CHAPTER – 2

PROGRAMMING WITH 8085 MICROPROCESSOR

2.1 Internal Architecture of 8085 Microprocessor

The Intel 8085A is a complete 8-bit parallel centra processing unit. The main components of 8085A are array o registers, the arithmetic logic unit, the encoder/decoder, an timing and control circuits linked by an internal data bus.

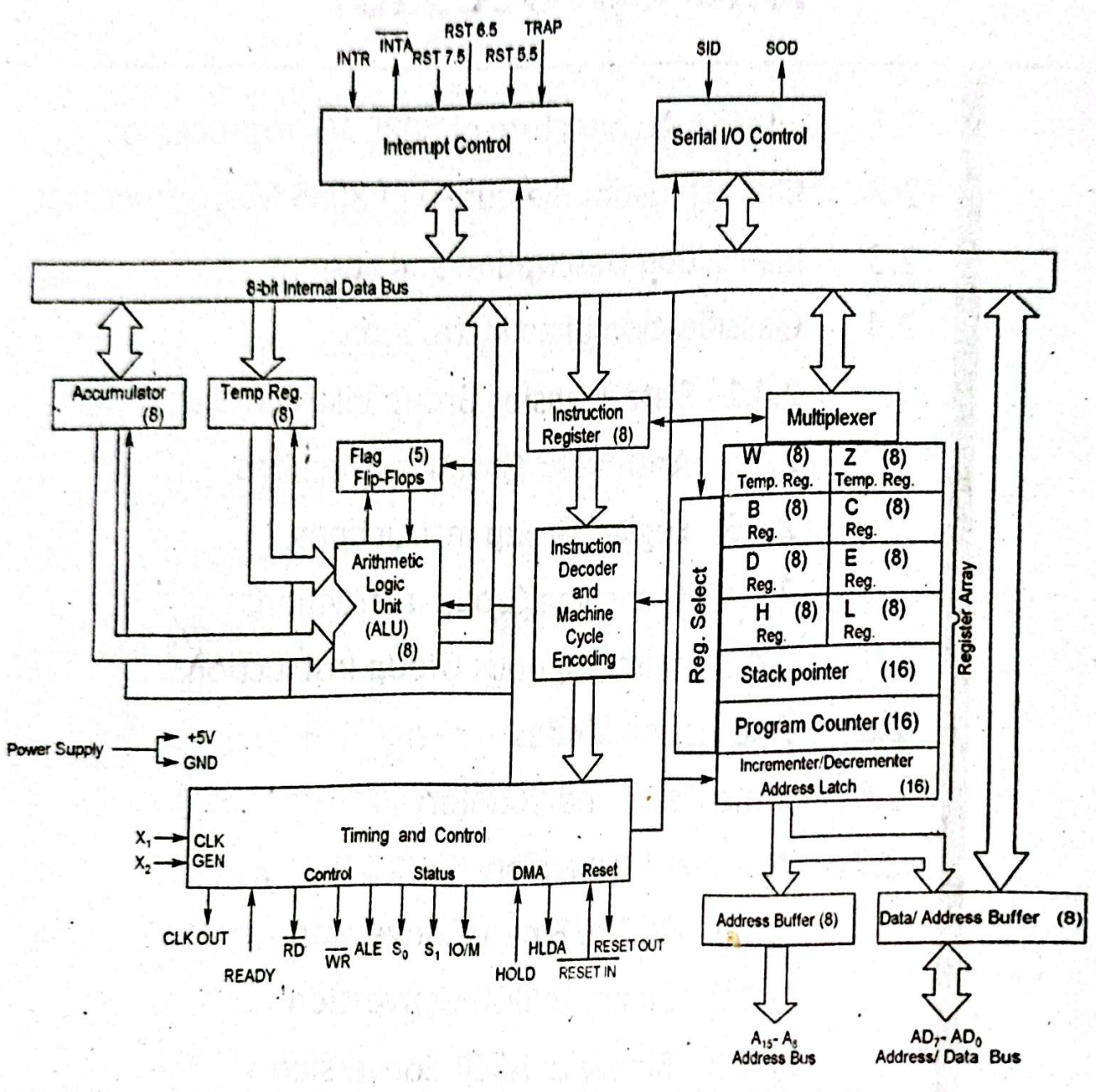

Figure 2.1: The 8085A microprocessor functional block diagram

Source: Intel Corporation. *Embedded Microprocessors (Santa* Clara. Calif: Author.1994), pp 1-11

1. **ALU:** The arithmetic logic unit performs the computing functions. It includes the accumulator, the temporary register, the arithmetic and logic circuits and five flags. The temporary register is used to hold data during an arithmetic/logic operation. The result is stored in the accumulator; the flags (flip-flops) are set or reset according to the result of the operation.

