

SOLAR ECLIPSE

save your energy

Solar Eclipse Manual

 KEEP THIS MANUAL IN A SAFE PLACE!

 IMPORTANT SAFETY INFORMATION INSIDE!



This manual contains important safety instructions that must be followed during installation and start-up of the device. It is advisable to pay particular attention to the installation instructions in order to reduce the risk of electrical shock and to prevent damage to the device.

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Any changes / modifications not approved by the party responsible could void the user's authority to USE the equipment

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1 GENERAL INFORMATIONS

1.1 About Solar Eclipse

Solar Eclipse totally works in DC and the only energy needed is from the sun!

Solar Eclipse is the smarter way to take advantage of all the energy produced by your PV plant (see picture no. 1).

It stores electricity overproduced by the photovoltaic modules even before it arrives at your inverter, charging standard batteries of any type (lead, gel, lithium, etc.) in DC, to re-use it when needed (at night or in poor sunlight moments), making you inverter behaving like a sun irradiated panel!

Solar Eclipse totally works in DC and does not need external power supply, the only energy needed is from the sun!

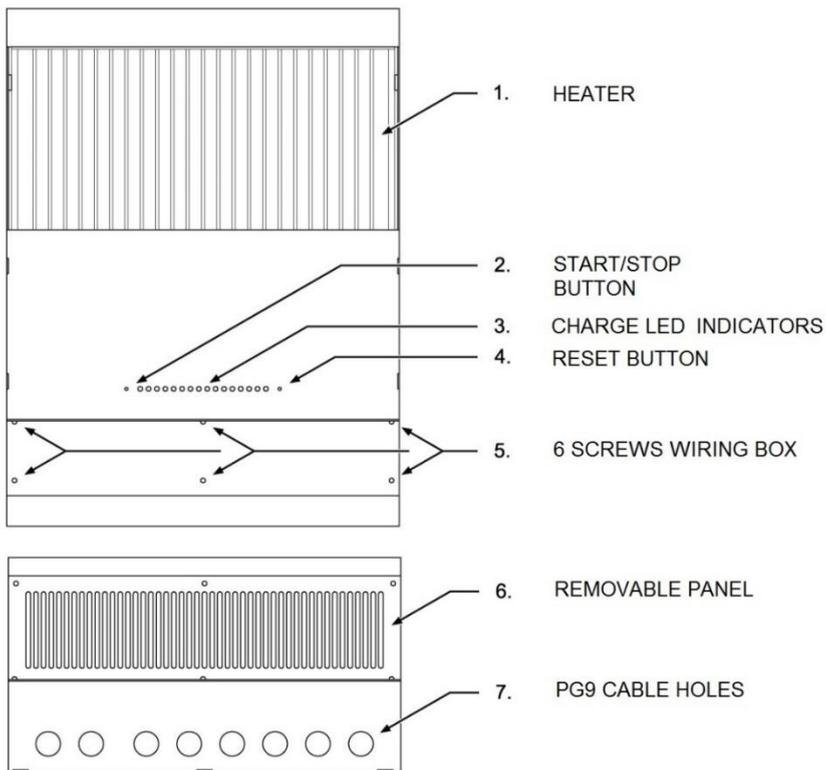


Figure 1 - Solar Eclipse

1.2 How the Solar Eclipse works

When the PV modules power exceeds the power required by the loads of the house, Solar Eclipse feels, through the network sensor, that there is an electricity grid connection and begins to store energy into the connected batteries.

On the contrary, when the power required by the loads of the house is higher than the one produced by the PV modules (for example if it is cloudy or at night), Solar Eclipse picks the energy stored by the batteries up and provides it via the inverter. Solar Eclipse works as a battery charger when the solar power is in excess, and as a solar module string irradiated from the sun when the solar power is not sufficient or it is totally absent.

This allows the inverter to deliver only the power required, minimizing unnecessary entries or withdrawals from the grid.

Solar Eclipse complies with the following rules:

- No batteries charge through grid energy
- The available energy from the PV modules is used to power utilities
- The excess energy is used to charge the batteries
- The further energy produced by the plant is sold to grid network.
- Battery power used only if the sun is not enough to power utilities, or at night

1.3 Manual use



WARNING: the manual is a guideline for a safe and effective use as well as for the maintenance and possible correction of minor Solar Eclipse malfunctions. It is therefore essential that the person who uses or carries interventions on has acquired a complete familiarity with the contents of this manual, and will closely follow the instructions.



WARNING: Solar Eclipse installation and maintenance must be carried on by qualified, trained and authorized personnel only, compliant with the local regulations and applying the guidelines and the safety measures. Keep the manual in a safe place.

1.4 Warranty

- The activation of this warranty is absolutely subject to the registration of the product within 30 days of its installation, on the computer portal available on the website www.solareclipse.it as indicated on the installer card inserted in the box. Computer registration will be faithful to any dispute and dispute, and is an integral part of the warranty itself.

In the absence of such registration, the guarantee will not be valid without exception.

- P800 SRL guarantees that this product is manufactured in accordance with the law. Maintenance not compliant with the guidelines, the instructions and the specifications contained in the user's manual, may cause damages. This could result in voiding the warranty.
- The warranty covers repairing cost and / or replacement of the product. Defective parts shipping cost and labour costs are not covered by this warranty.
- The warranty does not cover any damage to the batteries in any case, especially if the set parameters do not match those specified by the manufacturer.
- The proper operation of Solar Eclipse is guaranteed only with a minimum daily radiation power of at least 100 W.
- All verification, updating, repair and replacement operations will be carried out by qualified p800srl personnel exclusively in p800srl laboratories, no work on works or works on private or corporate clients will be provided.

1.5 Quality

All our products are tested and inspected during production and before delivery. The standard warranty period is 24 months from the date of purchase.

1.6 Responsibility

P800 SRL disclaims any liability in the following cases:

- consequential damages related to the use of Solar Eclipse
- possible manual errors and the consequences thereof
- damage caused by improper use of Solar Eclipse
- damage caused by the battery pack and its connections

1.7 Safety information



WARNING: All the following operations must be carried out by qualified personnel only in compliance with national and local security regulations.



WARNING: During the installation, you must follow manual instructions and warnings step-by-step in order to avoid danger to the operator and damaging the equipment. Operations that are not complying with the instructions will result in immediate warranty lapse.



WARNING: Some device parts can be live, non-insulated or have hot surfaces. Unauthorized removal of the necessary protections, improper use, incorrect installation or incorrect operation,

the unit tampering (for example opening additional holes), can cause serious damage to persons or things and leads to the immediate warranty voiding.



WARNING: to avoid the system damage and / or malfunction, please insert a standard fuse between the Solar Eclipse and the battery pack 32A as shown in the wiring diagram (see Figure 16).



CAUTION: The Solar Eclipse is INSULATION TRANSFORMERLESS. An inverter with insulation transformer is needed or, in case of inverter also without insulation transformer, it is necessary to maintain the battery pack floating: no pole must be connected to earth, also TERMINALS OF BATTERIES MUST BE PROTECTED WITH A DOUBLE INSULATION as they are located at the same potential of the grid **IT CAN CAUSE BODILY HARM OR ELECTRIC SHOCK!!!**



WARNING: PV plant design with Solar Eclipse must always respect the nominal ratings of voltage and current phase.



CAUTION !!!: Always install the battery pack in a room equipped with air intake, and not used as residential.



WARNING !!!: In case of liquid electrolyte batteries use, please put the battery pack in a widely ventilated room, separated from the one in which other electrical devices such as inverters, panels and Solar Eclipse are!!! **The use of liquid electrolyte batteries can cause highly explosive vapors !!!**

1.8 Type label and symbols explanation

The type label (see Figure 2) is located on the right side of the Solar Eclipse. The label reports important technical information about caring, maintaining and shipment of parts. Do not remove the label.

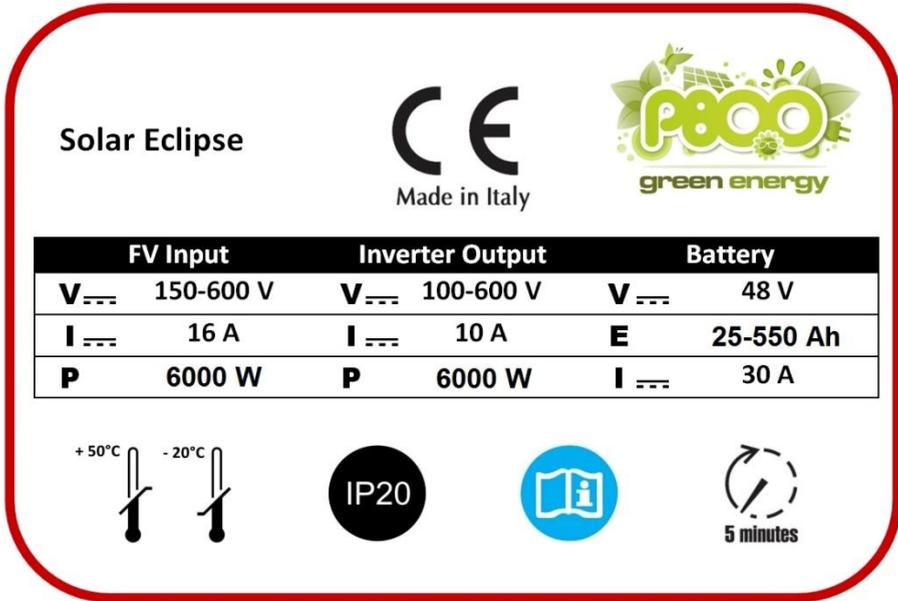


Figure 2 - Label and certifications

The following table lists the meaning of the symbols.

