EMPTY PROGRAM – MPLABX – XC8 compiler – Brainbox Fun

```
#include <xc.h>    // general XC8 library
#define _XTAL_FREQ 48000000  // Brainbox Fun running at 48Mhz

char x = 0;          // declaration of variables

void main(void) // main program
{
       // place code here
}
```

Include // define

```
include File from lib #include <filename>
include user file     #include "filename"

replacement text       #define name text
Example: #define LEDS       PORTD
```

CONFIG BITS

```
RC(ext RC)
HS(Xtal >3MHz)
XT(Xtal 1-4Mhz)
LP(Xtal 32k-200kHz)
WDTEN-WDTDIS (watchdog timer)
LVPDIS-LVPEN(Low volt progrm dis)
```

SET BIT 3

```
PORTC=PORTC|0x08;  // OR
PORTC|=0x08; // shorter
```

CLEAR BIT 3

```
PORTC =PORTC&0xF7; //AND
PORTC &= ~0x08; //short
```

FLIP BIT 3

```
PORTC=PORTC^0x08;  // OR
PORTC^=0x08;// shorter
```

TEST BIT 3

```
Is bit3 = 1 ?
       if (PORTB&0x08)
Is bit3 = 0 ?
       if (~PORTB&0x08)
```

IF / IF-ELSE / IF-ELSE IF - ELSE

```
if (i<10) //(TRUE or FALSE)
{
   som++;
}
else if (i>23)
{
   som--;
}
else
{
   som =0;
}
```

WHILE

```
while (i < N)
{
   som = som + i;
   i++;
}
```

DO WHILE

```
do
{
   som = som + i;
   i++;
} while (i < N);
```

FOR

```
for (i = 0; i < 10; i++)
{
   som = som + i;
}
```

GO TO

```
label_x:

goto label_x;
```

// try not to use goto!!

SWITCH

```
switch(PORTB)
{
 case 1:
    RC0=1;
    break;//jump to end
 case 2:
    RC1=1;
    break;
 default: //else….
    RC2=1;
    break;
}
```

void FUNCTION (void)

```
char x = 0;

void add_x (void)
{
x = x + 1;
}



main()
{
TRISC = 0x00;
while (1)
    {
    add_x();
    PORTC = x;
    __delay_ms(30);
    }
}
```

void FUNCTION (int)

```
void del (unsigned int w)
{
unsigned int i ;
for ( i=0 ; i < w ; i++);
      {
      }
}

main()
{
TRISC = 0x00;
while (1)
     {
     PORTC = 0x00;
     del(64000);
     PORTC = 0xFF;
     del(5000);
     }
}
```

int FUNCTION (int,int)

```
int macht(int x, int y)
{
  int i,m;
  int a = x;
  for (i = 1; i < y; i++)
      {
       m = (a*x);
       a = m;
      }
   return m;
}

main()
{
int a = 3,b = 3,z = 0;
z = macht (a,b);
TRISC = 0x00;
PORTC = z;
}
```

ARRAY / POINTER

```
char array[5] =
{2,4,3,1,5}; // array[0]=
2, array[1] = 4
char string[5] =
“Hello”; // string[0]=
“H”, string[1] = “e”
```

```
char a = 5; // declare a
char a and fill it with
value 5
char *money; // declare a
pointer that can point to
a char
money = &a; // money
points to adress in RAM
where a is stored
*money = 8;      //
changes value of a to 8
```

STRING / POINTER

```
void SHOW(const char
*pString )
{
while ( *pString != 0 )
      // no NULL char
   {
PORTB = *pString; //leds
pString++; // next adress
   }
}
void main (void)
{
char StringA[20] = "Hello
World";
SHOW(StringA);
//SHOW("Hello World");
// also good code
}
```

OPERATORS

ARITHMETIC	+,-,*,/,%	X=5
		Y=8
			Z=Y/X (Z=1)
			Z=Y%X (Z=3)

EQUALITY	==, !=	X=5	If (X!=0) TRUE Read as: if X is not equal to 0

ORDER	<,<=,>,>=	X=5
		Y=8
			If (X>=Y) FALSE
			Read: if X is greater or equal to Y

