ELECTRICAL INSTALLATION

A photovoltaic module behaves like a current generator (such as a battery) and therefore has a positive contact and a negative contact.

Normally, the module cannot supply an electrical device directly, due to the variability of the current which depends on the intensity of the sunlight. It is therefore standard practice to use the module to charge a battery, which then supplies current to the devices.

A battery may only be charged directly by the photovoltaic module if the voltage is exactly right for the chosen battery (e.g. 14V charge voltage for a 12V lead-acid battery). However, this set-up is at risk of overcharging and is inefficient. We therefore recommend the use of electronic charge controllers, which optimize the charging process. We strongly recommends using charge controllers with MPPT (Maximum Power Point Tracking), in order to exploit the maximum amount of energy possible.

The cables must be of sufficient cross-section to avoid significant voltage-drop. Always use specific cable for photovoltaic installations, resistant to atmospheric agents. The cross-section (wire size) must be chosen taking into account the cable length (distance of run X 2 because it is a loop), 3% Voltage drop, and max current. The following is what is recommended:

3% Voltage Drop at 12 Volts

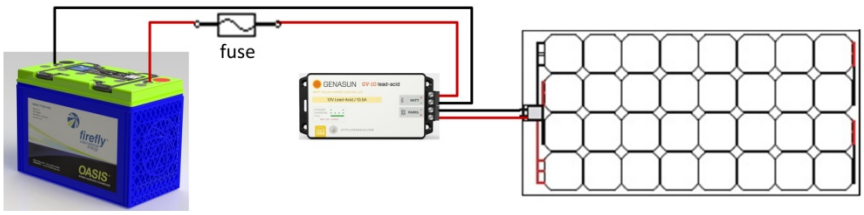
Length		Current (Amps) 5	10	15	20	25	30	40	50	60	70	80	90	100
10'	3 m	18	14	12	10	10	8	6	6	6	6	6	4	4
15'	5 m	16	12	10	10	8	8	6	6	4	4	4	2	2
20'	6 m	14	10	10	8	6	6	6	4	4	2	2	2	2
25'	8 m	12	10	8	6	6	6	4	4	2	2	2	1	1
30'	9 m	12	10	8	6	4	4	4	2	2	2	2	1	1
40'	12 m	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
50'	15 m	10	6	6	4	4	2	2	1	1/0	2/0	3/0	4/0	4/0
60'	18 m	10	6	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
70'	21 m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
80'	24 m	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0		
90'	27 m	8	4	2	2	1	1/0	2/0	3/0	4/0	4/0			
100'	30 m	6	4	2	2	1	1/0	2/0	3/0	4/0				
110'	33 m	6	4	2	2	1	1/0	2/0	3/0	4/0				
120'	36 m	6	4	2	1	1/0	2/0	3/0	4/0					
130'	40 m	6	2	2	1	1/0	2/0	3/0	4/0					
140'	43 m	6	2	2	1/0	2/0	3/0	4/0						
150'	46 m	6	2	1	1/0	2/0	3/0	4/0						
160'	49 m	6	2	1	1/0	2/0	3/0	4/0						
170'	52 m	6	2	1	2/0	3/0	3/0	4/0						

3% Voltage Drop at 24 Volts

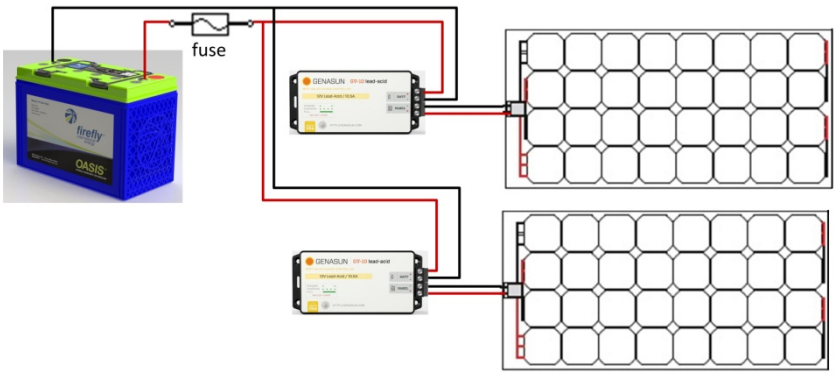
Length		Current (Amps) 5	10	15	20	25	30	40	50	60	70	80	90	100
10'	3 m	18	18	16	14	12	12	10	10	10	8	8	8	6
15'	5 m	18	16	14	12	12	10	10	8	8	6	6	6	6
20'	6 m	18	14	12	10	10	10	8	6	6	6	6	4	4
25'	8 m	16	12	12	10	10	8	6	6	6	4	4	4	4
30'	9 m	16	12	10	10	8	8	6	6	4	4	4	2	2
40'	12 m	14	10	10	8	6	6	6	4	4	2	2	2	2
50'	15 m	12	10	8	6	6	6	4	4	2	2	2	1	1
60'	18 m	12	10	8	6	6	4	4	2	2	1	1	1/0	1/0
70'	21 m	12	8	6	6	4	4	2	2	1	1	1/0	1/0	2/0
80'	24 m	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
90'	27 m	10	8	6	4	4	2	2	1	1/0	1/0	2/0	2/0	3/0
100'	30 m	10	6	6	4	4	2	2	1	1/0	2/0	2/0	3/0	3/0
110'	33 m	10	6	6	4	2	2	1	1/0	1/0	2/0	3/0	3/0	4/0
120'	36 m	10	6	4	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
130'	40 m	8	6	4	2	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
140'	43 m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
150'	46 m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	
160'	49 m	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	
170'	52 m	8	6	2	2	1	1	2/0	3/0	3/0	4/0	4/0		

