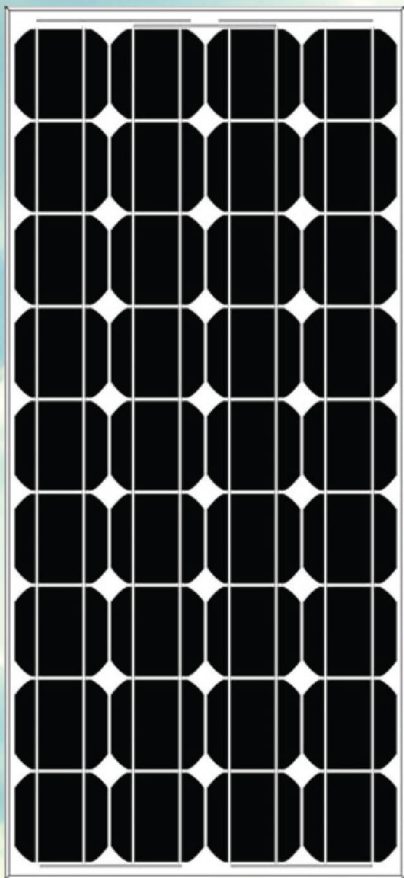


**RAMSOND**<sup>®</sup>  
sensible solutions



**SOLAR PANEL**  
**BASIC INSTALLATION GUIDE**

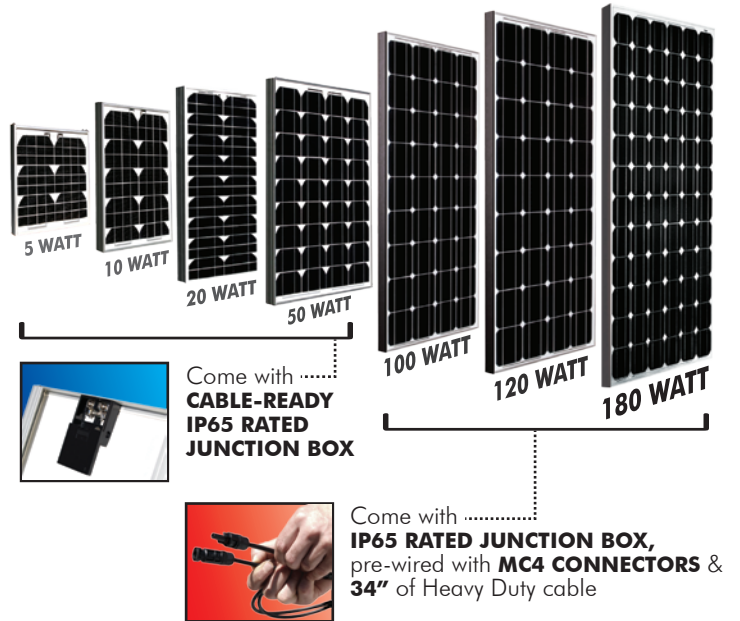
# THANK YOU FOR PURCHASING A Ramsond Mono-Crystalline PV Solar Panel

You are now one step closer to a sustainable energy system; when installed properly, you will be guaranteed to years of reliable, high quality power at very low cost.

The following guide contains the basic necessary information to begin installing your new Ramsond Solar Panel (hereafter referred to as "module"). Since there is no way to include every possible application or method of use, the information provided is of a general nature and is based on the experience and technical skills of many qualified Ramsond technicians and product specialists. The following information does not constitute a warranty, expressed or implied. Ramsond Corporation does not assume responsibility and expressly disclaims liability for loss, damages, or expenses arising from or in any way related to installation, operation, use, or maintenance of PV modules. Ramsond Corporation assumes no responsibility for any infringement of patents or other rights of third parties that may result from the use of PV modules. Ramsond Corporation reserves the right to make changes to the product(s), specifications or manual at any time without prior notice. All rights reserved.

Please inspect the unit thoroughly before you begin reading this guide. You should find the photovoltaic (PV) solar panel in perfect working order. If you notice any physical damage to the glass-encased **Solar Cells**, the rear-mounted **Junction Box** or the pre-installed **Heavy Duty Cables** (100 Watt panels and above only), DO NOT continue to install the panel or try to perform repairs yourself. Any attempt to do so is not only dangerous, but it will invalidate the warranty. If your panel appears to be in working order, please continue reading this manual completely and ensure all information is understood.

