Memory Map

存储映射

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This article describes the contents of the computer's physical memory at the moment that the BIOS jumps to your bootloader code.

本文介绍了计算机的物理内存中的内容，在BIOS跳转到你的bootloader代码的那一刻。

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"Low" memory (< 1 MiB)

“低”的记忆

When a typical x86 PC boots it will be in Real Mode, with an active BIOS. During the time the CPU remains in Real Mode, IRQ0 (the clock) will fire repeatedly, and the hardware that is used to boot the PC (floppy, hard disk, CD, Network card, USB) will also generate IRQs. This means that during the PC boot process, the Real Mode IVT (see below) must be carefully preserved, because it is being used.

当一个典型的x86 PC启动，它会在实模式下，以活动的BIOS。在CPU仍然在实模式下的过程中，IRQ0的（时钟中断）将触发反复，用来引导电脑（硬盘，软盘，光盘，网卡，USB接口）的硬件也会产生的IRQ。这意味着实模式IVT（中断向量表），在电脑开机过程中，必须小心保存，因为它正在使用。

When the IVT is activated by an IRQ, it will call a BIOS routine to handle the IRQ. Bootloaders will also access BIOS functions. This means that the two memory workspaces that the BIOS uses (the BDA and the EBDA) must also be carefully preserved during boot. Also, every time the BIOS handles an IRQ0 (18 times a second), several bytes in the BDA get overwritten by the BIOS -- so do not attempt to store anything there while IRQs are active in Real Mode.

当一个IRQ启动IVT的，它会调用BIOS例程来处理IRQ。引导程序还将访问BIOS功能。这意味着，两个内存工作区，BIOS使用（BDA和EBDA）也必须被仔细地保存在引导过程中。此外，每次BIOS（基本输入输出系统）处理IRQ0的（第二次的18倍），在BDA的几个字节被覆盖由BIOS - 所以不要尝试任何有存储，而活跃在实模式下的IRQ。

After all the BIOS functions have been called, and your kernel is loaded into memory somewhere, the bootloader or kernel may exit Real Mode forever (often by going into 32bit Protected Mode). If the kernel never uses Real Mode again, then the first 0x500 bytes of memory in the PC may be reused and overwritten. (However, it is very common to temporarily return to Real Mode in order to change the Video Display Mode.)

在所有的BIOS功能被调用后，和你的内核加载到内存中某处的bootloader或内核可能永远退出实模式（通常是由32位保护模式）。如果内核从未再次使用实模式，然后在PC机的内存量0x500字节可重复使用和覆盖。 （然而，这是很常见的暂时返回到实模式，以改变视频显示模式。）

When the CPU is in Protected Mode, System Management Mode (SMM) is still invisibly active, and cannot be shut off. SMM also seems to use the EBDA. So the EBDA memory area should never be overwritten.

当CPU在保护模式下，系统管理模式（SMM）仍是无形积极，不能被关闭。 SMM的似乎也使用EBDA。所以的EBDA内存区域应该永远不会被改写。

Note: the EBDA is a variable-sized memory area (on different BIOSes). If it exists, it is always immediately below 0xA0000 in memory. It is absolutely guaranteed to be less than 128 KiB in size. It is often 1 KiB. The biggest ones ever actually seen are 8 KiB. You can determine the size of the EBDA by using BIOS function INT 12h, or (often) by examining the word at 0x40E in the BDA (see below). Both of those methods will tell you the location of the bottom of the EBDA.

注：EBDA是一个可变大小的内存区域（不同的BIOS）。如果它存在，它始终是立即内存0xA0000以下。这是绝对保证是在规模小于128 KB。它往往是1 KB。实际上看到的最大的是8 KB。你可以使用BIOS功能INT12H，（通常）在BDA通过检查这个词在0x40E（见下文）确定大小的EBDA。这些方法都会告诉你的EBDA底部的位置。

It should also be noted that your bootloader code is probably loaded and running in memory at physical addresses 0x7C00 through 0x7DFF. So that memory area is likely to also be unusable until execution has been transferred to a second stage bootloader, or to your kernel.

还应当指出，你的bootloader代码是可能加载在内存中运行，在物理地址通过0x7C00-0x7DFF。因此，该内存区域很可能也无法使用，直到执行已转移到第二阶段引导程序，或到你的内核。

Overview

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 开始 | 结束 | 大小 | 类型 | 描述 |
| 0x00000000 | 0x000003FF | 1 KB  256\*4B | RAM - partially unusable (see above) | Real Mode IVT (Interrupt Vector Table) |
| 0x00000400 | 0x000004FF | 256 bytes | RAM - partially unusable (see above) | BDA (BIOS data area) |
| 0x00000500 | 0x00007BFF | almost 30KB | RAM (guaranteed free for use) | Conventional memory |
| 0x00007C00 | 0x00007DFF | 512 bytes | RAM - partially unusable (see above) | Your OS BootSector |
| 0x00007E00 | 0x0007FFFF | 480.5 KB | RAM (guaranteed free for use) | Conventional memory |
| 0x00080000 | 0x0009FBFF | approximately 120KB, depending on EBDA size | RAM (free for use, if it exists) | Conventional memory |
| 0x0009FC00(typical location) | 0x0009FFFF | 1 KB | RAM (unusable) | EBDA (Extended BIOS Data Area) |
| 0x000A0000 | 0x000FFFFF | 384 KB | various (unusable) | Video memory, ROM Area |
|  |  |  |  |  |
| 0x00100000 | 0x00EFFFFF | 14 MB | RAM -- free for use (if it exists) | Extended memory |
| 0x00F00000 | 0x00FFFFFF | 1 MB | Possible memory mapped hardware | ISA Memory Hole 15-16MB |
| 0x01000000 |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Overview

Low Memory (the first MiB)

start end size type description

0x00000000 0x000003FF 1KB RAM - partially unusable (see above) Real Mode IVT (Interrupt Vector Table)

0x00000400 0x000004FF 256 bytes RAM - partially unusable (see above) BDA (BIOS data area)

0x00000500 0x00007BFF almost 30KB RAM (guaranteed free for use) Conventional memory

0x00007C00 (typical location) 0x00007DFF 512 bytes RAM - partially unusable (see above) Your OS BootSector

0x00007E00 0x0007FFFF 480.5 KB RAM (guaranteed free for use) Conventional memory

0x00080000 0x0009FBFF approximately 120KB, depending on EBDA size RAM (free for use, if it exists) Conventional memory

0x0009FC00 (typical location) 0x0009FFFF 1 KB RAM (unusable) EBDA (Extended BIOS Data Area)

0x000A0000 0x000FFFFF 384 KB various (unusable) Video memory, ROM Area

BIOS Data Area (BDA)

The BDA is only partially standardized, and almost all the values stored there are completely obsolete and uninteresting. The following is a partial list. See the External Links references below for more detail.

address (size) description

0x0400 (4 words) IO ports for COM1-COM4 serial (each address is 1 word, zero if none)

0x0408 (3 words) IO ports for LPT1-LPT3 parallel (each address is 1 word, zero if none)

0x040E (word) EBDA base address >> 4 (usually!)

0x0410 (word) packed bit flags for detected hardware

0x0417 (word) keyboard state flags

0x041E (32 bytes) keyboard buffer

0x0449 (byte) Display Mode

0x044A (word) number of columns in text mode

0x0463 (2 bytes, taken as a word) base IO port for video

0x046C (word) # of IRQ0 timer ticks since boot

0x0475 (byte) # of hard disk drives detected

0x0480 (word) keyboard buffer start

0x0482 (word) keyboard buffer end

0x0497 (byte) last keyboard LED/Shift key state

Extended BIOS Data Area (EBDA)

You may see "maps" of the EBDA if you search the web. However, those maps are for the original IBM BIOS EBDA. They do not apply to any current EBDA, used by any current BIOS. The EBDA area is not standardized. It does contain data that your OS will need, but you must do a bytewise pattern search to find those tables. (See Plug-and-Play.)

ROM Areastart end size region/exception description

Standard usage of the ROM Area

0x000A0000 0x000BFFFF 128 KiB video RAM VGA display memory

0x000C0000 0x000C7FFF 32 KiB (typically) ROM Video BIOS

0x000C8000 0x000EFFFF 160 KiB (typically) ROMs and unusable space Mapped hardware & Misc.

0x000F0000 0x000FFFFF 64 KiB ROM Motherboard BIOS

"Upper" Memory (> 1 MiB)

The region of RAM above 1 MiB is not standardized, well-defined, or contiguous. There are likely to be regions of it that contain memory mapped hardware, that nothing but a device driver should ever access. There are likely to be regions of it that contain ACPI tables which your initialization code will probably want to read, and that then can be overwritten and reused. Some ACPI areas cannot be "reclaimed" this way. Some of the computer's RAM may extend above 4 GiB.

