

User Manual

- Installation
- Operation
- Maintenance



Solar PCU

(nGreen M Series: Pure Sine wave with LED Indication and LCD Display with Solar Charger)

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Introduction

Welcome to the ever-increasing family of satisfied user.

All **POWERLINE** products, like the one you have just purchased, Undergo a stringent quality check.

The product is designed to provide you with an efficient performance with minimal care and maintenance at your end. This manual will facilitate you to not only understand the basic working of the inverter but also facilitate the ease of its maintenance and use.

For readers

This manual is applicable for technicians of pcu installation, operation and maintenance. The readers shall be familiar with electrical knowledge.

About this manual

Please read this manual carefully before using products. Operator using this manual must be qualified electronics engineer or he should know proper installation.

PRODUCT INFO

POWERLINE Solar PCU provides backup power to tubes, fan, cooler, computer, medical appl. etc. in the event power failure.

Normally it operates on Solar & Mains, supplying power to the load from the utility input. The battery charger uses the solar power (2nd priority to mains) to keep the batteries at an optimal level. When the power supply fails, the inverter transfers the load to the battery and converts the battery's DC power to AC power. The load operates until the battery exhausted. The load is automatically transferred back to the mains.

Models and technical specifications



400 VA to 3 KVA with built in zero drop 40 Amp Solar charge controller.

Above 3 KVA On line Solar hybrid inverters without solar charge controllers (Solar charger cost extra at actual) are available.

MODEL	400VA/600VA/800VA/12V	1000VA/1500VA/24V	2000VA/2500VA/300VA/48V	4000VA/5000VA/6000VA 96V
Input voltage (UPS)	180-260V	180-260V	180-260V	180-260V
Input voltage (INV)	130-280V	130-280V	130-280V	130-280V
Output voltage on mains mode	Same as input	Same as input	Same as input	Same as input
Out voltage on inverter mode	220 ±5%	220 ±5%	220 ±5%	220 ±5%
Output frequency on inverter mode	50Hz ±0.1Hz	50Hz ±0.1Hz	50Hz ±0.1Hz	50Hz ±0.1Hz
Display	Battery - Voltage, load % ,Mains voltage ,Solar Generation, Status of inverter.	Battery - Voltage, load % ,Mains voltage ,Solar Generation, Status of inverter.	Battery - Voltage, load % ,Mains voltage ,Solar Generation, Status of inverter.	Battery - Voltage, load % ,Mains voltage ,Solar Generation, Status of inverter.
Switching from mains to inverter and from inverter to mains.	Automatic	Automatic	Automatic	Automatic
Switching from mains to UPS and from UPS to Mains	Automatic	Automatic	Automatic	Automatic
Bill Reducing Protocol	Available	Available	Available	Available
Output waveform on mains mode.	Same as input	Same as input	Same as input	Same as input
Output waveform on inverter mode.	PURE SINE WAVE	PURE SINE WAVE	PURE SINE WAVE	PURE SINE WAVE
Battery charging current Cccv with float boost charging	Constant charging approx 6% of the rated battery current in AH.	Constant charging approx 6% of the rated battery current in AH.	Constant charging approx 6% of the rated battery current in AH.	Constant charging approx 6% of the rated battery current in AH.
Charger	Power factor controlled boost technology	Power factor controlled boost technology	Power factor controlled boost technology	Power factor controlled boost technology
Efficiency	> 90%	> 90%	> 90%	> 90%
Inverter overload	120% for 20 sec 150 % for 3sec	120% for 20 sec 150 % for 3sec	120% for 20 sec 150 % for 3sec	120% for 20 sec 150 % for 3sec
Inverter short circuit	300%	300%	300%	300%
Technology	DSP BASED DESIGN.	DSP BASED DESIGN.	DSP BASED DESIGN.	DSP BASED DESIGN.
Auto reset features	Yes	Yes	Yes	Yes
	<u>SOALR CHARGER SPECIFICATON</u>			
PV Panel Input Voltage	14-24 V	30-80 V	55-110 V	110-200V
Output Voltage	12V	24V	48V	96V
Output Current, solar charging	10 to 40 Amp	10 to 40 Amp	10 to 40 Amp	10 to 40 Amp
Battery Full Charge Cutoff	13.8/14.2 VDC	27.6 /28.4 VDC	55.2/56.8 VDC	110.4/113.6 VDC





Safety warnings and instruction

Safety Symbols

	DANGER OF ELECTRICALLY LIVE PARTS Related to potentially hazardous voltage which may cause a serious personal injury or death.
	SAFETY WARNING This symbol is used for Warnings, Cautions and Notes.

