

PC Maintenance and Basic Troubleshooting

Chapter 1

Introducing Hardware

You Will Learn...

- | That a computer requires both hardware and software to work
- | About the many different hardware components inside and connected to a computer

Hardware Needs Software to Work

- | Hardware
 - └ Physical components of a computer
 - └ Visible part of a system
- | Software
 - └ Set of instructions that directs hardware to accomplish a task
 - └ The intelligence

Functions of a Computer

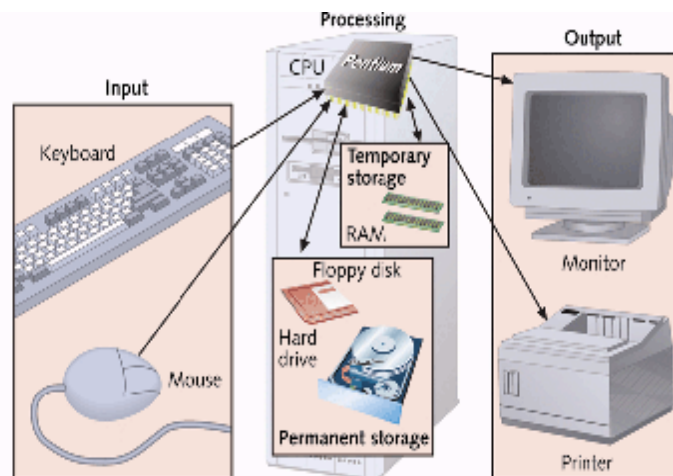


Figure 1-1 Computer activity consists of input, processing, storage, and output

Binary Communication Between Hardware and Software

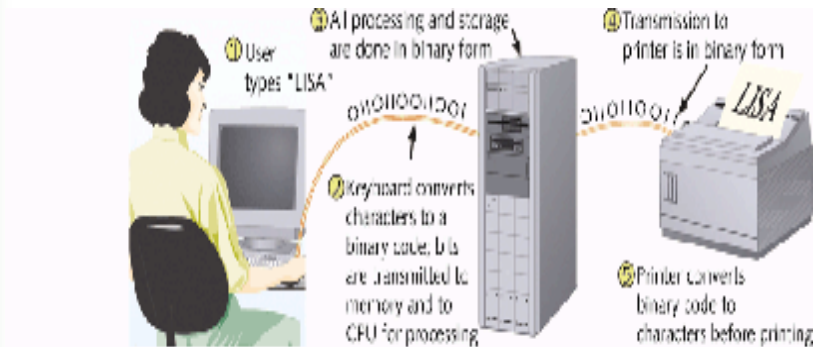


Figure 1-2 All communication, storage, and processing of data inside a computer are in binary form until presented as output to the user

Binary Number System

The letter A stored as 8 bits:



The number 25 stored as 8 bits:



Figure 1-3 All letters and numbers are stored in a computer as a series of bits, each represented in the computer as on or off

PC Hardware Components

- | Outside computer case: input/output devices
- | Inside the case: processing and storage
 - └ CPU – most important component
- | Requirements of a hardware device
 - └ Method for CPU to communicate with it
 - └ Software to instruct and control it
 - └ Electricity to power it

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Hardware Used for Input and Output

- | Connects to computer case by ports (eg, serial, parallel, USB, game, keyboard, mouse)
- | Popular input devices:
 - └ Keyboard
 - └ Mouse
- | Popular output devices:
 - └ Monitor
 - └ Printer

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Ports

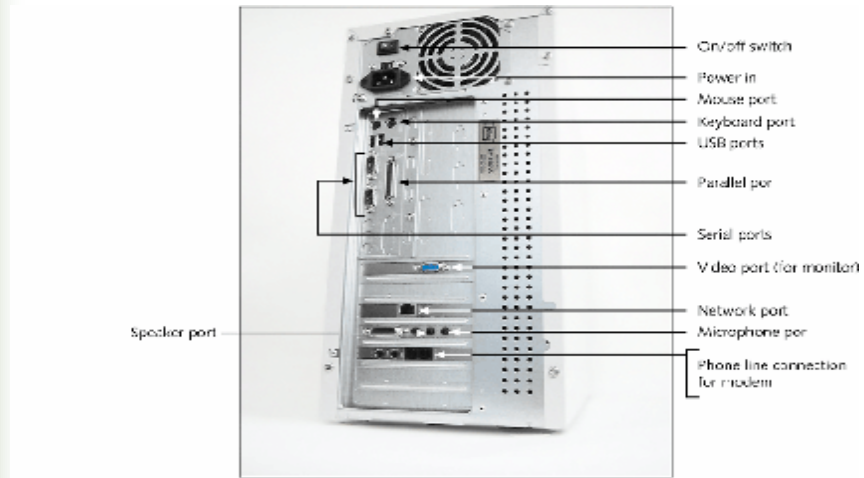


Figure 1-4 Input/output devices connect to the computer case by ports usually found on the back of the case

