

# The ABCs of REUs

*Discover how RAM expansion can add speed  
and productivity to your computing.*



By MALCOLM O'BRIEN

**T**here has never been a better time to be a C-64 or C-128 user, despite the popularity of PCs, Macs and Amigas. Today's Commodore enthusiasts have access to the most sophisticated hardware and software yet developed for 8-bit computers. In fact, many such developments were previously thought beyond the computers' capabilities.

Some of the most significant products have been extra RAM. While the possibility of RAM expansion has been with us for a number of years, today's users have a variety of options, and many *RUN* readers have written to ask about them. This article addresses their questions without going into a deep technical explanation of each device. When you've finished reading, you'll have a good understanding of the various options from a user's standpoint. First, though, if you aren't sure what RAM expansion is or whether you need it, see "Basic Questions on RAM Expansion" (page 26).

There are several important considerations to keep in mind when choosing expansion RAM: capacity, volatility, compatibility, power requirements, applications, and your own personal usage patterns. I'll touch on these points and more in describing each of the available RAM expansion devices.

## THE QUICK BROWN BOX

The Quick Brown Box (QBB) is the grandfather of 8-bit RAM expansion. Brown Boxes began marketing this handy device before Commodore began making their RAM expansion units (REUs). The original QBB contained 8K of RAM, but today's QBBs range from 64K to 256K.

Physically, the QBB is exactly the same size as a standard expansion-port cartridge. It's possible to use the QBB in conjunction with a Commodore REU, but doing so requires a cartridge-port expander, which plugs into the computer



**QBB is the grandfather of RAM expansion. Non-volatile memory sets it apart.**

and contains two, three or four slots that accept cartridges. Some expanders provide a switch for each slot, so you can select which cartridges are active, thereby accommodating several QBBs on one computer.

One of the QBB's best features is its nonvolatile RAM, which retains its data even when you turn off your computer. The RAM inside the QBB has very low power requirements, and the built-in battery will last for years. This makes the QBB an excellent choice if you're using several machines. Simply load your favorite programs into the Box and take them from machine to machine. Non-volatile memory and shirt-pocket portability make the Quick Brown Box very convenient.

But there's more. The software included with the QBB lets you add new files to the Box, delete old files, and copy the entire Box contents to or from a disk file. You can also designate one of the programs to autoboot—to run immediately when the computer is turned on. This is an ideal arrangement for the BBS operator. If a power failure knocks out your BBS, you can be sure that when power is restored your BBS program will reboot

without any need for operator intervention. Many users will autoboot with the Box's menuing system. Powering up this way puts a list of files on the screen, and you can select a program to run with just a few keystrokes.

This autoboot feature is also handy if you're a "one application" user. For example, if all you do is word processing, you can just turn on the computer and have your word processor running. There are several excellent applications available from Brown Boxes that will function in this way. The Write Stuff is a powerful word processor that will run from the Box and save text files to the Box, too. In fact, the C-64 version will save your text as you type—if the power fails, you won't lose a keystroke! Other applications include UltraTerm (telecommunications for the C-128) and Q-Disk, which allows using the QBB as a RAMdisk under C-128 CP/M.

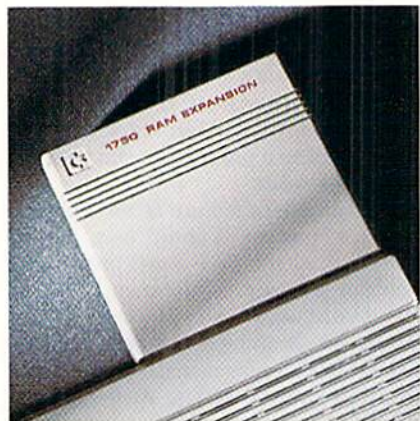
It's also possible to boot GEOS from the QBB, thanks to some programs written by Joe Buckley (a.k.a. Red Storm). There are versions of QBB BOOT for both the C-64 and C-128, as well as a variation that runs autoexecs (AUTO QBB). All of this supporting software (and more) is available from Brown Boxes.

## COMMODORE'S 1700-SERIES REUs

The Commodore REU series consists of three models: the 1700 (128K) and the 1750 (512K) for the C-128, and the 1764 (256K) for the C-64. These cartridges are larger than a Quick Brown Box. Each is approximately 5½ inches wide by 4¼ inches deep, so your available desk space may be a factor. All three models are powered by the computer and use standard RAM. Consequently, their power requirements are significant. The power supply included with the C-128 is up to the task, but the one supplied with the C-64 is not. For this reason, the 1764 comes with a replacement power supply. ▶

## A B C S O F R E U S

Since Commodore's REUs are powered by the computer and contain no batteries, the storage they provide is volatile. Therefore, you must copy your files to disk before shutting down if you want to retain them. Forgetting to do so will have the same result as turning off the computer before you've saved your work! The method of copying the files differs, depending on the application or operating environment in use. The GEOS deskTop, the CP/M PIP command and the JiffyDOS file copier will all function transparently—exactly as if the extra RAM were a disk.



