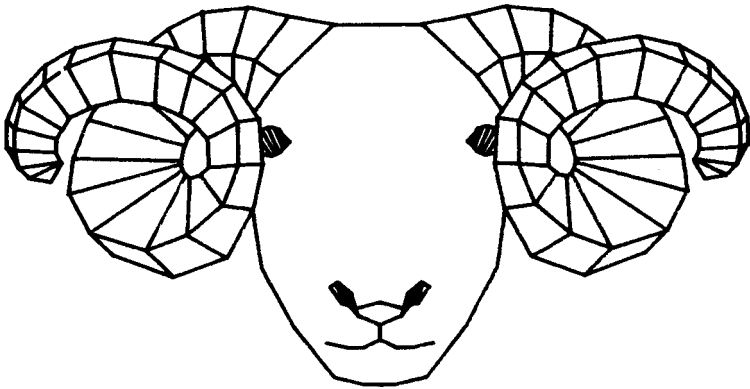# ARIES-B12

Sideways ROM expansion for the BBC Microcomputer Model B

Aries Computers

ARIES-B12

Sideways ROM expansion for the BBC Microcomputer Model B

Copyright

Disclaimer

Whilst every effort has been made to ensure that the information presented in this manual is accurate and complete, Aries Computers cannot accept any responsibility for any loss or damage resulting from errors or omissions. It is your responsibility to decide whether you are competent to fit ARIES-B12 to your BBC Micro; Aries Computers cannot accept any responsibility for any damage caused by incorrect fitting.

Fitting your ARIES-B12

Introduction

You should have no difficulty in fitting your ARIES-B12, provided you follow the instructions below carefully. Please read the instructions all the way through before starting.

When handling your ARIES-B12 take great care not to bend any of the pins on the undersides of the boards.

Tools Required
You will need:
1) A medium cross-point screwdriver
2) A small flat-bladed screwdriver
3) A pair of fine-nosed pliers
4) A felt-tip pen

Parts Supplied
You should have the following parts:
1) A small board with two ribbon cables attached -
   the 'base board'

2) A large board with two rows of sockets -
   the 'main board'

3) Four adhesive plastic feet
In addition, if your BBC Micro is not fitted with an ARIES-B20, you should have:

4) A small board with a 40-pin connector and a 40-pin socket
   -the 'adaptor board'

Opening the BBC Micro
You will need to open the case of your BBC Micro to fit ARIES-B12. To do this, remove the four main case screws (usually marked 'FIX'). Two of these are on the back of the computer and the other two are on the underside. When you have removed these four screws you should be able to lift the top of the computer off. Put the top and the screws to one side.