Input Devices

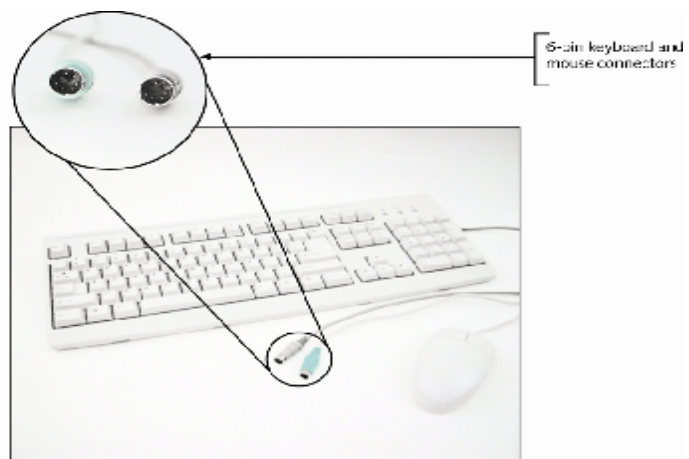


Figure 1-5 The keyboard and the mouse are the two most popular input devices

Output Devices

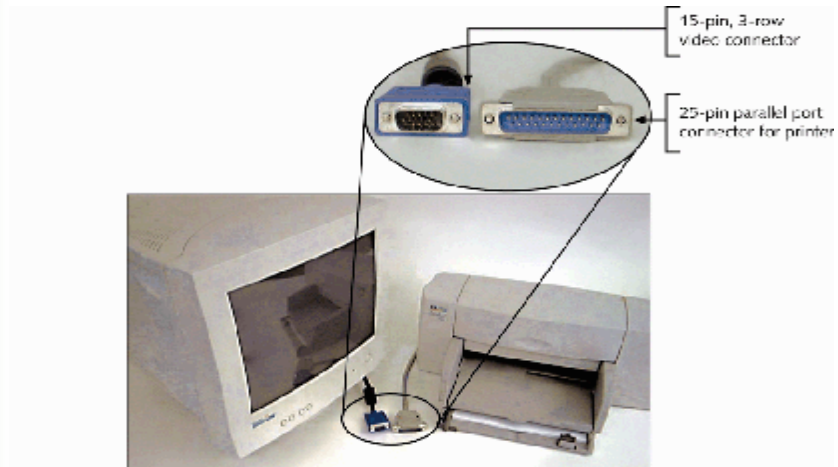


Figure 1-6 The two most popular output devices are the monitor and the printer

Hardware Inside the Case

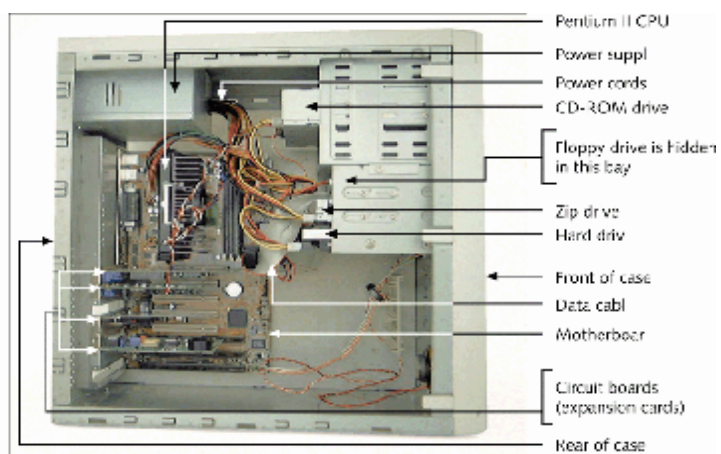


Figure 1-7 Inside the computer case

Motherboard Components

- | Processing
 - u CPU (most important)
 - u Chip set
- | Temporary storage
 - u RAM
 - u Cache memory
- | Electrical system
 - u Power supply connections
- | Communication with other devices
 - u Traces
 - u Expansion slots
 - u System clock
- | Programming/setup data
 - u Flash ROM
 - u CMOS setup chip

The Motherboard

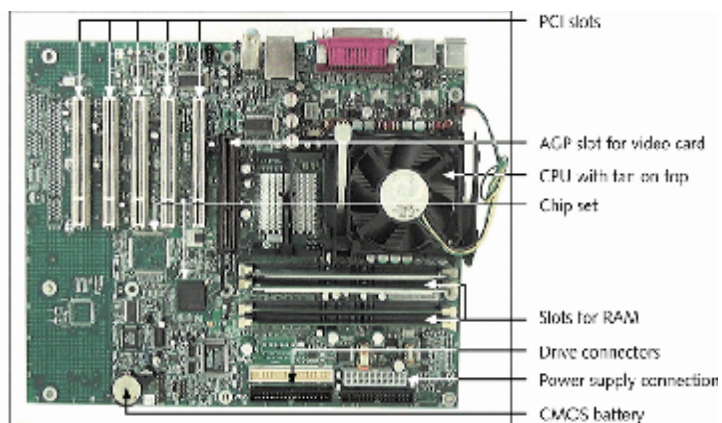


Figure 1-8 All hardware components are either located on the motherboard or directly or indirectly connected to it because they must all communicate with the CPU

