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GENERAL DESCRIPTION

FEPST3 is a simple kit designed particularly for students , beginners and recent graduated engineers to allow them to esily work with many ATMEL microcontroller chips, in addition to test and debug firmwares.

FEPST3 supports many ATMEL microcontroller chips, such as ATMEL89S51, ATMEL89S52, ATMEL89S8252 and more. It offers all microcontroller I/O pins to external connectors for direct port accessing , while provides the most common primary devices and circuits , such as 2 X 16 LCD, Multiplexed 7SEG, Matrix KEYPAD, and RS232 serial interface. Thus, it saves most of the wasted time and efforts in hardware design and test, hence , the user can concentrate his efforts in software development. the most important development in this kit is the ICSP circuit included. This circuit make the programming of chip is so easy. Because you don't need to plug the chip out during programming. only press one switch to change between program and run mode.

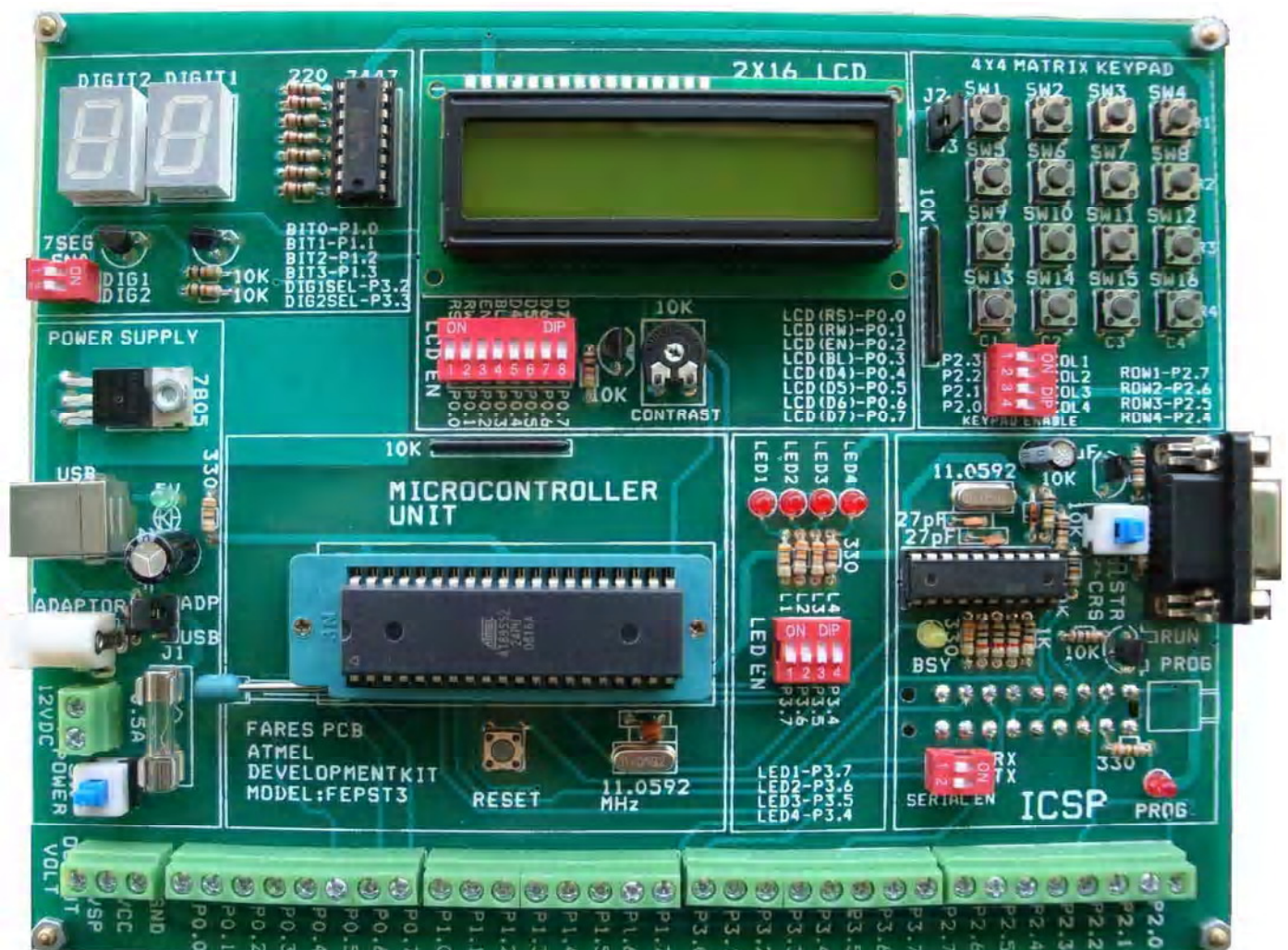**Figure 1. FEPST3 kit real PCB view**
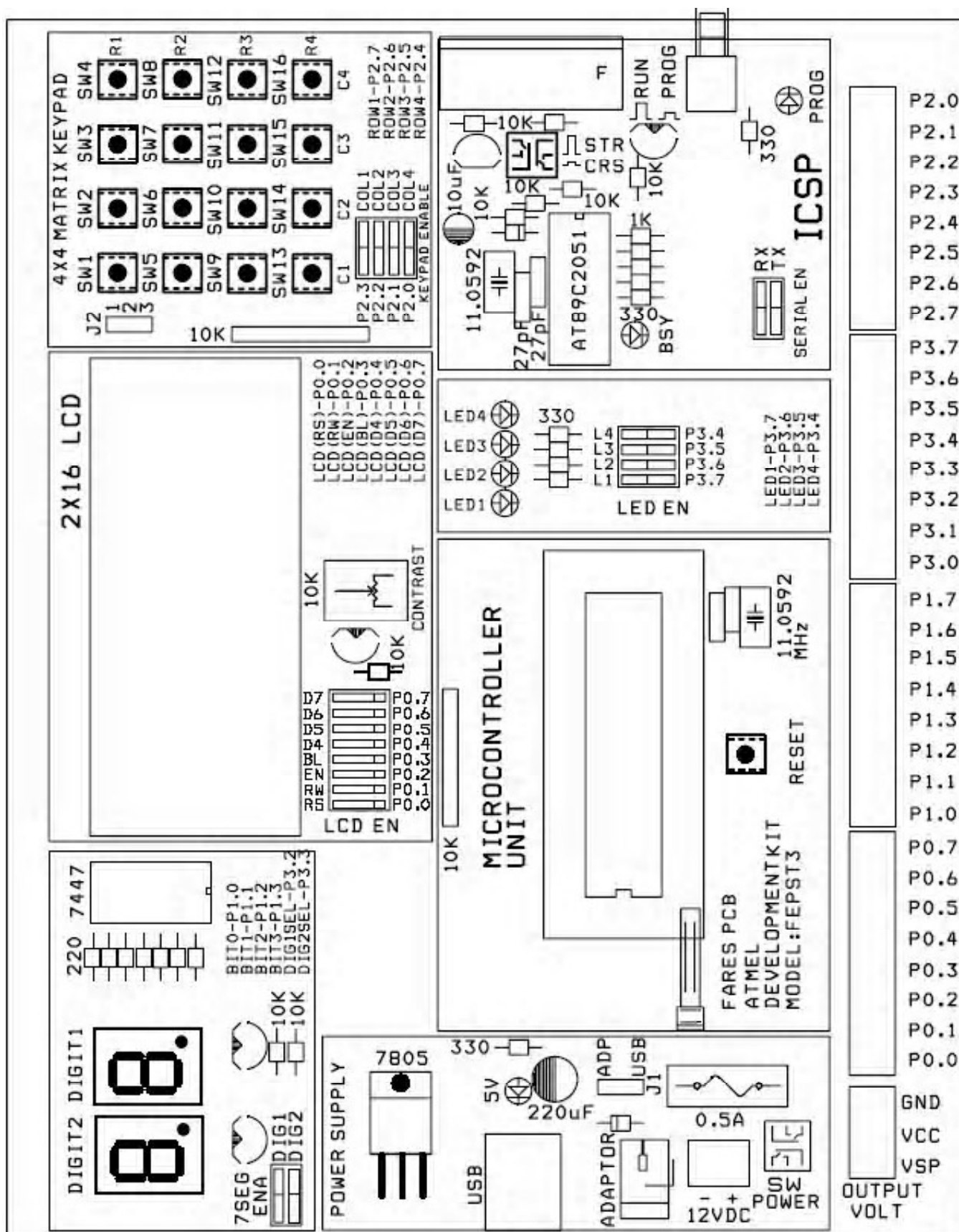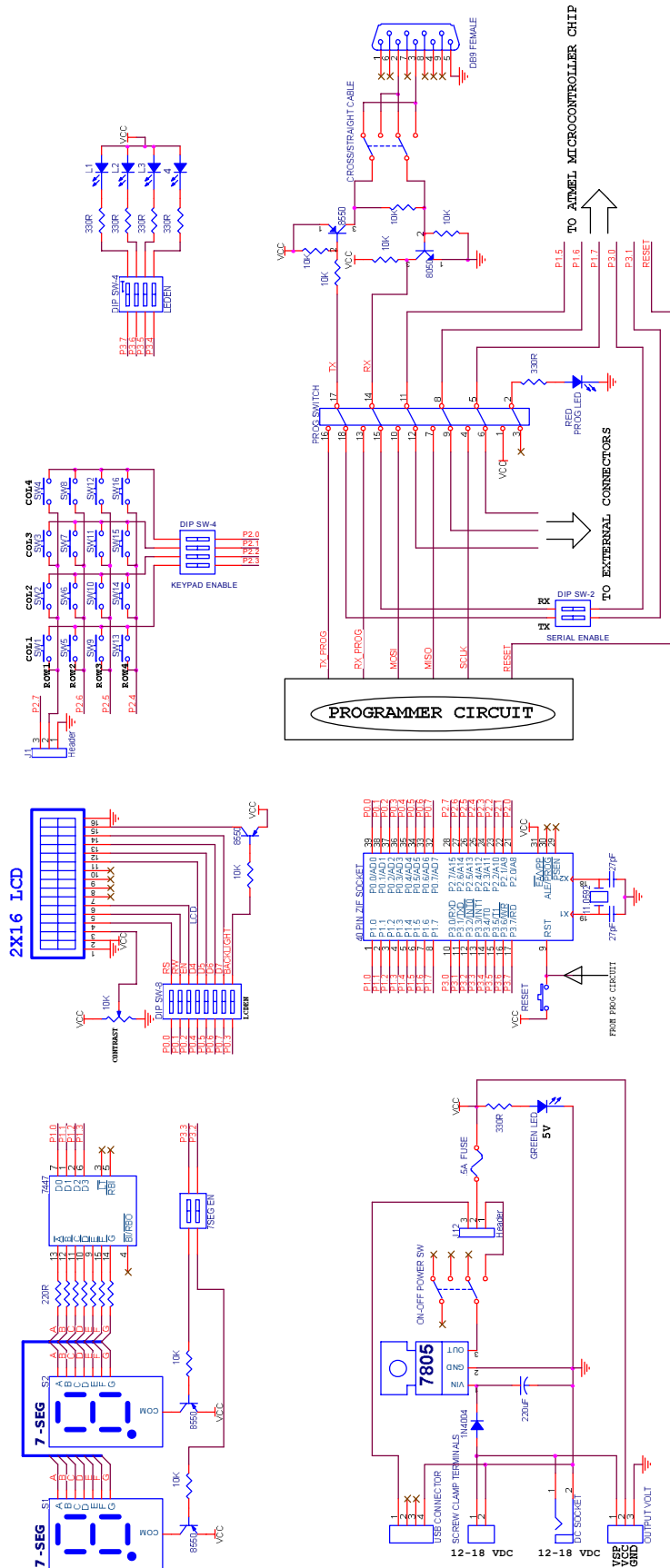
Figure 2. FEPST3 kit layout view

