Catalina 350

C350 Association Technical Editor

Jack McDonald
617 Todd Ct.
Lewisberry, PA 17339
(717) 938-5163
jack_mcdonald@comcast.net

In the summer of 2002, I received a sailing lesson as a birthday gift. My wife, Sylvia, and I fell in love with sailing from the very beginning. Fall of the same year we ordered a C350. Together, we sail Friendship on the Chesapeake Bay. –Jack McDonald

Thanks to Andy Sumberg for the following…

Getting More Out of your Catalina 350 Battery System

Those of us who keep our Catalina 350s on a mooring are totally dependent on batteries to start our engine and keep our electrical systems running. For some of us, it is likely that an entire season will go by without access to shore power. This presents certain challenges that our shore powered friends don't have. Specifically: 1) Keeping the batteries healthy by getting a full charge, 2) Maintaining sufficient battery reserve so that the engine can be started, and 3) Knowing the condition of the house batteries to know when to recharge and better maintain them.

Background. I took delivery of Portland, my Catalina 350 – hull number 231 – in May of 2004. It was shipped with the standard electrical setup with one exception; I chose the 72 Amp alternator over the standard 50 Amp unit. I considered getting the factory 50 Amp unit and immediately upgrading to a 100+ Amp aftermarket product, but figured that human nature would prevail and it would be a year or more before I was willing to tackle the upgrade. I considered the Catalina third (engine start) battery option but declined for two reasons. First, I also wanted the third water tank option. Catalina uses the same space under the port side settee for one or the other, but not both. Second, I did not get the sense that Catalina's third battery option was optimally configured. Had I seen a wiring diagram for this option, I may have concluded otherwise. I ordered the water tank figuring that it would be easier for me to add a battery near the existing water tank than to add (and plumb) a water tank around an existing battery.

Getting a full charge by adding a solar charger. One issue with alternator charging is that the alternator does a good job of charging the battery up to 80-90% but does not deliver sufficient voltage or deliver the current in a way that the batteries can approach a full charge. Quality shore charges do, but those of us who can only view shore power with binoculars need to find another way. There are several options; gas or diesel generator set, wind generator, and solar charger are the three most common. My style of use includes regular day sails, periodic overnights and one or two week long trips per season. While the solar charger is by far the least powerful (and least costly) of the three options, it seemed like a good fit for the way I use Portland. The boat sits on the mooring for long periods between uses. Why not grab some energy from the summer New England Sun?

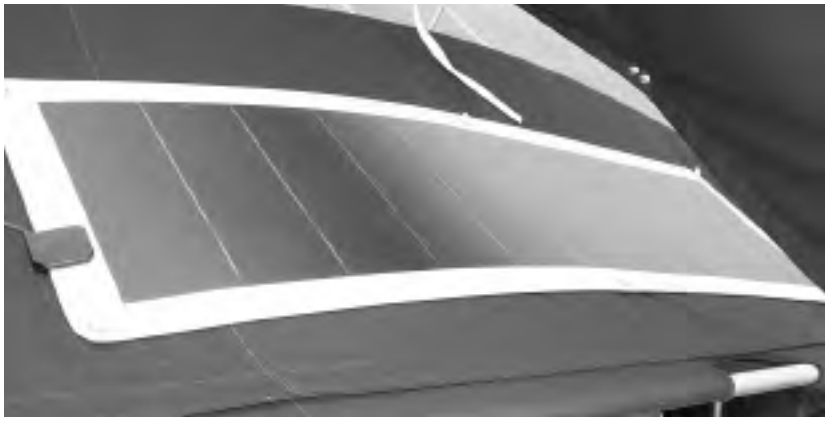
Equipment choices vary. I chose a 32 Watt flexible Uni-Solar FLX-32 panel that is light enough to be installed on the dodger. In addition I purchased a Flexcharge PV7D Battery Charge Controller to deliver the type of charge that maximizes battery acceptance.

Installation. I chose to install the panel on my dodger so it would be out of the way. At times the boom and sail cover shields as much as one-third of the panel from the Sun, a trade-off I was willing to make for having it out of the way. Figure 1 shows the FLX-32 panel on the dodger. The panel plugs into a waterproof connector that passes the wires through the deck. I chose to place the connector near the port side aft dodger support pole. Figure 2 shows

Location of waterproof connector for solar panel

the connector location. This location has the advantage of being out of the way, mostly dry under the dodger, and wires can be run from the connector to the battery without being exposed to or destroying the cabin interior.

