EVEREX

Maxi Magic EMS™
expanded memory adapter

OWNER'S MANUAL AND REFERENCE GUIDE
EV-165A
(VERSION 1.0)

EVER for EXcellence

MAN-00086-10

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Table of Contents

Chapter 1: Introduction

The Everex Maxi Magic EMS is 100% compatible with the Lotus/Intel/Microsoft Expanded Memory Specification. The Maxi Magic EMS can be installed in a system with the Intel Above Board and can run with that card's software.

The Everex Maxi Magic EMS breaks through the 640K memory limit imposed by DOS and gives you up to two megabytes of Lotus/Intel/Microsoft EMS-compatible RAM from a single expansion slot. The Maxi Magic EMS uses 256K-bit RAM chips, providing up to two megabytes of expanded memory per card. The Maxi Magic EMS may also be used to upgrade base memory to 640K (**Note:** If you use the Maxi Magic EMS to upgrade base memory, you need to use Everex System's EMM.SYS device driver.)

For all its power and flexibility, the Maxi Magic EMS is simple enough for a first-time user to set up and install.

The Maxi Magic EMS is for use in the IBM PC, IBM XT, IBM AT and compatible systems.

Chapter 2: Installation

There are three steps to the installation process.

1. Make any necessary adjustments to the switches on the Maxi Magic EMS card. This step is required ONLY if you have other expanded memory cards in your system, or if you will be adding base memory. (Chapter 2.1).

2. Physically place the Maxi Magic EMS board into your computer. (Chapter 2.2).

3. Install the software. (Chapter 3.)

All three of these steps are described in one of the sections of this manual.

2.1 Configuring the Maxi Magic EMS

It is only necessary to change the switches on your Maxi Magic EMS if you have other expanded memory cards in your system or if you will be using a portion of the Maxi Magic EMS card to fill your base memory. If neither of these conditions apply to you, please skip to section 2.2 on *Physically Installing Your Maxi Magic EMS.*

Figure 1 shows the factory default settings of the Maxi Magic EMS jumpers and dipswitches.

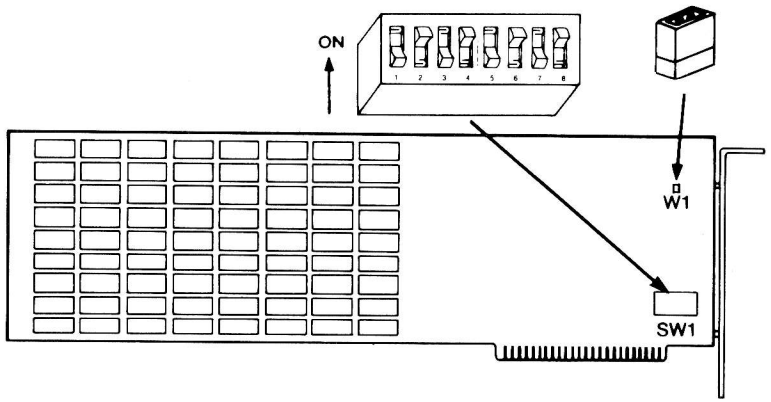


Figure 1: Maxi Magic EMS
Jumpers and Switches

The first four positions of dipswitch block SW1 set the address at which the Maxi Magic EMS starts mapping base memory. The factory default setting is 640K, which devotes the entire Maxi Magic EMS to expanded memory. **You will need to change the setting of SW1 if you add base memory.**

The last four positions of SW1 set the I/O port address of the Maxi Magic EMS. EMS memory uses I/O port addresses to set up page mapping information. The default I/O ports of the Maxi Magic EMS are 0258/9, 4258/9, 8258/9, and C258/9 (in HEX). These I/O port addresses are selectable, and you may need to change switch positions 5 through 8 of SW1 if this will be the second Maxi Magic EMS in your system. "Section 2.1.3" and "Appendix II: Technical Reference" both contain more information on EMS I/O Port Address Selections.

Jumper W1 enables the board's parity check. Always leave the plastic jumper shunt connected on jumper W1.

If you need to change one of the default settings, refer to the section of the setting you want to change:

2.1.1 Adding Base Memory

NOTE: You are not required to upgrade your base memory to 640K before installing expanded memory. You can devote your Maxi Magic EMS entirely to expanded memory, even in a system that has less than 640K base memory. In this case, the first four positions of the Maxi Magic EMS dipswitch should remain in their factory default settings.

If your system is not yet upgraded to the 640K of base memory allowed by DOS, you can use part of your first Maxi Magic EMS to add base memory. If you choose to add base memory, you must go all the way up to 640K. It is not possible, for example, to use the Maxi Magic EMS to upgrade from 64K to 512K.

When you use the Maxi Magic EMS to add base memory, you must set the first four positions of dipswitch SW1 according to the amount of base memory already present in your system. This includes the base memory that came on your system board plus any additional memory that you have added on memory or multifunction cards.

Use Table 1 to set the Maxi Magic EMS's first four switch positions.

TABLE 1
SW1 on the Maxi Magic EMS

Base Memory Already In System	Switch Position 1	2	3	4
64K	OFF	ON	ON	ON
128K	ON	OFF	ON	ON
192K	OFF	OFF	ON	ON
256K	ON	ON	OFF	ON
320K	OFF	ON	OFF	ON
384K	ON	OFF	OFF	ON
448K	OFF	OFF	OFF	ON
512K	ON	ON	ON	OFF
576K	OFF	ON	ON	OFF
640K*	ON	OFF	ON	OFF

***NOTE: 640K is the factory default setting.**

Remember to move only positions 1, 2, 3, and 4. Do not disturb the other four positions.

2.1.2 Other Expanded Memory Cards

You can have up to four Maxi Magic EMS cards per system. In addition, you can mix the Maxi Magic EMS with Intel's Above Board which will give you up to a total of eight megabytes of expanded memory (plus 640K of base memory) per system.

