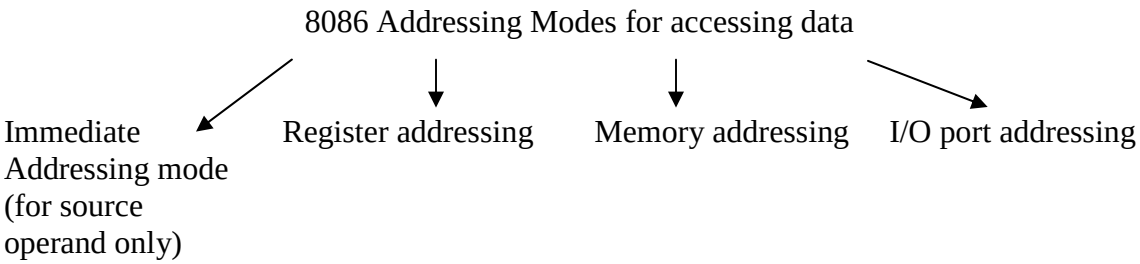
8086 Addressing Modes for accessing data

Addressing modes provide convenience in accessing data needed in an instruction.



Immediate Addressing

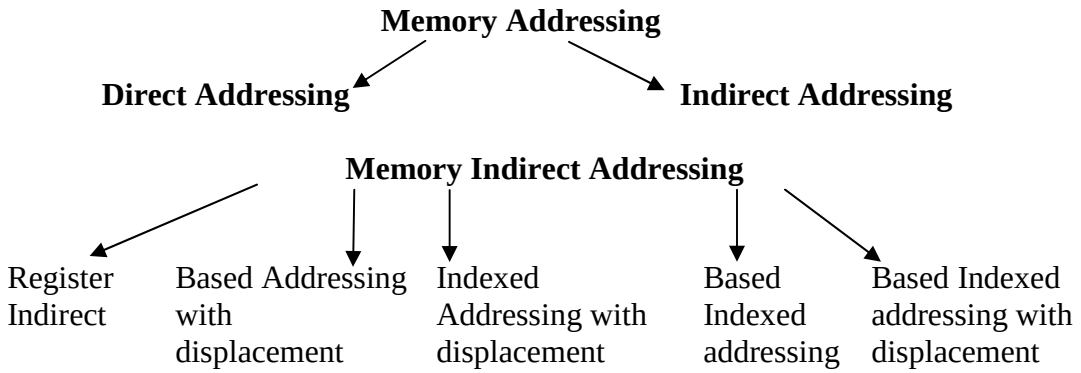
			Before	After
Ex1:	MOV DX, 1234H	DX	~~ABCDH~~	1234H

			Before	After
Ex2:	MOV CH, 23H	CH	~~4DH~~	23H

Register Addressing

			Before	After
Ex1:	MOV CX, SI	CX	~~1234H~~	5678H
		SI	5678H	5678H

			Before	After
Ex2:	MOV DL, AH	Dl	~~89H~~	BCH
		AH	BCH	BCH



Memory Direct Addressing

		Before	After
Ex1: MOV BX, DS:5634H	BX	~~ABCDH~~	8645H
	DS:5634H	45H	LS byte
	DS:5635H	86H	MS byte

		Before	After
Ex2: MOV CL, DS:5634H	CL	~~F2H~~	45H
	DS:5634H	45H	
	DS:5635H	86H	

Ex3: MOV BH, LOC

	Before	After
BH	~~C5H~~	78H

Program

```
.DATA
LOC  DB  78H
```

Register Indirect Addressing

		Before	After
Ex1: MOV CL, [SI]	CL	~~20H~~	78H
	SI	3456H	
	DS:3456H	78H	

		Before	After
Ex2: MOV DX, [BX]	DX	~~F232H~~	3567H
	BX	A2B2H	
	DS:A2B2H	67H	LS byte
	DS:A2B3H	35H	MS byte

		Before	After
Ex3: MOV AH, [DI]	AH	~~30H~~	86H
	DI	3400H	
	DS:3400H	86H	

Only SI, DI and BX can be used inside [ ] from memory addressing point of view. From user point of view [BP] is also possible. This scheme provides 3 ways of addressing an operand in memory.

Based Addressing with displacement

			Before	After
Ex1:	MOV DH, 2345H[BX]	DH	~~45H~~	67H
	2345H is 16-bit displacement	BX	4000H	
	4000 + 2345 = 6345H	DS:6345H	67H	

			Before	After
Ex2:	MOV AX, 45H[BP]	AX	~~1000H~~	CDABH
	45H is 8-bit displacement	BP	3000H	
	3000 + 45 = 3045H	SS:3045H	ABH	LS byte
	It is SS when BP is used	SS:3346H	CDH	MS byte

Base register can only be BX or BP. This scheme provides 4 ways of addressing an operand in memory.

