Wiring a boat

For the last several weeks, I have been chasing a problem that has been causing me to lose sleep at night. I finally conquered it by fixing a ground and using isolated power with a heavier guage wire. So I wanted to make a short checklist that might help you if you run into a similar issue. Unfortunately, not all boats have them. For as long as I can remember, however, Ranger has included one in most of their boats. Rather than purely guessing, having that roadmap can be huge when you're tracking down problems. I always use color-coded wire with red for positive and black for negative. This takes a lot the guesswork out of the problem solving. Use high-grade connections and always use dielectric grease and shrink tubing on connections. You should never skip this step because it will save you a lot of trouble over time. A good set of powerful crimpers are an excellent investment, too. Liquid tape is another inexpensive purchase that can protect against shorts. Always tighten battery terminals snugly on the battery posts. A good rule of thumb is to put the smallest leads on the bottom. Use the box-end of the wrench when tightening as it is less likely to slip and bloody your knuckles. A loose connection can cause a short or more resistance and which will keep your battery from performing optimally. Loose leads can use more power and significantly decrease your battery life. Always hook up the positive lead first, too. I also replace all wing-style nuts with nylock. They hold much better and are less susceptible to loosening due to vibration. They are inexpensive and can solve a problem quickly. Battery power is DC, or direct current, so set up your meter for that. I also have a battery load tester, too. These can point out a bad cell quickly and save you a lot of time. A good group 27 or 31 battery is the best choice to power them and I strongly ecommend a deep cycle over a starting battery for this application because they hold a longer charge. If it gets snug during the pull, back up and re-pull as nicks and scarring of the shielding can cause problems down the road including dead shorts. Never pull zip ties into a chase. Use ferrite rings or RF coils around electronics to dampen radio frequency interference. Load requirement and distance from the battery will help determine proper gauge wire and fuse requirements. For example, a trolling motor on a foot boat should have 4 or 6 gauge wire for best battery utilization. Every problem cannot be solved with this checklist, but it will give you a good starting place. Study schematics, never be afraid to attempt the job and if necessary, enlist expert help in the form of a reputable dealer or manufacturer and you can cut the down time significantly. Boat owners should never cut corners on wiring jobs. Photo: Terry Brown. Not only will your equipment not work, but bad wires can result in a fire. A limited amount of zip ties is the best choice as they can snag if wiring need to be worked on. Boats and Maintenance. In a boat, electricity is stored in one or more batteries. They can hold an enormous amount of energy, capable of pushing hundreds, or even a thousand amps more than your entire house uses â€¦ so care must be taken, and proper circuit protection should not be ignored. Greatly generalizing the topic here, but you usually run into two types of batteries in the size of boat we deal with:. Batteries have a positive and negative. For current to flow which does the work a complete circuit must be made from positive back to the negative. A normal battery might have AH amp hours of capacity. Meaning it can run a 1A load for 70 to 80 hours, or a 10A load for 7 to 8 hours before it is discharged. Much appreciated. Have an awesome holiday! In nearly all cases your boat wiring system should have a marine grade main battery disconnect switch. This allows you to open the switch turning everything off at once. Both battery positives are ran through this switch, and you can use it to select which battery you want to output, similar to an A-B switch. But a BOTH marine battery switch also allows you to parallel both batteries. The both setting might be used when you are running your engine and want to charge both batteries from the alternator, or if you need to parallel the batteries in an emergency to help start your engine if your start battery becomes too depleted. I allows your house and start battery to remain isolated except for emergency conditions. Used to shutoff everything and prevent trickle charges from draining your battery. This way, even if your battery switch is off, if your boat starts filling with water the pump will still kick on. Notice the fuse shown â€" this needs to be circuit protected with an inline fuse like this one. We have an in depth article here on how to wire a bilge pump â€¦ check that out as well for more details. It looks great and using your tutorials I have been able to rewire my 10 year old center console. The support I received from New Wire Marine went above and beyond. Thank You! The next step is to get the power from the house battery up to the switch panel where we can use it to do some good. Two conductors â€" a positive from the battery switch with a fuse and a negative from the ganged together battery negatives should be ran to where the central switch panel is. You should use marine grade primary wire for this. This is sometimes a long wiring run on a boat. Plus these two conductors will carry the current of all your electrical loads combined, so they are typically fairly beefy cables. Prevent voltage drop by using larger cable. The power cables will be run to your New Wire Marine custom marine switch panel and your tinned marine negative bus bar. The main house battery positive conductor will feed directly into the new switch panel. They asked the

right questions and provided great solutions! This is meant to land on a terminal block like this one. Each switch output gets its own gang on the terminal block, and with the labels right there it makes a handy breakout point for troubleshooting or adding items down the road. This is how one of our fully wired switch panels would interface with a terminal block. From here the rest of the wiring is straightforward. Just hookup your existing boat wiring infrastructure to the terminal block and buss bar. Positives to the terminal block, and negative to the bus bar. Most are terminated with standard 8 ring terminals. The positives of course must be installed on the correct gang associated with the respective switch for that load. The negatives can go on any screw on the buss bar, they are just trying to get back to the negative post on the battery. Wiring A Boat eric steele T A few notes before we start: Positive wires are red in our guide, your boat may have other colors Negative wires are black or may be yellow on your boat Current is measured in Amps A Potential difference is measured in Volts V Current flows through the wires like water through a pipe. Like water pressure in a pipe. Jump To Complete Diagram. The Electrical Source: a Battery. A normal battery might be able to push A or more current A normal battery might have AH amp hours of capacity. TIP: use the tabs to view and hide notes. Diagram View Notes. View Notes. Angels Camp, CA. Main Battery Switch. View Our Battery Switches. Bethesda, MD. See More Example Switch Panels. Houston, TX. Install Terminal Block as Breakout Point. Vero Beach, FL. Here is a tabbed step-by-step diagram for how to wire a boat. Battery Switch. Bilge Float Switch. Main Feeders. Terminal Block. Load Wiring. Dig our Boat Wiring Content? Go to Top. The following is meant to apply only to small outboard boats under 16 feet 50 horsepower or less. Is there one and where can I find it? Is there a set of step by step instructions? This is because no two boats are alike. But some generalizations can be made. Note 1 : I will not deal with the wiring specifically for the outboard motor