# Introduction to 8085 MicroProcessor, 8085 Architecture - Part I

Course on Advanced Electronics - 8085 Micro Processors

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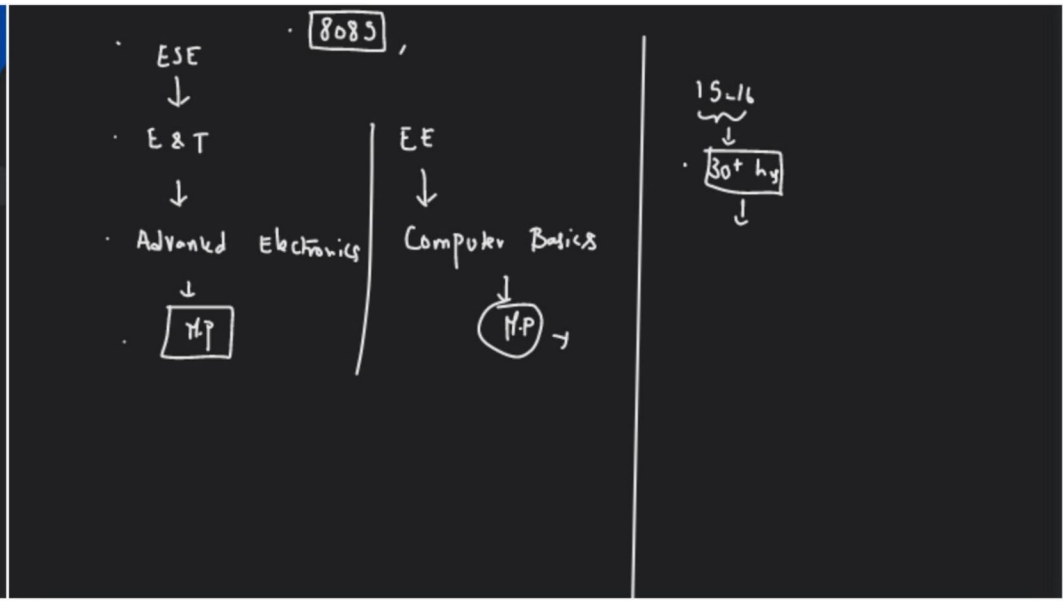



**Syllabus:**

1. BASICS
2. Block Diagram Architecture of 8085 and Pin Diagram.
3. Machine Cycles of 8085.
4. Adressing Modes of 8085.
5. Instruction Set of 8085.
6. Programming.
7. Memory and I/0 Interfacing to 8085.

Evolution of Processors :-

4004 → 4-bits → 1971
= Processor

8008
8080A } → 8-bit Processor → 1973

8085 → 8-bit Processor → 1976

8086 → 16-bit

80186 →

Virtual memory → 80286, 80386 } → 32bit

BJT → FET → VLSI

8085

| Intel Microprocess | | | | |
|---|---|---|---|---|
| Name | Year | Transistors | Clock speed | Data width |
| 8080 | 1974 | 6,000 | 2 MHz | 8 bits |
| 8085 | 1976 | 6,500 | 3- 5 MHz | 8 bits |
| 8086 | 1978 | 29,000 | 5 MHz | 16 bits |
| 8088 | 1979 | 29,000 | 5 MHz | 8 bits |
| 80286 | 1982 | 134,000 | 6 MHz | 16 bits |
| 80386 | 1985 | 275,000 | 16 MHz | 32 bits |
| 80486 | 1989 | 1,200,000 | 25 MHz | 32 bits |
| Pentium | 1993 | 3,100,000 | 60 MHz | 32/64 bits |
| Pentium II | 1997 | 7,500,000 | 233 MHz | 64 bits |
| Pentium III | 1999 | 9,500,000 | 450 MHz | 64 bits |
| Pentium IV | 2000 | 42,000,000 | 1.5 GHz | 64 bits |
| Pentium IV "Prescott" | 2004 | 125,000,000 | 3.6 GHz | 64 bits |
| Intel Core 2 | 2006 | 291 million | 3 GHz | 64 bits |
| Pentium Dual Core | 2007 | 167 million | 2.93 GHz | 64 bits |
| Intel 64 Nchalem | 2009 | 781 million | 3.33 GHz | 64 bits |

