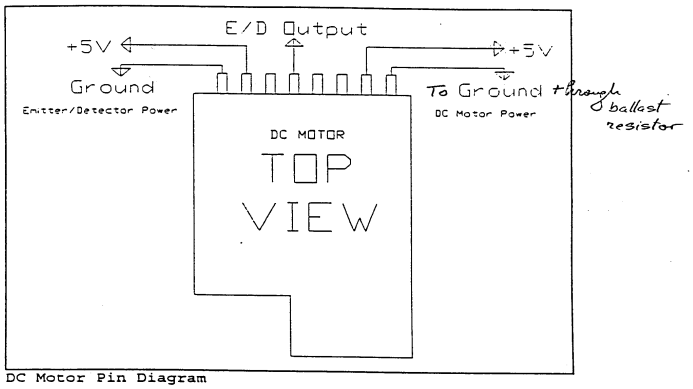
ELECTRIC MOTORS

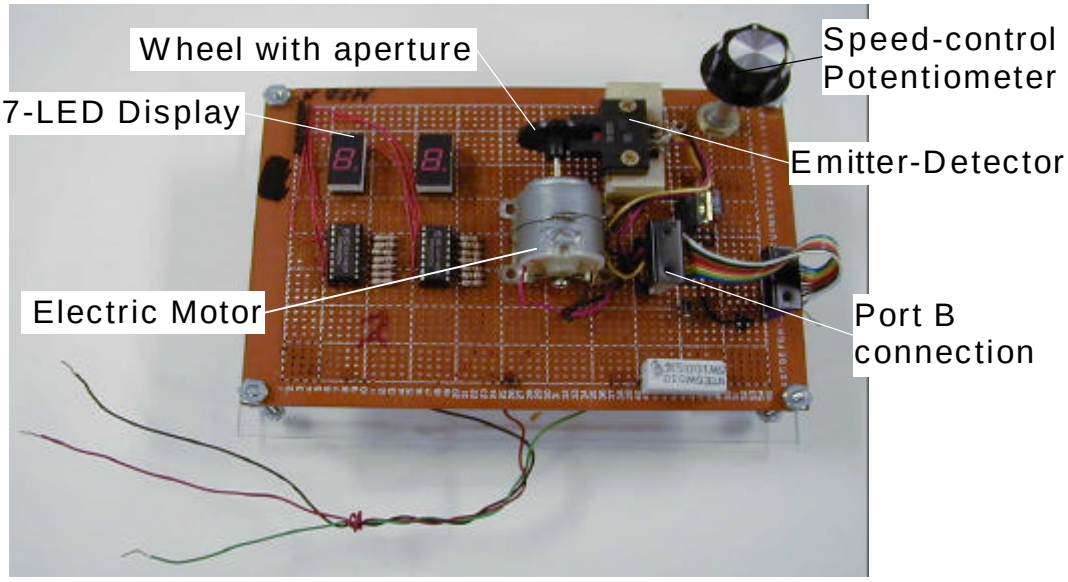
DC MOTORS

Direct current (DC) motors used in the lab have coils wound on the rotor and a permanent magnet stator. Current flowing through the rotor coils interacts with the magnetic field of the permanent magnet stator and generates an Ampere force, which turns the rotor. A collector is used to transfer the current from the stationary terminals of the DC motor to the rotating coils. In order to keep the DC motor rotating in the same direction, the collector switches (commutates) the rotor coils each half-cycle). DC motors are usually high speed, low torque motors.

