

# A testing time for battery monitors



With boat owners fitting ever increasing amounts of electrical equipment to their boats an easy means of checking the condition of the batteries is essential. In this month's Group Test **James Turner** examines 14 different models of battery monitor.



**A**cross the range of battery monitors available today a wide variety of features are available to suit all needs and budgets, ranging from simple readouts of Volts and Amps to devices that forecast how much longer you need to run your engine to fill the batteries when charging, along with the time remaining till you need to charge them when discharging. As sailors first and technicians second, the test team members were keen to find out what information each product gave, how it was presented, which products were the simplest to install and how easy they would all be to program and operate.

PHOTOGRAPHY BY RICK BUETTNER & JAMES TURNER



## The basic science

Amps, Ampere-hours, Volts and Ohms.

We all know the words, but exactly what do they mean? The easiest way to get your head round simple DC electrics is to use the plumbing analogy. Voltage is the equivalent of water pressure. The current (Amps) is its flow rate and the resistance to the flow (Ohms) changes with 'pipe size'. Volts are measured in parallel and Amps are measured in series. The higher the voltage of the battery the more fully it is charged. As it discharges, the voltage drops. Voltage when under load – running something – is always lower than when the battery is at rest.

The measure of Amps shows you how much you are using. The higher the Amps reading when discharging, the sooner the battery will be depleted.

### BATTERY CAPACITY

Batteries have their capacity measured in Ampere-hours (Ah). For example, a battery of 100Ah will deliver (in theory) 1A for 100 hours, 2A for 50 hours, 4A for 25 hours, etc. In fact, it's not quite as easy as that, though, because if you discharge a battery below 50 per cent of its capacity it can be damaged. Furthermore, as you approach maximum capacity during charging, the battery resists the

charging current, so getting the last 10 per cent capacity into the battery is normally only achieved using a slow trickle charge when connected to mains. 100 per cent charge is rarely achieved from the engine's alternator.

Realistically, therefore, a 100Ah battery is generally good from 90 per cent down to 50 per cent capacity, which gives you a useable window of 40Ah, ie 1A for 40 hours, 2A for 20 hours and so on.

### SHUNTS

As well as measuring voltage we need to measure current – the amount of electricity going into, and out of the battery. Because current is measured in series with the battery, a simple ammeter would need to be wired right next to the battery. On most boats this is not practical, because batteries are hidden away in the depths of lockers, so one or more shunts are used to remotely measure current. A shunt measures the flow of electricity across a short path of known resistance. It doesn't impede the flow of electricity, but enables remotely mounted instruments to gauge accurately the current flow. Most of the shunts supplied for this test were rated at 500A continuous, which

is ample for most boats. A couple had 100A shunts, which might be sufficient, but it's always worth just checking the current rating of any heavy duty electric motors running from the circuit you're monitoring before selecting a suitable model.

*☞ If you draw too much current too quickly the battery's capacity will be greatly reduced ☜*

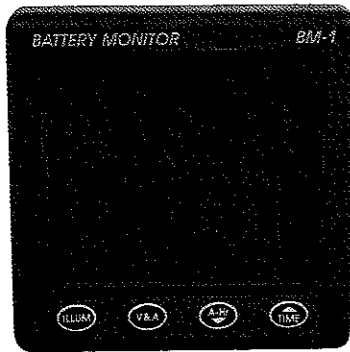
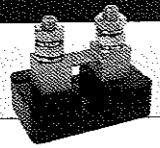
It's worth mentioning here something about the total capacity of batteries you carry for service use. The ideal total capacity of the service bank should be such that the batteries discharge at about 1/20th of their capacity per hour. For example, if the usual consumption on passage is 10Ah for a few instruments and a fridge, your service bank should be around 200Ah capacity. Draw too much power too quickly and the battery's capacity is significantly reduced. If you're interested in the theory around this, look up Peukert Exponent on the internet.

