

# Power Inverters

## Seven of the Most Commonly Asked Questions

**P**ower inverters — the devices that convert standard battery (DC) power to AC household power — are becoming more commonplace in the trucking industry. Depending upon whom you ask, that's to the delight, or chagrin of fleet and maintenance managers who often have a love/hate relationship with inverters.

"Inverters have always been a magnet of controversy," says Steve Carlson, Xantrex's OEM sales manager. Xantrex is a leading supplier of inverters, and Carlson says shipments have risen sharply since early 2012. The company expects this trend to continue in the next few years.

"Fleets know that drivers love them, as they provide an extra measure of creature comfort that helps with driver retention," Carlson says. "But, they can be nervous about inverters and their potential to damage the truck's electrical system."

Carlson says he often fields questions from fleets about inverters, and "the distrust of inverters is really a thing of the past, if, and I stress if, the right inverter and installation practices are followed. Inverters can be a great asset to drivers and fleets. The key is for fleets to do their homework and know what's best for their operation prior to making a purchase. One size does not fit all and inverter quality varies greatly."

Carlson says these questions typically rise above all others when fleets try to determine which inverters to purchase.

### *What size inverter should I buy?*

Far and away, Carlson says "what size?" is the number one and most important question he hears from fleets.

"It's easy to say get the biggest inverter on the market and you'll be covered for all your needs," Carlson says. "But that's not the best advice. Inverter sizes range from 300-watt cigarette lighter plug-in inverters to 5,000-watt units. Each fleet should do a survey on truck size and power usage and understand how their drivers will use an inverter — what items they want powered and what items will be used at the same time. That will help 'right size' the inverter for your operation."

As an example, Carlson says drivers will often run a microwave, TV and laptop all at the same time. "On each device you'll see a wattage number," he said. "A microwave might be rated at 1,000 watts, a TV at 250 watts, and a laptop at 95. Add them up to see how much continuous power you'll need and then add 20 percent. So, in this case you'll need just over 1,600 watts. Next, round up to find an inverter that meets your power needs. Xantrex, for example, offers an 1,800-watt unit, and that's what we would recommend."

While determining continuous power is an important consideration, so is "surge power. Whenever you power up any device, the initial load is more — and sometimes double — what the continuous power requirement is," Carlson says. "So the

surge rating on quality inverters should be about double. So, an 1,800-watt inverter can handle a short 3,600-watt power surge requirement."

Next, Carlson says to research how long the inverter can handle the surge. "The longer the better," he says. "Some on the market can handle only a few milliseconds of surge before the power draw shuts down the inverter. Others can last five seconds or more, and that's what you should look for."

### *What type of inverter should our fleet buy — sine or modified sine wave?*

There are two types of inverters on the market, a sine wave and modified sine wave.

"Both work well in a truck environment, but for those running sensitive electronics (like CPAP machines) or products that are plugged into their own chargers — a drill or a toothbrush — sine wave is the preferred choice," says Carlson. "Since sine wave is the same power as what you get at home, the voltage is consistent without spikes or drops. So, the device you're powering reacts just as it would if you were plugged in at home."