2.1.3 I/O Port Addresses

Each expanded memory card must have its own I/O port addresses. An I/O port is like a mailbox that allows the computer to send instructions to that card individually. When the card has completed the instructions, it sends its response back to the computer via the same mailbox. No two cards may be assigned to the same I/O port, or they will intercept each other's signal.

EMS memory uses I/O port addresses to set up page mapping information. The default I/O ports of the Maxi Magic EMS are 0258/9, 4258/9, 8258/9, and C258 (in HEX). These I/O port addresses are selectable, and you may need to change switch positions 5 through 8 of SW1 if this will be the second Maxi Magic EMS in your system. Before installing more than one expanded memory card you should check that each card is assigned to different I/O ports. "Appendix II: Technical Reference" contains more details about EMS I/O Port Address Selecting.

It is also possible to disable the Maxi Magic EMS's EMS memory entirely by setting positions 5 through 8 in the OFF position.

Table 2 shows you the possible switch settings for positions 5-8 on the Maxi Magic EMS SW1.

TABLE 2
I/O Port Address Switch Settings (SW1)

I/O Port Address	Switch Position 5	6	7	8
Y2X8*				
208	ON	ON	ON	ON
218	ON	ON	ON	OFF
258+	ON	OFF	ON	OFF
268	ON	OFF	OFF	ON
2A8	OFF	ON	OFF	ON
2B8	OFF	ON	OFF	OFF
2E8	OFF	OFF	OFF	ON
Disable	OFF	OFF	OFF	OFF

* EMS I/O port addresses are selectable and a number of I/O ports have been reserved for EMS with the basic setting being Y2X8. The X value is a variable that you can select to avoid port address conflicts in your computer. Select the X variable by changing the setting of positions 5 through 8 on dipswitch SW1. Y is not user selectable; it has the values of 0, 4, 8 and C.

\+ 258 is the factory default I/O address of the Maxi Magic EMS.

NOTE: All Maxi Magic EMS cards are set at the factory for I/O port address 258, therefore, if you another Maxi Magic EMS card, you will definitely have to change the port address of the second card. No two cards can share the same I/O port address.

After you use an I/O port address, circle it in this book and do not use it again for subsequent expanded memory cards.

2.2 Physically Installing the Maxi Magic EMS

Before You Begin: Clear an area around your computer leaving plenty of room to work.

1. Turn OFF your computer and unplug the power cord. It is not necessary to remove any other cables, but make sure there is no power going to your computer.

2. Remove the cover of your computer. Remove the retaining screws that hold the cover in place, and carefully slide the cover off.

3. If you have an IBM AT or compatible system, please skip to step 4.

    a. **If you have an IBM XT**, there is only one switch block on the system board, and its proper setting is the same for 256K or more base memory: positions 3 and 4 are OFF. If you are adding base memory on the Maxi Magic EMS, and/or you had 256K of memory in your XT already, look at the switch on the system board and confirm that 3 and 4 are OFF.

    b. **If you have an IBM PC** and you are using the Maxi Magic to add base memory to your system, you have to set dipswitch SW2 on the system board which resides on the floor of your computer. (If you are using an IBM PC compatible, please check your system's manual to see if there is a similar memory switch for your computer.)

There are two types of IBM PCs: the PC1 and the PC2. To determine which type you have, look for a "B" on the back of the chassis.

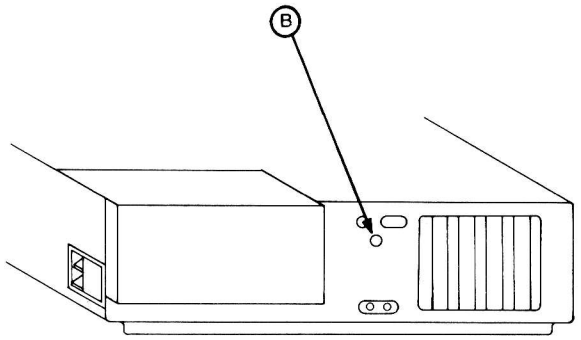


Figure 2: "B" on the back of the IBM PC chassis

If the "B" is present, you have a PC2; if the B is absent you have a PC1.

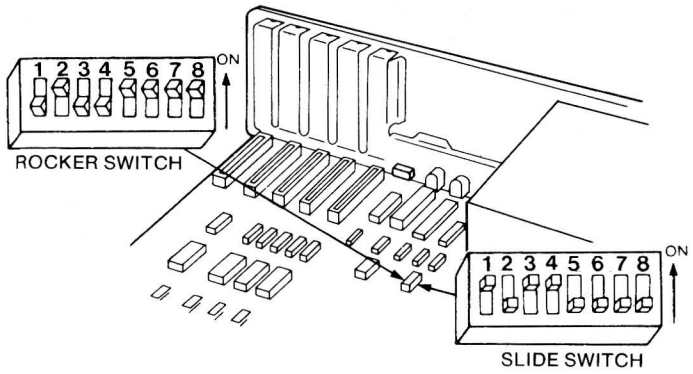
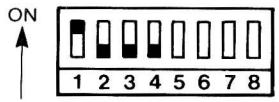
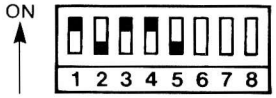


Figure 3: SW2 in the IBM PC

TABLE 3

System Switch Block SW2 Switch Settings

PC1 SWITCH SETTINGS	PC2 SWITCH SETTINGS
	

Remember to move only those switch positions illustrated in Table 3 as ON or OFF. Do not disturb the other switch positions.

NOTE: Only change the setting of your system switch if you have increased your base memory to 640K with the Maxi Magic EMS.

4. Next, you will need to remove the slot cover from an expansion slot and insert the Maxi Magic into this slot. Be sure that you have made any necessary adjustments to the switches on your motherboard (Step 3) before you install your card. Also, if you want to change the default configuration of the Maxi Magic, do so before you complete this step.