Use the BIOS function INT 15h, EAX=0xE820 to get a reliable map of Upper Memory.

High Memory

start end size region/exception description

0x00100000 0x00EFFFFF 0x00E00000 (14 MiB) RAM -- free for use (if it exists) Extended memory 1, 2

0x00F00000 0x00FFFFFF 0x00100000 (1 MB) Possible memory mapped hardware ISA Memory Hole 15-16MB 3

0x01000000 ???????? ???????? (whatever exists) RAM -- free for use More Extended memory 1

0xC0000000 (sometimes, depends on motherboard and devices) 0xFFFFFFFF 0x40000000 (1 GiB) various (typically reserved for memory mapped devices) Memory mapped PCI devices, PnP NVRAM?, IO APIC/s, local APIC/s, BIOS, ...

0x0000000100000000 (possible memory above 4 GiB) ???????????????? ???????????????? (whatever exists) RAM -- free for use (PAE/64bit) More Extended memory 1

???????????????? ???????????????? ???????????????? Possible memory mapped hardware Potentially usable for memory mapped PCI devices in modern hardware (but typically not, due to backward compatibility)

1: Different computers have different amounts of RAM, therefore the amount of extended memory you might find will vary and may be anything from "none" (e.g. an old 80386 system) to "lots".

2: Free for use except that your bootloader (ie. GRUB) may have loaded your "modules" here, and you don't want to overwrite those.

3: The "ISA Memory Hole" (from 0x00F00000 to 0x00FFFFFF) was used for memory mapped ISA devices (e.g. video cards). Modern computers have no need for this hole, but some chipsets still support it (as an optional feature) and some motherboards may still allow it to be enabled with BIOS options, so it may exist in a modern computers with no ISA devices.

CommentsSee AlsoDetecting Memory (x86)

External Linkshttp://www.nondot.org/sabre/os/files/Booting/BIOS\_SEG.txt -- detailed BIOS Data Area map

Format of BIOS Data Segment at segment 40h:

{items in curly braces not documented by IBM}

Offset Size Description

00h WORD Base I/O address of 1st serial I/O port, zero if none

02h WORD Base I/O address of 2nd serial I/O port, zero if none

04h WORD Base I/O address of 3rd serial I/O port, zero if none

06h WORD Base I/O address of 4th serial I/O port, zero if none

Note: Above fields filled in turn by POST as it finds serial

ports. POST never leaves gaps. DOS and BIOS serial device

numbers may be redefined by re-assigning these fields.

08h WORD Base I/O address of 1st parallel I/O port, zero if none

0Ah WORD Base I/O address of 2nd parallel I/O port, zero if none

0Ch WORD Base I/O address of 3rd parallel I/O port, zero if none

0Eh WORD [non-PS] Base I/O address of 4th parallel I/O port, zero if none

[PS] Segment of Extended BIOS Data Segment

Note: Above fields filled in turn by POST as it finds

parallel ports. POST never leaves gaps. DOS and BIOS

parallel device numbers may de redefined by re-assigning

these fields.

10h WORD Installed hardware:

bits 15-14: number of parallel devices

bit 13: [Conv] Internal modem

bit 12: reserved

bits 11- 9: number of serial devices

bit 8: reserved

bits 7- 6: number of diskette drives minus one

bits 5- 4: Initial video mode:

00b = EGA,VGA,PGA

01b = 40 x 25 color

10b = 80 x 25 color

11b = 80 x 25 mono

bit 3: reserved

bit 2: [PS] =1 if pointing device

[non-PS] reserved

bit 1: =1 if math co-processor

bit 0: =1 if diskette available for boot

12h BYTE [Conv] POST status

[AT] {Manufacturing test initialisation flags}

13h WORD Base memory size in kbytes (0-640)

15h BYTE [AT] {Manufacturing test scratch pad}

16h BYTE [AT] {Manufacturing test scratch pad}

[PS/2 Mod 30] BIOS control flags

17h BYTE Keyboard status flags 1:

bit 7 =1 INSert active

bit 6 =1 Caps Lock active

bit 5 =1 Num Lock active

bit 4 =1 Scroll Lock active

bit 3 =1 either Alt pressed

bit 2 =1 either Ctrl pressed

bit 1 =1 Left Shift pressed

bit 0 =1 Right Shift pressed

18h BYTE Keyboard status flags 2:

bit 7 =1 INSert pressed

bit 6 =1 Caps Lock pressed

bit 5 =1 Num Lock pressed

bit 4 =1 Scroll Lock pressed

bit 3 =1 Pause state active

bit 2 =1 Sys Req pressed

bit 1 =1 Left Alt pressed

bit 0 =1 Left Ctrl pressed

19h BYTE Keyboard: Alt-nnn keypad workspace

1Ah WORD Keyboard: ptr to next character in keyboard buffer

1Ch WORD Keyboard: ptr to first free slot in keyboard buffer

1Eh 16 WORDs Keyboard circular buffer (but see 80h, 82h for override)

3Eh BYTE Diskette recalibrate status:

bit 7 =1 Diskette hardware interrupt occurred

bits 6-4 reserved

bit 3 =1 Recalibrate diskette 3

bit 2 =1 Recalibrate diskette 2

bit 1 =1 Recalibrate diskette 1

bit 0 =1 Recalibrate diskette 0

3Fh BYTE Diskette motor status:

bit 7 =1 current operation is write or format

=0 current operation is read or verify

bit 6 reserved

bits 5-4 diskette drive number selected (0-3)

bit 3 =1 diskette 3 motor on

bit 2 =1 diskette 2 motor on

bit 1 =1 diskette 1 motor on

bit 0 =1 diskette 0 motor on

40h BYTE Diskette motor turn-off time-out count

41h BYTE Diskette last operation status (0 = OK)

bit 7 =1 drive not ready

bit 6 =1 seek error

bit 5 =1 general controller failure

bits 4-0:

00h no error

01h invalid request

02h address mark not found

03h write-protect error

04h sector not found

06h diskette change line active

08h DMA overrun

09h DMA across 64k boundary

0Ch media type unknown

10h CRC error on read

42h 7 BYTEs Diskette/Fixed disk status/command bytes

49h BYTE Video current mode

4Ah WORD Video columns on screen

4Ch WORD Video page (regen buffer) size in bytes

4Eh WORD Video current page start address in regen buffer

50h 16 BYTEs Video cursor position (col, row) for eight pages, 0 based

60h WORD Video cursor type, 6845 compatible, hi=startline, lo=endline

62h BYTE Video current page number

63h WORD Video CRT controller base address: color=03D4h, mono=03B4h

65h BYTE Video current setting of mode select register 03D8h/03B8h

66h BYTE Video current setting of CGA palette register 03D9h

67h DWORD POST real mode re-entry point after certain resets

6Bh BYTE POST last unexpected interrupt

6Ch DWORD Timer ticks since midnight

70h BYTE Timer overflow, non-zero if has counted past midnight

71h BYTE Ctrl-Break flag: bit 7=1

72h WORD POST reset flag:

= 1234h if to bypass memory test (warm boot)

= 4321h [PS/2 MCA only] if to preserve memory

= 5678h [Conv] system suspended

= 9ABCh [Conv] manufacturing test mode

= ABCDh [Conv] POST loop mode

= 64h Burn-in mode

74h BYTE Fixed disk last operation status: {except ESDI drives}

00h no error

01h invalid function request

02h address mark not found

03h write protect error

04h sector not found

05h reset failed

07h drive parameter activity failed

08h DMA overrun

09h DMA data boundary error

0Ah bad sector flag detected

0Bh bad track detected

0Dh invalid number of sectors for Format

0Eh control data address mark detected

0Fh DMA arbitration level out of range

10h uncorrectable ECC or CRC error

11h ECC corrected data error

20h general controller failed

40h seek failed

80h time out

AAh drive not ready

BBh undefined error

CCh write fault on selected drive

E0h status error/error register is zero

FFh sense failed

75h BYTE Fixed disk: number of fixed disk drives

76h BYTE Fixed disk: control byte {IBM document only for XT}

77h BYTE Fixed disk: I/O port offset {IBM document only for XT}

78h 3 BYTEs Parallel devices 1-3 time-out counters

7Bh BYTE parallel device 4 time-out counter [non-PS]

bit 5 set if Virtual DMA Spec supported [PS] (see INT 4B)

7Ch 4 BYTEs Serial devices 1-4 time-out counters

80h WORD Keyboard buffer start as offset from segment 40h (normally 1Eh)

82h WORD Keyboard buffer end+1 as offset from segment 40h (normally 3Eh)

[XT BIOS dated 11/08/82 ends here]

84h BYTE Video EGA/MCGA/VGA rows on screen minus one

85h WORD Video EGA/MCGA/VGA character height in scan-lines

87h BYTE Video EGA/VGA control: [MCGA: =00h]

bit 7: =1 if not to clear RAM (see INT 10h, AH=00h)

bits 6-5: RAM on adapter = (this field + 1) \* 64K

bit 4: reserved

bit 3: =0 if EGA/VGA video system active, =1 if inactive

bit 2: =1 if to wait for display enable (what means this?)

bit 1: =0 for color or ECD monitor, =1 for mono monitor

bit 0: =0 alphanumeric cursor emulation enabled, =1 not.

