

The Polar Power system is a flexible, robust, scalable renewable energy generation system designed to work in the challenging polar environment. The system can charge from multiple sources (solar panels, wind turbines or external 240V supply) and provide reliable energy storage and supply at 12V and 240V. Although it is simple to operate and use, for your own safety please read these instructions carefully before installing or using the system.

General notes

The external modules are designed to be left outside, but should be placed in a sheltered spot with the control panel facing away from prevailing winds.

For more information, and datasheets on all the components used in the system, visit: www.midsummerenergy.co.uk/polarpower

Solar panels & wind turbine

Installation Choose a shade-free, exposed spot to mount each mast. The masts can be mounted directly onto a north-facing wall, or erected as free-standing units on rock, ice or snow. **Solar masts:** First attach three guy lines to the top of each mast with the shackles provided. Bolt the back plate onto the solar PV panel using the four stainless steel bolts, and use the large U-bolts to attach the assembly securely near the top of the mast. Connect the 8m red and black solar cables to the panel, and secure them to the mast with cable ties to avoid wind damage. **Wind turbine mast:** Assemble the turbine as per the instructions provided. Carefully feed the long cables into the top of the mast and out of the oval-shaped hole until the turbine sits snugly on the top of the pole. Secure the turbine with the allen head bolts provided and fix the cable to the mast with cable ties to prevent wind damage. Proceed as for the solar masts above.

If erecting on snow or ice, dig a shallow pit and place a piece of scrap wood under the base of the mast to prevent it melting in. A screw or nail under the mast base can be useful to prevent it slipping off the wooden base. On rock, choose a spot where the base of the mast is secure and cannot slip sideways.

On snow or ice, the guys are best fastened to deadmen. In snow, this need be no more than a scrap piece of dunnage. On ice, an ice screw may be easier to insert - or melt scrap pieces of metal into the ice. On rock you may need expanding bolts or pitons. Attach the guy lines to the anchors and tighten well.

Instructions The solar panels are maintenance-free, but it is important to check regularly that the guys and fixings are tight. Brush off any snow that accumulates on the panel.

Battery modules

Each battery module is designed to contain, charge and maintain at operating temperature one 100Ah sealed lead-acid battery. Each module has connections for up to 130W of solar PV panels, which efficiently charge the battery through a Morningstar Sunsaver SS10L PWM regulator. In addition, one of the battery modules provided contains wiring and connections for a NASA Clipper BM-1 battery monitor, allowing accurate remote monitoring of the system charge and condition via the indoor power module. Any number of battery modules can be connected into the system - more modules will give a greater reserve capacity when larger amounts of power need to be drawn from the system.

Installation The battery module is designed to take one 100Ah "Sunlyte" X5000 sealed lead-acid battery, but any similar 12V sealed lead acid battery can be used provided it fits into the box. All batteries used in the system should be of a similar type, capacity and age for best performance.

To install the battery for the first time, remove the foam lid and discard the foam spacer, if fitted. With the help of an assistant, carefully lower the battery into the compartment using the lifting straps provided and with the terminals to the front (see picture). Take care not to snag or trap any wires and ensure the metal plate sits flat against the battery. The battery is a snug fit but should not require any force if correctly aligned. Connect the three ring terminals marked with red insulation to the positive terminal, and the three black ones to the negative (note that the battery module fitted with the battery monitor connections has only one black terminal and four red terminals). Tighten the terminals, and replace the lid. Connect your solar panel(s) to the terminals with the 8m solar cables provided with the panels (red for positive, black for negative). Once connected to the solar PV panels, switch on the internal heater. This is controlled by a thermostat, and the red LED will indicate when the heater is active. Finally, connect the module to the others with the 1m black interconnect cable provided.

Instructions Keep the battery heater turned on whenever the system is in use, but only when the system is connected to a power



source (eg. Solar PV panels). The box should only be opened for essential maintenance -- it is not designed for frequent battery changes. To prevent premature failure of the batteries, keep them charged as fully as possible and do not allow the resting voltage to drop below 12.2V.

Alternatively, if the NASA marine battery monitor is being used, keep an eye on the % state of charge. It's bad practice to discharge lead acid batteries to less than 50% capacity, or to keep them discharged for any length of time - if this is happening regularly, you need to cut back on your power usage, or add further solar panels or wind turbines to the system.

Indoor power module

The indoor module is designed to provide convenient connections for all 12V DC and 240V AC applications, allow remote monitoring of the state of the system and provide safety features.

A variety of 12V outlets are installed, and appliances can be connected via cigarette lighter style plugs, banana plugs or bare wire terminals. One high-power terminal fused at 25A is provided specifically for a HF radio set.

The module features a small internal inverter, which can provide up to 150W at 240V through an RCD-protected standard UK socket. When more power is needed, this socket can be switched to draw from an external inverter/charger module (see below).

The built-in voltmeter provides a basic guide to the system status, but when connected to the dedicated battery module, the NASA battery monitoring device gives accurate detailed information on the voltage, current and state of charge.

Installation Connect the indoor power module to the outdoor modules via the 8m black interconnect cable provided. To enable advanced battery monitoring, also connect the round battery monitor plugs on the same cable to the relevant sockets on the indoor power module and the battery module fitted with the battery monitoring connections (where available).

Where an external inverter/charger module is available, connect this to the indoor power module using the 8m blue cable provided.

Take care that the cables are suitably protected from damage / chafing where they pass into the building. Remember the fate of the Bonner lab!

Instructions The switch board on the left of the main panel controls which power outlets are available, and contains circuit breakers should a fault occur. If a circuit breaker triggers, remove the appliance that caused the fault, wait for a minute, then press

the button to reset.

