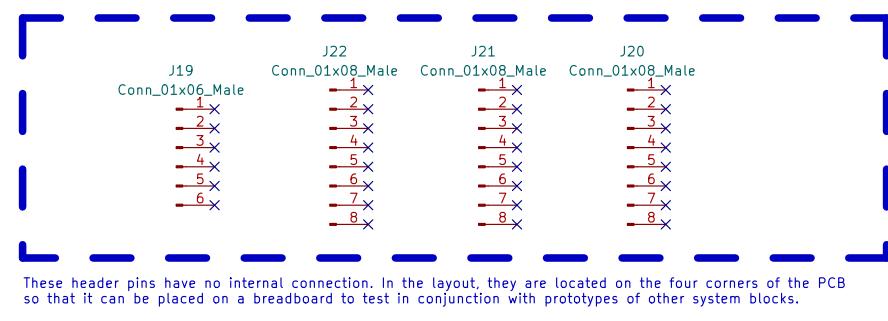
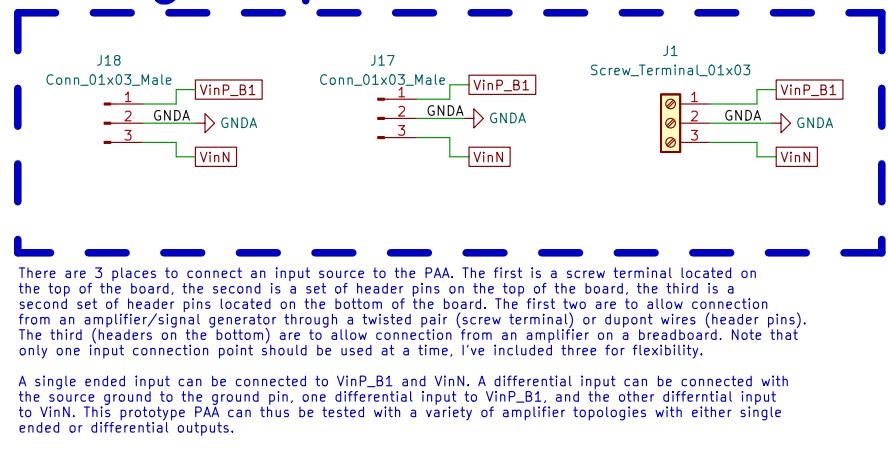


