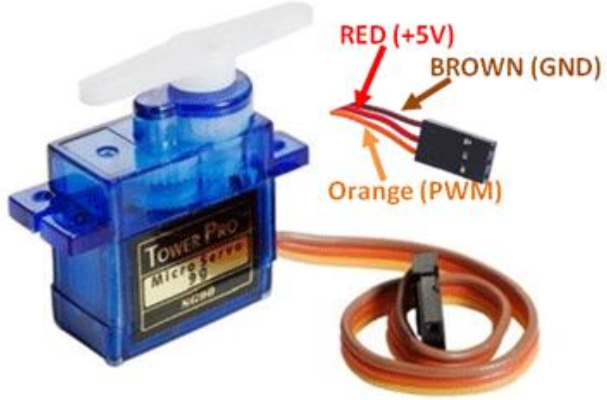
LAUNCH THE PROJECT - 13

Servo Motor

(SG90)

On AYNOP® UNO Launchpad Kit



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1. Overview

This project demonstrates how to control a **servo motor (SG90)** using the Arduino® UNO R4 Minima.

You will learn to:

- Connect a servo motor to the UNO R4 Minima.
- Use the **Servo library** in Arduino IDE.
- Move the servo from **0° to 180°** gradually, pause, and then return from **180° to 0°**.
- Learn about a new component: a **capacitor** — and why it is sometimes added to motor circuits.

This experiment helps you to understand servo motor control, and direction reversal.

2. Components Required

- Arduino® UNO R4 Minima board
- USB Type-C data cable
- SG90 Servo Motor
- 100 µF electrolytic capacitor (optional, for power stability)
- Breadboard
- Jumper wires

3. Software Required

- Arduino IDE (v2.3.6 or later recommended).
- Required library: **Servo (built-in with Arduino IDE)**

💡 Note: No external installation needed. The Servo library comes pre-installed with Arduino IDE.

Note:

We assume the **Arduino UNO R4 Minima board package** is already installed on your machine, as explained in the 00_Getting_Started/00_GettingStarted_Arduino_R4_Minima guide. If it is not installed, please refer to that document and complete the installation before proceeding.

4. Hardware Setup

This section explains how to connect the components to drive the **Servo motor**.

4.1 Wiring Diagram

- Servo **VCC** (Red) → **5V**.
- Servo **GND** (Brown/Black) → **GND**
- Servo **Signal** (Orange/Yellow) → **Arduino D6**
- *(Optional)* **100 µF capacitor** → Connect across **5V and GND** near the servo (positive leg to 5V, negative leg to GND)

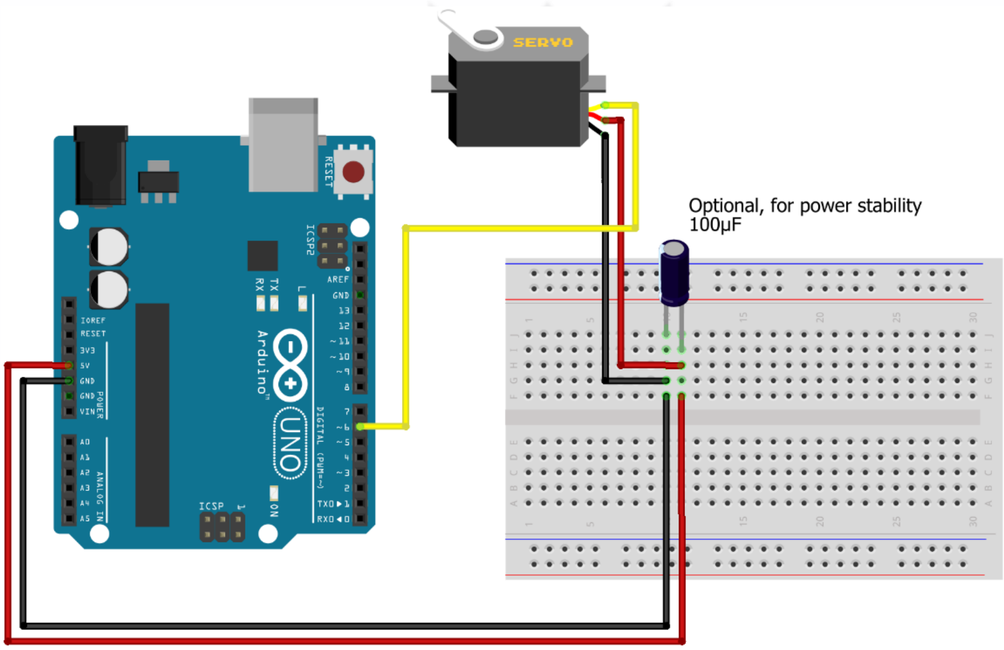

Figure 4.1 – Wiring diagram for SG90 servo motor

💡 **Tip:** Always disconnect the USB cable before making or changing hardware connections.

💡 Tip: The capacitor helps reduce power fluctuations caused by sudden servo movements. It is optional for this project but good practice for motor-based circuits.

5. Principle – How It Works

A servo motor is a **rotary actuator** designed for precise angular control.