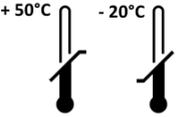
Symbolis explanation	
	<p>It shows the temperature range permitted for the inverter operation. The values are expressed in degrees Celsius and in degrees Fahrenheit</p>
	<p>It indicates the degree of environmental protection.</p>
	<p>It indicates that you must always keep the manual at hand to consult the documentation to operate properly and safely</p>
	<p>It shows the risk of electric shock after the shut down and the disconnection of the Solar Eclipse and the time span before you can perform safely any maintenance operation.</p>
	<p>It alerts of risk of burns for the presence of hot surfaces</p>
	<p>This symbol alerts the user to the presence of “dangerous voltage” inside the device that might cause bodily harm or electric shock.</p>
	<p>This safety alert symbol alerts to potential hazards. Read and follow instructions carefully to avoid possible harm.</p>

Table 1 – Label symbols meaning

2 GUIDELINES AND SAFETY MEASURES

2.1 Symbols and warnings

The following symbols are used throughout the manual to highlight important information:



CAUTION: indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



WARNING: indicates a hazardous situation which, if not avoided, could result in death or serious injury..

2.2 Specific requirements

- 1 Solar Eclipse is manufactured in accordance with safety and technical requirements
- 2 Solar Eclipse is to be used under the following conditions only:
 - To charge lead acid, gel, nickel, lithium-ion batteries and to provide power to grid connected inverter.
 - To convert the string voltage of the power supply modules for charging batteries.
 - Connected to a battery pack with all the safety systems required for the accumulation of chemical systems with nominal voltage of 48 V.
 - In appropriate technical conditions.
 - In an enclosed space, well ventilated, protected from rain, condensation, moisture and dust.
 - In compliance with the instructions in the manual.



CAUTION: set the parameters characteristic of the charge and discharge cycle of the battery pack as recommended by the battery manufacturer. Refer to the installer software available in the download area of website www.solareclipse.it download area.



WARNING: a misuse/improper use of the charge and discharge cycle can cause damage and / or battery explosion.



WARNING: Do not use the Solar Eclipse in situations where there is a risk of gas or dust explosions or in presence of potentially flammable products.

Any use of the product other than described in the Intended Use section does not qualify as appropriate. P800 SRL is not responsible for any damage that may ensue.

2.3 Before installing

Users must always:

- Follow this manual during installation and maintenance. Before installing or using the product, read all of the instructions, cautions, and warnings in this manual.
- Be familiar with the contents of this manual. This applies particularly to Chapter "guidelines and directives for safety."

2.4 Safety and installation guidelines

- Protect your Solar Eclipse from rain, snow, spray, moisture, excessive soiling and condensation situations. In order to reduce the risk of fire, do not cover or obstruct the ventilation holes. Do not install the Solar Eclipse in a room without ventilation because it could overheat.
- In case of fire, you must use a fire extinguisher suitable for electrical equipment.
- Short-circuiting the device or reversing the polarity will cause serious damage to batteries, Solar Eclipse and wiring. The fuses are located between the batteries and the Solar Eclipse are not able to avoid the damage caused by the reversal of the polarity, damage that will void the warranty.
- Protect the DC wiring with a fuse according to the guidelines of this manual.
- Connection and protection must be carried out in accordance with local regulations.
- Do not work on Solar Eclipse nor on the system if they are still connected to a power source. Allow only qualified electricians to carry out modifications to the electrical system.
- Check the wiring and connections at least once a year. Defects such as loose connections, burnt wiring etc. must be corrected immediately.
- Do not touch the equipment if wet or if you have sticky hands.
- Make sure that the product is mounted properly and safely and always use appropriate transport equipment.
- The opening of the service door is the sole responsibility of qualified and licensed

2.5 Batteries use warning

- Remember that despite the battery pack voltage is 48 V, when the Solar Eclipse is connected to an insulation transformerless inverter, the battery pack has the same voltage of the power grid and it is potentially dangerous for the human body!
- In the case of liquid electrolyte batteries it is necessary to place the batteries in a well ventilated room and not used for residential.
- Do not short circuit the batteries as this could cause an explosion and fire risk.
- Over-discharge of the batteries and / or high charging voltages can cause serious damage to the batteries. Do not discharge / charge batteries beyond the limits recommended by the manufacturer.
- The installation of the batteries and the Solar Eclipse adjustments are the sole responsibility of authorized personnel.

3 INSTALLATION

During installation and start up of Solar Eclipse, always refer to the guidelines and the safety instruction. See Chapter 2 of this manual.

3.1 Unpacking

Apart from the Solar Eclipse, the box includes the following:

- n. 1 bracket;
- n. 1 grid power sensor;
- n. 2 grid power sensor connectors;
- n. 7 PG-9 clamp;
- n. 1 16 mm cap;
- n. 4 MC4 type solar connectors;
- n. 6 ring lug;
- n. 6 ring lug M6 screws;
- n. 1 ExtremeSpeed 6x32 mm 10 A FF spare fuse



Figure 3 - Included accessories

After unpacking the product, check for any damage. Do not use the product if it is damaged. In case of doubt, contact your supplier.

3.2 Environment

During installation follow below instructions:

- Solar Eclipse is only suitable for indoor use
- Ambient temperature: -10 - 40° C.
- Humidity, non condensing: 0-95%.
- Mount the Solar Eclipse vertically on a stable surface, with the cables facing down.
- Ensure the hot air produced during operation discharge. The Solar Eclipse should be mounted in such a way as not to prevent the blocking of the air flow through the ventilation holes.
- Do not place any objects within a distance of 15 cm 25 cm laterally and vertically with respect to Solar Eclipse.
- Do not place the Solar Eclipse in the same place with liquid electrolytes batteries.
- Do not install Solar Eclipse immediately above liquid electrolyte batteries, due to the risk of corrosive vapors and explosives, in case these are to.

3.3 Solar Eclipse fixing

To fix the Solar Eclipse, follow below instruction:

- 1 Mark the two points for fixing the bracket on the wall using the two holes of the bracket itself, taking into account the overall dimensions and the space needed for ventilation.
- 2 Drill holes and secure the bracket with M6 bolts.
- 3 Hook Solar Eclipse through the back hook to the bracket on the wall.

3.4 Solar Eclipse board wiring



CAUTION: Before removing the service door make sure you have disconnected Solar Eclipse for at least 5 minutes to allow the internal parts to discharge to avoid risk of electrocution.

Before starting the wiring make sure that:

- The PV modules are disconnected from the inverter
- The inverter is electricity grid insulated
- The Solar Eclipse is insulated in relation to the inverter
- The battery pack is disconnected

Proceed with the wiring as follows:

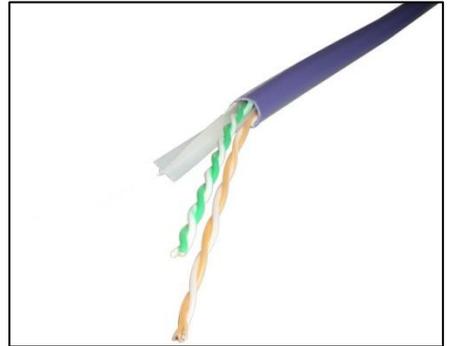
- Remove the service door (6) unscrewing the screws (5) see Figure 1
- Prepare the cables to connect to the inverter and the modules with lugs eyelet on one side and MC4 solar connectors supplied on the other, remembering to insert the PG9
- Prepare the battery pack cables (solar photovoltaic double insulation cables can be used) with ring terminals using a minimum section 4 mm cable remembering to insert the PG9.

The following table contains information for sizing the battery pack 48 V cables in mm² depending on the length:

48 V batteries pack cables length	Up to 6 meters	Up to 12 meters	Over 12 meters
Cable section in mm ²	6 mm	10 mm	16 mm
Cable type	Double insulation (solar PV cable can be used)	Double insulation (solar PV cable can be used)	Double insulation

Table 2 – Battery pack cables size

- Prepare the grid sensor wire with a three-pole terminal using an UTP twisted pair cable or a shielded STP twisted-pair cable with a minimum 0.25 mm square section (see image below).



WARNING: If the inverter has no isolating transformer, double insulated signal cables (double sheath in polyethylene) should be used and do not ground any screen stocking.

Figure 4 - Twisted-pair cable for Power Meter and house load sensors (Monitoring Kit)

NOTE: To prevent electromagnetic disturbances generated by power cables from generating "bounced" voltage, current and frequency readings of the Power Meter, always wrap the signal cables on dedicated cavities and appropriately separate, trying to avoid wiring lengths greater than 100 meters.

NOTE: In the presence of electromagnetic disturbance, the voltage and frequency values detected by the Power Meter could be "bumped" and this could cause the Solar Eclipse "block" status, which detects network parameters outside the admitted range.

- Use two pairs of twisted wires, making sure to connect the central PIN (O) to both pairs as shown in figure 4. In the case of STP shielded cable, connect the braid to the central PIN (O), remembering to insert the PG9 and note the color of the wires.