## FIND WHICH RAMSOND SOLAR PANEL YOU HAVE BELOW Different models may have different features out-of-box:



- **5 Watt - 50 Watt panels** have **cable-ready screws** inside the waterproof **Junction Box**
- **100 - 180 Watt panels** come with **heavy duty, 1/4" thick, insulated cables** using a **2.0mm copper core** soldered inside the waterproof **Junction Box**
- Pre-wired panels are set up for **SERIAL CONNECTION**, described later in this manual. All panels can be set up for **PARALLEL CONNECTION**, also described later.
- **All panels** can be prepared for use in either **SERIAL** or **PARALLEL** systems

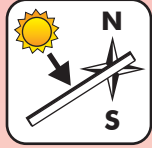
## GENERAL SAFETY GUIDELINES

Installation of solar photovoltaic (PV) products should always be performed only by qualified individuals, since they may require specialized skills and knowledge. The installer should follow all the safety precautions in this guide in addition to any local codes regarding this type of installation. They should be familiar with both the mechanical and electrical requirements of the system before performing any service, maintenance, or installation. Keep this guide in a safe place for future reference, care, and maintenance or if the modules are sold or disposed of.

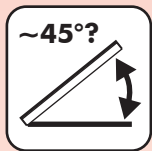
- ❌ **Do not disconnect any solar module while under load.**
- ❌ **Do not attempt to disassemble the modules, remove any components or attached nameplates.**
- ❌ **Do not touch any electrical terminal with unprotected hands or skin.**
- ❌ **Do not apply paint or adhesive to the top surface of the modules.**
- ❌ **Do not use mirrors or magnifiers to artificially concentrate sunlight onto the module's surface.**
- ❌ **Do not expose back sheet foils directly to sunlight.**
- ❌ **Do not wear metallic rings, watchbands, earrings, nose rings, lip piercings or any other conductive materials during installation of troubleshooting of photovoltaic systems.**
- ❌ **Do not attempt to drill holes through the glass surface of the modules. Doing so will void the warranty.**
- ❌ **Do not drill additional mounting holes in the aluminum module frame. This will also void the warranty.**
- ❌ **Do not lift the module by the junction box or any attached electric cables.**
- ❌ **Do not stand or step on the module.**
- ❌ **Do not drop the module or allow objects to fall onto it.**
- ❌ **Do not place heavy objects on top of the module; this could cause the glass encasements to break.**
- ❌ **Do not throw the module or otherwise set it down forcefully.**
- ❌ **Do not transport or install the module inappropriately as it could damage the module.**

# STEP 1: PLACEMENT

The first step of installation will require you to examine several things before any actual work can begin. The first aspect that will need to be decided on is **PLACEMENT**. For the highest efficiency, solar PV modules should ideally be **under direct sunlight during all daylight hours and all times of year**. Shade or indirect covering will lower the power output. Physical obstructions that interfere with sunlight will also lower output. If you will be installing the module in the **northern hemisphere**, your panel should **face directly south**; alternatively, if in the **southern hemisphere**, the module should **face directly north**. This is to maximize the amount of direct sunlight that will strike the module's solar cells; power loss due to incorrect orientation can be as high as -30% if the module is faced 60° away from true north/south. Also, this placement is especially important during winter months because sunlight will not be as direct and the module's efficiency will be lower. As a rule, if exposure is adequate during winter, it will be adequate year-round.



Once the best general location is chosen, the **ideal elevation angle** must be found. Solar PV modules should be tilted at an angle to maximize sunlight exposure. This angle is measured between a horizontal ground surface & the module's surface. Once again, in winter months, sunlight exposure will be more indirect, so if the elevation angle is set correctly during winter, it should be sufficient during the rest of the year. Generally speaking, **the ideal angle to set your panel at is the same as the latitude of the chosen location** (e.g. if latitude using a GPS system is 45°N, the module should be set at a 45° angle facing directly south). Once the ideal angle is found and set, the most complicated aspects of finding the correct placement is complete.



The other general considerations of placement are more obvious: the module **must not be installed near any sources of flammable gases** whatsoever. Electricity produced can ignite and create a serious fire hazard. Also to avoid a risk of fire, there must be adequate space left around the front and back of the module for air to circulate. If there is not enough space, heat caused by the module's normal operation can create a fire hazard. **The minimum space required from the back of the module to the nearest flat, non-ventilated surface is 4 in. (about 10cm).**



The solar module **should not be exposed to excessively heavy wind, snow, or cold**. Too much snow or wind can break the glass encasements if too much load is placed on the surface of the module. Ramsond Solar Panels have been UL evaluated to carry a maximum positive or negative load of 2400Pa (50.12 lb/ft.<sup>2</sup>), but more pressure than this is not advised. Additionally, since the modules will be tilted at an angle for optimum sunlight exposure, **excessive weight will exert drag force**, pulling the panels toward the ground. Secondary clamps or a lower-edge support system (e.g. a rack system or support rail) is highly advised to avoid this.