Having removed the top of the computer, undo the bolts holding the keyboard to the computer. You will find these at the sides of the keyboard. Some BBC Micros have three bolts, others have only two. Put the bolts aside with the top of the computer and the other screws. You need not disconnect the keyboard completely; simply slide it clear of the main circuit board (see figure 1).
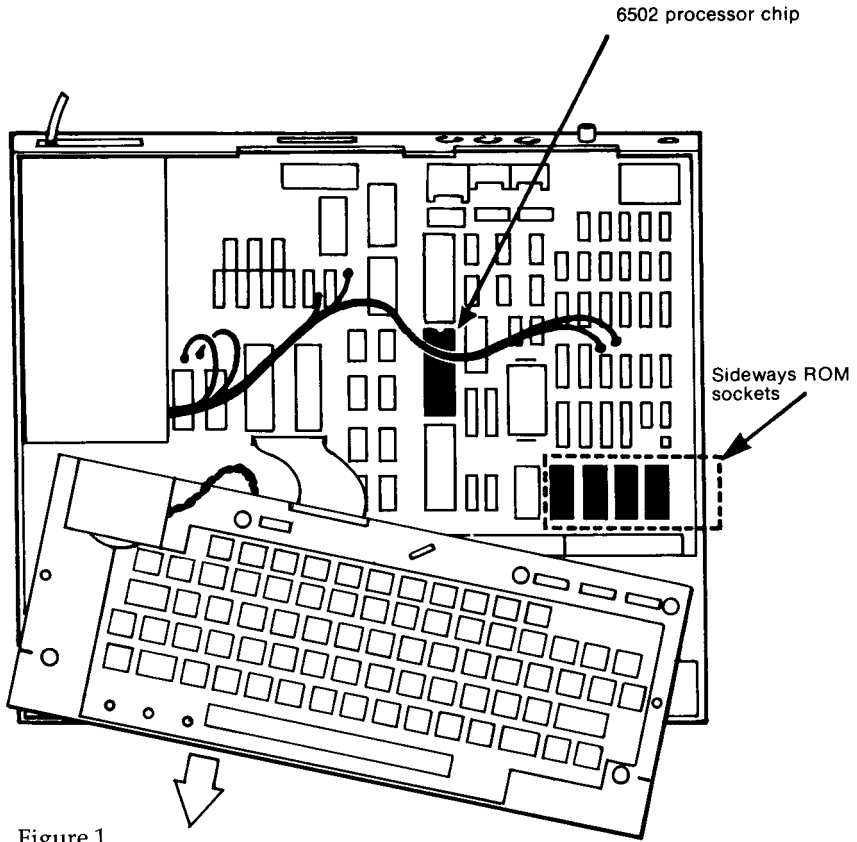
6502 processor chip

Sideways ROM sockets

Figure 1.

Fitting the Base Board

Identify the row of five 28-way sockets at the front right-hand side of your BBC Micro (some of them will already have chips in them). The rightmost four of these sockets are the ' Sideways ROM' sockets (see figure 1). The leftmost socket contains the operating system (MOS) ROM; this is NOT a sideways ROM. Make a written note of the order of the ROMs in the four sideways ROM sockets, from left to right.
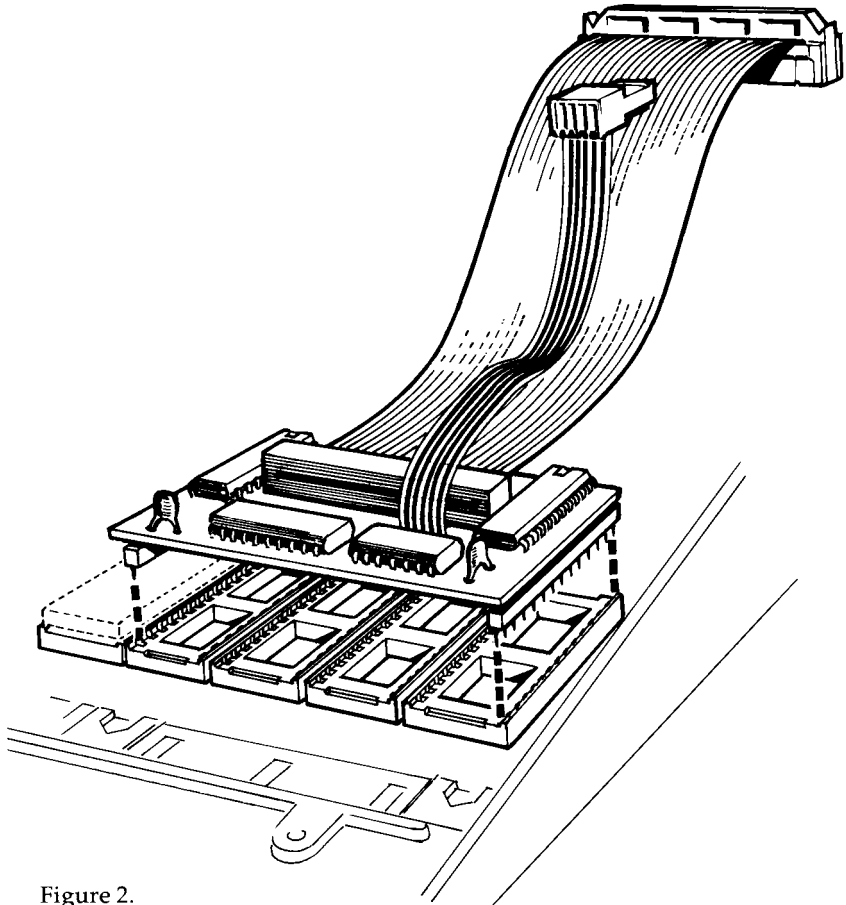
Figure 2.

