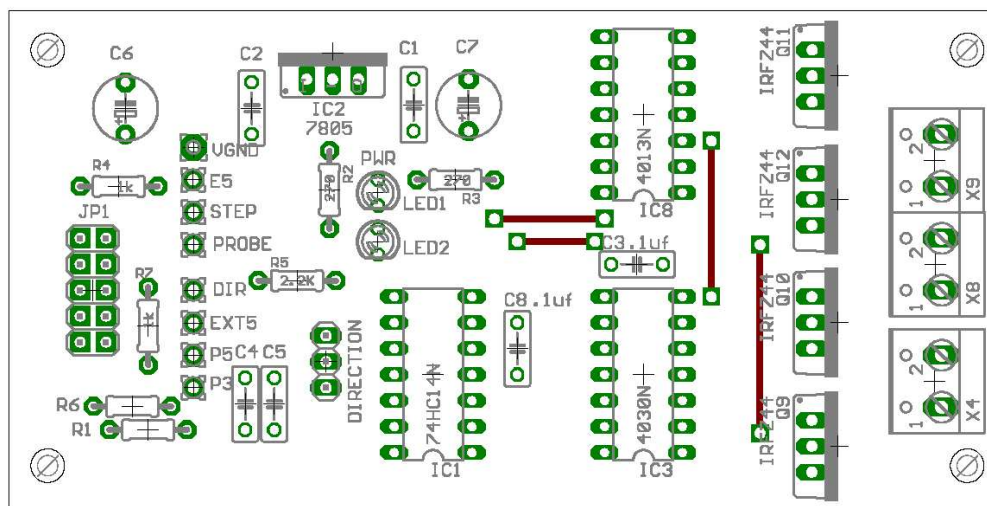


Unipolar Controller Board Data

Introduction

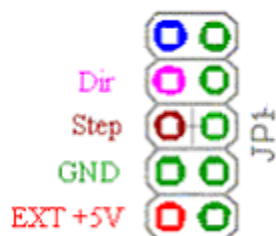
This is a simple unipolar stepper board that can control stepper motors rated to 30VDC. The FET drivers are rated at 50A, but in practicality this board should not be used with motors anywhere near that current for several reasons. The power supply voltage, heat sinks and cooling used for the FET's of your own application play an extremely important part in making that determination. The FET package is designed for 50 Watts of dissipative power. If you're not wise in electronics, the board should be built in stages and tested during each stage to eliminate problems.



Picture Courtesy of CNCZone's slp_prlzys

JP1 Inputs

Same orientation as the board layout above.



Using an external 5VDC Supply (Optional)

By not installing IC2 (7805 5VDC on board regulator) an external 5 volt DC supply can be used. External 5VDC can be supplied via the E5 connection point. For the highest reliability and noise immunity, install IC2.

Using the onboard 5VDC

By installing IC2 (7805 5VDC on board regulator) an external DC supply form 8VDC to 30VDC can be used. That power supply is connected via the X4 Wago connector. Observe polarity when connecting.

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. 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.

Current Limiting Resistors (IMPORTANT)

Anytime a power supply for the stepper motor is used that is greater than the rated voltage of the motor, current limiting resistors are required. This board does not contain room for them on the board, as they can be quite large sometimes. The coil resistance of the motor can be computed by dividing the rated voltage by the rated current. For example a motor rated at 5.2 volts @ 1.6 A ($5.2/1.6$) has a coil resistance of 3.25 ohms. To compute the size of the current limiting resistor subtract the motor voltage rating from the power supply voltage and divide it by the current rating. For example using a 12v power supply with the above motor ($12-5.2/1.6$), You would need a 4.25 ohm resistor. The wattage rating of that resistor is the current squared times the resistor value ($1.6 * 1.6 * 4.25$) or in this case 10.88 watts minimum. Power resistors come in standard wattage ratings or 1, 5, 10, 25, 50 watts.

Setting the Step Direction

A jumper must be installed in the Direction jumper. Pin 2 must be jumper to either pin 3 or pin 1, depending on your hardware setup. Leaving this jumper off, will not allow the motor to switch rotation directions, and give intermittent direction information if not installed.

Optional Logic Probe

Many times getting a board running a simple logic probe that visually gives an indication of a high or low logic state is helpful. Components R5, R2, R4, Q1, and LED2 make up the logic probe along with a spare gate from IC1. By installing a wire in the probe pad to use as a test lead with those components installed the LED will illuminate when the test lead is left open or connected to a logic hi, it will not illuminate when touched to a logic low. Once you are finished with the logic probe, wire the probe input to gnd to keep the LED off.

