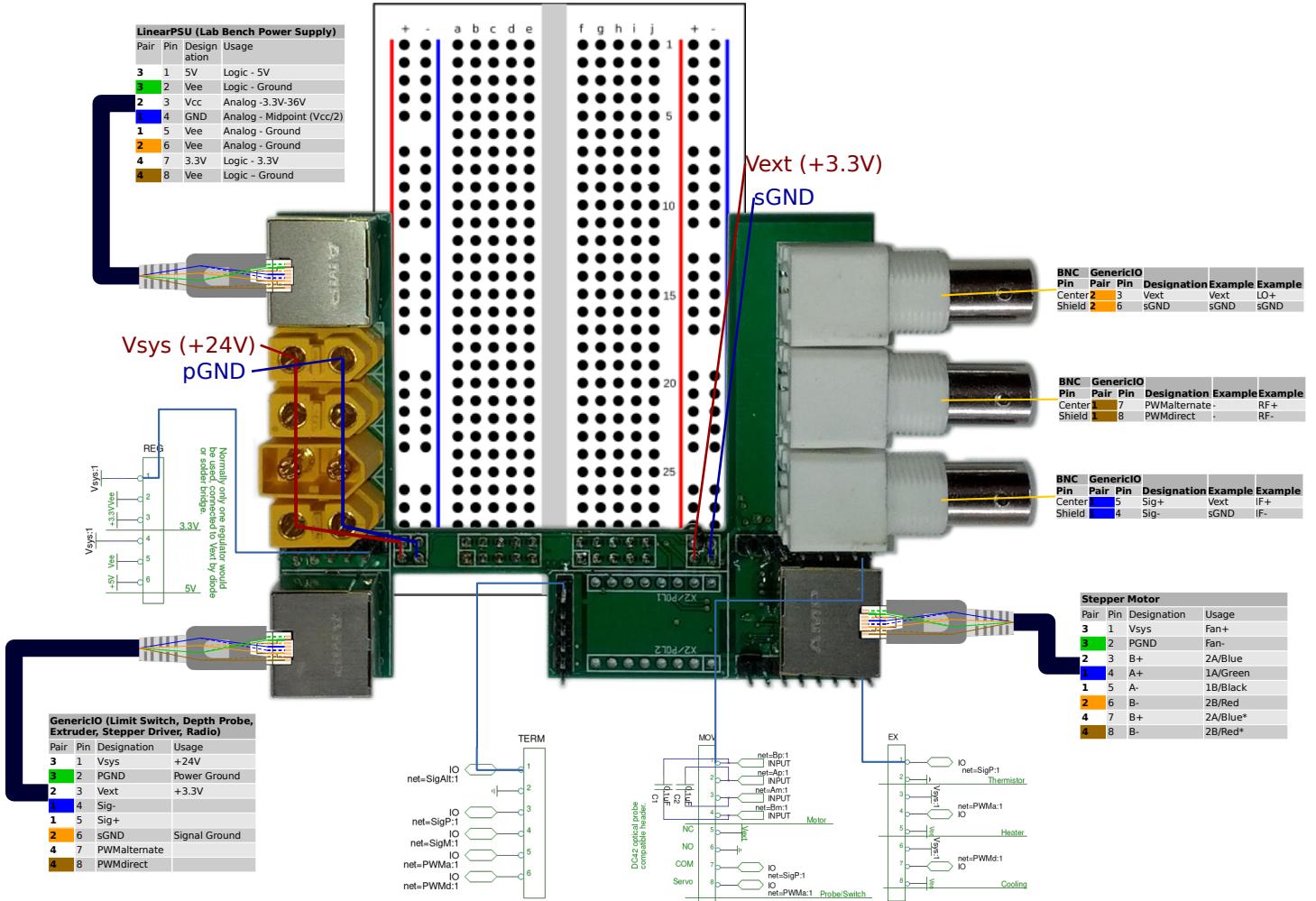
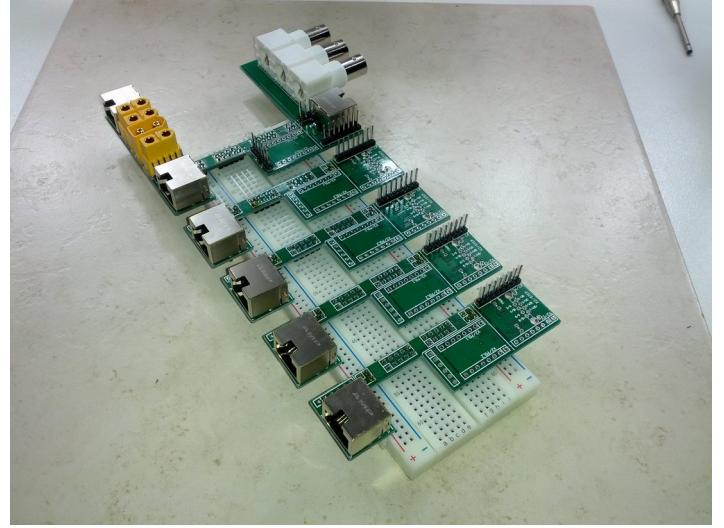


# PatchRap



Orderly formal standard, maximizing compatibility between logic, sensors, and actuators. Interconnected through widely available, inexpensive, highly shielded Ethernet/Telephone connectors/cabling. Solderless breadboard support minimizes internal wiring and enclosure requirements. Multipurpose breakout interfaces are provided as standard products of Soaring Industries LLC.



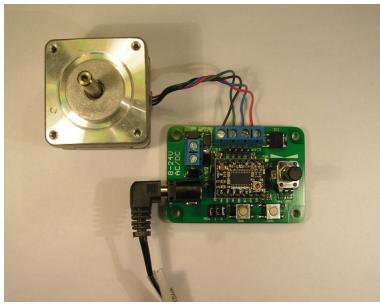
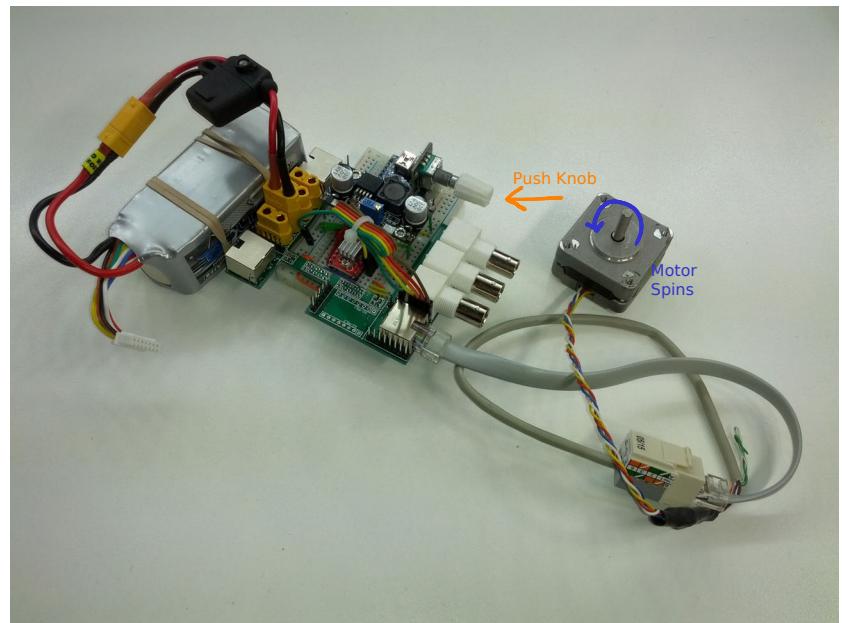
# Stepper Tester with PatchRap