Running wires from the connector to the battery took some effort. The easy part is getting wires from the battery to the space behind the electric panel. From there the wires run to the overhead light inside the aft cabin by way of the overhead channel that runs on the salon side of the partition between the salon and the aft cabin. From there the wires run to the hole drilled in the deck for the waterproof connector. To achieve this, the overhead light was unscrewed and a 3/4" hole was drilled next to the wires for the light. This hole allowed me to snag the wires when fished up the channel. Not to worry, the hole is covered by the light fixture when it is put back into place. A 3/8" hole was drilled in the corner of the channel next to the partition where the channel takes a sharp bend towards the ceiling. Figure 3 shows the location of this hole. Using pieces of 16 gauge steel wire as a snake I was able to fish the wires from the hole for the deck connector to the hole next to the overhead light in the aft compartment fairly easily. With more difficulty I was then able to snake the



Uni-Solar FLX 32 mounted on dodger

wires from there to the 3/8" hole in the hip of the channel. Then, with relative ease I snaked the wires to the back of the electric panel where they could easily be run to the battery compartment. The only cosmetic disturbance is the 3/8" hole that fortunately is not very noticeable. I plan to cover it with a white plastic plug.

The charger fit nicely in the battery compartment being about the size of a two Zippo lighters stacked together. Wiring up the charger is simple. Two leads connect the charger to the solar panel. Three other leads connect to the batteries - black to negative, red to the positive of one battery and yellow to the positive of the other battery. Figure 4 shows the solar charger mounted in the battery box. Mounted on the battery support strip, there is still adequate clearance for the seat.

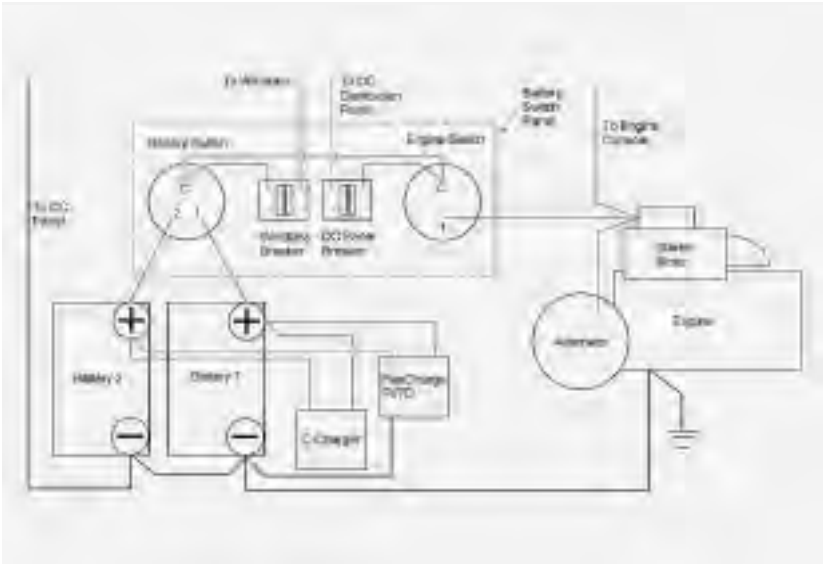
The next figures show the Catalina 350 battery wiring plan as shipped and the same plan with the solar charger connected. No existing wires needed to be removed for this installation.

For additional information on solar battery chargers check out the following web sites: Jack Rabbit Marine, an excellent dealer for these systems - www.jackrabbitmarine.com, Flexcharge - www.flexcharge.com, and Uni-Solar - www.unisolar.com