Simple Initial Checkout

After build verify your circuit is working correctly prior to hooking up the stepper motor. Start by only hooking up a DC power source between 8VDC and 30VDC to the X4 terminal. A simple 9-volt alkaline cell will work for checkout. Applying power both LED's should illuminate.

If you have a means of measuring DC voltages, measure from ground VGND pad to the E5 pad for 5VDC. It should be within the range of 4.8 to 5.2 VDC.

Measure the following points for voltages:

IC1 Pin 7 should be 0 volts, Pin 14 should be the same voltage as the E5 pad.

IC3 Pin 7 should be 0 volts, Pin 14 should be the same voltage as the E5 pad.

IC8 Pin 7 should be 0 volts, Pin 14 should be the same voltage as the E5 pad.

Utilize the onboard logic probe by soldering one end of a short (4 to 8 inches) wire to the probe pad. Strip the other end so it exposes a short amount of wire. That end will be used to probe (touch) parts of the board to verify logic states.

With the board connected to nothing but the power supply, and the direction jumper between pins 2 and 3 of that jumper, using the probe, IC1 pins should give you the following indications:

Pin 1 ON, Pin 2 OFF, Pin 3 ON, Pin 4 OFF, Pin 5 OFF, Pin 6 ON, Pin 7 OFF (GND),
Pin 10 ON, Pin 11 Off, Pin 12 Off, Pin 13 ON

Next IC3 pins should give you the following indications:

Pin 8 ON,

Pin 2 ON

Next IC8 pins should give you the following indications:

Pin 11 ON,

Pin 3 ON

Using a jumper wire, connect JP1 pin 3 to Gnd, Probe IC1

Pin 13 Off,

Pin 12 On,

Pin 11 ON,

Pin 10 Off

Next IC2 pins should give you the following indications:

Pin 8 Off,

Pin 2 Off

Using a jumper wire, connect JP1 pin 5 to Gnd, Probe IC1

Pin 1 Off,

Pin 2 On,

Pin 5 ON,

Pin 6 Off

Next IC8 pins should give you the following indications:

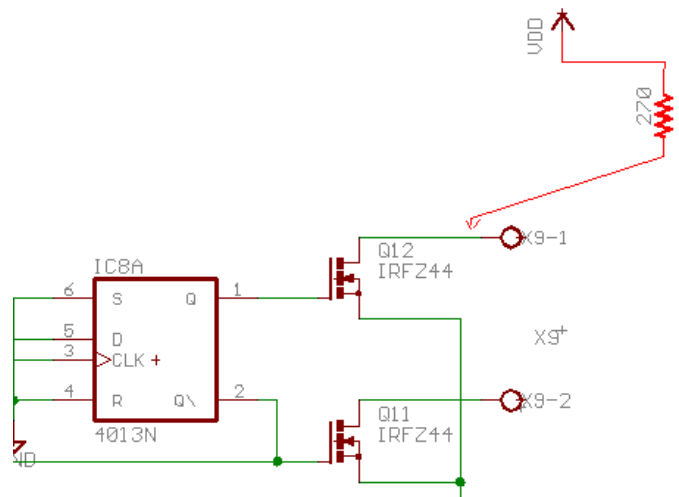
Pin 11 Off,

Pin 3 Off

Next the outputs of the 4013N (IC8) should be in opposites states. If pin 1 is off, pin 2 should be on, or if pin 1 is on pin 2 should be off. If pin 12 is off pin 13 should be on, or if pin 12 is on pin 13 should be off.

A method to simply determine if the fets are switching appropriately is to take a resistor, value is not important but would advise no lower than 100 ohms no higher than 1K initially. By hooking one end of the resistor to the 5 VDC logic power and the other end to the FET motor connection, you can use the logic probe to determine if the FET is switching under a minimal load. In the example below if pin 1 of IC8 is a logic high, the X9-1 terminal should indicate a logic 0 with the resistor hooked up. If pin 1 is a logic low then X9-1 should be a logic high. That can test can be repeated as below

