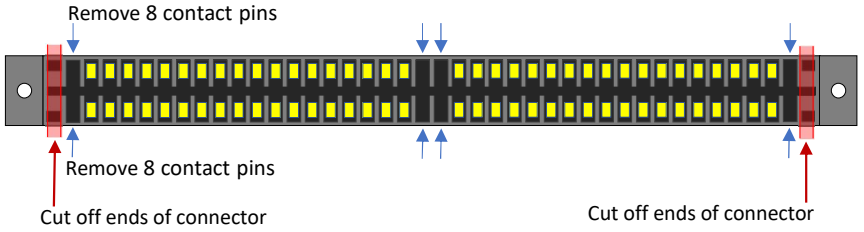
Instructions to modify the edge connectors #1

2 x 40 pin connector modifications for the dual middle connector (B-C)

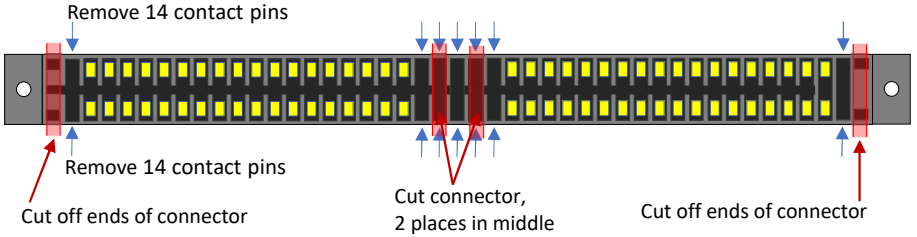


Need a total of 10 dual middle connector (B-C)

2 x 43 pin connector modifications for the two outside single connectors (A & D)

Recommended

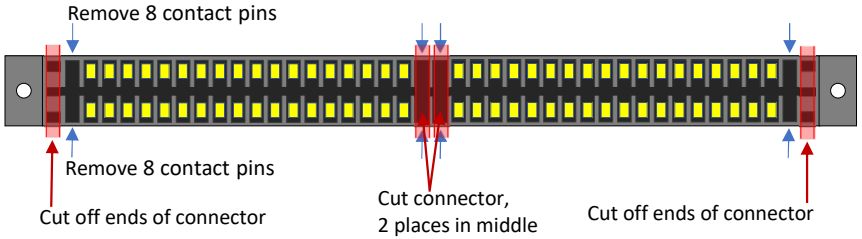
for **Connector Shim Configuration #1**, described on page 6



Need a total of 20 outside single connector (A & D)

Alternative 2 x 40 pin connector modifications for the two outside single connectors (A & D)

for **Connector Shim Configuration #2** , described on page 6



Slightly lower cost alternative and all connectors are the same 2 x 40 type. A & D connectors will be open on one side (shim on one side only).

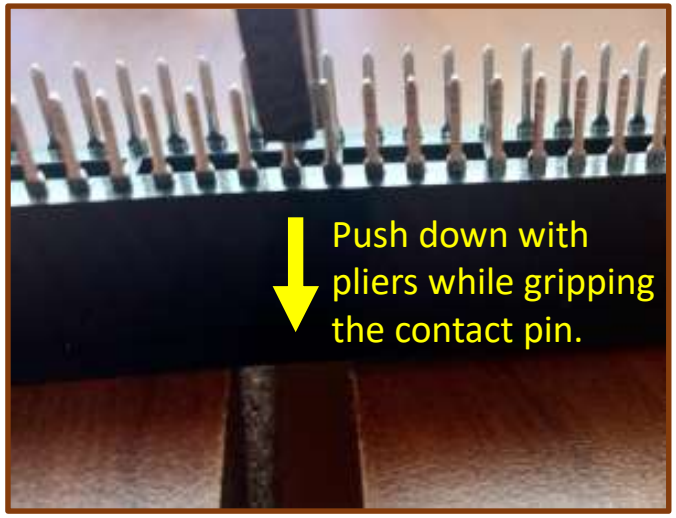
Instructions to modify the edge connectors #2

Remove the extra connector contact pins

Remove the extra connector contact pins before cutting. The contact pins to be removed are indicated by the blue arrows on the previous page.

