MANAGING EXTENDED MEMORY WITH THE TEMMXL2 DRIVER

TemmXL2 is an expanded memory manager driver. To use TemmXL2:

1. Use the MS-DOS COPY command to copy temmXL2.sys to your hard disk.

2. Add a DEVICE command to your config.sys file: device=\path\temmXL2.sys
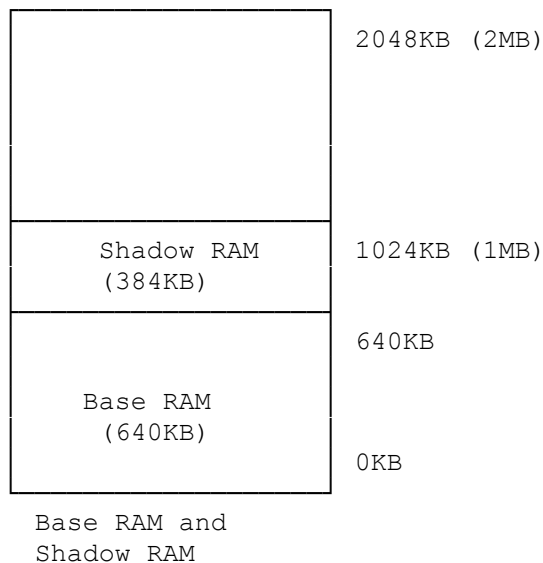   where path is the directory that contains temmXL2.sys

Refer to an MS-DOS reference manual if you need more information about the
COPY command or the DEVICE command. Refer to "Using TemmXL2" for more
information about the TemmXL2 DEVICE command.

In order to understand the function of this driver, you need to know the
definitions of shadow RAM, expanded memory, and extended memory.

SHADOW RAM

The first 640KB of RAM in any system is called base RAM. Base RAM is reserved
for your operating system and applications. Memory from 640KB to 1024KB (a
total of 384KB) is called shadow RAM. Your system BIOS (Basic Input-Output
System) uses a portion of shadow RAM. Video BIOS and SCSI BIOS (if applicable
to your computer) might also use shadow RAM.

The following diagram illustrates base RAM and shadow RAM in a 2MB memory
configuration:

```
          ┌─────────────────────┐
          │                     │  2048KB (2MB)
          │                     │
          │                     │
          │                     │
          ├─────────────────────┤
          │    Shadow RAM       │  1024KB (1MB)
          │     (384KB)         │
          ├─────────────────────┤
          │                     │  640KB
          │    Base RAM         │
          │     (640KB)         │
          │                     │  0KB
          └─────────────────────┘
            Base RAM and
            Shadow RAM
```
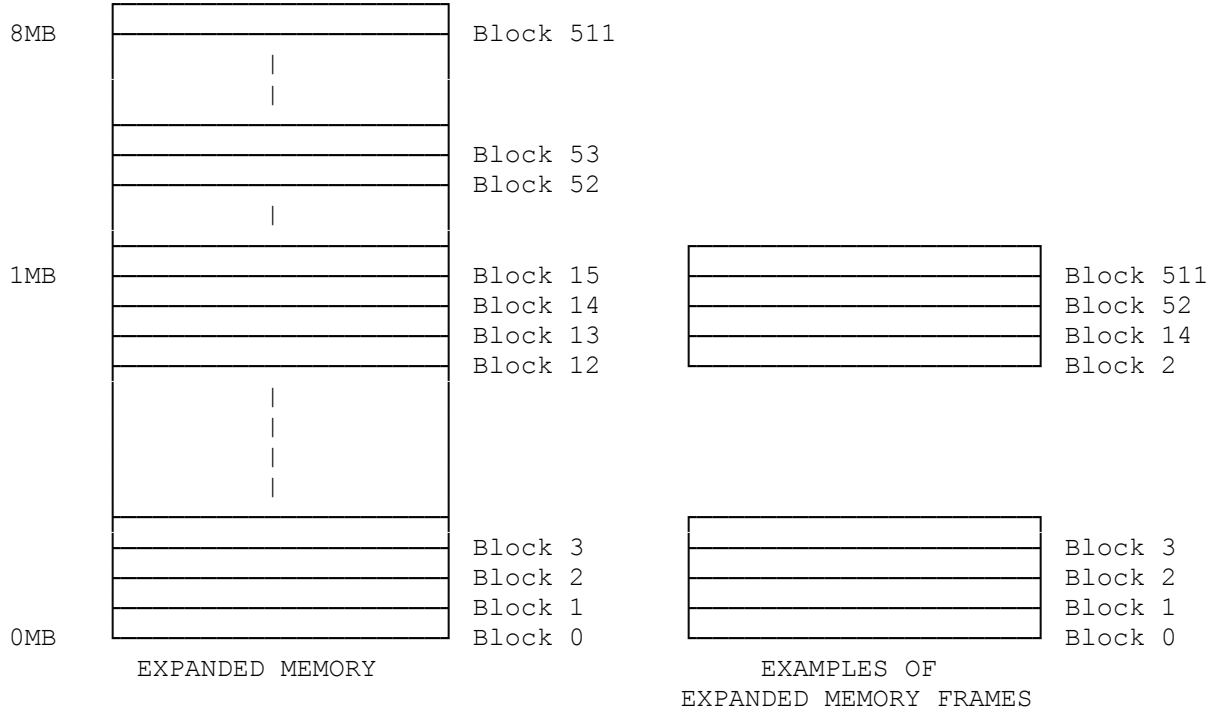
EXPANDED MEMORY

