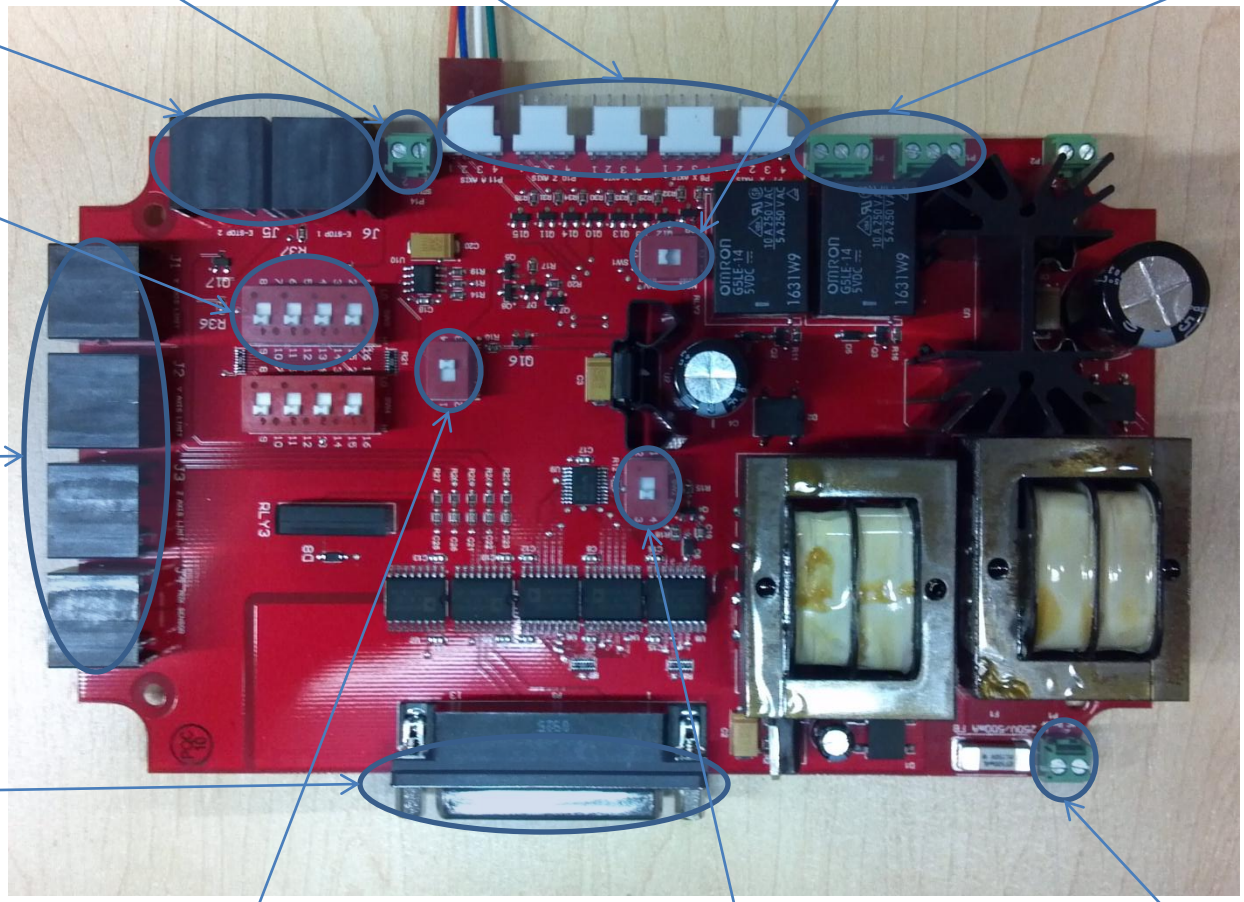
# CNC Router Parts 4+1 Axis Breakout Board