BYTEWISE LOGIC	!,&&,||	X=5
		Y=8
		Z= 7
			If ((X<Z) &&(Z<Y)) TRUE : X<Z<Y
			((TRUE)&&(TRUE)) = TRUE
			If (!(Z<=Y)) FALSE
			read as: If Z is not <= Y

BITWISE LOGIC	~,&,|,^		~0b00001111 = 0b11110000 0b00111100^0b00001111 = 0b00110011 (bitwise exor)
BITWISE SHIFTS	<<,>>	X=1	X=X<<2 (X=4)(shift left 2 positions) PORTB |=(1<<3) read as: make bit 3 of PORTB = 1
ASSIGNMENT	=, +=, -=, *=, /=, %=, &= , |=, ^=, <<=, >>=		X +=2 (short for X = X + 2) X <<=4 (short for X = X << 4)
INCREMENT	++	X=5	X++ (X=6)
DECREMENT	--	X=5	X-- (X=4)

VARIABLES

TYPE	Size (bits)	RANGE
bit	1	0 to 1
signed char	8	-128 to 127
unsigned char	8	0 to 255
signed short	16	-32768 to 32767
unsigned short	16	0 to 65535
signed int	16	-32768 to 32767
unsigned int	16	0 to 65536
signed short long	24	-8388608 to 8388607
unsigned short long	24	0 to 16777215
signed long	32	-2147483648 to 2147483647
unsigned long	32	0 to 4294967295
float	24	Real (floating point)
double	24 / 32	(FP – double precicion)

Const : something is not modifyable during the run of the program

Volatile : It tells the compiler that the object is subject to sudden change.

Static :A variable declared static in a function retains its state between calls to that function.

ASCII TABLE

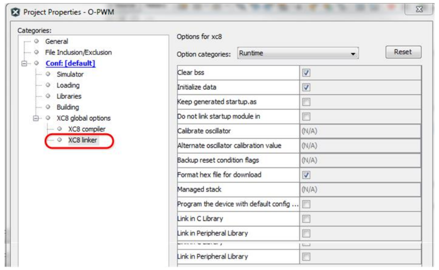
Dec	Hex	Description	Dec	Hex	Cha	Dec	Hex	Cha	Dec	Hex	Cha
0	0	null	33	21	!	64	40	@	95	5F	
1	1	start of heading	34	22	"	65	41	A	96	60	`
2	2	start of text	35	23	#	66	42	B	97	61	a
3	3	end of text	36	24	$	67	43	C	98	62	b
4	4	end of transmission	37	25	%	68	44	D	99	63	c
5	5	enquiry	38	26	&	69	45	E	100	64	d
6	6	acknowledge	39	27	'	70	46	F	101	65	e
7	7	bell	40	28	(	71	47	G	102	66	f
8	8	backspace	41	29	)	72	48	H	103	67	g
9	9	horizontal tab	42	2A	*	73	49	I	104	68	h
10	A	new line	43	2B	+	74	4A	J	105	69	i
11	B	vertical tab	44	2C	,	75	4B	K	106	6A	j
12	C	new page	45	2D	-	76	4C	L	107	6B	k
13	D	carriage return	46	2E	.	77	4D	M	108	6C	l
14	E	shift out	47	2F	/	78	4E	N	109	6D	m
15	F	shift in	48	30	0	79	4F	O	110	6E	n
16	10	data link escape	49	31	1	80	50	P	111	6F	o
17	11	device control 1	50	32	2	81	51	Q	112	70	p
18	12	device control 2	51	33	3	82	52	R	113	71	q
19	13	device control 3	52	34	4	83	53	S	114	72	r
20	14	device control 4	53	35	5	84	54	T	115	73	s
21	15	neg.acknowledge	54	36	6	85	55	U	116	74	t
22	16	synchronous idle	55	37	7	86	56	V	117	75	u
23	17	end of trans. block	56	38	8	87	57	W	118	76	v
24	18	cancel	57	39	9	88	58	X	119	77	w
25	19	end of medium	58	3A	:	89	59	Y	120	78	x
26	1A	substitute	59	3B	;	90	5A	Z	121	79	y
27	1B	escape	60	3C	<	91	5B	[	122	7A	z
28	1C	file separator	61	3D	=	92	5C	\	123	7B	{
29	1D	group separator	62	3E	>	93	5D	]	124	7C	|
30	1E	record separator	63	3F	?	94	5E	^	125	7D	}
31	1F	unit separator							126	7E	~
32	20	space							127	7F	DEL

