SIDEWISE: BATTERY BACKUP OPTION

The battery backup kit supplied by ATPL contains the following components which you should check on receipt. If your board was supplied with the battery backup option already fitted you may proceed to step 8 of the installation procedure.

BATTERY BACKUP KIT COMPONENTS CHECK LIST.

PCB Ref.	*DEVICE*	*Qty.*
ICl,2	74HCT138E	2
IC3	74HC32N or 74HCT32E	1
Rl	1K8 (Br/Gy/R)	1
R2	120R (Br/R/Br)	1
R3	680R (Bl/Gy/Br)	1
R4	470R (Y/Pu/Br)	1
R5	lOOK (Br/Bk/Y)	1
Rb	4K7 (Y/Pu/R)	1
C14	47uF 16V ELECT	1
Dl	BZY88 3V9	1
D8	1N914 (1N4148)	1
Tl	VNl0KM	1
T2	BCl84L	1
T3	2N2907	1
S1, S2, S3	8 WAY SIL STRIP	1
S1, S2, S3	PCB SHORTING LINK	3
-	BATTERY	1
-	ADHESIVE PAD	1

Please notify ATPL immediately of any discrepancies. Proof of purchase of the kit MUST be supplied in the event of any complaint.
NOTE: The above parts list is subject to the same copyright laws as the manual and must not be reproduced in any form, including physical components, without the written consent of ATPL.

INSTALLATION PROCEDURE

The following procedure must be followed carefully when making the upgrade. It has been assumed that you wish to configure the board to accept up to 16k of Battery backed RAM.

If you have an issue 2 SIDEWISE board, which is unlikely, the whole board should be returned to ATPL for the upgrade and other modifications to be fitted.

If you have an issue 3 SIDEWISE board, which is the first production issue, you should obey the section marked appropriately.

If you have issue 4 or later you should ignore the section relevant to issue 3 boards.

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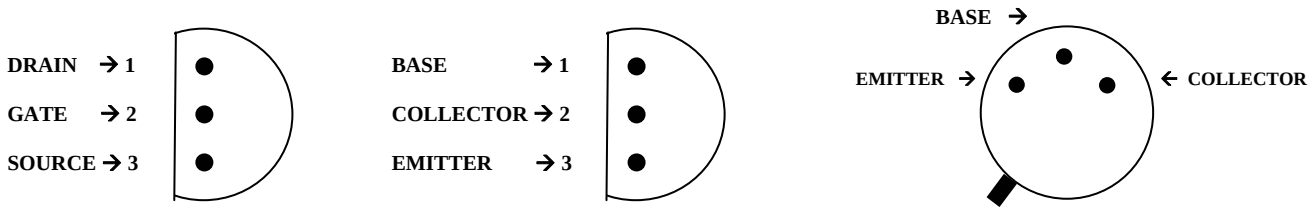
1) The SIDEWISE board should be removed from the machine detailed in the SIDEWISE user manual.
2) If you have already fitted any memory devices in sockets 15a and 15b these must be removed whilst you are modifying the board. The reasons will become clear later.
3) The SIDEWISE link options must be configured in the following manner. This is accomplished by carefully cutting the PCB tracks which form the default link settings with a sharp modeling knife. Be careful NOT to cut any other tracks. Refer to section 6 of the SIDEWISE user manual for an explanation of what you are doing.

   S1 Cut the default link (NORTH) on the underside of the board. This isolates the main 5v supply rail from socket 15b.
   S2 Cut the default link (NORTH) on the underside of the board. This isolates the main 5v supply rail from socket 15a.
   S3 Cut the default link on the top side of the board. This isolates the battery supply rail from the main 5v supply rail.
   S4 This may be left in the default condition (made) or may be wired to a switch as suggested in the manual.
   S5 This must be in the default condition i.e. NOT made.
   S6 This may be left in the default condition (not made - write enable) or may be wired to a switch as suggested in the manual.
   S7 Not applicable, therefore use as normal.
   S8 This must be in the default condition (EAST) as you are going to use RAM in socket 15a.

4) You may now solder in the components Rl - R5, Dl, Tl, T2, T3 referring to figure 1 to observe correct orientation for the semiconductor devices. The single in line stakes Sl, S2 and S3 may now be fitted. These are made by cutting the 8 way strip provided into two 3-way strips (Sl and S2) and one 2-way strip (S3).



T1 – VN10KM **T2 – BC184L** **T3 – 2N2907**

Figure 1 **TRANSISTOR PIN-OUT DIAGRAMS**

ISSUE 3 ONLY

Due to a variation in the power off characteristics of some ICs fitted to the BBC machine, we have discovered that slight modifications to SIDEWISE issue 3 boards are required in order to reduce the battery drain current to an acceptable level of less than 10uA.

