

By Bob Livingston

BATTERY CONDITIONING

Xantrex TRUECharge2 three-stage charger ensures optimum 12-volt DC performance and battery-bank longevity

A battery bank is the heart of any 12-volt DC electrical system, providing versatility on or off the grid. The larger the battery bank, the better the efficiency, especially when you're spending time in primitive locations. Most owners are aware of how many batteries are carried onboard, and hopefully the capacity of the battery bank. Surprisingly, however, few people give any thought to how these batteries are charged, figuring that the power converter automatically takes care of that process. The result: out of sight and mind until the batteries go kaput and there's not enough power to run 12-volt DC appliances and accessories.

Naturally, those who always plug in to a utility pole have less concern for battery charging until they find themselves in a state park with no

hookups and a curfew on running the generator. Add in a residential refrigerator running off an inverter and batteries, and the situation can

become even more demanding. Proper battery conditioning is key to battery service and longevity, and the fact remains that most motorhomes have converter/chargers that do a much better job "converting" than charging. An expert in the battery business put it succinctly: "If you want a five-year battery to last two years, use the stock converter/charger."

Typical converter/chargers do nothing more than keep the battery at a set voltage without regard to conditioning. That means the plates inside a battery are not being hit



[1] Removing the plate in the corner of the unit provides access to the power leads. [2] Wires were connected to a 12-gauge extension cord, which took a little maneuvering [3] to get all terminals and wires contained in the tight space.

with enough voltage to prevent sulfation, which restricts the flow of acid and eventually stifles the ability of the battery to receive a full charge. Intelligent, multistate chargers take the guesswork out of battery conditioning, providing proper charge rates through three phases: bulk, absorption and float. And one of the best products on the market to achieve this type of smart charging is the Xantrex TRUECharge2.

In order for a battery to be conditioned properly, it must first be subjected to a bulk charge. At this point the voltage from the TRUECharge2 is at 14.4 volts and the current (amperage) is at its maximum without causing damage to the batteries. The TRUECharge2 will allow you to configure the battery bank, which instructs the unit to produce the most effective charge algorithms for optimum conditioning, without risking battery

damage. This is especially important when using AGM batteries because this type of battery has charging-voltage limitations. (The charger is factory set for flooded-cell batteries; selecting the type of battery in your motorhome is as simple as pushing a button on the onboard display panel.) At the end of the bulk-stage cycle, the batteries will be about 80 percent charged.

The next step is the absorption stage, when the charger maintains the voltage from the bulk stage but allows the current to drop in response to battery resistance.

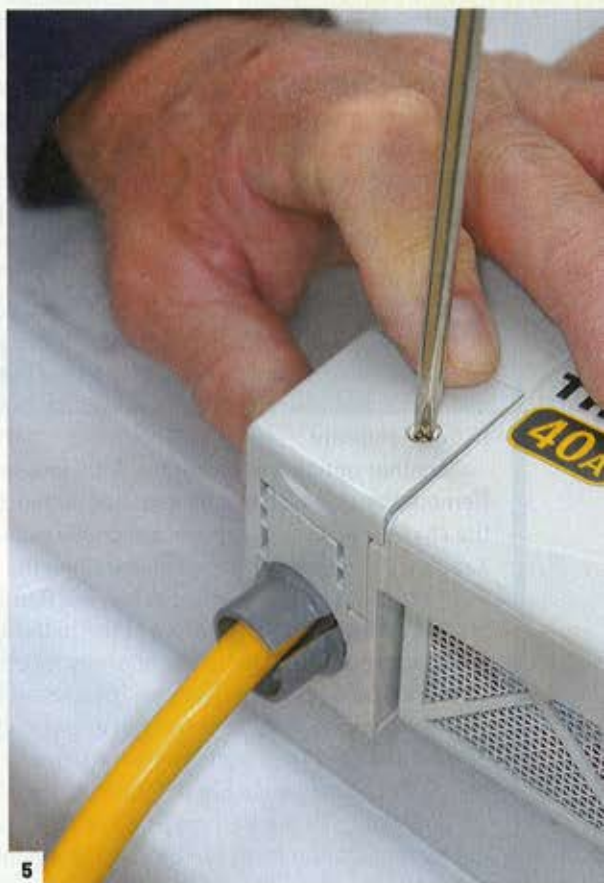
When the state of charge reaches 100

percent, the absorption stage gives way to a float stage that will keep the batteries at the full level. At this point, voltage is limited to around 13.4, which is high enough to keep the batteries charged, but low enough to limit gassing of open-cell batteries.

