

GROUP TEST

With ever more electrical and electronic kit being fitted to the average cruising yacht today, battery banks are expanding by the minute, making proper power management a priority. **Duncan Kent** looks at some of the devices designed to take the strain out of your power problems...



USEFUL CONTACTS

Barden UK Ltd (Victron) 01489 570770
www.barden-ukshop.com

Marathon Leisure (Blue Seas) 023 92 311150
www.marathonleisure.com

Merlin Equipment 01202 697979
www.merlinequipment.com

Marine Superstore (BEP) 023 9221 9433
www.marinesuperstore.com

Sterling Power 01905 771 771
www.sterling-power.com

Sure Power (Adverc) 01902 380494
www.adverc.co.uk

Vetus Ltd 023 8045 4507
www.vetus-shop.com

- 1: Sterling Prosplit R - £129.00
2: Merlin Smartbank - £159.98
3: Vetus Battery Splitter - £198.00
4: Mastervolt Battery Mate IG - £225



BATTERY ISOLATORS

As soon as you have more than one battery on your boat you create an isolation dilemma – how do you connect them together to charge them from one source (the engine alternator, say), but separate them in use? As you would never usually want to use the start battery for anything other than starting the engine, you need to find some way of isolating it from the service battery when it isn't being charged.

MANUAL BATTERY ISOLATORS

When multiple batteries were first introduced the simple answer to this problem was the rotating four-position isolator switch (Off – Batt 1 – Batt 2 – Both) that allowed you to use either battery in isolation, or connect them together for charging. This method works, but requires human intervention and a good memory! You have to turn it to 1 (Start) to fire up the engine, and then when it's running switch it to Both (1+2) to charge both banks. Then, when you kill the donkey and start sailing you need to turn it to 2, so the start

battery doesn't discharge with the service bank. The cycle then has to be repeated when you start the engine to motor onto your mooring. The Both position can also be used for emergency starting, should the start battery be flat.

Manual switching, then, is both tedious and likely to fail when the skipper has other more important things to do and as battery installations have grown larger and more complex, a method of automatically isolating them has become a necessity. Over the past two decades several methods have been devised.

DIODE ISOLATORS

One of the first, and simplest automatic devices invented to isolate batteries was the diode isolator (aka - charge splitter or battery combiner), which is still available and fitted today in some production boats – usually for simplicity, cost and safety. A diode is a semi-conductor component that allows electrical current to flow in one direction only. A diode charge splitter is simply a unit containing some heavy-

duty diodes that allow the charge from the alternator to feed into more than one battery simultaneously, but isolates them from each other once charging has ceased to prevent current flowing between them. Diodes have their drawbacks, however. Firstly, they have an internal resistance that creates a voltage drop of between 0.75-1.0V as the current travels through them, reducing the charge level at the batteries. Sometimes adjustments must be made to the regulator to overcome this – especially if a battery-sensed smart regulator is incorporated into the alternator charge circuit. Standard-fit alternator-sensed regulators won't 'see' the problem, however, so the batteries can often not reach full charge. The second problem with a diode splitter is that there is no way to disconnect the start battery from the charge circuit when it is fully charged. Because it is has thinner plates and usually requires much less charging than the service bank, it can gas itself dry (creating a risk of explosion), leading to permanent damage.

PRODUCTS

RELAY-BASED ISOLATORS



A popular alternative to diodes are relays, which can usually be ignition or voltage sensed. Ignition Sensed Relays (ISR) 'make' (close) when the engine ignition key is turned on, which is fine for motorboats, but not ideal for sailing yachts.

A basic Voltage Sensed Relay (VSR), however, only makes when it senses a voltage above a pre-set upper threshold. This means start and service batteries can be kept isolated, with all the charge from the alternator initially going to the start battery until the threshold is reached, at which point the relay closes, connecting the batteries together for simultaneous charging. As soon as the engine is switched off and the start battery voltage drops below the lower threshold (usually 12.8V), the VSR 'breaks' and isolates the two battery banks again.

Although this sounds like the ideal solution, there can also be a couple of problems with a VSR. Firstly, if your service bank is deeply discharged when the VSR

connects it to the smaller start battery, it can almost instantly drag the latter down below its lower threshold – at which point the relay disconnects. Being isolated again the start bank then recovers, the VSR makes... and so on. This can cause the relay to 'chatter' – i.e., switch on and off rapidly – slowing the recharging of the service bank and damaging the relay contacts. Most makers now build in a slight delay between it reaching the threshold and the VSR making, to help overcome this problem.

