Semi-flexible solar panel installation manual

Monocrystalline

English Language inside

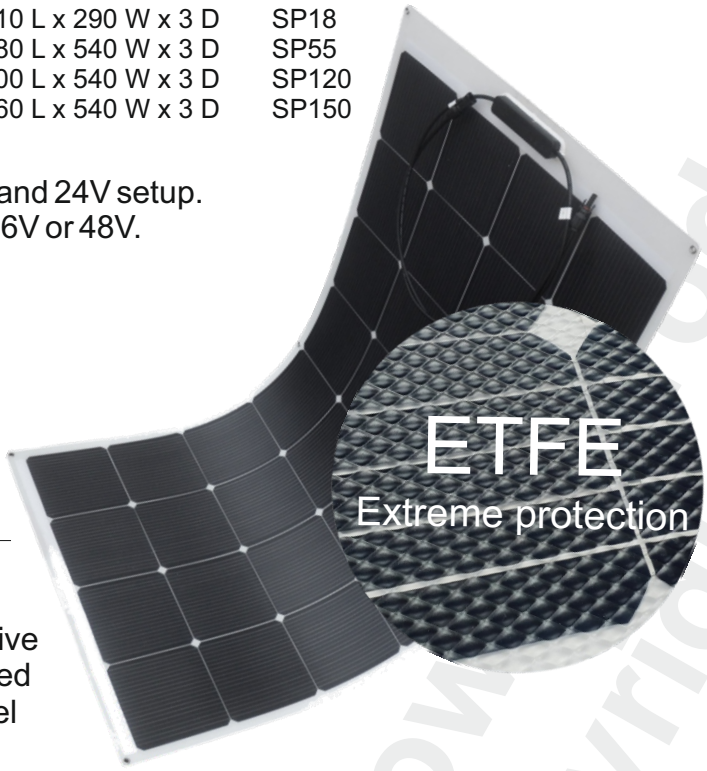
For European languages refer to website:
Europe / RoW: **www.sterling-power.com**
North America: **www.sterling-power.usa.com**

Panel information

Power	V max	Size mm	Part No.
18W	17.5	410 L x 290 W x 3 D	SP18
55W	17.5	580 L x 540 W x 3 D	SP55
120W	17.5	1200 L x 540 W x 3 D	SP120
150W	17.5	1460 L x 540 W x 3 D	SP150

Suitable for 12V and 24V setup.
Not suitable for 36V or 48V.

MC-4
30A (1000V)
Waterproof
Terminations



Non Corrosive
UV Protected
Back Panel

Solar regulators:
Recommend Sterling Solar regulators PWM and MPPT range.
PWM10 for a 10A
MPPT30 for a 30A

Handling and Fitting

Thank you for purchasing this product. The following guidelines apply only to Sterling semi-flexible solar panels with ETFE coating and back-contact solar cells.

Any work should follow the required safety standards and applicable regulations. The product should be handled and installed by professionals or appropriately qualified persons. Suitable precautions and safety measures should be taken in all cases.

On Delivery
Please remember to examine the condition of the box(es) containing the solar panel(s) immediately upon delivery. If you notice that the package has incurred any form of damage; i.e. it is deformed, punctured, torn, stained etc... You must sign for the delivery as “damaged”. This will be essential to the post-incident investigation with the courier, in the case that the contents of the box are also damaged.

Place the box containing the solar panel on a flat level surface, and open it carefully, without removing the solar panel from the foam packaging. Examine the surface of the solar panel and the condition of each black solar cell for any signs of damage (creases or cracks in the solar cell). Keep the solar panel flat in the packaging while performing this visual inspection.
Do not put any pressure on the solar panel (i.e. do not press down on the solar panel with your hands when checking for damage). Slight discolouration of solar cells or remnants of glue on top of the surface are permissible and are not classed as damage. Neither of these factors will affect the performance of the solar panel.

Visual check: If you detect any cracks in the solar cells or creases in the plastic surface coating, along with corresponding damage to the carton box, please contact your supplier immediately with photographic evidence for assessment.
Before removing the solar panel from its packaging, please check the dimensions and confirm that the solar panel fits in the required space.
Voltage check: Using a conventional voltmeter in any sort of day light conditions (inside lighting not good enough for this test). Insert the voltmeter probes into the ends of the connectors and confirm a voltage of about 16V+ across the terminals (for the 50-150W panels the smaller panel may only show about 14V+). Please ensure the negative and positive polarity is correct.
Do not waste time and effort if there is any damage to the panel or the electrical signal is not correct. We cannot take back panels which have been glued down as it would be hard to remove them without damage to the panel.

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Legal and Safety

Using the Instruction Manual

This manual must be read throughout before installing this electronic device. Do not lose these instructions - keep them safe. The most up to date instructions can be found on the Sterling Power website. Please refer to the latest instruction manual before contacting Sterling. At Sterling, we endeavour to include all of the product information that we can think of into the manual.

Installation of the electronic device must be carried out by a qualified and trained personnel only. The personnel must be familiar with the locally accepted guidelines and safety measures.

Sterling Power's warranty statement

A comprehensive warranty statement is provide at the back of the instruction manual. A comprehensive warranty statement can also be found on sterling-power.com.

Copyright and plagiarism

Liability

Sterling Power can not accept liability for:
- consequential damage due to use of this device
- possible errors in the manuals and the results thereof

Device modification

Please do not modify the device unless you have been instructed to do so by Sterling Power, directly. Product modification shall be done at Sterling, when needed. Warranty shall be voided if personal attempts are made to modify the device, without Sterling's approval.

Use the solar panels only:
- For solar power conversion.
- With fuses protecting the DC cables.
- With a suitable solar regulator.
- When instruction manual has been read through.

Safety Symbols

- **Example - WARNING. Never use the device in situations where there is danger of gas / dust EXPLOSION or potentially flammable products.**

General maintenance and repair

The device must be switched off during maintenance. It must also be protected against unexpected switching off. Remove battery connections and ensure unit is off. If repair is required, only use original parts.

General safety and installation precautions

- Always use a solar regulator, do NOT fit directly onto the battery.
- Device connects to common negative. Common negative must be earthed.
- In case of fire use a fire extinguisher.
- Ensure reverse polarity and short circuiting is avoided - to prevent damage to battery.
- Protect DC wires with the appropriate sized fuse.
- Check cabling annually- fix where needed.
- Avoid contact with device with damp hands.
- Ensure the device is adequately and securely mounted to prevent the unit from displacement.
- Use a professional to install device.

Battery safety

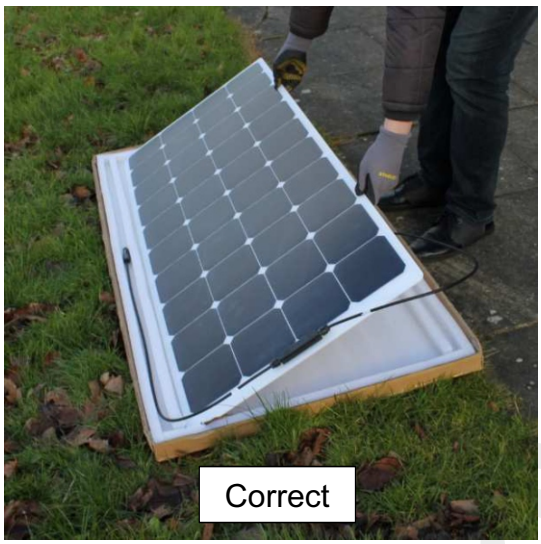
Excessive charge or discharge and high voltages can cause serious damage to batteries. Never exceed the recommended limits. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye(s), immediately flood the eye(s) with running cold water for 20 minutes and seek medical attention.

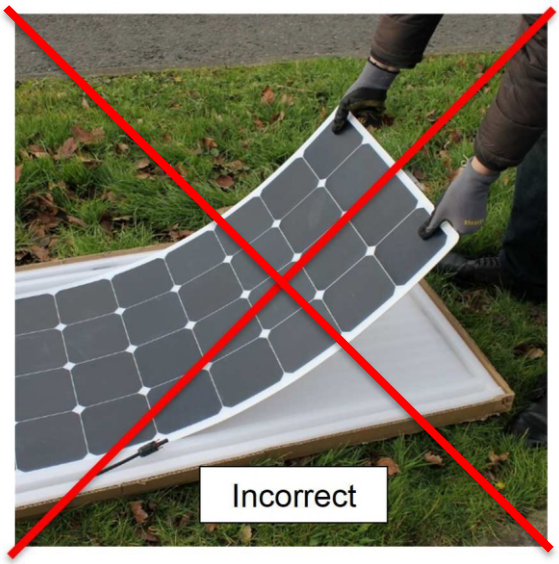
Give extra care to not drop metal tools or jewellery on to the battery terminals as short circuiting can take place.
Refrain from charging battery up to 4 hours prior of installation to avoid the formation of explosive gases.

Never smoke / generate a spark around batteries.