The text of this manual contains warnings to avoid risk to persons, to avoid damages to the UPS system and the supplied critical loads. Do not proceed beyond these warnings if you do not fully understand or are not able to meet the mentioned conditions. The non-observance of the warnings reminding hazardous situations could result in human injury and equipment damage.

Safety Rules

 	CAUTION! RISK OF ELECTRIC SHOCK The UPS has an internal battery supply with a nominal voltage of 72Vdc. The appliance outlets may be electrically live, even when the UPS is disconnected from the mains. The UPS contains potentially hazardous voltages. Do not open the unit, there are no user serviceable parts inside.
	CAUTION There may be damage to the equipment if procedures and practices are not strictly observed and followed.
	NOTE Do not attempt to service the UPS unless you have had proper training. Refer all maintenance and servicing to properly qualified, skilled and competent service personnel.

Qualified, skilled personnel are persons who (because of their training, experience, and position as well as their knowledge of appropriate standards, regulations, health and safety requirements and working conditions) are authorized to be responsible for the safety of the equipment, at all times whilst carrying out their normal duties and are therefore aware of, and can report, possible hazards (observe IEC 60364 and national wiring regulations and accident prevention rules).

Transportation Safety



WARNING!

Please consider the weight of the UPS. Lift the box with the help of a second person; never try to lift it by yourself!

- No liability can be accepted for any transport damage when the equipment is shipped in non-original packaging.
- Store the UPS in a dry location with the batteries in a fully charged state. Storage temperature must be within -20 and +50 °C.
- If the unit is stored for a period exceeding 3 months, optimal battery lifetime is obtained if the storage temperature does not exceed 30°C. If the unit is stored for an extended period of time, the batteries must be recharged periodically. Connect the unit to a wall outlet and recharge the batteries for 24 hours:
 - if the storage temperature is within -20 and +30°C: every 12 months,
 - if the storage temperature is within -20 and +50°C: every 3 months.

System Safety Instruction

Operation Safety

- Prior to the application, please read “Safety Instructions” carefully to ensure correct and safe application. Please keep the user manual.
- During operation, attention should be paid to all warning symbols and operations should be followed strictly as required.
- Equipment is not supposed to be used in environment that directly exposed to sunlight or rain or in a humid environment.
- The equipment should not be installed close to area of thermal sources or any area where there is presence of devices such as electric heaters and furnaces.
- Make sure the safety space should be left for proper ventilation and product maintenance when placing UPS. Refer to the instructions during installation.
- Dry and non-conductive items should be used for cleaning.
- In case of a fire hazard, dry powder extinguisher should be used properly. Using liquid fire extinguishers may result in electric shock hazard.

Electrical Safety

- Before electricity is switched on, make sure earthing is properly done and wire and battery polarity are correctly connected.
- When UPS relocation or wire reconnection is necessary, AC and battery should be switched off and UPS should be completely turned off, otherwise there might be a danger of electric shock because output terminal might be still electrified.

