Solar Grid Tie Inverter

User Manual
1. Notes

This manual is an integral part of the inverter. Please read this manual carefully before installation, operation or maintenance and it’s for future reference.

1.1 Scope

<table>
<thead>
<tr>
<th></th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4KTS</td>
<td>5KTS</td>
<td>6KTS</td>
<td>7KTS</td>
<td></td>
</tr>
</tbody>
</table>

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

1.2 Target Group

This manual is to be read by qualified installer and PV system user. The tasks described in this manual must only be performed by qualified technical service personnel.

1.3 Symbols Used

Some symbols are used in this manual in order to ensure safety of personal and property. Please read the following symbols carefully.

- **Danger!**
  - Danger indicates a hazardous situation, if not avoided, will result in death or serious injury.

- **Warning!**
  - Warning indicates a hazardous situation, if not avoided, could result in death or serious injury.

- **Caution!**
  - Caution indicates a hazardous situation, if not avoided, could result in minor or moderate injury.

- **Note!**
  - Note provides tips which are valuable for the optimal operation when using the product.

2. Safety

2.1 Appropriate Usage

The Series is a Solar PV inverter which converts the DC current from a PV generator into AC current and feeds it into the public grid.
2.2 Important Safety Instructions

**Danger!**
Danger to life due to high voltages in the inverter!
- All work on the inverter must be carried out only by qualified personnel.
- The appliance is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.
- Children should be supervised to ensure that they do not play with this appliance.

**Caution!**
Danger of burn injuries due to hot surfaces!
- During operation, the upper lid of the enclosure and the enclosure body may become hot.
- Only touch the lower enclosure lid during operation.

**Caution!**
Possible damage to health as a result of effect of radiation!
- Do not stay closer than 20 cm to the inverter for long periods.

**Note!**
Ground PV generator frame and other electricity conductor surfaces to protect the system and personnel.
2.3 Explanation of Symbols

This section gives an explanation of all the symbols shown on the inverter and on the type label.

● Symbols on the Inverter

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Danger to life due to high voltages in the inverter! There is residual voltage in the inverter. The inverter requires 5 minutes to discharge. * Wait 5 minutes before you open the upper lid or the DC lid.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Danger of high voltages Danger to life due to high voltages in the inverter!</td>
</tr>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>Caution, risk of electric shock! Only authorized personnel is allowed to set the DIP switch.</td>
</tr>
</tbody>
</table>

● Symbols on the Type Label

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Symbol" /></td>
<td>CE mark. The inverter complies with the requirements of the applicable CE guidelines.</td>
</tr>
</tbody>
</table>

● Important Safety Instructions

When using the product, please read follow information below to avoid fire, lightning or other personal injury:

| ![Symbol](image) | Warning! Ensure input DC voltage ≤ the Max. DC voltage. Over voltage may cause permanent damage to the inverter or cause other damages which are not covered in the warranty! This chapter contains important safety and operating instructions. Read and keep this Manual for future reference. |
Before using the Series inverter, read all instructions and cautionary markings on the Series inverter, and all appropriate sections of this guide.

- Use only accessories recommended or sold by, otherwise may result in risk of fire, electric shock, or injury to persons.
- To avoid risk of fire and electric shock, make sure that existing wiring is in good condition and cables used are not undersized. Do not operate the Series inverter with damaged or substandard wiring.
- Do not disassemble the Series inverter. It contains no user-serviceable parts. See Warranty for instructions on obtaining service. Attempting to service the Series inverter, the user may result in risk of electric shock or fire and will void the warranty.
- To reduce the risk of electric shock, authorized service personnel must disconnect both AC and DC power from the Series inverter before attempting any maintenance or cleaning or working on any circuits connected to the Series inverter. Turning off controls alone will not reduce this risk.
- Keep away from flammable, explosive materials to avoid fire disaster.
- The installation location should not be close to humid or corrosive substance.
- To avoid electric shock, please do not disassemble the inverter as there are high-voltage capacitances installed inside the inverter. Fatal High-voltage will remain in the inverter for 5 minutes after its disconnection from grid or PV plant.
- To reduce the chance of short-circuits, authorized service personnel must use insulated tools when installing or working with this equipment.

