

# REVIEWS

## HARDWARE

### WORKING ON THE SIDE

**Chris Drage brings you the latest on sideways RAM boards**

There are four main reasons why you might consider purchasing a sideways RAM board in preference to a ROM expansion board. (If you're unsure what sideways RAM is, see Tessie Revivis' article on page 53.)

First, software purchased initially in ROM form may be transferred to disc and subsequently loaded into sideways RAM – particularly useful for network users.

By using additional software, the sideways RAM may be configured as a printer buffer which will free the computer from being tied up during printing (see Richard Harris' articles in the June issue.)

Sideways RAM may be used to develop sideways ROM-type software. By using the BBC micro's own machine code assembler and loading the resulting machine code at & 8000, it can be used immediately as if it were in EPROM. In the course of development and debugging, considerable time can be saved as EPROMs do not have to be erased to make minor alterations to the software.

Finally, to use the sideways RAM as DFS workspace – this enables 2.8k of memory to be reclaimed (as PAGE is reset to &E00).

There are advantages in adopting the sideways RAM approach. Many more programs can be kept on disc than can occupy a normal-capacity ROM expansion board. Conflicts between ROMs are avoided because only one or two are ever loaded at any one time.

Solidisk was probably the first company to exploit fully the sideways RAM potential of the BBC micro. It markets a range of boards from a 16k card up to a 128k version capable of being configured as a 'silicon disc'. A 64k version is now available which can be expanded to a massive 256k. HCR Electronics markets a 16k board which can be expanded to 32k at any time by simply adding two RAM chips. Ramamp Computers produces a single 16k board which is proving popular in stand-alone systems and network workstations.

As you might expect, by increasing the sideways RAM pages to two or more a number of ROM-image programs may be loaded and be on-line concurrently. More importantly, perhaps, multiple RAM slots allow useful combinations of transferring software from

ROM disc and use as a printbuffer. For example, a 16k printer buffer for use with View may be loaded.

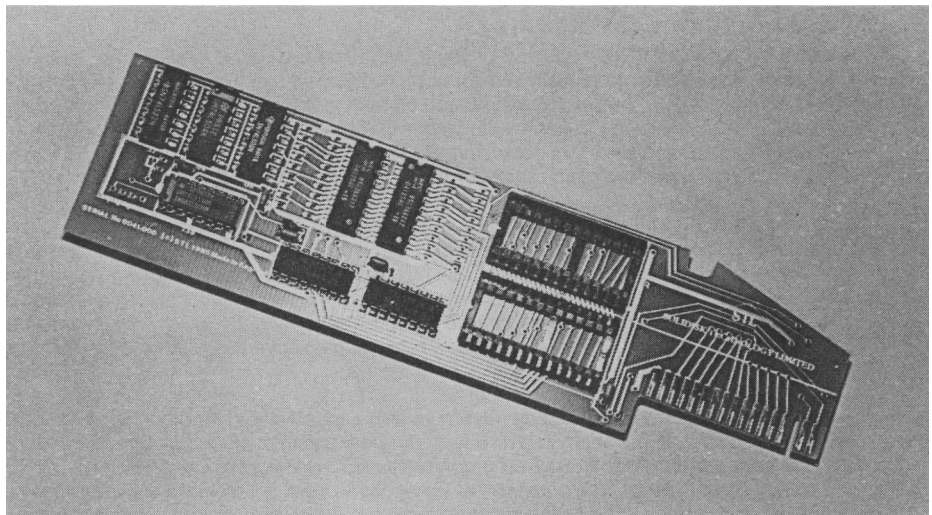
When you buy a RAM board think also of future expansion possibilities. For example, you may wish to add an Aries B20 shadow RAM board at a later date, and it makes sense to purchase a sideways RAM board that permits a wide variety of expansion options.