Single-stage chargers only provide a float voltage, and many times this voltage is poorly regulated and may creep up to 13.6-13.8 and even higher, which can cause flooded-cell batteries to gas and electrolyte to evaporate. If these batteries are left unattended, the electrolyte level becomes too low and the plates sulfate. Gassing also causes corrosion, which can damage terminals and hold-down hardware. Float voltage that exceeds the threshold for AGM batteries will shorten their lifespan.

To be fair, there are some converter/chargers with three-stage capabilities provided by the factory, but most are not sophisticated enough to condition properly, much less handle the charging requirements of AGM batteries. Motorhomes equipped with quality inverter/chargers will have capabilities comparable to the TRUECharge2.

A big factor that comes into play when charging is battery tem-



[4] Once the wires and connectors are contained, the strain relief is put in place and the cover [5] is reinstalled for a clean look. [6] A 50-amp (specified by the manufacturer) marine-grade circuit breaker was used to protect the charger. [7] Insulation on the 4-gauge marine-grade electrical cable is stripped to get ready to install the terminals.

➔ INSTALLATION TIP

First, take time to lay out the entire system so that the proper-length cables are determined and the location of the equipment meets the manufacturer's specifications.

perature. A warmer battery will accept current easier than one that is cold. An optional temperature sensor is offered by Xantrex for the TRUECharge2 and should be considered mandatory for efficient battery charging. The sensor simply attaches to a negative terminal and can be plugged into the charger via an RJ-12 (communication) connector. The default setting on the display panel is set for "Warm," which means the batteries can be at 41 to 86 degrees Fahrenheit. "Cold" and "Hot" settings are when the batteries are below 41 degrees or above 86 degrees Fahrenheit, respectively. The temperature sensor eliminates any guessing and in the long run the additional cost of around \$35 is worth the improved battery longevity.

Another option well worth the \$100 investment is the Remote Panel, which can be installed within 25 feet of the charger (a 50-foot cable is optionally available from Xantrex). Since the likelihood of installing the converter in an exterior compartment is great, the Remote Panel provides continuous monitoring of the batteries without going outside. The Remote Panel pretty much clones the onboard display panel and allows the user to make mode changes. A glance will confirm that everything is working properly and the fault icons will inform of any malady in the system, like when a breaker opens.

Installation of the Remote Panel is fairly easy since the rectangular housing can be surface mounted on any flat surface and only requires drilling a 48-mm (1.89-inch) hole. The only caveat is making sure there's enough clearance in the back of the mounting surface to tighten the 1½-inch locking nut and to make sure it doesn't interfere with other structures. In our case, we just cleared the drawer behind the mounting area.

It took us about 1½ hours to install the charger and Remote Panel, following directions that are clear and concise. There are a number of warnings from the factory, so reading the instructions first is a good idea. Also, if you're somewhat leery of working with electrical components and wiring, have a certified technician do the install. Pay particular attention to the mounting instructions that specify charger orientation and ventila-



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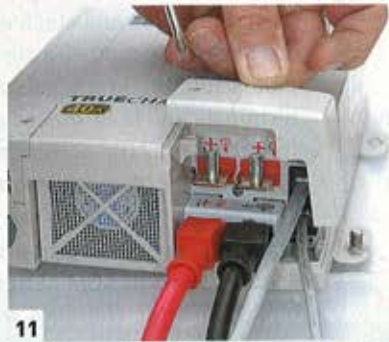
[8] Professional-grade cable crimpers are used to install terminals for connecting to the batteries. [9] Battery cable terminals are attached to studs that are found under the cover plate on the other side of the charger.

tion. Xantrex recommends against mounting the charger and battery bank in the same compartment to prevent corrosion, but we assume that's aimed at the use of flooded-cell batteries. We have Lifeline AGMs, which do not gas or corrode. Wire and circuit breaker size and terminal type are specified; we used marine-grade 4-gauge cable, terminals and a 50-amp breaker.

