

BECE204P-Microprocessors & Microcontrollers Lab

LAB-1

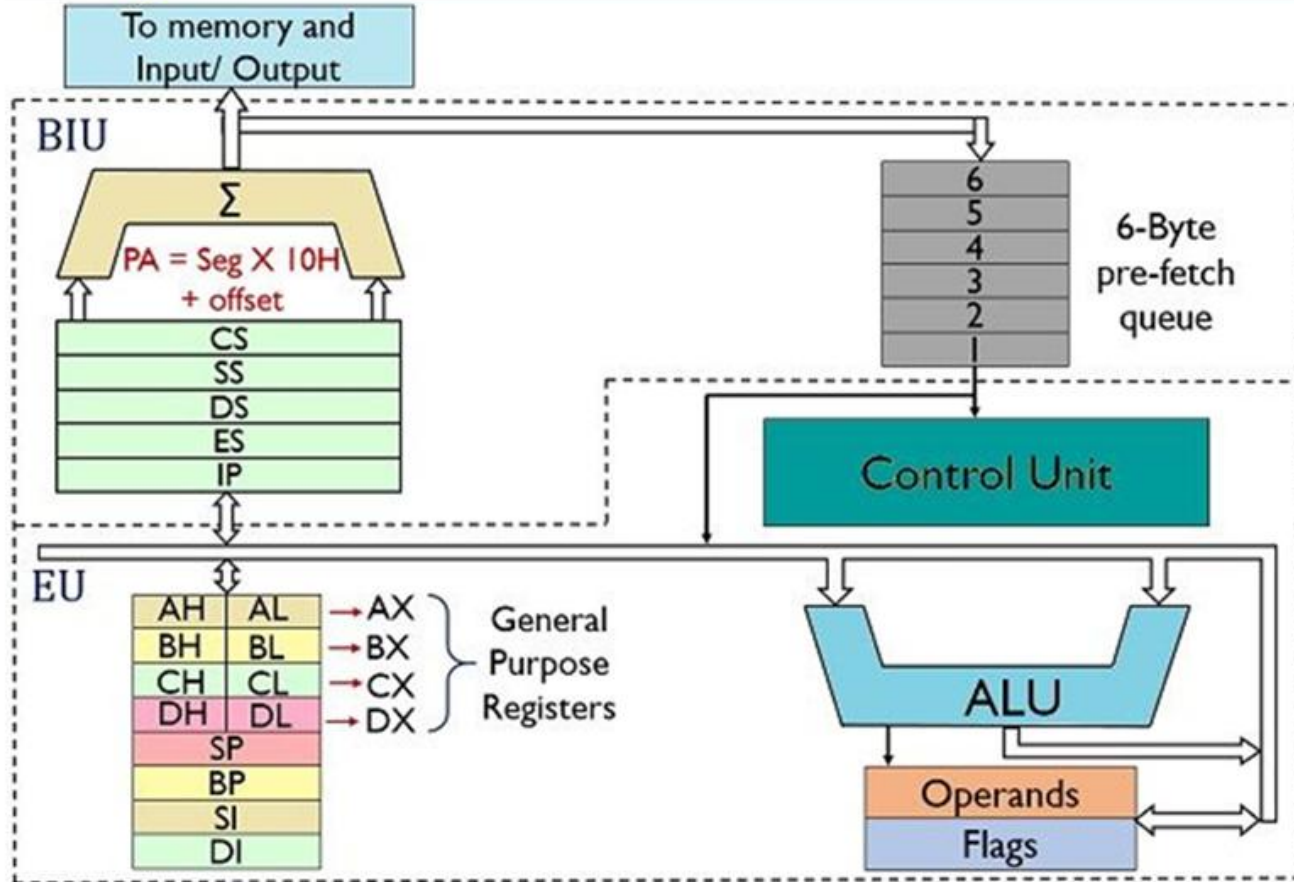
8086 – Arithmetic Operation

INTRODUCTION TO 8086 MICROPROCESSOR

FEATURES

- It is a **16-bit μ p**. Its ALU, internal registers work with 16-bit binary word.
- A **40 pin** dual in line package and it requires +5V power supply.
- 8086 has a **20-bit address bus** can access up to $2^{20} = 1$ MB memory locations.
- 8086 has a **16-bit data bus** and can read/write data either 16-bits or 8-bit at a time.
- Frequency range of 8086 is **6-10 MHz**
- It can support up to **64K I/O ports**.
- It provides **14, 16-bit registers**.
- It has **multiplexed address and data bus** AD0- AD15 and A16 – A19.
- It can prefetch up to **6 instruction bytes** from memory to speed up instruction execution.
- 8086 is designed to operate in two modes, **Minimum mode and Maximum mode**

INTRODUCTION TO 8086 MICROPROCESSOR



Block Diagram of 8086 Microprocessor



Microprocessor 8086 Pinout Diagram

INTRODUCTION TO 8086 MICROPROCESSOR

GENERAL PURPOSE REGISTERS

- **AH+AL → AX (Accumulator Register)**
 - Preferred register to use in arithmetic, logic and data transfer instructions
 - Must be used in multiplication and division operations
 - Must also be used in I/O operations
- **BH+BL → BX (Base Register)**
 - Serves as an address register
- **CH+CL → CX (Count register)**
 - Used as a loop counter
 - Used in shift and rotate operations
- **DH+DL → DX (Data register)**
 - Used in multiplication and division
 - Also used in I/O operations

INTRODUCTION TO 8086 MICROPROCESSOR

INSTRUCTION SET

- An instruction is a binary pattern designed inside a microprocessor to perform a specific function.
- The entire group of instructions that a μP supports is called Instruction Set.
- Classification of 8086 Instruction Set
 1. Arithmetic Instructions and Logical Instruction
 2. Data Transfer Instructions
 3. Branch and Loop Instruction
 4. Machine control Instruction
 5. Flag Manipulation Instructions
 6. Shift and Rotate Instruction
 7. String Instructions