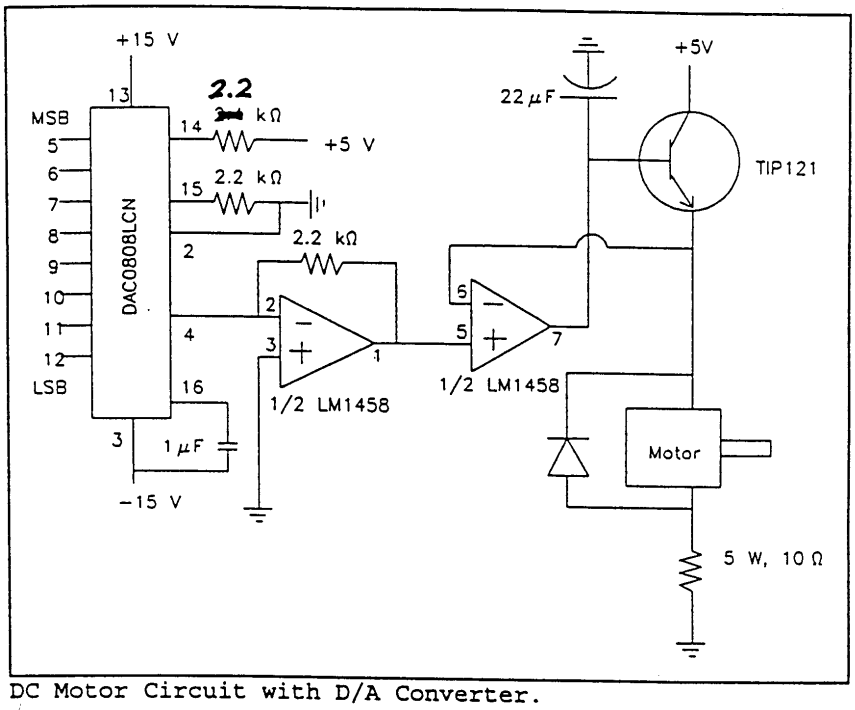
DC MOTOR WIRING DIAGRAM



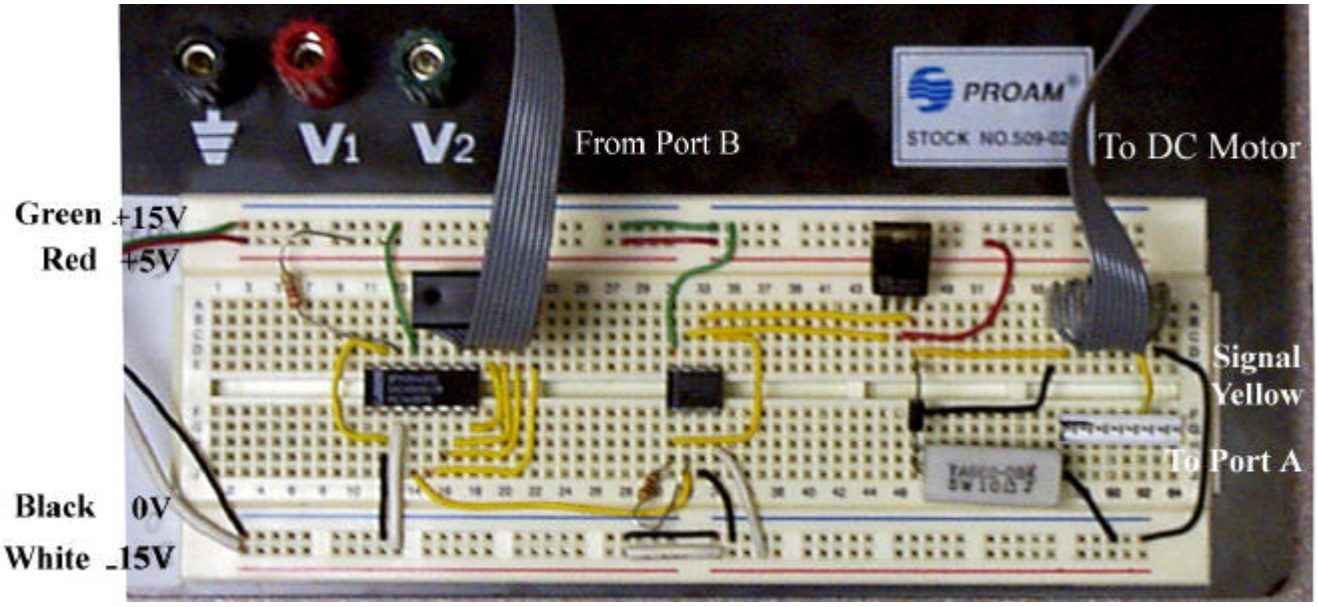