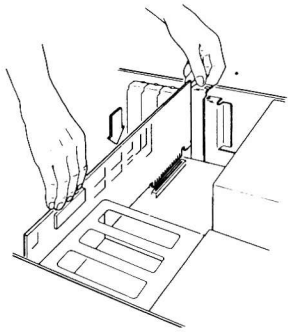


Figure 4: Installing the Maxi Magic EMS

5. Insert the screw that you removed from the slot cover in Step 4 to secure the Maxi Magic in place.

6. Replace the cover on your computer, and reinstall the power cable(s).

Next, you will need to install the software; Chapter 3 on the following page explains this procedure.

Chapter 3: Software Installation

Before you use the Everex utility diskette that accompanies your Maxi Magic EMS, you should make a backup copy. None of the programs are copy-protected. Use the DOS COPY command to copy all the files to a hard disk or another floppy diskette, and keep your master diskette in a safe place.

The Maxi Magic EMS comes with four software programs that allow you to use its expanded memory. The directory of your Everex utility diskette should contain these files:

EMM.SYS	Expanded Memory Manager
EDISK.SYS	Electronic Disk Program
SPOOLEMS.EXE	Printer spooler
CONFTEST.EXE	Configuration and Diagnostics

Of these four programs, only the first, EMM.SYS, is required for operating the Maxi Magic EMS. EDISK.SYS and SPOOLEMS.EXE are optional utilities that let you use the Maxi Magic EMS memory for specific purposes (as a RAM disk or as a printer spooler) even without EMS-compatible applications programs. CONFTEST.EXE is a utility that will help you configure and then test the Maxi Magic EMS.

3.1 EMS Memory Manager

Expanded memory was not yet invented when your PC and its operating system (DOS) were invented. By itself, DOS is unable to recognize or use the expanded memory on your Maxi Magic EMS. You need a special driver program, run every time you re-boot, to allow your Maxi Magic EMS to work. Then you need specially-written application software to take advantage of it.

The special driver is called EMM.SYS and it's provided by Everex on the diskette that accompanies your Maxi Magic EMS. No matter how many expanded memory cards you have, you need only one EMM.SYS program to manage them all.

There are two steps to installing the EMM.SYS software: copying the program to your system disk and entering the program name in your CONFIG.SYS file. Whether you boot from a hard disk drive or a floppy disk, these steps are the same.

NOTE: Throughout this chapter, you should type only the words that appear in boldface. The words in plain text are instructions for your use only.

Load the Everex diskette in drive A and type

copy a:*.* b:\ [enter] (where boot-up system disk is a floppy disk in drive B)

or

copy a:*.* c:\ [enter] (where system boots from a hard disk in drive C)

Most systems have a CONFIG.SYS file of "chores" for the computer to perform, automatically, every time it boots up. You should add EMM.SYS to this file so that your expanded memory will always be accessible.

If you already have a CONFIG.SYS file, then use your editor or word processor to add the line

device=emm.sys

If you do not have a config.sys file, you will need to create one with the following instructions.

3.1.1 Creating A CONFIG.SYS File

1. Make sure you are in the root directory of your system disk. At the DOS prompt type:

   type config.sys **[enter]**

If the message "File not found" appears, go on to step 2.

If one or more command lines appear, get a pencil and paper and copy down the line(s) exactly as they appear on your screen.

2. **WARNING: This step will overwrite any existing config.sys file!** At the DOS prompt type:

   cd **[enter]**
   copy con config.sys **[enter]**
   device=emm.sys **[enter]**

   If you wrote down the contents of a previous config.sys file, type the previous contents back in now.

   [F6] **[enter]**

   Pressing the [F6] function key will save your new config.sys file.

To confirm that "device=emm.sys" is now in the config.sys file, type: **TYPE CONFIG.SYS [ENTER]**. This command will list the contents of your config.sys file.

Re-boot your system and the EMM.SYS program will report the status of the expanded memory system. If everything is operating correctly, a message similar to "Expanded Memory Manager Installed" will be displayed.

3.1.2 Choosing the Expanded Memory Page Frame address

The EMM.SYS expanded memory manager lets you specify a page frame address in the CONFIG.SYS command line. The format of the command line is as follows:

device = emm.sys [page frame] [/c]

where:

[ ]	indicates an optional command line specification;
page frame	is the address to be used by EMM.SYS. Valid values are C400, C800, CC00, D000, D400, D800, DC00, and E000;
/c	enables the chaining option (refer to "Appendix III: Maxi Magic EMS & AST'S PC Net II").

For example, to locate the page frame at CC00, enter the following argument in the CONFIG.SYS file:

DEVICE = EMM.SYS CC00 [ENTER]

If the page frame address you specify is occupied (for example, by a ROM or RAM), EMM.SYS will scan from the next valid address for an alternate unused 64K area. The search will continue up to (and including) address E000. If the search does not find a valid 64K area, the message "No room on motherboard for page frame" will appear, and the search will terminate.

3.2 EDISK: RAMdisk Software

The Everex utility EDISK allows you to set aside part of your computer's base, extended, or expanded memory for a RAM disk. The RAM disk is recognized by ordinary DOS just as if it were a hard drive or a floppy: you can create directories and subdirectories on it, and transfer and save your files just as you would do on any disk. DOS will assign the next available drive letter to each RAM disk; for example, your first RAM disk will become drive C: if you do not have a hard disk or drive D: if you do have one.

These are the advantages of a RAM disk over a floppy or hard disk:

- The access time is extremely fast because there are no mechanical access procedures.
- The RAM disk can be any size. It can be made larger or smaller, deleted and re-created, at will.
- You already have all the requisite hardware to create a RAM disk; there is nothing else to buy. If you don't want it any more, you can get rid of it at any time and not be out your investment.

These are the disadvantages:

- None of the data in a RAM disk is permanently saved until it is stored on a real physical disk. The RAM disk consists of memory only, which is volatile. If you re-set your system or the power is interrupted (even accidentally), everything that was in the RAM disk is gone forever. But because the RAM disk so closely resembles a real storage device, it's easy to forget or overlook this fact.

- The portion of your memory that you devote to a RAM disk is unavailable for any other use.

