Digital Implementation of a DC-AC Single-Phase Power Supply

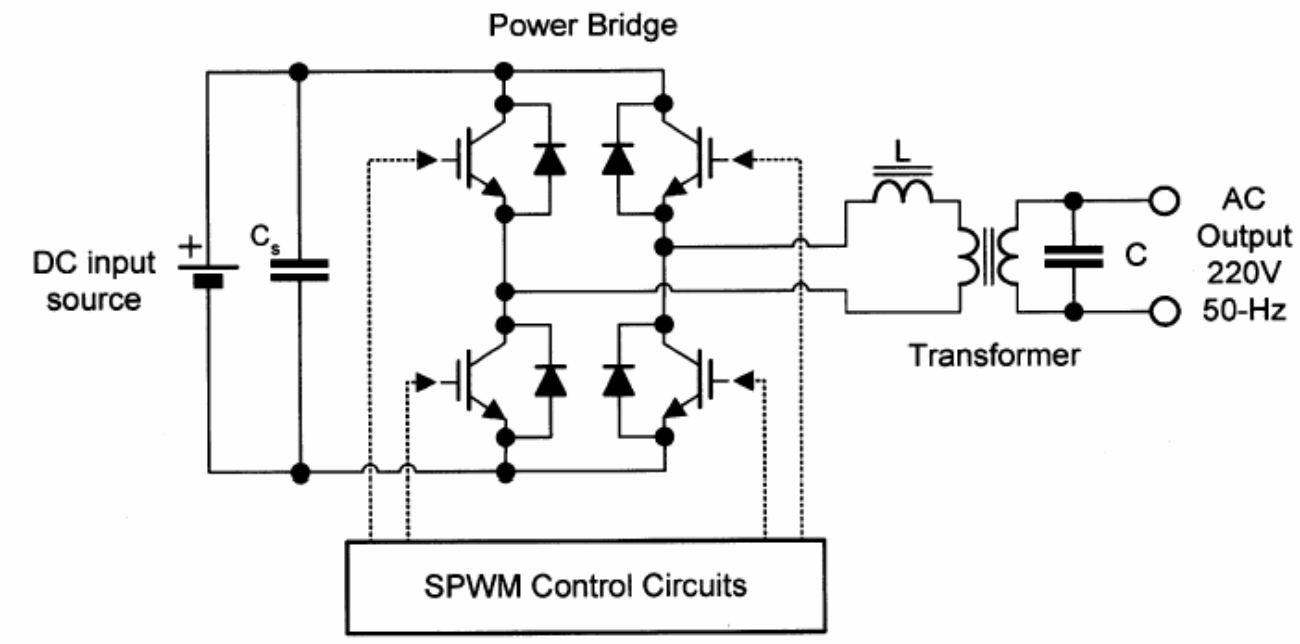
System Document

System Overview

The structure of the PIC DC-AC INVERTER system adopted is shown in Figure 1.The static inverter is supplying power based on 24VDC battery.

