



# NOVERGY

## USER MANUAL

### IPCL SERIES

### PCU / SOLAR INVERTER

### 1KW TO 10KW

#### 1. SAFETY

##### 1.1. General

Read safety notes carefully and thoroughly before operation ensure correctly use and save this manual properly.  
Installation, maintenance & repair of the equipment should be undertaken by trained, experienced and authorized by service personnel or electrical personnel. The handling, installation & maintenance of the battery associated with this equipment, must be done in accordance with the instructions & safety precautions given by the battery manufacturer. Risk of a possible electrocution is possible when the battery is connected to the Inverter. Therefore, do not forget to disconnect the batteries ,grid, panel, load before any service is to be done on the Inverter.

To disconnect,remove the battery fuse holder,turn off all MCB ,located at the rear of pcu.



We request you to read the Manual prior to installation, performing start up procedures or system operation or maintenance. Should you require any assistance for more information on installation, please call on our nearest service center.

##### 1.2. Safety Warnings

###### 1.2.1 Environment:

Inverter packing must be recycled in compliance with regulations.

Battery contains Lead and is dangerous substance for the environment hence same shall be dispose of by Govt. approved agency only.

###### 1.2.2 Safety for persons:

The System devices generate a large leakage current; grounding of the PCU & panel is necessary before connecting power. Therefore connect to ground prior to commissioning. Improper connection may damage the device and lead to injuries.



Hazardous voltage levels are present within the inverter. Inverter should be opened by qualified engineer only.

After the Inverter shut down, a dangerous voltage will be present on the battery termination

###### 1.2.3 Safety for product:

Suitable upstream protection must be installed with easy access to operators.

Inverter shall not be installed near liquid or with room exceeding specified room temperature and humidity.

Place the Inverter in a room with proper ventilation and safe distance. All ventilation apertures must be kept free and clean. Refer to manual to perform installation.

Avoid installing the Inverter in location under direct sunlight, running water, or excessive humidity.

Routine preventive check shall be done..

Store the Solar Inverter in its original Packing. Ensure the arrow on the box is pointing vertically upward direction.

Store it in dry location. Storage temperature must be between -10 to 70 oC.

Suitable handling equipment shall be used for handling of inverter.

The route / passage up to the installation site and the actual foundation location must be capable of supporting the weight of the Solar Inverter and its accessories.



The interior of the Solar Inverter cubical, after it is installed, has hazardous AC & DC voltages on exposed terminals and printed circuit boards. This condition prevails even when all the switches are OFF.

## 2 INSTALLATION

### 2.1 Receipt of System

When the INVERTER is received, please carry out visual check for any damage during transport.



Please immediately contact Service person, Dealer or Transport agency for following conditions occur :

- any damage observed, either external or internal.
- any accessory is missing or damaged.

### 2.2 Positioning and Installation

The system must be installed in a dry & clean room. To have proper ventilation, the user must ensure enough air exchange in the room.

Never install the equipment near liquids or in an excessively damp environment.

Never block the ventilation grates.

We are suggesting the distances require to be Solar Inverter :

- Minimum distance from the rear wall = 500 mm
- Minimum distance from the top = 500 mm
- Minimum distance from the front wall = 500 mm