Stepper Tester implements a programmable Arduino compatible platform for testing stepper motors.

Integrating commodity modules, inserted into a solderless breadboard, repairs are quick and painless. This gives developers confidence to work with expendable hardware, before endangering expensive equipment.

Widely used connectors allow maximum flexibility. Accessories, including an automotive fuse holder, can be placed inline. Existing machinery may be connected to the motor test equipment as needed. Through the breadboard or BNC connectors, diagnostic metering equipment may be attached to resolve problems.

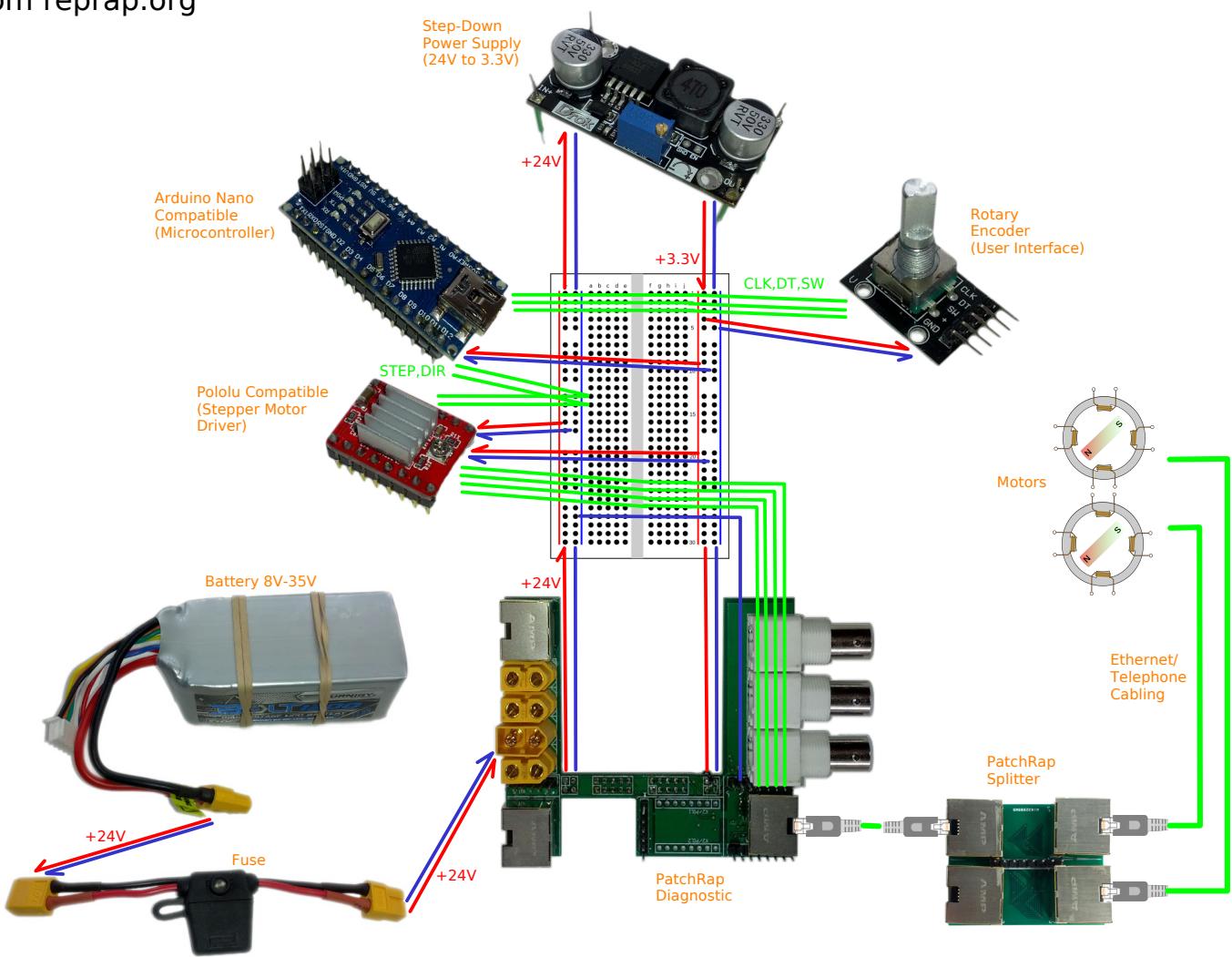
Quick connection to existing, comprehensive CNC machinery, was a primary driver for this technology.



**EasyStepper**  
from [reprap.org](http://reprap.org)

For comparison, an off-the-shelf stepper motor tester circuit does exist. Inexpensive, versatile, simple to use for a specific purpose, and nevertheless quite relevant. However, through PatchRap, similar functionality is implemented without any specialized circuit board. Attachment of different power supplies (including batteries), in-line accessories, diagnostic equipment, additional motors, or comprehensive CNC machinery, might require wire splicing. Severe damage due to short circuit of systems outside the stepper motor driver module may be more difficult to repair in the field.

