

The variety of input, output and memory devices and components

Variety of input devices:

typewriter-style keyboard: the most universal input device - the input portion of a 'terminal'
 magnetic (digital) tape: various formats, IBM 9 track, 6,250 bpi (obsolete)
 optical scanners: optical character readers (OCRs), mark sensors
 digitizer tablets: magnetic or acoustic
 light pens: senses light burst off of CRT to identify x,y coordinates on graphic image
 touch screens for CRT or active matrix LCD displays
 mouse, joysticks, paddles, trackballs: flight controls, potentiometric or optical
 bar code reader or magnetic strip readers: sense 'zebra' stripes
 sense switches on console of computer: high or low (0 or 1), parallel input from digital peripheral devices
 floppy disk drive: 8" (now obsolete), 5-1/4" or 3-1/2" - 800 KB or 1.4 MB
 hard fixed disk (to >100 GB) and removable disks (e.g. Zip 100, 220, 750 MB, Jaz 1, 2 GB)
 modem with UART (universal asynchronous receiver/transmitter), 56 kilobaud; cable modem
 analog-to-digital converters: connect to sensors delivering varying voltage output
 microphone: into A-to-D converter, used with voice recognition software
 video cameras, diode arrays, photomultipliers, etc into fast A-Ds; digital camera and interface
 flat bed whole page and hand-held scanners (using linear diode arrays)
 CD ROM reader (1x to 60 x) and recordable (RW) CDs and DVDs

Variety of output devices:

teletypewriter (teleprinter) or electric typewriter, interfaced (e.g. IBM Selectric; obsolete)
 dot matrix printers: solenoid-driven pins to form characters (e.g. ImageWriter II) (obsolete)
 daisywheel printers: produce 'formed' characters (e.g. Juki, Qume) (obsolete)
 ink-jet printers: electrostatically deflected ink droplets (e.g. HP, Canon, Epson)
 laser printers: 4 to 24 ppm; color laser printers to 10 ppm
 paper tape or card punch (obsolete)
 DAT (digital audio tape) magnetic tape
 floppy, hard, or removable cartridge disk; optical and magneto-optical systems
 pen plotters: analog (via digital-to-analog converters) X-Y, digital (using stepper motors) (obsolete)
 TV display tube, raster type: most common, display of 'terminal' (eg ViewSonic 17")
 COM (computer output microfilm): display screen plus camera, reducing optics (obsolete)
 switch closures, device controllers, digital control lines to peripherals set high or low (obsolete)
 LED, LCD, plasma, fluorescent displays; flat screen active matrix color LCD displays
 loudspeakers (driven by signal generators or D-A converters); voice synthesizers & loudspeaker
 serial output from UART to modem
 graphics display systems: color, raster or vector, inc. 3D

Memory devices: primary

Primary storage is randomly addressable: any one location is as easily (quickly) reached as any other; read/write times are independent of address value. Memory technologies include ferrite core (obsolete), and semiconductor memories and registers within the CPU. Semiconductor memories include: RAM (random access memory), which can be dynamic (requiring periodic 'refresh' cycle approx. every few μ sec, works like a reverb unit) or static (retains information as long as power is on); ROM (read only memory): usually consisting of programs and data 'burned in' by manufacturer; the ROM holds 'firmware', portions of the operating system and other information retained even when the power is turned off. The information contained cannot be changed. EPROM (erasable programmable read only memory): these ROMs can be erased by exposure to UV light, the power applied to special pins on the chip to allow writing of new program information; so, these are user-programmable, and retain information when the power is turned off. EEPROM (electrically erasable programmable read-only memory) use power applied to selected chip pins for erasure, rather than UV light. Major U.S. manufacturers of these 'chip' devices include Intel, AMD, Motorola, etc.

Memory devices: secondary:

Secondary storage devices are not randomly addressable: their access time depends on value of address (which determines recording position on the medium). The magnetic disk is the most common: Floppy diskette: 5 1/4 inch mini-floppy; micro-floppy, 3-1/2 inch diameter (Mac, PC format), 1.4 MB; 120 MB "super-disks"; Hard disks use a solid substrate, allowing a closer read/write head position, and a higher bit density. The disk can be fixed or removable, often a single disk but sometimes multiple disk surfaces (An older technology, the obsolete "disk pack"); Hard disk drives can be fixed or removable. Other earlier formats: the magnetic drum (from the 60s, now obsolete); Magnetic tape: analog is obsolete; digital tape drives are still in use;. CD-ROM: CD-RW (recordable once permanently, or erasable and re-recordable); Also, optical and magneto-optical disk recorders.

Relative storage capacity of memories:

Core: 4 to 32 KB; ROM: 1 K to 128 MB chips; RAM: 16 to 128 MBytes; Full sized (8") floppy: 256 KB; Mini-floppy (5 1/4 inch): 100 K (SSSD) to 1.2 MByte (DSQD); Micro-floppy: (3 1/2 inch) 400K SS, 800K DS, 1.4 MB HD on modern PC and Macintosh disks. Hard disks: originally 5 and 10 MBytes, now to >100 GBytes; Removable media: 100, 220, 750 MB (Zip) or 1 or 2 GB (Jaz); CD-ROM - . 760 or 800 MBMB ; DVD - 5 - 8 Gbytes.