Take a small flat-bladed screwdriver or similar tool and remove the ROMs from the four sideways ROM sockets by prising them up a little at a time at each end. DO NOT remove the the MOS ROM. Put the tip of the screwdriver between the ROM and the plastic body of the socket and try not to lever against the surrounding chips. Take great care not to bend the pins on the ROMs, especially when they are about to come free of their sockets.

Carefully fit the base board (the small one with the two ribbon cables) into the empty sideways ROM sockets (see
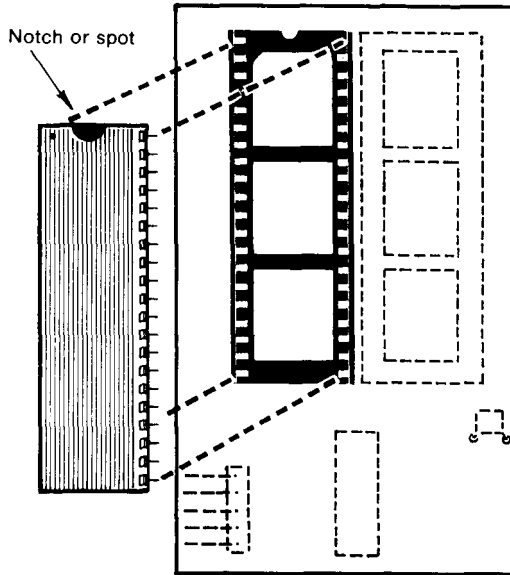
4

Notch or spot

Figure 3.

figure 2). Make absolutely sure that the two rows of pins on the outside edges of the base board are lined up exactly with the outermost sideways ROM sockets.

Fitting the Adaptor Board

If you already have an ARIES-B32 RAM expansion fitted to your BBC Micro you should skip this section.

Identify the 6502 processor chip (see figure 1). The number '6502' should be marked on the top of the chip. Take a small flat-bladed screwdriver or similar tool and remove the 6502 chip by prising it up a little at a time at each end. Put the tip of the screwdriver between the chip and the plastic body of the socket and try not to lever against the surrounding chips. Take care not to bend the pins on the chip, especially when it is about to come free of its socket.

Take the 6502 chip and fit it into the 40-pin socket on the adaptor board (the small board with a 40-pin connector and a 40-pin socket). Make sure that you put the chip in the right way round (see figure 3). The notch or dot on one end of the
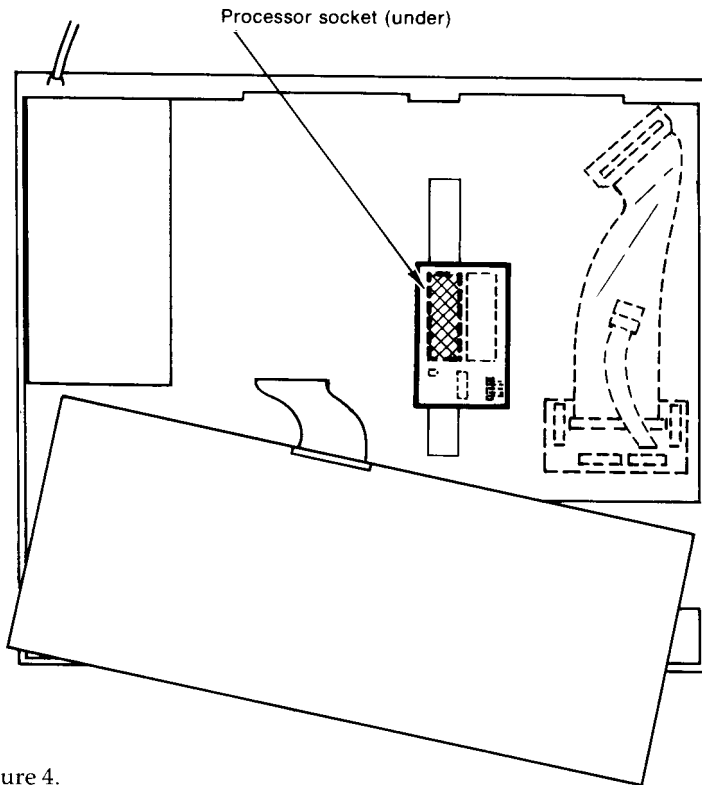
5

