

Frequently Asked Questions #E8

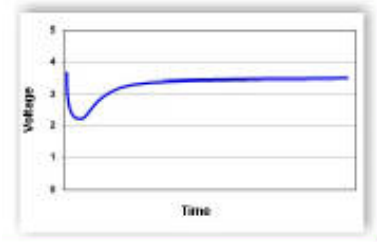
Question : When I do a DUR on my ML1 there is no data, but the total tip count looks correct ?

Answer : We have discovered there is a generic problem with all lithium batteries called “passivation”, which becomes especially evident when a circuit draws a very small current over a long period of time. This occasionally affects the memory writes within the ML1, resulting in an apparent loss of data – BUT the data is still there !!!!

Firstly, the “passivation” :

Passivation is a film of lithium chloride (LiCl) that forms on the surface of the lithium anode, and it serves to protect the lithium from discharging on its own when the load is removed from the cell. The film of LiCl, which is essentially a high resistance layer between the electrodes, is primarily responsible for the long shelf life (>10 years) of lithium cells. Passivation may cause voltage delay after a load is placed on the cell as illustrated in the following drawing:

After a load is placed on a cell, the high resistance of the passivation layer causes the cell's voltage to dip.



So what happens in the ML1 ?

The ML1 draws most current when it is writing an event to flash memory, and if the battery is suffering from passivation the voltage may dip below the safe operating voltage of the memory chip, causing an error in the data written. When dumping data with the DUR command, an error such as this may cause the dump to prematurely terminate, giving the appearance there is no data.

So what do we do now ?

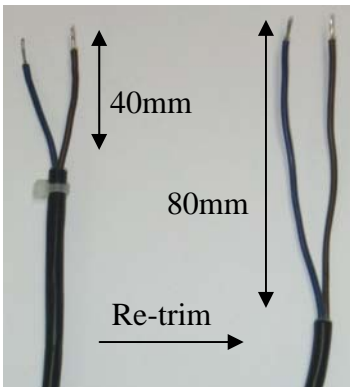
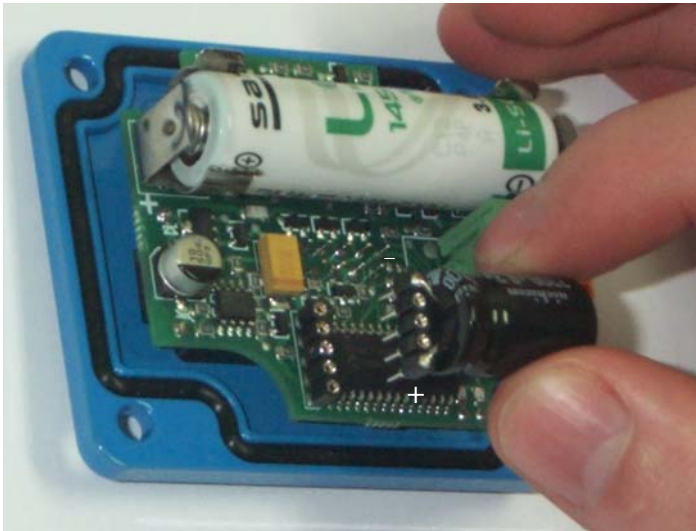
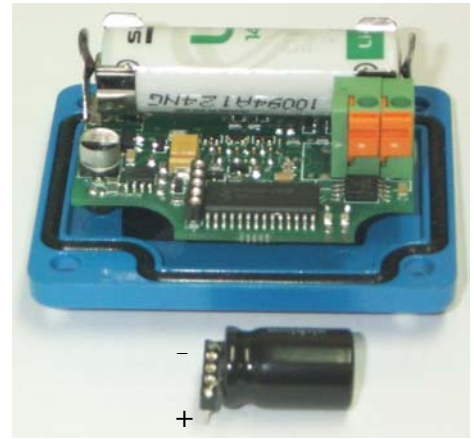
There is a command DUR/+ that allows the memory dump to occur, and skip past any problems found in the data. Once you enter this command, it will continue to dump forever, so you must stop it by pressing “Enter” on the keyboard a few times. (Also note that when you perform a CLR command, the data is not all erased, so when you perform a DUR/+ command, you will probably see some very old data appearing. You will need to sort through this data manually, and just extract the data you require.)

How can we fix this ?

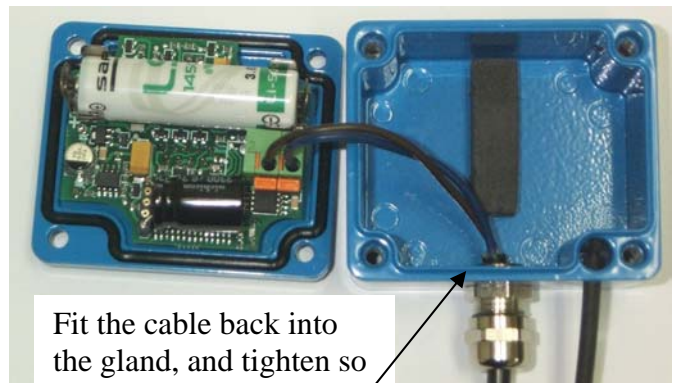
You can solve this battery “passivation” problem by adding a large capacitor across the power supply, which holds the battery voltage high during the memory write – eliminating the dip in voltage shown above. Hydrological Services will provide a retrofit capacitor module that can be easily fitted in the ML1, as shown in the following photos.

Installing Battery Filter Capacitor to the ML1 :

The battery supply filter capacitor is a 3300uF 6.3V capacitor fitted to a pin header that plugs in to the 5 pin programming socket on the ML1 PCB as shown.



Take the standard 2 wire cable (shown on the left) and re-trim the outer sheath to expose about 80mm of cable. (This is necessary so the cable does not push on the capacitor when the lid is put on the base of the enclosure)



Fit the cable back into the gland, and tighten so the outer sheath is only just visible. (DO NOT refit the cable tie !!)

When fitting the lid, push the cable to the left as shown.



PLEASE NOTE :

- After fitting the capacitor, use WinComLog to load firmware Rev 1.17 or higher
- Enter the password
- Check the Date and Time
- Clear the log with the CLR command
- Create some bucket tips and check that the ML1 is logging data correctly with a DUR.