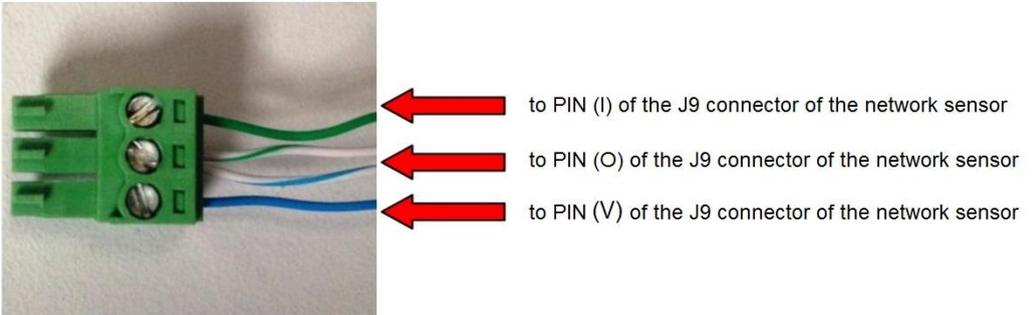


Figure 5 - Power Meter and house load sensor connectors wiring

- Make sure the PV modules DC switch is open (see Figure 6)
- Connect the PV modules cables to the board (see Figure 7)
- Put a 32 A fuse box 32 A on the battery cables (see Figure 6)
- Verify that the battery switch is open (see Figure 6)
- Connect the battery pack cables to the Solar Eclipse board (see Figure 7)

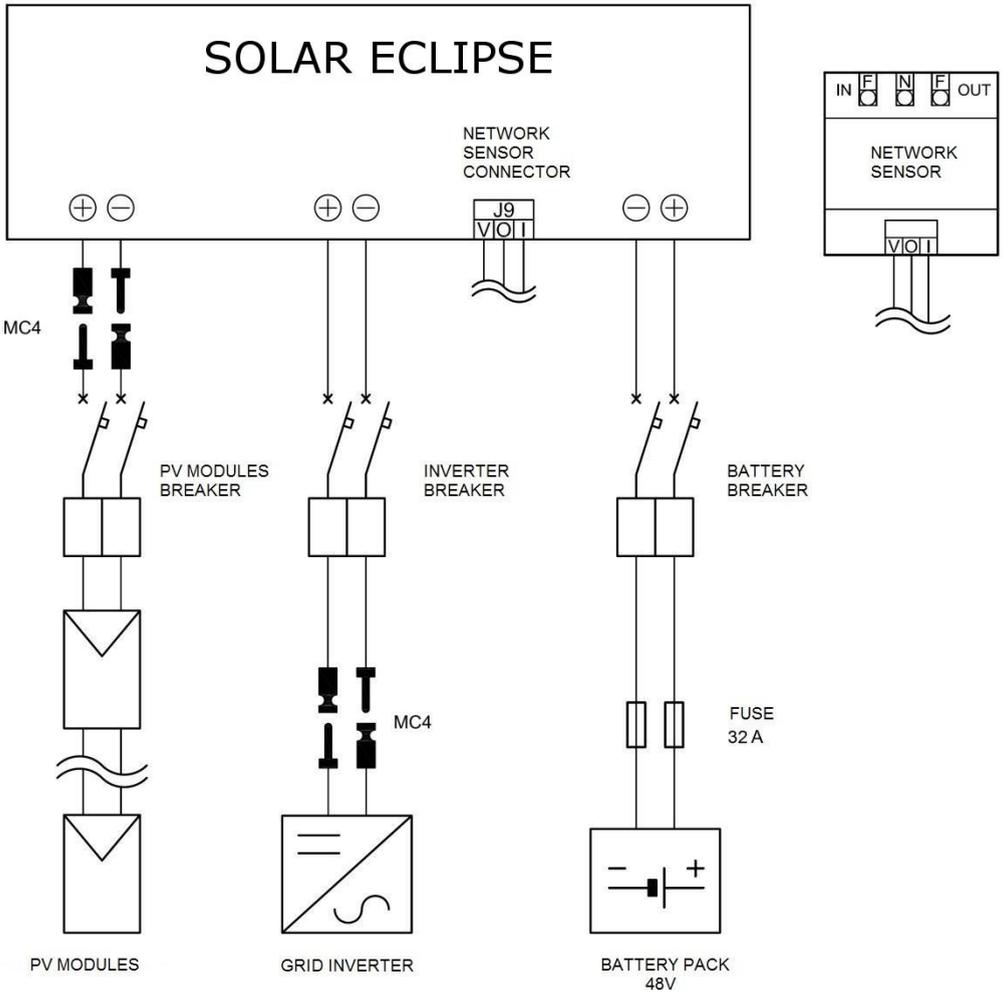


Figure 6 - Power wiring scheme



CAUTION: Solar Eclipse is not protected against the DC power inputs polarity reversal.

- Connect the inverter to the board (see Figure 7)
- Connect the connector of the grid sensor (Power Meter) to the Solar Eclipse board (see Figure 7)
- Connect the house load sensor connector (if used)
- Close the service door (6) fastening the screws (5) see Figure 1
- Insert the MC4 connectors inverter side and PV modules
- Plug in MC4 inverter and pv modules connectors

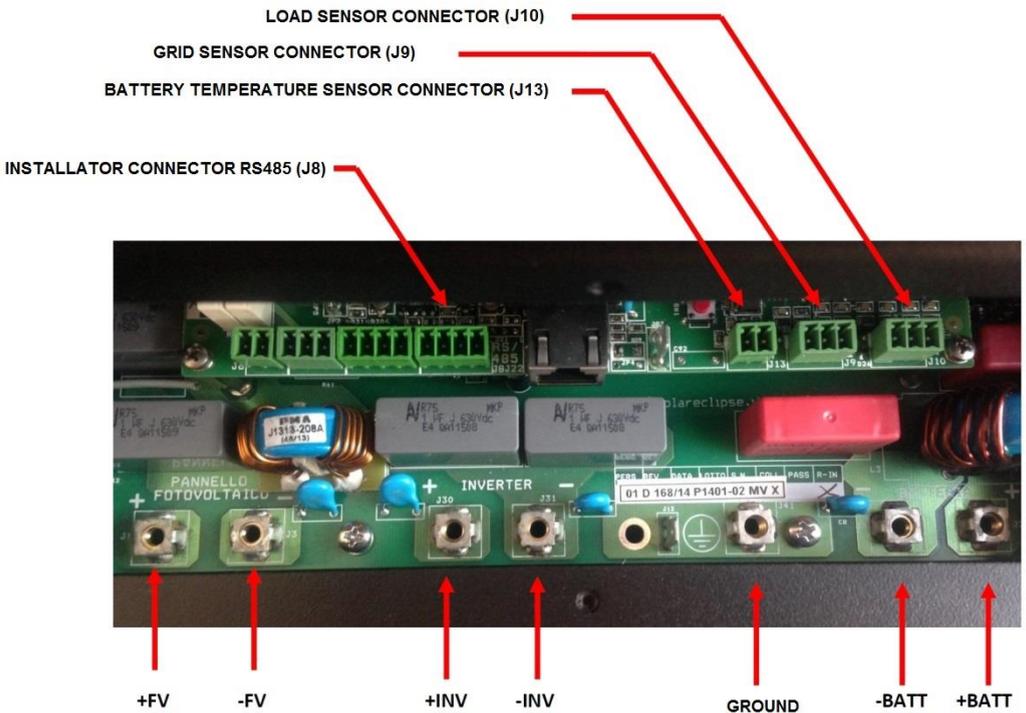


Figure 7 - Solar Eclipse wiring board

3.5 Grid-tied sensor installation and wiring

Install the Solar Eclipse grid Power Meter in the electrical panel or into the external panel, above the main PV plant DC switch as shown in Figure 6 and wiring the connectors as shown in Figure 7. Protect the sensor with a circuit 32A (max).

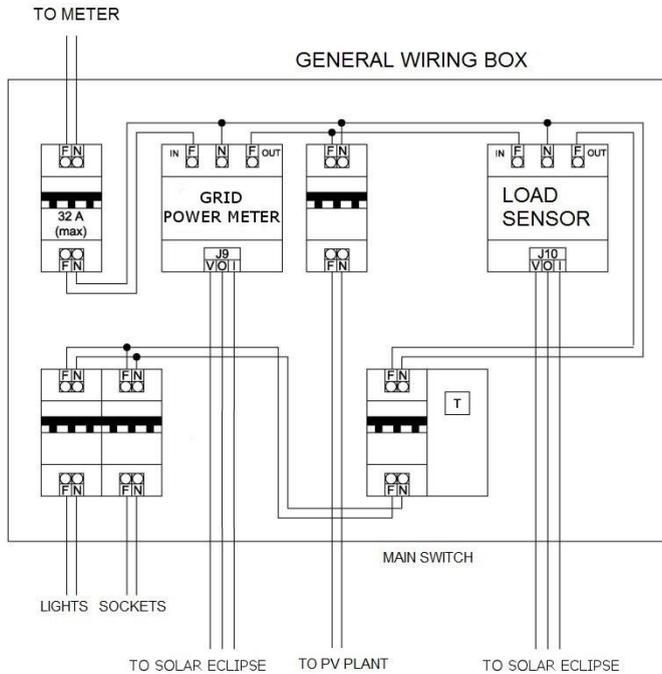


Figure 8 - Electrical panel wiring scheme

NOTE: The grid Power Meter must be traversed by the entire input and output current from the exchange meter, then it should be installed immediately after the exchange meter avoiding to have other power lines in parallel !!!

Installation can be made on DIN bar and it takes 4 modules.

