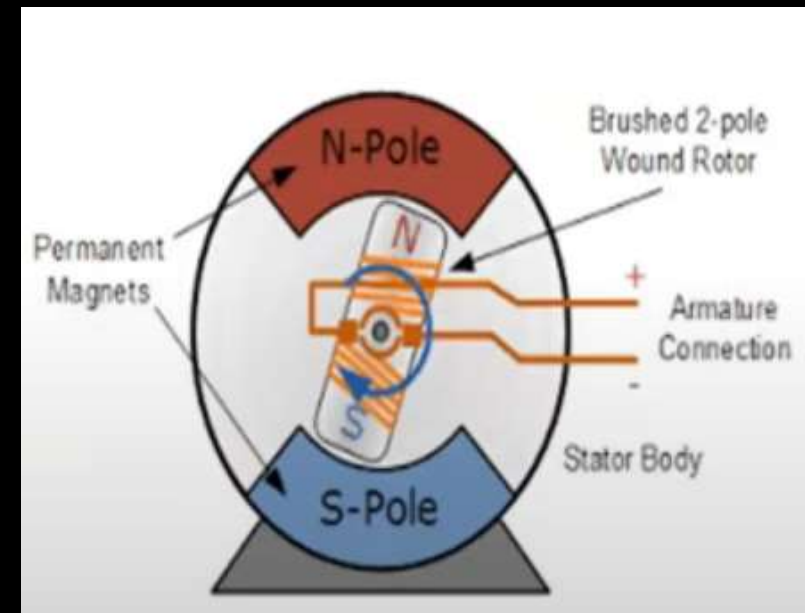




DC MOTOR

DC motor

- Class of electrical motors that convert direct current electrical energy into mechanical energy.
- Rely on the forces produced by magnetic fields.



DC motor

- For applying varying DC Voltage, we can make use of PWM technique.
- The direction of rotation of the motor can be changed by reversing the direction of current through I
- For reversing the current, we can make use of H-Bridge Circuit or Motor Driver ICs that employ the H-Bridge technique.
 - H-bridge circuit: electronic circuit that enables a voltage to be applied across a load in either direction.
 - It switches the polarity of the voltage applied to a load.
 - Allows DC motors to run forward and backward.
- Port lines used for DC motor are Po.8 and Po.11.

Interfaced with port lines Po.11 and Po.8

| P0.11 | P0.8 | |
|-------|------|---------------------------------|
| 1 | 0 | Runs in clockwise direction |
| 0 | 0 | Motor is stopped |
| 0 | 1 | Runs in anticlockwise direction |

| | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| IO0DIR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IO0SET (≈) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IO0SET(⊆) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

```

#include<lpc214x.h>
unsigned int j=0;
int main()
{
    PINSEL0=0x00000000;
    IO0DIR= 0X00000900;
    while(1)
    {
        //clock_wise
        IO0CLR = 0x00000900;           //stop motor and also turn off relay
        for(j=0;j<10000;j++);          //small delay to allow motor to turn off
        IO0SET = 0X00000900;           //Selecting the P0.11 line for clockwise and turn on motor
        for(j=0;j<40000;j++);          //delay

        //anti_clock_wise
        IO0CLR = 0X00000900;           //stop motor and also turn off relay
        for(j=0;j<10000;j++);          //small delay to allow motor to turn off
        IO0SET = 0X00000100;           //not selecting the P0.11 line for Anti clockwise
        for(j=0;j<40000;j++);          //delay
    }
}

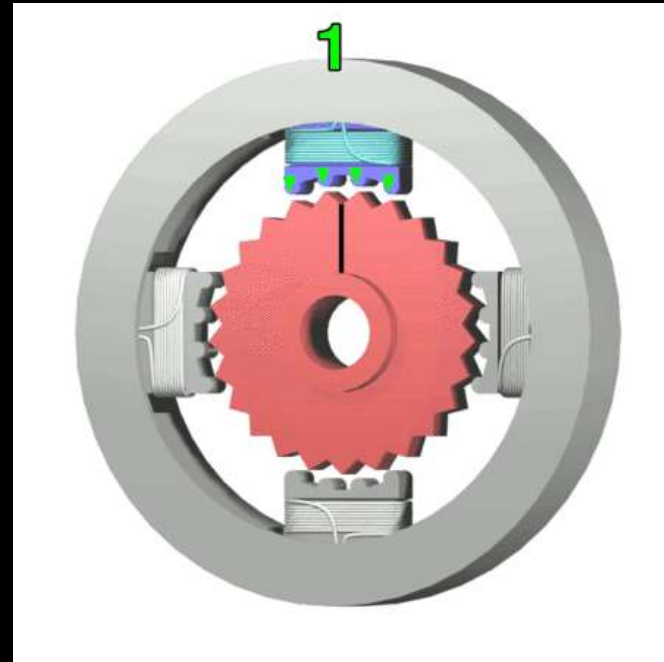
```



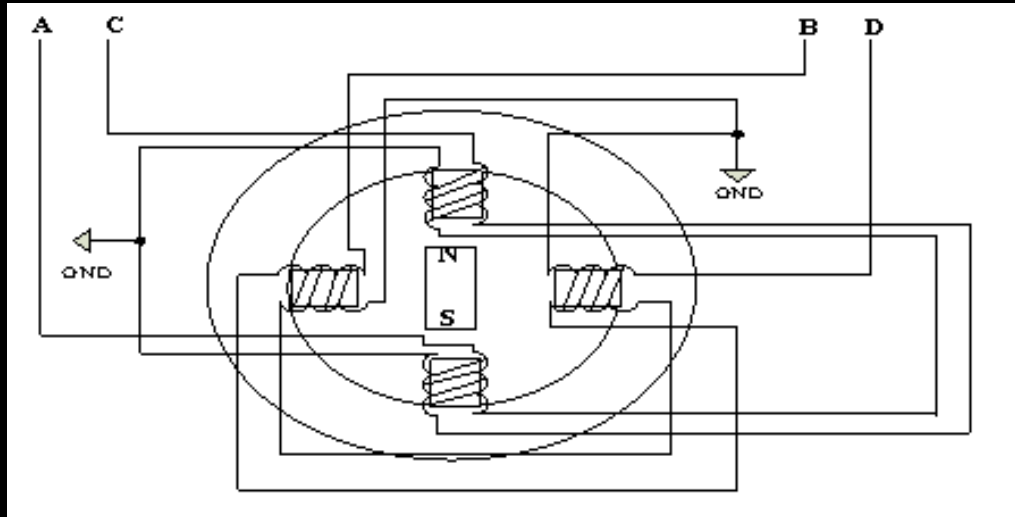
STEPPER MOTOR

Stepper Motor

- A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps.



Stepper Motor



P0.12---A
 P0.13---B
 P0.14---C
 P0.15---D

Wave Step

| Step | Coil A | Coil B | Coil C | Coil D |
|------|--------|--------|--------|--------|
| 1 | H | L | L | L |
| 2 | L | H | L | L |
| 3 | L | L | H | L |
| 4 | L | L | L | H |

| P0.15 | P0.14 | P0.13 | P0.12 |
|-------|-------|-------|-------|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 |


```

/*-----
 * A stepper motor direction is controlled by shifting the voltage across
 * the coils. Port lines : P0.12 to P0.15
 *****/

#include <LPC21xx.H>

void clock_wise(void);
void anti_clock_wise(void);

unsigned long int var1,var2;
unsigned int i=0,j=0,k=0;

int main(void)
{
    PINSEL0 = 0x00000000;           //P0.12 to P0.15 GPIO
    IO0DIR  = 0x0000F000;           //P0.12 to P0.15 output---1111 0000 0000 0000

