

# 1 Anexos

## 1.1 Main

```
#include "max7219.h"
#include "utils.h"
#include "drawing.h"
#include <msp430g2553.h>
#include <legacymsp430.h> // Para rodar interrupcoes
```

```
/*
```

*MSP430G2553*

	VCC	GND
RIGHT_BTN-->	P1.0	XIN
	P1.1	XOUT
	P1.2	TST
DIN<--	P1.3	RST
CS<--	P1.4	P1.7 <--STOP_BTN
CLK<--	P1.5	P1.6 <--LEFT_BTN
	P2.0	P2.5
	P2.1	P2.4
	P2.2	P2.3

```
*/
```

```
int main(){
    WDCTL = WDIPW + WDTHOLD; // Desabilita WDT
    DCOCTL = CALDCO1MHZ; // 1 Mhz DCO
    BCSCTL1 = CALBC11MHZ;

    initialise();
    setTestMode(0);
    setShutdown(0);
    setBrightness(0xff);
    showDigits(8);

    configure_buttons();

    __enable_interrupt();
```

```

    clear_screen ();

    while(1){
        ahead_arrow ();
    }

    return 0;
}

#pragma vector=PORT1_VECTOR
__interrupt void Port_1(void){
    if(P1IFG & RIGHT_BTN){
        while(!(P1IN & RIGHT_BTN)==0){
            right_arrow ();
        }
        P1IFG &= ~RIGHT_BTN;
    }
    if(P1IFG & LEFT_BTN){
        while(!(P1IN & LEFT_BTN)==0){
            left_arrow ();
        }
        P1IFG &= ~LEFT_BTN;
    }
    if(P1IFG & STOP_BTN){
        while((P1IN & STOP_BTN)==0){
            delay (20);
            stop ();
        }
        P1IFG &= ~STOP_BTN;
    }
    return 0;
}

```

## 1.2 MAX7219

```

#include "max7219.h"
#include "utils.h"
#include <msp430g2553.h>

#define MAX7219_DIN BIT3
#define MAX7219_CS BIT4

```

```
#define MAX7219_CLK BIT5
```

```
static void MAX7219_SendByte (unsigned char dataout)
{
    char i;
    for (i=8; i>0; i--) {
        unsigned char mask = 1 << (i - 1);
        P1OUT &= ~(MAX7219_CLK);
        if (dataout & mask)
            P1OUT |= MAX7219_DIN;
        else
            P1OUT &= ~(MAX7219_DIN);
        P1OUT |= MAX7219_CLK;
    }
}
```

```
void initialise(){
    P1OUT |= MAX7219_CS;

    P1DIR |= MAX7219_DIN;

    P1DIR |= MAX7219_CS;

    P1DIR |= MAX7219_CLK;

    output(0x0b, 7);
    output(0x09, 0x00);
}
```

```
void output(char address, char data){
    P1OUT |= MAX7219_CS;
    MAX7219_SendByte(address);
    MAX7219_SendByte(data);
    P1OUT &= ~(MAX7219_CS);
    P1OUT |= MAX7219_CS;
}
```

```
void setTestMode(int on){
    output(0x0f, on ? 0x01 : 0x00);
}
```

```

void setShutdown(int off){
    output(0x0c, off ? 0x00 : 0x01);
}

```

```

void showDigits(char numDigits){
    output(0x0b, numDigits-1);
}

```

```

void setBrightness(char brightness){
    output(0x0a, brightness);
}

```

```

void put_byte(char data) {
    char i = 8;
    char mask;
    while(i > 0) {
        mask = 0x01 << (i - 1);
        P1OUT &= ~(MAX7219_CLK);
        if (data & mask){
            P1OUT |= MAX7219_DIN;
        }else{
            P1OUT &= ~(MAX7219_DIN);
        }
        P1OUT |= MAX7219_CLK;
        —i;
    }
}

```

```

void max_single(char reg, char col) {
    P1OUT &= ~(MAX7219_CS);
    put_byte(reg);
    //asm("mov.w reg, R15");
    //asm("call #putByte");
    //asm("pop R15");
    put_byte(col);
    P1OUT &= ~(MAX7219_CS);
    P1OUT |= (MAX7219_CS);
}

```

```

void write8x8(char a, char b, char c, char d, char e, char f, char g,

```

```

    max_single(1,a);
    max_single(2,b);
    max_single(3,c);
    max_single(4,d);
    max_single(5,e);
    max_single(6,f);
    max_single(7,g);
    max_single(8,h);
    delay(5000);
}