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Figure 3. FEPST3 kit schematic view

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FEPST3 KEY FEATURES

1) POWER SUPPLY UNIT.
2) MICROCONTROLLER UNIT.
3) 4X4 MATRIX KEYPAD UNIT.
4) FOUR LEDs DISPLAY UNIT.
5) TWO MULTIPLEXED 7SEG DISPLAY UNIT.
6) 2X16 LCD DISPLAY UNIT.
7) ICSP AND SERIAL UNIT.

POWER SUPPLY UNIT

The power may be supplied from
1- Any DC walwart power supply adaptor via DC power socket (12V - 18V).
2- Any other source of power (12V – 18V) via screw clamp terminals.
3- Any PC via USB connecting cable.

The jumper labeled J1 is set to select the power supply source. It has two ways, one for USB Of any PC labeled (USB) , and the other for adaptor source or via screw clamp terminals labeled (ADP).

The power supply unit contains
- Power supply on-off switch.
- LED for power indication.
- 7805 (5V regulator IC with 5% tollerance).
- .5A Fuse for over current protection.

Note 1: FEPST3 kit is protected against reversed polarity of power.
2:The input voltage and the 5V regulated output voltage are redirected to external connector labled (output volt) for external using.

Figure 4. Power supply unit real PCB view

Figure 5. Power supply unit layout view
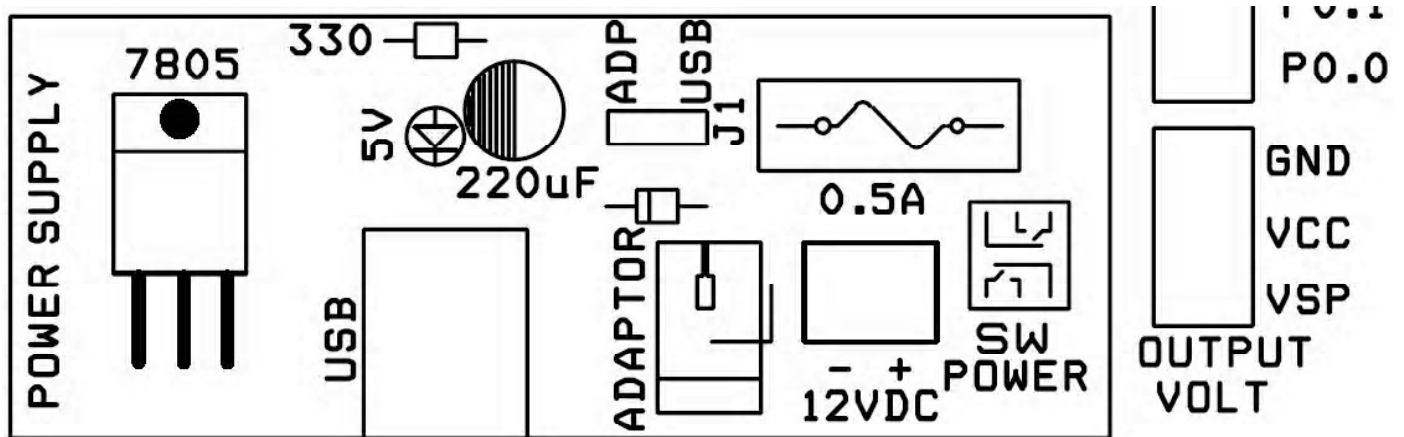
Figure 6. Power supply unit schematic view

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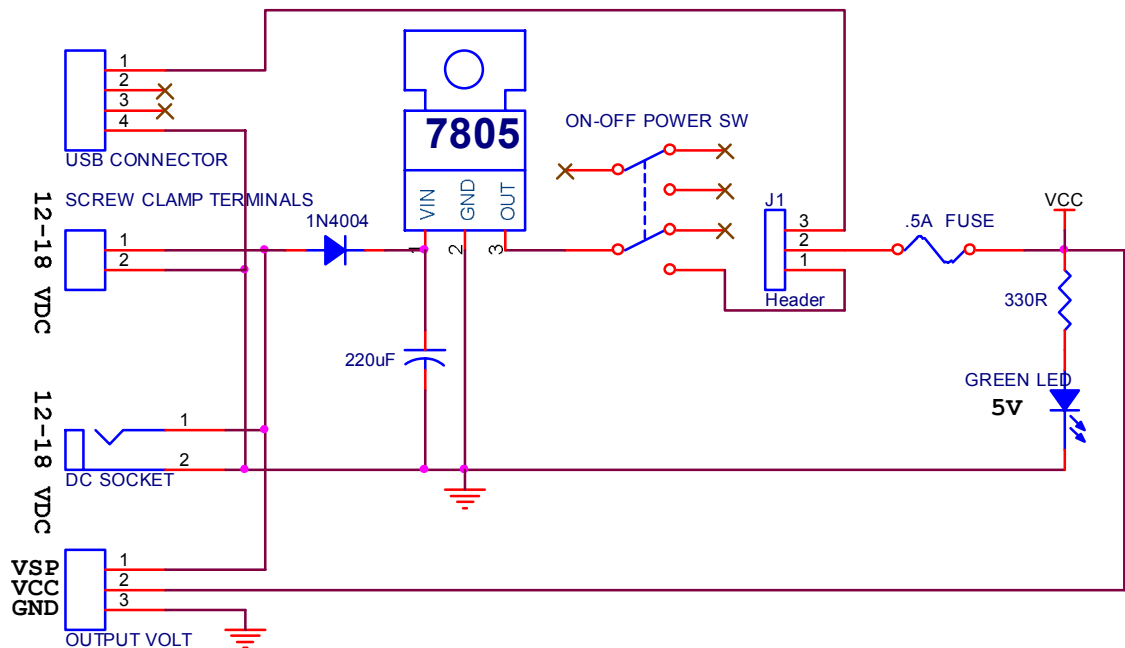
MICROCONTROLLER UNIT

- 40 pin DIP socket for microcontroller chip. Table 1 shows the supported microcontroller chips.
- 11.0592 MHz crystal oscillator.
- Power on reset circuit include reset switch.