Before you can start using EDISK, you have to identify which type(s) of memory you have:

Base memory is the first 640K of random access memory (RAM) in your machine. Every computer has some amount of base memory. If you don't know how much you have, run the DOS utility CHKDSK to get an accurate total.

Expanded memory refers to a bank-switching technique used to overcome the DOS 640K limitation. If you have some amount of expanded memory compatible with the Lotus/Intel/Microsoft Expanded Memory Specification installed in your computer, you can use EDISK to locate a RAM disk in this memory instead of in base memory. EDISK works with EMS-compatible expanded memory products in either PC or AT types of computers.

Extended memory exists only in IBM AT and compatible computers, where it starts at the 1MB boundary and extends for up to 15 additional megabytes. Since most programs don't run in extended memory, creating a RAM disk with EDISK is an excellent way for AT owners who have this type of memory to make use of it.

Identify which type(s) of memory your system has, and decide which one(s) you want to use for a RAM disk. EDISK lets you create as many RAM disks as you want, in one or more memory types. You are limited only by your system's total memory capacity.

Please note that only one of the three memory types may be used by a single RAM disk. It is not possible to split one RAM disk between two or more different types of memory. It is, however, possible to create two different RAM disks within one type of memory, providing that their combined total capacity is within your computer's limit of that type of available memory.

You should start by confirming that the file EDISK.SYS on the Everex utility diskette is copied into the root directory of your system disk. If your computer is floppy-based, the system disk is the DOS diskette that you use to boot up; if you have one or more hard disks then the system disk is drive C.

Follow these steps to create a RAM disk using EDISK:

1. EDISK is called at boot-up from a special file called CONFIG.SYS on your system disk. CONFIG.SYS designates a list of hardware-related "chores" that you want the computer to perform each time it boots up. The CONFIG.SYS file already exists on your system disk with the EMM.SYS device driver that is required to operate the expanded memory of the Maxi Magic. If necessary refer to section 3.1 *EMM.SYS* and the instructions in section 3.1.1 *Creating a CONFIG.SYS File.*

2. You need to edit your config.sys file to include the EDISK command line. Get into the root directory of your system disk by typing **CD**. Use your word processing program and load the file called "CONFIG.SYS."

3. When the config.sys file appears on the screen, the line

   device = emm.sys <page frame> < /c >

   should already be there. Refer to "Section 3.1.2 Choosing the Expanded Memory Page Frame Address" for more information on the optional argument <page frame>.

4. Type in your EDISK command line. The format of the EDISK call is as follows:

   device=disk.sys bbb sss ddd / <memory type> [enter]

   Steps 5 through 8 describe the possible entries in the EDISK command line; do not press the [enter] key until you have finished entering all the parts of your command line.

   NOTE: After you enter the EDISK command line into your config.sys file (including all optional arguments and parameters), make sure to save your file!

5. **bbb** defines the buffer size, or capacity, that you want to set aside for the RAM disk. The default buffer size is 128K; if you want a larger or smaller RAM disk, enter the appropriate number of K. The minimum buffer size is 1 K; the maximum is the total amount of your available memory of that type. When choosing a buffer size, remember that the amount of memory you devote to the RAM disk will be unavailable to other applications, even if the RAM disk isn't full of data.

   If this is going to be a base memory RAM disk, you must leave at least 64K of base memory free for DOS. EDISK will check that 64K of your base memory will be left after it is installed. If the specified buffer size leaves less than 64K of base memory, EDISK will reduce its buffer size. If this still leaves less than 64K, EDISK will not install itself.

6. **sss** defines the sector size, and **ddd** defines the maximum number of entries in the root directory of the RAM disk. The default values for these two arguments (512-byte sectors; 64 directory entries) are fine for most users. If you want to change the sector size, the valid choices are 128, 256, or 512. For the number of directory entries, the minimum is 2 and the maximum is 512.

bbb, sss, and ddd are all optional arguments; you don't have to enter any of them if you want to keep their default values.

For example, the line

device = edisk.sys

gives you an all-default RAM disk: the buffer size is 128K, the sector size is 512 bytes, and the maximum number of entries in the root directory is 64. The line:

device = edisk.sys 256

gives you a 256K RAM disk (twice the default buffer size) but leaves the sector size and number of directory entries alone. The line:

device = edisk.sys 64 128 256

creates a 64K RAM disk (half the default buffer size), and also changes the sector size to 128 bytes and the maximum directory entries to 256.

EDISK will interpret the first three numbers after **device = edisk.sys** as **bbb, sss,** and **ddd** respectively. Therefore, if you are changing the sector size or number of directories but not the preceding argument(s), then you must enter the defaults for the preceding argument(s) anyway, just as place holders.

For example, suppose you want to keep the default buffer and sector size but change the maximum number of entries in the root directory to 384. If you type

device = edisk.sys 384

what you get will be a buffer size of 384, with the sector size and number of directory entries unchanged. EDISK will interpret the 384 as representing bbb, not ddd. To get the RAM disk you want for this example, you must type:

device = edisk.sys 128 512 384

The 128 and 512 will hold the default buffer size and sector size places for you, and your 384 will be recognized as ddd and will increase your maximum number of directory entries to 384.

7. In place of **/MEMORY TYPE** enter the appropriate parameter for the type of memory you want to use for this RAM disk:

   For a base memory RAM disk, do not add any parameters; EDISK will automatically locate the RAM disk in base memory unless you add one of its valid arguments.

   For an **expanded memory** RAM disk, add **/x.**

   For an **extended memory** RAM disk, add **/e.**

   For example, the line:

   device = edisk.sys 1024 /x

   gives you a 1MB RAM disk in expanded memory. (The default sector size and maximum number of directory entries remain unchanged.) The line:

   device = edisk.sys 512 /e

   gives you a 512K RAM disk in extended memory, again leaving the sector size and directory entries alone.

   Since only one type of memory may be used per RAM disk, enter no more than one valid parameter at the end of each EDISK command line.

8. The EDISK program will consider only valid arguments and parameters in the EDISK call. Therefore, you can add non-numeric comments for your own reference, and EDISK won't be affected.

