

7 Segment LED Counter Design

Project Name: Single digit 7 Segment LED Counter Design

Objectives:

- I) To understand pin configuration and different types of 7 segment LED Display.
- II) To design a counter controlled by time or delay and display the corresponding numeric increment.

Apparatus List:

- I) PIC16F877A Microcontroller
- II) Crystal Oscillator 20 MHz
- III) 2 pcs 22 pf capacitor
- IV) 10K Resistor
- V) 8 pcs 470 Ohm Resistor
- VI) 1 push button
- VII) 7 Segment CC/ CA LED Display
- VIII) Power supply

Theory:

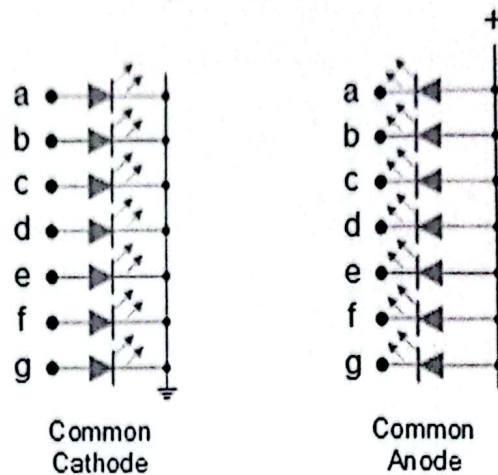
7-segment LED (Light Emitting Diode) or LCD (Liquid Crystal Display) type displays, provide a very convenient way of displaying information or digital data in the form of numbers, letters or even alpha-numerical characters. Typically 7 segment display consist of seven individual colored LED's (called the segments), within one single display package. In order to produce the required numbers or HEX characters from 0 to 9 and A to F respectively, on the display the correct combination of LED segments need to be illuminated and BCD to 7-segment Display Decoders such as the 74LS47 just do that.

A standard 7-segment LED display generally has 8 input connections, one for each LED segment and one that acts as a common terminal or connection for all the internal display segments. Some single displays have also have an additional input pin to display a decimal point in their lower right or left hand corner.

In electronics there are two important types of 7-segment LED digital display.

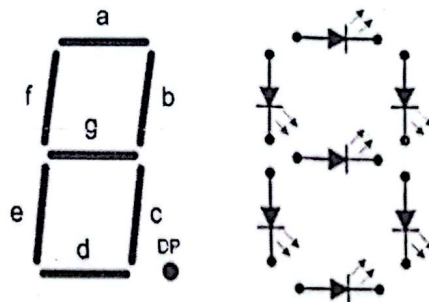
- 1. The Common Cathode Display (CCD) – In the common cathode display, all the cathode connections of the LED's are joined together to logic "0" or ground. The individual segments are illuminated by application of a "HIGH", logic "1" signal to the individual Anode terminals.
- 2. The Common Anode Display (CAD) – In the common anode display, all the anode connections of the LED's are joined together to logic "1" and the individual segments are illuminated by connecting the individual Cathode terminals to a "LOW", logic "0" signal.

Common Cathode and Common Anode Format:



Electrical connection of the individual diodes for a common cathode display and a common anode display and by illuminating each light emitting diode individually, they can be made to display a variety of numbers or characters.

7-Segment Display Format:



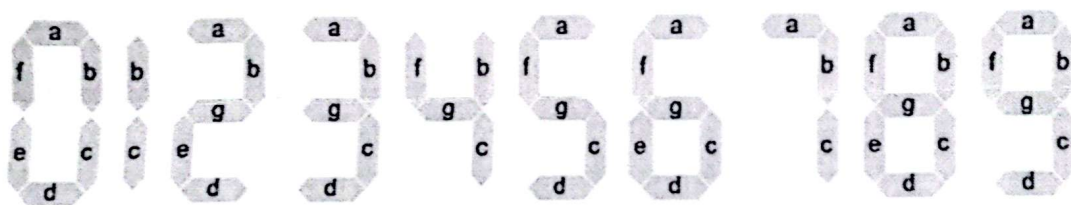
So in order to display the number 3 for example, segments a, b, c, d and g would need to be illuminated. If we wanted to display a different number or letter then a different set of segments would need to be illuminated. Then for a 7-segment display, we can produce a truth table giving the segments that need to be illuminated in order to produce the required character as shown below.

Truth Table for a 7-segment display:

Individual Segments							Display
a	b	c	d	e	f	g	
x	x	x	x	x	x		0

Individual Segments							Display
a	b	c	d	e	f	g	
x	x	x	x	x	x	x	8

	x	x					1	x	x	x	x		x	x	9
x	x		x	x		x	2	x	x	x		x	x	x	A
x	x	x	x			x	3			x	x	x	x	x	b
	x	x			x	x	4	x		x	x	x			C
x		x	x		x	x	5		x	x	x	x		x	d
x		x	x	x	x	x	6	x		x	x	x	x		E
x	x	x					7	x				x	x	x	F



7-Segment Display Elements for all Numbers.

It can be seen that to display any single digit number from 0 to 9 in binary or letters from A to F in hexadecimal, we would require 7 separate segment connections plus one additional connection for the LED's "common" connection. Also as the segments are basically a standard light emitting diode, the driving circuit would need to produce up to 20mA of current to illuminate each individual segment and to display the number 8, all 7 segments would need to be lit resulting a total current of nearly 140mA, (8 x 20mA).

Advantages Liquid crystal displays (LCD's) have one major advantage over similar LED types in that they consume much less power and nowadays, both LCD and LED displays are combined together to form larger Dot-Matrix Alphanumeric type displays which can show letters and characters as well as numbers in standard Red or Tri-colour outputs.

Micro C Code:

```
unsigned char display(char digit);
```

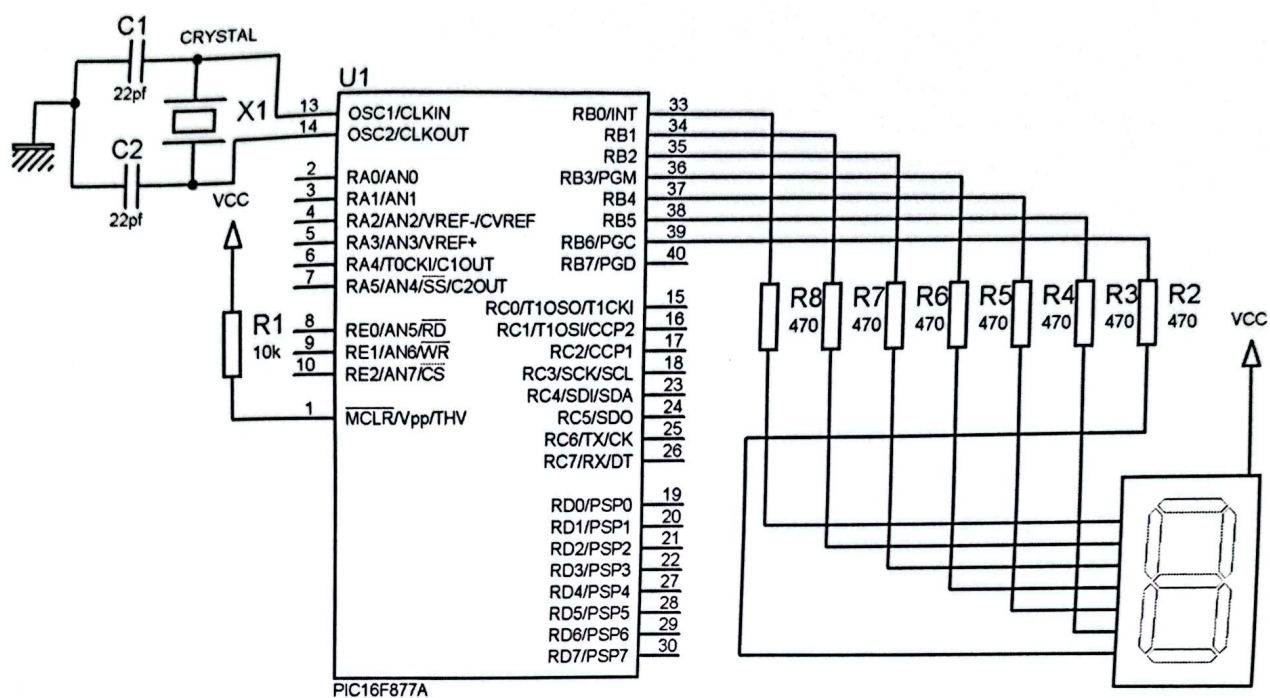
```
void main()
```

```
{
    unsigned char i; //Declaring Variable i as char type
    TRISB=0x00;
    portb=0xff;
    while(1)
    {
        for(i=0;i<=9;i++)
        {
            portb=display(i);
            delay_ms(1000);
        }
        if(i==10)
            i=0;
    }
}
```

```
unsigned char display(char digit)
```

```
{
    unsigned char pattern;
    unsigned char number[10]={0xC0,0xF9,0xA4,0xB0,0x99,0x92,0x82,0xF8,0x80,0x90};
    pattern = number[digit];
    return pattern;
}
```

Circuit diagram & Simulation in Proteus ISIS:



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