# 14 Battery monitors on test

Nasa BM-1 • Barden SBM-01 • Xantrex Link 10 • Sterling PMP1 • Mastervolt BM-1 • CruzPro VAH65 • Victron BMV600 • Adverc DCM MkIII • BEP 600-DCM

**BATTERY MONITORS FOR SINGLE BATTERY BANKS**

**NASA BM-1 £99.50**

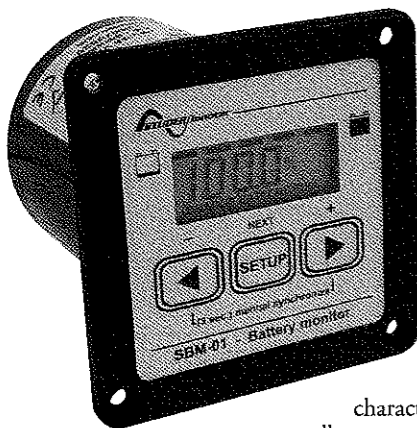
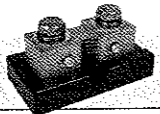


The BM-1 monitors battery voltage, the current into and out of the battery and the total Ah consumed since it was last fully charged. It then predicts the time to achieve full charge (during charging) or the time to full discharge. When the unit is first installed all that is required is to enter the battery capacity.

Designed specifically for owner installation, the BM-1 can handle a single 12V battery bank of up to 600Ah. The shunt is designed to carry a continuous

load of up to 100A and battery starting loads of around 2kW (180A), which is more than sufficient for most small and medium size yachts. NASA is the only company to provide all the wiring necessary for installation, including a 5m colour coded cable with fuse and terminals to link the display to the shunt. A short heavy duty wire to connect the shunt to the battery negative terminal is also included. We really liked the large display. The manual is clear and concise with an excellent wiring diagram. This is not the most sophisticated battery monitor available, but for many people it ticks all the necessary boxes.

**Barden SBM-01 £194.70**



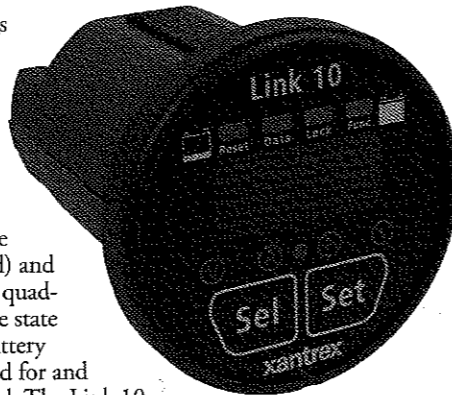
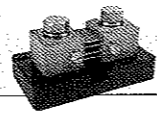
This unit will monitor a single 12V or 24V battery bank and is supplied with a 500A shunt. The display data is comprehensive, with battery voltage, current in or out, current consumption (Ah), state of charge (per cent) and time to go till it needs recharging. It also shows time to go until full during the charge cycle. Battery temperature, which can alter the charge/discharge characteristics, can be entered

manually or an optional temperature sensor can be fitted. An optional PC interface is also available.

We were impressed by the advanced features of the SBM-01, which include a record of the average and the deepest discharge in Ah, the number of under voltage alarms and the number of charge/discharge cycles to help the boat owner understand if the battery bank is sufficient for the boat's needs. The SBM-01 can also be adjusted to compensate for battery inefficiency.

The set up and operation menus are simple and logical and the manual, whilst short on drawings, is full of useful information. An optional cabling kit containing everything you need for installation except for a short length of heavy duty cable to link the battery to the shunt, is available for £51.75.

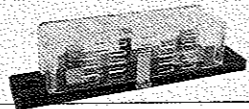
**Xantrex Link 10 £199**



The first of two offerings from Xantrex, the Link 10 is for a single 12V or 24V battery bank and is supplied with a 500A shunt. As well as showing Amps in and out, time remaining at present rate (which can be smoothed) and Volts, the Link 10 has a quad-LED display to show the state of charge at a glance. Battery efficiency is compensated for and can be manually adjusted. The Link 10 also measures and reports kiloWatt hours and historical information, such as number of cycles, deepest and average discharge. Wiring kit £15.

**BATTERY MONITORS FOR MULTIPLE BATTERY BANKS**

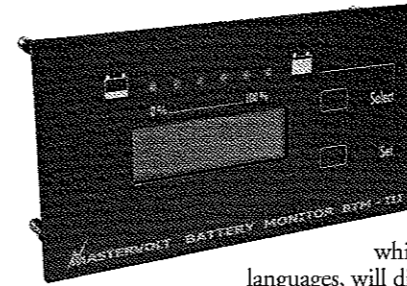
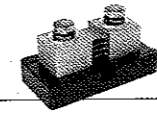
**Sterling PMP1 £199.90 (Additional shunt £41.13)**



The PMP1 panel features an Ah counter on one channel and in total enables four different Amp and Volt readings. It is the only product reviewed here that is suitable for boats with combined 12V and 24V systems.