and controls. Here is a web site where you can obtain wiring diagrams for most outboard motors. Most new outboards come with a wiring harness and a manual that has wiring diagrams. Use the old system to help make a plan in steps 1 through 7. Trace out each wire and put that on your diagram. This will make it far easier to locate wires and equipment. Wait until you actually start installing wiring in step Then replace each set of wires with new. This may take a little more time, but will result in far fewer mistakes and less troubleshooting. Step 1. Make a Plan. Decide what you want to install, and where it will go. Step 2. Draw a simple schematic diagram that shows each piece of equipment, the fuses, switches, and how all of this will be connected. Here are two alternative examples. Click on the diagram to expand. Just make a box or circle and write in what it is, or you can use a picture of the item. Remember, any 12V DC device has to have at least a positive and negative wire connected to it. Put a plus or minus next to the wire or use red for positive and black for negative. On Metal boats do not use the hull as a return path. None of the wiring should be electrically connected to the hull. Here is a link on how to draw electrical diagrams. There are several ways to do this. The most important thing is that you understand what you are diagraming. It needs to be simple enough and clear enough for you to be able to refer to it in the future and still understand what each item is, what the wiring is and how each item of equipment is tied into the electrical system. That way, in the future if you want to add or subtract equipment you can do so by referring to your diagram and determining where and how it fits into the system. Step 3. Batteries: Decide where you will put the battery. Later we will decide the capacity and type of battery but for now we only need to decide where to put it. The battery is the source of power for starting, instrumentation, and lighting. There may be a second battery on some boats for running a trolling motor or other equipment. Batteries should not be too close to anything that can cause an accidental short. There should be 12 inches of space all around them. Batteries must not be directly under or over fuel lines or under other electrical equipment such as a charger or inverter. If they are, there must be a floor or panel separating them. Batteries need to be in a space that is ventilated to the atmosphere. If the battery is in a box the terminals are protected against accidental contact with tools. If it is not in a box the terminals need to be covered with a boot or some other device that protects them from contact. The battery should be close to the engine. Since starting current is so high, and the wires to the starter are not fused, you want to keep the wires as short as is practical. How big a battery capacity, not size do you need? There is one non-electrical consideration; weight. Batteries weigh a lot. Think about how the weight of the battery will affect weight distribution on your boat, especially if it is on the same side as the helm and controls. You may have to move it to balance the boat side to side. If you have a very low transom, how will the weight of the battery affect the water line at the transom? Step 4. Where the battery is located determines where the battery switch goes. It should be close to the battery but easily accessible to be switched off in an emergency. The battery switch is necessary to turn everything off when you are not using the boat. A good brand is Perko but there are others. There are cheap ones on the market that will get hot and melt. Also a battery switch must be ignition protected. Ignition protection means

that it will not ignite gas fumes if they are present. This is extremely important if you have a fuel tank in the same compartment. Most small outboard boats have a motor well forward of the transom and the space under the motor well is where the battery, bilge pump, battery switch and fuses, and most importantly the fuel tank are placed. It may be a portable tank. If it is, it vents into the compartment. If it is a permanent tank it will have an overboard vent, but if there is a leak, it will leak fumes into the compartment. You don't want anything in there that will set this off. So use ignition protected components. Submersible bilge pumps are usually ignition protected. If you use circuit breakers instead of a fuse they must be marine ignition protected circuit breakers. However, batteries are not considered a source of ignition because there are no moving parts to cause a spark, but if you make accidental contact with metal tools it can create an arc. That is why the terminals must be protected, and why battery switches in this compartment must be ignition protected. Buy a switch that has a provision for two batteries because you may want to add a battery in the future. The 1 position uses the one battery and allows charging of that battery while the engine is running. The 2 position uses and charges the second battery, if there is one, and the BOTH position puts the two batteries in parallel doubling the capacity and charging both at the same time. Step 5. Next we need to install a fuse block close to the battery switch. Standard wire loom is fine. Not the equipment. If you overload wiring it gets hot, melts and starts a fire. This fuse is in the main power feed to the instruments and all the electrical equipment so it will most likely be 15 amps. But we will determine that later. See Step Buy a fuse block with two fuse holders. That way you have a spare if the fuse blows. Step 6. Determine where each piece of equipment will be. Think about where you want things to go. Depth finders need to be where they are easy to see, but not blocking your vision when operating the boat. Radios should be where the operator can easily reach the controls, and reach the mike if this is a marine VHF radio. The back of the console or place you are mounting them needs to be easily accessible for mounting the device and for access to the wires. Step 7. Locate the fuses, buss bars and switch panels. Use the locations of each piece to decide where to put fuse boxes, buss bars, switch panels, etc. Each of these must be close to the equipment they power, and easily accessible to be worked on. They cannot be hidden behind equipment or inaccessible panels. This may sound obvious, but I have seen some very bad installations. Also they should be where they are protected from spray or rain. Most electrical and electronic equipment comes with pigtails. Pigtails are wires coming out of the equipment and may only be a few inches or may be several feet long. Sometimes they have a connector attached to the ends of the wire. It can be open or covered. There are some devices that are connected directly to power and do not go through fuse blocks and switches. In other words, they always have power to them. One is the bilge pump. Bilge pumps usually have a float switch that automatically turns the pump on when water in the bilge gets to a preset height. It is not good practice to wire it directly to the battery though. Wire it to the power input side of the battery switch. Most automatic bilge pumps have an inline fuse or a built in fuse. It is also a good idea to install a switch at the helm that allows you to turn the pump on manually. Step 8. Make a drawing showing where the wiring will be. Make a rough drawing of the boat looking down from the top. This is what designers call a general arrangement and shows how the boat is laid out. Using your schematic, put in where the equipment, fuse boxes, buss bars, switch boxes and wiring are going to go. Remember, wiring cannot go through pieces of equipment, pipes, tubes and other solid objects that would be damaged. They can go through walls and bulkheads and panels. Wiring must be easily accessible for installation, trouble shooting and replacement. Where