   For example, the line

   device = edisk.sys the size of my RAM disk is 256K

   will set up a base memory RAM disk, size 256K instead of the default 128K, and keep the default sector size and number of directories at 512 and 64 respectively.

   Your comments must not include the character / which EDISK will mistake for a memory type parameter.

9. When you have finished entering your EDISK command line, including all its arguments, parameters, and comments, press the **[enter]** key to end the command line. If you want to create more than one RAM disk, enter your additional EDISK line(s) now, constructing each line in the same manner as the first. Then press the [F6] function key to save the new CONFIG.SYS file. The DOS message "1 File(s) copied" will confirm that your new CONFIG.SYS file has been saved to the disk.

10. Since the commands in CONFIG.SYS are executed only when you boot up, re-boot your system now and watch for the EDISK initialization message.

When you are ready to remove your RAM disk, you remove the EDISK command line from your CONFIG.SYS file. You can do this with the COPY CON command described previously by omitting the EDISK line(s), or you can use your line editor or word processor to edit the CONFIG.SYS file. The next time you re-boot there will be no RAM disk, and that portion of your memory previously occupied by the RAM disk will be released for other uses.

3.3 SPOOLER

The Maxi Magic EMS comes with a printer spooler program that allows you to set aside part of your expanded memory to feed data to your printer. Therefore, you can continue using your system while your printer is printing. You can still operate the printer without going through the printer spooler if you prefer.

To use the printer spooler, load the EVEREX diskette in drive A and type:

spoolems **[enter]**

Then use the cursor up and down arrow keys to select the amount of expanded memory that will be allotted to the printer spooler. Press the [enter] key to activate the printer spooler. Use your word processing or other applications program to send data to the printer spooler.

Please note that the amount of expanded memory set aside for the printer spooler will not be available for other uses. Also, while the printer spooler's data is kept in expanded memory, the program itself must reside in base memory and will deduct a small amount (13K) from the amount of base memory available.

Appendix I: Populating the Maxi Magic EMS

The process of adding memory chips to your Maxi Magic EMS is called populating. This may have been done already by Everex at our factory or by your dealer, or you can do it yourself.

The Maxi Magic EMS uses only 256K-bit RAM chips with a speed of 150 nanoseconds or faster. When you buy your chips, make sure you tell your dealer these specifications.

NOTE: RAM chips are even more sensitive to static electricity when they are loose than when they are installed on a circuit board. Be extremely careful to rid your hands of static electricity before you pick up a chip by touching your system chassis first.

The Maxi Magic EMS has eight banks (or vertical columns) of nine chip sockets. (See Figure 5.)

Each of these banks must be either full or empty. You may not leave any banks partially filled. For this reason, always buy your RAM chips in multiples of nine.

It is not necessary to fill all eight banks on the Maxi Magic EMS. You can fill only some of the banks now and add more chips later, if you prefer. The only consequence will be less expanded memory available for you to use.

If you have chosen to add base memory as well as expanded memory, you must add at least enough chips to fill the base memory. To calculate the minimum number of chips you need for base memory, subtract the amount of base memory (including any add-in cards) you already have from 640K. If the resulting number is 256 or less, you need a minimum of nine chips; if it's 512K or less, you need at least eighteen chips; if it's more than 512K you need at least 27 chips.

Begin populating with the leftmost bank of chip sockets, and move to the right for each subsequent bank. Do not skip any banks or leave any partially filled. If you are leaving any banks empty, they should be the rightmost banks on the card.

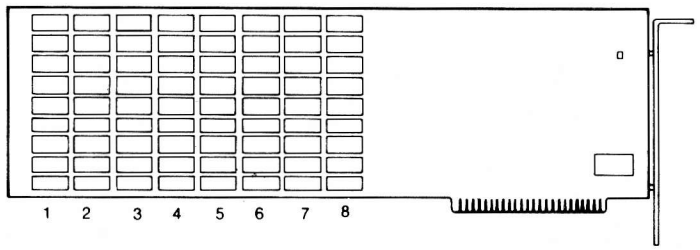


Figure 5: Populate the Chip Banks in this Order

Each chip has eight metal pins along each side. Each row of pins goes into a corresponding row of holes in the socket. The pins and holes must be perfectly aligned in order for the chip to work. If one pair of pins is hanging over into the socket next to it, the chip will look almost exactly right but will not work at all.

Each chip has a Pin 1, which is marked with a notch or a dot. (See Figure 6.)

If you look closely at the PC board beneath each chip socket you will see the outline of a notched chip in the proper orientation. Be sure to insert the chip following this orientation. Inserting the chip backwards could damage the chip.

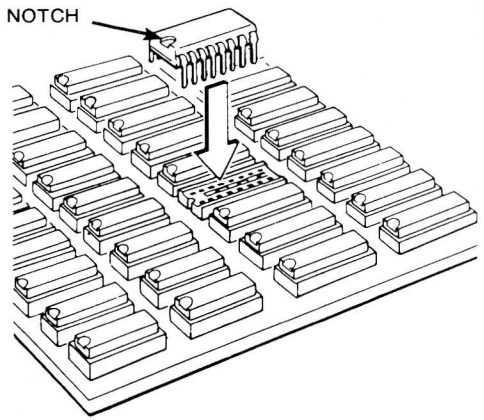


Figure 6: Installing a Chip

Use a two-step process to install each chip. Insert the tips of the pins into their holes in the socket. Then double-check that the alignment is exactly right, and press the chip into place. No force is needed to install RAM chips; if you have to press hard, you are probably bending a pin. If you do bend one of the pins, carefully remove the chip, straighten the bent pin, and try again being as gentle as possible.

Applications programmers writing software for the Maxi Magic EMS should refer to the Lotus/Intel/Microsoft (LIM) specification, version 3.20, released September 1985. Use of this document will facilitate portability to all specification-compatible expanded memory cards.

