

Science/Tech Note 5

Circuits using DPDT and SPDT switches to reverse the spin direction of DC motors

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DC motors use Direct Current, that is, current that only flows in 1 direction. DC motors run “forwards” or “backwards” depending on which way the current is flowing. It is easy to get DC power from batteries, and DC motors often have power requirements that correspond to battery sizes, such as 3V, 6V, and 12V.

Motors are often connected directly to power sources and controlled with manual switches. Starting and stopping a motor is easy, and can be done with a Single Pole, Single Throw (SPST) switch that simply opens and closes the circuit. In the SeaPerch robot application, as in many other cases, the user must be able to make the DC motors run forwards, backwards, and stop. The Left and Right thruster motors are each controlled with a Double Pole, Double Throw (DPDT) switch, while the Up/Down thruster motor is controlled with 2 Single Pole, Double Throw (SPDT) switches. The switches are wired such that the current can be stopped or reversed for each motor.

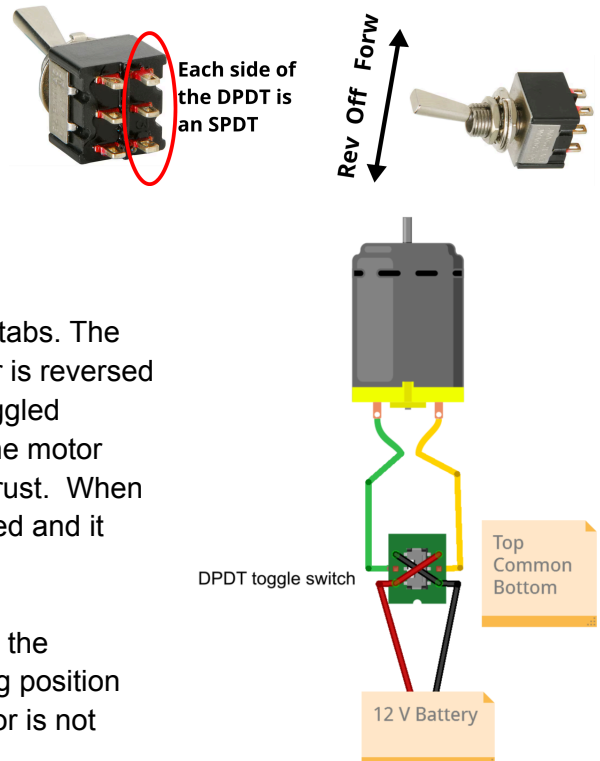
This Science Note presents wiring diagrams and explanations for circuits that use DPDT and SPDT switches to stop and to reverse the spin direction of DC motors.

Case 1: Use 1 DPDT toggle switch to control a reversible DC motor.

The DPDT switch consists of 2 SPDT switches that move together. Each is one side of the switch, with 3 connections:

Top, Common, Bottom

When the handle is toggled down, the Common tab is connected to the Top tab. Similarly, when the handle is toggled up, the Common tab is connected to the Bottom tab.



In this wiring configuration the motor is wired to the Common tabs. The Top and Bottom tabs are wired with an "X", so the 12 V power is reversed between the Top and the Bottom tabs. When the handle is toggled forward, the Common tabs connect to the Bottom tabs, and the motor receives power to spin in the direction that creates forward thrust. When the handle is toggled to reverse, power to the motor is reversed and it creates reverse thrust.

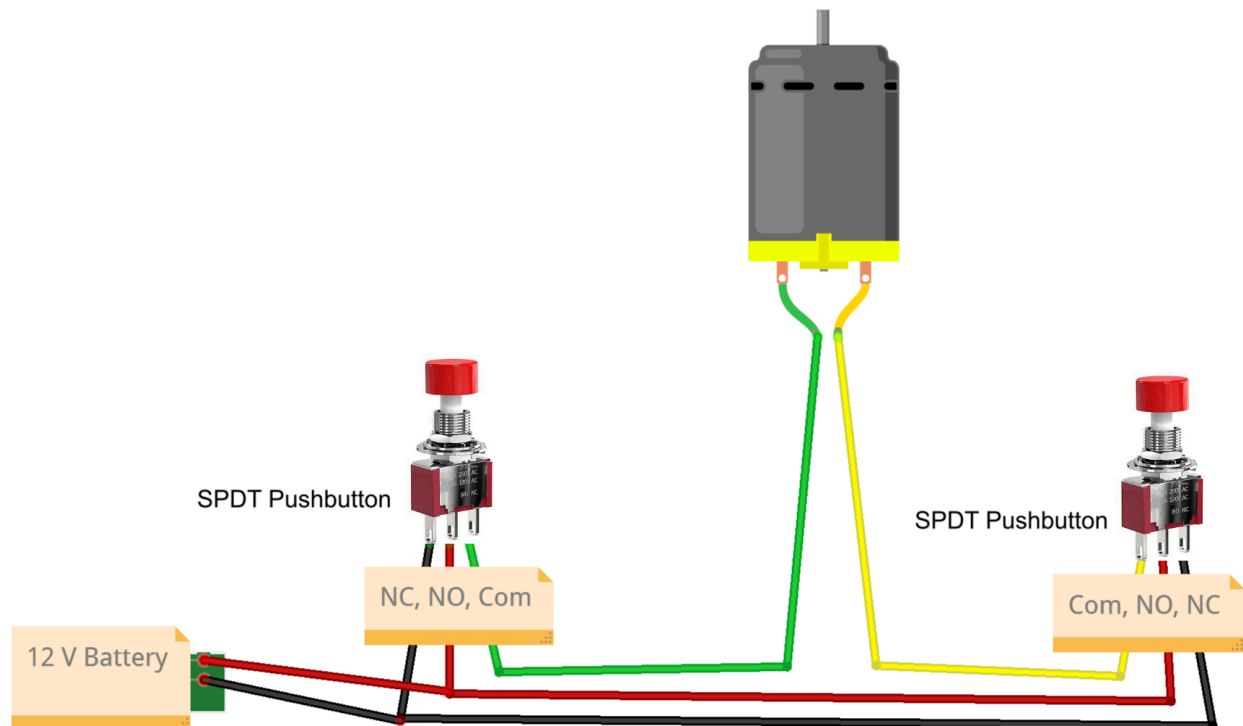
It is important that the switches have Momentary contact, and the handles spring back to center when not pushed. In that resting position the Common tabs are not connected to anything and the motor is not powered.

Case 2: Use 2 SPDT toggle switches to control a reversible DC motor.

The SPDT switch has 3 connection tabs:

- Common (C)
- Normally Open (NO)
- Normally Closed (NC)

The C tab connects to NC at rest, and to NO when the button is pushed.



In this wiring configuration, the 2 motor leads are wired to the C tabs of each switch.

The NC tabs on each switch are wired to Ground, and the NO tabs to 12 V.

- When neither switch is pushed, both motor leads are connected to NC, which goes to Ground, and the motor does not spin.
- When only one button is pushed, its C tab connects to NO, which connects one lead of the motor to 12 V, and the motor spins.
- When only the other button is pushed, the other motor lead is connected to 12 V, and the motor spins in the opposite direction.
- If both switches are pushed, both C tabs connect to 12 V, no current can flow, and the motor does not spin.

It is important that the push button switches have Momentary contact, and the button spring goes back up when not pushed.