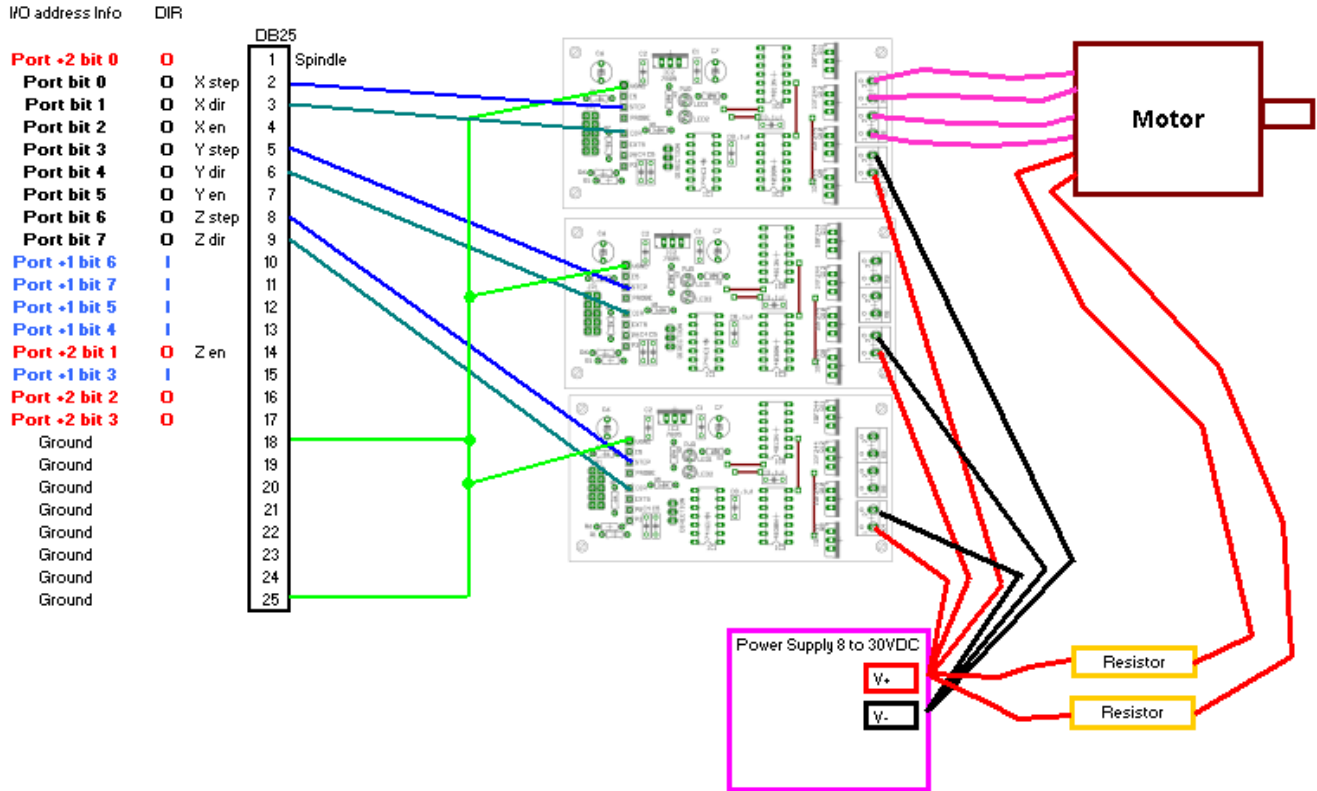
IC8	Output
Pin 1	Low X9-1 High
Pin 1	High X9-1 Low
Pin 2	Low X9-2 High
Pin 2	High X9-2 Low
Pin 13	Low X8-2 High
Pin 13	High X8-2 Low
Pin 12	Low X8-1 High
Pin 12	High X8-1 Low



Wiring the board

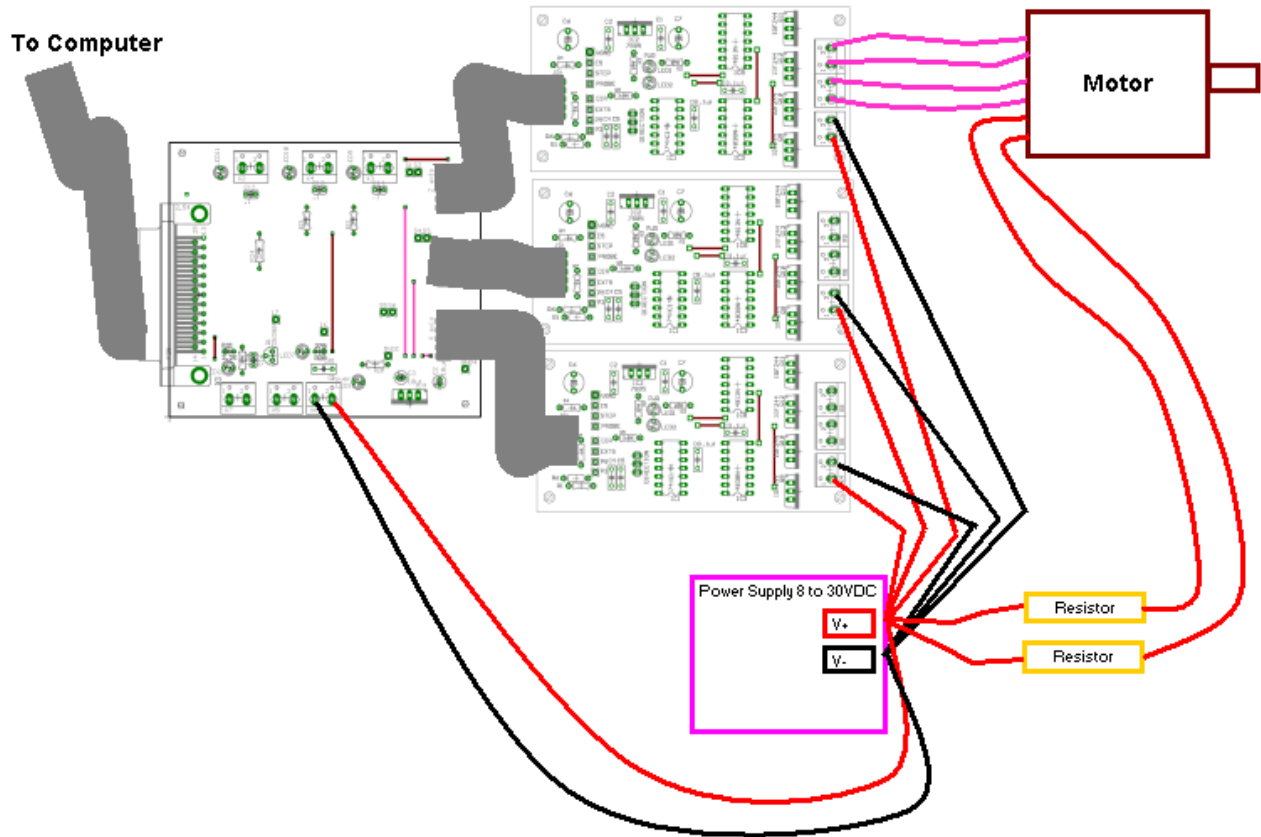
A unipolar stepping motor also requires a connection to a power supply, and depending on rating of the motor and the voltage of the power supply, sometimes current limiting resistors are required. These are often referred as “ballast” resistors. These current limiting resistors and power supply connection are not installed on this board.