Secondly, a relay consumes power (usually 150-200mA) when it is 'made'. While this isn't a problem when charging from the solar alternator, it can be if a smallish solar panel is being used to recharge the start battery when the engine isn't running. Sometimes, in low-light conditions, the VSR can consume more power than the panel is emitting!

VSRs can be single or dual sensing – i.e., can look for a voltage rise on just the

start battery, or both. This can be useful if you only have a single output charger on the service battery, or you have a 'combi' charger/inverter installed that only charges the service bank due to its wiring.

One very important factor to consider when installing an isolating relay of any sort is its maximum current capacity, which needs to be equal or greater than the highest domestic load you are ever likely to put onto the service bank (or the same or greater value as the in-line main battery fuse). Otherwise, if the latter is deeply discharged and you fire up a power-hungry device such as a windlass or inverter, much of the current will be initially derived from the start battery and alternator, conducted through the VSR contacts, until the starter battery drops below the lower threshold and disconnects. For this reason the relay must be capable of carrying the full current draw of any heavy consumer device. Any less could destroy the relay and create a serious fire hazard.

DEVICES

There are numerous different makes of VSR available today, so we selected just a handful to test to see if the VSR principle actually works in practice.

SURE POWER BATTERY SEPARATOR £70.34

How it works:

Rather industrial-looking, this 'Smart Solenoid' as the makers brand it, is just a simple VSR with start battery priority, timer delay, ignition sensing and emergency start functions. Available in 100A or 200A version, 12Vdc or 24Vdc.

Our comments:

Not very pretty, but the electronics are

potted into a waterproof resin box so it can be placed out of sight somewhere without fear of moisture ingress. A filament bulb-type lamp can be added to the circuit to show when the relay is active.

Verdict:

Does the job okay and handy to have the emergency start feature and indicator light terminal.



BEP/140A DUAL-SENSE VSR £69.99

How it works:

A fully potted (waterproof), neatly packaged device with two M6 terminals inside the box and a single negative lead. Threshold voltages are 12.8V/13.7V and dual sensing means that it works both ways – ie., if it sees 13.7V on either battery it will make, connecting the two together for charging. A small LED on the front indicates when it is active.



Our comments:

Well made and straightforward to install, this does the job of a simple VSR well.

Verdict:

Nice that it's waterproof, but consequently not the cheapest VSR around. Shame it doesn't have a remote indicator to let the user know what the batteries are doing.

BLUE SEAS SI-SERIES ACR £95.99

How it works:

Another waterproof (IP67) VSR with a delay timer to avoid relay chatter, plus ignition override that keeps the batteries isolated during the engine start sequence, eliminating the risk of any spikes or voltage drop on the service circuit. A remote status LED is optional. This is a well-made unit in which the electronics are completely sealed.

Our comments:

This unit is well protected against moisture and fumes. Reassuringly stout M10 stud terminals will take quite heavy cables and a simple, but tidy clip-on lid protects them from short circuits. Worth fitting the optional remote LED if you want to know what's going on.



Verdict:

A little bit more expensive than some, but it's very well made and submersible, so it should be a fit and forget device that should be easier than some to mount in a tidy, professional looking installation.

MERLIN SMARTBANK £159.98

How it works:

Smartbank is a VSR-based system for split charging multiple battery banks that is a slightly more comprehensive system than a simple, standalone VSR. In the same way to a VSR, the two-bank model allows the start battery to charge first, before closing a relay to connect the service bank into the charging circuit.

Although its operating method is identical to a standard, dual-sense VSR, where SmartBank does score is in its ability for the user to set their own preferred voltage thresholds for relay engagement

and disengagement. Also, it has a user-adjustable 'hold timer' of between 2-120 seconds, which is designed to defeat relay chatter when the service bank is deeply discharged.

SmartBank Advanced – This is the same device, only it comes with an upgraded version of the SmartGauge battery monitor that not only gives you the battery voltage and capacity for two battery

banks, but also provides the ability to adjust and set the voltage thresholds and timers from its keypad, as well as initiate a 30 second paralleling of all connected battery banks for emergency starting.

