

```

        .include <m2560def.inc>
        .cseg
        .org 0x00
        rjmp start
        .org 0xF6
start:   ldi    r20,low(RAMEND) ; set up stack pointer
        out    SPL,r20      ; "
        ldi    r20,high(RAMEND) ; "
        out    SPH,r20      ; "
        ldi    r16,3        ; configure USART1 to MSPI mode and shift data
        ldi    r17,0        ; at 2 MHz
        call   initMegaMSPI ; "
        ldi    r16,0x01     ; configure MC14489 to use hex decode mode
        call   initMC14489  ; to display 997.04 on seven-segment displays
again:   ldi    r28,10      ; set up loop count
        ldi    ZL,low(dispData<<1) ; set up table pointer
        ldi    ZH,high(dispData<<1); "
loop:    cbi    PORTD,PD0    ; enable SPI transfer to MC14489
        lpm    r16,Z+       ; transfer display data to MC14489
        call   putch_USART_MSPI; "
        lpm    r16,Z+       ; "
        call   putch_USART_MSPI; "
        lpm    r16,Z+       ; "
        call   putch_USART_MSPI; "
        sbi    PORTD,PD0    ; update seven-segment displays
        dec    r28          ; reach the last row?
        brne  loop         ; "
        rjmp  again        ; repeat

dispData:
        .db    0x81,0x23,0x45,0x82,0x34,0x56
        .db    0x83,0x45,0x67,0x84,0x56,0x78
        .db    0x85,0x67,0x89,0x86,0x78,0x90
        .db    0x87,0x89,0x01,0x88,0x90,0x12
        .db    0x89,0x01,0x23,0x80,0x12,0x34

; -----
; This subroutine initializes the USART1 of the MEGA AVR to MSPI mode, and also enables
; reception and transmission. The setting of baud rate is passed in r17:r16.
; -----
initMegaMSPI:
        clr    r20
        sts    UBRR0H,r20
        sts    UBRR0L,r20

```

```

in    r20,DDRD
andi  r20,0xD4      ; clear bit 5,3,1,0
ori   r20,0x29     ; set bit 5, 3, and 0
out   DDRD,r20     ; configure PD5/XCK1, PD3/TXD1, & PD0 for output
ldi   r20,(1<<RXEN1)|(1<<TXEN1) ; enable receiver and transmitter
sts   UCSR1B,r20
ldi   r20,(1<<UMSEL11)|(1<<UMSEL10)|(0<<UCPHA1)|(0<<UCPOL1)
sts   UCSR1C,r20   ; select MSPI mode
sts   UBRR1H,r17   ; set up baud rate
sts   UBRR1L,r16   ; "
ret

```

; This subroutine configures the MC14489's C5~C1 to hex decode mode with normal brightness.

initMC14489:

```

cbi   PORTD,PD0    ; enable SPI transfer to MC14489
call  putch_USART_MSPI
sbi   PORTD,PD0
ret

```

; The following subroutine outputs a character in r16 to USART1 in MSPI mode.

putch_USART_MSPI:

```

lds   r20,UCSR1A   ; wait until USART data register is empty
sbrs  r20,UDRE1    ; "
rjmp  putch_USART_MSPI ; "
sts   UDR1,r16     ; start data transmission
waitTXC1: lds   r20,UCSR1A ; wait until the character has been shifted out
sbrs  r20,RXC1    ; "
rjmp  waitTXC1    ; "
lds   r22,UDR1    ; clear RXC1 flag
ret

```