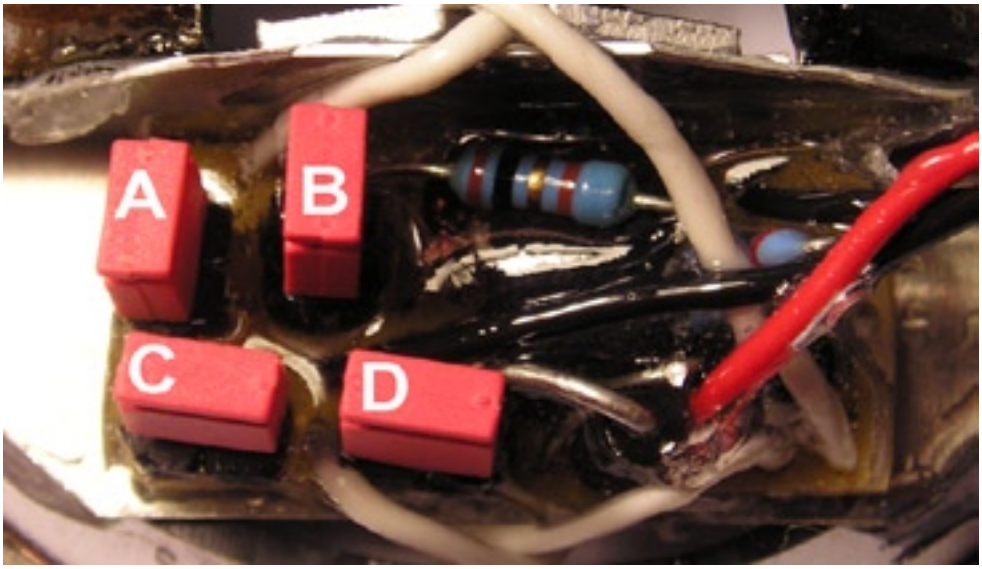
Configuration and Operation of the Bisun M3 caving light

In use there are only two 'settings' available, one for each switch contact in the headset, so operation is as simple as operating a headset with conventional incandescent bulbs.
For an M3, a 'setting' is a particular combination of power settings for one or both LEDs, configured inside the headset. One setting is 'mainly wide', and the other 'mainly spot', but it's easiest to think of them as thw wide and spot settings.

The control circuits for the two power settings are essentially independent, and each is connected to a different contact on the switch. What actually happens at the wide and spot settings depends on how the user has chosen to configure the light.

On the wide setting, the lamp runs at either a regulated 120 or 60 lumens total output, with that output coming all from the wide beam, or mainly from the wide beam with some fill-in from the spot beam.

On the spot setting, the spot beam always runs, at either an unregulated low pilot setting or a regulated 120lumen output, or without optional fill-in from the wide beam, also at an unregulated low setting.



All configuration is done with the headset open, by adding or removing 'jumpers' on the circuit board on the back of the reflector.

It is probably best to use the unit at the factory default setting of all jumpers present for a familiarisation, and then think about maybe reconfiguring once used to the operation of the lamp.

Two jumpers control what happens at the wide setting.
The wide setting power-level jumper (B) selects between 120lumen output if present, and 60 lumen output if absent. The wide+spospot jumper (D), if present, causes some fill-in from the spot beam, rather than the wide beam operating alone, though the total power consumed will be the same.

Two more jumpers control what happens at the the spot setting. The spot power jumper (C) selects whether the spot beam is on at 120lumens (present) or a pilot setting (absent).
The (A) selects whether the wide beam is on at a pilot setting (present) or not (absent).

The effects of all four jumpers are independent, apart from one minor exception. If the pilot-wide jumper (A) is present, then at the full power setting, the spot beam LED will be very weakly on even if the full-spot jumper is absent.
This means there are 4 possible setting for each of the two power levels, but the settings chosen are largely going to depend how much power the user wants to expend - someone wanting maximum output will likely have jumpers A..C all present. Similarly, the most miserly setting is with jumpers A..C missing. Jumper D only affects shifting some power from the wide to spot beam on the full power setting.

It is also easy to see the effects of the various settings by changing them as the unit is running. Very likely, a user will rarely alter the settings once they have settled on what they feel works best for them, but having flexibility does mean that someone normally running flat-out could change to a lower power output if on an extended trip or using low capacity batteries or depleted batteries. The design means that dropping to lower power levels in an emergency situation is always possible by removing jumpers.

Battery life

The approximate nominal capacities of various batteries are given below

NiMH AA	1800-2700mAh
Alkaline AA	~2700mAh
Headlite (NiCd, high capacity)	3000mAh
NiMH '18670' cells	4000-4500mAh
4.5V alkaline 'flat pack' (Duracell MN1203 or equivalent)	5500-6100mAh

120lumens output equates to roughly 2.5-3 hours run-time per amp-hour
The pilot setting is something like 20 lumens, and so equates to roughly 16 hours run-time per amp-hour

It might be expected that an MN1203 or equivalent battery would deliver approximately 15 hours of high power, or 90 hours on a pilot setting.
In real-life situations, things are a little more complicated. Even at 1 Watt output, the unit will drop out of regulation earlier than a simple calculation would suggest, and the output will then gently decline over quite a long period. This tail-off will generally be longer and smoother with alkaline cells than with NiMH rechargeables.

The supply for an M3 should be limited to no more than 5 Volts, which realistically usually means a 3-cell alkaline, NiCd or NiMH battery, a 3.7V Lithium pack, or a 4V Lead-acid battery. Use on an FX5 battery should **not** be considered.
The control circuits are protected against reverse voltages that could occur due to an incorrect installation into a headset, or from misconnection of a battery.

Care of your unit.
Whilst the circuitry is potted in resin and painted in sealant it is still advised to avoid getting water in the headset, primarily because of the potential effect on the reflector silvering. If the headset does get water inside, it should be opened and allowed to dry thoroughly as soon as possible after exit.
Care should be taken not to touch or otherwise damage the reflector surface, as this may allow water to penetrate the thin lacquer coating and corrode the metal reflective layer underneath, impairing spot-beam performance.
Reflector replacement would be possible if it became necessary.

If the unit is to be fitted to a headset known to have leaked in the past, such as one with internal corrosion, it is best to try and address the waterproofing issues of the headset before fitting the unit. For suggestions on waterproofing, email the address below.

Finally, despite the effort put into making the M3 maximally reliable, with independent control circuits for each power setting, and as much built-in redundancy as possible, it is still recommended to carry backup lights when caving.

For any further information, contact: cavelights@bisun.co.uk