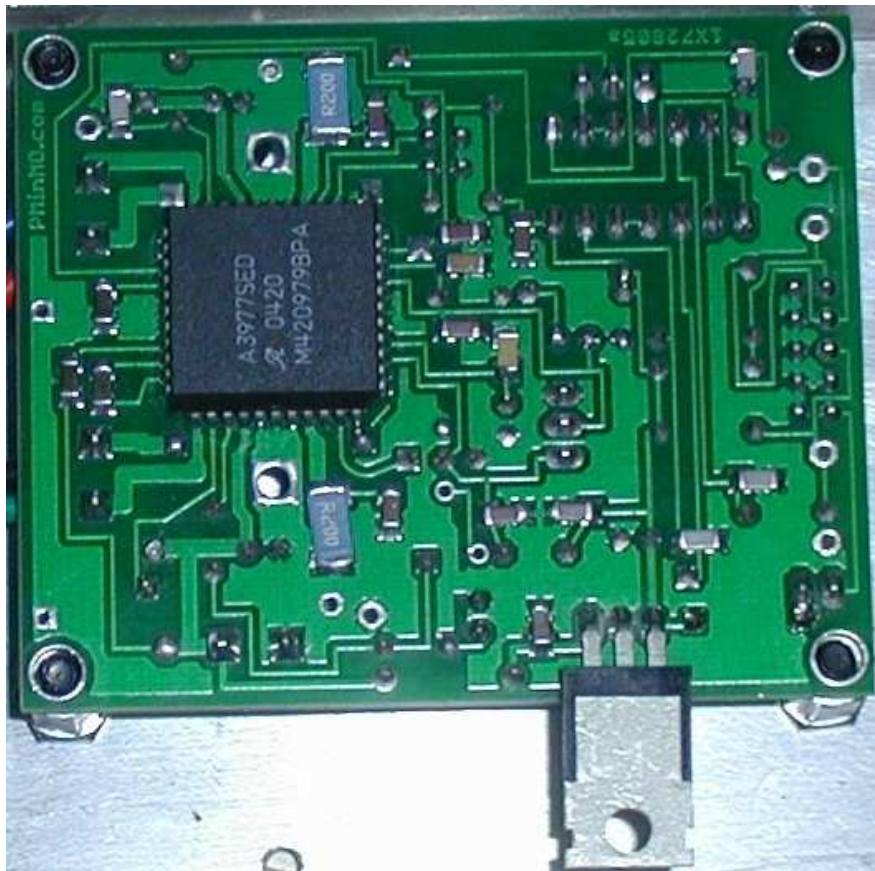
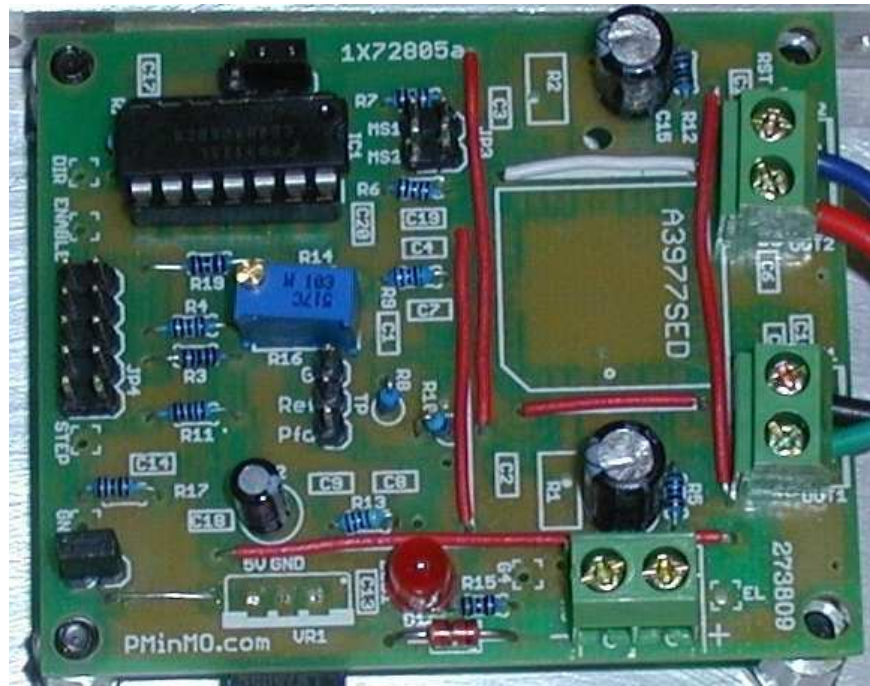
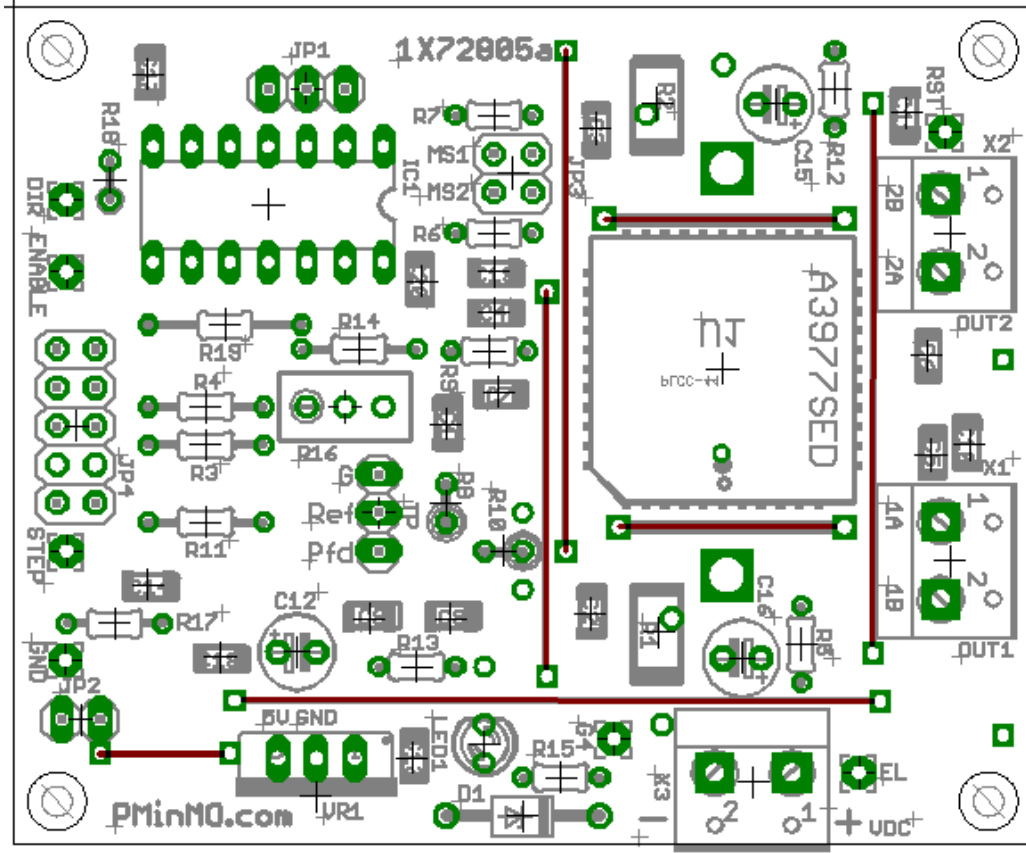