When enabled, text mode cursor size (INT 10,AH=01h)

settings looking like CGA ones are translated to

equivalent EGA/VGA ones.

88h BYTE Video EGA/VGA switches: [MCGA: reserved]

bits 7-4: power-on state of feature connector bits 3-0

bits 3-0: configuration switches 4-1 (=0 on, =1 off)

Values as read:

0h Pri MDA, Sec EGA+old color display 40 x 25

1h Pri MDA, Sec EGA+old color display 80 x 25

2h Pri MDA, Sec EGA+ECD normal mode (CGA emul)

3h Pri MDA, Sec EGA+ECD enhanced mode

4h Pri CGA 40 x 25, Sec EGA mono display

5h Pri CGA 80 x 25, Sec EGA mono display

6h Pri EGA+old color display 40 x 25, Sec MDA

7h Pri EGA+old color display 80 x 25, Sec MDA

8h Pri EGA+ECD normal mode (CGA emul), Sec MDA

9h Pri EGA+ECD enhanced mode, Sec MDA

Ah Pri EGA mono display, Sec CGA 40 x 25

Bh Pri EGA mono display, Sec CGA 80 x 25

When bit4 of 40h:89h is 0, VGA emulates 350-line EGA if

this byte is x3h or x9h, otherwise emulates 200-line CGA in

400-line double scan. VGA resets this byte to x9h after the

mode set.

89h BYTE Video MCGA/VGA mode-set option control:

bits 7 and 4:

0 0 350-line mode requested

0 1 400-line mode at next mode set

1 0 200-line mode requested

1 1 reserved

Apparently VGA BIOS mode set disregards bit 7 and uses

byte 40h:88h to determine 200/350 selection when bit 4

is zero. Presumably bit 7 is a convenience for other

purposes. Bit 7 is reset to zero after the mode set.

bit 6: =1 if display switching enabled, =0 if disabled

bit 5: reserved

bit 4: [VGA] =1 if to use 400-line mode at next mode set

=0 if to emulate EGA at next mode set

This bit set to 1 after the mode set.

[MCGA] =1 use 400-line mode at next mode set

=0 emulate CGA, digital monitor, 200 lines,

8 x 8 text font at next mode set

Bit unchanged by mode set.

bit 3: =0 if default palette loading enabled at mode set

bit 2: =1 if mono display, =0 if color display

bit 1: =1 if gray scale summing enabled, =0 if disabled

bit 0: [VGA] =1 if VGA active, =0 if not

[MCGA] reserved, zero

8Ah BYTE Video [MCGA/VGA]: index into Display Combination Code table

8Bh BYTE Diskette media control [not XT]:

bits 7-6: Last data rate set by controller:

00=500kbps, 01=300kbps, 10=250kbps, 11=reserved

bits 5-4: Last diskette drive step rate selected

bits 3-2: {Data rate at start of operation}

bits 1-0: reserved

8Ch BYTE Fixed disk controller status [not XT]

8Dh BYTE Fixed disk controller Error Status [not XT]

8Eh BYTE Fixed disk Interrupt Control [not XT]

8Fh BYTE Diskette controller information [not XT]:

bit 7: reserved

bit 6: =1 drive 1 determined

bit 5: =1 drive 1 is multi-rate, valid if drive determined

bit 4: =1 drive 1 supports 80 tracks, always valid

bit 3: reserved

bit 2: =1 drive 0 determined

bit 1: =1 drive 0 is multi-rate, valid if drive determined

bit 0: =1 drive 0 supports 80 tracks, always valid

90h BYTE Diskette drive 0 media state

91h BYTE Diskette drive 1 media state

bits 7-6: Data rate: 00=500kbps, 01=300kbps, 10=250kbps

bit 5: =1 if double stepping reqd (e.g. 360kB in 1.2MB)

bit 4: =1 if media established

bit 3: reserved

bits 2-0: on exit from BIOS, contain:

000 trying 360kB in 360kB

001 trying 360kB in 1.2MB

010 trying 1.2MB in 1.2MB

011 360kB in 360kB established

100 360kB in 1.2MB established

101 1.2MB in 1.2MB established

110 reserved

111 all other formats/drives

92h BYTE Diskette drive 0 media state at start of operation

93h BYTE Diskette drive 1 media state at start of operation

94h BYTE Diskette drive 0 current track number

95h BYTE Diskette drive 1 current track number

96h BYTE Keyboard status byte 3

bit 7 =1 read-ID in progress

bit 6 =1 last code read was first of two ID codes

bit 5 =1 force Num Lock if read-ID and enhanced keyboard

bit 4 =1 enhanced keyboard installed

bit 3 =1 Right Alt pressed

bit 2 =1 Right Ctrl pressed

bit 1 =1 last code read was E0h

bit 1 =1 last code read was E1h

97h BYTE Keyboard status byte 2

bit 7 =1 keyboard transmit error flag

bit 6 =1 LED update in progress

bit 5 =1 RESEND received from keyboard

bit 4 =1 ACK received from keyboard

bit 3 reserved, must be zero

bit 2 Caps Lock LED

bit 1 Num Lock LED

bit 0 Scroll Lock LED

98h DWORD Timer2: [AT, PS exc Mod 30] ptr to user wait-complete flag

(see INT 15, AX=8300h)

9Ch DWORD Timer2: [AT, PS exc Mod 30] user wait count in microseconds

A0h BYTE Timer2: [AT, PS exc Mod 30] Wait active flag:

bit 7 =1 wait time elapsed

bits 6-1 reserved

bit 0 =1 INT 15h, AH=86h has occurred

A1h 7 BYTEs reserved for network adapters (oh really?)

A4h DWORD [PS/2 Mod 30] Saved Fixed Disk Interrupt Vector

A8h DWORD Video: EGA/MCGA/VGA ptr to Video Save Pointer Table (see below)

ACh-AFh reserved

B0h DWORD ptr to 3363 Optical disk driver or BIOS entry point.

When 3363 BIOS present, the signature "OPTIC ",00h occurs 3

bytes beyond this entry point.

When 3363 BIOS and 3363 File System Driver present, the

signature "FILE SYSTEM DRIVER",00h occurs 3 bytes beyond

this entry point.

B4h WORD reserved

B6h 3 BYTEs reserved for POST?

B9h 7 BYTEs ???

C0h 14 BYTEs reserved

CEh WORD count of days since last boot?

D0h-EFh reserved

F0h-FFh reserved for user

100h BYTE Print Screen Status byte

Format of Extended BIOS Data Area (see 40:0Eh for ptr) [PS only]

Offset Size Description

00h BYTE Length of EBDA in kilobytes

01h 15 BYTEs reserved

17h BYTE Number of entries in POST error log (0-5)

18h 5 WORDs POST error log (each word is a POST error number)

19h-21h reserved

22h DWORD Pointing Device Driver entry point

26h BYTE Pointing Device Flags 1

bit 7: =1 command in progress

bit 6: =1 resend

bit 5: =1 acknowledge

bit 4: =1 error

bit 3: =0 reserved

bits 2-0: index count

27h BYTE Pointing Device Flags 2

bit 7: =1 device driver far call flag

bits 6-3: reserved

bits 2-0: package size

28h 7 BYTEs Pointing Device Auxiliary Device Data

2Fh BYTE reserved

30h DWORD Vector for INT 07h stored here during 80387 interrupt

34h DWORD Vector for INT 01h stored here during INT 07h emulation

38h BYTE Scratchpad for 80287/80387 interrupt code

39h WORD Timer3: Watchdog timer initial count

3Bh BYTE ??? seen non-zero on Model 30

3Ch BYTE ???

3Dh 16 BYTEs Fixed Disk parameter table for drive 0 (oh really?)

4Dh 16 BYTEs Fixed Disk parameter table for drive 1 (oh really?)

Neither of above seen on any Model 30, 50, 60 yet.

5Dh-6Bh ???

6Ch BYTE Fixed disk: (=FFh on ESDI systems)

bits 7-4: Channel number 00-0Fh

bits 3-0: DMA arbitration level 00-0Eh

6Dh and up: ??? seen non-zero on Model 60

3F0h BYTE Fixed disk buffer (???!!!)