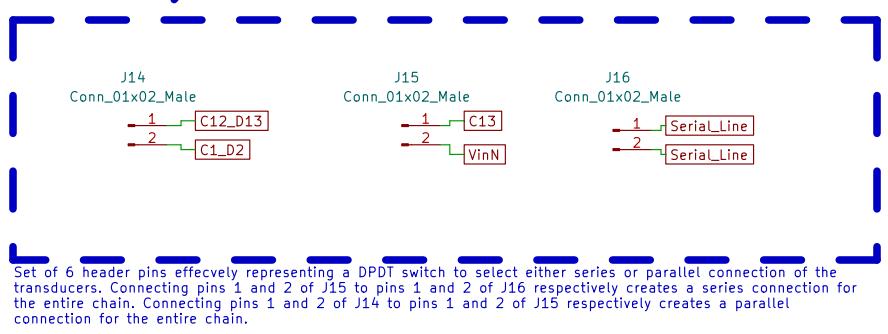
Breadboard Mounting Pins



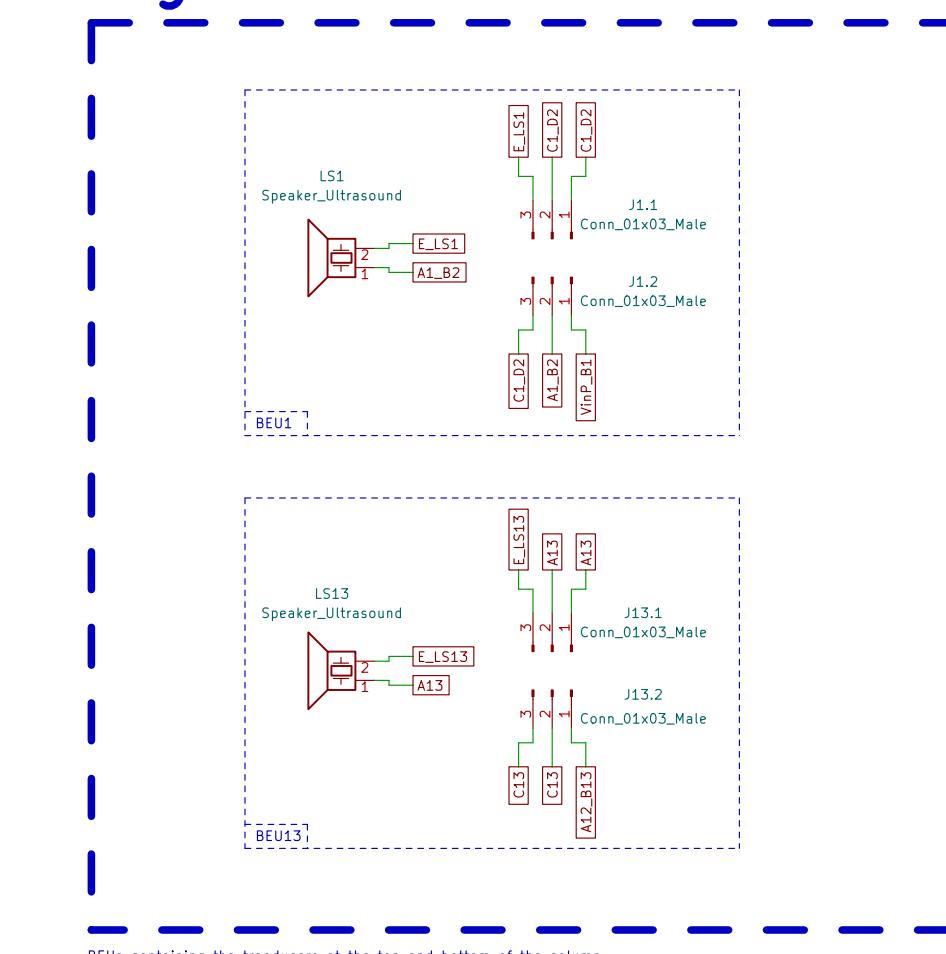
Voltage Input Terminals



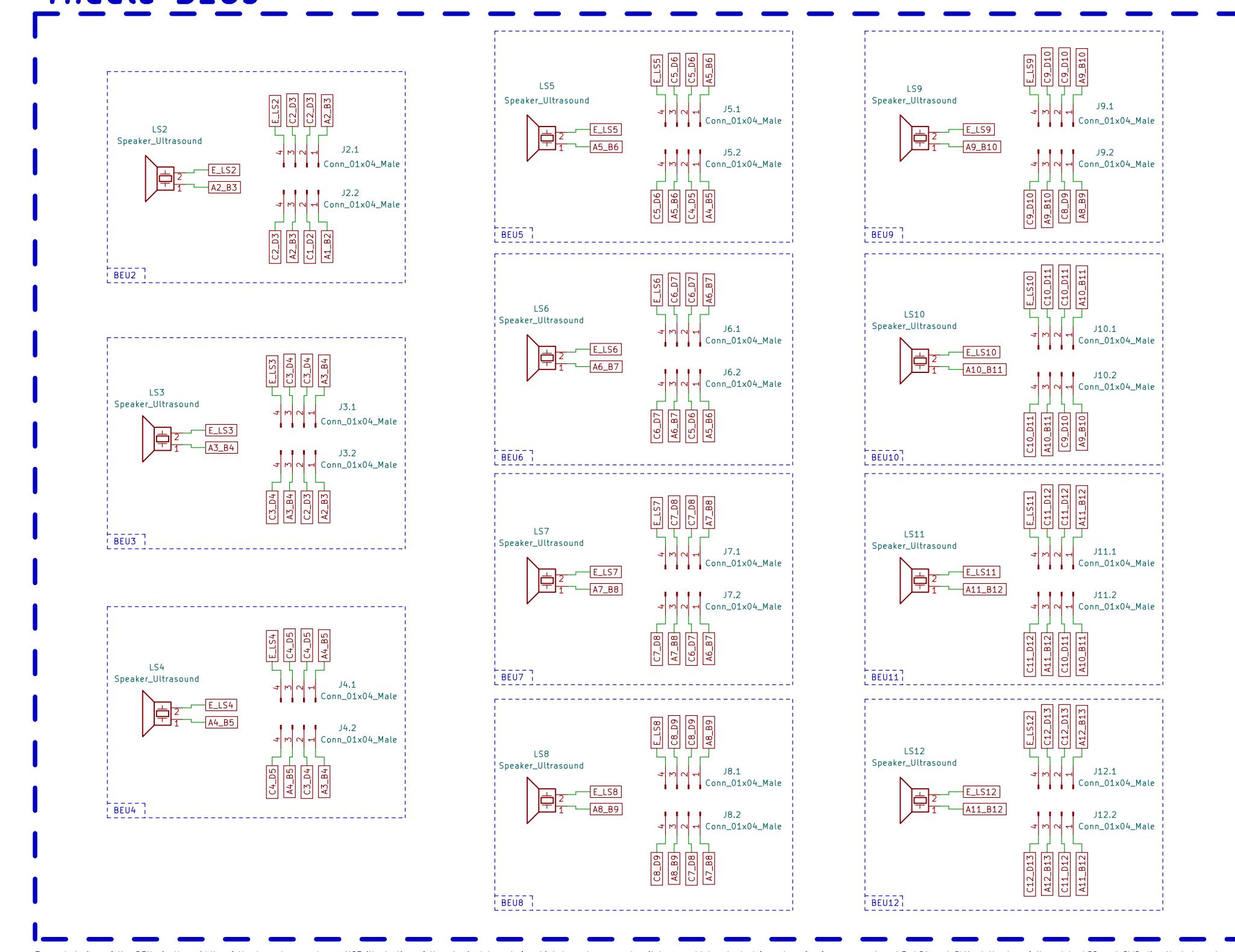
Series/Parallel Control Unit



Edge BEUs



Middle BEUs



NET Label Convention

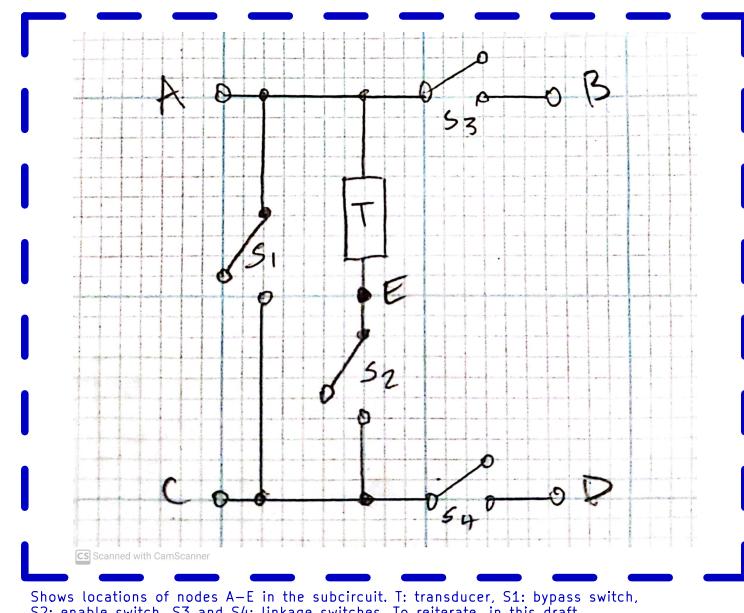
Each BEU has 5 nodes, 4 of which are terminals that connect to adjacent BEUs. I've labelled these 5 nodes A,B,C,D, and E. Node E is internal to each BEU (not directly connected to adjacent BEUs). Node A on one BEU connects to node B of the next BEU. Similarly, node C of one BEU connects to node D of the next BEU.

Node E: E_LSx where x is the reference number (i.e. LS1) of the transducer in a given BEU.

Node A/B: Ay_Bz where y is the reference number of the BEU where node A is located, and z is the reference number of the BEU where node B is located.

Node C/D: Cy_Dz where y is the reference number of the BEU where node C is located, and z is the reference number of the BEU where node D is located.

BEU Sketch



Definition: Bypass-Enable Unit (BEU)

A bypass-enable unit (BEU) is a sub-circuit comprised of a two-terminal circuit element, in our case an ultrasonic transducer, and a 3 or 4 position dip switch. For a column of x transducers, there are x BEUs.

In the general case, a BEU contains a 4 position dip switch. Each of the 4 SPST switches serves a different function. The first is the enable switch which, when closed, delivers signal to the single transducer in the associated BEU. The second is the bypass switch which, when closed, allows signal to bypass the single transducer in the associated BEU. Note that the bypass and enable switches should not both be closed at the same time. The last two switches are linkage switches, which connect adjacent or non-adjacent (sparse) BEUs, and hence transducers in series or in parallel. These 4 individual switches, located identically within each of the "Middle BEUs" section above are indexed from left to right as follows:

The switch connecting pins 4 of Jx.1 and 4 Jx.2 is the bypass switch.
The switch connecting pins 3 of Jx.1 and 3 Jx.2 is the enable switch.
The switch connecting pins 2 of Jx.1 and 2 Jx.2 is a linkage switch.
The switch connecting pins 1 of Jx.1 and 1 Jx.2 is a linkage switch.

In the BEUs associated with the top and bottom transducers in the column, shown in the "Edge BEUs" section above, one of the linkage switches is moved to the Series/Parallel control unit. The series/parallel control unit decides whether the entire chain of BEUs is connected in series or in parallel, hence it is isolated in its own section of the board for ease of use.

Purpose and Description

The purpose of this circuit configuration is to allow for parallel or series connection of any number of transducers contained in a single column. This configuration also allows for the creation of a "sparse array" of transducers, as I would call it. Meaning that we could connect every-other transducer in the column either in series or in parallel, every third transducer, fourth transducer etc. Therefore, with this prototype, we can test a multitude of different column configurations without designing and purchasing additional transducers and PCBs.

The core sub-circuit in this prototype, is what I call a bypass-enable unit (defined to the left). I do not know if such an idea already exists; if so some of the terms I've defined and used may be misnomers. I imagine that similar circuitry would be found in something like a resistor or capacitor bank, or maybe even something like a digital potentiometer – I cannot say for certain at this time.

The routing and functionality of this circuit may be rather unclear in this schematic alone. I have a sketch of the circuit on paper that better illustrates how to position the switches for different series or parallel configurations, which we can review in upcoming meetings. I will create a supplemental document that includes these illustrations as soon as possible.