

C= commodore 64

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**NOTE:** The following article also applies to expanding C1700 128K REU's to 512K with the following changes:

1. You will need to remove the 64x1 DRAMS, and replace them with 16 256x1 DRAMS.
  2. You will need to cut the "J1", aka "CUT 512K" jumper.
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## **EXPANDING YOUR 1764 RAM EXPANSION UNIT FROM 256 TO 512 KILOBYTES OF MEMORY**

by Scott A. Boydman (ScottB30 on QuantumLink)

This article details the steps required to increase the 1764 RAM Expansion Unit (REU) to a total of 512K. Although the article has been tailored primarily for the GEOS 64 user, it is also applicable to all 1764 REU users who wish a 512K expansion. I have had a great deal of correspondence with people, both by mail and over Quantum-Link, and I would like to share some of the knowledge gained from these rewarding interactions. You should note that since the Japanese "chip embargo" the prices have been inflated and availability is scarce. One of the best sources of chips may be found in the various advertisements in the "COMPUTER SHOPPER" magazine.

The 1764 REU consists of a plug-in cartridge, a deluxe power supply, and a disk containing software for using the REU with both BASIC (side 1) and GEOS (side 2.) The deluxe power supply is required with the C-64, since the original was not designed to meet the power requirements of the many chips present in the REU. The deluxe power supply is rated for 2.5 amps DC, which is sufficient to meet the power requirements of the computer, a modem, and an REU with up to 512K RAM. The C-128 power supply already has enough amps to handle any REU. The REU itself is nonfunctional without appropriate software. The front side of the disk contains Commodore's RAMDOS software for use with BASIC. The back side of the disk contains a GEOS upgrade which installs the GEOS Kernal V1.3 on your system boot disk, as well as other upgraded applications and input/printer drivers.

The latest release of GEOS (V2.0) is a two-disk system and already supports the REU. If you have Kernal V1.2 or lower, you will have to upgrade by one of two methods. The first is to run the GEOS Upgrade program on the back of the disk supplied with the REU. This will upgrade your GEOS System disk to Version 1.3. However, this technique does not always work properly, so many people have upgraded directly through Berkeley Softworks. The newest version of GEOS (V2.0) supports the REU as well as Commodore's new 1581 3.5 inch disk drive. Note that the GEOS and BASIC RAMDISKS are not compatible, therefore, GEOS RAMDISK files are not accessible from BASIC. The original REU test program on the BASIC side of the Test/Demo disk was designed to test the 256K of random access memory that is supplied in the original 1764, but Commodore has since released newer software (available for downloading over Quantum-Link, or directly from Commodore) that also supports the C-128, and any size REU from 128K to 512K.

The 1764 REU itself consists of a printed circuit (PC) board inside a plastic and metal housing, which plugs into the expansion port of the C-64 or 64-C computers. The PC board is the same as that used in the 1700 (128K) and 1750 (512K) REU's, intended for the C-128, but with the following changes:

1. The 1764 has only one bank of eight 256K Dynamic RAM chips installed. Each chip holds 256K bits of information; therefore eight chips are required to obtain 256K bytes (since eight bits make up one byte).
2. There is an empty row of eight chip positions labeled BANK II on the PC board. The traces for additional memory chips are present, and the holes for the pins on the chips are presoldered.
3. There is a 390 Ohm resistor in the 1700 and 1750 REU's that is not present in the 1764. The resistor's position is located in the upper-left corner of the board, and labelled R4 in the 1764. According to Fred Bowen of Commodore, this resistor "tweaks" the signal that is supplied to the C-128 computer. There are C-64 users that have installed unmodified 1750 REU's without reporting problems. In these installations, larger power supplies rated at 2.5 amps DC are used. Also, there are C-128 owners who have used 1764 REU's without difficulty. Therefore, the presence or absence of this resistor seems to be a non-critical factor for most C-64 or C-128 computers, at least when using the REU with GEOS.
4. A jumper, labelled with the notations J1 and CUT 512K is located on the bottom side of the circuit board. The jumper is cut in the 1750 and 1764 REU's, but left intact in the 1700 REU. Apparently, the cut jumper tells the Ram Expansion Controller (REC) that 256K RAM chips are being used, rather than the 64K RAM chips used in the 1700.