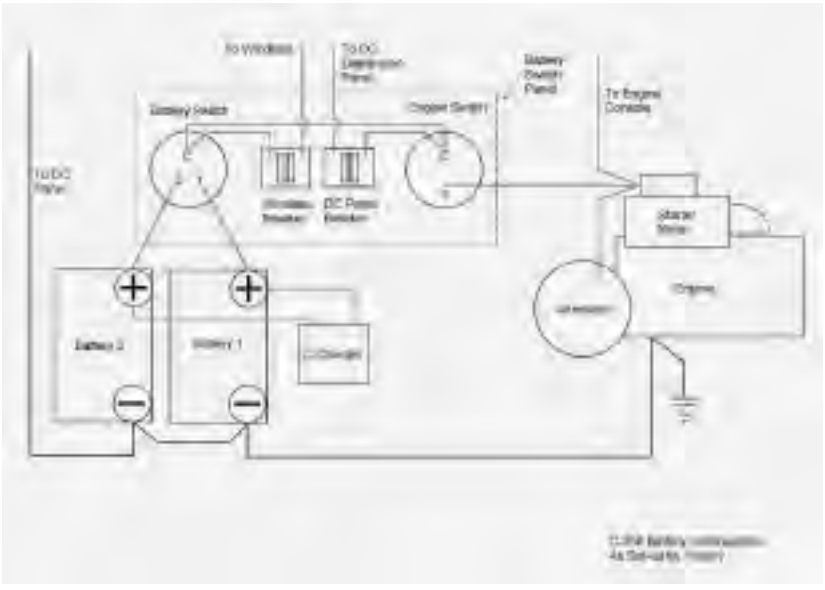
Starting the Engine. The two 200 Amp hour batteries as configured by Catalina have sufficient capacity to run the boats systems – no AC of course. The house batteries are charged by the standard alternator on the Universal diesel engine. There is no separate engine start battery. The user has the option of running the house (all electrical demand other than the engine starter) on one battery saving the other for engine starting, or running the house on both batteries and starting the engine with both as well. The drawback to the first scenario is that a wasteful one-half of the total battery capacity is held in reserve for engine starting. The drawback to the second is that no capacity is held in reserve for starting the engine. Run the refrigerator too long; add a few lights and you run the risk of not being able to start your engine. In addition to providing propulsion, remember, the engine is the only convenient way for us mooring people to charge the batteries. The solution: separate engine start battery.

Conceptually a separate engine start battery is not complicated but it does require some planning – and in my case advice. A few decisions need to be made: what charging system to use, how to wire up the system, what battery to buy, and in my case where to locate the battery or batteries. In practice, the wiring plan was a little more complicated than I initially expected. As far as the installation went, no difficult wire runs as with the solar charger, but never under estimate the difficulty of moving around 1/0 gauge (pronounced "one ought") battery wires.

Westerbeke recommends a 400-600 CCA (cold cranking amp) battery to start the M-35 engine. After consulting the engineers at Jack Rabbit marine it was decided that an AGM (absorbed glass mat) battery would do the trick. AGM is good because the battery is sealed having no venting requirements and has charging characteristics similar to the existing wet cell house batteries. The only problem for me was that a battery of that capacity is big enough (about 10"L x 7"W x 9"H) that is would not fit in any space I could find near the existing house batteries (without removing the optional water tank). I solved that problem by using



Factory setup with Solar Charger



Catalina 350 Battery & Charging System Wiring Diagram

Two PWC batteries next to port side water tank

two PWC size starting batteries (7"L x 3-1/2"W x 6"H each.) The combined CCA of the two batteries is 540, high enough to meet Westerbeke's specification. Best of all the two batteries could fit lengthwise next to the optional mid-cabin water tank. Figure shows these batteries in place.

Other decisions include charger selection, ganging the two house batteries, reworking the battery switch panel, and the rewiring that result from these choices. The charger I selected was Digital echo-charge by Xantrex. It isolates the house and start battery banks. It senses when the house bank is being charged diverts current up to 15 Amps to the start battery bank. Wiring the echo charger is simple with three relatively small gauge wires – two connected to the house bank and one connected to the start bank.

Now that I plan to have a separate start battery bank, I decided to gang the two house batteries. By doing so, I eliminated the 1-2-BOTH battery switch on the battery panel and reused one of the positive battery cables for the engine start battery bank. Note that the electric panel and windlass still have their master breaker on the battery panel. Another advantage to ganging the batteries is that a single battery monitor can be installed to monitor the health of the house batteries (see next section).

Eliminating the 1-2-BOTH battery switch allowed me to put a keyed ON-OFF switch in the same location that provides an emergency jump between the house battery bank and engine start in the event my start batteries fail. I used a keyed switch to prevent someone from mistaking it for the master power switch. Figure shows the new battery panel as described. The nylon line running from the white part of the switch holds the key. The two lines running at the top and bottom of the panel allow me to control the DC Panel and Windlass breakers without reaching under the navigation table.