DC Motor Pin Diagram

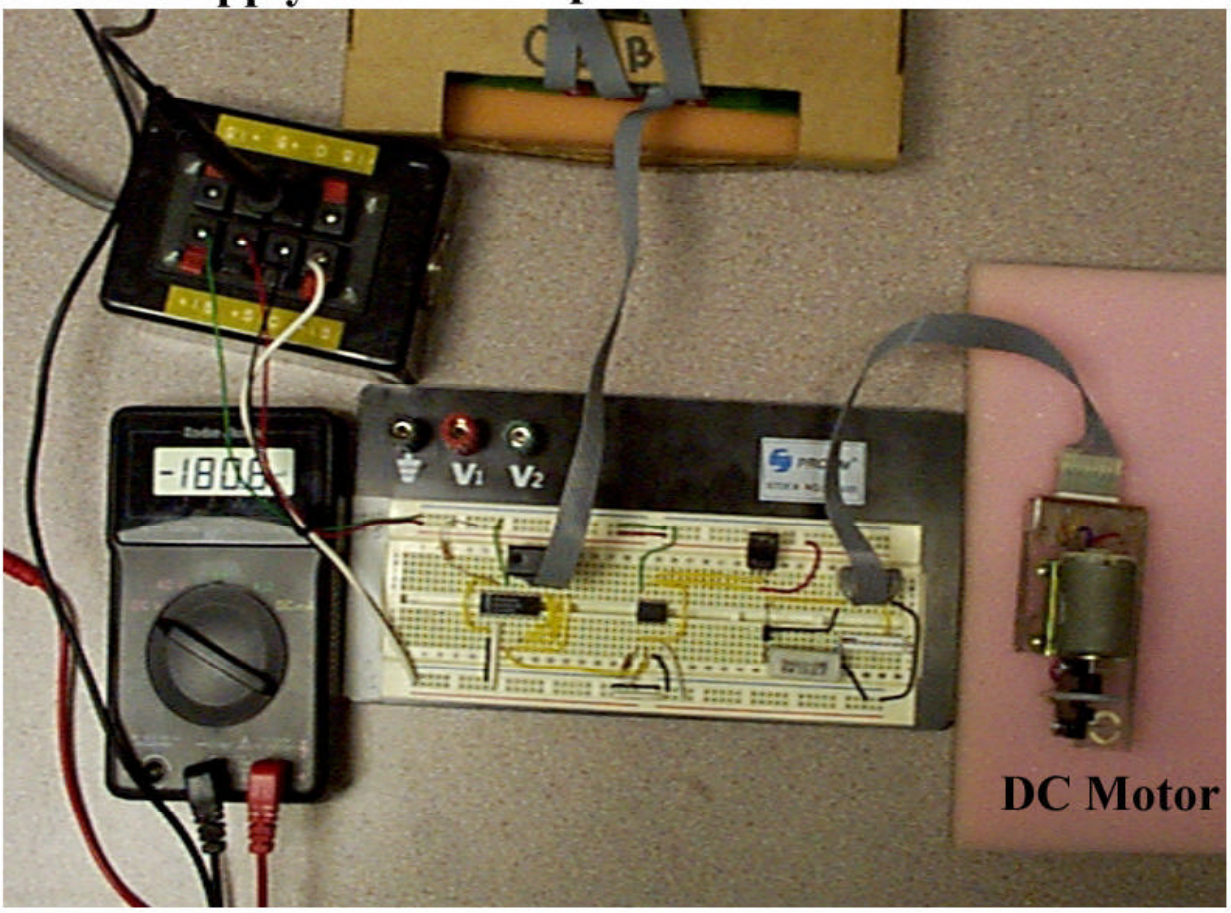


DIGITAL CONTROL