Battery Safety

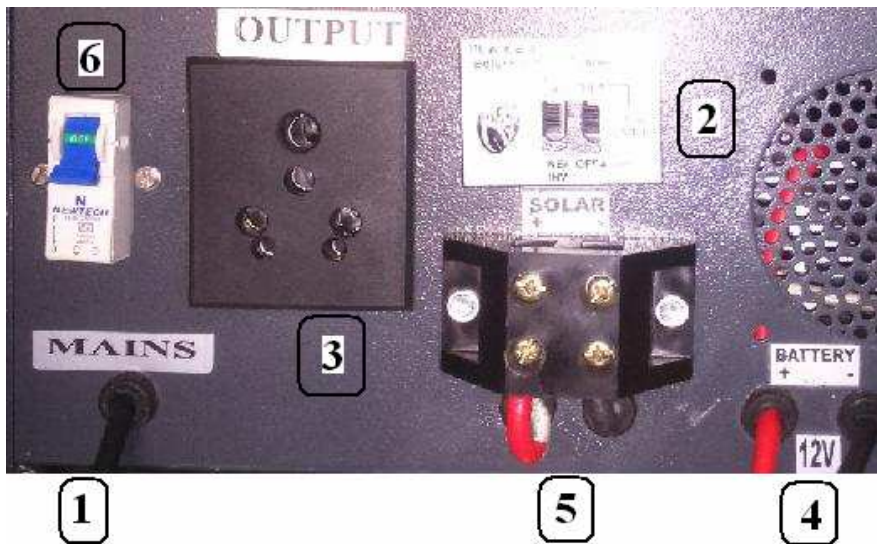
- Battery service lifetime will be shortened as ambient temperature rises. Replace batteries periodically to guarantee normal UPS performance and sufficient back-up time.
- As accumulator batteries may contain potential electric shock and short-circuit current danger, to avoid accidents that might be thus resulted, the following warnings should be observed during battery replacement:
 - A.** Do not wear watches, rings or similar metallic items;
 - B.** Use insulated tools;
 - C.** Put on rubber shoes and gloves;
 - D.** Do not place metallic tools or similar metallic parts on the batteries;
 - E.** Switch off load connected to the batteries before dismantling battery connection terminals.
- Do not expose accumulator battery to fire in order to avoid possible explosion that might endanger physical safety.
- Do not cause battery positive and negative polarity short circuit, otherwise, electric shock or inflammation may occur.

INSTALLATION

Precautions during installation

1. Install the system on steady loft above bathroom, stone platform, because the batteries are very heavy in weight.
2. Do not install the system in a closed space. Ventilation for battery gases & heat is a must.
3. **Install the system in such a place where topping of batteries and maintenance of battery terminals become easy.**
4. Use PVC insulated copper wire of proper gauge, as per the VA capacity of HOME UPS for wiring.
5. Always prefer separate wiring for better result and low failure of fuses, burning of sockets etc. Isolate Power Load from Inverter at the time of wiring.
6. Connect battery cables to proper battery polarities. Do not invert polarity.
7. Always connect the **POWERLINE** input to a two-pole, three wire grounding mains socket. The socket must be connected to appropriate branch protection (fuse) circuit breaker. Connection to any other type of socket may result in shock hazard.
8. Avoid installing the **POWERLINE Solar PCU** in an excessively humid place or where there is water.
9. Care must be taken to ensure that the **POWERLINE Solar PCU** kept away from heat emitting appliances such as a heater, blower, oven etc.
10. To switch-off the **POWERLINE Solar PCU** output in an emergency, use the front switch to turn off system. Also disconnect the power cord from the mains and remove solar wires from PCU, remove at least one battery connector.

Connections



1. Mains cord

This cord is to be connected to mains powered 3 pin socket through a switch (left-Neutral, Right-Live)

2. Switch

Sw1: Mains Charging On-Off Switch

Sw 2:- INV mode (I/P Utility Power Range –110-300v)/Normal Battery

UPS mode (for computer application) (I/P Utility Power Range 180-270v)/Tubular Battery

Normal Battery-Adjust Boost charging voltage to 13.8

TB\Tabular battery- Adjust Boost charging voltage to 14.2

Sw 2 sets as a normal battery or tubular battery at the time of battery connection. After connecting battery same switch acts as a UPS/INVERTER.

3. Output Socket

This is output port of **POWERLINE HOME UPS**. Power taken from this point through a 3 pin plug is given to appliance. The 'Neutral' of output and mains are internally short.