2. **Accumulator (Register A):** It is an 8-bit register that is the part of ALU. This register is used to store the 8-bit data and to perform arithmetic and logic operations. 8085 microprocessor is called accumulator based microprocessor. When data is read from input port, it is first moved to accumulator and when data is sent to output port, it must be first placed in accumulator.

3. **Temporary Registers (W and Z):** They are 8-bit registers not accessible to the programmer. During program execution, 8085A places the data into it for a brief period.

4. **Instruction Register (IR):** It is an 8-bit register not accessible to the programmer. It receives the operation codes of instruction from internal data bus and passes to the instruction decoder which decodes so that microprocessor knows which type of operation is to be performed.

5. **Register Array (Scratch Pad Registers B, C, D, E):** Each one (B, C, D, E) is an 8-bit register accessible to the programmers. Data can be stored upon it during program execution. These can be used individually as 8-bit registers or in pair BC, DE as 16-bit registers. The data can be directly added or transferred from one to another. Their contents may be incremented or decremented and combined logically with the content of the accumulator.

6. **Register H & L:** They are 8-bit registers that can be used in same manner as scratch pad registers.

7. **Stack Pointer (SP):** It is a 16-bit register used as a memory pointer. It points to a memory location in R/W memory, called the stack. The beginning of the stack is defined by loading a 16-bit address in the stack pointer.

8. **Program Counter (PC):** Microprocessor uses the PC register to sequence the execution of the instructions. The function of PC is to point to the memory address from which the next byte is to be fetched. When a byte is being fetched, the PC is incremented by one to point to the next memory location.

9. **Flags:**

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
S	Z	×	AC	×	P	×	CY

Register consists of five flip flops, each holding the status of different states separately is known as *flag register* and each flip flop are called *flags*. 8085A can set or reset one or more of the flags. The flags are sign (S), Zero (Z), Auxiliary Carry (AC), Parity (P), and Carry (CY). The state of flags indicates the result of arithmetic and logical operations, which in turn can be used for decision making processes. The different flags are described as:

- **Carry:** It stores the carry or borrow from one byte to another. If the last operation generates a carry or borrow, its status will be 1 otherwise 0.
- **Zero:** If the result of last operation is zero, its status will be 1 otherwise 0. It is often used in loop control and in searching for particular data value.
- **Sign:** If the most significant bit (MSB) of the result of the last operation is 1 (negative), then its status will be 1 otherwise 0.
- **Parity:** If the result of the last operation has even number of 1's (even parity), its status will be 1 otherwise 0.
- **Auxiliary Carry:** If the last operation generates a carry from the lower half word (lower nibble), its status will be 1 otherwise 0.

10. **Timing and Control Unit:** This unit synchronizes all the microprocessor operations with the clock and generates the control signals necessary for communication between the microprocessor and peripherals. The control signals are similar to the sync pulse in an oscilloscope. The $\overline{RD}$ and $\overline{WR}$ signals are sync pulses indicating the availability of data on the data bus.

11. **Interrupt Controls:** T
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interrupt a microprocessor.

12. **Serial I/O Controls:** Two serial I/O c
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***Programmer's* Model of an 8085 Microproc**

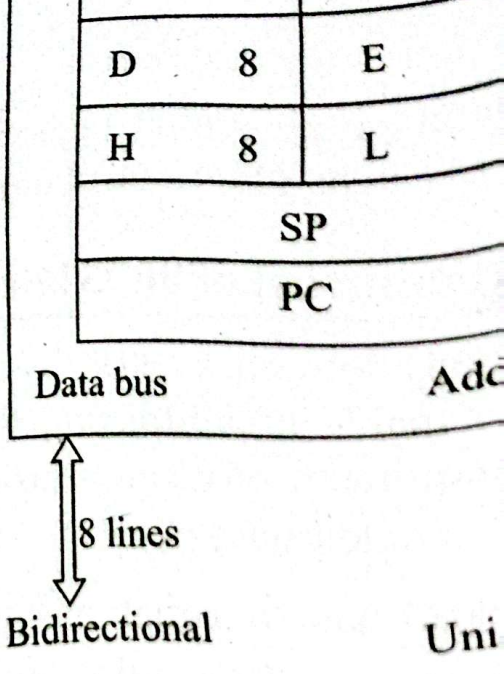

Figure 2.2 Programmer's model of an

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Accumulator

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Flags

Flags are 8-bit register that sl
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11. **Interrupt Controls:** The various interrupt controls signals (INTR, RST 5.5, RST 6.5, RST 7.5, and TRAP) are used to interrupt a microprocessor.

12. **Serial I/O Controls:** Two serial I/O control signals (SID and SOD) are used to implement the serial data transmission.