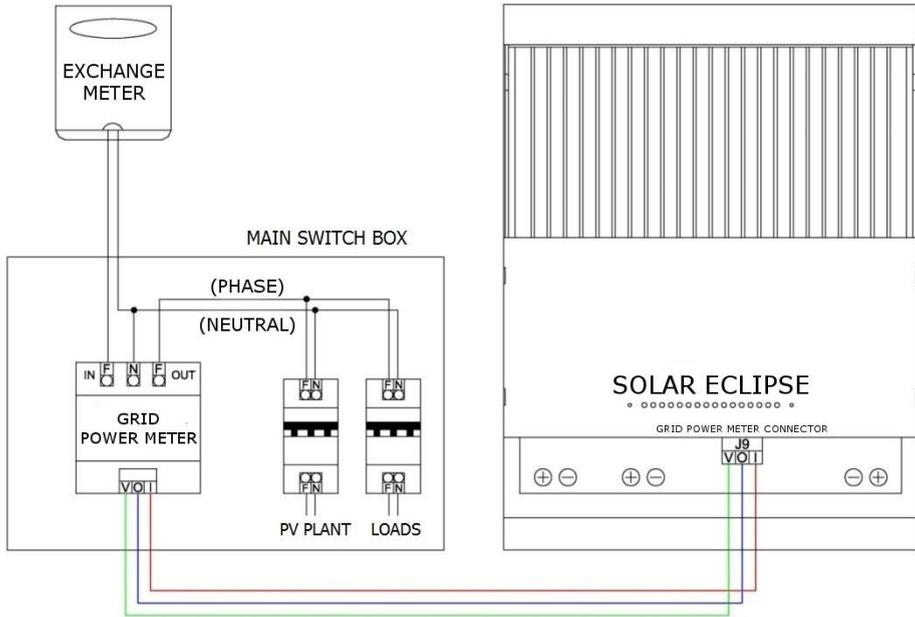


Figure 9 - Wiring grid Power Meter

4 SOLAR ECLIPSE CONFIGURATION

Solar Eclipse has already been factory-set to work automatically with a 48 V gel battery pack with capacity between 100 Ah and 400 Ah depending on the setting of the "dip switch" located on Solar Eclipse card see Figure 10, and a string of 60 cells modules consisting of 12 units ($V_{oc} = 450$ Volt approximately). If you have modules with a different number of cells from 60, see Table 8. If you want to configure the Solar Eclipse via PC, you have to let the "dip switch" in the factory location (100 Ah / Config.)



Figure 10 - Configuration dip-switches

Fig 11 shows the position of the "dip-switches" depending on the capacity of the stationary gel batteries used.

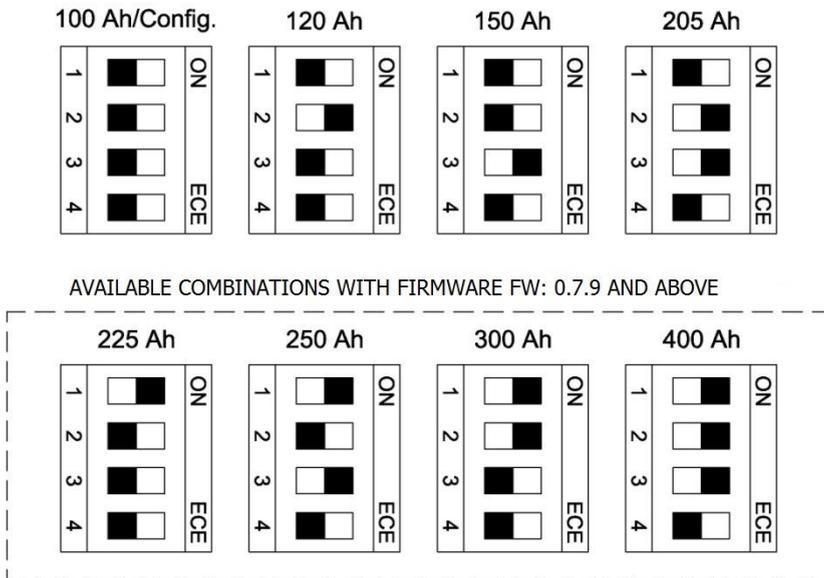


Figure 11 - Battery configuration through dip-switches

NOTE: The capacity of the batteries to be set is that stated by the manufacturer within 10 hours of discharge time (C10).

These 8 configurations appear to be a good compromise between costs and benefits for those who own a photovoltaic plant with a power of 3 to 6 kW, with average nightly consumption up to 10 kWh and a string of 60 cells modules made up of 12 panels.

However, for special needs and / or user profiles, you can change the default parameters using the installer software and USB / RS485 interface installer both supplied by P800 SRL.

NOTE: In order to have the parameters set via the USB / RS485 interface installer become executable the position of dip switch must be on 100 Ah / config !!!

4.1 Installing software for the installer

In the case the string of modules is different from 12 modules or the batteries are not standard it is necessary to configure Solar Eclipse using the installer software. In any case, for a professional installation of the equipment and for maximum performance and reliability of the system it is recommended to always use the configuration via PC.

On www.solareclipse.it/en/download you can download the software and system libraries needed to run the Solar Eclipse configurator, the use is reserved to authorized installers only. To install the software, proceed as follows:

- Goto www.solareclipse.it/en/download
- Download the zip file “Solar Eclipse Configurator”
- Unzip it and save all files in a folder in your PC
- Run the exe file you will find in the folder

If the above operations have been carried out correctly the software will start and you will see the screen in Fig 12:

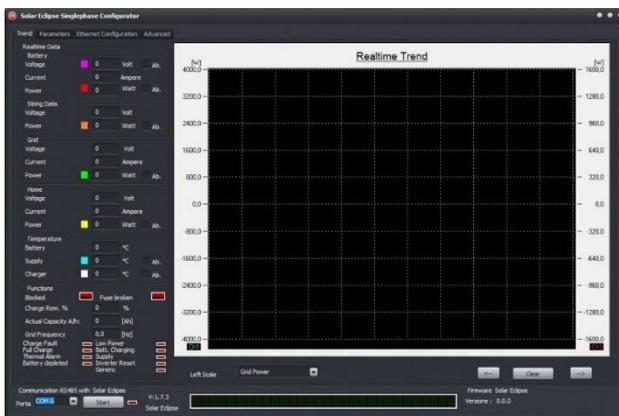


Figure 12 - Configuration Software – Trend tab

NOTE: In order to use the USB / RS485 interface installer provided by P800 SRL, you must first install the drivers included in the package.

Connect the USB / RS485 interface cable to the PC and to Solar Eclipse (see Figure 7) ensuring that the Solar Eclipse is in lock state (LED indicator on the left flashes). Select the COM port using the dropdown at the bottom left used by your PC and initiate communication with the key "start." In the bottom bar will show the message in green "COMMUNICATION OK". The software Solar Eclipse Configurator is now successfully installed and ready to set the operating parameters of Solar Eclipse, and verify the optimal functioning of the system.

NOTE: For proper operation, use only the original P800 SRL cable.

4.2 Advance configuration operating parameters

Proceed with the connection of Solar Eclipse as follows:

- Connect the RS485 socket on your PC (where you installed the software installer see section 4.1 through the appropriate interface
- Close the battery switch and switch-on the Solar Eclipse
- Select via the drop down on the bottom left the COM port used by your PC and initiate communication via the button "start". In the bottom bar will show the message in green "COMMUNICATION OK".

NOTE: To verify that the communication between Solar Eclipse and the PC is really effective check that the firmware version number displayed on the bottom screen to the right is different from 0.0.0 and the voltage and power values displayed in the "trend" screen are logically possible and constantly changing.

Select in the upper left the screen "Parameters", it will appear that shown in Fig 13

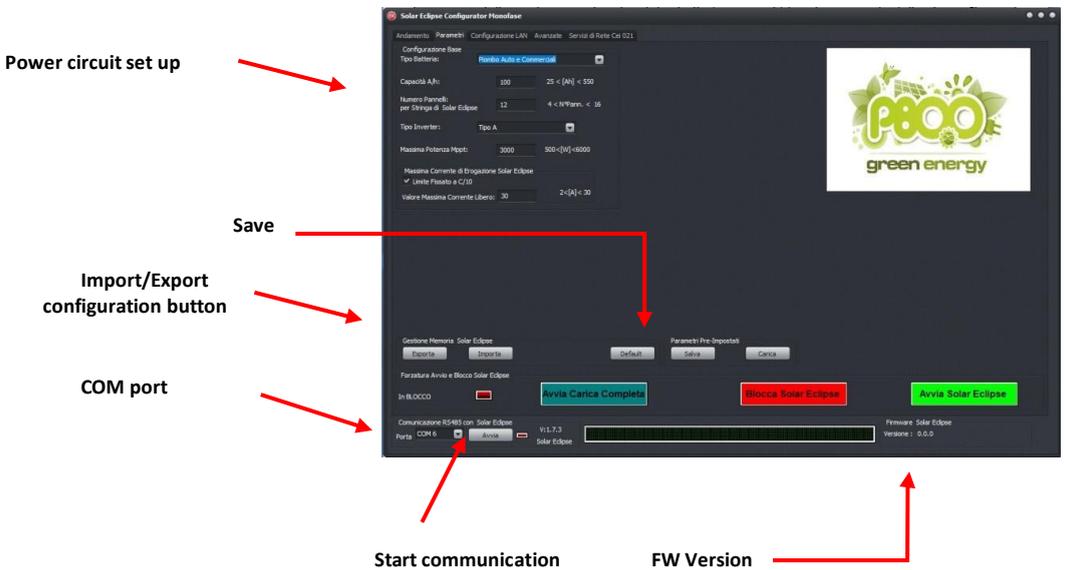


Figure 13 - Configuration software – Parameters tab

The basic parameters to be set are:

- **Battery Type:** Enter the type of batteries used, taking into account the charge and discharge parameters indicated in Table 7.
- **Capacity Ah:** Insert the Ah capacity stated by the manufacturer considering the data in ten hours of discharge, sometimes referred as C10 in the battery tech specs.
- **Number of panels:** Enter the number of modules connected in series to Solar Eclipse (if modules with 60 cells Voc = 37 Volt otherwise see conversion table Table 8). If it was done the parallel of two or more strings in the CC wiring box, we consider only the modules in series, for example two strings of 10 modules connected in parallel, enter a modules number equal to 10.
- **Inverter type:** normally leave Type A, except in cases indicated from P800 SRL service
- **Maximum current output value:** normally leave C10 value set. It is not recommended to increase the maximum current value as it causes a significant reduction in capacity and battery life.