Lastly, the module **should not be subjected to frequent freezing/thawing cycles** or continuous **water exposure, whether fresh water or salt water**, up to and including immersion. Freezing and thawing, when combined with collected moisture, **can warp or damage the anodized aluminum frame**. Drainage holes are a standard feature of all Ramsond solar panels, but excessive heat/cold cycles are not advised. Too much exposure to water, whether freshwater or salt water, can cause what is known as Electrolysis Corrosion that occurs when one type of metal is in direct contact with a different type of metal and exposed to any water over time. This can be remedied by using either **PVC or stainless steel washers between different metals** when bolting the module's frame to the support system below the module.



## PLACEMENT NOTES

# STEP 2: PHYSICAL INSTALLATION

After you have decided on the correct placement, you can now begin physically installing your solar module. There are many different ways your solar module can be set up; however the most common are set up as a **single panel** or are installed as part of a larger **multiple panel system**, known as a solar panel array. This manual will cover the basic elements of these two methods.

All solar panels are **highly recommended to be attached to a support structure** of some kind, instead of being directly screwed or bolted onto a surface. Solar modules **must have adequate airflow** around them to avoid a risk of fire or system damage due to overheating; **the minimum space required is 100mm from the back of the module to the nearest flat, non-ventilated surface**. Using a support structure should provide this room as well as help reduce physical strain caused by wind, snow, rain and other environmental factors. These support structures can vary widely by design, so only basic information about them will be addressed in this manual. If you have a solar system integrator or designer for this installation, consult them for more detailed information about the specific features of your support structure. **The following instructions assume the support structure(s) to be used have already been partially assembled and prepared for attachment of solar modules**. Please follow any included instructions provided by the support structure manufacturer and observe all safety precautions noted in them in addition to the contents of this manual.

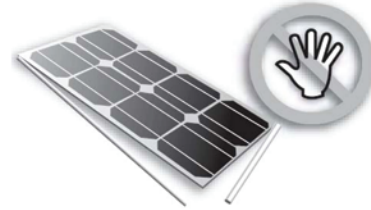
All solar panels **MUST have their front surface covered by an opaque material at all times during installation to avoid accidental power generation**. If uncovered, the modules can start producing power, leading to injury or fire. Use caution and keep the surface covered until the entire system is ready to use.

## FOR SINGLE PANELS

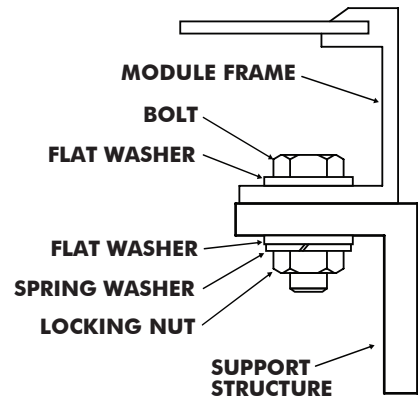
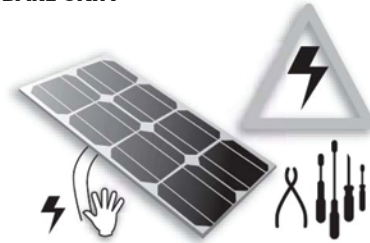
Single panel systems are the simplest way to start using your module. After preparing your support structure, first **locate the four 8.5mm mounting holes in the back of the solar module's aluminum frame**. These should be the only holes used to secure the module into position; any additional holes drilled or modifications made to the module will invalidate the warranty. **Line up the module's holes with the support structure's mounting holes**. Then, using high strength bolts, washers, and nuts, fasten the module to the support structure at each point of contact where the holes are aligned. M6-M8 bolts and nuts are recommended. Using the diagram shown at right, **washers should be placed where needed**; additional washers made of PVC or stainless steel may be used between the module's frame and the support structure to avoid corrosion when exposed to water. This is highly recommended if the support structure is not made of aluminum, as this corrosion often occurs between different types of metal. Once the washers are in place, **securely tighten the nut**; repeat this process for each mounting hole on the module's frame. The prepared mounting holes have been UL evaluated to carry a maximum positive or negative load of 2400Pa (50.12 lb/ft.<sup>2</sup>); this should be enough for most uses, but if additional support is needed, it can be added by using pressure clamps (if your support structure uses them), as described below. If you do not need additional support, you may skip to the **ELECTRICAL INSTALLATION** section of this manual.