OF DC MOTOR



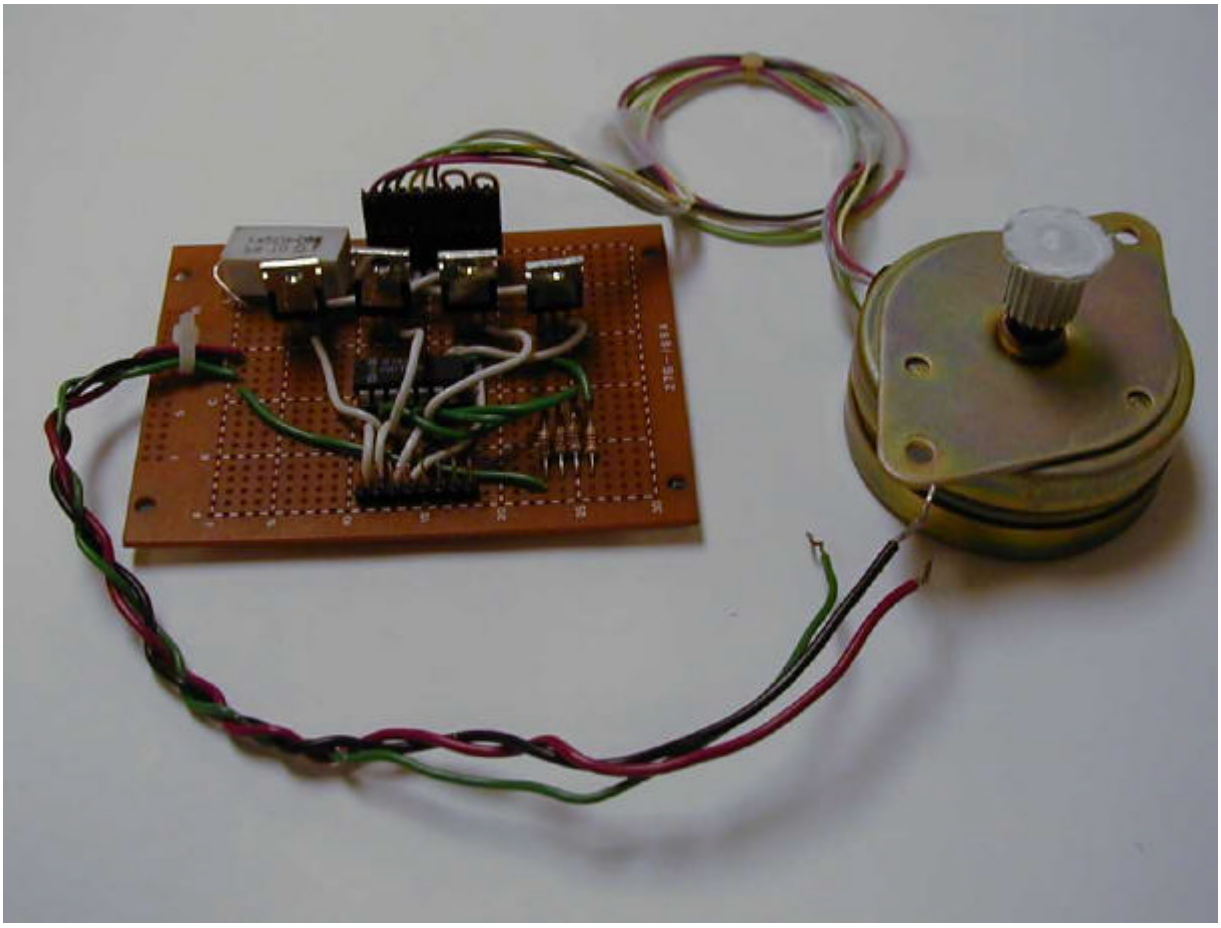
DC Motor Circuit with D/A Converter.



