

Power Inverters

A great onboard asset—if specified wisely and installed properly

Power inverters—the devices that convert standard battery (DC) power to AC household power—have become very popular in boating circles and are now commonplace in the marine community. When understood and installed correctly, these nifty devices significantly enhance the overall boating experience for thousands of power boaters and sailors alike. However, what is welcome equipment for the enlightened and educated can prove both challenging and difficult for the uninitiated.

“**F**or many years, inverters were one of the most misunderstood and least appreciated electronic components in a boat,” says Xantrex Sales Application Engineer Don Wilson. Wilson, who authors a popular editorial column, “Tech Doctor,” produced by Xantrex, is published by marine print and online publications and blogs throughout the US and Canada. His goal is to take the mystery out of inverters and educate the boating public and industry at large. The efforts are working, as marine industry inverter sales and installations are on the rise, with forecasts for continued growth.

“Once boaters understand the real beauty and benefit of what inverters can do and they enjoy a successful installation, they love the many added comforts they provide,” says Wilson. “My goal is to simplify the inverter or inverter/charger conversation so more boaters understand the opportunity and can take full advantage of today’s latest and most rewarding technology with confidence.”

As a technical columnist, guest speaker and seminar leader, Wilson frequently fields inverter-related questions from diverse audiences at trade and consumer shows and educational events.

“It’s exciting for me because boaters are very curious about inverters these days. I’m always surprised and pleased by both the level of interest and enthusiasm I encounter when addressing the topic, along with the important questions that are asked.”

His winning formula and advice for inverter success begins with education.

“For sure, inverters are a great asset to boaters. However, the critical factor and key for success is to make absolutely sure that whoever is responsible for selection and installation does his or her homework in advance prior to purchase. Knowledge is power. One size definitely does not fit all in this category,” he says.

B.J. Chapman, sales manager of Payne’s Marine Group, which has multiple dealership locations in Victoria, Vancouver, Burlington (Ontario), and Campbell River,

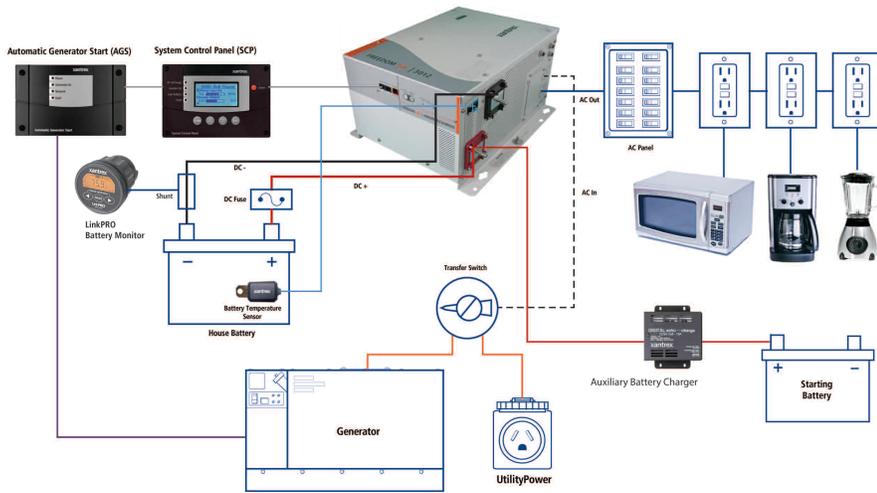
Canada, agrees. Consumers interested in inverters often visit his dealerships with preconceived notions and incorrect assumptions. Many of the same questions often emerge in the inverter discussion.

“Our customers all tend to ask many of the same questions and express similar concerns,” says Chapman. “They want to know if they need an inverter/charger or just a stand-alone inverter. They want to know how much power they will need, and if they can install an inverter/charger with an existing charger. Another major question they usually ask: do they have enough battery power? Of course, they always want to know if they should choose modified or pure sine wave inverters.”

Starting on page 42 Tech Doctor Don Wilson addresses Chapman’s customers’ most pressing questions involving inverter selection and purchasing process.



Tech Doctor Don Wilson says inverter/chargers are the way to go if you have access to shore power or a generator.



Installation is critical and starts with an analysis of the electrical system's size and power usage in order to understand how the owner will use the inverter. That information is important in specifying the right size of inverter to put on the boat.

1 Size—Does it matter?

Wilson claims his hands-down, single most frequently asked question is: What size inverter do I need?