If your support structure uses pressure clamps instead of mounting holes OR you require additional support for your module, **locate the four mounting holes in the back of the solar module's aluminum frame**. These will be the best places to position your clamps since they are already designed to carry weight at these points. Using the diagram shown at right, **place the clamp so that its mounting hole aligns with the matching support structure hole**. Then, using high strength bolts and nuts, fasten the module to the support structure through a clamp at each mounting point. **Place the bolt through the clamp and support structure, then securely tighten the nut**; repeat this process for each clamp to be used on the module's frame. Once this is complete, you may skip to the **ELECTRICAL INSTALLATION** section of this manual.

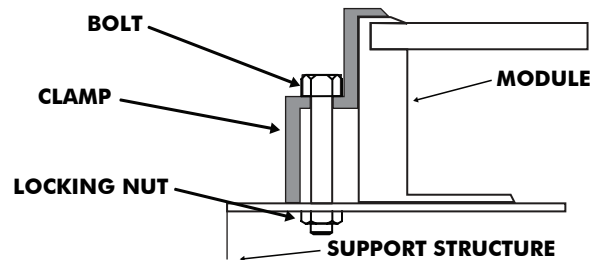
- DO NOT TWIST, BEND, OR DISASSEMBLE THE MODULE
- DO NOT ATTEMPT TO REPAIR A BROKEN MODULE



- USE INSULATED TOOLS DURING INSTALLATION
- NEVER TOUCH WIRING WITH BARE SKIN



**FASTEN USING BOLTS & WASHERS**



**FASTEN USING CLAMPS**

# STEP 2: PHYSICAL INSTALLATION

## FOR MULTIPLE PANELS

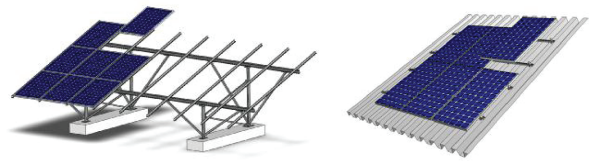
Multiple panel systems use several panels connected together for higher power output in groups called "arrays." Solar modules **must always be connected only to similarly rated modules** (for example 100 watt panels should only be connected with other 100 watt panels). This is to avoid overload and damage to the system itself, as well as damage caused by the system not operating correctly due to unbalanced power output from different types of panels. Because of this, it is **highly recommended that only similar panels be physically grouped together**. This is not completely necessary, but it will simplify the process and help make the electrical installation less complicated.

Also, when installing multiple panels together, there will likely be some space left in between each of the panels; this will depend on your chosen support system and the pressure clamps needed, if used. If your support system will use simple bolts and washers to fasten the modules, they can be as close to each other as desired. **The 100mm needed from the back of each module is still required for airflow.** If using clamps, the space between the modules will be determined by the type of pressure clamps used. All diagrams provided are for reference only and may not reflect your specific support system.

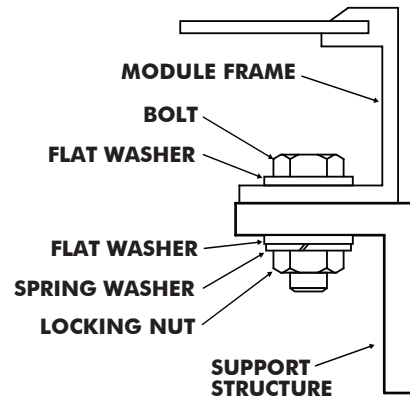
If your support structure will use bolts and washers to mount the modules, use the diagram to the right as a reference and follow the same fastening instructions listed under **FOR SINGLE PANELS** (Pg. 3) for every module to be placed. The prepared mounting holes have been UL evaluated to carry a maximum positive or negative load of 2400Pa (50.12 lb/ft. <sup>2</sup>); this should be enough for most uses, but if additional support is needed, it can be added by using pressure clamps (if your support structure uses them), as described below. If you do not need to add additional support and all modules have been securely bolted, you may skip to the **ELECTRICAL INSTALLATION** section of this manual.

