FlipPOST

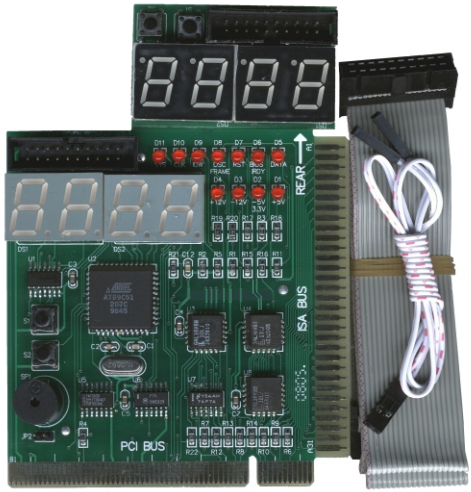
Power On Self-Test CARD for ISA and PCI Bus PCs

Test Card for ISA and PCI Bus Personal Computers

Debugs Dead PCs FAST

User's Manual

Document Number FLIPMAN20050502



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FOREWORD

There can be little doubt that diagnostic tools are critically important to everyone in the PC industry, from computer-illiterate end users to professional third party maintenance technicians. The one thing all of the millions of PCS in the world have in common is: sooner or later, used long enough, ALL of them will break down and stop working properly.

Therefore, the hope of any diagnostic product developer is: the product should be able to

1. detect a defect in the hardware,
2. detect a configuration problem in the hardware,
3. identify what caused the problem, and/or
4. suggest how to remedy the problem.

Support Hotline:
401-351-9990
support@pc-diagnostics.com

That is our *hope*. *Reality* is, understandably, a bit different. Those millions of PCs are represented by at least a dozen different architectures and scores of unique implementations, most of which are claimed by developers to be "IBM compatible". Unfortunately, every motherboard designed has SOME differences from other designs. How can a diagnostic tool provider possibly make a ubiquitous product that tests them all? Might this difficulty explain why Microsoft has stayed out of the serious PC Diagnostic product business?

Only a handful of companies in the world have the resources to procure samples of ALL those computers for testing, and they are not focusing on the diagnostic product business. To verify diagnostic tools DO work, you must use them on broken computers. It is impossible to break the hardware intentionally in all the different possible failure modes so we can prove the diagnostic product will detect the break. Imagine how we would do this with 25 million transistors in an advanced CPU, more than ten percent of which cannot be accessed without special hardware! That is why we must have "hope", and YOUR help.

There is a statistical likelihood that our product will not find a specific defect. If that happens to you, don't be surprised. Just be patient and understanding, and call, fax, or use the convenient technical report form on our web site to send us the details so we can do our best to fix it in the next release of the product. If you are a major contributor in helping us find and fix a bug, anomaly, or incompatibility, we may give you a free upgrade to the version containing the fix.

Remember that even though no diagnosic product is perfect, we have worked hard to give you perfect value for your hard-earned money.

The PC-Diag Staff

Contents

Features of the 4-digit Flip POST PC Card

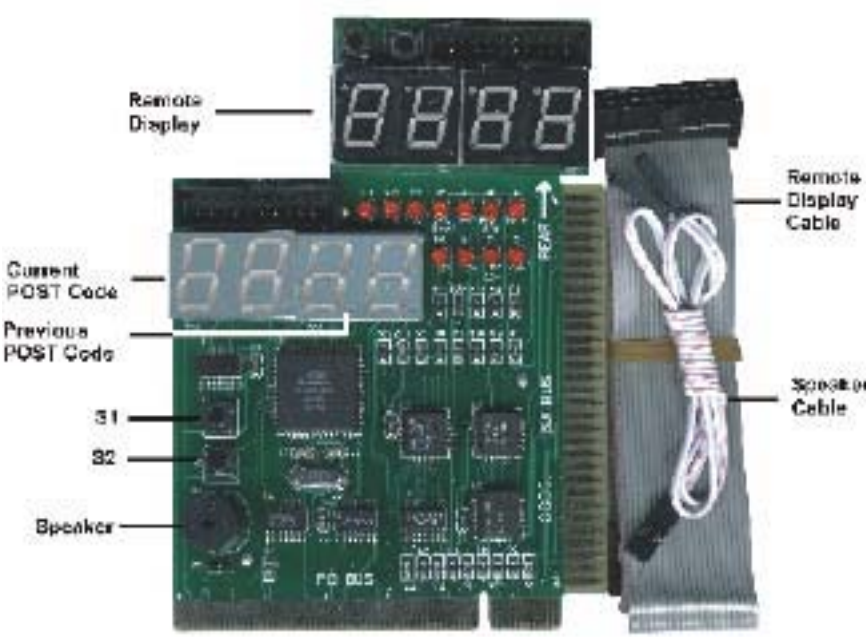
- Manually keep track of POST Code sequence
- Forward and backward buttons (S1, S2), it is easy to keep track of the POST code step by step.
- Remote LED display
- Self checking remote display function

- The left POST code display monitors the real time and the right display is the previous one.
- After boot, if S1 is pressed for 2 seconds it will show the testing speed rate, which represents the PCI clock frequency. For example if the display shows F-33 this meens the the PCI clock is 33 MHz.
- Press the S1 button again for 2 more seconds it starts the self-checking function from 0000 to 9999. to return to the original status press S1 again.

1 INTRODUCTION

Congratulations! Your selection of PC-Diag Inc's FlipPOST test card was a wise decision. It a Power-On Self-Test (POST) card that will help you debug dead PCs FAST, and it will serve you for years.

Internal Onboard Speaker, and External Speaker attachment



DUAL LED, use second LED outside case

FlipPOST is a stand-alone test card that does not need any supporting software to do its job, other than the software built into the system's BIOS boot-ROM. It might be supplied with companion diagnostic software that will help you troubleshoot systems that are running. If you do not have diagnostic software and would like to have some, contact PC-Diag.

All you will need to do to use FlipPOST is insert it in an ISA or PCI slot, switch system power on, observe the series of codes that appear on the two-digit display, wait for the code sequencing to halt, and look up the meaning of last code to appear on the display. The

meaning will indicate what test the computer failed. Normally, you can within minutes repair or deal with the problem that caused the failure. You will normally be able to determine quickly whether to replace or repair the defective motherboard or component. FlipPOST will thereby save you time and money troubleshooting computer problems. It is so easy to use that a novice can quickly master it.

FlipPOST represents an excellent value for your money. It is easy to use, gives fast results, saves repair time, reduces repair costs, and may come bundled with other utility programs or accessories. We appreciate having you as a customer and we applaud your use of FlipPOST.

We want FlipPOST to be the finest, most robust and versatile product of its kind, and we want it to be especially suitable to YOU, its users. Therefore, if you notice something that doesn't seem quite right, or you want more information or additional features, please WRITE YOUR SUGGESTION with your contact information on the Feedback Form and mail, FAX, or E-mail them to us. We can't guarantee we will do what you want, as we are faced with scheduling, research, and delivery problems like most other companies are. However, we will give your comments and suggestions immediate consideration. If possible AND practical, we will implement them. We will also notify you when the we have done so, and let you have the opportunity to be one of the first to test the new version.

About This Manual

This manual describes the FlipPOST product and tells you how to use it to troubleshoot dead computers. It contains a reference list of POST codes for the major BIOS and computer makers who publish the codes. It covers the following topics.

Chapter 1, Introduction, tells you about the manual, the product packaging, what to expect from the product, and how to get help.

Chapter 2, Operation, tells how to install and use the product.

Chapter 3, Testing Strategy, tells how to think through a problem.

Chapter 4, POST Codes, lists POST code values and meanings for major BIOSes.

Intended Audience

This manual is intended for people who have to test and troubleshoot computers. It can be educational for people who are relatively new to computers. We have attempted to write the manual so almost anyone who is familiar with the computer can understand it. The manual cannot realistically be a complete introductory text on the PC, nor can it adequately describe low-level functioning of computer components or troubleshooting techniques. All of that information is more appropriately delivered by a set of university or trainingcourses about the PC, its architecture, and how to use, configure, and repair it. If you need such training, contact PC-Diag for a recommended course.

Many of the things you might like to know are probably beyond the scope of this manual. If you need a better background in computers, we recommend you look into our training courses or those from your local community college. Call us for a specific suggestion and personal counseling on your career in PC maintenance technology.

How to Read this Book

We have tried to minimize “buzz words”. We had no choice but to use normal computer terminology, especially when referring to parts of the computer being tested, and to the PC’s internal structural or architectural elements. We suggest you have and use a dictionary of computer terms to look up unfamiliar words.

We cannot stress enough the importance of clearing up misunderstood words and phrases AS you read. Scientific evidence exists to demonstrate that...

you will become confused, unable to learn, and even upset with the subject matter if you read beyond words or phrases you do not understand.

As simple as this principle seems, to ignore it is *deadly* to your learning process; many people have given up an entire course of study just because of misunderstood words. Therefore, we encourage you not to bypass misunderstood words during reading and study. If you don’t understand it, even if the word is simple and has nothing to do with computers, look it up in an appropriate reference book.

If you want to become more familiar with the computer, order its technical reference manual from your computer manufacturer. Additional commercial texts are available to help you with maintenance and troubleshooting procedures.

We provide both email and website methods of sending us your comments, questions, and requests for assistance. It is important to write your problem or question with full details on your system, what you expected to happen, what actually happened, what you did before it happened, and your opinion on what the problem is. We welcome your feedback because it will help us improve the product. If you need more space to write, use additional paper.

We recommend that you read through the manual once before using the product, but the following paragraphs give you quick start instructions to ensure your package is complete and start using it FAST if you are in a hurry.

Package Contents

Package Contents

Item	Description
1	*FlipPOST* Test Card
2	User’s manual
3	Ribbon Cable
4	Remote Display
5	Speaker Cable

Inspect for Damage

Before using the product, inspect the package you received for evidence of shipping damage. We do not warrant the product against such damage, so if there is damage from shipping or rough handling you must file a claim with the shipping company. Inspect the card itself for evidence of damage and for completeness. Save the original packaging in case you need to ship or transport FlipPOST in the future.

Requirements and Limitations

FlipPOST requires that the system under test have an ISA (Industry Standard Architecture) or PCI (Peripheral Component Interconnect) bus slot, and that the BIOS (Basic Input Output System software) issue POST codes to I/O (Input/Output) port 80 or 680, in order to be installable and in order to be useful for testing.

If the BIOS does not issue POST codes to I/O port 80 or 680, then no intelligible information will show up on the FlipPOST display.

codes visible on a separate circuit board, such as one mounted on the front panel of the computer.

The indicators have the following meanings:

LED Display Lamp and Digital Display Meanings

LED	Meaning
5	+5VDC - the voltage supplying most integrated circuits in the system. Should be lit continuously
-12	-12VDC - the voltage supplying drives and serial ports. Should be lit continuously.
-5/3.3	-5VDC in bus systems, no longer used, or +3.3VDC in PCI bus systems with ATX power suppilies, used to power modern digital logic circuits in the system. -5V is not supplied by ATX power supplies, and 3.3V is not supplied by ISA power supplies. Should be lit continously.
12	+12VDC - the voltage supplying drives and serial ports. Should be lit continuously.
RESET	Monitors the RESET signal inside the system. RESET is generated by the clock generator circuit, and is activated for about 1/2 second during the power-on or power-off, or when you press the front panel Reset button. If on continuously, the Reset button is stuck or the power supply is defective or producing an out-of-tolerance voltage.
OSC	The Oscillator signal in ISA systems. This is the signal supplied to video boards to synchronize the horizontal retrace and the system timer. It should be lit continuously in ISA and not lit in PCI systems.
BIOS	The Memory Read signal qualified by the BIOS address range. This should be lit when BIOS is being accessed, and not lit when it is not being accessed. It will be steadily lit during POST and intermittently lit after POST.
CLK	The Bus Clock signal in ISA and PCI systems, used to synchronize operations on the motherboard and adapter cards. It should be continuously lit. CLK is If 1. -

2 INSTALLATION AND OPERATION

This chapter describes how to install and use FlipPOST to troubleshoot dead computers.

Typical Use of FlipPOST

The primary function of a Power-On Self-Test (POST) diagnostic card is to show you within seconds after you turn system power on WHAT is causing an IBM-compatible personal computer not to boot. It can also be helpful if the computer does boot but does not run properly. You will normally use the FlipPOST card to find out why a computer will not boot. A typical symptom is that the display remains blank when you switch power on. To use FlipPOST, you must switch system power off, install the card in a slot inside the computer, switch power on, and observe the two-digit while the system is attempting to boot the operating system. This is when the system runs its Power On Self Test, and displays test codes on the FlipPOST digital display. When the system does not boot, and the FlipPOST display halts, steadily showing a code, or cycling repeatedly through two or three codes, then you look up the failing code in the POST Code tables in the next chapter of this manual. You will need to refer to the specific table for the BIOS installed in your computer. To identify the BIOS, refer to the user documentation for the computer, or look for the BIOS ROM chip on the motherboard. It sometimes has a label on it that tells who the manufacturer is (typically AMI, Award, Phoenix, or the manufacturer of the computer). If you cannot find the BIOS, then you will have to look for a code meaning in all of the tables till you find one that seems correct. Once you have found the code meaning, you can ascertain what the test was doing when it failed. Normally it will be something that indicates memory, CPU, or keyboard controller failure. In some cases the failure is so catastrophic that POST cannot run at all, and the display will show only 00 or FF and not move from that value.

CAUTION: To avoid injury or damage and preserve your warranty: Do not install or remove a card while PC power is on (first remove power from the computer by disconnecting the power cord from the mains supply - the wall or power strip AC outlet, or switching power off at the power supply itself). Do not install FlipPOST backward. Prevent damage from static electricity by grounding yourself before and during handling of any circuit card. Do not hurt yourself on sharp pins protruding from the POST card or any other PC boards.

Technical Description

FlipPOST is an electronic circuit board that contains LEDs (Light Emitting Diodes) and two two-digit, seven-segment hexadecimal displays.

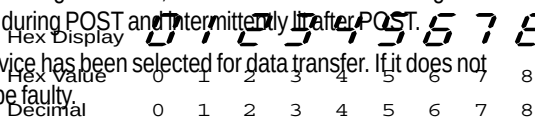
There are no switches or jumpers to set on the card. Operation is completely automatic.

The card has two edge connectors, one each for a PCI slot, an ISA slot, and an optional cable assembly for extending the digital display signals to make POST codes visible on a separate circuit board, such as one mounted on the front panel of the computer.

The indicators have the following meanings:

LED Display Lamp and Digital Display Meanings

LED	Meaning
SYS	Bus Pulse, if the LED blinks, the main board is running.
CLK	The Bus Clock signal is used to synchronize operations on the motherboard and adapter cards. It should be continuously lit. CLK is disabled in some systems during system RESET, so a defective power supply or Reset button can cause the CLK LED to be unlit.
IOW	I/o write LED lights when the BIOS writes to a device, this LED should flicker.
OSC	The Oscillator Frame signal supplied to video boards to synchronize the horizontal retrace and the system timer.
RST	Monitors the RESET signal inside the system. RESET is generated by the clock generator circuit, and is activated for about 1/4 second during the power-on or when you press the front panel Reset button. If on continuously, the Reset button is stuck or the power supply is defective or producing an out-of-tolerance voltage.
BIOS	This should be lit when BIOS is being accessed, and not lit when it is not being accessed. It will be steadily lit during POST and intermittently lit after POST.
DATA	Data Transfer shows that a device has been selected for data transfer. If it does not blink. the bus controller could be faulty.
+12	+12VDC - the voltage supplying drives and serial ports. Should be lit continuously.
-12	-12VDC - the voltage supplying drives and serial ports. Should be lit continuously.
-5/3.3	-5VDC in bus systems, no longer used, or +3.3VDC in PCI bus systems with ATX power suppilies, used to power modern digital logic circuits in the system. -5V is not supplied by ATX power supplies, and 3.3V is not supplied by ISA power supplies. Should be lit continously.
5	+5VDC - the voltage supplying most integrated circuits in the system. Should be lit continuously.



Digits	The two-digil display shows POST codes as hexadecimal values. Each digit is one of the following: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The figure shows what the codes look like on the digital display. Note that b and 6 look similar. This is a cause of problems for some users who mistake a b for a 6. Be alert to the fact that the 6 has the top segment illuminated, but the b does not.

What Is Hexadecimal?