An easy way to remove the pins is to place the connector slot-side down, pin-side up, on a flat surface that has an opening that allows the pins to be easily pushed through. The photo below shows an example of needle nose pliers gripping a contact pin which is pressed downward.

The example below shows two sides of a desk supporting the connector. A simple alternative would be to drill a large hole in a block of wood to support the connector while pushing the contact pin downward but to allow the removed pin to slip through the opening.

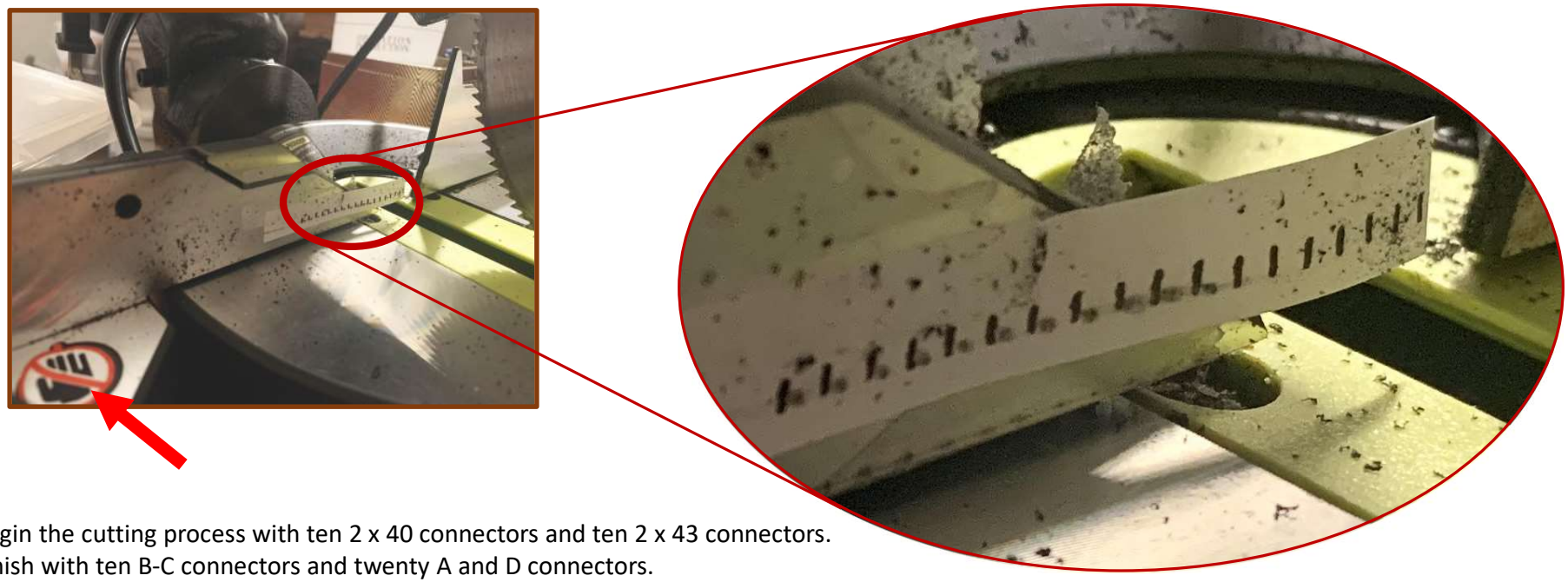


Instructions to modify the edge connectors #3

Cutting the edge connectors

I used a small 7 ¼ inch power miter saw with a 140 tooth blade. Make the cuts at the locations indicated by the red bands on the first page.

The photo below shows a guide taped to the saw that is used to help align the connectors during the cutting process. Notice the icon in the lower left warning to not put your hand there, so a clamp is necessary to secure the connector while cutting. Small marks from the connector pins are visible on the paper guide. I didn't have the marks perfectly aligned when I attached the paper guide and adjusted the position of the connector early in the cutting process. The connector pins made the small dots to the right of the larger marks. The connectors were cut lying flat with the open slot toward the front and the pins pressed against the guide.



Begin the cutting process with ten 2 x 40 connectors and ten 2 x 43 connectors.
Finish with ten B-C connectors and twenty A and D connectors.