NOTE: The Solar Eclipse comes with dynamic DHCP, then self-configures automatically on the local network by simply connecting the Ethernet port to a router-modem. But you can set all the network parameters according to the particular needs of advanced network.

After setting the required values press the export key of the page "parameters" and wait for confirmation "data exported successfully". To export the Ethernet data you must authorize the export via the dedicated "flag".

If you do not use batteries congruent to pre-set parameters of Table 7, you can set the values of charge-discharge of the batteries depending on the type of batteries used.

NOTE: Remember to place the switch in 100Ah / Config mode so that the configuration via USB / RS485 to take effect and can become executable by the Solar Eclipse!

4.3 Configuration with "free" parameters



WARNING: Use of the free parameters configuration mode MUST BE CARRIED OUT BY COMPETENT PERSON. The adoption of criteria other than those pre-set has to be done following the battery manufacturer's specifications.

The life of the batteries in fact depends in a direct manner by the charging and discharging cycles set. If you use special batteries that do not fit in the list provided by the configurator software, you can set custom parameters at each stage of the charge and discharge cycle.

Please ALWAYS follow the battery manufacturer's recommendations to make sure that the batteries are not damaged or may have a very short life.

In the "parameters" drop-down menu set "free parameters." It will appear on the right a series of values to be set. After you type the correct values for the battery pack used, press the Export button and start Solar Eclipse.

4.4 Solar Eclipse reboot procedure

Restarting the Solar Eclipse do not reset the parameters set via PC, however, it interrupt the complete charging procedure and the charge status of the batteries is recalculated.

To restart the following steps:

- Lock Solar Eclipse holding down the button (2) to the left of the LEDs for more than 5 seconds (see Fig 1), or with the button in the Software Configurator
- Verify that the first LED on the left starts flashing
- Open the battery pack switch, disconnecting power from the Solar Eclipse
- Ensure that all the LEDs turn off
- Wait 3 minutes for the electrostatic charges are exhausted
- Close the batteries DC switch and repower the Solar Eclipse
- Unlock Solar Eclipse holding down the button (2) to the left of the LEDs for more than 5 seconds (see Fig 1), or with the button in the Software Configurator
- Verify that the first LED on the left emits steady light

4.5 Solar Eclipse reset procedure



WARNING: Resetting the Solar Eclipse will lose all configuration parameters. Do not do this if you do not have all the data to make a new device programming.

The Reset procedure is only required in case of severe internal errors if the machine remains locked without any alarm present (see troubleshooting paragraph 5.11).

To complete the Total Reset, press the hidden reset button located to the right of the Led (see Figure 15) for more than 5 seconds and wait until all the red LEDs flash at the same time. Wait a few moments, then restart (see 4.4).

4.6 Notes on the battery pack sizing

Solar Eclipse works with a battery pack with a rated voltage 48 V.

Standard battery on sale can be both integrated type with an output voltage 48 V, both batteries with lower voltage (for example 24 V, 12 V, 2 V, etc.) which suitably connected in series to provide a nominal voltage of 48 V see table 3

Single battery voltage	48V	24V	12V	2V
Number of batteries to be connected in series	1	2	4	24

Table 3 – Number of batteries depending of the nominal voltage

The recommended capacity of the battery may vary depending on the system power and depending on the users' consumption from 25 Ah to 550 Ah.

By paralleling two groups 48 V you get a battery pack to double capacity in Ah.

The type of batteries can be of any type (Commercial Batteries, Gel-AGM-flat plate, tubular OPzV, Tubular OPZS, Aquion, Lithium type LiPoFe4, etc) as the charge cycle is programmable during configuration through the software supplied.

The rate of discharge of the batteries is automatically set by the Solar Eclipse logic, but can be varied according depending on the type of batteries used by following the "free configuration" procedure of the software.

The commercial batteries, for example, are not of great quality and the percentage of download set by default by Solar Eclipse is 20%, while the stationary AGM batteries are set at 30% discharge. If your home does not have special loads during the night other than a refrigerator, lights for lighting and normal utilities such as television, and using appliances during daytime you can restrict your night consumption at about 2 ~ 2,5 kWh.

In this case, therefore, for example, you can use 4 AGM batteries 12 V and 150 Ah connected in series to have that guarantee self-sufficiency throughout the night because:

$$\text{Battery energy available in Wh} = \text{batt voltage} \times \text{Ah capacity} \times \text{percentage of download}$$

$$\text{Battery energy available in Wh} = 48 \text{ V} \times 150 \text{ Ah} \times 30/100 = 2160 \text{ wh} = 2.16 \text{ kwh}$$

If your home or your user has constant night time loads like a computer always on or electric pumps for the pool operation or other, or even a freezer or other, your consumption may be around 4 ~ 5 kWh.

In this case, for example, you can connect 4 x 12 V and 200 Ah to the type OPzV gel that will grant you self-sufficiency throughout the night because:

$$\text{Battery energy available in Wh} = \text{batt voltage} \times \text{Ah capacity} \times \text{percentage of download}$$

$$\text{Battery energy available in Wh} = 48 \text{ V} \times 200 \text{ Ah} \times 50/100 = 4800 \text{ wh} = 4,8 \text{ kwh}$$

Finally, remember that if you own a photovoltaic plant with a capacity of at least 3 kW, you can connect even with batteries up to 300 Ah. In the case of your consumption profile is prevalent during the summer (for example, the use of air conditioners), it may be reasonable to form battery packs also of 300/550 Ah.

To help you choose the capacity and type of batteries to use fill in the following Table 4 and Table 5.

		PV plant power		
		1 ~ 2 Kw	2 ~ 3 Kw	3 ~ 20 kW
Average Night time	1 ~ 2 kWh	A	A	A
	3 ~ 5 kWh	A	B	B
	6 ~ 9 kWh	A	B	C
	9 ~ 13 kWh Only summer	*D	*E	*F

Table 4 – Energy reserve classes for 48V batteries

	Flat plate AGM, GEL			Tubular plate GEL OPZV		
	LONG LIFE	RECOMMENDED (default dip-switch)	SHORT LIFE	LONG LIFE	RECOMMENDED (default sw)	SHORT LIFE
Capacity Ah	20%	30%	50%	30%	50%	60%
100	0,96 Kwh	1,44 Kwh	2,40 Kwh	1,44 Kwh	2,40 Kwh	2,88 Kwh
120	1,15 Kwh	1,73 Kwh	2,88 Kwh	1,73 Kwh	2,88 Kwh	3,46 Kwh
150	1,44 Kwh	2,16 Kwh	3,60 Kwh	2,16 Kwh	3,60 Kwh	4,32 Kwh
205	1,96 Kwh	2,95 Kwh	4,92 Kwh	2,95 Kwh	4,92 Kwh	5,90 Kwh
240	2,30 Kwh	3,46 Kwh	5,76 Kwh	3,46 Kwh	5,76 Kwh	6,91 Kwh
300	2,88 kwh	4,32 kwh	7,20 kwh	4,32 kwh	7,20 Kwh	8,64 Kwh
400	3,84 kwh	5,76 kwh	9,60 kwh	5,76 Kwh	9,60 Kwh	11,52 Kwh
450	4,32 kwh	6,48 kwh	10,80 kwh	6,48 Kwh	10,80 Kwh	12,96 Kwh

A	Batteries with capacity up to 2kWh	B	Batteries with capacity from 2 kWh to 5 kWh	C	Batteries with capacity from 5 kWh to 8 kWh
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*D	*E	*F	Batteries with capacity from 8 kWh to 13 kWh for summer usage *i.e. air conditioning
-----------	-----------	-----------	---

Table 5 – Battery dimensioning depending on the loads and PV plant power

4.7 Warnings and tips for the formation of the battery pack 48 V

The setup of the battery pack 48 V must be made in accordance with current standards by qualified personnel. Below some important precautions and warnings to be followed to avoid serious damage to property and people. a formazione del pacco batterie 48 V



CAUTION: The Solar Eclipse **do not have the ISOLATION TRANSFORMER** (transformer-less). This type involves the use of inverters with isolation transformer, or in case of inverter also without isolation transformer is necessary to maintain the battery pack floating with respect to earth: no pole must be connected to earth, also **TERMINALS OF BATTERIES HAS TO BE PROTECTED WITH A DOUBLE INSULATION** as they are located at the same potential of the network **DANGEROUS FOR THE HUMAN BODY !!!**



WARNING !!!: If the battery pack used is liquid electrolyte type, it must be installed in a very well ventilated place and not in the same place as were the Solar Eclipse or inverter are installed. battery pack locally widely ventilated and other than where there are electrical devices such as inverters, panels and Solar Eclipse !!!

The use of liquid electrolyte batteries can cause highly explosive vapors !!!



WARNING: set the values of the charge cycle as recommended by the battery manufacturer.