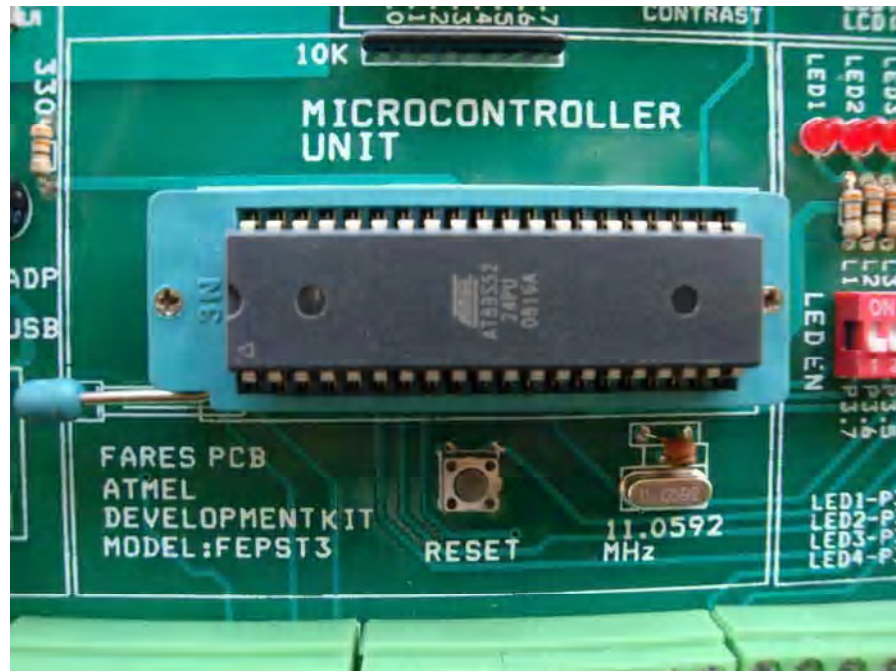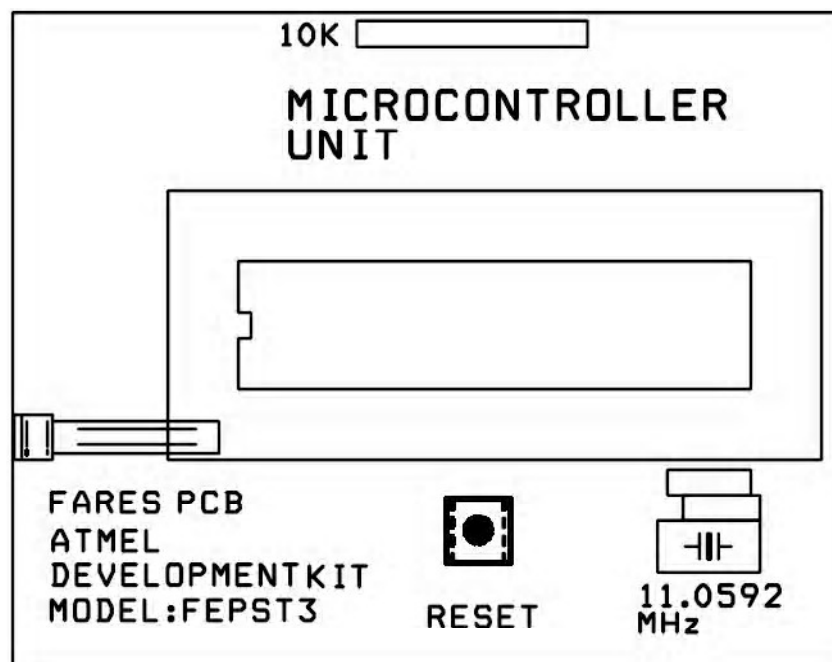**Figure 7. Microcontroller unit real PCB view**

Figure 8. Microcontroller unit layout view

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Figure 9. Microcontroller unit schematic view

40 PIN ZIF SOCKET

P1.0	1	P1.0	P0.0/AD0	39 P0.0
P1.1	2	P1.1	P0.1/AD1	38 P0.1
P1.2	3	P1.2	P0.2/AD2	37 P0.2
P1.3	4	P1.3	P0.3/AD3	36 P0.3
P1.4	5	P1.4	P0.4/AD4	35 P0.4
P1.5	6	P1.5	P0.5/AD5	34 P0.5
P1.6	7	P1.6	P0.6/AD6	33 P0.6
P1.7	8	P1.7	P0.7/AD7	32 P0.7

P3.0 10 P3.0/RXD   P2.7/A15 28 P2.7
P3.1 11 P3.1/TXD   P2.6/A14 27 P2.6
P3.2 12 P3.2/INT0 P2.5/A13 26 P2.5
P3.3 13 P3.3/INT1 P2.4/A12 25 P2.4
P3.4 14 P3.4/T0   P2.3/A11 24 P2.3
P3.5 15 P3.5/T1   P2.2/A10 23 P2.2
P3.6 16 P3.6/WR   P2.1/A9 22 P2.1
P3.7 17 P3.7/RD   P2.0/A8 21 P2.0

VCC
RESET

9 RST

EA/VPP 31 VCC
ALE/PROG 30
PSEN 29

FROM PROG CIRCUIT

X1 19   11.0592   X2 18
27pF   27pF

Table 1. List of chips supported by FEPST3

Chip number
AT89S51
AT89S52
AT89S53
AT89S8252
AT89S8253

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4X4 MATRIX KEYPAD UNIT

FEPST3 KIT includes 16 input switches attached to port D configured as 4 rows intersected by four columns. each intersection creates switch position.
The four row lines are connected to high nipple of port D as shown.
Port P2.7 ------ ROW1
Port P2.6------ ROW2
Port P2.5------ ROW3
Port P2.4------ ROW4
The four column lines are connected to low nipple of port D as shown.
Port P2.3------ COL1
Port P2.2------ COL2
Port P2.1------ COL3
Port P2.0------ COL4

		COLUMN			
		COL1	COL2	COL3	COL4
		P2.3	P2.2	P2.1	P2.0
ROW1	P2.7	SW1	SW2	SW3	SW4
ROW2	P2.6	SW5	SW6	SW7	SW8
ROW3	P2.5	SW9	SW10	SW11	SW12
ROW4	P2.4	SW13	SW14	SW15	SW16

✓ Each column can be enabled/disabled individually via "KEYPAD ENABLE" DIP switch. If you don't intend to use the keypad absolutely, you must disable all columns.
✓ You may use the first row i.e. (SW1,SW2,SW3,SW4) as a direct input switches (not in matrix mode) by setting jumper J2 to (1-2). Otherwise set it to (2-3).
Note: Port D is pulled up by a 10KΩ resistor. i.e. (microcontroller read high if no switch is pressed).

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Table 2. This table indicates the setting of jumper J2 and DIP switch to configure keypad.

DIP switch setting	J2(1-2) Direct	J2(2-3) Matrix
P2.3	SW1 enabled (P2.3)	P2.7,P2.3 ----> SW1 P2.6,P2.3 ----> SW5 P2.5,P2.3 ----> SW9 P2.4,P2.3 ----> SW13
P2.2	SW2 enabled (P2.2)	P2.7,P2.2 ----> SW2 P2.6,P2.2 ----> SW6 P2.5,P2.2 ----> SW10 P2.4,P2.2 ----> SW14
P2.1	SW3 enabled (P2.1)	P2.7,P2.1 ----> SW3 P2.6,P2.1 ----> SW7 P2.5,P2.1 ----> SW11 P2.4,P2.1 ----> SW15
P2.0	SW4 enabled (P2.0)	P2.7,P2.0 ----> SW4 P2.6,P2.0 ----> SW8 P2.5,P2.0 ----> SW12 P2.4,P2.0 ----> SW16

