

Some Words of Caution

If you have built your own pcb via toner transfer, check the board thoroughly for shorts before starting assembly. Attached an ohm meter to ground, and check all of the 3977 pins.

Check U1 pins 1,2,11,12,13,22,23,24, 26, 33,34,35,44 should all read continuity to ground. Pins 4,5,6,7,8,9,10,14, 15,16,17,18,19,20,25,27,28,29,30,31,32,33,36,37,38,39,40,41,42,43 should not ring continuity. Pins 3 and 21 will read real low resistance, or will seem to have continuity. You are reading through a .2 ohm resistor on those pins and without a more elaborate setup it is difficult to distinguish a true accurate reading. **Never remove a connection to the stepper motor with power applied, there is a HIGH probability you will damage your 3977 if you do.**

Build Sequence

Install C13,C12,C9,C20,R15, LED1, IC2 and connector X3. Apply power greater than 8VDC and no greater than 35VDC to X3. LED1 should illuminate and you should measure 5VDC + or - .25VDC on the output of IC2 to ground. Install the remainder of the components with the exception of IC1 (74HC14N) and U1 (3977SED). Install a 14 pin DIP socket for IC1. Install a 18awg wire (blue in the layout) between GND13 and GND14, also between GND15 and GND 16.

Troubleshooting

Without the 3977 soldered on and IC1 not installed:

1. Power up the board and with a DC Voltmeter with the negative lead connected to board ground, measure 5vdc at:
 - a) IC1 (74HC14) Pins 14, 13,1 and 5. U1 (3977) pin 16
2. Measure the V+ (power supply) at U1 pins 43 and 25.
3. Power down, install IC1, power back up.

4. Run the 74hc14 (IC1) through hi (Greater Than 4vdc) and low (Less Than .7vdc) states by:
 - a) IC1 pins 13, 5, and 1 should be hi, IC1 pins 2,3,6,9,12 and 11 should be low, and IC1 pins 10, 4 and 8 should be hi (GT 4vdc). Also 3977 pins 41 and 31 should be high.
 - b). Leaving power on, jumper pad ENABLE to ground, 3977 pin 41 should now be low
 - c) Move the jumper pad Step to ground, 3977 pin 31 should go low when the step pad is grounded and should go hi when you remove the jumper.

Now you may install U1 the 3977. (Make sure you've disconnected the board from the power source.

JP4 Inputs

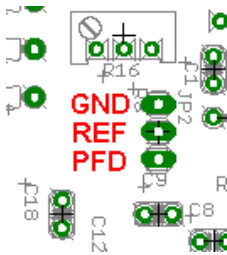
JP4 is a 10 pin IDC connector for easy hookup to the 4 axis interface board. The signal definition is below. Same orientation as the board layout above.



The outputs are enabled by a low logic signal (less than .7vdc) on the Enable pin. A second option of connection to the board is leaving JP4 off and installing a 6 pin polarized connector (.1 inch spacing). A third option is to discretely wire to the step, dir, enable and GND pads.

Jumper JP2

JP2 is 3 test points to facilitate voltage measurements for REF and PFD. Utilize the GND pin of JP2 when making measurements.



Setting Current Limit

Measuring the DC voltage between the REF Pin and GND Pin of JP2. Adjust R16 as follows:
 $V_{ref} = 1.6 * \text{Max motor current}$. i.e. .5A max = .8V, 1A max = 1.6V , 1.7A max =2.72V, 2.5A max = 4V.

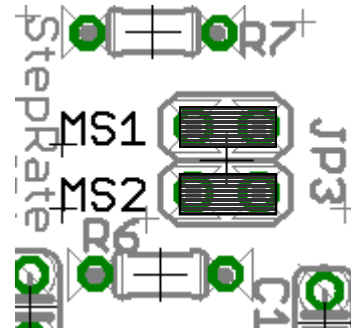
PFD

PFD is set by R10 and R13 and using the components listed in the Parts table will set it a 2.5V.

