

SADHANA ENERGY DEVICES

Solar Hybrid UPS

Dusk to Dawn Operation

Hybrid



Version 625 iH

USER MANUAL

- ? WORKING OF THE SYSTEM
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- ? MAINTENANCE

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WORKING OF THE SYSTEM:

GENERAL:

The Hybrid version of Solar UPS with automatic dusk to dawn controller is designed with unique feature of having uninterrupted power derived either directly from mains utility or from battery. The rated output is available in the form of 220VAC/50 Hz with sine wave approximation suitable to drive electric loads only during night. The unit has two inputs, mains from utility and DC from SPV Panels. The unit is always connected to mains and panels. During day time, charging will take place exclusively from panels disconnecting mains. The connected load is also switched off during day time. At dusk, Solar UPS will be automatically on deriving the power from battery. If battery goes low in the night, it will automatically switch over to mains supply giving uninterrupted power to the load and charging the battery as well. At dawn, the connected load is turned off, mains supply to charger is switched off and solar charging starts. If the battery and panels are so designed that connected load runs for full night and battery is fully charged during a day's charging, the unit will never utilize mains power. The flexibility of design is such that you can add a few panels and increase the battery capacity as and when required to have maximum share of solar energy.

The unit incorporates all necessary protections like reverse battery connection, reverse panel connection, mains abnormal voltage prevention, over load and short circuit connection, over charge and deep discharge protections.

OPERATION:

The main application of the system is providing uninterrupted power for switching on the lights at dusk and off at the dawn deriving it from solar and to supplement it from mains to make up the deficiency.

The system consists of the following items.

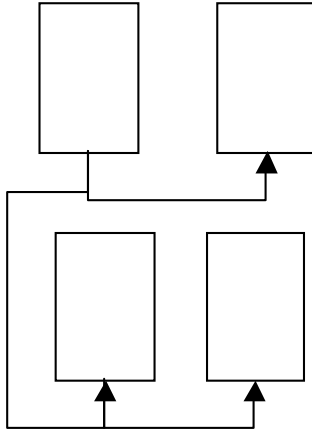
- Inverter of rated capacity, 625 VA
- Solar Photovoltaic Panels, 4 Nos of 40W/12V Nominal
- Battery (Recommended, 12V/180AH, Tubular)

The unit has a mains chord to connect to mains power. The battery and SPV Panels are connected to the unit through two different terminal strips.

During daytime, the internal circuit deliberately switches off the mains supply. The connected load cannot be ON during day time and there is no charging of battery either. Solar panels will charge the battery during day time.

At dusk, the unit will be on Inverter mode supplying power to the load, even if mains supply is available. The inverter will run till the battery reaches its lowest permissible limit when it will switch over to mains. Inverter thus shuts down when battery is discharged and it automatically switches over to mains operation to give uninterrupted supply to the connected load. When in mains mode, the unit also charges the battery till dawn when it disconnects mains supply to the load and charging to the battery is also stopped. At dawn, solar panels will start charging the battery till dusk. The cycle repeats regularly with no manual intervention. The supply from the unit either in Inverter mode or Mains mode will be available only during dusk to dawn period, The On/Off timings of the system are designed to automatically track the local Sunset and Sunrise times. Hence, in the winter, the lights will be on earlier etc.

SOLAR PANELS



All the solar panels are to be connected in parallel for 12 V operation. PV panels have at the back a terminal junction box. Open the cover and see the terminals are marked + and -. Positive terminals of all the panels are connected together. Similarly, -ve terminals of all the panels are tied together. This is done by making loops. The common cables, Red for positive and Black for negative, are taken to the rear of the unit to the terminals marked "SPV PANEL". You connect the panel cables to the respective terminals. Full protection is provided in the event of accidental reverse connection of the panel. When panels are connected in proper polarity, the Red LED marked 'CHARGE' will be on. The charging of battery will take place automatically irrespective of the front switch being on or off.

CHARGE CONTROLLER: The unit houses built-in charge controller using the latest MOSFET technique. No relay is used inside charge controller. The charge controller is rated for the capacity of 20A continuous so that you can add two more panels of 40W easily without any modifications. The panels can be added parallel to the existing array of the panels. The rear terminal for panel connection has one spare terminal marked + to add the panels. Negative terminal is common for both. The charge controller not only charges the battery to desired level with the minimum loss of power from panel, but it also

shuts off charging when battery voltage reaches its upper level. Charging is then automatically stopped effectively disconnecting the panels. Charge controller also prevents reverse current flow from battery to panel during night.

TWILIGHT CONTROLLER: This is also built-in to automatically switch on the connected lights at dusk and switch off at dawn depending upon the local Sunset and Sunrise timings respectively. At dusk, this controller first checks that battery is not in LOW condition. Then it gives signal to turn on the inverter, provided the front on/off switch is On. The AC supply generated by the inverter is fed to the connected light load. If after a few hours depending upon the load and capacity of battery and its charge level, battery goes low, it will give another signal to connect mains supply to the unit and thereby to the connected load. Simultaneously, battery is also charged from the mains power. The connected load will thus have uninterrupted supply. At dawn, it switches off mains power to the unit and to the connected load. Charging of battery from mains is also stopped and solar panel will take over the work of charging the battery further.

HYBRID UPS:

This is the heart of the system. It works on 12VDC from the battery. The battery of rated capacity of 12V/180AH, Tubular type is connected with the cables provided taking due care to connect to the battery terminals at the rear marked 'BATTERY 12 V'.

The UPS works on PWM technique using MOSFETs for the efficient conversion of energy.

It has sine approximated output of 220V/50 Hz with automatic voltage regulation against the load and battery variation. It will be automatically on at dusk if front switch is On. The UPS has protections against over load or accidental short circuits. It has built-in charger to charge the batteries when on Mains mode. The charger disconnects charging when battery is fully charged and also inverter is shut down if battery reaches its low.

Advance Warning Signal (AWS) is automatically generated when battery reaches its 90% depth of discharge. Audio signal at intervals is generated to indicate that battery is soon going to its low level and inverter is soon to shut down.

The unit has built-in protection against abnormal voltages of mains input. When mains is less than 170V or more than 160V, mains is automatically disconnected to the load. The unit can withstand dangerously high voltages upto 400V thereby protecting the connected load.

Front panel Indications:

MAINS: Green LED. It goes On when all the conditions mentioned below are simultaneously satisfied.

- Front ON/OFF switch is put on
- Mains supply is connected
- It is dark
- And battery is Low

It indicates mains is being fed to the load and battery is being charged from mains power.

BATTERY: Red LED. It is on when it is dark and front switch is put On. This indicates power to the load is being fed by inverter from battery.

BTLOW: Amber LED. It turns on when battery reaches its lowest permissible limit. Before battery goes to this level, audio signal is generated at intervals to give advance warning.

OVRD: It gets on if output load is more than rated capacity or there is accidental short at the output.

CHARGE: Red LED. When it is on, connected load is off and vice versa. Its on state indicates it is day time and charging from panels might be taking place

In both conditions mentioned in BTLOW and OVRD, inverter will be shut down. It can be reset by switching off and then on from the front switch.

INSTALLATION

Interconnecting the panels, battery and mains power is very simple job. And it does not need high technical skill.

1. SOLAR PANELS are to be preferably mounted on MS angle structure in a row or two depending upon the availability of space. The panels should face the South making an angle of 30 deg to horizontal. Interconnection of panels should be done with 2.5 sq. mm copper cable. All positive terminals are tied together with preferably red cable while all negative terminals with black one. This pair of cable is then connected to the rear terminal on the main unit marked 'SPV PANEL'. This terminal strip has three ways, first two for positive and last for negative. You can use any one positive terminal. The spare way is meant if additional panels are to be added in future. Presently, four panels can be connected to one way. Length of cables should be as small as possible. If it is unavoidable to have longer length, use thicker gauge cable to reduce the loss of solar power. As a thumb rule, not more than four panels for a distance of not more than 30 feet should be the limit of 2.5 sq mm wire. If distance is more than 30 feet, use 3 sq mm cable. If additional panels are to be incorporated (totaling not more than 7), connection should be made to other positive terminal with separate cable while you can connect the new negative cable to the existing way on the terminal strip with another cable tag. It should be borne in mind that we are dealing with very precious power from panel and cable loss should be minimized. Full protection is provided inside for accidental reverse connection of panels to the terminals. *But care must be taken to see that all positives and all negatives of the individual panels are connected properly to one another.*

Panels should be placed in a place such that sunlight is available on all the panels for maximum number of hours a day throughout the year.

SOLAR UPS unit should be placed inside the premises where batteries are also placed. The cables to connect battery to the unit is deliberately kept very small so that battery and unit are placed very near. Very high currents are passing through these cables hence, shorter the length the better.

PREVENTIVE MAINTENANCE:

The entire system is for all practical purposes maintenance free.

But a little care will go a long way to increase the life of system.

See that the battery terminals are not corroded. Clean the terminals once a month. If you are using Tubular battery, top up with water will be less frequent, once in 4 months. Water level in battery should be properly maintained. If battery goes dry, it will be self damaged .

See that panels are clean without heavy dust on them. Dust collected on panels will reduce the conversion of solar power to required electricity.

The main unit does not need any maintenance from the user as no parts inside the unit need any attention from the user.

In the event you need any assistance, we are just a mail away.