



# MAGIC POWER

An inverter makes it possible to use household appliances in an RV—without a generator

By Chris Hemer



Try to imagine if electricity were like cellular service, where some places you travel have it while others don't.

That's the gamble that all RVers take when they head out onto the open road with no agenda. You might find yourself at a cozy local RV park with full hookups. Then again, maybe you'll stop for the night under the stars of a national park campsite accompanied by little more than the hum of an absorption refrigerator fan and a few 12-volt DC lights to remind you of civilization.

That's not necessarily a bad thing — unless you're really hungry and the only thing you have is a frozen dinner. You turn to find the microwave staring back at you with its sullen, tempered glass eye...mocking you. The TV, meanwhile, offers only a cold and expressionless field of empty space in exchange for your longing glance. Thank goodness for a dogeared copy of Huck Finn and an old bag of potato chips.

It doesn't have to be this way. With the right power inverter, you can take advantage of the 12-volt battery power in your trailer or motorhome to run the household appliances you've become so accustomed to — anywhere. Sure, we all like to get away sometimes, but it's nice to know that if you want to use a hair dryer to get ready for your glam hike, or the convection microwave to crisp up some sustainably raised, uncured apple wood smoked bacon, you can. That is the beauty of having an inverter in your RV: It changes 12-volt DC power into household-quality power, without generator noise.



The Freedom SW features premium sine wave output with high surge capability and temperature compensated, power-factor corrected, multi-stage charging to meet power needs of demanding loads including inductive motor loads. Available in two 24-volt DC models (which requires special wiring, and comes as an option in some new Class B motorhomes), the Freedom SW offers series and parallel stacking capability to enable twice the rated output and operation of 240-volt AC applications, respectively.

### What is an Inverter, Anyway?

At the risk of going too far back to basics, consider that there are two types of electricity in an RV. The most common type is 12-volt DC power, which comes from the "house" battery(ies). The other, less-frequently used type is 120-volt AC power — which is the same thing you get in a house when you plug into a wall socket.

"Each type of power has its own benefit," explained Don Wilson, sales application engineer for Xantrex, one of the leading manufacturers of inverters for RV and marine applications. "DC power is storable, so you can use energy to charge a battery, then move it to a remote location and use that stored energy to run your devices. AC power is easily changed if you think about different types of appliances that you have." For example, Wilson notes that some AC devices run on 17 volts, some run on 120 volts and some small electronic devices run on just 5 volts. "AC power is easily changed if you think about different types of appliances that you have," Wilson explained. "AC power can easily be changed, where DC power isn't easily changed. So if you need to use AC power in a remote location, like dry camping in an RV, that's where the inverter comes in. You can take that stored energy in your battery(ies), plug in your AC device and use it wherever you need it." So whether it's something as small as a portable electronic device, a flat-screen TV computer or a power saw, a properly-sized inverter is designed to cope with your power needs.

### Series vs. Parallel

If you own, or plan to own, an RV at some time, you'll undoubtedly come across the terms "series" and "parallel," usually with reference to battery banks. But these terms also refer to circuits in general. What's the difference? To put it simply, in a series circuit, all components are connected end-to-end, forming a single path for current flow. In a parallel circuit, all components are connected across each other, forming exactly two sets of electrically common points. In an inverter application, parallel stacking enables the inverter or inverter/charger to double the current in inverter mode. Series stacking enables the unit to generate 120/240-volt AC split phase output, provided the AC system in the RV is wired for split phase as well.



The first step to choosing an inverter is to add up the wattage of all the appliances you will be using (or may use together) and size the inverter appropriately. Electrical appliances should have a label on them somewhere that indicates the required current, like this coffee maker, which requires 900 watts. If you think you would use it while watching the morning news on your 400-watt television, for example, you'd want an 1,800-watt inverter. If battery or inverter wattage is limited, you may have to run one high-wattage appliance at a time.

### What Kind of Inverter do You Need?

First, let's talk about sizing. Inverters are sized in watts, so the first thing you need to do is add up all of the wattage of the 120-volt AC appliances you have or are likely to use at the same time. For example, you may have a 1,000-watt microwave and a 400-watt television. Is it possible that you may be using both, for a total of 1,400 watts? Certainly. Who doesn't microwave popcorn while watching a movie? So, for this example, you'd want 1,400 watts. However, it's best to go for a higher-rated inverter to allow for circuit changes or power surges — so an 1,800-watt inverter would probably be ideal.



Among Xantrex's most popular inverters are the PROsine 1000 and 1800 stand-alone power inverters, which are ideally suited for electrical systems that already have a quality multi-stage battery charger. Designed for recreational and industrial applications, its 120-volt, 60 Hz AC power output is capable of handling both heavy duty and smaller, multiple AC loads. PROsine inverters also include a backlit LCD display panel, which can be mounted remotely.

"Another thing to consider is surge capability," said Wilson. "Some loads, like motors, which need more power to start (like roof A/C units), need inverters with either higher output power or higher surge power. Most inverters surge at twice the rated output power, but if you need more than that, upsize the inverter for more surge capability." There's no need to worry about draining your battery more quickly with a larger inverter, either, since drain is related to the actual load, Wilson said. When in doubt, it's better to have more inverter power than you think you need than to find out you don't have enough.



Compatible with all FREEDOM X inverters and FREEDOM XC inverter chargers, the FREEDOM X Bluetooth remote panel allows the user to view key system information via the FXC Control App on his/her smartphone or tablet. You can configure and monitor important parameters and settings, read fault/error codes and more.

In an RV application, there are other things to consider as well when shopping for an inverter. One of the most important — if you ever plan to plug into the electrical utility grid (aka "shore power") or a portable generator — is to use one with a built-in transfer switch. These units can sense when shore or generator power is present, then shut off the battery feed and use the incoming AC power instead. Next, consider if you want an inverter only, or an inverter/charger.



The FREEDOM XC PRO inverter/charger is rated up to 3,000 watts continuous power and weighs just 18 pounds. All models with built-in battery charger are programmable to use with lithium ion batteries.

"Chargers use many of the same components as inverters, so purchasing one with an integrated charger can ultimately save money and make installation simpler," said Wilson. "An inverter charger works just like an inverter with a transfer switch, but when transferring the incoming AC it also powers an onboard charger using the same wiring." An inverter charger will charge and maintain your battery when AC is available, when it's not, the system can automatically switch to inverter mode. On the other hand, if you already have a new or good-quality charger in your RV, then you may choose to purchase an inverter only.



The PROwatt SW inverter is available in 600-, 1,000- and 2,000-watt ratings and is designed for applications where the user will have direct access to the unit (as opposed to it being on a wall or in a compartment, for example). These entry-level, pure sine wave inverters feature dual GFCI AC receptacles to plug appliances into, plus a USB connection to provide power to most USB-chargeable devices.

Besides the wattage rating, you may also want to consider how the inverter will be used and the type of appliances that may be powered by it — now and in the future. For example, maybe all you need right now is a 2,000-watt inverter, but perhaps you've considered adding more appliances later on. In this case, it may be wise to seek an inverter/charger that features built-in parallel stacking. "Two inverter/chargers with parallel stacking can work in synergy to provide up to twice the rated current and charging output," said Wilson. "This allows you to expand your onboard AC power system." Inverters can also operate 240-volt AC applications, like a dryer, but only if the inverter is designed as series stackable so two inverters can be stacked to produce a 120/240-volt AC split phase (see sidebar).



In a compact RV application, a comprehensive inverter system may be easier to package than an on-board generator. The Coachmen Galleria is just one example of a small motorhome that uses inverter/charger and battery power exclusively.

Once you've established what you need, it's time to compare features. Not all inverters within the same wattage rating are equal. "There are a lot of considerations when choosing an inverter for your application," said Mitul Chandrani, director of marketing for Xantrex. "Do you want an inverter with a built-in transfer relay so incoming AC power can pass through and power downstream loads? Our Freedom X and PROsine do that. Are you going to mount the inverter where you will have access to it? Our PROwatt inverter has dual GFCI AC receptacles, plus a USB port."

### Sine of the Times

When it comes to inverters or generators, you'll often hear the terms, "modified sine wave" or "pure sine wave." Years ago, when portable generators like the Honda EU2000 and Yamaha EF2000s were introduced, the "pure sine wave" or "clean power" distinction was made so that users would know that the power these units produced was identical to the power that comes from a wall outlet in their home. Prior to that, lower-cost, modified-sine wave generators were designed for basic power needs like lights and power tools on a construction site, for example. "Modified sine wave is fine for some electronics," said Mitul Chandrani, director of marketing for Xantrex. "But they won't work well on some electronics like digital clocks, laser printers and electric blankets. Today, most inverters on the market are pure or 'true' sine wave, as they are sometimes called. The cost to produce pure sine wave inverters has come down dramatically over the years, so there is no longer a big cost difference between modified and pure sine wave inverters."

Finally, consider how the inverter will be installed. Freedom X and PROsine, for example, can be hardwired, where PROwatt can't be. Some are low-profile, lightweight and are slim enough to be installed in tight spaces, while larger, low-frequency inverters (typically required to handle one or more high surge loads) are not designed for space considerations. If you're not sure exactly what you need, don't hesitate to contact the manufacturer for specifics.

Inverter chargers, when used in combination with an appropriately sized battery bank and solar system, are a great choice for compact applications where there may not be room for a generator (like a camper van, Class B motorhome, truck camper or small travel trailer). Chandrani noted that the Coachmen Galleria is just one example of a contemporary Class B motorhome that uses only a 630-amp-hour (Ah) lithium ion battery pack and a FREEDOM XC PRO 3,000-watt inverter/charger to power the on-board microwave and all wall outlets.

As battery and appliance technology continues to improve, RVers will have more options when it comes to powering household devices. And that means the freedom to use modern conveniences when we need them.

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