



## User Manual and Installation Instructions **DURALUXE SUN Series Solar Inverters**



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## 1 Before you start

Thank you for choosing our product. The Duraluxe Grid PV-Inverter is a highly reliable product due to its innovative design and stringent quality control. Such a device is intended for use on high demand grid-connected PV systems.



This manual contains information regarding the installation and safe operation of this unit. Be sure to read this manual carefully before using!

If you encounter any problems during the installation or operation of this unit, always refer to the manual prior to contacting your local dealer or representative. The instructions provided within the manual will help you solve most installation and operational difficulties. To obtain the very latest manual and product information, please visit our web site.

Thank you again for choosing our product. Please keep the manual nearby for future reference.



The product through the TÜV certificate

## 2 Safety instructions

### ◆ Risk of Electric Shock

1. The Grid PV-Inverter must be installed by a professional knowledge electrical engineer to install.
2. This unit is designed to supply power to the grid (utility) only. Do not connect this unit to an AC source or generator. Connection of the PV Inverter to this type of equipment will cause damage.
3. Do not remove the covers. The Grid PV-Inverter contains no user serviceable parts. Refer any servicing to qualified service personnel.



Both AC and DC voltages are present within this equipment. All circuits must be disconnected prior to servicing.

4. Energy stored within this equipment's DC link capacitors presents a risk of electric shock. Even after the unit has been disconnected from the grid and photovoltaic panels, high voltages may still exist within the unit. Always allow at least 30 minutes following the disconnection of all power sources before removing any covers or panels.
5. Carefully remove the unit from its packaging. Inspect for external damage. If you find any damage, please contact your local dealer.

### ◆ Hot surface



Although designed to meet all safety requirements, certain parts and surfaces of the PV-Inverter will be hot during its operation. To reduce the risk of injury, do not touch the heat sink behind the unit or any surface near the heat sink while the Grid PV-Inverter is operating.

### **3 Features**

- ◆ Easy installation & easy operation
- ◆ Very high conversion efficiency
- ◆ MPPT (Maximum Power Point Tracking)
- ◆ Embedded LCD display, complete status information
- ◆ Natural convection cooling. Quiet, fan-less design
- ◆ Stylish, modern, Compact design, Transformerless
- ◆ High reliability, high performance
- ◆ Maintenance free
- ◆ Standard RS-232, optional RS-485 and others
- ◆ Embedded ENS complies with VDE 0126-1-1
- ◆ No Type B RCD according to IEC 62423 needed
- ◆ Broad input voltage range enables flexible application

### **4 Scope of delivery**

After opening the packaging, please check the contents of the box. It should contain the following:

1. One Grid PV-Inverter
2. Instruction manual
3. One mounting frame
4. Four mounting screws
5. Two safety-lock screws
6. Two PV connectors for the DC Input
7. One AC connector assembly

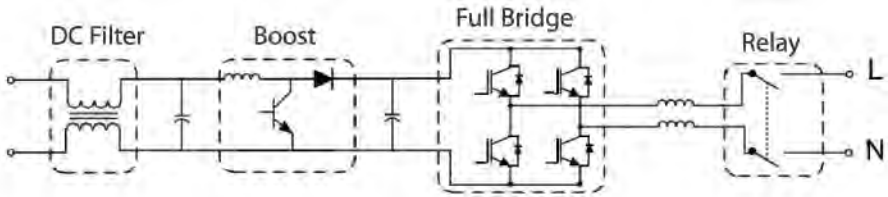
## 5 System diagrams



1. PV panel: Provides DC power to the inverter.
2. PV-Inverter: Converts the DC power from the PV panel(s) into AC power. Due to this unit being a grid connected inverter, it controls the output current amplitude according to the power being provided from the PV panel. The inverter will always attempt to obtain the maximum power from the PV panel.
3. Connection system: The “interface” between the Utility and the inverter. This will consist of a circuit breaker, fuse and terminals for the connection. To comply with local safety standards and codes, this part must be designed by a qualified technician.
4. Utility: This is also referred to as the “grid” within this manual. It is the method used by your electricity company to provide power to your site. Please note that the inverter can only be connected to low-voltage systems (namely, 220, 230VAC, 50/60Hz).

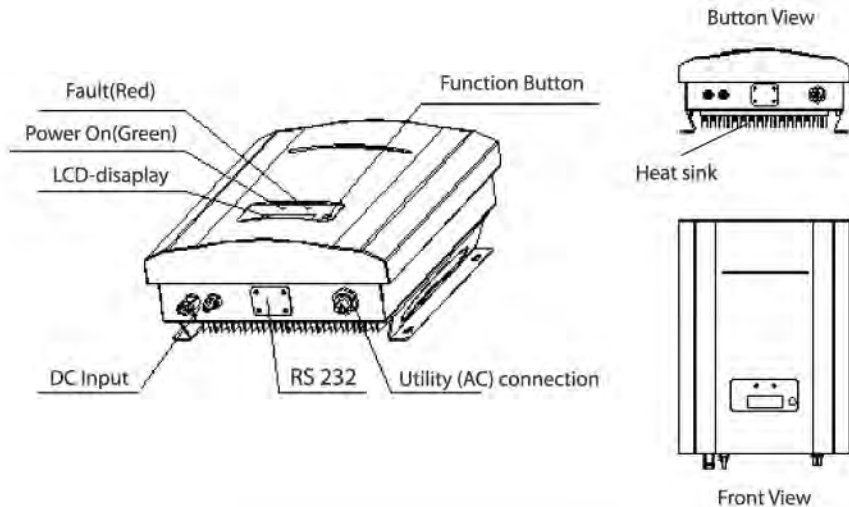


## 6 Circuit Description



DC-DC boost stage increases the input DC. The IGBT full-bridge converts the DC power to AC power. The AC power is then fed to the grid after being processed by a filter.