Most multiple panel systems will use pressure clamps instead of only bolts. The initial steps for each module will be roughly the same as the instructions **FOR SINGLE PANELS**, but will differ slightly. Locate the four mounting holes in the back of the first solar module's aluminum frame. These will be the ideal contact points for your clamps, but depending on the design of your support system, clamps may be placed anywhere on the longest sides of the modules to fit your support system. **Place the first module squarely on the support structure for fastening.** The first module should be at one end of the array and it should use the clamp intended only for end modules along the outer side. Using the diagram shown at right for end modules, **place the clamp so that its mounting hole aligns with the matching support structure hole.** Then, using high strength bolts and nuts, **fasten the module to the support structure through a clamp at each mounting point along the outer edge.** This should be performed only on the edge that will not be next to another module.

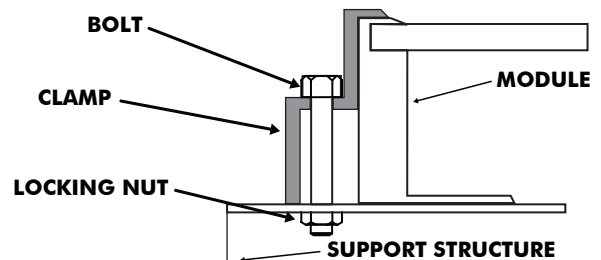
Next, **place the second module to be secured squarely next to the first module.** There should be a dual-sided clamp that will secure the first module's other edge and the second module's first edge at the same time. Using the diagram at right - and depending on the exact style of clamp used - **align the dual-sided clamp's mounting hole to the support structure's mounting hole** while ensuring that both module's edges are under the clamp. Pass a high strength bolt of appropriate length through both holes, then **securely tighten the bolt with a matching locking nut to fasten both edges of both modules to the support structure.** Now, the first module should be secure on both sides and the second module will be fastened on one side. Repeat the above process for each module within the solar array; **the final edge of the last module should use an end module pressure clamp**, like the first side of the first module used. Once all modules are fastened, you may continue to the **ELECTRICAL INSTALLATION** section of this manual.



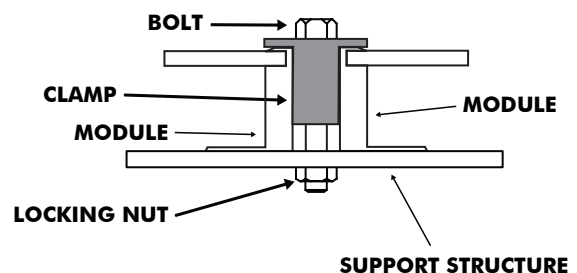
EXAMPLES OF DIFFERENT SUPPORT STRUCTURES



FASTEN USING BOLTS & WASHERS



FASTEN USING CLAMPS (END MODULE)



FASTEN USING CLAMPS (BETWEEN MODULES)  
Note: Actual clamp design may vary

# STEP 3: ELECTRICAL INSTALLATION

Now that your solar module (or modules) are physically secured and attached to its support system, the last step of installation is connecting the electrical wiring so that your modules can start producing power safely. **Important note:** Ramsond solar panels rated 50 Watts and below will not come with pre-wired cables or connectors; this means you will have to open the junction box to connect wiring (not supplied) using the terminal screws inside the junction box. All panels rated 100 Watts and above will already have heavy duty cables using MC4 connectors. **All pre-wired panels have been prepared for serial connection;** they can be re-fitted for **parallel connection**, which will be covered later in this manual.

## FOR SINGLE PANELS

Single panels are only connected one way, by attaching the positive and negative terminals inside the junction box to a power collection component (such as a battery) or to a charge controller, which may be connected to a battery. Whichever option you choose is beyond the scope of this manual, as there are many different products that can be connected to your panel; all diagrams are shown using a Ramsond SunShield Charge Controller, which is purchased separately, and a battery. Charge controllers are recommended for multiple panel use, but are not necessarily needed for single panels.

To connect a single panel that does not come pre-wired, **slide open the cover on the junction box**. Once open, **run a wire through each rubber wiring guide along the bottom, one for the positive flow and one for the negative flow**. Once there is enough exposed wire near each terminal screw in the junction box, **secure the end of one wire to the positive terminal using the screw, then secure the other wire to the negative terminal using the other screw**. Then, **pull any excess wiring through the rubber guides**, leaving a small amount of slack near the secured ends. Once you have connected both the positive and negative wires in the junction box and run them through the wiring guides, **close the junction box by snapping the cover back into place securely**. Then, take the other ends of the wires and **connect them to the positive and negative terminals on whichever power collection component or controller you will use**. Proceed to connect any additional wiring from whichever component your panel is now connected to (e.g. to a battery). Once all other instructions for other components are followed, you may remove the opaque covering from your solar module and it will begin working. Your single solar panel system is now complete.

