Easy Driver Hook-up Guide

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Introduction

The Easy Driver gives you the capability to drive bipolar stepper motors between 150mA to 700mA per phase.

Easy Driver

Materials Required

To follow along with this tutorial, we recommend you have access to the following materials.

Easy Driver Hook-Up Guide SparkFun Wish List

Jumper Wires Premium 6" M/M - 20 AWG (10 Pack)

PRT-11709

Jumper wires are awesome. Just a little bit of stranded core wire with a nice solid pin connector on either end. They have the flexibility of stranded…

SparkFun RedBoard - Programmed with Arduino

DEV-12757

At SparkFun we use many Arduinos and we're always looking for the simplest, most stable one. Each board is a bit different and no one board has everyt…

Female Headers

PRT-00115

Single row of 40-holes, female header. Can be cut to size with a pair of wire-cutters. Standard .1" spacing. We use them extensively in our SparkFun O…

Stepper Motor with Cable

ROB-09238

This is a simple, but very powerful stepper motor with a 4-wire cable attached. This is a [Bipolar](http://en.wikipedia.org/wiki/Bipolar\_electric\_moto…

You can either solder directly to the Easy Driver, or use headers for attaching power supplies, motors, etc. The best option for you will be dependent on your application.

Suggested Reading

If you aren’t familiar with the following concepts, we recommend reviewing them before beginning to work with the Easy Driver.

Installing the Arduino IDE

How to Power Your Project

Battery Technologies

How to Solder

Working with Wire

Motor Basics

Hardware Overview

The Easy Driver is designed by Brian Schmalz, and is designed around the A3967 IC. This IC enables you to drive bipolar stepper motors that are 4, 6, or 8-wire configurations. The board can either work with 3.3V or 5V systems, making it extremely versatile. Two mounting holes on-board give the user the option to mechanically stabilize the Easy Driver.

Pin Descriptions

Let’s take a look at all of the pins broken out from the A3967 IC on the Easy Driver.

Board Top Pins

If you look across the top of the board, you will see several pins.

Top Pins on Board

They function as follows:

Coil A+ - H-Bridge 2 Output A. Half of connection point for bi-polar stepper motor coil A.

Coil A- - H-Bridge 2 Output B. Half of connection point for bi-polar stepper motor coil A.

Coil B+ - H-Bridge 1 Output A. Half of connection point for bi-polar stepper motor coil B.

Coil B- - H-Bridge 1 Output B. Half of connection point for bi-polar stepper motor coil B.

PFD - Voltage input that selects output current decay mode. If PFD > 0.6Vcc, slow decay mode is activated. If PFD < 0.21Vcc, fast decay mode is activated. Mixed decay occurs at 0.21Vcc< PFD < 0.6Vcc.

RST - Logic Input. When set LOW, all STEP commands are ignored and all FET functionality is turned off. Must be pulled HIGH to enable STEP control.

ENABLE -Logic Input. Enables the FET functionality within the motor driver. If set to HIGH, the FETs will be disabled, and the IC will not drive the motor. If set to LOW, all FETs will be enabled, allowing motor control.

MS2 -Logic Input. See truth table below for HIGH/LOW functionality.

GND - Ground.

M+ - Power Supply. 6-30V, 2A supply.

Bottom Board Pins

There are also pins across the bottom of the board. Their functions are described below.

Bottom Pin Boards

GND - Ground.

5V -Output. This pin can be used to power external circuitry. 70mA max is required for Easy Driver functionality.

SLP - Logic Input. When pulled LOW, outputs are disabled and power consumption is minimized.

MS1 - Logic Input. See truth table below for HIGH/LOW functionality.

GND - Ground.

STEP -Logic Input. Any transition on this pin from LOW to HIGH will trigger the motor to step forward one step. Direction and size of step is controlled by DIR and MSx pin settings. This will either be 0-5V or 0-3.3V, based on the logic selection.

DIR -Logic Input. This pin determines the direction of motor rotation. Changes in state from HIGH to LOW or LOW to HIGH only take effect on the next rising edge of the STEP command. This will either be 0-5V or 0-3.3V, based on the logic selection.

Microstep Select Resolution Truth Table

MS1 MS2 Microstep Resolution

L L Full Step (2 Phase)

H L Half Step

L H Quarter Step

H H Eigth Step

Solder Jumpers

There are two solder jumpers on board. These provide the following features to the user:

3/5V - This jumper allows the user to set the configuration of VCC between 3.3V or 5V. With the jumper open, VCC will be 5V. If the jumper is closed, VCC is 3.3V.

VCC Jumper

APWR - This jumper allows the user to source Vcc on the 5V/GND pins to external hardware.

External Power Jumper

Potentiometer

The potentiometer on board is included to allow users the ability to select the max current provided to the motor. It ranges from 150mA to 750mA. This will require you to be aware what current range your motor can handle – check the motor’s data sheet for the current settings.

Potentiometer

If you can’t find this information, have no fear – you can still find the proper setting for the potentiometer. First, set it to the lowest setting of the potentiometer. Keep in mind that the potentiometer is delicate, so be careful to not force the potentiometer past the mechanical stops when turning it. Once you have the motor being driven at a slow, yet steady speed, slowly turn the potentiometer and pay attention to the motor’s behavior. You should find a sweet spot where the motor doesn’t skip or jerk between steps.

Hardware Hookup

Connect Motor Coil Wires

You will need to determine the wire pairs for each coil on the motor you plan to use. The most reliable method to do this is to check the datasheet for the motor.

Motor Coil Diagram

Coil wire diagram from the datasheet our NEMA 16 Stepper Motor with Cable.

However, if you are using a 4-wire or 6-wire stepper motor, it is still possible to determine the coil wire pairs without the datasheet.

For a 4-wire motor, take one wire and check its resistance against each of the three remaining wires. Whichever wire shows the lowest resistance against the first wire is the pair mate. The remaining two wires should show similar resistance between the two of them.

For a 6-wire motor, you will need to determine which of three the wires go together for one coil. Pick one wire, and test this against all other wires. Two wires should show some resistance between them and the first wire picked, while the other three will show no connection at all. Once the three wires for one coil have been determined, find two of the three that show the highest resistance between them. These will be your two coil wires. Repeat for the second group of three wires.

Once you have determined the coil wire pairs, you will need to attach them to the Easy Driver. The first coil pair should be plugged into Coil A+ and Coil A-, while the second coil pair plugs into Coil B+ and Coil B-. There is no polarity on the coils, so you don’t need to worry about plugging in a coil backwards on the board. In our example, we are using a 4-coil motor. The connections between the Easy Driver and motor are as follows.

Easy Driver → Motor

A+ → Green Wire

A- → Red Wire

B+ → Blue Wire

B- → Yellow Wire

Note: Do not connect or disconnect the motor while the Easy Driver is powered.

Connect a Power Supply

Once your motor is connected, you can then connect a power supply to the Easy Driver. You can use any kind of power supply (desktop, wall adapter, battery power, etc.), but verify that whatever choice you go with is capable of providing up to 2A and falls in the range of 6V to 30V.

Connect the power supply to M+ and GND. REMEMBER to disconnect the power before connecting/disconnecting your motor.

Connect a Microcontroller

For this example, we will be using the SparkFun RedBoard. However, any microcontroller that works at 3.3V or 5V logic and has digital I/O with PWM capability will work for this example.

Here are the following pin connections for our example.

RedBoard → Easy Driver

D2 → STEP

D3 → DIR

D4 → MS1

D5 → MS2

D6 → ENABLE

Final Circuit

Once you have everything connected, your circuit should look like the following:

final circuit