## Overview



## 7 Installation instructions

### 7.1 Prior installation

Before commencing the installation please consider the following:

#### ◆ IP 65 proof model



This unit is designed for outdoor use; however we do not recommend that it is exposed to moist or wet environments.



Do not expose this unit to direct sunlight. Direct sunlight will increase the internal temperatures, thus reducing the output power.

Please confirm that:

- ◆ The ambient temperature of the installation is within the specification (-20 to +55°C).

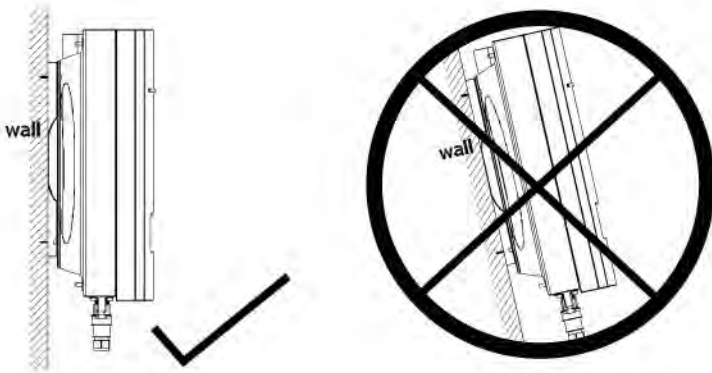


The IP 65 proof PV-Inverter can be installed and operated within locations where the ambient temperature is up to 55°C. However, for optimum operation, we strongly recommend that it is installed where the ambient temperature is with the range of 0 to +40°C.

- ◆ The electric utility company has approved the grid connection.
- ◆ Adequate ventilation space is provided around the inverter.
- ◆ The inverter is being installed in a room free of explosive vapors.
- ◆ No flammable items are near the inverter.
- ◆ The AC grid voltage is between 190 and 256VAC, 50Hz (Italy 260VAC).

### 7.2 Wall mounting

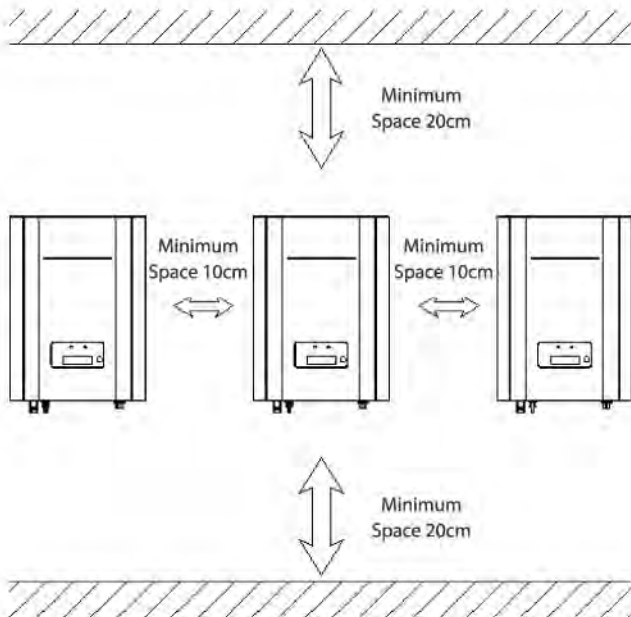
1. Select a wall or solid vertical surface which can adequately support the weight of the inverter. Do not install the Inverter at an angle.



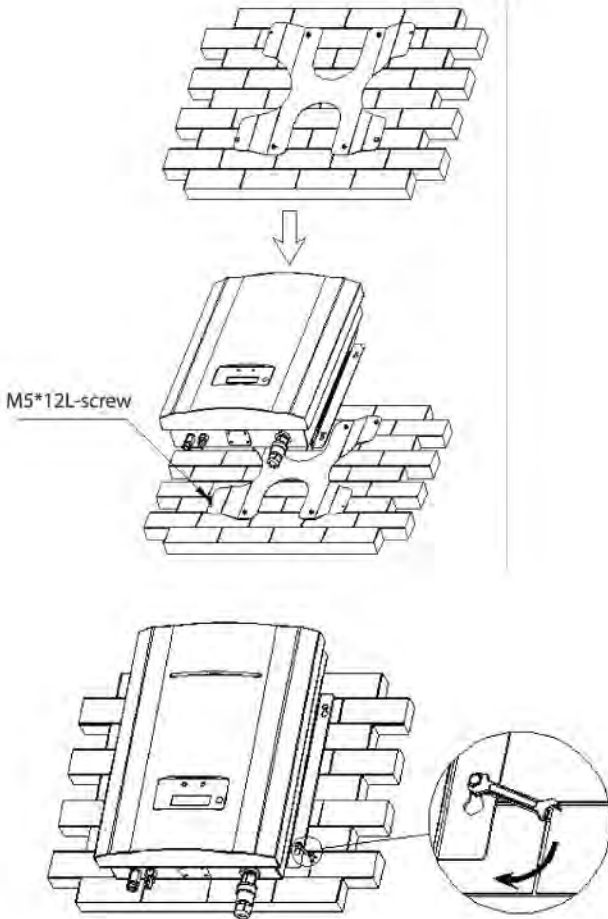
2. The Grid PV-Inverter requires adequate cooling space. Keep at least 20cm space above and below the inverter.



**No flammable items are near the inverter !**



3. Use the mounting frame as a template; drill 4 holes according to the installation requirements.
4. Fix the mounting frame as shown.
5. Hang the inverter onto the mounting frame.
6. Insert the safety-lock screws on the bottom leg to secure the inverter.