```

```
while(1)
{
    for(j=0;j<50;j++)    // 50 times in Clock wise Rotation(360 degree)
        clock_wise();

    for(k=0;k<65000;k++); // Delay to show anti_clock Rotation

    for(j=0;j<50;j++)    // 50 times in Anti Clock wise Rotation(360 degree)
        anti_clock_wise();

    for(k=0;k<65000;k++); // Delay to show clock Rotation

}                                     // End of while(1)

}                                     // End of main
```

```

void clock_wise(void)
{
    var1 = 0x00001000;          //For Clockwise 12th pin high and left shift--- 0001 0000 0000 0000
    for(i=0;i<=3;i++)           // for A B C D Stepping
    {
        IO0PIN = var1;
        for(k=0;k<=30000;k++);  //for step speed variation
        var1 = var1<<1;         //For Clockwise
    }
}

void anti_clock_wise(void)
{
    var1 = 0x00008000;          //For Anticlockwise----1000 0000 0000 000--- 15th pin high and do right shift
    for(i=0;i<=3;i++)           // for A B C D Stepping
    {
        IO0PIN = var1;
        for(k=0;k<=30000;k++);  //for step speed variation
        var1 = var1>>1;         //For Anticlockwise
    }
}

```

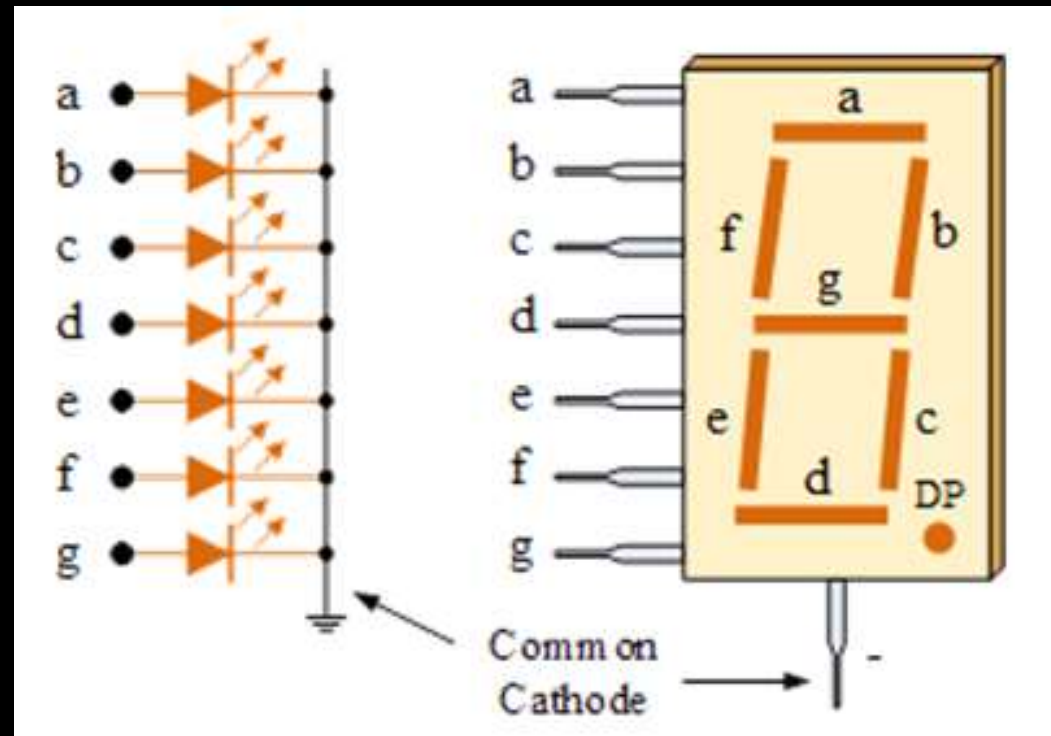