### 2.3 Electrical Connection

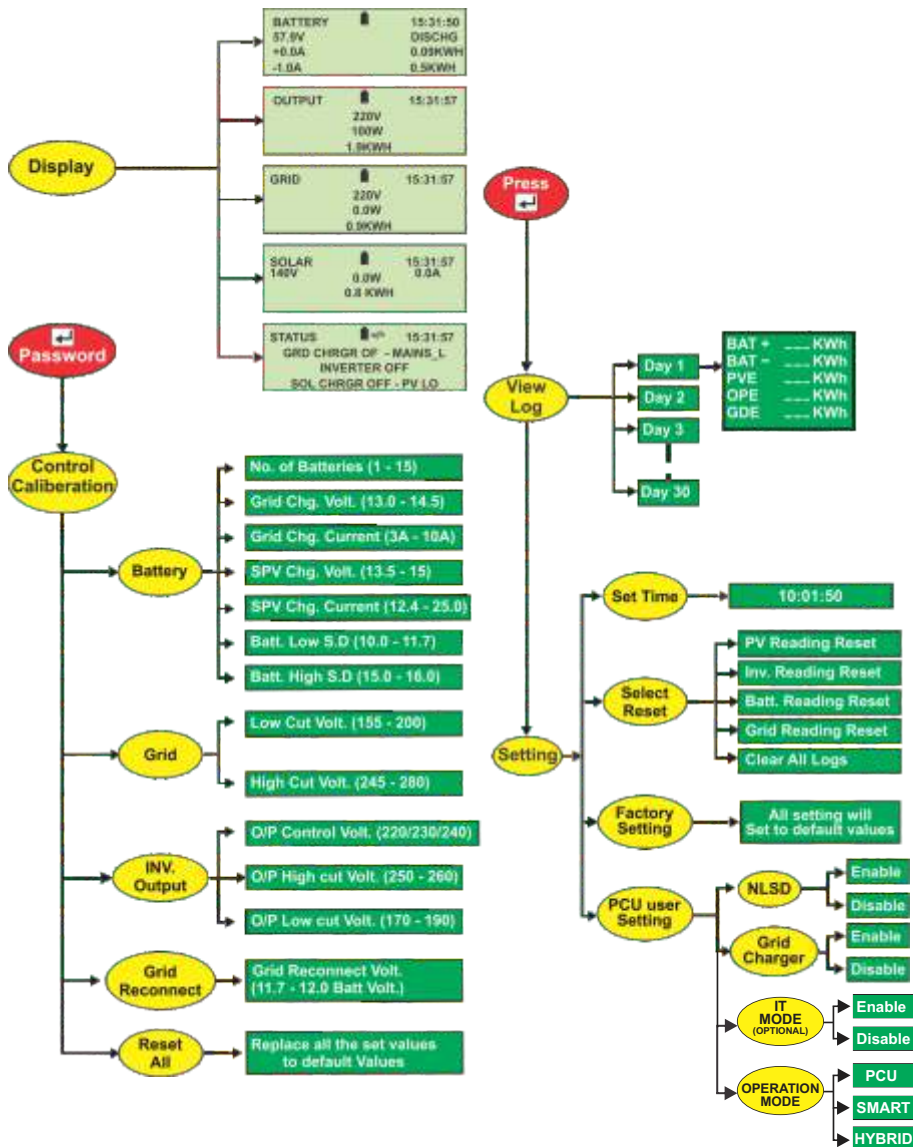
- Keep the Battery, Panel, Grid Input & Output MCBs in "OFF" position during installation.
- Connect Grid Input, Array & Battery supply to PCU.
- Ensure the correctness of the battery & Solar Panel Array supply polarity.
- Ensure proper earthing of the equipment.
- Connect load cables.
- For Array readily accessible disconnection device (MCB/MCCB) shall be incorporated in the distribution.

### 2.4 STORAGE

When the System is not installed immediately, it must be stored carefully in vertical position, as indicated on the packing and conserved in a dry and sheltered room. Cover it with an envelope so that it is protected from dust.

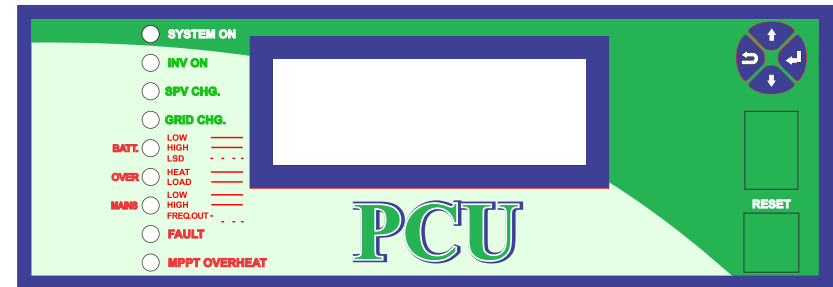
If the period of Inverter installation is over 6 months, be sure to charge batteries for at least 8 hours before the first use.