3. Introduction

3.1 Basic Features
Congratulations on your purchase of a Series inverter. The Series inverter is one of the finest inverter on the market today, incorporating state-of-the-art technology, high reliability, and convenient control features.

- Advanced MCU (Microcontroller Unit) control technology.
- Utilize the latest high-efficiency power component.
- Optimal MPPT technology.
- Advanced anti-islanding solutions.
- Excellent protections.
- IP65 protection level.
- Efficiency up to 97.6%.
- Total Harmonic Distortion (THD) < 3%.
- Safe & Reliable: transformer less design with software and hardware protection.
- Friendly HMI (Human Machine Interface).
  - LED status indication.
  - LCD display of technical data, Human-Machine interaction through press key.
  - RS485/RS232 communication interface.
  - PC remote control.

3.2 Electrical block diagram

![Electrical block diagram](image)

**Figure 2** Electrical block diagram

- Terminals on the inverter
Figure 3 Terminals of PV inverters 1KTS/ 1.5KTS

Figure 4 Terminals of PV inverters 2KTS/ 3KTS

Figure 5 Terminals of PV inverters 4KTS / 5KTS / 6KTS/ 7KTS

3.3 Dimensions and Weight

● Dimension
Figure 6  1KTS/1.5KTS

Figure 7  2KTS/3KTS
8

Figure 8  4KTS / 5KTS / 6KTS/7KTS

- Weight

Table 1 Weight in kilo grams, kgs

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight [kgs]</td>
<td>11Kgs</td>
<td>11.5Kgs</td>
<td>15Kgs</td>
<td>15.5Kgs</td>
<td>21Kgs</td>
<td>21.5Kgs</td>
<td>22.5Kgs</td>
<td>23Kgs</td>
</tr>
</tbody>
</table>

4. Technical Data

4.1 Input (DC)

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. DC power [W]</td>
<td>1100</td>
<td>1600</td>
<td>2300</td>
<td>3200</td>
<td>4200</td>
<td>5400</td>
<td>6100</td>
<td>7000</td>
</tr>
<tr>
<td>Max. DC voltage [V]</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. input Current [A]</td>
<td>8.8</td>
<td>9.7</td>
<td>11</td>
<td>13</td>
<td>21</td>
<td>26</td>
<td>32</td>
<td>37</td>
</tr>
<tr>
<td>Number of MPP trackers / Strings per MPP tracker</td>
<td>1 / 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPPT voltage range (at rated power) [V]</td>
<td>120-425</td>
<td>160-425</td>
<td>200-500</td>
<td>210-500</td>
<td>180-500</td>
<td>180-500</td>
<td>180-500</td>
<td>180-500</td>
</tr>
<tr>
<td>Shutdown voltage / Start voltage [V]</td>
<td>70 / 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70/100</td>
</tr>
</tbody>
</table>
4.2 Output (AC)

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC nominal power [W]</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2600</td>
<td>3000</td>
<td>3680</td>
<td>4000</td>
<td>4600</td>
</tr>
<tr>
<td>Max. AC power [W]</td>
<td>1000</td>
<td>1500</td>
<td>2200</td>
<td>2800</td>
<td>3300</td>
<td>3680</td>
<td>4400</td>
<td>5000</td>
</tr>
<tr>
<td>Max. AC current [A]</td>
<td>4.5</td>
<td>6.8</td>
<td>9</td>
<td>13.6</td>
<td>17.5</td>
<td>23</td>
<td>27</td>
<td>32</td>
</tr>
<tr>
<td>Nominal AC voltage / range [V]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>230</td>
<td>180~270</td>
<td></td>
</tr>
<tr>
<td>AC grid frequency / range [Hz]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>47~52</td>
<td></td>
</tr>
<tr>
<td>Power factor (cosφ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total harmonic distortion (THD) (at nominal power)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;3%</td>
<td></td>
</tr>
</tbody>
</table>

* Detailed parameter please see local grid standard

4.3 Efficiency, Safety and Protection

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. efficiency</td>
<td>96.6%</td>
<td>96.8%</td>
<td>96.8%</td>
<td>97.0%</td>
<td>97.4%</td>
<td>97.6%</td>
<td>97.6%</td>
<td>97.6%</td>
</tr>
<tr>
<td>Euro- efficiency</td>
<td>95.5%</td>
<td>96.0%</td>
<td>96.2%</td>
<td>96.3%</td>
<td>96.5%</td>
<td>97.1%</td>
<td>97.1%</td>
<td>96.8%</td>
</tr>
<tr>
<td>MPPT efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>99.9%</td>
</tr>
</tbody>
</table>

**Safety & Protection**

- Overvoltage / undervoltage protection: Yes
- DC isolation impedance monitoring: Yes
- Ground fault protection: Yes
- Grid monitoring: Yes
- Ground fault current monitoring: Yes
- DC injection monitoring: Yes
4.4 General Data

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension (W/H/D)</td>
<td>288<em>350</em>140[mm]</td>
<td>338<em>430</em>138[mm]</td>
<td>345/440/186[mm]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>11</td>
<td>11.5</td>
<td>13.5</td>
<td>15.5</td>
<td>2</td>
<td>21.5</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Cooling concept</td>
<td>Convection</td>
<td>Convection</td>
<td>Convection</td>
<td>Convection</td>
<td>Fan</td>
<td>Fan</td>
<td>Fan</td>
<td>Fan</td>
</tr>
<tr>
<td>Noise (typical) [dB]</td>
<td>&lt;28</td>
<td>&lt;28</td>
<td>&lt;30</td>
<td>&lt;30</td>
<td>&lt;30</td>
<td>&lt;40</td>
<td>&lt;40</td>
<td>&lt;40</td>
</tr>
<tr>
<td>Operating temperature range [°C]</td>
<td>-20 °C ~ +60 (de-rating at 45 °C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IP65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topology</td>
<td>Transformer less</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal consumption (night) [W]</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD display</td>
<td>Backlight, 16*2 character LCD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication interfaces</td>
<td>RS232</td>
<td></td>
<td></td>
<td></td>
<td>RS485</td>
<td>RS232</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard warranty</td>
<td>5 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Function

Operation Mode

【standby Mode】
The standby mode means that the inverter is ready for operation but still not connected to the grid. In this mode, it will continue to check whether PV array has enough power to feedback into grid. When the inverter passes dump load test after startup, it will change from standby mode to Checking mode.

【Checking Mode】
If inverter passes dump load test and no error/fault occurs, will start checking mode to deliver power.

【On-grid Mode】
In this mode, series inverters convert PV array’s DC into AC and feedback into grid.

CAUTION
It is normal that the inverter decreases the output power in the condition of thermal protection, but if this occurs frequently the heat sink and the fan will need to be checked and the inverter may need to be shifted to a place with better airflow. If the fan is dirty it should be cleaned and if the output power decrease is caused by electricity issues, please ask for professional support.
【MPPT Mode】
The default setting is MPPT mode, the operation mode will return to MPPT after DC&AC restart.

【Fault Mode】
If any fault/error occurs, inverter will stop delivering power until the fault/error is rectified. Some fault/error will recover automatically, and others may need manual restart.

【Setting Mode】
Press “Function” key for 5 seconds to get into the Setting mode if DC power exists. Please refer to chapter 7 of the Manual more information.

6. Installation

6.1 Packaging

<table>
<thead>
<tr>
<th>Type</th>
<th>Project No.</th>
<th>Description</th>
<th>QTY</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>1</td>
<td>PV Grid-tied Inverter</td>
<td>1 unit</td>
<td>Spare parts bag includes M5 flange nuts, expansion screws, M5 tapping screws</td>
</tr>
<tr>
<td>Accessories</td>
<td>2</td>
<td>Backboard</td>
<td>1 pc</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>3</td>
<td>Spare parts</td>
<td>1 bag</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>AC connector</td>
<td>1 pc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>DC connector assembly</td>
<td>1 / 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Product manual</td>
<td>1 pc</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Packaging list

Warning!
Ensure that the DC side is not charged before installation or maintenance. If the inverter is powered the capacitors will be charged if after the inverter is turned off, hence it is to wait for 5 minutes to ensure that the capacitors are discharged.