Connection between the SmartGauge and SmartBank Advanced box is made using an RJ11 data cable, but both units still require their own low current connections direct to the battery banks via fuses.

Our comments:

The principle operation of the SmartBank is almost identical to that of a simple VSR – the only difference is that you can adjust the voltage thresholds and time-outs to suit your own preferences. The other



difference is the sensor circuitry and the relay/s are separate modules, allowing the latter to be mounted close to the batteries, thus shortening heavy-duty cable runs. On the three-bank model a second relay makes in conjunction with the first, bringing a third battery into the charging circuit. As the sensing is only done on the battery one terminal and both relays

operate simultaneously, we struggled to understand the point of the second relay – other than to share charge current through two sets of contacts. Also, even on the Advanced system the SmartGauge is only able to monitor two battery banks. Because of this we wouldn't really class it as a genuine three-bank system.

Verdict:

A more flexible take on the VSR, SmartBank can be customised to suit different installations. For an extra £100 it's probably worth having the Advanced model with the SmartGauge monitor/remote control panel, but I'd look at something else for a 3+ bank system.

STERLING PROCONNECT CVSR £106.90

How it works:

This VSR is a far more serious piece of kit than any of the others we looked at. We mentioned earlier about needing to be careful that the relay was up to taking cross loads measured in hundreds of amps and that the contacts can actually weld together when seriously overloaded. Well Sterling's ProConnect is a Current-limited VSR (CVSR), which is clever enough to disconnect before any overload damage occurs, protecting the rest of your system and the batteries themselves as well as removing a potential fire risk. It does this by incorporating thermal fuses that increase their resistance as they heat up in an overload situation. This means the unit can disconnect safely at low load,

protecting relay contacts from possibly lethal damage.

As with Sterling's standard VSRs, voltage thresholds are user adjustable.

Our comments:

The mother of all VSRs, this is possibly the most sophisticated single relay CVSR on the market. It is waterproof to IP65, has five LEDs indicators on the front panel and will support a remote indicator panel.

It can also be programmed by the end



user to suit a number of different parameters, which includes setting your own threshold voltages and initiating single, dual or ignition sensing.

Verdict:

If your boat has any high current devices such as an electric winch, windlass or thruster and you only want to fit a single VSR for simplicity, then the ProConnect would be the logical choice to ensure maximum safety as well as protecting your starter battery from accidental discharge. Well worth the little extra on the price!

STERLING PROSPLIT R £129.90

How it works:

The unit is designed so that the alternator output and starter battery (battery 1) are connected when the engine is off, in case you have an alternator that needs an initial voltage to energise it. When the engine is started and the alternator fires up, the system maintains this connection until battery 1 voltage exceeds 13.3V. This could be in seconds or minutes.

The ProSplit R then checks battery 2 (service bank) to ensure that it doesn't have a short circuit, after which it also engages it for charging. It then keeps batteries 1 and 2 on line until they both reach 13.3V (at which point it checks battery bank 3 if you have the 3-output unit).

The unit continues to monitor the voltages on the outputs and alternator, and any attempt to pull these voltages below 13V means that one battery bank is attempting to

discharge in excess of the ability of the alternator to supply the current and is going to start taking power from one of its neighbouring battery banks. In the event of this happening the system will channel the alternator power into the battery bank that requires the extra load, disconnecting the other battery banks to protect them from discharge. At the same time it continues to monitor battery 1 – the priority battery. If the latter drops below 12.6V all other batteries are disconnected from the charging circuit and all the charge goes into the start battery again, before the process is repeated.

There is a dedicated connection on the unit for advanced regulators or remote sensors on alternators with

battery sensed regulators (Volvo alternators for instance). It is recommended that you use this connection



to ensure the maximum performance of the alternator and to compensate for any voltage drop between it and the ProSplit.

Our comments:

Although this device uses FETs in the control circuitry, the ProSplit R behaves more like a VSR than a simple FET-based battery isolator. Despite being a simple box to install, the ProSplit is packed with a number of unique and very useful features. It not only gives priority to ensuring the start battery is kept fully charged, but it has the added benefit of being compatible with smart regulators, so that any chance of cooking the smaller battery is removed. Furthermore, it is clever enough to prioritise the battery bank with the greatest load on it, providing maximum charge to it while taking all other batteries out of the charge circuit for the duration of that exceptional load (especially relevant to 3-bank systems with a dedicated windlass or thruster battery).

Another import feature, unique to the ProSplit, is its ability to isolate the start battery when it is full, rather than simply connecting it up to the service bank,

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thus ensuring it won't be overcharged. It continues to be monitored, though, and is reconnected should its voltage drop below 12.8V. This means full charge power can be directed to the service bank to reduce charging time.

Two, three and four output models are available, with 120A, 180A or 250A current ratings, although the 4-bank device is limited to 180A. As with most FET isolators, multiple alternator outputs can be connected, as well as the output from

a shore power battery charger, enabling a single-output charger to charge all the batteries on board simultaneously.

It also has a neat row of six LEDs that give you a very good idea of what it is doing at any given time, as well as clearly indicating any alarm situation that might arise with the battery bank.

Finally, the unit is completely sealed and waterproof to IP66 standards, so it will not be affected in the least by damp conditions and carries a four-year warranty.

Verdict:

Waterproof and simple enough for DIY installation. Probably the smartest FET device tested and useful for three or four bank systems, although it is cheap enough for two-bank charge control for those who want something more intelligent than a simple VSR or diode splitter.

The manual is pretty badly written, but it's just possible to understand the operating principles and at least the installation diagrams are clear!



remain open so as not to gradually diminish the start battery voltage.

Verdict:

At this price you'd be daft not to upgrade your old diode splitter!



VICTRON CYRIX-I BATTERY COMBINER £38.36

How it works:

A compact, waterproof (IP54) unit with four simple connections for two batteries, ignition sense and emergency start assist. It is dual sensing and has built-in anti-chatter delays. Competitively priced although it lacks a remote monitoring option.

Our comments:

Slightly cleverer than it appears, as it is able to sense a trend and act on it accordingly. So, for instance, if every time it makes connection the voltage gradually starts to decline, eventually it will

FIELD EFFECT TRANSISTORS

FET ISOLATORS

One of the more recent solutions to both these problems is achieved by using Field Effect Transistors (FET) rather than diodes. Unlike diodes, these solid-state switches

create no inherent voltage drop. So, although they're usually more expensive than diode-type charge splitters, FET isolators can actually save you money, if

this means that you might not need to install an advanced alternator regulator to get enough charge into your onboard batteries.

MASTERVOLT BATTERY MATE IG £225

How it works:

The Battery Mate is compatible with any type of alternator or battery charger. As the voltage loss between the alternator

and battery is negligible, it enables faster charging of your batteries, with or without having to fit a smart alternator regulator.

Using FET transistor technology means its components compensate for variations in voltage and ensure that charging continues at the right voltage level, even with multiple battery banks.

Our comments:

This unit is typical of all Mastervolt's electrical components – well made, over-engineered and attractive. Built onto a large alloy heat sink, it

is not waterproof so care must be taken as to where it is mounted. It is available with two or three outputs and, just like a diode splitter, is very simple to connect up with just one alternator/charger input and 2/3 battery feed outputs. Only the single negative connector gives it away and there is also an ignition connection for alternator excitation if required.

One thing lacking is any indicators (apart from a green 'on' LED), so you either just have to trust it is working or connect it into a MasterBus system, where a monitor will tell you all you need to know. The unit is guaranteed for two years.

Verdict:

A simple 'fit and forget' device that does the job with the minimum of fuss. A tad expensive, though, for such a basic piece of equipment.



BATTERY ISOLATORS

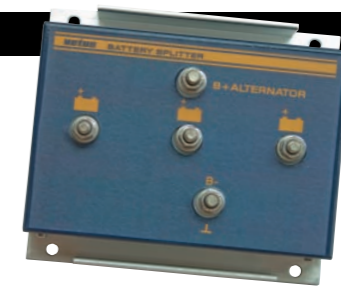
VETUS BATTERY SPLITTER £198

How it works:

Similar to the Mastervolt Battery Mate, this unit employs FET transistors rather than traditional diodes, meaning the internal voltage drop is negligible (0.1V at 20A instead of 0.7V of typical diode). As a result there is no need to adjust the alternator voltage to compensate, so you should save on the cost of an alternator regulator.

Our comments:

A pretty straightforward piece of kit that does as it says, but little more. The connector studs (M6) aren't as chunky as the Mastervolt unit, but it is available with two or three battery bank outputs.



