



OSUNKET-ESS[®]

User Manual

- Installation
- Operation
- Maintenance





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Three Phase Hybrid Inverter

O SKT4KTL3H O SKT5KTL3H O SKT6KTL3H O SKT8KTL3H O SKT10KTL3H O SKT12KTL3H

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1 Introduction

1.1 Safety Symbols & Warnings

SKT series hybrid inverters are designed , manufactured and tested as per international safety standards. However, as an electrical and electric product, it must be installed, operated and maintained strictly according to related safety notices.

If you have any problems, please contact the nearest service center or authorized dealer. Please DO NOT install or repair the product by anyone who is not qualified by local authority.

We are not responsible for any damage or loss caused by misuse or misunderstanding of the information in the manual.

1.1.1 Symbols Explanation



Inverter will be touchable or operable after minimum 10 minutes after totally disconnected, in case of any electrical shock.

Danger of high voltage and electric shock!

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Danger of hot surface and burn injury!

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Earth line!



The wasted products must be sent to the authorized collecting center!

Refer to the operating instructions.

1.1.2 SAFETY WARNING



The inverter must be installed according to the local standard and related standard for an electrical enterprise. Please follow the instructions in this manual to use and operate the inverter.



Keep the PV array covered and the DC circuit breaker OFF. High voltage will be generated by PV array exposed under sunshine. All the cables must be connected firmly.



PV negative(PV-) and battery negative(BAT-) on inverter side are not grounded as default design. Connecting PV- or BAT- to ground are strictly forbidden.



• High voltage is a hazard, make sure the system device away from children.

- Any touch with the device or terminal may cause electric shock or fire.Please follow all the safety instructions.
- A damage device or system fault may cause electric shock.Make sure that you have checked the package and the device before installation to avoid unnecessary damage or loss.



Be aware of the hot surface while the device is running.



Do not open inverter cover or change any components without our authorization, otherwise the warranty commitment of the inverter will be invalid.

1.2 System Diagram



1.3 Operation Modes Introduction

SKT system normally has the following operation modes based on your configuration and layout conditions.

1.3.1 General mode(Default)

The default is General mode, and there are mainly two common application scenarios as shown below:



A) When there is sufficient sunlight, it will give priority to supply power to the loads, charge the battery with excess, and then merge the excess into the grid.

B) When there is no sunlight, the battery supplies power to the loads.

1.3.2 Battery backup mode

In this mode, it is necessary to ensure that the battery is charged regardless of whether there is photovoltaic or not.



A) When there is sufficient sunlight, it will give priority to supply power to battery, supply power to loads, and then merge the excess into the grid.

B) When there is no sunlight, it will get power from grid to charge battery fully.

1.3.3 Micro-grid mode

Suitable for non-grid scenarios





A) When there is sufficient sunlight, it will give priority to supply power to the loads, charge the battery with excess.

B) When there is no sunlight, the battery supplies power to the loads.

1.3.4 Peak shaving and valley filling mode

According to the difference of electricity price, a day can be divided into three periods: peak, flat and valley.

1.3.4.1) In the valley level, the grid and PV charge the batteries.(Fig:1.3.4.1)



1.3.4.2) In the flat stage, if the PV is sufficient, the battery can be charged(Fig:1.3.4.2A); if the PV is insufficient, Priority is for loads(Fig:1.3.4.2B).





Fig:1.3.4.2A

1.3.4.3) In the peak level.



Fig:1.3.4.3(A)(PV is sufficient)



Fig:1.3.4.3(B)(PV is insufficient)

2 Installation

2.1 Unpacking and Checking

On receiving the inverter, please check before installation to make sure all the components as below are not missing or damaged.



2.2 Unacceptable Installations

Please avoid the following installations, which will damage the system or the inverter.



2.3 Mounting

inspection.

wall

2.3.1 Requirements For Mounting

※ The installation of the inverter should be protected under shelter from direct sunshine or any bad weather conditions as shown below:



Fig.2.1

% The inverter should be installed in a cool & dry place with temperature from -25 $^\circ$ C to

※ The inverter LCD should be leveled with eyes and with enough space in the front for

X The inverter should be installed on a vertical wall or within 15° at most if backwards to the

60 °C (High ambient temperature will cause the inverter's power derating).



