

Easy Steps



Unit 2783 (v7)

**Demonstrate knowledge of
the components of
personal computer systems**

- ☒ Easy to follow
- ☒ Step-by-step instructions
- ☒ Covers Unit Standard Criteria

A Cheryl Price Publication

Unit Standard 2783 (Version 7)

Demonstrate knowledge of the components of personal computer systems

This book covers the course outline for the following New Zealand Qualifications Authority Unit Standards:

Unit Standard 2783 - GENERIC COMPUTING (Level 3, Credit 3) - Version 7
Demonstrate knowledge of the components of personal computer systems

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Unit Standard 2783 Version 6

Title	Demonstrate knowledge of the components of personal computer systems		
Level	2	Credits	3

Purpose	People credited with this unit standard are able to demonstrate knowledge of: the features of main hardware components of a personal computer system and interaction between the components; operating system software and applications software and their interaction; and the relationship between hardware, software and data.
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Classification	Computing > Generic Computing
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Available grade	Achieved
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Explanatory notes

- 1 Range
The main components of a personal computer system include but are not limited to – memory, central processing unit (CPU), motherboard, storage devices, USB devices, monitor, keyboard, mouse.
- 2 Demonstration of knowledge can be oral, written, practical, and/or a combination, as appropriate to the assessment situation.
- 3 Definitions
Application software means software operated by end-users rather than the computer system itself, e.g. word processing.
CPU means central processing unit.
System software means software employed by the computer system rather than end-users, e.g. operating systems.
- 4 Legislation relevant to this unit standard includes:
Health and Safety in Employment Act 1992;
Copyright Act 1994;
Copyright (New Technologies) Amendment Act 2008;
and any subsequent amendments.
- 5 An assessment resource to support computing unit standards (levels 1 to 4) can be found on the NZQA website at www.nzqa.govt.nz/asm.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of the features of main hardware components of a personal computer system and interaction between the components.

Evidence requirements

- 1.1 System components are identified in terms of their specifications.

Range may include but is not limited to – clock frequencies, CPU speed, bus speed, memory size, bit rate.
- 1.2 The CPU is identified in terms of its main components.
- 1.3 The relationship between the CPU, memory and input/output is identified in terms of the data flow.
- 1.4 The interaction of the fetch and execute cycle is described in terms of the events that occur and their sequence.

Outcome 2

Demonstrate knowledge of operating system software and applications software and their interaction.

Evidence requirements

- 2.1 Operating systems and operating system tasks are identified and described in terms of how they interact in a personal computer.

Range a minimum of two different operating systems and three tasks for each.
- 2.2 Applications software for a personal computer system is identified and described in terms of how they interact with each other.

Range any two different types of applications.
- 2.3 Operating systems are compared in terms of features and functions.

Range any three operating systems.
- 2.4 The purpose of the operating system and its interaction with application software is described in terms of the need for compatibility.
- 2.5 Popular file formats and the utilities to convert between them are identified and described in terms of the processes used in conversion.

Outcome 3

Demonstrate knowledge of the relationship between hardware, software and data.

Evidence requirements

- 3.1 The relationship between hardware, software and data is described in terms of interaction.
- 3.2 The purpose of language and data translation utilities is described in terms of their function.
- Range may include but is not limited to – compiler, interpreter, assembler.
- 3.3 The steps of the processing cycle are identified and described in terms of input, processing and output.

Planned review date	31 December 2016
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
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Revision	5	16 July 2004	31 December 2013
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Table of Contents

Section 1 - Data and Information

Data versus Information.....	2
Digital versus Analogue.....	3
Bits and Bytes.....	4
Counting with Binary Numbers.....	4
ASCII.....	5
Unicode.....	5
Kilobytes, Megabytes, Gigabytes . . . and Terabytes.....	6
The Processing Cycle.....	6
Input.....	6
Processing.....	6
Storage.....	7
Output.....	7
Revision.....	8