wiring goes through a bulkhead, wall or panel, it must have a grommet or padding to protect the wire from damage. Step 9. Figure out what size wire you need and how much. What about the wires from the engine to the battery? Because starters draw a lot of current, the wire needs to be a very heavy gauge, at least a 4ga on small outboard boats. This includes the positive and negative side. Both wires should be the same gauge. If the engine has the power wires already installed, the wires from the battery to the switch should not be smaller than those wires. The engine manufacturer has already determined the amount of amperage the starter draws and correctly sized the wires for the load. The positive wire red goes to the input side of the battery switch. The negative black wire should go to a buss bar. A buss bar is simply a block with a lot of posts on it. One is for the wire from battery to the engine. The others are for the equipment. There should be as many posts as in the fuse block. The positive wire should be red. Negative can be black, or yellow, or black with a yellow stripe. Throughout the boat negative wires should be black or yellow or a combination. But from the fuse block to the equipment all positive wires should be color coded using the standard color codes for marine wiring. This way you know what the wire is connected to just by looking at it. But for additional help in later troubleshooting, label the wire on both ends. A simple piece of tape with a name written on it will do. Wire must be marine wire. You should not use auto wire. It is not made to

the same standards as marine. Most marine wire is labeled UL. It must be copper stranded wire. Do not scrimp on wire! Cheap wire could mean the difference between a reliable system and one that you constantly have to troubleshoot. Buy good quality wire. The larger the gauge number, the thinner the wire. The thickest wires are 00 or 0 gauge. The smallest gauge allowed on boats for a single wire is 16 gauge, or 18 gauge in a bundle or sheath, but this may be way too thin for the equipment or the length of the wire run. The thicker a wire is the less resistance it has. The longer a wire is the more resistance it has, and so the more the voltage drops from one end to the other. You want to minimize the resistance, and the voltage drop. So you first need to figure out the wire size based on how many amps are being used, and then by how long the wire is. But don't just guess at wire size and buy larger diameter wire such as 14 or 12 guage. Use the tables to determine the correct size. A Hummingbird Model C depth sounder draws ma from the specifications. Their installation includes a 6 foot power cable of 18ga wire. This may be fine for connecting it to a fuse block near the dash, but the cable running from the battery to the dash is going to be at least feet long. You need to double that for the return wire. So I would go up a size to 16ga for the run from the battery to the dash. Since this wire may be powering other equipment from the in dash fuse block it would be good to make it larger than the wires from the fuse block to the equipment. Suppose I have three pieces of electronics running off a fuse block. Each has its own fuse and power cable from the block to the equipment. A single wire runs from the battery fuse block to the block in the dash. And a wire runs back from the negative buss to the battery. Adding the two gives the total length of the wire. Each piece of equipment requires 1 amp at 12 volts to run. So the total amperage is 3 amps. Therefore the wire from the battery to the fuse block and back has to support three amps without any significant voltage drop, or without getting hot and causing a fire. So you size that wire for the total load amps for that circuit. The first table determines the wire size based on load in amps and the second the size depending on length and voltage drop. You use the larger if there is a difference. See Appendix A at the bottom of this page.. For instance most boat manufactures use wire rated for C degrees Celsius - the temperature rating of the insulation on the wire. Looking at the table under the column for C we see amperages starting at 20 amps, 25 amps, 30 amps, and so on. Following the row for 20 amps to the left column we find 18ga. So go up one size to 16ga. See the table in Appendix A. Step Wire connectors. Cheap crimpers make bad crimps. Bad crimps lead to bad connections. Poor wire strippers nick the metal conductor which may cause the wire to break or have a high resistance. Wire terminals must be used. Connections should never be a bare wire wrapped around a stud or post. This is bad practice, and can easily come loose or result in a high resistance connection. High resistance equals heat, which results in fire. Use crimp type ring or captive spade terminals. Captive spade terminals have a tang on the ends. This prevents them from being pulled off or slipping off the stud or post. Connections have to withstand being pulled off. There is in the wire standard a table listing how much of a pull they have to withstand depending on the size of the wire. A 16ga wire must withstand a ten lb. A 4ga wire must withstand a 70lb pull. You can solder connections if you like but crimp them first. ABYC standards do not prohibit soldering, but they do not allow soldering to be the sole source of support for the connection. This is because solder creates a hard spot in the wire which is not as flexible as the wire itself and not as resistant to flexing and vibration. So if you solder you must also crimp. Crimp first, then solder. You can tin the wire before crimping if you want. Never use wire nuts to connect wires on a boat! They are too prone to vibration and corrosion. Seal wire connections with a good waterproof sealant. There is no requirement to do this, but this prevents water from getting in the connection and wicking up the inside of the wire insulation or corroding the connector. My method. I do not solder. First I slide a short length of heat shrink tubing onto the wire. Then I use dielectric grease. Dielectric grease is non-conductive grease, usually silicone that is also waterproof and can be used to seal connectors. Before crimping the wire in the connector I squirt a little dielectric grease into the connector. I then insert the wire and crimp it. Then I slide the tubing down over the connector and shrink it with a heat gun or hair drier so it seals itself around the wire and connector. The combo of grease and tubing should keep the water out. See the below links. How big should your fuses be? Fuses are rated by amperage and are there to protect the wire from overheating and starting a fire. Fuses must be rated at the same or less rating of the wire. So if you have a wire that is rated at 15 amps you need a 15 amp fuse. This is why on bigger boats you will see many separate circuits for different systems on the boat. Each circuit is rated for a certain amperage, such as 15 amps or 20 amps, and more equipment is not added to the circuit if it would cause it to draw more current than the fuse is rated for. This can become an issue on little boats too if you have more equipment, or something like a powerful stereo system that draws a lot of amperage. Then it should have its own circuit and its own fuse for the circuit. The question is how many fuses in the block? That depends on how much stuff