```

### 1.3 Drawing

```

#include "drawing.h"
#include "utils.h"
#include "max7219.h"

void stop(){
    write8x8(0x0,0x42,0x24,0x18,0x18,0x24,0x42,0x0);
    delay(10000);
    write8x8(0xff,0xbd,0xdb,0xe7,0xe7,0xdb,0xbd,0xff);
    delay(10000);
}

void left_arrow(){
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x18);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x18,0x3c);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x18,0x3c,0x7e);
    write8x8(0x0,0x0,0x0,0x0,0x18,0x3c,0x7e,0xff);
    write8x8(0x0,0x0,0x0,0x18,0x3c,0x7e,0xff,0x18);
    write8x8(0x0,0x0,0x18,0x3c,0x7e,0xff,0x18,0x18);
    write8x8(0x0,0x18,0x3c,0x7e,0xff,0x18,0x18,0x18);
    write8x8(0x18,0x3c,0x7e,0xff,0x18,0x18,0x18,0x18);
    write8x8(0x18,0x3c,0x7e,0xff,0x18,0x18,0x18,0x18);
    write8x8(0x3c,0x7e,0xff,0x18,0x18,0x18,0x18,0x0);
    write8x8(0x7e,0xff,0x18,0x18,0x18,0x18,0x0,0x0);
    write8x8(0xff,0x18,0x18,0x18,0x18,0x0,0x0,0x0);
    write8x8(0x18,0x18,0x18,0x18,0x0,0x0,0x0,0x0);
    write8x8(0x18,0x18,0x18,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x18,0x18,0x0,0x0,0x0,0x0,0x0,0x0);
}

```

```

    write8x8(0x18,0x0,0x0,0x0,0x0,0x0,0x0,0x0);
}

```

```

void right_arrow(){
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x18,0x0,0x0,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x3c,0x18,0x0,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x7e,0x3c,0x18,0x0,0x0,0x0,0x0,0x0);
    write8x8(0xff,0x7e,0x3c,0x18,0x0,0x0,0x0,0x0);
    write8x8(0x18,0xff,0x7e,0x3c,0x18,0x0,0x0,0x0);
    write8x8(0x18,0x18,0xff,0x7e,0x3c,0x18,0x0,0x0);
    write8x8(0x18,0x18,0x18,0xff,0x7e,0x3c,0x18,0x0);
    write8x8(0x18,0x18,0x18,0x18,0xff,0x7e,0x3c,0x18);
    write8x8(0x18,0x18,0x18,0x18,0xff,0x7e,0x3c,0x18);
    write8x8(0x0,0x18,0x18,0x18,0x18,0xff,0x7e,0x3c);
    write8x8(0x0,0x0,0x18,0x18,0x18,0x18,0xff,0x7e);
    write8x8(0x0,0x0,0x0,0x18,0x18,0x18,0x18,0xff);
    write8x8(0x0,0x0,0x0,0x0,0x18,0x18,0x18,0x18);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x18,0x18,0x18);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x18,0x18);
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x18);
}

```

```

void ahead_arrow(){
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x0,0x80,0x80,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x80,0xc0,0xc0,0x80,0x0,0x0);
    write8x8(0x0,0x80,0xc0,0xe0,0xe0,0xc0,0x80,0x0);
    write8x8(0x80,0xc0,0xe0,0xf0,0xf0,0xe0,0xc0,0x80);
    write8x8(0x40,0x60,0x70,0xf8,0xf8,0x70,0x60,0x40);
    write8x8(0x20,0x30,0x38,0xfc,0xfc,0x38,0x30,0x20);
    write8x8(0x10,0x18,0x1c,0xfe,0xfe,0x1c,0x18,0x10);
    write8x8(0x8,0xc,0xe,0xff,0xff,0xe,0xc,0x8);
    write8x8(0x8,0xc,0xe,0xff,0xff,0xe,0xc,0x8);
    write8x8(0x4,0x6,0x7,0x7f,0x7f,0x7,0x6,0x4);
    write8x8(0x2,0x3,0x3,0x3f,0x3f,0x3,0x3,0x2);
    write8x8(0x1,0x1,0x1,0x1f,0x1f,0x1,0x1,0x1);
    write8x8(0x0,0x0,0x0,0xf,0xf,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x0,0x7,0x7,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x0,0x3,0x3,0x0,0x0,0x0);
    write8x8(0x0,0x0,0x0,0x1,0x1,0x0,0x0,0x0);
}

```

```
}
```

## 1.4 Utils

```
#include "utils.h"
```

```
#include "max7219.h"
```

```
#include <msp430g2553.h>
```

```
void delay(volatile unsigned int i){  
    while((i--)>0);  
}
```

```
void clear_screen(){  
    write8x8(0x0,0x0,0x0,0x0,0x0,0x0,0x0,0x0); // Cleaning screen  
}
```

```
void configure_buttons(){  
    P1DIR &= ~(RIGHT_BTN + LEFT_BTN + STOP_BTN); //Seta como entrada 0 =  
    P1OUT &= ~(RIGHT_BTN + LEFT_BTN + STOP_BTN); //Desliga ambos os leds  
    P1IE |= (RIGHT_BTN + LEFT_BTN + STOP_BTN);  
    P1IFG &= ~(RIGHT_BTN + LEFT_BTN + STOP_BTN);  
    P1REN = (RIGHT_BTN + LEFT_BTN + STOP_BTN);  
    P1IES |= (RIGHT_BTN + LEFT_BTN + STOP_BTN);  
}
```