4. Battery Cables

These wires are to be connected to the batteries. Red wire is to be connected to the positive (+) terminal of the battery and the black wire is to be connected to the negative (-) terminal of the battery. **Negative terminal is to be connected first and then positive.**

5. Solar

These wires should be connected to solar PV panel. Check the polarity before connecting wires. Connect red wire to solar positive and black wire to solar negative.

12V panel for 12V system max DC input 14-24 V

24V panel for 24V system max DC input 30-80V

36V panel for 36V system max DC Input 40-72V

48V panel for 48Vsystem max DC input 55-110V

72V panel for 72Vsystem max DC input 85-145V

96V panel	for 96V system max DC input 110-200V
120V panel	for 120V system max DC input 140-250V
180V panel	for 180V system max DC Input 210-360V
240V panel	for 240V system max DC input 280-480V
360V panel	for 360V system max DC Input 420-720V

6. Output MCB

This is the MCB for output or load of an inverter. Switch ON the MCB after all connections of inv/ups

Installation steps

- 1) Connect the batteries (in series or in parallel) as per system rating and check the battery voltage. The voltage must be matched with system battery rating.
- 2) Make the inverter switch off (on front panel). Connect the battery negative wire first and then battery positive.
- 3) Check, the display of system will be ON.
- 4) Connect the solar panels (in series or in parallel) as per system rating and check the panel voltage. The voltage must within systems solar voltage range.
- 5) Connect the solar negative wire first and then solar positive wire.
- 6) Plug in mains cable in mains socket.
- 7) Connect the load in output socket.

Front Panel



LED INDICATORS

1. **LED1** : Mains ON - Green
2. **LED 2**: Inverter ON - Yellow
3. **LED 3**: Charging ON - Blue (blink during charging in both UPS/INV mode)
4. **LED4**: Battery low - Red (Glow when battery discharge below 10.5V)
5. **LED 5**: Overload - Red (when load exceed 120%)
6. **LED6**: NOT applicable for PCU+MPPT.

Mains &Inv LED on simultaneously - Indicates Mains is present but INV works on battery or SOLAR power

***** If mains present and mains LED glows but the LOAD is not on mains (LD: MAINS – display in graphical LCD) then inverter display will not show mains voltage.**

7 Inverter LCD Display



- 1st Row of display show **status** of INV/UPS and **FAULT**

Status:

- N = Stands for Normal battery selection
- T = Stands for tabular battery selection
- INV = Inverter mode (i/p MSEB operating Range)(110V-300V)
- UPS = UPS mode (180-260)
- Charging = Battery is charging in Boost /Mode
- Charged = Battery is charging in float mode or Battery is fully Charged

Fault:

- Battery low Trip (If battery voltage go below 10.5 volt)
- Overload Trip (if load percentage goes above 120%)

- 2nd Row of Display Shows Following Parameters

- A. If inv OFF - Show no of batteries
If inv ON - Show mains voltage
- B. Battery voltage
- C. Load in percentage.
- D. Solar generation in wattage (not show anything in PCU+MPPT).

8 Inverter ON/OFF switch

When this switch is OFF electronic generator will not work in the event of failure of the mains. However when the Mains supply is ON charging would be continue when the switch is OFF.

Inverter Buzzer code

- Battery low-> 8 Beeps-Interrupted
- Overload ->15 Beeps interrupted
- Inverter to Main's conversion ->1 Beep
- Main's to Inverter conversion ->2 beep
- Inverter OFF -> 2 Beep

