```
;   PortA   free
;portb bit 1-3
;R/S = register select line
;R/S = 0 ensures that the data to the display will change the registers
;R/S = 1 writes the charakters to the display                                    ;
;   PortB   Bit0: RS
;
;           Bit1: RW                                                            ;
;           Bit2: E                                                             ;
;                                                                               ;
;           Bit6: incircuit programming                                         ;
;           Bit7: incircuit programming                                         ;
;                                                                               ;
;   PortC   Bit 0-7: Display                                                    ;
;                                                                               ;
;   PortD   Bit 0-7: Keypad                                                     ;
;   PortE   free

#include <p16F887.inc>
    __CONFIG    _CONFIG1, _LVP_OFF & _FCMEN_OFF & _IESO_OFF & _BOR_OFF & _CPD_OFF & _CP_OFF &
_MCLRE_OFF & _PWRTE_ON & _WDT_OFF & _INTRC_OSC_NOCLKOUT
    __CONFIG    _CONFIG2, _WRT_OFF & _BOR21V

     cblock     0x20

Delay               ; Assign an address to label Delay1
Delay2
Display             ; define a variable to hold the diplay
LastStableState     ; keep track of switch state (open-1; closed-0)
COUNT
     endc
e       equ 3
rw      equ 2
rs      equ 1
zero    equ 0
     org 0
Start:
     bsf        STATUS,RP0          ; select Register Bank 1
     movlw      0xFF
     movwf      TRISA               ; Make PortA all input
     movwf      TRISE               ; Make PortE all input
     clrf       TRISB               ; Make PORTB all output
     clrf       TRISC               ; Make Portc all output
     clrf       TRISD               ; Make Portd all output (für Tastatur, auf all input umstellen)
     MOVLW      B'00000111'         ;load value to configure optionreg
     MOVWF      OPTION_REG          ;configure timer 0, internal osci and prescale 256
     bsf        STATUS,RP1          ; select Register Bank 3
     movlw      0x1F
     movwf      ANSEL               ; PortA pins are all analog, PortE pins are digital
     movlw      0x00
     movwf      ANSELH              ; PortB pins are digitial (important as RB0 is switch)
     bcf        STATUS,RP0          ; address Register Bank 0
     bcf        STATUS,RP1
     clrf       PORTD               ; init LEDs to all off
     clrf       PORTC
     clrf       PORTB
     clrf       PORTA
     clrf       COUNT
     clrf       TMR0

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;Display inititialisation                                                       ;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
        CALL    DELAY1
        MOVLW   B'00111100'     ;Function set
        MOVWF   PORTC           ;bit 4-3 8bit data,two lines,5x7 dots display
        CALL    CLOCK
        CALL    DELAY1
wait1   BTFSC   PORTB,rw
        GOTO    wait1
        MOVLW   B'00001111'     ;Display on, curcor on, cursor flashing
        MOVWF   PORTC
        CALL    CLOCK
        CALL    DELAY1
wait2   BTFSC   PORTB,rw
        GOTO    wait2
```

```
        MOVLW   B'00000001'     ;clear display, cursor on position top left
        MOVWF   PORTC
        CALL    CLOCK
        CALL    DELAY1
wait3   BTFSC   PORTB,rw
        GOTO    wait3
        MOVLW   B'00000110'     ;cursor auto incrment
        MOVWF   PORTC
        CALL    CLOCK
        GOTO    write



;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;Subroutines;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;3 delay
DELAY3  CLRF    TMR0            ;start tmr0
LOOP1   movf    TMR0,w          ;tmr 0 into w
        sublw   .96
        BTFSS   STATUS,zero
        GOTO    LOOP1
        RETLW   0

;1 delay
DELAY1  CLRF    TMR0            ;start tmr0
LOOP2   MOVF    TMR0,w          ;read tmr0 into w
        SUBLW   .3
        BTFSS   STATUS,zero
        GOTO    LOOP2
        RETLW   0

CLOCK   BSF     PORTB,e
        NOP
        BCF     PORTB,e
        NOP
        RETLW   0

NUM0    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110000'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM1    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110001'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM2    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110010'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM3    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110011'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM4    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110100'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM5    MOVLW   6               ;enables portb bit 1 and bit 2
```

```
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110101'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM6    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110110'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM7    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00110111'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM8    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00111000'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

NUM9    MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00111001'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

GAP     MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00111010'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

DOT     MOVLW   6               ;enables portb bit 1 and bit 2
        MOVWF   PORTB           ;E und RS enable
        MOVLW   B'00101110'
        MOVWF   PORTC
        CALL    CLOCK
        RETLW   0

CLRDISP CLRF    PORTB
        MOVLW   B'00000001'
        MOVWF   PORTC
        CALL    CLOCK           ;clock charakter onto display
        CALL    DELAY1
        RETLW   0
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

write   CALL    CLRDISP
        CLRF    PORTB
        MOVLW   8H              ;cursor at top left, 80H
        MOVWF   PORTB
        CALL    CLOCK
        MOVLW   0H
        MOVWF   PORTC
        CALL    CLOCK

        CALL    NUM0
        CALL    DELAY1
        CALL    NUM1
        CALL    DELAY1
        CALL    NUM2
        CALL    DELAY1

        CLRF    PORTB
        MOVLW   0CH             ;cursor on second line
        MOVWF   PORTC
        CALL    CLOCK
```

```
        MOVLW   3H
        MOVWF   PORTC
        CALL    CLOCK

        CALL    NUM3
        CALL    DELAY1
        CALL    NUM4
        CALL    DELAY1
        CALL    NUM5
        CALL    DELAY1
        CALL    NUM6
        CALL    DELAY1
        CALL    NUM7
        CALL    DELAY1
        CALL    NUM8
        CALL    DELAY1
        CALL    NUM9
        CALL    DELAY1

        CALL    DELAY3          ;wait 3
        GOTO    write

sleep

end
```