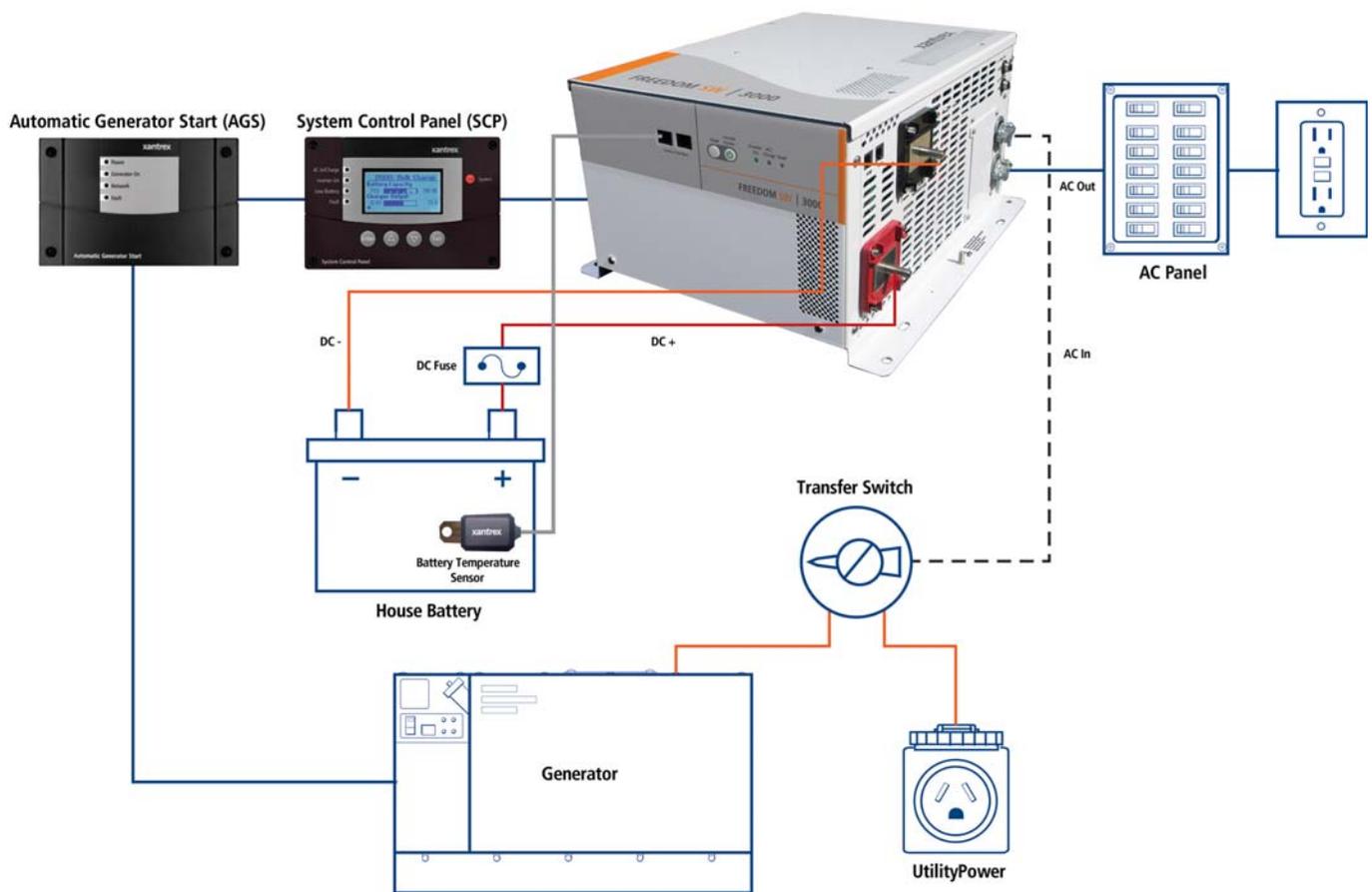
"But, in most cases, modified sine wave power is just fine in operating most electronics and appliances with the exception of a few sensitive applications."

As for the price difference? Carlson says the gap has narrowed and today

*A driver-installed power inverter was found to be the cause of the truck fire that destroyed this new 2012 Freightliner. The photograph is a good reminder why many fleets have strict policies against do-it-yourself installation of power inverters.*



*Photograph courtesy of Travis Cisneros*



most higher wattage sine wave inverters cost about 15 to 20 percent more than a modified inverter.

“With a sine wave unit, you’ll notice a slight decrease in the efficiency rating since electronics within the inverter use power to keep electrical levels consistent,” says Carlson. “It’s not much—we have an 87 percent efficiency rating on a Xantrex sine wave unit compared to 92 percent on a modified inverter. It’s like the difference between running a six-cylinder car versus four-cylinder car. That four-cylinder car may get a bit better fuel economy, but the six-cylinder is better in overall performance.”

### **Can our fleet install the inverter?**

“Generally speaking, yes,” says Carlson. “Most technicians will have no problem handling installation, and Xantrex does offer fleet training programs to our customers. We certainly would recommend our training program if there are any questions on installation. But, just remember, you’re working with electricity and electricity can bite if you’re not careful. It’s our recommendation that inverters over 300-watts feature hard-wiring and fusing.”

Carlson says there is a bevy of things to

consider when installing an inverter, starting with ‘where it should go’ and making sure there is adequate ventilation to allow heat to dissipate. “And you have to be cognizant of wire sizing and the distance between the inverter and plug-ins which can be put in the sleeper; plus the distance between the battery and inverter. There’s a lot to consider.”

According to Carlson, most fleets want the convenience of a factory-installed and warranted inverter. “We really recommend either an OEM install when you purchase a new truck, or have the installation done by an authorized dealer,” says Carlson.

“The OEMs have installation down to a science and it’s done on the line to rigid specs. Truck and aftermarket dealers also have the experience, so it’s worth spending a few extra bucks to have the installation done right, the first time, should your own staff not have the time or expertise.”

### **What kind of reliability can I expect?**

“When it comes to reliability, the old adage, ‘you get what you pay for’ comes into play,” says Carlson. “You will pay more for an inverter that has a ‘Regulatory Listed’ approval—such as UL or ETL with

UL458 rating. This means the inverter was inspected and approved by an independent agency which safeguards against issues with electricity. UL458 is the listing for inverters and chargers in mobile applications. They must meet strict vibration, environmental, and thermal requirements that non-UL458 units do not.

