

## Multiple Battery Systems

There are few boats these days that do not have some equipment on board that uses electrical current. Equipment can range from units that have modest power requirements such as radios, sounders, GPS plotter etc, to those having high power demands such as electric start outboards and electric outboards. All of this equipment depends on power stored in batteries, and these batteries need to have the power that has been consumed replaced by recharging.

Outboard motors, except for the smaller horsepower rating models, have an alternator charging system, which normally recharges the starting battery; however the alternator output can also be used to recharge other batteries used on the boat. Boats fitted with secondary electric motors can also use the alternator to charge the deep cycle batteries generally used to provide power for the electric motors. (These motors are often referred to as trolling motors). However, it is not just a simple matter of hooking these auxiliary batteries into the outboard's charging circuit, there are a number of conditions that must be taken into consideration when using a single charging source to recharge multiply batteries.

### Who's on first?

First and foremost to consider is the hierarchy of the batteries, or to put it into simpler terms, the order in which the various batteries are to be charged. It is of paramount importance that the starter battery

for the main outboard motor is always fully charged, otherwise one may be faced with a long row home. Outboard motors are usually supplied with a manual starting system consisting of a rope that is wrapped around the flywheel and then vigorously pulled. This works quite well for the small horsepower motors but once the size of the motor increases it becomes an almost impossible task. For these reasons it is also desirable to have a second battery that in an emergency can be used to start the motor.

While a simple three position battery switch can perform this job, this system depends on the operator switching the two batteries in and out of the charging circuit as required. Unfortunately when human nature comes into play, errors are sure to happen—but there is an automatic alternative available using voltage sensing relays.

### Voltage Sensitive Relay

A Voltage Sensitive Relay (VSR) allows two batteries to be charged at the same time. It will automatically prioritise the charging of the start battery in twin battery systems. When the engine is first started the relay is open and remains open until the start battery has reached a pre-set 13.7 volts for a 12 V system. At the rated voltage the relay closes providing charge to both batteries (start and auxiliary). When the voltage being supplied by the alternator drops below 12.8 volts (when the engine is stopped), the VSR disengages, separating the batteries.



A Voltage Sensitive Relay' (VSR)

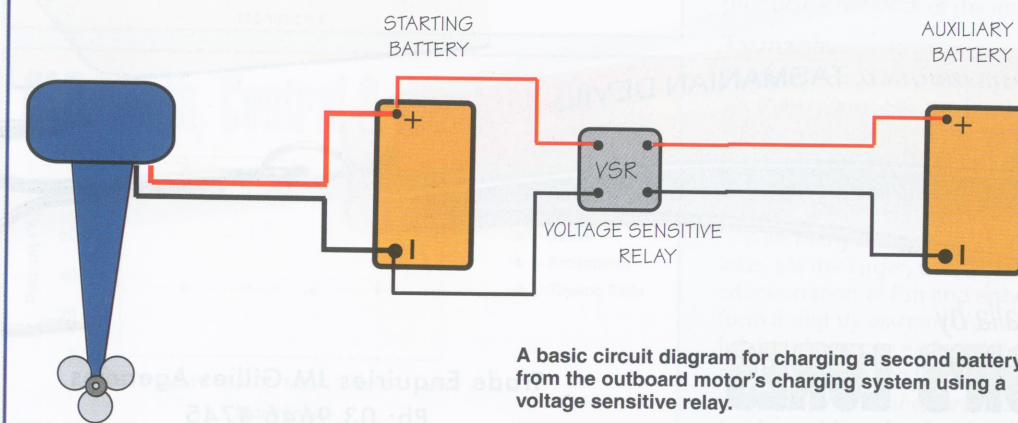
### Two batteries

The illustration is of the basic circuit for charging two batteries, the starting and the auxiliary, with the starting battery receiving the full output from the motor alternator until it reaches full charge (13.7 volts). Then, and only then, is the auxiliary battery automatically connected to the alternator via the starting battery. Not only does this ensure a fully charged starting battery, but it also provides an elegant solution to another problem, that of negative going pulses. If electronic equipment is connected to a battery system when the motor is started there is a real chance the equipment may be damaged or have its internal

memory corrupted—this is particularly so in the case of GPS receivers. This happens when a large load is placed on the battery as the starter motor first engages. This causes a sudden voltage drop, known as a negative going pulse, that can affect the stored data in the electronic equipment. Since the VSR is disengaged when starting the motor, the auxiliary battery, which supplies the power to the electronics, is not connected into the starting circuit.

For the sake of clarity, the basic circuit diagram shows only the VSR. In practice the circuit also requires the addition of isolating switches and a switch to connect the starting and auxiliary batteries together in the event of the starting battery having insufficient power to start the motor. The full circuit for such an installation is shown in the second illustration. It is important to note the inclusion of isolating switches to enable the batteries be removed from the circuit when the boat is not being used. This is important to reduce electrolysis taking place in the system and is doubly important if the boat's hull is aluminium. The illustration of the corrosion in a sounder plug graphically shows the result of this electrolysis.

### BASIC TWO BATTERY CHARGING CIRCUIT



A basic circuit diagram for charging a second battery from the outboard motor's charging system using a voltage sensitive relay.



A sounder plug which has been badly corroded as a result of battery power being left connected for long periods when the boat is not being used.