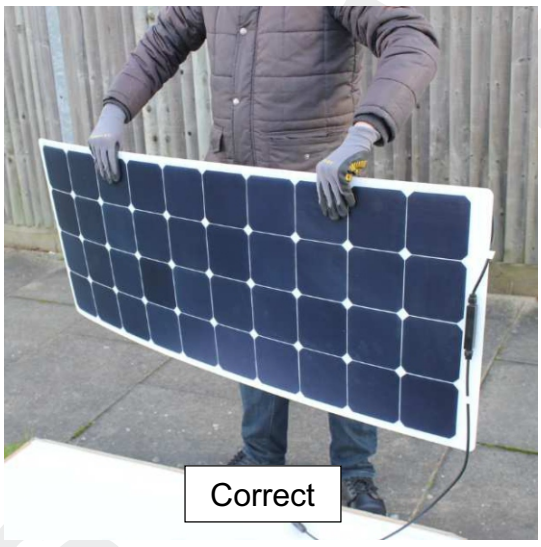
Manhandling advice

This product must be handled with care at all times. Detailed guidance on handling is provided below.
Even though this solar panel is semi-flexible, it is designed to be bent only once: upon permanent mounting to a curved surface. It is not designed to be repeatedly flexed (for example, it cannot withstand constant movement in the wind like a sail). It should not be suspended in the air; it must be fixed to a rigid surface.
• Do NOT bend the solar panels unnecessarily. When gripping the solar panel, ensure that your fingers do not cause any local stress or curving of the material.
• Do NOT step on the solar panel or put any pressure on it until it is securely mounted on to a rigid surface. No pressure should be applied if there is any void space underneath the solar panel.
• Do NOT rest the solar panel on any of its corners or edges as this will cause the panel to bend under its own weight.
• Do NOT apply unnecessary force to the solar panel (i.e.do not throw it or mishandle it in any way, even if it is still packaged).
• Do NOT puncture the solar panel.
• Do NOT lean the solar panel on sharp or angular objects.
• Do NOT use the junction box or the connection cable as a handle.
• Do NOT stack the solar panels once they have been removed from their original foam and cardboard packaging (the sharp edges of the junction box may damage the front surface of another module).
• Do NOT install or handle the solar panels in windy weather.
Keep the solar panel as straight as possible at all times until it is installed in place.
When removing the solar panel from the box, always grip the longer edge of the solar panel. Lift the panel upwards, keeping it constantly flat (as if handling a sheet of plywood): and lift it upwards without bending:

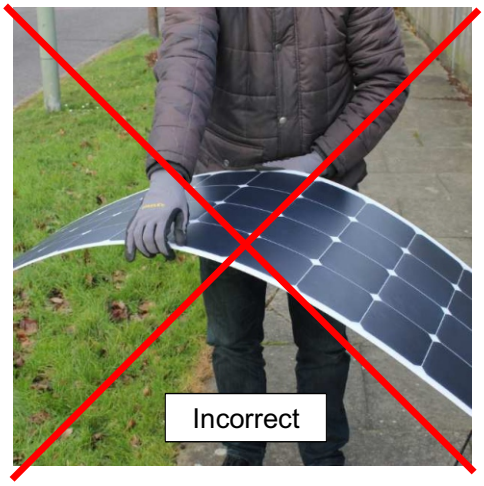


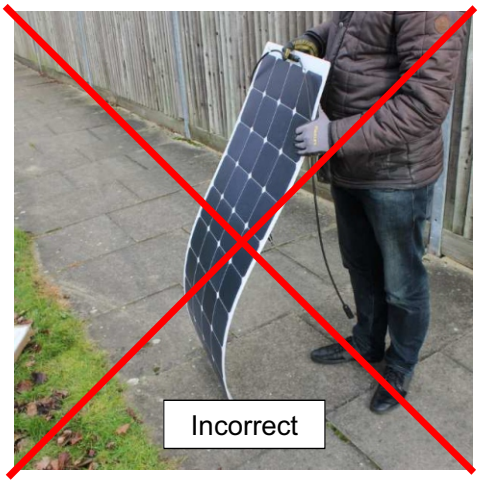


To carry the solar panel safely, always ensure that the solar panel is perpendicular to the ground and remains unbent in your hands. The best way to do this is to hold the solar panel along the long edge (keeping this edge in a straight line), allowing the solar panel to straighten itself naturally, as shown in the photos below. Do not carry the solar panel in a horizontally oriented plane (parallel to the ground) as this may cause the panel to bend under its own weight and become damaged. Do not rest the solar panel on the ground so that it begins to bend. Do not handle or install the solar panel in windy weather.

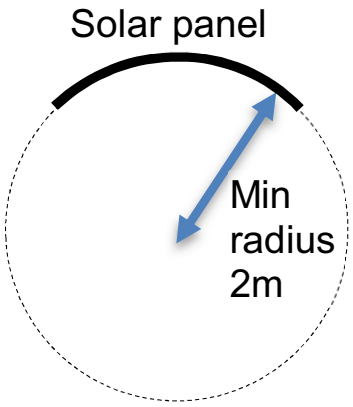


Manhandling advice



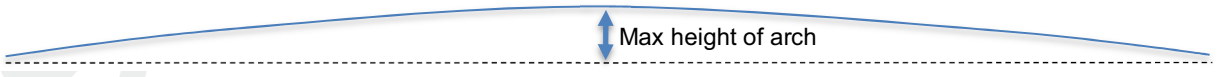


Never attempt to test the “local flexibility” of the solar panel by bending the material of the solar panel near the edges or in the corners. This can easily cause solar cell cracks. When handling or installing the solar panel, ensure that your grip does not pinch the solar panel in such a way that causes the panel to bend.



Maximum curvature

This solar panel is semi-flexible; which means that it can be curved to a certain degree, but cannot be rolled up nor folded.
The maximum allowed curvature for this solar panel corresponds with the minimum bending radius of 2000 mm. In other words, once curved, the solar panel must follow part of a hypothetical circle with a radius of at least 2m. This implies that the solar panel curve will be distributed uniformly across the full length of the solar panel (avoiding “sharp” bending angles or corners). In practice, the minimum radius rule translates into the following requirement: when the solar panel is mounted on a curved surface, there is a maximum arch height that the installation must not exceed (when measured against a straight horizontal line).



The maximum height of the arch of a bent solar panel will depend on the length of the solar panel. The table below provides some examples.

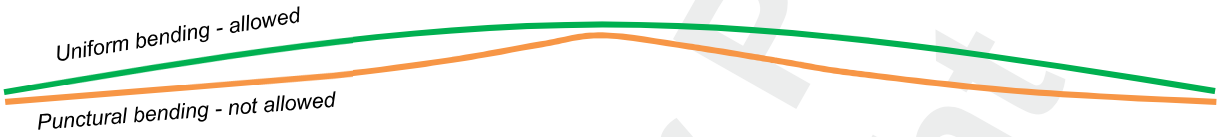
See table on next page

Installing

Length of the panel (cm / ft)	Maximum height / arc (cm / ft)
50 cm / 1.6 ft	16 mm / 0.6 in
80 cm / 2.6 ft	40 mm / 1.6 in
100 cm / 3.3 ft	62 mm / 2.4 in
120 cm / 3.9 ft	89 mm / 3.5 in
140 cm / 4.6 ft	121 mm / 4.8 in
150 cm / 4.9 ft	139 mm / 5.5 in
170 cm / 5.6 ft	178 mm / 7.0 in
200 cm / 6.6 ft	245 mm / 9.6 in

Excessive bending must be avoided when handling or installing the solar panels. The maximum arch height examples provided above are for the one-time bend of the solar panel, upon permanent mounting onto a curved surface. Do not mount the solar panel on any surface which may alter the solar panel curvature (i.e. surfaces which are insufficiently rigid).

Important! The surface curvature must be distributed uniformly across the entire length of the solar panel. Puncture bending may cause permanent damage to the solar cells.



Fitting to the surface
Whilst fitting the solar panel, the installer must adhere to the appropriate safety guidelines at all times, including those for safety at work, electrical installation and equipment usage, and construction, along with all other regional and national legislation.

Installing

The solar panel can be installed in a landscape or portrait orientation, and fixed in place by gluing, screwing or rivetting.

The mounting surface for the solar panel should be smooth and even. If the surface is uneven, it must be suitably prepared prior to installation, with all gaps being filled in For example, spaces between ridges on a vehicle roof must first be filled in before the solar panel is mounted.

In case of bonding the solar panel, always ensure that your chosen adhesive forms a good bond with both the solar panel and the substrate surface.

Before applying any adhesive to the underside of the solar panel, place the panel gently on a non-abrasive flat surface which will not cause any damage to the front side of the solar panel (e.g. its original carton box or foam packaging). Keep the solar panel as straight as possible whilst doing this (handle the solar panel like a sheet of plywood).

Gluing

Handling and Fitting Manual for semi-flexible solar panels EFLX series
Installation and fitting off these panels
there are various methods for fitting these panels each have pros and cons, you need to select you ideal choice,
Please note always check the panel is working before fixing it to the vehicle (measure the voltage off the panel in daylight and it should be about 17 V dc), as we cannot be responsible for panels fitted which do not work, especially if glued as is correctly glued there is little to no chance off removing them without major damage

Gluing with double-sided tape :

We recommend an industrial grade porous ("foam") tape for this application. Applying the tape across the entirety of the underside of the solar panel will improve the bond quality.

When gluing with double-sided tape:

• Apply the tape onto the solar panel first, by "unrolling" it on the solar panel. Use a soft cloth or a roller to gently apply pressure onto the tape (protective film side) to dispel all air from between the tape and the solar panel. Take care not to force the solar panel to bend underneath.
• If the length / width of the tape exceeds the solar panel, cut the tape carefully around the edges of the solar panel.
• Remove the protective film and stick the solar panel down on a clean and dry surface, keeping the solar panel as straight as possible up until the final moment when it takes the curved shape of the mounting surface. While sticking it down, gently apply pressure on the solar panel with a soft cloth or a roller to ensure that no air is trapped underneath the solar panel (2 people are recommended for the installation).
• Observe the required application temperature for the double-sided tape and the time for the glue to dry.

Warning! Double-sided adhesive tape forms a very strong immediate bond with the contact material and does not allow for repositioning. Attempting to remove the solar panel, even if only partially attached, can seriously damage the solar cells.

Gluing with adhesive :

Your chosen adhesive should be suitable for both the solar panel and the mounting surface. It should also be designed for outdoor applications (with a wide temperature range, UV light protection etc). Pay attention to the application temperature and drying time requirements.

