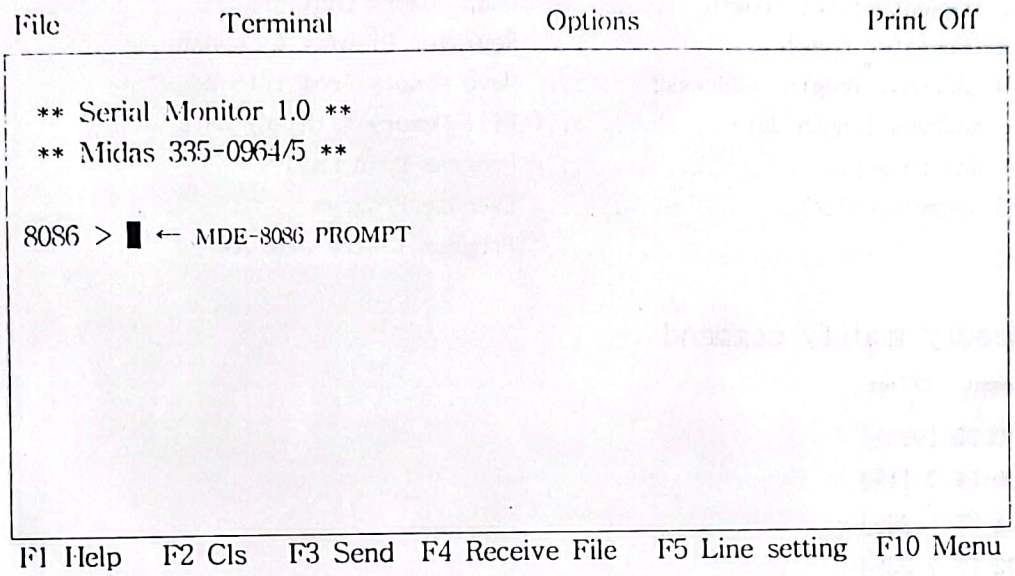
⑤ When on a power-up, following message will be displayed. This message is displayed only when on a power-up, and does not displayed when press RES key.



4-5. Operation serial monitor command

User can only use command which stored at serial monitor. Serial monitor can execute to command when user type command and then CR(**carriage return**) **key.**

⌘ If there is no any command at serial monitor, error message will be displayed with bell sound and serial monitor prompt will be displayed again.

```
** 8086 Monitor 1.0 **
** Midas 335-0964/5 **

8086 >↵ ← Carriage Return
```

```
8086 >?↵
        HELP     COMMAND
        E segment:offset.....................: Enter Data To Memory
        D segment:offset length..............: Dump Memory Contents
        R [register name]....................: Register Display & Change
        M address1, length, address2.........: Move Memory From 1 to 2
        F address, length, data..............: Fill Memory With Any Data
        L Return key.........................: Program Down Load
        G segment:offset.....................: Execute Program
        T....................................: Program 1 step execute
```

1 Memory modify command.

```
      Segment   Offset
         ↓        ↓
8086 >E 0000:1000↵
0000:1000 FF ? 11↵
0000:1001 FF ? 22↵
0000:1002 FF ? 33↵
0000:1003 FF ? 44↵
0000:1004 FF ? 55↵
0000:1005 FF ? /↵  ← (Offset decrement)
0000:1004 55 ? /↵
0000:1003 44 ? .↵   ← (Escaping command)
```

2 Memory display command.

```
      Segment   Offset
         ↓        ↓
8086 >D 0000:1000↵
0000:1000 11 22 33 44 55 FF FF FF - FF FF FF FF FF FF FF FF    ."3DU.........
0000:1010 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1020 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1030 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1040 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1050 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1060 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
0000:1070 FF FF FF FF FF FF FF FF - FF FF FF FF FF FF FF FF    ................
8086 >                                  Display the ASCII code to data
```

3 Memory fill command.

```
     Segment  Length Data
        ↓      ↓     ↓
8086 >F 1000 FF 1234↵
```

☞ Verifying ?

```
8086 >D 0000:1000↵
0000:1000 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1010 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1020 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1030 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1040 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1050 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1060 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1070 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4

8086 >D↵
0000:1080 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:1090 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10A0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10B0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10C0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10D0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10E0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:10F0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
```

4 Block move command.

The M command is used to move blocks of memory from one area to another.

```
     Segment  Length Data
        ↓      ↓     ↓
8086 >M 1000 100 2000↵
```

☞ Resulting ?

```
8086 >D 2000↵
0000:2000 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2010 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
```

```
0000:2020 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2030 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2040 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2050 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2060 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2070 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4

8086 >D↵
0000:2080 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:2090 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20A0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20B0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20C0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20D0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20E0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
0000:20F0 12 34 12 34 12 34 12 34 - 12 34 12 34 12 34 12 34    .4.4.4.4.4.4.4.4
```

5 Display Registers command.

The R command is used to display the i8086 processor registers.

```
8086 >R↵
        AX=0000  BX=0000  CX=0000  DX=0000
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=1000  FL=0000  = . . . . . .
```

☞ Individual register change

```
8086 >R AX↵
AX=0000  1234↵
BX=0000  4567↵
CX=0000  7788↵
DX=0000  1111↵
SP=0540↵
```

```
8086 >T↵
        AX=1234  BX=4567  CX=7788  DX=1111
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=1003  FL=0100  = . . . t . . . . .
          ↓
       Next address

8086 >T↵
        AX=1234  BX=5678  CX=7788  DX=1111
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=1006  FL=0100  = . . . t . . . . .

8086 >T↵
        AX=1234  BX=5678  CX=1000  DX=1111
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=1009  FL=0100  = . . . t . . . . .
          ↓
       Next address

8086 >T↵
        AX=1234  BX=5678  CX=1000  DX=2000
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=100C  FL=0100  = . . . t . . . . .
```

☞ Execute program command

```
      Segment  Offset
         ↓       ↓
8086 >G 0000:1000↵
Execute Address = 0000:1000
        °
        °
        °


8086 >
8086 >
```

☞ Resulting ?

```
8086 >R↵
        AX=1234  BX=4567  CX=7788  DX=1111
        SP=0540  BP=0000  SI=0000  DI=0000
        DS=0000  ES=0000  SS=0000  CS=0000
        IP=1000  FL=0000  = . . . . . .
```

```
8086 >R IP↵
IP=1000↵
8086 >
```

6 Program Down load & program execute command.

The L command moves object data in hexa format from an external devices to memory

```
8086 >L↵
   Down load start !!   ← ( Note : See section 4. Serial monitor experiment)

:14100000B83412BB7856B90010BA00208BF08BF5BD0030BC08
:0910140000408EDA8ED18EC0CCB2
:00
   OK Completed !!

8086 >
```

☞ Set IP

```
8086 >R IP↵
IP=1000↵
```

☞ Executes instructions, one at a time, beginning at the location pointed to by the program counter. After execution of each instruction, the processor registers are displayed.

The function of ICs at Figure 1.

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

② ROM(Read Only Memory) : It has program to control user's key input, 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(Character)×2(Line)

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

⑥ SPEAKER : Able to test sound using with speaker and further more able to test synthesizer.

⑦ RS-232C : It is ready to do data 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 : Convert analog signal to digital signal using with ADC0804.

⑩ D/A CONVERTER : Convert digital signal to analog signal using with DAC0800 and it is interfaced so as to more Level meter.

⑪ STEPPING MOTOR INTERFACE : So as to control stepping motor driver circuit of stepping motor is interfaced.

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