The 1750 REU makes GEOS and other applications run lightning fast.

The great advantage of the REU is lightning speed when loading and saving large blocks of data. This is due to its nonmechanical nature and a hardware trick known as direct memory access (DMA), which swaps blocks of data to and from the computer's memory without involving the microprocessor. However, sequential I/O (reading and writing data a byte at a time) is comparatively slow, because of the way RAMDOS has been implemented (see below for an explanation of RAMDOS).

In recent years, it has become common to have dealers and service centers install more RAM chips in the 1700 series REUs. I think GEOS has been a contributing factor to this trend. With 128K in your REU, you can't make a GEOS RAMdisk (although GEOS will use the memory to good advantage). With 256K, you can make a 1541-size RAMdisk, and with 512K, a 1571-size RAMdisk. Of course, many users wanted the larger RAMdisk, and so the REU expansion trend began. Today, many users have expanded their REUs to as much as 2MB!

Schematics and instructions for fattening up the REUs are widely available online. You should be aware, however, that expanding an REU isn't a trivial under-

taking. If you're not comfortable using a soldering iron, have the work done by someone who is.

You should resist the temptation to add more than 2MB of RAM. Any beyond 2MB will almost certainly exceed the capabilities of the RAM expansion controller chip inside the REU. At present, to my knowledge, only three programs will support a 2MB REU: RAMDOS II; Jim Collette's Configure 2.1 (available on Q-Link and CompuServe); and Creative Micro Designs' GEOS deskTop replacement, gateWay (reviewed in the September/October '91 RUN).

Commodore's RAMDOS is a group of programs supplied with (and specifically for) their RAM expanders. Freely distributable and widely available on BBSs and online services, it provides lightning-fast loads and saves in the native modes of the C-64 and C-128, and accepts standard disk commands via the command channel or a DOS wedge. RAMDOS has two particular shortcomings: First, as mentioned above, sequential I/O is comparatively slow. Second, it requires 256 bytes of computer memory, which may be overwritten by some programs. Still, a few commercial products, such as JiffyDOS and Dialogue 128, will recognize and use RAMDOS.

For the most part, RAMDOS will copy files to an REU as to a real disk. It has a few minor bugs, but nothing of catastrophic proportions. Sometimes the block counts are low, but this doesn't mean that data is missing. In fact, RAMDOS uses a more efficient storage scheme than a physical disk. Another anomaly is occasional failure of the rename and scratch commands (not always a bad thing!). Generally, you can use RAMDOS with confidence. Be sure you have one of the later versions, though. I'm using version 4.3, which is available on many BBSs and online services. Note that RAMDOS can see a limit of 512K of RAM; if you have more than that, you need RAMDOS II.

Commodore's REUs are no longer being made, but they are still available and have set the standard for adding extra RAM.

### GEORAM

As the availability of REUs dwindled and the demand increased, Berkeley Softworks (now GeoWorks) saw an opportunity for a new product: GeoRAM, which provides 512K of low-power volatile RAM. GeoRAM works with either Commodore 8-bit computer and, unlike the 1764 REU, doesn't require a new power supply for use with the C-64. The device measures approximately 3 1/2

inches wide by 6 inches deep. GeoRAM doesn't use DMA and therefore is not quite as fast as an REU. However, most of the time you won't notice the difference; it's still much faster than a floppy disk drive.

The main disadvantage of GeoRAM is that it works only with GEOS. In addition, GeoWorks says that it is not expandable. Rumor has it, however, that GeoRAM has been expanded successfully and the instructions for doing so will be released in time. It should also be possible to develop a GRAMDOS for use in the C-64 and 128 native modes.



GEORAM comes with a GEOS upgrade, and you won't need a new power supply.

You may ask, "Why can't I use regular RAMDOS and expand my GeoRAM in the same way I would a Commodore REU?" The answer is simply that the two devices are as different as night and day, even though they perform approximately the same function. Consequently, GeoRAM's two shortcomings need to be approached from a completely different standpoint. It's interesting to note here that the GeoRAM disk driver included with CMD's gateWay will recognize up to 2MB; there must be a good reason for that.