7-SEGMENT DISPLAY

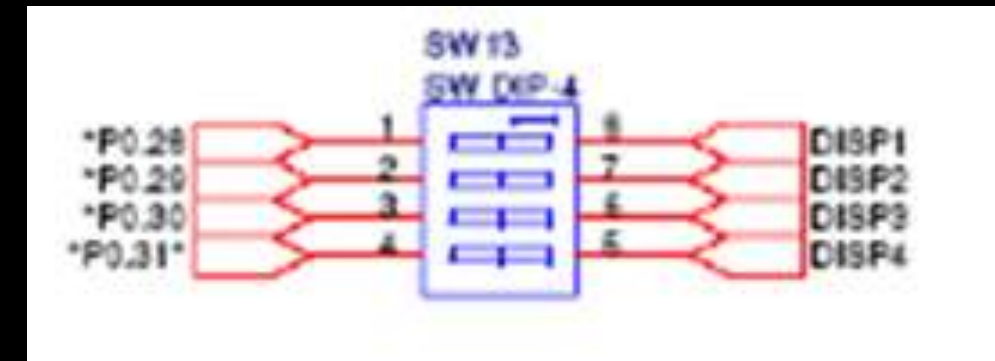
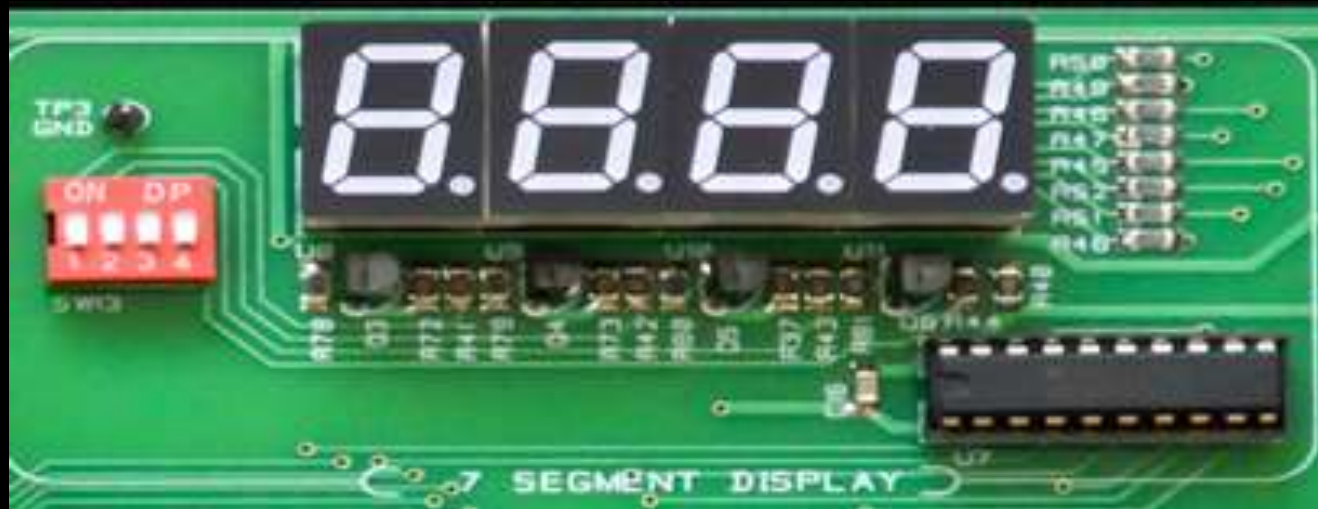
7-Segment display

Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.

Common Cathode 7-segment Display



- Four digit multiplexed 7 segment
- Port line po.28 –po.31 is used for selecting seven segment
- po.16 – po.23 for data lines
- Po.28 Po.29 Po.30 Po.31 Display unit selected



```
#include <LPC21xx.h>
unsigned int delay, count=0, Switchcount=0;

/*common cathode seven segment data for 0 to F*/

unsigned int Disp[16]={0x003F0000, 0x00060000, 0x005B0000, 0x004F0000,
0x00660000,0x006D0000, 0x007D0000, 0x00070000, 0x007F0000, 0x006F0000,
0x00770000,0x007C0000, 0x00390000, 0x005E0000, 0x00790000, 0x00710000 };

int main (void)
{
    PINSEL1 = 0x00000000;
    IO0DIR  = 0x10FF0000;

    while(1)
    {
        //Display values on Seven Segment
        IO0SET = 0x10000000;
```

```
IO0CLR = 0x00FF0000;
IO0SET = Disp[Switchcount]; // display the values 0 to F one after the other
for(delay=0;delay<=300000;delay++);
Switchcount++;
    if(Switchcount == 16)        // after F go back to 0
    {
        Switchcount = 0;
    }
}
```