

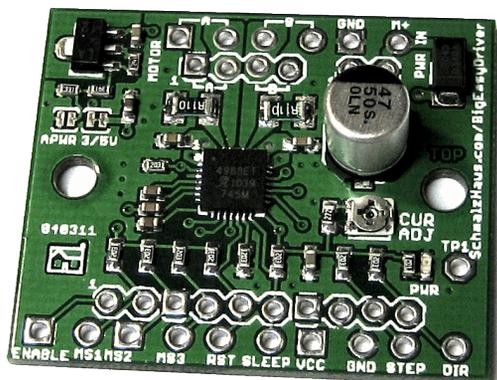
# Big Easy Driver stepper motor driver

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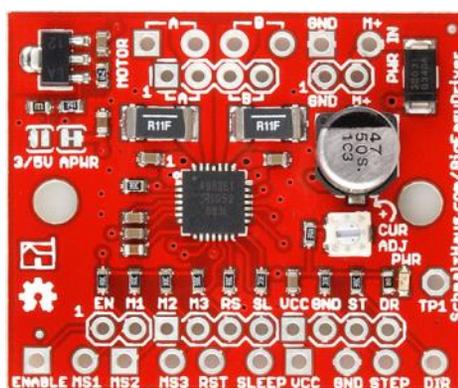


## Big Easy Driver Stepper Motor Driver

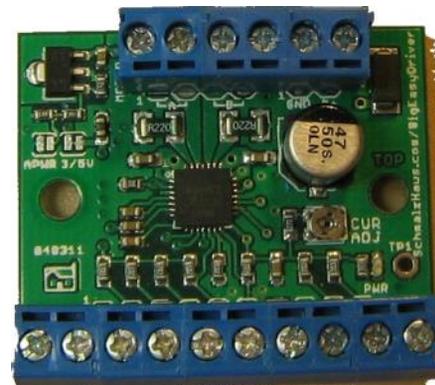
An Open Source Hardware Stepper Motor Driver



BigEasyDriver v1.1



Big Easy Driver v1.2



BED v1.1 with screw terminals on the top side

### Description:

The Big Easy Driver is a stepper motor driver board for bi-polar stepper motors up to 2A/phase. It is based on the Allegro A4983 or A4988 stepper driver chip. It is the next version of the Easy Driver board.

### User Manual:

Download the latest version of the Big Easy Driver user manual [here](#).

### Quick Specs:

Each BigEasyDriver (BED) can drive up to about 2A per phase of a bi-polar stepper motor. It defaults to 16 step microstepping mode. (So if your motor is 200 full steps per revolution, you would get 3200 steps/rev using the Big Easy Driver.) It is a chopper microstepping driver based on the [Allegro A4988](#) driver chip. For the complete specs of the design, read the A4988 datasheet. It has a variable max current from about 0mA/phase to 2A/phase, although I have tested it to 2.2A/phase with a heatsink and/or fan. It can take a maximum motor drive voltage of around 35V, and includes on-board 5V/3.3V regulation, so only one supply is necessary.

### Quick Pin Description:

Please see the Allegro A4988 data sheet linked above for complete technical details. The Big Easy Driver is basically just a breakout board for this driver chip, so the datasheet is your best source of information about how it all works. However, if all you need is a reference to the pins, here you go:

- GND : There are three GND (Ground) pins on the Big Easy Driver. They are all connected together inside the board. Connect the negative side of your power supply, as well as from any other boards you are using to drive the Easy Driver to one or more of the GND pins.
- M+ : This is the power input to the Easy Driver. Connect this to the positive power supply lead.

This should be a 6V to 30V, 3A (or more) power supply that is clean (low ripple).

- A and B : (four pins) These are the motor connections. See below diagrams for how to hook these up. A and B are the two coils of the motor, and can swap the two wires for a given coil (it will just reverse the direction of the motor). Make CERTAIN that this connection to the motor is solid, and NOT through a connector that has any chance of intermittent contact (which will fry the motor driver chip).
- STEP : This needs to be a 0V to 5V (or 0V to 3.3V if you've set your Big Easy Driver that way) digital signal. Each rising edge of this signal will cause one step (or microstep) to be taken.
- DIR (Direction) : This needs to be a 0V to 5V (or 0V to 3.3V if you've set your Big Easy Driver up that way) digital signal. The level if this signal (high/low) is sampled on each rising edge of STEP to determine which direction to take the step (or microstep).

