

The BIOS Companion

Phil Croucher

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Sources

Which are gratefully acknowledged:

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- **ambios.txt**, available from Jean-Paul Rodrigue in the University of Montreal, which had useful snippets, especially the explanation of Fast Decode.
- **amisetup**, a shareware program from Robert Muchsel. Copyrights, etc.

Praise For The BIOS Companion

"The computer book of the month is The Bios Companion by Phil Croucher. Long-time readers of this column will recall I have recommended his book before. This tells you everything you ought to know about the BIOS in your system. Post codes, options, upgrades, you name it. Years ago, I called an earlier edition of this invaluable and I see no reason to change my view. Recommended."

Jerry Pournelle, *Byte Magazine*

"You will find more information about your motherboard assembled here than I have ever seen."

Frank Latchford PCCT

"Thank! I really appreciated this. I read it and was able to adjust my BIOS settings so that my machine runs about twice as fast. Pretty impressive. Thanks again."

Tony

"This book is worth far more than is charged for it. Very well written. Probably the most-used reference book in my shop.a great value as the feature explanations trigger your thinking and allow you to figure out many related BIOS features in some of the newer versions."

Amazon reader

"For those who need or want to fine tune, or simply understand, the basic and advanced features of their PC's BIOS, this book is an invaluable guide. It has a very broad range and covers both fundamental and more advanced topics as well as issues specific to particular bios types (AMI, PHOENIX, etc.) and versions. This is one book you need to have as a PC technician and a valuable resource for trouble shooting and configuring your personal PC even if your not."

Amazon reader

"I found The Bios companion so useful that I "just have" to have all 3 books in the set. The extra Bios Companion is going to a friend who will gain great benefit from it. Yes I definitely want all three books. Thank you very much."

Mike Reinbolt

"I received my package today containing the BIOS Companion book and 2 CD set.... I'm really impressed with what I did receive. I already had about HALF of the information, and to get THAT much, I had to get several books and web pages. GOOD JOB!!

I had more time to go thru the book and think that you should change the word "HALF" to "FOURTH".

I commend you on the great job you did. That's a bell of a lot of work for any major company to do, let alone an individual."

Craig Stubbs

"I thoroughly enjoyed my purchase! The BIOS Companion is worth the cost just for the beep-code section alone. I am new to computers and have found the book and your site to be quite informative."

pcworker

"I thought the BIOS Companion was quite good. Just chock full of the kind of info I had been looking for. First book I've gotten that was worth the more than price I paid."

Tony

"While you are appreciative of my order, I am likewise appreciative of your efforts to make such a reference available. BIOS's are the most mysterious things in the computing world to figure out. I realize the BIOS manufacturers have made great effort to provide detailed information in the BIOS help (F1) (ok, so that's a bit of sarcasm). Traditionally, I have had to piece bits of information together that I have found at various locations. Once again thanks."

Brian Presson, System Engineer

"The Bios companion is an absolute must for anyone who builds or configures PC's! It is by far worth the money you pay for it. Phil Croucher has done a superb job! He explains in great detail all of the settings that even most PC technicians have no idea of what they do or effect, and mostly some very helpful suggestions on system settings as well. An Absolute Must have!"

Larry Stark, LPG Computers
Memphis, TN

"I purchased the 2000 edition of the complete The BIOS Companion - PDF from DigiBuy today. Any way you look at it, the information contained is well worth the \$15 dollar investment. I must personally thank you for publishing such a wonderful resource for techies such as myself. Thank you again for all of the hard work."

Sincerely, Boyd Stephens

"I spent two hours going through the different sections therein. Everything is there and I can only say, 'AW'SOME'."

Robert, San Francisco

"Hi, Phil

The book is absolutely phenomenal !! - Congratulations ! This is exactly the kind of reference many people (including our instructors) need - everything in one place, beautifully organised, crammed full of essential, UNDERSTANDABLE, info."

Alain Hendrikse, South Africa

"Your BIOS guide I had from 1994 was one of those 'never throw it away' items that I knew I would need an update for."

Adrian Clint

Contents

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| | | |
|----------|-------------------------------------|-----------|
| 1 | The BIOS | 1 |
| | BIOS Data Area | 2 |
| | What Happens When You Switch On | 13 |
| | How old is my BIOS? | 13 |
| | Identifying Your BIOS | 14 |
| | What's in my machine (using debug)? | 37 |
| | Where Can I Get A New BIOS? | 40 |
| | Flash BIOS Upgrades | 40 |
| | Recovering A Corrupt BIOS | 43 |
| | DMI | 44 |
| | Facilities Provided | 44 |
| 2 | The Motherboard | 47 |
| | The Central Processor | 49 |
| | Chip Reference Chart | 63 |
| 3 | Memory | 67 |
| | Static RAM | 67 |
| | Dynamic RAM | 67 |
| | Wait states | 69 |
| | Shadow RAM | 76 |
| | Random Access Memory | 77 |
| | CMOS Memory Map | 83 |
| | Numbers On Chips | 87 |
| 4 | Bus Types | 90 |
| | ISA | 90 |
| | EISA | 91 |
| | Micro Channel Architecture | 91 |
| | Local Bus | 91 |
| | PCMCIA | 93 |
| | USB | 94 |
| | FireWire | 95 |

| | | |
|-----------|-------------------------------|------------|
| 5 | Expansion Cards | 95 |
| | Direct Memory Access (DMA) | 95 |
| | Base Memory Address | 98 |
| | Base I/O Address | 99 |
| | Interrupt Setting | 101 |
| 6 | Performance | 105 |
| 7 | Open Sesame | 107 |
| | Setup Programs | 108 |
| 8 | Softmenu Setup | 109 |
| 9 | Standard CMOS Setup | 111 |
| | Settings | 111 |
| 10 | Advanced CMOS Setup | 119 |
| | Settings | 119 |
| 11 | Advanced Chipset Setup | 133 |
| | Refresh | 134 |
| | Data Bus | 139 |
| | Cacheing | 152 |
| | Memory | 164 |
| | Miscellaneous | 193 |
| 12 | VGA BIOS | 207 |
| | AGP | 207 |
| 13 | Power Management | 217 |
| 14 | Plug and Play/PCI | 233 |
| | ESCD | 234 |
| | PCI Identification | 234 |
| | PCI Slot Configuration | 256 |

| | |
|--------------------------------------|------------|
| 15 Peripheral Setup | 289 |
| System Monitor Setup | 298 |
| 16 Nasty Noises | 301 |
| ALR | 301 |
| Ambra | 301 |
| AMI | 301 |
| AST | 302 |
| Award | 307 |
| Compaq | 308 |
| Dell (Phoenix) | 311 |
| IBM | 312 |
| MR BIOS | 313 |
| Mylex/Eurosoft | 313 |
| NEC | 314 |
| Packard Bell | 315 |
| Phoenix | 315 |
| Quadtel | 316 |
| Tandon | 316 |
| 17 Error Messages & Codes | 317 |
| AMI | 317 |
| AST | 319 |
| Award | 320 |
| HP Vectra | 322 |
| Olivetti | 324 |
| Phoenix | 325 |
| 18 Post Codes | 327 |
| What is a POST Diagnostic Card? | 328 |
| ACER | 329 |
| ALR | 330 |
| Ambra | 331 |
| AMI | 331 |
| Arche Technologies | 354 |
| AST | 356 |
| AT&T | 358 |
| Award | 364 |
| Chips and Technologies | 388 |
| Compaq | 391 |

| | |
|----------------------------|-----|
| Dell | 396 |
| DTK | 398 |
| Eurosoft | 399 |
| Faraday A-Tease | 399 |
| Headstart | 399 |
| HP | 400 |
| IBM | 406 |
| Intel | 411 |
| Landmark | 426 |
| Magnavox | 427 |
| Micronics | 427 |
| MR BIOS | 428 |
| Mylex/Eurosoft | 434 |
| NCR | 435 |
| Olivetti | 438 |
| Packard Bell | 443 |
| Philips/Magnavox/Headstart | 443 |
| Phoenix | 444 |
| Quadtel | 457 |
| SuperSoft | 459 |
| Tandon | 460 |
| Tandy | 464 |
| Wyse | 464 |
| Zenith | 464 |

THE BIOS

The instructions that turn a PC into a useful machine come in three stages, starting with application programs, which are loaded by an operating system, which in turn is loaded by a bootstrap loader in the BIOS (the *Basic Input/Output System*). There are several in a PC, a good example being the one on the video card that controls the interface between it and the computer. However, we are concerned with the *System BIOS*, which is a collection of assembly language routines that allow programs and the components of a PC to communicate with each other at low level. It therefore works in two directions at once and is active all the time your computer is switched on. In this way, software doesn't have to talk to a device directly, but can call a BIOS routine instead. However, the BIOS is quite an Achilles Heel and can produce many incompatibilities, so these days it is often bypassed by 32-bit software (DOS relied on it totally) - some functions have migrated to the operating system, starting with Power Management (see *ACPI*), but NT and W2K have long been replacing BIOS Code with their own *Hardware Abstraction Layer* (HAL) in the Shadowed ROM area traditionally used by the BIOS after the machine has started.

LinuxBIOS is an Open Source project aimed at replacing it with a little hardware initialization and a compressed Linux kernel that can be booted from a cold start (inside 3 seconds at last count). Linux, once bootstrapped, does not make use of BIOS calls, as it has all the low level hardware drivers itself. In addition, a "trusted BIOS" is being developed that can be included in any system that requires high assurance, such as NetTop. Some access to the Video BIOS is also allowed by some manufacturers.

For the moment, though, the System BIOS will work in conjunction with the *chipset*, which is really what manages access to system resources such as memory, cache and the data buses, and actually is the subject of this book, as all those advanced settings relate to the chipset and not the BIOS as such.

On an IBM-compatible, you will find the BIOS embedded into a ROM on the motherboard, together with hard disk utilities and a CMOS setup program, although this will depend on the manufacturer (the BIOS and CMOS are separate items). The ROM will usually occupy a 64K segment of upper memory at F000 in an ISA system, and a 128K segment starting at E000 with EISA or similar. It's on a chip so it doesn't get damaged if a disk fails, as sometimes used to happen on the Victor 9000/Sirius, which had the BIOS and system on the boot floppy.

Older machines, such as 286s, will have two ROMs, labelled *Odd* and *Even*, or *High* and *Low* (they must be in the right slots), because of the 16-bit bus, but these days there tends to be only one-look for one with a printed label (older 386s sometimes had 4). You can get away with one because BIOS code is often copied into *Shadow RAM* (explained later), and not actually executed from ROM, but from extended memory. In addition, much of the code is redundant once the machine has started, and it gets replaced by the operating system anyway. Some newer machines may actually have two single-chip BIOSes, so if one fails, the back-up kicks in. Well, in theory, anyway - there have been reports of the BIOSes flashing each other out, so later backups have become read-only.

A *Flash ROM* allows you to change BIOS code without replacing chip(s). Flash ROM, or *programmable read-only nonvolatile RAM*, if you want to be posh, is similar to the EEPROM, being a storage medium that doesn't need a continuous power source, but deals with several blocks of memory at once, rather than single bytes, making it slightly faster, but only just. Also, Flash devices can be programmed in situ, whereas EEPROMS need a special device.

Older BIOSes used EPROMs, which require ultra violet light to erase them, so were a more permanent solution. Even older BIOSes used PROMs, which can't be changed at all once programmed. All are *nonvolatile*, which means that they don't need a continuous source of power to keep information in them. Actually, this does include CMOS chips, as the power referred to is mains and not battery power, but the A+ exam might not agree.

BIOS DATA AREA

As well as ROM space, the BIOS takes 256 bytes of low memory as a *BIOS Data Area*, which contains details about the Num Lock state, keyboard buffer, etc. DOS, or whatever, loads higher than this, so it's quite safe. When power is applied, the BDA is created at memory location 0040:0000h. Here is what's in it::

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|---------|--|
| 00h | 0 | Int 14h | 2 bytes | Base I/O address for serial port 1 (COM 1) |
| 02h | 2 | Int 14h | 2 bytes | Base I/O address for serial port 2 (COM 2) |
| 04h | 4 | Int 14h | 2 bytes | Base I/O address for serial port 3 (COM 3) |
| 06h | 6 | Int 14h | 2 bytes | Base I/O address for serial port 4 (COM 4) |
| 08h | 8 | Int 17h | 2 bytes | Base I/O address for parallel port 1 (LPT 1) |
| 0Ah | 10 | Int 17h | 2 bytes | Base I/O address for parallel port 2 (LPT 2) |
| 0Ch | 12 | Int 17h | 2 bytes | Base I/O address for parallel port 3 (LPT 3) |
| 0Eh | 14 | POST | 2 bytes | Base I/O address for parallel port 4 (LPT 4) |
| 10h | 16 | Int 11h | 2 bytes | Equipment Word |
| | | | | Bits 15-14 - parallel ports installed |
| | | | | 00b = 1 parallel port |
| | | | | 01b = 2 parallel ports |
| | | | | 03b = 3 parallel ports |
| | | | | Bits 13-12 are reserved |
| | | | | Bits 11-9 - 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 - floppy drives installed |
| | | | | 0b = 1 floppy drive |
| | | | | 1b = 2 floppy drives |
| | | | | Bits 5-4 - video mode |
| | | | | 00b = EGA or later |
| | | | | 01b = color 40x25 |
| | | | | 10b = color 80x25 |
| | | | | 11b = monochrome 80x25 |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|---------|--|
| | | | | Bit 3 is reserved Bit 2 - PS/2 mouse 0b = not installed 1b = installed Bit 1 - math coprocessor 0b = not installed 1b = installed Bit 0 - boot floppy 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 |
| 17h | 22 | Int 16h | 1 byte | Keyboard shift flags 1 Bit 7 - Insert 0b = Insert off 1b = Insert on Bit 6 - CapsLock 0b = CapsLock off 1b = CapsLock on Bit 5 - NumLock 0b = NumLock off 1b = NumLock on Bit 4 - ScrollLock 0b = ScrollLock off 1b = ScrollLock on Bit 3 - Alt key 0b = Alt key is up 1b = Alt key is down Bit 2 - Control key 0b = Control key is up 1b = Control key is down Bit 1 - Left Shift key 0b = Left Shift key is up 1b = Left Shift key is down Bit 0 - Right Shift key 0b = Right Shift key is up 1b = Right Shift key is down |
| 18h | 23 | Int 16h | 1 byte | Keyboard shift flags 2 Bit 7 - Insert key 0b = Insert key is up 1b = Insert key is down Bit 6 - CapsLock 0b = CapsLock is key is up 1b = CapsLock key is down Bit 5 - NumLock key 0b = NumLock key is up 1b = Numlock key is down Bit 4 - ScrollLock key 0b = ScrollLock key is up 1b = ScrollLock key is down Bit 3 - Pause key 0b = pause key is inactive 1b = Pause key is active Bit 2 - SysReg key 0b = SysReg key is up 1b = SysReg key is down |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|----------|---|
| | | | | Bit 1 - Left Alt key 0b = Left Alt key is up 1b = Left Alt key is down Bit 0 - Right Alt key 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 - next character in keyboard buffer |
| 1Ch | 28 | Int 16h | 2 bytes | Pointer - last character in 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 not calibrated 1b calibrated |
| 3Fh | 62 | Int 13h | 1 byte | Floppy disk drive motor status Bit 7 - current operation 0b = read or verify operation 1b = write or format operation Bit 6 is not used Bit 5-4 - drive select 00b = Drive 0 01b = Drive 1 10b = Drive 2 (PC, XT) 11b = Drive 4 (PC, XT) Bit 3 - drive 3 motor 0b = motor off 1b = motor on Bit 2 - drive 2 motor 0b = motor off 1b = motor on Bit 1 - drive 0 motor 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 - drive ready status 0b = drive ready 1b = drive not ready (time out) Bit 6 - seek status 0b = no seek error detected 1b = seek error detected Bit 5 - floppy disk controller test 0b = floppy disk controller passed 1b = floppy disk controller failed |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|--------|--|
| | | | | 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 - the interrupt code 00b = command completed normally 01b = abnormal termination 10b = abnormal termination, ready on, diskette changed 11b = seek command not completed Bit 5 - seek command 0b = seek command not completed 1b = seek command completed Bit 4 - drive fault 0b = no drive fault 1b = drive fault Bit 3 - drive ready 0b = drive ready 1b = drive not ready Bit 2 - 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, 0b = no error 1b = 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 read ID fail 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 on 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 |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|---------|--|
| 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 | 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 active video page relative to 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 background intensity 1b = attribute bit controls blinking Bit 4, 1b = mode 6 graphics operation Bit 3 - video signal 0b = video signal disabled 1b = video signal enabled Bit 2 - 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 - mode 5 foreground colors 0b = green/red/yellow 1b = cyan/magenta/white Bit 4 - background color 0b = normal background color 1b = intensified background color Bit 3 - intensified border color (mode 2) and background color (mode 5) Bit 2 - red Bit 1 - green Bit 0 - blue |
| 67h | 103 | | 2 bytes | Adapter ROM offset address |
| 69h | 106 | | 2 bytes | Adapter ROM segment address |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|---------|---|
| 6Bh | 107 | | 1 byte | Last interrupt (not PC) Bit 7 - IRQ 7 0b = did not occur 01 = did occur Bit 6 - IRQ 6 0b = did not occur 01 = did occur Bit 5 - IRQ 5 0b = did not occur 01 = did occur Bit 4 - IRQ 4 0b = did not occur 01 = did occur Bit 3 - IRQ 3 0b = did not occur 01 = did occur Bit 2 - IRQ 2 0b = did not occur 01 = did occur Bit 1 - IRQ 1 0b = did not occur 01 = did occur Bit 0 - IRQ 0 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 |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|---------|--|
| 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 retries on disk error 1b = enables retries 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 - virtual DMA services 0b = not supported 1b = supported Bit 4, 0b = not used Bit 3 - 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 - bit 7 of last video mode 0b = clear display buffer setting mode 1b = do not clear the display buffer Bit 6-4 - memory on video adapter 000b = 64Kb 001b = 128Kb 010b = 192Kb 011b = 256Kb 100b = 512Kb 110 = 1024Kb or more Bit 3 - video subsystem 0b = not active 1b = active Bit 2 is reserved |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|--------|--|
| | | | | Bit 1 - monitor type 0b = color 1b = monochrome Bit 0 - alphanumeric cursor emulation 0b = disabled 1b = enabled |
| 88h | 136 | Int 10h | 1 byte | Video display adapter switches Bit 7 - state of feature connector line 1 Bit 6 - state of feature connector line 0 Bit 5-4 not used Bit 3-0 - adapter type switch settings 0000b = MDA/color 40x25 0001b = MDA/color 80x25 0010b = MDA/high-resolution 80x25 0011b = MDA/high-res enhanced 0100b = CGA 40x25/monochrome 0101b = CGA 80x25/monochrome 0110b = color 40x25/MDA 0111b = color 80x25/MDA 1000b = high-resolution 80x25/MDA 1001b = high-res enhanced/MDA 1010b = monochrome/CGA 40x25 1011b = monochrome/CGA 80x25 |
| 89h | 137 | Int 10h | 1 byte | VGA video flags 1 Bit 7 and 4 - scanline mode 00b = 350-line mode 01b = 400-line mode 10b = 200-line mode Bit 6 - display switch 0b = disabled 1b = enabled Bit 5 is reserved Bit 3 - default palette loading 0b = disabled 1b = enabled Bit 2 - monitor type 0b = color 1b = monochrome Bit 1 - gray scale summing 0b = disabled 1b = enabled Bit 0 - 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 - last data sent to 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 - last drive step rate to controller 00b = 8ms 01b = 7ms 10b = 6ms 11b = 5ms Bit 3-2 - data rate, set at start (Bits 7-6) Bit 1-0 not used |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|--------|--|
| 8Ch | 140 | Int 13h | 1 byte | Hard disk drive controller status Bit 7 - 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 - write fault 0b = write fault did not occur 1b = write error occurred Bit 4 - seek state 0b = drive selected seeking 1b = drive selected seek complete Bit 3 - data request 0b = data request is inactive 1b = data request is active Bit 2 - data correction 0b = data not corrected 1b = data corrected Bit 1 - index pulse state 0b = index pulse inactive 1b = index pulse active Bit 0 - error 0b = no error 1b = error in previous command |
| 8Dh | 141 | Int 13h | 1 byte | Hard disk drive error Bit 7 - bad sector 0b = not used 1b = bad sector detected Bit 6 - ECC error 0b = not used 1b = uncorrectable ECC error Bit 5 - media state 0b = not used 1b = media changed Bit 4 - sector state 0b = not used 1b = ID or target sector not found Bit 3 - media change request state 0b = not used 1b = media change requested Bit 2 - command state 0b = not used 1b = command aborted Bit 1 - drive track error 0b = not used 1b = track 0 not found Bit 0 - 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 - drive 1 type determination 0b = not determined 1b = determined Bit 5 - drive 1 multirate status 0b = no 1b = yes |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|--------|--|
| | | | | Bit 4 - diskette 1 change line detection 0b = no 1b = yes Bit 3 not used Bit 2 - drive 0 type determination 0b = not determined 1b = determined Bit 1 - drive 0 multirate status 0b = no 1b = yes Bit 0 - diskette 0 change line detection 0b = no 1b = yes |
| 90h | 144 | Int 13h | 1 byte | Diskette 0 media state Bit 7-6 - transfer rate 00b = 500 Kbit/sec 01b = 300 Kbit/sec 10b = 250 Kbit/sec 11b = 1 Mbit/sec Bit 5 - double stepping 0b = not required 1b = required Bit 4 - media in floppy drive 0b = unknown media 1b = known media Bit 3 not used Bit 2-0 - last access 000b = 360k media in 360K drive 001b = 360K media in 1.2M drive 010b = 1.2M media in 1.2M drive 011b = known 360K media 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 |
| | | | | As for Diskette 0 |
| 92h | 146 | Int 13h | 1 byte | Diskette 0 operational starting state Bit 7 - 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 - drive determination 0b = drive type not determined 1b = drive type determined Bit 1 - drive multirate status 0b = drive is not multirate 1b = drive is multirate Bit 0 - change line detection 0b = no change line detection 1b = change line detection |
| 93h | 147 | Int 13h | 1 byte | Diskette 1 operational starting status As for Diskette 0 |
| 94h | 148 | Int 13h | 1 byte | Diskette 0 current cylinder |
| 95h | 149 | Int 13h | 1 byte | Diskette 1 current cylinder |

| Hex | Dec | Service | Size | Function |
|-----|-----|---------|----------|--|
| 96h | 150 | Int 16h | 1 byte | Keyboard status flags 3 Bit 7, 1b = reading 2 byte keyboard ID Bit 6, 1b = last code was first ID character Bit 5, 1b = forced Numlock on Bit 4 - 101/102 key keyboard 0b = present 1b = not present Bit 3 - right alt key active 0b = not active 1b = active Bit 2 - 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, 1b not used Bit 0 - 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 |

There are several types of BIOS because so many computers need to be IBM-compatible; they're not allowed to copy each other, for obvious reasons. The BIOS worries about all the differences and presents a standard frontage to the operating system, which in turn provides a standard interface for application programs. PC and motherboard manufacturers used to make their own BIOSes, and many still do, but most are now based on code from third party companies, the most well-known of which are Phoenix, Award, Microid Research and American Megatrends (AMI). However, all is not what it seems! Award Software owns Unicore (aka **esupport.com**, the upgraders), which in turn owns MR, which does the customised stuff. Phoenix also owns Quadtel and has merged with Award.

WHAT HAPPENS WHEN YOU SWITCH ON

.....

The (x86) CPU is programmed to read the address space at FFFF:0000h, the last 16 bytes of memory in the first megabyte, which is just large enough to contain a jump command (JMP) that tells the processor where to find the BIOS code it is looking for (this is the bootstrap process). Next, the *Power On Self Test* (or POST) is run, to ensure the hardware is working (see the listings for each manufacturer to see what is actually done). During the POST, the BIOS will look for a video BIOS between C000:000h and C780:000h, and test its checksum, after which it will allow the video BIOS to initialise itself and retake control afterwards (you will see the manufacturer's logo and various ID strings on the screen). Then the area between C800:000h to DF80:0000h will be searched in 2 K increments, looking for other ROMs. They, too, will be initialised after a checksum test.

The memory area at 0000:0472h contains a flag which will tell the BIOS if a cold or warm boot has occurred (a value of 1234h means it is a warm boot. Being in *little endian format*, where the least significant byte comes first, it will be in memory as 3412). A warm boot means that most of the POST can be skipped. Once the POST is over, the BIOS looks for an operating system in various locations. Traditionally, the order is the first floppy then the first hard drive, but you can change all that in the CMOS, to include CD ROM drives, Zip drives, etc.

If the floppy drive has a bootable disk in it, the BIOS will load sector 1, head 0, cylinder 0 into memory, starting at 0000:7C00h.

HOW OLD IS MY BIOS?

.....

If you want to check how old your BIOS is, the date is on the start-up screen, usually buried in the BIOS ID String, which looks a bit like this (**121291** is the date in this AMI sample):

```
40-0201-BY6379-01101111-121291-UMCAUTO-04
```

If you don't get one, you can also use **debug**. The BIOS lives between F000:0000 and F000:FFFF, with copyright messages typically at F000:E000, F000:C000 and F000:0000.

Type:

```
debug
```

at the DOS prompt. A minus sign will appear. Press *D* followed by an address in memory to see the 128 bytes' worth of the values stored there, for example:

```
-d f000:e000
```

You can also use the *S* command to search for the word "version", although some computers, IBM and Compaq, for example, don't use version numbers. In this case, the date will be near F000:FFE0. Quit **debug** by pressing *q* at the prompt. The AMI WinBIOS has a normal date on the startup screen. Otherwise, as you can see, you don't just get the date - many manufacturers include extras that identify the state of the chipset inside. For example, with the AMI Hi-Flex BIOS, there are two more strings, displayed by pressing **Ins** during bootup, or any other key to create an error condition.

IDENTIFYING YOUR BIOS

Acer ID Strings

In the bottom left hand corner of the screen:

ACR89xxx-xxx-**950930**-R03-B6

The first 2 characters after ACR identify the motherboard (see table). The last few are the BIOS revision. The ones before that are the date (e.g. **950930**).

| ID | Board | Product | ID | Board | Product |
|----|---------|----------------------|----|------------|----------------------|
| 05 | X1B | Altos 19000 | 4B | V55LA-2M | Acros, Power, Aspire |
| 07 | M7 | Altos 900 & 9000M | 5A | X3 | Altos 19000 Pro 4 |
| 19 | V55-2 | Acros, Power | 62 | V65X | AcerAcros PII |
| 1A | M3A | Altos 300 | 63 | V58 | Entra |
| 1B | V35 | Power | 67 | V65LA | Acros, Power |
| 22 | V50LA-N | Acros, Power | 6B | A1G4 | Acros |
| 24 | M9B | Altos 9000/Pro | 6D | V20 | AcerPower |
| 25 | V55LA | Acros, Power, Aspire | 89 | M5 | Altos 7000P |
| 29 | V60N | AcerPower | 8F | M3 (SCSI) | Altos 9000 |
| 2F | M11A | Altos 900/Pro | 8F | M3-EIDE | AcerPower (590) |
| 30 | V56LA | Acros, Power, Aspire | 99 | A1GX, -2 | Acros, Power |
| 33 | V58LA | Acros, Power, Aspire | 9A | V30, -2 | Acros, Power |
| 35 | V35N | Acros, Power | 9C | V12LC, -2X | Acros, Power, Aspire |
| 46 | M9N | Altos 920 and 9100 | | | |

ALR (Gateway) ID Strings

| BIOS ID Begins | Motherboard |
|----------------|---------------|
| SU81010A | E-1400 |
| 0AAGT | E-1000 |
| 0AAKW | PII |
| 404CLOX0 | PII |
| 4D4KLOX0 | Dual PII |
| 4J4NB0X1 | Pentium |
| 4K4UE0X1 | E-1200 |
| 4M4PB0X1 | PII |
| 4M4SG0X0 | PII |
| 4R4CB0XA | Pentium 440BX |

AMI ID Strings

The release number is at the top left of the screen for AMI boards. The ID string is at the bottom left. The AMI BIOS and BIOS Plus series (1986-1990) looks like this (for example):

DINT-**1123**-04990-K8

Or, in other words:

aaaa-**bbbb**-mmddy-Kc

where:

```

aaaa  BIOS type
bbbb  Customer Number
mmddy  Release date
Kc    Keyboard BIOS version number
    
```

If the first customer number (in bold above) is **1, 2, 8** or a **letter**, it is a non-AMI Taiwanese motherboard. If it is **3, 4** or **5**, it is from AMI. **50** or **6** means a non-AMI US motherboard and **9** means an evaluation BIOS for a Taiwanese manufacturer. Otherwise, there can be up to three lines (from 1991 onwards) at the bottom left of the screen. The first is displayed automatically, the other two can be seen by pressing the **Insert** key. Aside from version numbers, the 1s and 0s indicate the state of the settings inside. The Hi-Flex BIOS might look like this (from 1991):

```
41-0102-zz5123-00111111-101094-AMIS123-P
```

Again, check the bold numbers in the third set for the manufacturer.

NON-AMI TAIWANESE BOARDS (1XXX, 8XXX)

| Code | Manufacturer | Code | Manufacturer |
|------|---------------------|------|------------------------|
| 1003 | QDI | 1514 | Wuu Lin |
| 1045 | Vtech/PC Partner | 1519 | Epox |
| 1101 | Sunlogix | 1526 | Eagle |
| 1102 | Soyo | 1531 | Force |
| 1103 | Tidalpower | 1540 | BCM |
| 1105 | Autocomputer | 1546 | Golden Horse |
| 1106 | Dynasty | 1549 | CT Continental |
| 1107 | Dataexpert | 1564 | Random Technology |
| 1108 | Chaplet | 1576 | Jetta |
| 1109 | Fair Friend | 1585 | Gleem |
| 1111 | Paoku | 1588 | Boser |
| 1112 | Aquarius Systems | 1593 | Advantech |
| 1113 | MicroLeader | 1594 | Trigon |
| 1114 | Iwill | 1608 | Consolidated Marketing |
| 1115 | Senior Science | 1612 | Datavan |
| 1116 | Chicony | 1617 | Honotron |
| 117 | A-Trend | 1618 | Union Genius |
| 1120 | Unicorn | 1621 | New Paradise |
| 1121 | First International | 1622 | RPT Intergroups |
| 1122 | MicroStar/NoteStar | 1628 | Digital Eqpt Intl |
| 1123 | Magtron | 1630 | Iston |
| 1124 | Tekram | 1647 | Lantic |
| 1126 | Chuntex | 1652 | Advanced Semiconductor |
| 1128 | Chaintech | 1655 | Kingston Tech |
| 1130 | Pai Jung | 1656 | Storage System |
| 1131 | ECS (Elite Group) | 1658 | Macrotek |
| 1132 | Dkine | 1666 | Cast Technology |
| 1133 | Seritech | 1671 | Cordial Far East |
| 1135 | Acer | 1672 | Lapro |

| Code | Manufacturer | Code | Manufacturer |
|-------------|---------------------------|-------------|---------------------|
| 1136 | Sun Electronics | 1675 | Advanced Scientific |
| 1138 | Win Win | 1685 | High Ability |
| 1140 | Angine | 1691 | Gain Technology |
| 1141 | Nuseed | 1700 | DSG Technology |
| 1142 | Firich | 1707 | Chaining Computer |
| 1143 | Crete | 1708 | E-San |
| 1144 | Vista | 1719 | Taiwan Turbo |
| 1146 | Taste | 1720 | Fantas |
| 1147 | Integrated Tech Express | 1723 | NTK |
| 1150 | Achitec | 1727 | Tripod |
| 1151 | Accos1 | 1737 | Ay Ruey |
| 1152 | Top-Thunder | 1739 | Jetpro |
| 1154 | San Li | 1743 | Mitac |
| 1156 | Technical House | 1759 | Bek-Tronic |
| 1158 | Hi-Com | 1762 | Ansoon |
| 1159 | Twinhead | 1770 | Acer Incorp. |
| 1161 | Monterey Intl | 1771 | Toyen |
| 1163 | Softek | 1774 | Acer Sertek |
| 1165 | Mercury | 1776 | Joss |
| 1168 | Rio Works | 1780 | Acrosser |
| 1169 | MicroStar | 1783 | Efar |
| 1170 | Taiwan Igel | 1788 | Systemx |
| 1171 | Shining Yuan | 1792 | U-board |
| 1172 | Giantec | 1794 | CMT |
| 1175 | Applied Component Tech | 1796 | J & J |
| 1176 | Sigma | 1800 | Syzygia |
| 1177 | High Tech Information | 1801 | Palit |
| 1178 | Clevo | 1806 | Interplanetary Info |
| 1180 | Paladin | 1807 | Expert |
| 1181 | Leo Systems (FIC) | 1810 | Elechands Intl |
| 1182 | Alpha-Top | 1815 | Powertech |
| 1183 | Mirle Automation | 1820 | Ovis |
| 1184 | Delta Electronics | 1823 | Inlog Micro |
| 1188 | Quanta | 1826 | Tercomputer |
| 1190 | Chips & Technologies | 1827 | Anpro |
| 1192 | Interlogic Industries/ICP | 1828 | Axiom |
| 1193 | Sercom | 1840 | New Union KH |
| 1195 | GNS | 1845 | PC Direct/Proware |
| 1196 | Universal Scientific | 1846 | Garnet Intl |
| 1197 | Golden Way | 1847 | Brain Power |
| 1199 | Gigabyte | 1850 | HTR Asia Pacific |
| 1201 | New Tech Intl | 1853 | Veridata |
| 1203 | Sunrex | 1856 | Smart D & M |
| 1204 | Bestek | 1867 | Lutron |
| 1209 | Puretek | 1868 | Soyo |
| 1210 | Rise | 1879 | Aeontech Intl |
| 1211 | DFI | 1881 | Manufacturing Tech |
| 1214 | Rever Computer | 1888 | Seal Intl |
| 1218 | Elite Computer | 1889 | Rock |

| Code | Manufacturer | Code | Manufacturer |
|-------------|------------------------|-------------|------------------------|
| 1221 | Darter tech | 1906 | Freedom Data |
| 1222 | Domex | 1914 | Aquarius Systems |
| 1223 | BioStar | 1917 | Source of Computer |
| 1225 | Yung Lin | 1918 | Lanner |
| 1229 | Dataworld Intl | 1920 | Ipex ITG Intl |
| 1234 | Leadman Electronics | 1924 | Join Corp |
| 1235 | Formosa Industrial | 1926 | Kou Sheng |
| 1238 | Win Tech | 1927 | Seahill Tech |
| 1240 | Free Computer | 1928 | Nexcom Intl |
| 1241 | Mustek | 1929 | CAM Enterprise |
| 1242 | Amptek | 1931 | Aaeon Techlogu |
| 1244 | Flytech | 1932 | Kuei Hao |
| 1246 | Cosmotech | 1933 | ASMT |
| 1247 | Abit | 1934 | Silver Bally |
| 1248 | Muse | 1935 | Prodisti |
| 1251 | Portwell | 1936 | Codegen |
| 1252 | Sono Computer | 1937 | Orientech |
| 1256 | Lucky Star | 1938 | Project Info |
| 1258 | Four Star | 1939 | Arbor |
| 1259 | GVC | 1940 | Sun Top |
| 1260 | DT Research | 1941 | Funtech |
| 1262 | Arima | 1942 | Sunflower |
| 1266 | Modula | 1943 | Needs System |
| 1270 | Portwell | 1945 | Norm Advanced |
| 1271 | Tidal | 1947 | Ten Yun |
| 1272 | Ultima Electronics | 1948 | Beneon |
| 1273 | UFO Systems | 1949 | National Advantage |
| 1274 | Full Yes | 1950 | MITS |
| 1275 | Jackson Dai Industrial | 1951 | Macromate |
| 1276 | Jetway | 1953 | Orlycon |
| 1277 | Tarng Bow | 1954 | Chung Yu |
| 1281 | EFA | 1955 | Yamashita |
| 1283 | Advance Creative | 1957 | High Large |
| 1284 | Lung Hwa | 1958 | Young Micro |
| 1286 | Askey Computer | 1959 | Fastfame |
| 1291 | TMC | 1960 | Acqutek |
| 1292 | Asustek | 1961 | Deson Trade |
| 1297 | DD&TT | 1962 | Atra Comms |
| 1298 | Trigem | 1963 | Dimensions Electronics |
| 1299 | Trigem | 1964 | Micron design |
| 1301 | Taken | 1965 | Cantita |
| 1304 | Dual Enterprises | 1968 | Khi Way |
| 1306 | Sky Computer Europe | 1969 | Gemlight |
| 1309 | Protronic | 1970 | MAT |
| 1317 | New Comm | 1973 | Fugutech |
| 1318 | Unitron | 1974 | Green Taiwan |
| 1323 | Inventec | 1975 | Supertone |
| 1343 | Holco | 1977 | AT&T |
| 1346 | Snobol | 1978 | Winco |

| Code | Manufacturer | Code | Manufacturer |
|-------------|----------------------|-------------|---------------------|
| 1351 | Singdak | 1980 | Teryang |
| 1353 | J Bond | 1981 | Nexcom |
| 1354 | Protech | 1982 | China Semiconductor |
| 1355 | Argo Systems | 1985 | Top Union |
| 1357 | Portwell | 1986 | DMP |
| 1367 | Coxswain | 1988 | Concierge |
| 1371 | ADI | 1989 | Atherton |
| 1373 | SiS | 1990 | Expentech |
| 1379 | Win Technologies | 1994 | CBR (Japan Cerebro) |
| 1391 | Aten Intl | 1996 | Ikou |
| 1392 | ACC | 1998 | Chang Tseng |
| 1393 | Plato Technology | 2100 | Kapok |
| 1396 | Tatung | 2292 | Olivetti |
| 1398 | Spring Circle | 6069 | Ocean Tech |
| 1400 | Key Win Electronics | 6081 | CSS Labs |
| 1404 | Alptech | 6082 | Pioneer Computers |
| 1421 | Well Join | 6105 | Dolch |
| 1422 | Labway | 6132 | Technology Power |
| 1425 | Lindata | 6165 | Genoa |
| 1437 | Hsing Tech | 6182 | Peaktron |
| 1440 | Great Electronics | 6214 | HP |
| 1450 | Win-Lan | 6259 | Young Micro |
| 1451 | Ecel Systems | 6285 | Tyan |
| 1452 | United Hitech | 6326 | Crystal |
| 1453 | Kai Mei | 6328 | Alaris |
| 1461 | Hedonic | 6347 | Teknor |
| 1462 | Arche | 6386 | Pacific Information |
| 1470 | Flexus | 6389 | Super Micro |
| 1471 | CP technology | 6399 | Mylex |
| 1472 | Datacom | 6407 | Elonex |
| 1473 | PC Chips | 6423 | American Predator |
| 1484 | Mitac | 8003 | QDI |
| 1490 | Great Tek | 8005 | AVT Industrial |
| 1491 | President Technology | 8031 | Zida |
| 1493 | Artdex | 8045 | PC Partner (V-Tech) |
| 1494 | Pro Team | 8054 | Pine |
| 1500 | Netcon/Foxen Co | 8078 | Weal Union |
| 1503 | Up Right | | |

NON-AMI USA BOARDS (6XXX)

| Code | Manufacturer | Code | Manufacturer |
|------|------------------------|------|--------------|
| 105 | Dolch | 326 | Crystal |
| 132 | Tech Power Enterprises | 386 | Pacific Info |
| 156 | Genoa | 389 | Supermicro |
| 259 | Young Micro | | |

ID STRING LINE 1

12_4-7_9-14_16-23_25-30_32-39_41 decodes as follows:

| Byte | Description | |
|-------|---|--|
| 1 | Processor Type | 0 8086/8 2 80286 3 80386, 80486, Pentium |
| 2 | Size of BIOS | 0 64K 1 128K |
| 4-5 | Major Version Number | |
| 6-7 | Minor Version Number | |
| 9-14 | Reference Number | |
| 16 | Halt on Post Error | Set to 1 if On |
| 17 | Initialize CMOS every boot | Set to 1 if On |
| 18 | Block pins 22 & 23 of keyboard controller | Set to 1 if On |
| 19 | Mouse support in BIOS/keyboard controller | Set to 1 if On |
| 20 | Wait for if error found | Set to 1 if On |
| 21 | Display Floppy error during POST | Set to 1 if On |
| 22 | Display Video error during POST | Set to 1 if On |
| 23 | Display Keyboard error during POST | Set to 1 if On |
| 25-26 | BIOS Date | Month (1-12) |
| 27-28 | BIOS Date | Date (1-31) |
| 29-30 | BIOS Date | Year (0-99) |
| 32-39 | Chipset Identification | BIOS Name |
| 41 | Keyboard controller version number | |

ID STRING LINE 2

123 5_7-10_12-13_15-16_18-21_23-24_26-27_29-31

| Byte | Description |
|-------|---|
| 1-2 | Pin no for clock switching through keyboard controller |
| 3 | High signal on pin switches clock to High(H) or Low (L) |
| 5 | Clock switching through chipset registers 0=Off 1=On |
| 7-10 | Port address to switch clock high through special port |
| 12-13 | Data value to switch clock high through special port |
| 15-16 | Mask value to switch clock high through special port |
| 18-21 | Port Address to switch clock low through special port |
| 23-24 | Data value to switch clock low through special port |
| 26-27 | Mask value to switch clock low through special port |
| 29-31 | Turbo Sw Input Pin info (Pin no for Turbo Sw Input Pin) |

ID STRING LINE 3

1-3 5 7-10 12-13 15-16 18-21 23-24 26-27 29-30 31 33

| Byte | Description |
|-------|---|
| 1-2 | Keyboard Controller Pin no for cache control |
| 3 | Keyboard Controller Pin number for cache control |
| 5 | High signal is used on the Keyboard Controller pin |
| 7-10 | Cache Control through Chipset Registers. 0= control off 1= Control on |
| 12-13 | Port Address to enable cache through special port |
| 15-16 | Data value to enable cache through special port |
| 18-21 | Mask value to enable cache through special port |
| 23-24 | Port Address to disable cache through special port |
| 26-27 | Data value to disable cache through special port |
| 29-30 | Mask value to disable cache through special port |
| 31 | Pin number for Resetting 82335 Memory controller. |
| 33 | BIOS Modified Flag; Incremented each time BIOS is modified from 1-9 then A-Z and reset to 1. If 0 BIOS has not yet been modified. |

INTEL

The AMI version number looks like this when used on Intel motherboards:

```
1.00.XX.??Y
```

where:

```
XX    BIOS version number
??    Intel Motherboard model
Y     Usually 0 or 1
```

1.00.07.DH0 would be BIOS version 7 and a TC430HX (Tucson) motherboard.

AOpen ID Strings

Normally starts with **R** and found in between the model name and the date:

```
AP58 R1.00 July.21.1997
```

Award ID Strings

The date is at the front:

```
05/31/94-OPTI-596/546/82-2A5UIM200-00
```

The next bit is the chipset and the next to last the Part Number, of which characters 6 and 7 identify the manufacturer (**M2**). The first 5 letters (of the part number) refer to the chipset (here **2A5UI**) and the last 2 (**00**) are the model number. An *i* suffix means an Intel 12v Flash ROM, and *s* refers to an SST 5v (the difference is where ESCD is stored in upper memory).