To connect a pre-wired solar panel, you may **simply plug in the positive and negative cables to your desired power collection component using the connectors**. Whichever component you have will need to be wired with corresponding MC4 connectors, however, which is beyond the scope of this manual. Consult an experienced solar power equipment technician or service provider to do this for you if needed.

## FOR MULTIPLE PANELS

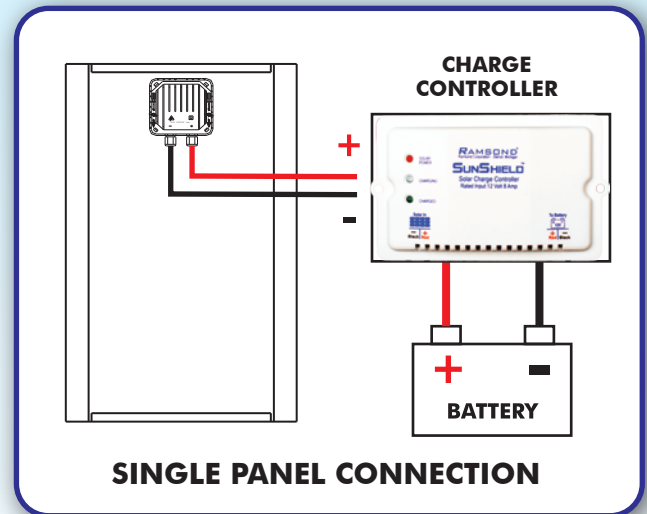
Multiple panel systems can be connected several different ways. One method is **SERIAL CONNECTION** (which all Ramsond solar panels rated 100 Watts and above are pre-wired to use) and **PARALLEL CONNECTION**. Again, solar modules **must always be connected only to similarly rated modules, regardless of connection type**. This is to avoid overload and damage to the system itself, as well as damage caused by the system not operating correctly due to unbalanced power output from different types of panels. On the following page, this manual will outline basic layouts of both **SERIAL** and **PARALLEL** connection types; more complex connections are possible, but are beyond the scope of this manual. Please consult an experienced solar system integrator, technician or service provider if you wish to develop a more complex connection system.



UP TO 50 WATTS



100 WATTS & ABOVE



# STEP 3: ELECTRICAL INSTALLATION

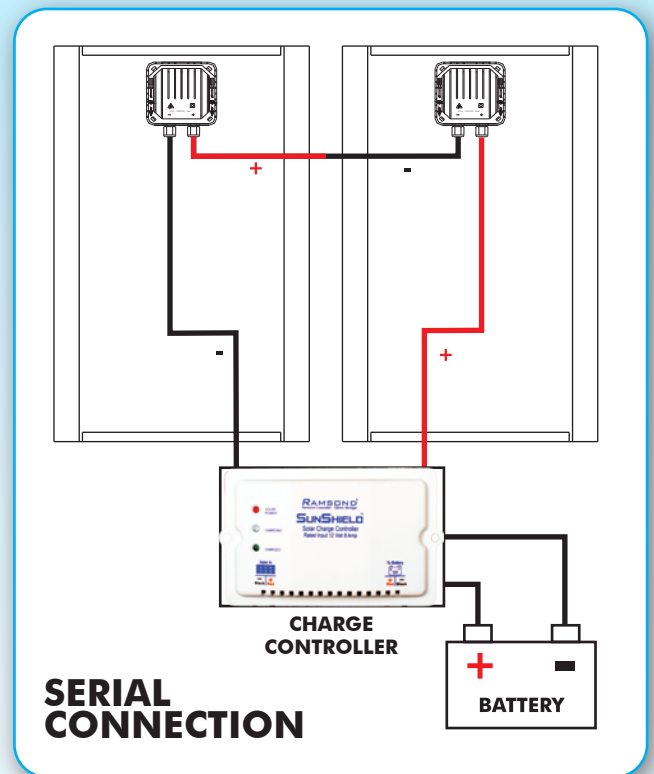
There are two main types of multiple panel connections: **SERIAL** and **PARALLEL**. The essential difference between them is how the power the modules generate is combined. **SERIAL** connection **combines the voltage** of each connected module, while the amperage (or **current**) remains the same as a single module would produce. For example, three 100 watt modules connected in series may produce 18.5 volts each at 5.4 amps; the total voltage output for all three would be 55.5 volts at 5.4 amps. **PARALLEL** connection, however, **combines the current** of each connected module, while the voltage remains the same as a single module would produce. For example, the same three 100 watt modules connected in parallel together would produce 18.5 volts but at 16.2 amps. Whether you choose to use **SERIAL** or **PARALLEL** connection will depend on your individual needs and is beyond the scope of this manual. The following information covers how to connect multiple panels to each other in a basic configuration for both **SERIAL** and **PARALLEL** connections.