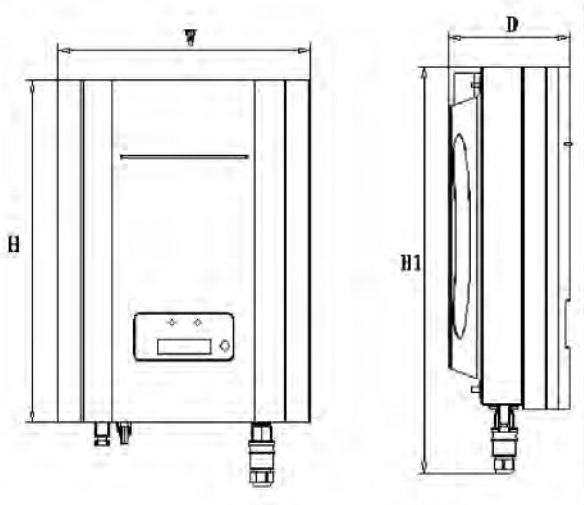


Check the Inverter is secure by trying to lift the Inverter vertically from the bracket.

Select the installation location such that the Inverter display can be viewed easily. Choose a strong mounting wall to prevent vibration whilst the PV Inverter is operating.

### 7.3 Size and weight(mm)

1. Select a wall or solid vertical surface which can adequately support the weight of the inverter.



W x H x D [mm]	500 x 340 x 165
H1 [mm]	545
Weight [Kg]	16

## 7.4 Installation

### 7.4.1 Connection to the grid (AC side)

1. Measure the grid (utility) voltage and frequency. It should be 230VAC (or 220VAC), 50/60Hz single phase.
2. Open the breaker or fuse located between the inverter and the utility.
3. Connect the AC cable as follows:
  - ◆ Suggested minimum cross-sections

Model	AC Power [W]	Cross section [mm <sup>2</sup> ]	
		Stranded wire	Solid wire
DS 1500TL	1500	1.5~4	1.5~6
DS 2000TL	2000	1.5~4	1.5~6
DS 2800TL	2800	2.5~4	2.5~6
DS 4000TL	4000	4	4~6



- ◆ Insert the utility cable through the cable gland. Connect the wires according to the polarity indicated on the terminal block.
  - L → Line (brown, black or grey)
  - N → Neutral (blue)
  - PE → system ground (green-yellow)
- ◆ Refer to the diagram on the right.
- ◆ Rotate the gland until the cable is firmly secured.



To prevent the risk of electric shock, it is critical to properly connect the Ground connection. Before operating the unit, please make sure that the Ground terminal is correctly wired.

## 7.4.2 Connection to PV panel (DC input)

1. Make sure that the maximum open circuit voltage (VOC) of each PV string is less than listed in the table below

Model	Voc [VDC]	Max. Current [ADC]
DS 1500TL	≤ 450	9
DS 2000TL	≤ 500	10
DS 2800TL	≤ 500	13
DS 4000TL	≤ 500	20



2. Use PV connectors for the PV array terminals.
3. Connect the positive from the PV panel to the (+) terminal and the negative to the (-) terminals. Each DC terminal is rated to a maximum of 20ADC



Before connecting the PV panels to the DC terminals, please ensure that the polarity is correct. Incorrect polarity connection could cause permanent damage to the unit.

Check the short-circuit current of the PV string. The total short-circuit current of the PV string should be less than the Inverter's maximum DC current.



High voltage arise when the PV array is exposed to the sun. This can cause an electric shock in conjunction with exposed live components. Always be very careful when handling the PV modules/array and any connections. Ensure touch protection for individuals.

## 7.5 Inverter status

Normal working status		
Operating conditions	Display	Description
Power off	No display	Vpv<70V Shutdown
Standby	Standby	Input voltage between 90-100v
Waiting	Waiting	The input voltage is within the range 100-155V . During start-up, once the PV voltage is higher than 155V. The inverter will wait to supply the grid.
Check grid	Checking	When the PV voltage is >155V, the inverter will check the supply conditions
Supplying grid	Normal State	The inverter is supplying power. After 10 seconds of this message, the LCD will show the supplied voltage.



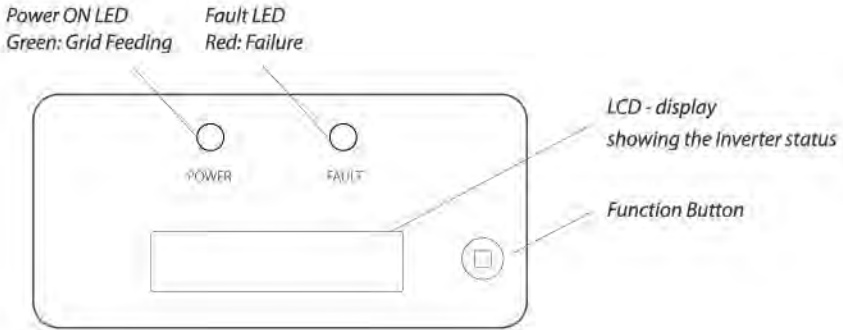
## 8 Operation

### 8.1 Modes of operation

The DS PV-Inverter has 3 different operational modes:

LED	Mode	Explanation
Green	Normal	During this mode the inverter is operating normally. Whenever the voltage from the PV panel is greater than 150VDC, the inverter converts the supplied power to the grid in accordance with the power from the PV panel. If the voltage from the PV panel close to 100V , the inverter will remain in a "waiting" state. During the "waiting"state only a small amount of power is required from the PV panel to ensure that the controller can continue monitoring the system. When in normal mode the green LED is illuminated.
Red	Fault	The inverter detects some errors, such as output relay failure.EEPROM problem.Isolation failure.Grid failure.GFCI failure.Consistent failure and so on.If the problem is not solved, the Red LED is illuminated. Please contact us.
Off	Shutdown mode	During the night or on days with very little sunlight, the PV Inverter will stop automatically and be disconnected from the grid. No power is consumed in this mode and all LED and LCD display will be off.

