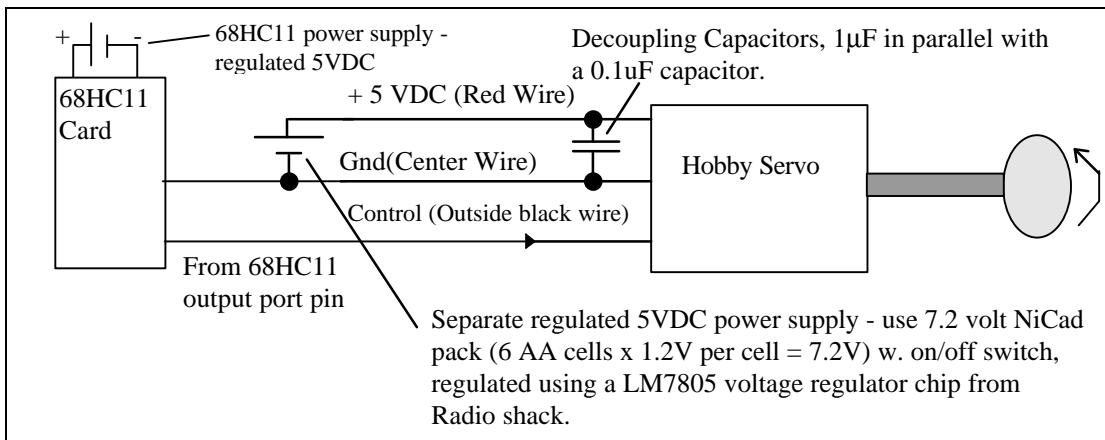


## Hobby Servos & PWM

-- by D.J. Mehrl - handout used in the past for my Microcontroller class --

- Readily available (in Hobby shops that sell R/C equipment). There are (4) standard sizes ranging from small/lightweight to heavy/high-torque models. These are great for steering control.
- Simple 3-wire interface:



- Since the 68HC11 does not use much power, consider powering it with a regulated 5VDC power supply - using an alkaline 9V battery, or a 7.2 volt NiCad pack composed of 6 AAA cells- regulated using a LM7805 voltage regulator chip from Radio shack.
- Servo position is controlled by PWM (Pulse width modulation)
  - Pulse train of TTL compatible signals(~ 0 to 5 VDC).
  - Pulses must repeat every 10 to 20 ms (i.e. - pulse period not critical --  $10\text{ms} < T_p < 20\text{ms}$  -- but the pulse width is critical).
  - Pulse width of ~ 1ms [i.e. signal high for 1ms, and low for ( $T_p - 1\text{ms}$ )] results in full CCW actuation..
  - Pulse width of ~ 2ms results in full CW actuation.
  - Pulse width of ~ 1.5ms should "center" the servo etc..
  - Nominal range of travel is  $\pm 45^\circ$  ( $90^\circ$  total).
- Important - supply the servo with a separate power supply (other than the one used to supply the 68HC11) as otherwise the servo motor noise will couple through the supply to the 68HC11 and will likely cause the 68HC11 to glitch (learned by experience!). A decoupling capacitor (see above figure) is also recommended to suppress motor noise. Remember, of course, to also provide a common ground connection, however, between the 68HC11 and the servo ground! Use twisted pair wires (color coded using red for positive etc.) between batteries and servo to reduce inductance.

The above circuit works fine - I've tested it. I would feel better however, if a small resistor were placed in series with the PWM signal line to provide a little bit of isolation to

protect the 68HC11 output pin in case of catastrophic failure (I always worry about little things like that - I'm just too conservative). Could try a 100 $\Omega$  resistor, if it doesn't work, try a 47 $\Omega$  resistor etc. until it does work etc..

If you have any need for 68HC11 assembly language code to drive the servo, check out the listing "servo.asm" under the link "68HC11 code" on my web page ([www.ee.ttu.edu/lab/robot](http://www.ee.ttu.edu/lab/robot))