you are running. I would have a fuse for the lights, one for the instrumentation, and one for any electronic devices, plus a spare. That is four. But for expansion maybe a six or 8 fuse block would be better. Installing equipment. Start with the battery, the battery switch, and the main fuse block. Selecting a Battery: Batteries are rated by voltage and capacity. We are using a 12V battery. This is a measure of how many amps the battery can deliver for 30 seconds and maintain the voltage at 12V. Basically the higher the CCA rating the longer the battery will maintain its voltage. Batteries are also rated by amp-hours. Generally the rating is based on how many amps the battery will discharge for 20 hours until the charge drops to The higher the amp hour rating, the longer the battery will power your equipment. Also they are rated for Reserve Capacity which is how many minutes it will deliver the same voltage at 80 degrees. An average marine battery should have a reserve Capacity of 60 to 90 minutes. Anything less is not adequate. They are relatively inexpensive, can be purchased anywhere, and for a small boat, more than adequate. Install the battery box if you are using one, or a tray, then the battery. See table below on how to calculate load. Battery Capacity should be at least twice the load. Then install lights and electronic equipment. You want everything in place before you begin wiring. Put in switch panels and fuse blocks. From Step 5. We need to determine the size of the main fuse. The continuous loads add up to The fuses for each circuit should be 3 amp except for the radio because on transmit it draws 6 amps. So use a 10 amp fuse for the radio circuit. Check the manufacturer's installation instructions for recommended fuse sizes for each piece of equipment. Remember, this fuse is to protect the wire to the equipment, not the equipment. Some equipment may have built in or in-line fuses for that purpose. Begin installing wire , starting at the battery location and working outward to each fuse block and buss bar, and then on to each piece of equipment. Remember to follow the color codes and label the wires on both ends. If you decide to make any variations from your diagrams make sure you change the diagram for future reference. Turn on the power. Test each item , one at a time to see if everything works. Troubleshoot as you go. Note: This is the table that is in the Federal Regulations. The table below is from ABYC. Table to determine wire size due to voltage drop based on the length of the wire. This table is for 12 volts only. Length of conductor from power source to the device and back to the power source. Usually these have a single swith with 3 positions; off, 1. The diagram shows a Cole-Hersee switch that is in common use for this, but there are other manufacturers that also make switches for this, such as BEM and Blue Seas. They all do the same functions. In this diagram the lights are wired directly to the battery. However, some prefer to wire it through the battery switch so the battery is not discharged if the lights are accidentally left on. It is just a matter of switching the power lead to the number one position on the battery switch. Custom Search. Those are the battery cables. The red block on the end of the red wire is the boot that covers and protects the Positive battery terminal. Click on the photos for full size. This is a typical submersible automatic bilge pump. It has a built in float switch that activates it. Note the black connector that plugs into the pump, with two black and two red wires. One set are the positive and negative wires to power it, the other two go to the manual switch at the helm. See the following table: Temperature Rating of conductor 0. Everything Boat Building Don't tell me that I can't. Tell me how I can. For an official interpretation of regulations or standards you must contact the US Coast Guard or other organization referenced.. The entire electrical section of this website may be purchased and downloaded. A step by step practical guide. Covers Planning, Diagrams, Wiring, Batteries, ignition protection and more. A Single Battery Tray. Two Battery Trays. Note the large red and black wires in both pictures. A Battery Switch. Buss Bar. Conductor Size English metric. Notes for the above table. Temperature Rating of Conductor Insulation. See the following table: Temperature Rating of conductor. See the following Table: Number of current carrying conductors.

If your boat came from the factory with only one battery, or with two batteries of inadequate size, consider installing a second battery bank. If you are installing a reserve starting battery, you can usually ensure enough amps of cranking power by duplicating the type and size of your original battery. Dual-purpose flooded batteries combine the ability to withstand deep discharges with cranking power to start your engine. Starting batteries are similar to automotive batteries. They can supply lots of current for a short

period of time, but like to be recharged almost immediately and are not tolerant of deep discharges. They are appropriate as the single battery for wakeboard boats, runabouts, personal watercraft and other boats with minimal DC loads where the engine is always running. Deep-cycle batteries can endure repeated deep discharging and recharging without damage. They are appropriate for sailboats, fishing boats and all other boats with larger DC power requirements. Any battery used to power onboard DC loads such as lighting, trolling motors, inverters and other systems should be a quality deep-cycle battery, like our West Marine brand. Most boats with dual-battery systems use one starting battery and one deep cycle battery. Dual-purpose batteries work well in some applications and are a good compromise because they tolerate deep discharges that would ruin a typical starting battery. Since they have lower storage capacity than comparably-sized deep cycles, we recommend them for boats with two identical batteries used interchangeably for starting and house electrical loads. Installing a Battery Charger. Selecting a Battery Charger. Selecting a Marine Storage Battery. Sizing Your House Battery Bank. This credo works as well for batteries as it does for real estate. Batteries are temperature sensitive, needing a temperature that is comfortable for a person, and high temperatures dramatically shorten their life. If the proposed battery location is too hot for you, it is also too hot for your battery. Batteries, especially the flooded type, give off lighter-than-air explosive hydrogen gas when charging, so they must be vented from the top directly to the outside of the boat. If there is insufficient natural ventilation you may have to add a sparkproof exhaust fan to eliminate gas buildup and to lower the temperature. Batteries, especially the flooded type, must also be easy to get to for service. We recommend low-resistance, tinned copper wire in all applications. Moisture, vibration, heat, abrasion and chemicals are major enemies of all electrical system components, and only marine rated wire like that from Ancor Marine is built to withstand these conditions. Be sure to use tin plated copper connectors as well, for the least electrical resistance and the best corrosion protection. We recommend double-crimped terminals, with solid metal-to-metal connections and heat shrink tubing for waterproof protection. Pre-manufactured battery cables are available in various lengths with well-constructed connectors, properly covered with adhesive-lined heat shrink and terminated with closed barrel ring terminals. However, the lengths available may not be appropriate for your installation so you may have to make your own battery cables. To do this requires a proper crimper. There is no way to shortcut this since terminals smashed on the cable with a pair of Vise Grips or a few hammer blows will certainly fail, perhaps with catastrophic results. You must use a heavy-duty crimper designed for the purpose. Use closed-barrel terminals with holes the right diameter for the bolts to be used at the terminations. Positive and negative terminals often have different diameters. Spray a corrosion inhibitor such as Fluid Film, Lanocote, or Boeshield into the connector before crimping. Cover the joint between the cable insulation and the connector body with a three-inch section of adhesive-lined heat shrink tubing. Using a heat gun is the best way to apply heat shrink, although you can use a propane torch