Battery panel with emergency jump to starter switch

Other rewiring decisions include eliminating one leg between the 120V C-Charger and the house bank since the two batteries are now functioning as one. When the C-Charger is on the echo charger will charge the start battery bank. Because the charge characteristics of the solar charger are such that the echo charger does not detect is charge pulses, one leg of the solar charger is moved to the engine start battery bank.

The last and to me most nerve racking decision for me was what to do with the alternator output. The alternator output is routed to the battery bank back along the positive wire running to the starter. In the new configuration this positive wire is connected to the start battery. Therefore the alternator output needed to be disconnected from starter motor and run directly back to the house battery bank using its own dedicated wire. I used a 15 foot #2 gauge cable for this purpose. With support from Jack Rabbit Marine I became convinced that rewiring the alternator output would not have disastrous unintended consequences, such as blowing up my alternator. Figure 9 shows the completed wiring plan for this configuration.

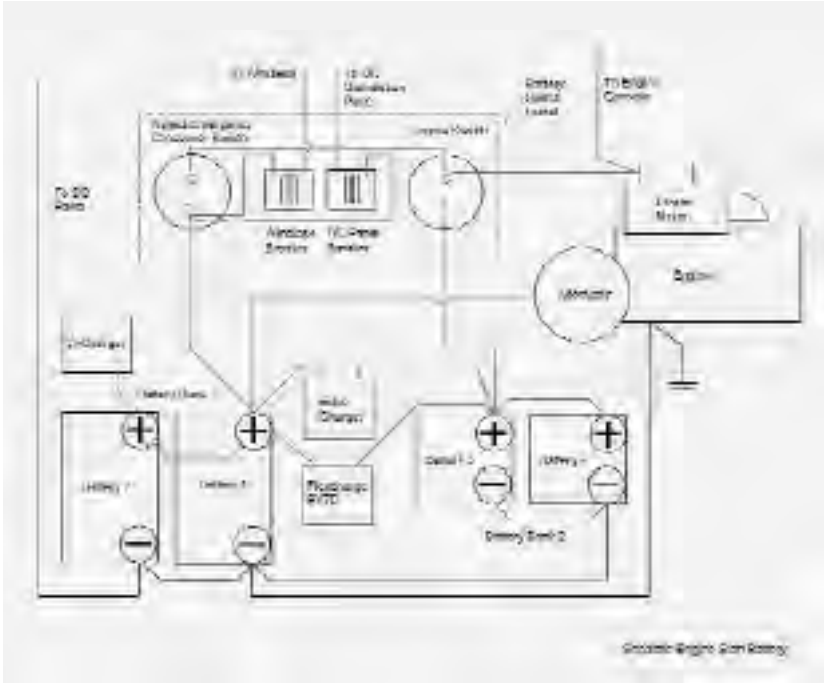
In practice moving the 1/0 cables around can be quite a chore particularly in the space behind the battery panel. With some thought, a little muscle and a minor stiff neck from working under the navigation table I was able to get the wires in place. My actual wiring differed from that of the diagram in one respect. I was not able to tap both the windlass wire and the DC panel wire off the hot (#1) tap of the emergency crossover switch. Fortunately the windlass switch has a second tap on the hot side and I use it to connect to the hot side of the DC panel.

One additional note. I was not happy with the fact that there was no easy way to see state of the DC panel, windlass, and/or start battery switches without bending down and looking at the battery panel. While I had the battery panel open, I ran three wires – one connected to the load side of each of the three switches – and installed three small LEDs on the DC panel as indicator lights for these switches.

For additional information on battery isolators and start battery systems check out the following web sites: Jack Rabbit Marine, has an excellent tutorial on these systems - www.jackrabbitmarine.com, and Xantrex - www.Xantrex.com.

Keep track of your batteries health by installing a battery monitor. How much capacity is left in my batteries? When do I need to recharge? How good was my last charge? How much can my batter really hold?

The answer is battery monitor, a simple to install; easy to use device that really lets you know what is going on with your batteries. Did I say simple to install? The answer is yes. If you followed my previous two projects you'll remember the difficulty of fishing the wires for the solar charger and the man handling (or should I say person handling) of the 1/0 battery cables for



Complete circuit with Engine Start Bank, Solar Charger & Ganged House Batteries

XBM Monitor located above DC panel

the engine start battery. Well none – or almost none - of that for installing the battery monitor.