Processor socket (under)

Figure 4.

chip should match up with the notch or bump at one end of
the socket. Check that all the pins have entered the socket
correctly and are not bent underneath the chip.

Carefully fit the adaptor board into the socket from which you
took the 6502 chip (see figure 4). Make absolutely sure that
the 40-pin connector on the bottom of the adaptor board is
lined up exactly with the 40-way socket in the BBC Micro.
The chip adjacent to the socket may have a large black
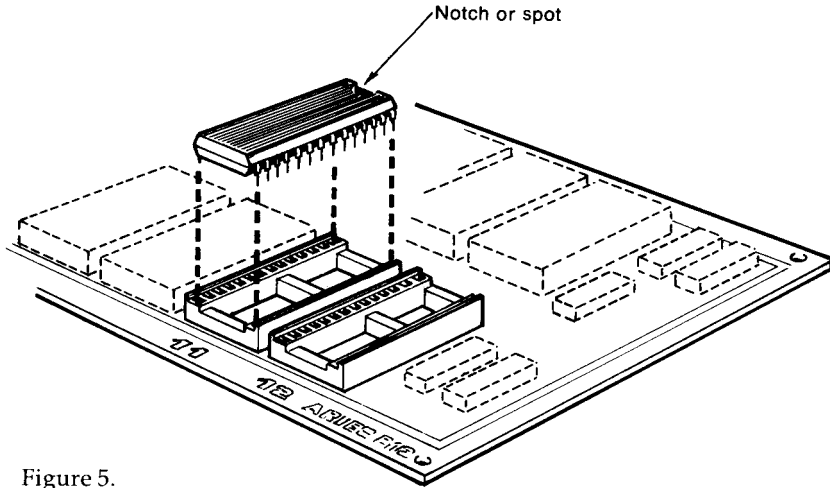heatsink fitted; this may need to be slipped sideways slightly.

Notch or spot

Figure 5.

Fitting the ROMs to the Main Board

The sockets on the main board (the large one with two rows of sockets) are marked 'OL', 'OH' and '1' to '12'. The sockets marked 'OL' and 'OH' are for sideways RAM and should NOT be fitted with ROM chips. Fitting details for sideways RAM are given below. The sockets marked '1' to '12' are for sideways ROMs.

A more detailed discussion of the sideways ROM system is given below. You may wish to read it before deciding which sockets to fit your sideways ROMs into. However, for the purpose of getting started, we recommend that you fit the ROMs you removed from the four sockets in your machine into the four sockets marked '9', '10', '11' and '12' on the main board. You should fit the ROMs in the same order, left to right, as they were fitted in your BBC Micro.

