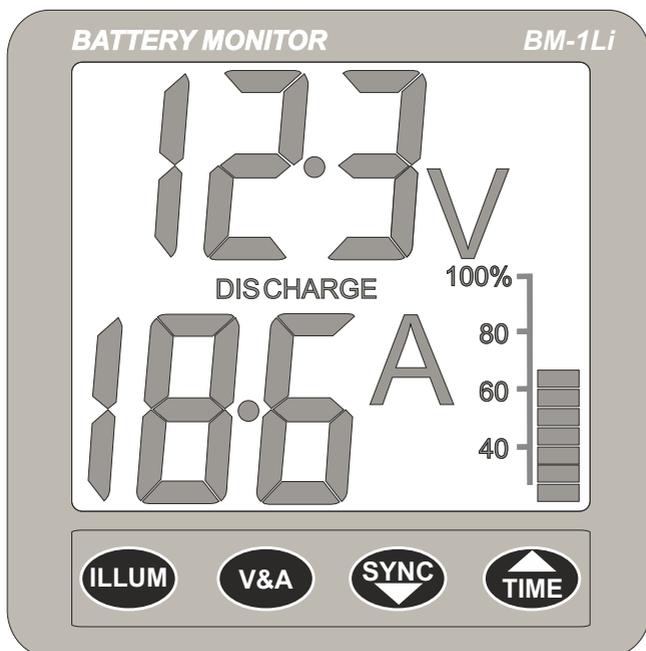




DESIGNED AND  
MANUFACTURED  
IN ENGLAND



*CLIPPER*

**LiFeP04 BATTERY  
MONITOR**

**BM-1Li**

**CE**







## **INTRODUCTION**

The NASA Marine BM-1Li is a coulomb counting, lithium battery monitor specifically intended for use with a 12-volt lithium iron phosphate (LiFePO<sub>4</sub>) battery installation.

It is supplied complete with display unit, current shunt (standard 50mV) and connecting cables for monitoring batteries with capacities from 20Ah to 600Ah.

With the ability to handle continuous charge or discharge currents up to 100 amps the BM-1Li displays the service battery voltage, the charge or discharge current, the state of charge and the time to achieve full charge during charging or the time remaining during discharge. The voltage of the engine start battery is also displayed and a visual alarm indicates when the service battery is exhausted .

The instrument's use is limited to monitoring the battery and is not intended to form part of the charging control system.

## **INSTALLING THE DISPLAY**

### **Safety notes - IMPORTANT**

Short-circuiting a battery with a metal tool or piece of jewellery can cause catastrophic currents to flow. Before installing the BM1, remove all jewellery (such as rings or metal necklaces). Ensure that no metal tool can cause a short circuit.

If you are not sufficiently skilled to undertake any part of this installation safely, you must seek the assistance of a suitably qualified person.

### **Installation of the Display unit**

The installation should be performed in the order specified in the following sections.

- 1 Select a convenient position for the display. Cut a hole in the panel 87mm wide and 67mm deep. The site must be flat and the cavity behind the panel must remain dry at all times. (The cable entry is deliberately not sealed to ensure adequate ventilation. This prevents misting of the display).
- 2 Bring the shunt cable through the hole in the panel.
- 3 Unscrew and remove the wing nut from the rear of the instrument and remove the stainless steel clamping bracket.
- 4 Fit the "O" ring seal into the groove in the panel-mounting face of the instrument. Ensure that it is correctly lying in its groove to provide the watertight seal for the display before fitting the instrument to the panel.

