Memory Unit

Memory Unit

- Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

- A Memory Unit is a collection of storage cells together with associated circuits needed to transfer information in and out of storage.

- **Word**
  - The memory stores binary information (1's and 0's) in groups of bits called words.

  - A memory word is a group of 1's and 0's and may represent a number, an instruction code, one or more alphanumeric characters, or any other binary coded information.

- **Byte**
  - A group of eight bits is called a byte. Most computer memories use words whose number of bits is a multiple of 8. Thus a 16-bit word

contains two bytes, and a 32-bit word is made up of 4 bytes.

➢ Internal Structure of a Memory Unit

- The internal structure of a memory unit is specified by the number of words it contains and the number of bits in each word.

- Special input lines called address lines select one particular word.

- Each word in memory is assigned an identification number, called an address, staring from 0 and continuing with 1, 2, 3, up to 2^k - 1 where k is the number of address lines.

- The selection of a specific word inside the memory is done by applying the k-bit binary address to the address lines.

- A decoder inside the memory accepts this address and opens the paths needed to select the bits of the specified word.

- Computer memories may range from 1024 words, requiring an address of 10 bits

  - **K(Kilo)** is equal to 2^{10}
  - **M(Mega)** is equal to 2^{20}
  - **G(Giga)** is equal to 2^{30}

- Two major types of memories are used in computer systems:
  1. Random Access Memory(RAM)
  2. Read Only Memory (ROM)

1) Random Access Memory(RAM)

- RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result.

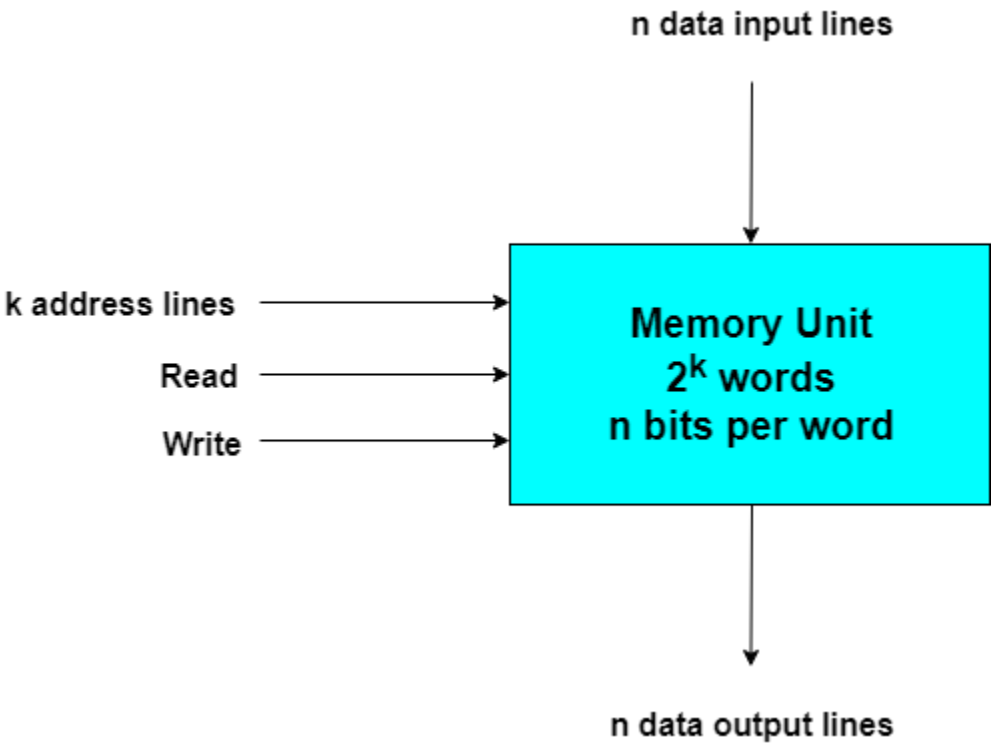
- It is a read/write memory which stores data until the machine is working. RAM is volatile, As soon as the machine is switched off, data is erased.

- Data in the RAM can be accessed randomly but it is very expensive.

RAM is of two types

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Block diagram



- The n data input lines provide the information to be stored in memory, and the n data output lines supply the information coming out of particular word chosen among the 2^k available inside the memory.
- The two control inputs specify the direction of transfer desired.

Write and Read Operations

- The two operations that a random access memory can perform are **the write and read operations**.

- **The write signal** specifies a transfer-in operation and **the read signal** specifies a transfer-out operation.

- On accepting one of these control signals. The internal circuits inside the memory provide the desired function. The steps that must be taken for the purpose of transferring a new word to be stored into memory are as follows:

  1. Apply the binary address of the desired word into the address lines.
  2. Apply the data bits that must be stored in memory into the data input lines.
  3. Activate the write input.

- The memory unit will then take the bits presently available in the input data lines and store them in the specified by the address lines.

- The steps that must be taken for the purpose of transferring a stored word out of memory are as follows:

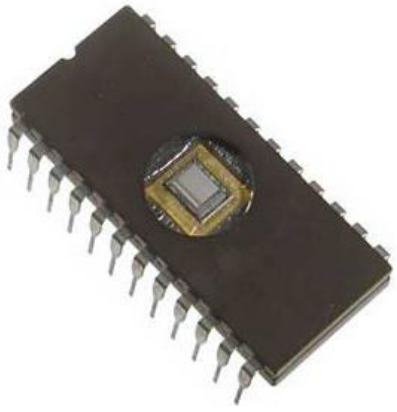
1. Apply the binary address of the desired word into the address lines.
2. Activate the read input.

- The memory unit will then take the bits from the word that has been selected by the address and apply them into the output data lines. The content of the selected word does not change after reading.

2) Read Only Memory(ROM)

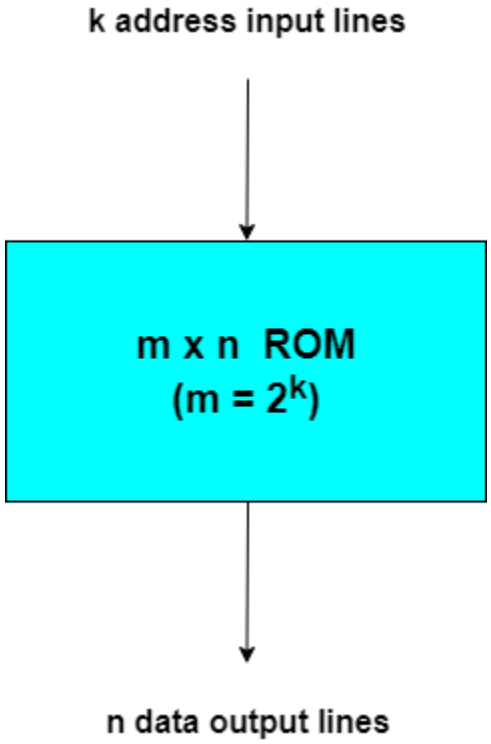
- ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile.

- The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap



- ROM is classified as a combinational circuit.

Block diagram



- An m x n ROM is an array of binary cells organized into m words of n bits each.
- As shown in the block diagram, a ROM has k address input lines to select one of 2^k = m words of memory, and n input lines, one for each bit of the word.

- The ROM does not need a read-control line since at any given time, the output lines automatically provide the n bits of the word selected by the address value

Types of ROM

1) PROM(Programmed Read Only Memory)

- It is a programmable device. User can programmed, but once programmed, the contents can not be deleted.
- A special equipment PROM programmer is used to store programs in a PROM.

2) EPROM(Erasable Programmed Read Only Memory)

- User can program on EPROM chip and can delete the contents also.
- The content of EPROM can be erased by using ultraviolet rays. For this the chip has to be removed from system and putting inside EPROM eraser equipment to be exposed to UV light.
- Deleting one or more locations is not possible but entire contents are erased.

3) EEPROM(Electrically Erase PROM)

- The contents are deleted electrically.
- The contents of any location can be altered without erasing the complete contents and need not be removed chip from the computer.
- It can be reprogrammed and erased more than 10,000 times.