

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
        BR EQ    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;
}

```