The shunts of the system (one is supplied as standard) can be fitted in the negative or positive cables. As with the Adverc – see opposite page – this means that separate shunts can be installed to view the output of solar panels and wind generators. The counter counts the Amps going into, and out of the battery bank. Set up is completely automatic. The display unit can be panel- or surface-mounted and the shunt has a clear Perspex safety cover, which we liked. No wiring was included, but this reflects the fact that it will be used for comprehensive power management, not just monitoring one or two banks of batteries. For example, the PMP1 can monitor alternator voltage and bow thruster or windlass batteries mounted up forward, in addition to the engine start and service banks. Rather than display time to go, the PMP1 resets its Amp counter to zero when it thinks the batteries are fully charged and displays a negative reading of Amps consumed as equipment is used. If you run a load of 10A for four hours it will display -40A. If you have 200Ah capacity you know you can go as low as minus 100A before you need to begin charging. We really liked the simplicity of this system and found the manual clear and easy to understand.

**Mastervolt BTMIII £367.77**



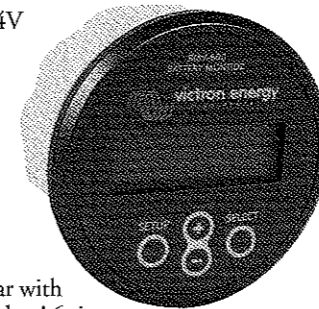
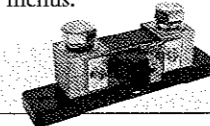
The BTMIII is designed for up to three banks of 12V or 24V batteries, using just one 500A shunt. The main (service) battery bank has the shunt installed on the battery negative. The control unit, which can be set to any of 10

languages, will display voltage, current in/out, Amps used, time remaining (until flat or full) and charge capacity as a percentage. The other banks – e.g. engine starting and bow thruster batteries – don't have shunts, so the current can't be measured, but they are measured for voltage. By programming in average charge and discharge rates manually, the BTMIII is able to calculate the approximate state of charge.

This is a very clever way of providing the necessary information without the complexity of extra shunts.

The control unit also has a series of LEDs to show the charge state of the main battery bank at a glance. BTMIII has adjustable compensation for battery efficiency. If not required for battery bank monitoring, the third circuit can be used to synchronise the BTMIII's backlight with the ship's lighting system. The manual is excellent with good wiring diagrams and simple explanation of menus.

**Victron BMV600 £184.48**



This is a comprehensive, single 12V/24V battery bank monitor that also shows Volts for a second (engine start) bank. It is supplied with a 500A shunt and all necessary wiring except for the heavy duty battery to shunt cable. Only a single, pre-terminated cable connects the instrument head with the shunt, making this one of the easiest products to install.

The wiring diagram sheet is very clear with excellent graphics, but the main manual – A6 size – has some very small print that the test team found difficult to read.

Factory settings are for a 12V battery bank of 200Ah capacity, but these can of course be adjusted. For most boats the only adjustment will be the battery capacity. The main displays are Volts, Amps, Ah consumed, percentage of remaining charge and time to go before recharge. There is also a range of visual and audible alarms and memories for battery use and abuse. The unit is adjustable for battery efficiency and can be linked to a PC.

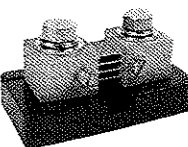


**BEP 600-DCM £170 (Cable kit £19.30)**

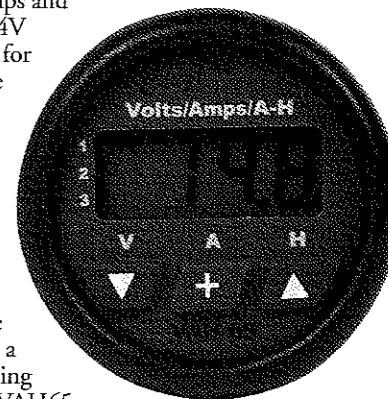
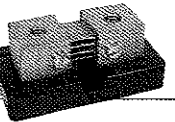
In common with a number of the products in this article, the 600-DCM monitors Volts and Amps on one battery and Volts only on another two. If only two batteries are required to be monitored a bilge pump may be monitored in place of the third battery.

For all three banks the display can show Volts and high/low alarms. For the service bank it also shows Amps charge/discharge and percentage of charge remaining. Battery bank names can be set by the owner and the alarm functions include the ability to set up a remote alarm.

This unit has one of the largest digital displays, making it easy to read and it is adjustable for battery efficiency.