The GeoRAM device comes with a GEOS upgrade (version 2.0r) that is designed specifically for use with GeoRAM, to take full advantage of the unit's 512K. The upgrade works on GEOS versions 1.2, 1.3 and 2.0. The upgrade includes a system disk, a backup system disk and a 92-page manual. When I installed the upgrade, I forgot to put my 1571 in 1541 mode. I was pleased (and surprised!) to find that the upgrade installation worked perfectly in spite of my oversight.

Remember, this is only an upgrade. The only application-specific program provided is PaintDrivers. All of the system files, input drivers and printer ▶

drivers are included, along with new Configure and Preferences files, and a few desk accessories. The deskTop is identical to the standard 2.0 deskTop.

Because you'll need to use the applications from your old version, answer "yes" when asked if you want to key the new system disk to those applications. (Unfortunately, the RBOOT file included in the GeoRAM package has not been updated for GeoRAM. Using it results in a cold boot and an empty RAMdisk. The updated version of RBOOT has been posted on Q-Link and CompuServe.)

#### THE LATEST RAM TECHNOLOGY: RAMLINK & RAMDRIVE

These two products are grouped together for several reasons. Both are available from Creative Micro Designs, both run under CMD's proprietary DOS (and are therefore compatible with almost everything), both have autoboot



RAMLink is the "everything" box: extra RAM, an interface and an expansion port.

capabilities and both are offered in multiple-megabyte configurations. And most important, both RAMDrive and RAMLink excel in three key areas: ca-

capacity, flexibility and compatibility.

A feature unique to these devices is user-definable partitions, and, because these partitions can emulate the 1541, 1571 or 1581, you can use software that expects to find a particular drive-type. Another option is "native mode" partitions with variable size up to 16MB. Managing a device of this capacity is made easier through subdirectories, which let you group files. This effectively limits the headaches you will most certainly incur if you try to manage a 16MB directory.

You should make good use of the sub-directory capability. Of course, both RAMDrive and RAMLink are supplied with their requisite software and with complete documentation that explains the device's use and provides valuable tips for determining which options are appropriate for your purposes.

It's important to understand the dif-

## Basic Questions on RAM Expansion

### Q. What is RAM expansion used for?

A. RAM expansion is most commonly used as a simulated disk drive, or RAMdisk. Because of the absence of moving parts in a RAMdisk, access times are greatly reduced. RAMdisks are generally considered to be 35 times faster than a fast floppy disk drive, such as the 1571 or 1581. In reality, they may be faster or slower than this, depending on the application; but they're always much faster than a mechanical disk drive.

The increased speed lets you do your work in less time. The amount of time saved, of course, is directly proportional to the amount of disk access required. A prime example is GEOS, which is very disk-intensive. The time you can save by using RAM expansion with GEOS is astounding.

### Q. Do I really need RAM expansion?

A. The answer to this question really depends on your personal usage patterns. If you use your computer only occasionally and don't mind waiting for your disk drive, your need is minimal. The two most important factors in assessing your need are the number of

hours you spend computing and the sophistication of your software. For example, I consider RAM expansion essential for all GEOS users. Financial considerations may be important, too. If you're using your computer to make money, you'll find RAM expansion well worth the investment.

### Q. How much RAM is enough?

A. This is almost like asking how much software is enough—better to have too much than too little! The real answer depends on what you want to do. If you often work with large volumes of data or switch between a variety of programs, you'll appreciate the convenience of having everything in RAM. A good example would be geoPublishers who need to have many text files, photo albums, and several applications at hand. If they also need to output PostScript files, their need greatly increases.

### Q. Which software will benefit from the addition of RAM?

A. There are three ways in which extra RAM can be used: as part of the oper-

ating environment, in conjunction with Commodore's own RAMDOS, or in a proprietary manner specific to an application.

In the operating environment category we have GEOS and, on the C-128, CP/M. Virtually anything that runs under these systems can use RAM expansion. Creative Micro Designs' RL-DOS (for RAMLink) or RD-DOS (for RAMDrive) can also be thought of as operating environments. Exhibiting a high degree of compatibility, the CMD devices will work with a wide range of programs.