“Powerline” Solar PCU Working

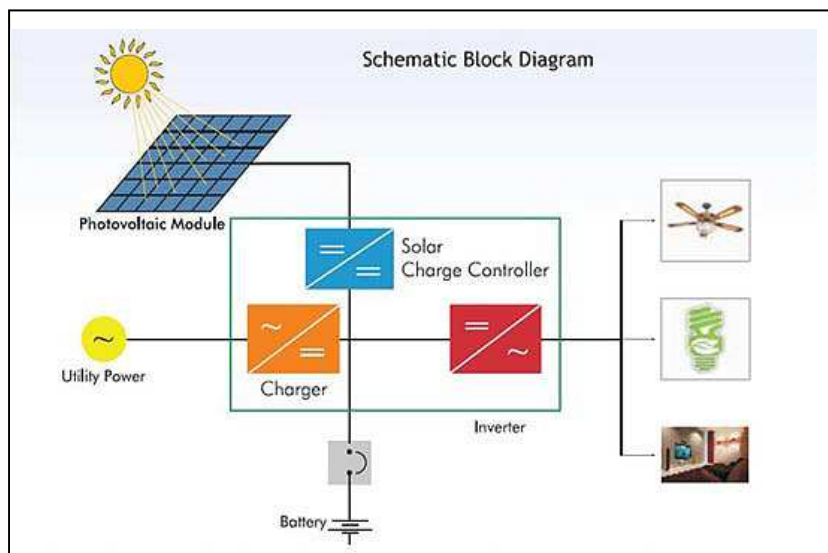


Fig: schematic block diagram of PCU.

1. Bill Reduction Protocol (BRP) for Solar Inverters

Considering the need of the Indian Customers, VITRONICS have introduced a unique feature of the Inverter Battery Power Management using a specific pattern of electricity utilization from Solar Panel and Mains Supply Lines.

This pattern is developed after rigorous surveys conducted across the country, both in rural and urban areas, to understand the power demands, availability of electricity supply and average solar energy available from moderately efficient solar panels.

The protocol thus developed, when bundled with the Pure Sine wave Inverters, renders a major benefit to the customer in achieving considerable reduction in his electricity bill.

What follows is a brief explanation of this protocol:

1. When the single battery voltage is between 10.5 V to 13 V, the inverter unit selects the Mains supply line (if present) as well as solar power & the inverter will compare itself the voltage generated by both (By Mains power & solar power). If voltage generated through solar power is more battery will start charging maximum through solar power only & vice versa
During this cycle the load will operate on Mains (if present)
2. Battery will be charged up to Max 14.2 v in above case.
3. When the battery voltage reaches 14.2V, the unit switches over to the Inverter mode, charging continues from the solar supply and the load gets shifted from Mains to the Battery(the INV ON indicator lights up) , even if the Mains is present . The unit is then supposed to have entered into SOLAR ZONE. In this zone, the solar energy stored in the battery is utilized, which saves the electricity.

Suppose during this cycle load connected through inverter is 300 watt & solar power generated through solar panels is 200 watt, then 100 watts only will be used through battery

200 watts savings of electricity bill

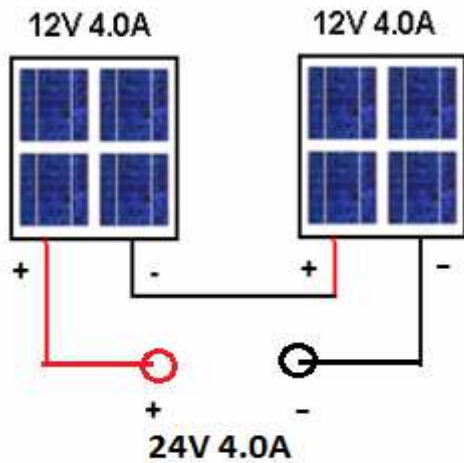
4. At battery voltage 14.2 V, the charging(either from Solar or from Mains) stops, then starts again when it falls down to 13.8V(when Solar present), again stops at 14.2 V. This is the trickle charging operation.
5. If Mains supply cuts off during the solar zone, the unit maintains its “solar-zone” mode. Therefore, when the Mains supply resumes, the unit continues to operate in Inverter mode and the load is supplied by the battery.
6. When the battery voltage reaches 11.5 V during the solar zone, the unit switches back to the Mains Supply, the charging continues from solar or mains supply and the load gets connected to Mains Supply.
7. We reserve the 11.5 to 10.5 voltage of battery for emergency use
(If Mains & Solar power both are not available)
8. When the battery voltage reaches up to 10.5V, the unit enters in a shut down mode

OVERLOAD WORKING

- 1) If load is between 100-110%, inverter will OFF after overload buzzer code and restart after 10 seconds. It retries 3 times and then permanently switch OFF if overload continue. Normally **Fold back Mode** is on when load increases 100%. It tries to maintain in Limit by reducing o/p voltage So Reduces Possibility of exceeding load more than 100%
- 2) If load is above 150%. Inverter switch OFF automatically. You have to cut off excess load and have to restart inverter manually.

