



Phoenix BIOS and the Year 2000

A Phoenix Technologies Ltd. White Paper

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Overview

The Year 2000 (Y2K) problem for computers results from limitations in hardware and software that have generally been present since the computer's initial development. The Y2K concern for PC users is whether their systems will correctly support dates beyond 1999.

Phoenix Technologies Ltd., as one of the developers of BIOS used by many manufacturers of compatible PC systems, provides the following information to assist customers and other interested parties in understanding BIOS-based issues for the Year 2000 and solutions to potential problems:

BIOS and the Compatible PC

The BIOS (Basic Input/Output System) is software that starts and configures compatible PCs — systems that generally follow the architecture originally developed by IBM for the IBM PC AT. Unlike most software, the BIOS program is stored in a chip, today typically a flash device. When the computer is switched on, the BIOS software is responsible for initializing and testing the hardware devices required to load the operating system, usually from a disk drive. After the operating system is loaded, the BIOS may continue to provide some basic hardware functions such as Power Management and Plug and Play.

Because the BIOS must support many applications and operating systems as well as meet the needs of different manufacturers, different hardware, and new PC technologies, each BIOS is unique.

While Phoenix Technologies Ltd. supplies core BIOS functionality, and may sometimes provide additional development services, the specific BIOS inside each computer is the final product and responsibility of the computer's manufacturer.

For information on the specific BIOS in your computer and its capabilities, contact the manufacturer directly.

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Background on the Year 2000 (Y2K) Problem

Most of the discussion regarding computers and the Year 2000 has focused on the problem of identifying and updating software applications to handle the century rollover. The Y2K problem started with early computer software. Many computer programs store the year in a date field using only two digits, "88", for example. The century designator "19" was assumed. These applications might recognize the date "00" as the Year 1900, when in fact the year should be "2000." As a result, after Dec. 31, 1999, these computer applications may shut down or produce incorrect data.

For customers and end users of BIOS products, the primary Y2K issue relates to the hardware capability of the personal computer to be able to advance its date beyond December 31, 1999.

Unlike many software applications, the system date problem can generally be fixed. The ramifications of not fixing it, however, can be significant. Many applications rely on the system date for accurate processing. Additionally, PC-based network servers base many functions on date and time.

The following is a discussion of the issues surrounding how PCs store and retrieve dates and how Phoenix BIOS products support Y2K date setting.

PC Design — The Role of the Real Time Clock

PCs initially set current date and time based on information received from a device common to all compatible PCs, the Real-Time Clock (RTC). The RTC, as defined for the IBM PC AT, was designed to allow the computer's user to set the date and time once when the system is first started, and to automatically maintain date/time information from then on. When the operating system (OS) is booted, it normally initializes its current date from the RTC through a BIOS call. Once initialized, the OS maintains the system date as long as the system is powered on. Originally, the RTC was located in its own device. In today's PCs, the chipset handles RTC operations, which remain essential for setting and maintaining information about date and time.

The RTC and an associated data storage area called CMOS-RAM are separately powered by a small battery to ensure that vital variable system information is constantly updated even if the PC is switched off. The CMOS-RAM data area contains information about the actual date and time as well as settings specified by the user in Setup. The BIOS uses these settings to setup the operation of the computer when it is started and to find the appropriate device for booting the operating system.

The original RTC only supported a two-digit year field stored in a one-byte register. As a result, only the lower two digits of the year are maintained automatically. When the year 1999 rolls over to 2000, the RTC will update the year digits from "99" to "00".

But unlike software applications, compatible PCs can store data describing the correct century in a separately defined area of CMOS-RAM, the century byte. However, because the century byte is not part of the core functionality of the RTC, it is not automatically updated when a century rollover occurs.

How Can the Century Byte be Updated?

Among the options are new timer hardware capabilities, software, and an add-in card.

Non-BIOS options for Century Byte Update

There are at least five options for updating the century byte that do not involve BIOS.

1. The operating system, either directly or through a user instruction
2. An application that monitors date/time, and updates the century byte as appropriate
3. Network date/time synchronization (a feature of many network environments)
4. An add-in card to monitor the date change and update the century byte
5. Direct update from a Y2K capable Real Time Clock

The first four options are available to users of existing PCs. The fifth option is a feature of some new PC systems.

Operating system and application options are related. Most operating systems have the ability to update the date/time of a computer and the associated CMOS storage (which contains the century byte) through user intervention or through an application. If the computer is left on during the transition, the operating system may, from a direct user instruction or an application, update the century to store the correct date. For PC users:

- At the DOS prompt, use the “DATE” command.
- In Windows, go to “Settings” then “Control Panel” then “Date/Time”.

Most network operating systems also provide date/time services, generally at login, because it is important for network users to maintain a common time reference.

Another option for resolving year 2000 roll-over is an add-in card. These cards, which monitor the 1999-2000 transition, may be useful for older systems that do not feature automatic century byte update.

When Does the BIOS Update the Century Byte?

In newer systems, the BIOS can update the century byte at system start or, during operation if the BIOS is queried for the date/time. A manual update option is available for older system BIOSes by using Setup.

Automatic Update

For many PhoenixBIOS 4.0 systems, most systems using Release 4.05 and later BIOS (systems shipping beginning in late-1995), the century byte can be automatically updated as appropriate when either of the following actions take place in 2000:

1. When the computer is running and the date change happens — If a request for a date read/write is received by the BIOS, the BIOS will reset the century byte when the years byte value from the Real Time Clock has a value less than “80” (Some Phoenix BIOS-based systems may use other year tests such as “35”).
2. When the system is started or restarted for the first time in 2000 — One of

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the start-up tasks performed by the BIOS is to make certain date and time functions are operating. As part of this process, the century byte is updated when the years byte value from the Real-Time Clock has a value less than “80” (Some Phoenix BIOS-based systems may use other values for this test such as “35”).

Manual Update

For many systems with older Phoenix BIOS capabilities, changing the system date to years beyond 1999 may require a manual update.

Again, if the system is running when the date change takes place, the date can easily be updated by:

- An application designed to monitor date and time and to update the century byte in CMOS.
- A user changing the date/time using the operating system (the change will be reflected in the CMOS century byte).
- An automatic update from a network operating system login (many network operating systems synchronize local user systems to ensure that all clients are using a consistent date and time).
- An add-in card designed to provide the update.

Note: Even if the century byte is not updated automatically during operation, as long as the system remains running, most operating systems will provide correct date and time information. A problem is most likely to be experienced when the system is restarted.

If the system is not running when the date change occurs, one option for changing the date is to enter the system’s Setup program before the system boots. A later section, “Using the computer’s Setup program” explains how to use this utility to change the date prior to the operating system being started.

After the century byte has been reset, the system should provide appropriate year information.

Limitations in BIOS Capabilities

Some, mainly older, applications query the Real-Time Clock CMOS directly, not using BIOS services. Until the century byte can be updated, by one of the methods shown above, the date/time will be wrong, even if the operating system clock is correct. The most likely scenario for this occurrence would be a PC left on during the date change, where none of the options above has been used to update the date.

Also, some applications may not use or be able to correctly interpret the four digit date information provided by the computer. It is important to test all applications for Y2K compliance, including ensuring that applications and operating systems support leap year in 2000, and provide appropriate leap year support for the years following.

In Summary

In mid-1995, Phoenix Technologies implemented enhancements to its basic BIOS product (PhoenixBIOS 4.0, Release 5) that were designed to ensure that the BIOS automatically handled the century change. This core software would have been available in some systems built in late 1995.

For systems with Phoenix BIOS released prior to mid-1995 (or which do not contain these extensions), it is generally possible to manually change the date using the computer's BIOS Setup program.

For Specific System Information...

Because the BIOS for any PC is unique, the computer's manufacturer is the single authority on Y2K compliance capabilities for any specific system.

We ask that you consult the manufacturer for information about your computer and its individual Y2K capabilities.

Glossary of Terms and Explanations

Century Byte The century byte is an area of CMOS-RAM defined to store the current century. The compatible location is byte 32h, and the century is stored in BCD (binary coded decimal).

New PC Technologies — In the past years, several new requirements have been added for BIOS support. Among them are support for new bus architectures such as PCI (Peripheral Component Interconnect) and USB (Universal Serial bus), as well as support for other new PC capabilities such as plug and play card configuration and large capacity disk drives. Other changes include the requirement for supporting ACPI, configuration, and power-management software, which is stored in the hardware of a system (although not properly a part of BIOS).

CMOS-RAM The small (usually 64-256 bytes) memory area in ISA and EISA systems associated with the real-time clock. The non-volatile memory area is battery-backed and is used to store the system time and date, as well as user-specific configuration data.

Using the computer's Setup program

CAUTION — Improper use of Setup (by changing system settings) can cause the computer to stop functioning or to function erratically!

Each compatible PC has a Setup program to define operational parameters including date and time needed by the BIOS to configure the system and to start the operating system. To run Setup, you have to press one or more specified keys (such as F2 , Esc, or Del) soon after you turn on your computer and before the operating system is loaded. The first messages on the screen usually give information about the BIOS and the system as well as the key(s) that activate the Setup program.

What if there are no messages displayed, only a graphical screen showing the manufacturer's name? Many newer PhoenixBIOS-equipped machines have a graphical screen that "hides" the information described above. By pressing the "esc" (escape) key shortly after the system starts, the BIOS characteristics described above will be displayed.

NOTE: Once the system starts to execute from disk, the key sequence will no longer work because the BIOS Setup program will no longer be available for execution (it is removed from memory). After the OS has loaded, shut down and restart the computer to enter Setup.

What if there is no Setup program contained in the BIOS? Some older machines use Setup programs executed from a disk. Contact the system's manufacturer if the disk has been misplaced.

Locate the appropriate Setup screen to configure system date and time (usually the first screen displayed). To change the system's date settings, follow the instructions on the screen that contains date/time information.

What if the system requires a password to enter the Setup program? If you do not have the appropriate password, contact your system administrator, or the system's manufacturer.

After the date has been reset, follow the computer's instructions for saving changes to CMOS and exit the Setup application.