### 3. IPCL PCU CONFIGURABLE CHART



### 4. LCD PANEL DETAIL

The LCD panel provides all the information relating to operating status, electrical measurements, access to controls and configuration parameters.



<b>Protection</b>	Under/Over voltage for Array & Battery Array & Battery reverse polarity Output Overload, Short circuit, Over Temperature, Surge Protection at I/P, O/P, Array & Battery Path MCB at Battery & Output
<b>Indication &amp; Display</b>	System ON, Inverter ON, SPV Charging, Grid Charging, Battery Low/high, Over Load, Over Heat, Mains low/high, Fault, MPPT Overheat
<b>Display Parameter</b>	Solar- Volt, Current, Cumulative power, Instantaneous power Battery- Volt, Chg/Dischg current, Cumulative Chg/Dischg, Battery graphical status Input- Volt, current, Cumulative power Instantaneous power Output- Volt, current, Cumulative power, Instantaneous power

## 5. LED INDICATIONS

**System on:-** This LED indicates whether the system is in **Active** mode or in **Sleep** mode.

**Note:-** During mains charging mode, if we press the reset switch this LED will turn OFF & if there is power failure then the system will not automatically switch to the Inverter mode.

**INV ON:-** This LED is ON whenever the Inverter is ON.

**SP CHG :-** This LED is switched ON whenever Solar Panel voltage is within the operational range.

**Mains Charging :-** This LED show Batt Charging with Grid Supply

**BATT. :-**

**BATT. LOW :** This LED is ON for 500 ms & OFF for 500ms.when battery is low.

**BATT. HIGH :**This LED is continuously ON, when battery voltage is high.

**BATT. L.S.D :**This LED is ON for 500ms & OFF for 1 sec, when the system is shut down in NO Load condition

**OVER:**

**OVER HEAT :** This LED will ON for 500 ms and OFF for 500 ms, when temp. of inverter (mosfet heatsink) goes above 84°C and system will be shut down.