with a flame spreader if you are very careful. Be sure to have a fire extinguisher on hand. Remember to cover positive terminals with a boot or the battery box cover to prevent shorting. Polypropylene Battery Box for Group 27 or Group 31 battery. The batteries must be secured so there is no more than one inch of movement in any direction. Pre-manufactured, acid-proof battery boxes are available in various sizes and are the best way to safely anchor the batteries. Use more than one box if your batteries require you to make a series or parallel arrangement. Home-built battery boxes must be ruggedly constructed from marine grade plywood, covered inside and out with fiberglass cloth saturated with several coats of epoxy, and secure even in the event of a capsize. Do not mount batteries directly above or below a fuel tank, fuel line or filter or directly below battery chargers or inverters. Most single engine boats built in the last 40 years are equipped with two nearly identical and undersized marine batteries, used interchangeably for starting or house loads. Once the engine was turned off while anchored or under sail the operator would in theory return the switch to the 1 or 2 positions, and reserve a battery for starting. When it was time to crank the engine again, the battery switch would be turned to BOTH, or possibly to the reserve battery, and the engine would be started. The problem is that this requires a lot of thought by the operator, who is trying to relax in the first place. Sooner or later a crew member may leave the switch in the BOTH position, resulting in a very dead battery. Statistically, dead batteries are one of the most common reasons for calling a towing service. Battery isolators used to be the best method of distributing charging current to multiple battery banks while assuring that they remain electrically isolated during discharge. Their disadvantage is that diodes cause a voltage drop that wastes charging energy, creates heat and causes batteries to be undercharged. Alternators with external voltage sensing can correct for the undercharging problem, but voltage drop and the heat generated remain a problem. Automatic Charging Relays ACRs, also called Voltage Sensitive Relays are a popular

method for achieving the same goal as isolators, but they work on a different principle. Instead of using diodes to block current from flowing in both directions, ACRs use mechanical relays combined with a circuit that senses when a charging source is being applied to either battery. ACRs can be used for load shedding, pilothouse navigation battery isolation, and charge current limiting for a remote battery. Adding another battery is a good idea if you want to add a powerful stereo subwoofer system, cabin lighting, electric windlass, wakeboard ballast pump or any of the other electrical and electronic accessories we all want. The installation can be as simple as connecting two batteries in parallel to make one larger battery bank. You can build in redundancy and failure protection with two battery banks, battery switches and charge management devices like ACRs. That way, when you drop anchor and use all your new gadgets, your engine will still start at the end of the day. Remember that you must match battery chemistries between your banks. If your starting battery is of the lead-acid type, stick to a deep cycle battery of the same chemistry, instead of choosing a gel or AGM battery with different charging requirements. We use cookies to optimize site functionality and improve your overall experience. You can change your cookie settings through your browser. To learn more about cookies, please see our Privacy policy. West Advisor Articles. Cookie Disclosure We use cookies to optimize site functionality and improve your overall experience. These switches are easy to install and durable. Even though these ignition switches are not used widely due to lack of knowledge about them. It has 6 terminals on its back, with two of them marked with the same letter, a boat's ignition switch wiring appears to be a challenging task. But it can easily performed by following the steps given below. Then once the hole is drilled, slide down the ignition switch into the bezel which will be provided with the switch. Then, thread the plastic nut onto the underside of the switch and tighten it such that it holds the bezel in place. Next, pull up the ignition cable through the hole in the dash. The terminal on the switch which is marked as "B" has to be located. Then find the red wire in the ignition cable with a purple stripe throughout its length. Using soldering iron, solder it to the "B" terminal along with the rosin core solder. Solder the purple wire into the "A" terminal. Next , solder the purple wire with a white stripe along its length to the "C" terminal. Then, solder the yellow wire with a red stripe on it to the "S" terminal. After soldering the terminals specified in the previous steps, solder the black wire with a yellow stripe to any one of the two terminals which is marked as "M". Then, solder the black wire with a white stripe to the another terminal which is marked as "M". Finally, using the spray vinyl electrical insulation, spray all the terminal connections. Now, mount the ignition switch in the dash with the mounting screws that are already provided. You have successfully wired your boat's ignition switch. We welcome your comments and suggestions. All information is provided "AS IS. All rights reserved. You may freely link to this site, and use it for non-commercial use subject to our terms of use. View our Privacy Policy here. Toggle navigation subscribe. How to Wire a Boat Ignition Switch. Written by Shaina Bakshi. To ensure our content is always up-to-date with current information, best practices, and professional advice, articles are routinely reviewed by industry experts with years of hands-on experience. What You'll Need. Spray vinyl electrical insulation. Hole saw. Rosin core solder. Soldering iron. Your boat ignition switch requires replacement when the switch does not provide electricity to the engine without efforts. Wiring the regular three-post ignition switch for the outboard may be a difficult task to some boaters who do not know the technical details of the boat wiring. It is indeed an easy process to wire a boat's ignition switch. Usually, all ignition switches have the same basic function despite its additional features, i. These ignition switches are basically used to control the power going to the primary side of the starter solenoid and the shipboard. When the switch is in the on mode the circuit is completed. These ignition switches are used in boats, off road vehicles, industrial equipment and generators. Critters ate the wires off on my Baja bass boat, model HLS, while it was Read More. Replacing a transom seal?? I am looking at a fixer upper boat that needs a new fuel tank and transom s Rewiring a whole motorcycle ignition switch wire gauge capacity limit. I am having a problem with my motorcycle lights getting weak and sometimes I have pared down Related Posts Wiring Ignition Switch. What do the letters stand for on my ignition switch A R I B Boat Trailer Wiring. Wiring for a boat lift Looking for advice. Out boat lift was recently installed and is wired as follows: from the hous Wiring shore power pedestal for boat. Hi, I have a question about wiring a new shore power pedestal on my dock. Popular Articles. Installing a Boat Ignition Switch. By Tim Bossie. How to Wire a Car Switch Panel. How to Test a Boat Ignition Switch. Symptoms of a Bad Ignition Switch. By Jackie Carmichael. Install an Automatic Anchor Light. By Sage C. It appeared in the October 15, issue of Practical Sailor magazine. Honey is a highly decorated competitive sailor with a sublime record as an ocean navigator. A large conducting body, such as the earth or an electric circuit connected to the earth, used as an arbitrary zero of potential. In a normal house on land, the problem of grounding is simple. It consists of the green grounding wire in the AC wiring system