A number of programs use the Commodore RAM expanders in their own way. Some well-known examples are The Write Stuff, the Pocket series, PaperClip III, Dialogue 128, Big Blue Reader, and Chris Smeets' CS-DOS. There are probably many more, considering that the Commodore RAM cartridges have been with us for several years now. Most of the commercial applications written (or updated) in the intervening time can probably use extra RAM, and I know some public domain programs will. Perhaps someone will amass a list of such software it would be nice to have. □

—MO

## A B C S O F R E U S

ferences between RAMDrive and RAMLink. RAMDrive is available in fixed configurations of 512K, 1MB and 2MB and isn't intended to be user-expandable. Since it's supplied with batteries (in addition to a 9-volt power supply), the storage is nonvolatile. When AC power isn't present, data will be maintained for about two weeks. RD-DOS is supplied on disk, and this is loaded into RAMDrive and maintained there. You'll need to repeat this load only if the batteries run down or a new version of RD-DOS is released by CMD.

Physically, the RAMDisk cartridge is about the length of GeoRAM but a bit narrower. Three switches on the case offer Reset, Swap 8/Swap 9 and Enable/Disable. Five LEDs indicate Activity, Error, Data Valid (battery status indicator), Device 8 and Device 9. If you have a RAMDrive in a cartridge-port expander along with an REU or GeoRAM, RAMDrive will sense the other device and use it. RAMDrive can also be plugged into the cartridge slot of RAMLink, and such a configuration appears as a single device to the computer. In other words, if you have a 2MB RAMDrive plugged into a 2MB RAMLink, you effectively have one 4MB RAMdisk. Note that such an arrangement will stand almost 8 inches above your desktop.

RAMLink is the "everything" box. In addition to its RAM functions, it serves as a parallel interface to the CMD hard drive and has a pass-through cartridge port. RAMLink's power requirements are significant; in fact, this device needs to be plugged into the wall. Don't plug it into the power strip you use for your other computer equipment; when you turn everything else off, you still want RAMLink to receive power to maintain your RAMdisk. An extra measure of protection is provided by the optional lead-acid battery pack. It measures 5 by 3 by 1 inches and will maintain your data for an average of 12 hours when RAMLink is unplugged.

RAMLink is close to the size of an REU, but about 1/2 inch longer and wider and 2 1/2 inches tall. Its five switches control Reset, Swap 8/Swap 9, Enable/Disable, Normal and Direct. In the direct mode, an REU in the RAMLink cartridge port will be found and used normally by REU-supporting software. Since such software can use only 512K, if you've expanded your REU the additional RAM will be available to RL-DOS. There you can partition it and use the subdirectories—a potentially valuable feature for those who already have an REU. Five LEDs on RAMLink indicate Error, Access, Activity, Device 8 and Device 9. On

the back of the device are the battery jack, the 4-pin DIN plug for the power supply, and the 14-pin DIN plug used as the hard drive's parallel connection.



**RAMDrive offers up to 2MB of nonvolatile RAM, and great features like Swap 8/9.**

RAMLink is available with no RAM installed, but most users will want to have the optional RAM card, which accepts a type of memory module called a SIMM. The RAM card can use SIMMs of two capacities, but they can't be combined—you must use one or the other. With 4M-by-1 SIMMs, a fully-populated RAM card will offer 4MB. RAMLink's maximum capacity of 16MB is achieved with 4M-by-4 SIMMs. You needn't add all the

SIMMs at once; they can be placed on the card one at a time, because RAMLink's RL-DOS (supplied on ROM inside the device) always knows how much RAM is available and acts accordingly. Adding the SIMMs is a fairly simple job, but the hardware novice will prefer to enlist the services of a technician or simply purchase a populated card from Creative Micro Designs.

I've tried to cover your RAM expansion options thoroughly in this article. However, if you still have questions, I will try to answer them. Contact me by EMAIL to 76703,4243 on CompuServe. ■

*Malcolm O'Brien, former editor of The Transactor, has been writing articles and reviews of Commodore products since 1984.*

## Sources and Prices

**Brown Boxes, Inc.**  
26 Concord Road  
Bedford, MA 01730  
617-275-0090  
*The Quick Brown Box* (from \$79)

**Creative Micro Designs**  
15 Benton Drive  
PO Box 646  
East Longmeadow, MA 01028  
413-525-0023  
*RAMLink* (from \$179.95)  
*RAMDrive* (from \$199.95)

**Software Support International**  
2700 N.E. Andresen Road, Suite A10

Vancouver, WA 98661  
800-356-1179  
*1750 Clone* (\$199.95)  
*C-64 Power Supply* (\$39.95)

**Tenex Computer Express**  
PO Box 6578  
South Bend, IN 46660-6578  
800-PROMPT-1  
*1700* (\$99.95)  
*1764* (\$119.95)  
*1750 Clone* (\$199.95)  
*C-64 Power Supply* (\$44.95)  
*Three-Slot Cartridge Expander*  
(\$19.95)  
*GeoRAM* (\$134.95)