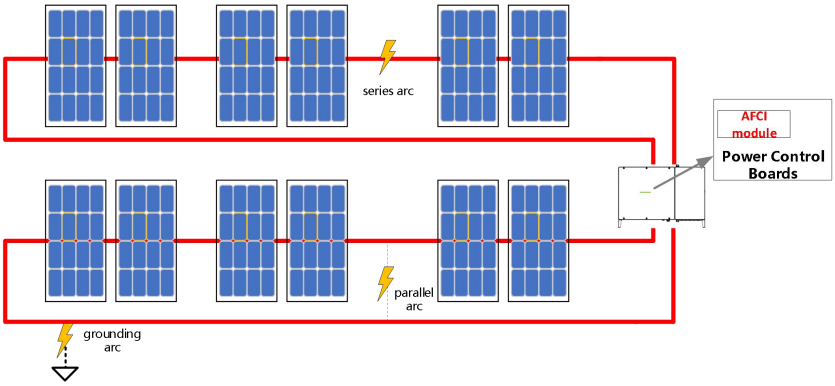


Figure 6.13 Schematic diagram of pulling arc detection

6.2.7 Generator mode

The generator wiring consists of two parts: one part is the control signal lines (generator start signal, generator ready signal), and the other part is the power cables (generator L1 terminal, generator L2 terminal and generator N line). The control signals mainly include the status off (Gen_On_Relay) and status on (Gen_Start_Relay). The APP function settings are shown in Table 6-4, and the control signals are as shown in the table below.

state	Gen_On_Relay	Gen_Start_Relay
CLOSE	PN Absorption（1）	PN Disconnect（0）
OPEN	PN Disconnect（0）	PN Absorption（1）

Note: The enabling of the oil engine is configured through the APP's DO function, which sets the Gen_On_Relay and Gen_Start_Relay. Customers can independently select the desired state according to the statuses listed in the table above.

Table 6-4 APP function setting

Setting name	Value	Instructions
Generator	0：Disable	Disable generator
	1：Enable	Enable generator
	2：Continuously enable	Enable generator
DO	0：Disable	Disable generator

	1：Enable	Enable generator
	2：Heat pump	Disable generator

Note: The generator function is only effective when both of the above signals are met simultaneously.

Table 6-5 Operation status control instruction table of APP

Setting name	Value	Instructions
Manual Control	0：Disable	Automatic operation mode
	1：Start	Force Start
	2：Stop	Force shutdown
Generator capacity	Actual capacity	U5-U20 model, maximum limiting operating range 48kW
Battery Charging Enable	0：Disable	Prohibit the generator from charging the battery
	1：Enable	Allow the generator to charge the battery
The time of start to charge	00:00~23:59	During automatic operation, the generator is allowed to work for a period of time, with the default being 00:00-00:00, which is valid for the entire day
The time of stop to charge	00:00~23:59	
Regular time to start	00:00~23:59	During automatic operation, the time for the generator to start within the allowed working period of the generator
Regular time to stop	00:00~23:59	During automatic operation, the amount of time the generator is shut down within the allowed operating time period
Min SOC when start generator	Default 20%	During automatic operation, the threshold for the generator to start based on the battery SOC is set outside the scheduled start time of the generator within the allowed working time period

Max SOC when stop generator	Default 90%	During automatic operation, within the allowed working time period of the generator and outside the scheduled starting time period of the generator, the generator stops according to the threshold of the battery SOC
Maximum generator running time	Default 10min	During automatic operation, within the permitted generator operating hours, the maximum running time of the generator will not be limited if set to 0
Minimum generator running time	Default 10min	During automatic operation, within the permitted generator operating hours, the minimum running time of the generator will not be limited if set to 0
Minimum generator shutdown time	Default 10min	During automatic operation, within the permitted generator operating hours, after the generator has been shut down, the minimum shutdown time will not be limited if set to 0

Note:

1) All generator start commands must be executed within the permitted working hours. When the permitted working hours end, the generator will shut down. The priority of generator commands is as follows: manual start > permitted working hours > maximum and minimum running time > scheduled start = SOC start && scheduled stop > SOC-based start and stop.

2) The default start SOC for the engine is 20%, and the default stop SOC is 90%; if the time setting is the default 0min or the default 00:00-00:00, it is equivalent to unlimited, with no related restrictions.

3) If currently within the scheduled time period, the SOC stop will not take effect; if currently outside the scheduled time period, the SOC stop will take effect.

4) If the maximum running time is reached within a single scheduled start and stop period, the generator will not restart again due to this time period. However, it will automatically start at the next scheduled start time or when the SOC start conditions are met.

5) Once the working hours and start time are set, they will cycle daily there after.

6.2.8 Parallel wiring method

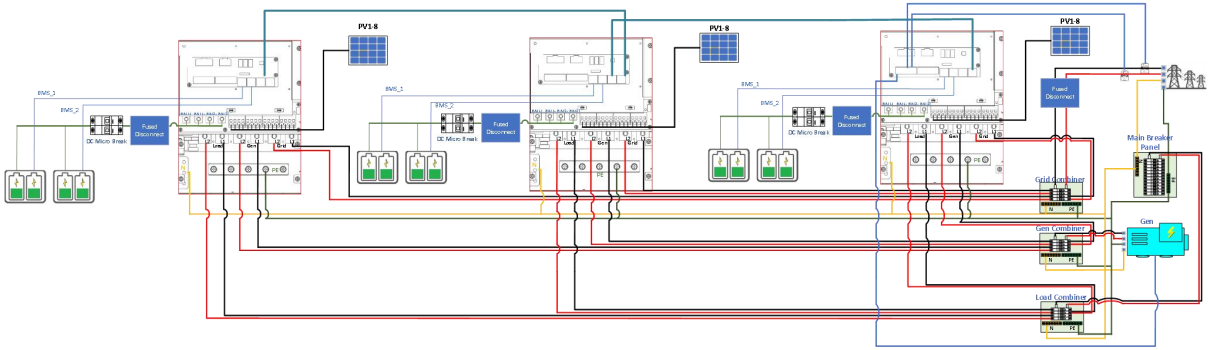


Figure 6.14 Isuna U20K 3 Parallel standard wiring diagram120V/240V

parallel communication and external dry contact signal.