"Many boaters mistakenly believe or assume that size is everything and bigger is better," he says, adding that such conclusions are intrinsically faulty.

"Inverter sizes range from 300 watt cigarette lighter plug-in inverters to 5,000 watt units. Each installer should thoroughly and carefully survey electrical system size and power usage to understand exactly how the owners 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 each unique operation."

As an example, he says owners may run a microwave, TV and laptop simultaneously. "On each device you'll find a wattage number. A microwave might be rated at 1,000 watts, a TV at 250 watts, and a laptop at 95. Add them up to determine how much continuous power you'll need at once; and then add 20%. So, in this example, you'll require just over 1,600 watts. Round up to find an inverter that meets your combined power needs. Using Xantrex brand options in this example, the 1,800-watt unit would be recommended."

In addition to continuous power, another important consideration is surge power.

"Whenever you power up any device, the initial load is always more—sometimes more than double the continuous power requirement," explains Wilson. "So the surge rating on quality inverters should be about double the continuous power rating. An 1,800 watt inverter, therefore, is capable of handling a short 3,600 watt power surge requirement."

And there's more: how long can the

inverter handle the surge?

"The longer the better is the right answer," says Wilson. "Some inverters on the market are only equipped to handle a few milliseconds of surge before the power draw shuts down the inverter. Others can last five seconds or longer. Be sure to ask, understand the requirement and compare the options."

2 Type of power—Sine or modified sine wave?

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

"Both work well in a marine environment, but for those running sensitive marine electronics or products that are plugged into their own chargers, sine wave is the preferred choice," says Wilson. "Since sine wave is the same power you use at home, the voltage is consistent without spikes or drops. Using sine wave for the device you're powering onboard will react just as it would if you were plugged in at home."

By comparison, modified sine wave power works equally well in operating most electronics and appliances, with the exception of the more sensitive and higher tech applications.

"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 Wilson. "It's not much. At Xantrex, for example, we have an 87% efficiency rating on a sine wave unit compared to 92% on a modified inverter. It's like the difference between running a 6 cylinder car versus 4 cylinder car. That 4 cylinder car may get a bit better fuel economy, but the 6 cylinder delivers better overall performance."

The price difference between the two? The gap has narrowed and today, most of the higher wattage sine wave inverters will run about 15 to 20% more than their modified inverter counterparts.

3 Installation—OEM, boatyards or local electricians?

Wilson notes there are multiple considerations to installing an inverter, ranging from where it should go to ensuring there is adequate ventilation to allow heat to dissipate. In addition, wire sizing, the distance between the inverter and appliances, plus the distance between the battery and inverter, among others, must be thoroughly analyzed.

"We really recommend either an OEM install with a new boat purchase, or have the installation done by a qualified marine dealer and technical service provider who has the necessary experience to do it right," says Wilson. "It's truly worth spending a few extra bucks to have the installation done right, the first time."

Xantrex invests in and provides training programs to its marine dealers and advocates such training program for best installation practices.

"After all, when you're working with electricity, you must always remember it can bite if you're not careful," says Wilson. "We recommend that inverters over 300 watts feature hard-wiring and fusing, so the training and experience are really critical."

Unfortunately, some boaters mistakenly turn to their local land-based electricians to tackle a marine inverter install, a potentially dangerous move.

A few words of advice and caution come from the American Boat & Yacht Council's (ABYC) Director of Educational Programming Ed Sherman regarding the importance of marine-centered onboard AC installations.

"One of the things I've learned over the years is that it is unreasonable to assume that field installers have any knowledge of very specific standards that apply to onboard AC installations," he says. "Most people think that a licensed, land-based electrician may be the most knowledgeable when it comes to onboard electrical installations. Nothing could be farther from the truth."

"The terrestrial and onboard installations are quite different from one another, and there are different standards that apply to each," he explains. "In fact, land-based electricians, if they follow their instincts and

Ask the Tech Doctor

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training, can actually create very dangerous situations on board boats. Manufacturers need to be keenly aware of this and recommend marine-centered training for these individuals to ensure a safe installation.”

4 Reliability—You get what you pay for

ABYC was created in 1954 as a non-profit organization to develop safety standards for the design, construction, equipage, repair and maintenance of boats. ABYC is the pre-eminent standards writing body for the marine industry in North America. Its standards are applied globally for vessels entering the US and Canada.

The organization, according to Sherman, has developed eight highly regarded industry certifications in the areas of electrical and corrosion, marine systems, gas and diesel engine installations and composites, along with basic training programs in the area of electrical trouble-shooting and installation and corrosion mitigation.

“Both our basic electrical and electrical certification programs provide installers and technicians with detailed information, both standards-related and best industry practices relative to onboard AC power technology and distribution,” he says.

Tech Doctor Wilson is a huge champion of ABYC standards and stresses the importance of ABYC compliance and related safety implications whenever the opportunity arises.

“When it comes to reliability, the old adage ‘you get what you pay for’ definitely rings true,” says Wilson. “Yes, you will pay more for an inverter that has a ‘Regulatory Listed’ approval, such as UL or ETL with a UL458 rating. This approval confirms that 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. The ABYC calls out this UL listing for all inverters and chargers installed in a boat.”

ABYC also specifies DC and AC wiring in a boat, and has requirements that are automatically met by UL458-listed inverters. The main requirement is that the neutral and ground are bonded together within the inverter. Any inverter that is not UL458 listed does not meet criteria; while such may have a lower price tag, it's definitely BUYER BEWARE.

“We've seen these types of products actually shock users,” says Wilson, “plus internally they often can't protect themselves against power surges.”

Another critical consideration? “Look for how inverters are internally tested in the quality control process,” says Wilson. “If the manufacturer you're considering tests to ensure quality, then they'll likely promote that fact in their marketing materials or on their website. Those inverters that have been tested will last longer versus inverters from manufacturers that don't invest in quality measures. A high-quality and reputable inverter often lasts beyond its warranty period.”

While inverters may occasionally shut down, quality inverters do so without damage.

“If dust or cat hair, for instance, gets inside the inverter, it can cause it to overheat. A higher watt Xantrex inverter has an error code that immediately identifies the problem. In this case, it will advise you of overheating and instruct you to check the fan. A simple cleaning or ‘blowing out’ will easily correct the problem and have you back up and running in no time. A cheaper inverter, on the other hand, may simply fail to operate and leave you guessing as to the source of and fix for the problem.

“If you overload the inverter, placing more wattage demands on the inverter than it can handle will cause the inverter to shut down,” he explains. “The difference between a quality inverter and low-end inverter is how they respond to shut-downs. The quality inverter will shut down with no ill effects, while the cheaper alternative often wears out following multiple overloads.

5 Battery charging—Should boaters opt for an inverter with a built-in battery charger?

“The simple answer is yes if you can use ‘shore power’ or a generator,” says Wilson. “When plugged in, you can operate everything you're running with your inverter for as long as desired, plus you can recharge and top off your batteries. The more you can use

shore power, or your generator, the better, as it prolongs the life of your batteries.”

In fact, Wilson claims the shore power option with a charger in the system will add 20 to 30% to the life of the batteries if it is plugged into grid power as often as possible.

“Here's a surprising statistic: This set-up has the potential to eliminate one battery swap-out over the five to six years use of the boat. This occurs as a result of keeping batteries fully charged, offsetting parasitic loads, and reducing the number of cycles.”

According to Wilson, some installations use the inverter off the boat's engine batteries. Quality inverters will have a low voltage disconnect (LVD) to shut down when voltage drops to 11.7 volts, ensuring sufficient juice when it's time to start the engines.

“Be sure to check on the LVD feature before you buy an inverter,” cautions Wilson. “Many inverters on the market will run the batteries down to 10.5 volts. Owners can continue to run their electrical devices at these levels, but when it's time to crank the engine, they'll be sorely disappointed to find they don't have the necessary power.”

Another option is to run dedicated deep-cycle batteries and connect them to the inverter. While they add weight and cost, deep-cycle batteries are designed to be drawn down to a 50% state of charge, or 10.5 volts. “This gives you double to triple the amount of continuous power to run house loads,” says Wilson, “and will be a worthwhile investment for many boaters.”

Chapman at Payne's Marine Group offers an additional recommendation.

“When choosing an inverter or a charger, always take into consideration potential additions you may make in the future, and select accordingly. In addition, if you are not a professional installer, you may want to have one assist you in designing your system, as this can save headaches down the road.”

We're grateful to Xantrex, a leading supplier of inverters based in Burnaby, British Columbia, for providing this article. We will continue the discussion about inverters in future issues. If you have comments or specific questions that you'd like us to address, please email them to mediagroup@roadrunner.com.