Thank you for your interest in Cramapple. We offer a low cost method for replacing 16K RAM ICs on the Apple II+ mother board with 64K RAM ICs and a method to make use of the extra memory space afforded. Four banks of 48K become available using the annunciator outputs of the game I/O connector for bank selection.

PHANTOM DRIVE:

The 144K of additional RAM can be configured as a so-called phantom floppy disk drive. As such it appears to the DOS as just another drive. It differs however in the following respects:

First, data transfer is on the order of 3 to 5 times faster with the phantom floppy than with a conventional disk II drive. This is particularly satisfying with programs that make much reference to disk, especially as it is completely silent.

However phantom disk data disappears should one power down. Nor is there a diskette to remove and replace with another. For these reasons the use of a phantom floppy generally follows the following procedure:

The phantom floppy driver routine is loaded and assigned a slot number and drive number. A diskette copy routine then runs to copy a real diskette onto the phantom floppy drive. The desired program is run from the phantom floppy drive. If the phantom drive is written to and it is desired that the alterations be saved, then the diskette copy routine is run again this time to copy the phantom diskette onto a real diskette. Unlike RAM card versions of phantom floppy drives, tracks 0-3 are included in all reads and writes with the Cramapple system.

Machine language programs that supply their own DOS will not support the phantom floppy without alteration to the program. Neither will programs too large to relinquish the memory space required for the phantom floppy driver. Pascal is not currently supported. The Cramapple modification still allows all such software to run except that the phantom floppy is not available. The only programs that would no longer run after modification would be those rare programs that set annunciator outputs in the game I/O connector. To run such programs the Cramapple plug would simply be removed from the game I/O socket.

The software driver for the phantom floppy is available in two forms. The first resides between DOS and its buffers occupying 200 hex bytes of memory. If a language card is in the system, the driver may instead be loaded on the unused 4K bank. (The language card version of the phantom floppy driver differs radically from the first and operates slightly faster.) The driver does not interfere with Integer BASIC on the language card. Cramapple will work with or without a language card.

It should be mentioned that Cramapple does not perform the function of language cards. Also floppy drive emulation is available from other vendors with plug-in RAM cards for around $700. Cramapple is strictly a low budget approach. It does nevertheless have its advantages. The power consumption of 64K RAMs is about half that of the 16K RAMs they replace. Also no slots are occupied.

64K RAMS:

Your Apple computer presently contains dynamic memory ICs with a 16,384 by 1 bit organization, so called 16K RAMs. The 16K RAM is packaged in an industry-standard 16 pin DIP (dual in-line package). The pins are numbered 1 through 16 counter-clockwise (top view) around the periphery of the DIP.

NMOS 16384-BIT DYNAMIC RAM

MB8116E
MB8116H

* Organized as 16,384 x 1
* Address Access Time: MB8116E - 200 ns Max.
  MB8116H - 150 ns Max.
* Cycle Time: 375 ns Max.
* Power Dissipation: Standby - 20 mW
  Active - 462 mW
* 10% tolerance on +12V, ±5V supplies
* Read-Modify-Write, Read/Write, RAS-Only Refresh, Page-Mode Capability
* Common I/O Capability using Early Write Operation
* "Gated" CAS Feature
* Output unlatched at cycle end allows extended page boundary and two dimensional chip select
* TTL compatible inputs
* Three-state compatible outputs
* 128 refresh cycles
* 16-pin industry standard DIP package

* Pin compatible with MK4116
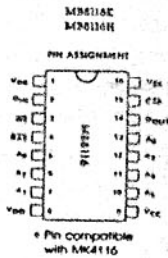
NMOS 65536-BIT DYNAMIC RAM

MB8264-15-
MB8264-20

* Organized as 65,536 x 1
* Address Access Time: MB8264-15   150 ns Max.
  MB8264-20   200 ns Max.
* Cycle Time: MB8264-15 - 270 ns Min.
  MB8264-20 - 330 ns Min.
* Power Dissipation: Standby -28 mW Max.
  MB8264-15, 303 mW Max. (Active)
  MB8264-20, 248 mW Max. (Active)
* +5V single power supply, ± 10% tolerance
* 128 refresh cycles (2 ms interval)
* On-chip substrate bias generator
* Hidden Refresh capability
* TTL compatible inputs, low capacitive load
* Three-state compatible output
* "Gated" CAS Feature
* Common I/O capability using "Early Write" operation
* Output unlatched at cycle end allows extended page boundary and two-dimensional chip select
* Read-Modify-Write, RAS-Only Refresh and Page-Mode Capability
* On-chip latches for Addresses and Data in
* Industry standard 16-pin DIP package

* Pin compatible with HM4864
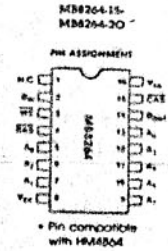
The 64K RAM differs slightly from this pin arrangement. First it requires an additional address line A8 to be provided at pin 9. Secondly the only supply voltage required is +5 volts at pin 8. Pin 1 is not connected. Installation of 64K dynamic RAMs therefore requires that:

1.) The +12 volt supply be disconnected from pin 8.
2.) The + 5 volt supply be disconnected from pin 9.
3.) +5 volts be connected to pin 8.
4.) An additional address line be generated and connected to pin 9.

