

Table of Contents

S1	General	P	1
S2	Switches	P	1
S3	Circuit Breakers and fuses	P	2
S4	Battery Monitoring	P	3
S5	Discussion on Battery Charging (and Discharging)	P	4
S6	How much have we left?	P	5
S7	Mains Battery Charger - MXS5.0 (5A) and mains RCD	P	5
S8	Bilge Pump & Socket	P	6
S9	DRI-Plug Connectors	P	6
S10	Alterations and Repairs	P	6
S11	Mast Cable Connections (for commissioning)	P	7
S12	Schedule of ratings etc	P	7
S13	Spares	P	8
S14	See also (in the black ring binder):	P	9
S15	Postscript	P	9

1 General

There are two batteries, both located below the bottom step of the companionway. Battery no 1 (starboard) is the ship's ("house") battery, and smaller battery no 2 (port) is the engine ("starter") battery. See schedule of ratings section for capacities and buying new ones

The engine battery runs engine controls and engine starting. The ship's battery runs all navigation instruments, lights, and internal services. There is no facility to parallel the batteries, except in an emergency so that ship's services cannot be run from the engine battery and the engine cannot be run from the ship's battery.

In an emergency, if the engine battery is flat, the main switch can be configured to combine which can be used to connect the two batteries in order to start the engine. This should **never** be used to run the ship's circuits from the engine battery, except in the event that an emergency radio message has to be sent. This position is protected by a bolt – leave in safe mode normally.

The two battery negatives are connected together (via the current measuring shunt for the ship's battery) to the engine block, and to a common solidly connected negative rail (i.e. negative earthing).

Useful to remember: AH = Amps x hours.

Watts = 12V X A eg 12W = 1A

When switching on for first time always check Batman voltages and current for sensible readings.

2 Switches

The main battery switch is located on the forward side of battery box.

The main battery switch should be OFF when you leave the boat at handover. This will NOT switch off the battery box connector (mostly used for bilge pump.) nor the mains charger nor the DCM

It is to be switched off in the event of an emergency such as fire or flooding. Again this will NOT disconnect the battery box connector.

Never switch off when engine running except in an emergency.

3 Circuit Breakers and fuses

IF YOU USE A FUSE WRITE IN DEFECTS BOOK. ONLY USE CORRECT VALUE – IT IS DANGEROUS TO USE DIFFERENT SIZES

There are several fuses as well as circuit breakers

Battery box: There are two mega brown 500A brown fuses on the front wall of the battery box. The upper one is for the start battery and the lower one for the house battery. The most likely reason for the start fuse to go is if the starter motor has seized (which has happened once in my time). The only other reason for either to go is a dead short somewhere which will most likely be protected by cct breakers/smaller fuses further on. If either of these fuses blows then there must be a major fault.

Note when referring to Blade fuses below they are Standard Blade, ATC or ATO, Not miniblade fuses. They are Fast Acting unless stated 'SLO-BLOW'.

There is a 6 way blade fuse holder beneath a cover on the rear side of the battery box. These fuses are as follows starting from clip, port side:

House services – goes to cct breakers	30A	GREEN
Start battery charger	7.5A	BROWN
Batman start bat	1A	BLACK
Bat Box Dri-Fit Connector	7.5A	BROWN
House Battery charger	7.5A	BROWN
Batman house bat	1A	BLACK

The ship's house distribution is protected by circuit breakers located in the engine compartment. It should not normally be necessary to operate these breakers, and they should remain ON with the red tops not visible. If there is an overload or short circuit on a circuit, the breaker will trip, and the red top will be visible. If this happens, use the circuit drawings, and follow the wiring to isolate the fault.

The circuit breakers are numbered from forward to aft, and they feed the following equipment:

Forward	No 1	2.5A	Goes via port qtrberth Secondary blade fusebox RHS – see below
	No 2	5A	Main navigation lights and tricolour.
	No 3	10A	Other lights above deck (steaming, deck and compass lights).
	No 4	10A	Goes to port qberth secondary blade fusebox LHS – see below
Aft	No 5	15A	Stb lights, forepeak lights, cockpit fpeak skts, Tictac

The engine controls fed from the start battery have a 40 amp in line blade fuse RED near the alternator. Spare fuses are in the electrical spares box. If the engine panel does not come to life, check this first.