Section 2 - Computer Hardware - Peripherals

What are Peripherals?	10
Input Devices	10
Keyboard.....	10
Standard keyboard	10
Natural keyboard (split or angled keyboard).....	10
Multimedia keyboard.....	11
Mouse	11
Traditional trackball mouse.....	11
Optical mouse.....	11
Wireless mouse.....	12
Trackball.....	12
Touchscreen.....	12
Scanner	13
Flatbed scanners	13
Handheld scanners.....	13
Scanner/printer/copier	13
Microphone.....	13
Storage Devices	15
Reading and Writing.....	15
The Hard Drive.....	15
Hard Drive construction	16
External and removable hard drives	16
USB/Portable hard drives	16
Floppy Disks.....	17
Form and capacity	17
Formatting and Write Protecting	17
Floppies' many uses	17
Optical Discs.....	18
Compact Discs.....	18
Writable compact discs.....	18
DVDs	19
Writable DVDs.....	19
Combination Disc Readers/Writers	20
Disc speeds	20
Blu-ray Discs	20

Tape	20
Backup	22
Compression and encryption	22
Types of backup	23
Output Devices.....	23
The Monitor	23
LCD monitors	24
CRT monitors	24
Monitor facts.....	24
Refresh rate.....	24
Pixels and Dot pitch.....	25
Display Resolution	25
Monitor standards	25
Colour Depth/Bit Depth.....	27
The Graphics Card	27
Onboard Video.....	27
3D Graphics	28
Sound	28
Sound card	28
Standards	28
Speakers/Headphones	29
Printers	30
Laser Printers	30
Ink-Jet Printers.....	30
Dot Matrix Printers	30
Fonts	31
Resolution.....	31
Screen Resolution	31
Printer Resolution	32
Unprintable Region.....	32
Memory	32
Communication – The Modem	33
Dialup Modems.....	33
Broadband Modems.....	33
Digital Subscriber Line modems	33
Cable modems	34
Modem Types	34
Networking	35
Networking Hardware.....	36
Hub	36
Bridge	37
Switch.....	37
Router	37
Network Interface Card	37
P2P and Client/Server Networks	38
Peer-To-Peer.....	38
Client-Server.....	38
Network Topology.....	39
Bus Topology.....	39
Ring Topology	40
Token Ring	40
Star Topology	40
Combined Topologies.....	40
Cabling.....	41

Twisted Pair	41
Coaxial	42
Fibre-Optic Cabling	42
Revision	43

Section 3 - Computer Hardware - Processing Devices

Processing Hardware	46
The System Unit	46
Power Supply	46
Motherboard	47
Expansion cards	48
Onboard features	48
Ports	48
Central Processing Unit	50
Control Unit	50
Bus	50
Arithmetic Logic Unit (ALU)	50
Registers	51
Instruction Register	51
Accumulator	51
Program Counter	51
Floating Point Unit	51
Interrupts	51
Cooling	52
Buses	52
Types of Buses	52
Address Bus	53
Control Bus	53
Data Bus	53
External Data Bus	53
Power Bus	53
Expansion Bus	53
Memory	54
Random Access Memory (RAM)	54
RAM, CPU, and data flow	55
RAM on your motherboard	55
ROM	56
BIOS	56
CMOS	56
Virtual Memory	57
Cache	57
Fetch and Execute	58
The Four Stages of the Cycle	58
Fetch	58
Decode	58
Execute	58
Store	59
Communication between Components	59
Clock frequencies	60
Bus speed	60
CPU speed	60
Bit rate	60
Computer Specifications	61
Revision	63

Section 4 - Software

Software	66
System Software	66
The Operating System	66
Modularisation	67
System utilities	67
Operating System Types	68
Single user versus multi-user	68
Single tasking versus multitasking	68
Single processing versus multiprocessing	69
GUI versus command line	69
Running Multiple Operating Systems	70
Software Compatibility	70
Common Functions	70
Operating System Examples	71
Microsoft	71
DOS	71
Windows 1.0-3.11	72
OS/2	73
Windows 95, 98, Me	74
Windows NT and 2000	75
Windows XP	76
Windows Vista	77
Windows 7	78
Windows 8	79
Apple	79
'Classic' Mac OS	79
Mac OS X	80
Other	81
UNIX	81
Linux	82
Application Software	84
Hardware Support	85
System Requirements	85
Application Interaction	86
Data Translation Utilities	86
Software Creation	87
Development Environments	87
Levels of Programming Languages	88
Compilers, Interpreters and Assemblers – Language Translation Utilities	88
File Formats and Utilities	91
File Formats	91
File Conversion	91
File Conversion Processes	91
File Conversion Utility Programs	92
Interaction between Hardware, Software, Data and Information	93
Inputting Data	93
Processing and Storage	93
Outputting Information	94
Revision	95

Sample Document

Learning Outcomes

At the end of this section you should be able to -

- ☐ Understand the differences between data and information
- ☐ Understand the difference between analogue and digital devices
- ☐ Understand bits, bytes, and binary numbers
- ☐ Identify the steps in the processing cycle

Data versus Information

The terms **data** and **information** are often used to mean the same thing. When it comes to computers, however, it's best to distinguish between the two.