Figure 10. 4X4 matrix keypad unit real PCB view

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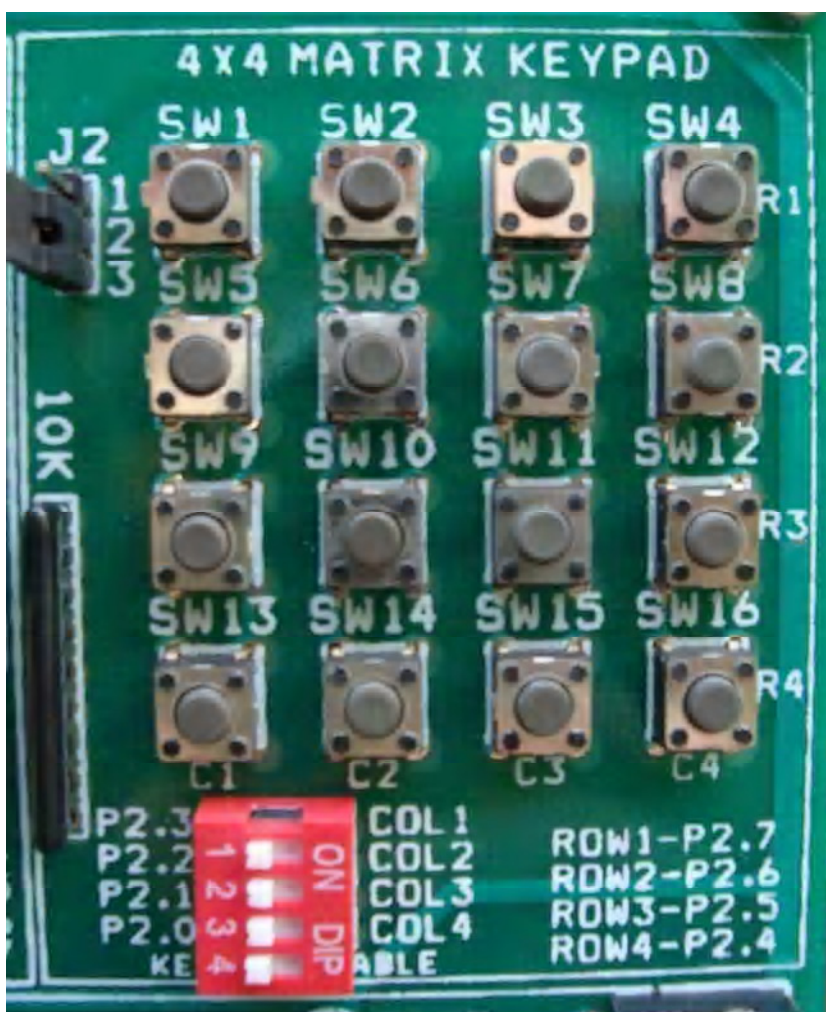
Figure 11. 4X4 matrix keypad unit layout view
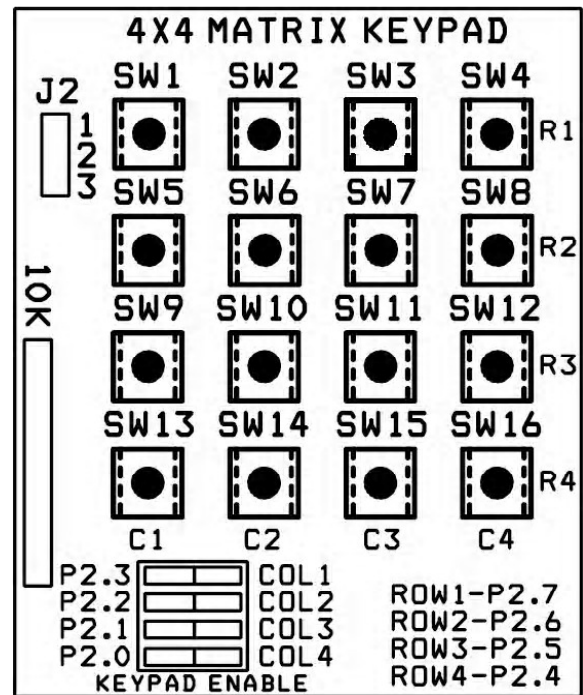
Figure 12. 4X4 matrix keypad unit schematic view

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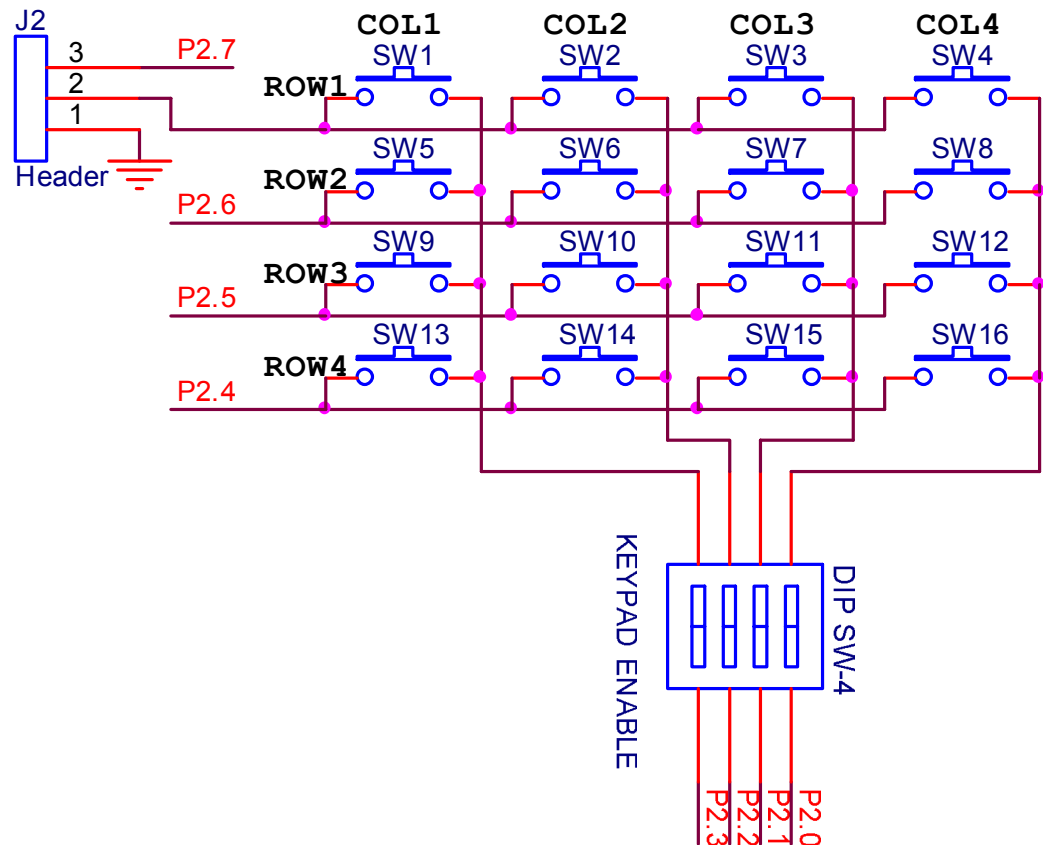
FOUR LEDs DISPLAY UNITS

Four red LEDs with 330Ω current limiting resistors are connected to port pins P3.7, P3.6, P3.5 and P3.4. Each LED can be individually enabled or disabled via LEDEN DIP switch. LEDs are active low. i.e. output low turn LED on and output high turn it off.
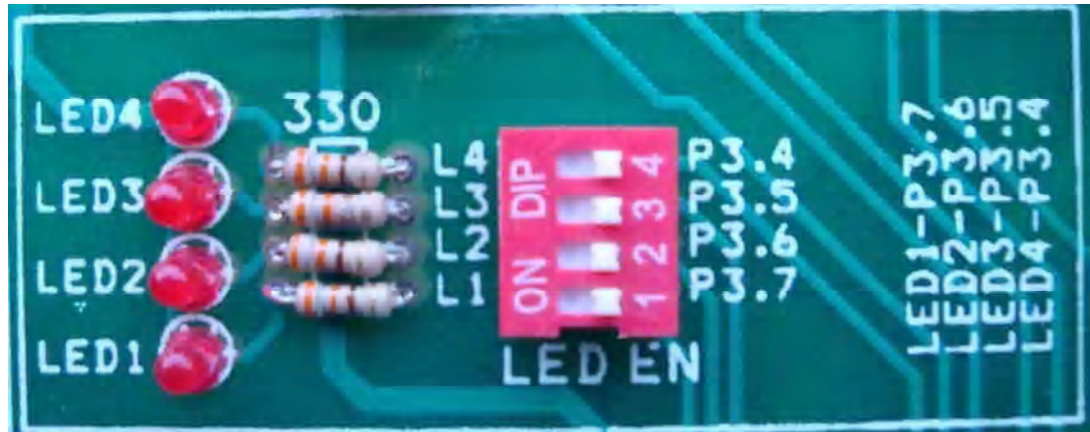
Figure 13. Four LEDs display unit real PCB view.