There is also a 12 way Blade fuse box located on the bulkhead of the port quarterberth. This replaces all the fiddly in line fuses that we used to have

Right hand side fed from Forward No1 2.5A cct breaker

FUSE POSITION

(AS MARKED ON FUSEHOLDER BASE)	FUSE RATING	FEEDS
2	2A GREY	Garmin GPS
4	1A BLACK	Gas Alarm
6	1A BLACK	Port Qberth Light
8		Spare
10		Spare
12		Spare

Left Hand Side fed from No 4 ` 10A cct breaker

FUSE POSITION (AS MARKED ON FUSEHOLDER BASE)

	<u>FUSE RATING/COLOUR</u>	<u>FEEDS</u>
1	2A GREY	Splitter and AIS
3	7A5 BROWN	VHF Radio
5		Spare
7	7A5 BROWN	Cigar Lighter twin
9	2A GREY	Chart table white l/Red light via dimmers
11	7A5 BROWN	USB Twin socket

4 **Battery Monitoring**

We have a new (2019) Battery Monitor Batmanpro

The manual for the monitor is in the black Maintenance ring binder (There is a summary guide at the front of the handover check-list and at the back of the Max Prop laminated guide.) In brief:

Note on Display MAIN is used for House/Ships Battery and AUX for Start/Engine Battery

It will show voltage on both batteries - Press < or > to cycle through.

It will show charge/discharge current on the ship's battery, the rate at which it is charging or discharging

It will show AH Consumed

State of Charge in %

Time Remaining in hours and minutes before recharge necessary

At commission, the unit was set as follows:

F1.0 13.2v F1.1 3% F1.2 240sec F1.3 70% F1.4 20deg C F1.5 1 F1.6 3
F2.0 70% F2.1 12v F2.2 80% F2.3 10sec F2.4 0.00 F2.5 6h F2.6 1
F3.0 10.5 F3.1 10sec F3.2 OFF F3.3 10.5 F3.4 10sec F3.5 OFF
F4.0 15.5v F4.1 5sec F4.2 OFF F4.3 15.5v F4.4 5 sec F4.5 OFF
F5.0 100Ah F5.1 20h F5.2 20 deg C F5.3 0.50 %Cap/deg C F5.4 1.25 F5.5 3%/Month
F5.6 AU
F6.0 – F6.1 450A F6.2 50mV F6.3 30sec F6.4 NO F6.5 1-1 F6.6 degC F6.7 0 F6.8 0
F6.9 OFF

However these are first stabs at settings and may need to be changed as we gain experience. Also I don't know if there is an audible alarm yet!!

To Reset Zero Offset current:

Menu (for 3 sec) shows Stat > 3 times shows rSt Menu 4 times shows rSt.c

> to set and show ON **Probably wrong!**

Press menu for 3 seconds.

Only do this with main switch off and charger disconnected and Backlight off (Backlight takes 0.4A) Also when checking current consumption ensure backlight is off

We will learn on this – please make notes if you can on your experiences with this meter

Note : this meter keeps a history of discharges etc – so BEWARE do not run battery down!

5 Discussion on Battery Charging (and Discharging)

Typically lead acid batteries can discharge to 50% of nominal capacity before being recharged, and last for 800 to 1500 cycles. During discharge, the chemical reaction causes both plates to convert to lead sulphate. If recharging is not carried out promptly (within a couple of hours) the lead sulphate starts to harden and become crystalline, and is almost irreversible.

Discharging to 70% of capacity will give appreciably longer life than discharging to 40%. That is why we have set the audible alarm to 60%. Please try, however, not to discharge the ship's battery below 70%. In cruising yachts where batteries are properly recharged, and cycle capabilities are maximised, battery life should be around five years. Ours seems to be about 3 years.

With the engine stopped, the ship's battery current monitor will show the current being taken by the navigation lights and any other connected loads. Please make use of this, and do your utmost to conserve battery power. Ensure the crew is briefed to turn off unwanted lights, and only recharge mobile telephones when the engine is running or charger is connected up in a Marina.

The batteries are charged by the Bosch engine alternator through a pair of split-charge diodes.

When charging, please go to full capacity, rather than stopping at, say, 80%.