The mounting surface must be even, clean (use a degreasing agent) and dry. The installation must be carried out with care and precision, as this permanent method does not allow for repositioning.

All adhesives have different requirements , some need air to harden (and as such need a spacer to be used) some do not , its important to read the instructions off your particular adhesive to ensure the bonding is achieved , failure to do this job right the panels could be dislodged from the vehicle at speed and cause a accident , where as gluing the panel is the neatest job , however once glued the panel will not be able to be removed.
For ribbed roofed vehicles once the panel has been glued to the higher ridges its important to run some sealer along the windward direction to fill in the troughs to prevent any wind pressure getting under the panels and causing a air pressure under the panel,

Warning! Although preparing the roof surface for better adhesion is permitted (if required, e.g. by removing the old paint, grinding, using a primer etc), you must not use any sand paper or other sharp or abrasive tools on the underside of the solar panel.

The below advice is not the case for all adhesives, its just some warnings, its off upmost importance that the instructions on the glue you chose to use are rigidity adhered too , and the correct pre cleaning agents are used for that glue

One of the most important things to bear in mind when gluing the solar panel using adhesive is to ensure that there are no pockets of trapped air underneath the solar panel, i.e. no void spaces with air that are sealed all the way around with adhesive. If you leave trapped air under the solar panel (no matter whether it is between beads of adhesive or in various slots and holes of the uneven roof surface), such air will inevitably warm up when the solar panel is receiving good sunlight. When the air gets hot, it will significantly expand in volume, causing upward pressure to the solar panel surface and possible bulging of the solar panel during hot weather. This can result in permanent damage to the solar cells.

Even a small amount of trapped air can result in premature reduction in solar panel output, or a complete failure of the solar panel, due to the constant warming and cooling of the air each day and night, which increases surface tension and stretches the surface material. This may also contribute to the development of dry solder joints between the solar cells.

To illustrate the danger of trapped air underneath the solar panel, the following picture shows an incorrect solar panel installation on a ridged van roof, where the spaces between the ridges were not filled in prior to the installation. The edges of the solar panels were mistakenly sealed; trapping air under the solar panel. In hot sunny weather, the pressure of the hot air in gaps between the ridges increased so much that the solar panels bulged, cracking the solar cells and causing permanent failure of the panels.

Bolt through the panels,
there are pre made holes in the panels to simply bolt the panels to the roof

Additional Gluing advice

To avoid these problems, there are two main mounting options:

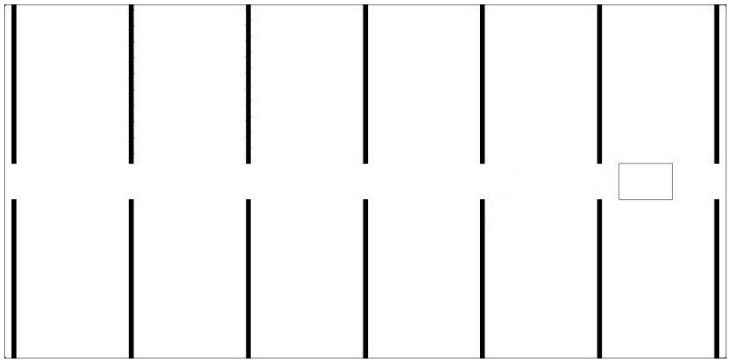
1) Cover the entire underside of the solar panel with a layer of adhesive, spreading it evenly with a trowel or a similar tool.

2) Apply the adhesive to the underside of the solar panel in parallel beads and do not seal the edges of the solar panel. This will make the solar panel breathable.

The second option is recommended, as it is also good for temperature expansion / contraction of the mounting surface material itself (particularly common in metal roofs).

Apply thick 10-12mm adhesive beads on the rear of the solar panel, in parallel to each other, as shown in the diagram below:

If your solar panel width (and the length of each adhesive line) is greater than 600 mm, break the adhesive lines in the middle of the solar panel with a gap of at least 100 mm to allow for additional escape routes for air and rain water.



The adhesive lines can be as close to each other as required (the number of lines depends on the strength of your chosen adhesive). A minimum gap of at least 70 mm between lines is recommended so that when the solar panel is placed on the mounting surface and the adhesive lines widen under pressure, they do not join to form closed pockets of trapped air. In general, for most plastic / fibreglass / metal surfaces and a good quality adhesive, a gap of 100 - 150 mm between parallel adhesive beads would form a strong bond.
Surface preparation of both the panel and the vehicle roof is of the upmost importance to ensure the roof and panel are extremely clean, wax / grease free, dry and there are no raised surfaces. Also, after the main clean is complete, the bonding area should be well cleaned with an alcohol based solvent. Cleaner is used on both the roof surface and the panel surface. Make sure all product labels and information stickers are removed from the back of the panel. A clean, flat, grease free, dry surface must be achieved. Failure to achieve this could result in the panel coming off at high speed.

Note bonding / gluing the panel on is regarded as a permanent installation. There is no way the panel can be removed after installing without catastrophic damage to the panel. For non permanent installation please use rivets or the bolt holes supplied with the panel.

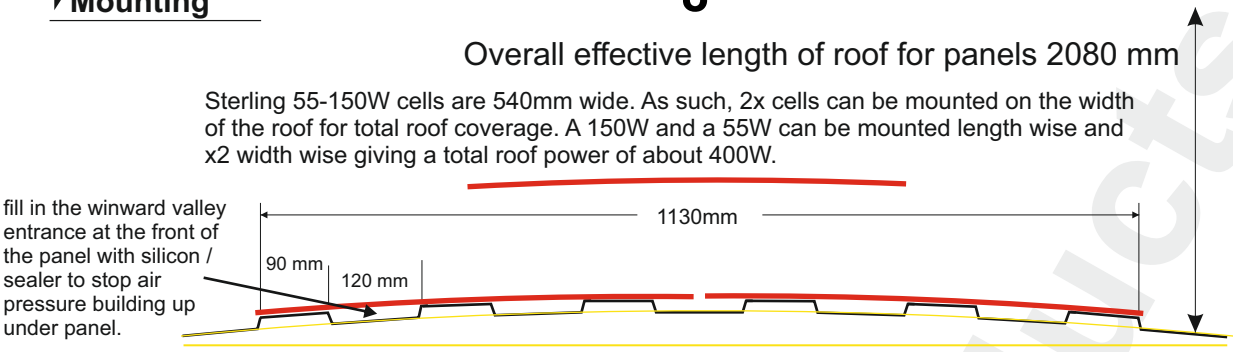
To fasten the glued solar panel to the mounting surface:

- It is recommended to use two people, particularly for large solar panels.
- Minimise bending of the solar panel when attaching it to the surface, keeping it as straight as possible.
- When pressing down the solar panel to the mounting surface, we recommend using a cotton cloth or a hand-roller to evenly distribute the compacting pressure.
- If not using a cloth or roller, use a flat hand to distribute the pressure (no point load) and press the solar panel gently in a wiping motion.

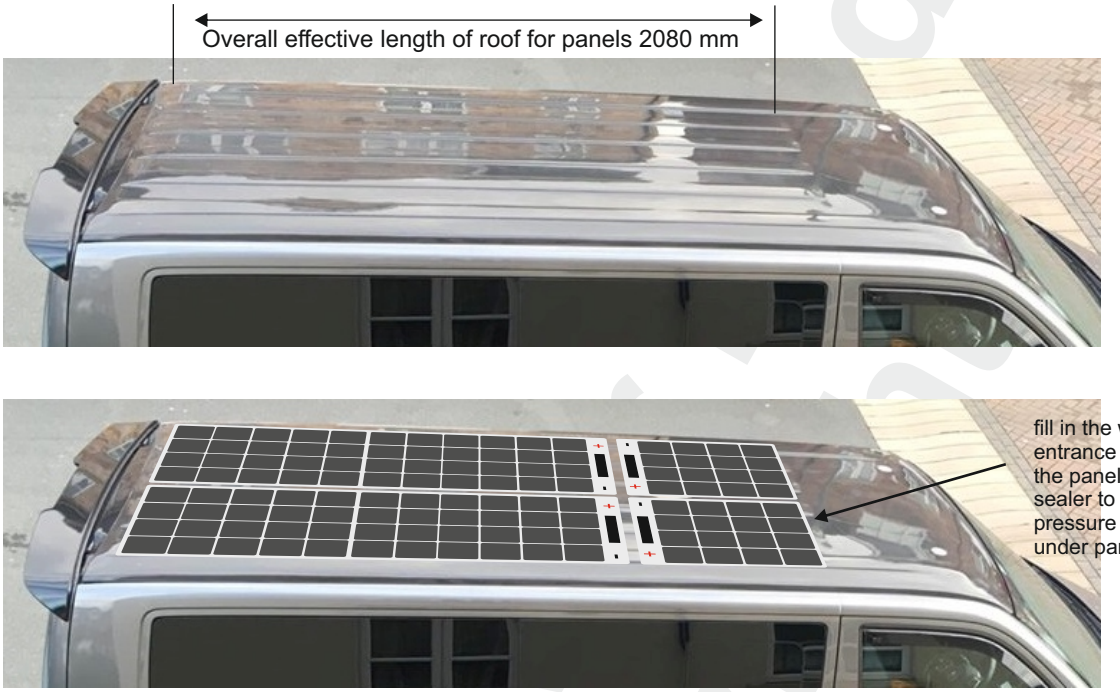
Warning:

Preparation of the vehicle and panel surface is extremely important when installing these panels. Only a professional installer with product good knowledge should be used. Failure to bond correctly would result in the panels detaching under high speed conditions and could cause a fatal accident.
Always use the correct cleaning and pre fit solutions recommenced by the glue manufacture

Sikaflex-252 is a good example of an adhesive we would recommend



Typical ridged roof on VW T6, Arc of roof exaggerated for effect



Important! For difficult shaped rooves, where a rebounding motion of the solar panel is likely, use other means to secure the solar panel in place while the adhesive dries. This may involve using weights (distributed evenly across the solar panel) or tape. If you decide to use tape, ensure that no residual glue is left on the solar panel surface after you remove the tape.