40CM Min.Size(CM) Position 40CM 40CM Front 40CM Lateral 40CM 40CM Тор 50CM 50CM Bottom

Fig.2.3

2.3.2 Mounting The Inverter

Step 1: Use the positioning the cardboard as template to drill 4 holes on walls.

Step2: Fix the borad to the wall using the tapping screws tightly.

X Leave enough space around the inverter as shown below:





Fig.2.5



Fig.2.2

※ To avoid burning and electric shock, the inverter should be installed beyond reach of children.

X Make sure the installation position does not shake.



Step 3: Screw on the back of the box to ensure that the inverter is parallel to the wall, and attach inverter to the wall bracket slightly to the top of its final position





Fig.2.6

2.4 Electrical Connection

2.4.1 System Wiring Diagram

General wiring diagram of SKT series hybrid inverter.





2.4.2 Overview Of The Electrical Connecting Part



Fig.2.8

2.4.3 PV Connection

Before connecting PV panels/strings to inverter, please make sure:

- 1) Use the right PV connectors in the accessory box.
- 2) The voltage, current and power ratings of the PV strings are within the allowable range

of the inverter. Please refer to the Technical Data Sheet for voltage and current limits.

- 3) Make sure the PV switch of the inverter is in the "OFF" position during wiring.
- 4) PV strings could not connect to EARTH conductor.

STEP1:

Assemble the PV connectors from the accessory box.(PV cable must be firmly crimped into connectors)





STEP2:

Connect the PV connectors to the inverter. There will be a click sound if connectors are inserted correctly into PV plugs.



Fig.2.10

2.5 Battery Connection

Battery connection diagram



Fig.2.11

1) Use the right BAT connectors in the accessory box.

2) Choose 4 to 6 mm²(AWG 10) tin-plated cable to connect the battery and the inverter.

3) Make sure battery switch is off and battery nominal voltage meets SKT series inverter's specification before connecting battery to inverter.

STEP1:

Assemble the battery connectors from the accessory box.(battery cable must be firmly crimped into connectors)



Connect the battery connectors to the inverter.

There will be a click sound if connectors

are inserted correctly into battery plugs.

STEP2:



Fig.2.13

STEP3:

Connect the BMS cable between battery and inverter, insert the RJ45 connector with water-proof cap into the port marked "BMS" on inverter and fasten the cap. Then insert the other end of the cable into the battery port.

1

2

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Fig.2.14

2.6 Grid & EPS Connection

Use the AC connectors from accessory box for grid and EPS connection. An external AC breaker(32A) is needed for on-grid connection to isolate from grid when necessary .

STEP1:

Assemble the grid connector. Follow the markings on the connectors, make sure 3L/N/PE lines are connected correctly.



Fig.2.15



Fig.2.16

STEP2:

Connect the grid connector and the EPS connector to the inverter. Just follow the markings on the inverter to connect them correctly.



Fig.2.17

2.7 Power key and Declaration for EPS Loads

The power button on the rear panel is only used for EPS function.

When mains power does not exist and EPS function is enabled, press and hold for 3 seconds, the inverter will enter backup mode;

When inverter operates in backup mode, press and hold for 3 seconds, inverter will exit backup mode;

X When inverter gives an alarm and shutdown in backup mode, press and hold for 3 seconds, inverter will clear alarm.

Accepted loads as blow;

XInductive load: a non-frequency conversion air conditioner within 1.5P can be connected to EPS side. Two or more may cause EPS output unstable.

Do not connect 3-phase inductive load(like motor) without Neutral line to EPS side. %Capacitive load: Total power <=0.6*nominal power of model.

2.8 Smart meter connection

Please Refer to the connection instructions in the meter box for connection

3.1 LED and LCD Display

The LED indicators are shown as blow:

LED	Status	Explanation
OVOTEM	ON	System is powered up
STSTEM	OFF	System is not powered up
	ON	Grid is normal
GRID	OFF	Grid loss
	FLASH	Grid is abnormal
		Inverter in offline mode, EPS is
EPS	ON	active
	OFF	Inverter is not in offline mode
	ON	WIFI module connected
COM	OFF	WIFI module not connected
METER	ON	Smart meter communication OK
METER	OFF	Smart meter communication fail
	ON	Alarm occurred and inverter stop
		work
FAULI	OFF	No Alarm
	FLASH	Alarm occurred but inverter still work