Remember that it may be necessary to run the engine just to recharge the ship's battery in particular, when you leave the boat at handover. The handover check sheet shows additional battery checks including a check for >95% battery capacity.

The batteries are both sealed and cannot be topped up with water. The only maintenance is to keep them charged and occasionally wipe the tops clean to prevent self discharge.

Generally it takes longer than expected to charge with either engine or battery charger.

Here is chart of very very rough state of charge versus voltage for AGM lead-acid bats. Note that this is when charging has been off for a few minutes.

State of Charge	Voltage
100%	12.80+
75%	12.60
50%	12.30
25%	12.00
0%	11.80

6 How much have we left?

Consumption during a night sail should be about 2 A - maximum use starting with a full battery at this discharge rate is about 15 hours to get to 70% capacity.

To check Consumption and remaining time – use DCM Battery Monitor : example 90AH showing, and you are using 5A, then you have:

$(\text{present charge level} - (\text{total bat capacity} \times \text{end discharge level})) / \text{discharge current}$ eg: $(90 - (100 \times 0.7)) / 5$ hours left = 4 hours to go before reaching the recommended 70% discharge state.

REMEMBER:

Battery Capacity is AT THE MOST 50% of rated capacity (ie 5A for 10 hours for house bat)

The house battery has an eye which measures the electrolyte state of one cell. If this is not green then CHARGE CHARGE CHARGE!! If voltage down to 12.3 volts or less then CHARGE CHARGE CHARGE!!

Reminder: (AH = Amps x Hours)

7 Mains Battery Charger - MXS5.0 (5A) and mains RCD

We have a mains RCD with double socket on portside berth through which all mains operations should go. This is for safety reasons. Press the test button to check RCD function – it should trip. When Hooking up to mains **PLEASE VISUALLY CHECK CABLE. IF DAMAGED THEN DO NOT USE** as you could be putting everyone including those on the pontoon at risk.

One of the sockets is **permanently** reserved for the battery charger and the other may be used for anything else that is **DOUBLE** Insulated (2 concentric squares and no earth terminal - max 13A). However please remember that use of **mains power tools and other items in a marine environment is inherently dangerous** even with the RCD so visually check leads, ensure portable appliance tests are up to date and if in doubt **DO NOT USE**.

The charger was new July 2012

See separate Operating Instructions in the Black Maintenance Binder.

Please use this if you are in a marina and the batteries are not fully charged (usually ship's battery) – the electricity is free, but batteries are expensive. It is simple to operate and cannot overcharge the batteries. You do not need the main switch on for this

You can still run equipment such as lights when this is connected, effectively you are running the ships services off the mains.

SIMPLE INSTRUCTIONS:

It is already connected to House Battery via a fuse (If you do need to connect to start battery, there is a second connector within battery box that can be swapped, but if this is necessary there is probably something wrong with start battery so please inform committee/ SS urgently) Put waterproof cover on socket not used.

Press Button till on car symbol

Turn on Mains.

When finished turn off mains

IF RED LIGHT ON then it is not charging – reset by pressing mode (till back to car)

SAFETY

Avoid covering the charger

Always check that the charger has reached Step7 before leaving the charger unattended and connected for long periods. If the charger has not reached Step7 within 50 hours, this is an indication of an error.

A Battery being charged could emit explosive gases. Prevent sparks close to the battery.

When batteries are reaching the end of their lifecycle internal sparks may occur

Provide decent ventilation when charging

Please note that the charger will probably not reset the meter to 100% (yet to be tested). This will only happen when the engine charges for 5 mins. (as above). However you will see the battery voltage rise.

For a 50% discharged battery the charger will supply 50AH of charge in approx 10 hours.

8 Bilge Pump & Socket

Connect the bilge pump to the socket on the battery box. This goes via a 7.5A bat box fuse (4 from pt side - Spares in electrical box) The bilge pump will only turn on when the sensor plate is covered and so the rate of battery discharge will be proportional to the ingress of water from the hull. If for instance it turns on for 10 seconds every 5 minutes, it will be equivalent to a constant discharge rate of 0.16A. Therefore the battery would be discharged to 70% of its full amount in 225 hours or 9 days. (not tested - prob less when efficiencies are taken into account).