Commodore's BASIC RAMDOS software (included with the 1764) is not compatible with many commercial software packages. GEOS, however, allows the expansion to operate as a fully functional disk drive in RAM. The current versions of both GEOS 64 and GEOS 128 have provisions for both 1541 and 1571 RAMDISKS. Another available feature is the shadow mode. GEOS is able to store data to the REU when reading files from the physical 1541 disk drive, so that further references of that file occur directly from RAM. This results in a significant speed-up by eliminating multiple disk reads of the same file. All writes go to both the physical drive and the REU, which eliminates the RAMDISK's primary disadvantage of being a nonpermanent storage device. In the shadow mode, your data is always current and up-to-date on your real disk. Of course, when using the RAMDISK, files must be copied to a physical disk, or be lost when the computer is turned off.

The 256K REU does not contain the amount of memory needed to shadow two physical 1541 drives, or shadow one drive while supporting the RAM 1541, or support a RAM 1571. For this reason many people have desired their 1764's to have 512K RAM. It is not very difficult for someone with basic mechanical and soldering skills to install additional chips on the 1764 PC board. I recommend soldering 16-pin DIP (Dual Inline Package) sockets to the board, which prevents possible heat damage from direct soldering of the memory chips. The chips are simply pushed carefully into the sockets. Radio Shack stocks the 16-pin DIP sockets, and the chips may be available from mail order houses.

NOTE: The steps required to install the chips should be undertaken by someone with some skill in handling and soldering PC boards. Also, some mechanical skill is needed to remove and install the PC board in its housing. Opening the REU housing will void Commodore's warranty and is done entirely at the owner's risk.

1. The housing of the 1764 must be opened carefully. There are four pins, one in each corner, holding the plastic case together with friction.

Starting at the expansion port opening, gently but firmly pull the top and bottom halves apart. The plastic case will begin to separate. Continue around the perimeter of the case until the top can be removed from the bottom.

2. Remove the metal shield from the plastic casing by pulling it out at each corner. The PC board is inside the metal shield. Open the shield, also starting at the connector. You may need a small screwdriver to pry the metal slightly where it is held together. When the shield opens, spread it only as much as needed to remove the PC board. Then slide the cardboard liner off from the expansion connector. This metal shield serves as a barrier to radio frequency (RF) interference as required by the FCC. When testing your expansion, the PC board can be safely plugged into the computer prior to final reassembly of the REU.
3. Examine the PC board. BANK I is the row of eight chips along the top of the board. The RAM Expansion Controller (REC) is the square chip in the lower portion of the board. The empty area labelled BANK II can be seen just below BANK I.
4. Solder eight DIP sockets into the locations in BANK II. This is the most difficult step, because it is hard to position all 16 pins at once. I recommend that a small, round toothpick be used to open the 16 holes on the PC board for each socket position. Using a soldering iron, heat the hole position until the toothpick can be inserted. By rotating the toothpick during cooling, a hole will be left upon its removal. An alternative method would be to use a desoldering tool or wick (available from Radio Shack) to remove the solder from the holes. Note however that removal of ALL the solder can make it difficult to achieve good contact when soldering the DIP sockets to the board. After doing this for all 16 holes, the DIP socket can be inserted into the holes, and then each pin soldered individually. Use care that each solder point makes a secure connection on both sides of the PC board. When opening the holes, be certain the metal traces printed on the circuit board are not disrupted, otherwise your REU may not function at all when tested.
5. Insert the chips carefully into the sockets, checking to maintain the correct chip orientation. The notch or dot on the chip points toward the top of the PC board. Be certain that all pins are inserted into the socket, and that none bend or break.
6. Before putting the REU together again, plug the PC board into the computer (make sure the power is off), turn the computer on, and boot GEOS V1.3 or higher. If necessary, run the UPGRADE conversion program on the disk that came with the 1764 REU, or 1351 MOUSE to convert your V1.2 to V1.3, but be sure to keep a V1.2 backup copy should anything go wrong. If you have a two-disk GEOS system, you already have a compatible version. From the deskTop, run the CONFIGURE program. The RAM EXPANSION box that appears should indicate 512K if your work was successful. If this is the case, reassemble the REU. If 256K or NONE is displayed, you should check the board for improperly soldered or disrupted traces, a chip that is not securely plugged in, or rarely a defective chip. Recheck all the connections systematically. You may have to desolder and remove one or more sockets to locate a bad connection point or points. Then rerun CONFIGURE to see if the problem has been corrected. If you are not a GEOS user, use Commodore's RAMTEST program to check out your expanded REU (see below.)