Note!
Inverters must be installed by qualified personnel only.

6.2 Preinstallation precautions
Check the location where inverter is to be installed to ensure the following.

- The ambient temperature is within the operation range (-20°C to +60°C -4°F to +140°F).
- The altitude is less than 2,000 m.
- Not prone to be damaged by sea water.
- Not close to corrosive gas or liquid (for example, locations where chemicals are processed or lots of poultry is fed).
- Not exposed to direct sunlight.
- Not prone to be flooded snowed in.
- Ensure good ventilation and low humidity.
- Not exposed to steam, vapor, or water.
- Not exposed to direct cool air.
- Not close to television antenna or antenna cae.
- Inverter needs to be at least 30 cm (see table 2) clearance. If this is not observed, inverter is likely to malfunction high temperature inside the inverter, will not cover any damage due to this condition.

<table>
<thead>
<tr>
<th>Position</th>
<th>Min. clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side</td>
<td>30cm</td>
</tr>
<tr>
<td>Top</td>
<td>30cm</td>
</tr>
<tr>
<td>Bottom</td>
<td>30cm</td>
</tr>
<tr>
<td>Front</td>
<td>10cm</td>
</tr>
</tbody>
</table>

Table 2 Minimum clearance needed

6.3 Preparation

Following tools are needed for installation.

Installation Tools

Installation Tools: Crimping tool, Plier, Electrical drill and Screwdrivers & adjustable spanner.

6.4 Installation Steps
**Step 1:** Drill holes in the wall with electrical drill according to the size of bracket (it is packed in the box). Drill straight into the wall do not shake the drill to avoid damage to the wall. Depth of the holes should be about 30mm and should be the same in all the holes. After removing dust from the holes, measure the net depth of the holes. If the depth is more than 33mm or less than 27mm, the expansion pipes can not be properly installed.
Step 2: Clean all dust outside/inside the hole and ensure the distances between hole are as per requirement. Insert expansion pipes into the holes vertically, use rubber hammer to tap the pipes into the wall completely. Insert the bracket into expansion pipes and use expansion screws to fasten the Bracket.

Step 3: Mount inverter onto the narrow vertical panel, ensure upper corner of the inverter is hooked onto the bracket, use M5 screws to fix the lower part of the inverter to the bracket (See figure 10).

Step 4: Use M5 flange nut to fix the bottom of the inverter.

Step 5: Complete the installation process.

6.5 Connections of the PV power system

- PV String

inverters 4KTS, 5KTS 6KTS and 7KTS have facility to connect two strings of PV modules while the other models can only take one module string. Use only one string PV modules with excellent performance and reliable quality. Open-circuit voltage of modules connected in series should be $< \text{Max}$. DC input voltage of the inverters (Ref Table 3) and the operating voltage at all times should be within the MPPT voltage range.
Table 3  Max. DC Voltage of inverters

Only use good quality PV cables to connect modules to inverter. Normally the voltage drop between 
modules and inverter could be about 1-2%. Hence inverter should be installed as close to the PV 
module as possible to reduce cable losses.

<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. DC voltage</td>
<td>500V</td>
<td>550 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note! 
Please don’t connect the PV panel positive or negative to ground.

Figure 11  Use of Multimeter to measure module array voltage

Warning! 
PV modules carry high DC voltage which is dangerous, please 
comply with all electrical safety rules and regulations when working.

Warning! 
In case of any faults with module arrays, do not connect the 
inverter to the arrays.

Note! 
Need not connect the input terminal to optimizer.

• AC Output

This series inverters are designed for single phase grid. Operating AC voltage range from 
180V to 260V (200V-270V for Australia) and the typical frequency is 50Hz. Other 
operating parameters should comply with local public grid regulations.

Table 4  Cable and MCB Requirement
<table>
<thead>
<tr>
<th>Model</th>
<th>1KTS</th>
<th>1.5KTS</th>
<th>2KTS</th>
<th>3KTS</th>
<th>4KTS</th>
<th>5KTS</th>
<th>6KTS</th>
<th>7KTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable (Cu)</td>
<td>1.5mm²</td>
<td>2.5mm²</td>
<td>2.5mm²</td>
<td>4mm²</td>
<td>4mm²</td>
<td>6mm²</td>
<td>6mm²</td>
<td>6mm²</td>
</tr>
<tr>
<td>MCB</td>
<td>10A</td>
<td>16A</td>
<td>16A</td>
<td>20A</td>
<td>20A</td>
<td>32A</td>
<td>40A</td>
<td>50A</td>
</tr>
</tbody>
</table>

MCB with rated load current of 30 mA≤I≤300 mA should be installed between inverter and grid.
No load should be connected directly with the output of inverter.

**Figure 12** Incorrect connections between Load and Inverter

Impedance of the AC connection should be less than 2Ω. To ensure anti-islanding function PV cable should ensure power loss to be < 1% of nominal power. Also AC cable between inverter and grid connection point should be less than 150m. Chart below provides relationship between AC cable length and cross section with losses.

**Figure 13** AC Cable Loss for inverter

Inverters come with good quality IP66 /IP68 AC connector. Please refer to information below to make correct AC connection.
Figure 14  AC Connector details

Follow below steps for wiring AC Connectors.

**Step1:** Pass the AC wire through the threaded sleeve and pressure screw (See figure 15).

![Figure 15](image1.png)

**Step2:** Connect the AC cables as explained below.
- Fix the green and yellow ground cable to the ground terminator in the AC Connector (Figure 16).
- Fix the blue Neutral cable to the N(Neutral) terminator in the AC Connector.
- Fix the Line cable (brown or black wire) to the L(Line) terminator in the AC Connector.

![Figure 16](image2.png)

**Step3:** Confirm that all the wires are fixed tightly (Figure 17).

![Figure 17](image3.png)
Step 4: Fix the threaded sleeve (Figure 18).

Step 5: Fix the pressure screw (Figure 19).

Step 6: Connect AC connector to inverter (Figure 20).
6.6 Inverter Start-up

Only start inverter after checking following.

a. Make sure all the DC and AC breakers and Isolators are in off position.
b. AC cable from inverter to connection point is done correct.
c. All PV panels are connected to inverter correctly, unused DC connectors should be sealed using covers provided.

Starting inverter.

a. Turn ON AC MCB
b. Turn ON DC Isolator and then AC Isolator
b. Inverter will start up automatically when PV arrays generates enough energy. Inverter goes through the following three stages during normal start-up.

Waiting: Inverter is waiting / checking PV arrays output DC voltage to be with adequate. At this time DC voltage is with in range of DC100V-DC150V.

Checking: Inverter checks AC grid conditions automatically when DC input voltage exceeds Start-up voltage. Inverter then goes through the start-up count down.

Normal: Inverter begins to operate normally with green light ON and feed power to grid, LCD displays present output power. Inverter will stop feeding power to grid when PV output is not enough for normal operation.

Note!

If inverter shows “Fault” status, please refer to Part 9.
7. Operation

7.1 Control Panel

![Control Panel Diagram]

Figure 21 Control Panel

Normal (green): The inverter is working in normal state. Fault (red): The system is in fault state.
Function key: To check the operating parameters, for details, see section 7.2.

7.2 Display Function

The function key is used to set the LCD. It can alternate between different parameters and languages.
Inverter will change into standby mode when 100V < the dc input < 150V.

When the PV voltage > 150V, inverter will change into “Normal State” mode after 180 second start-up time.
Initial State
- LCD lights up
- Normal State
  - Pac=x.xxxx xW
  - Displays total energy
  - E_total=x.x x kwh
  - Pac=x.xxxx xW
  - Displays today's energy
  - E_today=x.xxxx.x kwh
  - Pac=x.xxxx xW
  - Displays PV voltage
  - V_pv=x.x xV
  - Pac=x.xxxx xW
  - Displays PV current
  - I_pv=x.x xA
  - Pac=x.xxxx xW
  - Displays AC voltage
  - V_ac=x.x xV
  - Pac=x.xxxx xW
  - Displays AC current
  - I_ac=x.x xA
  - Pac=x.xxxx xW
  - Displays AC frequency
  - Freq=x.x xHz
  - Pac=x.xxxx xW

Displays inverter model
- 4KW
  - Pac=x.xxxx xW
  - Displays software version
  - Ver. V1.50
  - Pac=x.xxxx xW
  - Language setting
  - Select Language
    - Pac=x.xxxx xW
  - Energy today reset
  - Reset E_today
    - Pac=x.xxxx xW
  - Displays the initial state
  - Normal State
    - Pac=x.xxxx xW
7.3 LCD Display Information

**Table 5** Display Information

<table>
<thead>
<tr>
<th>Operating State</th>
<th>Information Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Working Condition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Off</td>
<td>No display</td>
<td>DC input voltage&lt;70V, inverter stops working</td>
</tr>
<tr>
<td>Initialization &amp; Waiting</td>
<td>Waiting</td>
<td>70V&lt; DC input voltage≤150V in standby mode</td>
</tr>
<tr>
<td>Checking grid</td>
<td>Checking</td>
<td>Input voltage &gt;150V, checking grid-tied mode</td>
</tr>
<tr>
<td>Normal State</td>
<td>Normal state</td>
<td>Inverter is working in grid-tied mode</td>
</tr>
<tr>
<td>Flash</td>
<td>Flash</td>
<td>Upgrading software</td>
</tr>
<tr>
<td><strong>Checking Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real-time Power</td>
<td>Pac=xxxxW</td>
<td>Real-time output power</td>
</tr>
<tr>
<td>Total energy generation</td>
<td>E_{\text{total}}=xxxx\text{kWh}</td>
<td>Total energy generated</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>Vac=xxx.xV</td>
<td>Output voltage</td>
</tr>
<tr>
<td>Output Frequency</td>
<td>Freq.=xx.xHz</td>
<td>Output frequency</td>
</tr>
<tr>
<td>Output Current</td>
<td>Iac=xx.xA</td>
<td>Output Current</td>
</tr>
<tr>
<td>PV Input Voltage</td>
<td>V_p= xxxV</td>
<td>PV input voltage</td>
</tr>
<tr>
<td>PV Input Current</td>
<td>I_{\text{dc}}= xxx A</td>
<td>PV input current</td>
</tr>
</tbody>
</table>

### Fault Information

<table>
<thead>
<tr>
<th>Isolation Fault</th>
<th>Isolation Fault</th>
<th>Grounding fault or surge voltage protection failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leakage Detecting</td>
<td>Ground I Fault</td>
<td>Leakage current over rating</td>
</tr>
<tr>
<td>Grid Fault</td>
<td>Fault OVR</td>
<td>AC Over voltage rating</td>
</tr>
<tr>
<td></td>
<td>Fault UVR</td>
<td>AC Under voltage rating</td>
</tr>
<tr>
<td></td>
<td>Fault OFR</td>
<td>AC Over frequency rating</td>
</tr>
<tr>
<td></td>
<td>Fault UFR</td>
<td>AC Under frequency rating</td>
</tr>
<tr>
<td>No Utility</td>
<td>No Utility</td>
<td>No Utility</td>
</tr>
<tr>
<td>Fan Fault</td>
<td>Fan Fault</td>
<td>Fan locked or circuit fault</td>
</tr>
<tr>
<td>PV Over Voltage</td>
<td>PV Over Voltage</td>
<td>PV voltage $\geq$ Max.DC voltage</td>
</tr>
<tr>
<td>Consistent Fault</td>
<td>Consistent Fault</td>
<td>CPU or other hardware failure</td>
</tr>
<tr>
<td>Relay Failure</td>
<td>Relay Failure</td>
<td>Relay between grid and inverters failed</td>
</tr>
<tr>
<td>DC INJ High</td>
<td>DC INJ High</td>
<td>DC injection in AC output over rated value.</td>
</tr>
<tr>
<td>EEPROM Failure</td>
<td>EEPROM Failure</td>
<td>EEPROM’s data collection failure</td>
</tr>
<tr>
<td>SCI Failure</td>
<td>SCI Failure</td>
<td>MCU internal communication failure</td>
</tr>
<tr>
<td>High DC Bus</td>
<td>High DC Bus</td>
<td>DC bus voltage is higher than the set value</td>
</tr>
<tr>
<td>DC Sensor Fault</td>
<td>DC Sensor Fault</td>
<td>Input DC detector failure</td>
</tr>
<tr>
<td>GFCI Failure</td>
<td>GFCI Failure</td>
<td>Leakage current detecting circuit failure</td>
</tr>
</tbody>
</table>