Format of Video Save Pointer Table [EGA/VGA/MCGA only]:

Offset Size Description

00h DWORD ptr to Video Parameter Table

04h DWORD ptr to Parameter Dynamic Save Area, else 0 [EGA/VGA only]

08h DWORD ptr to Alphanumeric Character Set Override, else 0

0Ch DWORD ptr to Graphics Character Set Override, else 0

10h DWORD [VGA only] ptr to Secondary Save Pointer Table, must be valid

14h DWORD reserved, zero

18h DWORD reserved, zero

Note: table initially in ROM, copy to RAM to alter, then update 40h:A8h.

Format of Secondary Video Save Pointer Table [VGA only]:

Offset Size Description

00h WORD Length of this table in bytes, including this word (1Ah)

02h DWORD ptr to Display Combination Code Table, must be valid

06h DWORD ptr to second Alphanumeric Character Set Override, else 0

0Ah DWORD ptr to User Palette Profile Table, else 0

0Eh DWORD reserved, zero

12h DWORD reserved, zero

16h DWORD reserved, zero

Note: table initially in ROM, copy to RAM to alter, then alter Save Ptr Table.

Format of Video Parameter Table [EGA, VGA only]:

An array of 23 [EGA] or 29 [VGA] elements, each element being 64 bytes long.

Elements appear in the order:

00h-03h Modes 00h-03h in 200-line CGA emulation mode

04h-0Eh Modes 04h-0Eh

0Fh-10h Modes 0Fh-10h when only 64kB RAM on adapter

11h-12h Modes 0Fh-10h when >64kB RAM on adapter

13h-16h Modes 00h-03h in 350-line mode

17h VGA Modes 00h or 01h in 400-line mode

18h VGA Modes 02h or 03h in 400-line mode

19h VGA Mode 07h in 400-line mode

1Ah-1Ch VGA Modes 11h-13h

Format of Video Parameter Table element [EGA, VGA only]:

Offset Size Description

00h BYTE Columns on screen (see 40h:4Ah)

01h BYTE Rows on screen minus one (see 40h:84h)

02h BYTE Height of character in scan lines (see 40h:85h)

03h WORD Size of video buffer (see 40h:4Ch)

05h 4 BYTEs Values for Sequencer Registers 1-4

09h BYTE Value for Miscellaneous Output Register

0Ah 25 BYTEs Values for CRTC Registers 00h-18h

23h 20 BYTEs Values for Attribute Controller Registers 00h-13h

37h 9 BYTEs Values for Graphics Controller Registers 00h-08h

Format of Video Parameter Table [MCGA only] {guesswork from inspection}:

- 16 triplet BYTEs of R,G,B DAC info for 16 colors;

- An array of 11 elements, each element being 32 bytes long.

Elements appear in the order:

Modes 00h,01h in 200-line mode for digital displays

Modes 00h,01h in 400-line mode for analog displays

Modes 02h,03h in 200-line mode for digital displays

Modes 02h,03h in 400-line mode for analog displays

Modes 04h,05h in 200-line mode for digital displays

Modes 04h,05h in 400-line mode for analog displays

Mode 06h in 200-line mode for digital displays

Mode 06h in 400-line mode for analog displays

Mode 11h

Mode 13h in 200-line mode for digital displays

Mode 13h in 400-line mode for analog displays

Format of Video Parameter Table element [MCGA only]:

Offset Size Description

00h BYTE Columns on screen (see 40h:4Ah)

01h BYTE Rows on screen minus one (see 40h:84h)

02h BYTE Height of character in scan lines (see 40h:85h)

03h WORD Size of video buffer (see 40h:4Ch)

05h WORD ??? always zero

07h 21 BYTEs Video data registers 00h-14h to port 3D5h indexed by 3D4h

1Ch BYTE PEL Mask to port 3C6h

1Dh BYTE CGA Mode Control to port 3D8h

1Eh BYTE CGA Border Control to port 3D9h

1Fh BYTE Extended Mode Control to port 3DDh

Format of Video Parameter Dynamic Save Area [EGA, VGA only]:

Offset Size Description

00h 16 BYTEs Last data written to Attribute Controller Palette Registers 0-15

10h BYTE Last data written to Attribute Controller Overscan Register

11h-FFh Reserved

Note: Need for table was that EGA registers were write-only.

Note: If default values (from the Video Parameter Table) are

over-ridden at a mode set by the VGA User Palette Profile

Table, then the Dynamic Save Area is updated with the

default values, not the User Profile ones.

Format of Alphanumeric Character Set Override:

Offset Size Description

00h BYTE Length in bytes of each character in font table

01h BYTE Character generator RAM bank to load, 0=normal

02h WORD Number of characters in font table, normally 256

04h WORD Code of first character in font table, normally 0

06h DWORD ptr to font table

0Ah BYTE Displayable rows (FFh=use maximum calculated value)

0Bh BYTEs Array of mode values to which this font is to pertain

BYTE FFh end of array

Format of Second Alphanumeric Character Set Override:

Authorities differ, some say same as first override above, but IBM say:

Offset Size Description

00h BYTE Length in bytes of each character in font table

01h BYTE Character generator RAM bank to load, normally non-zero

02h BYTE reserved

03h DWORD ptr to font table

07h BYTEs Array of mode values to which this font is to pertain

BYTE FFh end of array

Format of Graphics Character Set Override:

Offset Size Description

00h BYTE Number of displayable character rows

01h WORD Length in bytes of each character in font table

03h DWORD ptr to font table

07h BYTEs Array of mode values to which this font is to pertain

BYTE FFh end of array

Format of Display Combination Code Table [VGA only]:

Offset Size Description

00h BYTE Number of entries in the DCC table at offset 04h

01h BYTE Version number

02h BYTE Maximum display type code that can appear in DCC table

03h BYTE reserved

04h ARRAY OF 2 BYTEs Each pair of bytes gives a valid display combination

Meaning of each byte:

00h no display

01h MDA with mono display

02h CGA with color display

03h reserved

04h EGA with color display

05h EGA with mono display

06h Professional Graphics Controller

07h VGA with mono display

08h VGA with color display

09h reserved

0Ah MCGA with digital color display

0Bh MCGA with analog mono display

0Ch MCGA with analog color display

FFh unrecognised video system

Format of User Palette Profile Table [VGA only]:

Offset Size Description

00h BYTE Underlining: 01h=enable in all alphanumeric modes

00h=enable in monochrome alphanumeric modes only

FFh=disable in all alphanumeric modes

01h BYTE reserved

02h WORD reserved

04h WORD Number (0-17) of Attribute Controller registers in table

06h WORD Index (0-16) of first Attribute Controller register in table

08h DWORD ptr to table of Attribute Controller registers to override

Table is an array of BYTEs.

0Ch WORD Number (0-256) of video DAC Color registers in table

0Eh WORD Index (0-255) of first video DAC Color register in table

10h DWORD ptr to table of video DAC Color registers to override

Table is ??? triplets ??? of BYTEs???

