Charger Controller / Regulators

Why you need a Controller

The main function of a controller or regulator is to fully charge a battery without permitting overcharge while preventing reverse current flow at night. If a non-self-regulating solar array is connected to lead acid batteries with no overcharge protection, battery life will be compromised. Simple controllers contain a transistor that shunt the PV charging circuit, terminating the charge at a pre-set high voltage and, once a pre-set reconnect is reached, opens the shunt, allowing charging to resume. More sophisticated controllers utilize pulse width modulation (PWM) or maximum power point tracking (MPPT) to assure the battery is being fully charged. The first 70% to 80% of battery capacity is easily replaced, but the last 20% to 30% requires more attention and therefore more complexity.

How controllers work and available options

The circuitry in a controller reads the voltage of the batteries to determine the state of charge. Designs and circuits vary, but most controllers read voltage to control the amount of current flowing into the battery as the battery nears full charge. Features of a controller to consider include:

- Reverse current leakage protection – by disconnecting the array or using a blocking diode to prevent current loss into the solar modules at night.
- Low-voltage load disconnect (LVD) – to reduce damage to batteries by avoiding deep discharge.
- System monitoring - analog or digital meters, indicator lights and/or warning alarms.
- Overcurrent protection – with fuses and/or circuit breakers
- Mounting options – flush mounting, wall mounting, indoor or outdoor enclosures.
- System control – control of other components in the system; standby generator or auxiliary charging system, diverting array power once batteries are charged, transfer to secondary batteries.
- Load control – automatic control of secondary loads, or control of lights, water pumps or other loads with timers or switches
- Temperature compensation – utilized whenever batteries are placed in a non-climate controlled space. The charging voltage is adjusted to the temperature.

- Pulse Width Modulation (PWM) – an efficient charging method that maintains a battery at its maximum state of charge and minimizes sulfation build-up by pulsing the battery voltage at a high frequency.
- Maximum Power Point Tracking (MPPT) – a new charging method designed to extract the most power possible out of a solar module by altering its operating voltage to maximize the power output.

Some systems require most of these functions, others require only one or a certain combination. Your KSI dealer can help you select a unit to meet your specific needs.

Sizing a Controller

Charge controllers are rated and sized by the array current and system voltage. Most common are 12, 24, and 48-volt controllers. Amperage ratings run from 1 amp to 60 amps, voltages from 6-60 volts.

For example, if one module in your 12-volt system produces 7.45 amps and two modules are utilized, your system will produce 14.9 amps of current at 12 volts. Because of light reflection and the edge of cloud effect, sporadically increased current levels are not uncommon. For this reason we increase the controller amperage by a minimum of 25% bringing our minimum controller amperage to 18.6. Looking through the products we find a 20-amp controller, as close a match as possible. There is no problem going with a 30-amp or larger controller, other than the additional cost. If you think the system may increase in size, additional amperage capacity at this time should be considered.