That's it - those are the only signals that you absolutely need to connect to anything. All the rest below are optional - in other words, the Big Easy Driver sets them to reasonable default values.

- MS1/MS2/MS3 : These digital inputs control the microstepping mode. Possible settings are (MS1/MS2) : full step (0,0), half step (1,0), 1/4 step (0,1), and 1/8 step (1,1 : default).
- RST (reset) : This normally high input signal will reset the internal translator and disable all output drivers when pulled low.
- SLEEP : This normally high input signal will minimize power consumption by disabling internal circuitry and the output drivers when pulled low.
- EN (enable) : This normally low input signal will disable all outputs when pulled high.
- VCC : This is an OUTPUT pin that will provide either 5V (default) or 3.3V from the voltage regulator, at a small amount of current (say 50mA - depends on input voltage) to power a circuit that you may need powered.

## Where to buy Big Easy Drivers:

I do not sell Big Easy Driver boards. This design is being released into the general public just like the Easy Driver design. Anybody can take the design presented on this page and do anything they want with it. I'm providing Eagle schematic and board layouts as well as a Bill Of Materials and instructions on how to build and use the design. If you do decide to manufacture the Big Easy Driver for yourself or for sale, please remember that royalties are the only way that I can continue to provide support to Easy Driver users, so contact me.

## Status:

(11/04/12) Added a link in FAQ section below to [\(Big\) Easy Driver Example page](#) - how to use your Big Easy Driver with an Arduino or chipKIT board!

(11/04/12) Added note about how to calculate motor current from TP1 voltage (see below)

(8/19/11) Big EasyDriver v1.2 is now [for sale at SparkFun](#) for \$22.95

(6/19/11) Files published on this webpage - schematic, board layout, BOM, etc.

(5/26/11) Big EasyDriver v1.2 has been accepted for production by SparkFun

(5/17/11) Initial webpage created. More content to be filled in after Maker Faire.

EasyDriver Hardware Versions Matrix (guides and pictures be updated yet)					
	Schematic	Board	Picture	Guide	Eagle Files and BOM
BigEasyDriver v1.0	<a href="#">here</a>	<a href="#">here</a>	<a href="#">here</a>	N.A.	<a href="#">here</a>
BigEasyDriver v1.1	<a href="#">here</a>	<a href="#">here</a>	<a href="#">here</a>	N.A.	<a href="#">here</a>
BigEasyDriver v1.2	<a href="#">here</a>	<a href="#">here</a>	<a href="#">here</a>	N.A.	<a href="#">here</a>

## Version Notes:

- BigEasyDriver V1.0 - Initial version. Tried to keep similar board footprint to EasyDriver - not cool. Routing didn't work well, heat dissipation didn't work well. Forgot pull-up resistors on digital

inputs.

- BigEasyDriver V1.1 - New form factor, got all of the EE stuff right. Great power dissipation, works very well.
- BigEasyDriver V1.2 - Minor changes - silk screen cleanup, sense resistors now 0.11 ohms, minor layout tweaks, and R13 is now 2.49K. First SparkFun production version.

## FAQ:

**Q1)** Do I need a heatsink on that little chip?

**A)** Probably not. Most of the time, you will be able to get perfectly acceptable performance without running all the way up to 2A/phase. Even without a heatsink, you will be able to get close to 2A/phase. If, however, your BEDs will be enclosed, or in high ambient temps, or you really want to push them (I've gotten to 2.2A/phase with heatsink and fan) then I recommend this little guy: A [FISCHER ELEKTRONIK 34M6428](#). The board is designed for maximum heat dissipation, so its really good at getting rid of the heat even without the heatsink.

**Q2)** The datasheet for the driver chip shows that the motor connects to pins OUT1A, OUT1B, OUT2A and OUT2B, and the diagram in the datasheet has one coil connected across OUT1A and OUT1B, and the other across OUT2A and OUT2B. But the Big Easy Driver only has A, A, B, B for motor connections, and it looks like one coil should be connected across the two A pins and the other across the two B pins. What's up with that?

**A)** Yeah. Oops. Clearly that was a pretty bad choice for the Big Easy Driver labels. On a bi-polar stepper motor, there are four wires that connect to two coils. Each coils has two wires. The Big Easy Driver calls those two coils A and B. So one coils' wires are to be connected across the two A pins, and the other coils' wires are to be connected across the B pins. The driver chip datasheet refers to these two coils as coil 1 and coil 2. Sorry for the confusion. See the diagram below for the accurate connection diagram for the Big Easy Driver.

**Q3)** So if I can't trust the silk screen, how do I know which way to turn the CUR ADJ pot to set the current in my stepper motor to some value?

**A)** Well, there are two methods. One is to run your motor at a nice constant speed, say 500 steps/s, and slowly and carefully turn the current adjustment pot one way or the other (careful not to go past the mechanical end stops if the pot you have has them) and listen, feel, and watch the motor. There will normally be a place in the pot's range that produces smooth microstep action and minimizes the 'buzz' of the motor as it moves. That's probably a good place to leave it.

**A)** The other way to do it is by measuring the voltage on TP1. Get your volt meter out, and put the positive on TP1 and the negative on GND (any GND on the BED will do), and set it to DC volts, low range (you'll be measuring between 0V and about 3.8V). You can turn the power off to the BED, disconnect the motor from the BED, then turn power back on to the BED to do this measurement. As you turn the pot, you will get different voltages on TP1. You use the following equation to compute what the motor current will be based on the voltage at TP1:

$$I_{tripmax} = V_{ref}/(8 * R_s)$$

Where  $I_{tripmax}$  is the current that the driver will allow through to the motor coil,  $V_{ref}$  is the TP1 voltage, and  $R_s$  is the value of the current sense resistor, which is .11 Ohms for the current BED.

So if you have 0.0V at for  $V_{ref}$ , then the max current will be (theoretically) 0A.

And if you have  $V_{ref}$  maxed out at 3.8V, then the (theoretical) current will be 4.3A.

Now, you clearly can't get 4.3A/phase out of the BED. So the maximum usable range will probably be in the 0V to 1.76V (results in 2A/phase). Depending on if you have a heatsink, fan, low impedance motor, etc.

One really big factor to success here is that the input voltage to the BED must be high enough that the BED can actually limit the current to the coils. If your motor coil resistance is too high, or the input

voltage is too low, then you won't get accurate microstepping. In fact, you may not get any current chopping at all, which means you're limited to half-step mode. (Since there will be no microsteps.)

**Q4)** Do you have any examples of how to use the Big Easy Driver with an Arduino or chipKIT board?

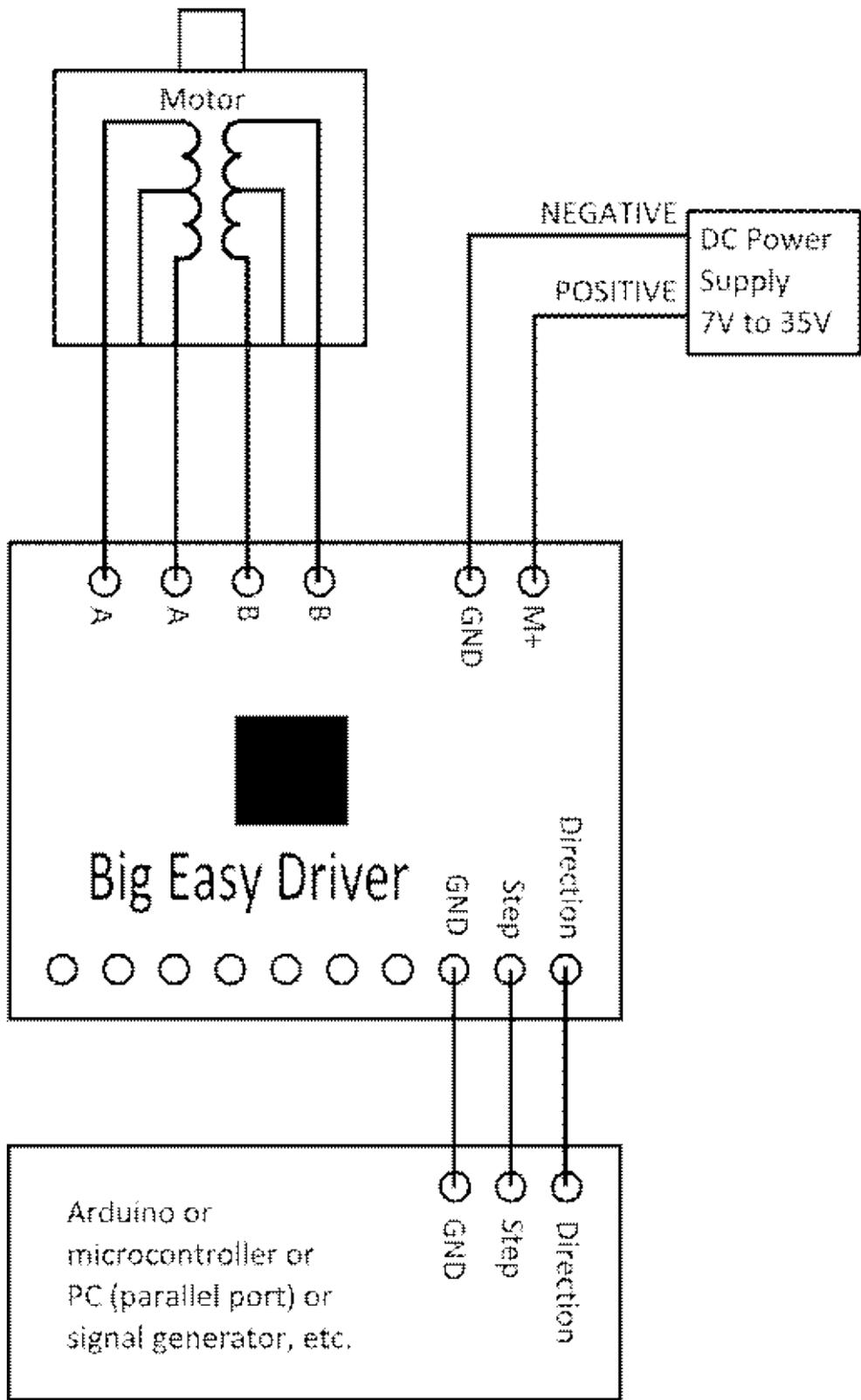
**A)** Yes! Check out [this page](#) - everything there for the Easy Driver applies to the Big Easy Driver.

**Q5)** Does it matter which order I power things on? Can the Big Easy Driver be damaged by the order that things power up?

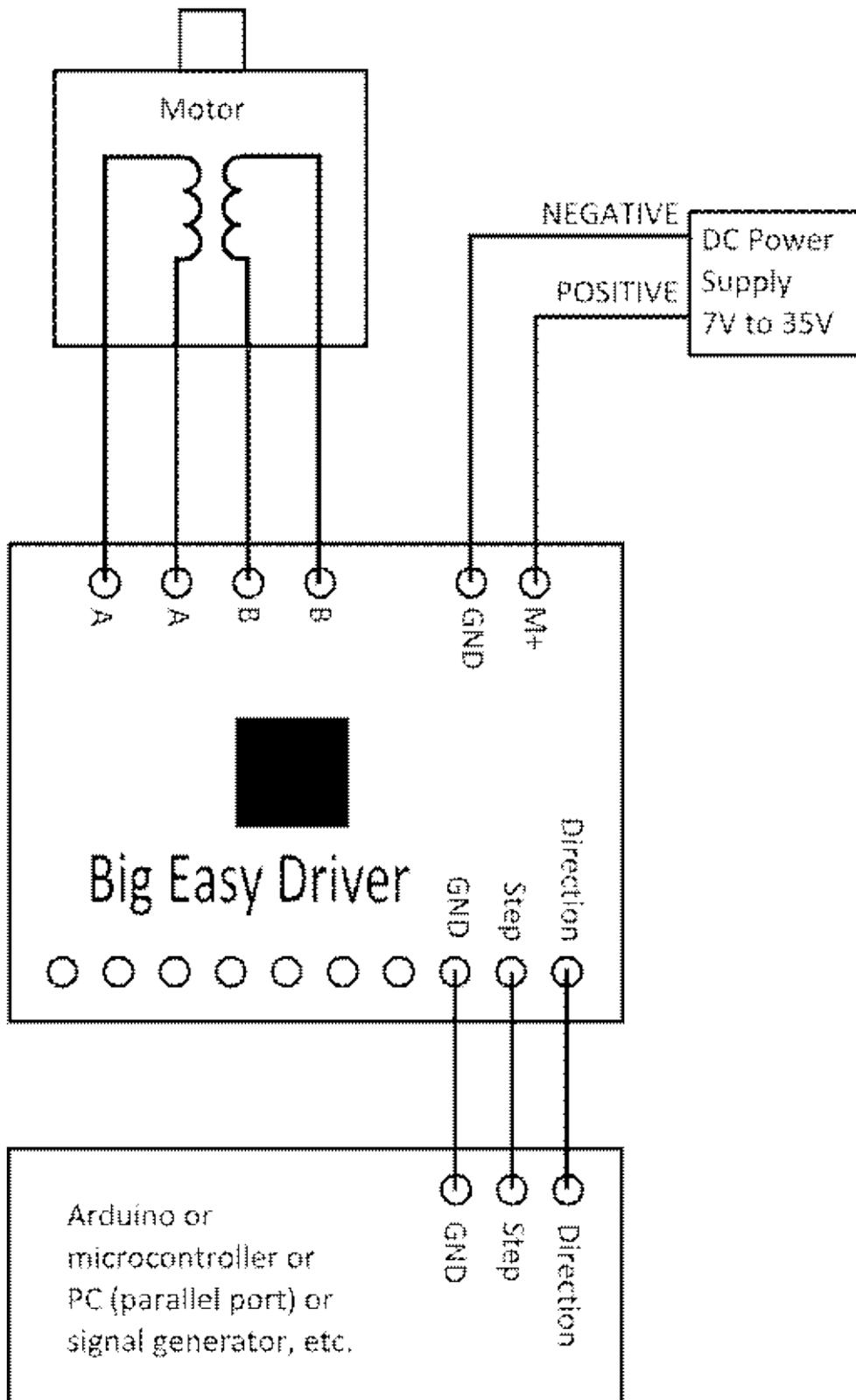
**A)** As far as I know, no. If you have a microcontroller board (like a chipKIT or Arduino) connected to your Big Easy Driver, and the microcontroller is powered from a different power supply than the BED is (say over USB from a PC), it might seem to make sense that powering up the microcontroller first would apply voltages to the Big Easy Driver pins before the BED is ready for them (since it isn't powered up yet) and cause damage. Based on my understanding of the input protection circuitry on the BED, and my extensive testing, there should be no damage caused in this situation. This answer only applies to the order in which power is applied to the boards - you still must not disconnect a motor from a BED that has power.