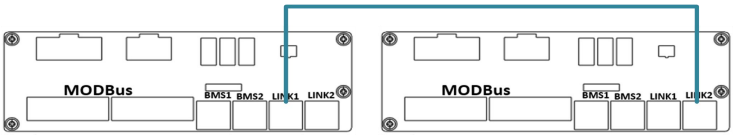


Figure 6.15 Interface diagram

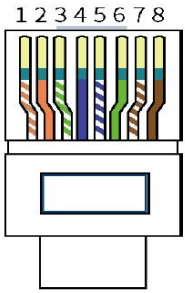


Figure 6.16 RJ45Sequence of RJ45 crystal terminals

1	2	3	4	5	6	7	8
Orange & White	Orange	Green& White	Blue	Blue& White	Green	Brown& White	Brown

If multiple inverters are used, connect the terminal of the network cable to LINK1 of the first inverter, connect the other end to LINK2 of the second inverter, and so on. Figure 6.15 shows the sequence of the network cable connection.

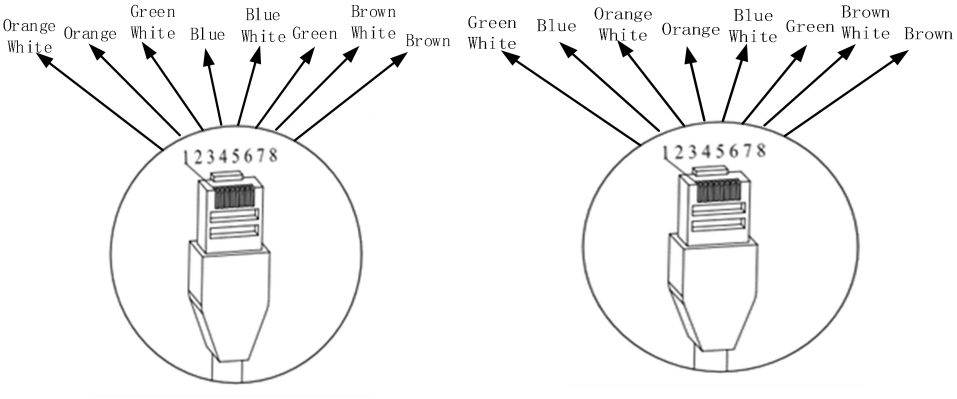


Figure 6.17 Parallel communication wiring diagram

Application note:

1.Supports up to 6 hybrid inverters in parallel;

2.Ensure that the inverters are connected to parallel lines;

3.Ensure that the load power is less than the maximum parallel power.

4.Parallel standard wiring as shown in 6.2.6 Figure 6.15 (structure schematic, non-electrical wiring standard, need to connect the circuit breaker correctly according to the electrical wiring diagram).

6.2.9 Grid AC Coupling Connection Method

The system supports the AC coupling function at the grid side. It integrates the photovoltaic inverter into the grid side and connects the relevant components. As shown in Figure 6.18, this is the wiring diagram for the AC coupling function. After correct wiring and setting the AC coupling enablement, and after powering on, the inverter can monitor the operating status of the photovoltaic inverter in the AC coupling mode.

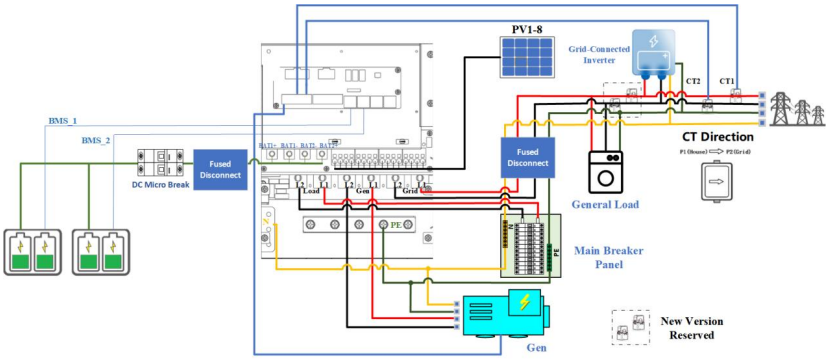


Figure 6.18 Wiring Diagram for AC Coupling Function

Note:

When the photovoltaic inverter is connected to the system for AC coupling, the current transformer should be properly clamped according to the wiring diagram. The current transformer should be placed on the main grid side, with the arrows pointing towards the grid side, and the signal lines should be connected to the corresponding signal connectors respectively.

In the AC coupling mode, the power values shown in the energy flow diagram on the ESS LINK APP home page are all real-time sampled values.

6.2.10 Communication side phase difference of 120° function connection method

The standard split-phase inverter provides two AC input/output signals with a phase difference of 180° between L1-N and L2-N. The inverter also offers two AC input/output signals with a phase difference of 120° between L1-N and L2-N. The wiring method is the same as that of the standard split-phase inverter. The difference lies in the phase difference of the input/output voltage signals. This depends on the requirements on the grid/generator/load side.

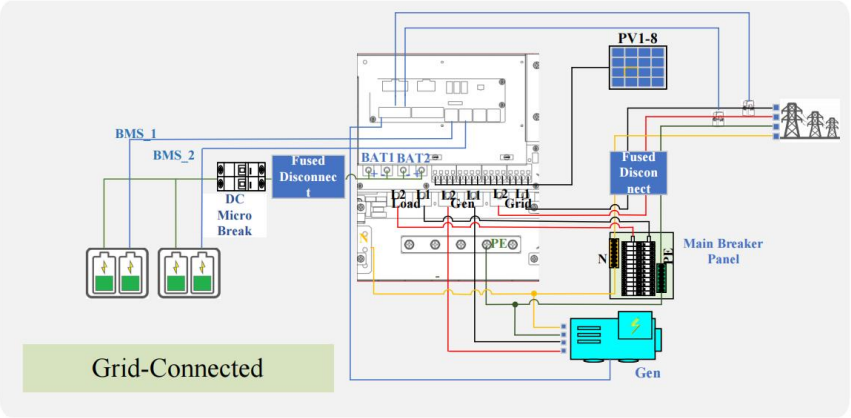


Figure 6.19 Function wiring diagram for 120° phase difference on the communication

Note:

The 120° phase difference function is not supported for parallel operation. It can only be used in single-machine mode.

6.2.11 Single-phase mode wiring method for the communication side

The standard split-phase inverter provides two AC input/output signals with a phase difference of 180°, namely L1-N and L2-N. This function offers L1-L2 input/output signals in single-phase voltage format. A single-phase power system consists of one live wire and one neutral wire. When using the "Output Mode: Single Phase" function, the live wire of the single-phase electricity should be connected to the L1 terminal of the split-phase inverter, and the neutral wire should be connected to the L2 terminal. The N row of the original split-phase inverter remains unconnected and should be connected to the PE terminal of the source end.

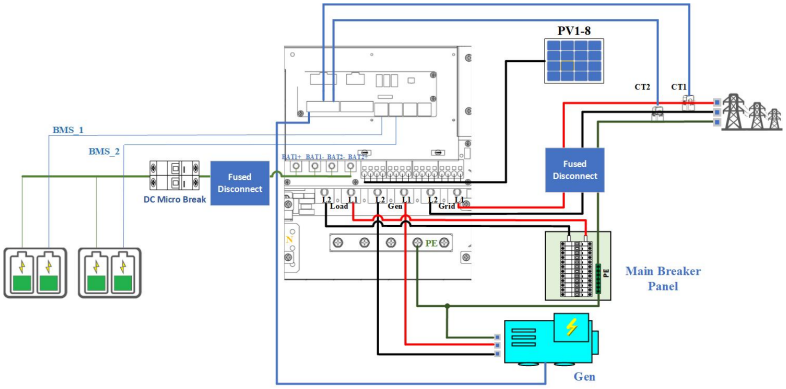


Figure 6.20 Single-phase mode wiring diagram for the AC output side

Note:

The output single-phase mode does not support the parallel operation function. It is only applicable in the single-machine mode.

6.3 Installation of Communication Dongle

The communication collector is an external component that you need to select by yourself.

The collector is connected. The default WIFI/ Bluetooth module is used for remote monitoring and control of the inverter.

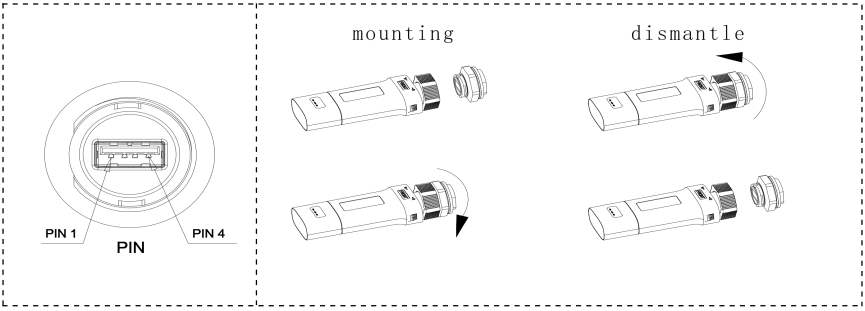


Figure 6.21 Communication Interface and Installation and Removal Diagrams

Table 6-4 Indicators on the AGN8 WIFI Dongle

LED	state	Specific meanings
RUN&COM&NET	Alternating flashing (cycle 1500ms, each light flashes for 500ms in sequence)	Self test mode
	Flashing together (cycle 1 second, off 900ms, on 100ms)	Dongle is currently upgrading (including Bluetooth App upgrade)
	Illuminate together for 5 seconds	Dongle upgrade failed
RUN	Slow flashing (on for 1 second and off for 1 second)	Dongle is running normally
	Light off	Dongle running abnormally
	Twice flashing (on (off) 100ms, off (on) 100ms, twice）	Dongle sends Bluetooth data to the app
COM	Flash (on for 200ms, off for 200ms)	Dongle time not synchronized (scanning will not start)
	Light off	Abnormal southbound communication
	Flashing once (on (off) 100ms, off (on) 100ms, once)	Normal southbound communication
NET	Flash	Connecting to WiFi
	Light off	Connecting to MQTT
	Slow flashing	Connecting to platform
	Always on	Successfully connected to the platform
	Twice flashing	Dongle sends platform data