If in a marina, it is allowable when using pump to turn on the battery charger and at the same time turn off the main switch. This will keep the battery in peak condition (but see notes on battery charger re leaving for extended periods)

9 DRI-Plug Connectors

There are 3 Dri-Plug 2 pole connectors on board – Cockpit, Forepeak, and 1 on battery box.

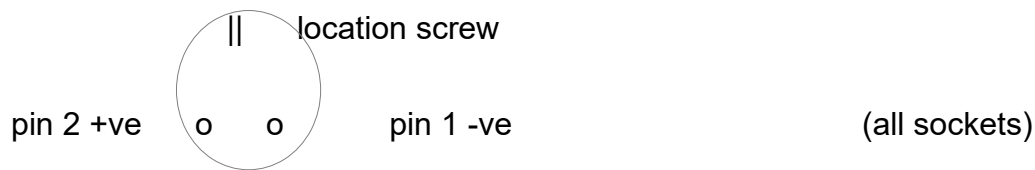
There are differences – the cockpit and forepeak go via the main switch whilst the battery box works with main switch off. The reason these are different is so that the bilge pump can be left on when the boat is unattended and the main power switch is off.

You can however plug the spot lamp, anchor light or bilge pump into any socket. (but see previous paragraph)

The connections for the dri-plug connectors are as follows:

Pin 1 is negative pin 2 is positive.

Looking at the bulkhead mounted socket from plug end (business end):



10 Alterations and Repairs

If it is necessary to make any repairs or alterations to the wiring, compression connectors, as already installed, should be used. A small selection of spare connectors is in the forward starboard spares locker. They should be compressed with the purpose-made crimping tool, but in an emergency, a mole grip may be used.

Strip the insulation off the wire for about 6mm, and insert the bare end into the connector. Use the crimper (or adjusted mole grip) and squash the connector until it is flattened to the same thickness as existing connectors. Before completing the connection, pull the wire to ensure it is firmly held in the connector.

If you find damaged cable PLEASE WRITE IN DEFECTS BOOK. In general repairs with tape are to be discouraged as that can mask faults whilst sea water is wicking up the cable.

11 Mast Cable Connections (for commissioning)

There is a junction box on the bulkhead in the forepeak, just to starboard of the mast.

Pin no 1 is at the top. The following is the key to the white cables:

TRICOLOUR	16AWG	Red Pin 1 & Black Pin 2
STEAMING (smallest cable marked 18AWG)		Red Pin 4 & Black Pin 5
DECK	14AWG	Red Pin 7 & Black Pin 8

12 Schedule of ratings etc

BATTERIES existing and new

No 1 Ships (house) 12v 100 Ah

AGM

Apr 2018 Greenham Regis. At S Q.

Ex Bardens.. Power Max 100 sealed. 12v. Cca 700. 12/2021.

Maximum size 320mm (although existing exceeds this at top) x 202mm x 245mm ht including terminals

No 2 Engine (start) 12v 44 Ah 560 CCA AGM Fullriver HC44

May 2015

Maximum size 198 mm x 166mm x 220mm ht

If you need to buy a new battery – Please call before buying new battery. New ones must be AGM. Wet Lead/acid are not considered safe any more in occupied spaces (acid leakage and gassing). Gel cells are not tolerant to overcharging or excess discharge.

Start: We use a smaller start / engine battery - ignore AH rating in engine manual (that is for basic open lead/acid batteries). The Cold Crank Amps needed for the Beta 722 20HP is 540A. This is the important figure, not the AH. Start batteries have different plate configurations. (a 45AH batt would give you almost 3 minutes continuous cranking to get to 50% discharge) Recommended Merlin Fullriver HC44 pt06-8511 44AH 560A CCA

Ships: it is the AH that is important (although you will find that a 100AH bat should have enough CCA to start engine in emergency via third switch position) The best sort of battery for this would be a deep cycle AGM traction battery. Recommended: Merlin 06-8323 105AH 550A CCA Independent equivalent 27T