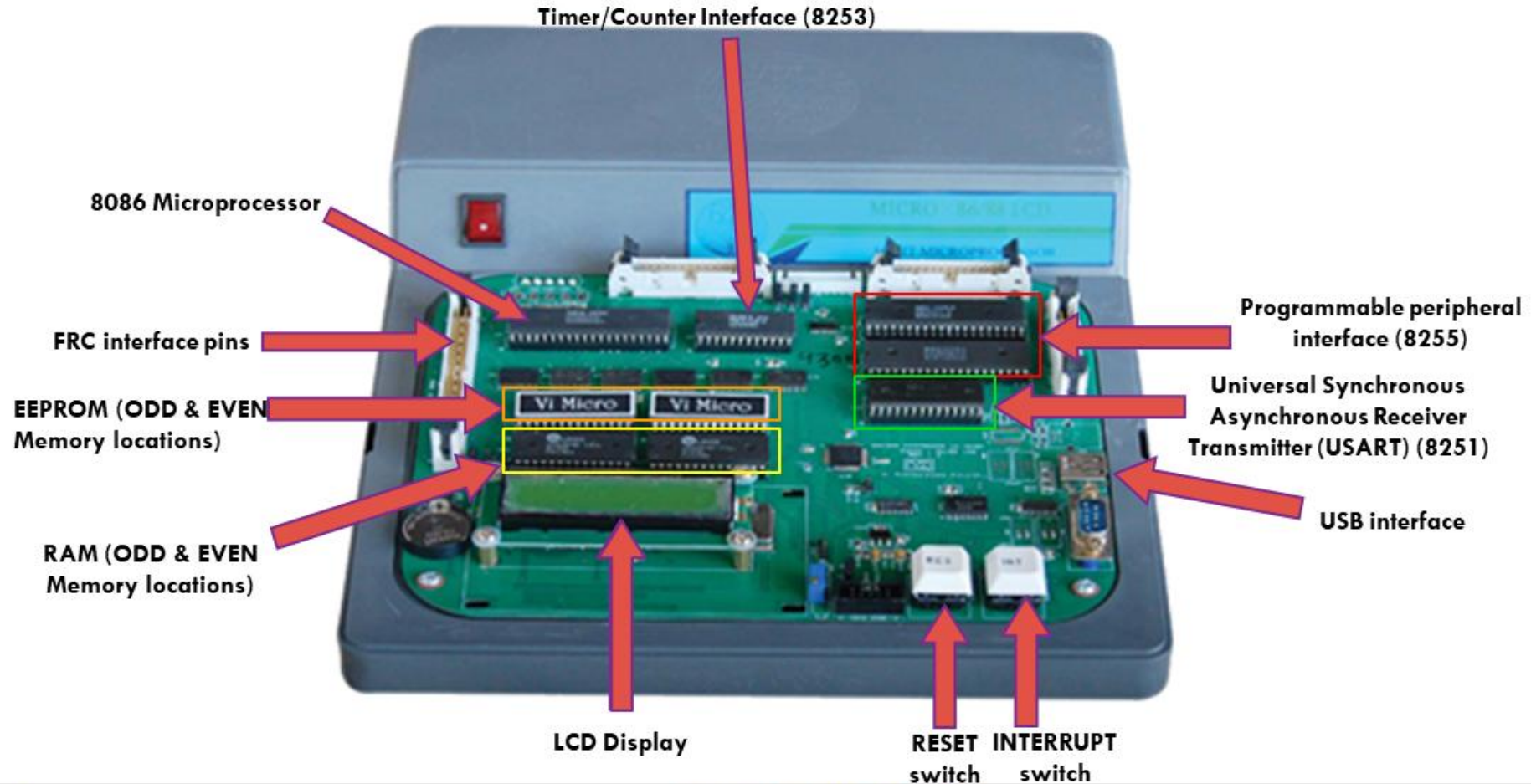
INTRODUCTION TO 8086 MICROPROCESSOR

ARITHMETIC INSTRUCTIONS

OPCODE	OPERAND	EXPLANATION	EXAMPLE
ADD	D, S	$D = D + S$	ADD AX, BX
SUB	D, S	$D = D - S$	SUB AX, [2000]
MUL	8-bit register	$AX = AL * 8\text{-bit reg.}$	MUL BH
MUL	16-bit register	$DX AX = AX * 16\text{-bit reg.}$	MUL CX
DIV	8-bit register	$AX = AX / 8\text{-bit reg. ;}$ AL = quotient ; AH = remainder	DIV BL
DIV	16-bit register	$DX AX = AX / 16\text{-bit reg. ;}$ AX = quotient ; DX = remainder	DIV CX

Here D stands for destination and S stands for source. D and S can either be register, data or memory address.

INTRODUCTION TO 8086 TRAINER KIT



INTRODUCTION TO 8086 TRAINER KIT

WORKING PROCEDURE

1. Connect the power cord and keyboard with the kit
2. Switch on the power supply
3. Press reset in the kit
4. Type "A" in the keyboard and press enter "Line assembler" will be displayed
5. Starting address will be displayed in the kit. Type "1000" as starting address
6. Type the program and note address of each line of the code till HLT
7. Press reset in the kit
8. Type "Go" [space] starting address [ex: 1000] for execution
9. Press enter in keyboard
10. "executing" message will be displayed
11. Press reset in kit
12. Give "SB" [memory location] [ex: 2000]
13. "Output" will be displayed

Important Commands

- A - Line assembler
- Go - Execution
- SB - To view output
- U - Disassembly

LAB TASK-1

8-BIT ADDITION

- Write 8086 Assembly language program to ADD two 8-bit number stored in AL, BL registers and store the result in memory location 2000H.

ADDRESS	MEMONICS	COMMENTS
	MOV AL,08H	Move data 08H to AL register
	MOV BL,05H	Move data 05H to BL register
	ADD AL,BL	Add AL and BL content
	MOV [2000H],AL	Move AL to memory location 2000H
	HLT	Halt the program

Input: AL = 08H, BL = 05H

Output: ADDRESS VALUE
 2000H 0DH

LAB TASK-2

16-BIT ADDITION

- Write 8086 Assembly language program to ADD two 16-bit number stored in AX, BX registers and store the result in memory locations 2000H.