INTERRUPT ROUTINE XC8

```
#include <xc.h>   // general XC8 library
#define _XTAL_FREQ 48000000  // Brainbox Fun running at
48Mhz

unsigned int secteller = 0; // global var

void main(void) // main program
{
        while(1)
        { // do nothing at all     }
}

void interrupt tc_int (void)     // interrupt routine
    {
    INTCONbits.T0IF = 0; // int flag must be cleared
    secteller ++;        // increment secteller
    }
```

BRAINBOX FUN PROGRAMMEREN

Settings om code na bootloader in te kunnen laden:
MPLABX >> RUN >> SET PROJECT CONFIGURATION >> CUSTOMIZE

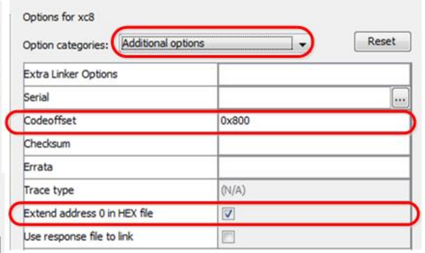

Project Properties - O-PWM

Categories:
- General
- File Inclusion/Exclusion
- Conf: [default]
  - Simulator
  - Loading
  - Libraries
  - Building
  - XC8 global options
    - XC8 compiler
    - XC8 linker

Options for xc8

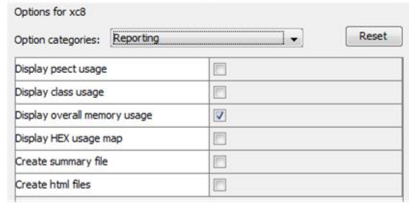
Option categories: Runtime

Clear bss	☑
Initialize data	☑
Keep generated startup.as	□
Do not link startup module in	□
Calibrate oscillator	(N/A)
Alternate oscillator calibration value	(N/A)
Backup reset condition flags	(N/A)
Format hex file for download	☑
Managed stack	(N/A)
Program the device with default config ...	□
Link in C Library	□
Link in Peripheral Library	□
Link in Peripheral Library	□


Options for xc8

Option categories: Additional options

Extra Linker Options	
Serial	
Codeoffset	0x800
Checksum	
Errata	
Trace type	(N/A)
Extend address 0 in HEX file	☑
Use response file to link	□

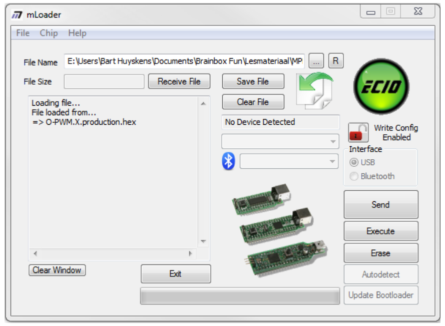

Options for xc8

Option categories: Reporting

Display psect usage	□
Display class usage	□
Display overall memory usage	☑
Display HEX usage map	□
Create summary file	□
Create html files	□

Download en gebruik MLOADER (Matrixtsl) om de hex file in de BBF te laden

1- select *.hex file
2- druk op reset knop
3- druk op “Send” knop
4- druk op “Execute” knop


mLoader

File Name: E:\Users\Bart Huyskens\Documents\Brainbox Fun\Lesmateriaal\MP

File Size:

```
Loading file...
File loaded from...
=> O-PWM.X.production.hex
```

No Device Detected

Write Config Enabled

Interface: ● USB ○ Bluetooth