A.1 Expanded Memory

Expanded memory is a bank switching technique that increases the memory capacity of the PC up to 8 megabytes beyond the present maximum of 640K. A 64K window (called a page frame) is located between the 640K and 960K boundaries. The page frame is divided into four contiguous 16K-byte pages. The memory on the Maxi Magic EMS is divided into 128 16K-byte blocks, totaling two megabytes. By sending commands to the control circuitry on the Maxi Magic EMS, the EMM.SYS expanded memory manager, can map any one of these blocks into any of the four pages. Refer to the Lotus/Intel/Microsoft (LIM) Expanded Memory Specification, version 3.20, September 1985 if you need a more thorough explanation of expanded memory.

A.2 Filling Base Memory

The Maxi Magic EMS is capable of filling base memory. The first four positions of dipswitch SW1 on the Maxi Magic EMS determine the lower boundary at which the board starts mapping memory. If *no base memory* is to be added, the lower boundary should be set at 640K. If base memory *is* to be added, the lower boundary should be set at the amount of RAM already present in the system (e.g. 256K) and the upper boundary of base memory is fixed at 640K and is not selectable. When adding base memory, the first three banks of chip sockets from left to right must be filled in order. No more than one Maxi Magic EMS per system may be used to fill base memory. If a second Maxi Magic EMS is present its dipswitch must be set for 640K.

A.3 Page Frame Addressing and Register Output

"Paging" is a method of memory mapping that allows a computer to utilize more memory than it can physically address. Paging works because EMS memory divides the physical memory on an EMS board into pages consisting of 16K each. These pages are subsequently mapped into an address space of the CPU; this address space is known as a **window**. By varying the values of the mapping registers, any one of the 16K physical memory banks on the EMS board can be mapped into the window. The following figure shows how the mapping is completed.

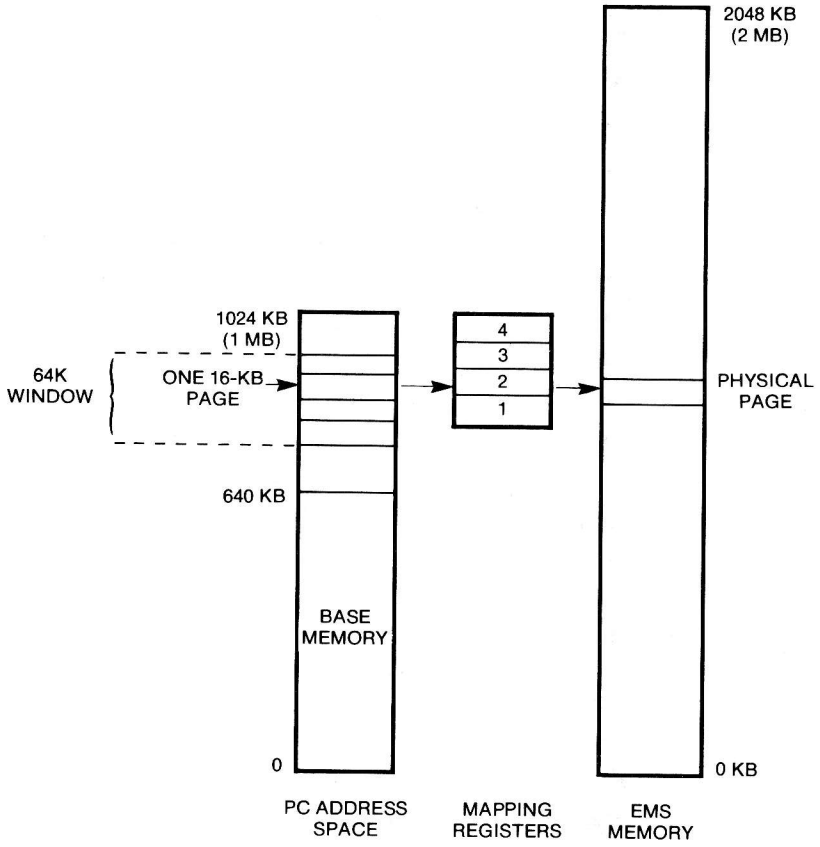


Figure 7: Page Frame Addressing

A.4 EMS I/O Port Address Selections

EMS uses I/O ports to set up mapping information. These I/O ports are selectable and a number of I/O ports have been reserved for EMS memory. These ports are:

Mapping Registers		Page Frame Registers
02X8 :	page 1	02X9
42X8 :	page 2	42X9
82X8 :	page 3	82X9
C2X8 :	page 4	

Where the variable **X** is selectable from 0, 1, 5, 6, A, B, or E.

The page frame registers determine the starting address of the EMS window in the CPU addressing space, while the mapping registers determine which 16K page of physical memory of the EMS board is to be mapped into the window.

Each Maxi Magic EMS has four 16K pages that map into the 64K window, yet at any one time there should not be more than one active page in the same page location within the window. By controlling the MSB of the mapping register, one can enable or disable the corresponding page. As a result, more than one EMS card can be used. According to specification, EMS can support up to 8 megabytes of memory.

A.5 Mapping Registers

Every page of EMS memory is 16K in size. By setting the mapping registers to values from 0 to 127, one of the 16K pages in a two megabyte EMS memory board can be mapped into the page frame window. Since bit 0 to bit 6 account for the 0 to 127 range, the last bit (MSB) in the mapping register is used as an enable/disable flag for that particular page. Each mapping register can handle up to 2 megabytes of EMS memory (16K x 128 = 2M). Since each page frame is 64K, four such pages can be mapped into the window at any time. These four mapping registers are located in the following addresses:

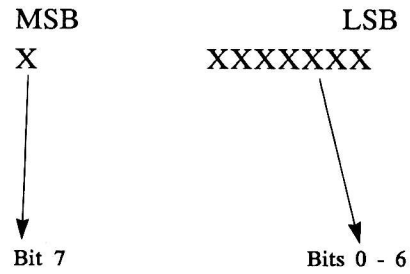
02X8
42X8
82X8
C2X8

X is the variable selected by positions 5 through 8 on the SW1 dipswitch (EMS memory mapping select). Dipswitch SW1 allows X to be any value between 0 and E (when X = F, EMS memory will be disabled). However, in order to avoid conflicts with other boards and devices, the Everex software will only accept the following variables as X values:

0, 1, 5, 6, A, B, E

For those who wish to write their own software to use EMS memory, all 15 values (0 through E) can be used as X provided that the resulting port address does not conflict with any other devices or boards. The contents of the mapping registers can be read by doing an I/O read from the same address location they were written to.