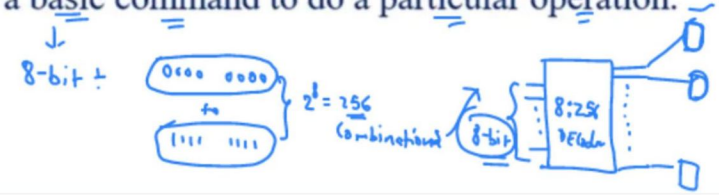
1010 1010
1100 0011

| Manufacturer | Processor | Date of introduction | Number of transistors | Process | Area [mm²] |
|---|---|---|---|---|---|
| Intel | Intel4004 | 1971 | 2,300 | 10 µm | 12 |
| | Intel8008 | 1972 | 3,500 | 10 µm | 14 |
| | Intel8080 | 1974 | 4,400 | 6 µm | 20 |
| | Intel8085 | 1976 | 6,500 | 3 µm | 20 |
| | Intel8086 | 1978 | 29,000 | 3 µm | 33 |
| | Intel80286 | 1982 | 134,000 | 1.5 µm | 44 |
| | Intel80386 | 1985 | 275,000 | 1.5 µm | 104 |
| | Intel80486 | 1989 | 1,180,235 | 1 µm | 173 |
| | Pentium | 1993 | 3,100,000 | 0.8 µm | 294 |
| | Pentium Pro | 1995 | 5,500,000 | 0.5 µm | 307 |
| | Pentium II | 1997 | 7,500,000 | 0.35 µm | 195 |
| | Pentium III | 1999 | 9,500,000 | 0.25 µm | 128 |
| | Pentium 4 | 2000 | 42,00,000 | 180 nm | 217 |
| | Itanium 2 McKinely | 2002 | 220,000,000 | 180 nm | 421 |
| | Core 2 Duo | 2006 | 291,000,000 | 65 nm | 143 |
| | Core i7 (Quad) | 2008 | 731,000,000 | 45 nm | 263 |
| | Six-Core Core i7 | 2010 | 1,170,000,000 | 32 nm | 240 |
| | Six-Core Core i7/8-Core Xeon E5 | 2011 | 2,270,000,000 | 32 nm | 434 |
| | 8-Core Itanium Poulson | 2012 | 3.100,000,000 | 32 nm | 544 |
| MIPS | R2000 | 1986 | 110,000 | 2.0 µm | 80 |
| | R3000 | 1988 | 150,000 | 1.2 µm | 56 |
| | R4000 | 1991 | 1,200,000 | 0.8 µm | 213 |
| | R10000 | 1994 | 2,600,000 | 0.5 µm | 299 |
| | R10000 | 1996 | 6,800,000 | 0.35 µm | 299 |
| | R12000 | 1998 | 7,1500,000 | 0.25 µm | 229 |
| IBM | POWER3 | 1998 | 15,000,000 | 0.35 µm | 270 |
| | POWER4 | 2001 | 174,000,000 | 180 nm | 412 |
| | POWER4+ | 2002 | 184,000,000 | 130 nm | 267 |
| | POWER5 | 2004 | 276,000,000 | 130 nm | 389 |
| | POWER5+ | 2005 | 276,000,000 | 90 nm | 243 |
| | POWER6+ | 2009 | 790,000,000 | 65 nm | 341 |
| | POWER7 | 2010 | 1.200.000.000 | 45 nm | 567 |
| | POWER7+ | 2012 | 2.100,000,000 | 32 nm | 567 |

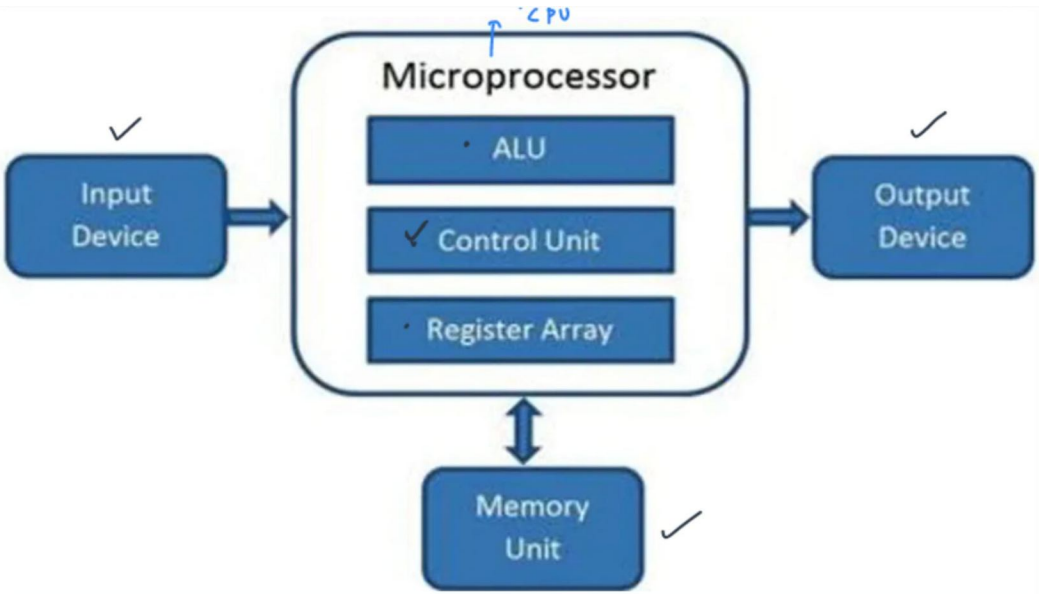
Basic Terminology

- Hard Ware →
- Soft Ware →
  - Prog
  - Instructions →

- **Hardware:** Physical devices like Keyboard , Mouse ,Printer etc.,
- **Software:** Set of Programs.
- **Program:** Set of Instructions.
- **Instruction:** It is a basic command to do a particular operation.




Block Diagram of Micro Computer




- CPU is the Heart of the computer.

It contains

- ALU
- Registers
- Control Unit.

Internal Buses.

If all of them are Embedded in a single chip then it is Called Microprocessor.

The Central Processing Unit (CPU) consists of

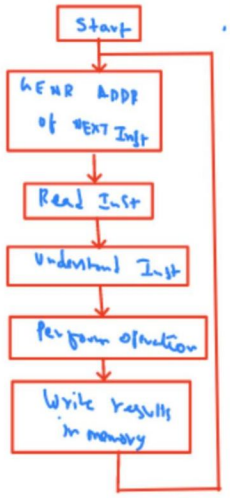
(a) ALU and Control unit only

(b) ALU, Control unit and Registers only

(c) ALU, Control unit and System bus only

(d) ALU, Control unit, Registers and Internal bus

C.P.U



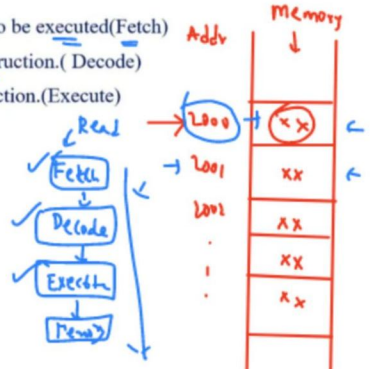

In a Micro Processor all are embedded on a single chip.

. The basic operations of CPU is

. To generate the address of next Instruction to be executed(Fetch)

. Read the Instruction and understand the Instruction.( Decode)

.Perform the operation required for the Instruction.(Execute)







It will perform Arithmetic and logical operation.

It provides temporary memory to store results.

It will provide necessary control signals.

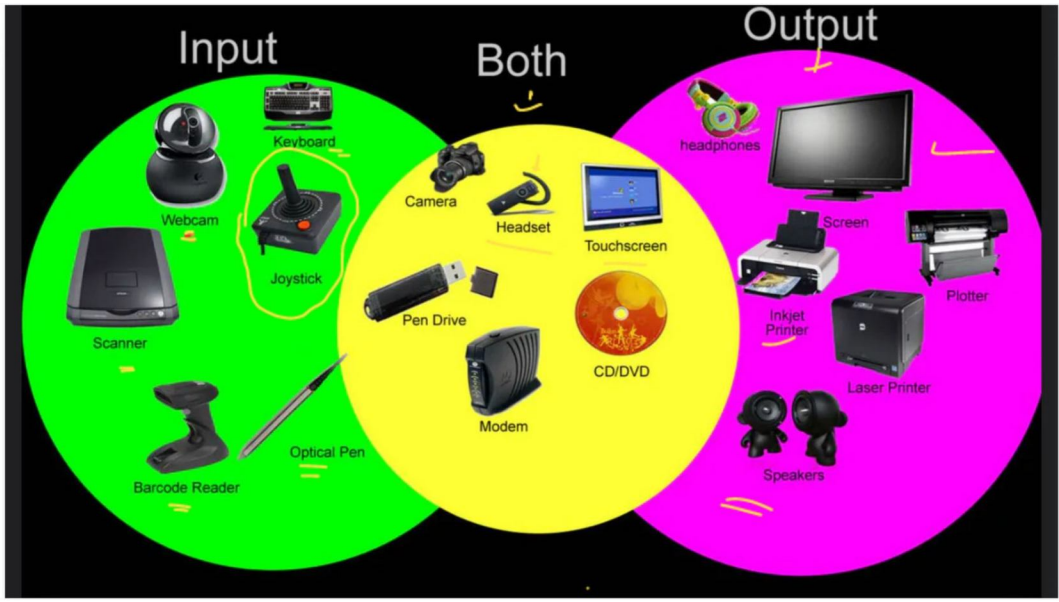
I/O DEVICES

Input Devices :- These are the Devices used to Input DATA (or) Program to C.P.U

Ex :- Mouse, keyboard etc.)