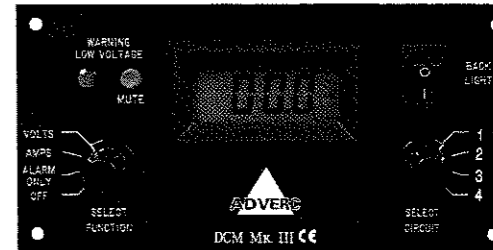
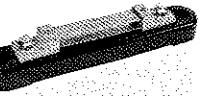
**CruzPro VAH65 £184.48**



This unit measures Volts, Amps and Ah for one bank of 12V or 24V batteries and displays voltage for two further banks, but unlike the Mastervolt BTMIII it does not estimate battery state for the additional banks based on average charge/discharge rates.

Battery efficiency is compensated for and can be adjusted manually. Installation and operation are quite well explained. There is a setting for automatically turning on and off a battery charger. VAH65 also features low Volts, high Volts and low Amps alarms and there is an NMEA output of Volts, Amps and Ah remaining. We didn't like the tiny instruction manual, because it looks easy to lose, but couldn't fault the contents.

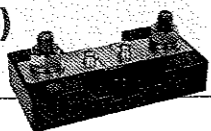
**Adverc DCM MkIII £186.23 (Additional 100A shunt £28.79; 200A shunt £43.48)**



Suitable for up to four banks of 12V or 24V batteries, the Adverc is simple to operate and understand. The large LCD shows Volts and Amps charge or discharge, but does not show percentage charge capacity – relying instead on the user knowing the battery capacity and doing a little mental maths to work out the state of charge.

Unusually, the shunt in an Adverc system is mounted on the positive side of the battery. A benefit of this is that you can add extra shunts dedicated to measuring output from solar panels or wind/water turbines. The main 100A shunt will show net gain/loss taking into account battery use, but the dedicated extra shunts will show output for the specific charging source. This could make the Adverc a clear favourite for long distance cruisers. The sensor leads from the shunt to the control unit are supplied, but not the heavy duty cable to connect the shunt to the battery.

**Merlin PowerGauge Lite (TBS) and PowerGauge Pro (TBS)**

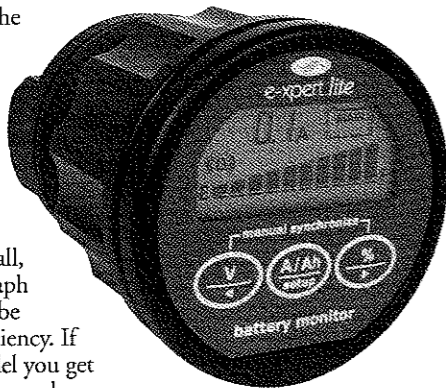


**Lite £149.99; Pro £189.99**

(Connection kits from £20.

Temperature sensors from £17.50)

With a 500A shunt on the service battery bank, the PowerGauge Lite will display Volts, Amps in and out, battery capacity in per cent and time remaining. It will display Volts only for a second bank. Whilst the display is small, it has a very clear bar graph and the instrument can be adjusted for battery efficiency. If you opt for the Pro model you get larger digits in the display and historical data – average discharge, deepest discharge, number of charge cycles – plus the ability to connect a PC and monitor remotely, so an offshore racing yacht's batteries can be monitored by a support team ashore. The Pro model can be fitted with any size shunt. You just tell it what the rating is.



**Xantrex Link 20 £249.99**



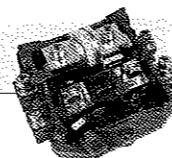
Link 20 is the only product we know of that will monitor all functions – Amps in and out, percentage charge, Volts, time to go – for two separate battery banks, without the need to purchase a second shunt. The shunt supplied is really two shunts in one, with a common output. This system is ideal for boats where the two batteries are used alternatively for domestics or engine start, i.e. systems with the kind of battery switches that show Batt 1, Batt 2, Both and Off, when both batteries are the same capacity. Link 20 has high and low Volt alarms and low Amps alarm.

We really liked the two sets of LED indicator bars that show battery state for both banks at a glance.

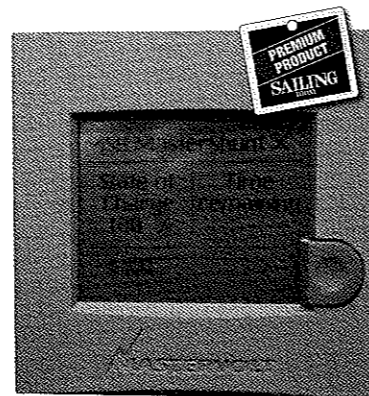
The manual is also clear and comprehensive.