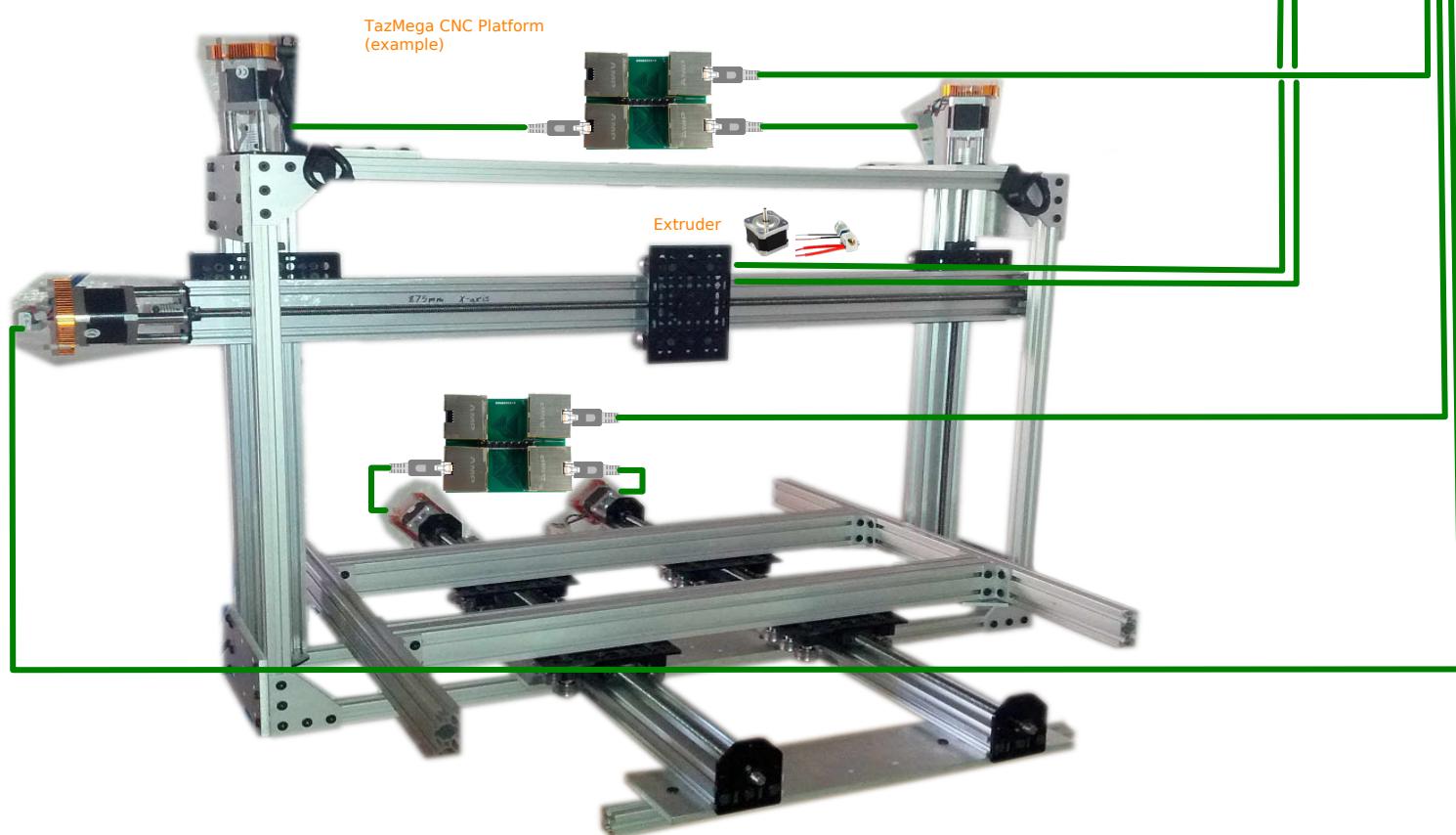
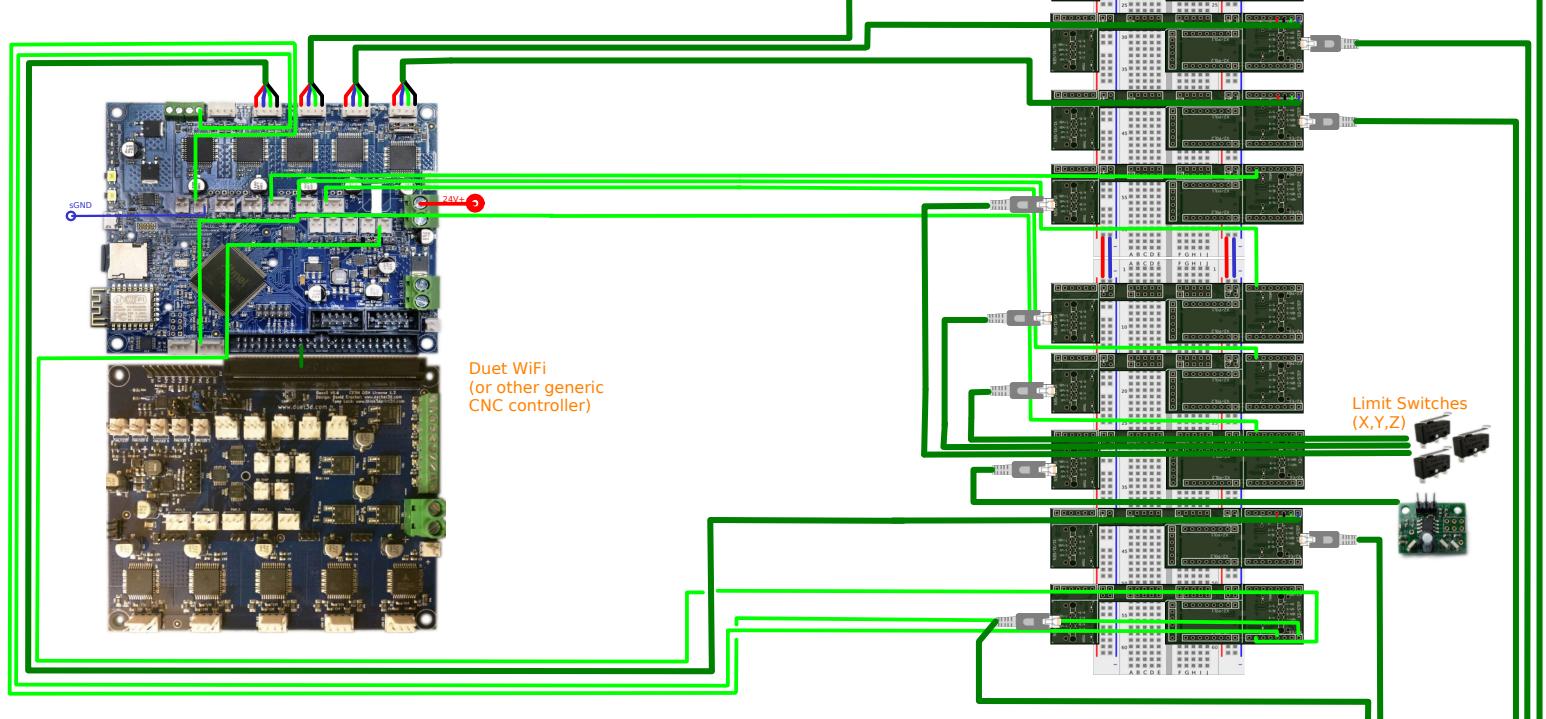
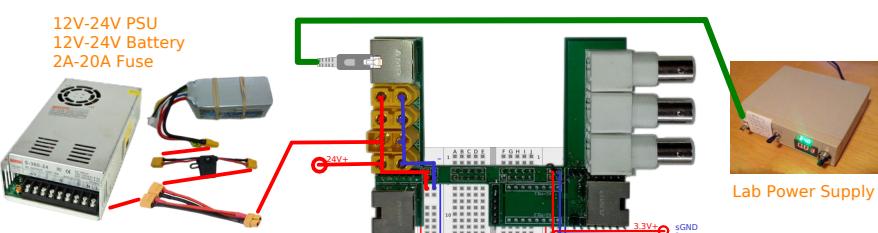
PatchRap also includes its own innovative features. For stepper motors, extra pairs in Ethernet/Telephone cabling are used for redundancy and power delivery. Diagnostic and protective components are integrated as well, notably optional LEDs at the RJ45 jacks, and surge suppressors. In some cases, these features may be repurposed for other common applications, such as conventional Ethernet/Telephone line protection.