To get power to the charger, we elected to route



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[10] RJ-12 cable for the remote panel is plugged into the top position in the charger. Bottom position is for battery temperature sensor. [11] The access cover is reinstalled on the charger after completing the wiring procedure. [12] Once wired, the charger can be installed in its permanent home.

a 12-gauge extension cord to the nearest GFCI outlet, hardwiring the other end directly into the charger's AC input. Romex wire can also be used to hardwire the unit into the motorhome's power-distribution panel.

A lesser-known stage of the battery-conditioning process among RV owners is equalization, whereby the batteries are subjected to high voltage for a controlled period of time. In most cases, voltage is raised to around 15.5, which technically overcharges the batteries. This is done to break up sulfation and is normally a process reserved for flooded-cell batteries. The TRUECharge2 has an equalization provision that can only be activated when two buttons on the onboard display or Remote Panel are intentionally depressed at the same time. This is a safeguard to prevent accidental overcharging, which leads to overheating and possible damage when equalization is not necessary

or recommended. Recognizing the potential damage to gel or AGM batteries that are subjected to high voltage, Xantrex allows equalization only when flooded-cell battery type is selected on the display or remote. But there are circumstances when an AGM battery, for example, should be equalized.

We installed a second TRUECharge2 unit in another RV that has 6-volt Lifeline AGM batteries, but older. A discussion with a Lifeline technician led to the discovery that the batteries were not conditioned properly by the factory converter/charger, even though it supposedly is a three-stage unit. Lifeline recommended equalizing the batteries for five hours, but the TRUECharge2 limits equalizing to one hour, so we had to reset the cycle five times. Fresh AGM batteries that are continuously connected to the TRUECharge2 should never need equalization.

Flooded-cell (lead-acid) batteries, in an RV environment, must be fully charged every three to five weeks, which may be problematic for owners on two fronts: the aforementioned lack of a charger that will fully condition batteries, and neglect simply because the motorhome is in storage for a period of time and it's difficult to hook up to a power source.

The sulfation on the plates is a substance that's jellylike, and it's easy to reverse this buildup within three weeks in hot weather and about five weeks in cold weather. If that jellylike substance is not driven back into the solution before the three- to five-week time frame, it crystallizes and is much harder to reverse. There's no need to equalize if the batteries are fully charged on a regular basis. Equalization is hard on the batteries, but not as damaging as plate sulfation. The high voltage drives the water out of the batteries and corrodes the grids that



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[13] The remote panel is installed in a convenient location inside the motorhome. Controls and indicator lights clone the panel [14] on the outside of the charger housing. [15] Temperature sensor is connected to the negative post of the battery.

hold the lead, so it should be done only as needed—and not very often. For ultimate battery longevity, it's best to use an efficient charger like the TRUECharge2 and keep it plugged in when in storage, if possible.

TRUECharge2 series battery chargers are available with 20-, 40- and 60-amp outputs. Choosing the right charger is dependent on

the size of the battery bank. The general rule is that charger size is determined by dividing the capacity of the battery bank by five. The 40-amp model is good for a 200-amp-hour (ah) battery bank, which was a close match for the 220ah capacity of the two Lifeline AGM 6-volt batteries. For larger battery banks, two TRUECharge2 units can

be wired in parallel to provide up to 120 amps of charging power.

The TRUECharge2 takes the guesswork out of proper battery conditioning and is a cost-effective way to realize the intended life cycle of any battery bank. Street price for the TRUECharge2 40A is around \$370. **M**

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800-670-0707, www.xantrex.com/industry-solutions/recreational-vehicles