1X72805a Stepper Motor Driver



1X72805a Single Sided A3977SED Controller Board Data

Preliminary 12/20/05



Some Words of Caution

Never remove a connection to the stepper motor with power applied, there is a HIGH probability you will damage your 3977 IC if you do. The 3977 is rated for 35VDC max. You should limit your power supply voltage to 32vdc to allow for back emf generated by the stepper. Take the necessary safety precautions when utilizing any electrical and electronic circuits and motors. Be Safe!

Regarding mounting the 3977. If you can solder an electronic component to a pcb, you can do the 3977SED. A fine point tip on your soldering iron is a **must, no more than 25 watts**. Do not over heat a pin when soldering. Flux the pads with some rosin flux or a rosin flux pin helps. I have a little made up device that is basically a spring wire on a 12" square board than hold's the chip to the board. Make sure your orientation is correct for pin one, and align them perfectly. With fine solder in hand, place the tip of the iron at the junction of the pin and the board, so both receive the heat of the iron. Place the end of the fine solder at that junction and it should suck the solder in to fill the gap, remove the iron as soon as it does. (A second or two at the most) It doesn't take much. Solder a corner pin, then an opposite corner pin. Double check the alignment and that the part is flush to the board. Then solder the remaining pins but not the three center ground pins on each side. The ground pins take more heat and longer, especially the first one, because there is a lot of copper pulling the heat from the iron. A 12W pencil iron won't solder the ground pins in fact. **OR** If you not sure of your soldering technique, do the center ground pins on each side first. The ground pins will tolerate overheating better than signal pins. On each side of the 3977 the center 3 pins are all ground. So, if you splash solder on the center pin, if its to an adjacent ground pin, there should not be a problem.



Build Sequence

Install C13, C12, C9, C20, R15, LED1, VR1 and connector X3. Observe the orientation of the LED per the above layout. Apply power greater than 8VDC and no greater than 32VDC 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 the six jumpers shown in red on the layout above. Utilize insulated wire.

Troubleshooting

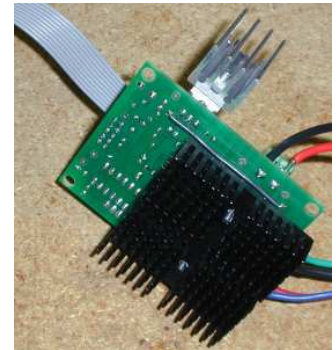
Without the 3977 soldered on and IC1 not installed:

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 the pads for the 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 and the 3977. (Make sure you've disconnected the board from the power source) and the orientation is correct. Remember it is on the backside of the board to the other components with exception to the two .2 ohm current sense resistors.

Heatsink

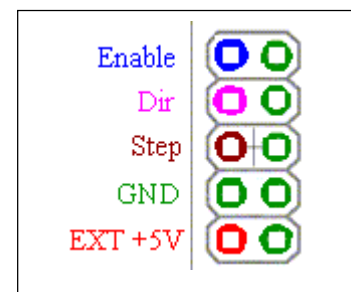
The 3977 part dissipates heat via the power ground pins which are the center 3 pins on each side. Adjacent to pins 1 and 22 of the 3977 are .090 drills which can be utilized to thermally connect to a heat sink. A heat sink is recommended for currents greater than 1 amp. The picture is using an old Intel 486 heatsink. Open air at 2.5A it gets quite warm. At higher currents, cooling fan should be used.



JP4 Inputs

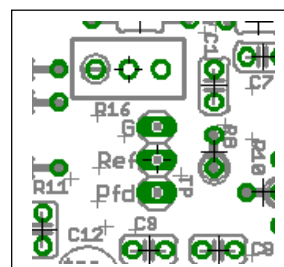
JP4 is a 10 pin IDC connector for easy hookup to the 4 axis interface board. The signal definition is below. Same orientation as the board layout above.

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 TP

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



Setting Current

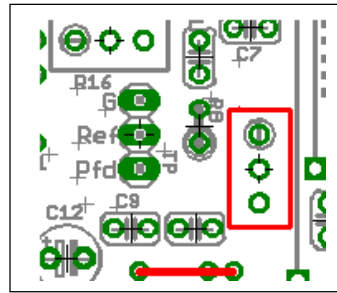
Limit

Measuring the DC voltage between the REF Pin and GND Pin of TP. 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

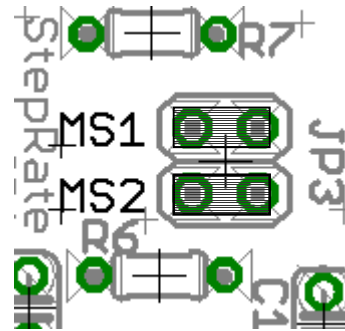
PFD is set by R10 and R13 and using the components listed in the Parts table will set it a 2.5V. It is also possible to make PFD adjustable by installing a 10K trim pot the same p/n as R16 as depicted:



Jumpers for Micro-Stepping JP3

Table 1. Microstep Resolution Truth Table

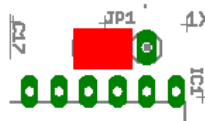
MS ₁	MS ₂	Resolution
L	L	Full step (2 phase)
H	L	Half step
L	H	Quarter step
H	H	Eighth step



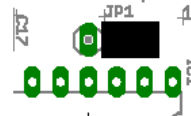
Jumper in = L, jumper out = H i.e. for full steps both MS1 and MS2 need to be installed.

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.



OR



Using the board

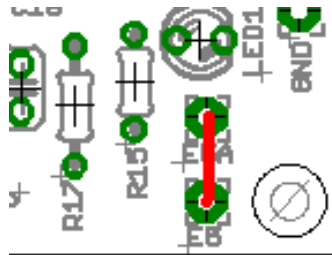
The board was designed with a high noise immunity environment in mind. Switching heavy currents and inductive loads are prone to noise. The A3977 driver chip is a chopper, in that it turns the outputs of the driving bridge on and off tens of thousands of times a second. The opportunity for electrical 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 5us. 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.

5VDC Output

Utilizing a wire jumper next to JP2 with JP2 installed will feed the driver boards 5VDC to pin 9 of JP4. This is used to power the 4 axis interface board as well as to provide 5V for to maintain true isolation for an opto isolated interface board



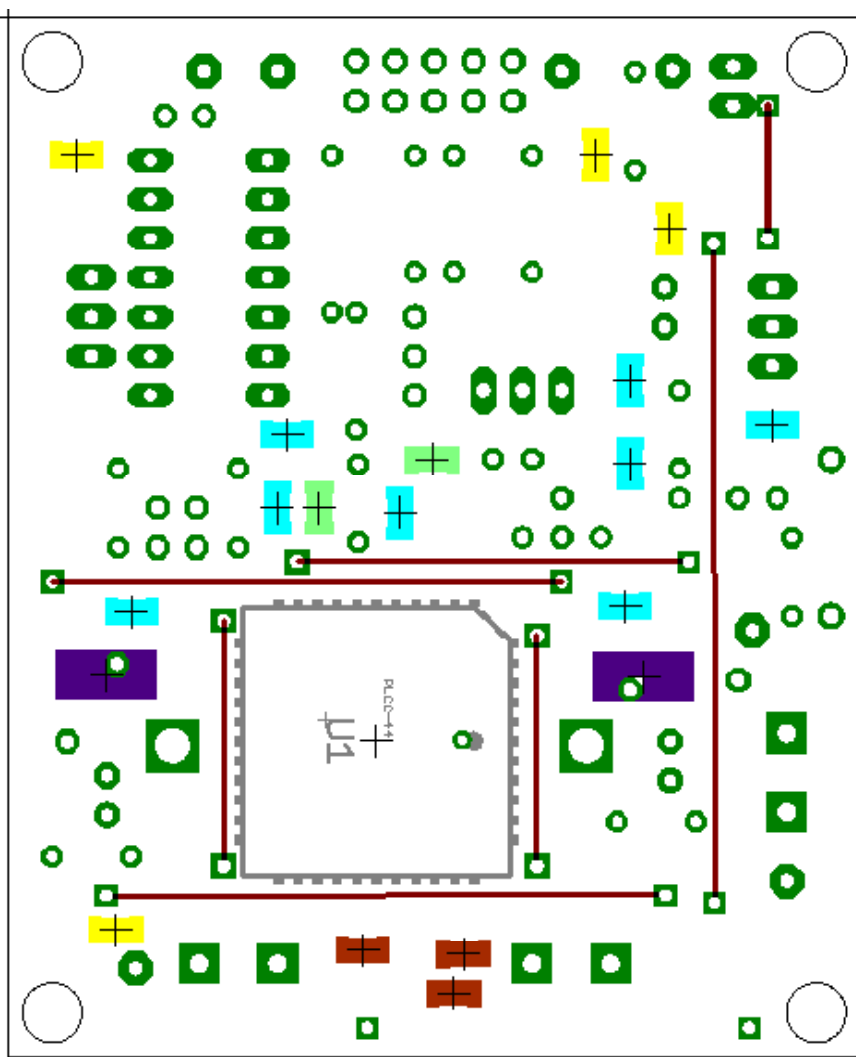
Parts

Qty	Value	Device	Parts	www.mouser.com	www.futurlec.com	www.digikey.com
1		LED3MM	LED1	696-SSL-LX3044IT	http://www.futurlec.com/LED/LED3Rpr.shtml	67-1066-ND
2		PINHD-1X3	JP1, TP	***	http://www.futurlec.com/Connectors/HEADS8pr.shtml	WM6424-ND
1		PINHD-2X5	JP4	517-836-02-36***	http://www.futurlec.com/Connectors/HEADD10pr.shtml	22-28-4142-ND
1	10K	R-TRIMM3296W	R16	652-3296W-1-103	http://www.futurlec.com/Potentiometers/CERM10Kpr.shtml	CT94W103-ND
			C2, C3, C7, C8, C9, C13, C19,			
8	.1uf	50V 1206smd	C20	80-C1206C104K5R		490-1775-1-ND
2	0.2	2 Watt	R1, R2	66-LR2512-01-R200-F		
3	.22uf	50V 1206smd	C5, C6, C10	80-C1206C224K5R		490-1776-1-ND
			R3,R5, R6,			
6	1K	1/8 W	R7,R12, R19	299-1K		
1	2.2K	1/8 W	R14	299-2.2K		
1	4.7K	1/8 W	R10, R13	299-4.7K		
			R4, R11, R17,			
4	10K	1/8 W	R18	299-10K		
