

'-----Title-----'

' File.....4331\_encoder1.pbp  
' Started....10/28/09

' Microcontroller Used: Microchip Technology 18F4331  
' Available at:  
' <http://www.microchipdirect.com/ProductDetails.aspx?Category=PIC18F4331>  
' or <http://www.digikey.com/>  
' Motor Controller Used: Xavien 2 Motor Driver "XDDCMD-1  
' Available at: [http://encodergeek.com/Xavien\\_Amplifier.html](http://encodergeek.com/Xavien_Amplifier.html)  
' Motor and Encoder Used: Small Motor with Quadrature Incremental Encoder  
' Available at: [http://encodergeek.com/DCMtr\\_SMALL.html](http://encodergeek.com/DCMtr_SMALL.html)  
'  
' PicBasic Pro Code: micro-Engineering Labs, Inc.  
' [melabs.com](http://melabs.com)

'-----Program Description-----'

' Program uses encoder to track position of motor.  
' Display also gives motor power.

'---Review PicBasic Pro Command---

' The PicBasic Pro Compiler Manual is on line at:  
' <http://www.microengineeringlabs.com/resources/index.htm#Manuals>  
'  
' HPWM Channel,Dutycycle,Frequency  
'  
' Outputs a PWM signal using the PICs hardware which  
' is available on some PICs including the PIC18G4331.  
' Channel specifies which PWM channel to use.  
' Dutycycle ranges from 0 (0%) to 255 (100%).  
' Frequency - lowest frequency depends upon oscillator speed,  
' highest frequency at any oscillator speed is 32,767 Hz.  
' Look around page 75 in the PicBasic Pro Compiler Manual  
' for detailed discussion of the HPWM command.

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

18F4331 Pin	Wiring
RA0(AN0)	Potentiometer, controls motor power
RA3	Signal 1 from Encoder
RA4	Signal 2 from Encoder
RB5	In Circuit Serial Programming (ICSP) PGM 100K Resistor to GND
RB6	ICSP PGC (Clock)
RB7	ICSP PGD (Data)
RC0	Brake Motor 1 on Xavien XDDCMD-1 (Pin 1)
RC1	PWM Motor 1 on Xavien XDDCMD-1 (Pin 2)
RC3	Direction Motor 1 on Xavien XDDCMD-1 (Pin 3)
RD4	LCD Data Bit 4
RD5	LCD Data Bit 5
RD6	LCD Data Bit 6

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'
    RD7          LCD Data Bit 7
    RE0          LCD Register Select
    RE1          LCD Enable
    MCLR         4.7K Resistor to +5V & ICSP Vpp
    VDD          +5V
    VSS          GND
    OSC1 & OSC2 4 MHz Crystal w/ 2-22 pF Cap. to GND
```

'----Xavien XDDCMD-1 Connections----

Xavien 2x5 Header Pin	Wiring	Pin Layout 2x5 Header
		2 4 6 8 10
Pin 1 Motor 1 Brake	RC0	0 0 0 0 0
Pin 2 Motor 1 PWM	RC1	0 0 0 0 0
Pin 3 Motor 1 Direction	RC3	1 3 5 7 9

' See schematic at:  
'[http://cornerstonerobotics.org/schematics/18f4331\\_hpwm\\_motor\\_encoder.pdf](http://cornerstonerobotics.org/schematics/18f4331_hpwm_motor_encoder.pdf)

'--Sample POSCNTH, POSCNTL Values and Corresponding Position Counter--

' position = 256 \* POSCNTH + POSCNTL

POSCNTH	POSCNTL	Position Counter
0	0	0
0	1	1
1	0	255
0	128	128
128	0	32768
0	255	255
255	0	65280
255	255	65535

'-----Defines-----