14h BYTEs array of mode values to which this profile is to pertain

BYTE FFh end of array

http://www.bioscentral.com/misc/bda.htm -- another detailed BIOS Data Area map

Geezer's memory layout description

When power is applied to the computer, the BIOS Data Area is created at memory location 0040:0000h with a typical size of 255 bytes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Offset Hex | Offset Dec | BIOS Service | Field Size | Function |
| 00h | 0 | Int 14h | 2 bytes | Base I/O address for serial port 1 (communications port 1 - COM 1) |
| 02h | 2 | Int 14h | 2 bytes | Base I/O address for serial port 2 (communications port 2 - COM 2) |
| 04h | 4 | Int 14h | 2 bytes | Base I/O address for serial port 3 (communications port 3 - COM 3) |
| 06h | 6 | Int 14h | 2 bytes | Base I/O address for serial port 4 (communications port 4 - COM 4) |
| 08h | 8 | Int 17h | 2 bytes | Base I/O address for parallel port 1 (printer port 1 - LPT 1) |
| 0Ah | 10 | Int 17h | 2 bytes | Base I/O address for parallel port 2 (printer port 2 - LPT 2) |
| 0Ch | 12 | Int 17h | 2 bytes | Base I/O address for parallel port 3 (printer port 3 - LPT 3) |
| 0Eh | 14 | POST | 2 bytes | Base I/O address for parallel port 4 (printer port 4 - LPT 4) (Only found in PC/XT systems) |
| 10h | 16 | Int 11h | 2 bytes | Equipment Word |
|  |  |  |  | Bits 15-14 indicate the number of parallel ports installed |
|  |  |  |  | 00b = 1 parallel port |
|  |  |  |  | 01b = 2 parallel ports |
|  |  |  |  | 03b = 3 parallel ports |
|  |  |  |  | Bits 13-12 are reserved |
|  |  |  |  | Bits 11-9 indicate the number of serial ports installed |
|  |  |  |  | 000b = none |
|  |  |  |  | 001b = 1 serial port |
|  |  |  |  | 002b = 2 serial ports |
|  |  |  |  | 003b = 3 serial ports |
|  |  |  |  | 004b = 4 serial ports |
|  |  |  |  | Bit 8 is reserved |
|  |  |  |  | Bit 7-6 indicate the number of floppy drives installed |
|  |  |  |  | 0b = 1 floppy drive |
|  |  |  |  | 1b = 2 floppy drives |
|  |  |  |  | Bits 5-4 indicate the video mode |
|  |  |  |  | 00b = EGA or later |
|  |  |  |  | 01b = color 40x25 |
|  |  |  |  | 10b = color 80x25 |
|  |  |  |  | 11b = monochrome 80x25 |
|  |  |  |  | Bit 3 is reserved |
|  |  |  |  | Bit 2 indicates if a PS/2 mouse is installed |
|  |  |  |  | 0b = not installed |
|  |  |  |  | 1b = installed |
|  |  |  |  | Bit 1 indicated if a math coprocessor is installed |
|  |  |  |  | 0b = not installed |
|  |  |  |  | 1b = installed |
|  |  |  |  | Bit 0 indicated if a boot floppy is installed |
|  |  |  |  | 0b = not installed |
|  |  |  |  | 1b = installed |
| 12h | 18 | POST | 1 byte | Interrupt flag - Manufacturing test |
| 13h | 19 | Int 12h | 2 bytes | Memory size in Kb |
| 15h | 21 |  | 2 bytes | Error codes for AT+; Adapter memory size for PC and XT |
| 17h | 22 | Int 16h | 1 byte | Keyboard shift flags 1 |
|  |  |  |  | Bit 7 indicates if Insert is on or off |
|  |  |  |  | 0b = Insert off |
|  |  |  |  | 1b = Insert on |
|  |  |  |  | Bit 6 indicates if CapsLock is on or off |
|  |  |  |  | 0b = CapsLock off |
|  |  |  |  | 1b - CapsLock on |
|  |  |  |  | Bit 5 indicates if NumLock is on or off |
|  |  |  |  | 0b = NumLock off |
|  |  |  |  | 1b = NumLock on |
|  |  |  |  | Bit 4 indicates if ScrollLock is on or off |
|  |  |  |  | 0b = ScrollLock off |
|  |  |  |  | 1b = ScrollLock on |
|  |  |  |  | Bit 3 indicates if the Alt key is up or down |
|  |  |  |  | 0b = Alt key is up |
|  |  |  |  | 1b = Alt key is down |
|  |  |  |  | Bit 2 indicates if the Control key is up or down |
|  |  |  |  | 0b = Control key is up |
|  |  |  |  | 1b = Control key is down |
|  |  |  |  | Bit 1 indicates if the Left Shift key is up or down |
|  |  |  |  | 0b = Left Shift key is up |
|  |  |  |  | 1b = Left Shift key is down |
|  |  |  |  | Bit 0 indicates if the Right Shift key is up or down |
|  |  |  |  | 0b = Right Shift key is up |
|  |  |  |  | 1b = Right Shift key is down |
| 18h | 23 | Int 16h | 1 byte | Keyboard shift flags 2 |
|  |  |  |  | Bit 7 indicates if the Insert key is up or down |
|  |  |  |  | 0b = Insert key is up |
|  |  |  |  | 1b = Insert key is down |
|  |  |  |  | Bit 6 indicates if the CapsLock key is up or down |
|  |  |  |  | 0b = CapsLock is key is up |
|  |  |  |  | 1b = CapsLock key is down |
|  |  |  |  | Bit 5 indicates if the NumLock key is up or down |
|  |  |  |  | 0b = NumLock key is up |
|  |  |  |  | 1b = Numlock key is down |
|  |  |  |  | Bit 4 indicates if the ScrollLock key is up or down |
|  |  |  |  | 0b = ScrollLock key is up |
|  |  |  |  | 1b = ScrollLock key is down |
|  |  |  |  | Bit 3 indicates if the Pause key is active or inactive |
|  |  |  |  | 0b = pause key is inactive |
|  |  |  |  | 1b = Pause key is active |
|  |  |  |  | Bit 2 indicates if the SysReg key is up or down |
|  |  |  |  | 0b = SysReg key is up |
|  |  |  |  | 1b = SysReg key is down |
|  |  |  |  | Bit 1 indicates if the Left Alt key is up or down |
|  |  |  |  | 0b = Left Alt key is up |
|  |  |  |  | 1b = Left Alt key is down |
|  |  |  |  | Bit 0 indicates if the Right Alt key is up or down |
|  |  |  |  | 0b = Right Alt key is up |
|  |  |  |  | 1b = Right Alt key is down |
| 19h | 24 | Int 09h | 1 byte | Alt Numpad work area |
| 1Ah | 26 | Int 16h | 2 bytes | Pointer to the address of the next character in the keyboard buffer |
| 1Ch | 28 | Int 16h | 2 bytes | Pointer to the address of the last character in he keyboard buffer |
| 1Eh | 60 | Int 16h | 32 bytes | Keyboard buffer |
| 3Eh | 61 | Int 13h | 1 byte | Floppy disk drive calibration status |
|  |  |  |  | Bits 7-4 are reserved |
|  |  |  |  | Bit 3 = floppy drive 3 (PC, XT) |
|  |  |  |  | Bit 2 = floppy drive 2 (PC, XT) |
|  |  |  |  | Bit 1 = floppy drive 1 |
|  |  |  |  | Bit 0 = floppy drive 0 |
|  |  |  |  | 0b indicates not calibrated |
|  |  |  |  | 1b indicates calibrated |
| 3Fh | 62 | Int 13h | 1 byte | Floppy disk drive motor status |
|  |  |  |  | Bit 7 indicates current operation |
|  |  |  |  | 0b = read or verify operation |
|  |  |  |  | 1b = write or format operation |
|  |  |  |  | Bit 6 is not used |
|  |  |  |  | Bit 5-4 indicates drive select |
|  |  |  |  | 00b = Drive 0 |
|  |  |  |  | 01b = Drive 1 |
|  |  |  |  | 10b = Drive 2 (PC, XT) |
|  |  |  |  | 11b = Drive 4 (PC, XT) |
|  |  |  |  | Bit 3 indicates drive 3 motor |
|  |  |  |  | 0b = motor off |
|  |  |  |  | 1b = motor on |
|  |  |  |  | Bit 2 indicates drive 2 motor |
|  |  |  |  | 0b = motor off |
|  |  |  |  | 1b = motor on |
|  |  |  |  | Bit 1 indicates drive 0 motor |
|  |  |  |  | 0b = motor off |
|  |  |  |  | 1b = motor on |
|  |  |  |  | 0b = motor off |
|  |  |  |  | 1b = motor on |
| 40h | 63 | Int 13h | 1 byte | Floppy disk drive motor time-out |
| 41h | 64 | Int 13h | 1 byte | Floppy disk drive status |
|  |  |  |  | Bit 7 indicates drive ready status |
|  |  |  |  | 0b = drive ready |
|  |  |  |  | 1b = drive not ready (time out) |
|  |  |  |  | Bit 6 indicates seek status |
|  |  |  |  | 0b = no seek error detected |
|  |  |  |  | 1b = indicates a seek error was detected |
|  |  |  |  | Bit 5 indicates floppy disk controller test |