1	10uf	16 VDC	C12	647-UVR1V100MDA1TD	http://www.futurlec.com/Capacitors/C010U16Epr.shtml	P11250-ND
2	51K	1/8 W	R8,R9	299-51K		
1	74HC14	14 Pin DIP	IC1	512-MM74HC14N	http://www.futurlec.com/74HC/74HC14pr.shtml	MM74HC14N
2	100uf	35 VDC	C15, C16	647-UVR1V101MEA		P5165-ND
1	390	1/8 W	R15	299-390		
			C11, C14, C17,			
4	220pf	50V 1206smd	C18	526-SMC1206J221		478-1484-1-ND
2	1000pf	50V 1206smd	C1, C4	80-C1206C102K5R		490-3348-1-ND
1	7805	TO220	VR1	512-LM7805CT	http://www.futurlec.com/Linear/7805Tpr.shtml	296-1974-5-ND
1	A3977SED	44 Pin	U1			
3	OUT1	W237-02P	X1, X2, X3	651-1729128	http://www.futurlec.com/Connectors/PCBT2pr.shtml	281-1435-ND
1	1N4740	Zener Diode **		512-1N4740A		
1	StepRate	PINHD-2X2	JP3	***	***	

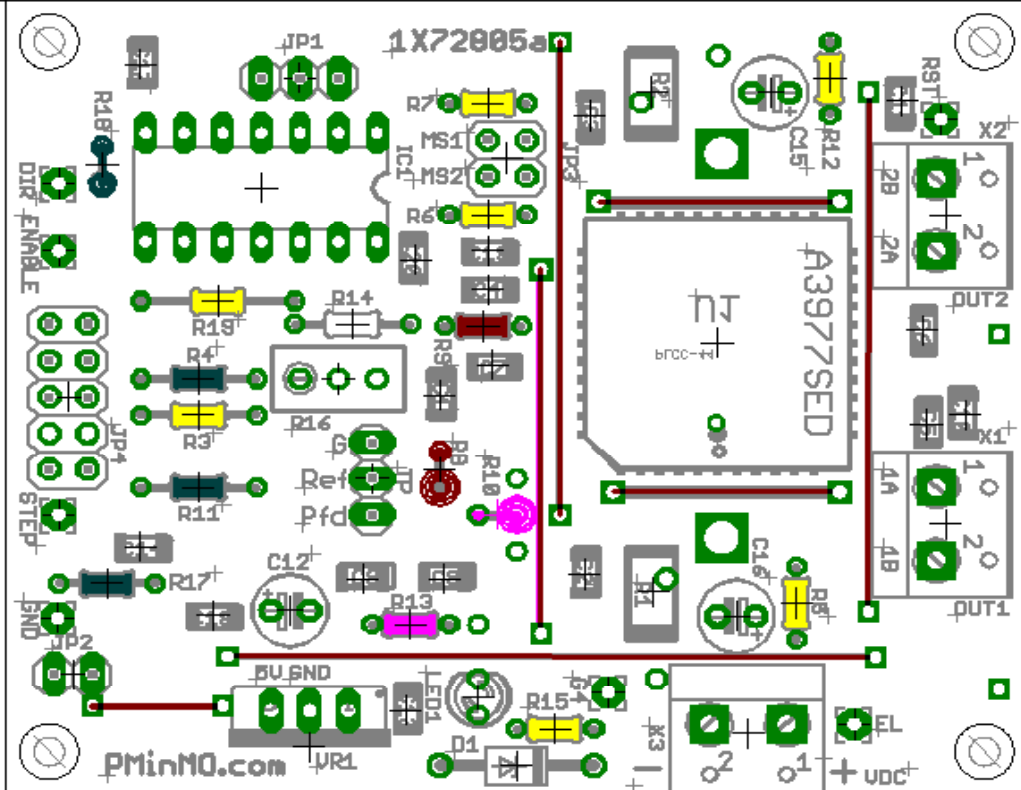
***These are breakoff pinheaders, one unit has enough on it to do a complete board
 ** If using a power supply voltage of 18V or lower install a jumper wire in place of the 1N4740

Bottom View

- 1000pf
- .22uf
- .1uf
- 220pf
- .2 ohm 2W



Top View



- 1K
- 10K
- 4.7K
- 51K
- 2.2K = R14

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