Computers use binary (base 2) numbers almost exclusively, but they are so difficult for humans to read that people commonly use a different number system instead: Hexadecimal, or base 16. Each group of four binary digits (known as a nybble, or half of a byte) is represented by one hexadecimal digit. That is, bits 7-4 are represented by the left-most hexadecimal digit, and bits 3-0 are represented by the right-most hexadecimal digit. The following table shows how to convert from binary numbers to hexadecimal numbers. As an example, binary 0101 1110 is the same as hexadecimal 5E, often expressed as 5Eh.

Note: the right-most bit is the least significant binary digit, as in decimal numbers. The hexadecimal value shown on the hex display is equivalent to the binary value in the table.

Decimal-Hexadecimal-Binary Conversion

Dec	Hex	Bin	Dec	Hex	Bin	Dec	Hex	Bin	Dec	Hex	Bin
0	0	0000	4	4	0100	8	8	1000	12	C	1100
1	1	0001	5	5	0101	9	9	1001	13	D	1101
2	2	0010	6	6	0110	10	A	1010	14	E	1110
3	3	0011	7	7	0111	11	B	1011	15	F	1111

How to Install FlipPOST

To install FlipPOST, you must switch power to the computer off, plug it into any ISA, EISA, or PCI bus slot, and switch power back on. If all the slots are full, you will have to remove a card. We recommend not removing the video card because it is needed to show information on the system display. You can identify an ISA or EISA slot because its edge connector has wider pins than a PCI slot. You should install the card so the component side of the board faces the power supply and the right-hand edge aims to the rear of the computer. The PCI edge of the card has a key slot that prevents you from installing the card backward. However, it is possible to install the card backward in an ISA slot. If you install it backward, protection components on FlipPOST prevent it from burning out immediately, but the card will not function, and you should immediately switch power off and install the card facing the opposite direction. Your warranty will be voided if you damage the card by plugging it in backward.

FlipPOST will not show POST codes in systems that does not emit POST codes to port 80 or 680, including the IBM PC, early Hewlett Packard Vectras, and systems with AMI-XT BIOS, ERSO BIOS, or DTK BIOS.

Operation Overview

To use FlipPOST to troubleshoot dead computers, you can refer to both the on-board digital display and the LEDs (Light Emitting Diodes). The most obvious indication of a problem is that the digital display flickers through a series of codes and then halts with some code showing on the display, or it does not flicker through any codes, but halts showing 00 or FF. The next most obvious indication is the condition of the LEDs. Another obvious indication is two or more beeps from the system speaker. Most computers beep once to notify the user that POST is complete and it is booting. Multiple beeps normally means a failure has occurred.

POST Indicates Failures with Beeps and POST Codes

Various BIOSes use beep patterns to indicate failures and test status. In our tables, L S means long and short beep, and H L means high and low pitch. Most BIOSes issue 1 beep to signify POST passed and 2 or more to indicate a failure.

When to Use FlipPOST

Your FlipPOST card is the ideal companion for higher-level system diagnostic test programs. When the system boots but still fails to run properly, diagnostic test software will help you to find the cause by displaying test results on the computer screen. But when the computer fails to boot, you will often be unable to see anything on the screen. This is when you need the FlipPOST Card to find the cause of boot failure.

Verify Voltages are Okay

Verify from the Voltage LEDs that power is available. If it is not, check the power supply.

Observe POST Codes

Observe the POST codes issued by BIOS during testing. On POST cards with a hexadecimal display, note that a B displays as lower case (b) and it resembles a 6 which has the top segment lit, so don't confuse them. The codes will flash on the digital display until the computer fails or boots. If no codes appear, the switches are set wrong, the system board or the POST card is defective, or the system does not issue codes (original PC, DTK BIOS, Hewlett Packard Vectra BIOS).

Check Failure Indications

If a failure occurs, the digital display will indicate which circuit caused the failure. In the next chapter, refer to the POST codes table corresponding to the BIOS in your system. If you cannot find a table for your BIOS or if the code you receive is not in the table, contact your motherboard manufacturer for help.

If Code Indications are Strange

There are a few indications that can seem strange or seem NOT to indicate what is wrong, but they are still useful. If the POST code display immediately goes to an unlikely value when you switch power on, and it shows no other codes: if FF, most likely the BIOS does not issue POST codes, but it is possible that the CPU is not running at all. Possible causes could be bad power, stuck Reset button, bad or misconfigured CPU, or a defective BIOS ROM chip or keyboard controller. You should remove all add-in cards and all plugin-chips, clean the contacts, reinstall CPU, BIOS, and keyboard controller, and try the POST test again. Intel CPUs are normally very reliable unless they are running too hot.

Test for Intermittent Power Supply

If your POST card has a reset detector, you can test for an intermittently bad power supply that occasionally resets the computer. To do so turn the card's reset trap on AFTER switching system power on. If the power goes off or reset occurs, the reset LED (on some cards it is the decimal point in the lower digit of the display) will come on and stay on, indicating a bad supply or bad incoming power. In such a case you may need to replace the supply.

Repair or Replace the Bad Part

Repair or replace the defective parts indicated by the test failure message. If the message is difficult to interpret, call the BIOS developer or your system manufacturer for assistance.

What A POST Card Won't Do

A typical POST card is passive, and it will not:

Actively test the computer (it is a passive device); show POST results on its display better than system BIOS allows; measure signal timing or relationships; find ALL computer problems, especially those that cannot be detected BEFORE the system boots (such as bad sectors on hard drives, software/hardware incompatibilities, and detailed hardware errors that are not detected by the system BIOS' POST.

Faithful Reporting and Limitations

A POST card faithfully reports test results, but much can go wrong that it cannot identify. If system BIOS (Basic Input Output System - the startup Read-Only Memory chip on the motherboard) does not do a good job in its testing, then its test reporting can be relatively meaningless. BIOSes are notoriously bad at testing hard and floppy drives, and many of them do not give sufficient information on memory errors and other common failures. Furthermore, if you are not familiar enough with your system's architecture, then even good reporting might not be enough to help you find the problem and fix it..

If Software Won't Boot or Run

There are only a few reasons why software might not boot or run properly on your computer:

Program	The software has a compatibility bug or anomaly in it, or disk is defective;
Operator	You are not operating the software or your system correctly;
OS	The software is not compatible with your operating system;
Drive	The boot drive or its interconnection to the motherboard is defective or the data structure, boot record, or critical file is defective
Power	The Power Supply is defective and supplying low or marginal outputs, the AC power mains voltage is too low, or the power is not applied to the computer, or the computer is switched off.
Display	The system monitor is defective, misadjusted, or turned off
Component	The motherboard or a component on it such as the keyboard controller, memory, video, or CPU is defective
Configuration	The motherboard or adapter card or other device is misconfigured by virtue of a wrong setting of a switch, jumper, or CMOS setup information. Possibly the CMOS RAM battery is defective

The following topics discuss these problems and what you can do about them.

Not the Boot Drive

The drive containing the operating system might NOT be the boot drive, and you will have to reconfigure the system setup program to select the proper boot drive.

Bad CMOS RAM Setup or Battery

Often the BIOS has a SETUP program built-in, and that is used to let you configure system drives BEFORE the operating system loads. There may be some simple error in the setup, in CMOS RAM, or a non-critical device. Invoke SETUP as described in the computer manual (usually by pressing DEL or another key just after you turn power on). Use it to set the drive type, time, date, and so on.

If it seems to forget the setup, you have a defective battery inside the computer, or the CMOS RAM itself is defective. You can often replace the battery yourself, but if not, it is an easy task for a qualified repair technician. On some systems, the CMOS RAM is also easy to replace, but on others you will be better off replacing the motherboard.

If the system boots from the hard drive instead of the floppy, it could be that the advanced CMOS setup has the BIOS configured to try the hard drive BEFORE the floppy drive, and you will have to reconfigure it by entering the system's built-in SETUP program just after resetting the computer or switching power on.

It is also possible that you have the CMOS RAM parameters set up for the wrong type of drive. The boot drive should be A: and the CMOS setting for the first floppy drive should be 1.44M if you are using a 3.5-inch high-density diskette.

Defective Power Supply

The +3, +5, or +12 Volt output of the power supply may be too low or missing. Since +12 is normally the voltage required for floppy drive motors to spin, if it is missing, the motor will not spin and the floppy cannot be read. If you can see the drive spindle, verify that it is turning. If it is, +12V is working. The +3 and +5V output supplies power to the logic circuits in the computer. +3 is available only on ATX-style power supplies. If +5V or +3V is not working, the computer will not run at all. We recommend: check the voltages and replace the power supply if the voltages are not correct.

Defective or Misconnected Cables

You may not have the power cable attached from the power supply to the drive. On 3.5-inch drives, the power jack is usually very weak and difficult to remove. Its connection to the drive's PC board will break if you wiggle the plug too much while trying to disconnect it.

A major cause of problems is that the drive signal cable is connected wrongly. It MUST be connected so that pin 1 (the side of the connector nearest the black or red strip on the ribbon cable) is attached to pin 1 of the drive's PC board jack. Normally, pin one of the jack is closest to the power connector; it should be marked on the PC board. Verify proper connection to BOTH the drive and the controller circuit (on the motherboard or an adapter card).

If the connector is on upside down, the drive access light on the front of the drive will come on as soon as you switch power on, and the light will not extinguish.

It is easy to plug the signal cable connector onto the drive with an entire row of pins NOT in the plug. Verify this carefully and make sure all pins are in the plug properly.

Finally, most floppy drive cables are set up for two drives, A: and B:. Such cables have 3 connectors, one on each end, and one near an end. Some of the wires are twisted intentionally between the connectors to be mated to drives. Drive A: (the boot drive) must be on the END of the cable, not in the middle. If you have them reversed, the wrong drive will be the boot drive. Normally, the boot drive's light will come on first during the Power-On Self-Test.

Defective, Dirty, or Misaligned Drive

A major problem with floppy drives is that the heads are dirty or misaligned, or the head positioner or electronics are broken or worn out. Sometimes, the drive is positioned wrongly in comparison to other system components.

You should buy head cleaning diskettes for your drives, and clean them regularly. Oxide buildups on the heads makes them read and write erratically. We recommend Marauder brand dry head cleaning diskettes, as they are guaranteed for at least 180 cleanings, whereas most cleaning diskettes are the wet type and last only a few uses.

Many times, the heads in the drive are misaligned so that they do not sit perfectly over the center of the track. In such a case, the drive can read the diskettes that it writes but cannot reliably read disks created on other drives. If you attempt to write on a disk that was originally written by another drive, you can destroy the data or files that are already on that disk, so DON'T.

To remedy floppy drive problems, use the alignment and cleaning disks that are optionally available for FlipPOST. You can clean and align the drive in less than 15 minutes, and you only need a small screwdriver.

If the drive is defective, swap it with another drive and try booting the software again.

Defective Floppy Drive Controller

The floppy controller electronics are usually on an adapter card or on the motherboard. If this circuitry is defective, the drive might not spin or read properly. Try removing and reseating it in its slot connector, or moving it to another slot. If this does not correct the problem, move it to another slot. If it still does not work, you may need to replace it.

Defective Motherboard Buffers or DMA

Circuitry on the motherboard can be defective in such a way that signals cannot get to or from the drive controller. If so, replacing the controller or cables will not help. In such a case, the only remedy is to replace the motherboard.

Incompatibility

It is possible that your software is not compatible with your computer. In such a case you must contact the computer and/or software manufacturer for recommendations as to how to proceed.

Minimum Requirements for Booting

Your system must be working well enough to boot the operating system and let you run programs. If you can boot, but the system does not seem to run right, you might need help configuring the operating system or system hardware, and you should contact a consultant or dealer. If you cannot boot, your system could be so defective that you must use FlipPOST

to do low-level troubleshooting.

System Beeps

The computer should beep at least once (but not more than twice) and load the operating system from drive A: or C: if it is working all right. If it beeps several times or not at all, you should suspect a defective motherboard, power supply, video adapter, keyboard, or drive. If it beeps inconsistently, suspect the motherboard or power supply.

Display Problems

If the computer seems to run but nothing appears on the display, suspect the video system. Make sure the computer and monitor are interconnected and plugged in to a power source. Then, make sure the monitor is adjusted properly for brightness and contrast. On some systems you can do this by centering the controls. If there are two monitors on the system, expect to see results on the monochrome display.

POST Messages

As the computer runs its Power-On Self-Test (POST), it normally displays the area of memory it is testing (except the original IBM PC and some other computers which display nothing). If it encounters an error during POST, it may try to display an error message. Usually the message is descriptive, but the IBM PC, XT, AT and some clones display only a number. The technical documentation on your computer should describe what the error messages mean. If you don't get messages, use the FlipPOST card to diagnose the problem.

Drives are not tested comprehensively during system POST. For example, lack of a drive failure message does not necessarily mean the drive is okay.

Totally Dead - POST Card Troubleshooting

It is possible that the system seems totally dead and will not show anything on the display. In such a case, you need to troubleshoot the system with the Power-On Self-Test (POST) card. Sometimes a fatal error keeps the system from booting, but it still runs its POST. A POST card shows POST codes to indicate the progress of the self test. If POST halts the system on a fatal error, you can look up the code stuck on the card's display and know what caused the failure. PC-Diag's companion diagnostic software contains a database of POST codes for various systems. The next chapter of this manual also contains POST code listings

To use the codes, following the foregoing procedures and look up the failing code. The description of the failing test will normally indicate what to repair. For example if the memory test fails, you should replace the memory module(s), and if that does not repair the problem, replace the motherboard.

If All Else Fails

If, in spite of performing all these checks and remedial actions, you cannot get your computer to function product still won't function, call our technical support department for suggestions.

The Setup Program Built Into BIOS

The Setup Program built into BIOS allows you to change the configuration of the computer, and sometimes that will make it possible to boot and run the computer that otherwise would not boot properly. Example uses are setting up drive configuration and boot password. You press a key at boot time to enter the Setup Program, as follows:

Kestrokes to Enter Setup

BIOS	Prompt?	Keystroke
AMI	Yes	Del or Esc
Award	Yes	Del or Ctl-Alt-Esc
MR	No	Esc or Ctl-Alt-Esc
Quadtel	Yes	F2
Compaq	No	F10
AST	No	Ctl-Alt-Esc
Phoenix	No	Ctl-Alt-S
HP	No	F2

Changing the BIOS / Boot Password

If your BIOS has a password set and you do not know what it is, you will be unable to boot the system or to enter Setup to make changes. Some BIOSes provide a special password that removes the old password and allows you to enter BIOS setup. Try these:

1. The first lower case letter in each word of the BIOS maker's name
2. New Award BIOS - Award,cBBB,Syxz
3. Old Award BIOS - h996 and wantgirl
4. AMI - AM1

You may also boot from floppy, run the DEBUG program, and enter and run a program to reset the password for AMI or Award BIOS. Before doing this be sure you have a boot floppy available that can restore CMOS settings if one is required. Program lines are as follows:

DEBUG Commands to Clear Password

Award	AMI
o 70 34	o 70 16
o 71 34	o 71 16
q	q
o 70 11	o 70 10
o 70 ff	o 70 0
q	q

Another way to clear passwords is to disharge the CMOS RAM. The values in the RAM are kept alive by a battery. There is normally a switch or jumper to disconnect the battery. The CMOS will still retain a charge, possibly for a day or more. To discharge it quickly, set a switch or short together the battery jumper pins that feed CMOS. Motherboards are different in the way they enable a discharge, so consult the motherboard documentation.

Sometimes BIOS that is in Flash ROM can be destroyed or infected by a virus. The only way to repair this is to replace the BIOS ROM with another from the motherboard manufacturer, or reflash the BIOS program into the ROM. Most BIOS and motherboard makers have a downloadable re-flash utility that will boot from a floppy. Contact the manufacturer's web site or tech support team for procedural advice.

Software to Test the POST Card Display

Not only is PC-Diag Pro Diagnostic Software the perfect companion to the FlipPOST Card, it also contains a utility to test the display functions of any POST Card.

3 TESTING STRATEGY

How to Think Through a Problem

INTRODUCTION

This chapter presents a testing strategy to use when you suspect problems with your computer. When you have finished reading it you should be able to think through the approach to troubleshooting and start an actual troubleshooting process, including doing basic checks of the system. This chapter is intended for novice or junior troubleshooters, but it is a good refresher for accomplished technicians. Be sure to refer to chapters that follow this one for much more detail.

FORMULATE A STRATEGY

Before starting to troubleshoot your computer, you should plan a diagnostic strategy. A good strategy starts with your knowledge that something is wrong. It guides you in testing, then observing symptoms till you find the failing part. While there are many different kinds of PCs among the millions in existence, there are also many similarities between. Almost all have a separate power supply, a motherboard with expansion slots, and an IBM-compatible internal architecture. This fact allows you to make a generalized approach to the trouble-shooting process, as shown in the Test Strategy table in Chapter 7. It will then be up to you to interpolate the steps specific to your computer.

TYPES OF TROUBLESHOOTING

There are generally three types of troubleshooting activities:

End User

As an end users you determine what is generally wrong to report it accurately to a service technician. Ideally, you can remedy the problem yourself without calling the technician. The preceding table should have cleared up typical problems. FlipPOST is good to use if the system does not boot or display, and any commercial diagnostic software can work on systems that do boot and display.

Service

As a service technician, you determine what Field-Replaceable Unit (FRU) is bad so you can swap it for a good unit and make the system operational again, usually in a hurry. Often, you can do this at the end user's site, but sometimes you will have to take it to the repair shop. Again, FlipPOST and diagnostics will help find the bad FRU.

Repair

As a repair technician, you find the faulty component in the FRU and repair or replace it with a good component. This usually takes place in a repair shop. Sometimes the problem is easy to repair: all you have to do is unplug a chip and replace it, then retest with FlipPOST or diagnostic software. Sometimes it is much more difficult, requiring an oscilloscope or other test equipment, detailed knowledge of the schematic diagrams of the circuitry in the FRU, and soldering tools.

The Troubleshooting Process

Let's overview the thought process behind finding out what is wrong. By reviewing this process, you can minimize both mistakes and troubleshooting time.

State Symptoms Precisely

The process starts with the fact that you have noticed, or suspect, that something is wrong with the way your computer is operating. The symptom could be as severe as "nothing happens" when you switch power on. It could be something simpler, such as not being able to load a program from a floppy diskette. It is important to be able to state exactly and precisely what the symptoms of the problem are.

Is Something Wrong?

Now, make sure that the symptoms are the symptoms of a real problem. In other words, make sure you know what should be happening, so you will know that a problem actually exists because that didn't happen. To be sure, read the documentation. There could be no problem at all, but you are expecting something different from the ideal.

What Happened Just Before?

Frequently, a problem occurs immediately after some action you or someone else took that set up conditions to make the problem occur. When noting symptoms, also note what happened immediately before the problem occurred. Did you move or change something, or do something unusual? Did you try to use a feature you had not tried before? If so, that might be related to the cause of the problem.

Preliminary Checks

Now that you know the symptoms, you need to check those very first things that must be in proper order before you can expect the computer to run right. For example, if "nothing happens" when you switch power on, you should check that the computer is plugged in to a wall outlet, and that power is available at the wall outlet. Or, if a floppy program won't load, check that the floppy diskette is inserted in the drive right-side up, that the diskette density matches the drive (you can't read a high-density floppy in a low-density drive), and that the drive door is closed properly.

Assume Nothing

It is important that you make no assumptions, and that you trust only what you yourself have observed. If you are going to assume anything, assume that the system is not configured properly, and / or that the operator has made an error. Be prepared to investigate everything, including configuration and operator error, incorrect documentation, and defective equipment.

Compare: What Should / What Did

Always ask the questions "What does the documentation say should be done?", and "What was actually done?". Then investigate the answers to those two questions and compare the

results. If they are different, and they frequently are, you have the basis of the solution to the problem: do it the way the documentation says to do it. Only after you have done this and failed to get good results should you assume that the documentation is wrong, or that the computer is defective.

Will the Computer Run?

If the answer to this question is yes, then prepare to run diagnostic test software. Once you have turned on the computer and DOS has booted, all you will need to do is insert the test software floppy in a drive and enter the DOS command to execute the tests. Then, use the program to test the major functions of the computer, as described in the manual. If the software detects an error and you cannot remedy it quickly yourself, it is time to call a technician or send the computer in for repair.

If the Computer Won't Boot

In this case, it is obvious that you cannot run diagnostic software. Therefore, you must use a POST card to help you find out what is wrong. In general, the process will be to switch computer power off, remove the computer cover, set up the POST card for your computer type, and install it in an available card slot. Then switch on power and observe indications on the POST card. Look up the symptoms in the manual, and take the indicated action. You may be able to repair the problem very quickly, or you may need to call a technician.

Practical Steps to Take

There are some fundamental things you can and should do to minimize system downtime:

Keep it Clean

Sometimes a cleaning alone will cure problems. Excessive dirt and dust buildup causes electronic circuits to overheat and fail prematurely. With power off to the system, clean it thoroughly inside and out. Being careful not to dislodge components, vacuum the keyboard, power supply fan, power supply intakes, the air intakes on the case, and the motherboard area. Use a stiff round paint brush to brush off all exposed components, and unplug the adapter cards if necessary. Then vacuum again. Use dry compressed air to blow out all debris and dust. Pick up the system unit and turn it upside down and shake it gently to cause any loose items to fall out. Watch out for items such as screws, solder splashes, or components. As long as you wait till they are dry, it is usually okay to wash circuit boards (not disk drives!) with soapy water and rinse them if they are exceptionally grimy. Circuit board makers usually do this in the manufacturing process after soldering components to the board. Get a floppy drive cleaning diskette (contact PC-Diag, Inc. for a recommendation), and clean your drive heads weekly.

Inspect for Damage

Look carefully through the entire system unit for any evidence of damage and correct it. Check all cables for evidence of abrasion and exposed wires, or melted insulation, and replace or repair them. Sniff inside to detect olfactory evidence of burnt circuitry, and look for burnt traces, splattering of components that may have exploded, or discolored surfaces. The burning can be caused by shorts resulting from defective components or pieces of conductive material (such as screws, solder splashes, or open wiring) touching exposed electronic surfaces.

Reseat Jacks and Plugs

Vibration, expansion and contraction of connections because of temperature changes, jostling, and normal use can cause adapter cards, components, and cables to work loose and precipitate system failures. Periodically, open the system and press down firmly on all socketed components. Remove adapter cards and clean their edge connectors with a pencil eraser to remove any evidence of oxidation (usually not necessary on gold-plated contacts). Firmly seat them into their sockets, and screw them in place. Firmly mate all cables to their connectors and screw them in place if screws are provided. Tighten screws holding the power supply and disk drives in place.

Check Configuration

Also make sure no one changed the system's configuration jumpers or switches, or (in AT compatibles) the system CMOS RAM setup. For example, some modern systems allow you to set the system bus clock at such a high speed that ordinary video adapters and disk controllers will not run. Be sure to set the speed at a normal AT level if it was changed to a faster level.

After you have done these things, rerun the test. If it still fails, continue troubleshooting.

Consult a Technician

Before replacing any item, be sure to consult a qualified repair technician or dealer to avoid unnecessary expense replacing or repairing the wrong items. You normally have the option of replacing the defective part or having it repaired. If the bad part is an integrated circuit chip or other electronic component on a circuit board, the part must be replaced. If it is a circuit board such as the motherboard or an add-in card, a technician can repair it by removing and replacing the defective component on it. Often, this will require the use of soldering tools, but sometimes it is as simple as unplugging a chip from a socket and plugging a new one in its place. Some add-in cards are so inexpensive that it is cheaper to throw a defective one away and replace it with a new one.

Selectively Swap / Replace

Remember that an adapter card could be defective, causing it to seem as if the motherboard is defective. Try booting the system without the cards installed, and one at a time install them and note results. If it runs better with the card out, the card may be defective.

Diagnostic Test Procedure

When you have to troubleshoot your computer, you should follow a procedure similar to that in the following list of symptoms and corresponding actions. to get the fastest results.

SYSTEM IS TOTALLY DEAD AND FAN IS OFF

The power is off or disconnected. Plug in the power cord, turn on the front panel keylock, and switch power on. Watch for the power light to come on. If the fan is still off, replace the power supply.

POWER AND FAN ARE ON BUT NOTHING ELSE HAPPENS

The incoming power to the computer is extremely low, or the power supply is disconnected from motherboard, or the motherboard or some adapter card is shorting power to ground. Use a meter to verify incoming AC power is at least 95% of rated voltage. Use FlipPOST to verify DC power output of supply is at least 95%. Some systems may require 98%. If the keyboard power LED is on, then some +5 voltage is present from the supply, but it may not be high enough.

FAN AUDIBLY CHANGES PITCH; CHIRPING SOUND COMING FROM SUPPLY.

The power supply may have a variable speed fan to optimize cooling while reducing noise, so the change in pitch may not be of concern. However, the incoming AC power may be varying, probably because of excessive load on the power generating facility. If so, you should consider outfitting your computer with a brown-out proof or uninterrupted power supply. A cheap supply can allow component damage or allow data faults to occur without your knowing it. Replace a chirping supply - it is defective.

POWER AND FAN ARE ON STEADILY BUT NOTHING ELSE HAPPENS

Open the computer. Check for evidence of electrical shorts (burning smell or burn marks) on the motherboard and adapter cards; repair or replace if you find it. Verify power supply connectors are plugged onto the correct motherboard jacks. Install FlipPOST and check the power LEDs.

FLIPPOST POWER LED(S) OFF, VERY DIM, OR FLASHING

The power supply is bad or power signal connections between the supply and the expansion slot are bad. Switch power off and move FlipPOST to another slot. If the symptom persists, replace the power supply. If not, repair the bad power lines on the motherboard, or replace the motherboard. A FlipPOST power LED could be burned out, so check the power supply voltages with a meter.

POWER LEDS ON, BUT NO BIOS BEEPS, NO POST CODES, NO DISPLAY

Use a voltmeter to select each voltage. If the voltage is below 95% of its rated value, the power supply output is bad, or there is a bad connection between the supply and the slot. Check connections and replace the supply.

POWER LEDS AND PWR OK LED ARE ON; STILL NO POST CODES/BEEPS

Look at FlipPOST's BIOS, OSC and CLK LEDs. If LEDs are on, the corresponding signal is toggling (though perhaps not at the correct rate), indicating major activity is occurring.

BIOS BEEPS MORE THAN ONCE BUT NO POST CODES ARE

DISPLAYED

BIOS may not be able to display POST codes, but POST is detecting an error. Refer to BIOS maker's data on the meanings of beep patterns. Contact PC-Diag, Inc. if you think the BIOS doesn't issue the POST codes.

POST CODE STAYS BLANK WHEN POWER IS SWITCHED ON

This is the power-up state of the hex display. If the display stays blank, then no POST codes are reaching FlipPOST. This could be because FlipPOST is defective, motherboard circuits are defective, or the BIOS is not issuing POST codes. Be sure the card is plugged into a slot correctly (try switching slots). Then if the symptom persists, look at the CLK (on), OSC (on), and RESET (off) LEDs. If they are okay, suspect the CPU is not fetching instructions because a major control signal or address or data buffer in the CPU-to-BIOS path is bad, or the system is being held reset by a bad clock circuit or power supply. Reseat all chips, and look for bent, broken, shorted, or open component leads.

BIOS IS NOT ISSUING POST CODES

The BIOS ROM may be defective, or may need to be reseated in its socket. Also, the BIOS might be a type that DOES NOT issue POST codes: the original IBM PC, certain early clones of the PC BIOS, AMI XT BIOS, early HP Vectra BIOS (was derived from Phoenix, but codes were removed and the display was used exclusively), DTK, and ERSO BIOS. In this case, replace the BIOS with an upgrade from one of the major BIOS makers.

POST CODE STICKS AT SOME VALUE WHEN POWER IS SWITCHED ON

This means several codes do not flicker across the hex display, but some code sticks there. The CPU is fetching instructions, but a spurious code is sent to the display. The indication is: the CPU is fetching or executing bogus instructions. Maybe the BIOS ROM or a data buffer between the CPU and BIOS ROM is bad.

POST CODE DISPLAY CHANGES, THEN STOPS, AND SYSTEM HANGS UP

One or more major system cards or motherboard circuits is dead. Use the following steps to find the problem:

1. Look at the BIOS ROM chip label for the BIOS manufacturer name. If you have ever seen the boot message on the screen, that will have also named the BIOS manufacturer. In AT compatibles, do not mistake the keyboard controller for the BIOS chips.

2. Now, look up the POST code in the POST Codes chapter. Be sure to read the information in the beginning of that chapter first, so you will know what the codes mean.

3. Assume that all of the POST test and initialization functions worked, up to the one which failed. That means circuitry required by those functions is at least partially good. Refer to your knowledge of the system configuration and the schematic diagrams as necessary to identify the major failing subsystem item.

4. Troubleshoot based on what the codes indicate:

   a. Switch power off
   b. Remove or swap the indicated item
   c. Switch power on
   d. Watch POST codes for change in symptoms

5. Items to remove are peripheral controllers (serial, parallel, disk, video) and adapter cards. Items to swap with known-good items or others in the system are: the CPU, math coprocessor, memory chips or modules, socketed motherboard chipset components (such as bus controller or address/data bus buffers), clock chip, or crystal oscillator. Finally, swap the motherboard. The CPU seldom fails unless it is run beyond rated clock speed or at a temperature that is too high.

NO CONSOLE DISPLAY

Video adapter or monitor has a problem. Correct the installation, setup and connections of video adapter, system, and monitor. Check the monitor function and adjustment of brightness and contrast.

BIOS BEEPS MORE THAN ONCE; MAY ALSO GET CONSOLE DISPLAY

Troubleshoot circuit based on nature of beeps or display. If disk problem, verify installation, configuration, interconnection, and CMOS RAM setup of disk drives and controller. Verify boot disk is properly low-level formatted, partitioned, high-level (operating system) formatted, and loaded with a valid operating system.

SYSTEM STARTS BASIC OR GIVES INT 18 ERROR

Drives are not recognized at all. IBM bios defaults to ROM BASIC in the PC, XT, and AT under this condition. Since BASIC is invoked by Int 18, and INT 18 error means the same thing in non-IBM BIOS. The drive controller is dead, not present, or not connected.

SYSTEM SEEMS TO PASS POST BUT WON'T BOOT; DRIVE LIGHT MIGHT COME ON AND STAY ON.

You have a defective or incorrectly configured disk subsystem. Suspect the boot disk (must have an operating system on it and be of correct density for the drive it is in), missing diskette, incorrect drive type in CMOS RAM (run the Setup program built into BIOS or on a separate disk), or a different CMOS RAM hard drive type from the one that was set when the hard drive was formatted (you need to set the same type or reformat the drive). Possibly, you have not plugged power into the drive, the control cable is missing or damaged or connected wrongly (upside down, offset by one or more pins, bent pin, wrong type of cable). Perhaps the controller and the drive are not matched properly.

ONE BEEP, DISPLAY OK, SYSTEM BOOTS, DOESN'T SEEM RIGHT

Run comprehensive system, hard drive, and floppy drive diagnostic and calibration software as necessary. Contact PC-Diag, Inc. for information on products available to help with problems.

FAST TROUBLESHOOTING

To troubleshoot as fast as you can, do the following. If the computer seems dead (and you KNOW that power is properly applied and switched on) or it keeps restarting by itself, switch power off, remove the cover, install FlipPOST in an empty slot, switch power on, and look at the lights.

You will see in an instant enough information to give you a good idea of the status of the system.

Hex Display Showing Numbers

If the hex display is showing a series of numbers flashing by, you know the CPU is able to fetch and execute instructions from system BIOS, and it can send POST codes to the FlipPOST display. Typically this means the clock, oscillator, CPU, BIOS ROM, interface circuits, and bus controller are functioning reasonably well. You might have a problem with RAM, the keyboard interface, DMA or Interrupt controllers, the timer, refresh logic, memory controller, video, or other peripheral controller, but at least the system is not totally brain dead.

Hex Display Stops Sequencing

If the display stops sequencing and one code sticks on it, look up the meaning of the code in the POST code tables. Often the table will point precisely to the failing component, but many times you will have to troubleshoot further with other techniques. If POST indicates a memory failure, the problem might be refresh timing or a memory controller, and the memory itself might be okay.

POST Finishes, but No Boot

If the system test continues all the way through POST, many times you will see a 00 or FF on the hex display (depending on BIOS), though sometimes another number will appear. In any case, the system might then try to boot (load the operating system from disk. If it does this, but still won't boot, then you have a problem with the boot drive configuration or initialization, a bad drive controller, or bad drive controller interface circuitry on the motherboard. See the POST Codes chapter for more information.

Hex Display Blank

If the POST display is blank after you turn power on, and you know FlipPOST is configured right and it is not defective (see test procedure later in this chapter), then the motherboard is what one might call "brain dead". It is so defective that it cannot fetch instructions, or if it can, it is not able to send codes to the POST port. It is now that you should look at the Voltage and Probe LEDs.

Check the Voltage LEDs

All voltage LEDs should be lit according the table in the Operation chapter. If the LEDs do not light properly, you have a defective power supply, defective power signals coming to the POST card, or a defective adapter card, drive, or other circuit that is loading the supply so badly that it has shut itself down. Try swapping the supply.

Verify RESET Is Okay

Watch the Reset indicator as you turn power on. It should come on for half a second (as power rises to its proper values), and then go off. If it does not come on at all, or if it stays on, you have a defective supply or defective motherboard reset circuit. To verify which is bad, attach the logic probe and probe the Power Good signal (the rear-most wire in the power-supply connector, where it attaches to the motherboard, is usually white or orange). The Power Good signal should be high (FlipPOST HI (red) LED on). If not, the supply is defective.

OSC

The OSC signal is an analog (not TTL) signal that feeds the system timer and provides synchronization for video adapters. If the system timer does not work, then there will be no memory refresh, and no timer interrupt to the CPU.

CLK

The CLK signal is the actual clock that synchronizes data transfers throughout the system, and without it the system will not run. This clock may be separate from the clock that actually drives the CPU to make it fetch and execute instructions, but if so, the two clocks usually are derived from the same oscillator circuit.

Live Systems Need a POST Card

FlipPOST can help you identify system problems even when the computer is not dead. For example, if serial communications don't work, use FlipPOST to verify +12V and -12V are working okay, as these are needed for the serial ports to communicate with outside devices such as printers and modems. Also, the reset detector can tell you if the power supply is going bad and causing occasional system resets.

Repair or Replace?

The main circuit board inside the computer, variously called the "system board", "planar board", or most commonly, "motherboard", is normally repairable and always replaceable. The same is true of adapter cards in the computer. For most systems it is far more economical to replace a circuit board than to repair it. Unless the computer is under warranty or you have an on-site maintenance agreement with a repair company, it will cost you at least two hours of labor charges plus repair parts (and delay time) to repair a defective motherboard.

A new motherboard does not include memory chips or a CPU that are extra items. New motherboards often require new memory and CPU which are not compatible with the old board. So you will have to replace those too. Nevertheless, once costly circuit boards and memories are now commodities. It is usually more sensible to replace a defective motherboard or adapter than to have it repaired.

If you intend to replace an ISA motherboard with a PCI motherboard, you will need to make sure the case and power supply fit the new motherboard. Modern motherboards are in an ATX form factor, and use ATX power supplies. You will need to replace any adapter cards that don't fit the available slots on the new motherboard.

It is easy to replace a motherboard, and you do not need to be a technician to do it. However, you must have adequate documentation to avoid costly mistakes and possible damage. When you buy a motherboard, you frequently do not receive adequate documentation or additional suitable screws and mounting hardware. That is why it may be best to have your dealer or a qualified technician perform the replacement for you. The cost will normally be less than $100 for the dealer's help.

Okay to Replace the BIOS?

If the BIOS on the computer you are testing cannot issue POST codes, or if you do not know what the codes mean, use an upgrade BIOS that does issue POST codes. On most motherboards the BIOS ROM chips are plugged into sockets, and you may easily remove them and replace them with equivalent BIOS ROMs. Modern motherboards come with BIOS in FlashROM, and you might be able to purchase a different BIOS to load into the FlashROM chip.

You should be aware that your BIOS may do special things to initialize the circuits on your motherboard. In such a case a generic upgrade BIOS or POST ROM may not work because it is intended for a true IBM XT or AT, and not a special motherboard chipset.

Upgrade BIOS

Upgrade BIOSes for various systems are available from the major BIOS makers or their distributors: AMI, Award, and Phoenix. These are usually rather expensive, costing in the range of $35 to $75.

A less expensive source is the manufacturer of your computer. Computer manufacturers license the BIOS from the BIOS developers, and usually pay between one and five dollars apiece for them. Since various customers request different name-brand BIOSes to be in those computers, the manufacturers often have them on hand and can supply them at a more reasonable price than distributors will.

Be sure to enquire of your computer manufacturer whether the BIOS has been specially adapted for a chipset, and notify the alternate BIOS supplier of this fact before obtaining the alternate BIOS. Even if the replacement BIOS does not initialize the system ideally, it still may work well enough to test the motherboard and identify major failures.

Be Careful When Replacing ROMs

If you do decide to replace the BIOS, be sure to look at the identifying numbers on top of the BIOS ROM chip(s) to be replaced, and order the same type from your supplier. Often, the numbers are hidden beneath a label or opaque sticker. If you do not check the numbers, you can have a problem with the new BIOS.

4 BIOS BEEPS AND POST CODES

Various BIOSes use beep patterns to indicate failures and test status. In our tables, L S means long and short beep, and H L means high and low pitch. Most BIOSes issue 1 beep to signify POST passed and 2 or more to indicate a failure. Otherwise, POST codes are hexadecimal values with each digit in the range:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

We have not included all POST code tables for all BIOSes. Any BIOS prior to 1990 is omitted. If you do not find the codes you are looking for, it will be because the BIOS maker has not supplied that code to us, or the motherboard maker has modified the original code list. We recommend doing a web search, starting with http://bioscentral.com.

AMI (American Megatrends Inc)

AMI's BIOS is one of the most popular, but the company's POST code descriptions are often inadequate. Codes are sent to port 80. If a system is hung up because of an incorrect CMOS RAM setup, and you cannot get the Setup program built into AMI's BIOS to run, try holding the INS key down after switching power on.

AMI Beeps

AMI BIOS emits beep patterns to indicate POST failures, but other POST codes can be more indicative of failures. The following table shows beep meanings. The patterns are normally preceded by two beeps to indicate there is an error.

AMI BIOS POST Beeps

BEEPS	MEANING
1	DRAM refresh circuit failure, fatal
2	Parity error in base 64K, fatal
3	Base 64K or CMOS RAM failure, fatal
4	Base 64K or System timer failure, fatal
5	Processor failure, fatal
6	Fatal keyboard ctrlr/ gate A20 error, won't enter protected mode
7	Virtual mode CPU exception error, fatal
8	Bad display memory, or bad/missing video card, nonfatal
9	ROM BIOS checksum failure, fatal
10	CMOS RAM shutdown register failure, fatal
11	Cache Error / bad external cache (cache not enabled), fatal
1L 3S	Conventional / extended memory test failure, nonfatal
1L 8S	Display and vertical/horizontal retrace tests failed, nonfatal

AMI Hi-Flex BIOS and WinBIOS

Hi-Flex was released 2 February 1991 and WinBIOS 15 December 1993 for AT and EISA systems. While the codes for these are similar, they are significantly different from earlier releases. The BIOSes are well documented in AMI's tech reference manual. Tests occur in numeric order, except for codes F0 and higher..

AMI HI-FLEX & WINBIOS POST Codes

HIFLEX WINBIOS PORT 80 MEANING

These codes are displayed BEFORE BIOS is decompressed into Shadow RAM.

-	C2	Disable NMI; Start Power-On delay
-	C5	Disable any cache and enable ROM
-	C6	Calculate ROM BIOS checksum
-	C7	Read/Write test the CMOS RAM shutdown register
-	C8	Calculate CMOS RAM checksum and write CMOS diagnostic byte
-	CA	Initialize Date and Time in CMOS RAM status register
-	CB	Do initializations before issuing keyboard controller BAT command.
-	CD	Issue Basic Assurance Test command to keyboard controller and verify the result is correct.
-	CE	Do initializations following the keyboard controller BAT command
-	CF	Write the command byte to the keyboard controller
-	D1	Check if user pressed INS key during power-on
-	D2	Disable DMA and Interrupt controllers
-	D3	Disable video controller, initialize port B. Perform chipset initialization and automatic memory detect. Failure here indicates bad or missing memory or bad memory controller in chipset.
-	D4	Decompress the BIOS runtime code into shadow RAM
-	D5	Runtime code is decompressed successfully.
-	DD	Transfer control to the decompressed BIOS code that is now in shadow RAM, starting at address F000:FFF0

These codes are displayed AFTER BIOS is decompressed into RAM. Shadow RAM must be enabled for decompression to occur. If an error keeps it from being enabled, POST will halt here.

01	01	Test CPU registers and disable NMI. The test verifies all registers can write/read 0555, 0AAA, 0CCC, and 0F0F. 5 beeps if fail.
02	02	Perform power-on delay
03		Perform initialization required before keyboard Basic Assurance Test
04	03	Read keyboard SYS bit to check for soft reset or power on reset
05	05	Enable BIOS ROM; disable shadow RAM and cache memory if any
06	06	Calculate ROM BIOS checksum (32K at F800:0); 9 beeps if fail;
07	0C	When keyboard controller input buffer is free, issue BAT command to keyboard controller

08	0D	Verify result of BAT command to keyboard controller is 55; 6 beeps if fail. Stop here if disk controller cable plugged on backward or other short on bus.
09	0F	Write the command byte code to the keyboard controller
0A	--	Write the command byte data to the keyboard controller
0B	10	Issue pin 23-24 block/unblock command to keyboard controller
0C	--	Issue NOP command to keyboard controller
0D	07	Test CMOS RAM shutdown register 0F can write/read 55 and AA; may fail if CMOS RAM battery is bad.
0E	08	Calculate CMOS RAM checksum and update DIAG byte
0F	09	If "INITIALIZE CMOS IN EVERY BOOT" is enabled, init CMOS RAM
10	0A	Initialize CMOS RAM status register for time and date
--	11	Check whether user pressed INS key during power-on (to reset CMOS to BIOS defaults).
11	12	Disable all 8237 DMA and 8259 Interrupt controllers
12	12	Disable video display and initialize port B
13	13	Initialize chipset; perform automatic memory detect (if this fails, a memory chip or module may be bad or missing)
--	14	Uncompress POST software if the BIOS is compressed.
14	15	Test 8254 timer channel 2, first half
15	15	Test 8254 timer channel 2, second half
16	16	Test 8254 timer channel 1; 4 beeps if fail
17	17	Test 8254 timer channel 0
18	18	Start memory refresh
19	19	Test memory refresh toggle; 1 beep if timer ch 0 or 1 fails
1A	1A	Test memory refresh 15 microsecond on/off time (30us)
1B	--	Test 64K base memory seqential/random read/write; 3 beeps if fail
--	1E	Verify Flembok algorithm still intact after reset if no battery power
20	20	Test memory address lines; 3 beeps if fail
21	21	Test memory parity toggle
22	22	Test 64K base memory sequential data read/write; 3 beeps if fail
23	23	Setup BIOS stack in RAM and perform other initialization.
24	24	Initialize interrupt vectors in lower 1K memory
25	25	Read 8042 keyboard controller for turbo switch setting if any clear password if POST diag switch is on
26	26	Initialize global RAM data area for turbo switch
27	27	Perform other initializations
F0	F0	EISA - Initialize EISA slots
F1	F1	EISA - Set up extended NMI test configuration
F2	F2	EISA - test extended NMI

28	28	Issue BIOS setmode command to enable monochrome video
29	29	Issue BIOS setmode command to enable color video
2A	2A	Toggle parity before video adapter option ROM test
2B	2B	Initialize circuits
2C	2C	Look for and pass control to video adapter option ROM (if this fails, the video adapter or motherboard is bad)
2D	2D	Do more video initialization; determine whether EGA/VGA installed
2E	2E	EGA/VGA not installed, so prepare to test display memory
2F	2F	Write/read test primary display adapter memory
30	30	Test for primary display adapter video retrace
31	31	Display memory or video retrace failed (video adapter bad or missing - not a fatal error); sound 8 beeps; Write/read test secondary video adapter memory
32	32	Test secondary video adapter retrace
33	33	Verify display type switch setting matches actual video card
34	34	Set video display mode
35	35	Test BIOS ROM data area
36	36	Set cursor for power-on identification message
37	37	Display power-on identification message
38	38	Read the new cursor position
F3	F3	EISA - Display any EISA slot initialization errors
39	39	Display the reference text string or 'Hit <Del>' message
3A	--	Display the "Hit <ESC>" message
3B	3B	Prepare to test extended memory in protected mode
40	40	Prepare virtual mode descriptor tables. Verify test setup from display memory (if it fails, video card may be bad or missing)
41	--	Prepare virtual mode descriptor tables
42	42	Enter virtual mode for memory test
43	43	Enable interrupts for diagnostics mode if diagnostic switch is on
44	44	Initialize data to check memory wrap around at 0:0
45	45	Check memory wrap around at 0:0; find total system memory size
46	46	Write test patterns to test extended memory; 3 or 7 beeps if fail
47	47	Write test patterns to test base 640K memory; 3 beeps if fail
48	48	Find amount of memory below 1M boundary
49	49	Find amount of memory above 1M boundary
4A	--	Check ROM BIOS data area
4B	4B	Check for <Del> and clear memory below 1M
4C	4C	IF SOFT RESET: clear memory above 1M boundary
4D	4D	IF SOFT RESET: save the memory size
4E	4E	IF POWER-ON RESET: display the first 64K memory test

4F	4F	Perform sequential and random memory test below 1M; update size on the display dynamically as test runs
50	50	Adjust memory size for relocation / shadow RAM as prescribed by CMOS parameters
51	51	Test memory above 1M
52	52	Save CPU registers and memory size in prep for reset to real mode
53	53	Shutdown system (reset) and return back to real mode
54	--	Restore registers saved prior to shutdown
55	54	Disable the address line A20 gate
56	--	Check BIOS RAM data area, first half
57	--	Check BIOS RAM data area, second half
58	58	Clear "Hit <Del" message; display "WAIT..." message
59	59	Test DMA page registers
60	--	Verify from display memory
61	60	Test DMA controller #1 base registers
62	62	Test DMA controller #2 base registers
63	--	Check BIOS RAM data area, first half
64	--	Check BIOS RAM data area, second half
65	65	Initialize 8237 DMA controllers 1 and 2
66	66	Initialize 8259 Interrupt controller
67	67	Test keyboard
F4	F4	EISA - enable the extended NMI
80	80	Clear keyboard output buffer, check for stuck key, issue keyboard reset command
81	81	Keyboard error or stuck key found; issue keyboard controller interface test command
82	82	Write keyboard command byte and initialize circular buffer
83	83	Check for lock key
84	84	Check CMOS RAM info for memory size mismatch
85	85	Display soft errors; check CMOS setup for password or bypass setup
86	86	Additional initialization prior to entering setup program
87	87	Uncompress compressed Setup code as needed, and enter CMOS RAM setup program, then clear screen on exit
88	88	Additional initialization after finishing setup
89	89	Display power-on identification message
8A	8A	Display "WAIT..." message. (HiFlex-check mouse and initialize)
8B	8B	Copy main and video BIOS to shadow RAM in accordance with CMOS RAM parameters
8C	8C	Program system setup options per CMOS RAM parameters
8D	8E	Reset hard disk and floppy disk

F5	8D	EISA/WINBIOS - Display "Wait" message. Set interrupt controller for PS2 mouse edge/level sensitivity; check & initialize mouse.
8E	--	Check presence of floppy drives
8F	8F	Initialize floppy interface
90	90	Check presence of hard disk
91	91	Initialize hard disk interface (if this fails, the hard drive cable may be loose or disconnected)
92	--	Check BIOS RAM data area, first half
93	--	Check BIOS RAM data area, second half
94	94	Test base and extended memory size; adjust size to compensate for added mouse, hard disk type 47 support
95	--	Verify from display memory
96	96	Do pre-ROM-scan initializations
97	97	Look for and pass control to adapter option ROMs at C8000-ED000
98	98	Do post-ROM-scan initializations
99	99	Set up BIOS RAM data area for timer and printer base address
9A	9A	Set up BIOS RAM data area for serial port base address
9B	9B	Do pre-mathchip test initializations
9C	9C	Initialize the 80x87 math coprocessor circuit
9D	9D	Do post-mathchip test initializations
9E	9E	Check extended keyboard, num-lock and keyboard ID settings
9F	9F	Issue keyboard ID and num-lock setup command
A0	A0	Reset keyboard ID flag
A1	A1	Test cache memory
A2	A2	Display messages for any soft (non-fatal) errors
A3	A3	Set keyboard typematic rate
A4	A4	Program the chipset for desired memory wait states
A5	A5	Clear the screen
A6	A6	Enable parity checking and non-maskable interrupt
A7	A7	Do pre-diagnostic initializations
A8	A8	Start optional diagnostics/hard drive format at E0000
A9	A9	Do post-diagnostic initializations
AA	AA	Display the system configuration message
	B0	Uncompress the SETUP program code in order to setup hotkeys.
	B1	Copy uncompressed code to appropriate RAM areas.
F0-F5	F0-F4	See codes 27-28, 38-39, 67-80, 8D-8E for these codes
00	00	Call INT 19 to get boot loader from sector 1 into address 7C00h (to boot the operating system from floppy, hard drive, or network). If no boot device found, or if boot device has an invalid partition table or boot sector, or the drive geometry (heads, sectors) specified by the drive

type table differs from that in the boot parameter block or partition table in sector 1, the boot process will fail and cause INT 18 (to load BASIC in the original IBM AT).

AMI Version 8 BIOS (5/2002+)

The boot block initialization code sets up the chipset, memory and other components before system memory is available. The following table describes the type of Codes that may occur during the boot block initialization portion of the BIOS:

AMIBIOS 8 Boot Block Codes

Code	Description
Before	Early chipset initialization is done. Early super 1/0 initialization is done including RTC and keyboard controller. NMI is disabled.
D1	Perform keyboard controller BAT test. Check if waking up from power management suspend state. Save power-on CPUID value in scratch CMOS.
DO	Go to flat mode with 4GB limit and GA20 enabled. Verify the bootblock checksum.
D2	Disable CACHE before memory detection. Execute full memory sizing module. Verify that flat mode is enabled.
D3	If memory sizing module not executed, start memory refresh and do memory sizing in Bootblock code. Do additional chipset initialization. Re-enable CACHE. Verify that flat mode is enabled.
D4	Test base 512KB memory. Adjust policies and cache first 8MB. Set stack.
D5	Bootblock code is copied from ROM to lower system memory and control is given to it. BIOS now executes out of RAM. D6 Both key sequence and OEM specific method is checked to determine if BIOS recovery is forced. Main BIOS checksum is tested. If BIOS recovery is necessary, control flows to Code EO. See Bootblock Recovery Codes for more information.
D7	Restore CPUID value back into register. The Bootblock- Runtime interface module is moved to system memory and control is given to it. Determine whether to execute serial flash.
D8	The Runtime module is uncompressed into memory. CPUID information is stored in memory.
D9	Store the Uncompressed pointer for future use in PMM. Copying Main BIOS into memory. Leaves all RAM below 1 MB Read-Write including EOOO and FOOO shadow areas but closing SMRAM.
DA	Restore CPUID value back into register. Give control to BIOS POST (ExecutePOSTKernel). See POST Codes for more information.

The boot block recovery code gets control when the BIOS determines that a BIOS recovery needs to occur because the user has forced the update or the BIOS checksum is corrupt. The following table shows the codes that may appear during the BIOS boot block recovery process:

AMIBIOS 8 Boot Block Recovery Codes

Code	Description
EO	Initialize the floppy controller in the super 1/0. Some interrupt vectors are initialized. DMA controller is initialized. 8259 interrupt controller is initialized. L1 cache is enabled.
E9	Set up floppy controller and data. Attempt to read from floppy.
EA	Enable ATAPI hardware. Attempt to read from ARMD and ATAPI CDROM.
EB	Disable ATAPI hardware. Jump back to Code E9.
EF	Read error occurred on media. Jump back to Code EB.
E9/EA	Determine information about root directory of recovery media.
FO	Search for pre-defined recovery file name in root directory.
F1	Recovery file not found.
F2	Start reading FAT table and analyze FAT to find the clusters occupied by the recovery file.
F3	Start reading the recovery file cluster by cluster.
F5	Disable L 1 cache.
FA	Check the validity of the recovery file configuration to the current configuration of the flash part.
FB	Make flash write enabled through chipset and OEM specific method. Detect proper flash part. Verify that the found flash part size equals the recovery file size.
F4	The recovery file size does not equal the found flash part size.
FC	Erase the flash part.
FD	Program the flash part.
FF	The flash has been updated successfully. Make flash write disabled. Disable ATAPI hardware. Restore CPUID value back into register. Give control to FOOO ROM at FOOO:FFFOh.

Codes that may occur during the normal POST portion of the BIOS:

AMIBIOS 8 Normal POST Codes

Code	Description
03	Disable NMI, Parity, video for EGA, and DMA controllers. Initialize BIOS, POST, Runtime data area. Also initialize BIOS modules on POST entry and GPNV area. Initialized CMOS as mentioned in the Kernel Variable "wCMOSFlags."
04	Check CMOS diagnostic byte to determine if battery power is OK and CMOS checksum is OK. Verify CMOS checksum manually by reading storage area. If the CMOS checksum is bad, update CMOS with power-on default values and clear passwords. Initialize status register A. Initializes data variables that are based on CMOS setup questions. Initializes both the 8259 compatible PICs in the system

05	Initializes the interrupt controlling hardware (generally PIC) and interrupt vector table.
06	Do R/W test to CH-2 count reg. Initialize CH-O as system timer. Install the POSTINT1Ch handler. Enable IRQ-O in PIC for system timer interrupt. Traps INT1Ch vector to "POSTINT1ChHandlerBlock."
08	Initializes the CPU. The BAT test is being done on Kbc. Program the keyboard controller command byte is being done after Auto detection of KB/MS using AMI KB-5.
OA	Initializes the 8042 compatible Key Board Controller.
OB	Detects the presence of PS/2 mouse.
OC	Detects the presence of Keyboard in KBC port.
OE	Testing and initialization of different Input Devices. Also,update the Kernel Variables. Traps the INT09h vector, so that the POST INT09h handler gets control for IRQ1. Uncompress all available language,BIOS logo, and Silent logo modules.
13	Early POST initialization of chipset registers.
24	Uncompress and initialize any platform specific BIOS modules.
30	Initialize System Management Interrupt.
2A	Initializes different devices through DIM. See DIM Codes for more information.
2C	Initializes different devices. Detects and initializes the video adapter installed in the system that have optional ROMs.
2E	Initializes all the output devices.
31	Allocate memory for ADM module and uncompress it. Give control to ADM module for initialization. Initialize language and font modules for ADM. Activate ADM module.
33	Initializes the silent boot module. Set the window for displaying text information.
37	Displaying sign-on message, CPU information, setup key message, and any OEM specific information.
38	Initializes different devices through DIM. See DIM Codes for more information.
39	Initializes DMAC-1 & DMAC-2.
3A	Initialize RTC date/time.
3B	Test for total memory installed in the system. Also, Check for DEL or ESC keys to limit memory test. Display total memory in the system.
3C	Mid POST initialization of chipset registers.
40	Detect different devices (Parallel ports, serial ports, and coprocessor in CPU, ... etc.) successfully installed in the system and update the BDA, EBDA...etc.
50	Programming the memory hole or any kind of implementation that needs an adjustment in system RAM size if needed.
52	Updates CMOS memory size from memory found in memory test. Allocates memory for Extended BIOS Data Area from base memory.
60	Initializes NUM-LOCK status and programs the KBD typematic rate.

75	Initialize Int-13 and prepare for IPL detection.
78	Initializes IPL devices controlled by BIOS and option ROMs.
7A	Initializes remaining option ROMs.
7C	Generate and write contents of ESCD in NVRam.
84	Log errors encountered during POST.
85	Display errors to the user and gets the user response for error.
87	Execute BIOS setup if needed / requested.
8C	Late POST initialization of chipset registers.
8E	Program the peripheral parameters. Enable/Disable NMI as selected
90	Late POST initialization of system management interrupt.
AO	Check boot password if installed.
A1	Clean-up work needed before booting to OS.
A2	Takes care of runtime image preparation for different BIOS modules. Fill the free area in FOOOh segment with OFFh.
A3	Initializes the Microsoft IRQ Routing Table. Prepares the runtime language module. Disables the system configuration diplay if needed.
A4	Initialize runtime lanRuage module.
A7	Displays the system configuration screen if enabled. Initialize the CPU's before boot, which includes the programming of the MTRR's.
A8	Prepare CPU for OS boot including final MTRR values.
A9	Wait for user input at config display if needed.
AA	Uninstall POST INT1Ch vector and INT09h vector. Deinitialzes the ADM module.

AB	Prepare BBS for Int 19 boot.
AC	End of POST initialization of chipset registers.
B1	Save system context for ACPI.
00	Passes control to OS Loader (typically INT19h).

AMIBIOS 8 DIM Codes

The Device Initialization Manager module gets control at various times during BIOS POST to initialize different BUSes. The following table shows the codes during which the DIM module is accessed:

Code	Description
2A	Initialize different buses and perform the following functions: Reset, Detect, and Disable (function 0); Static Device Initialization (function 1); Boot Output Device Initialization (function 2). Function 0 disables all device nodes, PCI devices, and PnP ISA cards. It also assigns PCI bus numbers. Function 1 initializes all static devices that include manual configured on board peripherals, memory and 1/0 decode windows in PCI-PCI bridges, and noncompliant PCI devices. Static resources are also reserved. Function 2 searches for and initializes any PnP, PCI, or AGP video devices.
38	Initialize different buses and perform the following functions: Boot Input Device Initialization (function 3); IPL Device Initialization (function 4); General Device Initialization (function 5). Function 3 searches for and configures Pel input devices and detects if system has standard keyboard controller. Function 4 searches for and configures all PnP and PCI boot devices. Function 5 configures all onboard peripherals that are set to an automatic configuration and configures all remaining PnP and PCI devices.

While control is in the different functions, additional Codes are output to port 80h as a word value to identify the routines under execution. The low byte value indicates the main POST Code. The high byte is divided into two nibbles and contains two fields. The details of the high byte of these Codes are as follows:

DIM Code High Byte XY, Upper Nybble X

The upper nybble 'X' indicates the function number that is being executed. 'X' can be from 0 to 7.

Code	Meaning
0	Disable all devices on the BUS concerned.
1	Static devices initialization on the BUS concerned.
2	Output device initialization on the BUS concerned.
3	Input device initialization on the BUS concerned.
4	IPL device initialization on the BUS concerned.

5	General device initialization on the BUS concerned.
6	Error reporting for the BUS concerned.
7	Add-on ROM initialization for all BUSes.
8	BBS ROM initialization for all BUSes.

DIM Code High Byte XY, Lower Nybble Y

The lower nybble 'Y' indicates the BUS on which the different routines are being executed. 'Y' can be from 0 to 5.

Code	Meaning
0	Generic DIM (Device Initialization Manager).
1	On-board System devices.
2	ISA devices.
3	EISA devices.
4	ISA PnP devices.
5	PCI devices.

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Tests might not be conducted in numeric order. Particularly, version 4.5 codes should display in the following order: C0, 1-7, BE, C1, C5, C6, 8-3F, BF, 40-63, B0, B1, E1-EF, FF. Award's 4.5 code list is inconsistent, even in their own documentation. Contact Award for clarification. Fatal errors halt the system

Award BIOS 4.x POST Codes

4.0	4.2	4.5	MEANING, EISA TO PORT 300, ISA TO PORT 80
01	01	01	Processor test 1: Verify CPU status flags - set, test, clear, and test the carry, zero, sign, overflow flags. Fatal.
02	02	02	Processor test 2: Write / read / verify all CPU registers except SS, SP, and BP with data patterns FF and 00. Fatal.
03	06	06	Calculate BIOS EPROM and sign-on message checksum; fail if not 0. V4.5- detect and initialize keyboard. Fatal.
04	07	07	Test CMOS RAM I/O port interface and verify battery power is available (battery status = 1). Fatal.
05	03	03	Initialize chips: Disable NMI, PIE, AIE, UEI, SQWV; disable video, parity checking, and DMA; reset math coprocessor; clear all page registers and CMOS RAM shutdown byte; Initialize timers 0, 1, and 2, and set EISA timer to a known state; initialize DMA controllers 0 and 1; initialize interrupt controllers 0 and 1; initialize EISA extended registers. Fatal:

beep, halt.

06	04	04	Test memory refresh toggle to ensure memory chips can retain data. Enable Chronoldek switch. Fatal: beep, halt.
-	-	05	Blank video and initialize keyboard controller.
-	-	06	Reserved
07	08	08	Set up low memory: Initialize chipset early; test presence of memory; run OEM chipset initialization routines; clear lower 256K of memory; enable parity checking and test parity in lower 256K; test lower 256K memory. Set up stack. Fatal: beep, halt.
08	0A	0A	Setup interrupt vector table in lower 1K RAM area: Initialize first 120 interrupt vectors with SPURIOUS_INT_HDLR, and initialize INT 00-1F according to INT_TBL.
09	0B	0B	Test CMOS RAM checksum; beep and load defaults if bad; also test extended storage of parameters in the motherboard chipset, and if valid, load these into extended CMOS RAM; if not warm-booting, display the Test CMOS RAM Checksum message.
0A	0C	0C	Initialize keyboard: If not warm-booting: Detect type of keyboard controller (optional 8242 or 8248, with Nebadon XOR gate control); set NUMLOCK status. Reset keyboard, test keyboard controller interface to verify it returned AAh and responded to enable/disable commands, set up keyboard buffer, enable keyboard and keyboard interrupts for normal use, check for 101-key type. Fatal: beep, halt.
0B	0D	0D	Initialize video interface: Detect CPU clock; read CMOS RAM location 14 to find out type of video in use; detect and initialize the video adapter.
0C	0E	0E	Test MDA &CGA video memory; write signon message to screen. V4.5 - setup & enable shadow RAM according to CMOS RAM setup.
0D	-	09	OEM specific - Initialize motherboard special chipset as required by OEM; initialize cache controller early, when cache is separate from chipset. Setup Orvonton writeback.
0E	-	-	Reserved
0F	0F	0F	Test DMA controller 0 with AA, 55, FF, 00 pattern. Fatal (display error).
10	10	10	Test DMA controller 1 with AA, 55, FF, 00 pattern. Fatal (display error).
11	11	11	DMA page registers; use I/O ports to test address circuits.

POST enables user reboot here. Fatal (display error).

12	12	-	Test 8254 timer 0 channel 0 (displays message)
13	13	-	Test 8254 timer 0 channel 1 (displays message)
14	14	14	Test 8254 timer 0 counter 2. Scan for DDNIL bits. Fatal (display error).
15	15	15	Verify 8259 interrupt controller channel 1 mask bits by toggling interrupt lines off/on. Display error.
16	16	16	Verify 8259 interrupt controller channel 2 mask bits by toggling interrupt lines off/on. Display error.
17	17	17	Test stuck 8259 interrupt bits: turn interrupts and DDNIL scan mask off and verify no interrupt mask register is on. Display error.
18	18	18	Test 8259 functionality: force an interrupt and verify the interrupt occurred. Display error.
19	19	19	Parity I/O check: Test NMI bits (I/O check) can be cleared.
-	-	1A	Display CPU clock
1A-1E	1A-1E	1B-1E	Reserved
1F	1F	1F	Set EISA mode if not warm boot: Test EISA configuration memory checksum and communication ability. If EISA non-volatile memory checksum is good, execute EISA initialization (set up INT 15 vector, set EISA mode flag). If not, execute ISA tests, clear EISA mode flag, display a message, go to POST 30.
20	20	20	Initialize and enable EISA slot 0 (system board) if not warm boot; if memory size doesn't match presence test result, display error, reset EISA mode flag disable slot, go to POST 30.
21-2F	21-2F	21-2F	Initialize and enable EISA slots 1 through 15 if not warm boot. If error, display message, reset EISA flag.
30	30	30	Size & test base memory from 256K to 640K and test it with various patterns. (v4.2 & 4.5 only size base and extended memory)
31	31	31	Size & test extended memory above 1MB using various patterns. Skipped in EISA mode. In ISA mode, press Esc to skip. (v4.2 & 4.5 only tests base and extended memory)
32	32	32	If EISA mode flag is set, then test EISA memory found during slots initialization. Skip this by pressing Esc. Display message if error.
33-3B	33-3B	33-3B	Reserved
3C	3C	3C	V4.0 verify CPU can switch in/out of protected, virtual 86,

and 8086 page modes; fatal halt. V4.2, 4.5 display the Setup message (to press Ctrl-Alt-Esc to enter Setup) at the bottom of the screen, and enable setup.			
3D	3D	3D	Detect if mouse is present, initialize it, and install interrupt vectors
3E	3E	3E	Initialize cache controller per CMOS RAM setup.
3F	3F	-	Enable shadow RAM per CMOS RAM setup or if MEM TYPE is SYS in the EISA configuration information.
40	40	40	Reserved (V4.5 - Display virus protect enable/disable)
41	41	41	If not warm boot, initialize floppy disk drive controller and any drives.
42	42	42	If not warm boot, initialize hard disk drive controller and any drives.
43	43	43	If not warm boot, detect and initialize and serial ports.
44			If not warm boot, detect and initialize and parallel and game ports. Typical stop if video board is missing or bad.
-	44	44	Reserved
45	45	45	If not warm boot, detect and initialize math coprocessor.
46	-	-	Display the Setup message (to press Ctrl-Alt-Esc to enter Setup) at the bottom of the screen, and enable setup.
47	47	-	Set system speed for boot.
48-4D	48-4D	48-4D	Reserved
4E	4E	4E	Reboot if manufacturing POST LOOP pin is set. Otherwise, display any messages for non-fatal POST errors; enter Setup if user pressed Ctrl-Alt-Esc.
4F	4F	4F	Security check (optional): Ask for password.
50	50	50	Write all CMOS RAM values back to CMOS RAM, and clear the screen.
51	51	51	Preboot enable if not warm boot: Enable parity checking, NMI, cache before boot.
52	52	52	If not warm boot, scan for and initialize any option ROMs present from C80000 to EFFFF. When FSCAN option is enabled, initialize from C80000 to F7FFF.
53	53	53	Initialize time value at address 40 of BIOS RAM area.
55	-	56	Initialize DDNIL counter to NULLs
-	-	60	Setup virus protect according to CMOS RAM
-	-	61	Set system speed for boot
-	-	62	Set up NumLock status according to CMOS RAM
63	63	63	Boot attempt: Set low stack and attempt boot by calling

INT 19.			
B0	B0	-	Spurious interrupt occurred in protected mode.
B1	B1	B1	Unclaimed NMI: If unmasked NMI occurs, display "Press F1 to disable NMI, F2 to boot".
-	-	BE	OEM Specific: program chipset registers with power-on defaults
BF	BF	BF	OEM Specific: program chipset registers with setup values from CT table (Called by POST 07 V4.0, 4.1)
C0	C0	C0	OEM Specific: Turn on/off chipset cache.
C1	C1	C1	OEM Specific: Detect and size on-board memory.
C2	C2	C2	OEM Specific Early memory initialization: Initialize board and turn on shadow and cache for fast boot.
C3	C3	-	OEM Specific: Turn on extended memory DRAM select and initialize RAM.
C4	C4	-	OEM Specific: Handle display/video switch to prevent display switch errors.
C5	C5	C5	OEM Specific: Early shadow RAM enable for fast boot (V4.0 Fast gate A20 handling).
C6	C6	C6	OEM Specific: Set cache for regions that are cacheable (V4.5 detect size of cache). Typical stop if one or more critical memory modules is missing or badly defective.
C7	-	-	OEM Specific: V4.0 Shadow video / system BIOS after memory proven good.
C8	C8	-	OEM Specific: Handle special speed switching.
C9	C9	-	OEM Specific: Handle normal shadow RAM operations.
-	CA	-	OEM Specific: Very early initialization of hardware before any other hardware initialization.
D0-DF	D0-DF	D0-DF	Debug: POST codes available during development.
E0	E0	E0	Reserved
E1-EF	E1-EF	E1-EF	Setup pages: E1 = page 1, E2 = page 2, etc.
FF	FF	FF	If no error flags such as memory size are set, boot via INT 19 - load system from drive A, then C; display error message if correct boot device not found.

Award Medallion BIOS 1.00 POST Codes (1/29/1999)

Code	Description (ISA to port 80, EISA to port 300)
CO	OEM-Specific: initialization to disable chipset, then perform cache control, internal cache and CPU test. Verify processor status Flags Carry, zero, sign, overflow. Set each flag, verify it is set, turn off each flag, verify it is off. Read/Write/Verify all CPU registers except SS, SP, and BP with data pattern FF and 00.

Periodically refresh RAM to keep the memory from, and verify memory refresh is working.

Cl	OEM-Specific: test to detect and size on-board memory. Early chip set initialization. Run OEM chipset routines. Clear, then test lower 64K of RAM.
C2	OEM-Specific: early memory and motherboard initialization
C3	OEM-Specific: extended memory selection - Turn on and initialize extended memory, cache, and Cyrix CPU.
C4	OEM-Specific: Special display handling to prevent display switch errors from occurring
C5	OEM-Specific: enable early shadow of BIOS for fast boot
C6	Detect presence and size of external cache.
CF	Check CMOS RAM circuitry.
BO	Detect spurious interrupt in protected mode.
Bl	Check for Non Masked Interrupt (NMI) and display message if occurs: "Press F1 to disable NMI, F2 reboot."
BF	Program chipset for default values
E1-EF	Setup Pages (El- Page 1, E2 - Page 2, etc.)
1	Force load default settings into chipset
3	Early initialization of Super IO
5	Reset Video controller (blanks the display)
7	Initialize the Keyboard Controller (KBC)
8	Test the Keyboard
A	Initialize the mouse
B	Initialize on-board audio controller if it exists
E	Checksum test the BIOS ROM and message area of BIOS.
10	Auto detect EEPROM - Check Flash type and copy flash write/erase routines to segment 0F000h.
12	Check CMOS circuitry and reset CMOS RAM
14	Program the chipset registers with CMOS values
16	Initialize onboard clock generator
18	Identify the CPU via CPUID and initialize Level 1 and 2 cache
lB	Setup Interrupt Vector table - Initialize first 120 interrupt vectors with SPURIOUS INT HDLR and initialize INT 00h-lFh according to interrupt table.
1D	Early PM Init - Initialization if single CPU onboard
1F	Re-initialize Keyboard
21	Initialize HPM if it exists in system
23	Test CMOS interface, functionality of CMOS circuitry, and battery functionality. If battery bad, load CMOS defaults into CMOS RAM, and then load them into chipset registers.
27	Do Final initialization of keyboard controller and setup BIOS data area

29	Initialize Video Interface - Read CMOS location 14h to find out type of video in use. Detect and Initialize Video Adapter.
2D	Test video memory, write sign-on message to screen.
2E	Setup and enable shadow RAM according to Setup.
33	Setup PS2 Mouse and reset KB
35	Test DMA channel 0
37	Test DMA channel 1
39	Test DMA Page Registers
3C	Test 8254 Timer 0 Counter 2.
3E	Verify 8259 Channel 1 masked interrupts by alternately turning off and on the interrupt lines.
40	Verify 8259 Channel 2 masked interrupts by alternately turning off and on the interrupt lines.
43	Test Stuck 8259 Interrupt - Turn off interrupts then verify no 8259's Interrupt mask register is on. Force an interrupt and verify the interrupt occurred.
47	Set EISA Mode -If EISA non-volatile memory checksum is good, execute EISA initialization. If not, execute ISA tests and clear EISA mode flag.
49	Size base memory from 256K to 640K and extended memory above 1MB.
4E	Test base memory from 256K to 640K and extended memory above 1MB using various patterns. NOTE: This test is skipped in EISA mode and can be skipped with ESC key in ISA mode.
50	Initialize USB controller
52	Test all memory of memory above 1MB using Virtual 8086 mode and page mode, then clear the memory
55	Detect CPU speed and display CPU vendor specific version string and turn on all necessary CPU features
57	Display Plug n Play logo and early-initialize PnP
59	Setup virus protect according to Setup
5B	Automatically load Awdflash.exe if required in POST
5D	Initialize on-board super IO
60	Display setup message and enable setup functions
63	Detect if mouse is present, initialize mouse, install interrupt vectors.
65	Perform special initialization for PS2 Mouse port if present
67	Initialize ACPI subsystem
69	Initialize cache controller.
6B	Enter setup check and auto-configuration check up
6D	Initialize floppy disk drive controller and any drives.
6F	Install FDD and setup BIOS data area parameters
73	Initialize hard drive controller and any drives.
75	Detect and install Hard Disk Drive and IDE devices

77	Detect & Initialize any serial, parallel, and game ports
7A	Detect & initialize math coprocessor
7C	Check Hard Disk Drive for write protection
7F	Display any soft POST errors and ask for user intervention
82	Ask for password (optional).
83	Write all CMOS values back to RAM and clear screen.
84	Pre-boot-enable parity checker, NMI, cache.
85	Initialize any option ROMs present from C8000h to EFFFFh (or to F7FFFh if FSCAN option is enabled
93	Detect boot medium - read and store boot partition head and cylinders values in RAM
94	Final initialization for last details before boot
95	Special patch for Keyboard Controller to set system speed for boot and Setup NumLock status according to Setup
96	Set low stack
FF	Bootstrap the operating system from boot medium via INT 19h

Award Medallion BIOS - Quick POST Codes

Code	Description
65	Initialize on-board devices - Early-initialize the on-board super IO. Reset video controller and initialize keyboard controller. Test the keyboard. Initialize mouse. Initialize any existing on-board audio controller. Verify checksum of ROM BIOS and message. Determine FlashROM type and copy flash write/erase routines to segments starting at 0F000h. Check CMOS circuitry and reset CMOS RAM. Program the chipset registers with CMOS values. Initialize on-board clock generator.
66	Early System setup - Check the CPU ID and initialize L1/L2 cache. Initialize first 120 interrupt vectors with SPURIOUS INT HDLR and initialize INT 00h-lFh according to INT TBL First step initialize if single CPU onboard. Re-initialize Keyboard. Initialize HPM if supported.
67	Initialize Keyboard Controller and CMOS RAM - Verify CMOS is working correctly, detect bad battery. If fails, load CMOS defaults and load into chipset. Final-initialize keyboard controller. Set up BIOS data area.
68	Initialize Video - Read CMOS location 14h to find out type of video in use. Detect and Initialize Video Adapter. Test video memory, write sign-on message to screen. Enable shadow RAM according to Setup.
69	Initialize 8259 channel 1 and mask IRQ 9
6A	Perform quick memory test
6B	Detect CPU speed. Display CPU vendor specific version string and turn on all necessary CPU features. Display PnP logo and early-initialize PnP. Setup virus

protect according to Setup. If required, will auto load Awdflash.exe in POST. Initialize onboard super IO controller.

70	Display setup message and enable setup functions. Detect and initialize mouse. Install interrupt vectors. Initialize PS2 mouse port. Initialize ACPI sub-system.
71	Initialize cache controller.
72	Install FDD Check setup and auto-configuration. Initialize floppy disk drive controller and any drives. Install FDD and setup BIOS data area parameters
73	Install HDD - Initialize hard drive controller and any drives. Detect and install IDE support. Initialize any serial, parallel, and game ports.
74	Detect & initialize math coprocessor.
75	Detect Hard Disk Drive Write protection
77	Check for and display any POST errors, and ask for user intervention. Ask for password if enabled.
78	Initialize CMOS and Option ROMs - Write all CMOS values back to RAM and clear screen. Enable parity checker. Enable NMI, Enable cache before boot. Initialize any option ROMs present from C8000h to EFFFFh or F7FFFh if FSCAN is enabled.
7D	Detect Boot Medium - Read and store boot partition head and cylinders values in RAM
7E	Final-initialize last details before boot
7F	Special patch for keyboard controller, set system speed for boot, and setup NumLock status according to Setup
80	Set low stack and boot via INT 19h.
FF	Boot done

Award Medallion BIOS - S4 POST Codes

Code	Description
5A	Early-initialize the super IO controller. Reset Video controller. Initialize keyboard controller. Test Keyboard. Initialize mouse.
5B	Check CMOS Circuitry and reset CMOS
5C	Program the chipset registers with CMOS values. Initialize onboard clock generator.
5D	Identify the CPU via CPUID and initialize L1/L2 cache
5E	Setup Interrupt Vectors - Initialize first 120 interrupt vectors with SPURIOUS INT HDLR and INT 00h-IFh according to INT TBL. Initialize features to support single CPU. Re-initialize Keyboard. Initialize HPM if supported.
5F	Test CMOS & Battery - verify CMOS RAM is working correctly, detect bad battery. If bad, load CMOS defaults and load into chipset
60	Final-initialize keyboard controller and setup BIOS data area

61 Initialize Video - Read CMOS location 14h to find out type of video in use. Detect and Initialize Video Adapter.

62 Test video memory, write sign-on message to screen. Enable shadow according to Setup.

63 Setup PS2 mouse and reset Keyboard. Test DMA channel 0

64 Test 8259 channel 1 and mask IRQ 9

65 Initialize Boot Device. Detect and initialize mouse. Install interrupt vectors. Initialize PS2 Mouse port. Initialize ACPI subsystem and cache controller.

66 Install Boot Devices Check setup and auto-configuration. Initialize floppy disk

drive controller and any drives. Install FDD and setup BIOS data area. Initialize hard drive controller and any drives. Detect and install IDE device.

67 Initialize Cache and USB

68 Initialize PM

69 Final initialize PM, and issue SMI. This is the final initialization before resume

FF Boot (full-on)

Award Medallion BIOS - Boot Block POST Codes

Code	Description
1	Test base memory by clearing base memory area (0000:0000-9000:ffffh)
5	Initialize Keyboard Controller
12	Install interrupt vectors 0-77 and initialize vectors 00-1fh to point to BIOS
OD	Initialize Video
41	Initialize Floppy Drives - Scan floppy and media capacity for on-board super IO
FF	Boot

Compaq Computer Corporation

Compaq computers send POST codes to port 84 and 85. The code sent to 85 is a special category of errors. The code sent to 84 is the actual checkpoint code for general POST. Meanings are as follows:

Compaq BIOS Category Codes

CODE	MEANING OF CODE SENT TO PORT 85
00	Major reset code
01	Major code during runtime
02	Major code for CEMM
05	Major code for VIDEO ROM
10	Entered _dum_eoi_3 module
11	Entered int_2 module
12	Emulating lock instruction
13	Emulating 286 loadall instruction
14	Illegal opcode instruction encountered
15	Entered _dum_iret module
16	Entered _irq9 module
17	Entered 287err module

Compaq BIOS Pre-Boot POST Codes

CODE	MEANING OF CODE SENT TO PORT 84
00	Init flags, MSW, IDTLIM.
01	Read manufacturing jumper.
02	8042 received read command.
03	No response from 8042.
04	Look for manufacturing ROM at E0000.
05	Look for manufacturing ROM at C8000.
06	No manufacturing ROMs.
07	Read CMOS reset code.
08	Init 8259, 80287.
09	Jump indirect indexed by reset code.
0A	Vector via 40:67 reset function.
0B	Vector via 40:67 with EOI function.
0C	Boot reset function.
0D	Test #2 8254 counter 0
0E	Test #2 8254 counter 2
0F	Warm Boot
09F	Invalid CPU Bridge ID
010	PPI disabled, Program timers 0 & 1.
011	Init (blast) VDU controllers.
012	Clear screen, trun on video.
013	Test timer 0.
014	Disable RTC interrupts.
015	Check battery power.
016	Battery has lost power.
017	Clear CMOS_DIAGS.
018	Test base memory (first 128K).
019	Clear and initialize base memory.
01A	Initialize and test VDU adapters.
01B	Test the system ROM.
01C	Test CMOS.
01D	Test DMA controller and page registers.
01E	Test keyboard controller.
01F	Test 286 protected mode.
020	Test real and extended memory.
021	Init time-of-day.
022	Init 287 coprocessor.

drive controller and any drives. Install FDD and setup BIOS data area. Initialize hard drive controller and any drives. Detect and install IDE device.

67 Initialize Cache and USB
68 Initialize PM
69 Final initialize PM, and issue SMI. This is the final initialization before resume
FF Boot (full-on)

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15	Entered _dum_iret module
16	Entered _irq9 module
17	Entered 287err module

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0C	Boot reset function.
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01A	Initialize and test VDU adapters.
01B	Test the system ROM.
01C	Test CMOS.
01D	Test DMA controller and page registers.
01E	Test keyboard controller.
01F	Test 286 protected mode.
020	Test real and extended memory.
021	Init time-of-day.
022	Init 287 coprocessor.

07C	High order address test failure
07D	Entered cache controller test
07E	Programming memory cacheability
07F	Copy System ROM to high RAM
080	Start of 8042 test.
081	Do 8042 self-test.
082	Check result received.
083	Error result.
084	OK 8042, Init mode = 5D.
086	Start kbd test, reset keyboard.
087	Got acknowledge, read result.
088	Got result, check it.
089	Test for stuc keys.
08A	Key seems to be stuck.
08B	Test keyboard interface.
08C	Got result, check it.
08D	End of test, no errors.
090	Start of CMOs test.
091	CMOS seems to be OK.
092	Error on CMOS read/write test.
093	Start of DMA controller test.
094	Page registers seem OK.
095	DMA controller OK.
096	8237 Initialization complete.
097	Initializing SMI Handler
098	SMI failed to occur
09A	START OF NCA RAM Test
0A0	Start of diskette tests
0A1	FDC reset active (3f2H bit 2)
0A2	FDC reset inactive (3f2H bit 2)
0A3	FDC motor on
0A4	FDC time-out error
0A5	FDC failed reset
0A6	FDC passed reset
0A7	(reserved)
0A8	Start of determine drive type
0A9	Seek operation initiated
0AA	Waiting for FDC seek status
0AB	(reserved)

0AC	(reserved)
0AD	(reserved)
0AE	(reserved)
0AF	Diskette tests complete
0B0	Start of fixed drive tests
0B1	Combo board not found, exit
0B2	Combo controller failed, exit
0B3	Testing drive 1
0B4	Testing drive 2
0B5	Drive error (error condition)
0B6	Drive failed (failed to respond)
0B7	CMOS RAM invalid or no fixed drives, exit
0B8	Fixed drive tests complete
0B9	Attempt to boot diskette
0BA	Attempt to boot fixed drive
0BB	Boot attempt failed (diskette or fixed)
0BC	Boot record read, jump to boot record
0BD	Drive error, retry booting
0BE	Weitek coprocessor test
0C0	EISA non-volatile memory check_sum
0C1	EISA initialize DDF map
0C2	EISA IRQ initialization
0C3	EISA DMA initialization
0C4	EISA slot initialization

0C5	EISA display config error msgs
0C6	EISA PZ initialization began
0C7	EISA PZ initialization done
0C8	(reserved)
0C9	(reserved)
0CA	(reserved)
0CB	(reserved)
0CC	PCI/PNP autoconfiguration phase 1
0D0	Entry to clear memory routine
0D1	ready to go to protected mode
0D2	ready to clear extended mem
0D3	ready to reset back to real mode
0D4	back in real mode
0D5	clear base memory
0DD	Built-In self test failed
0E0	Ready to replace E000 ROM
0E1	Completed E000 ROM replacement
0E2	Ready to replace EGA ROM
0E3	Completed EGA ROM replacement
0E8	Initialize Power managment subsystem

Hewlett Packard Company

HP computers typically do not show POST error codes on a POST card display, but instead show them on the monitor. The following table shows code meanings.

Hewlett Packard Company BIOS POST Codes

CODE	MEANING OF DISPLAYED CODE
0000	Any POST error that is not listed below
0010	CMOS checksum error (if no Serial EEProm)
0011	Date and Time lost (CMOS backed up from SE2P)
0012	PC configuration lost (both SE2P and CMOS lost)
0020	Any POST error regarding an AT option ROM
0021	Any POST error regarding an external PCI card issue
0022	Any POST error regarding a AT PnP issue
0023	Reserved one for NSD purposes related to ROM
0030	Unsupported CPU speed switch setting
0040	Serial number corrupted (bad checksum or null #)
0041	Prodcut flag not initialized or bad
0050	Fan not connected (according to CPU)

0060	RPO initialization failure
0100	Keyboard stuck key
0101	Keyboard self-test failure
0102	Keyboard controller IO access failure
0103	Keyboard not connected
0105	Mouse self-test failure
0106	Mouse not detected (but configured in CMOS)
0108	Mouse and Keyboard connectors reversed
0200	Conflict on serial port (@,IRQ)
0201	Conflict on parallel port (@,IRQ,DMA)
0300	Floppy A: self-test failure
0301	Floppy B: self-test failure
0310	Floppy A: not detected (but configured in CMOS)
0311	Floppy B: not detected (but configured in CMOS)
0305	Floppy A: plugged on Floppy B: connector
0306	General failure on floppy controller
0307	Conflict on floppy disk controller
0400	CD-ROM test failure
0401	CD-ROM not detected (but configured in CMOS)
0500	General failure on HDD on-board primary ctrl
0501	General failure on HDD on-board secondary ctrl
0510	HDD # 0 self-test failure
0511	HDD # 1 self-test failure
0512	HDD # 2 self-test failure
0513	HDD # 3 self-test failure
0520	HDD # 0 not detected (but configured in CMOS)
0521	HDD # 1 not detected (but configured in CMOS)

0522	HDD # 2 not detected (but configured in CMOS)
0523	HDD # 3 not detected (but configured in CMOS)
0530	Found a drive on slave connector only (primary)
0531	Found a drive on slave connector only (secondary)
0540	Conflict on hard disk controller
0600	Found less video memory than configured in CMOS
0700	Found less DRAM memory than at previous boot
0701	Reserved one for NSD purposes related to memory
0711	Defective SIMM (module 1, bank 1)
0712	Defective SIMM (module 2, bank 1)
0721	Defective SIMM (module 1, bank 2)
0722	Defective SIMM (module 2, bank 2)
0731	Defective SIMM (module 1, bank 3)
0732	Defective SIMM (module 2, bank 3)
0800	Found lower cache size than configured
0801	Cache self-test failure
0900	Lan (Chanteclerc) self-test failure
0901	Lan (Chanteclerc) not detected (but enabled in setup)
0A00	Plug@Play video auto-setting failure (DDC hang)

Microid Research Inc.

Microid's MR BIOS POST Codes are sent to port 80 to indicate failures, and are accompanied in some cases by a low-high pitched system of beeps.

Microid Mr. BIOS 1.0A POST Codes

CODE	BEEPS	MEANING (PORT 80)
Note:	all beep codes are preceded by LH (low then high)	
00	none	Cold boot commences (not seen in warm boot)
01	none	Hook 00. OEM specific. Typically restores chipset to default.
02	none	Disable critical I/O: 6845s, 8237s, 765, and parity latches.
03	LLL	Test BIOS checksum.
04	HLL	Test page registers (ports 80 - 8F).
05	LHL	Self-test 8042 keyboard controller.
06	none	Gang-initialize ports: 8237 slave, 8237 master, 8254 channel 1, 8254 channel 2, RTC register F, RTC register A, 8259 master, 8259 slave.
07	HHL	Hook 01. OEM specific. Typically disables cache, shadow.
08	LLH	Pattern-test 8237 master and slave, eight 16-bit registers each.
09	HLH	Test refresh toggle.
0A	below	Test 64K base memory.

0A	LLLL	Bank 0 pattern test failed
0A	HLLL	Bank 0 parity circuit failed
0A	LHLL	Bank 0 parity error occurred
0A	HHLL	Bank 0 data bus failed
0A	LLHL	Bank 0 address bus failed
0A	HLHL	Bank 0 block access read failed
0A	LHHL	Bank 0 block access read/write failed
0B	below	Pattern-test 8259 mask registers.
0B	HHHL	Master 8259 (port 21) failed
0B	LLLH	Slave 8259 (port A1) failed
0C	below	Test 8259/IRQs.
0C	HLLH	Master 8259 (port 20) interrupt address error
0C	LHLH	Slave 8259 (port A0) interrupt address error
0C	HHLH	8259 (port A0/20) interrupt address error
0C	LLHH	Master 8259 (port 20) stuck interrupt error
0C	HLHH	Master 8259 (port A0) stuck interrupt error
0C	LHHH	System timer 8254 ch0/IRQ0 interrupt failed
0D	HHHH	Test and initialize 8254 channel 0.
0E	below	Toggle-test 8254 channel 2.
0E	LLLLH	8254 channel 0 speaker failed
0E	HLLLH	8254 out2 speaker detect failed
0F	below	Test and initialize RTC: Initialize register B, write/read NVRAM, test PIE.
0F	LHLLH	CMOS RAM write/read test failed
0F	HHLLH	RTC periodic interrupt / IRQ8 failed
10	LLHLH	Initialize video; display cold boot sign-on and any error messages for video ROM checksum, mono or color card memory or address error.
11	none	Test CMOS RAM checksum. Fail if battery discharged or RAM bad
12	HLHLH	Accept keyboard BAT result; init keyboard; fail if stuck key or no keyboard detected. Beep if bad 8042 keyboard controller.
13	none	Hook 02. OEM specific.
14	none	Size and test base memory above lower 64K. Display message for all errors but parity or I/O channel.
14	LHHLH	Parity error occurred
14	HHHLH	I/O channel error occurred
15	none	Perform 2nd try at keyboard initialization if necessary. Error if stuck key or no keyboard detected.
16	none	Hook 03. OEM specific.
17	below	Test A20 gate off, then on.
17	LLLHH	Address line A20 gate failed due to 8042 keyboard controller timeout.

17	HLLHH	A20 gate stuck disabled (A20=0)
17	none	A20 gate stuck ensabled (A20=1)
18	none	Size and test extended memory. Display message for all errors but parity or I/O channel.
18	LHHLH	Parity error occurred
18	HHHLH	I/O channel error occurred
19	none	Hook 04. Size / test special OEM system memory. Display message for all errors but parity or I/O channel.
19	LHHLH	Parity error occurred
19	HHHLH	I/O channel error occurred
1A	none	Test Real Time Clock update in progress, and validate time. Error if settings are invalid.
1A	LHLHH	RTC is not updating
1B	none	Find off-board and on-board serial ports.
1C	none	Find off-board and on-board parallel ports.
1D	none	Find and initialize 80x87 math coprocessor chip.
1E	none	Find and test floppy disk controller; validate CMOS RAM setting. Error

if controller, CMOS. or drive A: or B: bad

1F	none	Find and test Fixed disk controller; validate CMOS RAM setting. Error if controller, CMOS. or drive C: (80) or D: (81) bad
20	none	Rigorously validate CMOS RAM parameters. Error if configuration change for any disk, serial/parallel port, video, memory, or math chip.
21	none	Check front-panel lock; if locked, wait for user to unlock.
22	none	Set NumLock, trap security password, dispatch to setup utility.
23	none	Hook 05. OEM specific.
24	none	Set typematic rate.
25	none	Initialize floppy disk subsystem.
26	none	Initialize fixed disk subsystem.
27	none	Acknowledge errors. Set primary adapter video mode.
28	none	Hook 06. OEM specific. Typically enables shadow, cache, CPU speed.
29	none	Scan and install adapter ROMs. Error if checksum failure.
2A	none	Acknowledge errors. Set video mode, and set DOS time variables from RTC.
2B	none	Enable parity checking and NMI.
2C	none	Set low stack. Install E0000 ROM.
2D	none	Acknowledge errors. Set primary video mode.
2E	none	Hook 07. OEM specific.
2F	none	Pass control to INT 19 (boot the operating system).

Phoenix Technologies, Ltd

Phoenix created the first clone of IBM's BIOS, and has a huge share of the BIOS market. Many computers, including Tandy, Dell, Wyse, Daewoo, Leading Edge, and most Japanese computers use Phoenix BIOS. The BIOS provides an elaborate system of beeps. It also sends POST codes to various I/O ports to indicate failures: XT port 60, AT and EISA port 80, PS/2 MCA port 680, PS/2 Model 25 and 30 port 90, and PS/2 Model 30-286 port 190.

Phoenix AT, EISA, MCA BIOS

Phoenix BIOS does not execute the POST tests in numeric order. Although the following table shows codes in numeric order, do not take that to mean tests are executed in the order shown. For example, the execution sequence for micro channel BIOS is as follows: 01, 03, 41, 02, 42, 05, 06, 08, 04, 09 - 22, 23, 25, 27, 28, 29, 2E, 2B, 2C, 2D, 30, 31, 32, 61, 62, 34, 35, 3A, 38, 3B. This order is based on information we received from Phoenix. If you have questions on other BIOS versions, call Phoenix.

Phoenix ISA/MCA/EISA BIOS POST Codes

CODE	BEEPS	FATAL SYSTEM ERROR MEANINGS (PORT 80)
Note:	* = PS/2 Model 25/30 Uses Only These Codes; ! = maybe no beep issued	
01*	1-1-2	CPU register test in progress

02	1-1-3	CMOS write/read test failed
03*	1-1-4!	ROM BIOS checksum bad
04	1-2-1	Programmable interval timer failed
05*	1-2-2	DMA initialization failed
06*	1-2-3	DMA page register write/read bad
08*	1-3-1	RAM refresh verification failed
09*	1-3-2!	First 64K RAM test in progress
0A*	1-3-3	First 64K RAM chip or data line bad, multi-bit
0B	1-3-4	First 64K RAM odd/even logic bad
0C*	1-4-1	Address line bad first 64K RAM
0D*	1-4-2	Parity error detected in first 64K RAM
0E	1-4-3	EISA fail-safe timer test in progress
0F	1-4-4	EISA s/w NMI port 462 test in progress
10*	2-1-1	Bit 0 first 64K RAM bad
11*	2-1-2	Bit 1 first 64K RAM bad
12*	2-1-3	Bit 2 first 64K RAM bad
13*	2-1-4	Bit 3 first 64K RAM bad
14*	2-2-1	Bit 4 first 64K RAM bad
15*	2-2-2	Bit 5 first 64K RAM bad
16*	2-2-3	Bit 6 first 64K RAM bad
17*	2-2-4	Bit 7 first 64K RAM bad
18*	2-3-1	Bit 8 first 64K RAM bad
19*	2-3-2	Bit 9 first 64K RAM bad
1A*	2-3-3	Bit 10 first 64K RAM bad
1B*	2-3-4	Bit 11 first 64K RAM bad
1C*	2-4-1	Bit 12 first 64K RAM bad
1D*	2-4-2	Bit 13 first 64K RAM bad
1E*	2-4-3	Bit 14 first 64K RAM bad
1F*	2-4-4	Bit 15 first 64K RAM bad
20	3-1-1	Slave DMA register bad
21*	3-1-2	Master DMA register bad
22*	3-1-3	Master interrupt mask register bad
23	3-1-4	Slave interrupt mask register bad
25*	3-2-2!	Interrupt vector loading in progress
27*	3-2-4	Keyboard controller test failed
28	3-3-1!	CMOS RAM power bad; calculating checksum
29	3-3-2!	CMOS configuration validation in progress
2B	3-3-4	Video memory test failed
2C*	3-4-1	Video initialization failed
2D	3-4-2	Video retrace failure

2E*	3-4-3!	Search for video ROM in progress
2F	none	DDNIL bit scan failed
30	none	Screen operable, running with video ROM
31	none	Monochrome monitor operable
32	none	Color monitor (40 column) operable
33	none	Color monitor (80 column) operable

Non-Fatal Errors for ATs (Beep and POST Code if Mfg Jumper on the POST setting)

34	4-2-1	Timer tick interrupt test in progress or bad
35	4-2-2	Shutdown test in progress or bad
36	4-2-3	Gate A20 bad
37	4-2-4	Unexpected interrupt in protected mode
38	4-3-1	RAM test in progress or high address line bad > FFFF
3A	4-3-3	Interval timer channel 2 test or bad
3B	4-3-4	Time-of-Day clock test or bad
3C	4-4-1	Serial port test or bad
3D	4-4-2	Parallel port test or bad
3E	4-4-3	Math coprocessor test or bad
3F	4-4-4	Cache test failure (Dell)
41	L-1-1-2	System board select bad (MCA only)
42	L-1-1-3	Extended CMOS RAM bad (MCA only)

Phoenix BIOS 4.0

Phoenix 4.0 BIOS attempts in all cases to send the POST code to port 80 AND the system display, but if the system halts before it can do this, the POST card will show the code for the most recent action performed. Errors 2C, 2E, and 30 also display a message showing which bit in the address or data failed.

Phoenix BIOS 4.0 POST Codes (before release 6)

CODE	BEEPS	MEANING OF CODE SENT TO PORT 80
01	1-1-1-1	Frandalank Shutdown Check
02	1-1-1-3	Verify Real Mode
04	1-1-2-1	Get CPU type
06	1-1-2-3	Initialize system hardware
08	1-1-3-1	Initialize chipset registers with initial POST values
09	1-1-3-2	Set in POST flag
0A	1-1-3-3	Initialize CPU registers
0C	1-1-4-1	Initialize cache to initial POST values
0E	1-1-4-3	Initialize I/O
10	1-2-1-1	Initialize Power Management
11	1-2-1-2	Load alternate registers with initial POST values

12	1-2-1-3	Jump to UserPatch0
14	1-2-2-1	Initialize keyboard controller
16	1-2-2-3	BIOS ROM checksum
18	1-2-3-1	8254 timer initialization
1A	1-2-3-3	8237 DMA controller initialization
1C	1-2-4-1	Reset Programmable Interrupt Controller
20	1-3-1-1	Test DRAM refresh
22	1-3-1-3	Test 8742 Keyboard Controller
24	1-3-2-1	Set ES segment to register to 4 GB
28	1-3-3-1	Autosize DRAM
2A	1-3-3-3	Clear 512K base RAM
2C	1-3-4-1	Test 512 base address lines
2E	1-3-4-3	Test 512K base memory
32	1-4-1-3	Test CPU bus-clock frequency
34	1-4-2-1	CMOS RAM read/write failure (this commonly indicates a problem on the ISA bus such as a card not seated correctly)
37	1-4-2-4	Reinitialize the chipset
38	1-4-3-1	Shadow system BIOS ROM
39	1-4-3-2	Reinitialize the cache
3A	1-4-3-3	Autosize cache
3C	1-4-4-1	Configure advanced chipset registers
3D	1-4-4-2	Load alternate registers with CMOS values
40	2-1-1-1	Set Initial CPU speed
42	2-1-1-3	Initialize interrupt vectors
44	2-1-2-1	Initialize BIOS interrupts
46	2-1-2-3	Check ROM copyright notice
47	2-1-2-4	Initialize manager for PCI Options ROMs
48	2-1-3-1	Check video configuration against CMOS
49	2-1-3-2	Initialize PCI bus and devices
4A	2-1-3-3	Initialize all video adapters in system
4C	2-1-4-1	Shadow video BIOS ROM
4E	2-1-4-3	Display copyright notice
50	2-2-1-1	Display CPU type and speed
52	2-2-1-3	Test keyboard
54	2-2-2-1	Set key click if enabled
56	2-2-2-3	Enable keyboard
58	2-2-3-1	Test for unexpected interrupts
5A	2-2-3-3	Display prompt "Press F2 to enter SETUP"
5C	2-2-4-1	Test RAM between 512 and 640k
60	2-3-1-1	Test expanded memory

62	2-3-1-3	Test extended memory address lines
64	2-3-2-1	Jump to UserPatch1
66	2-3-2-3	Configure advanced cache registers
68	2-3-3-1	Enable external and CPU caches
69	2-3-3-2	Initialize SMI handler
6A	2-3-3-3	Display external cache size
6C	2-3-4-1	Display shadow message
6E	2-3-4-3	Display non-disposable segments
70	2-4-1-1	Display error messages
72	2-4-1-3	Check for configuration errors
74	2-4-2-1	Test real-time clock
76	2-4-2-3	Check for keyboard errors
7C	2-4-4-1	Set up hardware interrupts vectors
7E	2-4-4-3	Test coprocessor if present
80	3-1-1-1	Disable onboard I/O ports
82	3-1-1-3	Detect and install external RS232 ports
84	3-1-2-1	Detect and install external parallel ports
86	3-1-2-3	Re-initialize onboard I/O ports
88	3-1-3-1	Initialize BIOS Data Area
8A	3-1-3-3	Initialize Extended BIOS Data Area
8C	3-1-4-1	Initialize floppy controller
90	3-2-1-1	Initialize hard-disk controller
91	3-2-1-2	Initialize local-bus hard-disk controller
92	3-2-1-3	Jump to UserPatch2
94	3-2-2-1	Disable A20 address line
96	3-2-2-3	Clear huge ES segment register
98	3-2-3-1	Search for option ROMs
9A	3-2-3-3	Shadow option ROMs
9C	3-2-4-1	Set up Power Management
9E	3-2-4-3	Enable hardware interrupts
A0	3-3-1-1	Set time of day
A2	3-3-1-3	Check key lock
A8	3-3-3-1	Erase F2 prompt
AA	3-3-3-3	Scan for F2 key stroke
AC	3-3-4-1	Enter SETUP
AE	3-3-4-3	Clear in-POST flag
B0	3-4-1-1	Check for errors
B2	3-4-1-3	POST done--prepare to boot operating system
B4	3-4-2-1	One beep
B6	3-4-2-3	Check password (optional)

B8	3-4-3-1	Clear global descriptor table
BC	3-4-4-1	Clear parity checkers
BE	3-4-4-3	Clear screen (optional)
BF	3-4-4-4	Check virus and backup reminders
C0	4-1-1-1	Try to boot with INT 19
D0	4-2-1-1	Interrupt handler error
D2	4-2-1-3	Unknown interrupt error
D4	4-2-2-1	Pending interrupt error
D6	4-2-2-3	Initialize option ROM error
D8	4-2-3-1	Shutdown error
DA	4-2-3-3	Extended Block Move
DC	4-2-4-1	Shutdown 10 error
DE	4-2-4-3	Keyboard Controller Failure (most likely problem is with RAM or cache unless no video is present)
DF	4-2-4-4	Orvonton Cache Controller tag RAM register error
		The following are for boot block in flash ROM
E2	4-3-1-3	Initialize the chipset
E3	4-3-1-4	Initialize refresh counter
E4	4-3-2-1	Check for Forced Flash
E5	4-3-2-2	Check HW status of ROM
E6	4-3-2-3	BIOS ROM is OK
E7	4-3-2-4	Do a complete RAM test
E8	4-3-3-1	Do OEM initialization
E9	4-3-3-2	Initialize interrupt controller
EA	4-3-3-3	Read in bootstrap code
EB	4-3-3-4	Initialize all vectors
EC	4-3-4-1	Boot the Flash program
ED	4-3-4-2	Initialize the boot device
EE	4-3-4-3	Boot code was read OK

Phoenix BIOS 4.0 Release 6 POST Codes

Code	Beeps	POST Routine Description
02h		Verify Real Mode
03h		Disable Non-Maskable Interrupt (NMI)
04h		Get CPU type
05h	1-1-1-3	Dual CPU APIC synchronicity check
06h		Initialize system hardware
08h		Initialize chipset with initial POST values
09h		Set IN POST flag
0Ah		Initialize CPU registers

0Bh		Enable CPU cache
0Ch		Initialize caches to initial POST values
0Eh		Initialize I/O component
0Fh		Initialize the local bus IDE
10h		Initialize Power Management
llh		Load alternate registers with initial POST values
12h		Restore CPU control word during warm boot
13h		Initialize PCI Bus Mastering devices
14h		Initialize keyboard controller
16h	1-2-2-3	BIOS ROM checksum
17h		Initialize cache before memory autosize
18h		8254 timer initialization
lAh		8237 DMA controller initialization
lCh		Reset Programmable Interrupt Controller
20h	1-3-1-1	Test DRAM refresh
22h	1-3-1-3	Test 8742 Keyboard Controller
24h		Set ES segment register to 4 GB
26h		Enable A20 line
28h		Autosize DRAM
29h		Initialize POST Memory Manager
2Ah		Clear 512 KB base RAM
2Ch	1-3-4-1	RAM failure on address line xxxx*
2Eh	1-3-4-3	RAM failure on data bits xxxx* of low byte of memory bus
2Fh		Enable cache before system BIOS shadow
30h	1-4-1-1	RAM failure on data bits xxxx* of high byte of memory bus
32h		Test CPU bus-clock frequency
33h		Initialize Phoenix Dispatch Manager
36h		Warm start shut down
38h		Shadow system BIOS ROM
3Ah		Autosize cache
3Ch		Advanced configuration of chip set registers
3Dh		Load alternate registers with CMOS values
42h		Initialize interrupt vectors
45h		POST device initialization
46h	2-1-2-3	Check ROM copyright notice
48h		Check video configuration against CMOS
49h		Initialize PCI bus and devices
4Ah		Initialize all video adapters in system
4Bh		QuietBoot start (optional)
4Ch		Shadow video BIOS ROM

4Eh		Display BIOS copyright notice
50h		Display CPU type and speed
51h		Initialize EISA board
52h		Test keyboard
54h		Set key click if enabled
58h	2-2-3-1	Test for unexpected interrupts
59h		Initialize POST display service
5Ah		Display prompt "Press F2 to enter SETUP"
5Bh		Disable CPU cache
5Ch		Test RAM between 512 and 640 KB
60h		Test extended memory
62h		Test extended memory address lines
64h		Jump to UserPatchl
66h		Configure advanced cache registers
67h		Initialize Multi Processor APIC
68h		Enable external and CPU caches
69h		Setup System Management Mode (SMM) area
6Ah		Display external L2 cache size
6Bh		Load custom defaults (optional)
6Ch		Display shadow-area message
6Eh		Display possible high address for UMB recovery
70h		Display error messages
72h		Check for configuration errors
76h		Check for keyboard errors
7Ch		Set up hardware interrupt vectors
7Eh		Initialize coprocessor if present
80h		Disable onboard Super I/O ports and IRQs
81h		Late POST device initialization
82h		Detect and install extemal RS232 ports
83h		Configure non-MCD IDE controllers
84h		Detect and install external parallel ports
85h		Initialize PC-compatible PnP ISA devices
86h		Re-initialize onboard I/O ports.
87h		Configure Motheboard Configurable Devices (optional)
88h		Initialize BIOS Data Area
89h		Enable Non-Maskable Interrupts (NMIs)
8Ah		Initialize Extended BIOS Data Area
8Bh		Test and initialize PS/2 mouse
8Ch		Initialize floppy controller
8Fh		Determine number of AT A drives (optional)

90h		Initialize hard-disk controllers
9lh		Initialize local-bus hard-disk controllers
92h		Jump to UserPatch2
93h		Build MPT ABLE for multi-processor boards
95h		Install CD ROM for boot
96h		Clear huge ES segment register
97h		Fixup Multi Processor table
98h	1-2	Search for option ROMs. One long, two short beeps on checksum failure
99h		Check for SMART Drive (optional)
9Ah		Shadow option ROMs
9Ch		Set up Power Management
9Dh		Initialize security engine (optional)
9Eh		Enable hardware interrupts
9Fh		Determine number of ATA and SCSI drives
A0h		Set time of day
A2h		Check key lock
A4h		Initialize Typematic rate
A8h		Erase F2 prompt
AAh		Scan for F2 key stroke
ACh		Enter SETUP
AEh		Clear Boot flag
B0h		Check for errors
B2h		POST done - prepare to boot operating system
B4h	1	One short beep before boot
B5h		Terminate QuietBoot (optional)
B6h		Check password (optional)
B9h		Prepare Boot
BAh		Initialize DMl parameters
BBh		Initialize PnP Option ROMs
BCh		Clear parity checkers
BDh		Display MultiBoot menu
BEh		Clear screen (optional)
BFh		Check virus and backup reminders
C0h		Try to boot with !NT 19
Clh		Initialize POST Error Manager (PEM)
C2h		Initialize error logging
C3h		Initialize elTor display function
C4h		Initialize system error handler
C5h		PnPnd dual CMOS (optional)
C6h		Initialize notebook docking (optional)

C7h	Initialize notebook docking late
C8h	Force check (optional)
C9h	Extended checksum (optional)
D2h	Unknown interrupt

The Following Codes are for Boot Block in Flash ROM

E0h	Initialize the chipset
Elh	Initialize the bridge
E2h	Initialize the CPU
E3h	Initialize system timer
E4h	Initialize system I/O

E5h		Check force recovery boot
E6h		Checksum BIOS ROM
E7h		Go to BIOS
E8h		Set Huge Segment
E9h		Initialize Multi Processor
EAh		Initialize OEM special code
EBh		Initialize PIC and DMA
ECh		Initialize Memory type
EDh		Initialize Memory size
EEh		Shadow Boot Block
EFh		System memory test
F0h		Initialize interrupt vectors
Flh		Initialize Run Time Clock
F2h		Initialize video
F3h		Initialize System Management Mode
F4h	1	Output one beep before boot
F5h		Boot to Mini DOS
F6h		Clear Huge Segment
F7h		Boot to Full DOS

System Soft Corporation

SystemSoft Corporation is a major developer ofIBM AT-compatible system BIOS and other system-related OEM software products, with emphasis on PCMCIA. The company was formed largely from ex-employees of Phoenix Technologies Ltd in the early 1990's. Its BIOS gained early popularity in the notebook computer market, but it may also be found in desktop systems. It will not be found in computers developed prior to 1992.

The BIOS emits beep and POST codes to indicate problems discovered in the POST process. The first 9 beep codes are predefined, and the remaining codes are available for future or OEM use.

System Soft Corporation BIOS Beeps

# Beeps	Meaning (S=short, P=pause, L=long)
SSSPSSLP	Faulty DMA page registers
SSSPSLSP	Faulty memory refresh circuitry
SSSPSLLP	Incorrect ROM checksum
SSSPLSSP	Faulty CMOS RAM or battery
SSSPLSLP	Faulty DMA controller

SSSPLLSP	Faulty Interrupt controller
SSSPLLLP	Faulty 8042 keyboard controller or interface
SSLPSSSP	No video adapter found
SSLPSSLP	No RAM detected and no message displayed
SSLPSLSP	Modifiable by OEM
SSLPSLLP	Modifiable by OEM
SSLPLSSP	Modifiable by OEM
SSLPLSLP	Modifiable by OEM
SSLPLLSP	Modifiable by OEM
SSLPLLLP	Modifiable by OEM
SLSPSSSP	Modifiable by OEM
1	Modifiable by OEM
2	Modifiable by OEM
3	Modifiable by OEM
4	Modifiable by OEM
5	Modifiable by OEM
6	Modifiable by OEM
7	Modifiable by OEM
8	Modifiable by OEM
9	Modifiable by OEM

System Soft Corporation BIOS POST Codes

Code	Meaning of Code Sent to Port 80
00	Reset
01	Turn off FAST A20 for POST
02	Reset Orvonton cache controller
03	Signal Power-On reset
04	Initialize the chipset (until this happens, no RAM is available)
05	Do special initialization of VGA
06	Search for ISA bus VGA adapter
07	Reset Interrupt Controllers
08	Reset Counter Timer channel 1
09	Initialize video adapters
0A	Initialize color graphics adapter
0B	Initialize monochrome adapter
0C	Test DMA page registers
0D	Verify BIOS ROM checksum
0E	Test keyboard
0F	Test keyboard controller

10	Verify CMOS RAM contents are valid
11	Verify CMOS RAM battery
12	User set up configuration in CMOS RAM
13	Determine base memory size, fail if no RAM
14	Test memory refresh
15	Read/write test base memory ability
16	Test base memory addressability
17	Initialize DMA controllers
18	Initialize interrupt vectors
19	Enter protected mode to quick-test memory
1A	Read/write test extended memory
1B	Exit from protected mode
1C	Successfully exited from protected mode
1D	Setup shadow RAM
1E	Initialize video controllers
1F	Find monochrome adapter
20	Find color adapter
21	No video display found
22	Sign-on messages displayed
23	Initialize keyboard controller
24	Verify keyboard is present
25	Verify keyboard interrupt works
26	Verify keyboard controller command byte
27	Halt POST because of fatal error
28	Enter protected mode to test extended memory
29	Test, clear, and count RAM
2A	Exit from protected mode
2B	Successfully exited from protected mode
2C	Update output port
2D	Set up cache controller
2E	Verify 18.2 ms timer interrupt working
2F	Verify real time clock working
30	Initialize IRQ interrupt vectors
31	Initialize COM and LPT ports
32	Configure COM and LPT ports
33	Initialize floppy drives
34	Initialize hard drives
35	Pass control to adapter/option ROMS
36	OEM initialization of power management
37	Search for and initialize mouse
38	Update keyboard's NUMLOCK status
39	Test for presence of math coprocessor
3A	OEM initializations before boot

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