ELECTRICAL EQUIPMENT POWER CONSUMPTION

Amps= W/V

Nereus Gas Detector	0.0 A	Milliamps do not register on DCM
Garmin 128 GPS	0.2 A	
Tack Tick	0.2 A	
Tri Colour Nav Light	0.3 A	Replaced 2010 LED AQ series 32
Compass Light	0.1A	
Chart Table light Red	0.4A	LED Strip with dimmer
	0.2A	Dimmed to half way
Chart Table Light White	0.8A	LED Strip with dimmer
	0.4A	Dimmed to half way
Deck Light	2.6A	2 x 12v Led floods
Navman VHF	0.3 A	standby
	0.8A/3.6A	TRANSMIT
AIS	0.4A	
AIS -VHF Splitter	0.2A	

Spare Sockets – handheld VHF / Mobile phone When recharging Mobile Phones check consumption and be prudent. Note there is a separate usb charger (2 sock 1 at 2A and one smaller)

Interior Lights

Galley White	0.5A	LED
Red	0.4A	LED

Saloon	port	0.3A	LED
	starboard	0.4A	LED
Fore peak		0.4A	LED
“	Strip	0.3A	LED
Quarter Berths	port	0.4A	LED
	starboard	0.5A	LED
Anchor Light (turns off in daylight)		0.3A	Large LED 0.4A Small LED bulb (spare)

So Total when anchored overnight say 2A

Navigation Lights – used when Engine Running:

Bow Side lights	1.4A }	Aqua Signal TD 40
Stern(on with bow lights)	0.2 A} 1.6A together	Evoked
Steaming	0.2 A 2W	Evoked
Spot/Beam lamp	Now rechargeable	

13 Spares

SPARES AVAILABLE IN ELECTRICAL SPARES BOX (STOWED STARBOARD FORWARD UPPER LOCKER) Three Boxes.

1. Fuses and small electric tools. Minimum no of fuses:

In Line (Blade) fuses for engine	40A Red Blade	x2
Fuses for Batman Monitorx2, Gas Alarm, port qtrb light:	1A Black Blade	x5
Fuses for Aerial splitter&AIS, chart table lights, Garmin GPS:	2A Grey Blade	x3
Fuses for Dri fit and mains chargerx2 vhf, Cigar skt usb socket	7.5A Brown Blade	x5
Main Fuse for house circuits	30A Green Blade	x2
Very large fuse for both start and house battery	500A Brown Mega	x1
IF YOU USE A FUSE WRITE IN DEFECTS BOOK PLEASE. ONLY USE CORRECT VALUE IT IS DANGEROUS TO USE DIFFERENT SIZE		
Also in this box small screwdrivers		x4
small wirecutters		x1

2. Electrical spares and multimeter separate plastic bags inside KEEP TIDY!

Crimp tool and select jaws
 Good wire stripper
 Short length of 16AWG cable red and black – good for ~ 20 A and blade fuseholder, solder
 Multimeter
 Selection good quality crimps Some are heat shrink ones, also separate heat shrink.
 Spare nuts (5/16 in and 3/8 in) for start cable posts
 Ty-wraps and spiowrap including marker tywrap different sizes
 Cable clips, different sizes

3. SPARE BULBS

This needs rationalising TO BE DONE

14 See also (in the black ring binder):

Engine Start and Stop Procedures and Navigation Light Controls
 Seascamp Schematic Battery Box

Seascamp Schematic Engine Elect
Seascamp Schematic Electrical Distribution
Battery charger instructions
Batman Instructions

15 Postscript

Any skipper or crew member who has any questions or helpful suggestions about these notes, or on the electrical system generally, is kindly asked to contact Simon Smewing (tel 07968 799835) Also please call this number from on board if you have problems – I may not be able to help, but it is better for me to get information real time rather than wait for an email after you leave the boat. If anybody wants this document as a pdf please email simon@post.eu.com

issue 1 April 2006 SS. issue 2 April 2009 SS. issue 3 May 2011 SS. issue 4 July 2012 SS. Issue 5 July 2012 – new bat charger SS. Issue 6 Mar 2013 – bilge pump SS. Issue 7 Apr 2015 – minor changes SS. Issue 8 May 2015 minor changes and formatting SS. Issue 9 Aug 2015 – bat volt chart added, low sh bat to 12.2v SS. Issue 10 May 2017 - batcharger and bat type SS Issue 11 Apr 2018 New battery box Issue 12 Sec Fuse Box Apr 2019 Issue 13 July 2019 Update Consumptions Issue 14 April 2020 Spares Boxes Issue 15 April 2021 Remove adverb. Issue 16 May 2021 minor