Custom ESS Breakout Board (BOB)

# General

The TAMI CNC project will use the Ethernet Smooth Stepper (ESS) motion controller board. **Problem:** the limit switch signals should go to both the ESS and the motor drivers, but the ESS expects 5V level signals and the motor drivers expect 24V. Existing ESS breakout boards still require non-negligible external circuitry because of this 24V / 5V issue.   
**Solution:** a custom breakout board (BOB) to the ESS.  
Additional advantages: will save work on wiring; easy to put in convenience features (LEDs, test points, override switches etc).

# Specs

### General

* SMD or through-hole components? If SMD, then only packages that are easy to hand-solder.
* A 2-layer board should suffice.

### Form factor

* Option 1: the breakout board will fit **on top of the ESS**. Eagle files (which Altium can import) are available here:  
  <https://warp9td.com/index.php/documentation/doc-ess#Mechanical>  
  advantages: no interference on connections to ESS, no external cables, smaller solution.
* Option 2: the breakout board will sit beside the ESS (probably on a DIN rail) and will connect to it with 26-pin ribbon cables (1 per port). Advantages: form factor is flexible, does not physically hide ESS.

### Power

* Can either provide 5V to the ESS, **or** draw 5V from the ESS (never both). i.e., we need to decide if the input from the 5V PSU goes to the ESS or to the breakout board.
* The ESS requires 500mA max (300mA typical).
* The breakout board will also require 24V.

### I/O

* ESS connections: At least two of the ESS’s 26 pin connectors, possibly all three. Each is a female 0.1” header on the bottom side (for the case of “on top of the ESS” form factor)
* Motor drive connections (x3 drives). Connectors: screw terminals? D-type? Other?
  + GND
  + 24V output
  + Step output (5V, direct pass-through from ESS?) (name in drive: PULS)
  + Direction output (5V, direct pass-through from ESS?) (name in drive: SIGN)
  + Enable output (24V, active low) (name in driver: /SV-ON)
  + Positive limit output (24V, active high) (name in driver: P-OT)
  + Negative limit output (24V, active high) (name in driver: N-OT)
  + Brake input (Z-axis only)
  + Alarm input?
  + Note: some of these signals are differential. Even if we don’t output true differential signals, we may want to bring the negative wires to the breakout board, rather than connect them all inside the connector backshell, for the sake of convenience. We should keep this in mind when counting the number of wires.
* Front panel connections:
  + All limit inputs
  + Brake output to Z-axis
* Relay outputs (relays on this board or external relay board? Need 220V input if on this board)
  + Spindle
  + Coolant for spindle
  + Coolant for cutting tool
  + Z-axis brake
  + Other general purpose outputs?

### Features

* LED per input?
* Switches to force limit switch operation?
* Relays on board or external relay board?
  + On board: additional board design work, additional component soldering to board.
  + External: additional wiring work, additional component in the unit 2 box.
* Spindle speed control?