The following figure represents how the contents of the mapping registers can be used:



0: disable the page
1: enable the page

0 - 127: maps one of the 128 16K size pages of EMS memory from the Maxi magic EMS board into a window.

Figure 8: Mapping Registers

A.6 Page Frame Registers

The page frame registers are used to store the mapping values which determine the starting address for the page frame in the physical memory space of your computer. These registers are write only. Choose one of the eight possible starting addresses by writing different values to the page frame registers. Only bit 7 (MSB) is used to set up these registers. Table 4 gives the values that should be assigned to a particular page frame register with respect to a page frame starting address.

TABLE 4
Page Frame Registers

Page Frame Register MSB:				
82X9	42X9	02X9	Page Frame Starting Address:	
Where D is bit 7 (MSB)				
D	D	D		
0	0	0	C4000	784K
0	0	1	C8000	800K
0	1	0	CC000	816K
0	1	1	D0000	832K
1	0	0	D4000	848K
1	0	1	D8000	864K
1	1	0	DD000	880K
1	1	1	E0000	896K

NOTE: Bit 0 to bit 6 are don't cares.

Generally, all EMS boards should have the same values in their page frame registers so that they all use the same 64K window in the physical memory space of a computer. However, if you wish to write your own software, use the page frame register to best suit your specific applications.

The Everex EMM device driver provided to manage EMS memory will automatically try to find a contiguous 64K space between C4000 and F0000 if there is no user-specified address; it will then set the page frame register accordingly. However, if the page frame registers are to be set directly with the user's own software, they must be set prior to accessing any of the mapping registers. Writing to the page frame registers will destroy the contents of the mapping registers.

Appendix III: Maxi Magic EMS & AST's PC NET II

When the Maxi Magic EMS and AST's PC NET II board coexist in a system, there is a conflict involving the use of interrupt vector 67 Hex. This vector is reserved by the standard EMS device driver, however, some other applications use the same vector for other purposes. To deter this conflict from happening, Everex Systems has included a "/c" parameter for the device driver in version 3.20A of the EMS software. The device driver is called EMM.SYS and it is provided by Everex on the diskette that accompanies your Maxi Magic EMS. The "/c" parameter enables the EMS device driver to share interrupt vector 67 Hex with the PC NET II board.

You add the device driver last into your CONFIG.SYS file. A CONFIG.SYS file contains the chores the computer performs every time it boots up. If you already have a CONFIG.SYS file, then use your editor or word processor to add the following line to the end of your config.sys file:

device=emm.sys /c **[enter]**

If you do not have a CONFIG.SYS file, create one at this time in the root directory of your DOS system disk by typing:

cd **[enter]**
copy con config.sys **[enter]**
device=emm.sys /c **[enter]**
[F6] **[enter]**

Re-boot your system to execute the EMM.SYS before you resume computing.

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Addendum
Expanded Memory Manager (EMM.SYS)
Driver to Support EMS Version 4.0

Everex Systems is shipping a new software device driver that recognizes your computer's expanded memory space, and conforms to the new Lotus/Intel/Microsoft (LIM) Expanded Memory Specification 4.0, dated October 20, 1987. The material in this addendum replaces the information in the product manual that refers to the software driver EMM.SYS supporting EMS version 3.20.

The new EMM.SYS device driver that conforms to the EMS 4.0 specification is backward compatible, and can be used with software designed to make use of expanded memory written with EMS 3.2 specifications. The main feature of the new EMM.SYS program conforming to the LIM EMS 4.0 specification is that it recognizes up to **32 megabytes** of expanded memory.

The EMM.SYS program defaults to certain operating parameters when it is loaded. However, you can explicitly reconfigure EMM.SYS for your system by specifying command line parameters within the CONFIG.SYS file. For more details on the EMM.SYS command line, refer to the last section of this addendum called "EMM.SYS Command Line Arguments."

If you have an Everex memory board with model numbers EV-165, EV-165A, or EV-173, you must use the following EMM.SYS command line:

DEVICE = EMM.SYS

If you have any other Everex memory board model numbers, you must use the [port,page] parameter in the EMM.SYS command line as follows:

DEVICE = EMM.SYS [PORT,PAGE]

For the [PORT,PAGE] parameter, type in the port address of the EMS memory, beginning at a specific logical page (indicate the port and page in hexadecimal values). For example, you would type in a command line like the following:

DEVICE = EMM.SYS 258,00

In this example, the port address of the EMS memory begins at 258, with the logical page starting at 00. All of these parameters are explained in more detail in the last section of this addendum called, "EMM.SYS Command Line Arguments."

NOTE: If you have a combination of Everex memory boards, for example, an EV-165 and an EV-158A, you would use the more comprehensive EMM.SYS command line similar to the following:

DEVICE = EMM.SYS 258,00

Installing the EMM.SYS Program

Expanded memory in your computer can only be accessed when it is managed by the expanded memory manager program EMM.SYS. This program is provided on the Everex Systems utility diskette. Most systems have a CONFIG.SYS file of "chores" for the computer to perform automatically every time it boots up. You need to add the line **device = emm.sys** to the CONFIG.SYS file.

1. Insert the Everex Systems utility diskette into floppy disk drive A and type:

   cd **[enter]**
   copy a:emm.sys c: **[enter]**

2. We recommend using a line editor or your word processing application program to load the file called CONFIG.SYS; this file is stored in the root directory of your system disk. You need to add the device driver emm.sys into CONFIG.SYS so your expanded memory will always be accessible. If you do not have a line editor or word processing program to modify or create the CONFIG.SYS file, create one now with the DOS command COPY CON CONFIG.SYS.

