

```

                                                    delay
/*
lowlevel delay routines

Designed by Shane Tolmie of KeyGhost corporation.  Freely distributable.
Questions and comments to shane@keyghost.com
Want to see 4Mb of Hi-Tech C FAQ and sample source code? http://www.keyghost.com/htpic
(also has tiny device to record keystrokes in hardware on PC)

For Microchip 12C67x, 16C7x, 16F87x and Hi-Tech C

Example C:
#define PIC_CLK 8000000

#include "delay.h"

unsigned int timeout_int, timeout_char;

timeout_char=timeout_char_us(1147);
while(timeout_char-- && (RA1==0)); //wait up to 1147us for port RA1 to go high
// - this is the max timeout

timeout_int=timeout_int_us(491512);
while(timeout_int-- && (RA1==0)); //wait up to 491512us for port RA1 to go high
// - this is the max timeout

dly250n: //delay 250ns
dly1u: //delay 1us
DelayUs(40); //do not do DelayUs(0) or else it bombs :)
DelayUs(255); //max

*/

#ifndef __DELAY_H
#define __DELAY_H

#define PIC_CLK 4000000

unsigned char delayus_variable;

#if (PIC_CLK == 4000000) || (PIC_CLK == 3686400) //3686400 is not entirely accurate, but it works
#define dly125n please remove; for 32Mhz+ only
#define dly250n please remove; for 16Mhz+ only
#define dly500n please remove; for 8Mhz+ only
#define dly1u asm("nop")
#define dly2u dly1u;dly1u
#elif (PIC_CLK == 8000000)
#define dly125n please remove; for 32Mhz+ only
#define dly250n please remove; for 16Mhz+ only
#define dly500n asm("nop")
#define dly1u dly500n;dly500n
#define dly2u dly1u;dly1u
#elif ( (PIC_CLK == 16000000) || (PIC_CLK == 16257000) )
#define dly125n please remove; for 32Mhz+ only
#define dly250n asm("nop")
#define dly500n dly250n;dly250n
#define dly1u dly500n;dly500n
#define dly2u dly1u;dly1u
#elif (PIC_CLK == 20000000)
#define dly200n asm("nop")
#define dly400n dly250n;dly250n
#define dly2u dly400n;dly400n;dly400n;dly400n;dly400n
#elif (PIC_CLK == 32000000)
#define dly125n asm("nop")
#define dly250n dly125n;dly125n
#define dly500n dly250n;dly250n
#define dly1u dly500n;dly500n
#define dly2u dly1u;dly1u
#else
#error please define pic_clk correctly
#endif

//*****
//delay routine

```

delay

```
#if PIC_CLK == 4000000 || (PIC_CLK == 3686400) //3686400 is not entirely accurate, but it works
    #define DelayDivisor 4
    #define WaitFor1Us asm("nop")
    #define Jumpback asm("goto $ - 2")
#elif PIC_CLK == 8000000
    #define DelayDivisor 2
    #define WaitFor1Us asm("nop")
    #define Jumpback asm("goto $ - 2")
#elif ( (PIC_CLK == 16000000) || (PIC_CLK==16257000) )
    #define DelayDivisor 1
    #define WaitFor1Us asm("nop")
    #define Jumpback asm("goto $ - 2")
#elif PIC_CLK == 20000000
    #define DelayDivisor 1
    #define WaitFor1Us asm("nop")
    #define WaitFor1Us asm("nop")
    #define Jumpback asm("goto $ - 2")
#elif PIC_CLK == 32000000
    #define DelayDivisor 1
    #define WaitFor1Us asm("nop"); asm("nop"); asm("nop"); asm("nop")
    #define Jumpback asm("goto $ - 6")
#else
    #error please define pic_clk correctly
#endif
```

```
#define DelayUs(x) { ¥
    delayus_variable=(unsigned char)(x/DelayDivisor); ¥
    WaitFor1Us; } ¥
    asm("decfsz _delayus_variable, f"); ¥
    Jumpback;
```

/\*

timeouts:

C code for testing with ints:

```
unsigned int timeout;
timeout=4000;
PORT_DIRECTION=OUTPUT;
while(1)
{
    PORT=1;
    timeout=8000;
    while(timeout-- >= 1); //60ms @ 8Mhz, opt on, 72ms @ 8Mhz, opt off
    PORT=0;
}
```

Time taken:   optimisations on:           16cyc/number loop, 8us @ 8Mhz  
                  optimisations off:       18cyc/number loop, 9us @ 8Mhz  
                  with extra check ie:   && (RB7==1), +3cyc/number loop, +1.5us @ 8Mhz

C code for testing with chars:

similar to above

Time taken:   optimisations on:           9cyc/number loop, 4.5us @ 8Mhz  
                  with extra check ie:   && (RB7==1), +3cyc/number loop, +1.5us @ 8Mhz

Formula:      rough timeout value = (<us desired>/<cycles per loop>) \* (PIC\_CLK/4.0)

```
To use:        //for max timeout of 1147us @ 8Mhz
                #define LOOP_CYCLES_CHAR       9                                    //how
many cycles per loop, optimizations on
char)((x/LOOP_CYCLES_CHAR)*(PIC_CLK/4.0))
                #define timeout_char_us(x)     (unsigned
                unsigned char timeout;
                timeout=timeout_char_us(1147);                                    //max
timeout allowed @ 8Mhz, 573us @ 16Mhz
                while((timeout-- >= 1) && (<extra condition>)); //wait
```

```
To use:        //for max 491512us, half sec timeout @ 8Mhz
                #define LOOP_CYCLES_INT       16                                   //how
many cycles per loop, optimizations on
```

```

int) ((x+LOOP_CYCLES_INT)*(PIC_CLK/4.0))
#define timeout_int_us(x) delay (unsigned
unsigned int timeout;
timeout=timeout_int_us(491512); //max
timeout allowed @ 8Mhz while((timeout-- >= 1) && (<extra condition>)); //wait
*/
#define LOOP_CYCLES_CHAR 9 //how many cycles
per loop, optimizations on
#define timeout_char_us(x) (unsigned char)((x/LOOP_CYCLES_CHAR)*(PIC_CLK/4000000.0))
#define LOOP_CYCLES_INT 16 //how many cycles
per loop, optimizations on
#define timeout_int_us(x) (unsigned int)((x/LOOP_CYCLES_INT)*(PIC_CLK/4000000.0))
#endif

```