

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

' File.....servo4.pbp
' Started....6/1/05
' Microcontroller used: Microchip Technology 16F88
' microchip.com
' PicBasic Pro Code: micro-Engineering Labs, Inc.
' melabs.com

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

' Three momentary switches rotate the servo into three
' different positions: left, center, and right.
' Discussion about basic servo pulse control may be found
' at www.seattlerobotics.org/guide/servos.html or
' www.geocities.com/hobby_robotics/was.htm

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

' servo4.pbp is used in the lesson PIC PROGRAMMING 3 SERVOS at:
' http://cornerstonerobotics.org/curriculum/lessons_year2/erii13_pic_programming3_servos.pdf

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

' WITH THE PIC16F88, MAKE SURE TO HAVE SEPARATE +5V
' POWER SOURCES FOR THE PIC AND THE SERVO. MAKE SURE TO
' HAVE A COMMON GROUND BETWEEN THE PIC AND SERVO. We use one 9V
' battery and two 78L05 voltage regulators. See
' discussion about voltage regulators at:
' http://cornerstonerobotics.org/curriculum/lessons_year2/erii3_diodes_power_supplies_voltage_reg.pdf

' Also, initialize the state of PORTB as LOW
' since that will set the correct polarity of the
' PULSOUT statement. See PULSOUT in PicBasic Pro
' Compiler manual by microEngineering Labs, Inc.
' Look around page 121 in the PicBasic Pro Compiler Manual

'-----Connections-----

PIC16F88 Pin	Wiring
RB0	Servo Control Wire
RB1	Momentary Switch 1
RB2	Momentary Switch 2
RB3	Momentary Switch 3
Vdd	+5 V
Vss	Ground
MCLR	4.7K Resistor to +5 V

'-----Revision History-----

' 11/14/07 Add 16F88 oscillator initialization
' 11/27/07 Add power supply warning and

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'          changed title from servo1.pbp to servo4.pbp

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

      i          VAR      BYTE          ' BYTE for counter, i

'-----Switch Connection Pins-----

      switch1    VAR PORTB.1          ' Labels PORTB.1 as switch1
      switch2    VAR PORTB.2          ' Labels PORTB.2 as switch2
      switch3    VAR PORTB.3          ' Labels PORTB.3 as switch3

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

      TRISB = %00001110

      PORTB = %00000000          ' Equivalent to: PORTB = 0
                                ' Sets all PORTB pins to LOW(0 volts)
                                ' Make certain to include this
                                ' initialization as it sets the
                                ' proper polarity of pulses in
                                ' the PULSOUT command.

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

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

loop:

      IF switch1 = 1 THEN GOSUB left
                                ' If the switch on PORTB.1 is pushed,
                                ' PORTB.1 becomes high (+5 volts) and
                                ' the comparison is true; the program
                                ' jumps to the subroutine labeled left.

      IF switch2 = 1 THEN GOSUB center
                                ' If the switch on PORTB.2 is pushed,
                                ' PORTB.2 becomes high (+5 volts) and
                                ' the comparison is true; the program
                                ' jumps to the subroutine labeled center.

      IF switch3 = 1 THEN GOSUB right
                                ' If the switch on PORTB.3 is pushed,
                                ' PORTB.3 becomes high (+5 volts) and
                                ' the comparison is true; the program
                                ' jumps to the subroutine labeled right.

      GOTO loop                  ' Jumps to label loop

      END                        ' Place subroutines after END

'Subroutines:

left:
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FOR i = 1 TO 10      ' Send left signal 10 times

PULSOUT 0,100      ' Pulse Width:
                   ' Sends a pulse out on pin RB0 for 1.0 mS.
                   ' The period,(100) is multiplied by the
                   ' increment for a 4 MHz oscillator (10 uS)
                   ' to get a pulse out time of 1.0 mS.
                   ' To get the full range of your
                   ' servo, you may have to decrease the period
                   ' to less than 100, being careful not to go too
                   ' low thereby forcing the servo to stop
                   ' mechanically against the internal mechanical
                   ' stops.

PAUSE 20 - 1      ' Pulse Interval:
                  ' Pause 20 ms less pulse width (1.0 ms)
                  ' This equation keeps the period of
                  ' the servo pulse a constant 20 ms, HIGH
                  ' for 1.0 ms and LOW for 19 ms = 20 ms.

NEXT i            ' Go back to the FOR statement and do
                  ' next count, i

LOW 1            ' Bring switch1,(RB1),state to LOW to prevent
                  ' the pin's voltage from floating

RETURN          ' Returns execution to statement following
                  ' GOSUB left command
center:

FOR i = 1 TO 10      ' Send center signal 10 times

PULSOUT 0,150      ' Pulse Width:
                   ' Sends a pulse out on pin RB0 for 1.5 mS.
                   ' The period,(150) is multiplied by the
                   ' increment for a 4 MHz oscillator (10 uS)
                   ' to get a pulse out time of 1.5 mS.

PAUSE 20 - 15/10    ' Pulse Interval:
                   ' Pause 20 ms less pulse width (15/10 = 1.5 ms)
                   ' This equation keeps the period of
                   ' the servo pulse a constant 20 ms, HIGH
                   ' for 1.5 ms and LOW for 18.5 ms = 20 ms.
                   ' Note: In PicBasic Pro, numbers and variables
                   ' must always be non-negative integers.
                   ' 20 - 1.5 is not permissible since 1.5 is not
                   ' an integer. To get around the problem, use
                   ' integers 15/10 to create the same value.

NEXT i            ' Go back to the FOR statement and do
                  ' next count, i

LOW 2            ' Bring switch2,(RB2),state to LOW to prevent
                  ' the pin's voltage from floating
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RETURN           ' Returns execution to statement following
                  ' GOSUB center command
right:
FOR i = 1 TO 10   ' Send right signal 10 times
PULSOUT 0,200     ' Pulse Width:
                  ' Sends a pulse out on pin RB0 for 2.0 mS.
                  ' The period,(100) is multiplied by the
                  ' increment for a 4 MHz oscillator (10 uS)
                  ' to get a pulse out time of 2.0 mS.
                  ' To get the full range of your
                  ' servo, you may have to increase the period
                  ' to more than 200, being careful not to go too
                  ' high thereby forcing the servo to stop
                  ' mechanically against the internal mechanical
                  ' stops.
PAUSE 20 - 2      ' Pulse Interval:
                  ' Pause 20 ms less pulse width (2 ms)
                  ' This equation keeps the period of
                  ' the servo pulse a constant 20 ms, HIGH
                  ' for 2 ms and LOW for 18 ms = 20 ms.
NEXT i           ' Go back to the FOR statement and do
                  ' next count, i
LOW 3            ' Bring switch3,(RB3),state to LOW to prevent
                  ' the pin's voltage from floating
RETURN           ' Returns execution to statement following
                  ' GOSUB right command
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