(a) The track between R7 and 1C2 pin 16 should be cut on the underside of the board and the R7 pad connected to the lower pin of S3 by a piece of thin insulated wire.

(b) Resistor R10 does not have a have a home on issue 3 boards and should be soldered between the El line (the RED flying lead) and Vcc. A convenient place is on the top side of the board between the El mounting hole and the end of R7 which you have connected in (a) above.

(c) Diode D8 should be mounted across the two outside holes of S7 with the bar end of the diode towards the right.

(d) If capacitor C14 is a disc ceramic, this should be replaced with the electrolytic capacitor supplied with the kit. Observe correct polarity by mounting this capacitor with the NEGATIVE electrode to the RIGHT.

ISSUE 4 ONWARDS ONLY

R10, D8 and C14 may now be soldered into the board. Observe correct polarity by mounting this capacitor with the NEGATIVE electrode to the RIGHT.

5) Remove ICs 1, 2, and 3 from the SIDEWISE board as these are now to be replaced with the three integrated circuits provided with the kit which are Hi Speed CMOS devices. These must be handled carefully to avoid damage due to static discharge. The circuits are expensive devices and ATPL cannot be held responsible for damage which may occur due to bad handling of the devices. The devices are necessary to ensure good data retention properties when the mains supply is removed and ICs 1 to 4 will remain powered up from the battery supply.

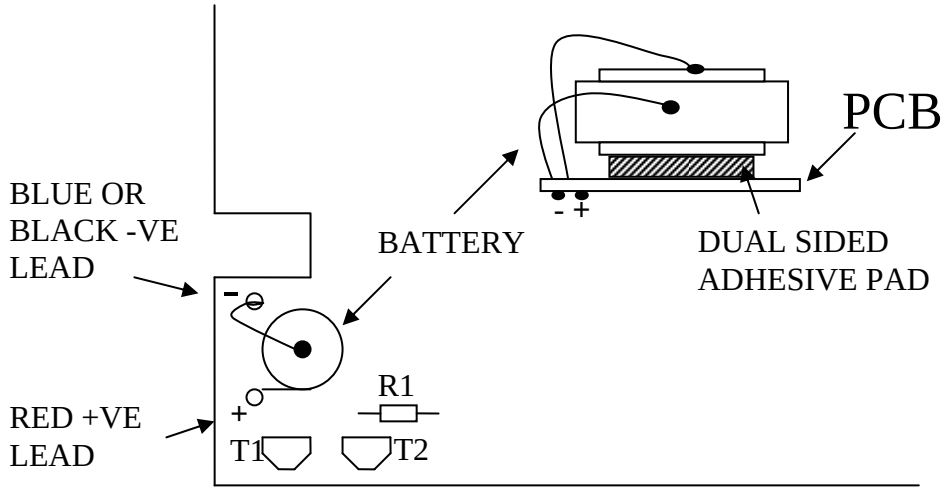
IMPORTANT - DO NOT INSERT THE NEW DEVICES YET!

6) Fit the shorting links S1 and S2 in their SOUTH position to provide power to sockets 15b and 15a from the battery supply rail.

7) The battery may now be soldered in as shown in figure 2 being careful to observe the battery handling precautions explained at the end of the manual and correct battery polarity. The battery should be affixed to the pcb using the double sided sticky pad provided.

SIDEWISE: BATTERY BACKUP OPTION

Figure 2



8) Having fitted the battery, there will now be a supply voltage on I.C.s 1 - 4 and sockets 15a and 15b. In order to prevent possible damage to I.C.s 1 - 3 and your expensive RAM chips due to input voltages being present during I.C. insertion, you must now temporarily remove power to these sockets. This is achieved by inserting the shorting link across S3. The effect of this is to discharge the battery through the charging resistor R1 into the other devices on the SIDEWISE board. The discharge current in this state will be approximately 1 mA and will effectively remove any damaging voltages on the CMOS devices. You should only insert S3 when you are ready to continue with the upgrade as you are, of course, discharging the battery quite quickly, although this will not cause any damage.

9) You may now insert the new CMOS devices I.C.l, I.C.3 and your RAM chips (which may have been supplied with the upgrade kit if you ordered them). Once you have inserted these, S3 should be removed to apply battery power to the SIDEWISE board. This procedure must be followed in reverse should you ever wish to remove any of the CMOS devices. In practice, damage due to not removing the supply using S3 very rarely results, but it is a sensible precaution to take and ATPL cannot accept responsibility for you not following the procedure. S3 may be saved for later use by mounting the shorting link on one pin only of the S3 jumper pair.