Take each ROM chip and fit it into the chosen 28-pin docket on the ARIES-B12. Make sure that you put the chip in the right way round (see figure 5). The notch or dot on one end of the chips should match up with the notch or bump at one end of the sockets. Check that all the pins have entered the sockets correctly and are not bent underneath the chips.
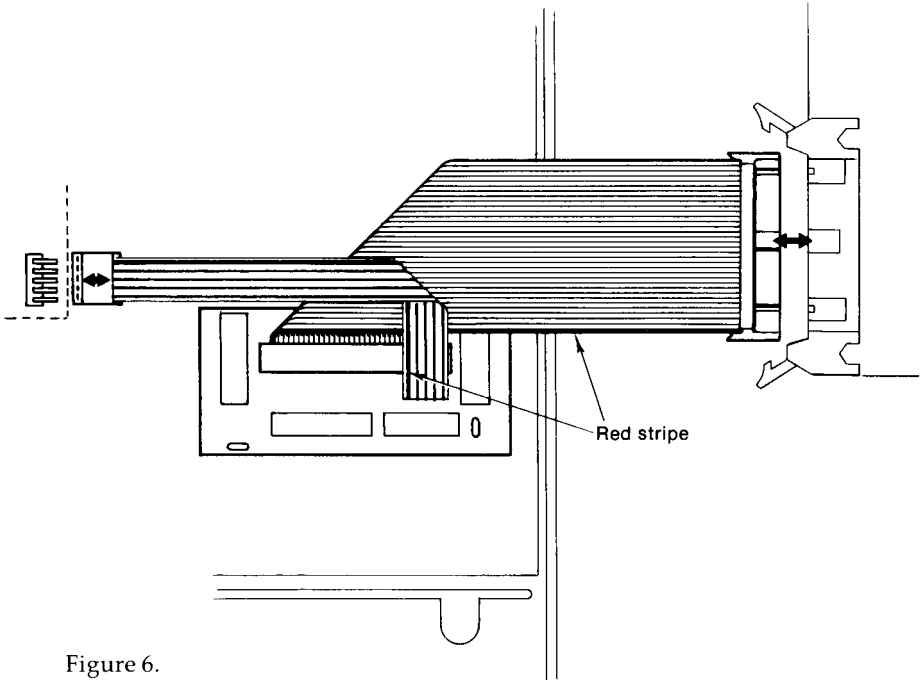
7

Figure 6.

Connecting the Cables

The broad grey ribbon cable connects to the plug on one end of the main board. The connectors are polarised so that the socket on the cable will only fit one way round. For the purposes of testing, you should arrange the cable so that the main board is outside the case (see figure 6).

The 5-way ribbon cable connects to the row of five pins on the corner of the ARIES-B32 board (or the adaptor board if you do not have an ARIES-B32). The connectors are not polarised, so you should take care to ensure that yon have the right fold in the cable (see figure 6).

Having connected the cables, you are now ready to test your ARIES-B12!

Testing Your ARIES-B12

Reposition the keyboard in its proper place, but do not replace the bolts yet. Check that the keyboard is not touching any metal parts of the computer. Make sure that there are no tools lying inside the computer. Connect the computer to a television or monitor and switch the television or monitor on.

Now turn your BBC Micro on. If you do not hear the familiar 'beep' and see the 'BBC Computer' message appear on the screen, turn the computer off instantly and refer to the 'Problems' section below.

If the normal messages appeared on the screen, congratulations! You now have a working ARIES-B12 installation.
Switch your BBC Micro off again. **Problems**
If your computer appears not to function correctly when you fit ARIES-B12 to it, check the following points:
• Is the computer plugged in to the mains?
• Are all the parts of ARIES-B12 fitted the right way round and properly aligned with the sockets?
• Are the chips fitted the right way round?
• Are the cables connected correctly?
• Are there any bent pins on any of the chips?

If you still cannot see any reason why the computer does not work, consult your dealer.

Mounting the Main Board Internally

You must now decide whether you wish to use your ARIES-B12 main board internally or externally. If you wish to use it externally, you should skip this section.