Table 6-5 Meaning of AGN9 4G Dongle indicator light

LED	state	Specific meanings
RUN&COM&NET	/	/
RUN	Always on	The process from power

		on to initialization
	Flash (with an interval of 100ms)	Gateway initialization completed, flashing for 5 seconds
	Twice flashing (on (off) 100ms, off (on) 100ms, twice）	Slow flashing (with an interval of 1 second)
COM	/	/
NET	Always on	Looking for the internet or on a call
	Flash (interval 200ms)	Data connection established or network registered
	Slow flashing (with an interval of 800ms)	2G/3G network registered
	Light off	Shutdown or module sleep

7. Inverter Operation

7.1 Pre-power-on Inspection

Serial	Check the entry
1	The inverter is firmly fixed to the mounting bracket on the wall.
2	Cables are bundled according to cable routing requirements, properly distributed, and without damage.
3	PV+/PV-, BAT+/BAT- cables are firmly connected, the polarity is correct, and the voltage is within the accessible range.
4	The DC switch is properly connected between the battery and the inverter, and the DC switch is off.
5	The AC circuit breaker is correctly connected between the inverter port and the power grid, and the circuit breaker is disconnected.
6	The AC circuit breaker is correctly connected between the inverter load port and the power grid, and the circuit breaker is disconnected.

7	For lithium batteries, ensure that the communication cables are properly connected.

7.2 Initial Power-on

Follow these steps to turn on the inverter

1) Ensure that the inverter is not working;
2) Close the AC circuit breaker between the inverter On Grid port and the Grid;
3) Turn on the PV DC switch on the inverter (when connected to PV);
4) Turn on the battery and close the DC switch between the battery and the inverter;
5) The inverter starts to run after the self-test is successful;
6) Close the AC circuit breaker between the inverter Back up port and the load.

7.3 Working Mode

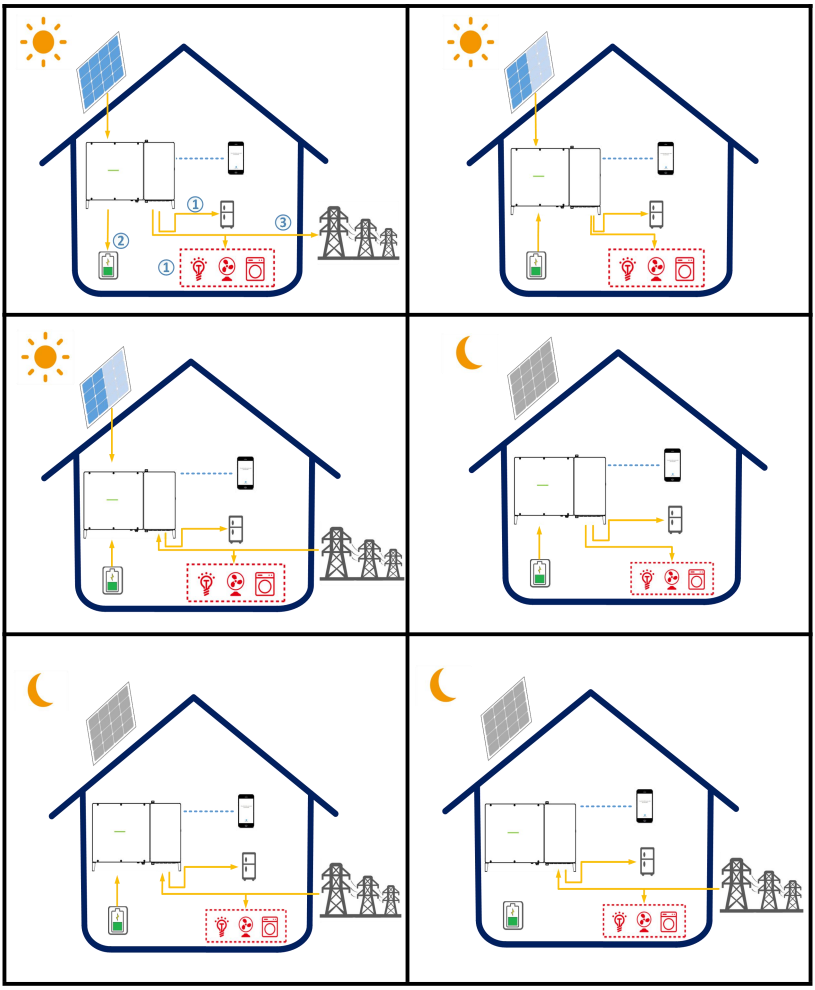
7.3.1 Self-use Mode (default mode)

Function:

Give priority to the use of photovoltaic and battery energy, as far as possible not to use the energy of the grid.

Specific working mode:

- When the PV is sufficient, the PV priority for supplies power to the load, and excess power charges the battery.
- When the PV is insufficient, the PV and battery supply power to the load.
- When the PV and battery are insufficient, the PV, battery, and power grid work together to supply power to the load.
- When the PV is not working and the battery is sufficient, the battery supplies power to the load.
- When the PV is not working and the battery is insufficient, the battery and the grid work together to supply power to the load.
- When the PV and battery are not working, the power grid supplies power to the load, forming a bypass output.
- When the power grid is unable to supply power, the photovoltaic and battery jointly power the load.



7.3.2 Timed Charge Mode

Function:

Set the charging period according to the user's own requirements. For example, when the electricity price is high during the day, the battery and photovoltaic power are used to power the load, and when the electricity price is low at night, the battery is charged with the electricity

of the grid, so as to achieve the role of peak cutting and valley filling. Non-charge and non-discharge inverters operate in self-actuating mode.

Specific working mode:

Charging period:

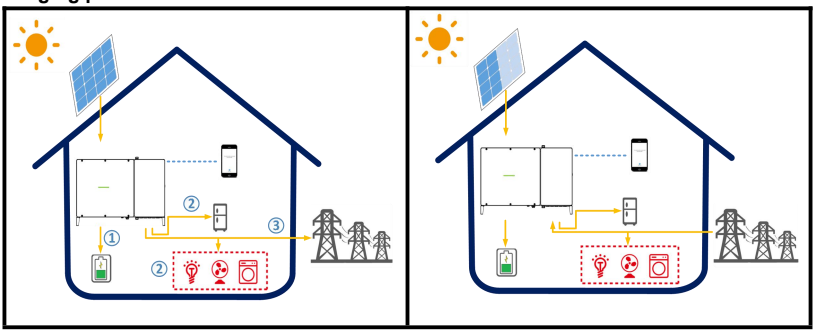
- When there is enough PV, the PV charges the battery, and the remaining power supplies the load.
- When PV is insufficient, the PV and the grid work together to charge the battery and power the load.
- When PV is not working, the grid charges the battery and powers the load.

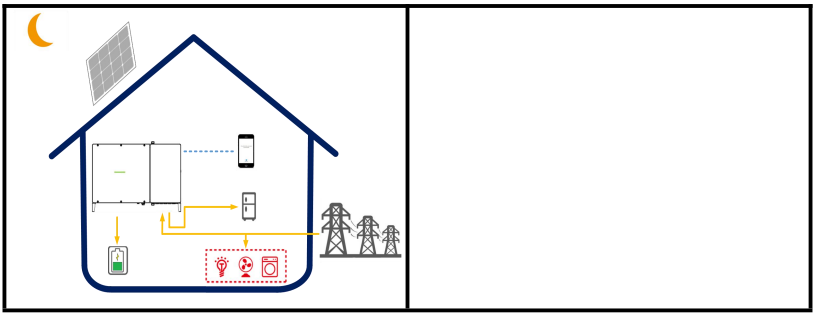
Discharging period:

- When PV is enough，PV supplies power to load.
- When PV is insufficient，PV and battery supplies power to load together.
- When PV is not working，and the battery is sufficient, the battery supplies power to the load.
- When PV is not working，and the battery is insufficient，battery and grid supplies power to the load.
- When PV and battery is not working, the grid supplies power to the load.Same as spontaneous BYPASS mode.

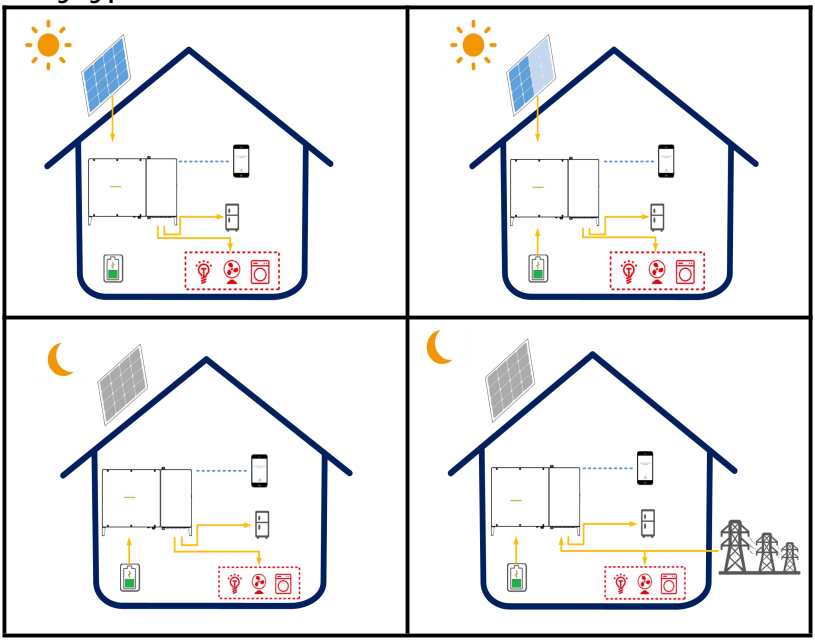
Note: The charging power is defined as the power of the inverter to charge the battery, and the discharge power is defined as the power of the inverter output.

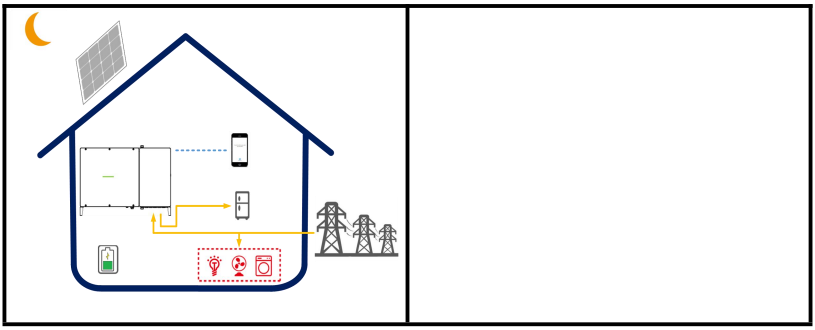
Charging period:





Disharging period:





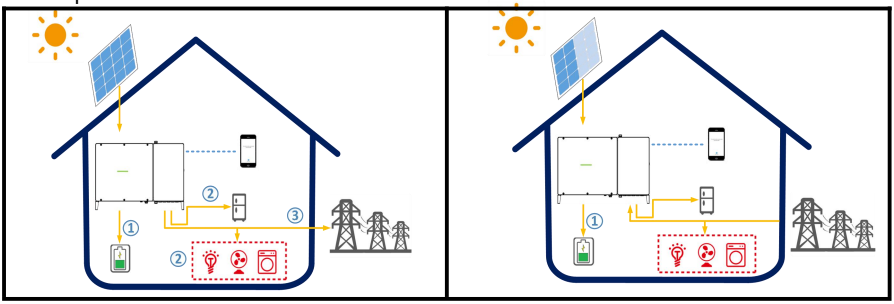
7.3.3 Backup mode/disaster recovery mode

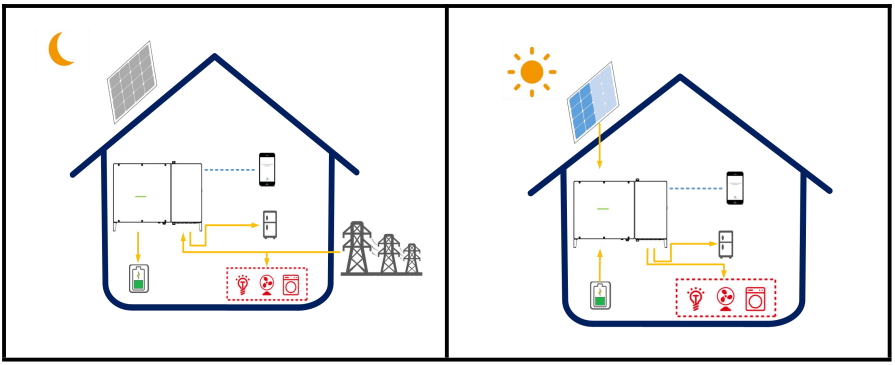
Function:

Always keep the battery fully charged to cope with sudden power outages or other emergency situations, ensuring that users can use the battery's power reserve to supply power to the load in case of emergencies.

Specific working mode:

- When the PV is sufficient, the PV first charges the battery and then supplies power to the load, and the remaining power can be fed back to the grid.
- When PV is insufficient, PV and the power grid give priority to charging the battery, while the power grid supplies power to the load.
- When the PV is not working, the power grid charges the battery and supplies power to the load.
- When the power grid is unable to supply power, PV and batteries jointly supply power to the load.





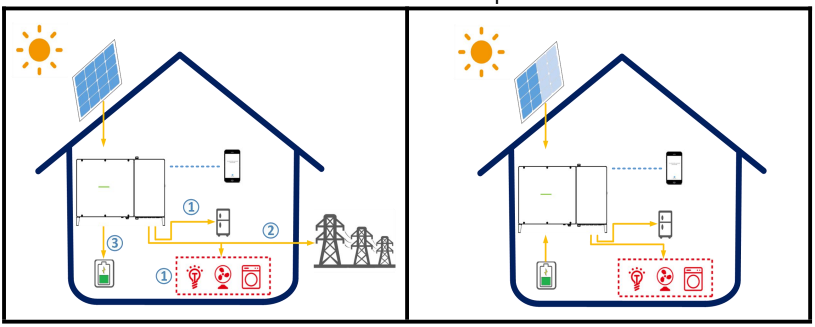
7.3.4 Free-in mode for selling electricity

Function:

After meeting the demand for electricity, excess PV power generation is prioritized for sale to the grid.

Specific working mode:

- When the PV is sufficient, it prioritizes supplying power to the load before feeding the grid, and the remaining power can be used to charge the battery.
- When the PV is insufficient and the battery is insufficient, the PV and the battery supply power to the load together.
- The rest of the situation is the same as the spontaneous self use mode.



7.4 Operating mode

7.4.1 Operation mode description

Table 7-1 Explanation of Inverter Operation Modes

NO.	Operating mode	Description
1	Waiting	➢ Waiting phase after the inverter is powered on. ➢ When the conditions are met, enter the self check state. ➢ If there is a malfunction, the inverter enters a fault state.
2	Self Test	➢ Before starting the inverter, perform continuous self checks, initialization, etc. ➢ If the conditions are met, the inverter enters the grid connected state and starts grid connected operation. ➢ If the power grid is not detected, it will enter an off grid state and the inverter will operate off grid. ➢ If the self-test fails, it will enter a fault state.
3	AC GRID	➢ The inverter is running normally on the grid.If it is detected that the power grid does not exist or the conditions do not meet the grid connection requirements, it will enter the off grid working state. ➢ If a fault is detected, it will enter a fault state. ➢ If it is detected that the grid conditions do not meet the grid connection requirements and the off grid output function is not enabled, it will enter a waiting state. ➢ If the grid conditions meet the grid connection requirements and the grid connection function is enabled after switching off the grid, the system will enter the grid connection state.

4	Off-grid	➢ When the power grid is cut off or the grid conditions do not meet the grid connection requirements, the inverter switches to an off grid state and continues to supply power to the load. ➢ If it is detected that the grid conditions meet the grid connection requirements, it will enter the grid connection state. ➢ When the working mode is set to off grid mode before operation, the inverter works off grid. ➢ If a fault is detected, it will enter a fault state.
5	Fault	➢ If a fault is detected, the inverter enters a fault state and waits for the fault to be cleared to restore its previous operating state.

7.4.2 Indicator light description

The strip indicator light is located in the middle of the equipment panel and represents the inverter status through three colors: red, green, and blue.

Table 7-2 Description of Indicator Light Status

Display color	Indicator light status	Corresponding status description	Remark
Red, green, blue 	Red light/green light/blue light/sequential 2S on	LED light self-test	Indicates that the inverter indicator is working properly and the subsequent work status can responded normally.

Green	1s flashing	pragmatic	Indicates that the inverter is currently in standby mode and can turned on normally
	0.1s flashing	inverter just powered up. Program initialization./Code Online Upgrade	Indicates that the inverter has just been powered up and initialized, and will blink for 10s;Indicates that it is now in a state of downtime, after the completion of the code upgrade can be turned on normal use
	Light	grid connection	Indicates that the inverter is currently working in a grid-connected state, where energy can be exchanged with the grid and the load can powered up and running.
Blue	Light	off-grid	Indicates that the inverter is currently operating in a off-grid state, with no energy exchanged with the grid, and the load can powered up and running.

Red 	Light	system failure	Means the inverter is currently in a shutdown state, with a serious alarm and the load unable to power on for operation.

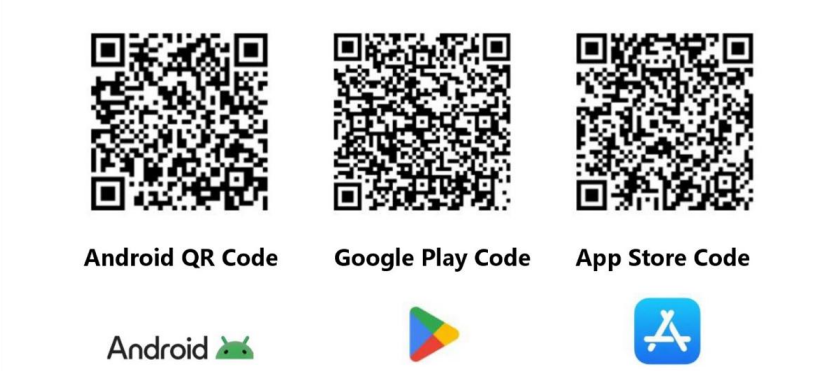
8. App introduce

Users need to choose between a WiFi dongle or a 4G dongle when using the app.

ESS LINK: Please contact the manufacturer for operation and use, and refer to the ESS LINK operation and user manual.

Android：Please scan the QR code below to obtain it.

IOS：Please scan the QR code below or go to the App Store to search for ESS LINK download.



9.Troubleshooting and Maintenance

This section will help users identify the possible causes of malfunction issues.

9.1Alarm and solution

Table 9-1 Alarm Information List and Solutions

<table>
<tr><th>NO.</th><th>Error</th><th>Solution</th></tr>
<tr><td rowspan="3">1</td><td>Abnormal output voltage</td><td rowspan="3">● If there is occasional alarm, it may be a short-term abnormality in the power grid. After the power grid returns to normal, the inverter will automatically resume normal operation. If the alarm is frequent, check if the output voltage/frequency is within an acceptable range. If so, please check the AC circuit breaker and AC wiring of the inverter.
● If the voltage/frequency of the power output is not within an acceptable range and the AC wiring is correct, but there are multiple alarms, please contact technical support to change the overvoltage and undervoltage and underfrequency protection values of the power output.</td></tr>
<tr><td>Abnormal off-grid output voltage</td></tr>
<tr><td>2</td><td>Output frequency abnormality</td></tr>
<tr><td>3</td><td>Zero line anomaly</td><td>● Please make sure the inverter is wired correctly. If there is no abnormality, the alarm will be cleared automatically.</td></tr>
<tr><td>4</td><td>DC converter over-temperature</td><td rowspan="2">● Please ensure that the inverter is installed in a place without direct sunlight.
● Please ensure that the inverter is installed in a</td></tr>
<tr><td>5</td><td>Inverter over</td></tr>
</table>

	temperature	cool/well ventilated area. ● Please ensure that the inverter is installed vertically and the ambient temperature is below the upper temperature limit of the inverter. ● If the fault persists, please contact your dealer or after-sales service center.
6	Insulation fault	● Check the impedance of the photovoltaic string to the protective ground. If the resistance value is greater than 125k Ω, it is normal. If the resistance value is less than 125k Ω, please investigate the short-circuit point and rectify it; Check if the protective grounding wire of the inverter is connected correctly. If there are no abnormal alarms during the power on test, it will automatically clear or send a fault clearing command. ● If it is confirmed that the impedance is indeed lower than the default value in cloudy and rainy weather, please reset the "insulation impedance protection point".
7	Leakage protection fault Abnormal leakage self-test	● Check if there are any problems with the inverter or wiring, and send a fault clearing command to retest if there are no issues。
8	Battery 1 reversed Battery 2 reversed	● Check if the battery overvoltage setting is inconsistent with the battery specifications. ● Please check if Battery 1 is connected correctly or if the voltage is abnormal. Once confirmed,

		the warning will automatically clear or a fault clearing command will be sent.
9	PV1 reverse connection PV2 reverse connection PV3 reverse connection PV4 reverse connection	● Please check if PV 1/2/3/4 is connected correctly or if the voltage is abnormal. Once confirmed, the alarm will automatically clear or a fault clearing command will be sent.
10	PV 1 overvoltage PV 2 overvoltage PV 3 overvoltage PV 4 overvoltage	● Check if the PV1/2/3/4 series voltage is higher than the maximum input voltage of the inverter. If so, adjust the number of PV modules in series and reduce the PV string voltage to adapt to the input voltage range of the inverter. After calibration, the inverter will automatically return to its normal state.
11	DC bus overvoltage	● confirms that it is normal and sends a fault clearing command. ● If the fault persists, contact your dealer or after-sales service center.
12	Hardware bus overvoltage	
13	Inverter overload	● Please check if the inverter is working in overload state. After confirming normal operation, the alarm will automatically clear or send a fault clearing command within 10 minutes.
14	Load power overload	
15	Balancing circuit overload timeout	
16	Model Capacity Failure	