and serves the purpose of preventing shocks or electrocution. The ground connection is usually made by clamping to a metal water pipe or by driving a long copper stake into the ground. On a boat, things are considerably more complicated. In addition to the AC ground, we need a DC ground or return line, a lightning ground, and a RF ground plane for the radio systems. Our first thought might be to simply make the ground connection to a metal thru-hull, propeller shaft or other underwater metal. This underwater metal will be grounded by connection to the seawater will serve as our water pipe. Unfortunately, a connection between any of these systems and underwater metal can, and probably will, give rise to serious electrolytic corrosion problems. This article will discuss the particular requirements of each system, resolve the contradictions between the systems and present a consistent and correct solution for a complete, integrated, marine grounding system. Figure 1. The boat's electrical system should be connected to seawater at one point only, via the engine negative terminal or its bus. Every light or appliance should be wired with its own DC return wire. Never use the mast, engine, or other metal object as part of the return circuit. The DC load returns of all branch circuits should be tied to the negative bus of the DC distribution panel. In turn, the negative bus of the DC distribution panel should be connected to the engine negative terminal or its bus. The battery negative is also connected to the engine negative terminal or its bus. The key factor here is that the yacht's electrical system is connected to seawater ground at one point only, via the engine negative terminal or its bus. See figure one. See Practical Sailor, August 15, for a detailed treatment of the green wire. The best solution is a heavy and expensive isolation transformer. The acceptable solution for the rest of us is to install a light and inexpensive Galvanic Isolator in the green wire, between the shorepower cord socket on your boat, and the connection to the boat's AC panel. Then, connect the grounding conductor green of the AC panel directly to the engine negative terminal or its bus. Note that this meets the ABYC recommendation. Certain Galvanic Isolators e, Quicksilver include large capacitors in parallel with the isolation diodes, which in certain situations theoretically provide better galvanic protection. Unfortunately, these units cost substantially more than conventional Galvanic Isolators. If you feel like spending real money on galvanic isolation, you might as well do it right and buy an isolation transformer. GFCI's will occasionally "nuisance trip" due to the humidity surrounding the wiring on boats, but the additional safety that they offer particularly to nearby swimmers in disconnecting power in the presence of ground currents is worth the nuisance. If your GFCI starts to nuisance trip, it is probably a very good idea to track down and clean up your damp wiring in any event. Figure 2. A GFCI will disconnect power in the presence of ground currents, helping prevent an electrocution. Connect a 4 AWG battery cable from the base of your aluminum mast to the nearest keel bolt from external ballast. If you have internal ballast, you should install a lightning ground plate. One square foot is recommended for use in salt water; fresh water requires much more. Do not rely on a thru-hull or a sintered bronze radio ground e, Dynaplate for use as a lightning ground. For additional comfort, also run a 6 AWG wire from your keel bolt or ground plate to the upper shroud chainplates, and to your headstay chainplate. Don't bother with the backstay if it is interrupted with antenna insulators. Have each of the cables that are used for lightning ground wires lead as directly as possible to the same keel bolt, with any necessary bends being smooth and gradual. Given that you have grounded your mast solidly to the ocean, your mast will be at exactly the same electric potential as the ocean. There is no chance that you can dissipate the charge between the ocean and the atmosphere, so don't bother with a static dissipater at the masthead. Wire "bottle brush" static dissipaters may be useful to dissipate seagulls, however, but that is beyond the scope of this article. Mount your automatic tuner as close to the backstay as possible, preferably just under the after deck. If the builder of your yacht had the foresight to bond into the hull a length of copper tape or an area of copper mesh, be sure to run a copper ground tape to this as well, and say a blessing for builders such as these. Sintered bronze ground plates e, Dynaplates can be used as radio grounds in situations where the ballast or engine is unavailable or awkward to connect. If the ballast, engine, and lifelines are available, however, they generally make a high performance ground. Do not bond any thru-hulls or other immersed metal that can be electrically isolated. It's worth understanding the reason. In an increasing number of marinas, there are substantial DC electric currents running through the water. If your bits of immersed metal are bonded, the electric current will take the lower resistance path offered by your boat in preference to the water near your boat, and the current will flow into one of your bits of metal, through your bonding wires, and then out another bit of metal. The anodic bit of metal or thru-hull that has the misfortune to be on the "out current" side of the current running through your bonding system will also become "out metal" and will disappear, sometimes rapidly. Your zinc is only intended to protect against the modest galvanic potentials and therefore currents that are caused by the dissimilar metals that are immersed and electrically connected together

on your own boat. Your zinc is incapable of supplying enough galvanic potential to protect against substantial DC currents that may be flowing in the water. These DC currents in the water will cause electrolytic corrosion to your bonded thru-hulls or metal parts. Use zincs to protect against the galvanic currents that are set up by dissimilar metals on your boat that are immersed and that are in electric contact with one another. The best example is your bronze propeller on a stainless shaft. The best protection is to put a zinc right on the shaft next to the propeller, or a zinc on the propeller nut. An isolated bronze thru-hull doesn't need protection because it is not in electrical contact with another immersed dissimilar metal. If electrically isolated, high quality marine bronze, is electrochemically stable in seawater; nothing good can come from connecting wires to it. Figure 3. Conductors running from the external keel or ground plate to the mast, stays and to the metal fuel tank will protect against a lighting strike, and there will be no DC connections to the engine or to the electrical system. Stainless steel is a special case. Generally, it is a bad idea to use stainless steel underwater, because it can pit. When it pits the "nobility" of the metal changes locally, and you end up with tiny galvanic couples that are made up of different parts of the same piece of metal and the pits grow deeper. One school of thought suggests that if you must use stainless steel underwater e. The electrochemistry of this assertion is compelling enough to recommend that you protect a stainless steel rudder shaft with a zinc. This may be done by mounting a zinc on the hull near the rudder shaft, and electrically connect it inside the hull to the stainless rudder shaft. For the reasons described above, ensure that your metal rudder shaft is not electrically connected to anything else. Your stainless steel propeller shaft will be protected from itself, by the same shaft zinc that protects the propeller from the stainless steel shaft. In