#### **Solidisk**

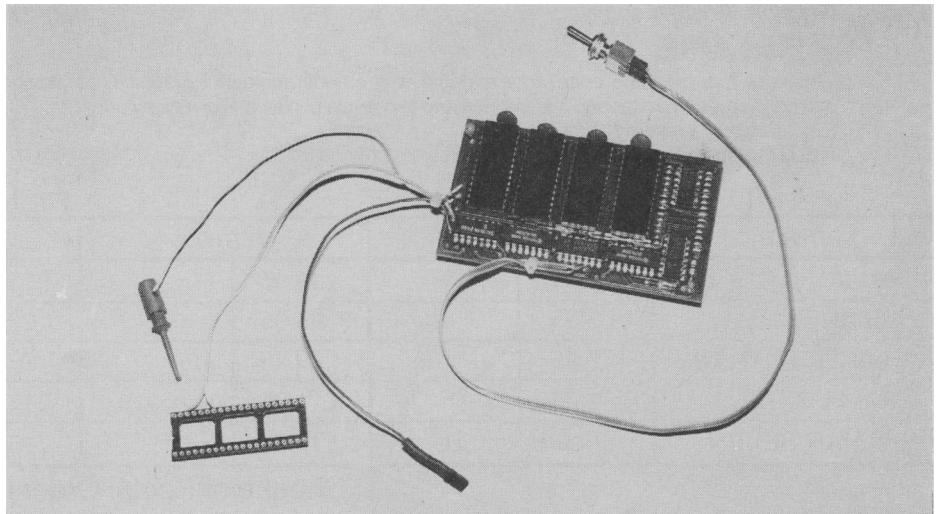
Solidisk Technology was the leader in this field. As 32k/128k RAM boards aimed at the hobbyist end of the market have proved very popular. The package contains a base unit, a RAM card, a ROM carrier board, a 68-page

manual and disc-based software. The 32k board may be expanded to 128k at any time. The RAM board lies vertically beside the Beeb's RAM area and the case.

Installing the base unit is far from straightforward and not really a task for the inexperienced. The base unit plugs into the right hand ROM sockets, and it is so low that it's easy to position incorrectly or bend the ROM socket. There are also 11 leads to connect. Unfortunately, Solidisk fails to provide suitable sockets to simplify the task and unless you are experienced with the soldering iron you must resort to pushing the wires into the socketed legs of chips. The one socket that is provided is meant



The Solidisk SWR64 features two ROM sockets. it can be upgraded to 128k, or even 256k with a piggy-back board



The HCR 32k sideways RAM board 'is simple to fit thanks to the design and use of high quality components'

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to straddle IC76, but it's inadequate. The board proved frustrating and difficult to get working correctly. I had to cut a section out of the Beeb's lid strut (and out of the keyboard with the 128k), just to make the system physically fit! Without this modification the main board flexed alarmingly.

The new 64k card is a considerable improvement on the above boards as it consumes far less power and features two ROM sockets. These assume higher priority over the other three sockets available in the Beeb and will take 8k, 16k, or 32k ROMs/EPROMs. Four RAM banks are available. The 64k board can be upgraded to 128k, but this is rather messy as it involves cutting a link, soldering a wire and adding two RAM chips. To upgrade further to 256k, a piggy-back board must be installed.

Only one serious problem has emerged – it is somewhat slimmer than the previous 32k unit and failed to make proper contact with the existing base unit, which is more a problem for those wishing to upgrade their 32k system than for the first time buyer.

The software provided contains a delightful menu program which manages the system very well. The range and scope of the software is well documented in Solidisk's advertisements. Owners of the 128k board may configure their system as either eight banks of RAM or as a 100k silicon disc – very useful for the likes of high speed data sorting or spelling checking.

I admire Solidisk for the flair and imagination of its products, but I'm not a fan of the way it goes about it. I am sure most users would prefer to spend another £8-£10 for a reliable, plug-in-and-go product comprising high quality components.

### HCR Electronics

The HCR Electronics RAM board is available in either 16k or 32k versions. The 100mm X 60mm board comprises two (or four) 8452 INMOS dynamic RAMs. If a 16k board is purchased initially it can be upgraded to the 32k version simply by adding the additional RAM chips.

The HCR board is simple to fit thanks to the design and the use of high quality components. The RAM card plugs into socket IC52; a 40-pin header plug with two soldered flying leads sits in the 6502 CPU socket; the processor piggy-backs on top; and a flying lead connects to link S-21. With the 32k unit, a further lead with a spring clip connects pin 11 of IC76.

