Problems faced while working with servos

Control is nothing without power!

The Arduino itself is very good at controlling servos, the Servo library will allow a single Arduino to control up to 12 servos with no additional hardware.

What the Arduino cannot do is deliver power to 12 Servos, its questionable whether an Arduino can reliably deliver power to even a single servo.

So How Can Successfully Drive Lots of Servos With An Arduino?

The power problem is easily solved through the addition of a 'power circuit'. This is can be as simple as four disposable AA Batteries

The Arduino has a narrow operating voltage around 5 Volts (3.3 Volts in some) and is sensitive to variation in this voltage. The Arduino design is based on the assumption that a stable 5 Volt power source will be feeding the chip at the heart of the Arduino. In the case of the popular UNO, this regulated 5 Volt power is supplied by the USB Connection or through a regulator built into the board.

The onboard regulator is designed to provide power to the Arduino and supporting circuitry. It is not designed to power external devices and trying to do so is the single most common reason for failure with servo projects. This 'Not designed to power external devices' also applies to USB Connected projects.


Step **1) Power The Arduino**

While running the servos, the Arduino is observed to be drawing only 10mA. A good PP3 could power the Arduino for days.

However,

Note - The PP3 is a poor battery choice for most applications, it has a small charge capacity (run time) and cannot deliver the higher currents required to drive servos or motors, however the 9 volts it provides is great for powering an Arduino through the onboard regulator. As the Arduino makes so little demand on a battery the PP3 is a common and practical choice to power the Arduino - just not any shields, motors, servos, transmitters etc.

The PP3's small charge capacity and limited ability to deliver current make it an unsuitable choice for providing the power circuit in our projects, the common AA battery is a far better alternative. In the case of servos the 9 Volts supplied by an unregulated PP3 is over the 4.8 to 6 volt recommended operating range and will result in immediate damage to the servo. Again AA Batteries are a better choice as four will provide a usable 6 Volts for our servo power circuit and a better run time.
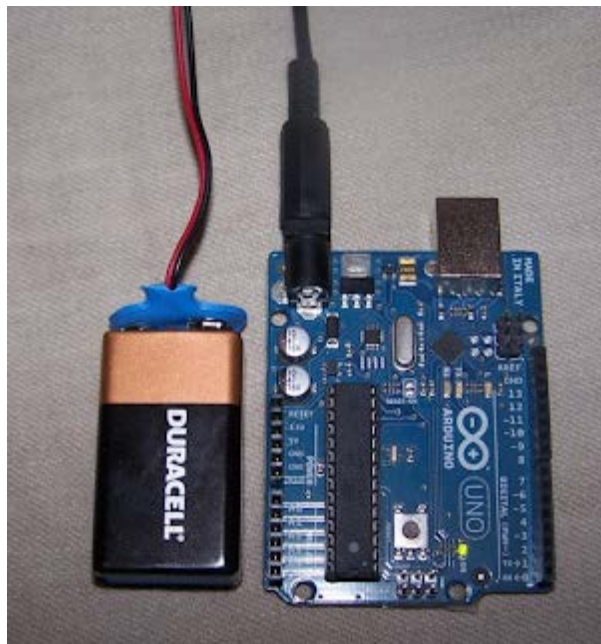

Step **2) Power For The Servos**

For servo power use disposable AA Batteries. These are high capacity versions sold for cameras which will give us enough current and charge (run time) for our servos.

Each AA Battery provides 1.5 volts for a total of 6 volts (4*1.5).

Most servos are designed to operate with 4.8 to 6 volts. Powering them with more voltage can result in instant damage. The four AA Batteries give us a usable 6 volts.