Data is the plural of the word datum, which means a single piece of evidence. In computing terms, data are the raw facts that are entered into a computer for processing. Data are used to represent a fact, figure, or idea in a way that a computer can understand and work with. Although the word "data" was originally used only as a plural, it is now used in place of "datum" to also indicate a single piece of evidence.

Information results from the processing of data by the computer. Information is presented in some understandable way to the computer user. Data is abstract and unusable in its raw form to the average computer user. It exists in the computer as a collection of electrical signals. Information, however, is meaningful to the computer user. Information is always presented in a way that a person can understand, for example, on an output device such as a monitor, or on a printed page.



Data is entered into the computer using an **input device**. These hardware devices provide a way for people to "talk" to a computer in the computer's language. For example, when you type on a keyboard you are sending signals to the computer that correspond to the letters you are pressing. The combination of all those keystrokes, as well as mouse clicks and other actions using input devices, can all result in a single document, like a business report.

There are many types of input devices that enable people to input data into the computer. They include:

- Keyboards • Mice • Trackballs • Touchpads • Tablets • Scanners • Digital cameras • Webcams • Microphones • Touch screens • Barcode readers • Digital music instruments

Note Hardware is the generic term used to describe any part of the computer you can physically touch.

Processed data is delivered by the computer to the user as information through one or more **output devices**. Like input devices, output devices bridge the gap between the computer and human user—just in the opposite direction. They make what the computer is doing meaningful and useful to the user. The business report the user typed using input devices can then be displayed on an output device such as a monitor or a printer.

Output devices include:

- Monitors • Printers • Plotters • Speakers • Headphones

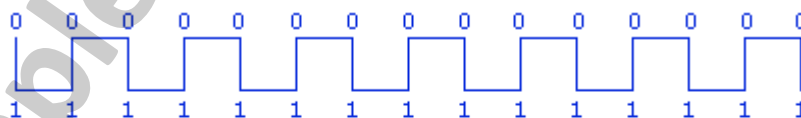
Digital versus Analogue

Understanding how computers work also requires some understanding of the difference between digital and analogue signals.

An analogue signal is continuous. Data is obtained from an analogue signal by measuring small changes over time in this continuous signal. A good example of an analogue signal is a sound wave through the air. The human ear distinguishes differences in sound by registering the changes in the sound wave's frequency. A phonograph is an example of an analogue device.

A digital signal, however, is not continuous; it is discrete, or made up of individual elements. Digital signals are sent using the binary number system of 0 and 1. Digital systems are rare in the natural world, but computers rely on them. A computer is a digital device; its hardware and software work with data in digital form. The 0 in a computer refers to an "off" electrical state; a 1 means "on." An MP3 player is another example of a digital device.

A digital signal is a sequence of 0s and 1s:



An analogue signal is a continuous



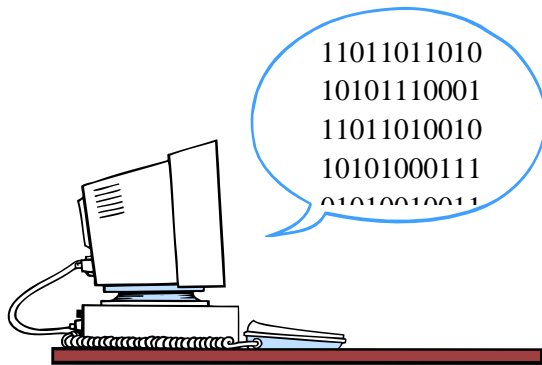
Let's look at an example of analogue and digital devices that perform the same function but in different ways. The traditional clock (right) is an analogue instrument because the hands move continually around its face. The hands of the traditional clock are controlled by the continuous movements of tiny mechanisms inside it.



A digital clock, however, represents time in discrete increments, such as hours, minutes, seconds, and divisions of seconds. Instead of the mechanisms of a traditional clock, the digital watch has a digital processor. The digital signal is pulsed so quickly that the digital clock seems to present the time as smoothly as a traditional, analogue one.

Bits and Bytes

Now let's look at how computers speak this digital language of 1s and 0s. The smallest unit of data communications for a computer is called a **bit**, which is short for "binary digit." In



computers, a bit of data is represented by the presence or absence of an electrical signal. If an electrical signal is present, the bit is represented by a 1. If there is no signal, the bit is represented by a 0.

Taking this information, we can see that two bits of information would have four possible combinations: 00, 01, 10, and 11. Three bits would allow eight possible combinations: 000, 001, 010, 011, 100, 101, 110, and 111. Seven bits, or a sequence of seven 0s and 1s, would have 128 possible combinations. This is the same as 2 to the 7th power, or 2^7 .

Eight bits make up a **byte**. The bits in a byte follow a particular order understandable by the computer. Historically, a byte contained the minimum number of bits required to encode an alphabetic character in a computer. Today, with the adoption of many non-Western languages into the computing world, a byte is not always sufficient to represent a character.

Counting with Binary Numbers

How do you represent numbers in a binary, or base 2, system? As humans, we usually count with a decimal, or base 10, system. Each place in a decimal or binary number has a value. For example, the decimal number 4,517 has a 7 in the ones place, a 1 in the tens place, a 5 in the hundreds place, and a 4 in the thousands place.

Here is the decimal number 4,690,489 with all of its decimal places named.

Number	4	6	9	0	4	8	9
Place	Millions	Hundred-thousands	Ten-thousands	Thousands	Hundreds	Tens	Ones
Place as a power of 10.	10^6	10^5	10^4	10^3	10^2	10^1	10^0

We can do the same thing for a binary number. Here is the binary number 10101101 with all of its places named.

Number	1	0	1	0	1	1	0	1
Place	128s	64s	32s	16s	8s	4s	2s	1s
Place as a power of 2.	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

The first column, starting on the right, represents multiples of 1. The second row represents 2, then 4, 8, 16, 32, 64, and 128 in the subsequent columns. Notice that in both tables the exponent increases by 1 each time you move to the left.

By using the values in the table, we can convert a binary number to a decimal. The binary number 10101101 would therefore represent one multiple of 128, zero of 64, one of 32, zero of 16, one of 8, one of 4, zero of two, and 1 of 1. Adding these multiples together, we get:

$$128 + 32 + 8 + 4 + 1 = 173.$$

Now let's use the table above to convert the decimal number 7 to binary. The highest binary number that "works" is in the 4s place, so we put a 1 there. We have 3 remaining, so we put a 1 in the 2s place and another 1 in the 1s place. The decimal number 7 is 111_2 in binary. Notice the small "2" in the answer? That indicates the number is binary, or base 2. (We could put a small "10" next to a decimal number if there were some question about the number system being used. Otherwise, decimal is assumed.)

This shows us how to convert a binary number to base 10 and vice versa, but remember that computers don't need to convert when working with data. As strange as binary math may seem to us, computers are quite comfortable with it!

ASCII

ASCII stands for the American Standard Code for Information Interchange. It was developed by the American Standards Association in 1968. ASCII was one of the early attempts to provide a common way for computers to exchange data in a language they all could understand.

ASCII is a code, or character set, which uses binary numbers to represent the characters and symbols of a language, such as English. Standard ASCII characters are 7 bits in size and are written in one group of three numbers and a second group of four. The English capital letter A, for example, is rendered in ASCII as 100 0001.

ASCII is still widely used because it is understandable by any computer, but other character sets have been developed which use 8 or more bits to represent characters. This has become necessary to represent characters in non-English languages, as well as special symbols for math and science.

Unicode

ASCII is gradually being superseded by a new computing industry standard called Unicode. Unicode provides more than 100,000 character representations in dozens of languages, with the potential for even more. In addition to providing coding for non-Western languages, Unicode accommodates right-to-left scripts such as Hebrew and Arabic. Development of Unicode is overseen by the Unicode Consortium, a non-profit organization.

Unicode was created in the late 1980s. It originally used 16 bits to represent each character, meaning it could represent more than 65,000 (2^{16}) unique characters. The emphasis at the time was on representing only modern languages, rather than also preserving older ones. In 1996, however, Unicode's scheme was changed so that it could represent more than 1 million characters.

Kilobytes, Megabytes, Gigabytes . . . and Terabytes

The byte is also the foundation of understanding size in the computer world. Hard drives, memory, documents, images, and many other objects are measured in bytes—or more likely, kilobytes, megabytes, and gigabytes.

Notice that each of these words consists of the word "byte" with a prefix indicating "how many." Just as 1,000 metres is a kilometre and 1,000 grams is a kilogram, 1,000 bytes is a kilobyte, shown with the notation KB. For example, 500 kilobytes is usually written "500 KB." (A kilobyte is more accurately 1,024 bytes, or 2^{10} bytes. Remember that computers think in base 2, not decimal.)

A megabyte (MB) is 1 million bytes and a gigabyte (GB) is 1 billion bytes. Today hard drives of 1 trillion bytes, or a terabyte (TB), are becoming common. Computer technology has come a long way since the floppy disk, which contained only 1.44MB of storage space.

The Processing Cycle

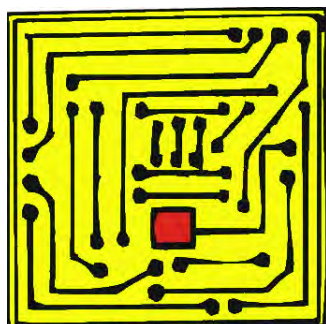
A computer is constantly processing data while it is running. There are four main actions undertaken during this process, in which data goes in and processed information comes out:

- Input • Processing • Storage • Output

Input

Raw data is entered into the computer using input devices such as keyboards.

Processing



Data processing is performed by the central processing unit or CPU. The CPU is a key component found in the system unit (contained in the computer's case). The CPU interacts with other parts of the system unit to process the raw data and turn it into meaningful information.

Data is processed by the computer using computer programs called software. Programs are sets of instructions that tell a computer what to do with data after it has been inputted.

The processing being performed by a computer includes a range of activities, such as:

- Verifying the accuracy of inputted data.
- Performing any calculations required.
- Consolidating separate pieces of data into a cohesive whole.

Note Computer programs are called software because, unlike hardware, they cannot be touched physically.

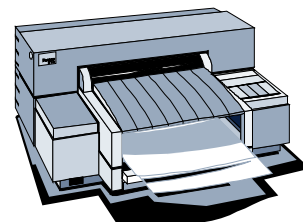
Storage

Before and after being processed, data is stored in one of a variety of locations in the system unit. Data which is needed for current operations is stored in some type of memory. When the data is needed again for processing it is retrieved from memory and acted upon by the processor. Data which is not currently needed for operations is stored on a medium like a disk drive.

The main storage device within the system unit is the hard disk drive (HDD). Most computers also have removable storage capabilities like compact disc drives and floppy drives, and some computer users have a personal flash drive that can be plugged into the computer's USB port.

Output

Output is the process of making information available to the computer user. Information can be presented in many ways, such as an image on a screen, a sound made through speakers, or a document printed on paper.



Important note: When a completed document is stored in a storage device such as a hard drive, it is still referred to as data (more specifically, as **processed data**). This is because information is user-driven; it only becomes information when the computer user views it on the screen or reads it on a printed document. The word "information" is only used for material which is meaningful to a human, not to the stored electronic data.

Now that we have the basics, we can offer a definition of a computer:

A computer is a programmable machine that receives input, stores and processes data, and provides output in a format that has meaning to the user.

Revision

1 What is the difference between data and information?

.....

.....

.....

2 How many bytes (rounded to the nearest thousand) are in a kilobyte?

3 Which is larger: 1GB, 1MB, or 1KB?

4 How would you write the number **6** in binary?

5 Describe the **four** stages of the processing cycle.

.....

.....

.....

.....

.....

.....

6 What does CPU stand for?

.....

7 Name **three** input devices.

.....

.....

.....

8 Give a definition of the term **hardware**.

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Computer Hardware – Peripherals

Learning Outcomes

At the end of this section you should be able to -

- ☐ Describe the specifications of input devices, including keyboards, mice, trackballs, scanners, and microphones
- ☐ Describe the specifications of storage devices, including hard drives, floppy disks, compact discs (CDs), digital versatile discs (DVDs) and USB/portable drives
- ☐ Describe the specifications of output devices, including monitors, graphics cards, sound cards, speakers, and printers
- ☐ Describe the principles of networking and the hardware required to communicate across a network

What are Peripherals?

Peripherals are hardware devices that are not part of the core processing computer, but which are attached to it. Some peripherals, such as a hard drive, can be attached inside the computer system unit (that is, inside the computer's case). These are referred to as **integrated** peripherals. Other peripherals, such as the keyboard, mouse, and printer, are attached to the outside of the computer system unit.

Input Devices

Input devices, as the name suggests, are used to input data into the computer for processing.

Keyboard

The computer keyboard is the most commonly used computer input device. The computer keyboard borrows its layout of letter keys from the traditional typewriter. It also has additional keys, such as Ctrl, Alt, and the Function keys, which are of use in a computing context. Keyboards allow you to communicate with the computer and to enter or edit data. They are used to enter characters or perform functions that give instructions to a computer program.

The keyboard contains a small microprocessor and a sensor grid upon which the keys rest. When a key is pressed, the sensor grid detects it and sends a message to the keyboard's microprocessor. The microprocessor then sends a message to the computer, telling it which key has been pressed. The software that is being used then interprets the keystroke.

There are various types and designs of keyboards available.

Standard keyboard

The standard keyboard has all the keys positioned in straight rows. This version is most similar to the traditional typewriter.

Natural keyboard (split or angled keyboard)

Natural keyboards, also called split keyboards, are designed in a curve, with the keyboard split into two halves—one for the keys struck by the left hand, and one for the right. These are meant to encourage a natural hand, wrist, and forearm position.



Multimedia keyboard

Multimedia keyboards have additional function buttons that are used to issue instructions to the software. These extra keys provide additional functionality for quick access to often-used software, for gaming, and for Internet access.

Mouse

A mouse is an input device used to select and access features within a software program. When a mouse is moved, a pointer, or some other symbol determined by the software, also moves across the monitor screen. This lets the user position the pointer, or in the case of a word processing program, the cursor, exactly where it is needed. Then an action can be taken, such as typing text or launching a software application.



The mouse also has buttons, which are used to perform actions. The traditional PC mouse has two buttons at the top of the mouse. The left button is used to select items and perform operations. The right button is used to display a so-called context sensitive menu. The menu that appears when you click the right button depends upon the software being used. Before 2005, the mouse used with Apple Macintosh computers had only one button.

Some mice also have a scroll wheel, usually set between the two buttons. This wheel allows the user to scroll up and down the screen and through documents. In some cases, the scroll wheel can also be clicked, and so functions like a third button.

There are several different mouse types available.

Traditional trackball mouse

With a traditional, trackball mouse, a ball located on its underside moves when the mouse is moved. The movement of the ball is transferred to two sets of rollers that are touching it. The movement of the rollers is registered by the software and is used to calculate the amount and direction of movement of the pointer on the screen. Trackball mice work best on specially designed mouse pads, which provide a suitable surface for the ball to glide over.

Optical mouse

In an optical mouse, the trackball is replaced with a light-emitting diode (LED) and an optical sensor. The movement and location of the mouse is detected by changes in reflected light. An optical mouse can be used successfully on a wide range of surfaces; it does not require a mouse pad. Optical mice tend to be more robust than trackball mice as they do not have moving parts. The optical technology is also more accurate in detecting mouse movements.

Wireless mouse

As the name suggests, wireless mice are not connected to the system unit with a cable. Instead, radio waves or infrared beams are used to communicate with the computer. The mouse is powered by rechargeable batteries. The wireless mouse offers the flexibility of being able to move the mouse independently of the system unit. However, there is a limit to the range at which the signals will work, and the mouse batteries need to be replaced when they run out.



Trackball

Trackballs are used to perform the same functions as a mouse. The ball is spun by the thumb to move the pointer to a location on the screen that allows the user to select an object or access features within a software program.

The same working principles of a mouse apply to a trackball. The ball's movements result in the movement of rollers inside the trackball. The rollers are used to calculate the cursor movement on screen. Trackballs also have some configuration of buttons, also like a mouse.

Laptop computers often have a built-in trackball. Large trackballs are often used as a teaching aid for children or by people with disabilities.



Touchscreen

Some types of computers let you use the monitor itself for input, instead of a mouse and keyboard. These monitors are called touchscreens and they are popular on computers in public places and on tablet PCs. Touchscreen monitors have a flat screen that responds to the touch of a finger, a stylus, or a digital pen. The screen may also display a software keyboard to take the place of a hardware one. Some newer touchscreens even have a multi-touch capability that lets you perform actions with two fingers at once.

Touchscreens use many different technologies. One of the most popular is the resistive touchscreen. It is made up of two flexible sheets of plastic coated with a material that is sensitive to the touch. These sheets are separated by a gap of air. When the user presses on the screen, the two sheets touch at that point. This creates an electrical connection which can be received by the computer.