To mount your ARIES-B12 internally you must use the four adhesive plastic feet provided. The inside of the top of your BBC Micro must be clean and free of grease for the feet to stick properly.
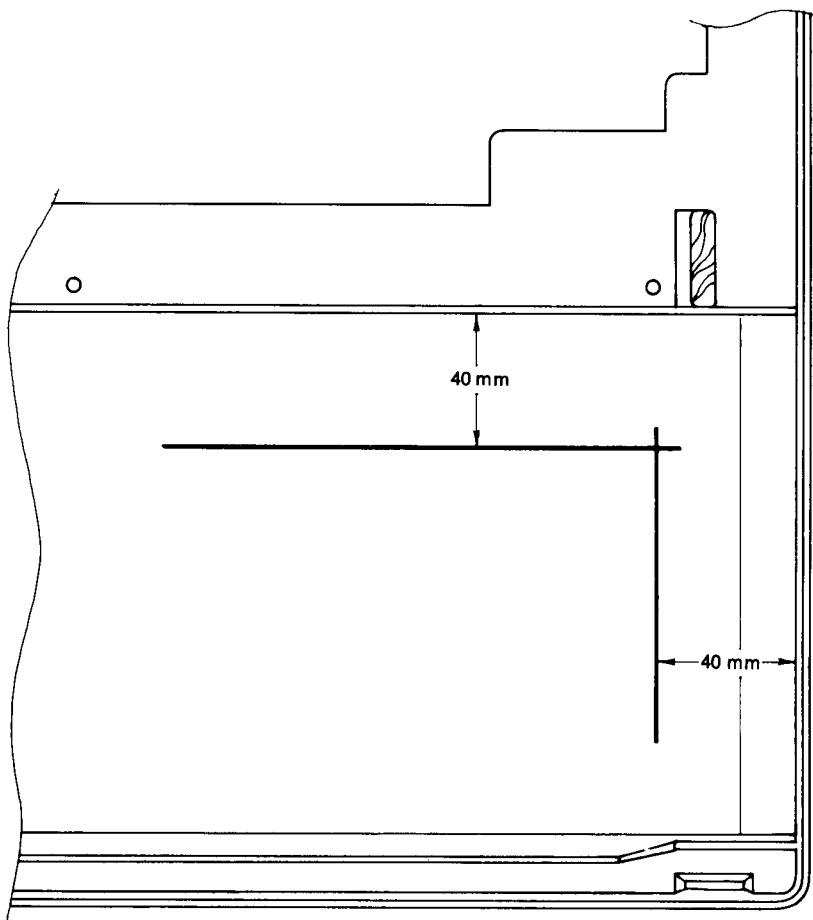
Figure 7.

Poke the pointed end of each foot through one of the large mounting holes in the main board, so that the locking tongue on the foot latches, then twist the foot so that the locking tongue is towards the edges of the board.