## **Motor Hookup**

Here's a drawing on one way to hook up a six wire stepper motor to the EasyDriver.



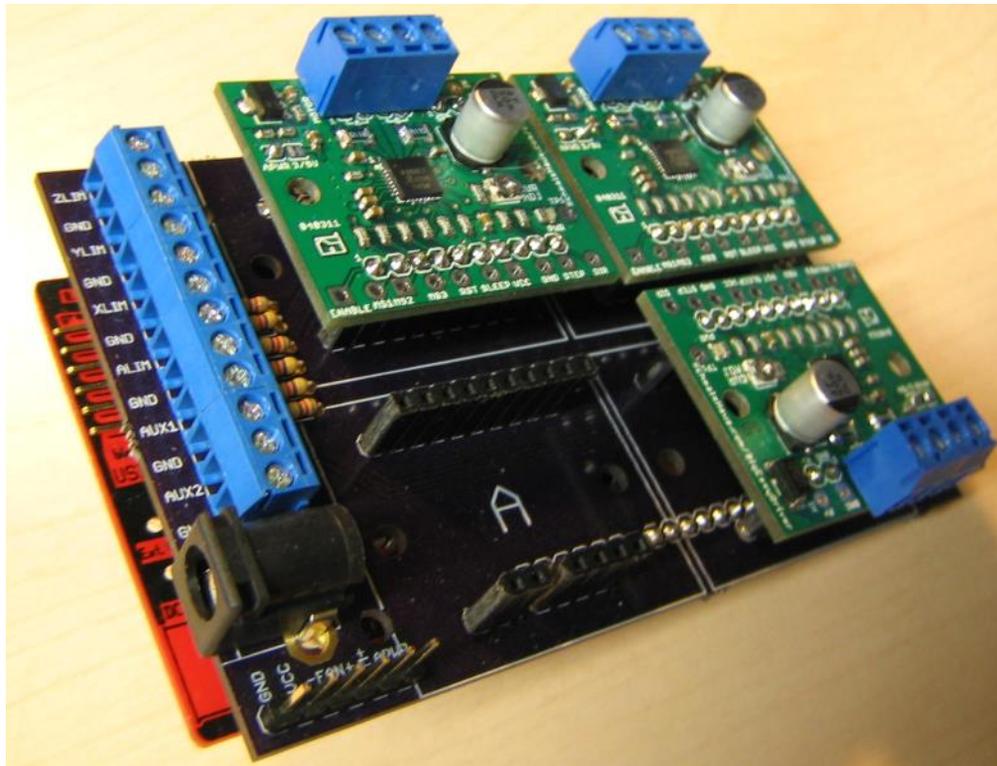
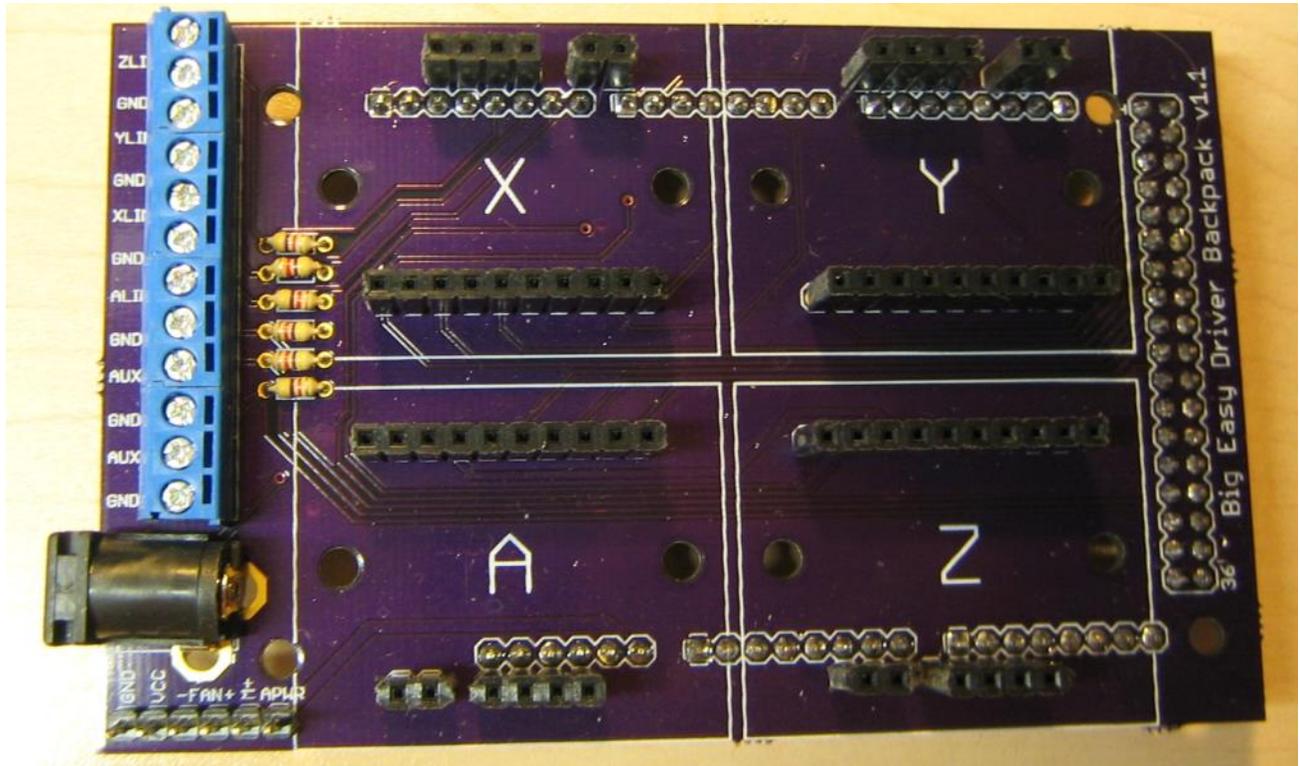
And here's how to hook up a Big Easy Driver to a four wire stepper motor:



### Big Easy Driver Backpack-

For Maker Faire San Mateo 2011 I threw together a quick Arduino shield that could hold four Big Easy Drivers - I called it the Big Easy Driver Backpack. This ran for 2 days straight, running my little Fireball mill. I ran [GRBL](#) on the [Divolino Arduino board](#) and streamed G-code to it from a custom written Libery Basic application.

Here are the Gerbers and Eagle files (schematic and board layout) for the [BED Backpack v1.1](#) (It's a very simple board - just connectors really)



Questions? E-mail me at  
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