### Others

<table>
<thead>
<tr>
<th>Lock</th>
<th>Lock</th>
<th>Frozen information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconnect</td>
<td>Reconnect</td>
<td>Reconnect to grid after relay disconnect</td>
</tr>
<tr>
<td>Inverter’s Version</td>
<td>Ver xx.xx</td>
<td>Version information</td>
</tr>
</tbody>
</table>
8. Communication and Monitoring

8.1 Communication Interface

Inverters have communication interface RS485 and/or RS232 depending on model. Output voltage, current, frequency, fault information, etc., can be delivered to a PC or other monitoring equipment via the RS485/RS232.

8.2 Communication types

Inverters come with one or both of the following types communication facility depending on model.

① RS232 Communication

RS232 is a standard communication interface within a distance of 12m. It transmits data between PC and one series inverter (Figure 22).

![Figure 22 RS232 Communication Diagram](image)

![Figure 23 RS232 Communication Cable and Interface](image)

<table>
<thead>
<tr>
<th>Pin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>NC</td>
<td>TxD</td>
<td>RxD</td>
<td>NC</td>
<td>Common (GND)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

Only one inverter can be connected with a PC at one time through RS232 port. This facility is generally used for single inverter communication, software update and testing by service person.

② RS485 Communication

RS485 allows up to 32 inverters to communicate at the same time by one cable, but the cable length should not be more than 1200m. In order to monitor multiple inverters at the same time, users need to install a monitor system Tress Browser in the PC to browse the PV plants operating data. Tress Browser doesn’t need PC software, pls check the manual of Tress Browser details. Connecting the system as blow (figure 24), user can easily monitoring the PV power station.
Two types of cable must be prepared when using for monitoring multiple inverters.

### RS485 Pin Definition

<table>
<thead>
<tr>
<th>Pin</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>TX+</td>
<td>TX-</td>
<td>RX+</td>
<td>RX-</td>
</tr>
</tbody>
</table>

#### Inverter wiring

Find a Ethernet cable with appropriate length. At one end of the cable, strip off about 2 inches of the Ethernet cable sheath. Choose 4 wires (brown, brown white, orange, orange white), and press the 4 wires into pin1 to pin4 of the RJ11 crystal head as below. Then Insert the ready-made crystal head into RS-485 port of inverter.
9. Troubleshooting

9.1 Troubleshooting

This section contains information and procedures for solving possible problems on series inverters, and provides troubleshooting tips to identify and solve most problems.

This section will help narrow down the source of any problem which you may encounter. Please read the following troubleshooting steps.

- Check the warning or fault messages on the System Control Panel or Fault codes on the inverter information panel. If a message is displayed, record it before doing anything further.
- Attempt the solution indicated in Table 8.
- If the inverter information panel is not displaying a Fault light during a fault condition, check the following to make sure that the installation allows proper operation of the unit.
  - Is the inverter located in a clean, dry, adequately ventilated place?
  - Is the DC Isolator in ON position
  - Are the cables adequately sized and short enough?
  - Are the input and output connections and wiring in good condition?
  - Are the configuration settings correct for the particular installation?
  - Are the display panel and the communications cable properly connected and undamaged?

Contact Installer or Customer Service for further assistance. Please be prepared to describe details of the system installation and also provide the model and serial number of the inverter.

<table>
<thead>
<tr>
<th>Faults</th>
<th>Diagnosis and Solutions</th>
</tr>
</thead>
</table>
| Grid Fault        | -Wait for some time to allow grid supply to stabilize for inverter to go back to normal working state.  
                    -Making sure that grid voltage and frequency complies with standards.  
                    -Seek help from Installer.                                           |
| No Utility        | -No grid supply.  
                    -Check grid connection like cables, interface, etc.  
                    -Check grid usability.   
                    -Seek help from Installer.                                     |
| PV Over Voltage   | -Check the panel’s open-circuit voltage to be less than Max.DC voltage.  
                    -If PV open circuit voltage is higher consider rewiring modules to get voltage under limits. |
| DC INJ High       | -Wait for a minute to see if DC injection returns to normal.  
                    -If fault persists, for assistance.                                            |
| SCI Failure       | -Disconnect PV +ve and –ve input, and re-connect after a short break.  
                    -If fault persists, for assistance.                                                                 |
<table>
<thead>
<tr>
<th>Issue</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| Isolation Fault  | - Check the impedance between PV (+), PV (-) and ground. For 1.5KW~2.8KW >1Mohm, 3.3~5KW>2Mohm.  
|                  | - Contact Tress Power if impedance value is not big enough.                     |
| Consistent Fault | - Disconnect PV +ve and –ve input, and re-connect after a short break.           
|                  | - If fault persists, for assistance                                             |
| Relay Failure    | - Disconnect PV +ve and –ve input, and re-connect after a short break.           
|                  | - If fault persists, for assistance                                             |
| Ground I Fault   | - Leakage current is too high.                                                  
|                  | - Disconnect DC and AC connector, check equipment on the AC side for concerns and rectify any faults found.  
|                  | - Reconnect the DC input and check operation..                                  
|                  | - If fault persists, for assistance                                             |
| EEPROM Failure   | - Disconnect PV +ve and –ve input, and re-connect after a short break.           
|                  | - If fault persists, for assistance                                             |
| High DC Bus      | - Disconnect PV +ve and –ve input, and re-connect after a short break.           
|                  | - Check AC connection for faults                                                
|                  | - If fault persists, for assistance                                             |
| Fan Fault        | - Check the fan for any block .                                                 
|                  | - Check fan cables.                                                             
|                  | - If fault persists, for assistance                                             |
| GFCI Failure     | - Disconnect PV +ve and –ve input, and re-connect after a short break.           
|                  | - If fault persists, for assistance                                             |

**9.2 Routine Maintenance**

Inverters generally do not have any maintenance needs.

The cooling fan is fitted should not be blocked or covered in dust..

● **Cleaning of Inverter**

Use small electric blower, soft dry cloth or brush to clean inverters. Water, corrosive chemical, or intense cleaning agents should not be used.

● **Cooling fin cleaning**

To ensure proper inverter performance, adequate space needs to be left all around the inverter and heat sink at the back. Fan should not be blocked by dust, snow or any other object. Use air blower, soft cloth or brush to clean cooling fin. Water, corrosive chemicals or intense cleaning agents should not be used for cleaning inverter or fan.
10. Decommissioning

10.1 Dismantling the Inverter

- Disconnect the inverter from DC Input and AC output.
- Remove all connection cables from the inverter.
- Remove the inverter from the bracket.

10.2 Packaging

- If possible, pack the inverter in the original packaging.
- If original packaging is not available, use an equivalent carton that meets the following requirements.
  - Suitable for loads more than 25 kg.
  - With handle.
  - Can be fully closed.

10.3 Storage

Store the inverter in dry place where ambient temperature is always between -20 °C - +60 °C.

10.4 Disposal

Warranty condition
Tress Power will be responsible for repairing and replacing faulty inverter within 5-year warranty period.