```
DEFINE LCD_DREG PORTD      ' Set LCD Data port
DEFINE LCD_DBIT 4          ' Set starting Data bit to 4
DEFINE LCD_BITS 4         ' Set LCD bus size to 4
DEFINE LCD_RSREG PORTE    ' Set LCD Register Select port to E
DEFINE LCD_RSBIT 0        ' Set LCD Register Select bit to 0
DEFINE LCD_EREG PORTE     ' Set LCD Enable port to E
DEFINE LCD_EBIT 1         ' Set LCD Enable bit to 1
DEFINE LCD_LINES 2        ' Set number of lines on LCD to 2
DEFINE LCD_COMMANDUS 2000 ' Set command delay time to 2000 us
DEFINE LCD_DATAUS 50      ' Set data delay time to 50 us
DEFINE ADC_BITS 8         ' Set number of bits in result to 8
DEFINE ADC_CLOCK 3        ' Set clock source (rc = 3)
DEFINE ADC_SAMPLEUS 50   ' Set sampling time in us
DEFINE CCP2_REG PORTC     ' Set HPWM Channel 2 port to C
DEFINE CCP2_BIT 1         ' Set HPWM Channel 2 bit to 1
```

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

```

mot_pwr  VAR    BYTE    ' Declare mot_pwr variable, reserve byte
pot_val  VAR    BYTE    ' Declare pot_val, reserve byte
position VAR    WORD    ' Declare position, reserve word

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

CCP1CON = %00111111    ' Set Capture/Compare/PWM Module Control
                    ' Register CCP1CON in PWM mode (bits 0-3),
                    ' bits 4,5 set LSBs of 10-bit duty cycle,
                    ' see 18F4331 datasheet page 151 +/--.
ANSEL0 = %00000001    ' Set AN0 to analog, AN1-AN7 to digital,
                    ' see datasheet page 249 +/--.
ANSEL1 = %00000000    ' Set AN8 to digital, see datasheet
                    ' page 249 +/--.
TRISA = %00011111    ' Set TRISA register, RA7-RA5 as outputs,
                    ' RA4-RA0 as inputs, see datasheet
                    ' page 107 +/--.
LATA = %00000000    ' Set all LATA register bits to 0.
TRISB = %00000000    ' Set RB7-RB0 pins in PORTB as outputs.
TRISC = %00000000    ' Set RC7-RC0 pins in PORTC as outputs.
QEICON = %10001000    ' Set Quadrature Encoder Interface Control
                    ' Register. See page 171 +/- for
                    ' encoder set up.
PORTC.0 = 1          ' Turn on brake.
PORTC.1 = 0          ' Set PWM bit for Channel 2 of HPWM to LOW.

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

    PAUSE 1000        ' Pause to start up LCD
    PORTC.0 = 0      ' Turn off brake
    PORTC.3 = 0      ' Set direction of motor
                    ' If position value on LCD is in the 65,
000s
                    ' and counting down, then change the
                    ' motor direction: PORTC.3 = 1.
' Set counter starting position:

    POSCNTH = 0      ' Set counter for encoder, H bit
    POSCNTL = 0      ' Set counter for encoder, L bit
                    ' With POSCNTH and POSCNTL = 0,
                    ' position counter will start at 0.
                    ' See table above for more sample values.

loop:

    position = 256*POSCNTH + POSCNTL ' Read position
    ADCIN 0, pot_val                ' Read AN0 and store result in pot_val.
                    ' This potentiometer (connected to AN0)
                    ' sets the motor power.

    mot_pwr = 11*pot_val/16 + 77    ' mot_pwr = 11/16 * pot_val + 77
                    ' (Can't write equation as 11/16 * pot_val
                    ' since interger division truncates: any
                    ' fractional part is discarded. Since 11
                    ' and 16 are integers, 11/16 would be
                    ' truncated to zero.)

```

```
HPWM 2, mot_pwr, 20000      ' 77 is the minimum power to start motor.
                             ' 11/16 is the slope of the line to give
                             ' mot_pwr values from 77 to about 255.
                             ' See graph & equation in schematic.
                             ' Send PWM signal from RC1 to Pin 2 on
                             ' the Xavien XDDCMD-1 DC motor driver.

GOSUB lcd                   ' Go to lcd subroutine
GOTO loop                   ' Go to loop label
END
```

lcd:

```
LCDOUT $FE, $80, "mot_pwr = ",DEC3 mot_pwr," "
                             ' Display motor power on first line
                             ' in 3 decimal digits.
LCDOUT $FE, $C0, "position = ",DEC5 position
                             ' Display position on second line
                             ' Position will count to 65535, then
                             ' cycle back to 0 and continue counting.
                             ' in 5 decimal digits.
RETURN                       ' Go back to main routine that called us.
```