NE-3102: Electronics-II Laboratory

Roll ____________ Date ____________ Experiment No. ____________

Name of the experiment

16-bit addition using 8086 microprocessor.

Contents

1 Objective

1. To perform addition on two 16-bit numbers in two consecutive memory locations using 8086 microprocessor and store the result.

2 Theory

3 Components and apparatus

1. MDA-8086 trainer board
2. RS-232 to USB 2.0 converter (optional)

4 Circuit diagram/setup

The MDA-8086 kit comprises a microprocessor board, power supply, keyboard, and monitor. The microprocessor board has an 8086 microprocessor, a clock generator, memory, and peripheral interfaces. Two 16-bit numbers (F002h + F002h = 1E004h) are entered into the memory such that,

	BX		AX	
Input Data	F0	02	F0	02
Segment Address	0000	0000	0000	0000
Offset Address	2003	2002	2001	2000

Table 1: Input data.

The following key presses of the microprocessor board using the keyboard will load the numbers in the respective locations:

Key	Action
AD	segment address selector
0000	16-bit segment address in hex
:	offset address selector
2000	16-bit offset address
DA	data input selector
02	8-bit data input in hex
+	increment offset
F0	8-bit data input in hex
+	increment offset
02	8-bit data input in hex
+	increment offset
F0	8-bit data input in hex

Table 2: Key combination to load numbers into memory.

A program for 16-bit addition is then executed in the microprocessor with the following algorithm :

1. Start the program
2. Load the first 16-bit number into AX register from memory location 0000h:2000h
3. Load the second 16-bit number into BX register from memory location 0000h:2002h
4. Clear CL register (for carry) by loading 00h
5. Add the two numbers in AX and BX registers and accumulate the sum into AX register

6. Jump to STORE if no carry, i.e., carry flag CF = 0
7. Increment the CL register if there is a carry, i.e., carry flag CF = 1
8. Store the sum in AX register into memory location 0000h:2004h
9. Store the carry in CL register into memory location 0000h:2006h
10. Stop the program

The following opcode/program will perform the addition of the two numbers and store the result in the memory in ‘Machine Code’ mode:

Address	Label	Opcode	Mnemonics	Operands	Comments
1000		8B 06 00 20	MOV	AX, [2000]	Load the first word
1004		8B 1E 02 20	MOV	BX, [2002]	Load the second word
1008		C6 C1 00	MOV	CL, 00	Clear the CL register for carry
100B		01 D8	ADD	AX, BX	Add two number, sum will be in AX
100D		73 02	JNC	#(1011)	Check the status of carry flag
100F		FE C1	INC	CL	If carry flag is set, increment CL
1011		89 06 04 20	MOV	[2004],AX	Store the sum result
1015		88 0E 06 20	MOV	[2006], CL	Store the carry
1019		F4	HLT		Stop the program

Table 3: 16-bit addition program.

Check whether you have the same values in the respective memory locations:

	Carry		Sum	
Output Data	00	01	E0	04
Segment Address	0000	0000	0000	0000
Offset Address	2007	2006	2005	2004

Table 4: Output data.

The Assembly code (to be compiled by the assembler):

```
;****************************************
;     MDA-Win8086 EXPERIMENT PROGRAM   *
;     FILENAME  : ADD.ASM
;     PROCESSOR : I8086
;****************************************
CODE   SEGMENT
       ASSUME CS:CODE,DS:CODE,ES:CODE,SS:CODE
       ;
       MOV AX, [2000]  ; LOAD THE FIRST NUMBER INTO AX
       MOV BX, [2002]  ; LOAD THE SECOND NUMBER INTO BX
       ADD AX, BX      ; ADD AX AND BX, AND ACCUMULATE THE SUM INTO AX
       JNC STORE       ; IF CF = 0, JUMP TO STORE
       INC CX ; INCREMENT THE COUNT REGISTER BY 1
STORE: MOV [2004], AX  ; STORE AX CONTENT INTO MEMORY
       MOV [2006], CX  ; STORE CX CONTENT INTO MEMORY
       HLT             ; TERMINATE THE PROGRAM
CODE   ENDS
       END
```

5 Data collection and analysis

6 Result

7 Discussion

8 References

1. Mathivanan, N. Microprocessors, PC Hardware and Interfacing. PHI Learning Pvt. Ltd., 2003.
2. MDA-Win8086 User's Manual, Version 10.0, Midas Engineering co., ltd.

Appendix