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Unit-1

Introduction

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(Lesser imp. chapter)

* Introduction to microprocessor

A microprocessor is an integrated circuit that contains all the functions of a central processing unit of a computer. It is a semiconductor chip like silicon with combination of transistors.

It is an electronic component that performs the instructions and tasks involved in computer processing which is central unit and manages the logical instructions passed to it. In short it processes on arithmetic and logical operations to provide desired output.

Evolution / History of microprocessor

(i) Marcian. E. Hubb is the father of microprocessor. The first commercial microprocessor came in 1971, which was INTEL 4004 having 2300 transistors. It was 4-bit microprocessor. It was basically designed for calculators at that time.

(ii) The next microprocessor was INTEL 8008 having 3500 transistors after this, INTEL 8080 having 4000 transistors and ZILOG Z80 having 6000 transistors came for commercial purpose. The evolution of transistors continued and first 8-bit microprocessor was developed which is INTEL 8085. The next to this microprocessor was INTEL 8086 having 16-bit. This evolution of microprocessor continued upto INTEL Pentium III having 95 lakh transistors and the next modern microprocessors came into existance like i3, i5 and i7.

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* Components of microprocessor (R)

The basic parts of microprocessor are CPU, Bus and Memory which are described below:-

(a) **CPU** → CPU is fabricated as a very large scale integrated circuit (VLSI) whose parts are as follows:-

i) **Instruction register (IR)**: It holds the instructions to be executed

ii) **Decorder**: It decodes (converts to machine level language) the instruction and sends to the ALU.

iii) **ALU**: It performs arithmetic, logical, memory, register and program sequencing operators.

iv) **Register**: It holds intermediate results obtained during program processing.

(b) **Bus** → The fine thin lines connecting the different internal parts of the microprocessor chip is called bus. There are three types of buses in a microprocessor.

i) **Data bus** → It carry data to and from memory. It is bidirectional bus with width equl to word length.

ii) **Address bus** → It is unidirectional bus. It carries address of a memory location or I/O port from CPU to memory or I/O port.

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iii) Control bus → It carry control signals like clock signals, interrupt signal or ready signal. It is also bidirectional.

(c) Memory → Microprocessor has two types of memory

i) RAM → It is Random Access Memory. It is a volatile memory. It is the working or runtime memory of the computer.

ii) ROM → It is Read Only Memory. It is a non-volatile memory. ROM comes programmed with most essential data like booting sequence by the manufacturer.

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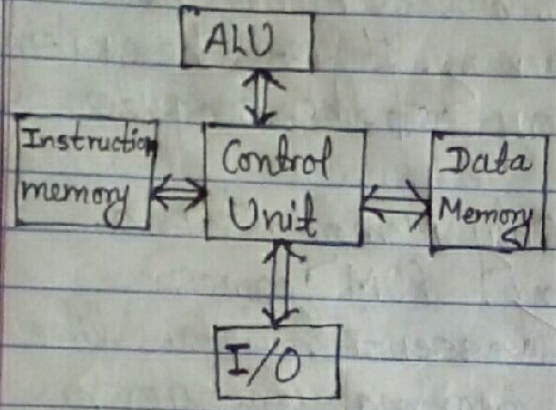
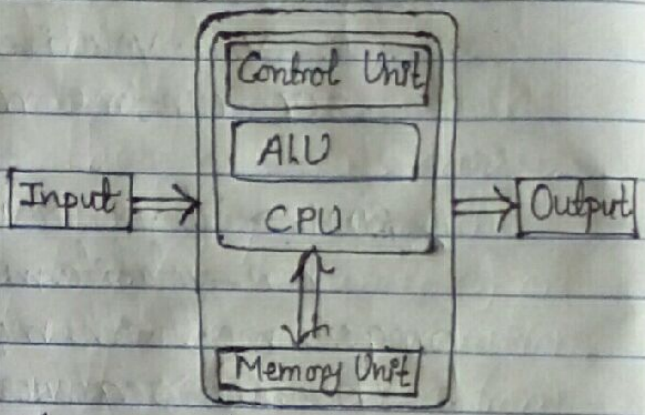
⊛ Differences between Harvard architecture and Von Neumann architecture with block diagrams.

S.N	Harvard architecture	S.N	Von Neumann architecture
1.	Block diagram for Harvard architecture is as follows:- 	1.	Block diagram for Von Neumann architecture is as follows:- 
2.	It required two memories for their instruction and data.	2.	It required only one memory for their instruction and data.
3.	Design of Harvard architecture is complicated	3.	Design of von Neumann architecture is simple.
4.	It required seperate bus for instruction and data.	4.	It required only one bus for instruction and data.
5.	Processor can complete an instruction ~~cycle~~ in one cycle.	5.	Processor needs two clock cycles to complete an instruction.
6.	Easier to pipeline so high performance can be achieved	6.	low performance as compared to Harvard architecture.

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⊛ Microprocessor systems with bus organization.

Bus is a group of conducting wires which carries information, all the peripherals are connected to microprocessor through Bus.

Let we take diagram of 8085 microprocessor to represent bus organization system as follows:-

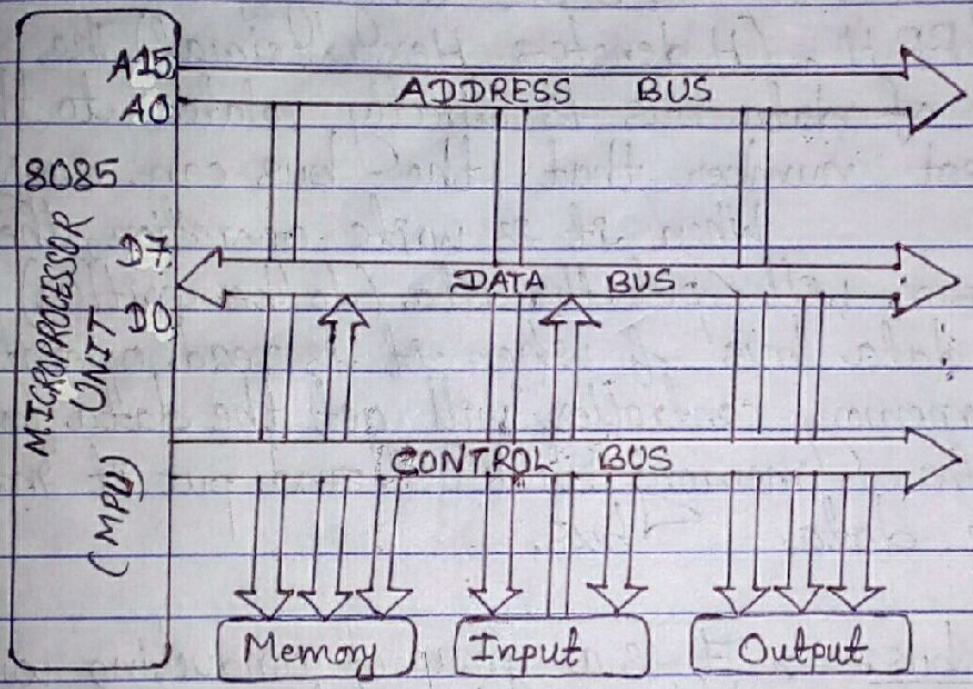

fig. diagram for bus organization system of 8085 microprocessor

There are three types of buses.

1. Address bus → It is a group of conducting wires which carries address only. Address bus is unidirectional because data flow in one direction from microprocessor to memory or from microprocessor to Input/output devices. Length of Address bus of 8085 microprocessor is 16 bit. Length of Address bus vary with type of microprocessor. The length of the address bus determines the amount of memory a system can address.

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2. Data bus → It is a group of conducting wires which carries data only. Data bus is bidirectional because data flow in both directions, from microprocessor to memory or Input/Output devices and from memory or Input/Output devices to microprocessor.

Length of data bus of 8085 microprocessor is 8 bit ranging from 00H to FF H. (H denotes Hexadecimal). The width of data bus is directly related to the largest number that the bus can carry.

When it is write operation, the processor will put the data (to be written) on the data bus & when it is read operation, the memory controller will get the data from specific memory block and put it into the data bus.

3. Control bus → It is a group of conducting wires, which is used to generate timing and control signals to control all the associated peripherals. Microprocess uses control bus to process data, that is what to do with selected memory location. Some control signals are:-

i) Memory read
ii) Memory write
iii) I/O read
iv) I/O write etc.

If one line of control bus may be read/write line. If a wire is low (no electricity flowing) then the memory is read and if the wire is high then the memory is written.

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* Control and Timing unit:

It provides timing and control signal to the microprocessor to perform the various operation. It has three control signals. It controls all external and internal circuits. It operates with refrence to clock signal. The three control signals are as follows:-

i) ALE (Arithmetic Latch Enable) → It provides control signal to synchronize the components of microprocessor.

ii) WR → This is used for writing operation. This is active low.

iii) RD → This is used for reading operation. This is active low.

There are three status signal used in microprocessor S_0, S_1 and IO/M. It changes its status according to provided inputs to these pins. Below is the truth table for various combinations of status signals.

IO/M	S_1	S_0	Data bus status (Output)
0	0	0	Halt
0	0	1	Memory write
0	1	0	Memory read
1	0	1	IO write
1	1	0	IO read
0	1	1	Opcode fetch
1	1	1	Interrupt Acknowledge

Rough

(i) All 0

(ii) 1

(iv) 10

(vi) 101

(vii) 110

(iii) 011

(viii) All 1

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⊛ Applications of microprocessors:

Following are the applications of microprocessors.

1) Instrumentation → It is very useful in the field of instrumentation. Frequency counters, function generators, frequency synthesizers, spectrum analyses and many instruments are available only when microprocessors are used as controllers. It is used in medical instrumentation also.

2) Control → Microprocessor based controllers are available in home appliances, such as microwave oven, washing machine etc. Microprocessors are being used in controlling various parameters like speed, pressure, temperature etc. These are used with the help of suitable transducers.

3) Communication → Microprocessors are being widely used in communication equipments like telephone industry, digital telephone sets, Telephone exchanges and modem. The use of microprocessor in television, satellite communication etc. is made. Railway reservation, air reservation, LAN and WAN for communication uses this technology.

4) Consumer → The use of microprocessor in toys, entertainment equipment and home appliances is making them more entertaining with full of features. Now the microprocessors are used in calculators, Accounting systems, Traffic light control, Military applications, Complex Industrial controllers etc.