Early microprocessors were not equipped to recognize memory address beyond
1 MB (1024KB) of memory. When additional memory was required, systems based on
such processors relied on expanded memory.

NOTE: The maximum amount of memory that can be used in this computer is 16MB.
See "Memory Configurations" in the "Installing Optional Hardware" section for

more information.

Expanded memory was stored on a separate adapter, and it used a different addressing protocol from base and shadow RAM. Expanded memory was accessed in blocks of 16KB called pages. A group of four pages is a frame. The blocks in a page are not necessarily adjacent in the available supply of physical expanded memory.

The following diagram shows two examples of valid frames. One includes sequential blocks; the other does not.

```
8MB  ┌──────────────────┐  Block 511
     │        |         │
     │        |         │
     ├──────────────────┤  Block 53
     ├──────────────────┤  Block 52
     │        |         │
1MB  ├──────────────────┤  Block 15          ┌──────────────────┐  Block 511
     ├──────────────────┤  Block 14          ├──────────────────┤  Block 52
     ├──────────────────┤  Block 13          ├──────────────────┤  Block 14
     ├──────────────────┤  Block 12          └──────────────────┘  Block 2
     │        |         │
     │        |         │
     │        |         │
     │        |         │
     ├──────────────────┤  Block 3           ┌──────────────────┐  Block 3
     ├──────────────────┤  Block 2           ├──────────────────┤  Block 2
     ├──────────────────┤  Block 1           ├──────────────────┤  Block 1
0MB  └──────────────────┘  Block 0           └──────────────────┘  Block 0
       EXPANDED MEMORY                            EXAMPLES OF
                                           EXPANDED MEMORY FRAMES
```
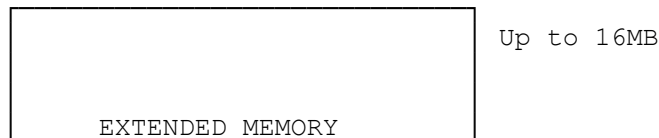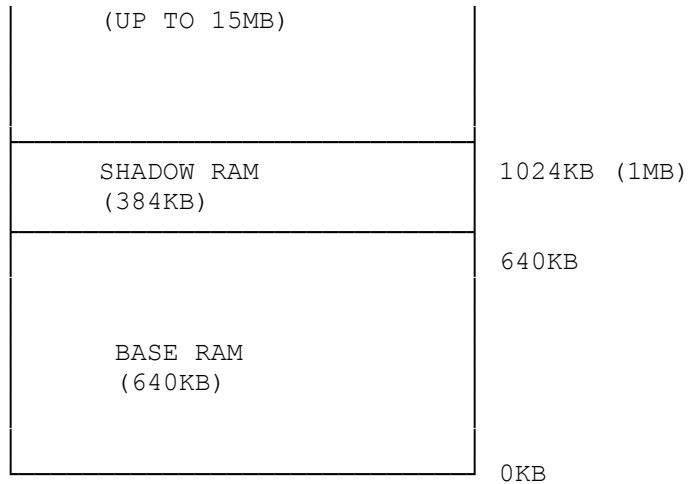
EXTENDED MEMORY

Current microprocessor technology supports memory beyond 1MB, so expanded memory is no longer required. Instead, current technology uses extended memory, defined as all memory (RAM) beyond the 1 MB boundary, to emulate expanded memory.

To emulate expanded memory, the processor copies a 64KB page (four 16KB blocks) of extended memory into a 64KB segment of RAM between 640KB and 1024KB. The beginning of the 64KB segment is called the frame address. Since RAM from 640KB to 1024KB is within the 1MB boundary, it is accessible to the processor.