both cases the pits, if they appear, will appear where the stainless steel is not exposed to the water. Trouble areas are in the cutlass bearing, inside the rudder bearing, and just inside the top of the rudder. If you have the misfortune to have an external iron or steel keel, however, mount a zinc directly on it to reduce the rate of corrosion. Figure 4. So now, you are annoyed with the inconsistencies. We said to leave all bits of immersed metal electrically isolated when we described electrolytic corrosion and hot marinas, but then we said to connect wires and copper tape to your keel and engine for lightning and RF grounds. So what to do? RF ground. The RF ground needs to be a ground for RF signals only. The solution is to find a dry secure place along each of the copper RF ground tapes that are running to your engine and keel. These capacitors will be transparent to the RF, which will be happily grounded by the ground tape system, but they will block any DC currents from running through the RF ground system, and will avoid any resulting susceptibility to hot marina electrolytic corrosion. It is worth selecting the capacitors carefully, because they may carry a significant amount of RF current. The lightning ground needs to be a direct DC connection to the keel or to a ground plate to handle currents due to lightning strikes. So how do we keep the keel or ground plate electrically isolated as required in "Bonding and Electrolytic Corrosion The solution is to connect the keel or ground plate directly to the mast, but make sure the mast is not electrically connected to the boats DC ground system. If your steaming light, masthead light, tricolor, Windex light etc. Make sure that this is the case. This should also be true of your masthead instruments. The unintended DC connection between mast and DC ground is typically made by the masthead VHF whip, which connects the shield of the coax to the bracket connected to the mast. The easiest solution is to insert what is called a "inner-outer DC block" into the coax. This RF device puts a capacitor in series with the center conductor, and another capacitor in series with the shield. This device is transparent to the VHF RF signals in the center conductor and shield, but blocks any DC current in either the center conductor or shield. This device can be made by a good radio technician, or purchased from radio supply houses, pre-fitted with any kind of coax connection on both ends. The commercial units look like a coax "barrel" connector. Once the DC connection from the mast to the VHF is broken, check for any other connections with an ohmmeter, and straighten out any other wiring errors or unintended connections. If your metal fuel tank is also bonded to the lightning ground system per ABYC then make sure that it does not have DC connections either to the engine via the fuel line or to the electrical system via the fuel level sensor. A piece of approved rubber fuel hose in the fuel lines to the engine solves that connection, and a well designed fuel level sensor will not make electrical contact with the tank. When you're done, there will be heavy conductors running from the external keel or lightning ground plate to the mast, stays, and to the metal fuel tank; but there will be no DC connections to the engine or to the yacht's electrical system. See Figure 3. By using capacitors to block DC connections in a few key areas, it is possible to have perfect ground systems for AC, DC, RF, lightning, and corrosion, and have a boat that is immune to stray DC currents that are traveling through the water in "hot marinas. In the old days, the technique of bonding everything together worked okay. In its defense, the "bond everything together" approach makes your boat less sensitive to electrolytic corrosion that can

result from faulty wiring on your own boat. The problem is, the "bond everything" approach leaves your boat totally defenseless to wiring errors in nearby boats and nearby industry, that cause stray DC currents to run through the water. Today the technique of bonding everything together would still work fine if your boat spent all of its time on the high seas, in remote anchorages, or in marinas that were wired perfectly and in which all of the nearby yachts were wired perfectly. Having underwater metal bonded together in crowded marina's today, however, is asking for expensive trouble. As outlined above, it is avoidable trouble. It is possible, with careful wiring and a few capacitors, to have the best of all worlds, good RF and lightning grounds, ABYC-approved DC and AC grounds, and security against electrolytic corrosion caused by hot marinas. We use cookies to optimize site functionality and improve your overall experience. You can change your cookie settings through your browser. To learn more about cookies, please see our Privacy policy. West Advisor Articles. Marine Grounding Systems ground n. Cookie Disclosure We use cookies to optimize site functionality and improve your overall experience. Luckily, though, adopting just two easy habits can help you start making headway on that spaghetti monster lurking in your engine space or bilge. A job done right Photo courtesy of Concept Yachts. Note how the wires in this photo are properly supported and neatly run. Search and destroy: Keep a lookout for wire nuts and remove them as soon as you find them. A proper marine-grade butt connector should be installed instead. Photo courtesy of Wikimedia Commons. Use marine-grade butt connectors to join wires. Image courtesy of Ancor. Back Explore View All. Back Types View All. Unpowered Boats Kayaks Dinghies. Personal Watercraft Personal Watercraft. Back Research. Reviews Boats Engines and Parts. How-to Maintenance Buying and Selling Seamanship. Back Services. Boats PWCs. Boats for Sale View All. Or select country. Search Advanced Search. Personal Watercraft for Sale View All. Liked it? Share it! Facebook Twitter. Gary Reich is a Chesapeake Bay-based freelance writer and photojournalist with over 25 years of experience in the marine industry. Boat Reviews. Boating Guides. Boat Buyer's Guide. Boat Seller's Guide. Spring Commissioning for Your Boat. Popular Articles Related Articles 1. Five Affordable Trawlers Under 40 Feet. What Hull Shape is Best? Best Boat Brands. What Type is Right for You? Top 10 Choices for Boaters. Tidy Cockpit Wiring. Boat Wiring: Shorepower Mystery Box. The vast majority of recreational boats in service today are still using analogue instrumentation systems. More modern digital, NMEA-networked, and multifunction gauges may be all the buzz, but the reality is that most boats are still equipped with the same analogue set-ups that have been in use for decades. The insides of instrument panels can get a little crowded, but untangling it is all a matter of circuits, senders, and wire colors. Doug Logan photo. Figure 2. Variable resistor activated gauge. Back Explore View All. Back Types View All. Unpowered Boats Kayaks Dinghies. Personal Watercraft Personal Watercraft. Back Research. Reviews Boats Engines and Parts. How-to Maintenance Buying and Selling Seamanship. Back Services. Boats PWCs. Boats for Sale View All. Or select country. Search Advanced Search. Personal Watercraft for Sale View All. Figure 1. Tachometer terminals. Liked it? Share it! Facebook Twitter. Ed Sherman is a regular contributor to boats. He also is the curriculum director for the American Boat and Yacht Council. Bonefish Made Easy Chris Dummit. Boat Reviews. Boating Guides. Boat Buyer's Guide. Boat Seller's Guide. Spring Commissioning for Your Boat. Popular Articles Related Articles 1. Five Affordable Trawlers Under 40 Feet. What Hull Shape is Best? Best Boat Brands. What Type is Right for You? Top 10 Choices for Boaters. Canvaswork Made Easy. Bonefish Made Easy. Engine Wiring: Cable Ties. Boat Handling Made Easy. Easy Cleaning. In season one of the Netflix series Ozarks , Ruth discovers that one of her uncles is working