The Motherboard (continued)

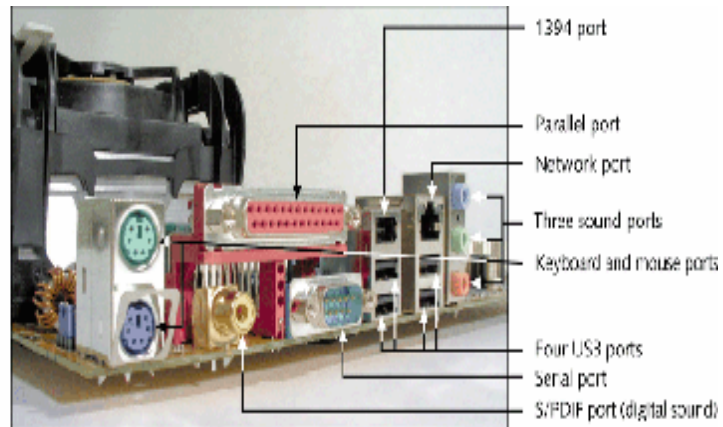


Figure 1-9 A motherboard provides ports for common I/O devices

The CPU

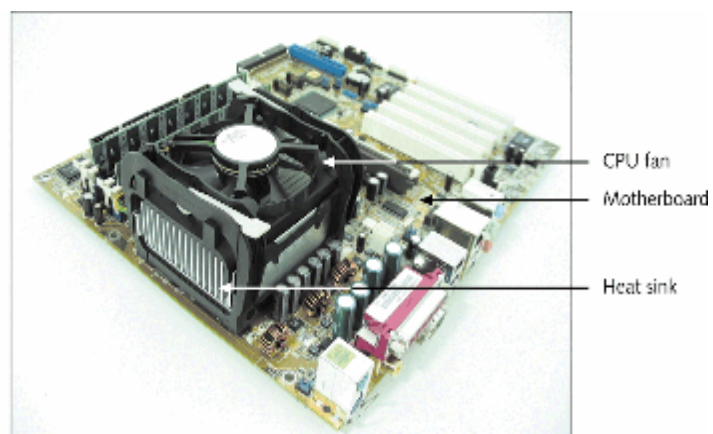


Figure 1-10 The CPU is hidden underneath the fan and the heat sink, which keep it cool

The Chip Set

- | Controls most activities on the motherboard
- | Includes several device controllers
 - u USB controller
 - u Memory controller
 - u IDE controller

The Chip Set (continued)

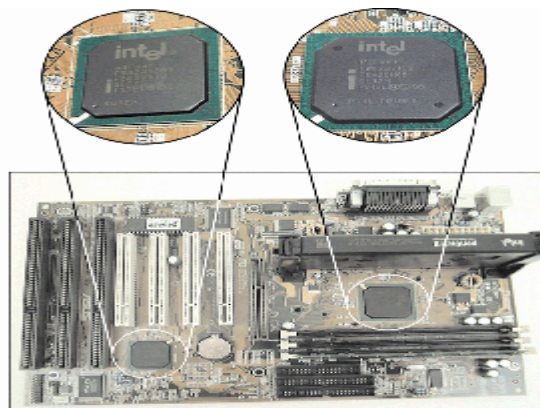


Figure 1-11 This motherboard uses two chips in its chip set (notice the bus lines coming from each chip used for communication)

Storage Devices

- | Temporary (primary storage, or memory)
 - Temporarily holds data and instructions while processing them
 - Faster to access than permanent storage
- | Permanent (secondary storage)
 - Data and instructions must be copied into primary storage (RAM) for processing

Primary and Secondary Storage

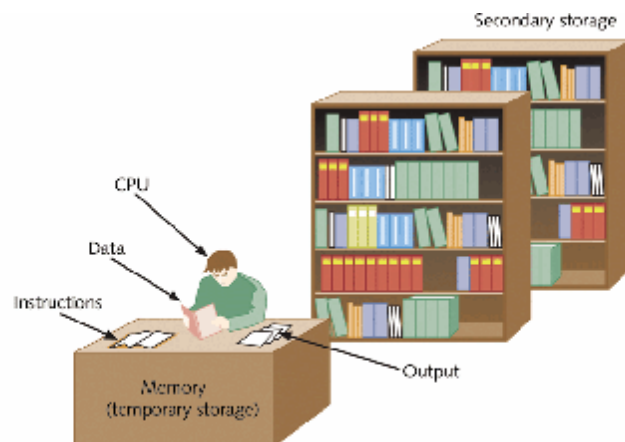


Figure 1-12 Memory is a temporary place to hold instructions and data while the CPU processes both

Primary Storage Devices

- | Memory, or RAM, located on motherboard and other circuit boards
 - └ Volatile versus nonvolatile (or ROM) memory
- | Types of boards that hold memory chips
 - └ SIMMs
 - └ DIMMs
 - └ RIMMs

