```
'---------------Title--------------

' File......DS1620_4_fan.pbp
' Started....5/28/08
' Microcontroller used:  Microchip Technology 16F88
'                        microchip.com
' PicBasic Pro Code, micro-Engineering Labs, Inc.
'                    melabs.com

'--------Program Desciption--------

' The program uses the Dallas DS1620 digital
' temperature device as a thermostat to:
'   * Control a 12 V fan acting as a cooling system.
' The PIC16F88:
'   * Reads the DS1620 device and displays results on an LCD.
'   * Displays positive and negative °C temperatures.
' The DS1620 measures temperatures from -55°C to +125°C
' in 0.5°C increments

'-------------Comments-------------

' See:
'
' http://cornerstonerobotics.
org/curriculum/lessons_year2/erii_ds1620_thermometer.pdf
'
' for a more detailed description of the application of this program.

'-------------Includes-------------

    INCLUDE "Modedefs.bas"      ' The Mode names for SHIFTIN and
                                ' SHIFTOUT are defined in the
                                ' file MODEDEFS.BAS

'----------PIC Connections---------

'       16F88 Pin               Wiring
'       ---------           ----------
'       RA0                 LCD pin 11(DB4)
'       RA1                 LCD pin 12(DB5)
'       RA2                 LCD pin 13(DB6)
'       RA3                 LCD pin 14(DB7)
'       RA4                 LCD Register Select(RS)
'       RB0                 DS1620 RST (Pin 3)
'       RB1                 DS1620 DQ (Pin 1)
'       RB2                 DS1620 CLK (Pin 2)
'       RB3                 LCD Enable(E)
'       Vdd                 +5 V
'       Vss                 Ground
'       MCLR                4.7K Resistor to +5 V

'--------DS1620 Connections--------

'       DQ (Pin 1)          PIC RB1
'       CLK (Pin 2)         PIC RB2
'       RST (Pin 3)         PIC RB0
'       GND (Pin 4)         Ground
'       TCOM (Pin 5)        To a NPN transistor switch that controls
'                           the 12 V fan
'       TLOW (Pin 6)        No Connection
'       THIGH (Pin 7)       No Connection
'       Vdd (Pin 8)         +5 V

'--------DS1620 Control Pins-------

    DSRST   VAR     PORTB.0     ' Name PORTB.0 as DSRST (DS1620 Reset)
    DSDQ    VAR     PORTB.1     ' Name PORTB.1 as DSDQ (DS1620 Data)
    DSCLK   VAR     PORTB.2     ' Name PORTB.2 as DSCLK (DS1620 Clock)

'------------Variables-------------

    temp    VAR     WORD        ' WORD to store temperature variable,
                                ' temp
    temp1   VAR     BYTE        ' BYTE to store 8-bit temp1


'---------Initialization--------

    TRISB = 0               ' Set pins B7-B0 of PORTB as outputs

    ANSEL = 0               ' Configure all pins to digital
                            ' operation since not using ADC
                            ' (Analog to Digital Converter)

    OSCCON = $60            ' Sets the internal oscillator in the
                            ' 16F88 to 4 MHz

'--------Main Code--------

    PAUSE 1000              ' Pause 1 second to allow LCD to setup

    LOW DSRST               ' Reset the DS1620

' Main loop to read temperature from the DS1620 and then
' display it on the LCD.

start:

' Convert temperature from DS1620

    DSRST = 1               ' Enable DS1620

    SHIFTOUT DSDQ, DSCLK, LSBFIRST, [$ee]
                            ' Send initiate temperature conversion
                            ' command, $ee, on data pin DSDQ,
                            ' synchronized by clock pin DSCLK, shift
                            ' data out lowest bit first, LSBPRE

    DSRST = 0               ' Reset the DS1620 to enable conversion
    PAUSE 1000          ' Pause 1 second to complete conversion

 ' Read temperature from DS1620

    DSRST = 1           ' Enable DS1620

    SHIFTOUT DSDQ, DSCLK, LSBFIRST, [$aa]
                        ' Send read command, $aa

    SHIFTIN DSDQ, DSCLK, LSBPRE, [temp\9]
                        ' Read 9-bit temperature.
                        ' Shifts in 9 bits of variable temp,
                        ' [temp\9], on data pin DSDQ,
                        ' synchronized by clock pin DSCLK,
                        ' shift data in lowest bit first,
                        ' LSBPRE

    DSRST = 0           ' Reset the DS1620

' Check to see if temp is below 0°C

    IF temp > $0191 THEN print_temp_below_zero

' Display temperature as a decimal

    LCDOUT $fe, 1, DEC (temp >> 1), ".", DEC (temp.0*5), " Degrees C"

                        ' Shift temp to right one position,(temp >> 1),
                        ' to display the integer portion of temp then
                        ' multiply bit 0 of temp by 5 (temp.0*5) to
                        ' display decimal portion of temp.
                        ' The bit temp.0 is either a 0 or 1,
                        ' so (temp.0*5) is either 0 or 5 proceeded
                        ' by a decimal from  the entry "."

    GOTO start          ' Jumps to loop label, starts all over

print_temp_below_zero:

' Express temp in the 2's complement form:

    temp1 = ~ temp + 1  ' temp1 is the 2's complement form of temp.
                        ' temp1 is an 8-bit variable to truncate
                        ' the upper 8-bits of the 16-bit temp.

    LCDOUT $fe, 1,"-", DEC (temp1 >> 1),".",DEC (temp1.0*5)," Degrees C"

    GOTO start

    END
```