After bonding with adhesive, do not seal the edges of the solar panel. The solar panel must be kept breathable underneath to allow any air to escape.

If multiple solar panels are mounted on the same surface, or if the edges of the solar panel are close to other objects (such as a roof skylight), leave a gap between the solar panels (or between the solar panel and nearby objects) of at least 2mm to compensate for the linear expansion of material under different temperatures.

Important! If mounting a solar panel on a non-horizontal façade or a difficult mounting surface (e.g. glass, wood, concrete, brick, canvas etc.) the instructions provided above are not applicable. Please seek special guidance for installations of this nature.

Drilling, screwing and riveting

Mounting by self-tapping screws or securing the solar panel with fasteners via mounting holes are both good methods of fitting the solar panel which help eliminate the risk of trapped sealed air under the solar panel. To secure a solar panel using one of these methods:

• Mounting holes can be drilled into the corners of the solar panel and along the long edges in gaps between the solar cells corners.
• Holes should be positioned at least 8 mm away from the solar cells.
• Holes should be sealed with an adhesive after mounting to avoid the risk of future delimitation of the solar panel material.

Mounting with Velcro tape

Fitting the solar panel using strips of Velcro tape helps avoid the risk of trapped sealed air underneath the solar panel. However, this method is not recommended for vehicles and speedboats due to the wind drag which might force the solar panel to detach.

Once the solar panel has been mounted with Velcro tape, it should be treated as a permanent installation. Attempting to remove the solar panel, particularly if a large part of or the entire back surface is covered with Velcro, can seriously damage the solar panel.

Electrical connection

Warning! This product generates electrical current when the front side is exposed to light. Even if the voltage and current from a single solar panel is low, multiple solar panel connected in the same circuit can have a much greater voltage and current. Touching the terminals or wiring may cause an electric shock or burns. To avoid risks, fit an isolator switch for solar panels or cover them during the installation.

When connecting the solar panel(s) to a solar charge controller, remember that most solar charge controllers require a battery connection first, so that they can detect the battery voltage and condition - before they start taking power from the solar panel. The solar panel(s) should be connected to the solar charge controller after the battery connection has been made live.

Always observe general safety standards, specifications and manuals of the connected equipment, as well as the installation advice below:

• Do not use different types or sizes of solar panels in the same system, unless your installation has been pre-approved by your supplier or another qualified person.
• Do not modify the electrical connections of the solar panels. In particular, do not open or remove the junction box.
• Do not cut or pierce the solar panels, as this may cause live components to become exposed and/or damaged.
• Any installation or maintenance of solar panels must take place in dry weather on dry surfaces.

Maintenance advice

• Use tools with insulated grips only.
• Do not use damaged solar panels (including damages received in transit or during the installation).
• Do not apply any protection covers, coating, paint or varnish to the solar panels.
• Do not drop heavy or sharp items onto the solar panels.
• Do not concentrate sunlight (e.g. from mirrors or lenses) or other sources of artificial light on the solar panels.
• Do not install solar panels in locations where they may be submerged in water for lengthy periods.

Keep the maximum system voltage that can flow through your semi-flexible solar panel(s) to a minimum. In a solar system with multiple semi-flexible solar panels, the preferred method of connection is in parallel (rather than in series). It is recommended that no more than 2 semi-flexible solar panels are connected in series in a single string. Also, the maximum open circuit voltage should be kept within 50V per string, with multiple strings of the same power and voltage connected in parallel.

In addition, if your system includes multiple semi-flexible solar panels, for any parallel connection either of individual solar panels or strings of panels, fit suitable blocking diodes to ensure that the system delivers the highest output in any shading conditions. For a single solar panel system connected via a solar charge controller, a blocking diode is typically not required.

When installing the solar panel, always check that the cabling is not under stress. Do not bend the solar cables below the minimum bending radius of 40 mm. Ensure that the cables are not tight or stretched when mounting the solar panel.

Cleaning and care

Due to the special ETFE surface of these solar panels, dirt and grime will usually be washed away by the rain. Nevertheless, if the solar panel is fully or partially shaded by dirt or debris, this must be cleaned to prevent loss of performance.

Clean the front side of the solar panel gently using a soft cloth (dry or moist, with lukewarm water). Do not use brushes, scrapers, metal tools, or any high-pressure water tools. Do not use any cleaning substances and do not allow contact of the surface of the solar panel with any chemicals.

If the solar panel has been used in marine conditions and the surface is covered in sea salt, remove the buildup very carefully, ensuring that the salt crystals do not scratch the solar panel surface.

In areas with low winter temperatures, remove any snow and ice without force (e.g. with a very soft broom) in order to avoid damage to the protective layer of the solar panel.

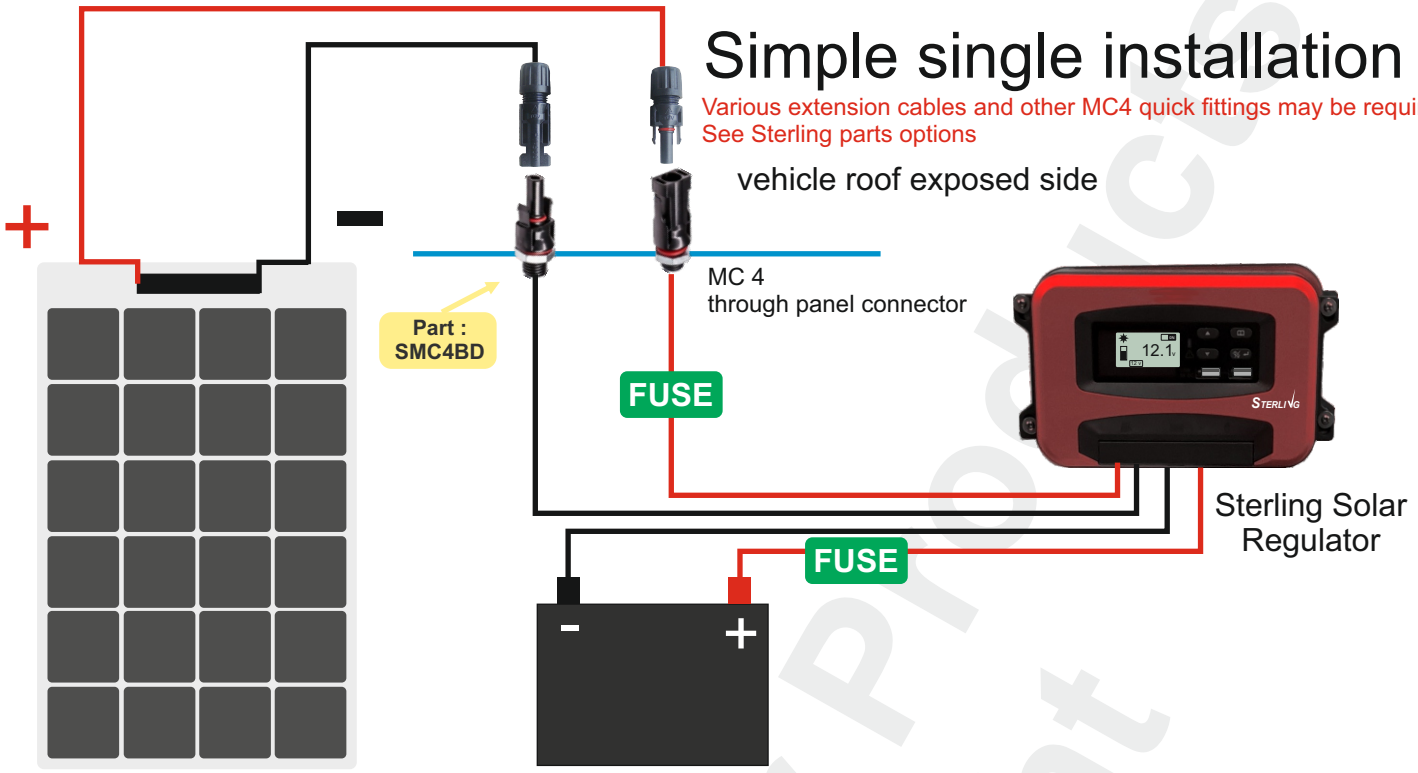
Inspect the solar panels regularly after first installation. Putting a little upward force on the leading edges to see if there is any sign of the panel de-bonding. At least once a year check all connections and fixings are tight and corrosion free. Examine the solar cells to confirm that they are not cracked or damaged.

Solar installation electrical :
the Sterling solar cells are what are known as 12V cells, however, their true voltage is between 6V and 21V. To charge a battery you must go via a controller / solar regulator to correctly regulate the voltage exposed to the battery. Solar cells should not be used by themselves direct to a battery, without a solar regulator. They will eventually increase the battery voltage, so high, it will destroy the battery. So, if a solar regulator or battery is not used the solar cell at night will become a heating element and discharge your battery as heat. Basically, only use solar cells in conjunction with a solar regulator or a diode.

Voltages, as already stated up to about 21V. For smaller installations (most vehicle installations) 12V is the most common. However, for larger installation especially when using MC 4 connectors then, once you exceed 30A it may be worth looking at putting the cells in series to make 24V as 2x the power can be efficiently transmitted down the connectors. A special multi voltage regulator must be used to permit this type of installation. The new Sterling supreme range will have a 12V / 24V / 36V / 48V input and a 12V / 24V / 36V / 48V output ability. (**Sterling flexible solar cells can only be used up to a 24V installation**).