A three position, write enable/disable switch provided may be fitted into the Beeb's 'ashtray' or at the rear of the computer. It allows either

Ram Board	Solidisk 32/64/128	HCR 16/32	Ramamp RAM 16	Acorn User UserRAM
Design	3	4	4	4
Construction	3	5	4	4
Ease of installation	1	4	4	5
Versatility	4	3	4	4
Software provided	3	–	4	4
Documentation	4	3	3	4
Value for money	3	4	4	3
<b>Total (out of 35)</b>	<b>21</b>	<b>23</b>	<b>27</b>	<b>28</b>
<b>Key: 5 Excellent, 4 Good, 3 Satisfactory, 2 Poor, 1 Very Bad</b>				

How the boards scored on seven points and overall

RAM bank to be selected and write-protected and is useful if you want to develop your own sideways software. In use the HCR card performed faultlessly, and just as well when mounted on the HCR external ROM expansion board. This configuration looks untidy but does provide a total of 64k of sideways RAM (providing the board already contains

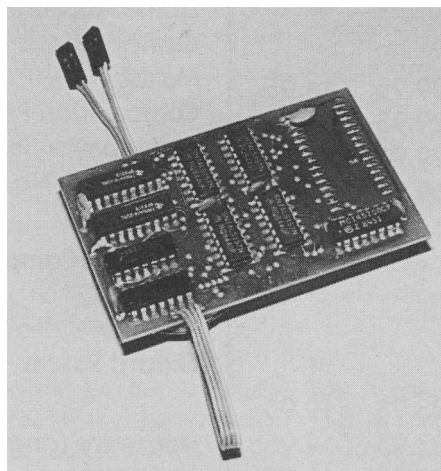
32k of CMOS RAM). However, I can't say whether this configuration is reliable when the ROM board is full.

The HCR RAM board is built to a high specification and the company has informed me that it is developing software which will use this excellent board to the full. For a basic, no-nonsense system at a sensible price, look no further than the HCR RAM board.

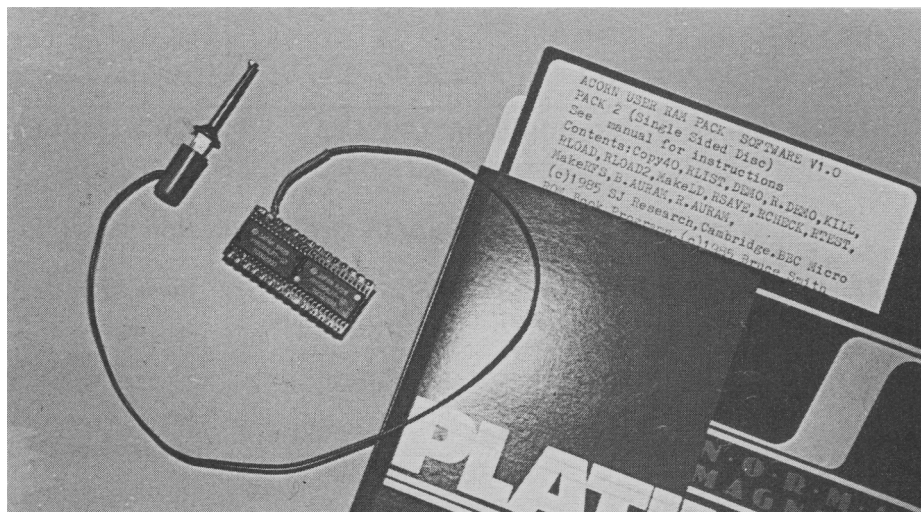
### Ramamp

If you require a simple 16k of sideways RAM for network stations, then the Ramamp 16k Ram Expansion Board may be just the ticket. This neat, compact unit functions happily in any sideways ROM socket in the BBC micro, and it is capable of loading any utility into its 16k of dynamic RAM, that is addressed from &8000 to &BFFF. Naturally, it works equally well in stand-alone computers.

The 90mm X 55mm board comes with a disc of utility programs and four A4 sheets of instructions and software details. Fitting the board is straightforward. Apart from plugging in the board itself, there are two flying leads to connect – one goes to link S-21, the other to



Ramamp 16k board may be ideal for network stations



Acorn User UserRAM: 'fully network compatible and so simple to install, it is a must for educational users'

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two pins on the Tube connector. Second processor users will need to contact Ramamp regarding arrangements for this lead.

As no bits of the I/O port are used the Basic ROM can be fitted in a higher priority than the RAM board, which also means that all eight bits of the I/O port are yours. I was rather concerned with the large pins on the board, but closer inspection revealed that they have been machine tapered to a sensible cross-section. A link connector is provided on the board to enable a write-protect switch to be included.