# CNC with PatchRap

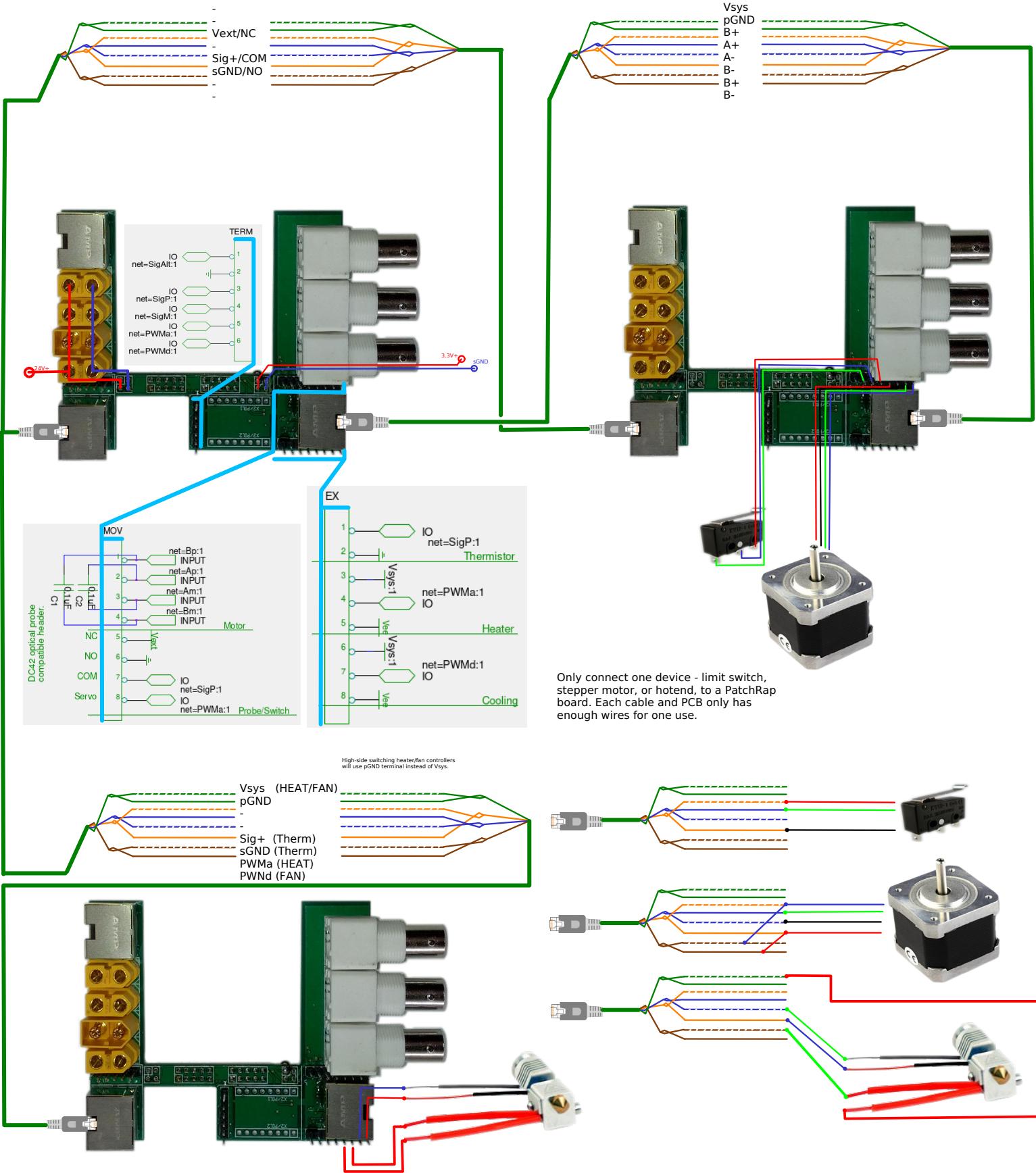
PatchRap eases connection between control electronics and entire CNC machines, like multi-tool 3D printers.

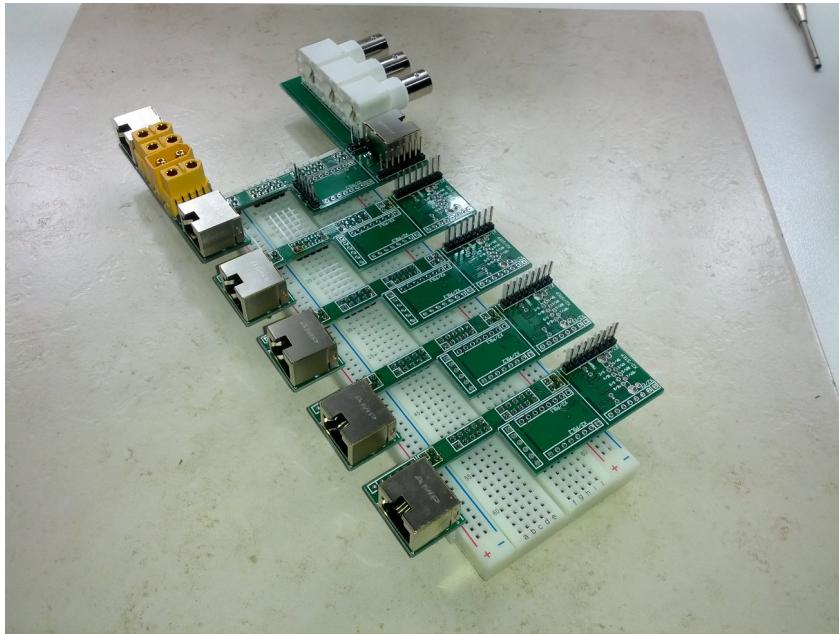
Notably, only one wire is needed for each limit switch, probe, thermistor, or heater. Integrated stepper driver module support allows efficient two-wire command of distant motors.