Simple single installation

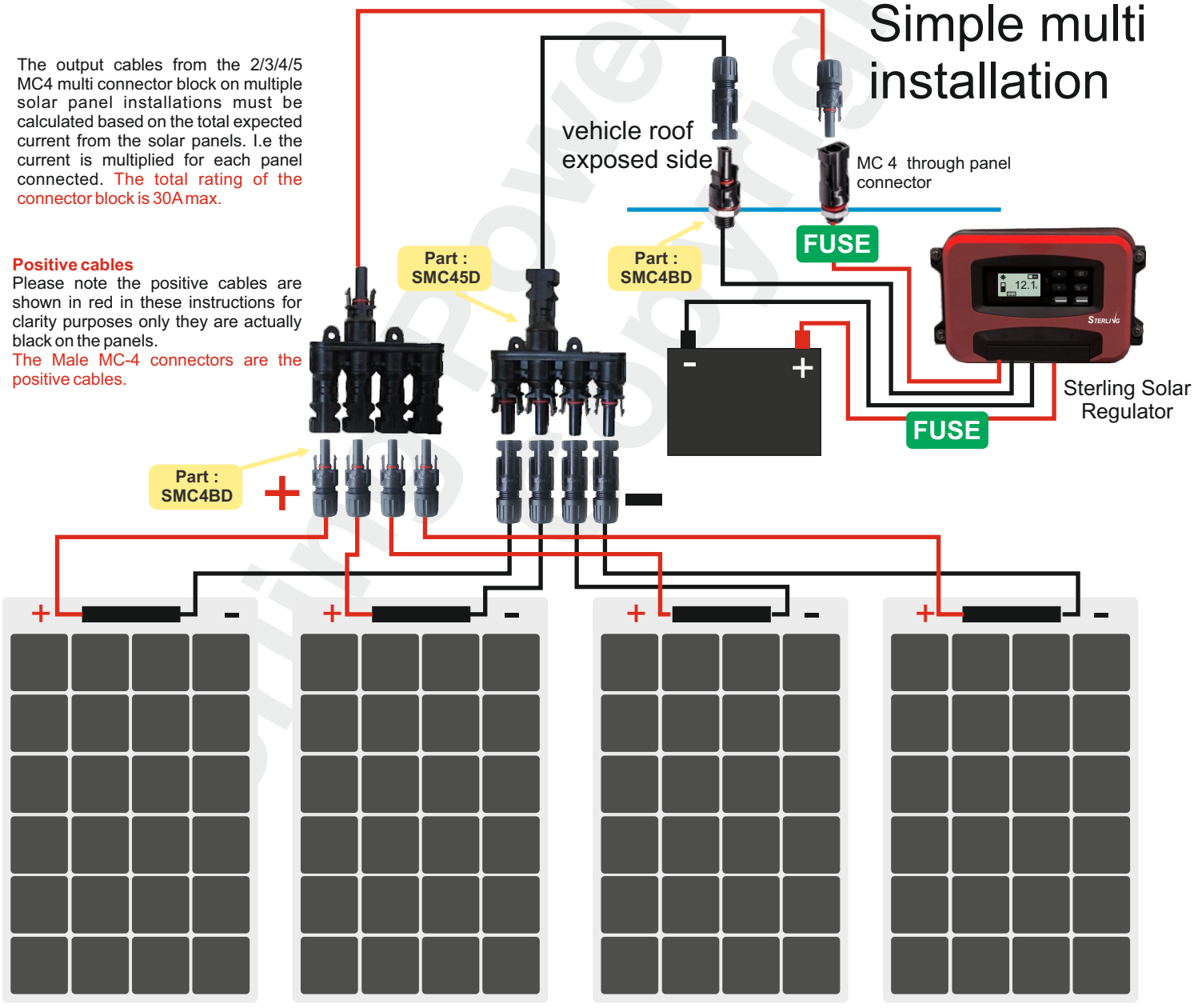
Various extension cables and other MC4 quick fittings may be required
See Sterling parts options



Simple multi installation

The output cables from the 2/3/4/5 MC4 multi connector block on multiple solar panel installations must be calculated based on the total expected current from the solar panels. I.e the current is multiplied for each panel connected. The total rating of the connector block is 30A max.

Positive cables
Please note the positive cables are shown in red in these instructions for clarity purposes only they are actually black on the panels.
The Male MC-4 connectors are the positive cables.



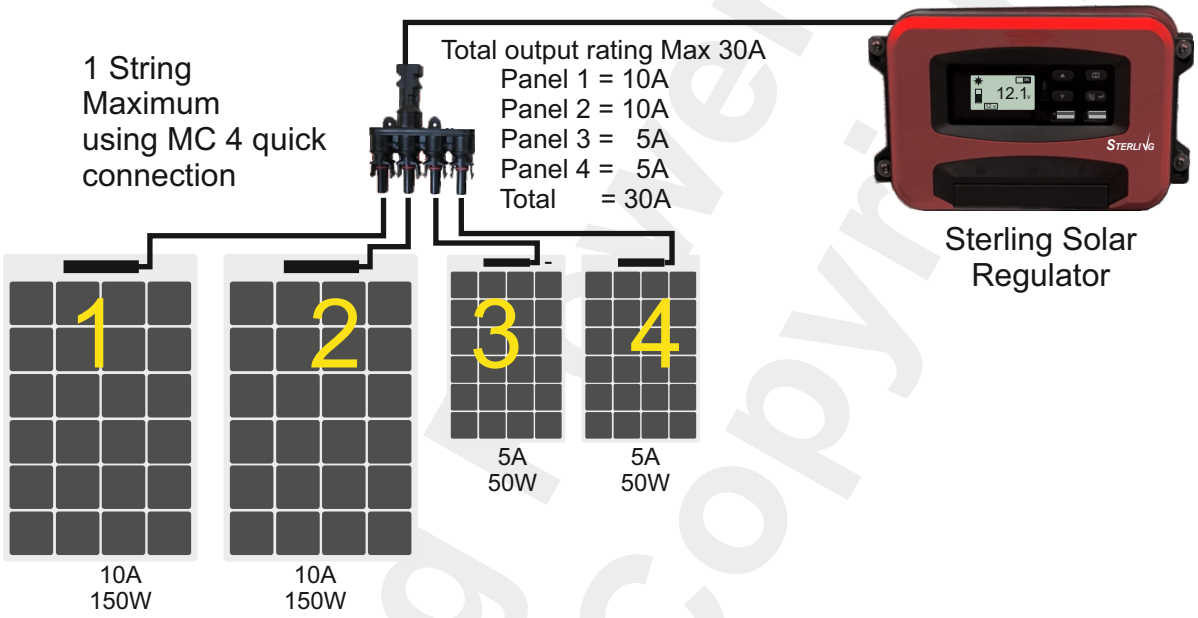
Additional Wiring examples

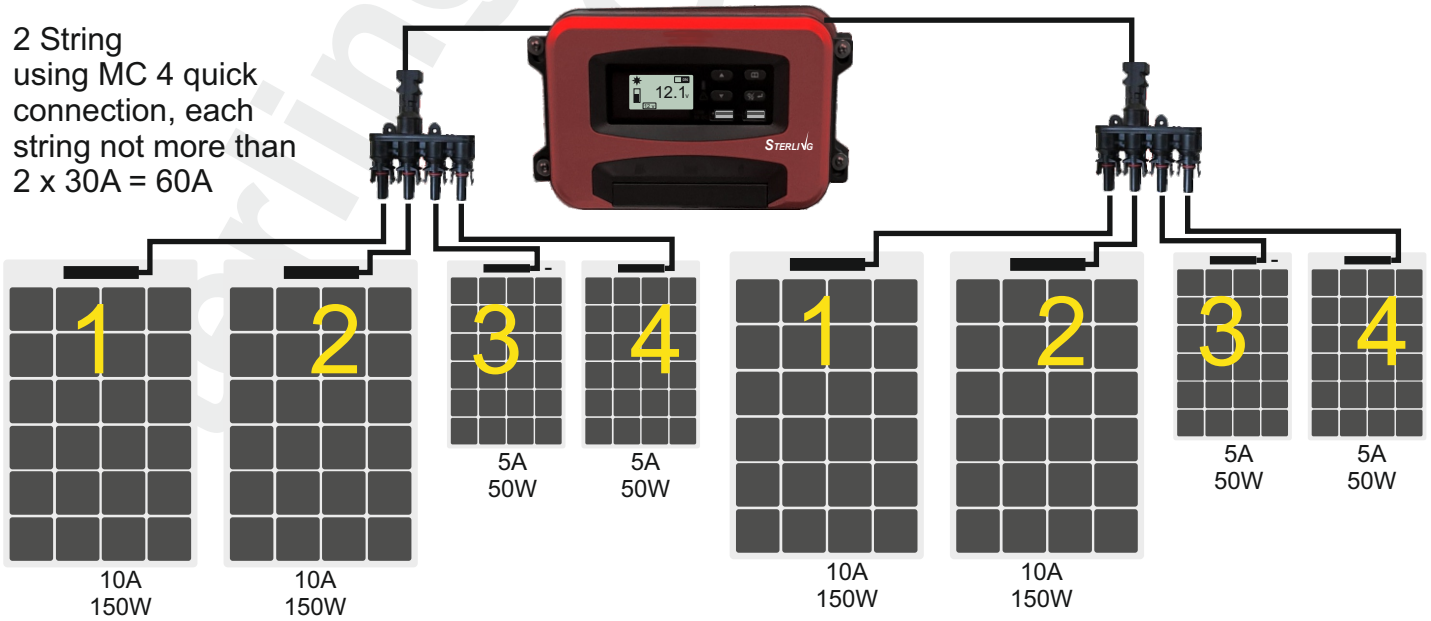
Installing:
Solar installations take many shapes and sizes not to mention voltages and currents. It is impossible to cover all installations, however, we envisage the vast majority of these panels etc. to be used in 12V configurations and as such that is the voltage we will focus on.
The first thing to bear in mind is that the MC-4 quick install plug and play system used by the Sterling panels are rated to 30A max (up to 1000V) so technically speaking they are good for systems at about 400W at 14V to 14000W at 1000V. Our focus will be on the 400W side as we are dealing in the 12V nominal range. You may have much more wattage I.e. 1000W installed. In which case, multiple connector paths will be needed for higher powered solar regulators.

