

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

' File.....adc3.pbp  
' Started....1/8/08  
' Microcontroller used: Microchip Technology PIC16F88  
' microchip.com  
' PicBasic Pro Code: micro-Engineering Labs, Inc.  
' melabs.com

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

' The program uses one of the analog-to-digital  
' converters,(AN4), to measure the voltage  
' on the center pin of a potentiometer (an analog signal).  
' It then converts the analog voltage into an 10-bit  
' digital value and displays the result as a  
' voltage (0-5V) on an LCD.

'-----Schematic-----'

' See schematic at:  
' [http://www.cornerstonerobotics.org/schematics/pic\\_programming\\_adc1.pdf](http://www.cornerstonerobotics.org/schematics/pic_programming_adc1.pdf)

'-----Related Lesson-----'

' adc3.pbp is used in the lesson Resistive Sensors at:  
' [http://www.cornerstonerobotics.org/curriculum/lessons\\_year2/erii23\\_resistive\\_sensors.pdf](http://www.cornerstonerobotics.org/curriculum/lessons_year2/erii23_resistive_sensors.pdf)

'-----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       | Center Lead of Potentiometer |
| RB4       | LCD Register Select(RS)      |
| RB3       | LCD Enable(E)                |

' See schematic for the other usual PIC connections

'-----LCD Connections-----'

| LCD Pin | Wiring                      |
|---------|-----------------------------|
| 1       | Ground(Vss)                 |
| 2       | + 5v(Vdd)                   |
| 3       | Center of 20K Pot(Contrast) |
| 4       | RB4(Register Select,RS)     |
| 5       | Ground(Read/Write,R/W)      |
| 6       | RB3(Enable)                 |
| 7       | No Connection(DB0)          |
| 8       | No Connection(DB1)          |
| 9       | No Connection(DB2)          |

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'          10          No Connection(DB3)
'          11          RA0(DB4)
'          12          RA1(DB5)
'          13          RA2(DB6)
'          14          RA3(DB7)

'-----Constants/Defines-----

' To free up AN4 (Pin RA4) for an analog input, the
' default LCD Register Select function must be
' removed from RA4. This is relocated to PORTB.4
' using the LCD DEFINE statements below. All other
' default LCD pins and functions are left unchanged.
' For details see:
' http://www.cornerstonerobotics.org/curriculum/lessons\_year2/erii16\_lcd3\_pot\_command\_and\_lcd\_defines.pdf
' or
' Look around page 97 in the PicBasic Pro Compiler Manual.
' The PicBasic Pro Compiler Manual is on line at:
' http://www.microengineeringlabs.com/resources/index.htm#Manuals

DEFINE LCD_RSREG      PORTB  ' PORTB - RS port for LCD
DEFINE LCD_RSBIT      4      ' Bit 4 - RS bit for LCD
DEFINE ADC_BITS       10     ' Sets the number of bits in
                               ' the result to 10

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

x          VAR WORD      ' Word (16-bits) for potentiometer input
temp_int   VAR WORD      ' Word for integer
temp_fract VAR WORD      ' Word for fraction

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

ANSEL = %00010000          ' Leaves AN4 in analog mode, but
                            ' changes other analog bits to digital.
                            ' See table below.

'
'   Analog Bit      Analog or Digital      PIC16F88 Pin
'   -----
'   AN0             Digital                 RA0
'   AN1             Digital                 RA1
'   AN2             Digital                 RA2
'   AN3             Digital                 RA3
'   AN4             Analog                  RA4
'   AN5             Digital                 RB6
'   AN6             Digital                 RB7

' For the ANSEL Register table, look at the
' PIC16F88 Datasheet. For Microchip PIC DATASHEETS, see:
' http://www.microchip.com/stellent/idcplg?IdcService=SS\_GET\_PAGE&nodeId=2046
' Select 8-bit PIC Microcontrollers, then the device from the
' drop down menu. Now download the 16F88 Datasheet.

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' The ANSEL Register is Register 12-1: ANSEL Register,  
' look around page 113 in the 16F88 datasheet.

```
ADCON1 = %10000000      ' Right justifies 10-bit value of x
                        ' in 16-bit WORD. Adds "0" in the
                        ' 6 Most Significant bits of the Word,
                        ' shifting the 10-bit value of x to
                        ' the right. This changes the LCD
                        ' values to 0 - 1023.
```

' The ADCON1 Register is Register 12-3: ADCON1 Register,  
' look around page 115 in the 16F88 datasheet.

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

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

```
PAUSE 1000              'Pause to allow LCD to setup
```

start:

```
ADCIN 4, x              'Read analog voltage on AN4 and
                        'convert to 10-bit digital value
                        'and store as x.
```

```
LCDOUT $FE,1,"POT = ", DEC x 'Clears LCD screen, displays
                        '"POT = " and the 10-bit value of x
```

```
x = x * 49/10
```

```
temp_int = x/1000
```

```
temp_fract = x//1000
```

```
LCDOUT $FE,$c0,"Voltage = ",DEC temp_int, ".", DEC3 temp_fract
```

```
PAUSE 500              'Pause 1/2 second
```

```
GOTO start             'Go to loop label
```

```
END
```