Take the top of your BBC Micro and mark lines with a felt-tip pen where the main board is to lie (see figure 7).
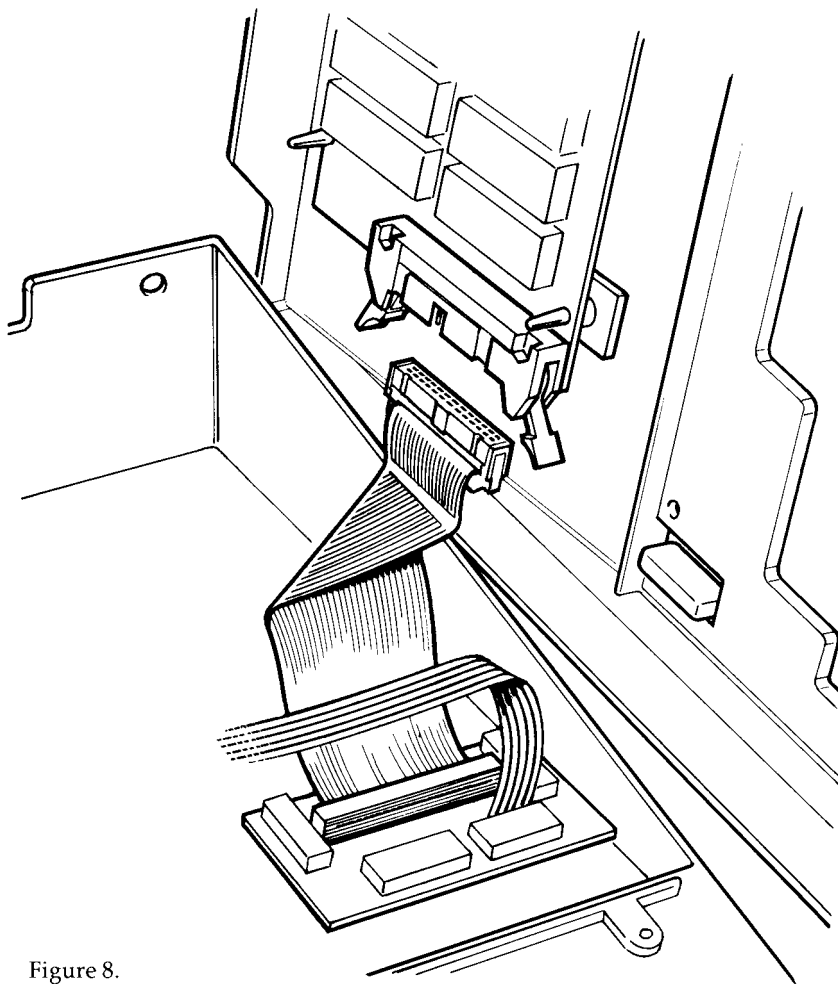
Figure 8.

Detach the main board from the ribbon cable by pulling the
latches at each side of the connector outwards. Remove the
backing paper from the adhesive feet and stick the main board in
place inside the top so that the edges of the board match up with
your lines (see figure 8).

Fold the ribbon cable (see figure 8) and re-attach it to the main
board.

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Mounting the Main Board Externally
If you wish to use the main board outside your BBC Micro, you should position it with the sockets uppermost, to the right of your computer (see figure 6). When the top is in place the ribbon cable will be gripped between the two halves of the case.

It is advisable to put the main board in a suitably-sized plastic case to protect it. You may use a ribbon cable extension not more than 200mm long to give you more freedom in positioning.

When the main board is used externally, you should detach it from the ribbon cable by pulling the latches at each side of the connector outwards, before moving your BBC Micro. This will prevent undue strain on the cable and connectors.

Reassembling Your BBC Micro
Detach the main board from the ribbon cable. Replace the bolts securing the keyboard to the computer (the washers and nuts go inside the computer).

Re-attach the ribbon cable to the main board. Replace the top of the computer and secure it with the four large screws. Switch the BBC Micro on again to check that it is still working.

Adding More ROMs to Your ARIES-B12
If you have used the adhesive feet to mount your ARIES-B12, you should detach the main board from the feet before adding or removing ROMs. In any event, you should detach the main board from the ribbon cable. These precautions will reduce the risk of straining the unit.

A discussion of the sideways ROM system, and in particular which sockets to fit ROMs into, is given below.

Adding Sideways RAM to your ARIES-B12
The two sockets marked 'OL' and 'OH' on your ARIES-B12 are designed to take RAM chips to give you up to 16K of

sideways RAM. (A discussion of sideways RAM is given below.)

The type of RAM chips to use is '6264' 8K x 8 static RAM. All types of 6264 will work equally well.

If you only wish to have 8K of sideways RAM, you should fit just one 6264, in the socket marked 'OL'.

The BBC Microcomputer Sideways ROM System

General Description

The sideways ROM system on the BBC Micro is a means whereby a number of pieces of software in ROM can occupy the same area of the 6502 processor's address space. This means that up to 256K of ROM software takes up just 16K of the 64K that the 6502 can address (addresses in the range &8000 to &BFFF). The 256K is arranged in banks of 16K which appear to be 'sideways' from each other in the address space.

Since only one bank of sideways ROM can be addressed by the processor at any one time, a means of selecting between banks is needed. This is in the form of a hardware latch controlled by the operating system.