**BATTERY MONITORS AS PART OF A NETWORKED ELECTRICAL SYSTEM**

**Mastervolt Easy £522.87**



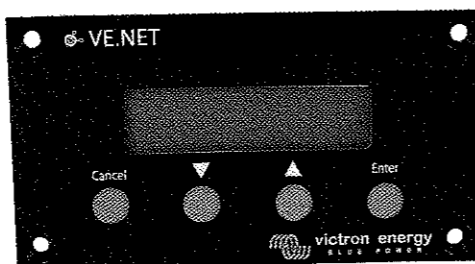
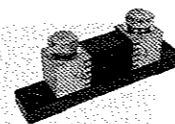
Mastervolt Easy is part of a networked electrical control system where one head unit can programme and control many devices, including generators, inverters and battery chargers. A complete battery monitor system comprises a MasterView Easy display and a MasterShunt, which combines a 500A shunt with a 500V DC fuse. If you already have a MasterView you need only buy the shunt for another device. If you buy both parts then subsequently add a Mastervolt inverter or battery charger or inverter, the system instantly recognises the arrival of the new product and the MasterView Easy becomes its control unit. If you want to monitor additional battery banks, just add more shunts.



The MasterView features a touch screen with only a single button – to turn it on and off. I went to see one being installed in a new Southerly 32 at Northshore Yachts, Itchenor. Mark Watkinson, who was doing the installation, completed the job in no time (see picture sequence opposite). Mastervolt claims that installation time is a good two hours less on this system than one with simple shunts and lots of wires.

With 10 selectable languages, the Easy display shows Volts, current in/out, Amps used, time remaining until flat or full and per cent charge. We liked the flexibility to personalise the system, e.g. naming battery banks.

**Victron VE.Net £472.35 (Additional shunt and controller £183.30)**

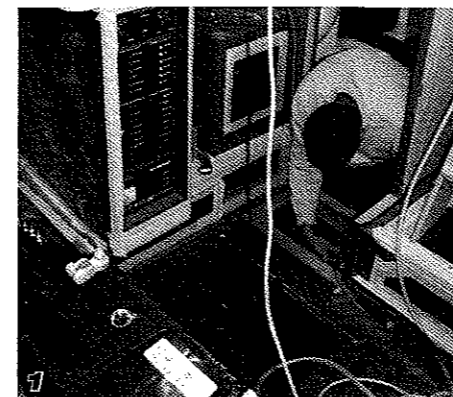


VE.Net is another network control system where a single panel can be used to operate multiple electrical devices, including battery monitors, chargers and inverters. A single battery monitoring system comprises a panel, a battery controller and a 500A shunt. Additional battery banks can be monitored by adding battery controllers and shunts. Set up is completely plug and play, so when a control unit is powered up it automatically searches for all compatible instruments.

VE.Net will run on 12V and 24V systems. Features include Volts, Amps in and out, consumed Ah, temperature (with optional sensor), percentage state of charge and time to go to recharge. There are also multiple alarms and range of historic data is stored.

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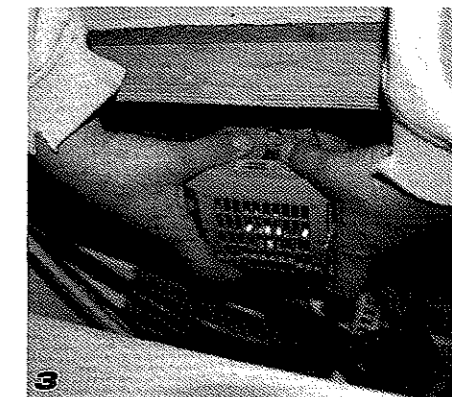
**STEP BY STEP INSTALLATION OF THE MASTERVOLT EASY ON A NEW SOUTHERLY 32**



(1) As much installation work as possible is done on the Southerly 32 before the deck goes on, but when I arrived to photograph the installation, the deck was on and interior



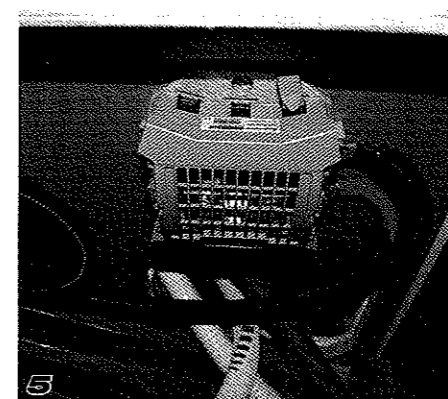
wiring was well under way. Begin work with batteries disconnected. Locating the position for the MasterShunt combined shunt and DC fuse (2) keeping the DC cables from



the battery to the shunt as short as possible (3) Screwing the MasterShunt in place with space at both ends and above for heavy duty cables, network and temperature cables.



