

Unit 11

Input – Output Devices

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11.1 Introduction

Many common and easily recognizable input devices like keyboard and mouse are used to give instructions through commands or information to a computer to accomplish a task. The keyboard allows you to enter a text into word processing software so that you can complete your assignment, or

type in a search query on a web browser while the mouse allows you to navigate around the screen and select options by clicking the button.

Output devices like the computer monitor and the printer enable you to see or obtain information once the data has been fed into the computer and the computer in turn has completed its function. The monitor who provides instant feedback on the screen in the form of an image is referred to as 'soft copy' while the printer allows you to create a 'hard copy' of the information. Apart from these, sound cards allow you to record and playback your voice, about which function you will be learning in this unit.

This unit will enable you to learn about other kinds of device that can be attached to the computer so that special information can be fed into it and then viewed in a number of ways.

Objectives:

After studying this unit, you should be able to:

- Explain the functions of mouse and ways of troubleshooting it
- Discuss the importance of keyboards and their maintenance
- Describe the features of sound boards
- Troubleshoot the problems associated with sound boards

11.2 Mice

Modern PCs come with a pointing device called Mouse which is used to point at a particular option on the screen and then select that option by clicking it. Although there are varieties of mouse manufactured by various companies, their basic function remains the same. Microsoft and Logitech are the top manufacturers of Mice.

11.2.1 The Mouse

The standard mouse consists of several components: a housing to hold roller ball to move the cursor on the monitor by moving the device on the flat surface, two Buttons for selection, a cable to connect the mouse, an interface connector. The outermost housing, made of plastic, generally has two buttons on the top; some mice may have three buttons requiring special software to operate. Modern mice come with a scroll wheel in between two buttons, which will be very much useful to scroll through the pages. The bottom of the housing contains a small roller ball that rotates as the mouse

moves across the tabletop. The movements of this roller ball are translated into electrical signals transmitted to the computer across the cable. The connector used with the mouse depends on the type of interface used. Once the mouse is connected to the computer, a device driver, which can be separately loaded or built into the system software, helps it to communicate with the system. Figure 11.1a shows a mouse with two buttons and a scroll wheel.



Figure 11.1a: A modern mouse

The cross section of the mouse is as shown in the Figure 11.1b.

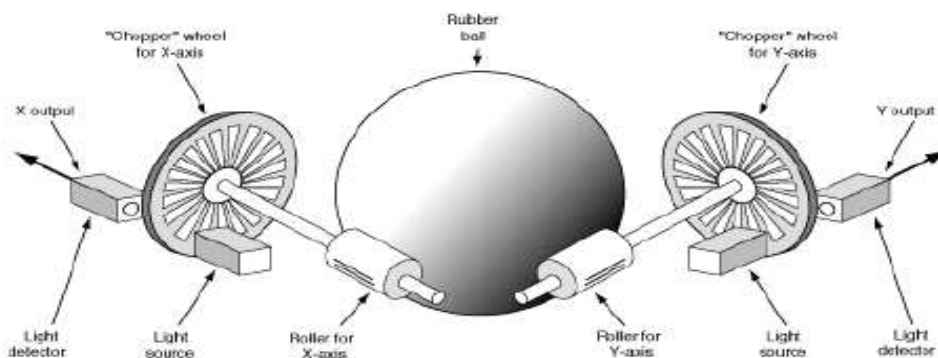


Figure 11.1b: Typical opto-mechanical mouse mechanism

The mechanism of the mouse internally is very simple. The rubber ball in it rests against two rollers, one for translating the X-axis movement and the other for the Y-axis movement. These rollers are usually connected to small disks with shutters that alternately block and allow the passage of light.

There are small optical sensors which detect movement of the wheels by noting an internal infrared light blink on and off as the shutter wheel rotates and "chops" the light. The infrared light blinks are then translated into movement along the axes. This type of setup is called an opto-mechanical mechanism and is popularly used nowadays.

Microsoft IntelliMouse

A new variation of the popular mouse called IntelliMouse was introduced by Microsoft in late 1996 looking exactly like the standard Microsoft mouse except for a miniature gray wheel rising up between the left and right buttons. The only change in mouse are the wheel has two main functions: the primary function to act as a scrolling device, allowing one to scroll through documents or Web pages by merely pulling down or pushing it up with the index finger and the secondary function to act as a third mouse button when pressed. This is very useful while browsing Web pages or working with word processing documents or spreadsheets. The major advantage of IntelliMouse is that, unlike other three-button mice by other vendors, it does not get in the way while working and there is less likelihood of it being clicked by mistake. Its only drawback is that the new wheel will work only if the software is rewritten to support it.

11.2.2 The Trackball

If you were to turn over a traditional mouse you will observe a stationary device called a track ball or roller ball. If you move or rotate this roller ball, the cursor also will move in turn.

