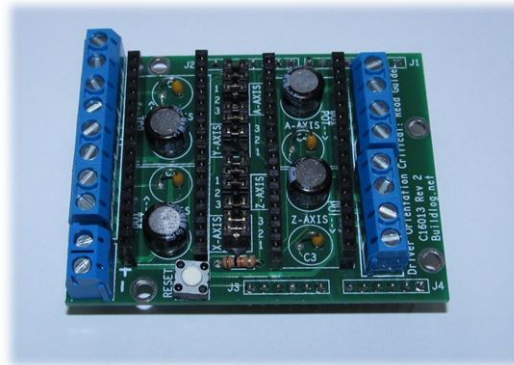


Buildlog.net 4 Axis Stepper Driver Shield (p/n C16013 Rev 2)

User Guide Rev 5



Safety & Disclaimers

This stepper driver board is designed for experienced technicians only. The schematic should be studied to see if it will safely work in your system before installing or using the board. Improper use in CNC or other machines could cause personal injury or damage to expensive equipment.

No circuit can be truly fail-safe. Even with properly connected interlocks and safety switches, there is always the chance for unintended motion of the motors or engagement relays.

The user is the sole person responsible for the safety of the system. If at any time you are concerned about the suitability of this circuit for safe operation you can return it for a refund.

Unless otherwise specified in the document, no connections should be made to this board while the board is powered. Remove power and wait for the voltage to reach 0 before making changes.

Do not assume anything. Please ask if anything is unclear. Orientations and connection order are very important and might not be what you assume from previous experiences or assumed "standards".

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Caution

The pins from the shield can short to tall components on the Arduino. Place insulation wherever contact could occur.

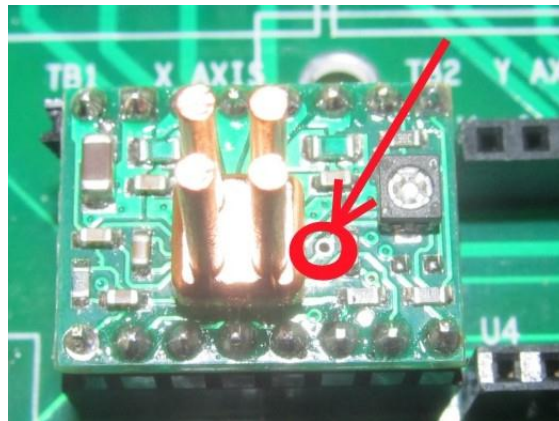
The orientation of the drivers is critical. They will be instantly destroyed if they are plugged in backwards and voltage is applied. **They are not all oriented the same way.** Review the picture of the PCB. There is an arrow on the silkscreen of the PCB that shows the direction of the pots.



Current Adjustment

The current is set using the potentiometer on the driver board. You adjust the pot until the correct voltage is measured on the very little point shown below. The voltage is calculated using the following formula. For 1.5A you would set the voltage to 0.6V.

$$V = I * 0.4$$



Note:

Never disconnect a stepper motor with the board powered. It will destroy the stepper drivers. Make sure the wires are securely fastened in the terminal blocks to prevent accidental disconnect. The use of heatsinks on the drivers is suggested. Heatsinks are attached with special heatsink tape or thermal epoxy.

More information on these Pololu drivers can be found at the Pololu web site (www.pololu.com)

Features

1. 4 axis support with optional relay driver support on any socket.
2. Sockets for standard Pololu and StepStick stepper drivers.
3. Jumpers for microstep resolution selection (Full,2x,4x,8x,16x microstepping).
4. Reset button.

Assembly

If assembly is required....Use the Bill Of Materials (BOM) section near the end of this document to determine the parts. Here are some tips to make assembly easier.

- I find it easiest to assemble the shortest parts first because they can be inserted and the board flipped over and placed on a table.
- There are no static sensitive parts except for the drivers.
- An assembled stepper driver PCB can be used to hold the mating connectors properly aligned while soldering.
- I use a little dab of super glue to hold the terminal blocks in place while soldering. This makes it easier to solder them straight. Be sure no glue flows onto the solder pads.
- The large capacitors have a minus sign printed on the device. The positive side has longer lead and goes in the square hole.

Arduino Port information.

Function	Pin Label	Port	Bit
X Step	2	D	2
X Dir	3	D	3
Y Step	4	D	4
Y Dir	5	D	5
Z Step	6	D	6
Z Dir	7	D	7
A Step	10	B	2
A Dir	11	B	3
Enable (not...0=On)	8	B	0

The fourth axis (A) is currently not supported by GRBL. The circuit is setup for possible future expansion to a fourth axis. This axis can be used for spindle control, which GRBL does support. A special relay driver is used in the A axis stepper driver socket. The socket is too small to safely place an AC relay circuit so the relay must be located remotely.

Stepper Resolution

Mode	Jumper 1	Jumper 2	Jumper 3
Full Step	0	0	0
½ Step	1	0	0
¼ Step	0	1	0
1/8 Step	1	1	0
1/16 Step	1	1	1

Program modification

GRBL has hard coded pin assignments. The program must be recompiled with the correct values. Edit the files below, then recompile.

Congif.h (near the beginning of the file)

```
#define STEPPERS_ENABLE_DDR    DDRB
#define STEPPERS_ENABLE_PORT  PORTB
#define STEPPERS_ENABLE_BIT   0
#define STEPPERS_ENABLE_VAL   0 // 0=low 1=high

#define STEPPING_DDR          DDRD
#define STEPPING_PORT         PORTD
#define X_STEP_BIT            2
#define Y_STEP_BIT            3
#define Z_STEP_BIT            4
#define X_DIRECTION_BIT      5
#define Y_DIRECTION_BIT      6
#define Z_DIRECTION_BIT      7

#define LIMIT_DDR             DDRB
#define LIMIT_PORT            PORTB
#define X_LIMIT_BIT           1
#define Y_LIMIT_BIT           4
#define Z_LIMIT_BIT           5

#define SPINDLE_ENABLE_DDR    DDRB
#define SPINDLE_ENABLE_PORT  PORTB
#define SPINDLE_ENABLE_BIT   2

#define SPINDLE_DIRECTION_DDR DDRB
#define SPINDLE_DIRECTION_PORT PORTB
#define SPINDLE_DIRECTION_BIT 3
```

Steppers.c (in the st_init() function)
Change the enable routine to look like this

```
// set enable pin
if (STEPPERS_ENABLE_VAL)
    STEPPERS_ENABLE_DDR &= 1<<STEPPERS_ENABLE_BIT; // bit low is enable
else
    STEPPERS_ENABLE_PORT |= 1<<STEPPERS_ENABLE_BIT; // bit high is enable
```

Programming

Bill of Materials

Designator	Description	Source
R1	Resistor, 10k, 1/4W	Generic
C1-C4	0.1uF 50V Ceramic Cap	Generic
C5-C8	47uF 35V Electrolytic Capacitor	
TB1	Terminal Block 2POS 5mm	On Shore Technology ED500/4DS
TB2-TB5	Terminal Block 4POS 5mm	On Shore Technology ED500/4DS
S1	Switch, Momentary	Panasonic EVQ-21304M

Change history

Rev 1 – Initial Release (Link to Old [Schematic](#) and [User Guide](#))

Rev 2

- Removed pull up resistors for micro stepping selection. This means board is no longer compatible with Pololu A4983 drivers. Only use A4988.
- Added 47uF Capacitors on motor voltage at all driver locations. This reduces the noise in the stepper motors and potentially reduces a capacitor failure on the driver boards.
- Reduced capacitance on 5V line to comply with USB standards.