It is important to note that on multiple solar cells being connected to 1 system and using the MC 4 multiple plugs the total input into the plugs must not exceed the rated power of the plug i.e. at 12V the total maximum input to the multi socket is 30A - as that is the rating of the single output. The voltages of the cells must be the same but there is no reason for the cell sizes to be the same. You may require different cell sizes in order to facilitate the shape of your vehicle or boat roof. The total power must not exceed 30A input per string. Multiple strings can be used in parallel in the event of more power required. Of course you don't have to use the MC 4 connectors, simply cut them off and hard wire as many as you need using conventional electrical connectors correctly rated for your required amperage.
A cable reference chart is provided for you to work out what cable sizes are required to efficiently install the cells.

Selecting your solar regulator of choice?
Obviously our choice of regulator would be a sterling unit. For larger power requirements over about 100W we recommend the MPPT regulator. MPPT are more efficient and it cannot be overloaded as they are current limiting. The good aspect about this is you can fit more power on your solar array than the regulator is rated for. In places, like the UK, this is a big advantage. Bear in mind that on a sunny day you will get the rated power of the solar cell. However, in northern climates (with mostly cloud cover) the most likely day to day power is in the 10-20% range. If you are requiring an actual power quantity, on a day to day basis, then you can over power the solar cells into the MPPT regulator. This will give you more power on cloud covered days but limit the extra power being produced on a good summer day to the max performance of the regulator.

Higher power installations over 300W:
Once you exceed 300W you are at the limit off the MC-4 30A connector ratings. You can then add a 2 string install to give up to 30A per string or in very large installations. You can add the solar regulators in series to make a 24V string and use the new 24V-12V solar regulators under development with Sterling Power in their new battery to battery charger supreme range of products. This can go all the way to 36V and 48V to 12V solar regulators.



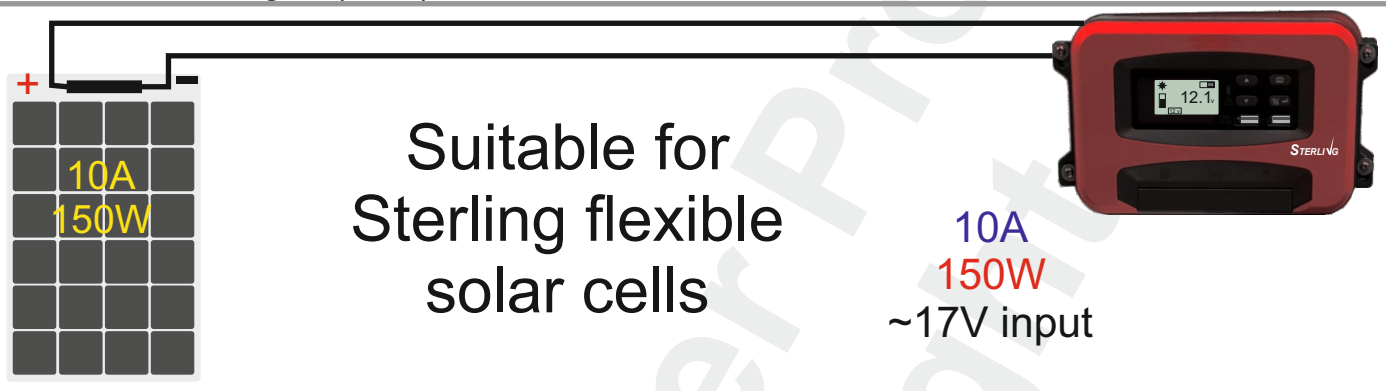


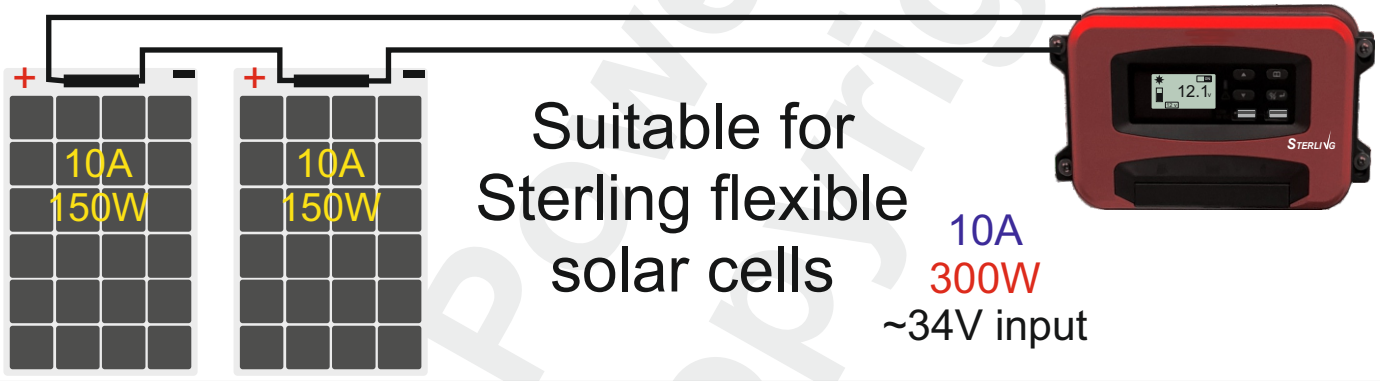
Panels in series Wiring examples

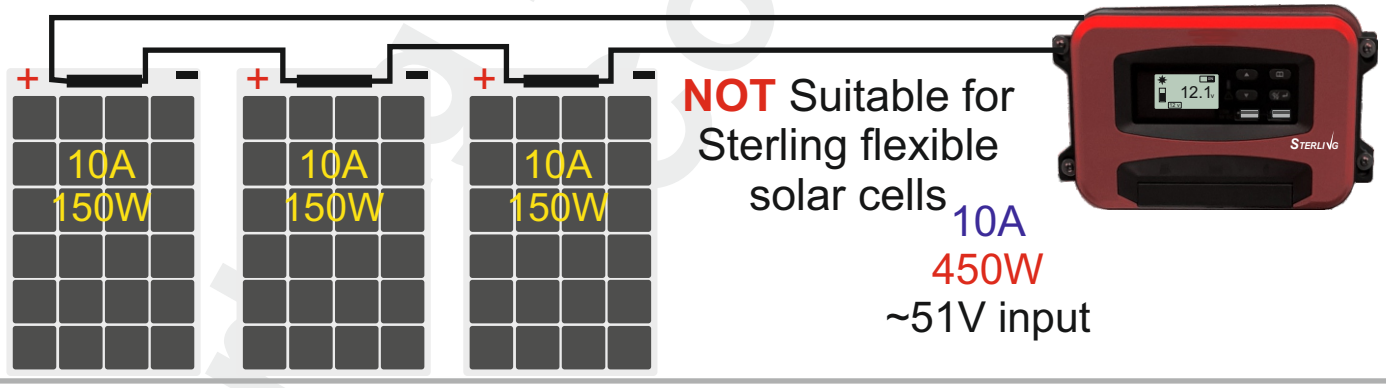
Configuration Options when using a good MPPT solar regulator (not a PWM regulator):

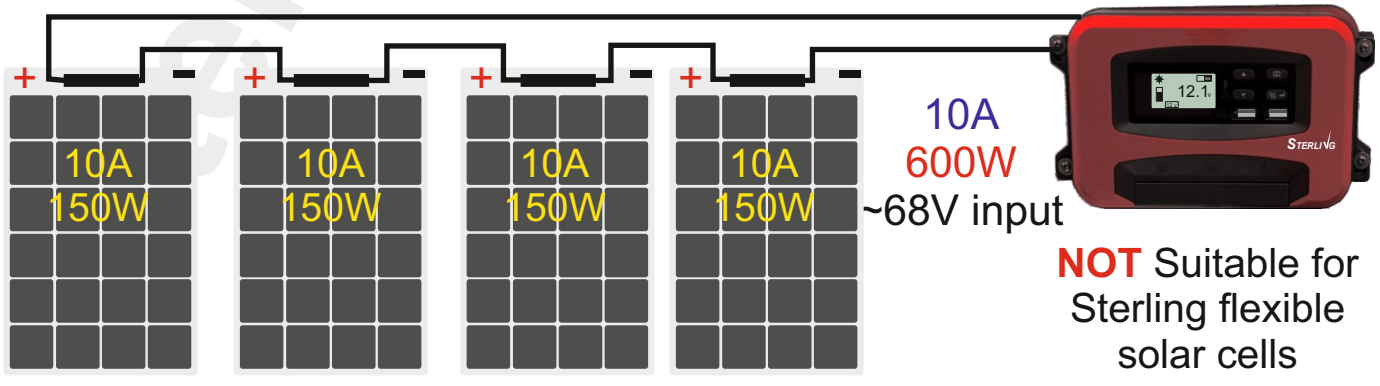
Series install as opposed to parallel install:
The big advantage of a good MPPT solar regulator is that the input voltage can go as high as 90V. For larger installations this means that the cells can be arranged in series rather than parallel. I.e. if you are fitting only 1 cell this is not any advantage, however, if you are fitting 2 / 3 / 4 then you can add the cells in series. This reduces the current in the cables and allows the MC-4 connectors to be used on the 50A unit because the current is reduced through the connectors in series. The max is 4 cells in series as any more than that will increase the input voltage above the safety threshold.