The accompanying software comprises some useful utilities. A menu program makes the loading of ROM-image software fail-safe. There are two printer buffers — one transforms the RAM page into a 15k printer buffer, the other is very clever: it allows an 8k 'ROM' to be loaded, then places a 7k printer buffer in the otherwise wasted RAM above it. Two DFS patches are provided (to conform with Acorn's 0.9 and 1.2 versions). Each uses the sideways RAM as DFS workspace.

The system functions very well, particularly on a network where a Ramamp board is fitted to every machine except the fileserver, so that any utility can be loaded into all machines simultaneously for use by every student. Indeed any sideways software could be called from the fileserver by any station (see *Acorn User* October '85 pages 135-137).

### UserRAM

On opening the box my first thought was: 'Where is it?' as this RAM card's so tiny. It comprises a board no larger than an EPROM, on which are mounted two 8k RAM chips and a flying lead with a spring clip. UserRAM certainly wins the prize for the quickest and easiest installation — a three minute job.

The UserRAM fits into any of the ROM

### JARGON

**Printer buffer** — Memory used to hold data being sent to the printer, thereby 'freeing the micro' for other use.

**EPROM** — Erasable Programmable Read Only Memory. Used to hold commercial software.

**Workspace** — An area of memory used by a sideways ROM to perform its calculations and store data.

**Silicon disc** — Memory used as a filing system. Its advantage is its speed.

**Shadow RAM** — Memory used to display the screen, freeing the normal screen memory for programs. (See First Byte on page 53.)

sockets of the Beeb or B + and may be doubled up with a second UserRAM in an adjoining socket or up to three with the B+. In practice, it is best inserted into IC88 in the model B.

The RAM board comes with a disc of ten utilities. Pack one contains a demonstration ROM image and software to manage the ROMs, ROM image software and the RAM in the computer. Pack two contains these and the *Acorn User* RAM utilities (see Richard Harris' articles in the June, July and August '85 issues), a suite of programs from the *BBC Micro ROM Book* by Bruce Smith, and the book is thrown in too. In all, an extremely useful compendium of supporting software. The only item missing is a comprehensive menu program like Solidisk's which would help manage ROM image software.

UserRAM works very well with the Viglen cartridge system and Micro Pulse Rombox, two expansion systems which should be popular with UserRAM owners. I did not test UserRAM with any ROM expansion boards, as the best option would be to use CMOS

(6264) RAM chips in this case. As UserRAM is fully network compatible and so simple to install, it is a must for educational users.

The depth and breadth of the supporting software make it very attractive to those wishing to develop firmware, albeit at a high price. However, the versatility of the software and the guarantee of further support from the magazine makes this particular board an attractive proposition.

In my opinion, *Acorn User* is to be congratulated for helping to gain wider acceptance of the concept of sideways RAM. It 'expands' the sideways ROM concept to the full, and it's now up to the software publishers to provide licences for their ROM image software.

Whether you decide on a purpose-built sideways RAM board or opt for the new Aries and Ramamp 32k shadow sideways RAM boards is a purely personal choice, governed by available finances as much as anything. The versatility offered by supporting software is an important consideration and must be taken into account if you want to get the most from your new acquisition.

### ADDRESSES

#### Solidisk Technology

17 Swayne Avenue, Southend-on-Sea, Essex SS2 6JQ.

Tel: (0702) 354674.

#### HCR Electronic Services

HCR House, Bakers Lane, Inglestone, Essex CM4 0BZ.

Tel: (0277) 355407/8

#### Ramamp Computers

25 Avon Drive, Whetstone, Leicester. Tel: (0533) 864966

#### UserRAM

Acorn User, 68 Long Acre, London WC2E 9JH. Tel: 01-836 2441.

Board	Manufacturer	RAM option	RAM position(s)	RAM write protect	Installation	Cost	Software provided
SWR 32	Solidisk Technology	32k	15,14	No	Bared wires to	£58	5 discs
SWR 64		64k	15,14,13,12	No	push in (or	£85	5 discs
SWR 128		128k	15,14,13,12,11 10,9,8	No	solder) to legs of chips	£135	5 discs
HCR 16	HCR Electronics	16k	15 to 12	Yes	Plug in	£36.22	No
HCR 32		32k	15 to 12	Yes	Plug in	£47.72	No
RAM 16	Ramamp Computers	16k	15 to 12	Optional	Plug in	£32	8 utilities
UserRAM	Acorn User	16k	12,13	No	Plug in	Pack 1 —£45.50 Pack 2 — £62	10 utilities 27 utilities + book

### What the boards have to offer