**OVER LOAD :**This LED will be continuously ON, when system is in overload condition.

**MAINS :-**

**MAINS LOW :** This LED will be ON for 500 ms & OFF for 500ms,whenever MAINS voltage is under range

**MAINS HIGH :** This LED will be ON continuously when MAINS volt over range.

**FREQ. OUT :** This LED will be ON for 500 ms & OFF for 1 sec, when mains input freq. is <47Hz or >53Hz.

**FAULT :** Fault occurs when INVERTER Shut down.

**MPPT OVERHEAT :** This Indication shows, Solar charging OFF in Overheat condition

## 6. SCROLLING LCD DISPLAY

**View - 1**

<b>BATTERY</b>		15:31:50
57.9V		DISCHG
+0.0A		0.09KWH
-1.0A		0.5KWH

**View - 2**

<b>OUTPUT</b>		15:31:57
220V	0.0A	50Hz
	100W	
	1.9KWH	

**View - 3**

<b>GRID</b>		15:31:57
220V	0.0A	50Hz
	0.0W	
	0.9KWH	

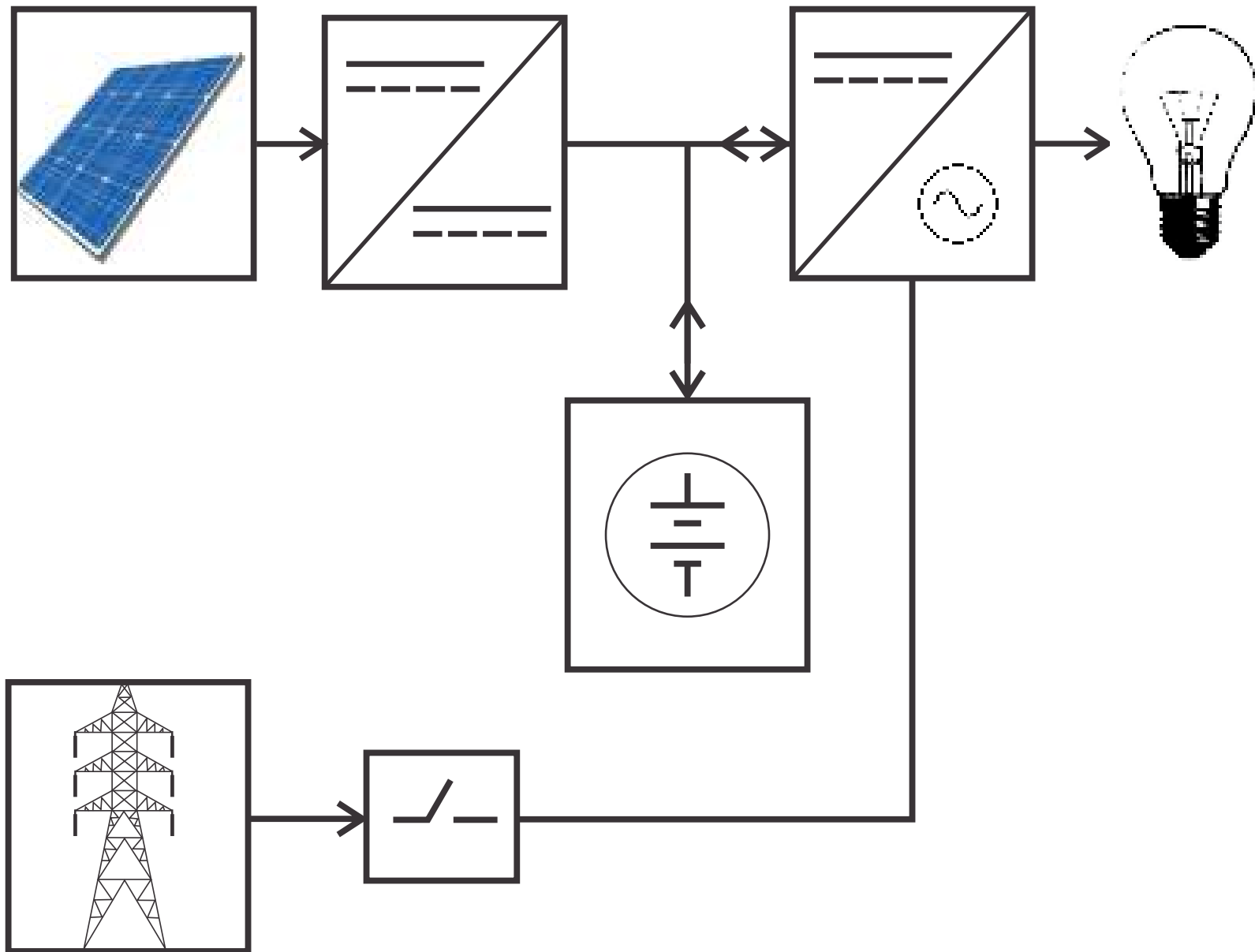
**View - 4**

<b>SOLAR</b>		15:31:57