## 8.2 Front Panel View



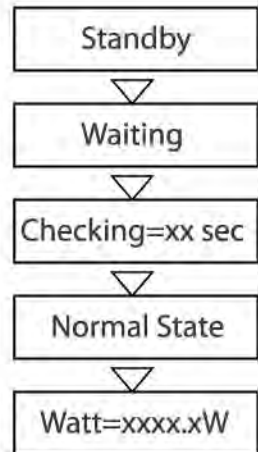
## 8.3 Display panel operation

The operation of the PV-inverter is simple. During normal operation it will work automatically. However, to achieve maximum usability, we suggest reading the following information:

During normal operation the display is configured to automatically show the power supplied to the grid. If further information is required, this can be obtained by pressing the "set button" located on the display.

**8.3.1 Automatic start:** The inverter starts up automatically when the DC power from the PV panel is sufficient. Once the inverter starts, it will operate in one of the following 3 states:

- ◆ Standby: The PV string is only providing enough voltage for the minimum requirements of the controller.(about 97V)
- ◆ Waiting:When the PV string DC voltage is greater than 100V , the inverter remains in the waiting state. During this state, the inverter is waiting for the connection to the grid.



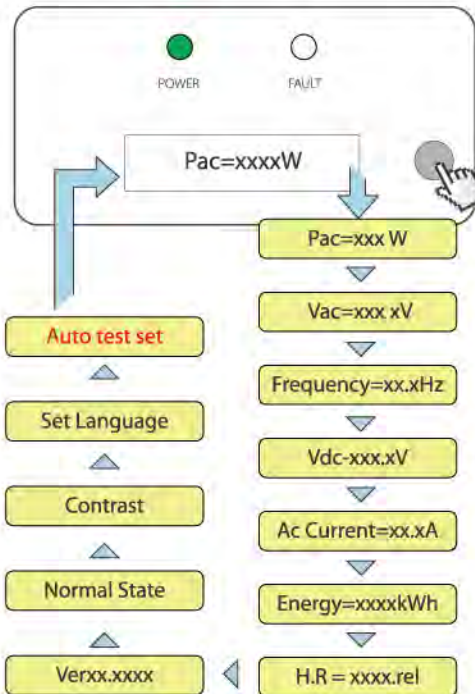
◆ **Checking:** When the PV panels are connected and their output voltage is greater than 155VDC. If the AC utility is not connected, the LCD will display the following message “MODEL= XkW” -> “Waiting” -> “No Utility”.

During this condition, the “No Utility” will remain and the RED “fault LED” will be illuminated. When the inverter is operating normally, the LCD will display “Watt=xxxx.xW”. This completes the checks.

**Normal operation :** When the PV string DC voltage is greater than 155V , the inverter will operate normally. During this state power will be supplied to the grid.

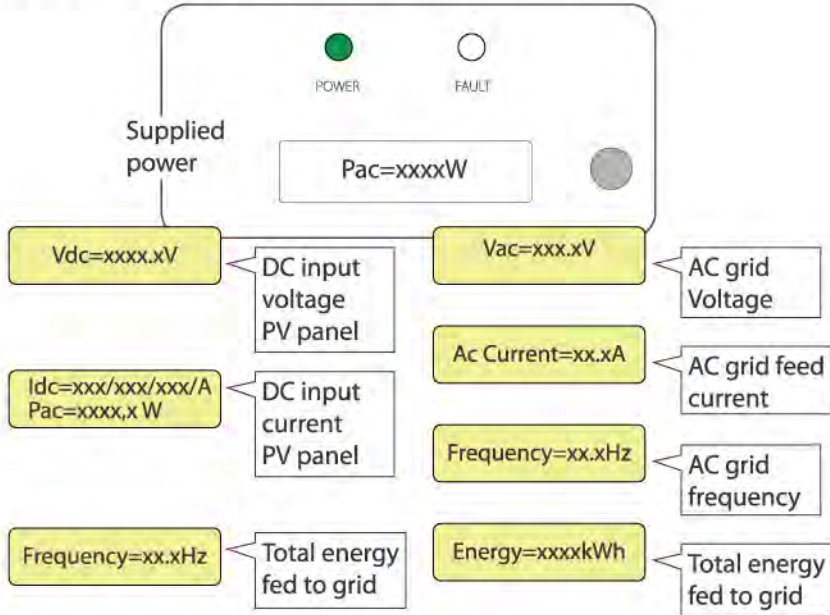
### 8.3.2 Display monitoring parameters

Each touch of the button scrolls through the available information fields one by one. The display sequence is shown.