In the case of traditional mouse, the user needs to perform three tasks simultaneously viz. grasping the mouse, moving it and clicking the button. However, the newer version allows the user to perform these tasks independently of each other. The trackball comes in various sizes. If the ball is small, it requires less effort for its movement or rotation. As regards buttons on the trackball, they can be single click, right click, double click, or drag-lock. While some trackballs are of the plug and play type requiring no installation other than connecting of a cable to the computer's port others have supporting software to be installed in the computer. This software enables you to customize the acceleration of the mouse and assign different functions to the buttons of the trackball. Below figure 11.2 shows a sample trackball.



Figure 11.2: The Trackball

The largest trackball available is the 3 inch trackball found in BIGtrack (a trackball model from Info grip, an hardware company) which requires less fine motor control than a standard trackball. The left and right mouse click buttons located behind the trackball prevent unwanted mouse clicks.

1. The trackball allows for the user to perform each of these tasks separately of one another.
2. The size of ball of trackball will vary from as large as a cue ball, to as small as a marble. The smaller the ball, the less amount of effort or rotation of the ball.

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3. Buttons on the trackball can be a single click, right click, double click, or drag-lock which helps in selecting various features of computer such as selecting an icon on desktop, refreshing the PC, choosing word file on the desktop, etc.

11.2.3 Cleaning the Pointing Device

Cleaning Mouse: Whenever you notice the mouse pointer moving across the screen in a jerky fashion, it is advisable to clean it. This jerkiness is a result of dirt and dust getting trapped around the mouse's ball and roller assembly, thereby restricting its free movement. When you turn over the mouse housing you will notice the mouse ball surrounding which is an access panel that can be opened. Remove the panel and observe the roller ball and the socket in which it rests. Turning the mouse back over will make

the roller ball fall into your hand. You should ensure that there is no visible dirt or any other contamination or you need to wash it with soapy water or a mild solvent such as contact cleaner solution or alcohol and dry it off. Next take a look at the socket in which the roller ball normally rests. You will see two or three small wheels or bars against which the ball normally rolls. If you see dust or dirt on or around these wheels or bars, then clean them. It is important to ensure that there is no dirt or dust remaining because if it is present the movement of the roller ball is hindered and the mouse will not work properly. After thorough cleaning, insert the roller ball into the socket and securely attach the cover panel thus making the mouse function again.

11.2.4 Troubleshooting

If you encounter problems with the mouse, it is advisable to look in only two general places-hardware or software.

Hardware Problems: The hardware problem generally relates to interrupt conflicts and is more difficult to solve.

- ***Interrupt Conflicts:*** A computer uses internal signals called Interrupts to indicate when something needs to be done. A mouse uses an interrupt whenever it has information to be sent to the mouse driver. The mouse might not work properly or even might not work at all if a conflict occurs and a different device uses the same interrupt used by it. If your system uses a mouse port then interrupt conflicts do not normally occur but they can occur with the other types of mouse interfaces. Mouse ports built into modern mother-boards are almost always set to IRQ 12. On machines that use a PS/2 mouse (a type of mouse that plugs into a PS/2 mouse port), this is the IRQ reserved for its use. Using a PS/2 mouse frees up the COM1 serial port and the interrupt it uses for other devices. If your system has a motherboard mouse port, you should take care that you don't set any other adapter cards to IRQ 12, otherwise a conflict occur. Whenever you use a serial mouse (a mouse that connects to a computer via a serial port) there is every likelihood of interrupt conflicts occurring if you add a third or fourth serial port. The reason behind this is that in ISA bus systems, odd-numbered serial ports (1 and 3) are often improperly configured to use the same interrupts as the even-numbered ports (2 and 4). Therefore, if your mouse is connected to COM2: and an internal modem uses COM4: both might use the same interrupt, resulting in a conflict. But if you move either the

mouse or the modem to a different serial port you can use both of them at the same time. For example, if your mouse uses COM1: and the modem still uses COM4:, you can use them both at the same time because odd and even ports use different interrupts. The best way to prevent these interrupt conflicts is to make sure that no two devices use the same interrupt.

- In case the driver declines to acknowledge the mouse irrespective of its type, then try using a different mouse which works. If you find that the problem is caused by a defective mouse, then the best option would be to replace it with a good mouse.

Software Problems: Software problems, which are trickier than hardware problems generally, manifest themselves as the mouse "just not working." In such instances, you would do well to check the driver and the software applications before assuming that the mouse itself is faulty.

- **Driver Software:** The mouse requires the installation of a device driver to function properly. It is recommended that you use default drivers built into the Windows or OS/2 operating environments. In case you want the mouse to work with DOS applications then you should load an extra driver (via CONFIG.SYS).
- **Application Software:** It is necessary to check the setup information or configuration section of the program if your mouse does not work with a specific piece of application software. Even after indicating to the program that you are using a mouse, and it does not work, then it is recommended that you contact the technical support department of the application software company for help.

Self Assessment Questions

1. The largest manufacturers of mice are _____ and _____.
2. Trackball is a stationary device. (True or False).
3. _____ in the mouse are very difficult to resolve.

11.3 Keyboards

The keyboard, a primary input device is one of the basic system components. Used for entering commands and data into the system the keyboard is the friendliest input peripheral. You can not only key in program

and data through it, but also give commands to the software from the keyboard. It is almost impossible to use a computer without a keyboard.

11.3.1 Basics of Keyboard

Keyboard generally consists of 105 keys. The keyswitch (a type of small switch placed under the keys) is activated when a key is pressed. An electronic circuit in the keyboard determines as to which key has been pressed. Then a standard 8-bit code is generated and sent to the computer. Detecting which key is pressed and generating the corresponding code is known as encoding. There are two types of keyboards. One is the serial keyboard which sends data, bit by bit, in a serial fashion and the computer converts the data into parallel byte. The other is the parallel keyboard which sends the data as a byte in a parallel form; all the bits are sent simultaneously on the different lines (wires). It is essential that the cable between the keyboard and the computer has more wires in a parallel keyboard.

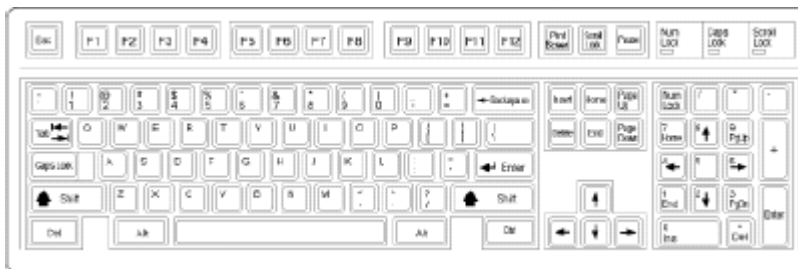


Figure 11.3: 101-key enhanced keyboard layout.

Keyboard Functions

A matrix of rows and columns connect the keyswitches; each keyswitch having a fixed set of coordinates, namely, row number and column number. The keyboard electronics performs the following functions:

- Sensing a key depression
- Encoding
- Sending code to computer

The keyboard electronics follows a standard technique known as scanning. The keyboard electronics sends inputs, signals to the matrix through the rows while the outputs are sent through the columns. The electronic circuit

senses the column lines. There are different types of keyswitches. Some of the common types are:

- Mechanical keyswitch – These switches will have metal contacts in a momentary contact arrangement.
- Membrane keyswitch – These switches are formed together on a sheet that is fixed on a rubber dome sheet.
- Capacitive keyswitch - Capacitive switches are non-mechanical type of switches currently used.

Key Switch Design

Keyboards nowadays come with several types of switches; most keyboards use one of several variations on a mechanical key switch. A mechanical key switch relies on a mechanical momentary contact type switch to make electrical contact in a circuit while some high-end keyboard designs use a totally different non-mechanical design that relies on capacitive switches. The following are the variations of mechanical type switches:

- Pure mechanical
- Foam element
- Rubber dome
- Membrane

Pure Mechanical: Generally it has a tactile feedback mechanism with a clip and spring arrangement to give a "clicky" feel to the keyboard and a built-in feature offers some resistance while pressing the key. Mechanical switches, whose life time is 20 million keystrokes, are very durable and usually have self-cleaning contacts.

Foam element: Older keyboards used this technology in which switches are characterized by a foam element with an electrical contact on the bottom that is mounted on the bottom of a plunger attached to the key itself. When the switch is pressed, a foil conductor on the bottom of the foam element closes a circuit on the printed circuit board below and a return spring pushes the key back up when the pressure is released. The advantage of using foam is that it reduces the contact, thereby preventing bounce. The disadvantage of using this type of switch is that it is prone to corrosion on the foil conductor and the circuit board traces below.

Rubber dome: Rubber dome switches are mechanical switches which are the improved versions of the foam element-type switches. These switches which use a rubber dome instead of a spring that has a carbon button contact on the underside, are very simple in design, use fewer parts, are highly reliable and very popular in modern computers. When the key is pressed, the key plunger presses on the rubber dome, causing it to resist and then collapse all at once,. As the rubber dome collapses, the user feels the tactile feedback, and the carbon button makes contact between the circuit board traces below. When the key is released, the rubber dome reforms and pushes the key back up.

Membrane keyboard: Membrane keyboards are very suitable for extremely harsh environments. When no other type of keyboard can work in certain situations, these sheets can be bonded together and sealed and protect from the elements.. Many industrial applications use membrane keyboards especially for terminals that do not require extensive data entry but are used to operate equipment such as cash registers.

Capacitive switches: Although they are expensive, these switches have the advantage of being resistant to dirt and corrosion and also offering the highest-quality tactile feedback of any type of switch. A capacitive switch does not work by making contact between conductors but instead, two plates usually made of plastic are connected in a switch matrix designed to detect changes in the capacitance of the circuit. When the key is pressed, the plunger moves the top plate relative to the fixed bottom plate. These switches have a lifetime of up to 25 million or more keystrokes.

11.3.2 Maintenance and Troubleshooting

Although difficult intermittent problems might give rise to keyboard errors, generally two simple problems are usually faced by users:

- Defective cables
- Stuck keys

Defective cables are easy to spot if the failure is not intermittent. If the keyboard stops working altogether or every keystroke results in an error or incorrect character, then the problem lies with the cable. Troubleshooting such a fault is simple, especially if you have a spare cable on hand. To do this simply replace the suspected cable with one from a known working keyboard, and ensure that the problem is set right. However, if the problem

still exists then you should try to look elsewhere for its source. By using a DMM (Digital Multi-Meter). you can test the cable for continuity by removing it from the keyboard.

Keyboard stuck key failure

When you press a key on the keyboard, the processor built into the keyboard (8048- or 6805-type) reads the keyswitch location in the keyboard matrix. The processor then sends to the motherboard a serial packet of data containing the scan code for the key that was pressed. This is called the Make code. When the key is released, a corresponding Break code is sent, indicating to the motherboard that the key has been released. The Break code is equivalent to the Make scan code plus 80h ('h' stands for hexadecimal). For example, if the Make scan code for the "A" key is 1Eh, the Break code would be 9Eh. By using both Make and Break scan codes, the system can determine whether a particular key has been held down and determine whether multiple keys are being pressed. If you get the message "keyboard struck, key failure", you can look up the scan code to determine which keyswitch is causing the problem. You can solve the problem removing the keycap of the offending key and cleaning the switch.

Many newer systems have a electrical fuse that can be replaced. This protects the motherboard keyboard and mouse connectors. Locate any type of fuse on the motherboard in the vicinity of the keyboard or mouse connectors. Some other systems may have a socketed keyboard controller chip (8042-type), in which case, it may be possible to repair the motherboard keyboard circuit by replacing this chip. As these chips have ROM code in them, it is advisable to get the replacement from the motherboard or BIOS manufacturer.

Cleaning a Keyboard

Periodical cleaning is a part of maintenance, which is essential to maintain a keyboard in good condition. Preventive maintenance requires that you vacuum clean the keyboard weekly or at least monthly. You could also use canned compressed air (available at electronics supply stores) to blow the dust and dirt out instead of using a vacuum cleaner. Before you dust a keyboard with the compressed air, turn the keyboard upside down so that the particles of dirt and dust collected inside can fall out. You should avoid

pressing the keys hardly. You should also avoid playing games for a long time to increase the durability of key switches.

Self Assessment Questions

4. A standard technique known as _____ is followed by the keyboard electronics.
5. _____ is a keyboard controller chip.
6. One of the best ways to maintain a keyboard in top condition is _____.

11.4 Basics of Sound Boards

A sound card is also known as an audio card. It is a computer expansion card that facilitates the input and output of audio signals to and from a computer under control of computer programs. Sound cards are very much useful in providing the audio component for multimedia applications such as music composition, editing video or audio, presentation, education, and entertainment (games). Many computers have sound capabilities built in, while others require additional expansion cards to provide for audio capability.

When the PC standard was first created, it did not have audio capabilities than basic beeping or tone generation. The reason for this was that the PC standard created in 1981, and other computers of that time had similar rudimentary capabilities. However, systems that were designed later, such as the Macintosh, which was introduced in 1984, did include high-quality audio capabilities as an integral part of the system hardware and software. Although there still is no universal audio hardware and software standard for PC compatible systems, the inherent expandability of the PC platform allows audio capability to be easily added, and at least one genuine standard has emerged.

Sound Card Devices

Joysticks: A number of sound cards may have a joystick, or game port. A joystick is ideally meant for game playing and is best chosen through hands-on experience like speakers.

MIDI Connector: In order to use MIDI (Musical Instrument Digital Interface) to create synthesized music, you have to connect musical keyboard or other MIDI device to the sound card. The joystick port on sound cards has unused

pins that can be used to send and receive MIDI data. If you connect a MIDI cable to the joystick port, you can connect PC to a MIDI device.

Synthesizer: If you are considering MIDI and you intend to compose or play music, then you will need sequencer software, which is a musical application designed to play back musical notation to record, edit, and play back MIDI files.

11.4.1 The Recording

You need to connect a microphone to the sound card to record sound in the computer. Some of the sound cards may not have options to connect a microphone. While purchasing a sound card, you should check whether it is having an 'Audio In' jack to plug the microphone.

11.4.2 The Playback

Speakers are used to playback the recorded sound. Successful multimedia presentations, business applications, and MIDI work require external high-fidelity stereo speakers. Sound cards offer little or no power to drive external speakers. Although some sound cards have small 4-watt amplifiers, they are not powerful enough to drive quality speakers which are essential for quality sound. A 16-bit sound card may provide better sound to computer speakers. However if you have good speakers then 8-bit sound card can also provide better sound. Speakers are measured by the following three criteria:

- **Frequency response:** This is a measurement of the range of high and low sounds that a speaker can reproduce. The ideal range is from 20 Hz to 20 KHz.
- **Total Harmonic Distortion (THD).** This is an expression of the amount of distortion or noise created by amplifying the signal. The amount of distortion is measured in percentages. An acceptable level of distortion is below .1 percent (one-tenth of 1 percent). For some CD-quality recording equipment, a common standard is .05 percent. Some speakers have a distortion of 10 percent or more. Headphones often have a distortion of about 2 percent or less.
- **Watts.** This is the amount of amplification available to drive the speakers. Many sound cards have built in amplifiers, providing up to 8 watts per channel. (Most provide 4 watts.)

Headphones are an option when you can't afford a premium set of speakers. Headphones also provide privacy and allow playing sound card as loud as you like.

11.4.3 Sampling Concept

A technique called digital sampling helps in recording and playback of sounds. In order to record your voice, you first speak into a microphone. The Analog-to-Digital Converter (ADC) translates the analog waves of your voice into digital data that the computer can understand. To do this, it samples, or digitizes, the sound by taking precise measurements of the wave at frequent intervals. Figure 11.3 shows the sampling technique.

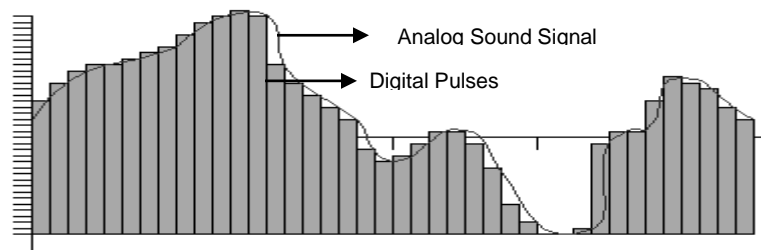


Figure 11.3: The sampling technique

The number of measurements per second, called the sampling rate, is measured in kHz. The faster a card's sampling rate, the more accurate its reconstructed wave is.

In case you want to play back your recording through the speakers, the Digital-to-Analog Converter (DAC) will perform the same basic steps in reverse. With accurate measurements and a fast sampling rate, the restored analog signal can be nearly identical to the original sound wave.

Some reduction in sound quality can be caused even with high sampling rates. Distortion may also occur due to the physical process of moving sound through wires. Two measurements are used by manufacturers to describe this reduction in sound quality:

- Total Harmonic Distortion (THD), expressed as a percentage
- Signal to Noise Ratio (SNR), measured in decibels (dB), a unit of sound.

For both THD and SNR, smaller values indicate better quality. Some cards also support digital input, allowing people to store digital recordings without converting them to an analog format.

11.4.4 The role of MIDI

1980's saw the development of MIDI (Musical Instrument Digital Interface) to communicate between synthesizers. Although it was earlier just a specification, now it has become a standard, which allows programs to play music through the PC sound card.

MIDI, a computer standard music format is used to write compositions and musical events. Actually the sounds are found in your sound card not in the MIDI files. These files only give a description of how the music is to be played. For example a MIDI sequence can describe the hit on a piano key.

The MIDI sequence describes:

- The instrument
- The note
- The strength of the key hit
- How long to maintain the note

11.4.5 An Inside Look of a Sound Board

Figure 11.4 shows an inside look of a PCI (Peripheral Computer Interface) sound card. The sound card may contain a lot of jumpers, which you have to set/reset before connecting other devices.

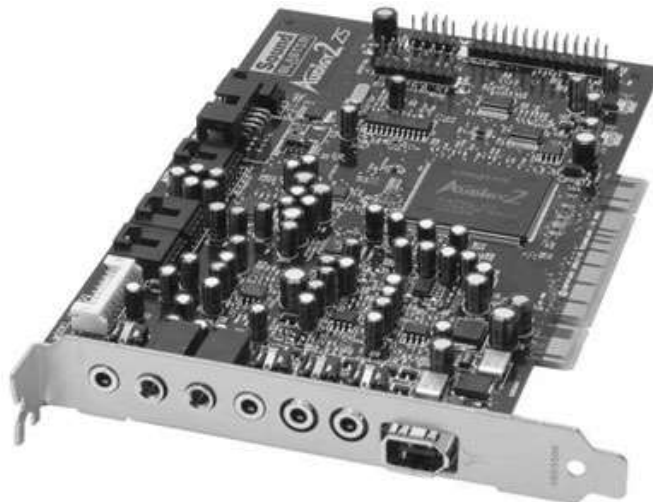


Figure 11.4: A PCI sound card

Locate any jumpers on the sound card if used by it and identify what they control. There may be jumpers that set the MIDI port to use with a joystick, or jumpers that set the IRQ (Interrupt Request) for the controller for CD-ROM. Locate the jumpers for the IRQ setting. When a bridge is made with a jumper between two adjacent posts, the jumper is said to be ON. When the jumper is removed, it is OFF.

Self Assessment Questions

7. _____ is required to record the sound.
8. The number of measurements per second, called the _____, is measured in kHz.
9. MIDI stands for _____.

11.5 Troubleshooting a Sound Board

In order to install a sound card, you will have to select IRQ numbers, a base I/O address, or DMA channels that don't conflict with other devices. Although most cards are already configured to be used on an otherwise idle set of ports, sometimes problems do occur. Therefore troubleshooting may be required which may mean changing board jumpers or switches, or even reconfiguring other cards.

11.5.1 Hardware (Resource) Conflicts

- A device or hardware conflict occurs when sound card simply doesn't work (no sound effects or music). Sometimes it may repeat the same sounds over and over and causes PC to freeze. Sound cards usually clash with other devices installed in the PC. There are generally three sources of conflict in sound card installation:
 - *Interrupt ReQuests (IRQs)*. IRQs are used to "interrupt" PC and get its attention.
 - *Direct Memory Access (DMA) channels*. DMA channels are the way to move information directly to PC's memory, bypassing PC's processor. DMA channels allow sound to play while PC is doing other work.
 - *Input / Output (I/O) Port addresses*. An I/O Port address in PC is used to channel information between the hardware devices on sound card and PC. The addresses usually mentioned in a sound card manual are the starting or base addresses. A sound card has

several devices on it, and each one will use a range of addresses starting with a particular base. Most sound cards include installation software that analyzes PC and attempts to notify any of the standard settings in use by other devices.

It is advisable to install a sound card using the default settings where possible because poorly written software cannot work properly with alternate settings, even if they do not cause conflicts.

Solving Hardware Conflicts

The best way to find a hardware conflict is to locate all of the documentation for the PC and its various devices, such as a tape backup interface card, CD-ROM drive, and so on. The most common causes of system resource conflicts are the following:

- SCSI host adapters
- Network interface cards
- Bus Mouse adapter cards
- Serial Port adapter cards for COM3: or COM4:
- Parallel Port adapter cards for LPT2:
- Internal modems
- Tape drive interface cards
- Scanner interface cards.

You could find out as to which device is conflicting with the sound card by temporarily removing all of the expansion cards except the sound card and other essential cards like the video card. Then add each of the cards removed, one at a time, till you find that sound card does not work. When you come to the last card, it is most likely the troublemaker, the card causing the conflict. Now, either switch the settings for the device that is conflicting with sound card or change the settings of the sound card. To do this, set jumpers or DIP (Dual In-line Package) switches, or use sound card's setup software to change its settings.

11.5.2 Other Sound Card Problems

No Sound

You could consider the following solutions if you don't hear anything from the sound card,:

- Ensure that the sound card is set in such a way that it uses all default resources, and that other devices using these resources are either changed or removed.
- Are the speakers connected? Check that the speakers are plugged into the sound card's Stereo Line Out or speaker jack.
- Find out whether they are amplified speakers and are powered on. Check the strength of the batteries or the adapter's connection to the electrical outlet.
- If the speakers are stereo check that the plug inserted into the jack is a stereo plug, not mono (short form of Monaural or Monophonic sound reproduction, which is a single-channel).
- Make sure that the mixer settings are high enough. Many sound cards include a mixer control for DOS and/or Microsoft Windows. The mixer controls the settings for various sound devices, such as a microphone or CD player. There may be controls for both recording and playback. Increase the master volume or speaker volume when in the play mode.
- Use sound card's setup or diagnostic software to test and adjust the volume of the sound card. Such software usually includes sample sounds that play.
- Switch off computer for a minute and then switch it back on. Such a hard reset (as opposed to pressing the Reset button or pressing Ctrl+Alt+Delete) may clear the problem.
- If computer game lacks sound, check that it works with sound card. For example, some games may require the exact settings of IRQ 7, DMA 1, and address 220 to be Sound Blaster-compatible.

Scratchy Sound

If there is a scratchy sound then the solution is quite simple. You could solve the problem in the following ways:

- If the sound card is near other expansion cards could be picking up electrical interference from other expansion cards inside the PC. Therefore, move the sound card to an expansion slot as far away as possible from other cards.
- If you find that the speakers are too close to the monitor move them farther as the speakers may be picking up electrical noise from monitor.

- Ensure that you are not using a cheap FM (Frequency Modulation) synthesis sound card because most of the cards that use FM synthesis instead of wave table sound generation have very poor quality output. It is recommended that you upgrade to a card that has wave table synthesis so you can get the full benefit of high quality sound.

11.5.3 Other Problems

Sometimes sound problems can be difficult to solve. Due to quirks and problems with the way DMA is implemented in some motherboard chipsets, there can be problems interacting with certain cards or drivers. Sometimes altering the Chipset Setup options in CMOS settings can resolve problems. These kinds of problems can take a lot of trial and error to solve.

11.5.4 Full-Duplex Drivers

If you can play a wave sound and record it at the same time (e.g., using Windows Sound Recorder), then your sound card is full-duplex. However, if the program you are trying to use needs DirectSound. You need full-duplex compatible DirectSound drivers. You might find some information on this at your card's manufacturer website.

Sometimes sound card drivers become corrupt or have conflicts after an operating system update, or if additional hardware is installed. To solve this problem, if you have a new sound card, reinstall the driver that came with the device. If audio support is built into your motherboard, or the sound card is not a newer model, download and install the latest drivers from the manufacturer's website.

If system conflicts occur after installing additional hardware, try uninstalling the sound card drivers, reboot the computer a few times, and then install the drivers again. If your operating system has a system restore feature, try restoring the computer to one of the restore points when the sound card worked.

11.5.5 Soundboard Accelerations

It is found that soundcards, especially onboard, can cause a number of problems. More often than not you might find that the card is not the real cause of the problem, as you may hear the sound properly but the game might be running slower than usual or even might crash. A number of problems could be caused like: distorted/weird sound slowdown, especially

on top of the line PC's. This is especially true if the game is reporting 30 or higher FPS (frames per second). This may lead to random crashes of the desktop or hanging.

Blue screen crashes (especially protection faults and similar) are often due to this. You could prevent this from occurring by: ensuring you have the most up-to-date driver for your sound hardware; disabling Direct X's (Microsoft's gaming technology) sound optimization.

Follow the below steps to do this:

1. Go to start. Select run. Type in "dxdiag" (an executable file to diagnose direct X) and hit enter.
2. The Direct X Diagnostic tool will launch. Wait a couple of seconds while it detects hardware information.
3. Click on the sound tab.
4. Move the hardware acceleration slider all the way to the left (off or none will be displayed).
5. Ok and exit.

The actual performance hit on your system is variable. Many manufacturers bypass Direct X's software acceleration in favor of their own hardware or driver based routines. In majority of the cases, you won't notice any difference with how the game plays (except less crashes and more stability). If you do see decreased performance, try moving the slider up a notch and retest the game. Often you can get basic acceleration or better before the initial problem reappears.

11.5.3 Multiple Codecs

If you find there are several codecs on the same card, you need to call *snd_ac97_mixer ()* (a procedure to run codecs) multiple times with *ac97.num=1* (setting the value of the variable *num*) or greater. The *num* field specifies the codec number. If you set up multiple codecs, you either need to write different callbacks for each codec or check *ac97->num* in the callback routines.

11.5.4 WAV Playback Problems

When you try to play wave sound (.wav) files in Windows you might encounter the following problems prompting you to troubleshoot them: Program-specific problems such as improper configured Playback device,

incorrect Mixer settings, incorrect Hardware configuration, Damaged wave sound files, Compression-related problems

Program-Specific Problems

In case you are not able to play .wav files with a specific program that you use in Windows, then you should check if the same problem occurs when you play the file with another program. For example, if you are attempting to play the file from a third-party program that is not included with Windows, try to play the file from Media Player or Sound Recorder.

To start Media Player or Sound Recorder, click Start → Programs → Accessories → Multimedia and Multimedia → click Media Player

In case the problem occurs only when you try to play the .wav file with one program, the files that are associated with that program may be damaged, or the program may not be configured correctly then it is advisable to contact the software manufacturer to solve it. However if the problem occurs with multiple programs, then it could be that the problem may be caused by any of the reasons discussed in this unit.

Playback Device Not Configured Properly

If you find that you are unable to play .wav files in Windows, or if .wav files are not played at the proper volume, then the reason could be that you have not selected a playback device, or the playback device that you have selected may not have been configured properly. Therefore, in order to select and configure a playback device you should:

1. Click Start → Settings → Control Panel.
2. Double-click Multimedia or Sounds and Multimedia.
3. In the Playback box, click the playback device that you want to use in the Preferred Device list, and then move the Volume slider to the value you want.
4. In the Recording box, click the playback device that you want to use in the Preferred Device list, and then move the Volume slider to the value you want.
5. Verify that your speakers are properly connected to the sound card, and that the speakers are turned on.

Mixer Settings Not Configured Properly

If the mixer control settings are not configured properly then you will not be able to play .wav files in Windows, or .at files (audio file created with Sony's Adaptive Transform Acoustic Coding (ATRAC) compression algorithm; designed for storage and playback on portable media devices) in their proper volume. You could use the mixer control program that is included with Windows to adjust the volume for playback, recording, and voice commands. If you are using Windows 3.1 drivers with your sound card, you must use the mixer control program that is included with the sound card to adjust the volume for playback, recording, and voice commands. It is sensible to contact the sound card manufacturer if your sound card does not include a mixer control program, or if you need information about how to use the mixer control program that is included with your sound card.

In order to configure mixer control settings with the mixer control program that is included with Windows:

1. Click Start → Programs → Accessories → Multimedia or Entertainment → click Volume Control
2. Verify that the Mute All check box below the Volume Control slider is not selected.
3. Verify that the Mute check box below the Wave slider is not selected.
4. Verify that the Balance sliders for Volume Control and Wave are in the center of the scale.
5. Move the Volume Control and Wave sliders at least halfway to the top of the scale.

You may need to adjust the current Volume Control or Wave slider settings to play .wav files at the volume level that you want.

Damaged Wave Sound Files

If you cannot play .wav files in Windows, or if .wav files are not played properly, the .wav files that you are attempting to play may be damaged. To determine if a .wav file is damaged,

1. right-click the .wav file
2. click Properties → click the Details tab. The Audio Format box should contain information about the type of compression that was used to compress the file, the sound quality of the file, and whether or not the file is in stereo. If this information is missing, the .wav file may be damaged.

In case the information in the Audio Format box is not missing, try to play other wav files that are compressed by using the same type of compression as the wav file that you are attempting to play. If you are successful then it is possible that the first .wav file that you tried to play may be damaged.

Self Assessment Questions

10. _____, _____, and _____ should not conflict with other devices while installing a sound card.
11. _____ is the way to move information directly to PC's memory, bypassing PC's processor.
12. The _____ box should contain information about the type of compression that was used to compress the file, the sound quality of the file, and whether or not the file is in stereo.

11.6 Summary**Let's recapitulate important concepts discussed in this unit:**

- A standard mouse consists of several components: A housing that can be held in the hand and moved around, a roller ball that signals movement to the system, buttons (usually two) for making selections, a cable for connecting the mouse to the system and an interface connector to attach the mouse to the system.
- The keyboard is the primary input device. It is used for entering commands and data into the system. The keyboard is the friendliest input peripheral.
- A sound card has many uses, including: adding stereo sound to entertainment (game) software, increasing the effectiveness of educational software, particularly for young children, adding sound effects to business presentations and training software, creating music by using MIDI hardware and software, adding voice notes to files, adding sound effects to operating system events, enabling a PC to read, enabling PC use by disabled individuals, playing audio CDs.
- In order to install a sound card, you will have to select IRQ numbers, a base I/O address, or DMA channels that don't conflict with other devices.

11.7 Glossary

Term	Description
Mouse	Mouse is a pointing device which is used to point a particular option on the screen and then select that option by clicking. Different manufacturers produce different varieties of mouse.
Trackball	Trackballs are also called as "rollerballs". They are best described if you turned the traditional mouse over exposing the ball. Trackballs are a stationary device. Movement or rotation of the ball moves the cursor.
Keyboard	The keyboard is the primary input device. It is used for entering commands and data into the system. The keyboard is the friendliest input peripheral. Both program and data can be keyed in through it.
Analog-to-Digital Convertor (ADC)	The Analog-to-Digital Convertor (ADC) translates the analog waves of your voice into digital data that the computer can understand. ADC will be used while recording the sound in a PC.
Digital-to-Analog Convertor (DAC)	Digital-to-Analog Convertor translates the digital signals in the computer to analog waves. Using DAC you can playback the recorded sound.
Direct Memory Access (DMA)	DMA channels are the way to move information directly to PC's memory, bypassing PC's processor. DMA channels allow sound to play while PC is doing other work.

11.8 Terminal Questions

1. Explain the features of a mouse and a track ball.
2. How does the key board function? How will you determine the Key board failure?
3. List out the steps involved in installing a sound card.
4. How will you overcome the IRQ conflict with sound card?

11.9 Answers

Self Assessment questions

1. Microsoft, Logitech
2. True
3. Hardware problems
4. Scanning
5. 8042
6. Periodic cleaning
7. Microphone
8. Sampling rate
9. Musical Instrument Digital Interface
10. IRQ numbers, base I/O address, DMA channels
11. DMA channels
12. Audio format

Terminal Questions

1. Mouse is a pointing device which is used to point a particular option on the screen and then select that option by clicking. Different manufacturers produce different varieties of mouse. Trackballs are also called as "rollerballs". Trackballs are a stationary device. Movement or rotation of the ball moves the cursor. (Refer sections 11.2.1 & 11.2.2)
2. When a key is pressed, the keyswitch is activated. The keyboard has an electronic circuit to determine which key has been pressed. Then a standard 8-bit code is generated and sent to the computer. (Refer section 11.3.1)
3. To install a sound card, you have to select IRQ numbers, a base I/O address, or DMA channels that don't conflict with other devices. Most cards come already configured to use on otherwise idle set of ports, but problems occasionally arise. (Refer section 11.5)
4. The audio portion of a sound card has a default IRQ setting, but also supports any of several alternate interrupts. You should try to leave the sound card at the default setting (usually IRQ 5) and change other adapters where possible. (Refer section 11.5)

References:

- Troubleshooting, Maintaining and Repairing PC's by Stephen J. Bigelow, TMH
- Understanding and Repairing PCs by Mueller, PHI.

E-References:

- <http://www.freeopenbook.com/upgrading-repairing-pc/ch18lev1sec2.html>
- <http://www.fileinfo.com/extension/at3>
- <http://www.wisegeek.com/what-is-a-sound-card.htm>