When you arrive at this point, CONGRATULATIONS! GEOS makes use of the 512K REU in the following ways; the first 64K holds a copy of the entire C-64 RAM, which allows for fast memory access and rebooting GEOS from the REU. If you select a RAM 1541, 165K plus directory space are reserved. This amount is also allocated if you are shadowing a real 1541 drive. GEOS V2.0 also allows for a 1571 RAMDISK. The BASIC RAMDISK software included with the REU also uses the expanded amount of REU memory, but the original version of Commodore's RAMTEST program was only designed for 256K. If you have this version, it can be modified to check the entire 512K in the expanded 1764 as follows:

1. Copy the files 1764 RAMTEST.BAS and 1764 RAMTEST.BIN from the demonstration disk onto another formatted disk. If the files have different names than those noted above, then you may not have to alter the test program (your disk may be an updated version of Commodore's RAMDOS). You may use the FILE COPY utility included on side 1 of the disk to do this, or even copy the files from the GEOS deskTop.
2. From BASIC, type the following: **NEW** (RETURN)  
**LOAD "1764 RAMTEST.BAS",8** (RETURN)  
**501 REM LINES 502 & 503 POKE THE CODES TO TEST 512K!** (RETURN)  
**502 POKE 33093,7: POKE 33099,33** (RETURN)  
**503 POKE 36003,53: POKE 36004,49: POKE 36005,50** (RETURN)
3. List lines 501-503 to confirm the changes have been entered. Then, list line 100 and space over the beginning characters 100 REM (to erase them) and press . This will resave the altered version of 1764 RAMTEST.BAS to the disk, and delete the original version. Reload 1764 RAMTEST.BAS and relist lines 500-503, rechecking for errors. Then, run 1764 RAMTEST.BAS, and the program should test all 512K in the expansion. If this does not happen, recheck the poke codes in lines 502 and 503 for errors.

You should be aware of some bugs in the original Commodore RAMDISK software:

1. The DOS NEW command does not seem to work (a syntax error is returned). However, the SCRATCH command using the wildcard symbol (S0:"\*") will do the same job. This bug has been corrected in subsequent revisions of the Commodore RAMDOS. In fact, the RAMDOS has now been upgraded for use in C-128 mode. The latest revisions of RAMDOS are version 4.2 for C-64 mode, and version 4.3 for C-128 mode.
2. With the 256K REU, the BLOCKS FREE message in the original RAMDOS directory reports an incorrect number (2014) of blocks, as if the expansion contained 512K. This number remains about the same after the 512K is installed. This bug has been corrected in the newest releases of RAMDOS.
3. In version 4.2 and 4.3 of RAMDOS (downloaded from Quantum-Link), the unit (or device) number of the RAMDISK cannot be changed with the CHANGE UNIT program. The only way to change unit numbers (i.e. from 9 to 8) is to reinstall RAMDOS specifying the new unit number, but without reinitializing the REU memory (in other words, files in the REU memory are retained).

The operation of the 1764 with GEOS seems flawless, although I have heard of occasional incompatibilities with user-programmed software. This, however, is a very rare case. It would be nice to be able to exit GEOS and directly utilize the GEOS RAM 1541 files in the BASIC environment; but due to the differences between the GEOS and Commodore RAMDOS formats, this isn't possible.

In the area of troubleshooting, the majority of people who have upgraded their 1764's have done so without problems. Of the people who have experienced difficulty, the usual defect has been poor connections at the soldering points, or disruption of the PC board traces occurring at the time the presoldered holes were opened. In most cases, a careful inspection and reheating of the solder points will reestablish the proper connection(s). Use of a continuity tester (available from Radio Shack) may be helpful in isolating any bad connections. In the case of an extremely hard-to-identify problem, it may be best to desolder and remove the sockets and reinspect the PC board, checking for disruptions on both sides of the

board. A careful, meticulous job of soldering is the best way to avoid trouble.

Regarding the compatability of the 1764 with the C-128, in most cases, no alteration seems required. However, the addition of a 390 Ohm resistor to the empty R4 position of the 1764 circuit board makes it virtually identical to the 1750 REU. Conversely, removal of this resistor makes the 1750 equivalent to the 1764.

I hope this information will be helpful to all 1764 owners who desire to have 512K RAM rather than the 256K supplied by the factory. If you need assistance, feel free to contact:

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