

Control of Dot Matrix and 7-Segment MDA-8086 Kit – PPI Application

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Abstract

This experiment aims at understanding and testing the dot matrix structure, and the principle of display using the 82C55 Programmable Peripheral Interface devices.

The MDA 8086 subsystem will be used to control the display of patterns, digits, and characters. The display elements are:

- An 8x8 LEDs dot matrix
- A single 7-segment display

PART I Technical Introduction

1.1 Dot- Matrix LED Display

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

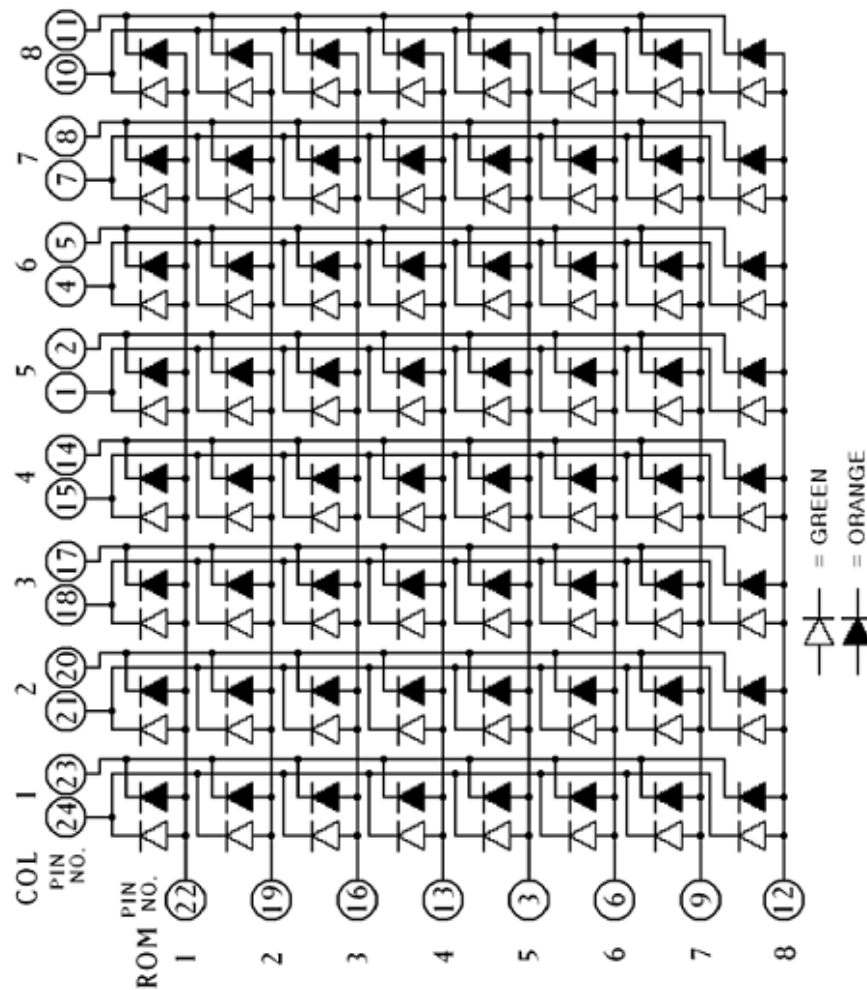


Figure 1 LED Matrix Connected to the PPI Ports

The dot matrix terminals are controlled using all three ports on an 82C55 peripheral programmable interface. Ports A and B are used to drive the cathode of the LEDs, while Port-C would drive the anodes terminals. Port-A drives the red LEDs while port-B drives the green LEDs. If the two LEDs with the same coordinates are enabled then the outcome will be an orange dot. Ports A and B select the rows while Port-C select the columns as shown below:

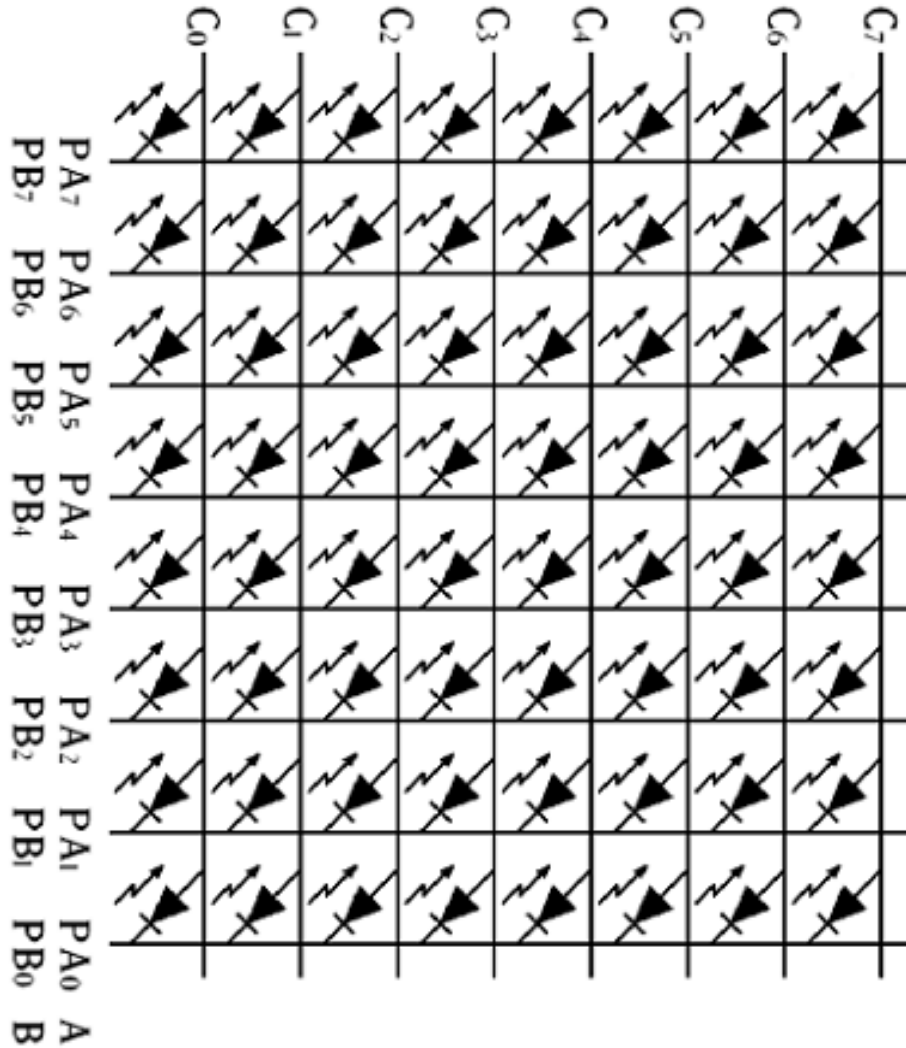


Figure 2 LED Matrix

PART II Pre-Lab

(This part should be handed on to the teaching assistant in your Lab)

Study the schematics shown below (Figure 3) for the interface between the 82C55 PPI and the LED Dot Matrix (DOT1). Answer the following questions based on the details mentioned in the Practical Introduction and the schematics, as well as your review of the 82C55 datasheet:

1. What are the modes of operation the 82C55 ports A, B, and C?
2. What happens if all the PPI ports receive a byte of 0xFF from CPU?
3. What happens if Port-A receives a byte of 0x00 while Port-C receives a byte of 0xFF?
4. Referring to the schematics below, how can you disable the 82C55 PPI by a simple hardware change? Note: P6 is a connector such that you can connect any two adjacent pins together using a jumper.
5. Referring to schematics, if address to port-A is 0x18, then what would that be for ports B, C and the control register of the 82C55?

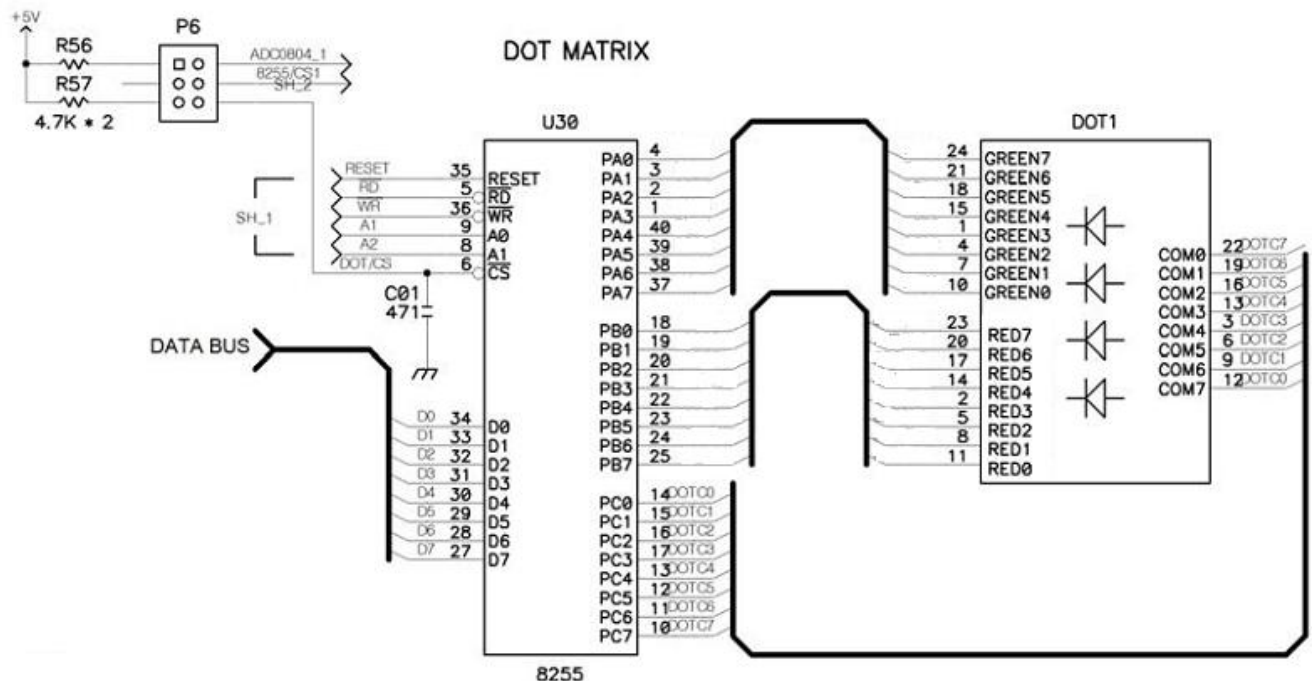


Figure 3 PPI Schematics

PART III Practices

3.1 PRACTIC I: LED MATRIX

The MDA 8086 kit has three 82C55 PPI controllers. The LED dot matrix is interfaced to the 82C55 device labeled U30 (i.e. Unit 30) as shown in the schematics (Figure 3). Look-up this unit on your kit and familiarize yourself with the hardware surrounding it.

WARNING: Do not touch any exposed wiring or the pins of any of the ICs.



The following example demos the ability to scroll from left to right a beam of 8 vertically emitting LEDs across the dot matrix display.



Step-1: configure the P6 connector using two jumper caps as shown in the diagram to the right.

P6

Step-2: Write the following assembly code and store it into the assigned work folder for your group. Give it the name MATRIX_1.ASM.

Step-3: Add missing code as instructed by the given tasks.

```
*****
;
;* MDA-8086 Dot-Matrix EXPERIMENT *
;* *
;* "Scrolling a vertical line of 8-lit LEDs" *
*****
;
; FILENAME : MATRIX_1.ASM
; PROCESSOR : I8086

CODE SEGMENT
    ASSUME     CS:CODE,DS:CODE,ES:CODE,SS:CODE
;
; Task-1: write the address values you have calculated in the pre-lab
; section for PPI ports B,C, & Control Reg.
;
PPIC_C EQU    ; control register
PPIC     EQU
PPIB     EQU
PPIA     EQU    18H
;
    ORG     1000H
    MOV    AL,          ; Task-2: write the value of the control word
    OUT   PPIC_C,AL
;
```