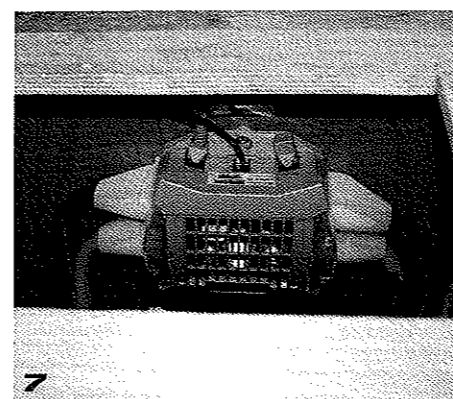
(4) We recommend you arm yourself with decent tools – heavy duty cable cutters and crimping tool – to avoid hours of frustration.



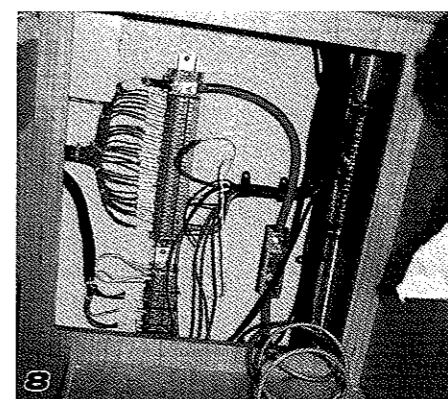
(5,6) Northshore was obviously well equipped and cable termination took only seconds. Note that solder filled battery cable



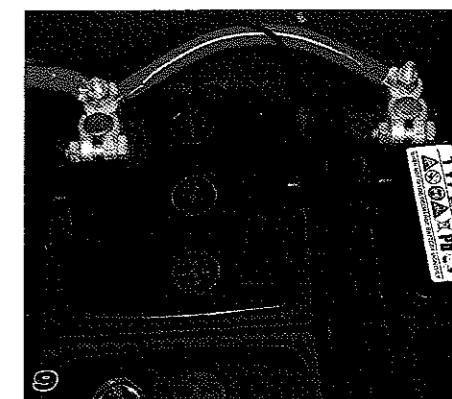
terminals are no longer recommended. With the MasterShunt in place connect the heavy duty cables for the shunt and fuse.



(7) Next connect the temperature sensor in the top middle socket and the blue network cable for the MasterView in the top left socket.

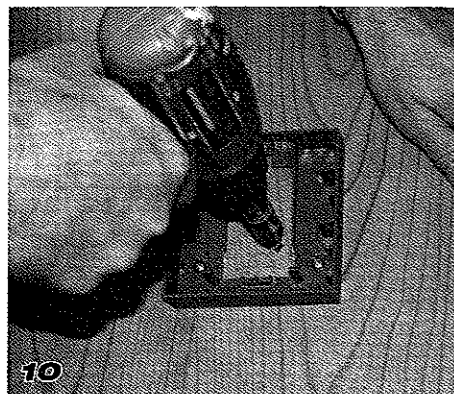


(8) Feed the network cable to the chart table mounting position of the MasterView and stick (literally) the temperature sensor on one

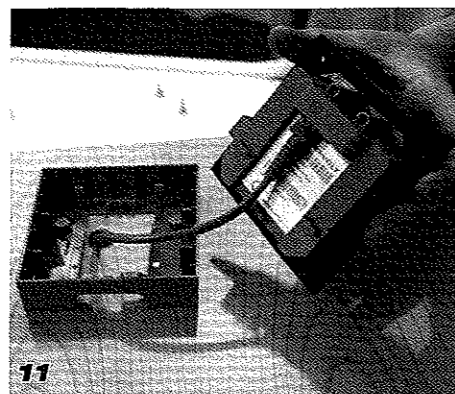


of the service batteries (9) Only when the MasterShunt wiring is completed should the battery terminals be connected.