Series multi cell installation using MPPT regulator allowing current to remain at lower level and saving on MC-4 connectors and cable. Please note the increase in power levels (RED) with no current changes (Blue) in series installation.

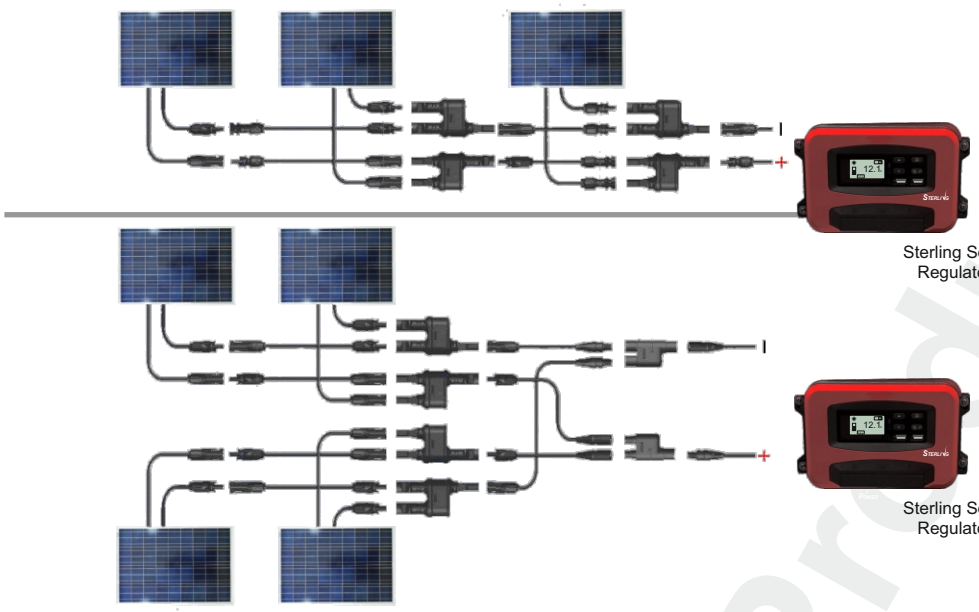








Additional Wiring examples



There are simply too many variations on the use off the MC 4 quick connectors to list

Cable and fuse sizes

Safety regulations demands any cable directly connected to a battery source must be fused

Voltage drop specification	Required Current based at approx 60 deg C 12V	Warning: this is total cable length not distance to product remember to add the pos and neg cable length as total

Low voltage drop inverters chargers Critical equipment

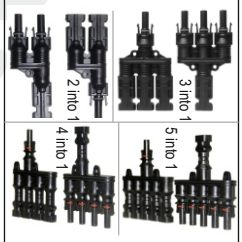
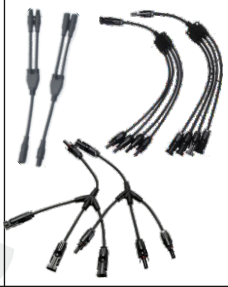
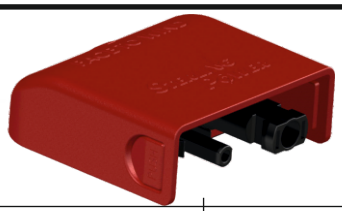
This chart for general reference only, cables sizes vary with ambient temperatures and other aspects
Use only multi strand cable not solid core cable.

Cable length meters

	5A	10A	15A	20A	25A	30A	40A	50A	60A	70A	80A	90A
0-2												
2-3												
3- 4.5												
4.5- 6												
6-7.5												
7.5-9												
9-12												
12-15												
15-18												
18-21												
21-24												
24-27												
27-30												
30-33												
33-37												
37-40												

AWG American Wire Gauge	Copper diameter mm	Copper Cross sectional mm sq
16	1.29	1.5
14	1.63	2.5
12	2.05	4.0
10	2.59	6.0
8	3.26	10.0
6	4.11	16.0
4	5.19	25.0
2	6.54	35.0
1	7.35	50.00
0	8.25	60.00
00	9.27	70.00
000	10.40	95.00
0000	11.68	120.00

For unknown cable simply measure ***copper conduit*** diameter and equate to the above chart.
do not measure the cable insulation diameter. The mm sq figure is rounded up for Euro cables.

Product Name and part number	Specification	Application	Photo
MC-4 Connector Sterling Part Number SMC4D **Dual pack** 1 x Male MC4 connector 1 x Female MC4 connector	Rated current : 30 Amps Rated Voltage : 1000VDC Suitable cable: 2.5 & 4 & 6 mm2 Waterproof IP67 Contact resistance 0.2 mm Ohms Connecting system : Crimping Contact material : Copper Tin plated Temperature rating - 40 to 90 deg C Pin Dia 4.0 mm dia Flame class:UL94-VO Safety class:11 Insulation material : PPO	Used to connect cables into the MC 4 system	
MC-4 Group Con 2/3/4/5: 1 1 x Male MC4 connector 1 x Female MC4 connector Sterling Part Number SMC42GD **2-1 Dual pack** SMC43GD **3-1 Dual pack** SMC44GD **4-1 Dual pack** SMC45GD **5-1 Dual pack**	Rated current : 30 Amps total Rated Voltage : 1000VDC Suitable cable: 2.5 & 4 & 6 mm2 Waterproof IP67 Contact resistance 0.2 mm Ohms Connecting system : Crimping Contact material : Copper Tin plated Temperature rating - 40 to 90 deg C Pin Dia 4.0 mm dia Flame class:UL94-VO Safety class:11 Insulation material : PPO	Used to connect 2/3/4/5 x MC 4 cables into 1x MC 4 ie for 2 cells Warning make sure that the total input cell Amps does not exceed 30 amps total	
MC-4 Branch Con 2/3/4/5: 1 1 x Male MC4 connector 1 x Female MC4 connector Sterling Part Number SMC42BD **2-1 Dual pack** SMC43BD **3-1 Dual pack** SMC44BD **4-1 Dual pack** SMC45BD **5-1 Dual pack**	Rated current : 30 Amps Rated Voltage : 1000VDC Suitable cable: 2.5 & 4 & 6 mm2 Waterproof IP67 Contact resistance 0.2 mm Ohms Connecting system : Crimping Contact material : Copper Tin plated Temperature rating - 40 to 90 deg C Pin Dia 4.0 mm dia Flame class:UL94-VO Safety class:11 Insulation material : PPO	Used to connect 2/3/4/5 x MC 4 cables into 1x MC 4 ie for 2 cells Warning make sure that the total input cell Amps does not exceed 30A total	
MC-4 Through bulkhead Sterling Part Number SMC4BD **Dual pack** 1 x Male MC4 thr bulkhead 1 x Female Mc4 thr bulkhead	Rated current : 30 Amps Rated Voltage : 1000VDC Suitable cable: 2.5 & 4 & 6 mm2 Waterproof IP67 Contact resistance 0.2 mm Ohms Connecting system : Crimping Contact material : Copper Tin plated Temperature rating - 40 to 90 deg C Pin Dia 4.0 mm dia Flame class:UL94-VO Safety class:11 Insulation material : PPO	Used to connect cables through a bulkhead to achieve a waterproof seal terminating in a male and female external connection . Ideal for vehicle panels including roofs	
MC-4 M & F Terminated Pre made cables Single 4 mm2 and 6 mm2 Sterling Part Number: SMC405M4 SMC405M6 = 0.5 mtr SMC41M4 SMC41M6 = 1 mtr SMC42M4 SMC42M6 = 2 mtr SMC43M4 SMC43M6 = 3 mtr SMC44M4 SMC44M6 = 4 mtr SMC45M4 SMC45M6 = 5 mtr SMC46M4 SMC46M6 = 6 mtr	Rated current : 30 Amps Rated Voltage : 1000VDC Suitable cable: 2.5 & 4 & 6 mm2 Waterproof IP67 **Solar UV protected cable** Contact resistance 0.2 mm Ohms Connecting system : Crimping Contact material : Copper Tin plated Temperature rating - 40 to 90 deg C TUV UV Dual sheath rated cable **4 mm2** and **6 mm2** copper options Pin Dia 4.0 mm dia Flame class:UL94-VO Safety class:11 Insulation material : PPO	Used to connect long cable runs , terminated in MC-4 male and female on either end	
MC-4 Connector With Fuse Sterling Part Number SMC4F10 Male MC4 10 A SMC4F20 Male MC4 20 A 1 x Male MC4	Used in series with more than 2 cells in parallel. In the event off major damage done to one cell the fuse should fail when the 2 x the power from the other cells try to feed into the damaged cell 	Self adhesive cable tie holder for roof cable system plus cable tie Sterling Part Number SMCSAT single	
MC-4 Connector With Diode Sterling Part Number SMC4D 20amp diode 1 x Male MC4 built in diode	Used in series with more than 2 cells in parallel. In the event that 1 x cell which may have a regular shadow on, this will prevent power from the active cells being lost in the cell with shadow 	Sikaflex 252 adhesive Sterling Part Number SMC252 single	
MC-4 M & F Through roof waterproof pod 12 mm holes **Connectors not included** Sterling Part Number: SMC4TP **Pod+gasket only** suitable for MC-4 or conventional gland use		MC-4 Tool kit for working with MC-4 connectors and cables Sterling Part Number: SMC4KIT	