Output Devices :- These are the Devices used to monitor (or) display results

Ex :- Monitor, Printer etc.,




- Memory :- It is used to store DATA (or) Program (or) result.

RAM :- R/W (SRAM, DRAM = memory)

ROM :- Read only memory } Both Random Access.

Semi random Access :- CD, DVD, HDD - - - -.

Seq memory Access :- Magnetic tape.

To write a program to the Processor there are three different ways.

① High Level Lang Programming
↓
If Value = yes → do → some thing
← Similar to English

② Assembly Lang Level prog
↓
Mov A,B Mnemonics
ADD C
:
↓ Code Lang

③ Machine Language.
↓
10101100
10111010
10001111
:
10001111
Very ↑ diff to Debug

- Compiler (or) Interpreter is required to convert high Level Lang in to Machine Lang.
- Assembler is required to convert Assembly Lang to Machine Lang.

| Interpreter | Compiler |
| --- | --- |
| Translates program one statement at a time. | Scans the entire program and translates it as a whole into machine code. |
| Interpreters usually take less amount of time to analyze the source code. However, the overall execution time is comparatively slower than compilers. | Compilers usually take a large amount of time to analyze the source code. However, the overall execution time is comparatively faster than interpreters. |
| No intermediate object code is generated, hence are memory efficient. | Generates intermediate object code which further requires linking, hence requires more memory. |
| Programming languages like JavaScript, Python, Ruby use interpreters. | Programming languages like C, C++, Java use compilers. |

| Compiler | Interpreter | Assembler |
| --- | --- | --- |
| Software that converts programs written in a high level language into machine language | Software that translates a high level language program into machine language | Software that converts programs written in assembly language into machine language |
| Converts the whole high level language program to machine language at a time | Converts the high level language program to machine language line by line | Converts assembly language program to machine language |
| Used by C, C++ | Used by Ruby, Perl, Python, PHP | Used by assembly language |

| | Machine Lang | Assembly Lang | High Level Lang |
|---|---|---|---|
| Program Contains | 1's & 0's | English like words called Mnemonics. | English Like Statements. |
| writing prog | Difficult | Slightly diff | Easy |
| Execution | Fast | medium | Relatively Slow |
| Debug | Difficult | Slightly diff | Easy |
| Translator | NO | yes → Assembler (Masm) | yes → Compiler (Turbo C) Interpreter |
| Processor dependent | Yes | Yes | No |

# 8085 → Introduction

8085 → . NMOS Technology.

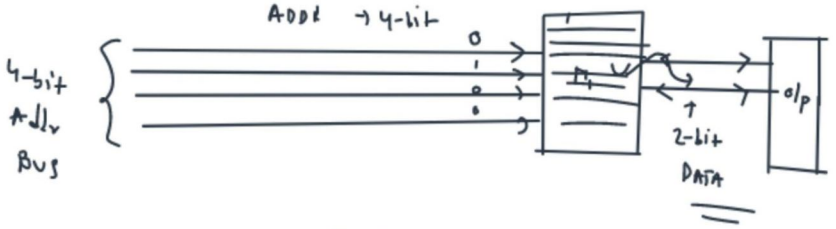
- 8-bit Processor
- Clk Frequency = 3 MHz ($T = \frac{1}{3 \times 10^6} = 0.33\,\mu s$)
- Power Supply → 5V
- Addr Bus = 16-bit
- DATA Bus = 8-bit

We can connect up to $2^{16} \times 8$ bit memory

- 40 PIN IC
- 21 I/p
- 24 o/p

$2^{16}$ → Location, Each Location 8-bit → 64KB. memory handling capability.

Ex




16-bit Addr

$2^{16}$ Addr →

8-bit DATA

Each location 8-bit

Textbooks

1. 8085 Microprocessors & Interfacing
   ↳ S.R. Ghoankar
2. 8085 M.P by SRIWATH
3. IIT MADRAS → NPTEL → PDFs

8085

- 40 PIN IC
- 27 o/p PINS
- 21 I/P PINS
- NMOS Technology
- Clk freq = 3MHz
- 6500 Transistor
- $V_{cc}$ = 5

- DATA Bus :- 8-bits
- Addr Bus :- 16-bit.

Bus Structure of 8085

1. DATA Bus
2. ADDR Bus
3. Contrl Bus

Bus :- A Group of wires.

DATA Bus : The processor length and data handling capability of the processor is decided by its DATA bus size.

An N-bit processor contains n-bit data bus and it's ALU is capable of performing n-bit operations at time.

8085 DATA BUS is 8-bit size ,Bi-directional bus multiplexed with lower order address bus to save no of pins.