with the feds looking for harmful info to her new employer. This type of electrocution is called electric shock drowning and is quickly becoming an epidemic of sorts. It occurs when people swim into waters that have come into contact with an electrical current. CBS News reported in April three deaths by electric shock and that same year, the Boat Owners Association of The United States reported four more electric shock drowning deaths, with two of those occurring on the Lake of the Ozarks. According to the Electric Shock Prevention Association , most people have never heard of Electric Shock Drowning and are unaware of the danger. Wiring a boat dock for electricity is almost a necessity as you build the boat dock. You will need electricity on the dock for boat lifts, or lights, or water pumps on your boat, or the electrical circuit of your boat that powers your tv, your surround system, your boat fridge, etcâ€¦ Usually the companies that build boat lifts will also install the electric part or one can hire an electricity expert. Boats with alternating current AC systems should have isolation transformers or equipment leakage circuit interrupter ELCI. NFPA 70 and NFPA Docks and Marinas address electrical standards and inspection requirements for dock and marina safety so make sure to always follow current code and standards. Water and electricity do not mix very well therefore make sure to qualified electricians and have a safe dock for you and your family. In order to install electricity, the electrician will be looking a many

details and below are a few of them. The very first thing that you will have to do in order to wire a boat dock is to install a source of power. The most popular item used to connect the boat to an electricity source is a shore power chord. It relays a current worth volts and 30 amperes â€" give or take. The length of your shore power chord needs to be measured in accordance to the total length of the boat. This is to ensure that all parts of the boat receive electrical current. Make sure that you maintain an appropriate distance from the circuit breaker. Opt to keep the cables in an area that is covered so that you and your electrical wires are protected from harm. The second thing you might want to do is to install an insulator â€"perhaps a galvanic insulator. This is an item that will help cause breaks in the flow of currents between the boat and dock so that you are safe from external danger. It is best to test it out, according to the guidelines provided, once you have successfully installed it so that you are aware of its function and efficacy. Bonding jumpers are devices that connect all the metal parts of your dock to a ground rod on the shore. When your dock is properly grounded in this manner, any electrical charge on your dock will trigger the GFCI and shut off power immediately. Thirdly, you need to install a breaker panel that meets state and production standards. Depending on the size of your boat, and the amount of electricity needed, install a breaker panel for protection against current fluctuation and overflow. If such precautionary measures are not taken then you could be exposing yourself to an increased risk of electrocution, especially considering the amount of conductors around you â€"water and metal for instance. Before you go about wiring the entire boat to the shore power cable, you will want to follow a few steps so that the wiring process if efficient, safe and quick. After you have wired your entire dock and established routes for electrical current to pass, you could have the following features added to your boat dock: Depending on your preferences, needs and the size of the boat, you can add more features to make your boat as advanced as possible. When building a boat dock, adding electricity to it and wiring it completely, you will want to ensure that you are taking every measure to make the boat, the dock wood or metal and the water around it as safe as possible. However, accidents happen and there may be times when you fear that loose currents may be putting everyone around you in danger. There are a few steps you can take in order to prevent the likeliness of such incidences from happening. Always ensure that you have multiple breakers installed into the dock, the house or so, so that you can dismiss such dangers. They will be able to shut down the electrical power if need be. In fresh water, the human body is much more conductive than the water itself. So, more current flows through the body in fresh water than in saltwater. Thus, in salt water current is more likely to flow around a human being rather than through them. You can still get shocked depending how strong and how far you are from the electricity source, so make sure to always be safe. It all depends on how much salt water there is, how much current your power source can drive and how far you are from that source. New or tighter laws should require circuit breakers and outlets that shut down when they overload or short out. Shock alarms that detect a current in the water should also be installed in both public and private swimming areas where electric shock is possible. A dock by nature is exposed to the harsh marine environment so electricity needs to be treated seriously on them. Skip to content. April 27, Max Francisco. Netflix Ozarks Ruth electrifying the boat dock. Author Recent Posts. Max Francisco. Latest posts by Max Francisco see all. Marine-grade wire is more expensive than standard SAE automotive wire, but it's much better suited for boats, with more copper conductor in a given gauge size, and better resistance to chafe and heat. Doug Logan photo. SAE vs. Marine-Grade Wire. As for the selection of the proper type of wire for use on your boat, there are several things you need to be aware of. First of all, there's a pretty significant difference between automotive and marine-grade wire. One of the primary differences is in the actual amount of copper used for a given gauge size. In your car, that makes little or no real difference for several reasons. Also, wire-run distance in a car is typically not that long compared to wire runs on your boat in many cases. The bottom line here? More copper reduces electrical resistance and therefore enables the delivery of more amperage for a given gauge size. Besides oil and fuel resistance, we're also concerned with properties related to chafe resistance and thermal rating. Typically, the marine-grade wire will be superior than the automotive counterpart in these areas as well. Tinned Wire vs. Untinned copper wire left is used in boats with good results, but tinned wire right is better able to resist corrosion, both at terminals and in capillary action along the wire. Additionally, and dependent upon some of your usage habits, you may want to consider how long you intend to operate a given appliance under normal circumstances. The idea here is that if you're running an appliance continually versus intermittently, you may generate some additional heat in the power supply circuit to the appliance. So, what's the best way to figure out what wire gauge to use in a given circuit? The data entry page from the site looks like this:. Back Explore View All. Back Types View All. Unpowered Boats

How much amperage do we need? What is the system operating voltage? How long is the wire run, or total circuit length as measured from the power source to the load or appliance and back to the source of power? Liked it? Share it! Facebook Twitter, Ed Sherman is a regular contributor to boats. He also is the curriculum director for the American Boat and Yacht Council. Boat Reviews. Ed Sherman. Boating Guides. Boat Buyer's Guide. Boat Seller's Guide. Spring Commissioning for Your Boat. Popular Articles Related Articles 1. Five Affordable Trawlers Under 40 Feet. What Hull Shape is Best? Best Boat Brands. What Type is Right for You? Top 10 Choices for Boaters. Marine Grade. Boat vs. Automotive Grade Wire.