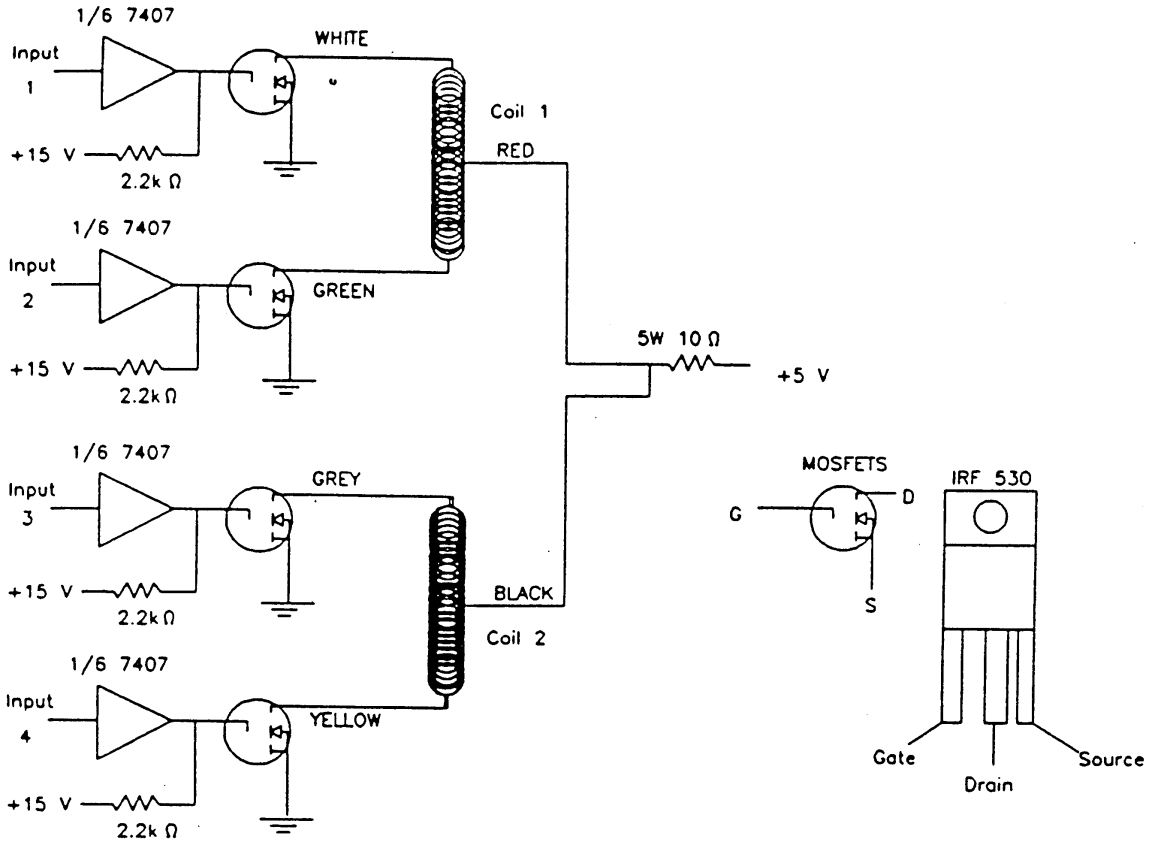

Power Supply
Microprocessor
V1
V2
DC Motor
Multi-Meter
Circuit Board

STEPPER MOTORS

Stepper motors used in the lab have coils wound on the stator, and a permanent magnet with multiple poles as a rotor. The stepper motors can achieve angular motion in finite steps. To make the stepper motor rotate, one has to send certain energizing patterns to the coils in a predetermined sequence. This is achieved with the microcontroller. The patterns can be coarse (full-steps) or fine (half-steps). Half-step patterns fall between the full-step patterns. The use of half steps gives better resolution. However, the half-step holding power is weaker than the full-step holding power, since only half of the coils are energized.



STEPPER MOTOR CONTROLLER



SERVO MOTORS

Servo motors are an efficient, easy way to precisely position or move things. Higher torque and easier code make sometimes servos a better choice over Stepper Motors.

Servo motors used in our lab have three wires coming out of their case: +5V (red), GND (black), and CONTROL (white). The +5V and GND wires carry +5 VDC and ground, respectively. The CONTROL line carries a short pulse that the servo uses to position its wheel.

The Servo Motor's position is limited by mechanical stops inside the case that only allows the wheel to rotate through about 90 degrees. Servos can also be modified to rotate in a full circle (instead of just 180 °), which makes them useful as drive motors for lightweight robots. There is also a circuit inside the case connected a potentiometer that reads the current position of the wheel. This circuit allows the following control to occur: The rotation is controlled through a pulse on the CONTROL wire. This pulse is usually anywhere from 0.7 msec to 1.7 msec. The shortest pulse causes the motor to turn to the right while the longest pulse causes the motor to turn to the left. A pulse of 1.2 msec will rotate the wheel back to its center position.

The Futaba FP-S148 Servo is easily modified for continuous rotation and has a sintered-bronze brushing that reduces friction and wear. The metal bearing is of particular value if the servo is being modified for continuous rotation such as for use as a drive wheel on a robot, since that application subjects the servo to side-loads (the weight of the robot) that can cause plastic bushing servos to wear out prematurely.