Jumpers for Micro-Stepping JP3

Table 1. Microstep Resolution Truth Table

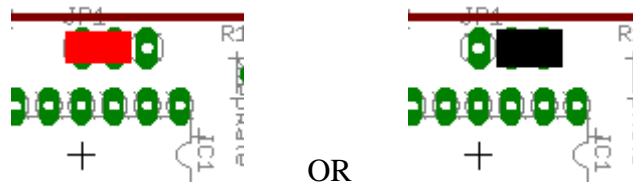
MS ₁	MS ₂	Resolution
L	L	Full step (2 phase)
H	L	Half step
L	H	Quarter step
H	H	Eighth step



Jumper in = L, jumper out = H i.e. for full steps both MS1 and MS2 need to be installed.

Jumper JP1

JP1 is used to reverse motor direction if the software used does not have the capability to set jumper direction. JP1 must have a jumper from the center post to an adjacent post.



Using the board

The board was designed with a high noise immunity environment in mind. Switching heavy currents and inductive loads are prone to noise. The A3977 driver chip is a chopper, in that it turns the outputs of the driving bridge on and off tens of thousands of times a second. The opportunity for electrical noise is a concern. For that very reason, IC1 is utilized to provide excellent noise rejection. There are two options for IC1. Either a 40106 or 74HC14 Schmitt Trigger Inverter can be installed. The 40106 is older slower technology is preferred for the best noise immunity, but can't be relied to be driven directly by a PC's parallel port. If driving from a PC parallel port with no active conditioning logic, a 74HC14 must be used.

Software Setup

The step signal has a simple RC filter on it, as do the direction and enable signals. **Minimum pulse width for the step pulse is 10us. Maximum step frequency is 40khz.** Most steppers torque really drop above 1khz at full step, or 8khz if your using the 1/8th step mode.

Parts

Part Table Reference for SS 3977SED Board				
Reference Designator	Value	Package	Part	Digikey P/N
C2, C3,C7,C8,C9,C13,C19,C20	.1uf		Capacitor	BC1084CT-ND
C5, C6, C10	.22uf		Capacitor	BC1149CT-ND
C1,C4	1000pf		Capacitor	BC1072CT-ND
C15, C16	100uf		Capacitor	P5165-ND
C12	10uf		Capacitor	P11250-ND
C11, C14, C17, C18	470pf		Capacitor	BC1021CT-ND
IC1	74HC14	DIL14	Hex SCHMITT TRIGGER	MM74HC14N-ND
LED1		LED3MM	LED	67-1066-ND
JP3		2X02	PIN HEADER	22-28-4142-ND *
JP1, JP2		1X03	PIN HEADER	WMB6424-ND *
JP4		2X05	PIN HEADER	*
R1, R2	0.2		Resistor	13FR200-ND
R15	390		Resistor	390QBK-ND
R3, R4, R5, R6, R7 ,R11 ,R17,R18	10K		Resistor	10KQBK-ND
R12	1K		Resistor	1.0KQBK-ND
R14	2.2K		Resistor	2.2KQBK-ND
R10, R13	4.7K		Resistor	4.7KQBK-ND
R8, R9	51K		Resistor	51KQBK-ND
R16	10K		Trimm resistor	CT94W103-ND
IC2	7805	78XXS	VOLTAGE REGULATOR	296-1974-5-ND
X1, X2, X3		W237-132	WAGO SREW CLAMP	281-1435-ND
U1	A3977SED	Allegro A3977SED		
<p>* One WMB6424-ND will supply enough contacts to handle JP1-JP4. It is a 24 pin single stip break away header, so to work for JP3 and JP4 you can use two strips. The 22-28-4142-ND is a dual row 14 contact breakaway header, it can be split to handle JP3 and JP4 if you want the mechanical strength.</p>				

Schematic