Indexed Addressing with displacement

			Before	After
Ex1:	MOV CL, 2345H[SI]	CL	~~60H~~	85H
	2345H is 16-bit displacement	SI	6000H	
	6000 + 2345 = 8345H	DS:8345H	85H	

			Before	After
Ex2:	MOV DX, 37H[DI]	DX	~~7000H~~	B2A2H
	37H is 8-bit displacement	DI	5000H	
	5000H+ 37H = 5037H	DS:5037H	A2H	LS byte
		DS:5038H	B2H	MS byte

Index register can only be SI or DI. This scheme provides 4 ways of addressing an operand in memory.

Based Indexed Addressing

			Before	After
Ex1:	MOV CL, [SI][BX]	CL	~~40H~~	67H
		SI	2000H	
		BX	0300H	
	2000H + 0300H = 2300H	DS:2300H	67H	

			Before	After	
Ex2:	MOV CX, [BP][DI]	CX	~~6000H~~	6385H	
		BP	3000H		
		DI	0020H		
	2000H + 0300H = 2300H	SS:3020H	85H		LS byte
	It is SS when BP is used	SS:3021H	63H		MS byte

This scheme provides 4 ways of addressing an operand in memory. One register must be a Base register and the other must be an Index register.
For ex. MOV CX, [BX][BP] is an invalid instruction.

Based Indexed Addressing with Displacement

			Before	After
Ex1:	MOV DL, 37H[BX+DI]	DL	~~40H~~	12H
	37H is 8-bit displacement	BX	2000H	
		DI	0050H	
	2000H + 0050H + 37H = 2300H	DS:2087H	12H	

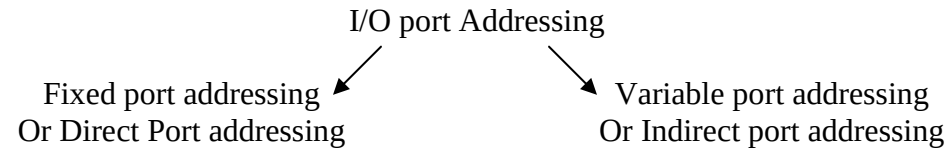
			Before	After	
Ex2:	MOV BX, 1234H[SI+BP]	BX	~~3000H~~	3665H	
		SI	4000H		
		BP	0020H		
	4000H + 0020H +1234 = 5254H	SS:5254H	65H		LS byte
	It is SS when BP is used	SS:5255H	36H		MS byte

This scheme provides 8 ways of addressing an operand in memory.

Memory modes as derivatives of Based Indexed Addressing with Displacement

Instruction	Base Register	Index Register	Displacement	Addressing mode
MOV BX, DS:5634H	No	No	Yes	Direct Addressing
MOV CL, [SI]	No	Yes	No	Register Indirect
MOV DX, [BX]	Yes	No	No	
MOV DH, 2345H[BX}	Yes	No	Yes	Based Addressing with Displacement
MOV DX, 35H[DI]	No	Yes	Yes	Indexed Addressing with displacement
MOV CL, 37H[SI+BX]	Yes	Yes	No	Based Indexed Addressing
MOV DL, 37H[BX+DI]	Yes	Yes	Yes	Based Indexed Addressing with displacement

I/O port Addressing



Fixed Port Addressing

Ex. 1: IN AL, 83H

	Before	After
AL	~~34H~~	78H
Input port no. 83H	78H	

Ex. 2: IN AX, 83H

	Before	After
AX	~~5634H~~	F278H
Input port no. 83H	78H	
Input port no. 84H	F2H	

Ex. 3: OUT 83H, AL

	Before	After
AL	50H	
Output port no. 83H	~~65H~~	50H

Ex. 4: OUT 83H, AX

	Before	After
AX	6050H	
Output port no. 83H	~~65H~~	50H
Output port no. 84H	~~40H~~	60H

IN and OUT instructions are allowed to use only AL or AX registers. Port address in the range 00 to FFH is provided in the instruction directly.

Variable Port Addressing

I/O port address is provided in DX register. Port address ranges from 0000 to FFFFH. Data transfer with AL or AX only.

Ex. 1: IN AL, DX

	Before	After
AL	~~30H~~	60H
DX	1234H	
Input port no. 1234H	60H	

Ex. 2: IN AX, DX

	Before	After
AX	~~3040H~~	7060H
DX	4000H	
Input port no. 4000H	60H	
Input port no. 4001H	70H	

Ex. 3: OUT DX, AL

	Before	After
AL	65H	
DX	5000H	
Output port no. 5000H	~~80H~~	65H

Ex. 4: OUT DX, AX

	Before	After
AX	4567H	
DX	5000H	
Output port no. 5000H	~~25H~~	67H
Output port no. 5001H	~~36H~~	45H