

SG90 Servo

The "SG90" is a small "servo motor" which is commonly used for radio controlled models and small robotics projects. It includes a selection of "horns", which are used to attach the mechanism to be rotated, to the splines on the rotating output shaft of the servo motor. While the manufacturers specify 4.8 Volts Direct Current as the nominal (normal) operating voltage, they can be powered with up to 6.6 VDC for short term use.

Notes!

- Some versions of "SG 90" servo motors do not have a physical end stop at the extents of their travel, so the only way to determine their position is to connect them electrically using the wiring and code below.
- While it is possible to manually rotate a servo with your fingers using its "horn", care must be taken not to apply excess force, as the motor may already be at its extent of travel in the direction being rotated.
- Never manually rotate a servo motor while it has electrical connections as the drive motor becomes a generator and produces current which can result in damage to the connected electrical circuit.
- Servo motors can draw up to 200 milliamps [mA] under load which is far more current than a standard Arduino board is designed to supply, so they must be supplied with power from an external source.

How a servo motor works

The on-board electronics receive a pulsed signal which is decoded by the servo electronics to determine the requested position of the output shaft. This position is checked against the position reported by a potentiometer which is linked to the output shaft of the gearbox, and, the electronics determine the correct polarity voltage to supply the motor to move the output shaft to the requested position.

The pulsed signal is based on a 20 millisecond [ms] interval with the duration of the high pulses at the start of each interval used to determine the position. Typically, pulses with a duration of up to 1 ms will be interpreted as its minimum position (90° anticlockwise), pulses of 1.5 ms duration will be interpreted as the centre position (0°), and pulses of 2 ms or greater will be interpreted as its maximum position (90° clockwise).

The drive train begins with the motor which converts the main electrical power to rotational movement. The gear train reduces the motor's speed through a set of pinion gears consisting of a 9 tooth drive gear (red) at the motor which drives a 47:10 (green), 38:8 (blue), 32:7 (purple) and finally to the 23 tooth final output splined shaft (yellow). This results in a total speed reduction of 1:55.49... with 1 rotation of the output shaft equal to 55.49... rotations of the motor, and an equivalent increase of the motor's torque.

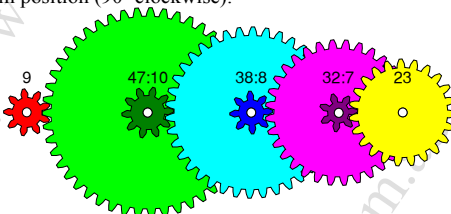


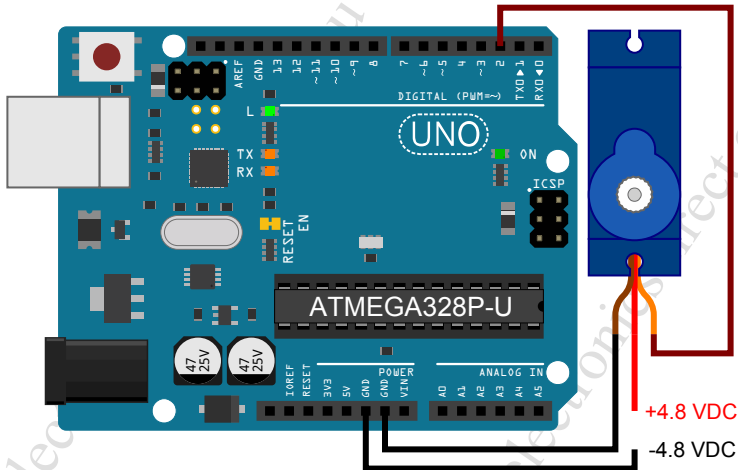
Diagram 1: SG90 gear train laid flat

Table 1: SG90 Servo Connections

| Device | Arduino | Wire | Description |
|---------------|---------|------|--|
| ■ Brown Wire | GND | ■ | Ground connection for both negative signal and servo 4.8 VDC supply. |
| ■ Red Wire | NC | ■ | 4.8 VDC positive supply for servo electronics and motor. |
| ■ Orange Wire | D2 | ■ | Digital input signal to servo to control the motor's position. |

D2: can be any digital pin.

SG90 Servo...



The sketch below rotates the servo motor through 0°, 90°, and 180° positions at 2 second intervals.

```
#include <Servo.h>
Servo myServo;
int pMyServo = 2;
int iServoPos = 0;
void setup() {
  myServo.attach( pMyServo );
}
void loop() {
  myServo.write( 0 );
  delay( 2000 );
  myServo.write( 90 );
  delay( 2000 );
  myServo.write( 180 );
  delay( 2000 );
}
```

Servo Specifications

| | |
|-------------------------------------|--|
| Body Dimensions (H × W × D): | 22.7 × 12.1 × 27.1 millimetres [mm] |
| Enclosing Dimensions (H × W × D): | 32.4 × 12.1 × 30.7 mm |
| Extent of rotation: | ~180° (Can vary up to 10° between motors). |
| Weight (including lead and plug): | 10.05 grams [g] |
| Wire Length: | 250 mm |
| Plug: | "JR" (Female) @ 2.54 mm {0.1 inch} spacing |

Servo Manufacturer's (Tower Pro) Specifications

| | |
|------------------------|---|
| Stall Torque: | 1.8 kilograms [kg] / centimetre [cm] = 18 kg / mm or 18 000 g / mm or 18 g / m |
| Nominal Input Voltage: | 4.8 VDC |
| Max Input Voltage: | 6.6 VDC |
| Operating Temperature: | 0 to 55 degrees Celsius [°C] |
| Rotational Speed: | 1.0 s / 60° @ 4.8 VDC |

SG90 Servo...

Servo Performance

| | |
|-----------------------------------|--|
| Current Draw (stationary): | 3.57 milliamps [mA] @ 5.00 VDC |
| Current Draw (moving): | up to 200.0 milliamps [mA] @ 5.00 VDC |
| No Load Speed (min to max angle): | 270 milliseconds [ms] @ 5.00 VDC = 0.66° per ms |

Included Accessories

| | |
|--|---------------------|
| Plastic Horn #1 (2 Equal Arms) weight: | 0.30 grams [g] |
| Plastic Horn #2 (4 Equal Arms) weight: | 0.26 grams [g] |
| Horn #3 (4 Unequal Arms) weight: | 0.31 grams [g] |
| Horn #4 (Single Arm) weight: | 0.19 grams [g] |
| 2 Self Tapping (mounting) screws: | 0.23 grams [g] each |
| 1 Servo Horn attaching screw: | 0.10 grams [g] |

Servo Mounting

The module has 2×2.2 mm diameter holes at each end, and includes 2 self tapping screws to fix the motor to materials such as plastic, wood, or thin sheet metal. Servo motors can develop considerable torque, so the mounting point must be capable of withstanding this rotational force.

Module Projects

Folder: \Hardware\Motors\SG90_Servo\

- **SG90_Servo_Sweep**: Runs the servo through the 0°, 90°, and 180° positions.

Libraries

- **Servo**: This library is included with recent versions of the Arduino Integrated Development Environment.

SG90 Servo - Dimensions