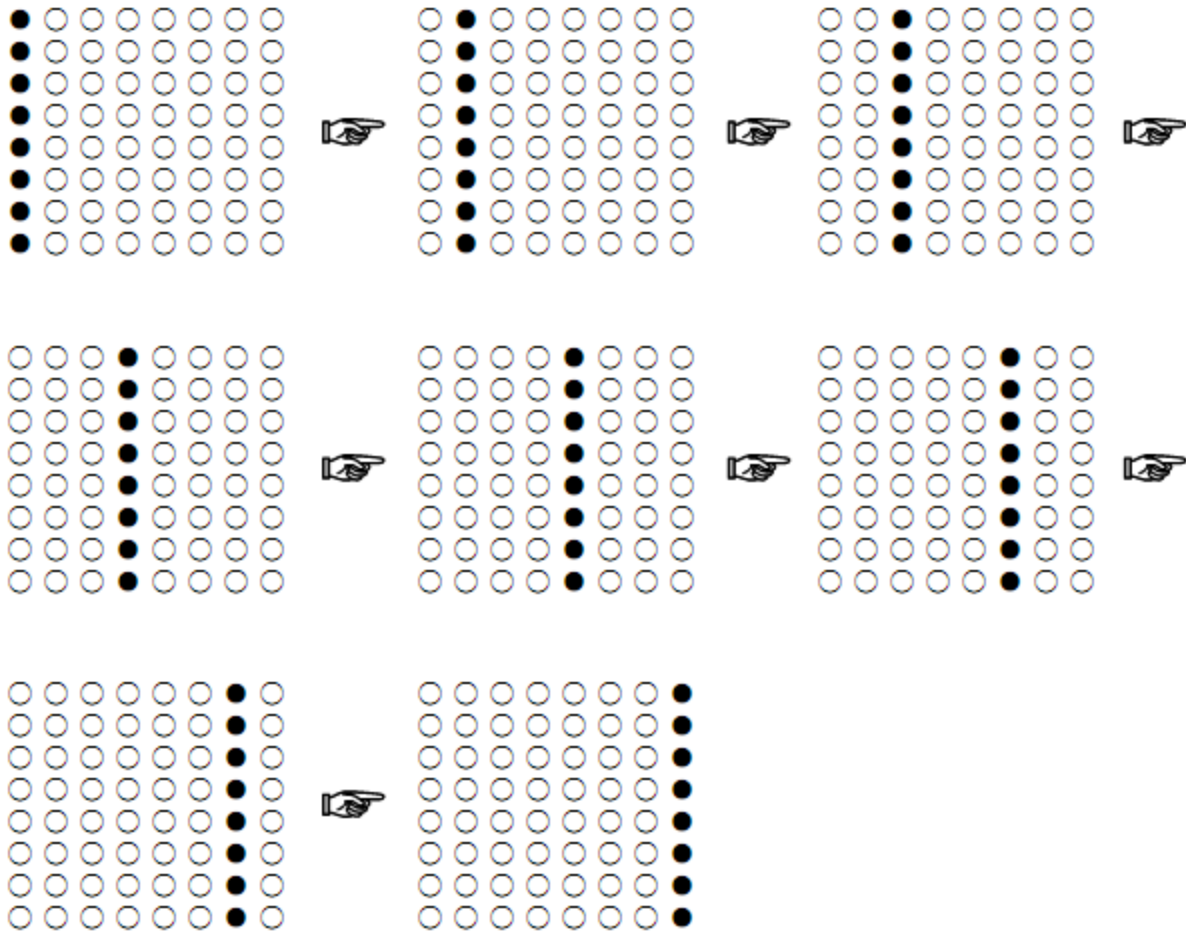



Figure 4 The Result of executing the first example

You may press the RESET key of the MDA-8086 kit to stop the program.

TO DO1: Repeat the previous exercise so that a beam of 8-lit LEDs would scroll from top to bottom of the dot matrix (i.e. moving a row down).

TO DO 2: The LED dot matrix can also be used to display any characters. Use the LED dot matrix to display an upper case letter A. Use the following set of 8x8 DATA to enable/disable particular dots:

DATA: DB 11111111B ; the left most column. All dots are off
 DB 11000000B ; the next column with the top 2 dots being off
 DB 10110111B
 DB 01110111B
 DB 01110111B
 DB 10110111B
 DB 11000000B
 DB 11111111B ; the right most column

3.2 PRACTIC II: SEVEN-SEGMENT DISPLAY

The display consists of seven active low segments (A, B, C, D, E, F, G) and an active low decimal point (P).

The segments and P are driven by the 82C55 Port-A signals as follow:

Segment	82C55 Port-A
A	PA0
B	PA1
C	PA2
D	PA3
E	PA4
F	PA5
G	PA6
P	PA7

The following schematic (Figure 5) shows the interface circuitry between the 82C55 and the 7-segment display. The interconnection is done by connecting pins 2-9 of P3 connector to pins 2-9 of P4 connector.

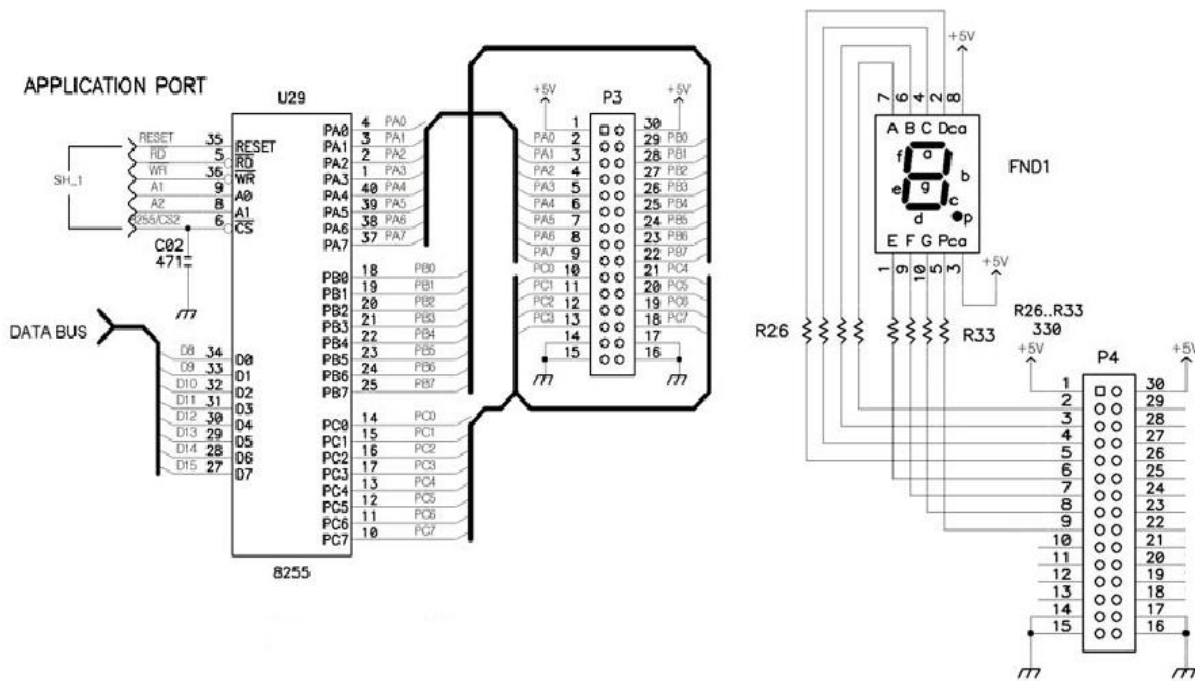


Figure 5 PPI with Seven Segment Display Schematics

TO DO3: Write an assembly code that will count from 0 to 9 and wraps back to 0. Use the 7-segment display to demo your code. It should look something like (Figure 6):

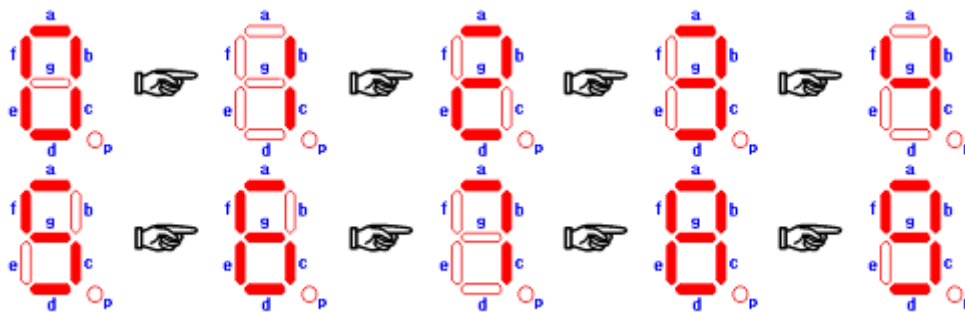


Figure 6 Output of TODO 3

Hint: use the following partial set of data to turn on/off certain segments for every displayed digit:

```
DATA: DB 11000000B ; "P G F E D C B A" values for number 0
      DB 11111001B
      DB 10100100B
      DB 10110000B
      DB 10011001B
      DB 10010010B
      DB 10000010B
      DB 11111000B
      DB 10000000B
      DB 10010000B
      DB 00H
```

Bibliography

Tech., MEDAS. 2008. *MDA 8086 Kit User Manual*. Korea : s.n., 2008.