Position	Description
A	It indicates the power output amount of total and today alternately. Unit: kWh or MWh
В	PV panels indicator
С	PV1,PV2 panels parameters. Voltage and current are displayed alternately.
D	Total PV power
E	Battery parameters. Voltage and current are displayed alternately.
F	Battery power
G	Battery indicator
н	SOC of battery
I	Current time
1	Power flow array of battery. When it towards battery, it means charging; when it towards inverter, it
J	means discharging.
к	Default as current date. When an error occurs, fault code will be displayed alternately.
L	Loads indicator
М	Loads power consumption of each phase
N	Load parameters. Voltage and current of each phase are displayed alternately.
0	Power export or import of each phase
Р	Grid indicator
Q	Grid parameters. Voltage and current of each phase are displayed alternately.
R	Power flow array of load

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Operating of the Inverter

PowerView monitoring platform support both APP and web monitoring, user can monitor detailed running information like generating capacity, system data, and send command, set parameters at same time.

3.2.1 Software acquisition

APP: Download APP by searching 'PvPro' in Google Play or Apple App Store. Web: <u>https://pv.inteless.com</u>

3.2.2 WiFi Configuration

Plug in the WiFi module, power up inverter with PV or Battery, the WiFi module red LED will turn on, configure WiFi follow steps below.





Operating of the Inverter



Select the corresponding router signal,fill in password of the router, click "Confirm", WiFi module green LED will turn on



3.2.3 Monitoring and Setting

Both web and APP are available, this part shows monitoring and setting on web page.

The default setting is the most common, and users generally do not need additional settings.

Open web <u>https://pv.inteless.com</u> , fill			
in account and password			
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F Preservice	Pressing 2 Jugar -		
	the set		
	A.T.		
	Log in to your account		
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On the plant informa	ion page, click "Equipment">"Parameter Setting", Users can
S	et the inverter according to their needs
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	State Mathematics Gaminer Maple Maple State Maple
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3.2.4 ESS Working Modes Setting Instruction

• Working mode selection

Working mode	General Mode
Anti-backflow	General Mode Peak shaving and valley filling mode
* On-grid power limit(0-100%)	Battery Backup Mode
Three-phase unbalanced output	Histogrid Hode
Velley time charging	

The energy storage inverter provides four working modes to meet the needs of users in different applications, namely

Automatic mode (default), peak shaving and valley filling mode, battery backup mode and Microgrid mode.

Automatic mode: the automatic mode can maximize the self use rate of photovoltaic power generation, and achieve the goal of not consuming grid power as much as possible within the regulation range of the energy storage system. The load at any time is the first priority, and charging is the second priority. When the battery is full, selling power to the grid is the third priority. When the photovoltaic power is less than the load power, the battery will automatically discharge to avoid consuming the power of the grid. The automatic mode can meet the application needs of most families. It is generally recommended that users keep the automatic mode setting.

Peak shaving and valley filling mode: when the battery capacity of the energy storage system is small, the user's power consumption is relatively large, and there is a big peak valley electricity price difference in the user's region, the user can choose whether to adopt the peak shaving and valley filling mode according to his own power consumption. It should be noted that after setting the peak shaving and valley filling mode, the user must correctly set the peak valley period at the bottom of the page, and the period outside the peak valley period is the flat period. Compared with the automatic mode, the self utilization rate of photovoltaic power generation in the energy storage system will be reduced. During the peak period, the priority of load & charging & selling power is the same as that in the automatic mode; During the valley period, if the photovoltaic power of the grid, and the user can set whether to charge the battery from the grid during this period; In the flat section, the system only charges the battery will not discharge or get charged from the grid.

Battery backup mode: in areas with unstable power grid, this mode can try to meet the power demand of users during power loss. At the bottom of the setting page, you can set whether to charge the battery from the grid in the battery backup mode. Microgrid mode: applicable in areas without power grid.

Operating of the Inverter

• Power limit setting

Anti-backflow	
* On-grid power limit(0-100%)	100

Users can choose whether to turn on the on-grid power limit function after the battery is fully charged according to whether the local power grid company allows the photovoltaic power being exported to the power grid. This function is turned off by default. When the photovoltaic power is greater than the load power, the system will charge the battery. If the battery is full at this time, if the on-grid power limit function is turned off, the excess photovoltaic power will be sent to the power grid; If the on-grid power limit function is enabled, the system will adjust the amount of power sent to the grid according to the power limit percentage set by the user. For example, if the system is 10kW and the on-grid power limit is 0%, the power export is completely prohibited; If it is 50%, after the system is fully charged, the excess photovoltaic energy is allowed to send 5kW to the grid at most.