Verdict:

Well made, but like the Mastervolt Battery Mate it is mounted on a large alloy heat sink, which isn't waterproof and can get quite hot so care must be taken to ensure it stays dry and that it gets air circulating around it.

VETUS BATTERY WATCH £349

How it works:

Similar to the Battery Splitter but with extra features, including the ability to fit a remote control monitor panel (+£110).

Battery Watch is a 3-way splitter, with just 0.1V drop, enabling three banks to be charged simultaneously. When B2 reaches 13.2V, B3 also receives a trickle charge (3A max), disconnecting again below 12.2V.

It also has an audible low-voltage alarm (11.0V) with a 70A relay to disconnect the service supply should it drop below 10.5V.

The monitor and audible alarm can be switched on or off (no current draw when off) and power from the service bank can also be switched on/off remotely, removing the need for a manual battery switch.

The optional remote control panel has a display that shows the voltage of each

battery bank at timed intervals (an LED indicates the battery being monitored) and there is a variety of alarm LEDs for low volts etc. a button for an emergency paralleling relay for engine starting should the start battery become discharged for some reason. The unit can be used for two banks only, but the settings must be changed on internal dip switches.



Our comments:

Connecting up the splitter side of the unit is as easy as the Battery Splitter and adding the remote control requires just one extra data lead only. We would definitely recommend you opt for the remote panel – it's great to have so much control over the device and to be able to monitor each battery so closely. The low-voltage alarm/guard is an added bonus, as is the relay for remote service bank switching.

Verdict:

A bit on the pricey side if bought as a simple, stand-alone, low-volt loss splitter, but much better value if the monitor is ordered as well. Though not waterproof, it is well engineered and looks pretty professional too.

VICTRON ARGOFET BATTERY ISOLATOR £95.56

How it works:

The voltage drop for this FET-based isolator is between 0.02V-0.1V (low/high currents), so there is no need to increase the output voltage of the alternator with an advanced regulator.



The unit also has an 'excite' terminal for alternators that require a DC voltage on their B+ output to enable charging to start.

Our comments:

Well made, mounted onto an alloy heat sink and having stout (M8) connection terminals.

Nothing special about its operation and it's as simple as a diode splitter to install, though it does require a negative.

Verdict:

Reassuringly heavy, no-nonsense battery isolator that does what it says on the box. You can be pretty sure that it will be durable and reliable for many years. Exceptional value for a FET-based device.

MAKE	MODEL	BANKS	PRICE	CONT A RATING	LEDS	REMOTE	EMERG SW	DELAY	THRESHOLDS	SENSE	LOW V PROT
VSR ISOLATORS											
BEP	VSR MODULE	2	£69.99	125A	1	NO	NO	NO	12.7V/13.8V	1+2+IGN	NO
BLUE SEAS	SI-SERIES ACR	2	£95.99	65/120/500A	OPTION	NO	NO	YES	12.35V/13.6V	1+2+IGN	NO
MERLIN	SMARTBANK	2/3	£159.98	200A	NO	OPTION	YES	YES	12.8V/13.4V/ADJ	1+2	NO
STERLING	PROCONNECT CVSR	2	£106.90	70/140/210/280A	5	YES	YES	YES	12.8V/13.3V/ADJ	1+2+IGN	NO
STERLING	PRO SPLIT R	2/3/4	£129.90	120/180/250A	6	NO	NO	YES	12.6V/13.3V/ADJ	1+2+IGN	NO
SURE POWER	BATTERY SEPARATOR	2	£70.34	100/200A	OPTION	NO	YES	YES	12.9V/13.5V	1+2+IGN	NO
VICTRON	CYRIX-I COMBINER VSR	2	£38.36	120/225/400A	0	NO	YES	YES	12.8V/13.8V	1+2	NO
FET ISOLATORS											
MASTERVOLT	BATTERY MATE	2/3	£225.00	160A	ON ONLY	NO	NO	N/A	N/A	N/A	NO
VETUS	BATTERY SPLITTER	2/3	£198.00	125A	NO	NO	NO	N/A	N/A	N/A	NO
VETUS	BATTERY WATCH	3	£349.00	125A	NO	OPTION	NO	N/A	N/A	N/A	ALM & S/O
VICTRON	ARGOFET ISOLATOR	2/3	£95.56	100/200A	ON ONLY	NO	NO	N/A	N/A	N/A	NO