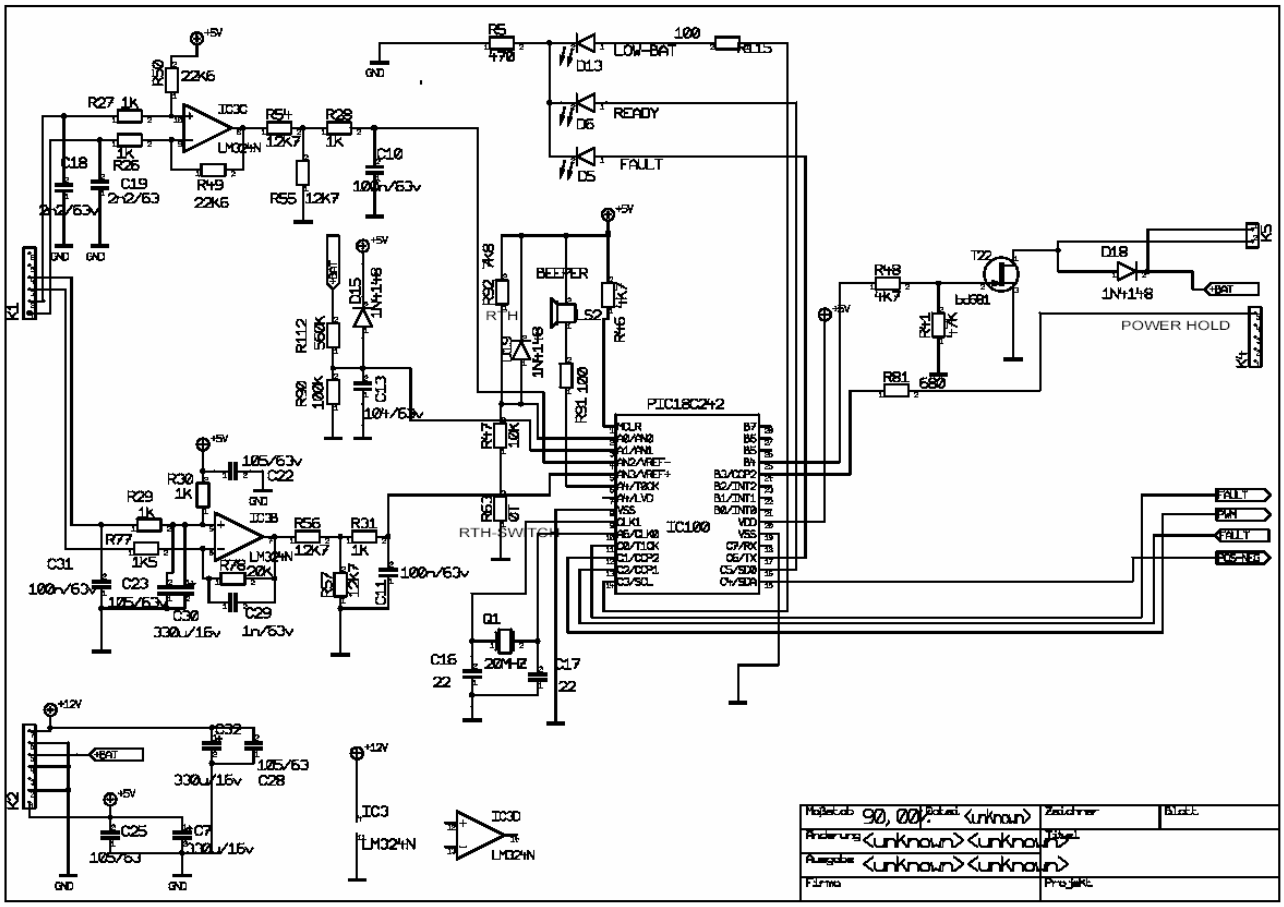
1.1 Implementation

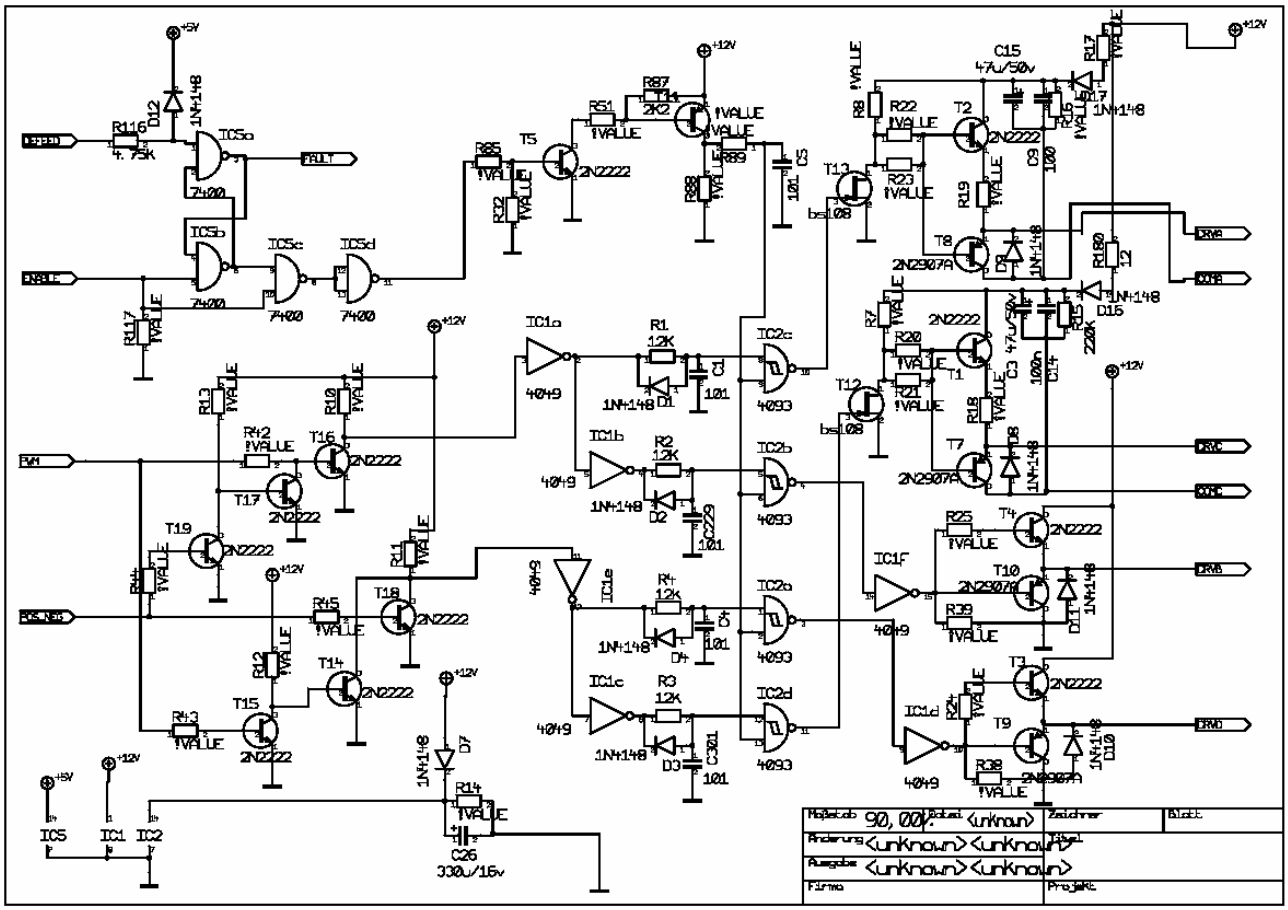
A diagram of the inverter process is given as shown in Fig. 1.