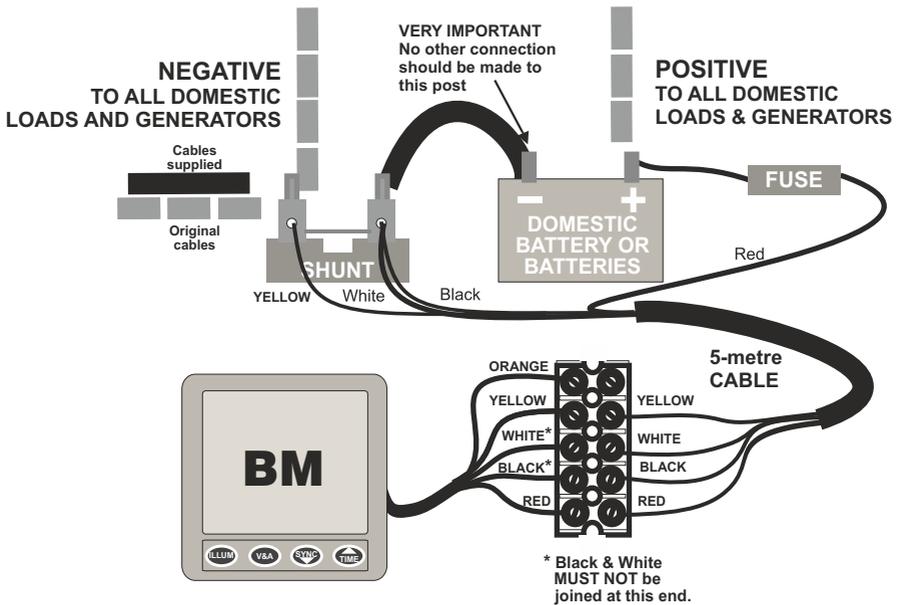
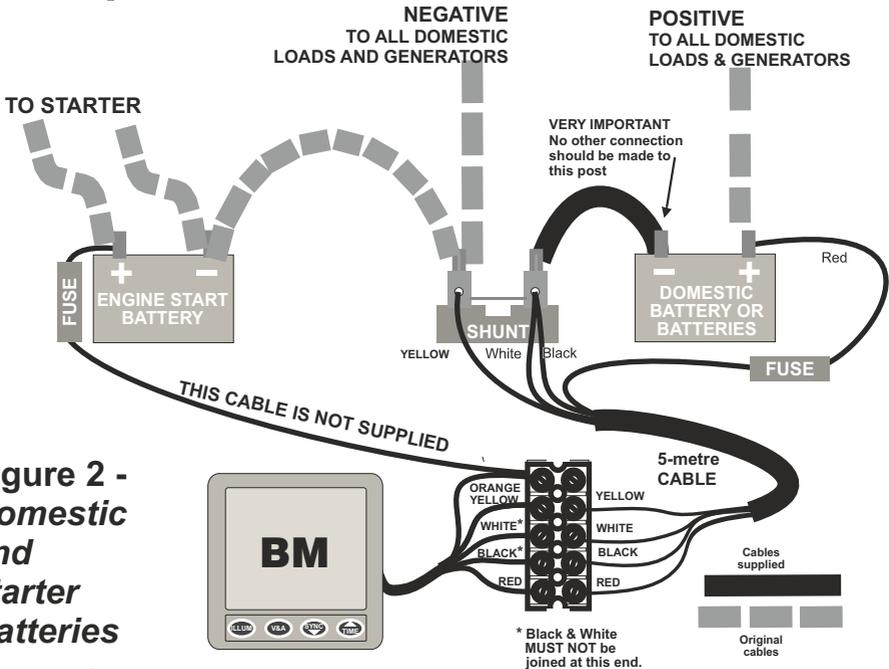


Figure 1 - Domestic battery only

- 5 Connect the shunt cable to the display unit as shown on Figure 1, below, using the terminal block supplied. Be careful to connect the wires exactly as shown, noting that the black and white wires are joined at the shunt connection, and are connected separately at the instrument end of the cable.
- 6 Fit the instrument into the panel, fit the stainless clamp over the stud, fit and tighten the wing nut finger tight only. It is important that the O-ring rubber seal makes good contact with the panel to prevent water getting behind the unit and entering the cavity behind the panel.
- 7 It is good practice to run the cables vertically downwards from the unit, even if they later have to rise to connect to the vessel's supplies. Doing so prevents any water that might get onto the cables from running back along the cables and into the unit.
- 8 Ensure that all loads are switched off
- 9 Disconnect the NEGATIVE terminal from the battery and connect to the shunt as shown on Figure 1. Ensure it is positioned where it cannot come into electrical contact with other parts, and ensure it will remain dry and free from contaminants. Also note that the shunt can get warm when heavy currents flow, so ensure it is secured in a position where its heat cannot affect other parts. TAKE CARE TO AVOID OVER-TIGHTENING THE CONNECTION TO THE SHUNT.
- 10 Connect the Black and White wires and Yellow wire to the shunt as shown on Figure 1.