17	Battery 1 overload timeout Battery 2 overload timeout	
18	Inverter soft start failure	● Internal fault in the inverter, turn off the inverter, wait for 5 minutes, then turn on the inverter and send a fault clearing command to restart the soft start.
19	Battery 1 soft start failed Battery 2 soft start failed	
20	DSP Communication Failure	● SPI after communication is normal, the alarm will be automatically cleared.
21	Relay self-test failed	● Power up and test once ● Power down and power up again, or the fault still exists after treatment, please contact your dealer or after-sales service center.
22	DC converter hardware overcurrent	● Please check if the inverter is working in overload state. After confirming normal operation, the alarm will automatically clear or send a fault clearing command within 10 minutes.
23	Fan failure	● Confirm whether it is an external fan abnormality, whether it is blocked or does not rotate. ● If it is an internal fan abnormality, or the fault persists after treatment, please contact your dealer or after-sales service center.

9.2Regular maintenance

⚠ Warning
➢ Make sure that the inverter is disconnected from power. ➢ Wear personal protective equipment when operating the inverter.

Table 9-2 Maintenance Instructions

Maintain content	Maintenance methods	Maintenance Cycle
System cleaning	Check for foreign objects and dust on the heat sink and air inlet/outlet.	Once/Half a year~Once/Year
DC switch	Continuously turn on and off the DC switch 10 times to ensure that the DC switch functions properly.	Once/Year
Electrical connection	Check whether the cable connection is loose or detached, whether the appearance of the cable is damaged, and whether there is copper leakage.	Once/Half a year~Once/Year

10.Technical Parameter

Table 10.1 Technical Parameter Description

Model	Isuna U5K-PH	Isuna U6K-PH	Isuna U8K-PH	Isuna U10K-PH	Isuna U12K-PH	Isuna U15K-PH	Isuna U20K-PH
Battery parameters							
Battery input number	2						
Battery type	li-ion battery						
Rated battery voltage	200V						
Battery voltage range	80-480V						
Max voltage	480V						
Rated charging and discharging power	5kW	6kW	8kW	10kW	12kW	15kW	20kW
Max charging and discharging currentof split circuit	50A						
Interface	RS485/CAN						
PV input							
PV input number	8						

Isuna U5K-U20K

Max input power①	10kWp	12kWp	16kWp	20kWp	24kWp	30kWp	30kWp
Max inout voltage	500V						
Starting voltage	95V						
MPPT Voltage range	80~500V						
MPPT Full load voltage range	210~500V						
Rated voltage	380V						
MPPT number	4						
MPPT string	1/1/1/1	2/2/1/1	1/1/1/1	1/1/1/1	1/1/1/1	2/2/1/1	2/2/2/2
MPPT Max input current	18A	18A	18A	18A	18A	36A/36A/18A/18A	36A
MPPT max short circuit current	22A	22A	22A	22A	22A	44A/44A/22A/22A	44A

Remark①: Recommend four MPPT input independently, per MPPT max power no more than 7500W

Grid parameters							
Rated output power	5kW	6kW	8kW	10kW	12kW	15kW	20kW
Max input power of grid	48kW						

Isuna U5K-U20K

Max input current of grid	200A						
Rated grid connected voltage	120V/240V/208V（Can set the single phase）						
Voltage range of grid	211~264Vac						
Rated grid frequency	50Hz/60Hz						
Grid frequency range	45Hz-55Hz/55Hz~65Hz						
Off grid parameters							
Rated output power	5kVA	6kVA	8kVA	10kVA	12kVA	15kVA	20kVA
Max output power	10kVA	12kVA	16kVA	20kVA	24kVA	30kVA	32kVA
Rated output current	21A	25A	33.5A	41.7A	50A	62.5A	83.5A
Rated output voltage	240V						
Output Voltage Range	211V~264V						
Rated output frequency	50Hz/60Hz						
THDu (@Linear Load)	<3%						
On/off grid switching time	<8ms						

Isuna U5K-U20K

Overload capacity	Supports 1.1x long term overload, 1.6x 10s, overload output needs to include sufficient PV output.
Efficiency	
Maximum efficiency	97.6%
Maximum battery charging and discharging efficiency	97.6%
Protection	
Insulation impedance testing	Integration
Residual current monitoring	Integration
Input reverse protection	Integration
Anti islanding protection	Integration
AFCI	Integration
Overvoltage and overload protection	Integration

Isuna U5K-U20K

AC short circuit protection	Integration
AC overvoltage level	III
Battery and PV overvoltage level	II
Surge protection	Integration
Lightning Protection	Integration
General Parameters	
Installation method	Wall mounted
Size	800*180*470mm
Weight	48kg
Standby power loss	≤30W
No-load loss	≤90W
Temperature range	-25℃~+60℃（>40℃，Power reduced operation）
Humidity range	0~100%
Allowable altitude	<4000m （≤3000m full load，Reduce power by 5% for every 100m increase）
Cooling method	Intelligent air-cooled

Isuna U5K-U20K

IP Grade	IP66/NEMA 4X
Monitoring	LED/APP/WIFI/4G/Bluetooth
Communication port	RS485/CAN/Parallel
Performance and Certification	
Parallel function	Yes
Warranty	10 years
UL	UL 1741, CSA 22.2 No. 107-01, UL 1998, UL1699B
FCC	FCC part15 CLASS B
Grid	UL1741 SB, California Rule 21, HECO Rule 14, IEEE 1547, IEEE 1547.1