# CNC with PatchRap

PatchRap generally uses Ethernet cable terminated by RJ45 connectors to carry power and signals from a central hub to peripherals, or between hubs. These cables bundle four pairs of two twisted wires, providing eight wires total, numbered and color coded by the widely accepted T568A standard. PatchRap assigns each of these wires to specific function. Following these conventions, devices may be connected through a circuit board, or any off-the-shelf RJ45 jack available at common hardware stores.





## GenericIO (Limit Switch, Depth Probe, Extruder, Stepper Driver, Radio)

3 / 1 - Vsys/Vcc				
3 \ 2 - pGND/sGnd				
2 - 3 - Vext/Vmid/Avcc/SigAlt	(NC)			(L0)
1 / 4 - Sig-/SigTx-	(sGND)	(Dir)	(I2C, UART)	
1 \ 5 - Sig+/SigTx+	(COM, ANA, Probe)	(Step)	(I2C, UART)	(IF)
2 - 6 - sGND	(NO)			
4 / 7 - PWMAAlternate/SigRx+	(Control, Servo, Heater)		(I2C, UART)	(RF)
4 \ 8 - PWMdirect/SigRx-	(Fan)		(I2C, UART)	

## DigitalIO (Display, SDCard, SPI)

3 / 1 - A0				
3 \ 2 - dRST				
2 - 3 - Vext				
1 / 4 - MOSI	(I2C, UART)			
1 \ 5 - MISO	(I2C, UART)			
2 - 6 - pGND				
4 / 7 - SCK	(I2C, UART)			
4 \ 8 - CS				

## Steppers (Stepper Motor)

3 / 1 - Vsys				
3 \ 2 - pGND				

2 - 3 - B+	Fwd(2A/Blue/Red)	Rev(1A/Green/Blue)
1 / 4 - A+	Fwd(1A/Green/Blue)	Rev(2A/Blue/Red)
1 \ 5 - A-	Fwd(1B/Black/Yellow)	Rev(2B/Red/White)
2 - 6 - B-	Fwd(2B/Red/White)	Rev(1B/Black/Yellow)
4 / 7 - B+	Fwd(2A/Blue/Red)*	Rev(1A/Green/Blue)*
4 \ 8 - B-	Fwd(2B/Red/White)*	Rev(1B/Black/Yellow)*

## LinearPSU

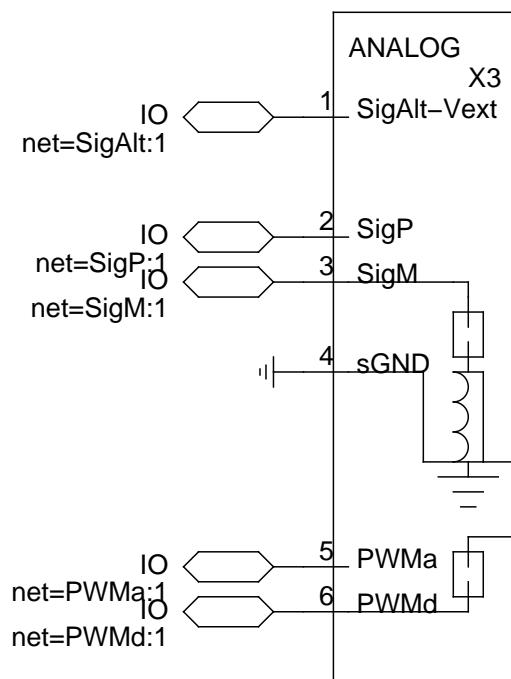
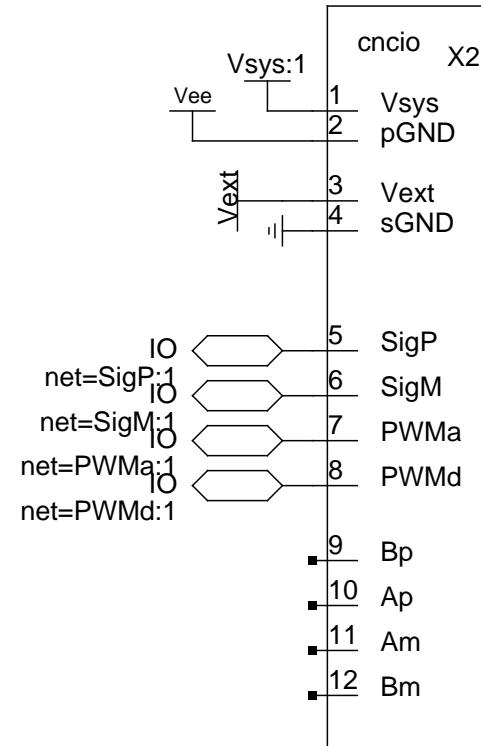
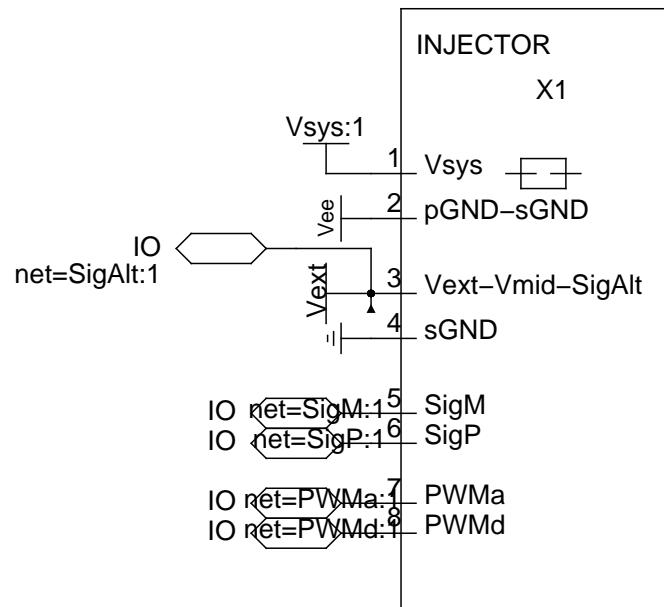
3 / 1 - 5V  
 3 \ 2 - Vee  
 2 - 3 - Vcc  
 1 / 4 - GND  
 1 \ 5 - Vee  
 2 - 6 - Vee  
 4 / 7 - 3.3V  
 4 \ 8 - Vee