10) The SIDEWISE board may now be re-installed in the BBC machine as normal, being careful to avoid causing a battery short circuit when refitting. In addition, if the SIDEWISE board is to be stored outside the machine, be careful not to place the board on a conducting surface or in contact with other circuit boards as the battery is capable of supplying quite large currents and will destroy itself if shorted.

11) The battery should now be discharging at approximately 10uA (ATPL test spec.) and a quick calculation yields a memory support time on full charge of around 6000 hours.

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THEORY OF OPERATION

When the 5v supply is present, i.e. above 4.5v, the voltage sensing circuit built around Dl will cause T2 and T3 to conduct allowing the battery to trickle charge through Rl and providing a write enable signal to the logic via the MOSFET transistor Tl, providing that S6 is not fitted.
When the supply rail falls below approximately 4.5v, T2 and T3 turn off and a write protect signal is applied via Tl, therefore preventing spurious write access to the RAM devices. The action of the High Speed CMOS devices causes the RAM chips to be deselected as main power is removed, the battery supply to these devices ensuring that this condition is maintained.
The retention properties of the battery backup circuit rely to some extent on the SIDEWISE board being installed in the BBC machine and you should not expect 100% retention if you remove the board to install in another machine. This is not entirely due to the board being "in circuit" but also partly due to handling of the board affecting the battery discharge current which can increase significantly as CMOS inputs are allowed to "float". The basic rule is, if you want good retention, then keep your fingers off!

THINGS TO CHECK

The commonest problem so far experienced with the battery backup circuit has been an inability to write to the RAM. This is due to a low power voltage being present on the SIDEWISE board, causing the voltage sensing circuit to apply a write protect to the RAM, as indeed it should. The problem was eventually tracked down to dirty PSU connectors from the BEEB's power supply the main PCB, resulting in a voltage of about 4.5 volts at SIDEWISE. Cleaning the connectors brought the voltage back up to 4.95 volts at the SIDEWISE board, therefore permitting write access to the RAM. This appears to be a common problem and so it is quite worth while cleaning these connectors anyway.

The circuit diagram of the charging circuit and voltage sensing circuit is shown in figure 3 in case you have any other problems with the circuit.

When using SIDEWISE with battery backup fitted and developing programs in the RAM area it is quite easy to screw up the machine, particularly if you have a SIDEWAYS ROM header block in the RAM and very little else. The effect is that the operating system jumps into the RAM and may never cane back out. Even powering down has little effect, because of course the RAM is battery backed. The way to get out of this is to deselect the chip in socket 15a by breaking the S4 link, as suggested in the main manual. This prevents the OS from reading the header block and therefore prevents the RAM from being entered.

SIDEWISE: BATTERY BACKUP OPTION

BATTERY HANDLING PRECAUTIONS

In compliance with the British requirements of the Health and Safety at Work Act 1974 we, as suppliers of cells and batteries, have to advise you of the safety precautions to be observed whenever these products are handled or used. Provided these products are not subjected to physical and/or electrical abuse, they are safe to use and are free from hazards to health. Nevertheless the appropriate health and safety precautions must be observed as follows:-

1) Consult ATPL if in doubt about any aspect of the use of cells or batteries particularly if any unusual or extreme applications are contemplated.
2) Do not exceed published specifications.
3) Do not short circuit cells or batteries.
4) Do not incinerate, solder directly to cell cases or otherwise overheat cells or batteries.
5) Do not attempt to recharge cells or batteries which are not specifically designed as a rechargeable type.
6) Always insert or connect cells and batteries correctly. Do not mix new cells or batteries with used or unequalised types.
7) Do not open, puncture, crush or tamper with cells or batteries or otherwise subject to abnormal mechanical forces.
8) Do not enclose cells or batteries in a sealed pressure container unless a safety vent is fitted. Do not encapsulate cells or batteries without first seeking advice from the manufacturer.
9) Do not connect Nickel Cadmium cells or batteries in parallel.

EMERGENCY ACTION

If cells or batteries start to heat up or vent gasses due to abuse, they could be disconnected immediately. They should then be moved outdoors or to a well ventilated area to cool down.

If a cell is ruptured, electrolyte will be released. This will usually be a liquid but may be in the form of a jelly or paste. Most types will exude a caustic alkali although lead acid types will exude acid. The electrolyte should be removed from equipment or clothing with copious amounts of water. If electrolyte comes into contact with skin or eyes, swill immediately with large quantities of water, and seek medical attention. Water should not be allowed to come into contact with cells or battery.

Figure 3

CIRCUIT DIAGRAM