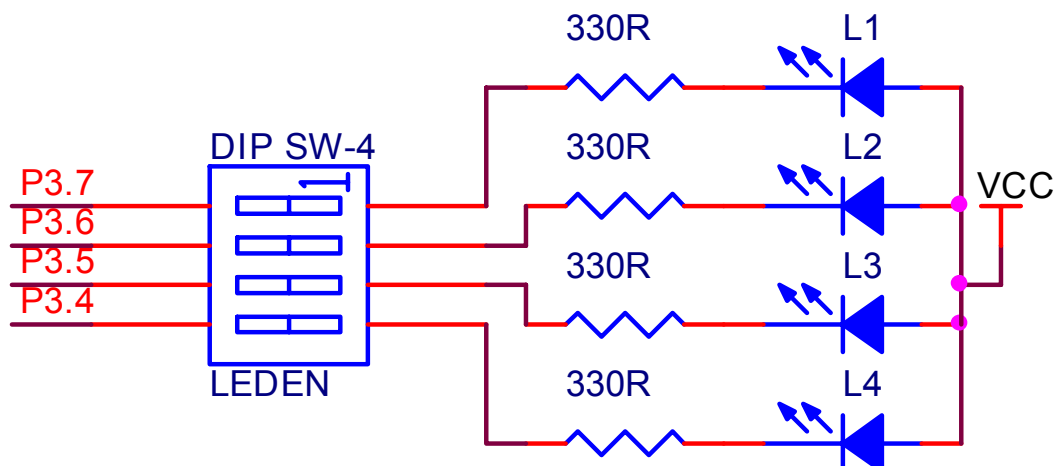**Figure 14. Four LEDs display unit layout view.**
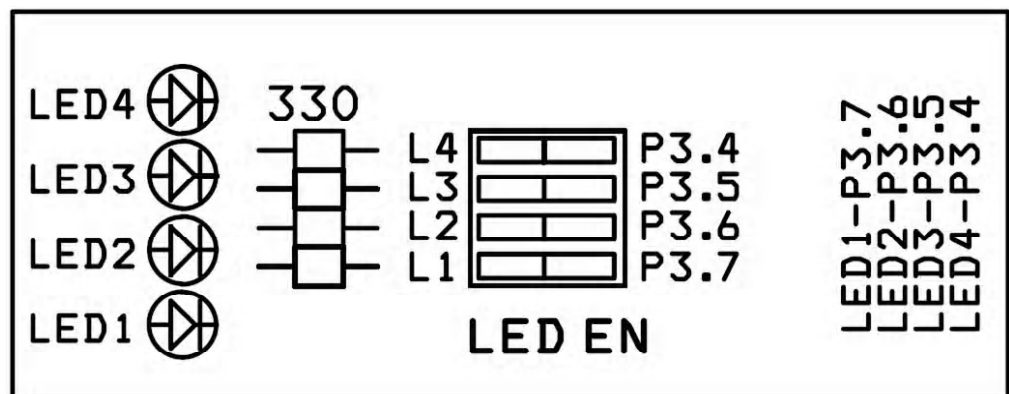
Figure 15. Four LEDs display unit schematic view.

TWO MULTIPLEXED 7SEG DISPLAY UNITS

Two multiplexed 7seg digit with BCD decoder (7447). The decoder inputs are connected to microcontroller pins P1.0, P1.1, P1.2, and P1.3. Each 7seg digit can be enabled or disabled individually using 7-SEG ENA DIP switch. Note that enable signal is active low i.e. a low output enables the required 7SEG.

Table 2. The following table shows the required decoder input to display the numbers from 0 to 9.

Digit	Decoder inputs			
	P1.3	P1.2	P1.1	P1.0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

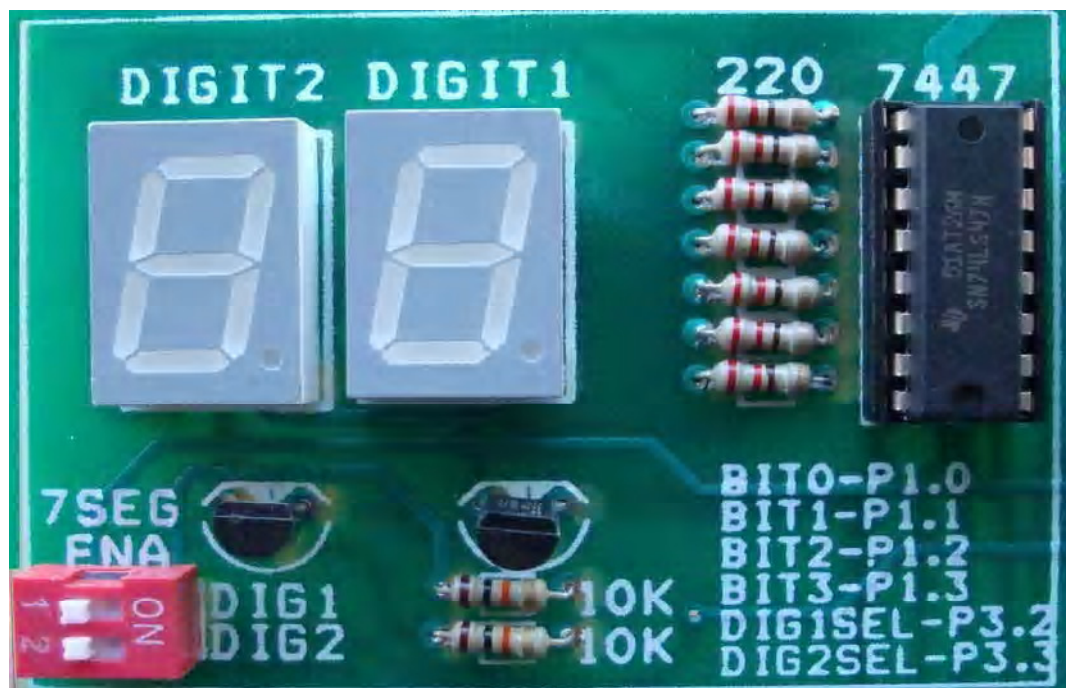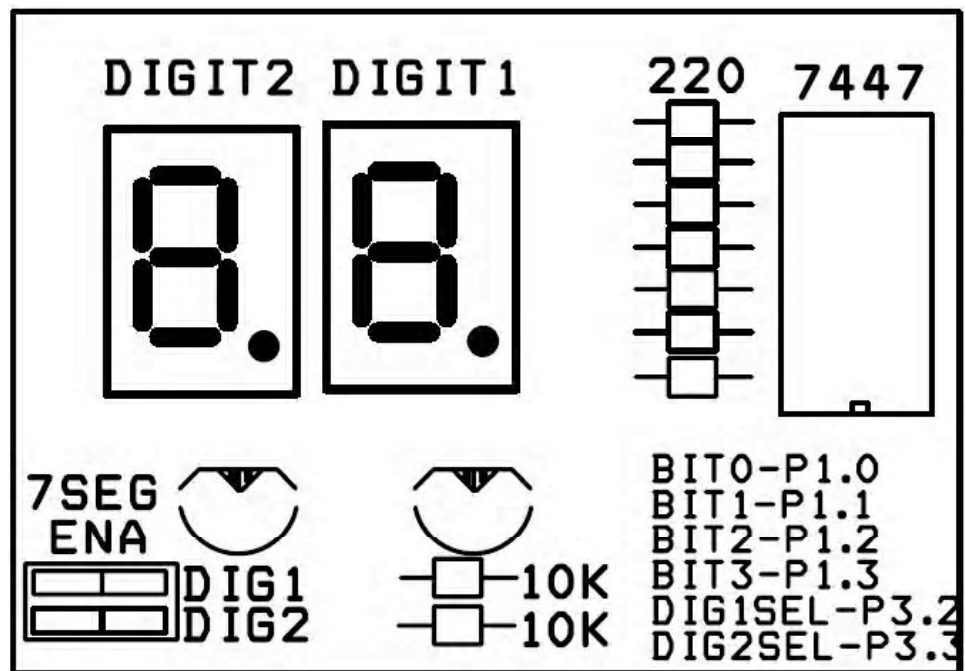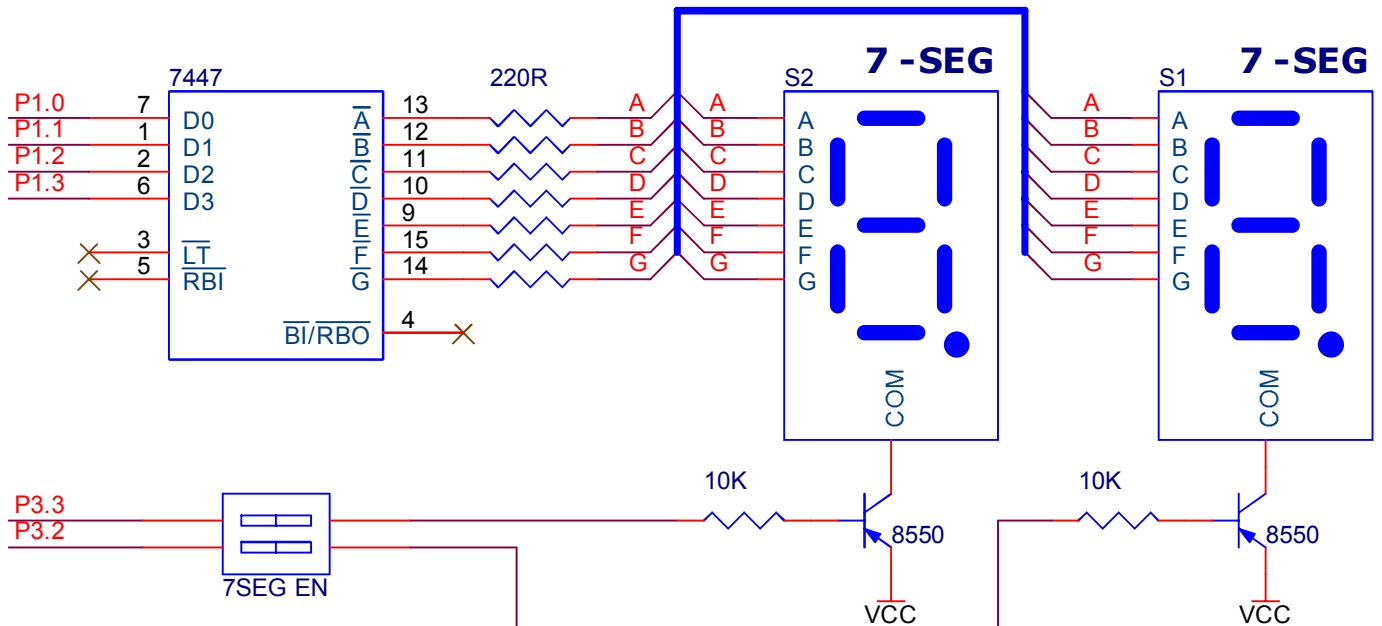**Figure 16. Two multiplexed 7SEG unit real PCB view.**

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Figure 17. Two multiplexed 7SEG unit layout view.

