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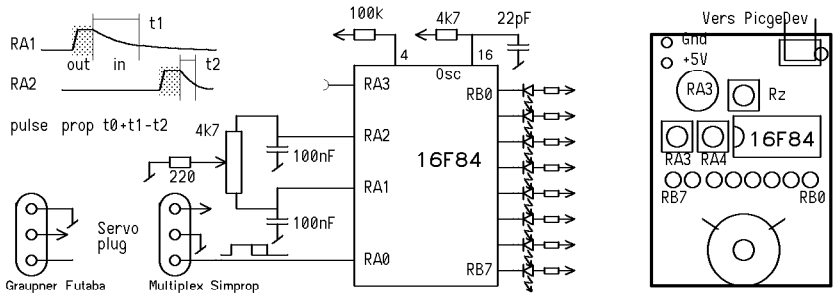
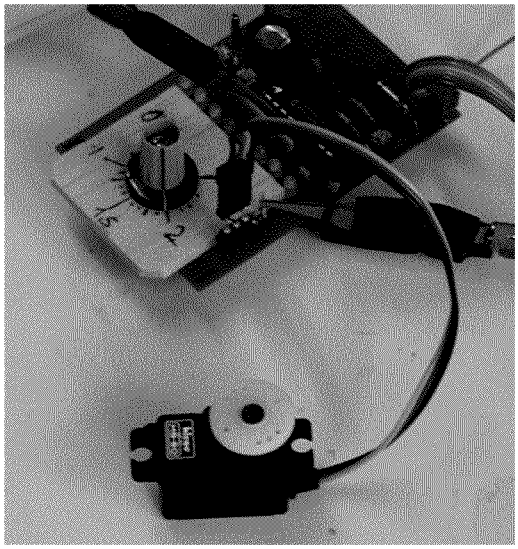
R/C Servo Test Program

The **PIC***Smart* is programmed to read a pot and set the servo pulse length every 15 ms within the usual 1 ... 2 ms pulse range which control servo position.

Since the 16F84 does not have analogue inputs, the time for discharging a capacitor is measured. The pin is set to an output at level one for 20 microseconds, and then switched as an input. A counter is incremented as long the input level is one, that is higher than about 1.5V. In order to get a better linearity, two capacitors are used, as shown below. Components´ value are not critical. Capacitor discharge time depends on the product of the capacitor and resistance. Count loop can be adjusted to adapt to this product value.



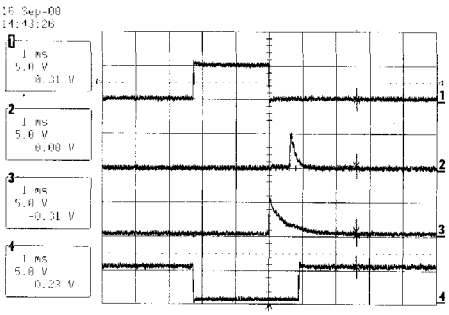
wdservo2 *Fig. 1 Test device schematic with a PIC 16F84 microcontroller*



wdservo3 *Fig. 2 Picture of the system (click here for color)*

The program we have implemented uses the timer for a 15 ms repetition rate. Variable "Pulse" defines the duration of the pulse, according to two parameters: t1 and t2 depends on the capacitor value and the duration of the loop measuring the capacitor discharge (one Nop has been added for adjusting the max value when the resistor is maximum).

Macros makes it more easy to change the wiring if different port bits have to be used.



wdservo4

Fig. 3 Measured timings

Program **PicServo**

```
.Proc 16F84
TOIF = 2
```

Variables **Variables**

```
.Loc  16'C
T1:   .Blk.16   1           ; Pot duration
T2:   .Blk.16   1           ; Pot duration
Pulse: .Blk.16  1           ; Servo pulse duration
T0    = 120     ;  So that #T0+T1-T2 value is
                  between 80 and 240 (0.8 and 2.4
                  ms)
```

Constant **PortA**

```
bServo = 0
bT1    = 1
bT2    = 2
bS0    = 3
.Macro ServoOn
       Set      PortA:#bServo
.EndMacro
.Macro ServoOff
       Clr      PortA:#bServo
.Endmacro
.Macro T1On
       Move     #2'10100,W
       Move     W,TrisA
       Set      PortA:#bT1
.EndMacro
.Macro T1Off
       Move     #2'10110,W
       Move     W,TrisA
.EndMacro
.Macro T2On
       Move     #2'10010,W
       Move     W,TrisA
       Set      PortA:#bT2
.EndMacro
.Macro T2Off
       Move     #2'10110,W
       Move     W,TrisA
.EndMacro
```

Program **Program begin here**

```
.Loc  0
       Move     #0,W                    ; Outputs
       Move     W,TrisB
       Move     #2'00000101,W   ; Prescaler :16
       Move     W,Option
       Clr      TMR0
       Move     #2'10110,W
       Move     W,TrisA
Loop:
       Set      PortA:#bS0      ; Check available time
; Wait for 20ms repetition period
 W$:   TestSkip,BS  IntCon:#TOIF
       Jump     W$
       Clr      Intcon:#TOIF
       Clr      PortA:#bS0
```

Module **Servo control**

Servo pulse duration according to Pulse variable

```
; Loop P1 is multiple of 10 us  200 --> 2 ms
       ServoOn
P1:                                    ; 10 us loop
       Move     #2,W
 P2:   Add      #-1,W                  ; 4 us inside loop
       Skip,EQ
       Jump     P2
       DecSkip,EQ  Pulse
       Jump     P1
       ServoOff
```

Module **Pot reading**

One measure T1

```
       T1On
       Move     #T0,W                  ; Save later add
       Move     W,T1
       Move     #10,W
D1:    Add      #-1,W
       Skip,EQ
       Jump     D1
       T1Off
A1:    Nop      ; adjust
       Inc      T1
       TestSkip,BC  PortA:#bT1
       Jump     A1
```

One measure T2

```
       T2On
       Move     W,T1
       Move     #10,W                  ; 40 us
D2:    Add      #-1,W
       Skip,EQ
       Jump     D2
       Clr      T2
       T2Off
A2:    Nop      ;
       Inc      T2
       TestSkip,BC  PortA:#bT2
       Jump     A2
```

Calculation

```
       Move     T2,W
; Move  W,PortB
       Sub      W,T1,W                 ; T1 - T2
       Move     W,Pulse
        Xor     #-1,W                  ; LEDs active low
        Move    W,PortB
       Jump     Loop
.End
```