• Three phase unbalance setting



In some countries or regions, such as the Czech Republic, three-phase billing meters charge independently on each phase. Users can choose whether to turn on the three-phase unbalanced output function. It should be noted that in most countries, three-phase billing meters are charged uniformly after three-phase summary, so it is not necessary to turn on this function, because the conversion efficiency of the inverter will be slightly reduced after turning on this function.

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Valley time charging	
* Valley time charging SOC(20-100%)	60
* Valley time charging power(500-10000W)	3000

This function is only effective when the user selects the peak shaving and valley filling mode, and it is generally not recommended to start it.

• Valley period & peak period

Valley period 1	
Valley period 1 start hour	00:00
Valley period 1 start miniute	00:00
Valley period 1 end hour	00:00
Valley period 1 end miniute	00.00

Peak and valley periods are only effective when the user selects the peak cutting and valley filling mode. The system can set three Valley periods and three peak periods, and the periods cannot overlap.

•Peak time discharge

Peak time discharge mode	Automatic power regulation \sim
* Peak time discharge power(500-10000W)	3000

The peak time discharge setting is only effective when the user selects the peak shaving and valley filling mode. During the peak time, the default setting is that the system automatically adjusts the discharge power according to the household power detected by the smart meter; If the smart meter is not installed, the user can select a fixed discharge power according to the approximate power consumption.

•Battery backup mode charging setting

Charging with grid in storage mode	
* Storage mode charge SOC(20 100%)	40
* Storage mode charge power(500-10000W)	4000

The battery backup mode charging setting is only effective when the user selects the battery backup working mode. You can set whether to turn on the mains power to charge the battery, and the charging power and battery charging cut-off SOC.

4 Trouble Shooting

This part introduces the common fault and solving steps, provides troubleshooting methods and skills to the user, and helps the user identify and solve some common faults of the inverter.

Protection code	Description	Recommended solution				
P001	PV over voltage protection	Check the configuration of the PV panels				
P002	Battery over voltage protection	Check if battery volt larger than 600V				
P003	Insulation resistance low	Check the insulation of PV panels				
P004	Leakage current high	This error will reset itself.				
POOF	Over temperature protection	The inverter will recover automatically				
P005	Over temperature protection	when the temperature gets lower.				
P006	Bus voltage unbalance					
P007	Bus voltage high	The inverter will recover automatically.				
P008	Bus voltage low					
P009	Grid and EPS are reversed	Check the connection of AC side. Make sure the grid and EPS load are connected to the ports on the inverte correctly.				
P010	Grid relay open-circuit					
P011	Grid relay stick	Shut down and restart . If it still can't be				
P012	On-grid mode bus soft start fault	auto-recover, please contact the				
P013	MCU communication fault	Service.				
P010	Battery SOC low in on-grid	Battery discharged to low level, it will				
F019	mode	recover after charged automatically				
P020	Battery SOC low in EPS mode					
P021	Battery voltage low					

P022	Battery open-circuit	Check the connection of battery and set			
P022	Pattony SOC deadly low	right battery SOC in each mode.Check			
F023	Ballery SOC deadly low	the battery for parameter settings.			
P024	PMS communication fault	Check the BMS communication cable			
P024	DIMS communication fault	and BMS protocol setting			
No time interval setting for		Check invertor work mode setting			
F025	shaving and valley filling mode				
P026	Remote off	Inverter turn off through monitoring			
P027	Smart meter communication	Check the communication cable for			
F 027	fault	smart meter and meter protocol			
P033	Grid voltage high				
P034	Grid voltage low				
P035	Grid frequency high	- Check if grid fails or not connected well			
P036	Grid frequency low				
P037	Islanding protection				
P038	Grid wave loss				
P039	DC injection high	The inverter will recover automatically.			
P040	Utility not three phase	Check if grid cable well connected			
P0/11	Phase sequence fault	Reverse connection order of L2 and L3			
1041	r hase sequence lauk	cable			
P042	PLL error	The inverter will recover automatically.			
		Decrease EPS loads to make sure the			
P048	EPS overload	total loads power is lower than EPS			
1040	Li o ovendad	nominal output power, press power key			
		more than 3 seconds to clear alarm			
P049	EPS output voltage high				
P050	EPS output voltage low	Check if EPS over load pross power			
P051	EPS mode bus soft start fault	key more than 3 seconds to clear clarm			
P052	Inv soft start fault				
P053	EPS load short circuit				

P059	Battery current limited	
P060	Inv trip	
P061	Transient trip	The inverter will recover automatically.
P062	Bus trip	

If you meet any problem that you cannot solve by yourself, please contact with your local distributor or our company.

