Here is a working outline of the User Manual for customers who have bought our solar charger or who wish to buy them. This should answer most of the questions being asked. I am sorry for the delay.

Rick

**Renaissance Charger Solar Panel (working) User Manual.**

Connect charging batteries to right side connectors as indicated on top label. Red is the positive and black is the negative connection.
Connect solar panel input to left side as indicated. Solar source can be 12V to 36V maximum. Battery bank can be 12V or 24V. A 24V battery bank can only be charged with a 24V source, but a 12V bank can be charged with a 12V or (preferably) a 24V source.
A 12V solar panel system is typically around 22V open voltage line in full sun (not loading anything), and 17 or 18V under load in full sun in new condition. This gives several volts over a 12V battery bank.
A 24V solar system typically gives double this with open voltage around 43 or 44V and loaded voltage in full sun anywhere from 29 to 36V. The present Solar chargers from Renaissance allow for up to 36V input at the amperage shown on the circuit breaker. Exceeding the voltage will ruin the charger, and exceeding the amperage will cause the breaker to pop out and/or ruin the charger. Buyer therefore must select a solar source that does not exceed maximum voltage and amperage in full sun conditions.
The trickle switch allows for the customer to put the charger in trickle charge mode when they are not using a load on the batteries or solar panel. The customer may wish to go away for a day or more and this feature allows for a gentle charge on the batteries.
An inverter can be used while the charger is charging, but ideally a two battery bank setup is preferred where one battery is powering loads and not being charged while another bank is being charged but not powering loads. Every system we build over 80A will be made to run with such dual banks, and will have a switching relay system to do this automatically. This was developed 5 years ago with our first solar kick system. The batteries need time to be charged and do not charge well while continually being loaded.
If customer only has only one battery bank it is recommended that they give the batteries some rest periodically while under charge (running no load), and also some complete rest for at least an hour once a week.

**Selecting the right batteries and solar panels.**

The voltage of the batteries as already been discussed above. Customer will select the voltage depending on the load they need, which usually consists of matching it with an inverter or with the existing DC requirements. That is 12 or 24V.
The size or capacity of the batteries is to be carefully considered to match or exceed the maximum load ever used. The same goes for selecting the solar panels. Customer must figure out three things in this respect. They must estimate the average wattage throughout the day, the total wattage consumed in a typical day, and the peak wattage used.
The average US home consumes about 1KW per hour for a total of 24KWA daily. During the day it will usually be higher, and if you were to monitor the power you would see around 1.5KW being consumed with occasional peaking of 5KW when running water heaters or major appliances. Off the grid customers may have replaced major appliances that consume high amounts of electricity. But peak loading may be as high as 10KW to 20KW in a typical US home.
Customers need to be aware of what they are running in order to avoid drawing too much power at one time. This is similar to drawing too much power from one outlet and thus tripping a circuit breaker or fuse. When drawing from a solar system with battery bank and inverter, you will only be able to draw as much as your AC inverter allows. Such inverters usually have a peak value that allows very short surges to start up motors or pumps. This can be as much as double the rated maximum power. Further, you can only sustain such ratings as long as you have power from the solar panels or stored power in the batteries. Such calculations a complex due to the fact

that solar power output varies with the cloud cover and length of daylight (as well as temperature).

Customers must calculate first their loads as above mentioned. Then they must select the solar and battery system sizes. If you consume 100W average throughout the day, you will have 2.4KWA. You will thus want more than 100W worth of panels as the sunlight is less than 8 hours. Full sun at 8 hours is 800WA. 200W would be 1600WA in ideal full sun conditions. 300W would be 2.4KW. Typically a 100W average (2.4KWA total) customer would opt for at least 400W of solar panels to allow for cloud cover and charging of batteries for night times.

The batteries selected would need to be large enough to retain enough charge to deliver all the power required. The bigger the better. Batteries used for solar are not rated in CA or CCA even if they say dual purpose or Deep cycle batteries. Such batteries are made to run high amp loads for a very short period of time. If you deep cycle these batteries, or run them on a solar system, you may quickly damage them as the plates are not made to sustain loads for long periods of time. Do not therefore use starter batteries for this application. Use true deep cycle batteries used for golf-carts or solar systems. A smaller solar system usually consists of 4 or 8 six-volt batteries rated at about 225AH. These weigh about 62 pounds. They are connected in series and parallel arrangements for 12 or 24 volts. Medium off the grid systems usually use L-16 batteries that are 6 volts and around 400AH. And the larger systems use 1600 to 2000AH 2V cells in series to make 12, 24, 36 or 48V total. Such batteries can be loaded safely at the C1 rate of discharge (which is fully discharging them in one hour) momentarily (that is not running them actually down fully in one hour but for a few minutes at that rate).

Practically you can run these at the C8 rate or even C5 rate throughout the day with the Renaissance Charging systems. Ideally batteries are discharged at the C20 or above rates, but too much money would be required to purchase such batteries. However, customers may experience many days of cloudy conditions which would limit their ability to run loads unless they have powerful enough panels and big enough batteries to store the power. Each customer must determine the amount of sunlight in their area in all seasons as well as the electrical load they wish to power in order to determine the solar panels and batteries needed.

Continuing with the customer who draws on average 100W for a total of 2.4KWA who runs a load of 12V through an inverter. Typical battery bank selected would be 4 to 8 six volt golf cart batteries. During the day the batteries are being charged and periodically loaded when clouds cover and load demand exceeds solar panel output. Four new (actual) 225AH six volt batteries arranged in 12V gives us 450AH to work with. There will usually never be a constant draw and constant charging in the system so calculations are complex without meters. But such batteries can safely deliver 450 Amperes for a few minutes, or around 100A for several hours, or around 18A all day when they have been fully charged. This will allow this customer to have stored power for several cloudy days. If the customer uses less capacity batteries then they will have less stored power and will risk wearing their batteries out by running them to hard.

Renaissance Chargers allow the customer to keep their batteries in good condition as well as restore batteries that have become sulfated over time through use of other charging systems or from just sitting not used. The rejuvenation process can take anywhere from a few days to a few weeks depending on the age and condition of the batteries. In-house and independent testing have shown about 80% of used batteries have been able to be restored using these products.