Hard wiring a simple 3 axis system

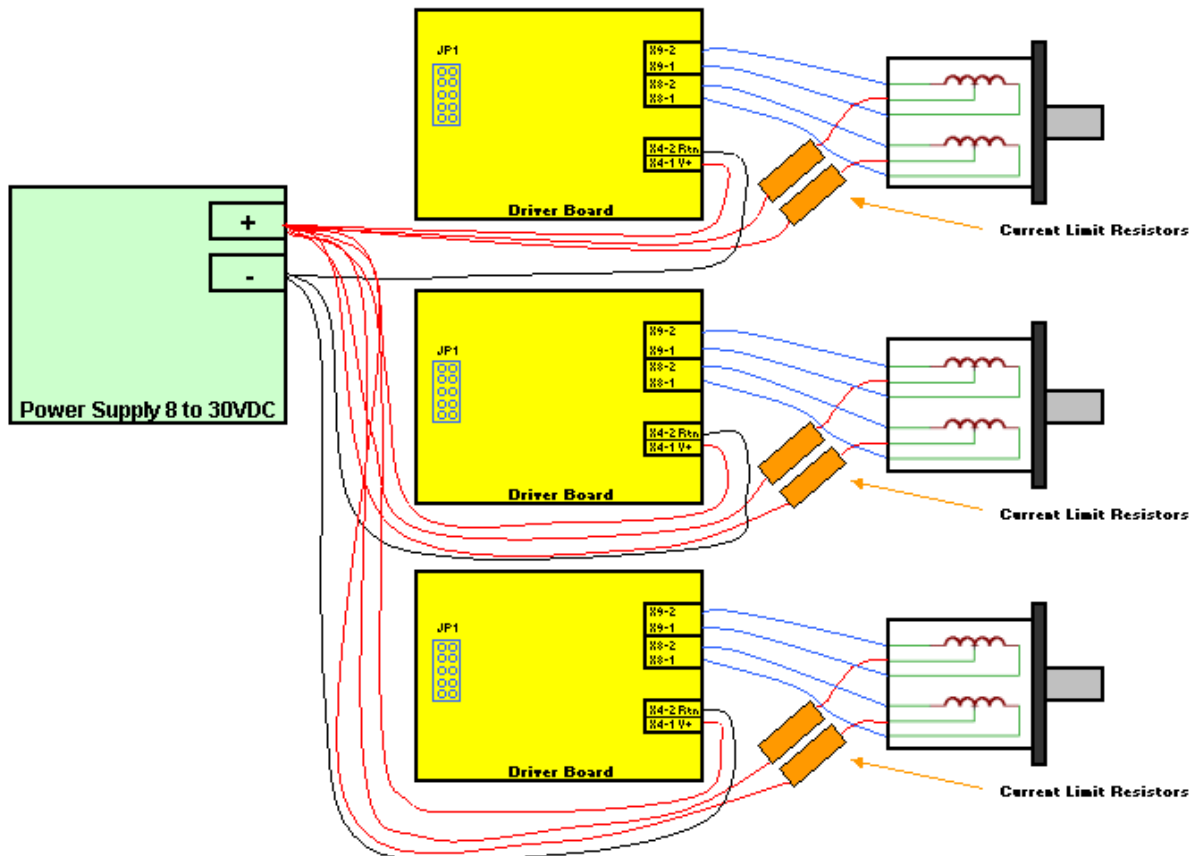


Only one Motor hookup is shown for clarity. The other two axis are wired the same as the one illustrated. With the exception it would wire to the associate second and third driver boards. As depicted above the power supply wiring is done with the power supply as the common point. In other words there are three wires on each of the positive and negative terminals each wire running independently to the associated driver board. Wiring in this method helps to eliminate potential problems that can manifest if wired sequentially. When wiring the electronics to control your motors, the wires should be neatly routed and separated. By this I mean the wiring from the X axis driver to the x axis motor should not be routed with any other wiring. Same for Y and Z axis's. Board power wiring should be routed independently of all motor wiring. Computer signal wire routing should be independent of power and motor wiring. Physical placement of the wire

Wiring a 3 axis system with the compatible BOB



Motor Wiring 3 Axis

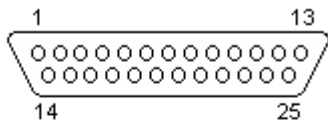


Parts

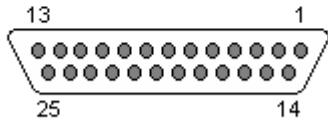
Part	Value	Device	Description
C1	.1uf		CAPACITOR
C2	.1uf		CAPACITOR
C4	220pf		CAPACITOR
C5	220pf		CAPACITOR
C6	10uf	35WVDC	CAPACITOR
C7	10uf	16WVDC	CAPACITOR
DIRECTION	PINHD-1X3		PIN HEADER
IC1	74HC14N		Hex SCHMITT TRIGGER (DIP Package)
IC2	7805		VOLTAGE REGULATOR
IC3	CD4030N		Exclusive OR (DIP Package)
IC4	CD4013N		Dual Flip Flop (DIP Package)
JP1	PINHD-2X5		PIN HEADER (optional)
JP2	PINHD-1X2		PIN HEADER
LED1	LED3MM		LED
LED2	LED3MM		LED (optional)
R1	10K		RESISTOR
R3	270		RESISTOR
R4	270		RESISTOR (optional)
R6	10K		RESISTOR
Q9, Q10, Q11, Q12	IRLZ44		Power FET
X4	W237-02P		WAGO SREW CLAMP
X8	W237-02P		WAGO SREW CLAMP
X9	W237-02P		WAGO SREW CLAMP

PC Parallel Port

The DB25 subminiature D connector has been a defacto standard from original IBM PC for the parallel port historically used for a printer interface.



DB-25 Male



DB-25 Female

Many breakout boards utilize a DB-25 Female connector.