- The SG90 is a small hobby servo that rotates typically between **0° and 180°**.
- The servo has three pins: **VCC, GND, and Signal**.
- The **Signal pin** receives PWM (Pulse Width Modulation) control signals from Arduino.
  - A pulse of ~1 ms → moves to 0°.
  - A pulse of ~2 ms → moves to 180°.
  - Values in between correspond to intermediate angles.

💡 **New Component: Capacitor (Optional)**

- A **capacitor** is an electronic component that stores and releases electrical energy.
- Motors (like servos) can draw **sudden bursts of current**, which may cause voltage drops and sometimes reset the Arduino.
- Adding a capacitor across the motor's **VCC and GND** helps:
  - Smooth out sudden power changes.
  - Reduce servo jitter.
  - Prevent board resets.
- In this project, the capacitor is **optional** — the servo will usually work fine without it. But we recommend including it as a **good practice** when working with motors.

6. Procedure – Steps to Run

1. **Build the Circuit**
   a. Connect the servo motor as shown in the wiring diagram (Figure 4.1). If available, place a **100 µF capacitor** between 5V and GND near the servo.

2. **Connect the Board**
   a. Use a USB Type-C data cable to connect your UNO R4 Minima to your computer.

3. **Open the Project Code**
   a. Simply **double-click** the file *13_Servo_Motor.ino* in the project folder, and it will open directly in the Arduino IDE (if installed).

4. **Confirm Board Selection**
   a. The IDE usually auto-detects the UNO R4 Minima if the package is installed.
   b. If not installed, refer to the *00_Getting_Started/00_GettingStarted_Arduino_R4_Minima* document to install the necessary board package.
   c. Verify that *Arduino UNO R4 Minima* is selected in the IDE's board selector (top toolbar).

5. **Upload the Code**
   a. Click the **Upload** button (arrow icon) in the top-left corner of the IDE.
   b. Wait until the console displays "**Done uploading**."

6. **Observe the Behaviour**
   a. The servo shall gradually rotate from **0° to 180°**, pauses briefly, then rotates back from **180° to 0°**.
   b. This sequence shall repeat continuously.

7. Expected Output

- The servo gradually rotates from **0° to 180°**, pauses briefly, then rotates back from **180° to 0°**.
- This cycle repeats automatically.
- If the **100 µF capacitor** is added, the motion will be smoother and the Arduino is less likely to reset.

8. Code

The source code for this project is included in the downloaded folder:

📁 uno-launchpad-kit/01_Basic_Projects/13_Servo_Motor/13_Servo_Motor.ino

👉 **Tip:**

- To open the project, simply **double-click the .ino file**. If the Arduino IDE is installed, it will launch automatically and load the code.
- If you **haven't installed the Arduino IDE yet**, please refer to:
  📁 uno-launchpad-kit/00_Getting_Started/00_GettingStarted_Arduino_R4_Minima
  to **download and install it.**

8.1 Function References

- setup() – runs once when the board is powered on or reset.
- loop() – runs continuously after setup() finishes.
- Servo myServo; – creates a Servo object named myServo to control the motor.
- myServo.attach(pin) – attaches the servo object to a digital pin.
- myServo.write(angle) – rotates the servo to the given angle (0–180°).
- delay(ms) – pauses the program for smooth movement and timing.

📚 **For more details and advanced usage, visit:**

🔗 Servo Library Reference — The guide for servo library functions.

🔗 Arduino Language Reference — The official guide for all Arduino functions.

9. Troubleshooting Tips

- **Servo not moving?**
  - Check that VCC is connected to 5V and GND is common with Arduino.
  - Ensure Signal wire is connected to D6.
  - If using a capacitor, check orientation: positive leg → 5V, negative leg → GND

- **Servo moves erratically or twitches?**
  - Power supply might be insufficient. Avoid powering multiple servos directly from Arduino 5V pin.
  - Adding the **100 µF capacitor** usually helps.
  - For multiple servos, use an external 5V supply.

- **Upload error in Arduino IDE?**
  - Verify that the correct board (**Arduino UNO R4 Minima**) is selected in the IDE.
  - Check that the correct **COM port** is chosen.

- **Board not detected via USB?**
  - Ensure you are using a **data-capable USB Type-C cable** (some cables only provide charging).
  - Try reconnecting the cable or using a different USB port.

- **Board not listed in Arduino IDE?**
  - If you don't see **Arduino UNO R4 Minima** in the board selector, the **board package is not installed**.

  - To fix this, follow the installation steps in:
    📂 *uno-launchpad-kit/00_Getting_Started/00_GettingStarted_Arduino_R4_Minima*

💡 **Tip:** If nothing works, press the **RESET** button on the UNO R4 Minima and try uploading the code again.

10. License

11. Support & Feedback

We value your feedback and are happy to assist with any questions, troubleshooting, or suggestions you may have.

✉ Email: *support@aynop.com*

When sending an email, please include your kit name (AYNOP® UNO Launchpad Kit) and, if applicable, the project name in the subject line. This will help our team respond faster and more accurately. We aim to respond to all queries within 2–3 business days. Your feedback helps us improve our products and create even better learning experiences for all Arduino beginners.