5 Technical Data

Model	SKT4KTL3H	SKT5KTL3H	SKT6KTL3H	SKT8KTL3H	SKT10KTL3H	SKT12KTL3H	
Input(PV)							
Max PV Power	5500W	6500W	7500W	9500W	11500W	13200W	
Max PV Voltage	1000Vd.c						
MPPT voltage range	200~850Vd.c						
Max input current/per string			13A	/13A			
Number of MPP trackers			2	2			
Number of input string				1			
Battery Input							
Battery Type			Li-l	_on			
Battery voltage range	130~700V						
Max charge/discharge current	25A/25A						
Charge strategy for Li-lon Battery			Self-adapt	ion to BMS			
AC Output (On-Grid)							
AC nominal power	4000VA	5000VA	6000VA	8000VA	10000VA	12000VA	
Max AC apparent power	5000VA	5500VA	7000VA	8800VA	11000VA	13200VA	
Max output current	8	10	12	15	17	20	
Nominal AC output	50/60Hz;400/350						
AC output range	45/55Hz;280~490Vac(Adj)						
Power factor	0.8leading~0.8laging						
Harmonics	<3%						
Grid type	3W/N/PE						
Three-phase unbalance output	0~100%				0~80%		
AC Output (Back-up)							
Max AC apparent power	4000VA	5000VA	6000VA	8000VA	10000VA	10000VA	
Norminal Output Voltage	400/380						
Norminal Output Frequency	50/60						
Output THDV (@Linear Load)	<3%						

Efficiency							
Max conversion efficiency	98.0%	98.0%	98.2%	98.2%	98.2%	98.2%	
European efficiency	97.3%	97.3%	97.5%	97.5%	97.5%	97.5%	
MPPT efficiency	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%	
Safety and protection							
DC reverse-polarity protection	yes						
DC breaker	yes						
DC/AC SPD	yes						
Leakage current protection	yes						
Insulation Impedance Detection	yes						
Residual Current protection	yes						
Output short circuit protection	yes						
Bat reverse connection protection	yes						
General Parameters							
Dimensions (W/H/D)	555*446*205mm						
Weight	28kg						
Operating temperature range	-25°C~+60°C						
Degree of protection	IP65						
Cooling concept	Natural convection						
Topology	Transformerless						
Display	LCD						
Humidity	0~95%,No condensation						
Communication	GPRS/WiFi						
BMS communication	CAN/RS485						
Meter communication	RS485						

Smart Meter Connection Instruction

1. Packing list



2. Installation instructions

2.1 Diagram



2.2 Installation Steps

Step 1: Connect the yellow live core of volt sample cable to power grid phase A,and let grid phase A pass through CT-A in the direction indicated by the arrow "Grid-Load"



Step 3: Connect the red live core of volt sample cable to power grid phase C,and let grid phase C pass through CT-C in the direction indicated by the arrow "Grid→Load",and the blue neutral core to power grid neutral



Note: Pay attention to the line sequence during AC wiring of hybrid inverter, pin 1 (or pin L1) connect to grid phase A, pin 2 (or pin L2) to phase B and pin L(or pin L3) to phase C. Otherwise, it may cause the inverter abnormal operation when the three-phase unbalanced output mode is enabled.

Connect the green live core of volt sample cable to power grid phase B,and let grid phase B pass through CT-B in the direction indicated by the arrow "Grid→Load"



Step 4 Connect the smart meter to the Inverter using a network cable.





2.3 System with multi-inverters

We support multi inverters with one smart to form a large capacity energy storage system,



With APP, in the setting page, choose "Basic Settings", Set the 1st inverter as "Master" and set internal comm address 1 Set the 2nd inverter as "Slave" and set internal comm address 2, etc. We design support up to 20 inverters in one system. Note: Please keep the slave backup terminal unconnected, otherwise it may cause damage to the inverter.



Step 2: