User Manual

Suntrio-TL Series

www.saj-electric.com

Preface

Thank you for choosing SAJ solar inverter. We are happy to provide you with first-class products and quality service.

The manual includes installation, operation, maintenance, troubleshooting, and safety notice. As long as you follow the instruction of this manual, you will get the professional guidance and our wholehearted service.

Customer-orientation is our forever commitment. We hope this “User Manual” become your good helper in solar power generation.

Please check the latest version at www.saj-electric.com

Guangzhou Sanjing Electric Co., Ltd.

Contents

1. Information on this Manual

1.1 Validity

This User Manual describes instructions and detailed procedures for installing, operating, maintaining, and troubleshooting of the following SAJ grid-tie inverters:

Suntrio-TL6K, Suntrio-TL8K, Suntrio-TL10K, Suntrio-TL12K

Suntrio-TL15K, Suntrio-TL17K, Suntrio-TL20K

Please keep this manual where it will be accessible at all times.

1.2 Target Group

This manual is for qualified electrically skilled person, who must strictly perform the tasks follow this manual.

1.3 Symbols Used

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, can result in death or serious injury or moderate injury

CAUTION

CAUTION indicates a hazardous condition which, if not avoided, can result in minor or moderate injury.

NOTICE

NOTICE indicates a situation that can result in potential damage, if not avoided.

2. Safety

2.1 Intended Use

The Suntrio-TL series inverters are PV inverter which converter the direct current of a PV array into alternating current and feed this into the electricity grid.

The inverters are designed according to the safety rules. However, improper use, alteration or modification may cause lethal hazards for the operator or third parties, or may result in damage to the units and other property. SAJ is not responsible for the loss and invalidate these warranty claims.

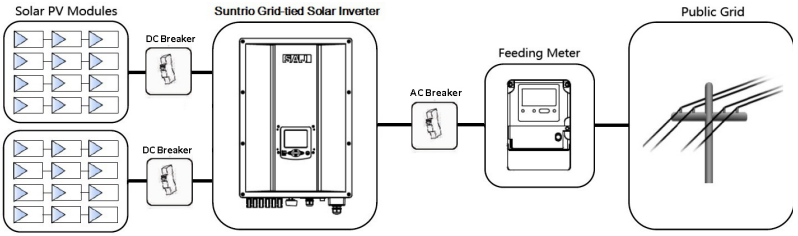


Figure 2.1 Grid-tie Solar System with Suntrio inverter

2.2 Safety Precaution

DANGER

● DANGER due to electrical shock and high voltage

● Do not touch the operating component of the inverter; it might result in burning or death.

● To prevent risk of electric shock during installation and maintenance, please make sure that all AC and DC terminals are plugged out.

● Do not touch the surface of the inverter while the housing is wet, it might lead to electrical shock.

● Do not stay close to the inverters while there are severe weather conditions including storm, lighting, etc.

● Before opening the housing, the SAJ inverter must be disconnected from the Grid and PV generator; you must wait at least five minutes to let the energy storage capacitors fully discharged after disconnecting from power source.

WARNING

- The installation, service, recycling and disposal of the inverters must be performed by qualified personnel only in compliance with national and local standards and regulations.
- Any unauthorized actions including modification of product functionality of any form may cause lethal hazard to the operator, third parties, the units or their property. SAJ is not responsible for the loss and deny these warranty claims.
- Suntrio inverters must only be operated with PV generator. Do not connect any other source of energy to the inverters.
- Be sure that the PV generator and inverter are well grounded in order to protect properties and persons.

CAUTION

- The PV inverter will become hot during operation. Please don't touch the heat sink or peripheral surface during or shortly after operation.
- Risk of damage due to improper modifications.
- Never modify or manipulate the inverter or other components of the system.

NOTICE

- The PV inverter is designed to feed AC power directly to the public utility power grid; do not connect AC output of the inverter to any private AC equipment.

2.3 Explanations of Symbols on Inverter

This section give an explanation of all the symbols on the inverter and on the label.

Symbol	Description
	**Dangerous electrical voltage** This inverter is directly connected to public grid, thus all work to the inverter shall only be carried out by qualified personnel.
	**DANGER to life due to high electrical voltage!** There might be residual currents in inverter because of large capacitors. Wait 5 MINUTES before you remove the front lid.
	**NOTICE, danger!** This is directly connected with electricity generators and public grid.
	**Danger of hot surface** The components inside the inverter will release a lot of heat during operation. Do not touch metal plate housing during operating.
	**An error has occurred** Please go to Chapter 9 “Troubleshooting” to remedy the error.
	**This inverter SHALL NOT be disposed of in residential waste** Please go to Chapter 8 “Recycling and Disposal” for proper treatments.
	**Without Transformer** This inverter does not use transformer for the isolation function.
	**CE Mark** Equipment with the CE mark fulfills the basic requirements of the Guideline Governing Low-Voltage and Electro-magnetic Compatibility.

3. Product Overview

3.1 Product Appearance

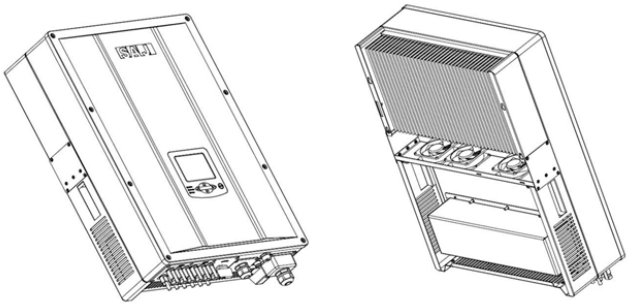


Figure 3.1 Suntrio inverters Overview

3.2 Major Characteristics

SAJ Suntrio inverter has following characteristics which make SAJ grid-tied solar inverter "Higher Efficiency, High Reliability and Lower Cost".

Leading technology

• Max. efficiency 98.1%

• MPPT accuracy up to 99.5% efficiency

User-friendly

• 5 inch LCD display with comprehensive information

• Embedded webserver monitoring

• Easy installation

Flexible

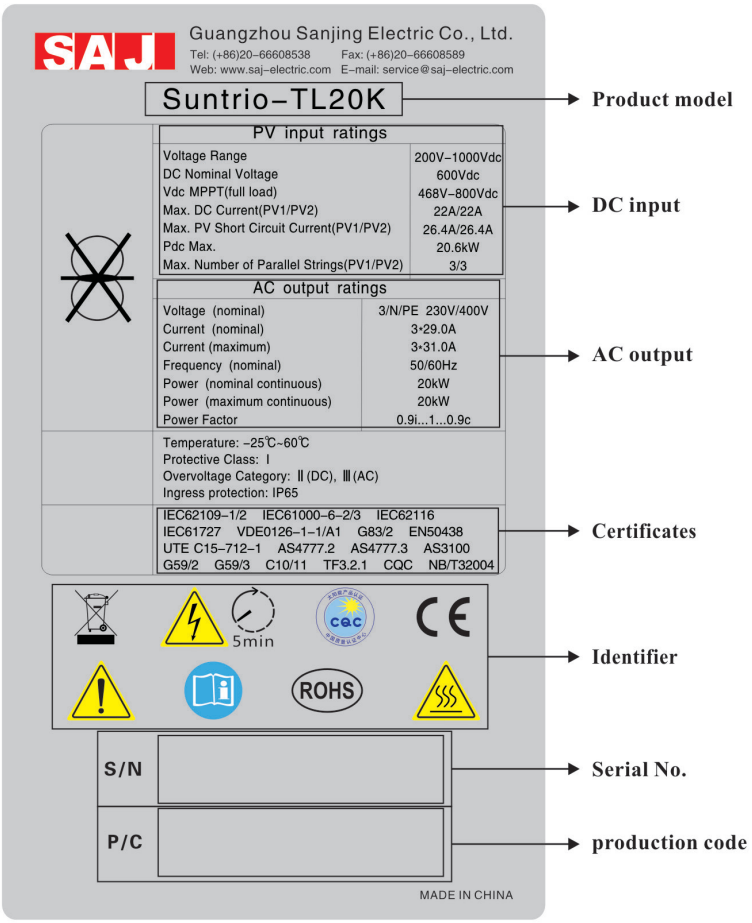
• Multi-country configuration

• RS485 / Ethernet / Wi-Fi communication

• Wide range of DC input voltage

• IP65 for indoor and outdoor

3.3 Nameplate instructions



3.4 Technical Data

Type	Suntrio-TL5K	Suntrio-TL6K	Suntrio-TL8K	Suntrio-TL10K
Input (DC)				
Max. DC Power [W]	5200	6300	8200	10400
Max. DC Voltage [V]	1000			
MPPT Voltage Range of Full Load [V]	240-800	320-800	340-800	430-800
Nominal DC Voltage [V]	600			
Start Voltage[V]	300			
Min. DC Voltage[V]	200			
Max. DC Input Current PV1 / PV2 [A]	12/12			
Number of MPPT	2			
String(s)per MPPT	1/1		2/1	
DC Switch	Optional			
Output (AC)				
Rated AC Power [W](@230V,50Hz)	5000	6000	8000	10000
Max. AC Apparent Power [VA]	5000	6000	8000	10000
Rated AC Current[A]	7.2	8.7	11.6	14.5
Max. AC Current [A]	8.1	9.7	12.9	16.1
Nominal AC voltage/ range	3/N/PE, 220/380V,230/400V,240/415V;180V-280V/312V-485V			
Grid frequency/ range	50Hz,60Hz /44Hz-55Hz,54-65Hz			
Power factor,adjustable	0.9 leading~0.9 lagging			
Total Harmonic Distortion (THDi)	< 2% (at nominal power)			
Feed-in Phase / Connection Phase	3 /3			
Efficiency				
Max. Efficiency	97.9%	97.9%	97.9%	98.0%
Euro Efficiency (at 600V_{dc})	97.3%	97.3%	97.3%	97.5%
MPPT Accuracy	>99.5%			
Protection				
Internal Over-voltage Protection	Integrated			
DC Insulation Monitoring	Integrated			
DCI Monitoring	Integrated			
GFCI Monitoring	Integrated			
Grid Monitoring	Integrated			
AC Short Circuit Current Protection	Integrated			
Thermal Protection	Integrated			
Anti-island protection monitoring	AFD			
Interface				
DC Connection	MC4/H4			
LCD Display	Graphic LCD Display, Backlight, Inverter Parameter and Data Display			
Display Language	Multi Language			
Datalogger & Communication	RS485 (Standard), Ethernet (Webserver embedded), Wi-Fi(Optional)			
General Data				
Topology	Transformerless			
Consumption at Night [W]	<1			
Consumption at Standby [W]	<12			
Operating Temperature Range	-20°C to +60°C (45°C to 60°C with derating)			
Cooling Method	Natural Convection		Fans	
Ambient Humidity	0% to 95% Non-condensing			
Altitude	Up to 2000m (without power derating)			
Noise [dBA]	<30		<40	
Ingress Protection	IP65 (Indoor & Outdoor Installation)			
Mounting	Rear Panel			
Dimensions (W*H*D) [mm]	480×550 ×180			
Weight [kg]	25			
Standard Warranty [Year]	5 (standard) /10/15/20/25 (Optional)			
Certificates	CE IEC62109-1/2, IEC61000-6-2/3, PEA/MEA, VDE0126-1-1/A1, C10/11, G83/2, G59/2, G59/3, EN50438, TF3.2.1, UTE C15-712-1, IEC62116, IEC61727, AS4777.2, AS4777.3, AS3100			