- 11 Connect short link cable to the shunt and then to the negative terminal of the battery.
- 12 If the starter battery voltage is to be monitored then connect the orange wire to the positive terminal of the starter battery. A 1 amp fuse close to the starter battery will afford protection if a fault occurs.
- 13 Finally, connect the red wire to the POSITIVE terminal of the battery to complete the electrical installation.



**Figure 2 -  
Domestic  
and  
starter  
Batteries**

## OPERATION

### Switching the backlight.

Press ILLUM to switch the backlighting on or off. The backlit area is restricted in the top corners of the display to concentrate the lighting to the area of interest. To save power the backlight will automatically turn off after two minutes.

### Showing the voltage and current.

Press the V&A key to display the service battery voltage, current and state of charge. A second press of V&A displays the starter battery voltage together with the symbol ST. The starter battery can be a lithium battery or a lead acid battery where the open circuit voltage can be a reliable indication of state of charge. Note when displaying the starter battery voltage, the unit continues to monitor the domestic battery and display its state of charge.

## **Showing time to go.**

Press the TIME key to display the state of charge and the latest estimate of how long it will take to fully charge or discharge the battery. The time will continuously update as the load or charge current changes. Values in excess of 199 hours are shown as 199Hr. the gauge to the right of the screen continues to show the domestic battery's state of charge

## **ENGINEERING**

Engineering is the mode for setting various operational parameters. It is accessed by keeping the ILLUM key depressed until the word ENG is displayed. After releasing the ILLUM key pressing the V&A key will scroll through the various settings. The magnitude of some of the settings can be raised or lowered by pressing the UP or DOWN key. Pressing V&A will advance to the next parameter or pressing ILLUM will store the new values and exit the engineering mode.

## **SETTING THE BATTERY CAPACITY**

From ENG the first parameter is the battery capacity. This can have a value between 20AH and 600AH with a default value of 100AH. Set the capacity to that stated on the battery. In case of a bank of batteries wired in parallel then add all the individual capacities.

## **SETTING THE TEMPERATURE**

From ENG press V&A to get the approximate working temperature. The range is -10 degrees centigrade to +40 degrees in 10-degree steps. Set the approximate working temperature of the battery. The default value is 20 degrees.

## **SETTING THE ZERO CURRENT**

From ENG press V&A to get to the residual current screen. If no current is flowing in or out of the battery but a small residual current is shown on the display, then the reading will need to be adjusted to zero. First ensure that the reading should truly be zero, that is there is no current flowing in or out of the battery, wait ten seconds to ensure the reading is stable then press the DOWN key until the bar graph counts down to one bar. Release the key to complete the procedure.

warning! Do not attempt the zero-set procedure if current is flowing in the shunt as this will introduce errors.

## **SETTING THE CHARGE EFFICIENCY**

From ENG press V&A to get to the charge efficiency screen. The charge efficiency is the ratio of charge you get out divided by the charge put in. The default value is 95% which is typical of a LiFePO4 battery in good condition.

## **VIEWING THE V(max) VOLTAGE**

From ENG press V&A to get to the V(max) screen.

A LiFePO4 battery is usually charged from a substantially constant current source until the terminal voltage rises to 14.4 volts V(max) at which point the battery is within a few percent of being fully charged. Maintaining this terminal voltage until the charge current falls to a low level completes the charging process. V(max) cannot be adjusted from this screen it is set using the semi-automatic approach as described in the SYNCHRONISING section.

## **SYNCHRONISING**

When the monitor is first installed it will show the voltage and charge or discharge current of the service battery. The state of charge indicator will flash on and off indicating that the system requires synchronising.

Synchronisation is the process by which the system establishes when the battery is fully charged. The monitor then calculates the subsequent state of charge by integrating the charge and discharge current over time. As charging a LiFePO4 battery in excess of 14.4 volts reduces its life expectancy some charging systems set V(max) a little lower. This has the advantage of protecting the battery and extending its service life at the expense of a small amount of available capacity. The BM-1Li indicates the state of charge of available capacity. The available capacity will be slightly less than the stated capacity if V(max) is less than 14.4 volts as the charger cannot fully charge the battery.