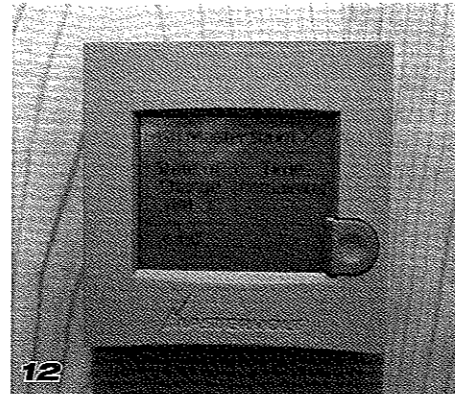
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(10) Fit the MasterView backing plate and drill a hole for the network cable.



(11) Thread the network cable through the panel and connect to the MasterView



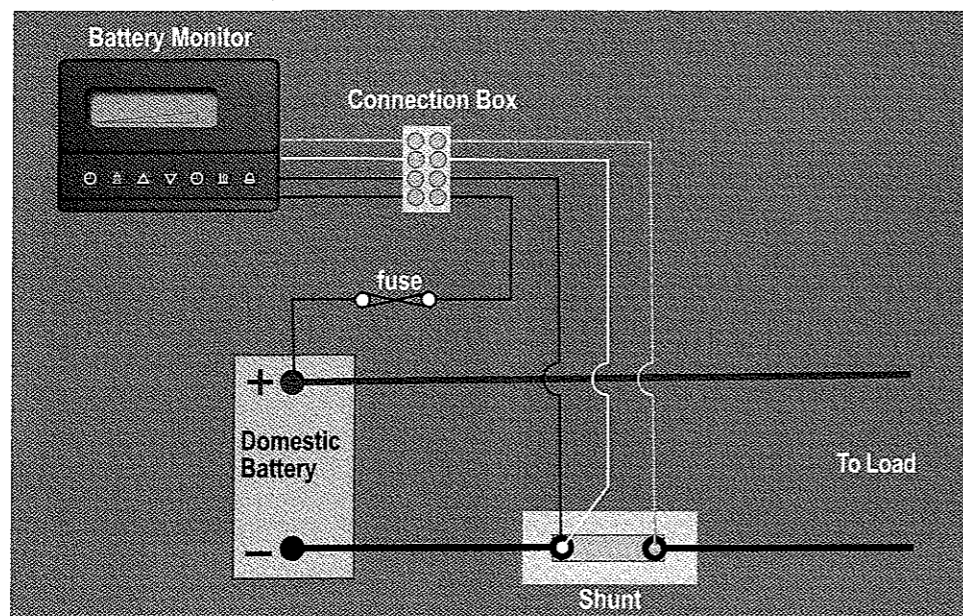
display, (12) snap the display onto the backing plate and the job is finished.

### Typical single battery wiring diagram

Most of the units featured require the shunt to be on the negative side of the battery, as shown here. Locate the shunt as close to the battery as possible. The monitor needs sensing wires to be connected on both sides of the shunt and to the battery positive terminal.

Voltage is sensed by the battery positive and the battery side of the shunt. Current is sensed across the shunt by determining the voltage drop. Typically a drop of 1 millivolt equates to a current of 10A. Any cable from battery positive to the monitor must be fused.

For voltage only sensing of additional batteries, wires will be run from the monitor to battery positive and negative.



### WHICH ONE IS BEST FOR YOU?

Because there is a wide range of battery monitoring products on the market you must study the features and decide which ones are important before making your choice. First, are you just looking for a battery monitor or do you want it to be part of an integrated network of electrical devices? Then, how many battery banks do you want to monitor and are you happy to monitor voltage only on the secondary bank(s)? Do you need alarms? Most of the units have them, but are they necessary?

It is hard to say which product is best as they all look pretty good and any of the units featured is better than going without. The unit most suited to a friend's Rustler 36, with two dual-purpose 110Ah batteries, is not the unit most suited to our Editor's Jaguar 27 with a 90Ah service battery and small engine start battery.

#### Test team views

We don't think a shunt is necessary to monitor an engine starting battery – if it shows 12.6 to 12.8V it's full enough and

healthy. The same applies to separate batteries for bow thrusters and windlasses, though vendors of multi-shunt systems will tell you – and rightly so – that you can glean more information about such equipment if you monitor Amps as well as Volts.

A note of caution on 'charge state', or 'percentage charge remaining', a feature of many of the monitors tested. Such data will only be as accurate as the last time the system was synchronised. Left to their own devices boat batteries tend to discharge at

around 3 per cent per month and variations in battery efficiency can further corrupt this reading.