140V	0.0W	0.0A
	0.8 KWH	

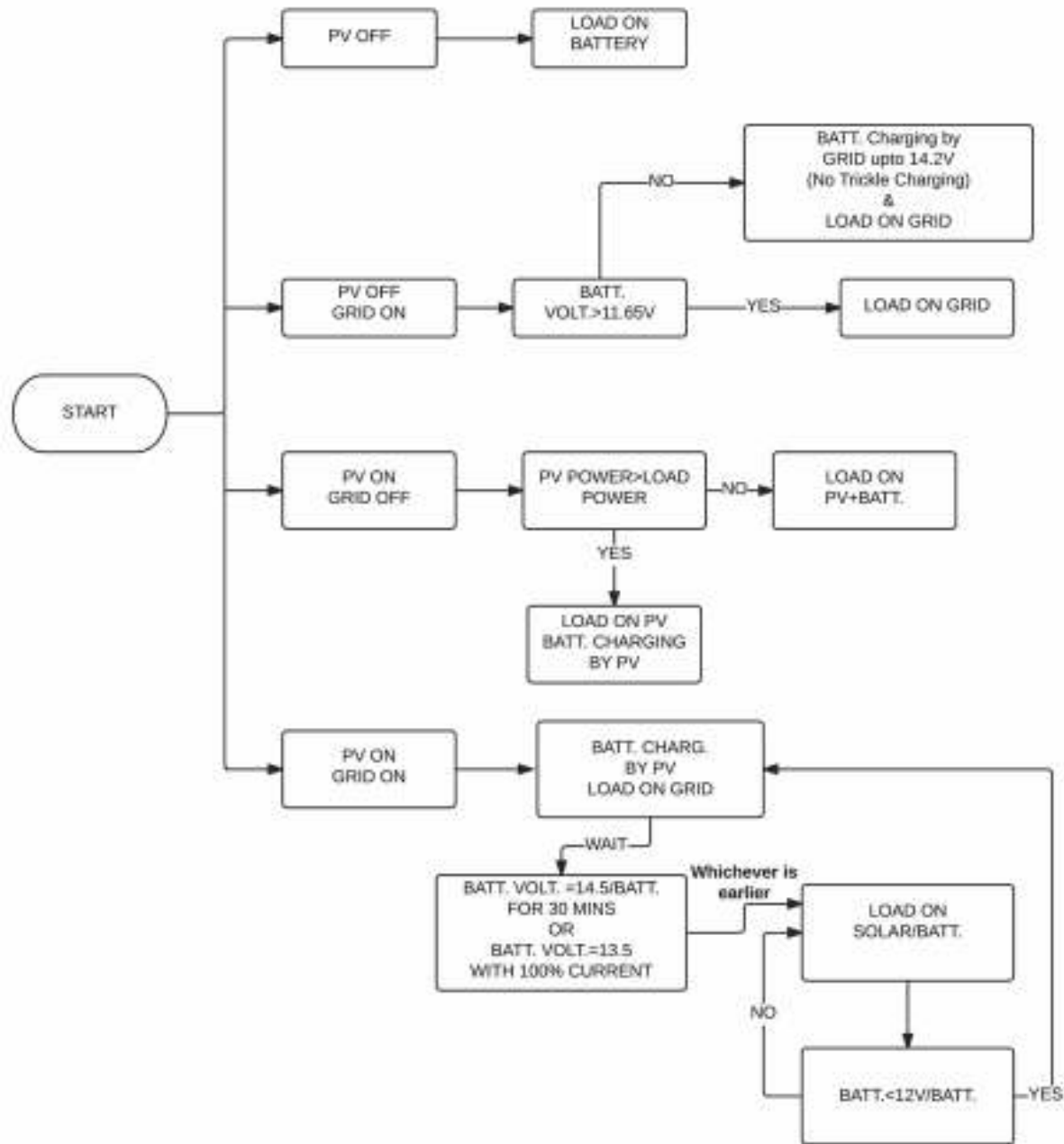
**View - 5**

<b>STATUS</b>		15:31:57
GRD CHRGR OF - MAINS_L		
INVERTER OFF		
SOL CHRGR OFF - PV LO		

## 8. PCU BLOCK DIAGRAM



# 10. IPCL NORMAL PCU FLOW CHART



## 11. SYSTEM DESCRIPTION

PCU is single phase output, Inverter system.

In normal mode, Inverter operates from battery or array power source and produces 1phase AC output to cater the load requirement.

MPPT based array charger, supplies the DC power for battery charging as well as for the inverter.

In case batteries are going in to discharge mode due to array unhealthy, Grid input source will get triggered automatically at certain predetermined battery voltage level . Grid Input source starts battery charging as well as takes care of output load and after sufficient battery charge level.

### 11.1 System Details

System comprises the following main control boards.

- a) Control Board
- b) Display Board

1) Control Board: It controls operation of MPPT charger and Inverter. It contains power modules of MPPT and Inverter. MPPT receives DC supply from solar array and provides charging voltage to battery and DC voltage for Inverter operation. This board also contains Power relays for grid and Inverter, based on signal from DSP board transfer operation is controlled and Output is available at load.

2) Display Board: It receives all inputs from Control Board. It displays Array, Battery, Inverter and Grid parameters

### 11.2 Priority

Solar / Batt/ Grid and Solar / Grid / Batt  
Automatic Select

### Standalone Mode

In this mode inverter work with solar as well as batteries. Grid charger takes place only when solar power is not available & battery discharges up to battery low level trip. It will charge the batteries up to certain limit to maintain float level of battery.

## 12. OPERATING INSTRUCTIONS

To start the system

- Ensure that all Connectors on the various Cards are connected.
- Check tightness of all power terminals in-side & outside of the Cabinet.
- Connect earth to the system.
- Keep Inverter ON/OFF switch at OFF position.
- Ensure battery voltage and Polarity.
- Switch ON Battery MCB.
- Ensure SOLAR array voltage & polarity.
- Connect solar Array supply.
- Now turn ON inverter Reset switch.
- While connecting Grid supply, Please ensure line & neutral connection
- Switch ON Output MCB.

### To Shutdown the System

1. Switch OFF Output MCB.
2. Switch OFF Grid Supply.
3. Switch OFF Array Supply.
4. Switch OFF Battery MCB.

### 13. SPECIFICATION

Parameters	Units	Rating							
		1	2	3	5	6	7.5	10	
System Rating	KVA	1	2	3	5	6	7.5	10	
Operating DC voltage	V	48	48	48	96	120	120	180	
<b>Photovoltaic input</b>									
Input voltage range (Min.-Max)	VDC	72-180	72-180	72-180	144-360	144-450	180-450	324-450	
Maximum PV power recommended	KW	1.0	2.0	3.0	5.0	6.0	7.5	10	
Number of charge controller		1							
<b>MPPT based charge controller</b>									
Switching element		IGBT							
controller		DSP							
type of charger		PWM with MPPT							
<b>Configurable Parameter</b>		<b>Default Value</b>							
Battery Low Buzzer	V	10.4 - 11.85					11.2		
Battery Low Cut	V	10 - 11.7					11.0		
Battery High Cut	V	15 - 16					15.5		
Battery Charging Voltage by SPV	V	13.5 - 15					14.5		
Battery Charging Current by SPV	A	12.5 - 25					18		
Battery Charging Voltage by Grid	V	13.0 - 14.5					14.2		
Battery Charging Current by Grid	A	3 - 12					10		
Grid Low Cut Voltage	V	155 - 200					175		
Grid High Cut Voltage	V	245 - 280					275		
Output Voltage Low	V	170 - 190					185		
Output Voltage High	V	250 - 260					260		
No Load Shut Down	%	Enable / Disable					Disable		
<b>Battery</b>									
Battery low/Grid connect	V	12.0V @Solar Present							
Grid Disconnect (Solar Available)		@14.5 / Battery for 30 minutes							
Temp. compensation		@ 3mV/cell; 18mV/battery							
<b>Inverter</b>									
Switching element		MOSFET			IGBT				
control		PWM							
Nominal output voltage	VAC	220							
Output supply phase		1 phase, 3 wire							
Output waveform		sinewave							
Nominal frequency	Hz	50.0							
Load power factor		0.8 lag							
Voltage regulation	%	1.00							
Output voltage distortion with 100% linear load	%	<3							
Overload at nominal output voltage for 1 minute	%	100-120 (3 times auto reset)							
Overload at nominal output voltage for 30 sec	%	120-150 (3 times auto reset)							
Peak efficiency	%	>85	>85	>85	>85	Typical			
Noise @ 1 meter	dB	60							
cooling		Temp Controlled, fan							
Protections		Overload, Battery low, Battery high, Output low, Output high, Output Short Ckt Input Short Ckt, Overheat, under frequency,over frequency, Solar panel reverse, Battery Reverse,							
Display parameters		Battery voltage, charging current, discharging current, charging AH, discharging AH, battery status bargraph							
		Solar voltage, solar current, instantaneous power, cumulative power							
		grid voltage, grid current, cumulative power							
Switches		Output voltage, output current, instantaneous power, cumulative power							
		Reset for system on/off, up, down, back, enter (for LCD configuration)							
Indications		system on, inv on, SPV charging, Grid charging, batt low/high, overload, overheat, mains low, mains high, under frequency,over frequency,							
<b>Environment</b>									
operating temperature	C	0-50							
Max relative humidity @25°C (non condensing)	%	95							
Standard compliance		IP21							
Data logging		30 days data storage							

### 14. PREVENTIVE MAINTENANCE

We would like to inform you that specialized periodic maintenance (with yearly frequency) is recommended for the PCU, in order to offer optimum operating efficiency and avoid downtime of the equipment by authorized Service Engineer. Maintenance consists of accurate functional checks on . electronic and mechanical parts with replacement of parts subject to wear if necessary (typically batteries, fans and capacitors)

Following are the guidelines for the same.

1. Ensure the ventilation and the cleanliness surrounding the System.
2. We recommend to keep Battery Room Temperature at about 30 C (± 5 C) for the better life cycle of the batteries.

Checkpoints:-

Check points	Quarterly	Yearly
Check Electrical power connections for tightness on terminals		
Battery inter cell connectors for tightness and corrosion on terminals		
Verify Display parameters with actual readings.		
Cleaning of dust filter ( In case of IP4X).		
Power transformer cable tightness.		
Fan Operation.		
Physical verification of AC and DC power capacitors.		
Cleaning of total system by removing side covers.		



## 15 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	RESOLUTION
In day Hours with good solar radiation, Solar Inverter is running on battery	<ul style="list-style-type: none"> <li>i) Array voltage absent</li> <li>ii) Array is at extremely low / high voltage condition</li> </ul>	<ul style="list-style-type: none"> <li>i) Check array supply</li> <li>ii) Check Array supply low/high voltage Condition</li> </ul>
Low battery backup	<ul style="list-style-type: none"> <li>i) Solar Inverter Overload</li> <li>ii) Battery deteriorated</li> <li>iii) Battery is not fully charged</li> <li>iv) Battery charger fail</li> <li>v) Battery path fuse fail</li> <li>vi) High ambient Temp.</li> </ul>	<ul style="list-style-type: none"> <li>i) Check load condition</li> <li>ii) Check battery status</li> <li>iii) Contact Our Service Center.</li> <li>iv) Contact Our Service Center.</li> <li>v) Contact Our Service Center.</li> <li>vi) Maintain ambient temp. as per spec</li> </ul>
Output Under/Over Voltage	<ul style="list-style-type: none"> <li>i) Output short circuit</li> <li>ii) Control board failed</li> </ul>	<ul style="list-style-type: none"> <li>i) Check load.</li> <li>ii) To reset the fault press reset switch on front LCD display. If fault repeats</li> <li>iii) Contact Our Service Center</li> </ul>
Inverter Over temperature	<ul style="list-style-type: none"> <li>i) High ambient Temp.</li> <li>ii) Output overload.</li> <li>iii) Inverter cooling fan failed</li> <li>iv) Temp . sensor failed</li> <li>v) Control board failed.</li> <li>vi) Ventilation input is blocked</li> </ul>	<ul style="list-style-type: none"> <li>i) Check Solar Inverter room ventilation is proper</li> <li>ii) Reduce the load</li> <li>iii) Contact Our Service Center.</li> <li>iv) Contact Our Service Center.</li> <li>v) Contact Our Service Center.</li> <li>vi) Clean ventilation input by blower fan</li> </ul>