First, what monitor to choose? There are a few good choices. After consulting (again) with Jack Rabbit Marine I decided on the Xantrex XBM which is Xantrex's relatively new replacement for the Link 10 monitor. XBM stands for Xantrex Battery Monitor – no rocket science to their naming convention. The XBM is a single bank monitor which has a little to do with with my decision to gang the house batteries in the last project. I can use one monitor to check the health of both house batteries. I am less worried about the health of my engine start batteries since the demand on them is less and much simpler.

Installation is straight forward. I placed the monitor display and brains in the wood panel above DC panel just below the water level indicator. A two inch hole does the trick. A shunt is placed between the output of your house battery negative and the negative load. A special cable is run from the monitor to the battery bank. Five wires from the cable are connected to monitor. Three of these connect to the shunt and two connect to the positive side of the battery. By now my battery area looks a little complicated, with the solar charger, echo charger, and battery shunt, but it really is not so bad. Figure 13 shows the final wiring diagram for all three projects.

In the final figure, I did not show the five wires running between the battery area and the XBM display unit. The wiring diagram that comes with the XBM is very clear.

For additional information on battery monitors check out the following web sites: Jack Rabbit Marine, has an excellent tutorial on this system - www.jackrabbitmarine.com, and Xantrex - www.Xantrex.com.

Summary It took me almost as long to type up these notes as it did to install the systems (if you discount how long it took me to figure out where and how to run the wires for the solar charger.) Now that I've figured out where to run them, it should take someone else less time. The eureka moment for me was drilling the 3/8" hole. Without that hole I couldn't get the wires up the channel. My backup plan was to use the fat electric winch wires that Catalina pre-installed on my boat. I'm glad I didn't need them. I see an electric winch sometime in my future.

What else can I do to my electric system? Other things I've thought about and probably will not get to any time soon include:

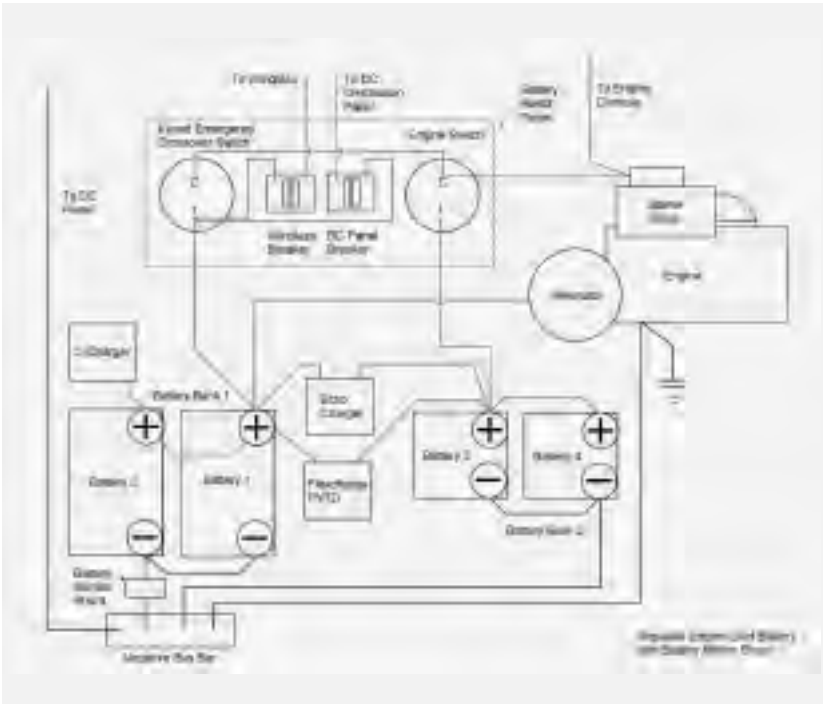
1) External voltage regulator - I may get to this one,

2) Large capacity alternator – I'd like to see how my 72 Amp unit works out,

3) Wind generator – hmm, it has its appeal, and

4) Gas or diesel generator set – it would be fun to have the power! Story submitted by *–Andy Sumberg, Portland #231*

XBM monitor shunt installed



Full battery wiring diagram showing solar charger, start battery bank, and battery monitor