## MULTIPLE PANELS: SERIAL CONNECTION

Exactly how you connect your panels will vary based on how your overall system is designed. There are many different products that can be connected to your panel; all diagrams are shown using a Ramsond SunShield Charge Controller, which is purchased separately, and a battery. Charge controllers are highly recommended for multiple panel use to regulate the flow of power and to ensure nothing is damaged during operation.

To connect panels that do not come pre-wired, **slide open the cover on the junction box of your first panel**. Once open, **run a wire through each rubber wiring guide along the bottom, one for the positive flow and one for the negative flow**. Once there is enough exposed wire near each terminal screw in the junction box, **secure the end of one wire to the positive terminal using the screw; then secure the other wire to the negative terminal using the other screw**. Then, **pull any excess wiring through the rubber guides**, leaving a small amount of slack near the secured ends. Once you have connected both the positive and negative wires in the junction box and run them through the wiring guides, **close the junction box by snapping the cover back into place securely**. Using the diagram shown at right as a reference, **connect the positive wire from the first panel to the negative terminal of the second panel inside the junction box**, using the above instructions on accessing the terminal screws inside. If connecting more than two panels, repeat the process of connecting each successive panel's positive wire to the next panel's negative terminal until you reach the end of the module array. Finally, **connect the last panel's positive wire and the first panel's negative wire to your desired power controller or battery system**. Proceed to connect any additional wiring from whichever component your panels are now connected to. You may remove the opaque covering from your solar modules and they will begin working. Your serial connection solar panel system is now complete.

To connect pre-wired solar panels in series, you may **simply plug in the positive and negative cables between each panel using the diagram as a reference**. Once you are ready to connect the array to the other components, **plug the first panel's negative lead and the last panel's positive lead into your power controller or battery system**. Whichever component you have will need to be wired with corresponding MC4 connectors, however, which is beyond the scope of this manual. Consult an experienced solar power equipment technician or service provider to do this for you if needed.



# STEP 3: ELECTRICAL INSTALLATION

## MULTIPLE PANELS: PARALLEL CONNECTION

Exactly how you connect your panels will vary based on how your overall system is designed. There are many different products that can be connected to your panel; all diagrams are shown using a Ramsong SunShield Charge Controller, which is purchased separately, and a battery. Charge controllers are highly recommended for multiple panel use to regulate the flow of power and to ensure nothing is damaged during operation.

To connect panels that do not come pre-wired, **slide open the cover on the junction box of your first panel**. Once open, **run a wire through each rubber wiring guide along the bottom, one for positive flow and one for negative flow**. Once there is enough exposed wire near each terminal screw in the junction box, **secure the end of one wire to the positive terminal, then secure the other wire to the negative terminal**. Then, **pull any excess wiring through the rubber guides**, leaving a small amount of slack near the secured ends. Once you have connected both the positive and negative wires in the first panel's junction box and run them through the wiring guides, **close the junction box by snapping the cover back into place securely**.

The next step is more complex. Using the diagram shown at right as a reference, **connect the positive wire from the first panel to the positive terminal inside the second panel's junction box**. After this is done, **connect the negative wire from the first panel to the negative terminal inside the second panel's junction box**. While the junction box of the second panel is still open, you will need to **repeat the initial wiring procedure from the first panel for the second panel also**. This will result in **TWO wires connected to each terminal** in the second panel - one coming in from the first module, and one leading back out. Once both wires are secured to each terminal, you may **close the junction box securely by snapping the cover back into place**.