MPPT Solar Regulators

10A - 50A MPPT solar regulators with Bluetooth / WIFI and App

TYPE	AMPS	Blue tooth	Part number
10A PWM	10A	No	PWM10
30A MPPT	30A	Yes	MPPT30
50A MPPT	50A	Yes	MPPT50

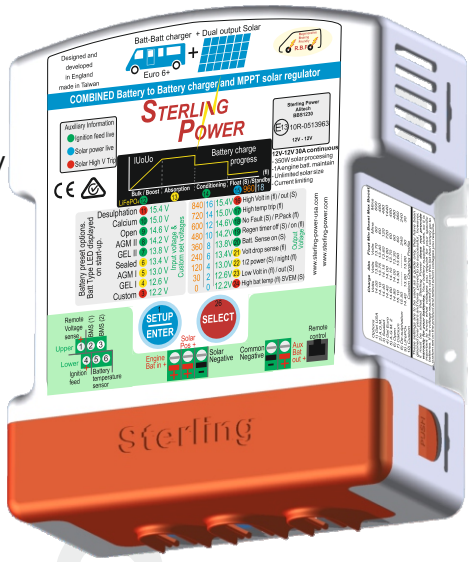
10 Amp PWM

30 Amp MPPT

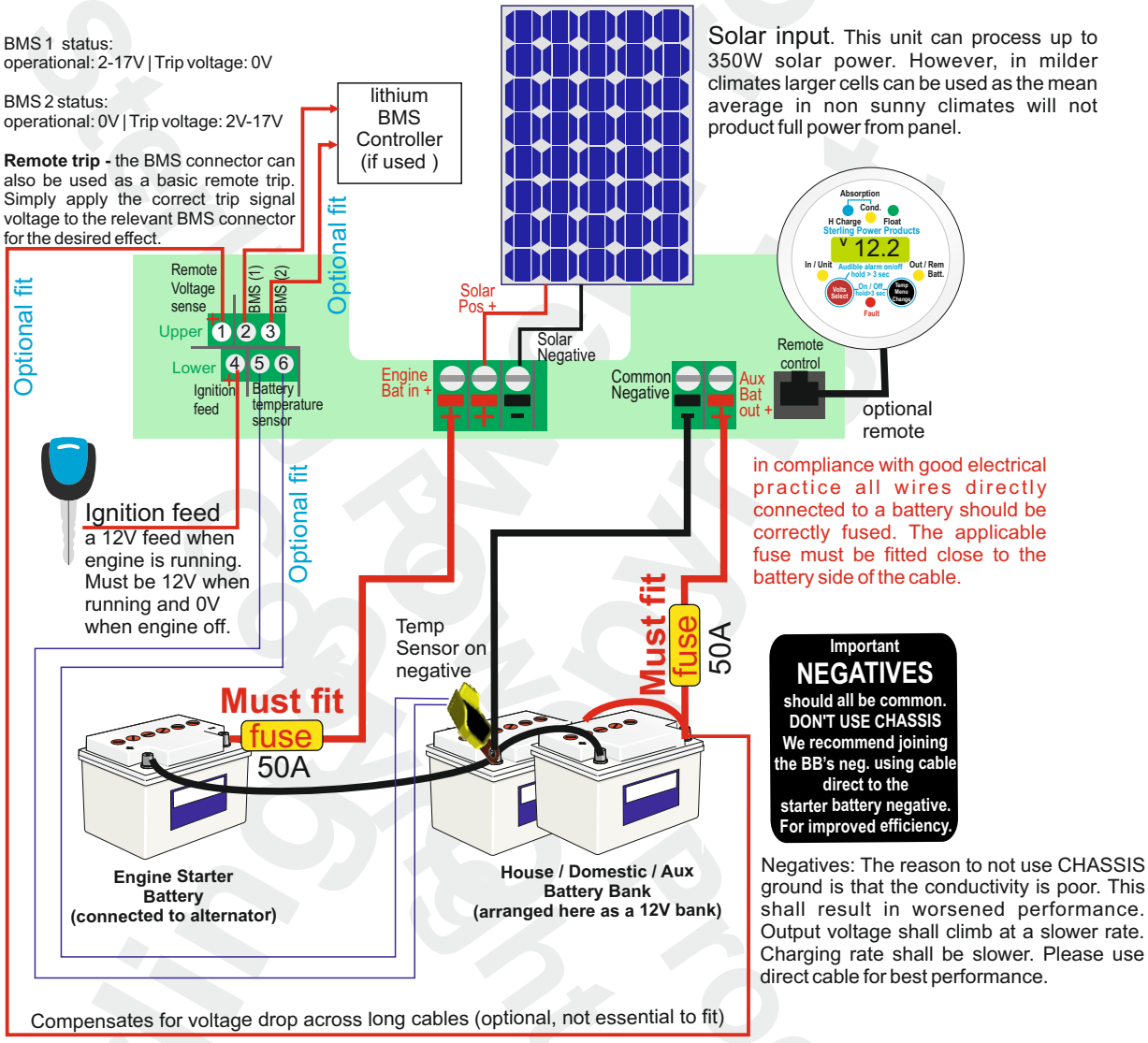
50 amp MPPT

Use with Sterling's BBS1230

Sterling Power do a combined
Battery to Battery Charger and Solar Regulator.
This is ideal for charging up both the starter battery and leisure battery when stationary and when moving.



Quick install of combined Sterling Batt to Batt charger and solar regulator: If you already have a battery to battery charger fitted for charging from the auxiliary system on a vehicle or boat then simply leave that installation. Connect the solar system as per the previous installation instructions



Solar input. This unit can process up to 350W solar power. However, in milder climates larger cells can be used as the mean average in non sunny climates will not product full power from panel.

in compliance with good electrical practice all wires directly connected to a battery should be correctly fused. The applicable fuse must be fitted close to the battery side of the cable.

Important
NEGATIVES
should all be common. DON'T USE CHASSIS We recommend joining the BB's neg. using cable direct to the starter battery negative. For improved efficiency.

Negatives: The reason to not use CHASSIS ground is that the conductivity is poor. This shall result in worsened performance. Output voltage shall climb at a slower rate. Charging rate shall be slower. Please use direct cable for best performance.

Lithium Battery installation | BMS shutdown

Lithium batteries present a few extra challenges due to the lithium safety BMS protocol in conflict with our safety protocol. I.e. if your lithium battery becomes sufficiently discharged then the battery will totally isolate your lithium battery effectively removing it from the charging circuit and, as such, presenting our Pro Batt Ultra with 0V. This means our default safety system sees 0V and will not start up due to our reverse polarity protection system. To overcome this problem after installation simply remove our reverse polarity protection by pressing and holding the SETUP button for 15-30 seconds, let go, then press the SELECT button firmly once – LED24 shall flash, then press both SETUP and SELECT. If successful, the output of the BB shall be a live 14V or so without any battery connected to the output terminal.

Temperature sensor:
Not obligatory to connect.
If you wish to install, connect the temp sensor to the negative of the domestic / aux. batteries.
When temp sensor senses the temperature lower than 20Deg C the voltage shall go up on the charger's output and when the temperature is higher than 20Deg C the voltage.
Sensor shall trip the charger if the temperature of battery >55DegC.

Your 100 % satisfaction is our goal. We realise that every customer and circumstance is unique. If you have a problem, question, or comment please do not hesitate to contact us. We welcome you to contact us even after the warranty and return time has passed.

Product Warranty:
Each product manufactured by Sterling Power comes with at least a 2 year limited factory warranty. Certain Products have a warranty period of time greater than 2 years. Each product is guaranteed against defects in material or workmanship from the date of purchase. At our discretion, we will repair or replace free of charge any defects in material or workmanship that fall within the warranty period of the Sterling Power product. The following conditions do apply:

- The original receipt or proof of purchase must be submitted to claim warranty. If proof cannot be located a warranty is calculated from the date of manufacture.
- Our warranty covers manufacture and material defects. Damages caused by abuse, neglect, accident, alterations and improper use are not covered under our warranty.
- Warranty is null and void if damage occurs due to negligent repairs.
- Customer is responsible for inbound shipping costs of the product to Sterling Power either in the USA or England.
- Sterling Power will ship the repaired or warranty replacement product back to the purchaser at their cost.

If your order was damaged in transit or arrives with an error, please contact us ASAP so we may take care of the matter promptly and at no expense to you. This only applies for shipping which was undertaken by our company and does not apply for shipping organised by yourself. Please do not throw out any shipping or packaging materials.

All returns for any reason will require a proof of purchase with the purchase date. The proof of purchase must be sent with the returned shipment. If you have no proof of purchase call the vendor who supplied you and acquire the appropriate documentation.

To make a claim under warranty, call our customer care line at (USA 1-(207)-226-3500, England 01905 771771). We will make the best effort to repair or replace the product, if found to be defective within the terms of the warranty. Sterling Power will ship the repaired or warranty replacement product back to the purchaser, if purchased from us.

Please review the documentation included with your purchase. Our warranty only covers orders purchased from Sterling Power. We cannot accept warranty claims from any other Sterling Power distributor. Purchase or other acceptance of the product shall be on the condition and agreement that Sterling Power USA LLC and Sterling Power LTD shall not be liable for incidental or consequential damages of any kind. Some states may not allow the exclusion or limitation of consequential damages, so, the above limitations may not apply to you. Additionally, Sterling Power USA and Sterling Power LTD neither assumes nor authorizes any person for any obligation or liability in connection with the sale of this product. This warranty is made in lieu of all other obligations or liabilities. This warranty provides you specific legal rights and you may also have other rights, which vary from state to state. This warranty is in lieu of all other, expressed or implied.