This can all be achieved with 4 foil cuts, 3 capacitor removals, a jumper wire installation and insertion of the plug-in module.

ADDRESS GENERATION:
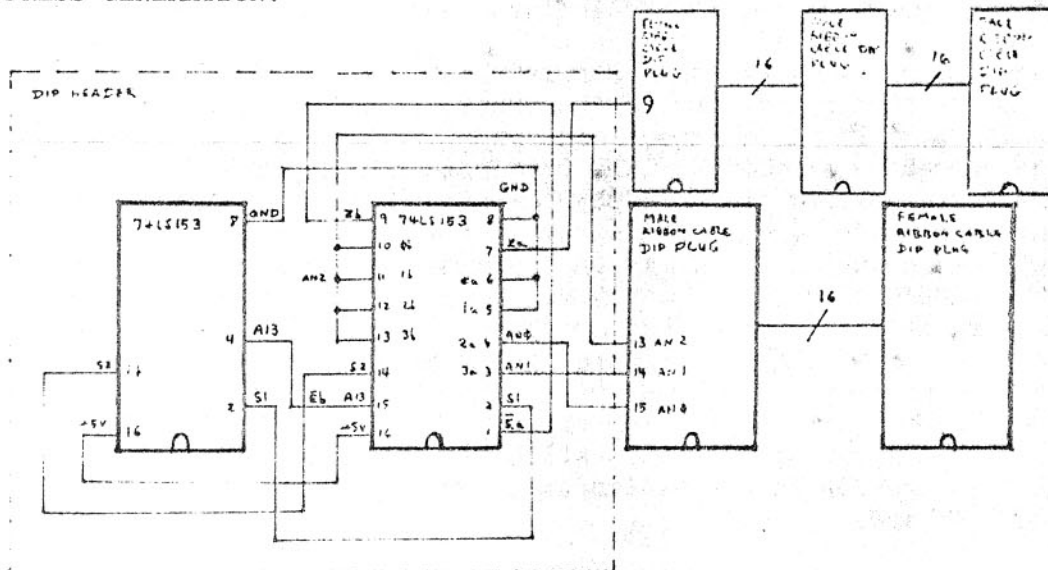
A 16K RAM IC has 16,384 locations. It thus requires 14 binary bits to specify an address. However only 7 pins are allotted to addressing. The full address must therefore be sent to the IC in two steps of 7 bits each. During a memory access, each address line must carry 2 bits of address data. Furthermore memory is accessed not only by the central processor but by the video refresh circuitry as well so all together 4 bits must be multiplexed into each address

line.   The 64K RAM requires one more address line for 2 more address bits. The
address module provides this line via a 74LS153 IC piggy-backed on the one at
location #C1, The video inputs are grounded so that the video display always
gets its information from the same memory space. The other two inputs come from
annunciator outputs of the game I/O connector. Four separate banks of 48K
memory may thus be selected by setting the annunciator outputs to 00, 01, 10, or
11 but in any case the video memory is in bank 00. A third annunciator bit is
employed to enable a split bank addessing mode where addresses with bit 14 low
access bank 00 of RAM whereas addresses with bit 14 high access the bank
specified by the other two annunciator outputs

     Physically the address module consists of a ribbon cable on which are
mounted the following six elements: two female sockets, three male plugs and a
potted assembly of two 74LS153 chips on a DIP header. One male plug inserts in
the game I/O connector. A female socket extends the game I/O connector and may
even be installed outside the case providing full access. The other plugs and
socket connect on a ribbon cable that replaces the strap to the language card if
present.   The potted assembly inserts in socket #C1 in place of the IC there
otherwise.

     The full Cramapple kit includes the above described address module, the
phantom floppy software on a DOS 3.3 diskette, and complete installation
instructions and documentation. Source files are provided for all routines.

     The kit is priced at $79.95 without the 24 required 64K RAMS. The price is
$349.95 with 24 64K RAMs. Send check or money order to CRAMAPPLE, Box 98,
Cambridge B Branch, Boston MA 02140.

     Cramapple is now available in a form that requires no modification to the
mother board!

     In the new form, all the 64K RAMs are are connected together in daisy
chain fashion for pins 8 and 9. The other pins insert in the sockets in the
ususal manner. The daisy chain connections go then to the address module.

     The kit comes as a single unit ready to be plugged in. It is compatible
with RAM card straps and is otherwise as described in our previous flyer.

     The no-modification kit is available ~~early~~ with the 24 64K RAM ICs
included and is priced for direct order at $349.95. $99.75 WITHOUT RAM

     For those who have their own 64K RAM ICs and are willing to modify their
mother boards, the the kit requiring modification is available for direct
order for $79.95.

     Finally for those who prefer to modify their mother board, the kit and 24
64K RAM ICs are available for $349.95.

To order send check or money order to:

                    CRAMAPPLE
                    Box 98
                    Cambridge B Branch
                    Boston MA   02140

Please indicate which kit is desired.