The AA Batteries have been connected to the power (red) and ground (black) rails on the bread board.
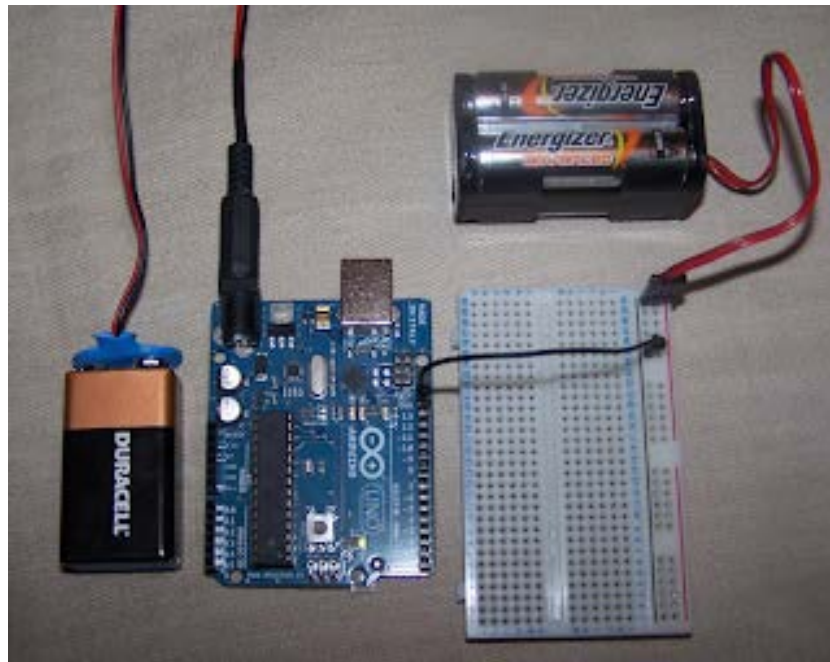
Notice the black jumper running from the bread board to the Arduino?

This is the next most common mistake in servo projects, when people introduce the servo power pack, they forget to connect a **common ground**.

You must connect the ground wire between the power circuit and the Arduino (control circuit) without this connection your circuit will not work. This applies whether you are powering your Arduino from a wall socket, USB port or a battery.

In the picture you can see where I have simply connected the two circuits through the black jumper wire running from the black ground rail of the bread board to the ground (GND) pin on the Arduino next to pin 13.

All of the ground pins on the Arduino are connected so use which GND pin is most convenient.

These two circuits now share a common ground allowing us to add some servos.

Step 3) Connecting Individual Servo Power

Add a 3-Pin section of PCB Header to make it easier to connect the female servo plug to female breadboard. Next to this add a green jumper from the battery pack ground rail to pin1 of the header, this is the shared ground between the Arduino, battery pack and servo.

Add a yellow jumper from the power rail - 6 Volts from the AA Battery pack - to the center pin of the header. This will provide power to the servo directly from the AA Battery pack, not from the Arduino or its 9 Volt PP3 Battery.
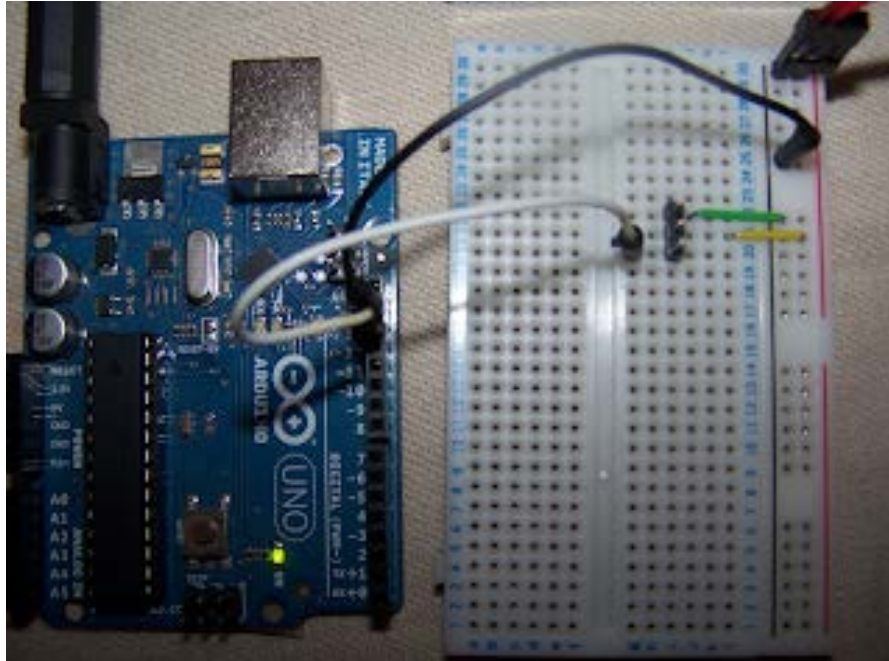
The final pin is the signal pin, this is the pin which the Arduino will use to tell the servo which position to hold.

Remember - Without the common ground between the Arduino and the Servo AA battery pack, your project will not work. In the picture, this common ground is provided by the black wire linking the ground rail of the breadboard with the GND pin next to pin 13 of the Arduino.