RAM Chips

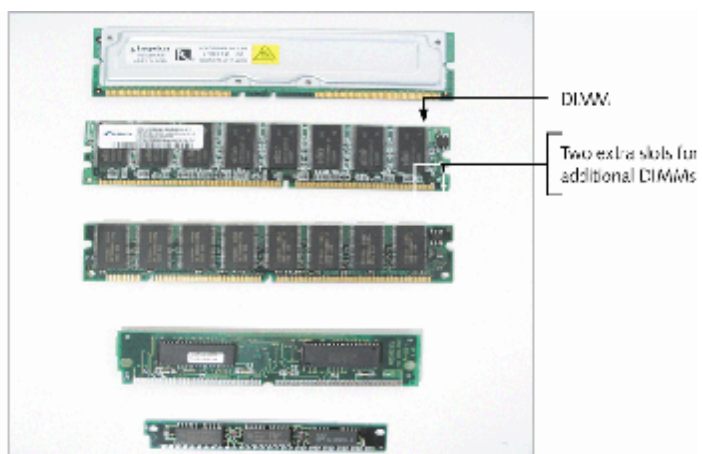


Figure 1-13 A SIMM, DIMM, or RIMM holds RAM and is mounted directly on a motherboard

Types of RAM Modules

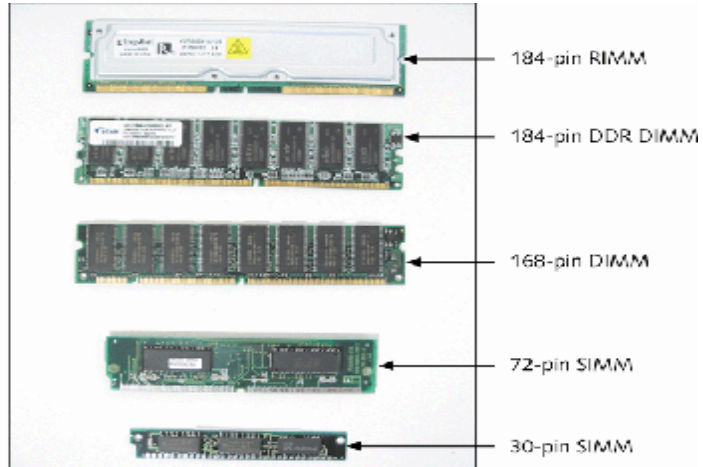


Figure 1-14 Types of RAM modules

Secondary Storage Devices

- | Hard drives
- | CD-ROM drives
- | DVD drives
- | Zip drives
- | Floppy drives

Hard Drive



Figure 1-16 Hard drive with sealed cover removed

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EIDE Technology

- 1 Used by most hard drives, CD-ROM drives, and DVD drives
- 1 Can accommodate up to four EIDE devices on one system

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IDE Connectors on a Motherboard

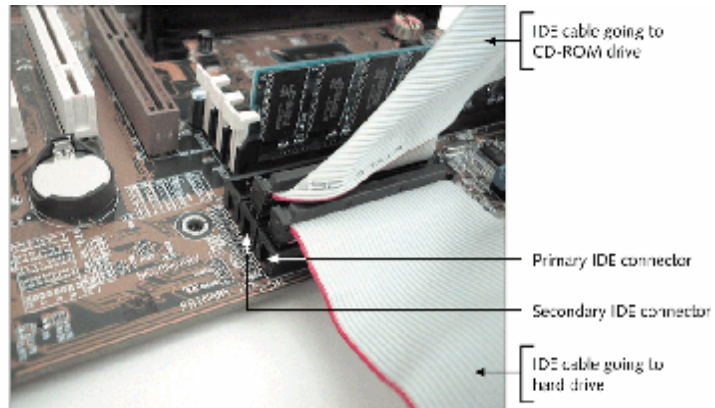


Figure 1-17 A motherboard usually has two IDE connectors, each of which can accommodate two devices; a hard drive usually connects to the motherboard using the primary IDE connector

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IDE Connectors on a Motherboard (continued)

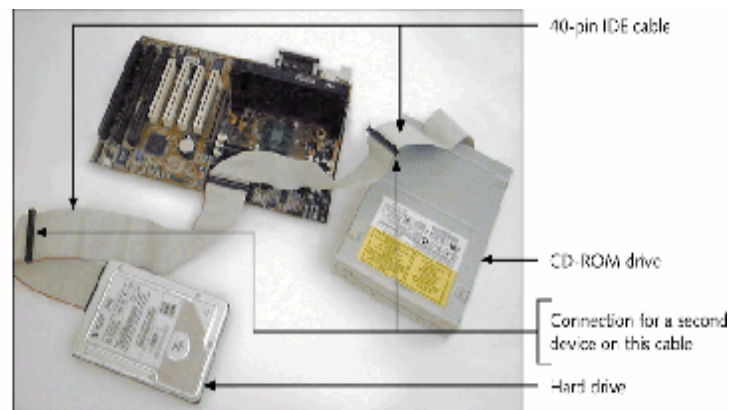


Figure 1-18 Two IDE devices connected to a motherboard using both IDE connections and two cables

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IDE Connectors on a Motherboard

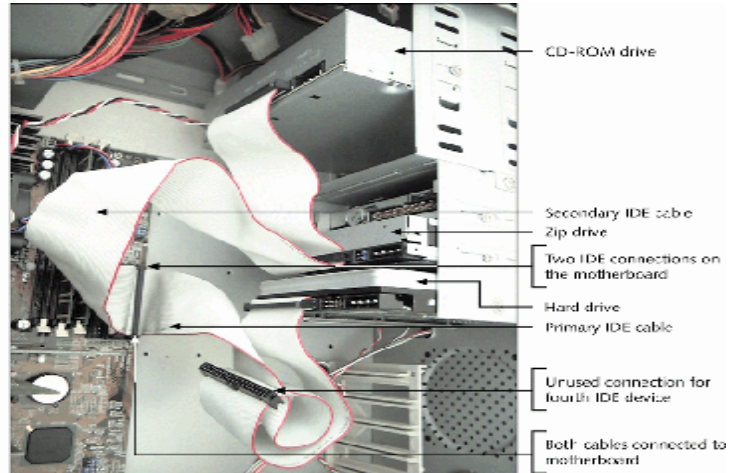


Figure 1-19 This system has a CD-ROM and a Zip drive sharing the secondary IDE cable and a hard drive using the primary IDE cable

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Hard Drive's Power Supply

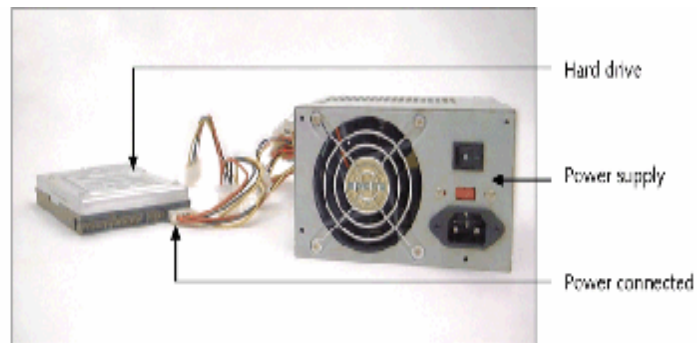


Figure 1-20 A hard drive receives power from the power supply by way of a power cord connected to the drive

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Floppy Drive Connection

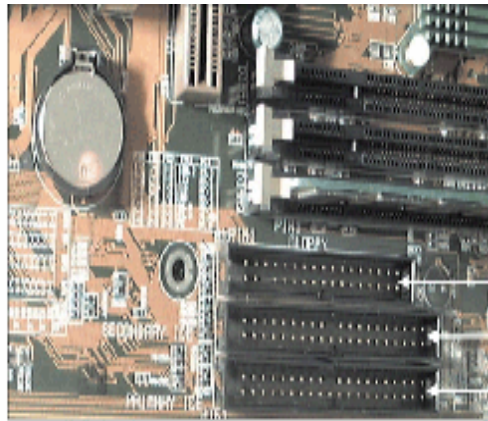


Figure 1-21 A motherboard usually provides a connection for a floppy drive cable

Floppy Drive Connection (continued)

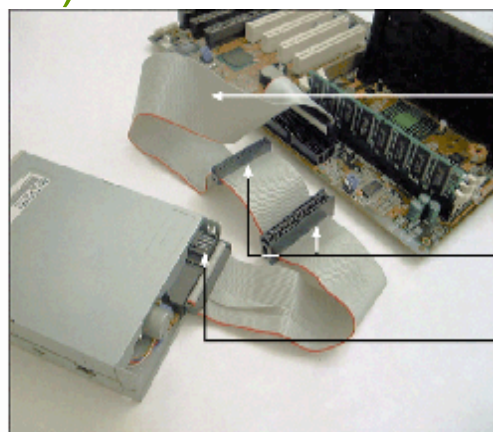


Figure 1-22 One floppy drive connection on a motherboard can support one or two floppy drives

CD-ROM Drive Connection

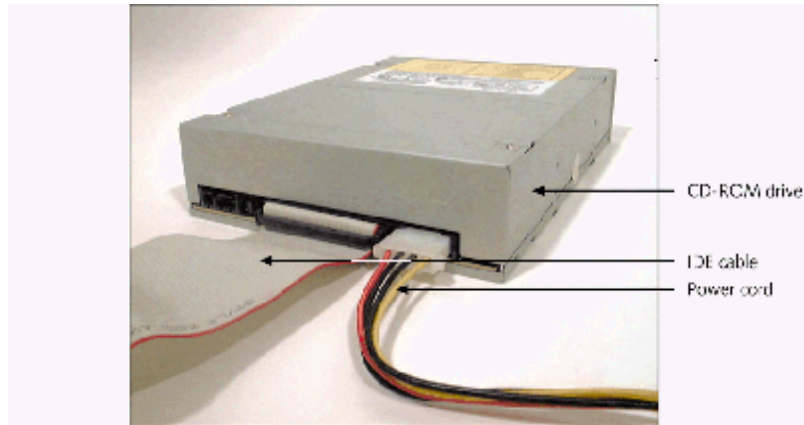


Figure 1-23 Most CD-ROM drives are EIDE devices and connect to the motherboard by way of an IDE data cable

Motherboard Components Used for Communication Among Devices

- 1 The data bus
 - u System of pathways used for communication and the protocol and methods used for transmission

The Bus and Bus Lines

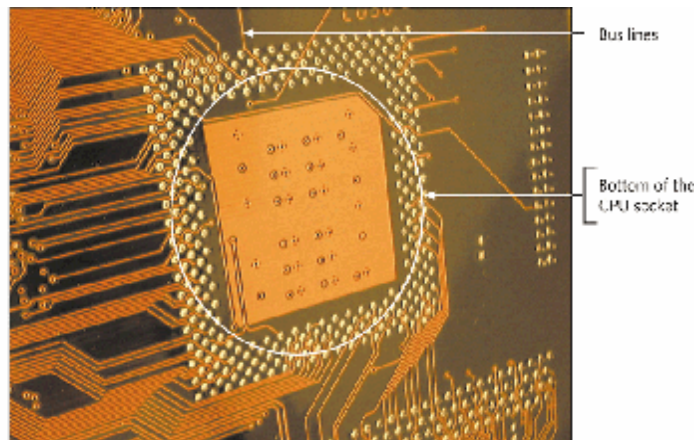


Figure 1-24 On the bottom of the motherboard, you can see bus lines terminating at the CPU socket

Data Bus

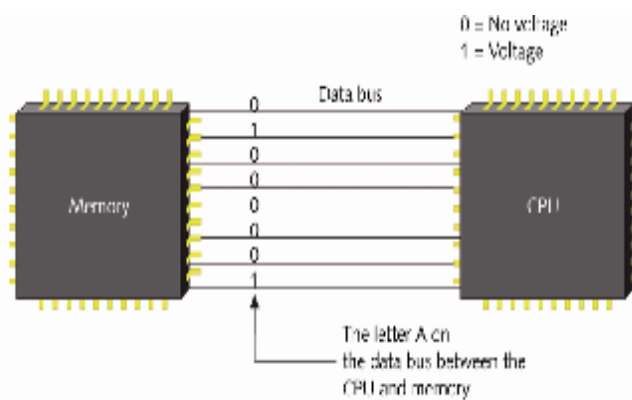


Figure 1-25 A data bus has traces or lines that carry voltage interpreted by the CPU and other devices as bits

System Clock

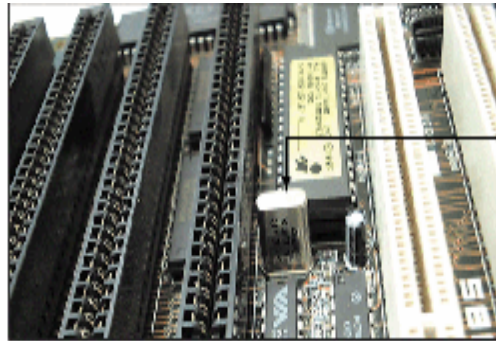


Figure 1-26 The system clock is a pulsating electrical signal sent out by this component that works much like a crystal in a wristwatch (one line, or circuit, on the motherboard bus is dedicated to carrying this pulse)

Clock Speed

- | Of motherboard
 - u Measured in megahertz (MHz)

- | Of CPU
 - u Measured in gigahertz (GHz)

Expansion Slots

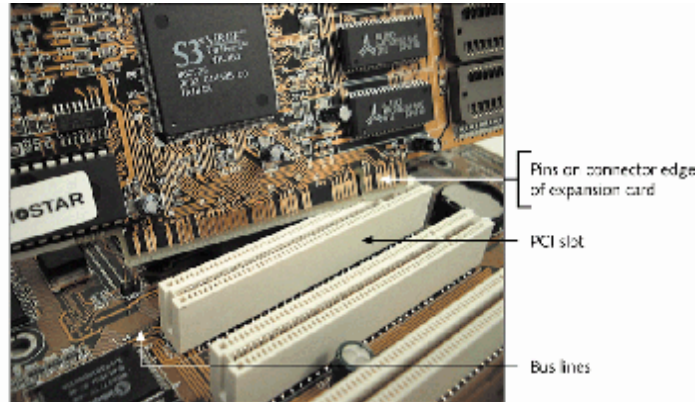


Figure 1-27 The lines of a bus terminate at an expansion slot where they connect to pins that connect to lines on the expansion card inserted in the slot

Types of Expansion Slots

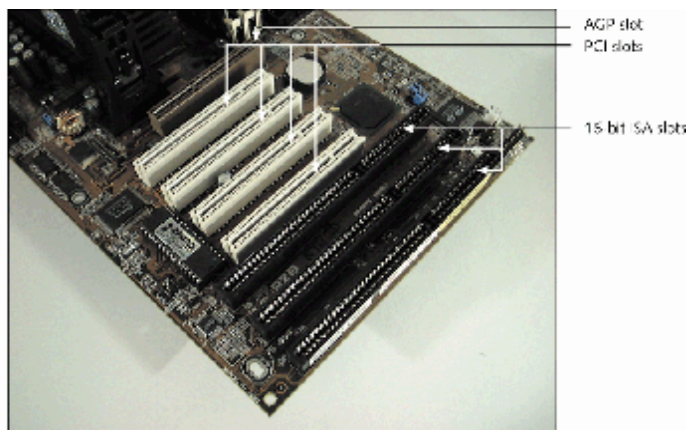


Figure 1-28 PCI bus expansion slots are shorter than ISA slots and offset farther; the one AGP slot is set further from the edge of the board

Interface (Expansion) Cards

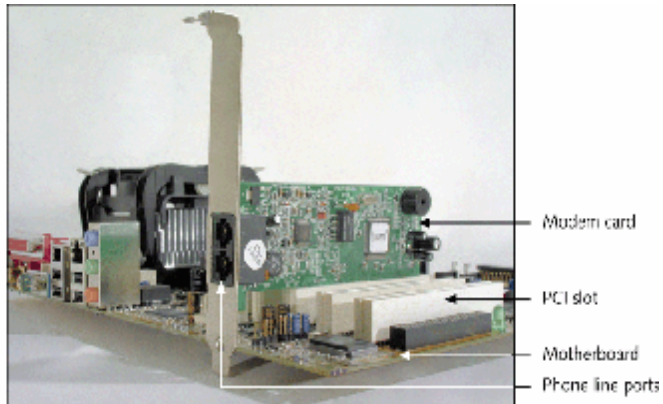


Figure 1-29 The circuit board is a modem card and is mounted in a PCI slot on the motherboard.

Interface (Expansion) Cards (continued)

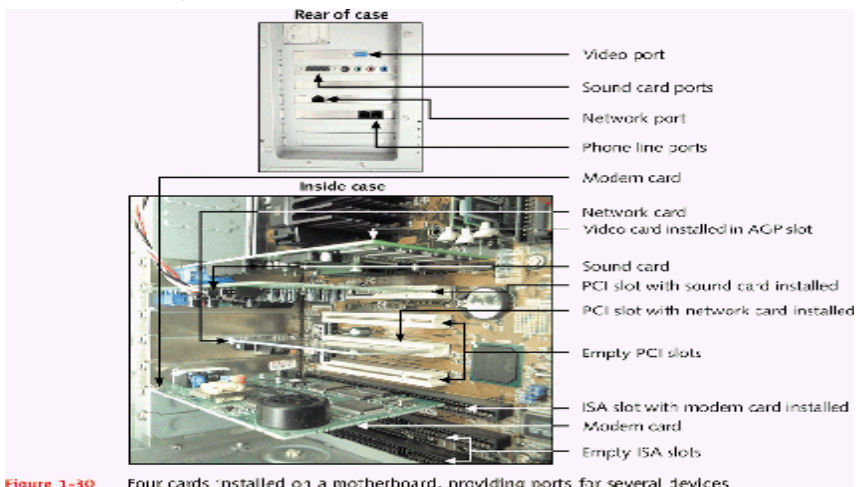


Figure 1-30 Four cards installed on a motherboard, providing ports for several devices

The Electrical System

i Power supply

- u Most important component of computer's electrical system
- u Converts/reduces electricity to voltage the computer can handle
- u Runs a fan directly from electrical output voltage to cool inside of computer case

The Electrical System (continued)

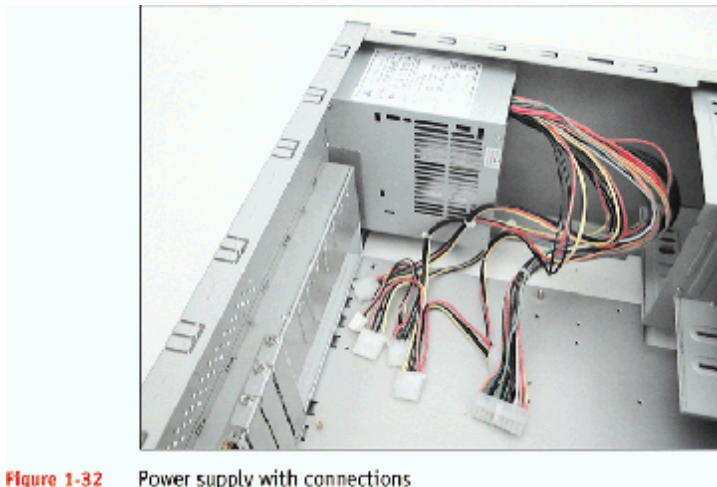
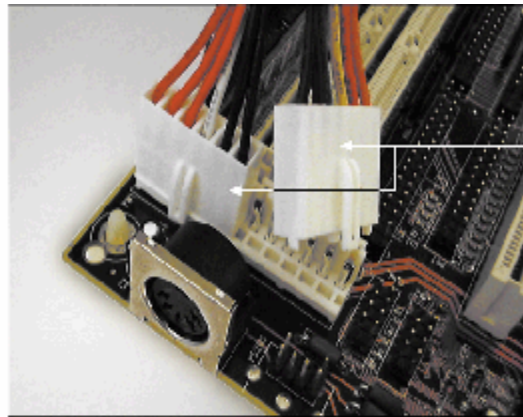


Figure 1-32 Power supply with connections

The Electrical System (continued)



Power connector
from power supply
to motherboard

Figure 1-33 The motherboard receives its power from the power supply by way of one or two connections located near the edge of the board

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Instructions Stored on the Motherboard

- | ROM BIOS (most are flash ROM)
 - └ System BIOS
 - └ Startup BIOS
 - └ CMOS setup
- | Motherboard BIOS supports ACPI, APM, and Plug and Play technologies

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ROM BIOS Chip

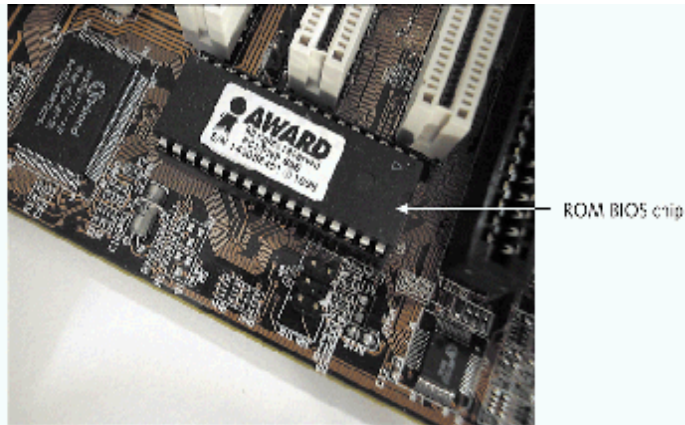


Figure 1-34 The ROM BIOS chip on the motherboard contains the programming to start up the PC as well as to perform many other fundamental tasks

Motherboard Configuration Settings

- | CMOS chip
 - └ Stores setup (configuration) information
 - └ Powered by a battery on motherboard when power is off
- | Setup information can also be set by jumpers and DIP switches

CMOS Configuration Chip

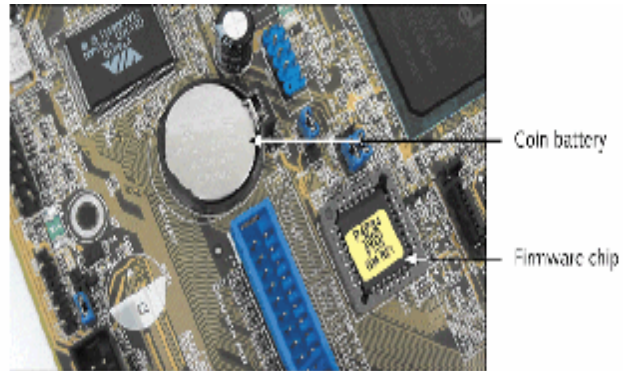


Figure 1-35 This firmware chip contains flash ROM and CMOS RAM; CMOS RAM is powered by the coin battery located near the chip

Setting Jumpers

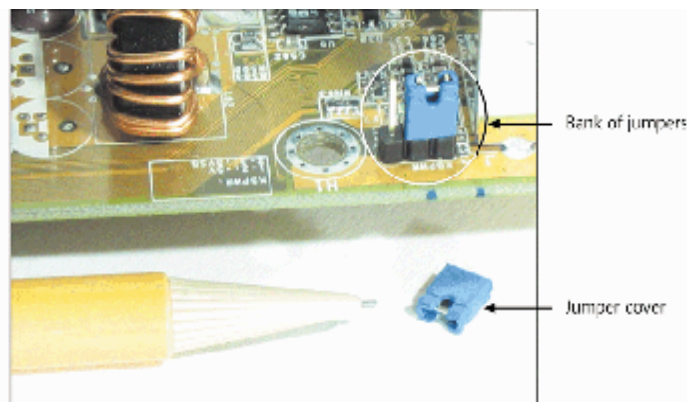


Figure 1-36 Setup information about the motherboard can be stored by setting a jumper on (closed) or off (open). A jumper is closed if the cover is in place, connecting the two pins that make up the jumper; a jumper is open if the cover is not in place.

Using DIP Switches

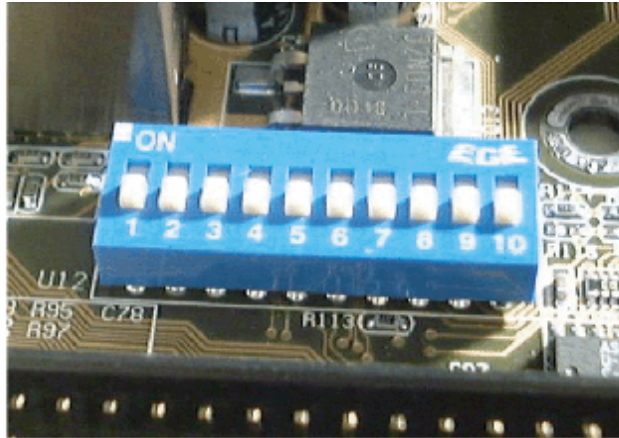


Figure 1-37 A motherboard can use a bank of DIP switches for configuration settings