WARNING: a non-conforming use of the charge cycle can cause damage and / or battery explosion

To form a battery pack is advisable to follow the following minimum rules:

- Place a fuse 20 A more 'closely as possible to the same battery terminals
- Use a double insulated cable
- Insulate the battery terminals through appropriate cover terminals and shrink tubing
- Isolate the battery pack in a closed cabinet in fiberglass but provided with the ventilation air vents, or in a metal cabinet ventilated and earthed

4.8 Warnings and parameters to be set on the grid inverter



WARNING: Do not use Solar Eclipse with inverters which have an MPPT operating voltage lower of 150 V. The operation of the inverter to tension lower than 150V may damage Solar Eclipse.



Some network inverters are not compatible with Solar Eclipse due to particular operating parameters. To check compatibility, see **Appendix B** at the bottom of this manual.

For all the inverters that have the ability to set the "Vstart" voltage start MPPT operation, set "Vstart" greater than 200 V if compatible with the string of photovoltaic modules.

MPPT anti-shadowing functions interrupt battery charge and may cause malfunctions of the "Solar Eclipse-Inverter grid" storage system, and then turn off these features if possible through the inverter configuration panel.

4.9 Inverter Power One / ABB

Enter the inverter settings menu by typing the default password **** (if not changed). From the menu, select V start, and enter a value of at least 200 V. If the module string is very short, you can drop off exceptionally at V start = 180 V.

Also from the settings menu, select > MPPT Scan (if available on the Power One / ABB model) and set to Disable

4.10 Inverter SMA

Most SMA inverters come with a Sunny Explorer configuration program that interfaces with the inverter via Bluetooth connection. Once the connection is stable, locate the section dedicated to the CC settings and set V start = 250 V (minimum compatible with string length), V stop = 200 V minimum, OptiTrac Global Peak = "OFF".

NOTE: Some SMA models have experienced malfunctions, to check the compatibility of your SMA inverter model, check Appendix B at the bottom of the manual.

4.11 Inverter FRONIUS

To correctly set the new Fronius PRIMO models, you must enter the BASIC MENU by typing the default password 22742 (if not edited), and set operating mode > MPPT > FIX = "Vmppt" by entering the "Vmppt" value of the module string connected to Solar Eclipse. For example, if there are 10 modules with Vmppt 31.5 V each, set MPPT > FIX = 315 V.

5 START-UP



WARNING: During the Solar Eclipse operation, do not disconnect any cables nor open any switch.

To start the Solar Eclipse and photovoltaic system proceed as follows:

- all the switches are open.
- close the isolator 1 (battery - Solar Eclipse);
 - Verify that the Solar Eclipse lights up by illuminating some of the of the charge indicator LEDs
 - Verify that the first left LED flashes (lock status)
- close the switch 2 (Inverter - Solar Eclipse if present);
- close the switch 3 (PV string - Solar Eclipse);
- close the switch 4 AC side
 - Wait until the inverter starts correctly (if there is sunlight)
- start Solar Eclipse pressing for 5 seconds the lock / unlock button (2) (see Figure 1) located to the left of the LED charge indicators

Solar Eclipse has now started and it works completely automatically

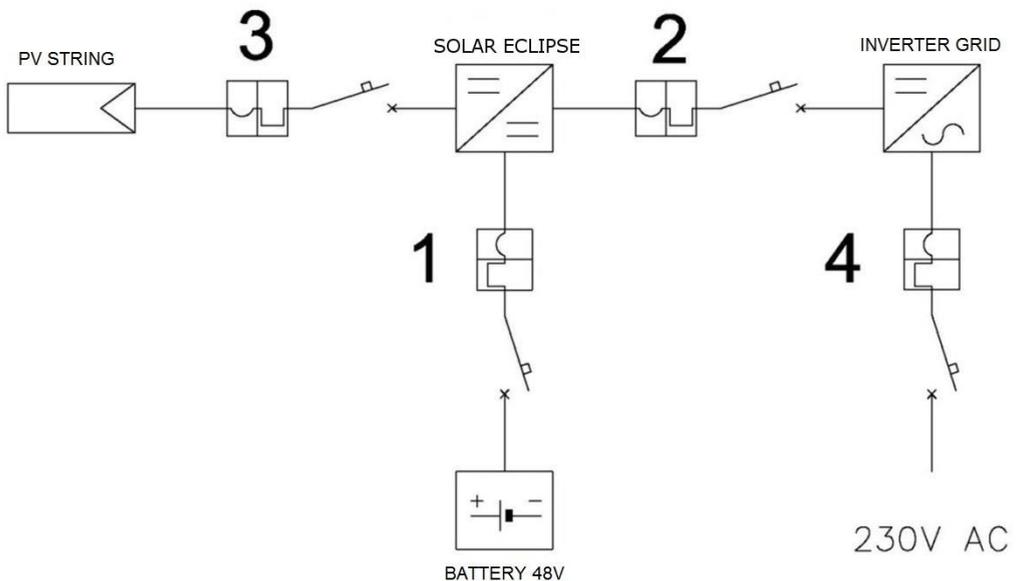


Figure 14 - Scheme order closing / opening switches start / stop

5.1 Stopping the Solar Eclipse

To stop the Solar Eclipse and photovoltaic system proceed as follows:

- Lock Solar Eclipse pressing the lock button /unlock (2) (see Figure 1) located to the left of the LED charge indicators
- open the disconnecting switch 4 AC side
- open the switch 3 (PV string - Solar Eclipse)
- open the disconnecting switch 2 (Inverter - Solar Eclipse if present);
- open the isolator 1 (battery - Solar Eclipse)

5.2 Operation Modes

Solar Eclipse feeds itself from the battery pack, which in turn are loaded exclusively by photovoltaic modules. Solar Eclipse works without the need for any external command with no exchange of information with the drive and /or utilities.

The only external parameter Solar Eclipse use to determine its operation (in addition to the PV modules) is that of the network power meter.

The goal of Solar Eclipse in fact is to keep close to zero as possible the value of the power exchanged with the network: if we are taking energy from network, Solar Eclipse feeds the grid inverter to increase the power produced from it. If we are emitting energy in the network, Solar Eclipse draws power from the modules and stores it in the batteries.

5.3 Battery Charger Mode

If the power of the photovoltaic modules is higher than that required by the users the battery charger mode activates automatically, drawing energy from the modules, and then decreases the output power of the inverter grid.

NOTE: If with good solar irradiation the power of the inverter seems not to be adequate to the photovoltaic field, this may mean that the Solar Eclipse is charging and therefore there is NO ANOMALY OF OPERATION!

5.4 Night Mode delivery

NOTE: If the battery power is not enough (for example in the case of batteries at the end of the life cycle), the Solar Eclipse limits the power delivery to protect the battery pack from deep discharges.

During the hours without irradiation, Solar Eclipse powers the grid inverter with DC current and a power equal to that absorbed by the users.

If the batteries are depleted, the power needed by the users is taken from the network without having to do any operation.

5.5 Power mode

Solar Eclipse not only provides energy to the inverter at night, but also in all the moments in which the loads require a power that exceeds that provided by the photovoltaic modules.

In these cases, Solar Eclipse switches to "power supply" mode by increasing the apparent power of the photovoltaic field

NOTE: The grid inverter output power can be greater than the power output of the PV modules under the same irradiation conditions; this means that Solar Eclipse is helping to fuel the photovoltaic field with energy from the battery pack!

Solar Eclipse does not go into "power supply" mode if the batteries are exhausted or if it is running a "full charge" cycle of the battery pack, see section 5.7 (cyclically).

5.6 Battery charger maintenance Mode

When the charging cycle is over and the power of the photovoltaic modules is still higher than the consumption of the utilities, Solar Eclipse does not stop working but continues to power the battery pack with a "maintenance" voltage as recommended by the manufacturers of batteries.

5.7 Battery pack “full charge” mode

After a certain number of charge and discharge cycles, variable depending on the type and capacity of the batteries, the weather conditions and the users' consumption, the Solar Eclipse enters full charge mode.

In this phase the Solar Eclipse charge the batteries with the energy of the photovoltaic modules completing a slow charge cycle.

NOTE: During the full charge cycle Solar Eclipse never goes to the “power supply” mode either during the day or during the night. In summer, the operation should be completed in one day but in winter it is possible that it lasts for two or three days. Therefore, please do not be alarmed if for a few days Solar Eclipse not operate even though the battery LEDs are all switched on.

The full charge cycle cannot be deleted because it is necessary to keep in good condition the batteries and the proper functioning of Solar Eclipse system.

Solar Eclipse on these other situations may decide to automatically start a full charge:

- After a few hours of operation following the closure of the battery switch
- If the battery voltage drops below 44.0 V in the power supply mode
- If the battery voltage drops below 46.0 V during stand-by

5.8 Power-up and Power-off

The power up of Solar Eclipse takes place closing the battery if the voltage exceeds 40V. The power-off happens opening the battery switch.

5.9 Indicator lights

The Solar Eclipse operation is displayed in a simple and direct way via the LEDs located on the front of the device.

When Solar Eclipse is powered by the battery pack 48 V always starts in "lock" mode, with the first LED to the left flashing. In "Active mode" the first LED illuminates with a steady light.

The remaining LED indicated the available energy in the battery pack from which Solar Eclipse can tap in case of energy needs from homes.

The LED number 9 (center) flashes when the output fuse is interrupted and simultaneously the Solar Eclipse goes into a state of "LOCK", also the first LED on the left flashes.

When Solar Eclipse is in “full charge” mode, LEDs light up with a fixed light gradually from right to left and then go off in reverse, up to a maximum of LEDs of the battery charge status.

Finally, if all LEDs are flashing, it has incurred a Reset or there is an ongoing failure alarm.