Programmer's Model of an 8085 Microprocessor

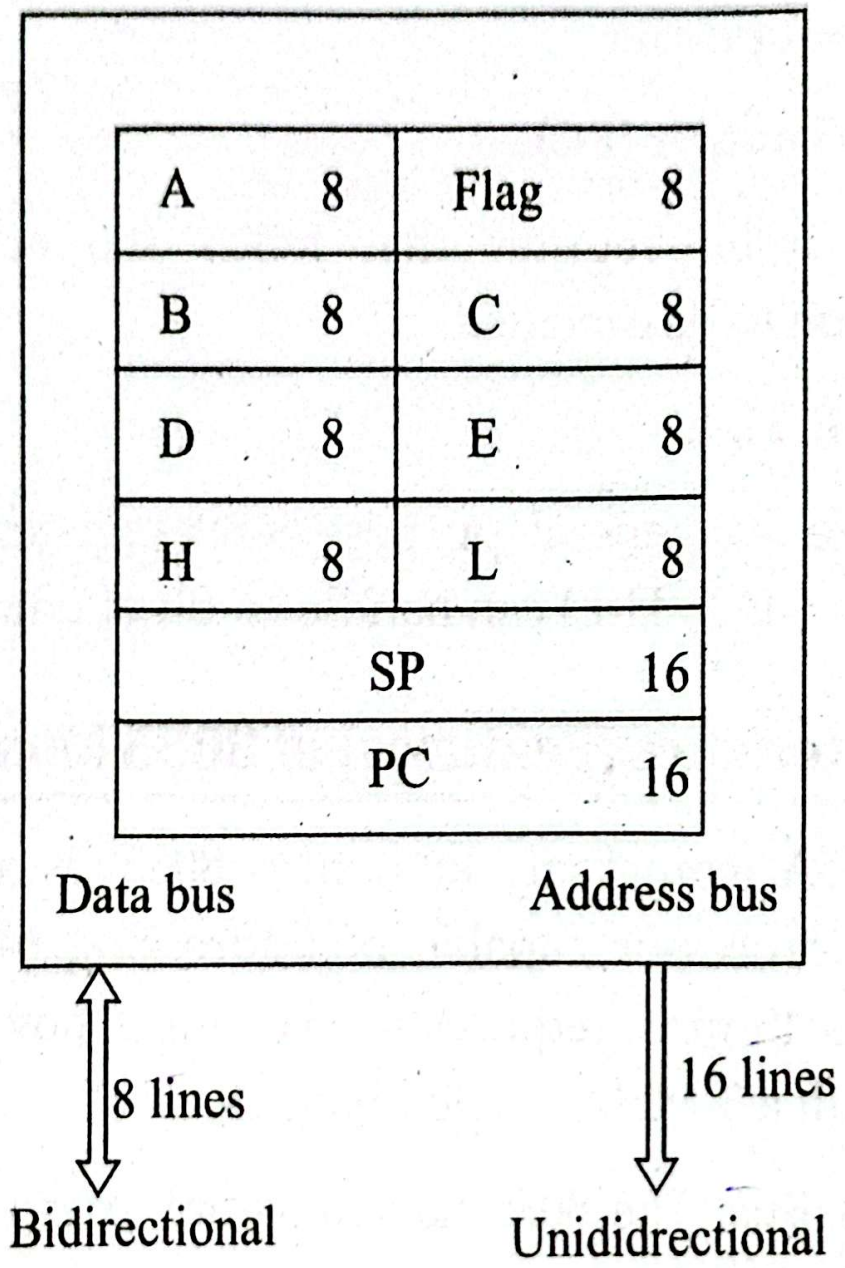

Figure 2.2 Programmer's model of an 8085 microprocessor

The programmer's model of an 8085 microprocessor consists of:

Accumulator

It is an 8-bit register accessible to programmer. Almost all arithmetic, logical, and I/O operations are performed on the accumulator.

Flags

Flags are 8-bit register that shows the status of last ALU operations. There are five flip flops, each flip flop is called flag, each holding the status of different states separately.

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
S	Z	×	AC	×	P	×	CY

Stack pointer (SP)

It is a 16-bit register used as a memory pointer. It points t memory location in R/W memory, called the stack. T beginning of the stack is defined by loading a 16-bit addr in the stack pointer.

Program counter (PC)

It is a 16-bit register that holds the address of ne instruction to be executed.

B, C, D, E, H, L

These are six general purpose 8-bit registers. The regist pairs (B-C, D-E, H-L) can handle 16-bit of data.

2.2 Characteristics (Features) of 8085 Microprocesso

The 8085A (commonly known as 8085) is an 8-bit gener purpose microprocessor capable of addressing 64K of memor The device has 40 pins, requires a +5V single power supply, a an operate with a 3-MHz, single phase clock.

Address Bus: The 8085 has 16 signal lines that are used the address bus; however, these lines are split into tw segments A_{15}-A_8 and AD_7-AD_0. The eight signals A_{15}-A_8 a unidirectional and used as higher order bus.

Data Bus: The signal lines AD_7- AD_0 are bidirectional, the serve a dual purpose. They are used as lower order addre bus as well as data bus.

Control and Status Signals: This group of signals includ