3. Once the CONFIG.SYS file is loaded, add the following line:

   For Everex memory boards with model numbers EV-165, EV-165A, and EV-173:

   device = emm.sys **[enter]**

   For Everex memory boards with any other model numbers:

   device = emm.sys 258,00 **[enter]**

   Where 258 and 00 are the port address, and logical starting page of the EMS memory.

4. Save the CONFIG.SYS file and reboot the system. The EMM.SYS program will report the status of the expanded memory in your computer. If everything is operating correctly, a message similar to "Expanded Memory Manager Installed" will be displayed.

Using the DOS COPY CON Command to Create or Modify the CONFIG.SYS File

We recommend using your editor or word processing program to create or modify the CONFIG.SYS file. However, if you do not have an editor or word processing program, you can use the DOS COPY CON command to add the EMM.SYS device driver.

1. Make sure you are in the root directory of your system disk. At the DOS prompt type:

   cd **[enter]**
   type config.sys **[enter]**

   If the message "File not found" appears, go on to step 2.

   If one or more command lines appear, get a pencil and paper and copy down the line(s) exactly as they appear on your screen.

2. **WARNING: This step will overwrite any existing config.sys file!** At the DOS prompt type:

   cd **[enter]**
   copy con: config.sys **[enter]**

3. Type in one of the following EMM.SYS command lines depending upon which Everex memory board you have:

   For Everex memory boards with model numbers EV-165, EV-165A, and EV-173 type:

   device = emm.sys **[enter]**

   For Everex memory boards with any other model numbers type:

   device = emm.sys 258,00 **[enter]**

   Where 258 and 00 are the port address, and logical starting page of the EMS memory.

4. If you wrote down the contents of a previous config.sys file, type the previous contents back in now.

   [F6] **[enter]**

   Pressing the [F6] function key and the [enter] key will save your new config.sys file.

5. To confirm that "device=emm.sys" is now in the config.sys file, type: **TYPE CONFIG.SYS [ENTER].** This command will list the contents of your config.sys file.

6. Reboot your system and the EMM.SYS program will report the status of the expanded memory. If everything is operating correctly, a message similar to

"Expanded Memory Manager Installed" will be displayed.

EMM.SYS Command Line Arguments

Although the command line "device=emm.sys" with its default values is fine for most users, the EMM.SYS expanded memory manager lets you specify certain parameters in the CONFIG.SYS command line. The format of the command line is as follows:

device = [\path]emm.sys [/c] [pppp] [port,page]* [/v(:nnn)] [/d] [/h(:nnn)]

The [ ] characters are for your reference only; do NOT type in the [ ] characters.

* Do NOT use the [port,page] parameter in the command line with Everex memory board model numbers EV-165, EV-165A, or EV-173. In contrast, the [port,page] parameter is NOT optional for all the other Everex memory board model numbers.

Where:

\path defines the location of the directory where the EMM.SYS program is stored for those who prefer not to have the program in their root directory. If you would like EMM.SYS in your root directory, omit the **\path** option altogether.

/c informs EMM.SYS to chain interrupt vector 67 Hex. If you have another device that uses interrupt vector 67 Hex, such as AST's PC-NET II adapter, include the **/c** option in your command line. The LIM EMS specification defines this vector as a means of performing EMS service calls.

pppp informs EMM.SYS to start searching for a page frame at a particular segment address. The page frame is the first valid address of the EMS memory mapping window. If the specified page frame is occupied (for example, by a ROM or a RAM), EMM.SYS will scan starting from the next page frame address for an alternate unused 64 kbyte area. The

search will continue up to, and including, address E000. If the search fails to find an unused 64 kbyte area, a message is printed and the search terminated. Valid page frame addresses are C400, C800, CC00, and D000. The default value is C400.

NOTE: Four additional page frame addresses are available and these are D400, D800, DC00, and E000. However, these four addresses do not work in AT computers whose BIOS and BASIC ROMs occupy address segments below F000.

port,page communicates to EMM.SYS that an Expanded Memory board is addressable at a given port, beginning at a specific page. Do NOT use this parameter if you have an Everex board model number EV-165, EV-165A, or EV-173. Valid port addresses are 208, 218, 258, 268, 2A8, 2B8, and 2E8. Valid logical page values range from 00 to 7F (HEX).

NOTE: If you have used an Everex memory board to upgrade your computer's system board memory, for example, from 512K to 640K, do NOT

use logical pages 00-07; these pages are used for the memory upgrade. The next available logical page would be 08.

/V:nnn informs EMM.SYS to use the Extended Memory found on the IBM PS/2 2 Megabyte Expansion board and other compatible cards as Expanded Memory. **nnn** is the number of 16 kbyte pages to use for this purpose, with the pages ranging from 1 to 896.

/D tells EMM.SYS *not* to check the default page frame. As a result, the page frame will not be checked for a possible RAM or ROM.

/H:nnn informs EMM.SYS of the maximum number of Expanded Memory handles to support. Using fewer handles reduces the amount of base memory the Expanded Memory Manager will occupy. **nnn** is the number of handles, and ranges from 64 to 255. The default value is 64.

Examples of Optional Command Lines:

1. **DEVICE = EMM.SYS CC00 [ENTER]**

This command line locates the page frame address at CC00. If the page frame address you specify is occupied (for example, by a ROM or RAM), EMM.SYS will scan from the next valid address for an alternate unused 64K area. The search will continue up to (and including) address E000. If the search does not find a valid 64K area, the message "No room on motherboard for page frame" will appear, and the search will terminate.

2. **DEVICE=EMM.SYS D000 2A8, 08 [ENTER]**

This command line begins page frame addressing at D000, selects the EMS port address at 2A8, and assigns the logical EMS starting page at 08H. In this example, we assume that the computer's base memory was 512K, and that the Everex memory board was used to upgrade the base memory from 512K to 640K. In this case, the first 8 logical pages from 00-07 Hex are already being used. Therefore, we assign the EMS memory the next available logical page at 08H.

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