|  |  |  |  | 0b = floppy disk controller passed |
|  |  |  |  | 1b = floppy disk controller failed |
|  |  |  |  | Bit 4-0 error codes |
|  |  |  |  | 00000b = no errors |
|  |  |  |  | 00001b = illegal function requested |
|  |  |  |  | 00010b = address mark not found |
|  |  |  |  | 00011b = write protect error |
|  |  |  |  | 00100b = sector not found |
|  |  |  |  | 00110b = diskette change line active |
|  |  |  |  | 01000b = DMA overrun |
|  |  |  |  | 01001b = DMA boundary error |
|  |  |  |  | 01100b = unknown media type |
|  |  |  |  | 10000b = CRC error during read |
| 42h | 65 | Int 13h | 1 byte | Hard disk and floppy controller status register 0 |
|  |  |  |  | Bit 7-6 indicate the interrupt code |
|  |  |  |  | 00b = command completed normally |
|  |  |  |  | 01b = command terminated abnormally |
|  |  |  |  | 10b = abnormal termination, ready line on, or diskette changed |
|  |  |  |  | 11b = seek command not completed |
|  |  |  |  | Bit 5 indicated seek command |
|  |  |  |  | 0b = seek command not completed |
|  |  |  |  | 1b = seek command completed |
|  |  |  |  | Bit 4 indicated drive fault |
|  |  |  |  | 0b = no drive fault |
|  |  |  |  | 1b = drive fault |
|  |  |  |  | Bit 3 indicates drive ready |
|  |  |  |  | 0b = drive ready |
|  |  |  |  | 1b = drive not ready |
|  |  |  |  | Bit 2 indicates head state when interrupt occurred |
|  |  |  |  | 00b = drive 0 |
|  |  |  |  | 01b = drive 1 |
|  |  |  |  | 10b = drive 2 (PC, XT) |
|  |  |  |  | 11b = drive 3 (PC, XT) |
|  |  |  |  | Bit 1-0 indicates drive select |
|  |  |  |  | 00b = drive 0 |
|  |  |  |  | 01b = drive 1 |
|  |  |  |  | 10b = drive 2 (PC, XT) |
|  |  |  |  | 11b = drive 3 (PC, XT) |
| 43h | 66 | Int 13h | 1 byte | Floppy drive controller status register 1 |
|  |  |  |  | Bit 7-0 indicates no error |
|  |  |  |  | Bit 7, 1b = indicates attempted access beyond last cylinder |
|  |  |  |  | Bit 6, 0b = not used |
|  |  |  |  | Bit 5, 1b = CRC error during read |
|  |  |  |  | Bit 4, 1b = DMA overrun |
|  |  |  |  | Bit 3, 0b = not used |
|  |  |  |  | Bit 2, 1b = Sector not found or reading diskette ID failed |
|  |  |  |  | Bit 1, 1b = medium write protected |
|  |  |  |  | Bit 0, 1b = missing address mark |
| 44h | 67 | Int 13h | 1 byte | Floppy drive controller status register 2 |
|  |  |  |  | Bit 7, 0b = not used |
|  |  |  |  | Bit 6, 1b = deleted data address mark |
|  |  |  |  | Bit 5, 1b = CRC error detected |
|  |  |  |  | Bit 4, 1b = wrong cylinder |
|  |  |  |  | Bit 3, 1b = condition of equal during verify |
|  |  |  |  | Bit 2, 1b = sector not found during verify |
|  |  |  |  | Bit 1, 1b = bad cylinder |
|  |  |  |  | Bit 0, 1b = address mark not found during read |
| 45h | 68 | Int 13h | 1 byte | Floppy disk controller: cylinder number |
| 46h | 69 | Int 13h | 1 byte | Floppy disk controller: head number |
| 47h | 70 | Int 13h | 1 byte | Floppy disk controller: sector number |
| 48h | 71 |  | 1 byte | Floppy disk controller: number of byte written |
| 49h | 72 | Int 10h | 1 byte | Active video mode setting |
| 4Ah | 74 | Int 10h | 2 bytes | Number of textcolumns per row for the active video mode |
| 4Ch | 76 | Int 10h | 2 bytes | Size of active video in page bytes |
| 4Eh | 78 | Int 10h | 2 bytes | Offset address of the active video page relative to the start of video RAM |
| 50h | 80 | Int 10h | 2 bytes | Cursor position for video page 0 |
| 52h | 82 | Int 10h | 2 bytes | Cursor position for video page 1 |
| 54h | 84 | Int 10h | 2 bytes | Cursor position for video page 2 |
| 56h | 86 | Int 10h | 2 bytes | Cursor position for video page 3 |
| 58h | 88 | Int 10h | 2 bytes | Cursor position for video page 4 |
| 5Ah | 90 | Int 10h | 2 bytes | Cursor position for video page 5 |
| 5Ch | 92 | Int 10h | 2 bytes | Cursor position for video page 6 |
| 5Eh | 94 | Int 10h | 2 bytes | Cursor position for video page 7 |
| 60h | 96 | Int 10h | 2 bytes | Cursor shape |
| 62h | 97 | Int 10h | 1 byte | Active video page |
| 63h | 99 | Int 10h | 2 bytes | I/O port address for the video display adapter |
| 65h | 100 | Int 10h | 1 byte | Video display adapter internal mode register |
|  |  |  |  | Bit 7, 0b = not used |
|  |  |  |  | Bit 6, 0b = not used |
|  |  |  |  | Bit 5 |
|  |  |  |  | 0b = attribute bit controls background intensity |
|  |  |  |  | 1b = attribute bit controls blinking |
|  |  |  |  | Bit 4, 1b = mode 6 graphics operation |
|  |  |  |  | Bit 3 indicates video signal |
|  |  |  |  | 0b = video signal disabled |
|  |  |  |  | 1b = video signal enabled |
|  |  |  |  | Bit 2 indicates color operation |
|  |  |  |  | 0b = color operation |
|  |  |  |  | 1b = monochrome operation |
|  |  |  |  | Bit 1, 1b = mode 4/5 graphics operation |
|  |  |  |  | Bit 0, 1b = mode 2/3 test operation |
| 66h | 101 | Int 10h | 1 byte | Color palette |
|  |  |  |  | Bit 7, 0b = not used |
|  |  |  |  | Bit 6, 0b = not used |
|  |  |  |  | Bit 5 indicates mode 5 foreground colors |
|  |  |  |  | 0b = green/red/yellow |
|  |  |  |  | 1b = cyan/magenta/white |
|  |  |  |  | Bit 4 indicates background color |
|  |  |  |  | 0b = normal background color |
|  |  |  |  | 1b = intensified background color |
|  |  |  |  | Bit 3 indicates intensified border color (mode 2) and background color (mode 5) |
|  |  |  |  | Bit 2 indicates red |
|  |  |  |  | Bit 1 indicates green |
|  |  |  |  | Bit 0 indicates blue |
| 67h | 103 |  | 2 bytes | Adapter ROM offset address |
| 69h | 106 |  | 2 bytes | Adapter ROM segment address |
| 6Bh | 107 |  | 1 byte | Last interrupt (not PC) |
|  |  |  |  | Bit 7 indicates IRQ 7 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 6 indicates IRQ 6 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 5 indicates IRQ 5 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 4 indicates IRQ 4 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 3 indicates IRQ 3 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 2 indicates IRQ 2 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 1 indicates IRQ 1 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
|  |  |  |  | Bit 0 indicates IRQ 0 hardware interrupt |
|  |  |  |  | 0b = did not occur |
|  |  |  |  | 01 = did occur |
| 6Ch | 111 | Int 1Ah | 4 bytes | Counter for Interrupt 1Ah |
| 70c | 112 | Int 1Ah | 1 byte | Timer 24 hour flag |
| 71h | 113 | Int 16h | 1 byte | Keyboard Ctrl-Break flag |
| 72h | 115 | POST | 2 bytes | Soft reset flag |
| 74h | 116 | Int 13h | 1 byte | Status of last hard disk operation |
|  |  |  |  | 00h = no errors |
|  |  |  |  | 01h = invalid function requested |
|  |  |  |  | 02h = address mark not found |
|  |  |  |  | 04h = sector not found |
|  |  |  |  | 05h = reset failed |
|  |  |  |  | 06h = removable media changed |
|  |  |  |  | 07h = drive parameter activity failed |
|  |  |  |  | 08h = DMA overrun |
|  |  |  |  | 09h = DMA boundary overrun |
|  |  |  |  | 0Ah = bad sector flag detected |
|  |  |  |  | 0Bh = bad track detected |
|  |  |  |  | 0Dh = invalid number of sectors on format |
|  |  |  |  | 0Eh = control data address mark detected |
