INTRODUCTION OF MANUAL

This manual is designed to be used in conjunction with the "multi tech" MDA-Win8086 Microcomputers as part of a laboratory class on microprocessor 8086. With the help of this manual, students will be able to learn the fundamentals of microcomputers, 8086 instructions to practical applications.

The first three experiments of this manual are introduction to the MDA-Win8086 Microcomputer’s system configuration, operation introduction and MDA-WinIDE8086 software. Experiment number (4-6) is based on microcomputer programming such as, data transfers, arithmetic and logic operations jump and subroutine and memory address allocation in simple program. The remaining experiments are based on applications and will make the students learn about input/output, interrupt, timer and counter.

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EXPERIMENT NO.1

MDA - 8086 SYSTEM CONFIGURATION

Objective:
To get familiar with the MDA-8086 kit and it's components.

Equipment:
MDA-8086 kit.

Introduction:
MDA-8086, is a kit having 8086 as a central processing unit and various other components (memories, i/o, buses) etc. for the detailed understanding of 8086 microprocessor.

Components and Its Functions:

1- CPU (Central processing unit):
Using Intel 8086, Using 4.9152 MHz.

2- ROM (Read Only Memory):
It has program to control user's key inputs.
LCD display, user's program. 64K Byte, it has data communication program.
Range of ROM Address is F0000 ~ FFFFFH.

3- SRAM (Static Random Access Memory):
Input user's program & data. Address of memory is 00000H ~ 0FFFFH, totally 64K Byte.

4- DISPLAY:
It is LCD, 16(Characters) × 2(Lines).

5- KEY BOARD:
It is used to input machine language and has 16 hexa-decimal keys and 8 of function keys.

6- SPEAKER:
It is used to test the sound and.

7-RS-232C:
It is used for serial communication with IBM compatible personal computer.

8-DOT MATRIX LED:
To understand & test of dot matrix structure and principle of display it is interfaced to 8255A (PPI).

9- A/D CONVERTER:
Converts analog signal to digital signal using ADC0804.

10- D/A CONVERTER:
Converts digital signal to analog signal using DAC0800 (8-bits D/A converter) and controls the Level meter.

11- STEPPING MOTOR INTERFACE:
Stepping motor driver circuit is designed.

12-POWER:
AC 110 ~ 220V, DC +5V 3A, +12V 1A, -12V 0.5A SMPS.

Memory Map:

<table>
<thead>
<tr>
<th>Address</th>
<th>Memory</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000H ~ 0FFFFH</td>
<td>RAM</td>
<td>PROGRAM &amp; DATA MEMORY</td>
</tr>
<tr>
<td>F0000H ~ FFFFFH</td>
<td>ROM</td>
<td>MONITOR ROM</td>
</tr>
<tr>
<td>10000H ~ EFFFFH</td>
<td>USER’S RANGE</td>
<td></td>
</tr>
</tbody>
</table>

I/O Address Map:

<table>
<thead>
<tr>
<th>ADDRESS</th>
<th>I/O PORT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>00H ~ 07H</td>
<td>LCD &amp; KEYBOARD</td>
<td>LCD Display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>00H : INSTRUCTION REGISTER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02H : STATUS REGISTER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>04H : DATA REGISTER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>KEYBOARD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01H : KEYBOARD REGISTER</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Only read)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01H : KEYBOARD FLAG (Only write)</td>
</tr>
<tr>
<td>Address Range</td>
<td>ICs</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 08H ~ 0FH     | 8251 / 8253 | 8251 (Using to data communication)  
08H : DATA REGISTER  
0AH : INSTRUCTION / STATUS REGISTER  
8253 (TIMER/COUNTER)  
09H : TIMER 0 REGISTER  
0BH : TIMER 1 REGISTER  
0DH : TIMER 2 REGISTER  
0FH : CONTROL REGISTER |
| 10H ~ 17H     | 8255A-CS1/8255A-CS2 | 8255A-CS1 (DOT & ADC INTERFACE)  
18H : A PORT DATA REGISTER  
1AH : B PORT DATA REGISTER  
1CH : C PORT CONTROL REGISTER  
8255-CS2 (LED & STEPPING MOTOR)  
19H : A PORT DATA REGISTER  
1BH : B PORT DATA REGISTER  
1DH : C PORT CONTROL REGISTER  
1FH : CONTROL REGISTER |
| 20H ~ 2FH     | I/O EXTEND CONNECTOR |
| 30H ~ FFH     | USER'S RANGE |
EXPERIMENT NO.2

OPERATION INTRODUCTION

Objective:

To get familiar with the MDA-8086 kit's programming:
1- Function of Keys
2- Basic Operation

Equipment:

MDA-8086 kit.

Introduction:

MDA-8086 keys are broadly classified into two groups function keys and data. Introduction of keys and its basic operations.

1- FUNCTION OF KEYS:

MDA-8086 has high performance 64K-byte monitor program. It is designed for easy function. After power button is turned on, the monitor starts working. In addition to all the key function the monitor has a memory checking routine. The following is a simple description of the key functions.

<table>
<thead>
<tr>
<th>FUNCTION KEY</th>
<th>DATA KEY</th>
</tr>
</thead>
<tbody>
<tr>
<td>GO</td>
<td>MON</td>
</tr>
<tr>
<td>STP</td>
<td>RES</td>
</tr>
<tr>
<td>+</td>
<td>8</td>
</tr>
<tr>
<td>REG</td>
<td>9</td>
</tr>
<tr>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>DA</td>
<td>5</td>
</tr>
<tr>
<td>:</td>
<td>0</td>
</tr>
</tbody>
</table>

- **RES**: system reset
- **AD**: set memory address
- **DA**: Update segment & Offset, and input data to memory
- **:**: Offset set.
- **STP**: execute user's program, a single step
- **GO**: go to user's program or execute monitor functions
- **MON**: Immediately break user's program and Non makable interrupt
- **REG**: Register Display
2-BASIC OPERATIONS:
On a power-up, following message will be displayed on a LCD.

<table>
<thead>
<tr>
<th>MDA-8086 Kit!!</th>
<th>Serial monitor!</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midas 2109-5964</td>
<td>Midas 2109-5964</td>
</tr>
</tbody>
</table>

Figure 1-1. Or Figure 1-2.

So as to use serial monitor, move jumper P1 which located on the PCB like this.

+ Segment & Offset +1 increment. Register display increment.
- Segment & Offset -1 increment. Register display decrement.

Machine code Serial monitor

※ RES System Reset Key

Whenever RES is pressed, the display becomes FIGURE 1-1 and user can operate keyboard only in this situation.

+ Seg. Oset data
  0002 1000 FF

(segment +1 increment
[The contents of memory
0002:1000 (it may be different)])

- Seg. Oset data
  0001 1000 FF

(segment -1 increment
[The contents of memory
0001:1000 (it may be different)])

※ AD HEXA-DIGIT KEY: Update to memory contents.
EXAMPLE 2) Let's store the following like to 01000H ~ 01003H contents.

< ADDRESS  DATA >
01000  AB
01001  CD
01002  EF
01003  34

<table>
<thead>
<tr>
<th>KEY</th>
<th>LCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>RES</td>
<td>MDA-8086 Kit!! Midas 2109-5964</td>
</tr>
</tbody>
</table>
| AD  | Seg. Oset data
|     | 0000 1000 FF |
|     | segment offset |
|     | [The contents of memory 0000:1000] |
| DA  | Seg. Oset data
|     | 0000 1000 FF |
|     | segment offset |
|     | [The contents of memory 0000:1000 (it may be different)] |
| A   | Seg. Oset data
|     | 0000 1000 AB |
| B   | Offset increment |
| +   | Seg. Oset data
|     | 0000 1001 FF |
| C   | Seg. Oset data
|     | 0000 1001 CD |
| D   | Offset increment |
| +   | Seg. Oset data
|     | 0000 1002 FF |
| E   | Seg. Oset data
|     | 0000 1002 EF |
| F   | Offset increment |
| +   | Seg. Oset data
|     | 0000 1003 FF |
| 3   | 4   | Offset increment |
|     | Seg. Oset data
|     | 0000 1003 34 |
Lab Manual for EngE322-Lab
Department of Electrical Engineering, Jazan University

THEORY

KEY:

REG, +, -

KEY : Display to register contents.

LCD:

| AX=0000 | BX=0000 |
| CX=0000 | DX=0000 |

Current register contents.

| SP=0540 | BP=0000 |
| SI=0000 | DI=0000 |

Current register contents.

| DS=0000 | ES=0000 |
| SS=0000 | CS=0000 |

Current register contents.

| DS=0000 | ES=0000 |
| SS=0000 | CS=0000 |

Current register contents.

| SP=0540 | BP=0000 |
| SI=0000 | DI=0000 |
EXPERIMENT NO.3
SERIAL MONITOR

Objective:
To get familiar how MDA-8086 kit can be connected to computer and performs different operations.

Equipment:
PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Introduction:
Serial monitor is the basic monitor program for data communication between MDA-8086 and computer.

1. How to use serial monitor?
So as to use serial monitor, move jumper P1 which located on the PCB like this.

![Diagram showing how to move jumper P1]

2. HOW TO CONNECT MDA-8086 TO YOUR PC:
The MDA-8086 is connected serially through COM port of PC and in the following way:
The connector of computer RS-232C is 9 pin and RS-232C of MDA-8086 is 9 pin, must be connected as shown below.
3. MDA-8086 INSTALLATION:
The MDA-8086 is installed by connecting it to PC having Intel microprocessor and these two will be connected by third party software WinnComm.

4. SETUP THE CONFIGURATION OF “WinnComm”:
The data communication between MDA-8086 and computer, need fixing initial of COMM. When you push F5 key, following is displayed and the step of fixing initial is like follow.

```
<Line setting>

Serial port (1/2) : 2 ==> 2

Serial baud rate set
1200 = 1  2400 = 2  4800 = 3
9600 = 4  19.2k = 5  38.4k = 6
Baud rate select (1---6) : 4 ==> 4

Parity bit NP = 0  Po = 1  Pe = 2  : 0 ==> 0

Word size 7bit = 2  8bit = 3  : 3 ==> 3

Stop bit 1bit = 0  2bit = 1  : 0 ==> 0

Change OK (Y/N) ? y
```

When power button is turned on, following message will be displayed. This message is displayed only when power is on, and does not display when RES key is pressed.

```
** Serial Monitor 1.0 **
** Midas 2109-5964 **

8086 > m ← MDA-8086 PROMPT
```

5. ASSEMBLING/COMPILING THE SOURCE CODE:
For assembling or compiling the source code first open the related source code and assemble or compile it according to either it is in assembly or in C language. So for assembly click on the ASM 8086 and for C click on C 8086 this will generate ABS (absolute file).
6. DOWNLOAD AND EXECUTE THE SOURCE FILE:
When the ABS file is generated press ‘L’ for the program to download and then press F3 to send the file for execution and lastly press ‘G’ to execute and display the result.

```
8086 >L
   Download start !!
   :14100000B83412BB7856B90010BA00208BF08BFBB0030BC08
   :0910140000408EDA8ED18EC0CCB2
   :00
      OK Completed !!
         Segment Offset
            ↓  ↓
  8086 >G 0000:1000
   Execute Address = 0000:1000
```
EXPERIMENT NO. 4

Objective:

Type and execute the following program on MDA-WinIDE8086 to learn how the addressing takes place with instructions MOV, XCHG, LEA, LES, LDS.

Equipment:

PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Program:

CODE SEGMENT


; ORG 1000H

MOV AX, 0000H
MOV DS, AX
MOV SS, AX
MOV ES, AX

; MOV BX, 2000H
MOV BP, BX
MOV SI, 2
MOV DI, 4

; MOV CL, [BX+SI+1]
MOV CH, [BP+DI+2]

; MOV AL, 0ABH
MOV [BX+SI], AL
MOV CL, 0FFH
MOV [BP+SI+1], CL

; MOV DX, [BP+SI+4]

; MOV AH, [BX+SI+1]
MOV AL, [BP+SI+2]
Lab Task:

Change the data of your own choice which are sent to memory locations and execute the program.
EXPERIMENT NO.5

Objective:

Type and execute the following program on MDA-WinIDE8086 to learn how the addition, subtraction, multiplication, division, increment etc. takes place with instructions, ADD, ADC, SUB, SBB, MUL, IMUL, DIV, IDIV, INC, DEC, NEG.

Equipment:

PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Program:

```
ORG 1000H

MOV AX,0000H

ADD AX,4789H
ADC AX,6545H
ADD AL,88H
ADC AH,33H

SUB AX,3567H
SBB AX,8000H
SUB AL,45H
SBB AH,78H

MOV AL,0FFH
INC AL
DEC AL

NEG AL

MOV AL,0F0H
MOV BL,11H
MUL BL

MOV AX,0F000H
MOV BX,1234H
IMUL BX
```
Lab Task:

Take data of your own choice and execute the program and verify the answers.
EXPERIMENT NO.6

Objective:

Type and execute the following program on MDA-WinIDE8086 to learn how the logical instructions like NOT, OR, AND, XOR, NOR, shift instructions like SHL, SHR and rotate instructions like ROL, RCL, RCR works.

Equipment:

PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Program:

CODE SEGMENT


ORG 1000H

MOV AL,01011010B
AND AL,11110000B
OR AL,00001010B
XOR AL,01011111B
NOT AL
INC AL

MOV BX,39ABH
MOV AL,BL
OR AL,0FH
AND AL,BH

AND BL,0FH
OR AL,BL

MOV DL,11111111B
SHL DL,1
SHR DL,1
MOV CL,11110000B
ROL CL,1
RCL CL,1
RCL CL,1
RCR CL,1
INT 3
;

CODE ENDS
END.

Lab Task:
Practice the above instructions with a new data and note down the values of flag register for each instruction with their result.
EXPERIMENT NO.7

8255A INTERFACE (LED)

Objective:

Glow of LEDs on the MDA-8086 kit using port B of PPI 8255.

Equipment:

PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Introduction:

8255A is a general purpose programmable I/O device designed for use with microprocessors (Intel). It has 3 I/O ports named as port A, B, C and has 24 pins (lines) for I/O that are programmable in group of 12 pins. These I/O lines can be grouped as Group A and Group B. Group A contains an 8-bit port A along with a 4-bit port C upper. Group B contains an 8-bit port B along with a 4-bit port, C lower. The C upper and C lower ports can be combined to use as an 8-bit port. Thus for on 8255 we can have either three 8-bit I/O ports or two 8-bit and two 4-bit ports. All these ports can function independently either as input or as output ports. This can be achieved by programming the bits of an internal register called as Control Word Register (CWR).

Interfacing of 8255A with 8086:
Lab Task 1:

There are four LEDs on the board, glow each LED for 5 seconds using the port B of 8255.

Lab Task 2:

Glow the red LED for 30 seconds then glow yellow LEDs for 5 seconds and finally the green LED again for 30 seconds.
EXPERIMENT NO.8

8255A INTERFACE (7-SEGMENT)

Objective:

To get familiar with the 7-segment display and its interfacing with 8086 microprocessor using 8255A.

Equipment:

PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

Introduction:

Seven segments is a display which may be either common anode or common cathode. Which is ON either on 1 or zero but here we use the format ‘ON’ on zero.

Interfacing of Seven segment with 8086 and 8255A:
Lab Task:

Displaying Hexadecimal Numbers from 0 to F.
EXPERIMENT NO.9

DOT MATRIX LED

Objective:
To get familiar with dot matrix leds and their connections.

Equipment:
PC having Intel microprocessor installed with MDA-WinIDE8086 software, MDA-8086 kit.

1-DOT-MATRIX LED DISPLAY:

Introduction:
The KMD D1288C is 1.26 inch height 3mm diameter and 8 × 8 dot matrix LED displays. The KMD D1288C are dual emitting color type of red, green chips are contained in a dot with milky and white lens color.

Internal Circuit Diagram:
2-DOT-MATRIX LED INTERFACE:
Lab Task:

1) Write a Code to Display your Name on Dot Matrix.

2) Write a Code to Display “JAZAN UNIV.”: