Microdigitaled.com Chp12 LCD examples

Eg12.1……

```
.INCLUDE "M32DEF.INC"
.EQU    LCD_DPRT = PORTA
.EQU    LCD_DDDR = DDRA
.EQU    LCD_DPIN = PINA
.EQU    LCD_CPRT = PORTB
.EQU    LCD_CDDR = DDRB
.EQU    LCD_CPIN = PINB
.EQU    LCD_RS = 0
.EQU    LCD_RW = 1
.EQU    LCD_EN = 2

        LDI     R21,HIGH(RAMEND)
        OUT     SPH,R21
        LDI     R21,LOW(RAMEND)
        OUT     SPL,R21

        LDI     R21,0xFF;
        OUT LCD_DDDR, R21
        OUT LCD_CDDR, R21
        CBI     LCD_CPRT,LCD_EN
        CALL DELAY_2ms
        LDI     R16,0x38
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI     R16,0x0E
        CALL CMNDWRT
        LDI     R16,0x01
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI     R16,0x06
        CALL CMNDWRT
        LDI     R16,'H'
        CALL DATAWRT
        LDI     R16,'i'
        CALL DATAWRT
HERE:   JMP HERE
;-----------------------------------------------------
CMNDWRT:
        OUT     LCD_DPRT,R16
        CBI     LCD_CPRT,LCD_RS
        CBI     LCD_CPRT,LCD_RW
        SBI     LCD_CPRT,LCD_EN
        CALL    SDELAY
        CBI     LCD_CPRT,LCD_EN
        CALL    DELAY_100us
        RET
DATAWRT:
        OUT     LCD_DPRT,R16
        SBI     LCD_CPRT,LCD_RS
        CBI     LCD_CPRT,LCD_RW
        SBI     LCD_CPRT,LCD_EN
        CALL    SDELAY
        CBI     LCD_CPRT,LCD_EN
        CALL    DELAY_100us
        RET
;-----------------------------------------------------
SDELAY: NOP
        NOP
        RET
;-----------------------------------------------------
DELAY_100us:
        PUSH    R17
```

```
        LDI     R17,60
DR0:
        CALL    SDELAY
        DEC     R17
        BRNE    DR0
        POP     R17
        RET
;----------------------------------------------------
DELAY_2ms:
        PUSH    R17
        LDI     R17,20
LDR0:
        CALL    DELAY_100US
        DEC     R17
        BRNE    LDR0
        POP     R17
        RET
```

//////////////////////

Eg12.2……

```
.INCLUDE "M32DEF.INC"

.EQU    LCD_DPRT = PORTA
.EQU    LCD_DDDR = DDRA
.EQU    LCD_DPIN = PINA
.EQU    LCD_CPRT = PORTB
.EQU    LCD_CDDR = DDRB
.EQU    LCD_CPIN = PINB
.EQU    LCD_RS = 0
.EQU    LCD_RW = 1
.EQU    LCD_EN = 2

        LDI     R21,HIGH(RAMEND)
        OUT     SPH,R21
        LDI     R21,LOW(RAMEND)
        OUT     SPL,R21

        LDI      R21,0xFF;
        OUT  LCD_DDDR, R21
        OUT  LCD_CDDR, R21
        LDI      R16,0x33
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x32
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x28
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x0E
        CALL CMNDWRT
        LDI      R16,0x01
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x06
        CALL CMNDWRT
        LDI      R16,'H'
        CALL DATAWRT
        LDI      R16,'i'
        CALL DATAWRT
HERE: JMP HERE
;----------------------------------------------------
CMNDWRT:
        MOV      R27,R16
```

```
        ANDI R27,0xF0
        OUT  LCD_DPRT,R27
        CBI      LCD_CPRT,LCD_RS
        CBI      LCD_CPRT,LCD_RW
        SBI      LCD_CPRT,LCD_EN
        CALL SDELAY
        CBI      LCD_CPRT,LCD_EN
        CALL DELAY_100us

        MOV      R27,R16
        SWAP R27
        ANDI R27,0xF0
        OUT  LCD_DPRT,R27
        SBI      LCD_CPRT,LCD_EN
        CALL SDELAY
        CBI      LCD_CPRT,LCD_EN
        CALL DELAY_100us
        RET
;-----------------------------------------------------
DATAWRT:
        MOV    R27,R16
        ANDI R27,0xF0
        OUT  LCD_DPRT,R27
        SBI      LCD_CPRT,LCD_RS
        CBI      LCD_CPRT,LCD_RW
        SBI      LCD_CPRT,LCD_EN
        CALL SDELAY
        CBI      LCD_CPRT,LCD_EN

        MOV      R27,R16
        SWAP R27
        ANDI R27,0xF0
        OUT  LCD_DPRT,R27
        SBI      LCD_CPRT,LCD_EN
        CALL SDELAY
        CBI      LCD_CPRT,LCD_EN

        CALL DELAY_100us
        RET

;-----------------------------------------------------
SDELAY: NOP
        NOP
        RET
;-----------------------------------------------------
DELAY_100us:
        PUSH R17
        LDI      R17,60
DR0:
        CALL SDELAY
        DEC      R17
        BRNE DR0
        POP      R17
        RET
;-----------------------------------------------------
DELAY_2ms:
        PUSH R17
        LDI      R17,20
LDR0:
        CALL DELAY_100US
        DEC      R17
        BRNE LDR0
        POP      R17
        RET
//////////////////////////
```

Eg12.3……

```
.INCLUDE "M32DEF.INC"

.EQU    LCD_PRT = PORTA
.EQU    LCD_DDR = DDRA
.EQU    LCD_PIN = PINA
.EQU    LCD_RS = 0
.EQU    LCD_RW = 1
.EQU    LCD_EN = 2

        LDI     R21,HIGH(RAMEND)
        OUT     SPH,R21
        LDI     R21,LOW(RAMEND)
        OUT     SPL,R21

        LDI     R21,0xFF;
        OUT     LCD_DDR, R21
        OUT     LCD_DDR, R21

        LDI      R16,0x33
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x32
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x28
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x0E
        CALL CMNDWRT
        LDI      R16,0x01
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI     R16,0x06
        CALL    CMNDWRT

        LDI      R16,'H'
        CALL DATAWRT
        LDI      R16,'i'
        CALL DATAWRT
HERE:
        JMP      HERE

;-----------------------------------------------------
CMNDWRT:
        MOV      R27,R16
        ANDI R27,0xF0
        IN       R26,LCD_PRT
        ANDI R26,0x0F
        OR       R26,R27
        OUT  LCD_PRT,R26
        CBI      LCD_PRT,LCD_RS
        CBI      LCD_PRT,LCD_RW
        SBI      LCD_PRT,LCD_EN
        CALL SDELAY
        CBI      LCD_PRT,LCD_EN

        CALL DELAY_100us

        MOV      R27,R16
        SWAP R27
        ANDI R27,0xF0
        IN       R26,LCD_PRT
        ANDI R26,0x0F
        OR       R26,R27
```

```
        OUT  LCD_PRT,R26
        SBI      LCD_PRT,LCD_EN
        CALL SDELAY
        CBI      LCD_PRT,LCD_EN

        CALL DELAY_100us
        RET

;-----------------------------------------------------
DATAWRT:
        MOV     R27,R16
        ANDI R27,0xF0
        IN      R26,LCD_PRT
        ANDI R26,0x0F
        OR      R26,R27
        OUT LCD_PRT,R26
        SBI     LCD_PRT,LCD_RS
        CBI     LCD_PRT,LCD_RW
        SBI     LCD_PRT,LCD_EN
        CALL    SDELAY
        CBI     LCD_PRT,LCD_EN

        MOV      R27,R16
        SWAP R27
        ANDI R27,0xF0
        IN       R26,LCD_PRT
        ANDI R26,0x0F
        OR       R26,R27
        OUT  LCD_PRT,R26
        SBI      LCD_PRT,LCD_EN
        CALL SDELAY
        CBI      LCD_PRT,LCD_EN

        CALL DELAY_100us
        RET

;-----------------------------------------------------
SDELAY:
        NOP
        NOP
        RET

;-----------------------------------------------------
DELAY_100us:
        PUSH    R17
        LDI             R17,60
DR0:CALL        SDELAY
        DEC             R17
        BRNE    DR0
        POP             R17
        RET

;-----------------------------------------------------
DELAY_2ms:
        PUSH    R17
        LDI             R17,20
LDR0:
        CALL    DELAY_100us
        DEC             R17
        BRNE    LDR0
        POP             R17
        RET
////////////////////
```

Eg12.4……

```
.INCLUDE "M32DEF.INC"

.EQU    LCD_PRT = PORTA
.EQU    LCD_DDR = DDRA
.EQU    LCD_PIN = PINA
.EQU    LCD_RS = 0
.EQU    LCD_RW = 1
.EQU    LCD_EN = 2

        LDI     R21,HIGH(RAMEND)
        OUT     SPH,R21
        LDI     R21,LOW(RAMEND)
        OUT     SPL,R21

        LDI     R21,0xFF;
        OUT     LCD_DDR, R21
        OUT     LCD_DDR, R21

        LDI      R16,0x33
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x32
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x28
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI      R16,0x0E
        CALL CMNDWRT
        LDI      R16,0x01
        CALL CMNDWRT
        CALL DELAY_2ms
        LDI     R16,0x06
        CALL    CMNDWRT

        LDI     R31,HIGH(MSG<<1)
        LDI     R30,LOW(MSG<<1)

LOOP:
        LPM     R16,Z+
        CPI     R16,0
        BREQ    HERE
        CALL    DATAWRT
        RJMP    LOOP
HERE:JMP        HERE

MSG: .DB "Hello World!",0



;----------------------------------------------------
CMNDWRT:
        MOV      R27,R16
        ANDI R27,0xF0
        IN       R26,LCD_PRT
        ANDI R26,0x0F
        OR       R26,R27
        OUT  LCD_PRT,R26
        CBI      LCD_PRT,LCD_RS
        CBI      LCD_PRT,LCD_RW
        SBI      LCD_PRT,LCD_EN
        CALL SDELAY
        CBI      LCD_PRT,LCD_EN
```

```
        CALL DELAY_100us

        MOV     R27,R16
        SWAP R27
        ANDI R27,0xF0
        IN      R26,LCD_PRT
        ANDI R26,0x0F
        OR      R26,R27
        OUT  LCD_PRT,R26
        SBI     LCD_PRT,LCD_EN
        CALL SDELAY
        CBI     LCD_PRT,LCD_EN

        CALL DELAY_100us
        RET

;----------------------------------------------------
DATAWRT:
        MOV    R27,R16
        ANDI R27,0xF0
        IN     R26,LCD_PRT
        ANDI R26,0x0F
        OR     R26,R27
        OUT LCD_PRT,R26
        SBI    LCD_PRT,LCD_RS
        CBI    LCD_PRT,LCD_RW
        SBI    LCD_PRT,LCD_EN
        CALL   SDELAY
        CBI    LCD_PRT,LCD_EN

        MOV     R27,R16
        SWAP R27
        ANDI R27,0xF0
        IN      R26,LCD_PRT
        ANDI R26,0x0F
        OR      R26,R27
        OUT  LCD_PRT,R26
        SBI     LCD_PRT,LCD_EN
        CALL SDELAY
        CBI     LCD_PRT,LCD_EN

        CALL DELAY_100us
        RET

;----------------------------------------------------
SDELAY:
        NOP
        NOP
        RET

;----------------------------------------------------
DELAY_100us:
        PUSH   R17
        LDI            R17,60
DR0:CALL       SDELAY
        DEC            R17
        BRNE   DR0
        POP            R17
        RET

;----------------------------------------------------
DELAY_2ms:
        PUSH   R17
        LDI            R17,20
LDR0:
        CALL   DELAY_100us
```

```
        DEC             R17
        BRNE    LDR0
        POP             R17
        RET
//////////////////////////////
```

Eg12.5 (in C)……

```
#define F_CPU 8000000UL

#include <avr/io.h>
#include <util/delay.h>

#define LCD_DPRT  PORTA
#define LCD_DDDR  DDRA
#define LCD_DPIN  PINA
#define LCD_CPRT  PORTB
#define LCD_CDDR  DDRB
#define LCD_CPIN  PINB
#define LCD_RS  0
#define LCD_RW  1
#define LCD_EN  2

//*********************************************************
void delay_us(unsigned int d)
{
  _delay_us(d);
}

//*********************************************************
void lcdCommand( unsigned char cmnd )
{
  LCD_DPRT = cmnd;
  LCD_CPRT &= ~ (1<<LCD_RS);
  LCD_CPRT &= ~ (1<<LCD_RW);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_CPRT &= ~ (1<<LCD_EN);
  delay_us(100);
}

//*********************************************************
void lcdData( unsigned char data )
{
  LCD_DPRT = data;
  LCD_CPRT |= (1<<LCD_RS);
  LCD_CPRT &= ~ (1<<LCD_RW);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_CPRT &= ~ (1<<LCD_EN);
  delay_us(100);
}

//*********************************************************
void lcd_init()
{
  LCD_DDDR = 0xFF;
  LCD_CDDR = 0xFF;

  LCD_CPRT &=~(1<<LCD_EN);
  delay_us(2000);
  lcdCommand(0x38);
  lcdCommand(0x0E);
  lcdCommand(0x01);
  delay_us(2000);
  lcdCommand(0x06);
}
```

```
//*******************************************************
void lcd_gotoxy(unsigned char x, unsigned char y)
{
 unsigned char firstCharAdr[]={0x80,0xC0,0x94,0xD4};//table 12-5
 lcdCommand(firstCharAdr[y-1] + x - 1);
 delay_us(100);
}

//*******************************************************
void lcd_print( char * str )
{
  unsigned char i = 0 ;
  while(str[i]!=0)
  {
    lcdData(str[i]);
    i++ ;
  }
}

//*******************************************************
int main(void)
{
        lcd_init();
        lcd_gotoxy(1,1);
        lcd_print("The world is but");
        lcd_gotoxy(1,2);
        lcd_print("one country");

        while(1);
        return 0;
}
////////////////////////////////////
```

Eg12.6……

```
#include <avr/io.h>

#define F_CPU 7372800UL
#include <util/delay.h>

#define LCD_DPRT  PORTC
#define LCD_DDDR  DDRC
#define LCD_DPIN  PINC
#define LCD_CPRT  PORTC
#define LCD_CDDR  DDRC
#define LCD_CPIN  PINC
#define LCD_RS  0
#define LCD_RW  1
#define LCD_EN  2

void delay_us(int d)
{
  _delay_us(d);
}

void lcdCommand( unsigned char cmnd )
{
  LCD_DPRT = (LCD_DPRT&0x0F)|(cmnd & 0xF0);
  LCD_CPRT &= ~ (1<<LCD_RS);
  LCD_CPRT &= ~ (1<<LCD_RW);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_CPRT &= ~ (1<<LCD_EN);
  delay_us(100);
  LCD_DPRT = (LCD_DPRT&0x0F)|(cmnd<<4);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
```

```
  LCD_CPRT &= ~ (1<<LCD_EN);
  delay_us(100);
}

void lcdData( unsigned char data )
{
  LCD_DPRT = (LCD_DPRT&0x0F)|(data & 0xF0);
  LCD_CPRT |= (1<<LCD_RS);
  LCD_CPRT &= ~ (1<<LCD_RW);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_CPRT &= ~ (1<<LCD_EN);
  LCD_DPRT = (LCD_DPRT&0x0F)|(data<<4);
  LCD_CPRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_CPRT &= ~ (1<<LCD_EN);
  delay_us(100);
}

void lcd_init()
{
  LCD_DDDR = 0xFF;
  LCD_CDDR = 0xFF;
  LCD_CPRT &=~(1<<LCD_EN);
  lcdCommand(0x33);
  lcdCommand(0x32);
  lcdCommand(0x28);
  lcdCommand(0x0e);
  lcdCommand(0x01);
  delay_us(2000);
  lcdCommand(0x06);
}

void lcd_gotoxy(unsigned char x, unsigned char y)
{
  unsigned char firstCharAdr[]={0x80,0xC0,0x94,0xD4} ;

  lcdCommand(firstCharAdr[y-1] + x - 1);
  delay_us(100);
}

void lcd_print(char * str )
{
  unsigned char i = 0 ;

  while(str[i]!=0)
  {
    lcdData(str[i]);
    i++ ;
  }
}

int main(void)
{
  lcd_init();
  lcd_gotoxy(1,1);
  lcd_print("The world is but");
  lcd_gotoxy(1,2);
  lcd_print("one country");

  while(1);

  return 0;
}
////////////////////////////////////
```

Eg12.7……

```
#define F_CPU 8000000UL
#include <avr/io.h>
#include <util/delay.h>
#define LCD_PRT  PORTA
#define LCD_DDR  DDRA
#define LCD_PIN  PINA
#define LCD_RS  0
#define LCD_RW  1
#define LCD_EN  2

void delay_us(int d)
{
  _delay_us(d);
}

void delay_ms(int d)
{
  _delay_ms(d);
}

void lcdCommand( unsigned char cmnd ){
  LCD_PRT = (LCD_PRT & 0x0F) | (cmnd & 0xF0);
  LCD_PRT &= ~ (1<<LCD_RS);
  LCD_PRT &= ~ (1<<LCD_RW);
  LCD_PRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_PRT &= ~ (1<<LCD_EN);

  delay_us(20);

  LCD_PRT = (LCD_PRT & 0x0F) | (cmnd << 4);
  LCD_PRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_PRT &= ~ (1<<LCD_EN);
}

void lcdData( unsigned char data )
{
  LCD_PRT = (LCD_PRT & 0x0F) | (data & 0xF0);
  LCD_PRT |= (1<<LCD_RS);
  LCD_PRT &= ~ (1<<LCD_RW);
  LCD_PRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_PRT &= ~ (1<<LCD_EN);

  LCD_PRT = (LCD_PRT & 0x0F) | (data << 4);
  LCD_PRT |= (1<<LCD_EN);
  delay_us(1);
  LCD_PRT &= ~ (1<<LCD_EN);
}

void lcd_init(){
  LCD_DDR = 0xFF;

  LCD_PRT &=~(1<<LCD_EN);
  delay_us(2000);
  lcdCommand(0x33);
  delay_us(100);
  lcdCommand(0x32);
  delay_us(100);
  lcdCommand(0x28);
  delay_us(100);
  lcdCommand(0x0e);
  delay_us(100);
  lcdCommand(0x01);
```

```
  delay_us(2000);
  lcdCommand(0x06);
  delay_us(100);
}

void lcd_gotoxy(unsigned char x, unsigned char y)
{  //table 12-5
  unsigned char firstCharAdr[] = {0x80, 0xC0, 0x94, 0xD4};

  lcdCommand(firstCharAdr[y-1] + x - 1);
  delay_us(100);
}

void lcd_print( char * str )
{
  unsigned char i = 0 ;

  while(str[i]!=0)
  {
    lcdData(str[i]);
    i++ ;
  }
}

int main(void)
{
  lcd_init();
  while(1)
  {
        lcd_gotoxy(1,1);
        lcd_print("The world is but");
        lcd_gotoxy(1,2);
        lcd_print("one country     ");
        delay_ms(1000);
        lcd_gotoxy(1,1);
        lcd_print("and mankind its ");
        lcd_gotoxy(1,2);
        lcd_print("citizens        ");
        delay_ms(1000);
  }
  return 0;
}
```