Type	Suntrio-TL12K	Suntrio-TL15K	Suntrio-TL17K	Suntrio-TL20K
Input (DC)				
Max. DC Power [W]	12500	15600	17700	20600
Max. DC Voltage [V]	1000			
MPPT Voltage Range of Full Load [V]	380-800		400-800	468-800
Nominal DC Voltage	600			
Start Voltage [V]	300			
Min. DC Voltage [V]	200			
Max. DC Input Current PV1 / PV2 [A]	18/18	22/22		
Number of MPPT	2			
Number of DC Connection Sets per MPPT	2	3		
DC Switch	Optional			
Output (AC)				
Rated AC Power [W](@230V,50Hz)	12000	15000	17000	20000
Max. AC Apparent Power [VA]	12000	15000	17000	20000
Rated AC Current [A]	17.4	21.7	24.6	29.0
Max. AC Current [A]	19.3	24.2	27.4	31.0
Nominal AC voltage/ range	3/N/PE,220/380V,230/400V,240/415V;180V-280V/312V-485V			
Grid frequency/ range	50Hz,60Hz /44Hz-55Hz,54-65Hz			
Power factor,adjustable	0.9 leading~0.9 lagging			
Total Harmonic Distortion (THDi)	< 2% (at nominal power)			
Feed-in Phase / Connection Phase	3/3			
Efficiency				
Max. Efficiency	98.1%	98.1%	98.1%	98.1%
Euro Efficiency (at 600V_{dc})	97.4%	97.5%	97.5%	97.5%
MPPT Accuracy	>99.5%			
Protection				
Internal Over-voltage Protection	Integrated			
DC Insulation Monitoring	Integrated			
DCI Monitoring	Integrated			
GFCI Monitoring	Integrated			
Grid Monitoring	Integrated			
AC Short Circuit Current Protection	Integrated			
Thermal Protection	Integrated			
Anti-island protection monitoring	AFD			
Interface				
DC Connection	MC4/H4			
LCD Display	Graphic LCD Display, Backlight, Inverter Parameter and Data Display			
Display Language	Multi Language			
Datalogger & Communication	RS485 (Standard), Ethernet(Webserver embedded), WiFi(Optional),			
General Data				
Topology	Transformerless			
Consumption at Night [W]	<1			
Consumption at Standby [W]	<12			
Operating Temperature Range	-20°C to +60°C(45°C to 60°C with derating)			
Cooling Method	Fans			
Ambient Humidity	0% to 95% Non-condensing			
Altitude	Up to 2000m without power derating			
Noise [dBA]	<40dB (with fan<50dB)			
Ingress Protection	IP65			
Mounting	Rear Panel			
Dimensions (W*H*D) [mm]	480×680 ×200			
Weight [kg]	42			
Standard Warranty [Year]	5 (standard) / 10/15/20/25 (Optional)			
Certificates	CE IEC62109-1/2, IEC61000-6-2/3, PEA/MEA, VDE0126-1-1/A1, C10/11, G83/2, G59/2, G59/3, EN50438, TF3.2.1, UTE C15-712-1, IEC62116, IEC61727, AS4777.2, AS4777.3, AS3100, CQC NB/T32004			

4. Installation Instructions

4.1Unpacking

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

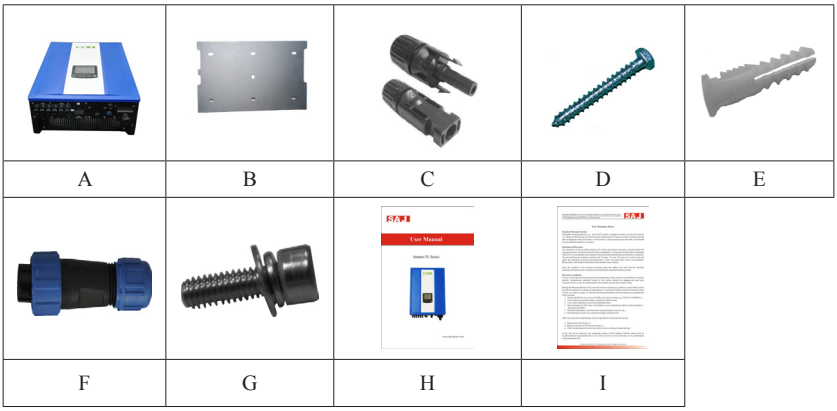


Figure 4.1 Inverter and Accessories

Object	Quantity	Description
A	1	SAJ Suntrio solar inverter
B	1	Rear panel
C	4 sets for Suntrio-TL6K/8K/10K/12K 6 sets for Suntrio-TL15K/17K/20K	DC connector
D	7	M6×50 Expansion screw
E	7	Expansion tube
F	1	RS485 connector(if attached)
G	4	M4×12 Cylinder head screw and Lock washer
H	1	User manual, including installation guide
I	1	Warranty card

Table 4.1 Detail Information of Inverter and Accessories

4.2 Mounting Instructions

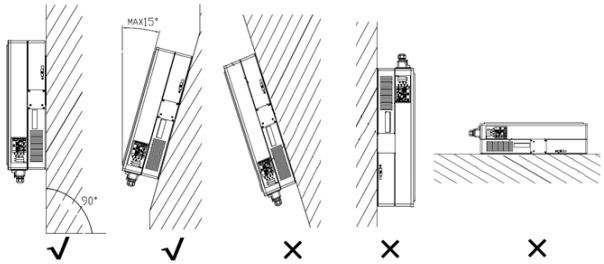


Figure 4.2 Mounting Instructions

Mounting on a solid surface out door or indoor.

● Site altitude is less than 2,000m above the sea level.

● The mounting location must be clear and safely accessible at all times without the use of additional aids such as scaffolding or lifting platforms. If this is not the case, service work may be restricted.

● Mount vertically or tilted backwards by max. 15°

● The connection area must point downwards.

● Never install the inverter forward tilt, sideways tilt, horizontally or even upside down.

● Install the inverter at eye level for convenience checking the LCD display and possible maintenance activities.

● Given the weight of the device, this will facilitate disassembly for service work.

● The ambient temperature should be below 45°C to ensure optimum operation. Choose locations with sufficient air exchange. Ensure additional ventilation, when necessary.

● Do not expose the inverter to direct solar irradiation as this could cause power derating due to overheating.

● In order to avoid audible vibrations in living areas, do not mount the unit on plasterboard walls or similar.

● Observe the recommended clearances to walls, other inverters or other objects, as shown in the follow diagram. That ensures sufficient heat dissipation and gives you enough space to unplug the PV Connector, communication port and operate the DC-switch.

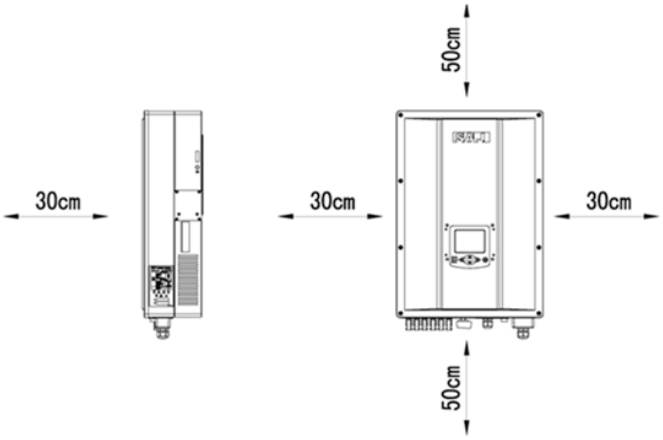


Figure 4.3 Safety Clearance of Single Inverter

●Multiple inverters are mounted in an area,the below clearances between the inverters are recommended.This ensure the flow of the air inlet and air outlet openings and optimize heat dissipation.

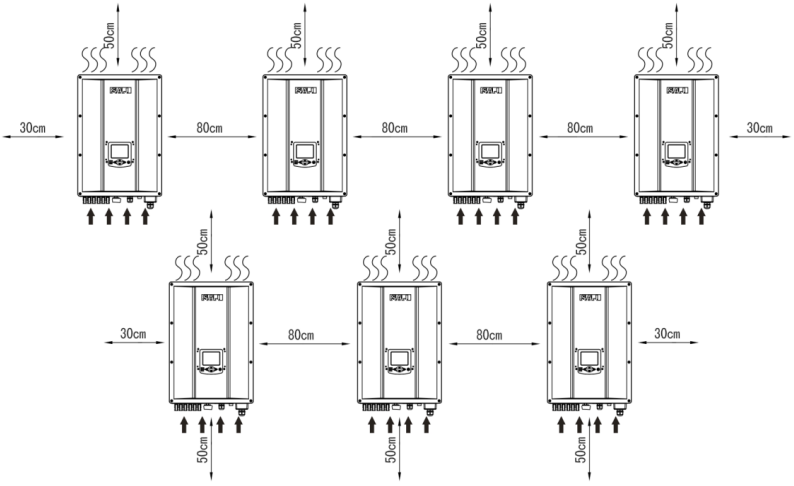


Figure 4.4 Safety Clearance of Multiple Inverters

4.3 Mounting Procedure

1) Use the rear panel in the package as a drilling template and drill 7 holes with 8mm diameter and depth in 50mm, as illustrated below, (Units: mm)

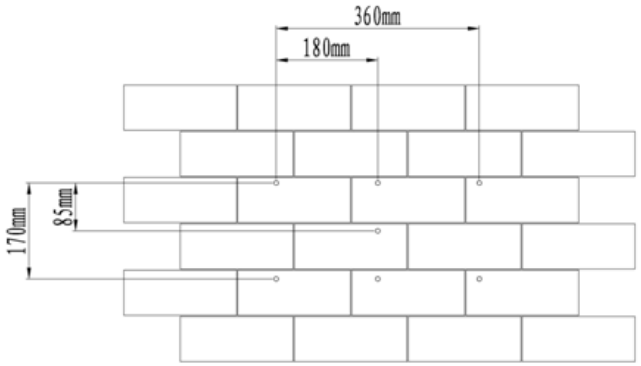


Figure 4.5 Holes Position

2) Fix the rear panel on the wall with the expansion tubes and expansion screw.

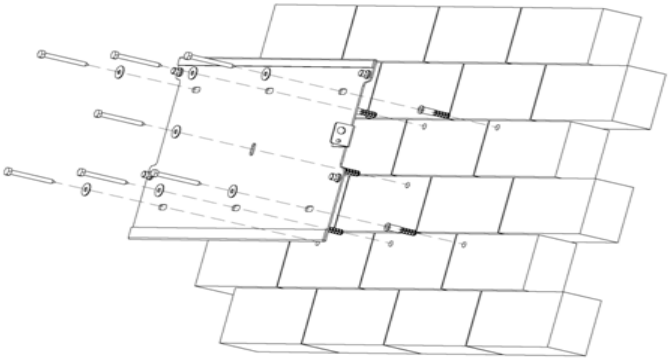


Figure 4.6 Mounting Real Panel

3) Hang the inverter on the rear panel, and check whether the pothook is installed in place. If there are any errors, remove the inverter, reinstall, as shown below.

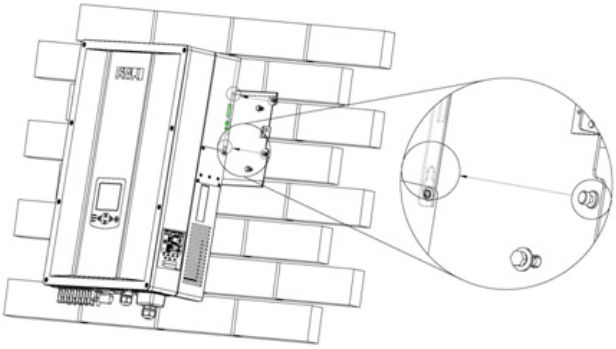


Figure 4.7 Mounting the Inverter

4) After Confirming the inverter is installed well, tight the inverter with M4 Phillips pan head screws.

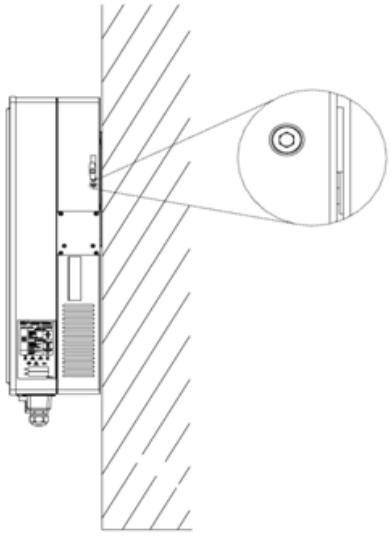


Figure 4.8 Secure the Inverter

5)Please carefully check the accessories and original carton to make sure during the installation every necessary part is used and nothing is missed.

4.4 Optional Anti-Theft Protection

To protect the inverter from theft, you can lock inverter with a padlock. The padlock must meet the following requirements:

Size:

A:6 mm – 8 mm diameter

B:23mm – 29 mm

C:23mm – 28 mm

D:39mm – 50 mm

E:13mm – 18 mm

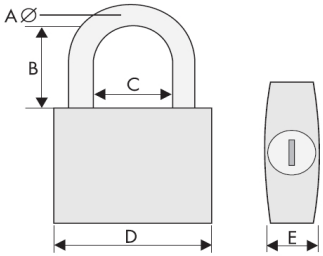


Figure 4.9 Padlock for Anti-theft Protection

Installation of the padlock

Put the shackle of the padlock through the hole and close the padlock, as following picture.

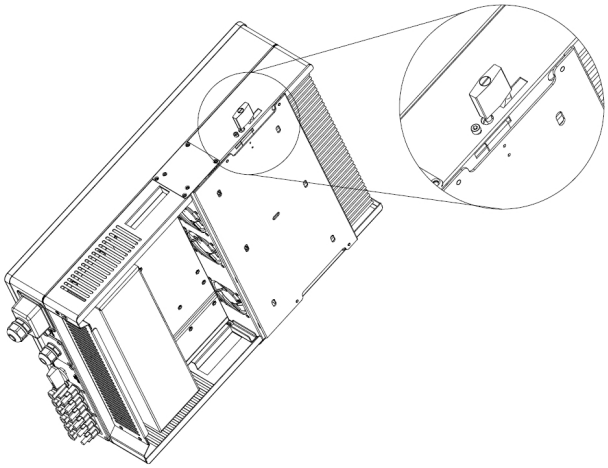


Figure 4.10 Secure the Inverter with Padlock

5. Electrical Connection

5.1 Safety

NOTICE

- Internal components of the inverter can be damaged by Electrical discharge, take measurement to avoid Electrical discharge during relevant operation.
- Earth yourself before touching any components.

5.2 Overview of Connection Area

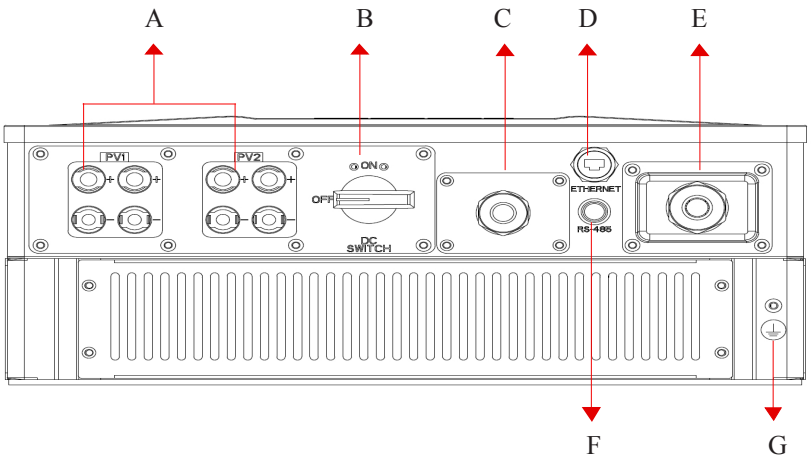


Figure 5.1 Connection Area Overview of Suntrio-TL6K/8K/10K/12K

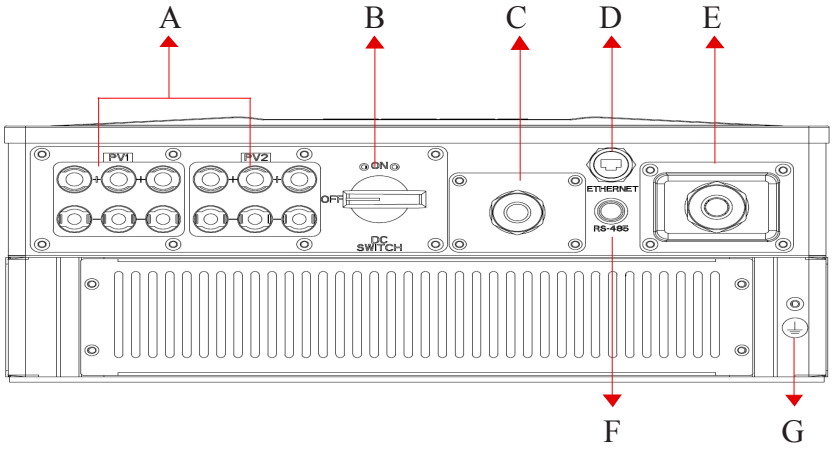


Figure 5.2 Connection Area Overview of Suntrio-TL15K/17K/20K

Object	Description
A	DC input terminals (PV1 and PV2)
B	DC switch (optional)
C	EXT port
D	Ethernet RJ45 interface
E	AC cover terminal
F	RS485 interface
G	Grounding terminal

Table 5.1 Description of Connection Area

5.3 Connection Cables Requirements

The user can select connection cable according the table below.

Model	DC Side	AC Side
	cross section (cu)	Mini cross section (cu)
Suntrio-TL6K/8K	$4mm^2$ / $6mm^2$	$4mm^2$
Suntrio-TL10K/12K	$4mm^2$ / $6mm^2$	$4mm^2$
Suntrio-TL15K	$4mm^2$ / $6mm^2$	$6mm^2$
Suntrio-TL17K	$4mm^2$ / $6mm^2$	$6mm^2$
Suntrio-TL20K	$4mm^2$ / $6mm^2$	$6mm^2$

Table 5.2 Connection cables requirements

Note:The cable loss due to the cross section and the length, to avoid too much power loss, user can select the proper cable according the actual situation. The below chart specific the relationship among the Cable Loss, cross section, cable length.

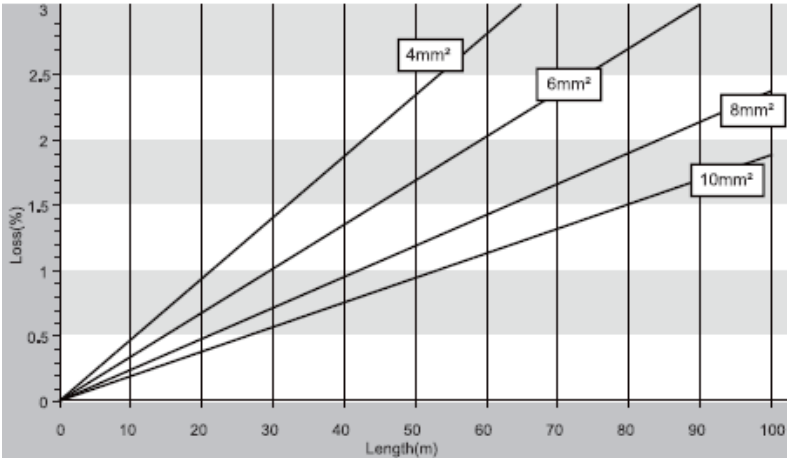


Figure 5.3

5.4 Miniature circuit breaker

DANGER

When more than one inverter is connected in parallel to the same miniature circuit-breaker, the protective unction of the miniature circuit-breaker is no longer guaranteed. This could result in a cable fire or destruction of the inverter.

●Never connect several inverters to a single miniature circuit-breaker.

In order to securely disconnect the inverter from the PV generate and the public-Grid, SAJ recommend to install circuit breaker at DC Input and AC output as figure 2.1 shown.

Breaker specification:

Model	DC input	AC output
	Recommended DC breakers	Recommended AC breakers
Suntrio-TL6K	DC1000V,C20A,2P	AC400V,C20A,4P
Suntrio-TL8K	DC1000V,C20A,2P	AC400V,C20A,4P
Suntrio-TL10K	DC1000V,C20A,2P	AC400V,C20A,4P
Suntrio-TL12K	DC1000V,C20A,2P	AC400V,C25A,4P
Suntrio-TL15K	DC1000V,C25A,2P	AC400V,C32A,4P
Suntrio-TL17K	DC1000V,C25A,2P	AC400V,C32A,4P
Suntrio-TL20K	DC1000V,C25A,2P	AC400V,C40A,4P

Table 5.3 Miniature circuit breaker requirements

5.5 Connecting the Electricity Grid (AC)

5.5.1Conditions for the AC Connection

You must comply with the connection requirements of your network operator.

Residual Current monitoring

The inverter is equipped with an integrated all-pole-sensitive residual-current monitoring unit.

The inverter can automatically differentiate between residual currents and normal leading leakage currents.

If an external RCD or residual-current device (RCMU breaker) is strictly required, you must use a switch that trips at a residual current 100mA≤ Ifn ≤300mA.

The external RCMU breaker should be installed between inverter and Grid. No load should not connected to the inverter directly.

Connection of a Second Protective Conductor

In some installation countries, a second protective conductor is required in order to prevent a contact current in the event of failure of the original protective conductor.(See section 5.5.3)

IEC standard 62109 requirements:

• Installation of the protective earthing conductor at AC terminal with a cross-section of at least 10mm^2 (copper), or 16mm^2 (aluminum).

UTE C15-712-1:2010 requirements:

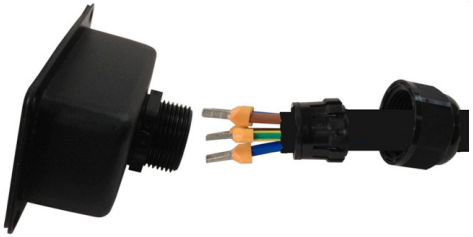
• The inverter body conductive accessories must be connected to the equipotential bonding via a conductor with a minimum cross-section of 6mm² Cu or equivalent and to the protective conductor at AC terminal.

5.5.2 AC Connection procedure

1)Strip the cable with the length 12mm, be careful NOT to nick conductors.

2)Please insert the striped cable into bootlace ferrule and crimp the contact.

3)Screw off the AC cover and insert the 5 wires into AC cover assembly with the following sequence.



4)Release the five screws at the cable terminal. Then route the 5 wires into the cable terminal according to the marks on the front case while L1(R), L2(S), L3(T) represent 3 Live line, N represent Neutral line and PE is ground.

NOTE:

- The PE conductor must be 5 mm longer than the L and N conductor.
- L and N must not be swapped.
- The direction of rotation of L1, L2 and L3 is not relevant.

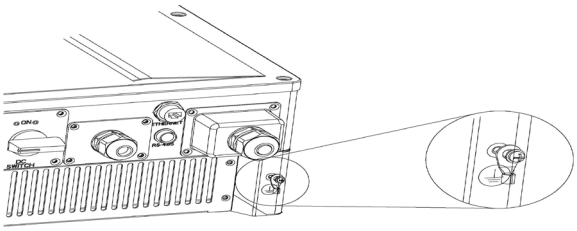
5)Screw the cap nut of the cable tightly.

5.5.3 Connecting the Second Protective Conductor

If required by the installation, the earth terminal can be used to connect a second protective conductor or as equipotential bonding.

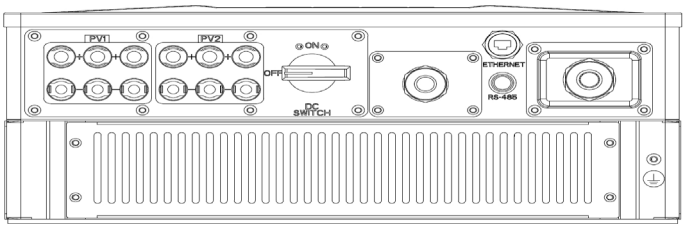
Procedure

Take out parts from the packing and insert the earthing wire to “PE” terminal located at the right of the inverter, then tighten the screw.



5.6 Connecting the PV Array (DC)

5.6.1 Conditions for DC Connection



NOTE:

Suntrio-TL6K/8K/10K/12K: Dual MPPT(PV1 and PV2), two DC input connection sets per MPPT.

Suntrio-TL15K/17K/20K: Dual MPPT(PV1 and PV2), three DC input connection sets per MPPT.

● For input area PV1 or PV2, The PV modules must meet the following requirements:

− Same type

− Same number of in-series-connected PV modules

− Identical direction

− Identical tilt

− The open circuit voltage of each string should never exceed 1000VDC.

5.6.2 Connection Procedures by H4:

Connect the PV generator and the inverter using H4 connectors, as follows.

Note: If using MC4 connector, the operating procedures are similar to that of H4 connector.

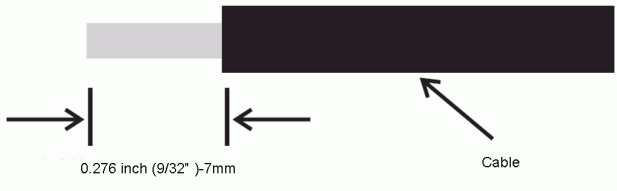
The DC connectors come pre-assembled and the caps are loose. The whole connector will include the male side and female side as showed below:

Male side connector (M)

Female side connector (F)

Assembly Instructions:

1)Strip the cable with the length of 0.276 inches (9/32")-(7mm) and please be careful NOT to nick conductors.



2)Use specified strip tool in this step. Adjust the strip stopper and put the cable in corresponding notch to strip the length of 7mm.

3)Insert stripped cable into contact barrel and insure all conductor strands are captured in the contact barrel and the conductors are visible in the contact barrel observation hole.

Barrel observation hole
Conductor should be visible

Barrel observation hole
Conductor should be visible

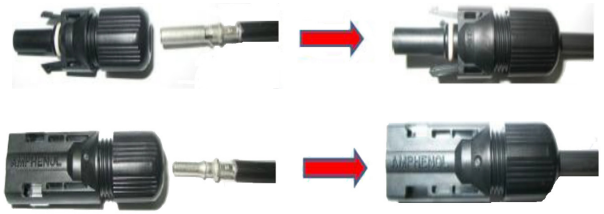
4)Crimp contact barrel by using the hex crimping die. Ensure it is fixed.

Crimped socket contact

Cable Requirements

Cable Size	Cable pull – out force requirement
4 mm²	Min. 400 N.m(90Lbs)
6 mm²	Min.450N.m(100Lbs)
10 mm²	Min.500N.m(110Lbs)

5)Insert contact cable assembly into back of male and female connector. A“click” should be heard or felt when the contact cable assembly is seated correctly.

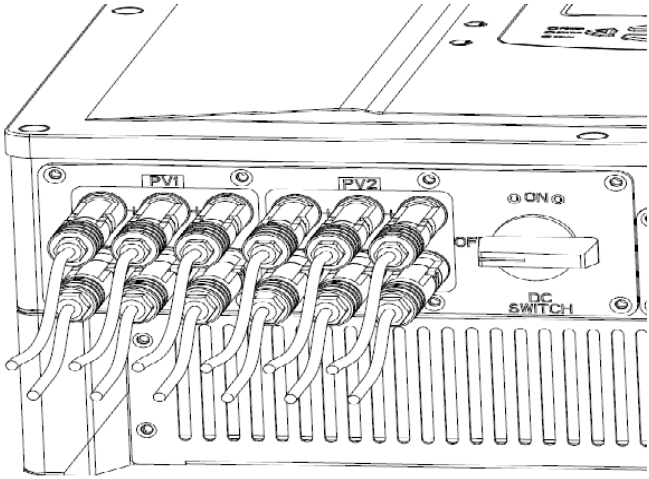


6)Wrest the cap by using the torque of 2.6~2.9N·m.

7)After wrested the cap tightly, align the 2 half connectors and mate them together by hand until a “click” is heard or felt.

8)Connect the positive and negative terminals from the PV panels to positive and negative terminals on the PV inverter.

Note: In order to seal the inverter, all DC inputs that are not required have to be closed.



5.7 Communication and Monitoring Setting

SAJ offers 2 standard communication interfaces for Suntrio-TL series solar inverters: RS485 and Ethernet RJ45. All the SAJ products involved in the solar monitoring system are:

SAJ Logger: data logger for local monitoring and maintenance of large solar power plants.

SAJ Web Portal: free monitoring application through web, IPhone, IPAD and Android App. Internet access must be ensured for the inverter network configuration before SAJ Web Portal service registration.

SAJ Web Server: the local web monitoring application through web browser built in all SAJ inverters.

For more details, please refer to SAJ Monitoring Solution through www.saj-soalr.com

5.7.1 Communication through RS485

RS485 is used for multi-point communication.

Note:

1)RS485 can communicate and monitor up to 32 inverters.

2)The MAX. length of the communication cable should not exceed 1000m.

SAJ Logger Multi-point Monitoring

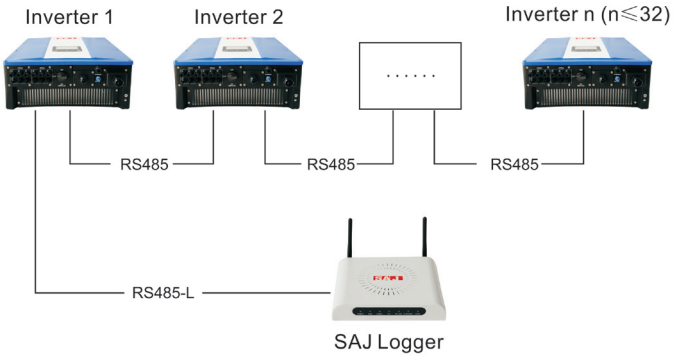


Figure 5.19 SAJ Logger Multi-point Monitoring

PC+SAJ Logger Multi-point Monitoring

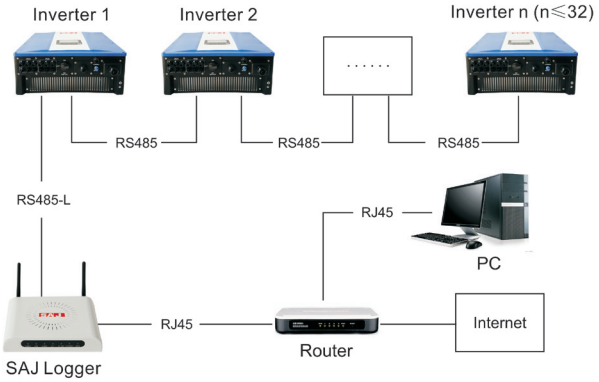


Figure 5.20 PC+SAJ Logger Multipoint Monitoring

Connection Procedures

1)Inverter 1 connects to Inverter 2 through RS485 cable; Inverter 2 connects to Inverter 3 through RS485 cable. In the same way to connect all inverters.

2)Inverter 1 connects to SAJ Logger through RS485-L cable.

3)Connect SAJ Logger to PC through Router.

4)Open the internal Web Server of SAJ Logger for plant and inverter monitoring.

5.7.2 Communication through Ethernet RJ45

When users choose Ethernet communication solution, users can access to Inverter real-time information through Inverter IP address, or through SAJ Logger IP address. The configuration is shown in **Figure 5.21** as below:

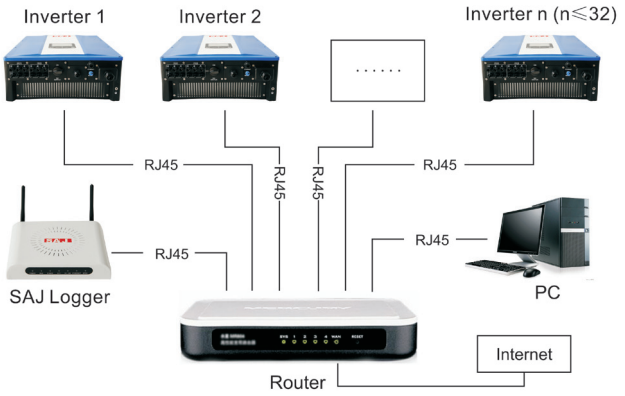
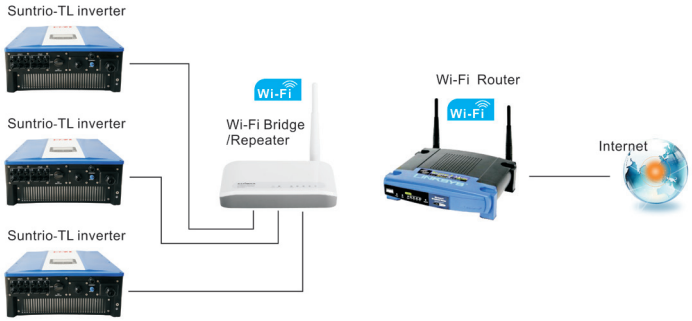


Figure 5.21 Communications through Ethernet RJ45

5.7.3 Extended Wi-Fi Solution with Wi-Fi Bridge

We choose EW-7228APn of EDIMAX as the Wi-Fi bridge reference



All the Wi-Fi bridge or repeater(For example, Edimax EW-7228APn) which has Ethernet RJ45 port can connect to SAJ solar inverters with RJ45 cable and to Wi-Fi router wirelessly.(For details please refer to the document “SAJ Monitoring Solution with Integrated RJ45 Plus Wi-Fi Bridge.pdf” from www.saj-solar.com)

5.7.4 Communication Cable Assembly InstructionsAll cables

All cables mentioned in this mentioned in this Manual are 5E Shielded Cable, as shown in **Figure 5.22.**

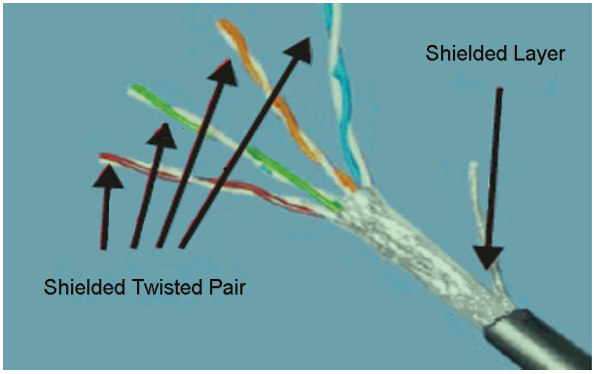


Figure 5.22 5E Shielded Cable

Terminals:

According to different communication solutions, users may need at least one of the below terminals. They are 3Pin Connector and RJ45 Plug as shown in Figure 5.23 and Figure 5.24

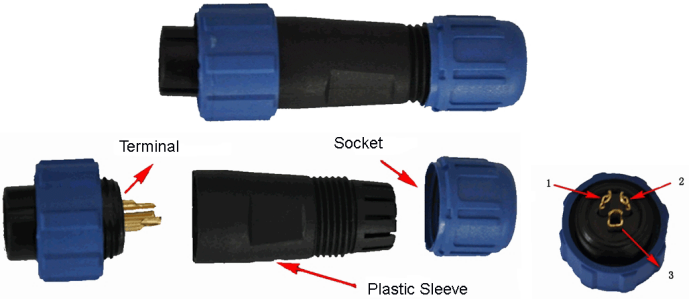


Figure 5.23 3Pin Connector

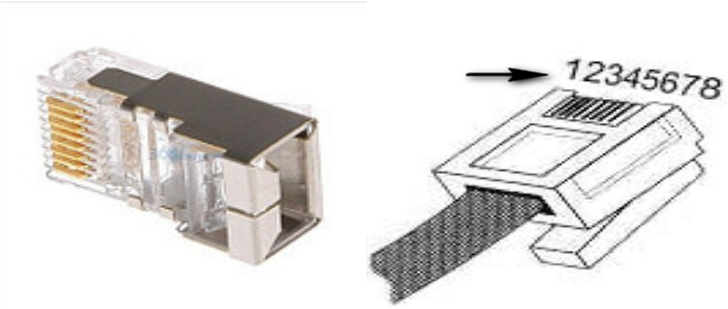


Figure 5.24 RJ45 Plug and Pin Number

Tools

When making a communication cable, the professional tools shown in **Figure 5.25** below are needed.

Figure 5.25 Tools for Making a Communication Cable

RS485 Cable

When using RS485 for monitoring, users need RS485 cables to connect between inverters for multi-point monitoring. In this case, we provide connection by using the 3Pin connectors as shown in **Figure 5.23**.

Each cable should be connected to the connectors according to below **Table 5.4**

Connector No.	Color
1	Blue & White
2	Blue
3	Metal shielded wire

Table 5.4 Connector No and Color

RS485-L Cable

RS485-L cable is used to connect Inverter and SAJ Logger when inverters are monitored via RS485. One end of the cable uses 3Pin Connector, and the other end uses RJ45 Plug. Connection is shown in **Table 5.5** as below:

Wire	Connector No.	RJ45 plug's Pin NO
Blue & White	1	5
Blue	2	4

Table 5.5 RS485-L Cable Assembly Order

RJ45 Cable

RJ45 cable is the standard cable for Ethernet communication. Users can buy this cable in stores, or can assemble RJ45 cable as below:

Each end of the cable must be connected to RJ45 Plug according to **Table 5.6**. Make sure they are fixed well.

RJ45 plug's Pin NO	**One RJ45 plug's Wire color**	**One RJ45 plug's Wire color**
1	White & Green	White & Orange
2	Green	Orange
3	White & Orange	White & Green
4	Blue	Blue
5	White & Blue	White & Blue
6	Orange	Green
7	White & Brown	White & Brown
8	Brown	Brown

Table 5.6 RJ45 Cable Assembly Order

6. LCD Operation

6.1 LCD Display Overview

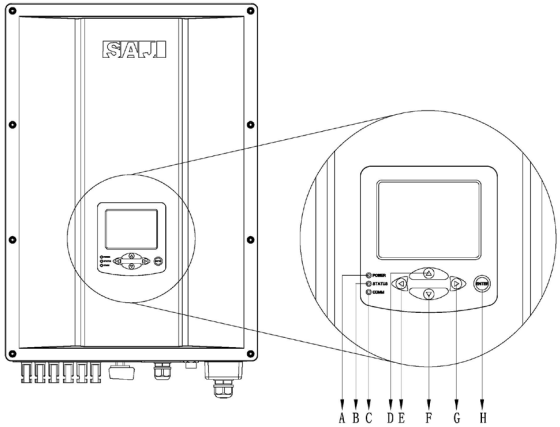


Figure 6.1 Inverter HMI (Human Machine Interface)

Object	Description
A	Power status indicator Yellow light on: Inverter power systerm normal
B	Inverter status indicator: Flashing red light: Inverter faulty status. Green light on: Inverter normal status. Red light and Green light are both off: inverter initialization status or inverter counting down to connect to grid.
C	Communication status indicator: Flashing blue light: receiving data. Flashing yellow light: transmitting data.
D(▲)	Move the cursor/focus up or increase the setting value.
E(◀)	Move the cursor/focus left.
F(▼)	Move the cursor/focus down or decrease the setting value.
G(▶)	Move the cursor/focus right.
H	Start the menu/confirm

Table 6.1 Inverter HMI Description

All the running information, including energy yield, error record, communication settings and inverter settings can be viewed from the LCD.

6.2 Startup the Inverter

Suntrio inverter can be configured for various countries, if it is the first time the inverter starts up after installation, LCD will quickly switch to and stay at the country setting interface. Only the inverter is set to comply with a certain country, it will work and display normally. Otherwise, LCD will always stay at the “Please Set The country First” interface.

There are 28 countries for choosing

1	Australia	15	Italy
2	Austria	16	Portugal
3	Belgium	17	China
4	Brazil	18	Thailand
5	Denmark	19	Default
6	Finland	20	Hungary
7	France	21	Croatia
8	Luxembourg	22	Czech Republic
9	Netherland	23	Germany
10	Norway	24	Israel
11	Poland	25	Greece
12	Sweden	26	Malaysia
13	Switzerland	27	New Zealand
14	UK	28	Spain

Note: if you can’t find the country you want, please directly select ‘Default’.Default mode represent the VDE 0126-1-1.

After Country configuration, Inverter will have a self-check when starting up. If no malfunction is found and grid connection requirement is met, inverter LCD will go to the countdown screen, as shown in **Figure 6.2.**

Figure 6.2 Connect to the Gird Countdown

6.3 LCD Main Screen

When inverter countdown finishes and starts to connect to grid, LCD will display the main screen as below. The main screen consists of menu bar, main display area, auxiliary display area, status bar (including inverter status, description of main display area, data and time). Please refer to Table 6.2 for inverter status description, Table 6.3 for auxiliary display area items description. Information in main display area varies according to menu selected. Please refer to the next section.

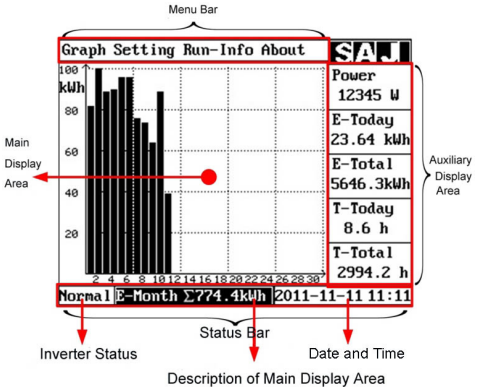


Figure 6.3 LCD main Screen

6.4 LCD Menu Structure

Menu structure is shown as Figure 6.4.Menu can be selected by pressing the '▲', '▼', '◀', '▶' and confirmed by pressing 'Enter', then LCD main display area will display the information accrodingly. "Exit" option in every submenu exit selected menu stat

Inverter State	Explanation
Init	The inverter is on self-checking
Wait	The inverter in stand-by state
Normal	The inverter in normal (function) operation
Error	A fault occurs during operation
Update	The state of updating firmware

Table 6.2 Inverter status description

Data name	Explanation	Unit
Power	The inverter generated power	W
E-Today	The generated energy of current day	kWh
E-Total	The total energy generated by the inverter and total generated energy of the year.	kWh
T-today	The operating time of current day	h
T-total	Total hours of operation time	h

Table 6.3 Auxiliary display area items description

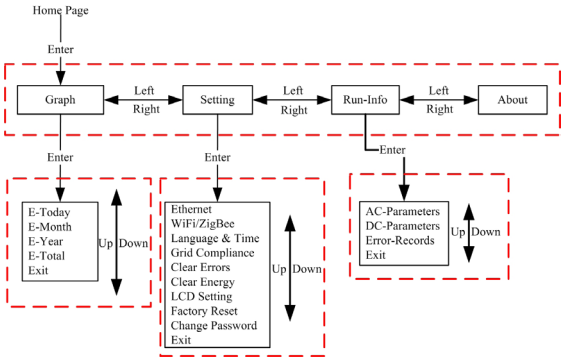


Figure 6.4 Menu structure

6.4.1 LCD Graph Submenu

Graph submenu consists of E-Today, E-Month, E-Year and E-Total. LCD main display area will display the corresponding information after confirming the Graph submenu by pressing 'Enter'. The **Figure 6.5** below is the E-Month Screen.please refer to the **Table 6.4** for E-Today, E-Month, E-Year and E-Total display information explanation.

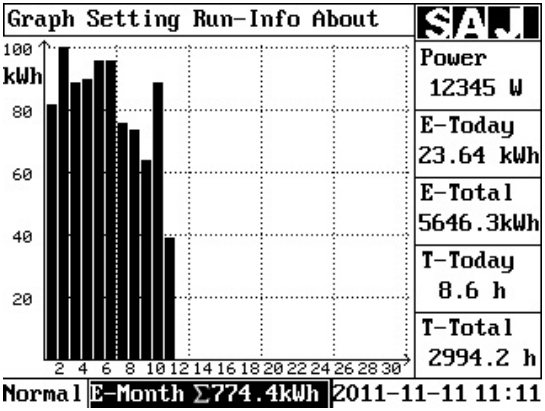


Figure 6.5 E-Month Screen

Item	Display information explanation
E-Today	Bar chart of energy yield today
E-Month	Bar chart of energy yield every day of this month
E-Year	Bar chart of energy yield every month of this year
E-Total	Bar chart of energy yield every year

Table 6.4 Graph submenu explanation

6.4.2 LCD Setting Submenu

Setting submenu includes the below setting of the inverter:

Ethernet:

Figure 6.6 is the Ethernet setting screen.Either the IP address is set to be obtained auto or manually, the IP address displayed on the screen is the current IP address of the inverter. The focus can be moved by pressing the '◀', '▶', and IP address/IP address obtain method can be changed by pressing the '▲', '▼'. The change will be saved by pressing 'Enter'. 'Web server Port' is the inverter embedded Web Server listening port. Inverter embedded Web Server will monitor two ports, and the default one is port 80.

How to visit Web Server: if the inverter and your PC/Mobile phone are in the same network, inverter embedded Web Server can be visited by typing inverter IP address in the web browser. Another listening port can be changed in the screen. And ': web Server port' is required to be added after the IP address. For example, as shown in **Figure 6.6**, the address to be typed in web browser should be http://192.168.1.111:81, and the Web Server screen is shown in **Figure 6.7**.

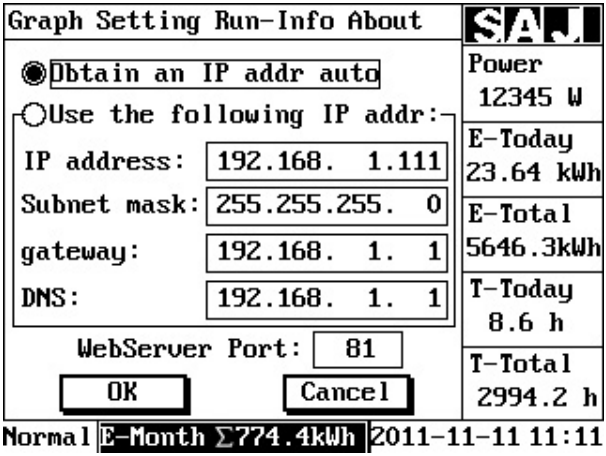


Figure 6.6 LCD Ethernet Screen

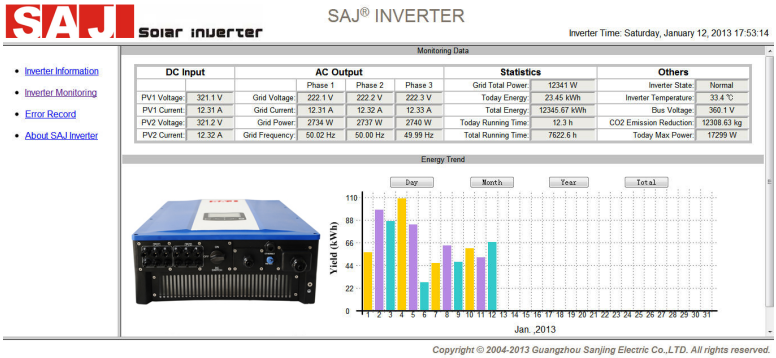


Figure 6.7 Inverter Embedded Web Server Screen

Language & Time:

Move the focus to the setting item by using '◀', '▶' , and the setting can be changed by pressing '▲', '▼'. The setting will be saved by moving the focus to 'OK' and press 'Enter'.

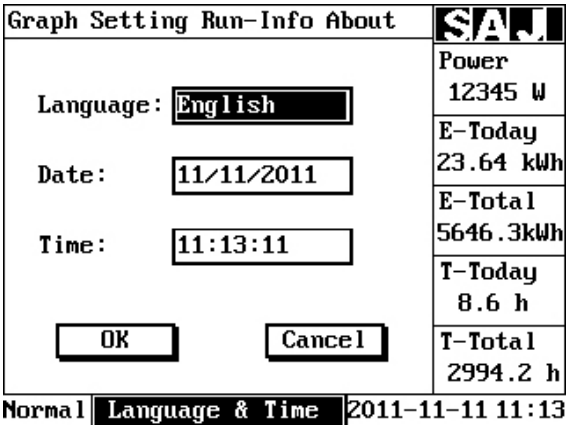


Figure 6.8 Language & Time setting Screen

Grid Compliance:(only for SAJ or SAJ representative)

Different country has different grid connection standard for inverter. The grid compliance of the inverter can be changed by this setting menu when the inverter is run for the first time or the country selection is wrong.

Enter the Grid Compliance submenu and confirm the password, then the country which the inverter installed in can be selected. After the selection, press '▶' to move the focus to button 'OK', then press 'Enter'.

Clear Errors:

After entering the Clear Errors submenu, the LCD will display as below. The operation by moving the focus to button 'OK and pressing 'Enter' will delete the error record saved in the inverter permanently. If you want to exit, press '▶' to move the focus to button 'Cancel' and press 'Enter'

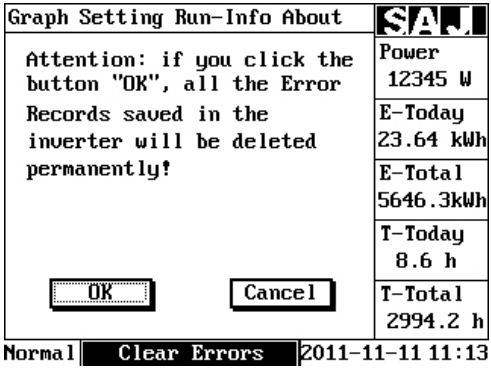


Figure 6.9 Clear Errors operation Screen

Clear Energy:

After entering the Clear Energy submenu, the LCD will display as Figure 6.10. The operation by moving the focus to button 'OK and pressing 'Enter' will delete the energy yield data saved in the inverter permanently. If you want to exit, press ' ▶ ' to move focus to button 'Cancel' and press 'Enter'

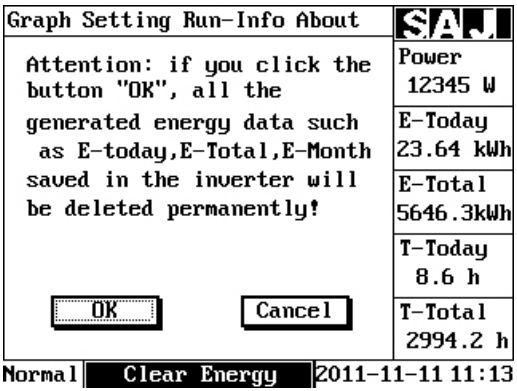


Figure 6.10 Clear Energy Operation Screen.

LCD Setting:

LCD setting includes: LCD backlight brightness and LCD backlight Time-out, as shown in Figure 6.11.Press '◀', '▶'to move the focus and press '▲', '▼' to change the value. After the change, move the focus to button 'OK' and press 'Enter'.

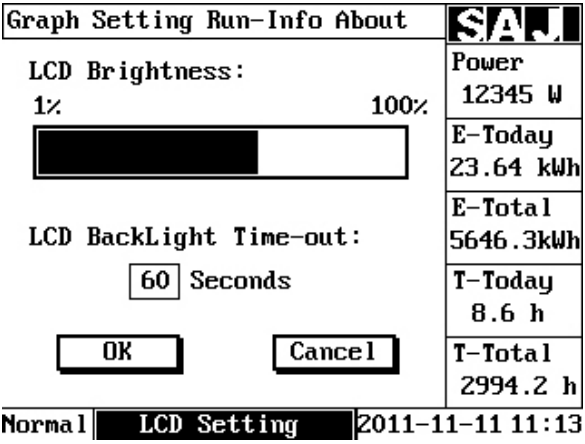


Figure 6.11 LCD Setting Screen

Factory Reset: (only for SAJ or SAJ representative)

The user will set inverter to factory setting and delete all data saved in the inverter, for example, Error Records and Energy. The operation requires a password. After inputting the password, move the focus to button 'OK', and press 'Ent er'.

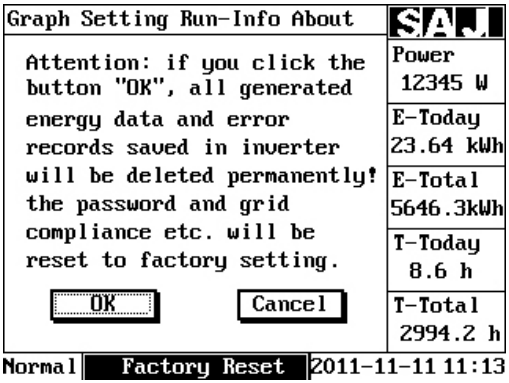


Figure 6.12 Factory Reset Screen

Change Password (only for SAJ or SAJ representative)

SAJ or SAJ representative can change the passwords for 'Grid Compliance' and 'Factory Setting'. After entering this menu, the old password will be required. After passing the old password verification, the screen will be displayed as below, as shown in **Figure 6.13**.

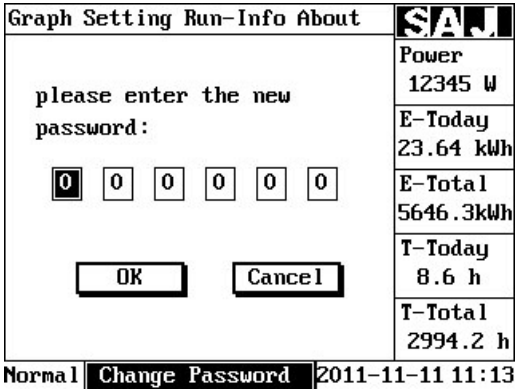


Figure 6.13 Change Password Screen

■Run-Info

AC-Parameters:

Inverter AC output data can be viewed in the menu, as shown in **Figure 6.14** .

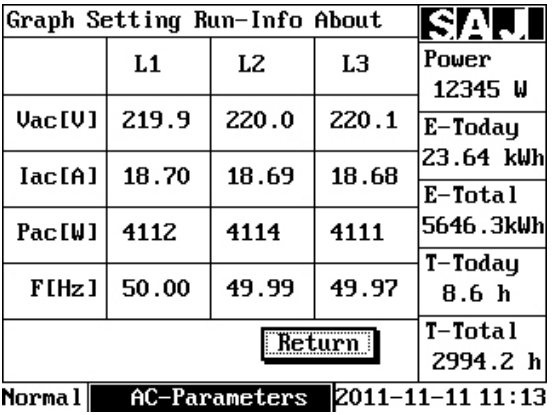


Figure 6.14 AC Parameters Screen

DC-Parameters:

DC data can be viewed in this screen, as shown in **Figure 6.15**.

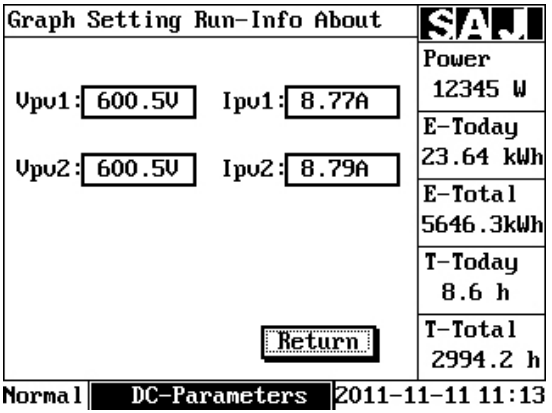


Figure 6.15 DC Parameters interface

Error-Records:

Inverter error record can be viewed in this menu, as shown in **Figure 6.16**. The screen can be scrolled by pressing '▲', '▼'. Error record can be flipped over to another one by moving the cursor to button 'Previous' or 'Next' and press 'Enter'. Please refer to chapter eight for error description and guidance.

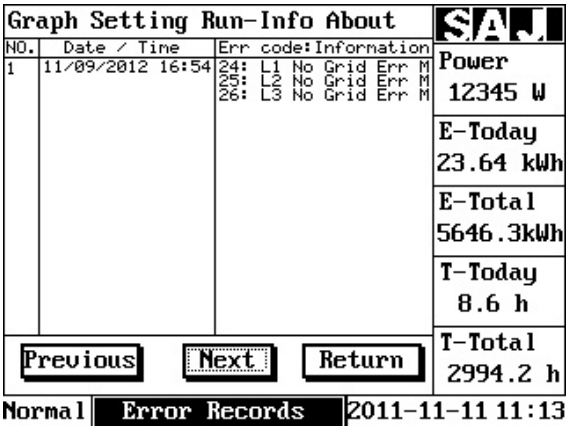


Figure 6.16 Error Records

About

When the focus is moved to "About", press "Enter" to enter the "About Screen", as shown in **Figure 6.17**. Please refer to **Table 6.5** for description of the items in it.

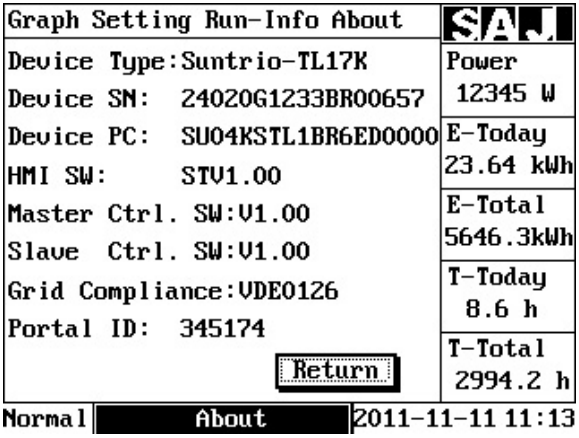


Figure 6.17 About Screen

Item	Descripiton
InverterType	Inverter Model
Inverter SN:	Inverter Serial Number
Inverter PC	Inverter Product Code
HMI SW:	Human Machine Interface Software Version
Master Ctrl. SW	(Control Board Master MCU Software Version)
Slave Ctrl. SW	(Control Board Slave MCU Software Version)
Portal ID	Portal ID. The Portal account ID for Web portal registration: http://webportal.saj-solar.com. The inverter has to be connected to internet, otherwise it will keep displaying 'Getting…', If the inverter is connected to the internet, but it still keeps displaying 'Getting…', please exit the 'About' interface and enter it again to get the account ID. Attention: if the inverter just starts up, the Portal ID can be obtained after two minutes.

Table 6.5 About Screen Description

6.5 Error Report Mechanism and Guidance

When there is fault in the solar system or inverter itself, an error report window will pop up, as shown in **Figure 6.18**. Please refer to error description and guidance in chapter eight.

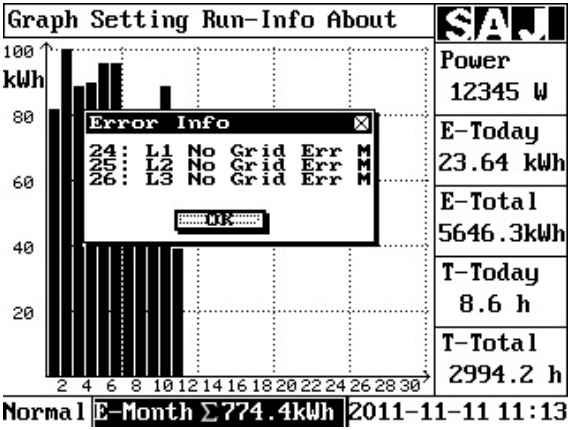
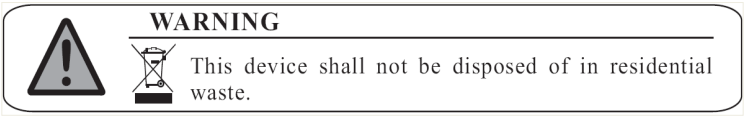


Figure 6.18 Error Report Window

7. Recycling and Disposal



To comply with European Directive 2002/96/EC on waste Electrical and Electronic Equipment and its implementation as national law, electrical equipment that has reached the end of its life must be collected separately and returned to an approved recycling facility. Any inverter that you no longer required must be returned to your dealer or you must find an approved collection and recycling facility in your area.

Ignoring this EU Directive may have severe affects on the environment and your health.

8. Troubleshooting

Error Code	LCD Display Message	Phenomenon and Possible Cause	Phenomenon and Possible Cause
1	Relay Error M	1)A fault has occurred in the Relay(Suntrio Series have 8 relays at the AC side of the inverter) when the inverter detects itself during start-up. 2)The Grid voltage at both sides of the relays is interfered when the relays switch on and off.	If this error occurs often, please contact local agent or SAJ Service line.
2	Eeprom Error M	The EEPROM Device Error.	If this error occurs often, please contact local agent or SAJ Service line.
3	Temp. High Err M	1)The thermal resistance is defective. 2) Environment temperature too high or too low.	If the thermal resistance is defective, change it. Check the ambient and installation condition. If everything is correct, please contact local agent or SAJ Service line.
4	Temp. Low Err M		
5	Lost Com. M<->S M	Communication between Master and Slave Micro-controllers fails.	Please contact local agent or SAJ Service line.
6	GFCI Device Err M	The internal sensor has detected that the GFCI Device is out of function.	Please contact local agent or SAJ Service line.
7	DCI Device Err M	The internal sensor has detected that the DCI Device is out of function.	Please contact local agent or SAJ Service line.
8	Curr Sensor Err M	A fault has occurred in the one or more current sensors of the inverter.	Please contact local agent or SAJ Service line.
9	L1 Voltage High M	1)The local Grid voltage is beyond the permitted range. 2)The connection between Grid and inverter has problems.	Check the Grid Compliance of the inverter (Germany, Italy, Australia, Denmark, Belgium, Netherlands, etc) and Grid voltage. If everything is correct, you need to contact local agent or SAJ Service line.
10	L1 Voltage Low M		
11	L2 Voltage High M		
12	L2 Voltage Low M		
13	L3 Voltage High M		
14	L3 Voltage Low M		

Error Code	LCD Display Message	Phenomenon and Possible Cause	Phenomenon and Possible Cause
15	L1 Volt 10Min High M	Average of output voltage out of range.	
16	L2 Volt 10Min High M		
17	L3 Volt 10Min High M		
18	L1 Freq High M	1)The local Grid Frequency is beyond the permitted range. 2)The connection between Grid and inverter has problem.	Check the Grid Compliance of the inverter (Germany, Italy, Australia, Denmark, Belgium, Netherlands, etc) and Grid frequency. If everything is correct, you need to contact local agent or SAJ Service line.
19	L1 Freq Low M		
20	L2 Freq High M		
21	L2 Freq Low M		
22	L3 Freq High M		
23	L3 Freq Low M		
24	L1 No Grid Err M	The connection between Grid and inverter has problems or is missing.	Check the AC connection. If everything is correct, you need to contact local agent or SAJ Service line.
25	L2 No Grid Err M		
26	L3 No Grid Err M		
27	GFCI Error M	A Ground fault has occurred at the DC or AC side.	Check the insulation of the modules and external surge protection. Check the ambient condition (humidity can increase the probability of this error). Check internal ground connection. If the error is still active ,please contact the local agent or SAJ Service line.
28	L1 DCI Error M	1)The DCI value of the output current is beyond limit. 2)The quick variation of the output current causes this problem.	If the error is still active, please contact the local agent or SAJ Service line.
29	L2 DCI Error M		
30	L3 DCI Error M		
31	ISO Error M	A Ground fault has occurred at the DC side.	Check the insulation of the modules and external surge protection. Check the ambient condition(humidity canincrease the probability of this error). Check internal ground connection. If the error is still active, please contact the local agent or SAJ Service line.

Error Code	LCD Display Message	Phenomenon and Possible Cause	Phenomenon and Possible Cause
32	Bus Volt Bal.Err M	1)The Voltage of the BUS middle point is beyond half of the BUS voltage. 2)If random, a possible cause is the quick variation of grid voltage.	If the error is still active, please contact the local agent or SAJ Service line.
33	Bus Volt High M	1)The open-circuit voltage of the PV generator is higher than the maximum DC input voltage of the inverter. 2)Sudden DC surge.	If the error is still active, please contact the local agent or SAJ Service line.
34	Bus Volt Low M	1)Boost MOSFET/IGBT damaged or the PV string configuration is not correct. 2)Happens during Sunset. Can reproduce daily.	If the error is still active, please contact the local agent or SAJ Service line.
35	L1 Current High M	The output current is beyond the firmware limited value. If random, a possible cause is the quick variation of grid voltage. Repetitive error means firmware failure (Iac sensor).	Check the Grid-voltage stability and AC connection. If the error is still active, please contact the local agent or SAJ Service line.
36	L2 Current High M		
37	L3 Current High M		
38	HWBus Volt High M	1)The voltage of PV string connect to the inverter is higher than the HW limited value. 2)Sudden DC surge.	Check the PV string configuration. The SAJ Designer can help you. If everything is correct, you need to contact local agent or SAJ Service line.
39	HWPV1 Curr.High M	Input current sensing circuit damaged or wrong string configuration .	Check the PV string configuration. The SAJ Designer can help you. If everything is correct, you need to contact local agent or SAJ Service line.
40	HWPV2 Curr.High M		
41	HWL1 Curr. High M	The output current is beyond the HW limited value. If random, a possible cause is the quick variation of grid voltage. Repetitive error means HW failure (Iac sensor)	Check the Grid-voltage stability and AC connection. If the error is still active, please contact the local agent or SAJ Service line.
42	HWL2 Curr. High M		
43	HWL3 Curr. High M		
44	Reserved(bit 46) M		
45	Fan1 Error M	Fan locked or damaged.	Check the fans under the case of the inverter. If fans are good, please clean them. If the error is still active, please contact the local agent or SAJ Service line.
46	Fan2 Error M		
47	Fan3 Error M		
48	Fan4 Error M		

Error Code	LCD Display Message	Phenomenon and Possible Cause	Phenomenon and Possible Cause
49	Reserved(bit 52) M		
50	Lost Com. M<->S S	Communication between Master and Slave Micro-controllers fails.	Please contact local agent or SAJ Service line.
51	L1 Volt Consis Err S	The redundant measurement HW circuit of the Grid voltage has problems.	If the error is still active, please contact the local agent or SAJ Service line.
52	L2 Volt Consis Err S		
53	L3 Volt Consis Err S		
54	L1 Freq Consis Err S	2)Sudden DC surge. The redundant measurement HW circuit of the Grid frequency has problems.	If the error is still active, please contact the local agent or SAJ Service line.
55	L2 Freq Consis Err S		
56	L3 Freq Consis Err S		
57	GFCI Consis Err S	The redundant measurement HW circuit of the GFCI has problems.	If the error is still active, please contact the local agent or SAJ Service line.
58	L1 DCI Consis Err S	The redundant measurement HW circuit of the DCI has problems.	If the error is still active, please contact the local agent or SAJ Service line.
59	L2 DCI Consis Err S		
60	L3 DCI Consis Err S		
61	L1 Voltage High S	1)The local Grid voltage is beyond the permitted range. 2)The connection between Grid and inverter has problems.	Check the Grid Compliance of the inverter (Germany, Italy, Australia, Denmark, Belgium, Netherlands, etc) and Grid voltage. If everything is correct, you need to contact local agent or SAJ Service line.
62	L1 Voltage Low S		
63	L2 Voltage High S		
64	L2 Voltage Low S		
65	L3 Voltage High S		
66	L3 Voltage Low S		
67	L1 Freq High S	1)The local Grid Frequency is beyond the permitted range. 2)The connection between Grid and inverter has problems.	Check the Grid Compliance of the inverter (Germany, Italy, Australia, Denmark, Belgium, Netherlands, etc) and Grid Frequency. If everything is correct, you need to contact local agent or SAJ Service line.
68	L1 Freq Low S		
69	L2 Freq High S		
70	L2 Freq Low S		
71	L3 Freq High S		
72	L3 Freq Low S		

Error Code	LCD Display Message	Phenomenon and Possible Cause	Phenomenon and Possible Cause
73	L1 No Grid Err S	The connection between Grid and inverter has problems or is missing.	Check the AC connection. If everything is correct, you need to contact local agent or SAJ Service line.
74	L2 No Grid Err S		
75	L3 No Grid Err S		
76	PV1 Volt High S	1)The open-circuit voltage of the PV generator is higher than the maximum DC input voltage of the inverter.	Check the PV string configuration. The SAJ Designer can help you. If everything is correct, you need to contact local agent or SAJ Service line.
77	PV2 Volt High S		
78	PV1 Curr. High S	1)The PV input current is beyond the Max. Input Current. The value is specified in the datasheet of the inverter. 2)The internal current sensor is damaged.	If the error is still active, please contact the local agent or SAJ Service line.
79	PV2 Curr. High S		
80	PV Voltage Low S	The voltage of the PV input is too low.	Check the PV string configuration. The SAJ Designer can help you. If everything is correct, you need to contact local agent or SAJ Service line.
81	Lost Com. D<->C D	Communication between Control board and Display board fails.	Check the connection between Control board and Display board. If everything is correct, you need to contact local agent or SAJ Service line.

9. Guaranty Service

Please refer to the warranty card.

10. Contact SAJ

If you have technical problems concerning our products, contact the SAJ Service line.

Technical Support & Service:
International Service & Technical Support
Addr: SAJ Innovation Park, No.9, Lizhishan Road, Science City, Guangzhou
High-tech Zone, Guangdong, P.R.China.(Zip: 510663)
Tel: +86 20 6660 0082
Fax: +86 20 6660 8589
Email: service@saj-electric.com

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Addr: Maagdenstraat 44, 9600 Ronse, Belgium
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*Note: Guangzhou Sanjing Electric Co., Ltd has a policy of continuous product improvement and reserves the right to change design and specifications without notices.

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