Figure 18. Two multiplexed 7SEG unit schematic view.

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2X16 LCD DISPLAY UNIT

2X16 alphabetic LCD with backlight and contrast control configured in 4bit mode is connected to port P0 as follows,

PORTP0.7 is connected to D7 of LCD
PORTP0.6 is connected to D6 of LCD
PORTP0.5 is connected to D5 of LCD
PORTP0.4 is connected to D4 of LCD
PORTP0.3 is connected to backlight control. output low on this pin turn backlight on.
PORTP0.2 is connected to EN of LCD
PORTP0.1 is connected to R/W of LCD
PORTP0.0 is connected to RS of LCD

- A 10KΩ variable resistor labeled "CONT" is added to control the LCD contrast.
- Set "LCDEN" DIP switch to enable or disable LCD module.
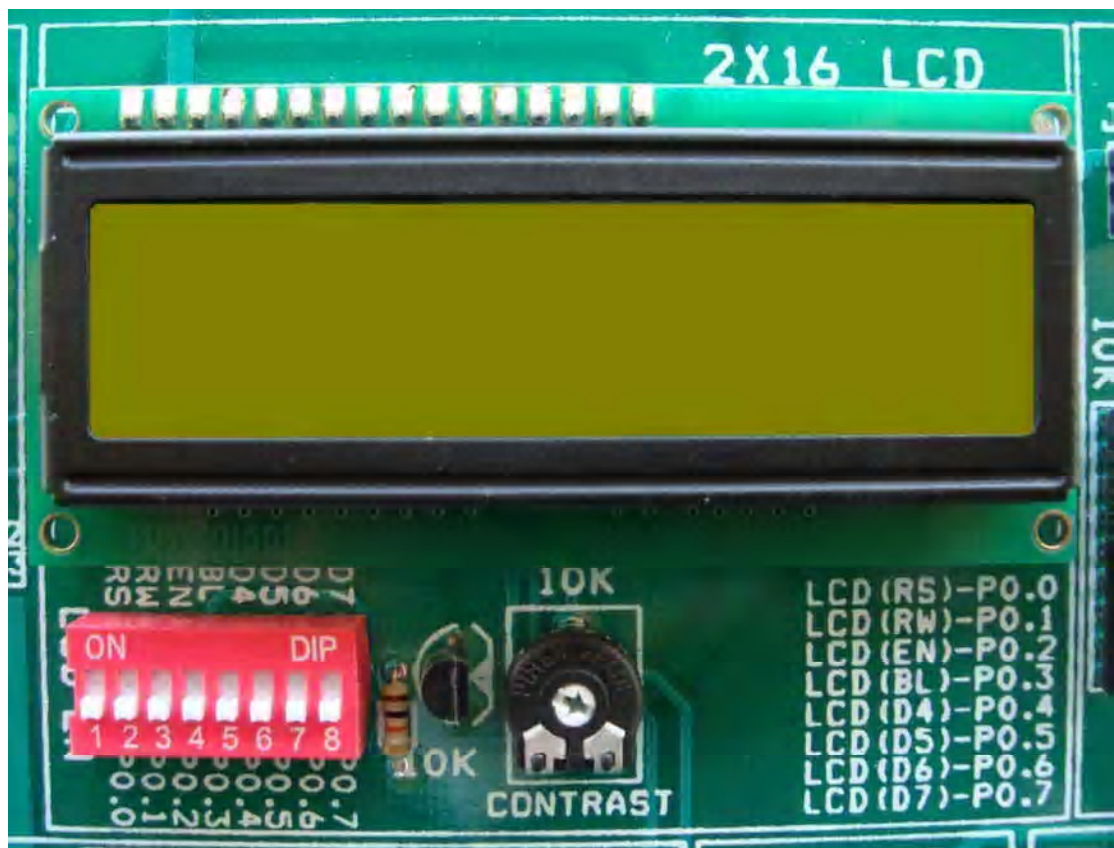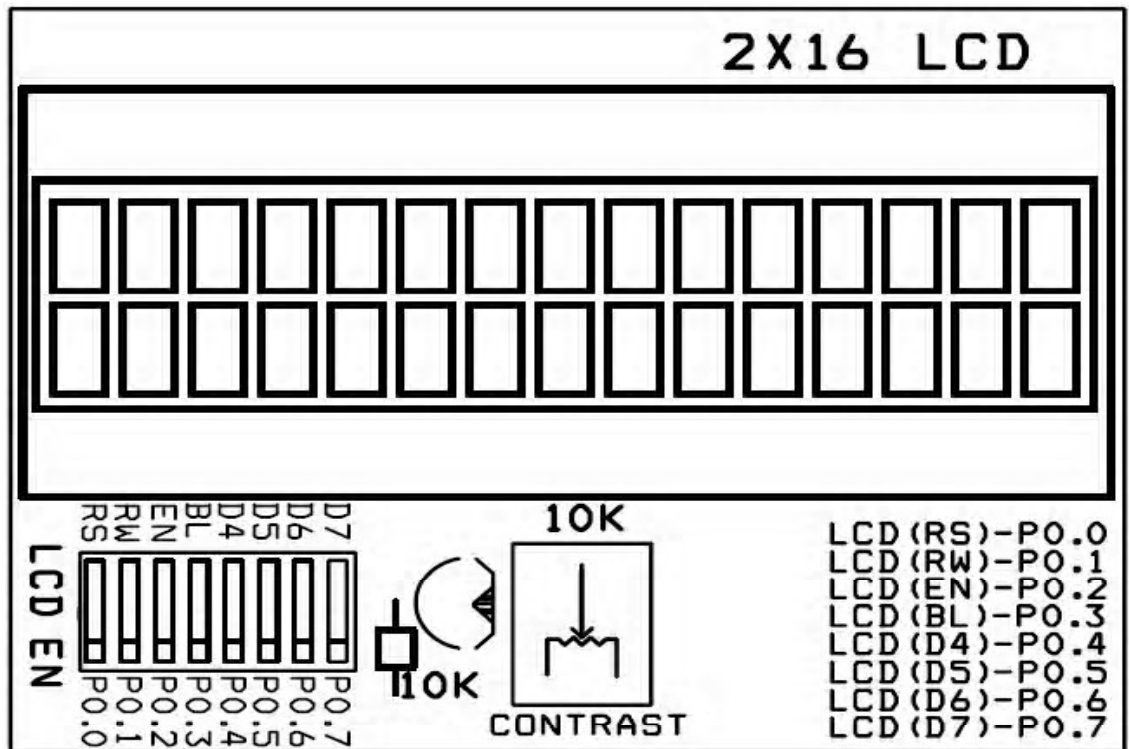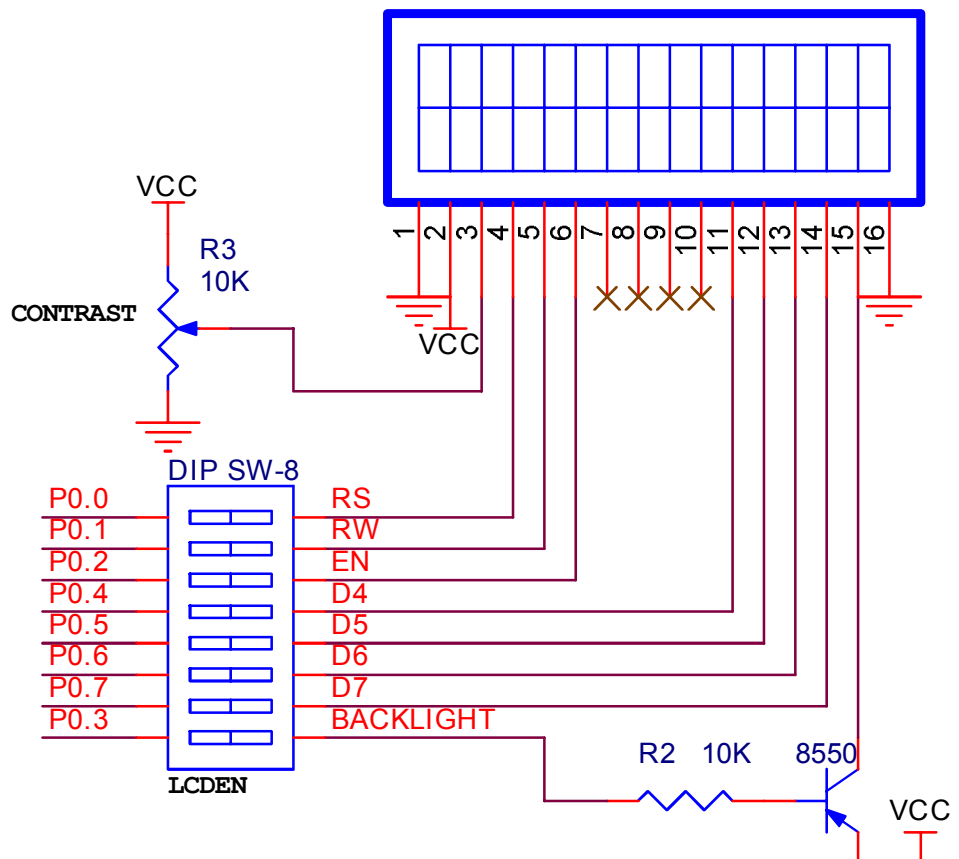
Figure 19. 2X16 LCD display unit real PCB view.

Figure 20. 2X16 LCD display unit layout view.

Figure 21. 2X16 LCD display unit schematic view.

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ICSP AND SERIAL UNIT

Serial unit include RS232-TTL logic converter using two small signal transistors. And provides DB9F socket for PC serial communication. Serial interface circuit can be enabled or disabled using DIP switch labeled Rx , Tx . If this unit is enabled, you can't use the two port pins P3.0, P3.1 from external connectors. Cross or straight cable can be used by switch setting .
To switch between run mode and programming mode use PROG switch. Press the switch to enter in programming mode (PROG) and release it to switch to run mode (RUN).the green LED labeled PROG is an indicator for programming mode.

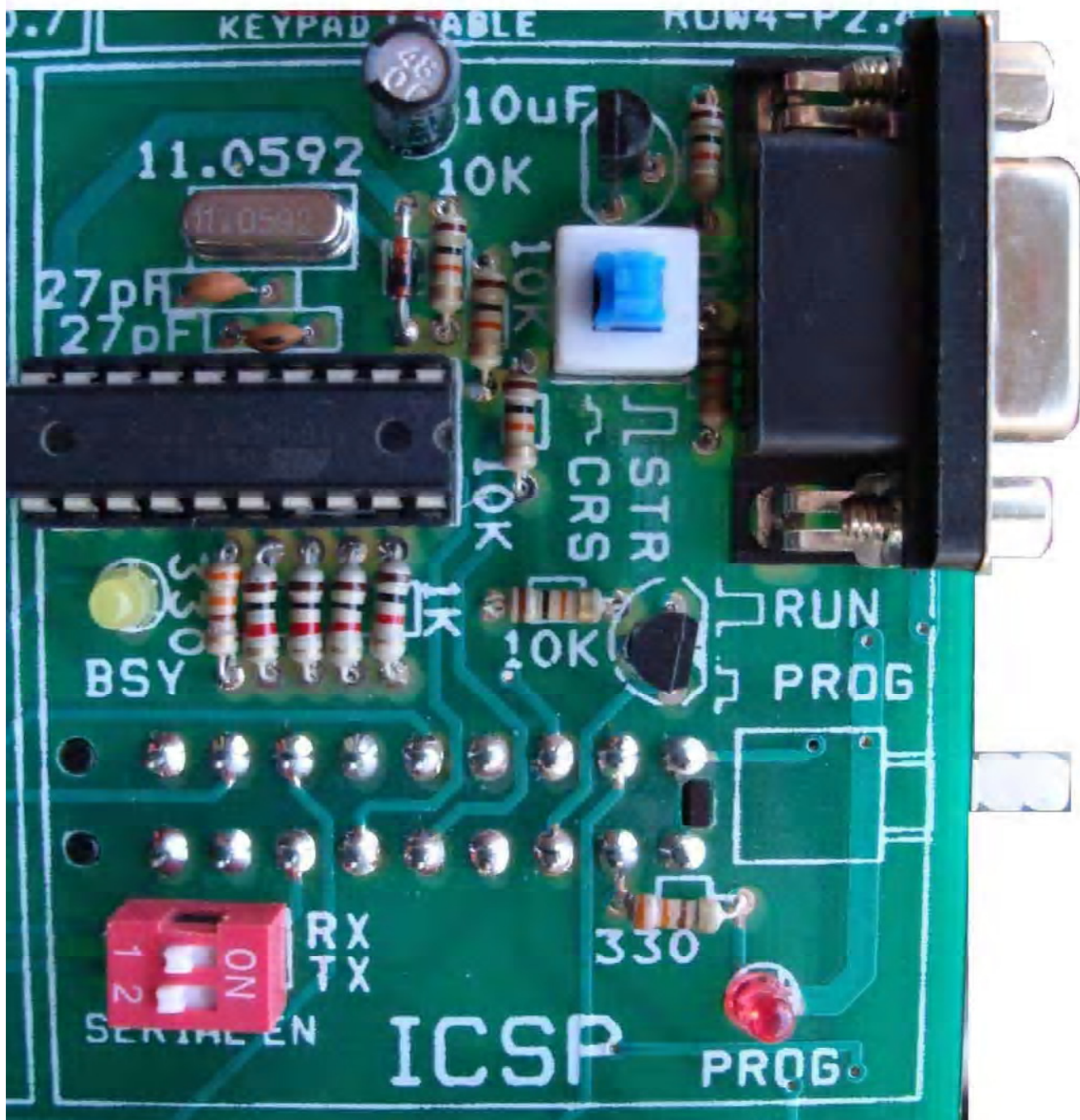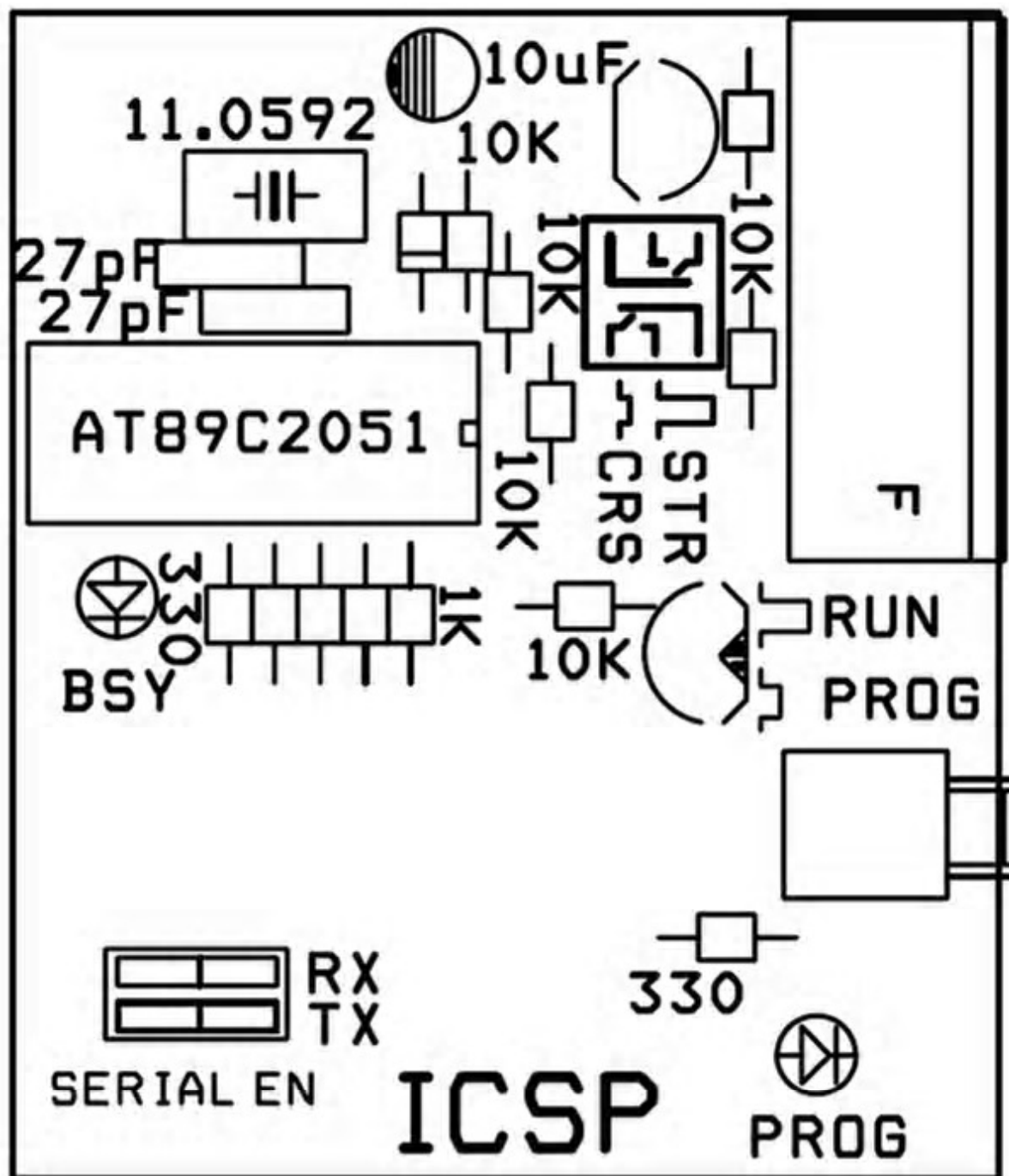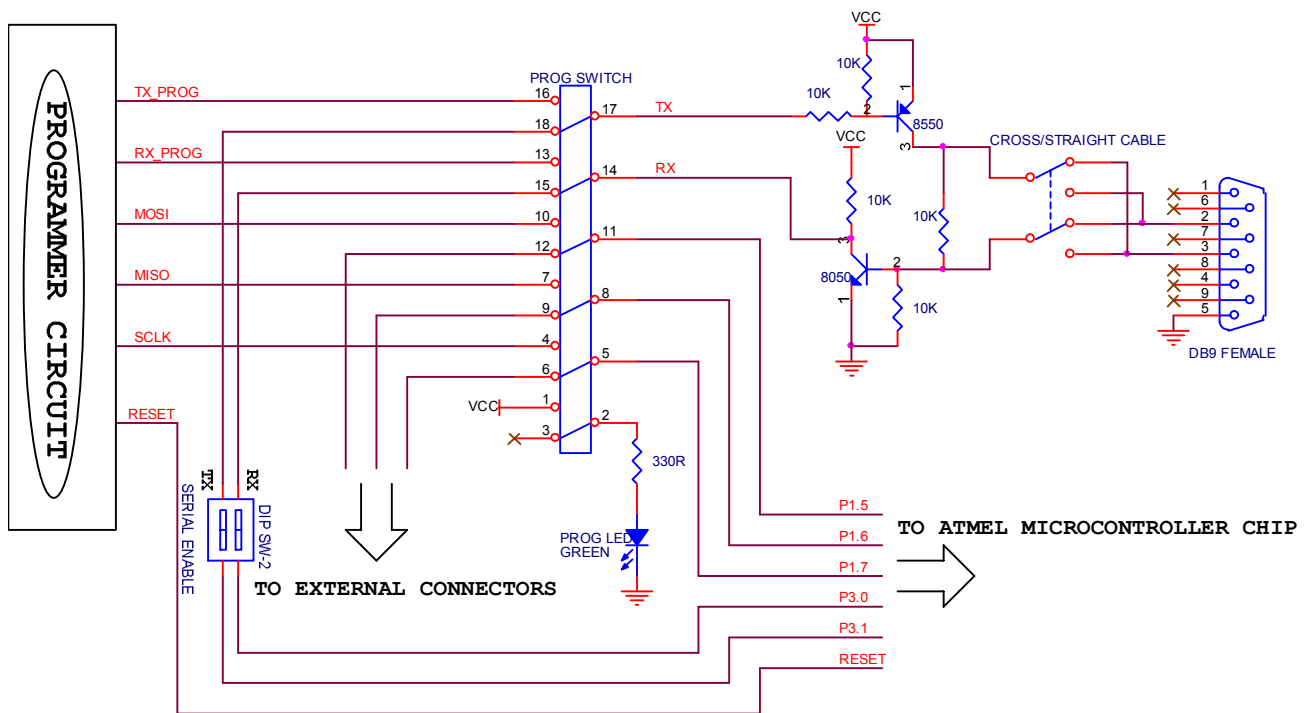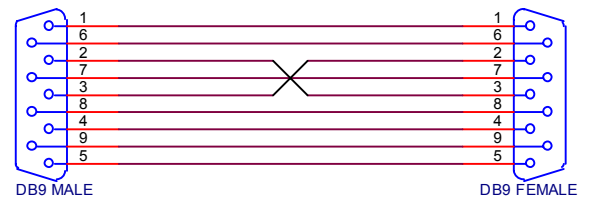**Figure 22. ICSP and serial unit real PCB view**

Figure 23. ICSP and serial unit layout view

Figure 24. RS232 serial interface unit schematic view

Figure 25. Straight/Cross cable connection

**Straight serial cable
(a)**

**Cross serial cable
(b)**

PORT CONNECTORS

Although FEPST3 Kit has a very popular built in circuits and devices (switches , LEDs , 7seg , LCD and other), but any circuit can be enabled or disabled via DIP switch setting. And so the associated port pins are allowed to any other applications through screw clamp terminals .
Note Please insure to disconnect the built in circuits which is connected to the port pins you decide to use.
The external connectors are grouped into 4 units each represent one microcontroller port (8 I/O).

Figure 26. Microcontroller port pins real PCB view

Figure 27. Microcontroller port pins layout view
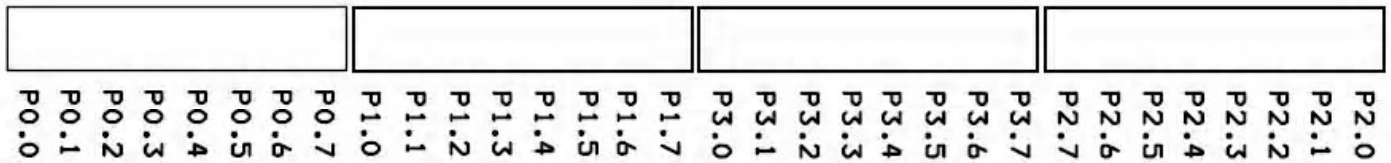
Figure 28. Microcontroller port pins schematic view
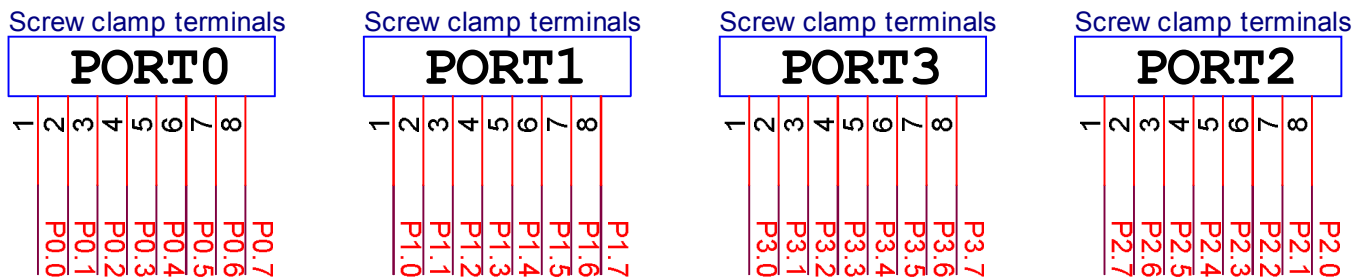
FEPST3 includes standard 2.5" X 6.75" breadboard for easy circuit making and extensions.

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HOW TO START?

We recommend few tests before begin to use FEPST3 KIT.

1-Determine the supply source and set jumper1 as illustrated previously in the POWER SUPPLY UNIT section.

2-Deselect all unused built in circuits in the kit. This is accomplished by setting DIP switches
- LCDEN for LCD enable/disable.
- KEYPAD ENABLE for KEYPAD enable/disable.
- LEDEN for LEDs enable/disable.
- DIP SW-2 for selected digits.
- SERIALEN for serial enable/disable.

2-Before plugging the chip in ZIF socket, insure the power delivery by connecting the supply and switching the power. If the power LED is initiated then there is a power connected to the KIT. Using a voltmeter, measure the voltage difference between GND and VCC at the OUT connector. It should be 5V±0.5V.

3-Now turn off the power switch and insert your programmed microcontroller chip in the ZIF socket, and enjoy your time with FEPST3 KIT.

If you want to test the built in circuit functionality, use a microcontroller programmed with the test code FEPST3test.hex which included in the CD.

The test operation is:
- Enable all DIP switches in kit(LEDEN,7SEGEN,LCDEN,KEYPADENABLE,SERIALENABLE).
- Set J1 according to the supply source.
- Set J2 To (2-3) position.
- Set RUN/PROG switch to PROG mode (PROG LED will be turned on).
- Connect serial cable (male to female) and set direction switch according to the serial cable type (release the switch if straight cable is used or press it if cross one).
- Turn power switch on.
- Open the burner program micropro.exe .
- Set the com port from (options - settings)
- Chose the AT89S51 chip from (options – device)
- Load the test code included in CD (FEPST3.hex) from (file - load flash file).
- Select CHIP ERASE then click RUN button.
- Right click the program button.
- After programming is completed set RUN/PROG switch to RUN mode.
- And follow the next steps to test all circuits in FEPST3 kit.

LCD test

When you power on FEPST3 kit LCD displays ****** FEPST3 **** FARES EDU PROD** and flickers for 4 seconds then turnoff.

7SEG test

Each 7seg digits counts from 0 to 9 continuously.

LED test

LEDs are turned on in a periodic sequence continuously.

KEYPAD test

The pressed switch is detected and its number is displayed on LCD in the first line as

SW(12) IS PREESSED

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SERIAL test

RECEIVING test

Any text received from the serial module will be displayed at the second line of LCD.

TRANSMITTING test

If SW16 is pressed Serial module Transmits "FARES EDUCATIONAL PRODUCTS FEPST3 KIT"

Compact Disc (CD) contains,
- User's Manual.
- Datasheet of supported microcontroller chips.
- Test code FEPST3test.hex