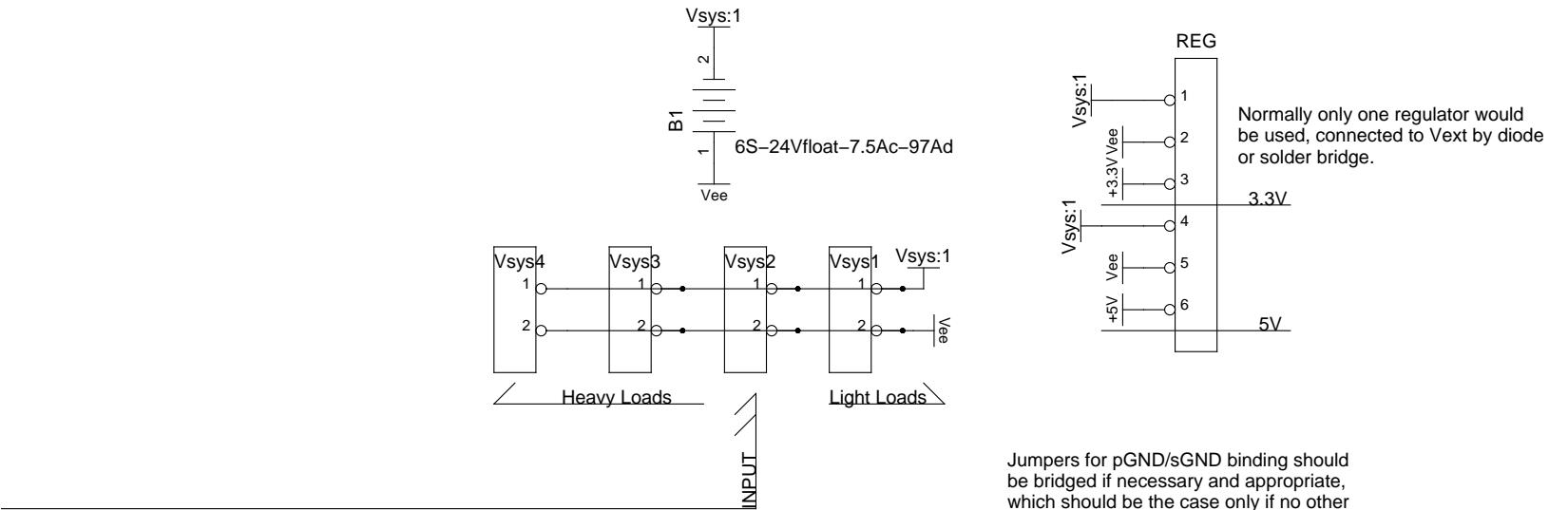
See <https://github.com/mirage335/LinearPSU/blob/master/Photo.jpg> .

## Ratings

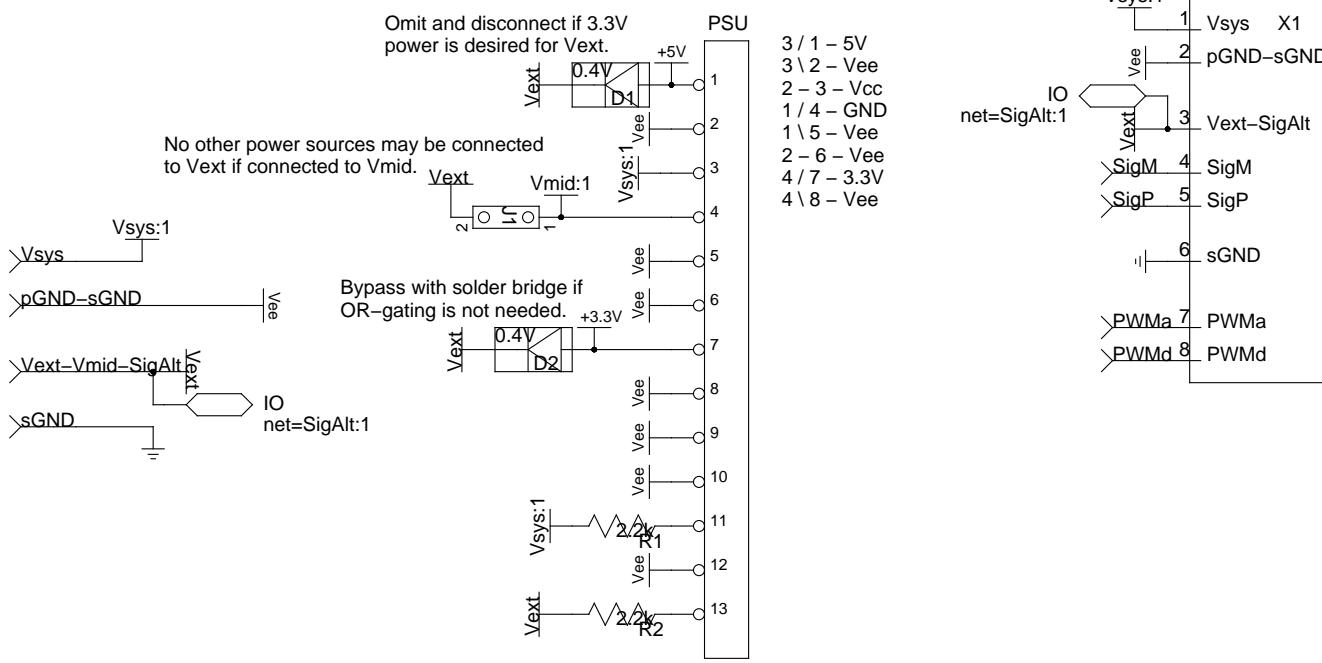
Please beware the following ratings.

- Vext is intended as logic power, and must never exceed 5.5V. Recommend 3.3V||5V depending on system needs.
- Vext may be used as a diode (eg. CDBU0530) OR-gated power bus if all connected devices can operate at 2.8V-5V.
- Vmid/Avcc are alternate uses for the Vext line, and may exceed 5.5V as appropriate.
- Vsyst is intended for high-power delivery, and may be any voltage all attached devices are configured to tolerate. Recommend 12V||24V.
- Ground-referenced voltage (ie. wall current) should only be considered for Vsyst. Earth-ground and neutral may be bound to pGND/sGND.
- Maximum current into an RJ45 socket or breadboard is typically around 3A/pin. Consider using high-quality header/jumpers, and redundant pins, as appropriate.
- Voltage drops can be significant, especially across pGND/sGND. Take care to follow star-toplogy grounding to the greatest extent possible when accuracy counts.
- Rough changes to voltages can be made (eg. for fans) by high-power zener diodes (ie. 863-1N5919BG).
- Pins 7/8 of GenericIO may be repurposed for digital I2C/UART if needed, specifically for digital control of stepper driver.

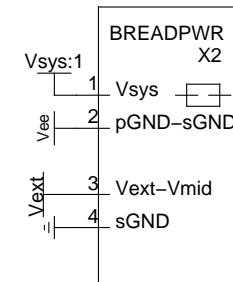


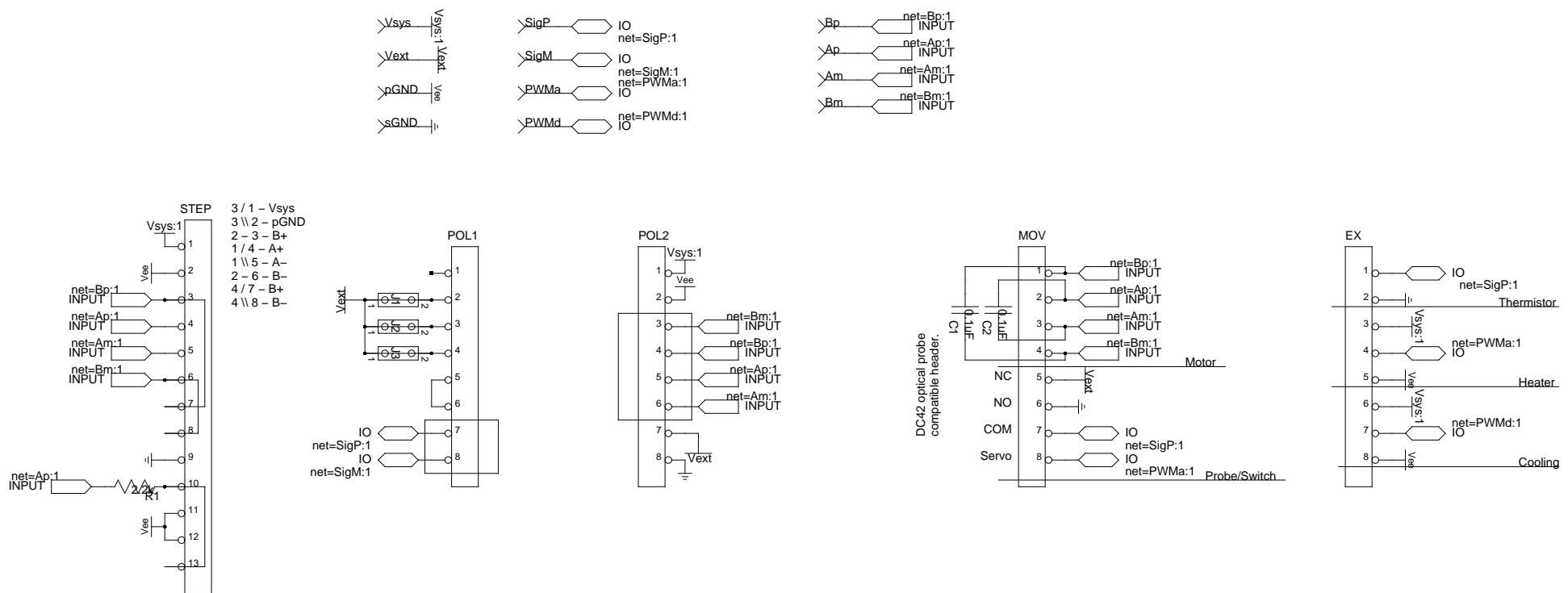


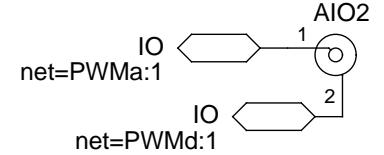
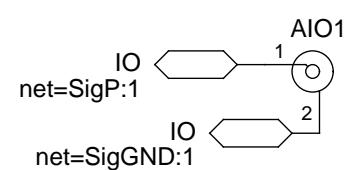
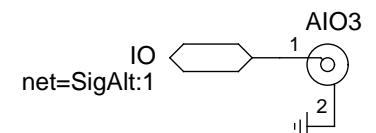
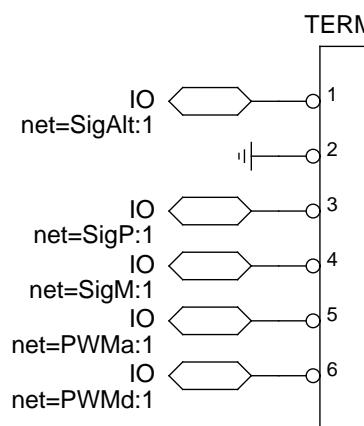
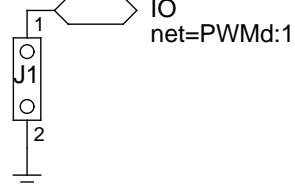
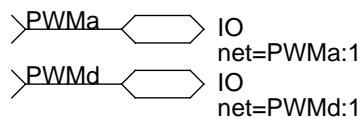
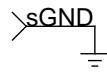
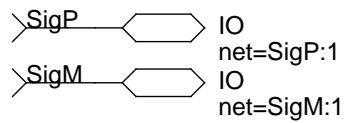
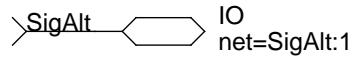
Jumpers for pGND/sGND binding should be bridged if necessary and appropriate, which should be the case only if no other common point is used for signal grounding.



Connect to breadboard power rails.  
Ideally should be a breakable extension.

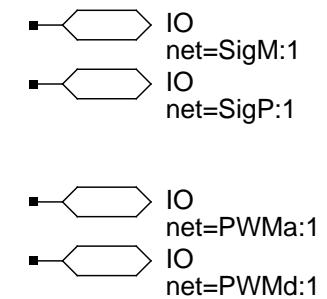
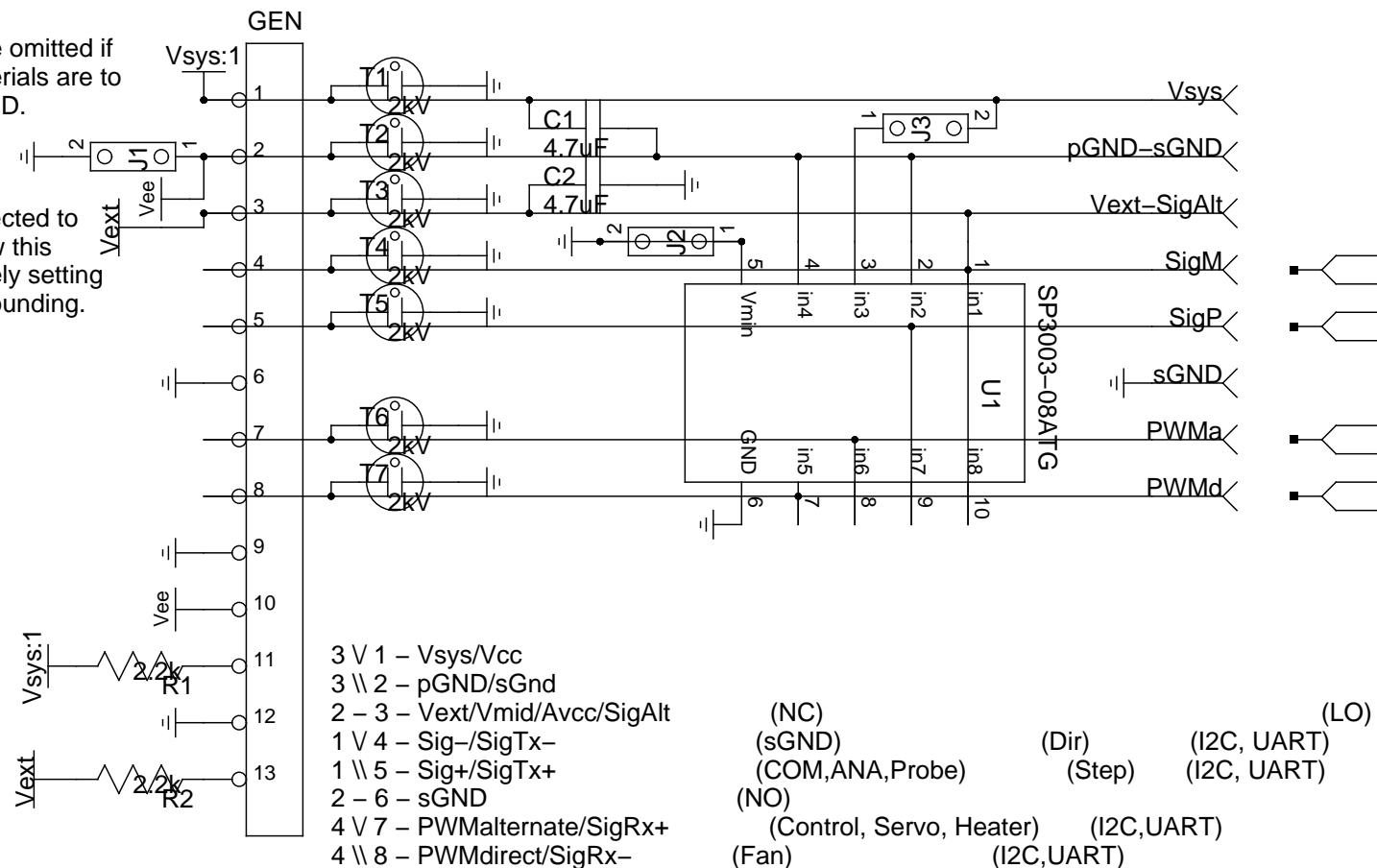




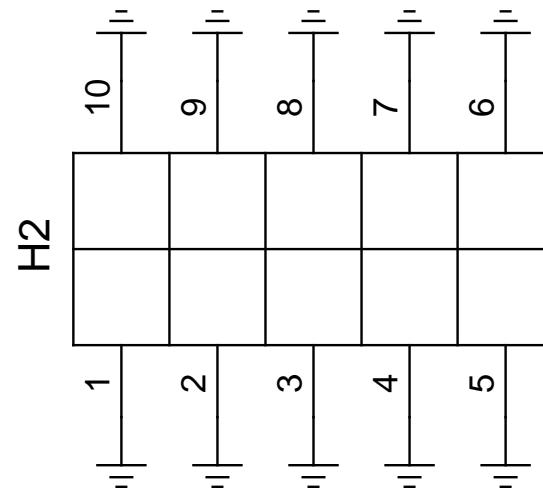
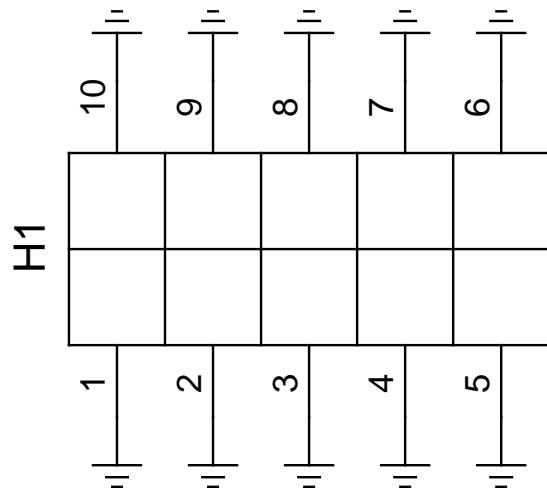
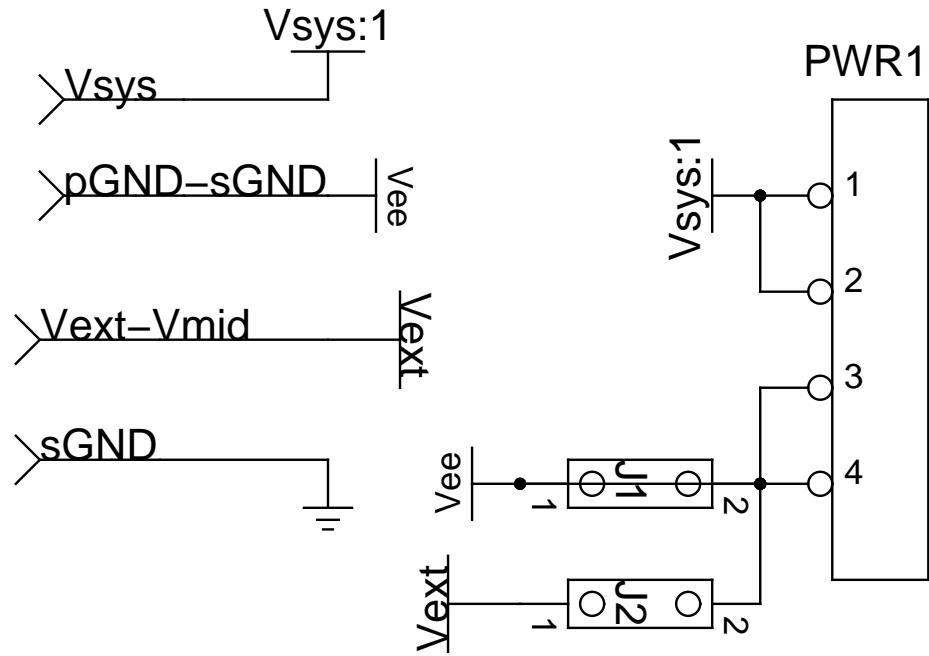


Vext capacitor should be omitted if any downstream peripherals are to sink Vext current to pGND.

If pGND–sGND is connected to ground, netlists will show this jumper shorted, effectively setting minimum impedance grounding.



Connect to breadboard power rails.



Mechanical supports.