Configuration and Operation of the Bisun M1 caving light

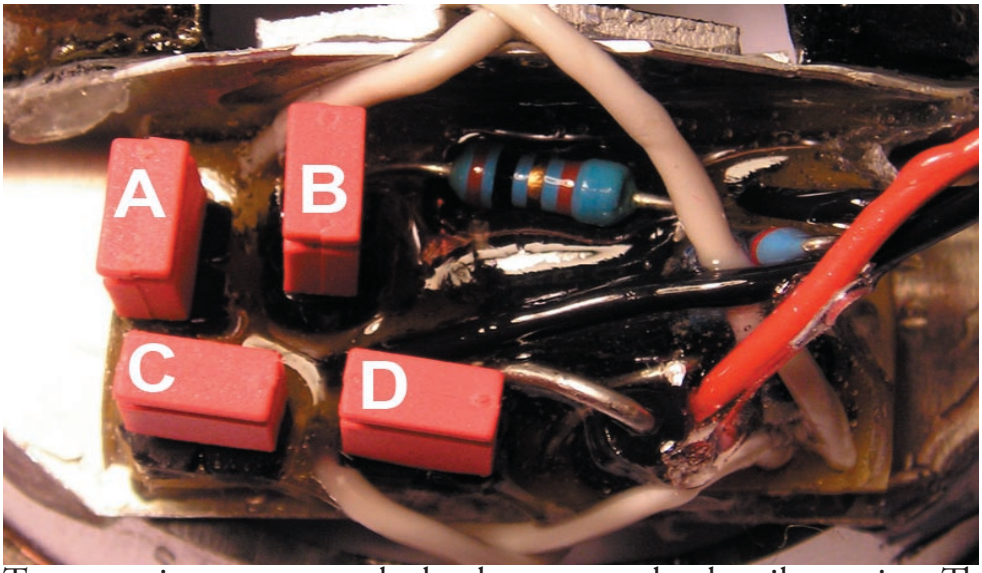
The rotary switch in the headset containing an M1 is used to control both 'full' and 'pilot' power settings in the same way as operation with conventional incandescent bulbs.

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 full and pilot settings depends on how the user has chosen to configure the light.

On the full power setting, the lamp runs at either 1 Watt or 1/2 Watt, and that power either all goes to the spot beam, or mainly to the spot beam with some fill-in from the wide beam.

On the unregulated pilot setting, the wide beam always runs, at either an approximate 1/6 or 1/3 Watt, with or without optional fill-in from the spot beam, also at approximately 1/6 Watt.

All configuration is done with the headset open, by adding or removing 'jumpers' on the circuit board on the back of the reflector, and so is a pre-caving task. 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.



Two jumpers control what happens at the full-power setting.
The full-level jumper (B) selects between 1 Watt total power if present, and 1/2 Watt total power if absent.
The full-wide jumper (D), if present, causes some fill-in from the wide beam, rather than the spot beam operating alone, though the total power consumed will be the same.

Two more jumpers control what happens at the the pilot setting. The pilot-wide jumper (C) selects whether the wide beam is on at an approximate 1/6 Watt or 1/3 Watt. The pilot-spot jumper (B) selects whether the spot beam is on at an approximate 1/6 Watt, or not on at all.

The effects of all four jumpers are independent, apart from one minor exception. If the pilot-spot jumper is present, then at the full power setting, the wide beam LED will be very weakly on even if the full-wide 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 spot to flood 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.

Battery life
The approximate nominal capacities of various batteries are given below

NiMH AA	1800-2400mAh
Alkaline AA	~2700mAh
Headlite (NiCd, high capacity)	3000mAh
NiMH '18670' cells	4500mAh
4.5V alkaline 'flat pack' (Duracell MN1203 or equivalent)	5500-6100mAh

1 Watt equates to roughly 2.5-3 hours run-time per amp-hour
1/6 Watt 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 1/6 Watt pilot setting.
In real-life situations, things are a little more complicated. Even at 1 Watt output, it is likely that the unit would drop out of regulation earlier than a simple calculation would suggest, and will then slowly decline in output over a long period.

Warning - The supply for an M1 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 can occur due to incorrect installation into a headset, or from misconnection of a battery.

Care of your unit.
Whilst the circuitry is largely potted in resin, has so far proved immune to water problems even in generally leaky headsets, and is likely to temporarily fail safe even if water did somehow penetrate the resin, it is still advised to avoid getting water in the headset, primarily because of the potential effect on the reflector silvering and eventual corrosion of then jumper pins. If the headset does get water inside, it should be opened and allowed to dry thoroughly as soon as possible after exit. Mud should be gently rinsed off, ideally not with hard water. 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. An isolated case of significant loss of reflector silvering seems related to the use of Vaseline or similar on the rubber sealing ring, so such substances are best avoided. Reflector replacement is possible if it becomes necessary
If the unit is to be fitted to a headset known to have leaked in the past, it is best to try and address the waterproofing issues of the headset before fitting the unit.

Finally, despite the effort put into making the M1 as reliable as possible, with independent control circuits for each power setting, and built-in redundancy wherever possible, it is still recommended to carry backup lights when caving, as one would with any other light source.

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