|  |  |  |  | 0Fh = DMA arbitration level out of range |
|  |  |  |  | 10h = uncorrectable ECC or CRC error |
|  |  |  |  | 11h = ECC corrected data error |
|  |  |  |  | 20h = general controller failure |
|  |  |  |  | 40h = seek operation failed |
|  |  |  |  | 80h = timeout |
|  |  |  |  | AAh = drive not ready |
|  |  |  |  | BBh = undefined error occurred |
|  |  |  |  | CCh = write fault on selected drive |
|  |  |  |  | E0h = status error or error register is zero |
|  |  |  |  | FFh = sense operation failed |
| 75h | 117 | Int 13h | 1 byte | Number of hard disk drives |
| 76h | 118 | Int 13h | 1 byte | Hard disk control byte |
|  |  |  |  | Bit 7 |
|  |  |  |  | 0b = enables retries on disk error |
|  |  |  |  | 1b = disables retries on disk error |
|  |  |  |  | Bit 6 |
|  |  |  |  | 0b = enables reties on disk error |
|  |  |  |  | 1b = enables reties on disk error |
|  |  |  |  | Bit 5, 0b = not used |
|  |  |  |  | Bit 4, 0b = not used |
|  |  |  |  | Bit 3 |
|  |  |  |  | 0b = drive has less than 8 heads |
|  |  |  |  | 1b = drive has more than 8 heads |
|  |  |  |  | Bit 2, 0b = not used |
|  |  |  |  | Bit 1, 0b = not used |
|  |  |  |  | Bit 0, 0b = not used |
| 77h | 119 | Int 13h | 1 byte | Offset address of hard disk I/O port (XT) |
| 78h | 120 | Int 17h | 1 byte | Parallel port 1 timeout |
| 79h | 121 | Int 17h | 1 byte | Parallel port 2 timeout |
| 7Ah | 122 | Int 17h | 1 byte | Parallel port 3 timeout |
| 7Bh | 123 |  | 1 byte | Parallel port 4 timeout (PC, XT) support for virtual DMA services (VDS) |
|  |  |  |  | Bit 7, 0b = not used |
|  |  |  |  | Bit 6, 0b = not used |
|  |  |  |  | Bit 5 indicates virtual DMA services |
|  |  |  |  | 0b = not supported |
|  |  |  |  | 1b = supported |
|  |  |  |  | Bit 4, 0b = not used |
|  |  |  |  | Bit 3 indicates chaining on interrupt 4Bh |
|  |  |  |  | 0b = not required |
|  |  |  |  | 1b = required |
|  |  |  |  | Bit 2, 0b = not used |
|  |  |  |  | Bit 1, 0b = not used |
|  |  |  |  | Bit 0, 0b = not used |
| 7Ch | 124 | Int 14h | 1 byte | Serial port 1 timeout |
| 7Dh | 125 | Int 14h | 1 byte | Serial port 2 timeout |
| 7Eh | 126 | Int 14h | 1 byte | Serial port 3 timeout |
| 7Fh | 127 | Int 14h | 1 byte | Serial port 4 timeout |
| 80h | 129 | Int 16h | 2 bytes | Starting address of keyboard buffer |
| 82h | 131 | Int 16h | 2 bytes | Ending address of keyboard buffer |
| 84h | 132 | Int 10h | 1 byte | Number of video rows (minus 1) |
| 85h | 134 | Int 10h | 2 bytes | Number of scan lines per character |
| 87h | 135 | Int 10h | 1 byte | Video display adapter options |
|  |  |  |  | Bit 7 indicates bit 7 of the last video mode |
|  |  |  |  | 0b = clear display buffer when setting mode |
|  |  |  |  | 1b = do not clear the display buffer |
|  |  |  |  | Bit 6-4 indicates the amount of memory on the video display adapter |
|  |  |  |  | 000b = 64Kb |
|  |  |  |  | 001b = 128Kb |
|  |  |  |  | 010b = 192Kb |
|  |  |  |  | 011b = 256Kb |
|  |  |  |  | 100b = 512Kb |
|  |  |  |  | 110 = 1024Kb or more |
|  |  |  |  | Bit 3 indicates video subsystem |
|  |  |  |  | 0b = not active |
|  |  |  |  | 1b = active |
|  |  |  |  | Bit 2 is reserved |
|  |  |  |  | Bit 1 indicates monitor type |
|  |  |  |  | 0b = color |
|  |  |  |  | 1b = monochrome |
|  |  |  |  | Bit 0 indicates alphanumeric cursor emulation |
|  |  |  |  | 0b = disabled |
|  |  |  |  | 1b = enabled |
| 88h | 136 | Int 10h | 1 byte | Video display adapter switches |
|  |  |  |  | Bit 7 indicates state of feature connector line 1 |
|  |  |  |  | Bit 6 indicates state of feature connector line 0 |
|  |  |  |  | Bit 5-4 not used |
|  |  |  |  | Bit 3-0 indicate adapter type switch settings |
|  |  |  |  | 0000b = MDA/color 40x25 |
|  |  |  |  | 0001b = MDA/color 80x25 |
|  |  |  |  | 0010b = MDA/high-resolution 80x25 |
|  |  |  |  | 0011b = MDA/high-resolution enhanced |
|  |  |  |  | 0100b = CGA 40x25/monochrome |
|  |  |  |  | 0101b = CGA 80x25/monochrome |
|  |  |  |  | 0110b = color 40x25/MDA |
|  |  |  |  | 0111b = color 80x25/MDA |
|  |  |  |  | 1000b = high-resolution 80x25/MDA |
|  |  |  |  | 1001b = high-resolution enhanced/MDA |
|  |  |  |  | 1010b = monochrome/CGA 40x25 |
|  |  |  |  | 1011b = monochrome/CGA 80x25 |
| 89h | 137 | Int 10h | 1 byte | VGA video flags 1 |
|  |  |  |  | Bit 7 and 4 indicate scanline mode |
|  |  |  |  | 00b = 350-line mode |
|  |  |  |  | 01b = 400-line mode |
|  |  |  |  | 10b = 200-line mode |
|  |  |  |  | Bit 6 indicates display switch |
|  |  |  |  | 0b = disabled |
|  |  |  |  | 1b = enabled |
|  |  |  |  | Bit 5 is reserved |
|  |  |  |  | Bit 3 indicates default palette loading |
|  |  |  |  | 0b = disabled |
|  |  |  |  | 1b= enabled |
|  |  |  |  | Bit 2 indicates monitor type |
|  |  |  |  | 0b = color |
|  |  |  |  | 1b = monochrome |
|  |  |  |  | Bit 1 indicates gray scale summing |
|  |  |  |  | 0b = disabled |
|  |  |  |  | 1b = enabled |
|  |  |  |  | Bit 0 indicates VGA active state |
|  |  |  |  | 0b = VGA inactive |
|  |  |  |  | 1b = VGA active |
| 8Ah | 138 | Int 10h | 1 byte | VGA video flags 2 |
| 8Bh | 139 | Int 13h | 1 byte | Floppy disk configuration data |
|  |  |  |  | Bit 7-6 indicate last data sent to the controller |
|  |  |  |  | 00b = 500 Kbit/sec/sec |
|  |  |  |  | 01b = 300 Kbit/sec |
|  |  |  |  | 10b = 250 Kbit/sec |
|  |  |  |  | 11b = rate not set or 1 Mbit/sec |
|  |  |  |  | Bit 5-4 indicate last drive steprate sent to the controller |
|  |  |  |  | 00b = 8ms |
|  |  |  |  | 01b = 7ms |
|  |  |  |  | 10b = 6ms |
|  |  |  |  | 11b = 5ms |
|  |  |  |  | Bit 3-2 indicate data rate, set at start of operation (Bits 7-6) |
|  |  |  |  | Bit 1-0 not used |
| 8Ch | 140 | Int 13h | 1 byte | Hard disk drive controller status |
|  |  |  |  | Bit 7 indicates controller state |
|  |  |  |  | 0b = controller not busy |
|  |  |  |  | 1b = controller busy |
|  |  |  |  | Bit 6 indicates drive ready state |
|  |  |  |  | 0b = drive selected not ready |
|  |  |  |  | 1b = drive selected ready |
|  |  |  |  | Bit 5 indicates write fault |
|  |  |  |  | 0b = write fault did not occur |
|  |  |  |  | 1b = write error occurred |
|  |  |  |  | Bit 4 indicates seek state |
|  |  |  |  | 0b = drive selected seeking |
|  |  |  |  | 1b = drive selected seek complete |
|  |  |  |  | Bit 3 indicates data request |
|  |  |  |  | 0b = data request is inactive |
|  |  |  |  | 1b = data request is active |
|  |  |  |  | Bit 2 indicates data correction |
|  |  |  |  | 0b = data not corrected |
|  |  |  |  | 1b = data corrected |
|  |  |  |  | Bit 1 indicates index pulse state |
|  |  |  |  | 0b = index pulse inactive |
|  |  |  |  | 1b = index pulse active |
|  |  |  |  | Bit 0 indicates error |
|  |  |  |  | 0b = no error |
|  |  |  |  | 1b = error in previous command |
| 8Dh | 141 | Int 13h | 1 byte | Hard disk drive error |
|  |  |  |  | Bit 7 indicates bad sector |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = bad sector detected |
|  |  |  |  | Bit 6 indicated ECC error |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = uncorrectable ECC error occurred |
|  |  |  |  | Bit 5 indicates media state |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = media changed |
|  |  |  |  | Bit 4 indicates sector state |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = ID or target sector not found |
|  |  |  |  | Bit 3 indicates media change request state |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = media change requested |
|  |  |  |  | Bit 2 indicates command state |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = command aborted |
|  |  |  |  | Bit 1 indicates drive track error |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = track 0 not found |
|  |  |  |  | Bit 0 indicates address mark |
|  |  |  |  | 0b = not used |
|  |  |  |  | 1b = address mark not found |
| 8Eh | 142 | Int 13h | 1 byte | Hard disk drive task complete flag |
| 8Fh | 143 | Int 13h | 1 byte | Floppy disk drive information |
|  |  |  |  | Bit 7 not used |
|  |  |  |  | Bit 6 indicates drive 1 type determination |
|  |  |  |  | 0b = not determined |
|  |  |  |  | 1b = determined |
|  |  |  |  | Bit 5 indicates drive 1 multirate status |
|  |  |  |  | 0b = no |
|  |  |  |  | 1b = yes |
|  |  |  |  | Bit 4 indicates diskette 1 change line detection |
|  |  |  |  | 0b = no |
|  |  |  |  | 1b = yes |
|  |  |  |  | Bit 3 not used |
|  |  |  |  | Bit 2 indicates drive 0 type determination |
|  |  |  |  | 0b = not determined |
|  |  |  |  | 1b = determined |
|  |  |  |  | Bit 1 indicates drive 0 multirate status |
|  |  |  |  | 0b = no |
|  |  |  |  | 1b = yes |
|  |  |  |  | Bit 0 indicates diskette 0 change line detection |
|  |  |  |  | 0b = no |
|  |  |  |  | 1b = yes |
| 90h | 144 | Int 13h | 1 byte | Diskette 0 media state |
|  |  |  |  | Bit 7-6 indicate transfer rate |
|  |  |  |  | 00b = 500 Kbit/sec |
|  |  |  |  | 01b = 300 Kbit/sec |
|  |  |  |  | 10b = 250 Kbit/sec |
|  |  |  |  | 11b = 1 Mbit/sec |
|  |  |  |  | Bit 5 indicates double stepping |
|  |  |  |  | 0b = not required |
|  |  |  |  | 1b = required |
|  |  |  |  | Bit 4 indicates media in floppy drive |
|  |  |  |  | 0b = unknown media |
|  |  |  |  | 1b = known media |
|  |  |  |  | Bit 3 not used |
|  |  |  |  | Bit 2-0 indicates last access |
|  |  |  |  | 000b = trying 360k media in 360K drive |
|  |  |  |  | 001b = trying 360K media in 1.2M drive |
|  |  |  |  | 010b = trying 1.2M media in 1.2M drive |
|  |  |  |  | 011b = known 360K media on 360K drive |
|  |  |  |  | 100b = known 360K media in 1.2M drive |
|  |  |  |  | 101b = known 1.2M media in 1.2M drive |
|  |  |  |  | 110b = not used |
|  |  |  |  | 111b = 720K media in 720K drive or 1.44M media in 1.44M drive |
| 91h | 145 | Int 13h | 1 byte | Diskette 1 media state |
|  |  |  |  | Bit 7-6 indicate transfer rate |
|  |  |  |  | 00b = 500 Kbit/sec |
|  |  |  |  | 01b = 300 Kbit/sec |
|  |  |  |  | 10b = 250 Kbit/sec |
|  |  |  |  | 11b = 1 Mbit/sec |
|  |  |  |  | Bit 5 indicates double stepping |
|  |  |  |  | 0b = not required |
|  |  |  |  | 1b = required |
|  |  |  |  | Bit 4 indicates media in floppy drive |
|  |  |  |  | 0b = unknown media |
|  |  |  |  | 1b = known media |
|  |  |  |  | Bit 3 not used |
|  |  |  |  | Bit 2-0 indicates last access |
|  |  |  |  | 000b = trying 360k media in 360K drive |
|  |  |  |  | 001b = trying 360K media in 1.2M drive |
|  |  |  |  | 010b = trying 1.2M media in 1.2M drive |
|  |  |  |  | 011b = known 360K media on 360K drive |
|  |  |  |  | 100b = known 360K media in 1.2M drive |
|  |  |  |  | 101b = known 1.2M media in 1.2M drive |
|  |  |  |  | 110b = not used |
|  |  |  |  | 111b = 720K media in 720K drive or 1.44M media in 1.44M drive |
| 92h | 146 | Int 13h | 1 byte | Diskette 0 operational starting state |
|  |  |  |  | Bit 7 indicates data transfer rate |
|  |  |  |  | 00b = 500 Kbit/sec |
|  |  |  |  | 01b = 300 Kbit/sec |
|  |  |  |  | 10b = 250 Kbit/sec |
|  |  |  |  | 11b = 1 Mbit/sec |
|  |  |  |  | Bits 5-3 not used |
|  |  |  |  | Bit 2 indicates drive determination |
|  |  |  |  | 0b = drive type not determined |
|  |  |  |  | 1b = drive type determined |
|  |  |  |  | Bit 1 indicates drive multirate status |
|  |  |  |  | 0b = drive is not multirate |
|  |  |  |  | 1b = drive is multirate |
|  |  |  |  | Bit 0 indicates change line detection |
|  |  |  |  | 0b = no change line detection |
|  |  |  |  | 1b = change line detection |
| 93h | 147 | Int 13h | 1 byte | Diskette 1 operational starting status |
|  |  |  |  | Bit 7 indicates data transfer rate |
|  |  |  |  | 00b = 500 Kbit/sec |
|  |  |  |  | 01b = 300 Kbit/sec |
|  |  |  |  | 10b = 250 Kbit/sec |
|  |  |  |  | 11b = 1 Mbit/sec |
|  |  |  |  | Bits 5-3 not used |
|  |  |  |  | Bit 2 indicates drive determination |
|  |  |  |  | 0b = drive type not determined |
|  |  |  |  | 1b = drive type determined |
|  |  |  |  | Bit 1 indicates drive multirate status |
|  |  |  |  | 0b = drive is not multirate |
|  |  |  |  | 1b = drive is multirate |
|  |  |  |  | Bit 0 indicates change line detection |
|  |  |  |  | 0b = no change line detection |
|  |  |  |  | 1b = change line detection |
| 94h | 148 | Int 13h | 1 byte | Diskette 0 current cylinder |
| 95h | 149 | Int 13h | 1 byte | Diskette 1 current cylinder |
| 96h | 150 | Int 16h | 1 byte | Keyboard status flags 3 |
|  |  |  |  | Bit 7, 1b = reading two byte keyboard ID in progress |
|  |  |  |  | Bit 6, 1b = last code was first ID character |
|  |  |  |  | Bit 5, 1b = forced Numlock on |
|  |  |  |  | Bit 4 indicates presence of 101/102 key keyboard |
|  |  |  |  | 0b = present |
|  |  |  |  | 1b = not present |
|  |  |  |  | Bit 3 indicates right alt key active |
|  |  |  |  | 0b = not active |
|  |  |  |  | 1b = active |
|  |  |  |  | Bit 2 indicates right control key active |
|  |  |  |  | 0b = not active |
|  |  |  |  | 1b = active |
|  |  |  |  | Bit 1, 1b = last scancode was E0h |
|  |  |  |  | Bit 0, 1b = last scancode was E1h |
| 97h | 151 | Int 16h | 1 byte | Keyboard status flags 4 |
|  |  |  |  | Bit 7, 1b = keyboard transmit error |
|  |  |  |  | Bit 6, 1b = LED update in progress |
|  |  |  |  | Bit 5, 1b = re-send code received |
|  |  |  |  | Bit 4, 1b = acknowledge code received |
|  |  |  |  | Bit 3, 1b = reserved |
|  |  |  |  | Bit 2 indicates CapsLock LED state |
|  |  |  |  | 0b = CapsLock LED off |
|  |  |  |  | 1b = CapsLock LED on |
|  |  |  |  | Bit 1 indicates NumLock LED state |
|  |  |  |  | 0b = NumLock LED off |
|  |  |  |  | 1b = NumLock LED on |
|  |  |  |  | Bit 0 indicates ScrollLock LED state |
|  |  |  |  | 0b = ScrollLock LED off |
|  |  |  |  | 1b = ScrollLock LED on |
| 98h | 155 |  | 4 bytes | Segment:Offset address of user wait flag pointer |
| 9Ch | 159 |  | 4 bytes | User wait count |
| A0h | 160 |  | 1 byte | User wait flag |
|  |  |  |  | Bit 7, 1b = wait time has elapsed |
|  |  |  |  | Bit 6-1 not used |
|  |  |  |  | Bit 0 indicates wait progress |
|  |  |  |  | 0b = no wait in progress |
|  |  |  |  | 1b = wait in progress |
| A1h | 167 |  | 7 bytes | Local area network (LAN) bytes |
| A8h | 171 |  | 4 bytes | Segment:Offset address of video parameter control block |
| ACh | 239 |  | 68 bytes | Reserved |
| F0h | 255 |  | 16 bytes | Intra-applications communications area |