Unit 5 CMOS

Structure:

5.1 Introduction

In the previous unit we have discussed about the meaning of BUS and its different types. You get to know the function of each type of BUS and the different kinds of BUSes used in PC/AT and PC/XT. After the PC/AT came into existence IBM gave more options to setup the parameters. *CMOS* is a small and low-power RAM chip which was used to store the system's setup parameters. In PC/AT the discrete switches were replaced by logical switches. When the computer starts, the BIOS read the parameters which are stored in the CMOS RAM. BIOS use these parameters in the normal operation of the system. For this reason it is very important that while confirmation of the system you must always use correct settings.

In this unit you will get a detailed view of selection of CMOS parameters. You will get to know the guidelines for proper CMOS optimization and battery maintenance.

Objectives:

After studying this unit you will be able to:

- Identify the need for CMOS.
- Get the CMOS set up key sequences and tactics.
- Do the configuration of standard CMOS setup
- Maintain and resolve the CMOS problems through troubleshooting.

5.2 The need of CMOS

CMOS RAM is the acronym for Complementary Metal Oxide semiconductors. CMOS is the semiconductor or battery powered chip which exists on the Motherboard and is responsible for retaining certain system information like date, time and some system setup parameters when the computer system is shut down. It is also called as *Very Low-Power static RAM*. The present CMOS RAM provides 128 bytes of memory. The main function of CMOS provides storage facility to the RAM to store information whenever the computer boots up, such as hard disk types, keyboard and display type, chip set, and even the time and date. This information's is lost when the power goes off. Only the last saved information will remain. Therefore CMOS is used to access your hard disks along with needful information. This also helps in accessing operating system**.**

Although the CMOS RAM has nickel cadmium battery as its protection for power supply as it recharges, it is always advisable to keep a copy in CMOS in case disaster strikes.

BIOS require the information present in the CMOS to carry out the basic input/output system and functioning of interfaces. Therefore CMOS is very useful when the RAM is lost after the power goes off. A battery is connected to the PC to provide power to the CMOS. This battery is called *CMOS battery* which helps in storing the date, time and system attributes until the next time system is turned on.

Self Assessment Questions

1. _____ is a small and low-power RAM chip which was used to store the system's setup parameters.
2. When the computer starts, _____ read the parameters which are stored in the CMOS RAM.BIOS
3. CMOS RAM is also called as _____.
4. CMOS RAM has _____ battery.
5. _____ helps in storing the date, time and system attributes until the next time system is turned on.

5.3 CMOS Optimization Tactics

- As you know CMOS set up data does not automatically get all the data or it does not configure itself as a package. It needs to be keyed in by the manufacturer by using some setup routines. Earlier PC/AT depended on disk-based setup utility for its setup routines. That means floppy disk which contained the CMOS setup utility was used during the booting of the computer. Before learning the procedures you must first know how to enter CMOS setup in the computer.
- CMOS optimizing tactics is a method of choosing as many number of suitable set as possible. Due to complexity in the architecture, the PC seeks more and more CMOS setup to be downloaded. In this case it is very difficult to choose the optimizing method. However if we follow some of the points we can get the CMOS setup as per our requirement. These points can be tactics to download the setup which you will be listing later in this section 5.3.
- To initiate CMOS setup, launch the setup utility in the first place as the manufacturers are hardly consistent in accessing the setup utilities. Most of the times we should launch the set manually in beginning of the configuration once your set up is complete and testing is done a message will appear on the monitor indicating the correct key or key combination. These key combination may be press <F2>, press <F3> or Del. One of the example of the key combination may be similar to as shown below,
- Press <F1> to enter Setup…
- Some BIOS versions will not display these kinds of setup messages on the monitor but the setup routine is still accessible.
- As there are various numbers of key combinations, to practice and to keep in mind all the combinations is a cumbersome task. Table 5.1 will help you in case of any difficulty you may face during CMOS configuration. The key combination of the BIOS differs from the type of manufacturers which is as shown below

Table 5.1 CMOS setup key sequences

Sl. No.	BIOS manufacturers	Key or Key sequence	Manufacturer
1	DTK BIOS	ESC key at the time of POST	DTK
2	AMI BIOS	Del Key at the time of POST	American Megatrends incorporation
3	Award BIOS	CTRL+ALT+ESC	Award
4	Gateway 2000 PC	F1	Gateway
5	ALR PC(PCI systems)	F2	ALR
6	ALR PC(non-PCI systems)	CTRL+ALT+ESC	ALR
7	Compaq PC	F10	Compaq PC
8	IBM PS/2 BIOS	CTRL+ALT+INS after pressing CTRL +ALT+ DEL	IBM
9	Phoenix BIOS	CTRL+ALT+ESC or CTRL + ALT + S	Phoenix
10	Sony PC	F3 during the starting of PC , and then press F1	Sony

- If you forget any of the key combinations or you get stuck during the configuration verify then use anyone of the key listed in the table. This will force the CMOS setup routine by causing configuration change. Some times this will cause error in the CMOS configuration and still ask you to proceed to setup routine.
- As the PC systems continue to progress, the number of devices as well as the key combinations went on increasing and there were many possible setup entries which gave rise to 100s of combination.. Therefore, it became very difficult to select the optimum combination among these. Due to the complexity in the architecture if you have to choose the right one, you must follow the following points:
  - *Basic Check:* ensure that the components which are installed have standard CMOS settings. For example, you should verify for date, time, memory available, hard disk and floppy disk etc.

- *System cache must be enabled*: ensure that all your cache memory is enabled. You must enable the level-1 and level-2 cache available in the system. These caches are called as internal and external caches respectively.
- *Wait states of RSM must be minimized*: ensure that your main memory or RAM is setup at the minimum wait state values. You should also be careful while setting the low wait state. If the vales are too low it can hang the configuration. RSM stands for Removable Storage manager is an interface designed to manage removable storage devices and media.
- *ROM shadowing must be enabled*: by shadowing the video and system ROM you can increase the performance of the system.
- *Power management must be enabled*: ensure that the power management features in the system are enabled. It saves electricity and increases the life of many components.
- *Drive access must be optimized:* ensure that the both the drive and drive controller you are using support each other. You should always use fastest data transfer protocol.
- *Go with BIOS defaults:* you are always presented with the built in default CMOS BIOS setup. It is a mere waste to re-enter the CMOS parameters from the beginning. In the CMOS main menu you can find the option on select BIOS defaults. Though default settings may not have effective performance it can help you when you are frustrated in making wrong attempts once or twice.
- There is no guarantee that you will able to use all the available features through CMOS setup. Some of the options may have activated their hidden settings. When you are not able to see the options it may cause severe damage with respect to PC performance. For example, if the cache setting and DRAM timing settings are unavailable it can have serious problem in PC performance. Therefore, there are various methods and tools available to use these hidden settings based on the BIOS versions. The following are some of the machines with their ways to access BIOS.

- *AMI (American Megatrends) machines:* AMI setup is a program that allows you to access AMI BIOS and change the hidden settings. This program is suitable for AMIs High Flex BIOS and AMI WinBIOS.
- *Non AMI Machines:* The machine which does not use AMI BIOS like Award, phoenix, etc., uses CTCHIPZ utility to check and access the hidden settings. CTCHIPZ is a utility program that allows you to change chipset specific registers that is specifically a system configuration setting similar to BIOS set up that affect all kind of system operation from cache size to PCI settings. In this type you need to know the chipset type so that correct configuration file can be selected for that particular system. You need to check the document to select correct file name with an extension for configuration which is represented as *.CFG* is a configuration file format used for storing settings. CFG files are created by many programs to store information and settings that differ from the defaults settings.

Activity 1:

What will you do when you cannot enter CMOS setup even though the correct key combination is used?

Hint: Refer the concept of symptom of motherboard under the book on troubleshooting, maintaining, and repairing PCs by S. J. Bigelow

Self Assessment Questions

6. In PC/AT, _____ was being used which contained the CMOS setup utility during booting of the computer.
7. _____BIOS used Del key at the time of POST.
8. _____ saves electricity and increases the use of many components.
9. Non AMI machines use _____utility to check and access the hidden settings.
10. By _____ the video and system RAM you can increase the performance of the system.

5.4 Configuring the standard CMOS setup

- In-order to configure the system you should know the system correctly. Otherwise the computer will not boot the system in the first stage. The Standard CMOS setup consists of a display with basic information about system's date, time, floppy disk drives, hard disk drives and other external peripherals. These data are the important requirements for booting the system.
- The below are the configuration steps for CMOS
- Computer hardware specification gathering: you need to gather necessary information needed to configure the CMOS. The different specifications are to set the system data and time, minimum requirement of memory to be installed, the requirement of the drives if any and its type.
- You need to select the second screen to set the parameters for the booting and disk drives. Set the locations so that you can boot the operating system and the options for second and third location can be set. You can also set the characteristics on how the system should behave from this page.
- In order to set the video characteristics you need to set the shadow memory and disable the video on-board memory. you can label the type of video you have installed and set memory timing.
- When you create a setting on the computer you need to enter legacy products that don't detect the PnP (plug and play) details. Plug and play is a device that enables the external devices to be connected to the computer and automatically detects the devices in the system. This you can set in the PnP/PCI page. It will allow you to define the addresses and interrupts for each card. Once the settings are prepared as per the requirements you need to press the Esc key to get back to the main menu. One you save and exit the system will reboot.
- You can re-enter the CMOS settings program and check for any errors if your system don't boot and rectify them.
- There are many entries found commonly in the CMOS standard setup menu list. They are as given below:
- *Date and time*: you can change the date and time of the system clock using these settings.

- *Error halt*: if an error is detected in the initial stage of the PC start, to ensure whether the PC will stop, this entry is used. There are some more similar entries which help in handling the halt. They are:
  a. *No errors*: this entry is used to ensure that system will not stop when the error is detected.
  b. All errors: this entry is used when the BIOS detects a nonfatal error and stops the system. It will prompt you for the inputs.
  c. All, but keyboard: this entry is used when you do not require the system to stop for keyboard error and to stop when other devices encounter error.
  d. All, but disk: this entry is used when you want to continue running in disk error and stop for other devices.
- *Floppy drive A*: this setting is used to know the type of the floppy of the floppy drive installed for drive A. for example, 1.44MB 3.5 inch or 1.2 MB 5.25 inch floppy disk drive. Please note that there were 2 floppy disk drives in older computers. Therefore two drives were used for floppy disks. Floppy drive A and floppy drive B.
- *Halt on*: whenever you need to skip the errors during the POST, you can use this entry.
- *Hard disk C*: you can auto-detect the hard drive attributes by setting the SCSI drive setting the position as none. If not you can define the hard drives using the following six parameters. *Cyl* is the number of cylinders available on your hard disk. Heads is the number of heads available in the hard disk. WPre is the setting which specifies where write Pre-compensation begins in the cylinders. Please note that in the newer computers this entry has no value. So set it to a negative value or to a maximum value so that it does not have any effect on the calculations. LZ setting helps in specifying the cylinder used as the landing zone without an auto-parking feature. In the newer computers it has no value so set it to 0 or to the maximum number of the cylinders of the drive. Sect/Trk is used to get the number of sectors per track. Size based on the number of cylinders, heads and the sectors entered the total drive size is automatically calculated using the formula,

$$\frac{heads \, X \, Cyl \, X \, Sect \, X \, 512}{1048}$$

- Like floppy disk drive hard disk drive also has two drives C and D.
- Daylight savings: this entry helps in allowing the RTC to activate the daylight saving scheme. If this scheme is not activated automatically then you need to activate the scheme manually.
- HDD Delay: some of the hard disk will require more time to initialize itself in the BIOS. When the BOOT is very fast then there may not be enough time to initiate itself properly therefore this setting helps in prompting delay in the boot up and identify the hard disk drive. Though you can select various options of time select the lowest time for the HDD delay to maintain the boot speed.
- Keyboard: this setting helps to identify whether a keyboard is attached to the system. If this is not installed then BIOS performs the keyboard check during the POST and allows booting of PC without prompting the keyboard error.
- Memory: this setting is used to choose the kind of memory elements to be displayed in the start time. Based on the following types the content is distinguished by the BIOS POST:
    - Base Memory: finds out the amount of base memory installed.
    - Extended Memory: finds out the amount of extended memory installed.
    - Other memory: finds out the available memory that can be allotted to different applications. For example AGP buffer area and RAM area.
    - Total Memory: this is the sum of base, extended and other memory of the system.
- Primary display: this setting is used to identify the type of display used in the system. For example, for the older computers the type of display differs from VGA, PGA or EGA. For newer computers VGA alone serves the purpose.
- Quick Power-On-Self-Test: you can speed up your booting time by selecting Quick POST. This entry prompts the BIOS to skip some of the check like memory count during the POST.

Activity 2:

How will you manage when you notice that only some CMOS setup entries are corrupted when running a particular application?

Hint: Refer to the concept of symptom of motherboard in the book on troubleshooting, maintaining, and repairing PCs by S. J. Bigelow

Self Assessment Questions

11. _____ is the number of cylinders available in the hard disk.
12. _____ is the setting which specifies where write pre-compensation begins in the cylinder.

5.5 Troubleshooting

- CMOS failure is a very rare case since it is most important feature for system boot. But still, due to the loss of some of the CMOS settings or data, the system is compromised due to the poor configured CMOS setup. In this section you will discuss on identifying the CMOS set up problems and how to correct those problems.

5.5.1 CMOS password troubleshooting

- Password is a means of protecting your system away from the malicious and snooping entities. When there is shift or transfer of system from one person to another or one department to another department, then there is a great chance of losing the password. This will lead to unused of the system because computer will not start without the password luckily this data will be stored in the CMOS settings. If you could manage to clear the CMOS RAM you can easily disable the password security. But you should be careful while clearing the settings because some of the settings are very crucial and if they are lost then it is very difficult to get them back.
- You may deal with these unwanted passwords in many ways with the help of some of the tips given below.
- *Ask a friend*: whenever you lose your CMOS password it can sometime happen that one of your friends or colleagues knows about it. Ask them if anybody knows the password. This saves so much of difficulty and any time after log in you can change the set up.

- *Check for the jumper by name "Clear password"*: Jumper is a conductor which is used to close a break or bypass part of an electrical circuit. These are used basically to set up or adjust mother boards. You can take a look inside the motherboard and check for the jumper on the mother board by name password clear. It will be written clearly with similar names for the reason of security once you find the jumper then you can set it and boot the system. Later you may cut the power supply and reset the jumper. By now your password should be clear and your CMOS settings will not be lost.
- *Prompt for configuration change*: you can also disconnect SIMM (single inline memory module) or DIMM (dual inline memory module) from the system and start the computer. BIOS will recognize the configuration change and give you an error message prompting you to setup the CMOS. This allows you to disable the password by entering inside the CMOS without clearing the other settings inside it.
- *Clear the CMOS RAM:* finally this can be used to clear the password. But this is the most crucial step because if you are careless enough to lose the important CMOS settings then it is very difficult to get back the settings unless you tweak it. Here you can search for the jumper on the motherboard which is written as CMOS clear. Start the computer by setting the jumper. You can see message indicating the loading of default settings or CMOS clear. Now switch off the computer and reset the jumper. By now your password will be disabled. Now you can restart and reconfigure the CMOS setting from the beginning.

5.5.2 MOS battery Maintenance

It is very important to maintain the CMOS chip and CMOS battery to be maintained separately. This battery needs to be changed frequently. When you replace the battery ensure that you have the CMOS backup on external disk. Once the backup is taken then,

- Shut down the computer
- Unplug the system
- Remove the battery
- Now the CMOS RAM loses its settings.
- Recycle the original battery

- Install the new battery based on the instructions provided by the manufacturer.
- Secure the new battery
- Restart the computer
- After booting, go to CMOS setup routine and restore each setting. Boot the system from the disk which contains the setup routines.
- Now you should be able to restart the computer in a normal way.

In case you are using the older batteries, remove the CMOS back up battery first. Though the batteries are safe and secure, due to their acid based electrolyte which can leak. Electrolytes are the substances that produce ions when they are in contact with the solutions as they are free to move in solutions. It may cause damage in the contacts and damage motherboard itself. Circuit damage or destroyed motherboard cannot be repaired.

Activity 3:

Suppose you have lost your system password, then perform the best step to start your computer.

Self Assessment Questions

13. State whether the following statements are true or false
    a. “Clear password” is a jumper name.
    b. Circuit damage in the motherboard can be repaired.

5.6 Summary

Complementary Metal Oxide semiconductors are known as CMOS RAM in short and also called as Very Low-Power static RAM. BIOS read the attributes from the CMOS RAM to perform normal operation in the system. Therefore, to have a proper system you should have correct CMOS settings. The information on date, time or addresses are lost when the power goes off. BIOS require CMOS to carry out the basic input/output system function, hardware devices and interfacing function. A battery is connected to PC to provide power to the CMOS. This battery is called CMOS battery which helps in storing the date, time and system attributes until the next time system is turn on.

Launch set up utility in the first place as the manufacturers; CMOS setup initiates hardly are consistent in accessing the setup utilities, in most of the cases you only have to launch the setup in the beginning of the configuration.

- You have studied the key sequences and their functions. If you forget any of the key combination or get stuck during the configuration verify and use anyone of the key listed in the table shown earlier. This will force the CMOS setup routine by causing configuration change. As the number of devices as well as the key combinations increase a number of combinations come into existence. To get optimum solutions we need to choose the right one with the help of following points like:
- Basic Check, System cache must be enabled, Wait states of RSM must be minimized, ROM shadowing must be enabled, Power management must be enabled, Drive access must be optimized, Go with BIOS defaults. These options give no guarantee to use available features of CMOS setup use. While configuring the standard CMOS setup there are many entries found commonly in the CMOS standard setup menu list. They are Date and time, Error halt-No errors, All errors, All, but keyboard, All, but disk, Floppy drive A, Halt on, Hard disk C.

Troubleshooting and maintaining the CMOS involves maintenance the battery rather than maintain the CMOS chip. Here you need to take care of CMOS of password of maintenance and battery maintenance.

5.7 Glossary

Term	Description
RSM	Remote switching module is a switch that Is away from the host or control office.
Shadowing	Certain settings are hidden to increase performance. This is called shadowing
HDD delay	It is the setting that allots halt time to CMOS when the hard disk drive is slow and takes too long time to set up itself in the computer and BIOS is very fast so that it can initiative itself.
Jumper	It is a conductor which is of shorter length and is used to close a break in the computer. They are used to setup the circuit boards
RAM	Random Access memory is a type of memory that can be accessed anytime dynamically. It is volatile memory

5.8 Terminal Questions

1. List the need of CMOS.
2. Why is it difficult to select optimum combination?
3. List the entries of CMOS standard menu list.
4. What is a password? How do you manage password problem?
5. Explain CMOS battery maintenance.

5.9 Answers

Self Assessment Questions

1. CMOS
2. BIOS
3. Very low-power static RAM
4. Nickel Cadmium
5. CMOS battery
6. Floppy disk
7. AMI
8. Power management
9. CTCHIPZ
10. Shadowing
11. Cyl
12. WPre
13. a. True
    b. False

Terminal Questions

1. Refer Section 5.2.1 the need of CMOS
2. Refer Section 5.3 CMOS Optimization tactics
3. Refer Section 5.4 Configuring the standard CMOS setup
4. Refer Section 5.5.1 CMOS password troubleshooting
5. Refer Section 5.5.2 CMOS battery maintenance

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