“This is the most important safety point I can make, and in fact, TMC’s RP 163, “Power Inverter Selection Recommendations,” calls out this UL listing for all inverters and chargers installed in a truck. What’s more, RP 160, “Wiring and Circuit Protection Guidelines for 12-Volt DC to 120-Volt AC In-Cab Inverter Systems,” discusses DC and AC wiring in a truck has requirements that are automatically met by UL458 listed inverters. The main point being that the neutral and ground are bonded together within the inverter. Inverters that are not UL458 listed do not do this as it allows the inverter to be made at a much lower cost.”

Buying an inverter that is not Regulatory Listed tells you “buyer beware.” “We’ve seen these types of products actually shock users, plus internally they often can’t protect themselves against power surges.”

Carlson says that inverters installed



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by truck manufacturers all are UL approved, but inverters sold at truck stops are not. He also suggests you look for how inverters are internally tested for quality control. "If the manufacturer you're considering tests to ensure quality, then they'll likely promote that fact in their marketing material, or on their web site," he says. "And, those inverters that have been tested will last longer versus inverters from manufacturers that don't spend the time and money to ensure quality. A quality inverter should last well beyond its warranty period."

Carlson says inverters will occasionally shut down, but quality inverters do so without damaging themselves. "If dust or cat hair, for instance, gets inside the inverter, it can cause it to overheat. A higher watt Xantrex inverter, for example, has an error code that lets you know what the problem is — in this case it will tell you that you are overheating and to check the fan. A simple cleaning or 'blowing out' will correct the problem and you'll be back up and running. Other inverters could leave you guessing as to what the problem is.

"And, if you overload the inverter, placing more wattage demands on the inverter than it can handle, the inverter will shut down. The difference between a quality inverter and low-end inverter is how they deal with a shut down. A quality inverter is designed to shut down with no ill effects. A low-end inverter can 'wear out' after multiple overloads."

***Should I get an inverter with a battery charger?***

"The simple answer is 'yes' if you can use 'shore power' (electrical outlets at home or on the road at terminals, loading docks, or truckstop)," says Carlson. "When plugged in, you can run everything you're running with your inverter for as long as you want, plus you can recharge and top off your batteries. The more you can use shore power, the better, as it prolongs the life of your batteries."

In fact, Carlson says having the shore power option and a charger in the system will add 20 to 30 percent to the life of the batteries if plugged into grid power whenever possible. "It also has the potential to eliminate one battery swap out over the five to six years use of the truck. This happens by keeping batteries fully charged, offsetting parasitic loads, and reducing the number of cycles."

According to Carlson, most installations

**How Much Power Do You Need?**

- Microwave: 1,000 watts
- TV: 250 watts
- Hot Plate: 1,300 watts
- DVD Player: 40 watts
- Laptop: 95 watts
- Hair Dryer: 1,500 watts
- Electric Blanket: 200 watts
- Portable Heater: 1,000-1,500 watts
- Electric toothbrush: 2 watts

use the inverter off the truck's starting batteries and quality inverters will have a low voltage disconnect (LVD) to shut down when voltage drops to 11.7 volts. This ensures the truck will have enough juice to start.

"Check on the LVD feature before you buy an inverter," cautions Carlson. "Many inverters on the market will run the batteries down to 10.5 volts, which will let drivers run electrical devices longer in the cab and sleeper. However, they won't be able to start the truck unless the truck comes equipped with its own LVD.

"Another option is to run two dedicated deep-cycle batteries and connect them to the inverter," continues Carlson. "Yes, they do add weight to the vehicle, and added cost. But, deep-cycle batteries were designed to be drawn down to a 50 percent state of charge, or 10.5 volts. This gives you double to triple the amount of continuous power to run hotel loads. Something your drivers will appreciate."

***What if I allow our drivers to bring in their own inverters?***

According to Carlson, not knowing what kind of inverter your driver is bringing in is why fleets often have a policy of not allowing drivers to outfit company trucks with their own inverters.

"But, if you do allow drivers to bring in their own inverters, then we recommend you give them a list of approved devices, with the most important common denominator being UL458 listed. And we suggest you make it mandatory that your shop or outside dealer does the installation."

***What is the purpose of an inverter if i already have a fuel-fired APU?***

The addition of an inverter to a truck electrical system will reduce hours of use on a diesel-fired APU (assuming that the APU does not already have shore power compatibility). "And, it will reduce maintenance costs and increase APU life," said Carlson. "An inverter can be used for hotel loads in the cab as long as environmental conditions do not require air conditioning. When those conditions happen, just power up the APU for air conditioning."

With this set-up, the only time the APU would need to come on is if the batteries drop to a low level. Once the batteries are charged, the APU can shut off again. "This significant reduction in APU run time means a quick payback on the cost of the inverter," says Carlson.