EXAMPLES OF INSTALLATIONS

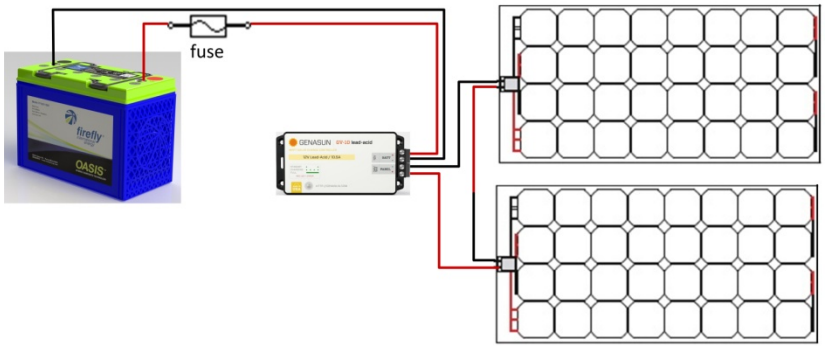
a) One single module with a charge controller, battery and load. The load can be supplied directly by the controller (when the model of controller allows) or by the battery. In this arrangement, the controller needs to be able to handle the full rated current and voltage of the panel. The cable to the battery needs to be able to handle the maximum current of the controller. The fuse needs to be sized for 1.5 X the max current of the controller.



b) With several modules, the best solution is to connect each one independently to a separate controller. The controllers can then be connected in parallel to the battery, as they are protected against reverse current. Each controller should be sized for the individual panel ratings. When the controllers are connected in parallel, the total current to the battery is the sum of each controller's max current. The size of the cable to the battery must be calculated by adding together the max currents of each controller and the fuse must be sized 1.5X the sum of the currents.

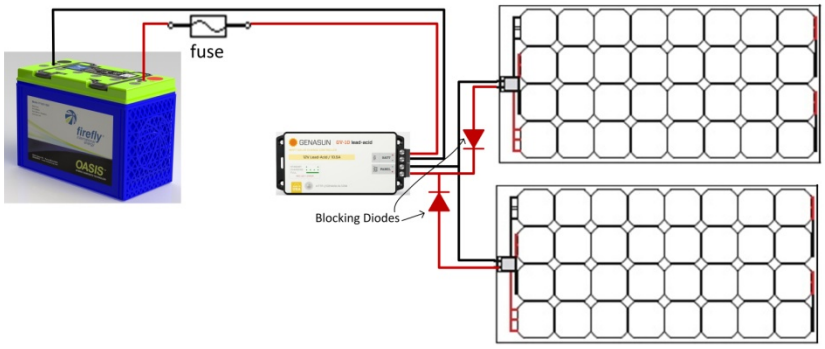


c) Multiple modules may be connected in series to a single controller. Only modules with the same current (i.e. same cell type) can be connected in series. The controller needs to be sized for the total of all panel voltages and the current rating of an individual panel. The cabling to the battery needs to be able to handle the rated current of the controller and the fuse should be sized for 1.5 X the max current of the controller. This arrangement should only be used when shading or partial shading is NOT an issue. If any portion of either panel is shaded, it will affect the performance of the entire array.



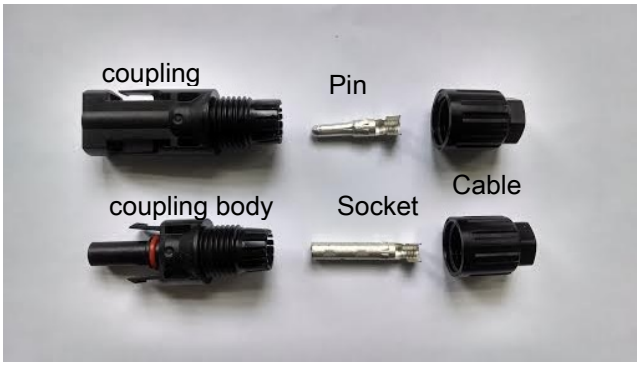
d) Multiple panels can be wired in parallel to a single controller. This should be done when shading is anticipated and where installing one controller per panel is not possible. Only panels of the

same voltage may be wired in parallel. In order to avoid wasted energy, overheating and even fires, **it is essential to use blocking diodes with parallel connections (see circuit diagram).** Expect .7 V drop across the diodes**.** In this case, the controller should be sized for the voltage of the panel and the max current of all panels combined. The cabling should be sized for the max current of the controller and the fuse should be rated for 1.5 X the max current of the controller.



The choice of charge controller depends on the configuration of the installation, the type of modules and the battery.

ASSEMBLY OF MC4 CONNECTORS



Note: The couplings supplied on Solbian solar panels are high quality industry standard MC 4 connectors. See above photo to properly match up the aluminium fitting with the appropriate coupling body. When making your connections, make sure that the positive side of the panel is connected to the positive side of the controller. ***In order to confirm the + and – cables from the panel, use a voltmeter. If the voltage reads positive, then the red side of your voltmeter is on the positive cable. If your voltmeter reads negative, then the red side of your voltmeter is on the negative cable.***

1. Unscrew cable clamp from Coupling body. Inside the “teeth” on the cable side of the coupling body you should see a black rubber gland. In most cases this will be set into the teeth when you receive it. If it is separate, as shown below, set it into the coupling body inside the teeth.

2. Strip end of cable approx. ¼” and mate it with the winged end of the pin or socket. Squeeze wings of Pin or Socket down to restrain the portion of wire that has been stripped. Then solder where the wings of the pin pinch the bare wire. Note: The insulation should not be inside the wings of the pin but should come fairly close to the wings.
3. Slide Cable Clamp over cable then push Pin or Socket into respective Coupling until it clicks into place. Pull on wire to confirm correct engagement.
4. Tighten Cable Clamp on to Connector body.