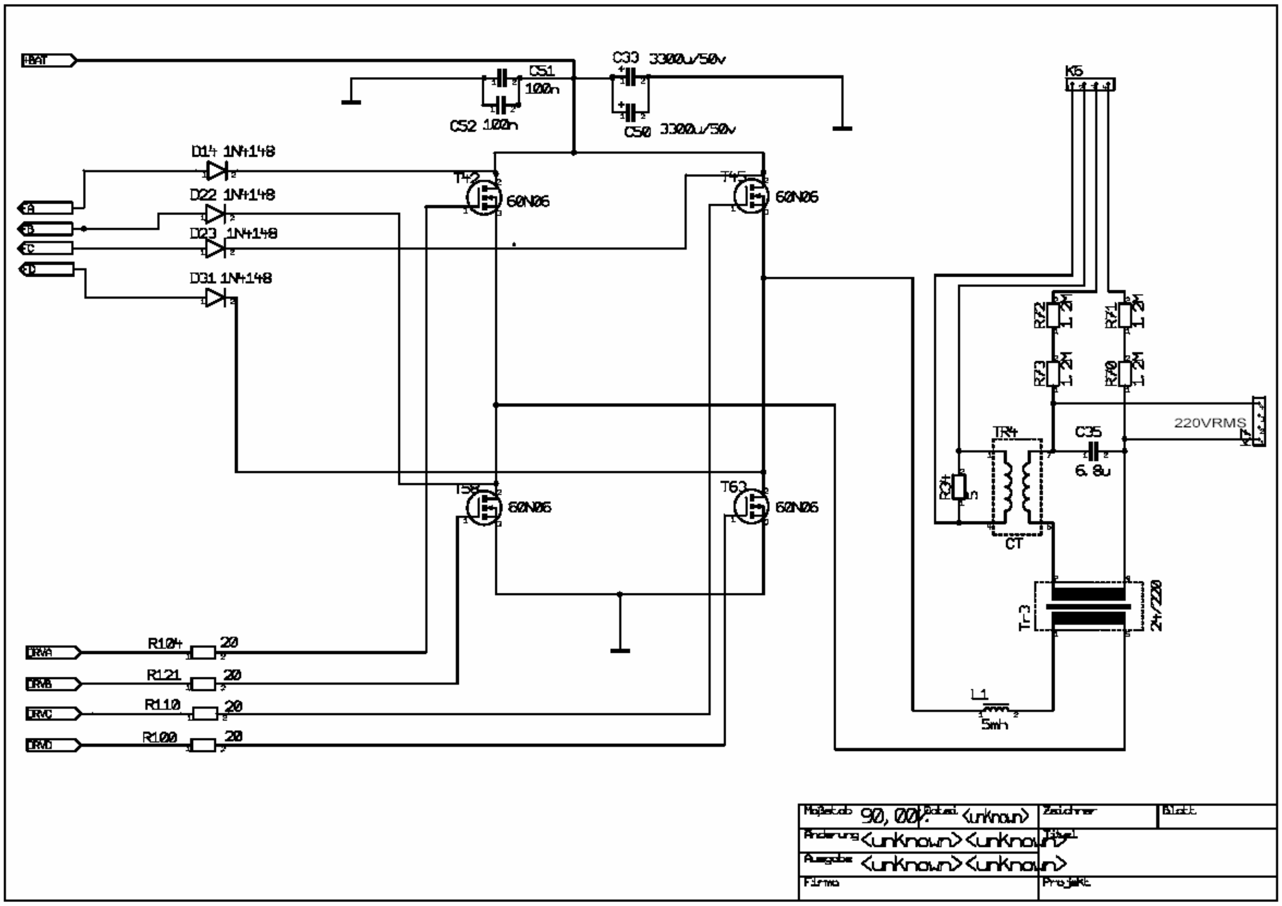


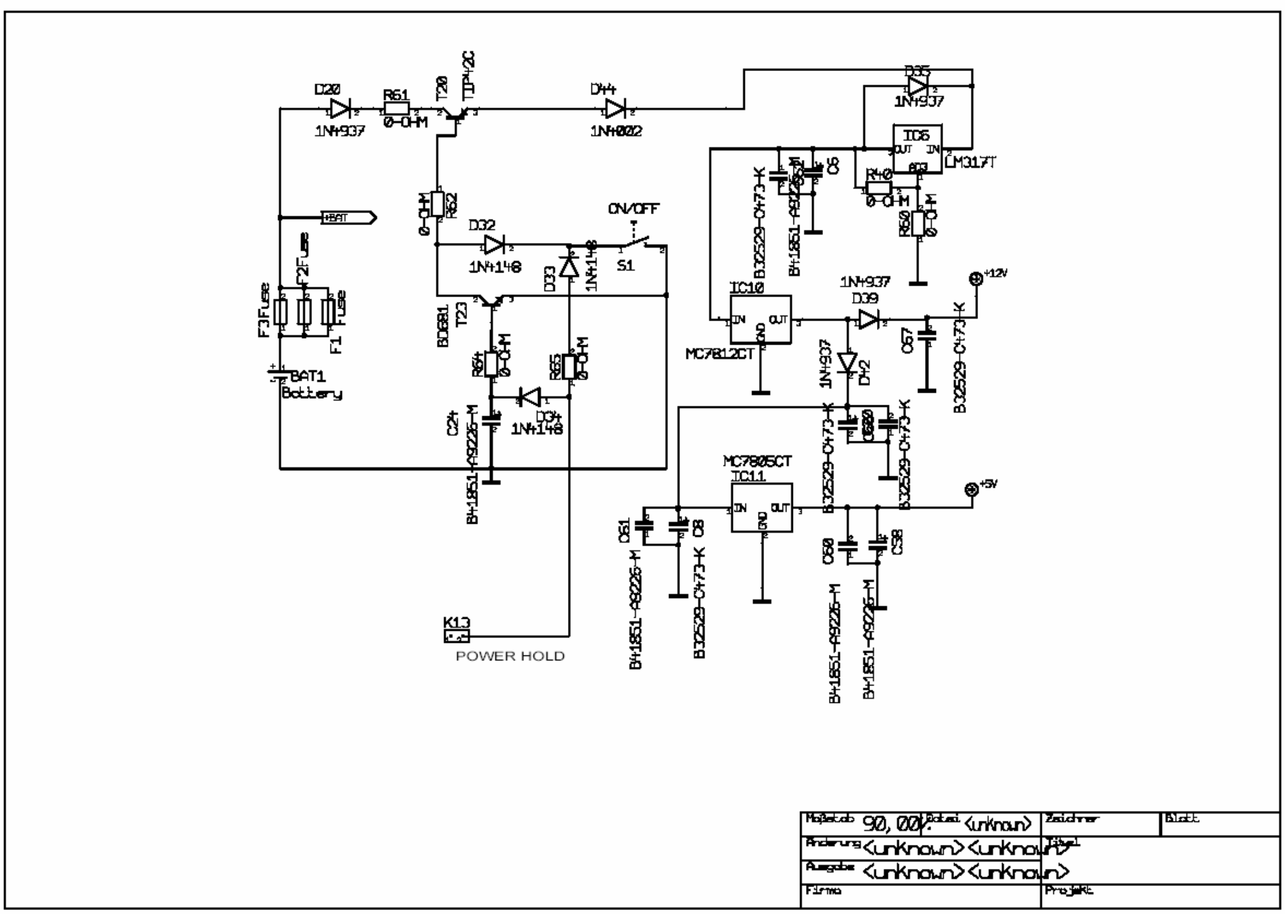
The 24V goes through the dc-ac Inverter stage that will transform the 24V dc to about 13vac 50 Hz sine wave and to a 1:17 step- up transformer to 220vac 50Hz to power an electrical load.

Schematics: NOTE: the de-saturation network for the fault activation is not yet ready.


PIC18C242
IC100
LM324N
LOW-BAT
READY
FAULT
BEEPER
POWER HOLD
RTH-SWITCH
20MHZ
Maßstab 90,00%
Datei <unknown>
Zeichner
Blatt
Änderung <unknown> <unknown>
Ausgabe <unknown> <unknown>
Firma
Projekt


7400
4049
4093
2N2222
2N2907A
Maßstab 90,00%
Datei <unknown>
Zeichner
Blatt
Änderung <unknown> <unknown>
Ausgabe <unknown> <unknown>
Firma
Projekt


+BAT
C51 100n
C52 100n
C33 3300u/50v
C50 3300u/50v
D14 1N4148
D22 1N4148
D23 1N4148
D31 1N4148
T42 60N06
T45 60N06
T58 60N06
T63 60N06
K5
R72 1.2M
R73 1.2M
R71 1.2M
R70 1.2M
TR4
CT
C35 6.8u
220VRMS
Tr3 24/220
L1 5mh
DRVA R104 20
DRVB R121 20
DRVC R110 20
DRVD R100 20
Maßstab 90,00% Datei <unKnown>
Zeichner
Blatt
Änderung <unKnown><unKnown>
Titel
Ausgabe <unKnown><unKnown>
Firma
Projekt


D20 1N4937
R61 0-OHM
T20 TIP42C
D44 1N4002
D35 1N4937
IC6 LM317T
R40 0-OHM
R50 0-OHM
+BAT
R62 0-OHM
D32 1N4148
ON/OFF
S1
D33 1N4148
F3Fuse
F2Fuse
F1 Fuse
BAT1 Battery
BD681 T23
R64 0-OHM
R65 0-OHM
D34 1N4148
C24 B41851-A9226-M
IC10 MC7812CT
1N4937 D39
+12V
C57 B32529-C473-K
1N4937 D42
MC7805CT IC11
+5V
C61 B41851-A9226-M
C8 B32529-C473-K
C58
C38
K13
POWER HOLD
Maßstab 90,00% Datei <unKnown>
Zeichner
Blatt
Änderung <unKnown><unKnown>
Titel
Ausgabe <unKnown><unKnown>
Firma
Projekt

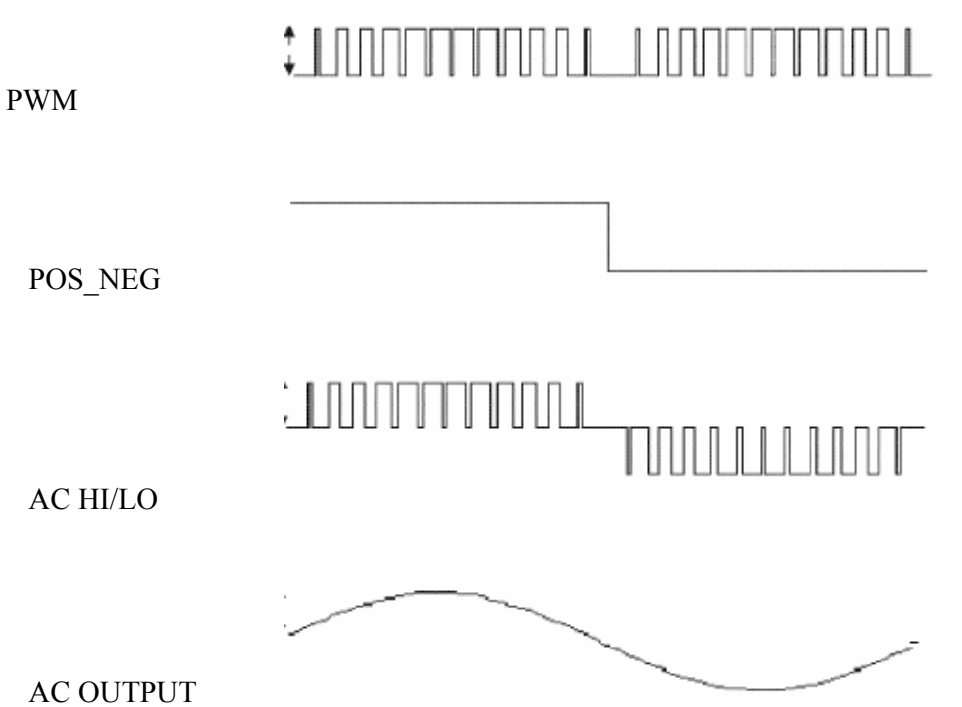


Fig.3 Principal wave-form of the inverter

```
/*
 * Project name: DC-AC Inverter

 *        Author: Babalola.

 * Description:
        This  project generate sine-wave PWM in an open loop
        using timer1 to generate interupt.
 * Test configuration:
        MCU:                    P18f252

        Oscillator:       HS, 20.0000 MHz

        SW:                     mikroC v7.0
 * NOTES:
```

```
        The project considers angles from 0 to pi/2 only, since the rest of the
        sinusoid can be reproduced by algebric operations using provided samples values.
*/

// These are 64 samples of the sine function
// Samples[index] = Round(1.4*sine(x)),
//          where x E [0, pi/2] and index E [0..31]

 unsigned char const pwmtab[32] =
          { 0,3,5,8,11,13,16,18,20,,22,23,25,26,27,
            27,28,28,28,27,27,26,25,23,22,20,18,
            16,13,11,8,5,3 };
 unsigned  char index;

void CLRWDT( )
{

        asm CLRWDT;

}
// TIMER INTERRUPT SERVIVE ROUTINE
//Inverter run in an open-loop mode
void Interrupt( )
{
        T0CON &= ~( 1<<TMR1ON );            //  Stop the timer for a moment
        TMR0H  = 0xF9;                      //reload timer to interrupt every 312.5uS
        TMR0L  = 0XE6;
        T0CON |= ( 1<<TMR2ON );             //  Start the Timer0
  CLRWDT( );

        CCPR1L = pwmtab[ index ];           //  lookup the value of sinewave and  update duty cycle
        if( !index );

        {
                PORTC.F0 = 0;                 // gate drive off
                PORTC.F2 = ~PORTC.F2;         // Flip pos/neg bit
                PORTC.F0 = 1;                 //        gate drive on
        }
        ++index;
        if( index == 32 )                     //  Take care we do not overflow array index [0..31]
                index = 0;

}
// intialise variables and the controller hardware
void Init_Main( )
{

        index      = 0;                       // init variable

        TRISA   = 0XEF;                       //  set ports direction
         TRISB   = 0XC0;
        TRISC   = 0X04;
        PORTB    = 0X08;              //activate fully the power supply to the control board
        PORTA.F4  = 1;                //activate buzzer briefly
        Delay_ms(2000);               // 2 second pause
```

```
        PORTA .F4 = 0;                  //DEACTIVATE BUZZER

        PORTC           = 0;          // make sure the fets are turn-off

// pwm setup
        PR2       = 0XF9;                                   //  20 MHz clock - > 20kHz PWM frequency
        T2CON           = ( 1<<TMR2ON );                  // timer2 on
        CCPR1L          = 0;                               // Initial Duty
        CCP1CON    = 0x0C;                                 // configure and start as pwm

// TIMER0 Setup

  T0CON         = 0x08;                        // Set internal clock, NO prescale,16bit,off at this moment
  TMR0H         = 0xF9;                         // Set TMR0 start value
TMR0L           = 0XE6;

//set up the interrupts, enable it and start timer0

        INTCON = 0xA0;                          // enable global interrupt /timer0 overflow
        T0CON.F7   = 1;                         //  start timer 0

}


void main( )
{
        Init_Main( );                           // Prepare PIC for operation

        PORTC.F0 = 1;                           //  Enable inverter
        while( 1 );                  //loop forever, execute in INT



}
```