Revision D, 2011-12-21

# Board Overview



# P3 Parallel Port Pinout Summary

| Parallel Port Pin / Mach Assignment | Breakout Board Function | Breakout Board Connection |
|---|---|---|
| 1 | Relay Output | P12 |
| 2 | Step X / X' | P7-1 / P8-1 |
| 3 | Dir X / X' | P7-2 / P8-2 |
| 4 | Step Y | P9-1 |
| 5 | Dir Y | P9-2 |
| 6 | Step Z | P10-1 |
| 7 | Dir Z | P10-2 |
| 8 | Step A | P11-1 |
| 9 | Dir A | P11-2 |
| 10 | Input 1 | J1 |
| 11 | Emergency Stop | J5 / J6 |
| 12 | Input 2 | J2 |
| 13 | Input 3 | J3 |
| 14 | PWM Spindle Output | P14 |
| 15 | Input 4 | J4 |
| 16 | Charge Pump Output | Internal Connection |
| 17 | Relay Output 2 | P13 |
| 18 | Ground / Unused | NA |
| 19 | Ground / Unused | NA |
| 20 | Ground / Unused | NA |
| 21 | Ground / Unused | NA |
| 22 | Ground / Unused | NA |
| 23 | Ground / Unused | NA |
| 24 | Ground / Unused | NA |
| 25 | Ground / Unused | NA |

The above table shows how signals from the parallel port are routed to terminals on the board. These functions simply need to be assigned to the same pins in Mach 3 in order for the board to function as intended.

# P7-P11 Step and Direction Signals

Pins P7-P11. The board is equipped to easily interface with Gecko G201X or G203V motor drives via the supplied 4 pin cables. Breakout board step/dir/common/disable connections are labeled by drive on the silkscreen of the board (X, X', Y, X, and A) on pins P7-P11. Make sure to connect the white common cables to the proper terminals on the Geckos to avoid potential damage to the board. The colors associated with each connection are as follows:

- Green = Disable (Pin 4)
- White = Common (Pin 3)
- Blue = Direction (Pin 2)
- Orange = Step (Pin 1)

To make wiring easier, the disable signal listed above is controlled through the breakout board. This signal is tied to board logic ground when an estop is activated, and floats under other conditions. This can be wired directly to the Gecko disable signal.

Hardware slave X Axis. Your Rev D breakout board is equipped with an auxiliary X-axis output that can be used as a hardware slave. This is optional, and the X can also be slaved in software to the A axis or another discretely controlled axis, but for those who wish to run a rotary axis in addition to a dual drive gantry machine, the hardware slave allows this control without the use of an additional parallel port. To support slaved axes that rotate in opposite directions, SW1 can be used to invert the direction bit of X' with respect to X. X' is still tied to pins 2 and 3 on the parallel port.

# J5/J6 Emergency Stop Signals

J5 and J6, E-stop and auxiliary E-stop. For straightforward connection of both a panel mounted e-stop and an auxiliary stop, two RJ11 connections are provided. These are 6 pin connections, and are normally closed connections – in other words, both of these circuits need to be closed, or the system will both send a signal to pin 11 on the parallel port (informing Mach3 / EMC2 that an estop condition has occurred), and will also tie the disable signals to ground on any attached drives.

To close the connections, pins 3 and 4 (the two middle pins on the RJ11 connector) need to be connected. We recommend running one or both of these ports to a NC emergency stop switch. Any unused e-stop ports must have these pins jumpered in order to allow operation of the machine. On a straight through RJ-11 cable, the colors for these middle wires are usually Green and Red.

# SW2 Charge Pump

As a safety feature, the board is equipped with a software monitoring charge pump – when this switch is in the "SGE" (or "Software Good Enable") position, all relays and drive outputs will remain non-functioning unless a signal is seen from Mach3 indicating that it is in control of the parallel port, avoiding spurious motions during PC startup. This feature can be enabled on pin 16 in Mach3. This feature is known as a charge pump, as the mechanism by which the outputs are enabled is through charging a capacitor with a 10kHz signal from Mach.

If the switch is in the "ENA" position, the charge pump feature is bypassed.

Screenshot of Mach3 setup of charge pump coming soon.

# P1 120V AC Power

The breakout board operates conveniently off of 100-120VAC power. DC power for sensors and logic level commands is provided by onboard circuitry. If you are in a county with 220V, you will need a step-down converter to avoid damaging the board.

# J1-J4 Inputs / Limits

J1 through J4 are used for inputs such as home or limit switches. These are housed in convenient RJ11 connectors to allow for quick swapping of cables. PLEASE NOTE: The wiring configurations below are for straight through cables only (data) not crossover (voice) cables. Straight through cables can be found affordably through many online merchants, or you can make/crimp your own.

| Pin | Color | Function |
|---|---|---|
| 2 | BLK | GND |
| 3 | RED | 12V |
| 4 | GRN | Signal |

For limit switches, you will always have two of these three lines connected (or possibly all 3 if you have a powered sensor, rather than a mechanical limit switch). You will always have pin 4 connected to your switch, as this is the actual input. Depending on the setting of SW3, the board will expect either 12V or 0V (GND)to be connected to the other side of your switch/sensor, and when the switch is closed, this will be passed through to the input signal on pin 4:

- When SW3 is set to “High”, the signal line is normally high (and will show lit up on the Mach 3 diagnostics page), and the other side of your switch should be connected to pin 2, GND.

- When SW3 is set to “Low”, the signal line is normally low (and will show dark on the Mach 3 diagnostics page), and the other side of your switch should be connected to pin 3, 12V.

- Take care not to connect Pin 2 and Pin 3 together – in rare cases, this can cause a short on the board that may require repair.

# P12/P13 Relay Outputs

Two 10A relays are provided on-board the breakout board for switching. If you will be switching more than 10A, it is advisable to purchase larger relays that will be driven by the board relays – contact CNC Router Parts for 48V compatible 30A relays.

Each relay has 3 terminals, a common, normally open, and normally closed terminal. The relays are controlled (opened and closed) via parallel port pins 1 (P12) and 17 (P13) once these are assigned in Mach 3. You will connect the voltage you want to switch to the "common" terminal, and then the output to either the normally open or normally closed terminal (typically, use of Normally Open is recommended unless you want your circuit "on" by default).

| Pin | Function |
|---|---|
| 1 | Normally Closed (circuit closed when relay is off) |
| 2 | Common |
| 3 | Normally Open (circuit open when relay is off) |

For example, if you had a trim router you wanted to switch on and off, you would use this relay to switch either the 110V or neutral leg of your AC circuit. Let's assume you wanted to switch the neutral. In that case, you would hook a neutral wire from an AC power cord up to pin 2 "Common", and then the neutral of the router up to Pin 3. You would connect the 110V side of the router directly to the 110V from your AC power cord. When you toggle the output to "high" in Mach3, the relay will close the neutral side of the circuit, turning the router on.

If you have a larger AC peripheral or wish to switch on/off multiple items, these relays can be used to drive the coil on our larger 30A, 48V relays. In this configuration, 48V from the DC power supply will connect to the Pin 2 "Common", and be passed through to the 30A relay coil. 48V- will be connected directly to the 30A relay coil. The 30A relay will then switch the neutral leg of your AC line, as discussed above.

# P14 PWM / Analog Output

P14 is run through SW5, which changes its behavior from a general purpose output to a 0-10V analog output. Some VFD's only accept 0-10V analog, in which case the analog output must be selected by setting the switch to "Volt". However, many VFD's, as well as the Super PID, can accept a digital PWM (Pulse Width Modulation) signal at logic levels. In this case, SW5 should be set to "PWM"

In either case, Mach 3 is configured as a spindle control signal that sends a high frequency pulse train out. In the event of an analog setup, voltage scales linearly from 0-10 V with a 11 kHz to 14 kHz signal from Mach.