The radio circuit has a built-in 25A fuse. Should this fail, disconnect ALL inputs and remove the four screws that secure the main panel. Lift the panel to access the fuse.

The 240V outlet socket can be switched between the small internal inverter, the external inverter and "off". The outlet contains an RCD protection device which will trip out in the event of any current leakage. Test this device often! In addition, the module should be connected to a suitable earth via the external inverter / charger module (see below).

If the internal inverter overloads or detects a very low system voltage, it will cut out and may trigger an alarm. To reset, turn off the inverter switch on the switch board for a few minutes and try again. Turn off the inverter when not in use as it does draw a small current even when not connected to an appliance.

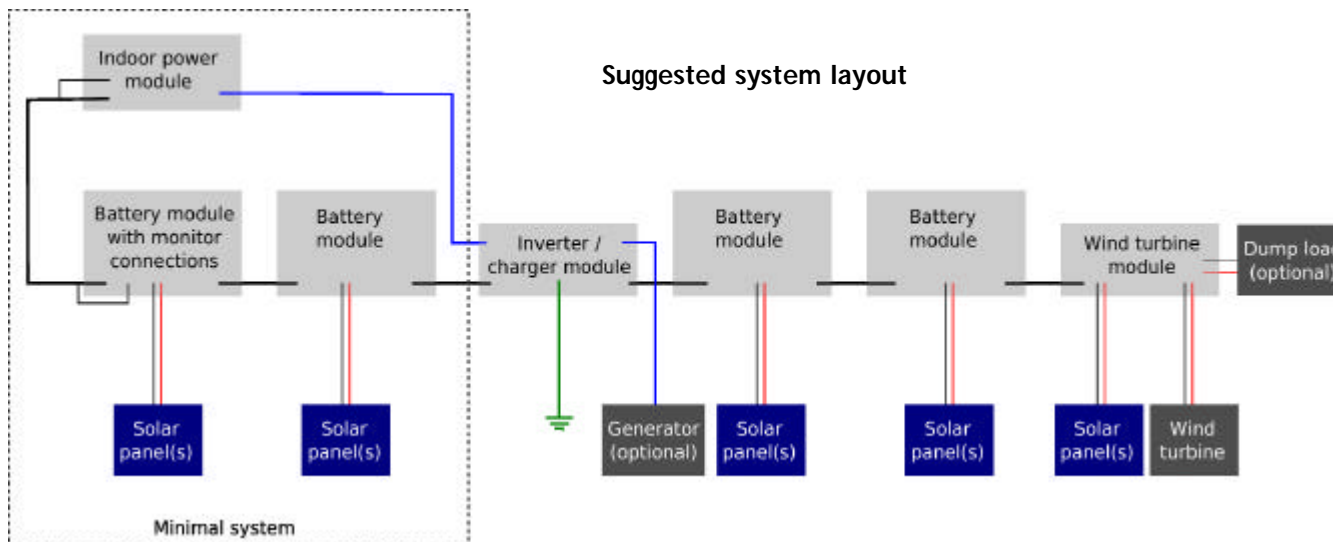
In addition, the battery monitor provides state of charge information (after settle-in period) that accurately indicates the energy left in the batteries.

If the module is to be left in unheated accommodation over winter, the battery monitor should be removed to prevent the LCD screen freezing. To do this, disconnect ALL inputs, remove the four screws that secure the main panel, and lift up the panel. Disconnect the four small wires that from their "choc-a-block" connector, and loosen the two brass wing nuts to remove the unit.

Inverter / charger module

This module can provide 240V AC power at up to 800W continuous (2000W peak for 5 seconds), and can be connected to the indoor power module with the separate low-loss lead for convenience and safety.

Also included is the advanced battery charger, allowing all battery modules installed on system to be simultaneously charged from any available AC source, such as a petrol generator.



Installation IMPORTANT: This module should be earthed using the earthing bolt provided on the front. A metal pole or stake driven into the ice will serve as a suitable earth. Ensure a good connection is installed between the earth stake and the module, using the cable provided or wire of at least 2.5 square mm, and check regularly that it is present and secure.

Connect the module to the rest of the system with the 1m black interconnect cable provided. For maximum efficiency, the module should be connected in the middle of the chain. Connect the module's 240V outlet socket to the indoor power module using the 8m blue cable provided.

Finally, open the box and switch on the inverter.

Instructions The inverter will automatically go into standby when not used for a period of time, but should still be switched off if not required for extended periods.

To charge the system, connect any available AC power source (100 - 250V) to the charging inlet socket. There must be at least one battery box connected to the system. The system will charge at 30A until fully charged, when it will automatically switch to a float voltage.

Wind power module

Both a wind turbine and solar PV panels can be connected into the system via this module. The module also provides for an external dump load which allows spare energy to be used for melting snow etc. when the batteries are fully charged. The module features an advanced Morningstar Tristar TS45 diversion regulator.

Installation Connect the module to the system using with the 1m black interconnect cable provided BEFORE connecting any wind turbine or solar PV panels. Any 12V turbine and/or PV panel(s) may be connected provided the total generating capacity does not exceed 30A (400W).

To use an external dump load (eg the snow melter provided), connect it to the terminals marked, then activate it via the switch-over inside the module.

Instructions Never disconnect the module from the system without first disconnecting the wind turbine and any solar panels. Do not operate the unit without a suitable dump load connected - if no external dump load is in use, the built-in dump load MUST be switched on. Any dump load MUST be matched to the system - it should have a resistance of no more than 0.7 ohms and be rated at 30 amps. An incorrect load may cause the regulator to cut out, possibly causing the wind turbine to over-speed and suffer damage. **WARNING:** the top of the module may become hot in use!