Sideways ROMs fall into three broad groups:
1) Languages
For the purposes of describing sideways ROMs, 'languages' includes not only programming languages, such as BASIC and BCPL, but also programs such as the VIEW word-processor and VIEWSHEET spreadsheet.

Only one language can be active at any one time.

2) Filing Systems
This group includes the disc filing system and the network filing system.

Only one filing system can be active at any one time.

3) Services

'Services' are ROMs which extend the operating system, such as the ARIES-B32 ROM.

A number of services may be active at any one time.

In practice, some ROMs are a combination of the above. For example, disc filing system ROMs also contain utility commands, which makes them services as well as filing systems.

Priority and Choosing Sockets

When you switch your computer on, or press [CTRL] [BREAK] , the operating system has to choose which language and which filing system should be active. This decision is made by giving the physical ROM sockets a priority order, and taking the highest priority language and filing system.

The BBC Micro's operating system can support up to sixteen sideways ROM sockets. On the basic model B, there are only four sockets, numbered 12 to 15 from left to right. On the ARIES-B12, there are twelve ROM sockets, numbered 1 to 12, and two RAM sockets which behave like a single ROM socket, numbered 0L and 0H. In each case, the highest numbered socket has the highest priority.

This system of priority means that you must choose carefully which ROMs you put into which sockets, in order that your computer will switch on in your preferred state. If, for instance, you wish to start up in BASIC, and you also possess BCPL and VIEW, you should ensure that BASIC is fitted in a higher numbered socket than either of the others. Similarly, if you possess more than one filing system ROM, the one in the highest numbered socket will take priority.

After the highest priority one of each, the ordering of languages and filing systems should make no difference.

The ARIES-B12 Sideways RAM System

In addition to the twelve sideways ROM sockets, your ARIES-B12 includes two sockets for sideways RAM.

The ARIES-B12 sideways RAM system is a bank of 16K of RAM which behaves exactly like a sideways ROM, with the additional property that it can be written to.

In addition to the possibilities for using this RAM for data storage, the sideways RAM facility enables you to load your own sideways ROM software from disc, which allows you to have a vast library of sideways ROMs without running out of sockets.

You should note that copying commercial ROM software to disc for this purpose without the authors' permission is strictly forbidden by copyright law. Distributing such copies to your friends is not only illegal, but also highly antisocial, as it robs authors of the means to finance development of new programs and upgrades to existing software. Many commercial ROMs contain protection systems to prevent them from being run in sideways RAM in this way.

The ARIES-B12 sideways RAM system features 'write-through'. This means that read operations from the sideways ROM area of memory will give the contents of the currently selected bank of sideways memory, but ALL write operations to that area will cause data to be written to the sideways RAM.

This facility enables sideways ROM software to be loaded into sideways RAM from disc simply by using the *LOAD command, eg.:

```
*LOAD MYROM
```

The write-through feature also allows you to assemble machine-code programs directly into sideways RAM, for quick and simple development of your own sideways ROM software.

Unfortunately, you cannot save the contents of sideways
RAM quite as simply as you can load them. The program
below copies the contents of sideways RAM down into
normal RAM, then saves them to disc.

```
100 INPUT "Filename: " F$
110 L% = &3FFF  :REM &1FFF for 8K RAM
120 DIM C% L%   :REM buffer for copy
130 O% = &FFB9  :REM OS read rom entry point
140 Y% = 0      :REM RAM socket number
150 B% = &8000  :REM base of sideways area
160 D% = &F6    :REM address of address in ROM
170 FORI%=0TOL%:!D%=B%+I%:C%?I%=USR (O%):
NEXTI%
180 REM OSCLI for BASIC I
185 DIM CL% 100
190 $CL% = "SAVE " + F$ + " " + STR$~(C%) + "
+" + STR$~(L%+1) + " 8000 8000"
200 X% = CL% MOD 256
210 Y% = CL% DIV 256
220 CALL &FFF7
```

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