Mechatronics Stepper Motor Driver #s377

This document gives an overview of the s377 Stepper Motor Driver designed and built by the UWO Engineering Electronics Shop. The circuit uses the Allegro 3967 Microstepping Driver with Translator. For a full description of this device, visit www.allegromicro.com.

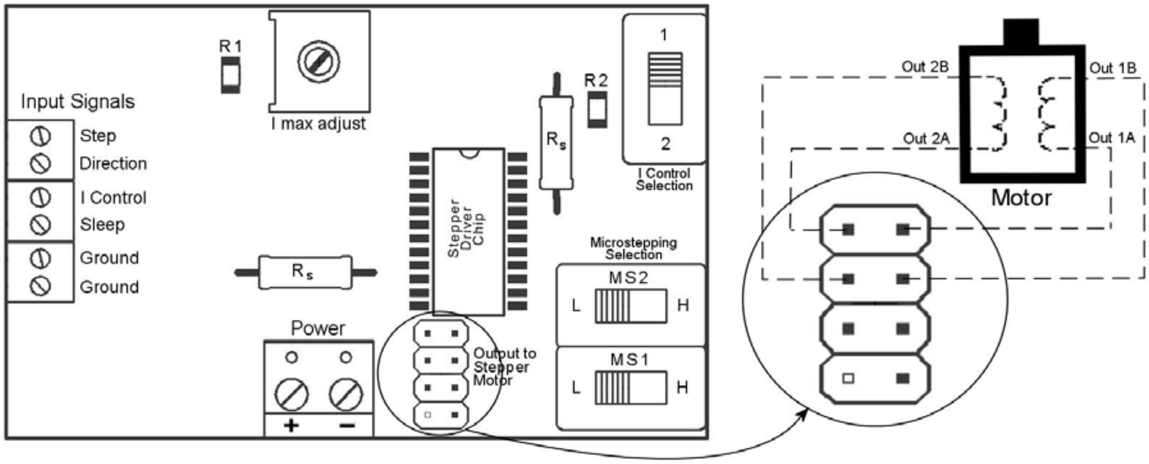

Figure 1: Circuit Board Layout and Output Configuration

Power

Hook up the DC voltage source (6V to 26V) to the power terminals shown in Figure 1. Ensure that the polarity is correct. This will be the raw voltage supplied to the motor. Check the voltage rating of your stepper motor to see what voltage you should use. The 6V to 26V mentioned above refers to the minimum and maximum voltages that can be applied to the voltage regulator that supplies the logic voltage to the stepper driver chip.

Input Signals

All input signals should be TTL (low = 0V, high = 5V.)

Current Control

The 3967 can deliver up to 800mA output current. The circuit has been designed such that the student can use the stepper driver at its maximum current rating or limit the output current using either the I max adjust potentiometer or by applying a PWM signal to the I control input terminal.

The maximum output current (I trip max) is determined by the equation:

$$\text{I trip max} = V_{ref} / 8\,R_s$$

where V_{ref} is the reference voltage applied to pin 1 of the 3967 and R_s is the value of the current sense resistor. R_s for this circuit has been fixed at 0.56 Ω. V_{ref} however, can be varied using the potentiometer or by applying a PWM signal to the I control input terminal.

With the I control switch in position 2, the potentiometer can be used to vary V_{ref} from 1V to 3.6V and hence I trip max can be varied from 220 mA to 800 mA. A low signal should be applied to the I control input terminal (i.e. connect this terminal to ground).

With the I control switch in position 1 and a low signal applied to the I control terminal, V_{ref} will be fixed at 3.6 V and hence I trip max will be set at 800 mA. Alternatively, one can apply a PWM signal to the I control input terminal. I trip max can then be varied from 220 mA to 800 mA depending on the duty cycle. The smaller the duty cycle, the greater the I trip max value.

Stepping Resolution

Different microstepping modes can be selected with the MS_1 and MS_2 switches:

MS_1	MS_2	Resolution
L	L	Full step
H	L	½ step
L	H	¼ step
H	H	⅛ step

Step

A low-to-high transition on the step input advances the motor by one increment. The size of the increment is determined by the state of inputs MS_1 and MS_2 (see table above).

Direction

A high signal applied to the Direction input terminal will cause the motor to rotate in one direction; a low signal will cause the motor to rotate in the opposite direction.

Sleep

Apply a high signal to the Sleep input terminal to put the 3967 into sleep mode. This will disable the outputs and minimize power consumption when the device is not in use.

* Advanced: Percent Fast Decay (PFD)

Read the 3967 data sheet for a full description of PFD.
To select slow decay mode, install R1 (10 kΩ).
To select fast decay mode, install R2 (6.8 kΩ).
To select mixed decay mode, install both R1 and R2.

The circuit will be set up for slow decay mode by default. To change this, please visit the Electronics Shop (SEB 3105.)