If Vmax never reaches 14.4 volts (The default setting of Vmax) then synchronisation cannot occur and the state of charge display will continue to flash. Ensure that the battery is in a fully charged condition then press and hold the SYNC key until the bar graph counts down to one bar and release the key. This is the semi-automatic synchronisation process which synchronises the monitor and automatically resets the value of V(max) in engineering. Further synchronising should not be necessary unless power

to the display is interrupted or any engineering parameter (With the exception of the zero-current setting) have been changed.

Warning! Do not attempt the synchronising procedure until  $V(\max)$  has been achieved as this will introduce errors.

## QUESTIONS AND ANSWERS

Q The screen of my BM-1Li blank.

A Check the wiring is correct and securely terminated. Check the fuse and check the battery is not completely exhausted.

Q The battery voltage is correct, but the charge or discharge current is incorrect.

A Check the wiring of the shunt. Ensure that the only connection to the battery negative post is the shunt. There should be no other connections to the negative battery terminal.

Q My battery is made up of a bank of several batteries. Is that a problem?

A Not if the combination produces a nominal 12 volts and all the current flows through the shunt.

Q Can my BM-1Li monitor my engine start battery as well as my service battery?

A Yes it can also monitor the engine start battery voltage. The open circuit voltage of the starter battery can be used to estimate its state of charge.

Q The monitor shows there is still charge in the battery, but the low voltage alarm is flashing.

A The available capacity of the battery has been overstated. You need to reduce the available battery capacity by that amount. This could be due to the battery capacity being less than stated or the charging system is failing to fully charge the battery. See chapter on synchronising.

Q Do I need to disconnect my BM-1Li when I leave the boat for long periods.

A Probably not, the unit is designed to be permanently connected to the battery. It is independently fused and consumes only about one-amp hour per month. However, you must ensure that the battery retains enough capacity to power all residual loads over the period of none use. Allowing the battery to become completely exhausted could cause irreparable damage.

Q The time to discharge is correct but the time to charge takes longer than predicted.

A The charge efficiency is set too high and needs to be reduced.





# IMPORTANT READ THIS BEFORE UNPACKING INSTRUMENT

Prior to unpacking this instrument read and fully understand the installation instructions. Only proceed with the installation if you are competent to do so. Nasa Marine Ltd. will not accept any responsibility for injury or damage caused by, during or as a result of the installation of this product. Any piece of equipment can fail due to a number of causes. Do not install this equipment if it is the only source of information and its failure could result in injury or death. Instead return the instrument to your retailer for full credit. Remember this equipment is an aid to navigation and not a substitute for proper seamanship. This instrument is used at your own risk, use it prudently and check its operation from time to time against other data. Inspect the installation from time to time and seek advice if any part thereof is not fully seaworthy.

## LIMITED WARRANTY

Nasa Marine Ltd. warrants this instrument to be substantially free of defects in both materials and workmanship for a period of one year from the date of purchase. Nasa Marine Ltd. will at its discretion repair or replace any components which fail in normal use within the warranty period. Such repairs or replacements will be made at no charge to the customer for parts and labour. The customer is however responsible for transport costs. This warranty excludes failures resulting from abuse, misuse, accident or unauthorised modifications or repairs. In no event shall Nasa Marine Ltd. be liable for incidental, special, indirect or consequential damages, whether resulting from the use, misuse, the inability to correctly use the instrument or from defects in the instrument. If any of the above terms are unacceptable to you then return the instrument unopened and unused to your retailer for full credit.

Name \_\_\_\_\_

Address \_\_\_\_\_

Dealer Name \_\_\_\_\_

Address \_\_\_\_\_

Date of Purchase \_\_\_\_\_

**Proof of purchase may be required for warranty claims.**

**Nasa Marine Ltd.**

**Boulton Road, Stevenage, Herts SG1 4QG England**

### EU Declaration of Conformity

This declaration is issued under the sole responsibility of NASA Marine Ltd. This product is in conformity with the relevant Union harmonisation Legislation. Harmonised standards applied: EU directive 2014/30/EU (Electromagnetic compatibility) EN60945:2002-08

The original Declaration of Conformity certificate can be requested at [info@nasamarine.com](mailto:info@nasamarine.com)

**THIS PRODUCT IS INTENDED FOR USE ONLY ON NON SOLAS VESSELS**