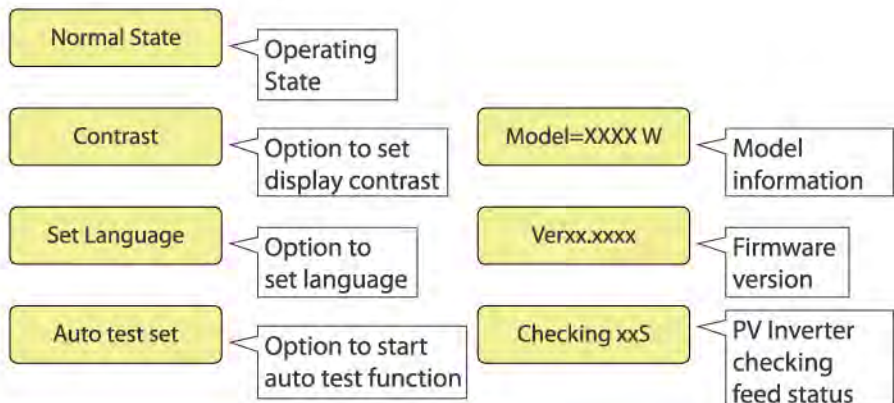


### 8.3.3 Explanation of monitoring parameters

#### ◆ Electrical information

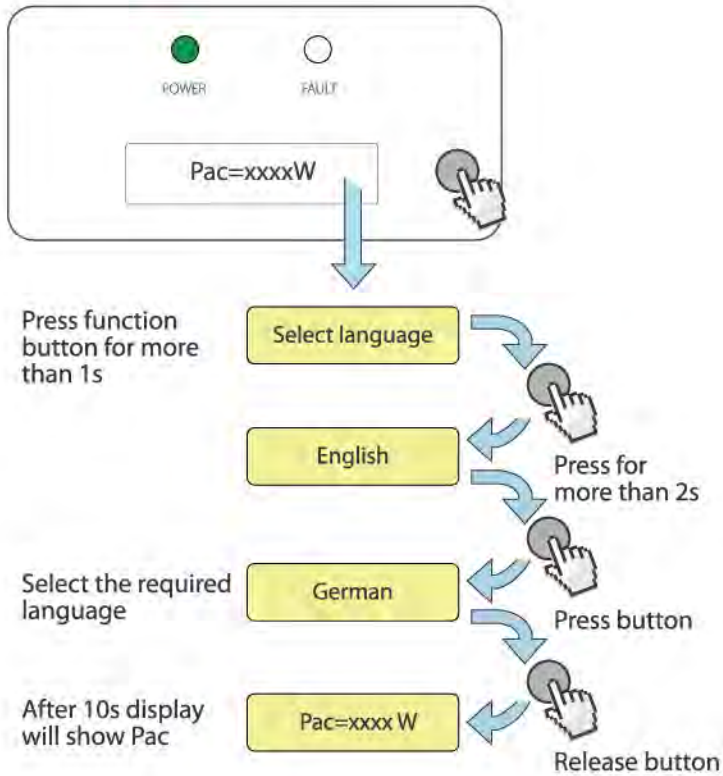


#### ◆ System information



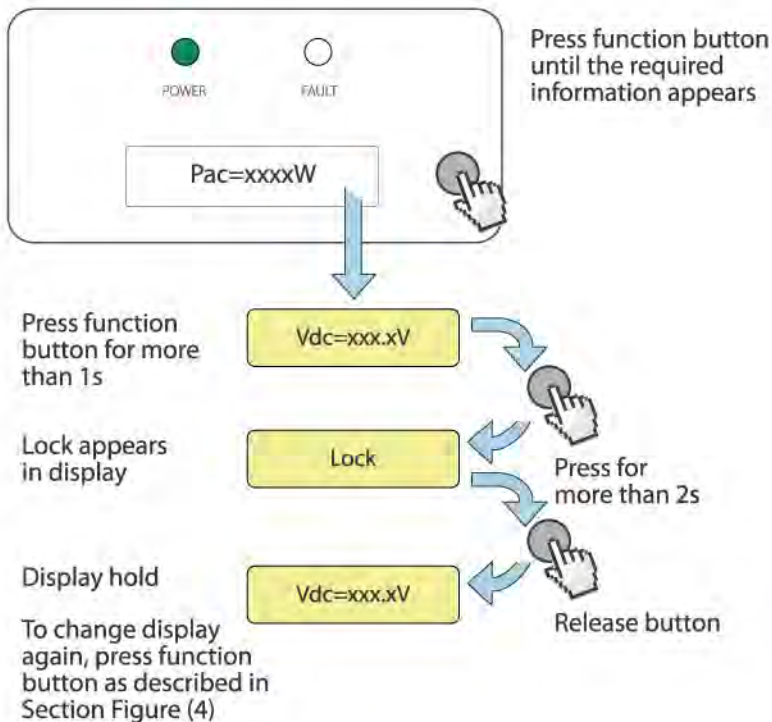
### 8.3.4 Select Language

Press function button until Set language appears



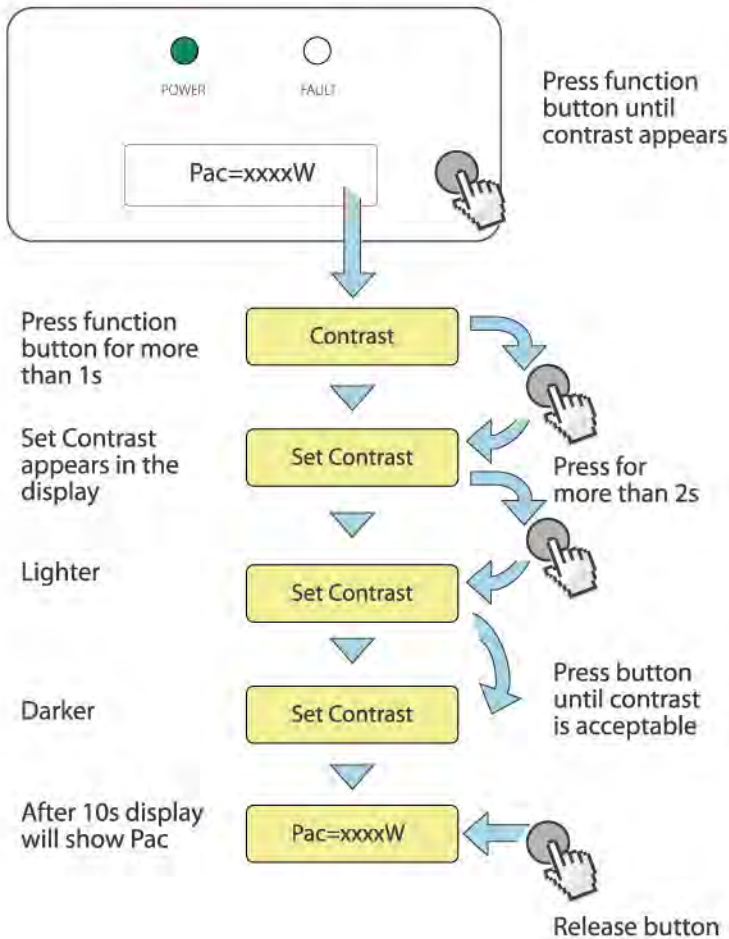
### 8.3.5 Display hold

If you want to keep certain information on the display, firstly change the display by pressing the Sel/Set button repeatedly until the information you want to show appears. Release the button and then press and hold it for more than 1 second until you see "Lock" appearing, then release the button; the information will remain on the display.



### 8.3.6 Contrast control

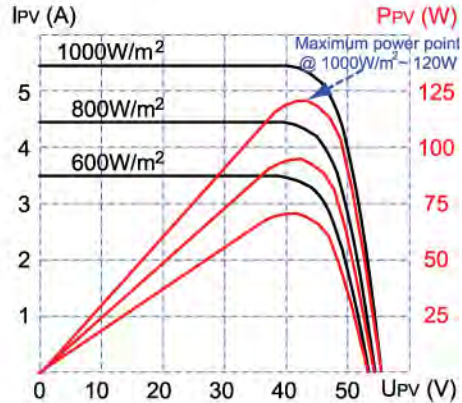
A natural phenomenon of LCD displays is that the background colour is darker at higher temperatures. At higher temperatures, the characters may not be easily identified. The user can adjust the contrast as follows:



## 8.4 Maximum Power Point Tracking (MPPT)

A good PV inverter must be capable of obtaining the maximum power available from any PV panel. Due to advanced design, the PV-inverter can track the maximum power being provided by the PV panel during any condition.

When the displayed power output does not change dramatically, the inverter is obtaining the maximum power from panel.



When the power reading changes significantly, the inverter is tracking the power according to the variation of sunlight.

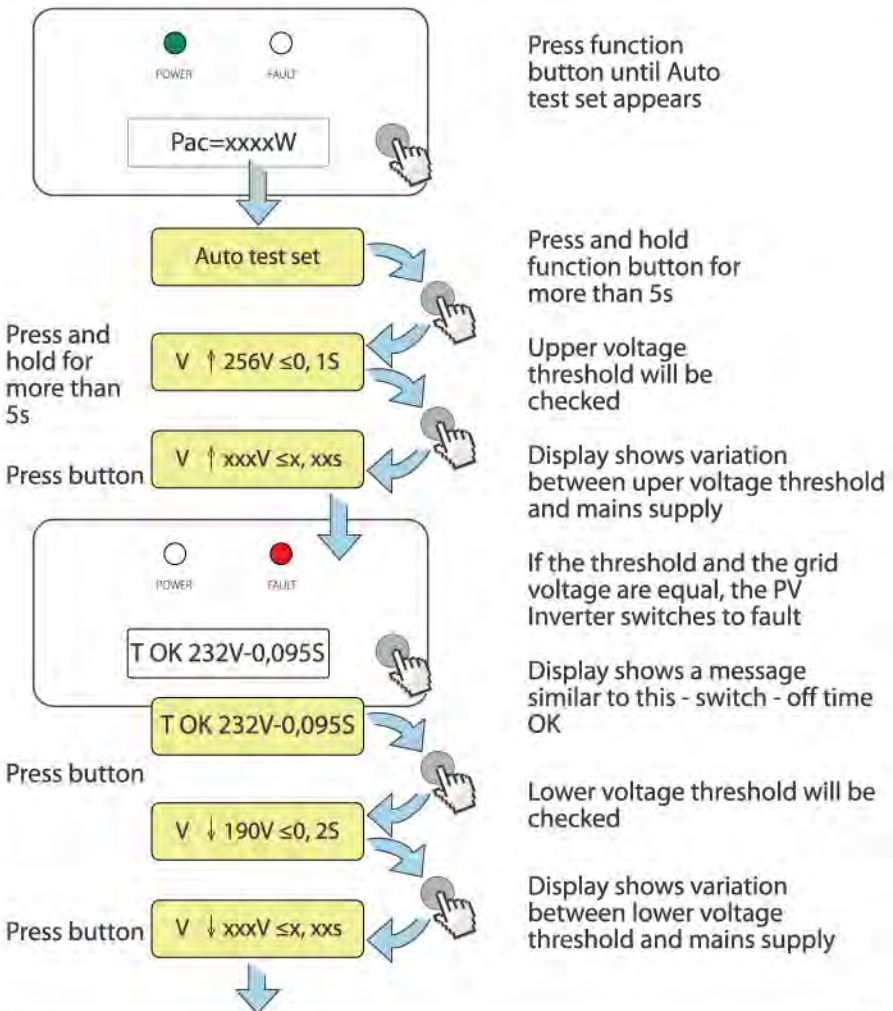
## 8.5 Display accuracy

The reading on the LCD is only for reference. We do not recommend the user to use this data for checking or testing the system. Normally, the accuracy is around  $\pm 2\%$ . During all ranges of operation, the accuracy can be up to  $\pm 5\%$ .

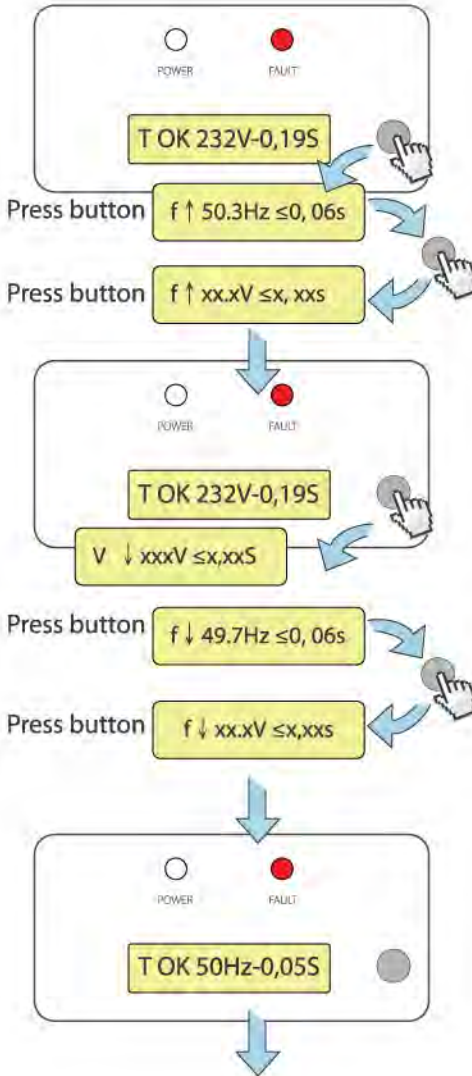


## 9 Auto Test

The inverter is supplied with an auto-test function which enables the user to verify the correct operation of the protection interface. In order to select this function press the Sel/Set button until the message "AUTO TEST SET" appears on the display panel. Press and hold the same button for at least 5 second, to initiate the auto-test procedure.



## Auto Test



If the threshold and the grid voltage are equal, the PV Inverter switches to fault

Display shows a message similar to this - switch - off time OK

Upper frequency threshold will be checked

Display shows variation between upper frequency threshold and mains supply

If the threshold and the grid frequency are equal, the PV Inverter switches to fault

Display shows a message similar to this - switch - off time OK

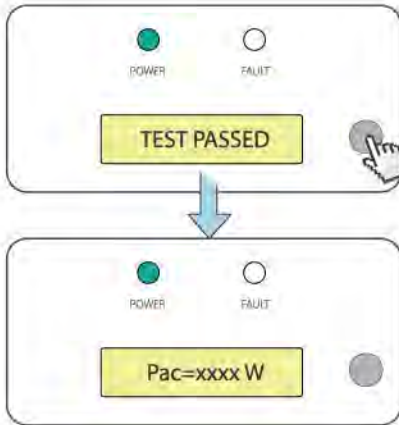
Lower voltage threshold will be checked

Display shows variation between lower voltage threshold and mains supply

If the threshold and the grid frequency are equal, the PV Inverter switches to fault

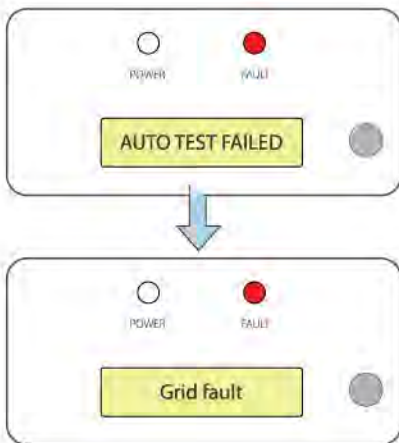
Display shows a message similar to this - switch - off time OK

## Auto Test



If all the above tests have been performed, the display shows the message TEST PASSED

PV Inverter switches to normal operation mode



If one of the above tests failed, the display shows the message AUTO TEST FAILED

PV Inverter switches automatically and permanently to fault status

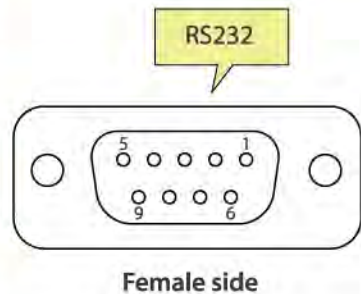
Contact the installer

## 10 Communication

The inverter is equipped with powerful communication interface and options. The user can use software to monitor the status of the inverter. Also, qualified personnel can upgrade the firmware via the RS232 port.

To use the RS232 port, remove the RS232 cover from the underside of the inverter. This is a DB9 socket and the pin-out is as follows:

Pin	Functional description
1	N.C.
2	TXD
3	RXD
4	N.C.
5	Common
6	N.C.
7	N.C.
8	N.C.
9	N.C.



N.C. means “no connection”

## 11 Trouble shooting

During most situations, the inverter requires very little attention. However, if the inverter is not working correctly, please refer to the following instructions before calling your local dealer. The user can typically solve most of the problems.

- ◆ Whenever the red (Fault) LED is illuminated, the LCD will display the information relating to this problem. Please read this information and refer to the table below:

Fault		
Display	Description	Actions
Isolation Fault	Earth fault within the PV-panels or failure of the surge voltage protection.	Check the impedance between PV (+) & PV (-) and earth ground. The impedance must be greater than 8MΩ
Ground Fault	The leakage current on the ground conductor is too high.	<ol style="list-style-type: none"> <li>1. This is caused by high ground current</li> <li>2. Switch off the DC connector or unplug the PV panel from the input, and check the AC system</li> <li>3. If the fault is cleared, reconnect the PV panel. Then check the status of the inverter</li> </ol>
Grid Fault	The measured grid data is outside of the required specification (voltage & frequency).	<ol style="list-style-type: none"> <li>1. Wait for 5 minutes, if the grid returns to normal, the inverter will start automatically</li> <li>2. Ensure that the grid voltage and frequency meet the specifications</li> </ol>
No Utility	Grid is not available.	<ol style="list-style-type: none"> <li>1. The grid is not connected</li> <li>2. Check the grid connection</li> <li>3. Check grid availability</li> </ol>

## Trouble shooting

Fault		
Display	Description	Actions
PV over Voltage	The input voltage is higher than the permissible value.	Check the open PV voltage, confirm if it is more than or too close to 500V
Consistent Fault	The values of the 2 micro-processors are not consistent. This could be caused by a CPU and/or other units, or the control board circuit not functioning properly.	Disconnect the PV (+) or PV (-) from the input, and restart the unit again
Over Temperature	The internal temperature is higher than the normal value.	<ol style="list-style-type: none"> <li>1. The internal temperature is higher than the specific value</li> <li>2. Reduce the ambient temperature by some other means or move the inverter to cooler place</li> </ol>
Relay Failure	The relay between Inverter and grid is not functional	<ol style="list-style-type: none"> <li>1. Switch off the PV array with the DC connector</li> <li>2. Wait for a few seconds.</li> <li>3. Once the display has switched off, switch on the DC connector.</li> </ol>
DC INJ High	Output DC injection too high	
EEPROM Failure	Internal EEPROM has data access problem	
SCI Failure	The communication between internal MCU is abnormal	
High DC Bus	The internal DC BUS is higher than expected	

## Trouble shooting

Fault		
Display	Description	Actions
Low DC Bus	The internal DC BUS is lower than expected	<ol style="list-style-type: none"> <li>1. Switch off the PV array with the DC connector</li> <li>2. Wait for a few seconds.</li> <li>3. Once the display has switched off, switch on the DC connector.</li> <li>4. If the message appears again, please call you installer.</li> </ol>
Ref 2.5V Fault	The internal 2.5V reference value is abnormal	
DC Sensor Fault	The DC output sensor is abnormal	
GFCI Failure	The GFCI detection circuit is abnormal	

- ◆ If there is no display on the panel, check the input PV connections. If the voltage is higher than 150V, please call your local dealer.
- ◆ During early morning or late afternoon, or when the sunshine is significantly obscured, the inverter may continuously start up and shut down. This situation occurs when the PV panel(s) are generating insufficient power to operate the control circuits.

## 12 Specification

### 12.1 Electrical

Model	DS 1500TL	DS 2000TL	DS 2800TL	DS 4000TL
<b>Input ( DC )</b>				
Max. DC power	1760 W	2320 W	3180 W	4630 W
Max. DC voltage	450 VDC	500 VDC	500 VDC	500 VDC
MPP voltage range	150~400 VDC	150~450 VDC	150~450 VDC	150~450 VDC
Nominal DC voltage	360 VDC	400VDC	400 VDC	400 VDC
Max. input current	9 A	10 A	13 A	20 A
MPP Tracker	1	1	1	1
<b>Output ( AC )</b>				
AC nominal power	1500 W	2000 W	2800 W	4000 W
Max. AC apparent power	1650 W	2200 W	3000 W	4400 W
Normal AC voltage/range	230 VAC / 190~260 VAC			
AC grid frequency	50Hz			
Power factor	>0.99	>0.99	>0.99	>0.99
Connection phases	Single phase			
Current THD	<3%, at nominal power			
<b>System</b>				
Max. efficiency	96%	97.1%	97.2%	97.2%
Euro efficiency	95%	96%	96.2%	96.2%
Operating temperature	- 20°C to + 60°C (up 40°C derating )			
Relative humidity	0% to 95%, no condensation			
Protection rating	IP 65 according to IEC 60529			
Noise level	< 35dBA			
LCD display	LCD, 1- line, 16 - character with keypad, backlight			
Date comm. interfaces	RS232, RS485 (Optional)			
<b>Mechanical</b>				
W x H x D [mm]	500 x 340 x 165	500 x 340 x 165	500 x 340 x 165	600 x 408 x 198
H1 [mm]	545	545	545	645
Weight [Kg]	15	16	16	20

Note: We reserve the rights to change our products specifications without notice.



## Compliance with Standards

### EMC

EN 61000-6-1

EN 61000-6-3

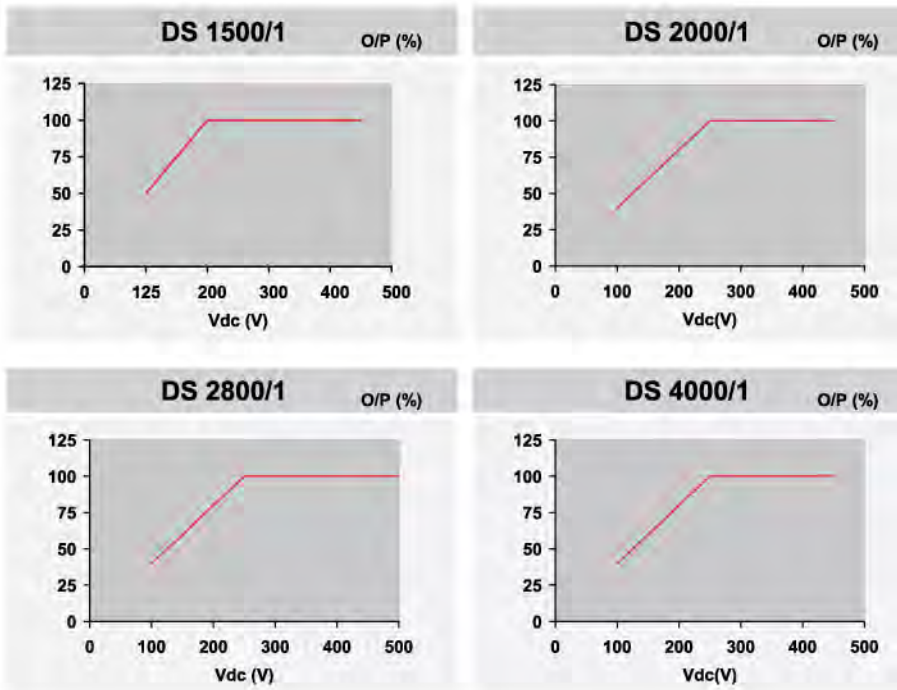
### Grid monitoring

Independent disconnection device (MSD, Mains monitoring with allocated Switching Devices) according to VDE 0126-1-1

### Low Voltage Regulation

DIN EN 50178 (VDE 0160) (IEC 62109)

## 12.2 Load Graphs for the different models



**Note:** Test equipment tolerances and deviation between products may cause the test results to be slightly different.

### **13 Service and maintenance**

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

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

- Improper or inappropriate use of the product
- Operating the product in an unintended environment
- Operating the product when ignoring relevant safety regulation
- Altering the product or supplied software without authority

### **14 Contact us**

If you have any questions during the installation or operation of this unit. Please contact us.

ADD: No2288, Cuihu No.5 Road,  
Development Zone of Economy & Technology,  
Tongling, Anhui, 244000, China

TEL:+86 562 2196808  
FAX:+86 562 2196880

[www.duraluxe.com](http://www.duraluxe.com)