The following diagram shows base RAM, shadow RAM, and extended memory:

```
┌──────────────────────┐  Up to 16MB
│                      │
│                      │
│   EXTENDED MEMORY    │
```

```
        (UP TO 15MB)
        |
        |
        |_____
        |                      |
        |    SHADOW RAM        |    1024KB (1MB)
        |    (384KB)           |
        |_____|
        |                      |    640KB
        |                      |
        |    BASE RAM          |
        |    (640KB)           |
        |                      |
        |                      |
        |_____|    0KB
```

                EXTENDED MEMORY

USING TEMMXL2

You can install up to 5MB of memory on the main logic board in your computer.
All memory above 1MB on the main logic board is extended memory (up to 4MB
total extended memory).

TemmXL2.sys uses the extended memory to emulate expanded memory as defined in
the LIM (Lotus/Intel/Microsoft) 4.0 expanded memory specification. For
example, if you have 2MB installed on the main logic board, TemmXL2 uses up to
1MB to emulate expanded memory. If you have 5MB installed, TemmXL2 uses up to
4MB to emulate expanded memory.

TemmXL2 only uses the memory that is on the main logic board. The memory
between 640KB and 1MB either can be used as shadow RAM or can be used by
TemmXL2 to emulate expanded memory.

If your system is configured with 1MB of memory, a shadow RAM configuration
field is displayed when you run the setup utility. The default option of the
field configures the memory between 640KB and 1MB as shadow RAM with 0KB of
extended memory. To use shadow RAM as extended memory, select the alternate
option of the shadow RAM configuration field. After selecting the alternate
option, you must set the amount of extended memory to 384KB; TemmXL2 can use
this memory to emulate expanded memory. If you need to change the amount of
extended memory after configuring shadow RAM as extended memory, you must
first run Setup to reconfigure the memory utility for more information about
the fields displayed on the Setup configuration screen.

To use TemmXL2:

1. Copy temmXL2.sys from the Startup and Operating Diskette to your hard disk.
To do this, insert the Startup and Operating Diskette into Drive A and type
the following command at the MS-DOS system prompt (A> or C>):
    copy a:temmXL2.sys c: Then press <ENTER>.

2. Add a DEVICE command for TemmXL2 to your config.sys file. The format for
the TemmXL2 DEVICE command is: device = temmXL2.sys options

If you want to use expanded memory with other device drivers, the temmXL2.sys

DEVICE command must by listed before the DEVICE commands for the other drivers in your config.sys file. See and MS-DOS reference manual for more information.

The command options for temmXL2.sys are summarized in the following chart. The symbols ddd, ddddd, xx, and xxxx represent different types of numbers, as follows:

ddd = a 1-byte decimal value, 0 to 255
ddddd = a 1-word decimal value, 0 to 65535
xx = a 1-byte hexadecimal value, 00 to FF
xxxx = a 1-word hexadecimal value, 0000 to FFFF

When typing the DEVICE command, separate all options with spaces.

For example, device = temmXL2.sys /m=384 /f

TEMMXL2 OPTIONS

If xxxx is not a controller address, the memory manager initialization routines will fail.

/m=ddddd

 Specifies to the memory manager the number of kilobytes of extended memory that can be used for EMS memory. For example, /m=384 indicates that 384KB of available memory can be used. If ddddd is not a multiple of 16, TemmXL2 rounds it to the next higher multiple of 16.

/c=ddd

Sets the number of contexts (3 to 255) that EMS can save simultaneously. For example, /c=8 indicates that EMS can save eight contexts simultaneously.

/d=ddd

Sets the depth of a context (the number of registers, 1 to 32 that can be saved. For example, /d=12 specifies that each stack frame can hold 12 registers.

/h=ddd

Sets the maximum number of handles (3 to 255) the manager can have open at the same time. For example, /h=128 specifies that 128 handles can be open at the same time.

/x=xxxx-xxxx

Causes the memory manager to exclude the specified address range from paging. For example, /x=COOO-CFFF excludes the range COOO to CFFF.

Use the /x option to exclude portions of RAM specifically required by other options or programs in your computer.

NOTE: You do not need to use /x to exclude the address ranges for ROM and standard video adapters. The memory manager automatically excludes these ranges.

The memory manager considers both the start address and the end address to be paragraph addresses. If either address is not a multiple of 1000 (hexadecimal), the memory manager rounds the address to the next higher multiple of 1000. An error occurs if the start address is higher that the end address.

/f

Selects full display mode; displays the status of the memory manager.

/z

Disables memory testing during memory manager initialization.