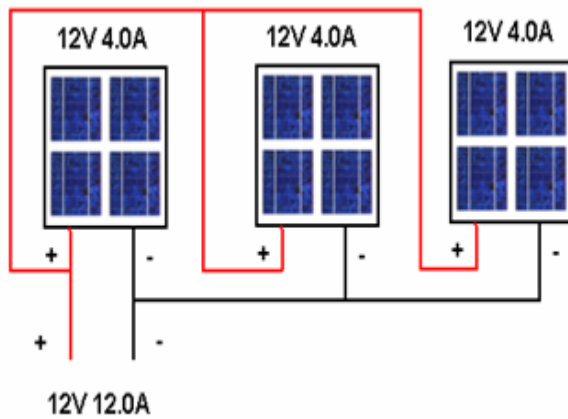
Connections of Battery and Solar panels

1. Series connection of solar panels



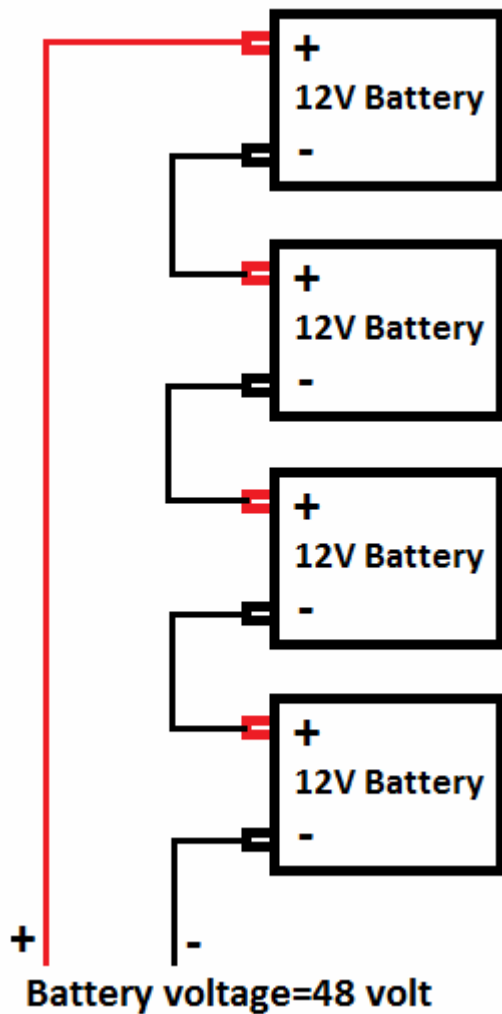
- Series connection of solar panels
- Ex. If 10 no of panels, each of 12V & 4A connected in series gives 120 volt and 4 amp panel combination

2. parallel connection of solar panels



- Parallel connection of solar panels Increases solar current and voltage remains same
- Ex. If 10 no of panels, each of 12V & 4A connected in parallel gives 12 volt and 40 amp panel combination

3. Battery series connection



- For higher voltage multiple batteries are connected in series
- Figure shows 48 volt battery connection (four 12 volt batteries in series)
- Battery voltage combinations
 - 1) 24 volt: 2 batteries in series
 - 2) 48 volt: 4 batteries in series
 - 3) 72 volt: 6 batteries in series
 - 4) 120 volt: 12 batteries in series
 - 5) 180 volt: 15 batteries in series
- Batteries are connected in series by using wire link (at least 4mm² gauge)

MAINTENANCE

Battery maintenance

1. During charging and discharging of battery, hydrogen (H₂)&Oxygen (O) splits from water (H₂O) contained in battery. Water level in battery decreases day by day.This reduction in water can be seen by opening the vent plugs of the battery .If water level reduces up to battery plates,some amount of water is to be added so as to deep immerse the battery plates. This procedure is required once in two months.Avoid use of hard water(bore-well & well water).

2. Sulfate deposits on terminals and nut-bolts, can cause the system failure. Cleaning of these terminals and nut –bolts is essential once in every six months. Apply petroleum jelly to nut-bolts & lugs to avoid corrosion

TROUBLESHOOTING

Based on various research surveys on the most common problems faced by users, the following table is presented, to enable the users to overcome some problems.

PROBLEM	PROBLEM CAUSE	ACTION RECOMMENDED
The mains supply is on But... a) The mains LED is off, The electronic generator is either working on battery has exhausted	<ul style="list-style-type: none"> • mains cord plug is loose • Dead wall socket • Mains input voltage is too high or low 	<ul style="list-style-type: none"> • Fit the cord plug properly • Check socket • Wait for mains to normalize
b)The mains LED is glowing but no output supply	<ul style="list-style-type: none"> • O/p MCB is tripped 	<ul style="list-style-type: none"> • Switch on MCB • Fit O/P plug properly • Bypass the unit
c) In the battery mode all LED's are off but bat low LED blinking	<ul style="list-style-type: none"> • The battery may have got discharged from recent use 	<ul style="list-style-type: none"> • Recharge the battery
d) In the battery mode all LED's are off but overload Led ON	<ul style="list-style-type: none"> • The POWERLINE HOME UPS is tripped due to over load condition 	<ul style="list-style-type: none"> • Reduce the load and reset unit
e) Inverter on but output voltage became zero	<ul style="list-style-type: none"> • Load current goes beyond system rating current 	<ul style="list-style-type: none"> • Turn off the inverter • Turn off some load • Start the inverter

Warranty card

Warranty registration card

Customer information	Name : Address : Mobile no : E-mail : Zip code :
Product information	Name : Model no : Serial no : Invoice no : Purchase date :

Stamp and signature of authorized dealer

Warranty period months(12/24/36)

Customer signature

Warranty statement

To insure a delightful product experience vitronics recommends reading the user guide carefully and contacting our customer care helpline to understand the product warranty period and conditions. In the unlikely event that your vitronics product requires any support, please call our customer care number 020-26962548 or 09404731535 , or email us at service@vitronicscontrols.com .please visit our website www.vitronicscontrols.com for further support details.

Vitronics warrants that the product at the time of its original purchase is free of defects in material and workmanship.

Terms and conditions

1. *The warranty is given to the original purchaser (“customer”) of the product.*
2. *For the entire warranty period vitronics controls or its authorized dealer will be at their discretion, without any charges repair/replace a defective part. Repair or replacement may involve the use of same or equivalent reconditioned unit. Vitronics will return the repaired system or can replace with another same or equivalent product to the customer in full working conditions. All replaced faulty parts or components will become the property of vitronics controls*
3. *For any product repaired or replace during the warranty period, the period of replaced product shall continue to be within warranty period for the remaining time of the original warranty period of original product.*
4. *The warranty will be automatically terminate on the expiry of warranty period, even in case of the product not being in use for specified period*
5. *The warranty will be invalidated if defects arising in company’s opinion by reason of accident, rough handling, exposure to any kind of liquid(water, sweat, oils etc) exposure to moisture, dampness or exposure to extreme thermal or environmental conditions, neglect improper installation (if not taken by company or it’s authorized dealer) fire flood or act of god or any other natural calamities or any other unauthorized repairs or done or carried out will have to be born by the purchaser*
6. *The company will not be held liable in any conditions for any loss or injury or damage caused to line or property or death and disability caused in any form of life for any reason whatsoever*
7. *The warranty will not apply if the original seals are found broken or tampered*
8. *Customer will get site service during warranty period from where he has originally purchased the system. In case if the customer has purchased system along with batteries from Mfgr. then & then the Mfgr. will provide on site service during warranty period only with ref. to the details mentioned in original invoice. In all other conditions at actual charges will be applicable.*
9. *For any claim under the warranty is subject to notifications to vitronics controls or vitronics controls authorized dealer for the alleged defect within a reasonable time of it’s occurrence and in no event not later then expiry of warranty period.*
10. *All claims will be settled in pune jurisdiction only.*