ADDRESS	MEMONICS	COMMENTS
	MOV AX,4433H	Move data 4433H to AX register
	MOV BX,2211H	Move data 2211H to BX register
	ADD AX,BX	Add AX and BX content
	MOV [2000H],AX	Move AX to memory location 2000H
	HLT	Halt the program

Input: AX = 4433H, BX = 2211H

Output:	ADDRESS	VALUE
	2000H	44H
	2001H	66H

LAB TASK-3

8-BIT SUBTRACTION

- Write 8086 Assembly language program to SUBTRACT two 8-bit number stored in AL, BL registers and store the result in memory location 2000H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AL,08H	Move data 08H to AL register
	MOV BL,05H	Move data 05H to BL register
	SUB AL,BL	Subtract AL and BL content
	MOV [2000H],AL	Move AL to memory location 2000H
	HLT	Halt the program

Input: AL = 08H, BL = 05H

Output: ADDRESS VALUE
 2000H 03H

LAB TASK-4

16-BIT SUBTRACTION

- Write 8086 Assembly language program to SUBTRACT two 16-bit number stored in AX, BX registers and store the result in memory locations 2000H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AX,4433H	Move data 4433H to AX register
	MOV BX,2211H	Move data 2211H to BX register
	SUB AX,BX	Subtract AX and BX content
	MOV [2000H],AX	Move AX to memory location 2000H
	HLT	Halt the program

Input: AX = 4433H, BX = 2211H

Output:	ADDRESS	VALUE
	2000H	22H
	2001H	22H

LAB TASK-5

8-BIT MULTIPLICATION

- Write 8086 Assembly language program to MULTIPLY of two 8-bit number stored in AL, BL registers and store the result in memory location 2000H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AL,08H	Move data 08H to AL register
	MOV BL,05H	Move data 05H to BL register
	MUL BL	Multiply AL and BL content
	MOV [2000H],AL	Move AL to memory location 2000H
	HLT	Halt the program

Input: AL = 08H, BL = 05H

Output: ADDRESS VALUE
 2000H 28H

LAB TASK-6

16-BIT MULTIPLICATION

- Write 8086 Assembly language program to MULTIPLY two 16-bit number stored in AX, BX registers and store the result in memory locations 2000H and 2002H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AX,4433H	Move data 4433H to AX register
	MOV BX,2211H	Move data 2211H to BX register
	MUL BX	Multiply AX and BX content
	MOV [2000H],AX	Move AX to memory location 2000H
	MOV [2002H],DX	Move DX to memory location 2002H
	HLT	Halt the program

Input: AX = 4433H, BX = 2211H

Output:	ADDRESS	VALUE
	2000H	63H
	2001H	4DH
	2002H	13H
	2003H	09H

LAB TASK-7

8-BIT DIVISION

- Write 8086 Assembly language program to DIVIDE of two 8-bit number stored in AL, BL registers and store the result in memory location 2000H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AL,08H	Move data 08H to AL register
	MOV BL,05H	Move data 05H to BL register
	DIV BL	Divide AL by BL content
	MOV [2000H],AL	Move AL (quotient) to 2000H
	MOV [2001H],AH	Move AH (remainder) to 2001H
	HLT	Halt the program

Input: AL = 08H, BL = 05H

Output :	ADDRESS	VALUE
	2000H	01H
	2001H	03H

LAB TASK-8

16-BIT DIVISION

- Write 8086 Assembly language program to DIVIDE two 16-bit number stored in AX, BX registers and store the result in memory locations 2000H and 2002H.

ADDRESS	MEMONICS	COMMENTS
1000	MOV AX,4433H	Move data 4433H to AX register
	MOV BX,2211H	Move data 2211H to BX register
	DIV AX,BX	Divide AX by BX content
	MOV [2000H],AX	Move AX (quotient) to 2000H
	MOV [2002H],DX	Move DX (remainder) to 2002H
	HLT	Halt the program

Input: AX = 4433H, BX = 2211H

Output:

ADDRESS	VALUE
2000H	02H
2001H	00H
2002H	11H
2003H	00H

THANK YOU

THANK YOU



by
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