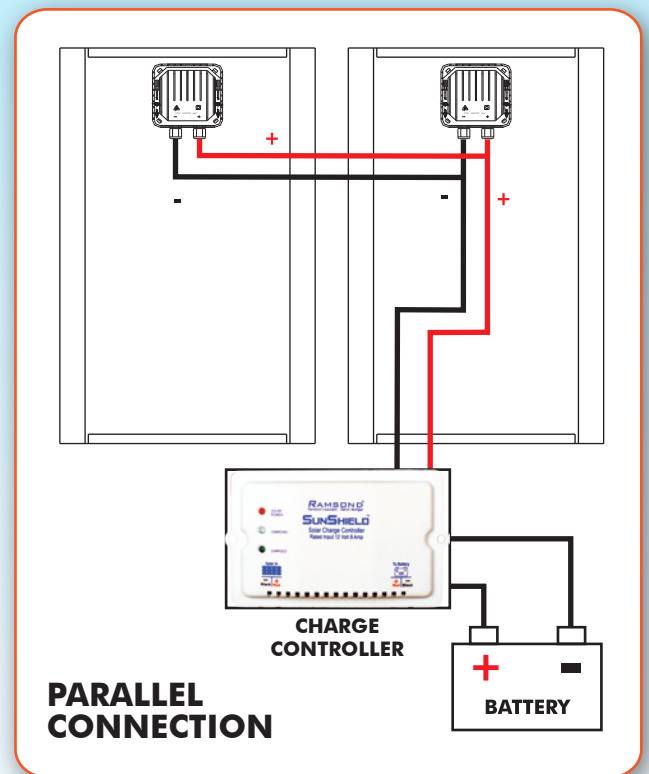
If connecting more than two panels, repeat the **ENTIRE** wiring process performed on the second panel for each additional module until you reach the last panel of the module array. You should now have **four wires connecting every module except for the first** - two coming from the previous module and two leading out to the next module.

Finally, **connect the last panel's positive wire out and negative wire out to your desired power controller or battery system**. Proceed to connect any additional wiring from whichever component your panels are now connected to. You may remove the opaque coverings from your solar modules and they will begin working. Your parallel connection solar panel system is now complete.

**Important Note: Pre-wired solar panels are set up for serial connections out-of-box.** To connect pre-wired solar panels in parallel, you have several options:

- (1) Replace the pre-installed MC4 connectors with different connectors (not provided) specifically designed for parallel connection
- (2) Follow the above procedure for non-wired panels, disregarding the pre-soldered cabling and/or removing it entirely
- (3) Consult a solar power equipment specialist to splice the provided cables together for parallel connection

The first option is the most common solution, but is beyond the scope of this manual. With any option, consult an experienced solar power equipment technician or system integrator for the safest, best solution that fits your system.





# Thank for purchasing a Ramsond product.

Hopefully your installation has been simple and as smooth as possible. We have taken great effort to make our manual easy to understand yet comprehensive enough to cover the basic information necessary for you to get the most out of your new solar system. If the instructions were followed properly, your Ramsond solar panel should provide you with years of trouble-free, high-quality power generation.

If for some reason, you do have any issues, questions or comments, feel free to contact us using the information provided below, Monday through Friday 10am-6:30pm, EST. or just visit <http://www.ramsond.com>.

## 25 YEAR LIMITED POWER WARRANTY

Your Ramsond Solar Panel comes with a 25 Year Manufacturer's Limited Power Warranty. The warranty begins on the date of purchase warranting peak power output of Ramsond solar modules shall not be less than 80% of the minimum peak power as specified in the product details. This warranty only applies under normal application, installation, use and service conditions. In the event of power loss exceeding the aforementioned percentage, Ramsond Corporation shall replace or repair (at its option) the effected solar module. Said repair or replacement shall occur only if it is determined the loss is due solely to defects in material or workmanship within the 25 year period. To initiate warranty, please return the product to: Ramsond Corporation WPC Service Department, 4051 Haggerty Road, West Bloomfield, Michigan 48323. You MUST include the following to receive warranty service: 1. Proof of purchase; 2. Detailed description of the fault or problem; 3. Visible Serial Number of the unit; 4. \$30 Handling fee (check, money order); 5. Return Shipping Label (prepaid) for returning to you the repaired/replaced product. Please allow up to 30 days from date that we receive the unit for repair/replacement. In the event that we are not able to repair the product, we will replace the product with same or similar unit. In the event that the model is not available, we will replace the product with an existing model with same or more superior characteristics, functionality and quality. We reserve the right to replace a defective unit with an identical refurbished unit that has been subjected to testing, which will similarly be warranted against defect or workmanship. This limited warranty specifically excludes any consequential and/or incidental damages. Additionally, this limited warranty expressly excludes labor costs provided by third parties. We make no representations or warranties whatsoever concerning the suitability of any merchandise for a particular use or purpose and any such warranty is expressly excluded from the terms of this limited warranty. We reserve the right to make slight modifications necessary to the merchandise for product improvement. This limited warranty shall be subject to the laws of the State of Michigan and any claiming arising therefrom shall be interpreted in accordance to the laws of the State of Michigan and subject to the exclusive jurisdiction of the Courts of State of Michigan.



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# NOTES

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# NOTES

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