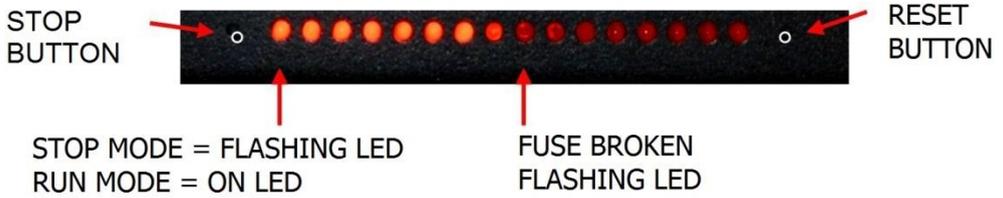


Figure 15 - lights – Front LED's

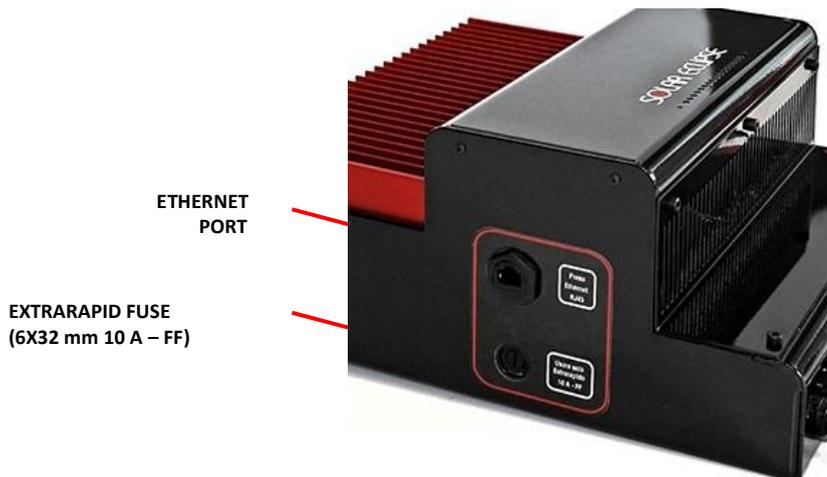


Figure 16 - Ethernet port e Supply Fuse



WARNING: never reset the Solar Eclipse without the assistance of a qualified installer and authorized to operate by P800 SRL. Resetting will restore all default parameters (see. Tab 7).

5.10 Remote monitoring via Ethernet network jack

Solar Eclipse comes with a web-server ready to send all data to a cloud server at any moment, allowing you to monitor the operation, status, alarms and saved parameters from any remote location, as well as record production, consumption, and battery storage data.

If you have an optional "Monitoring Kit", then you can fully monitor the photovoltaic system using the SolarApp application or installer portal.

To activate the plant monitoring kit, the installer must have registered the plant in advance at <http://www.solareclipse.it/en/tech-assistance-portal/>

Upon registration, the installer must enter the activation codes on the kit. In this way, even the end customer can monitor the system at any time and anywhere via Tablet or Smartphone.

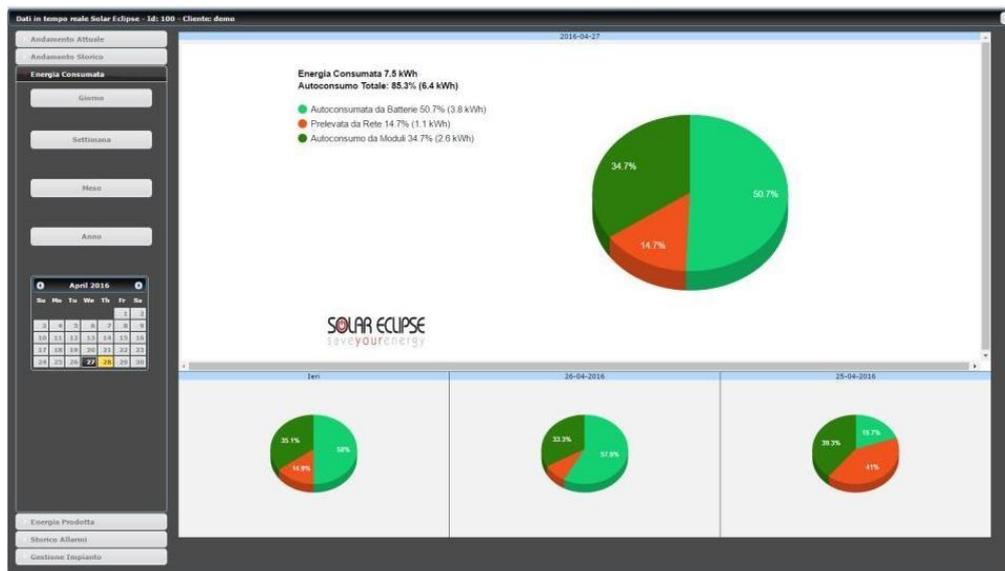


Figure 17 – Installer monitoring portal

Solar Eclipse, is equipped with a RJ-45 port (see Figure 16) that allows connection to a local network or directly to a computer.

The Solar Eclipse connection to a modem-router must be done with a normal LAN cable.

To verify the proper configuration of Solar Eclipse within the local network, open an Internet browser through a PC connected to the local network and type `http://solareclipse000` or `http://charger000` on the address bar.

If your network has correctly recognized the Solar Eclipse, and Solar Eclipse is powered by the batteries, the following screen appears:

Impostazione indirizzo IP				
Indirizzo IP:	192	168	001	011
Subnet:	255	255	255	000
Gateway:	192	168	001	001
DNS:	192	168	001	001
Server Locale:	193	182	016	067
NetBios Nome : Solareclipse000				
Tipo Indirizzo: Dinamico <input type="radio"/> Statico <input checked="" type="radio"/>				
Tipo Server: Locale <input type="radio"/> Remoto <input checked="" type="radio"/>				
Impostazione Base				
Numero Pannelli verso inverter:	12			
Capacita' Batteria:	100	Ah		
Tipo Batteria:	Piombo Plastra Piana tipo AGM ▼			
Tipo Inverter:	Tipo A ▼			
Versione FW:	1.5.2			
Memorizza				

Figure 18 - Solar Eclipse configuration with browser

In case the RS485-USB cable is not available, you can also set the basic parameters from the browser, simply by pressing the "store" button.

5.11 Fault search

SOLAR ECLIPSE DOES NOT SWITCH ON (with open DC disconnecter of PV modules)

- Verify with a voltmeter that the voltage at the head of the Solar Eclipse board (+ batt / - batt) is greater than 43 V and less than 55 V
- If the voltage is ZERO, check that the external battery fuse is not interrupted
- If the voltage is less than 43 V, charge the 48 V battery pack (with Solar Charger, Solar Method, 12 V Battery Charger, etc ...)
- If the voltage is greater than 55 V, check the battery pack connections (Warning: possible damage to the Solar Eclipse!)

- If the voltage is correct ($43 < V < 55$) disassemble the installer door, check the internal battery fuses on the right side of the power board inside the Solar Eclipse
- If the fuses are interrupted check the polarity of the connections and replace the fuses (3 fuses 10 A 6x 32 AT type)
- If the fuses are not interrupted contact P800SRL Technical Support

SOLAR ECLIPSE DOES NOT START (first led to the left flashing)

- Verify that Solar Eclipse is on (LEDs on)
- Check with Software Configurator the presence of voltage from the grid (230 V)
- Check the correct installation and wiring of the Power Meter (make sure that the cable does not get disturbed and use a "twisted" and shielded upper category cable)
- Check that the supply fuse is not interrupted (central LED must be fixed)
- Check with Software Configurator that the mains voltage is between 210 and 250 V and the network frequency between 49 and 51 Hz
- Check that there is no alarm in the "trend" table (battery thermal alarm, supply or charger)
- Check in the "Advanced" tab that there is no internal alarm or "battery fault". If present, click on "Reset Charge Fault"

SOLAR ECLIPSE DOES NOT CHARGE BATTERIES (zero charge power in charge)

- Verify that Solar Eclipse is "STARTED" (first left LED on)
- Connect to interface 485 and start Software Configurator
- Shut off loads
- Enable the green line "Grid Power" in the "Trend" tab and check for negative values < 100 W (line below zero)
- If the green line is above zero and the PV system is producing more than the consumption of the user, check the position of the network sensor (Power Meter)
- Verify that the "String Power" is greater than 100 W
- Verify that "String Voltage" with inverter operating is compatible with the number of modules set in the Software Configurator at configuration stage (see table 8. eg: 8 modules set to $30 \times 8 = 240$ V)
- Verify that the battery percentage is $< 90\%$
- If the "Batt. Charging" light turns green and "Battery Power" does not increase (positive values - red Line over Zero) Contact P800 SRL Technical Support

SOLAR ECLIPSE DOES NOT SUPPLY POWER (zero “Battery Power” on “Supply” mode)

- Verify that Solar Eclipse is "STARTED" (first left LED on)
- Connect to interface 485 and start Software Configurator
- Switch on user loads, possibly constant (resistances)
- Enable the green line "Grid Power" in the “Trend” tab and check for positive values > 100 W (line above zero)
- Se la linea verde sta sotto lo zero e l'impianto FV sta producendo meno di quello che consuma l'utenza verificare il posizionamento del sensore di rete (Power Meter)
- If the green line is below zero and the PV system is producing less than the consumption of the user, check the position of the network sensor (Power Meter)
- Verify that the percentage is > 2.5%
- Check that the "Full Charge" light is red (full charge is NOT active)
- Verify that “Battery Voltage” is > 45 (or the minimum value set in the free parameters)
- If the "Supply" light turns green and the battery power does not decrease (negative values - red line below zero) check:
 1. The grid inverter is connected to the grid
 2. The inverter is not in error or in a "countdown" phase
 3. The DC disconnectors are closed
 4. Any external fuses are NOT interrupted
 5. The Solar Eclipse internal fuse on the left side is NOT interrupted (central LED must be fixed)

5.12 Maintenance

Every 6 months, check the tightness of the DC connections. No special maintenance is required. If necessary, use a soft cloth to clean Solar Eclipse especially on the part of the heat exchanger. Never use liquids, acids and / or detergents.

6 TECHNICAL FEATURES

Input stage Photovoltaic Modules		
Input voltage	150 ~ 600 V c.c.	
Max input power	0 ~ 16 A c.c.	Note: it is possible to parallel two PV strings with Max 8A before the input port. It is suggested only if the inverter has only 1 mppt.
Output stage Inverter Grid		
Output voltage	150 ~ 600 V c.c.	
Supply output power	P string + 1500 w	Note: the maximum output power is equal to the string modules power plus 1500W (never greater than the inverter grid mppt input).
Storage battery output power	P string - 1500 w	Note: the minimum output power is equal to the string modules power minus 1500W (only with 300Ah battery fully discharged, otherwise the load power is less).
Battery pack		
Nominal voltage	48 V	
Capacity	25 ~ 550 Ah	
Load cycle voltage	35 ~ 62 V	programmable
Load current	0 ~ 30 A	Programmable (default C ₁₀) Ah battery/10
Battery pack fuses	30 A (3 x 10 A)	6 x 32 mm – 10 A – AT (retarded)
Supply fuse	10 A	6 x 32 mm – 10 A – FF (extrarapid)
General		
Logic	Network power sensor	Network power sensor (optional)
Communication ports	Seriale RS 485 Ethernet RJ45	Internal Web Server with DHCP
Weight	6 kg	Aluminium case
Dimension	339 x 256 x 141	H x L x P
Norms	CEI - EN	Directive 2006/95/CE Low Voltage Directive Directive 2004/108/CE Electromagnetic Compatibility Directive CEI EN62109-1:2010 CEI EN61000-6-2:2006 CEI EN61000-6-3:2007 CEI EN50581:2013
Certificazioni	CE - CEI	CEI 0-21 V1 year 2014 CEI 0-21 ed. year 2016
Protection	IP20	
Working temperature	-20°C ~ 50°C	Thanks to variable speed fans
Relative humidity	Max 95%	

Table 6 – Solar Eclipse datasheet

6.1 Default parameters

Solar Eclipse is already set by default to run with the following parameters:

- Batteries stationed flat plate Gel / AGM 48 V - (30% DoD)
- Capacity 100 Ah in ten hours (other capabilities selecting "dip switch") - 400 Ah
- 12 photovoltaic modules in series of 60 cells (string Voc about 450 V)
- Dynamic IP address (DHCP active)
- Charge/Discharge batteries in C10

Through the configurator software and USB / RS485 interface (or with browser) you can also select different types of batteries such as commercial, AGM flat plate, tubular type OPzV, OPzS, Aquion and Pylontech Lithium. The capacity is adjustable from 25 Ah to 200 Ah. For each of these types, standard charge cycle values are reset as shown in Table 7:

Parameters	Unità Misurata	Car and Commercial Lead	Flat Plate Lead AGM, Gel type	Tubular Plate Lead Gel Opzv type	Tubular Stationary Lead Opzs type	Aquion 	Lithium 
End-of-Charge Voltage	Volt	57,5	56,5	56,5	57,5	57,6	54,0
Holding Voltage	Volt	54,5	54,5	54,5	54,5	54,0	53,5
Power Limitation Threshold (Derating)	Volt	45,0	45,0	45,0	45,0	47,5	47,0
Low Voltage Protection Threshold	Volt	44,0	44,0	44,0	44,0	46,5	46,5
Deep discharge threshold Stand-by	Volt	46,0	46,0	46,0	46,0	48,5	47,5
Charge time	C*10	10	10	10	10	8	5
Discharge time	C*10	10	10	10	10	8	5
Dept of Discharge (Dod)	%	20	30	50	60	70	80
Equalization voltage	Volt	60,8	-	-	60,8	-	
Number of cycles		1000	1500	2500	2800	3750	5000
Battery stop temperature	°C°	45,0	45,0	45,0	45,0	45,0	45,0

Table 7 – Default parameters for generic batteries

6.2 Modules with a number of cells other than 60

In case the string to connect to Solar Eclipse is made up of modules different from the normal 60-cell modules, which have an open circuit voltage of about 37 V, it is equally possible to configure Solar Eclipse according to the following conversion table:

PV STRING MODULES	48 CELLS	60 CELLS	72 CELLS	96 CELLS
4	NO	NO	NO	6
5	NO	NO	6	8
6	NO	6	7	10
7	6	7	8	<i>(dip-switch)</i>
8	6	8	10	<i>(dip-switch)</i>
9	7	9	<i>(dip-switch)</i>	15
10	8	10	<i>(dip-switch)</i>	NO
11	9	11	<i>(dip-switch)</i>	NO
12	9	<i>(dip-switch)</i>	15	NO
13	10	<i>(dip-switch)</i>	16	NO
14	<i>(dip-switch)</i>	<i>(dip-switch)</i>	NO	NO
15	<i>(dip-switch)</i>	15	NO	NO
16	<i>(dip-switch)</i>	16	NO	NO
17	<i>(dip-switch)</i>	NO	NO	NO
18	15	NO	NO	NO

Table 8 – PV modules conversion table

If crossing the number of cells of the photovoltaic module used with the number of modules of the string connected to Solar Eclipse you find the word "dip-switch", this means that you do not need to use the advanced configuration procedure (with Software Configurator).

Otherwise, you must enter the corresponding number in the table into the "Parameters" tab of the Software Configurator.

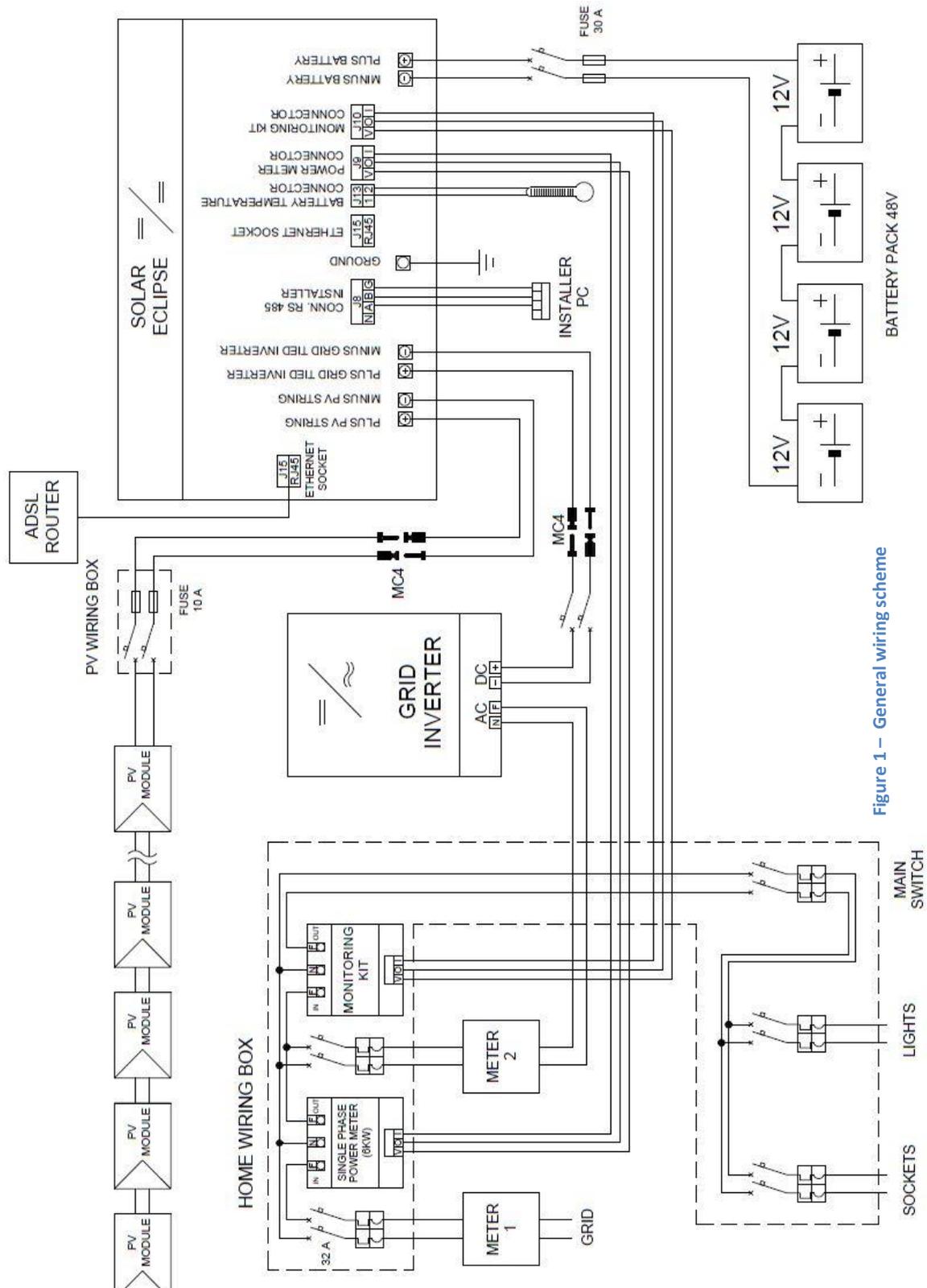


Figure 1 – General wiring scheme