

How-To Guide: Controlling Generic DC Motors on Raspberry Pi

Copyright: I give permission for this document to be posted online for future students to access.

Introduction

In many embedded robotics projects, you need to drive motors using specific logic that requires more current than a GPIO pin can source. This guide demonstrates how to interface a Raspberry Pi with an **L298N Motor Driver** to control standard 2-wire DC motors (such as Vex motors).

This guide will cover the entire process: from flashing the OS onto the SD card, to wiring the hardware (powering the driver directly from the Pi's 5V rail), to writing a simple Python script that controls the motors.

Hardware Requirements

- **Raspberry Pi** (3, 4, or 5).
 - **MicroSD Card** (16GB+).
 - **L298N Motor Driver Module** (Dual H-Bridge).
 - **DC Motor:** Any 2-wire brushed DC motor (e.g., Vex).
 - **Jumper Wires** (Female-to-Female and Male-to-Female).
-

1. Setting up Raspberry Pi OS

Before we touch the hardware, we need a working OS. We will use the **Raspberry Pi Imager** to flash the OS and pre-configure WiFi and SSH so we don't need a monitor/keyboard.

Step 1: Download and install the [Raspberry Pi Imager](#) on your laptop.

Step 2: Insert your MicroSD card into your laptop.

Step 3: Open Raspberry Pi Imager.

1. **Choose Device:** Select your specific Pi model.
2. **Choose OS:** Select **Raspberry Pi OS (32-bit)** (or 64-bit if using a Pi 4/5).
3. **Choose Storage:** Select your MicroSD card.

Step 5: Click **NEXT**, then **NO** to keep default settings. Once finished, insert the SD card into the Pi.

2. Wiring

In this specific configuration, we are powering the L298N driver using the Raspberry Pi's 5V rail. This simplifies the build by removing the need for a secondary battery pack for the motors, suitable for lower-torque applications.

4.1 Wiring the L298N

Caution: Ensure your Raspberry Pi is powered off while wiring.

1. Motor Connections:

- Connect the motors wires to the **OUT1 / OUT2** terminals.
- You may additionally connect a second motor's wires to the **OUT3 / OUT4** terminals if you desire 2 motor control.

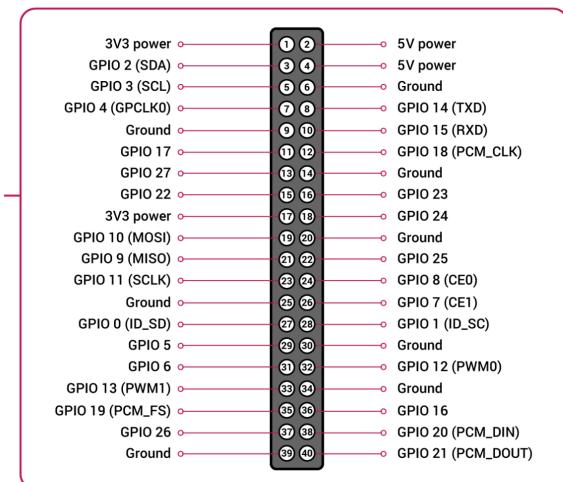
2. Power Connections (The 5V Setup):

- Use a Female-to-Male wire to connect a **5V Pin** (Physical Pin 2 or 4) on the Raspberry Pi to the **VCC** terminal on the L298N.
- Connect a **GND Pin** (Physical Pin 6) on the Raspberry Pi to the **GND** terminal on the L298N.

3. Control Pins:

Connect the GPIO pins to the L298N inputs. You may use other available GPIO pins that are available on the GPIO pinout. We are using **GPIO.BOARD** (physical) numbering.

Function	Raspberry Pi Pin	L298N Pin
Motor A (Back)	Pin 7	IN1
Motor A (Fwd)	Pin 11	IN2
Motor B (Back) <i>Optional</i>	Pin 13	IN3
Motor B (Fwd) <i>Optional</i>	Pin 15	IN4



3. Software Implementation

3.1 Imports

Create a python script and add this import at the top of the file.

```
import RPi.GPIO as GPIO
```

3.2 Initialization

Run this code block to initialize the GPIO pins.

```
# Use Physical Pin Numbering (BOARD)
GPIO.setmode(GPIO.BOARD)

# Setup GPIO
GPIO.setup(7, GPIO.OUT)
GPIO.setup(11, GPIO.OUT)

#Start with all motors stopped
GPIO.output(7, False)
GPIO.output(11, False)
```

3.2 Controlling The Motors

The motor is controlled through a difference in voltage across the two GPIO pins. Use these commands to control the motor.

```
#Stop the motor
GPIO.output(7, False)
GPIO.output(11, False)

#Move the motor forward
GPIO.output(7, False)
GPIO.output(11, True)

#Move the motor back
GPIO.output(7, True)
GPIO.output(11, False)
```

4. Troubleshooting

Problem: Motor moving while Raspberry Pi is starting up

- **Cause:** Some GPIO pins are active while the Raspberry Pi is starting up.
- **Solution:** Change to pins set inactive on startup.

Problem: Motors buzz but don't turn.

- **Cause:** Since we are powering the L298N from the Pi's 5V rail, the current might be limited, or the voltage drop across the L298N (approx 1.5V) leaves only ~3.5V for the motors.
- **Solution:** Ensure your connections are tight. This setup works best for low-load tasks. If you need more torque, you must switch to an external battery pack connected to the rail of the L298N.