#### Instruction manuals

Our only negative thought, applicable to about half the manufacturers, was that there seems to be a competition to make instruction manuals as small as possible. Manufacturers please note that most cruising yachtsmen like A4 instruction books that can be put in ring binders, not tiny booklets that can be lost down the side of the chart table.

### BATTERY MONITOR COMPARISON CHART

Model	Price	Control unit size (mm)	Screen size (mm)	Height of main digits in display (mm)	Number of battery banks	Continuous capacity of shunt (A)*	Installation cable supplied	Alarms
Nasa BM-1	£99.50	110 x 110	85 x 74	29	1	100	All	No
Barden SBM-01	£194.70	66 x 66	32 x 14	11.6	1	500	No	Yes
Xantrex Link 10	£199.00	64 dia	31 x 14	10 (LED)	1	500	No	Yes
Sterling PMP1	£199.90	170 x 90	60 x 16	5	4 (with extra shunts)	200	No	No
Mastervolt BTMIII	£367.77	120 x 65 (140 x 85 without facia/box)	48 x 15	5	1 + 2 (see text)	500	No	Yes
CruzPro VAH65	£184.48	63 dia	36 x 15	11.5	1 + 2 for Volts only	450	No	Yes
Victron BMV600	£184.48	69 x 69, or 62 dia	32 x 13	7.5	1 + 1 for Volts only	500	Most	Yes
Adverc DCM MkIII	£186.23	160 x 80	42 x 13	12.5	4 (with extra shunts)	100	Most	Yes
BEP 600-DCM	£170.00	88 x 67	32 x 22	13	1 + 2 for Volts only	450	No	Yes
Merlin PowerGauge Lite	£149.99	64 dia	40 x 18	5	1	500	No	Yes
Merlin PowerGauge Pro	£189.99	64 dia	40 x 18	13	1 + 1 for Volts only	500	No	Yes
Xantrex Link 20	£249.99	120 x 75	34 x 13	10	2	Double 500	No	Yes
Mastervolt Easy	£522.87	112 x 112	71 x 56	7	Multiple (with extra shunts)	500	Most	Yes
Victron VE.Net	£472.35	120 x 65	63 x 16	5	Multiple (with extra shunts)	500	Most	Yes

\*Figures quoted are for continuous current load. Load for short periods of engine starting can be much higher

### Suppliers

Nasa BM-1	NASA Marine. Tel: 01438 221023 <a href="http://www.nasamarine.com">www.nasamarine.com</a>
Barden SBM-01	Barden Energy Solutions. Tel: 01489 570770 <a href="http://www.barden-uk.com">www.barden-uk.com</a>
Xantrex Link 10	Merlin Equipment. Tel: 01202 697979 <a href="http://www.power-store.com">www.power-store.com</a>
Sterling PMP1	Sterling Power Products. Tel: 01905453999 <a href="http://www.sterling-power.com">www.sterling-power.com</a>
Mastervolt BTMIII	Mastervolt. Tel: 01794 516443 <a href="http://www.mastervolt.co.uk">www.mastervolt.co.uk</a>
Cruz Pro VAH65	Energy Solutions. Tel:01634 290772 <a href="http://www.energy-solutions.co.uk">www.energy-solutions.co.uk</a>
Victron BMV600	check the website – multiple distributors <a href="http://www.victronenergy.com/where-to-buy">www.victronenergy.com/where-to-buy</a>
Adverc DCM MkIII	Adverc. Tel: 01902 380494 <a href="http://www.adverc.co.uk">www.adverc.co.uk</a>
BEP 600	Merlin. Tel: 01202 697979 <a href="http://www.power-store.com">www.power-store.com</a>
PowerGauge Lite	Merlin. Tel: 01202 697979 <a href="http://www.power-store.com">www.power-store.com</a>
PowerGauge Pro	Merlin. Tel: 01202 697979 <a href="http://www.power-store.com">www.power-store.com</a>
Xantrex Link 20	Merlin. Tel: 01202 697979 <a href="http://www.power-store.com">www.power-store.com</a>
Mastervolt Easy	Mastervolt. Tel: 01794 516443 <a href="http://www.mastervolt.co.uk">www.mastervolt.co.uk</a>
Victron VE.Net	check the website – multiple distributors <a href="http://www.victronenergy.com/where-to-buy">www.victronenergy.com/where-to-buy</a>