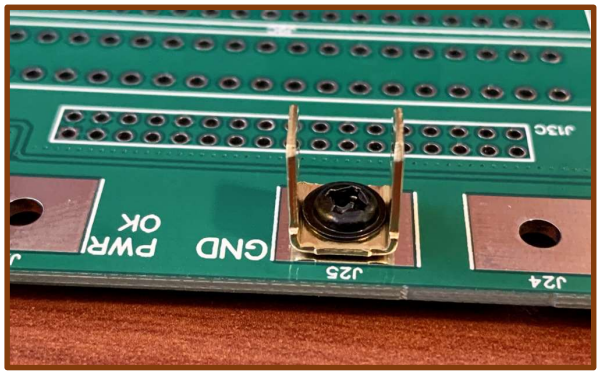
Mounting and Soldering the Quick Fit power terminals

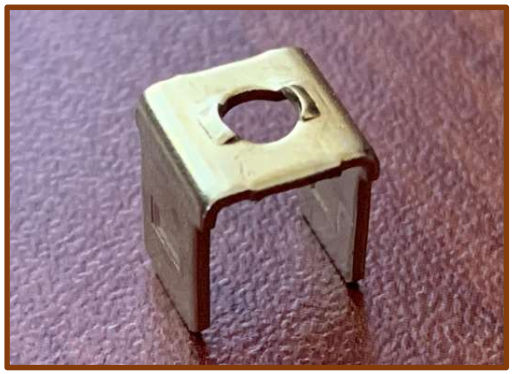
Mounting the Quick Fit terminals, Keystone Electronics 1257

Solder the Quick Fit terminals to the backplane first, before attaching any other components or connectors, because this requires a lot of heat and you'll want to have easy access to the terminals from all sides during the hot air reflow soldering process. This also reduces the risk of overheating any other components that you'll attach in subsequent steps.

The Quick Fit terminals should be secured to the backplane before soldering so the terminals don't move while they are being soldered. A short M3 screw and nut are a good choice because they have a relatively small thermal mass. Below left is an image of the Quick Fit terminal attached to the backplane and below center is an image of the bottom side of the Quick Fit terminal. Notice that the bottom of the terminal has a small "Anti Rotation Tab" which will create a small gap between the base of the Quick Fit terminal and the metal pad on the PCB. This gap will allow solder to wick between the tab and the PCB pad.

I used a hot air reflow soldering tool with a 7 mm diameter nozzle to direct the heat to one side of the terminal at a time. Reflow air temperature was set to 340° C. I used Lead Free Solder Sn 99 Ag 0.3 Cu 0.7. Heat the entire side of the terminal first and then direct the heat toward the bottom of the terminal and the PCB pad on the side that you're soldering and feed a generous amount of solder between the terminal and PCB pad. Keep the heat directed there until the solder flows and wicks well onto both surfaces. Repeat this for all four sides of the Quick Fit terminal. A photo of the soldered terminal is also shown below right.





Ordering the PCB with SMT Assembly

The PCB itself

The Mini Omnibus Backplane v2 was designed to be fabricated on the most basic PCB process. Voltage drops of power traces were analyzed based on the use of 1 ounce copper. The backplane can be fabricated from standard 1.6 mm thick FR4 material or a different thickness can be used without any adverse effects. The Lead Free HASL-RoHS process is recommended. The set of Gerber files are in "Gerber_PCB_Omnibus mini-backplane v2d.zip". (At JLCPCB, simply upload the zip file, choose "LeadFree HASL-RoHS" process , and proceed to the SMT assembly section.)

SMT Assembly of the POWER OK circuit

The POWER OK circuit consists of a small group of SMT components in the upper left corner of the board. It is probably more convenient to order SMT assembly for these parts at the same time the PCB is ordered. JLCPCB offers a very cost-effective SMT assembly service, but it helps to know how to use it effectively. JLCPCB has two classifications of parts: "Basic Part" and "Extended Part". Basic Parts are frequently used by many customers and are already loaded on carriers that can be configured easily. There's no extra charge for Basic Parts, other than the component cost. Extended Parts are less often used and there's an extra charge of a few dollars for the first instance of each Extended Part. The Mini Omnibus Backplane v2 is designed to use all Basic Parts to minimize cost. There are actually some non-Basic Parts in the design but these are through-hole parts that you will install after receiving the PCB with SMT from JLCPCB.

After uploading the PCB Gerber files in "The PCB itself" section above, just upload the following two files:

1. add the BOM file: "BOM_PCB_Omnibus mini-backplane v2_2022-06-19d SMT only.csv"
2. add the CPL file: "PickAndPlace_PCB_Omnibus mini-backplane v2_2022-06-19d.csv"

It is of course possible to order only the PCB but having JLCPCB also do the SMT assembly is very inexpensive and will save you a lot of time. Ballpark figure for PCB fabrication of 5 PCBs on Lead Free HASL-RoHS and 1.6 mm material is about $17. SMT assembly including parts cost for 5 boards is about $24. Be sure to claim one of the SMT assembly coupons that JLC frequently offers. I think the $24 SMT charge was discounted by $9, so I actually paid about $15 for SMT assembly (including parts cost).

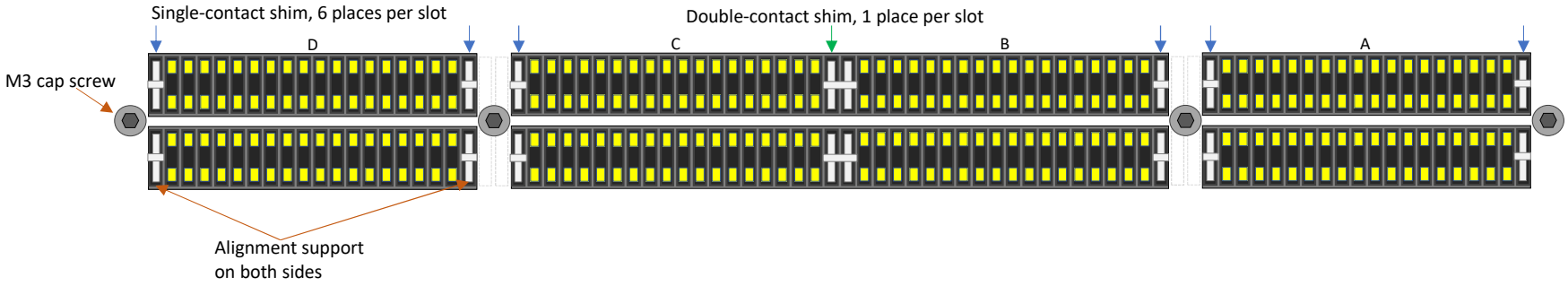
Note that shipping from China to the US can add an additional 20% to 100% depending on the shipping speed that you require. Even with shipping, the total cost is quite painless.

Connector Shims #1

Connector Shim Configuration #1

Better support for Omnibus board alignment, but tighter access to mounting screws between A&B, and C&D.

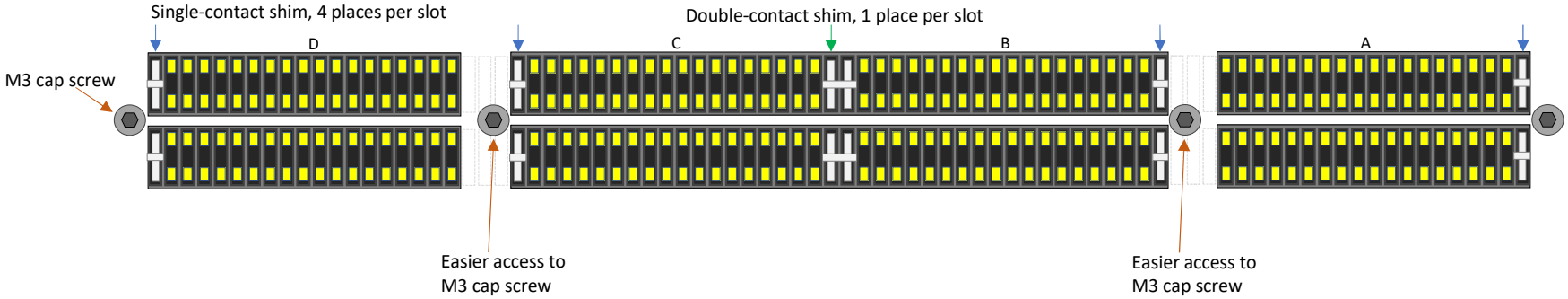
Recommended



Connector Shim Configuration #2

Easier access to mounting screws between A&B, and C&D, but less support for Omnibus board alignment.

Slightly lower cost alternative and all connectors are the same 2 x 40 type before connector modifications. A & D connectors are open on one side (shim on one side only).

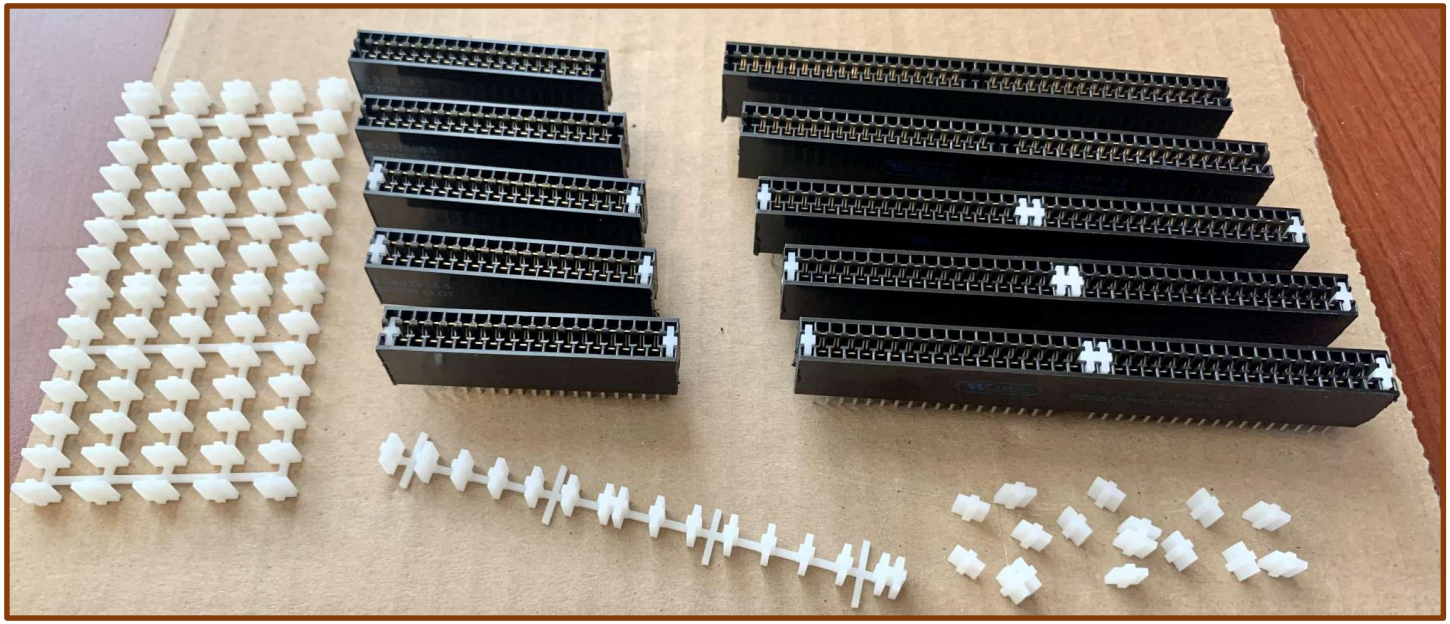


Connector Shims #2

The connector shims are 3D printed in a rack that contains exactly the number of shims required for a 10-slot backplane. There are 60 single-shims and 10 double-shims. An entire set of shims are printed together because this is easier to handle a single 3D print job and it reduces the printing cost. The shims in the photo below were printed at JLCPCB in LEDO 6060 Resin. The file to be printed is “connector_shim_v06.stl”, an STL format file in millimeter units. (At JLCPCB, simply upload the file, choose “LEDO 6060 Resin”, and order the part.)

A network of 1 mm disposable ribs connects the entire set of shims. They can be cut apart easily using a set of diagonal cutters that is flat on one side. When separating a single shim, place the flat side of the diagonal cutter next to the part you are removing from the rib.

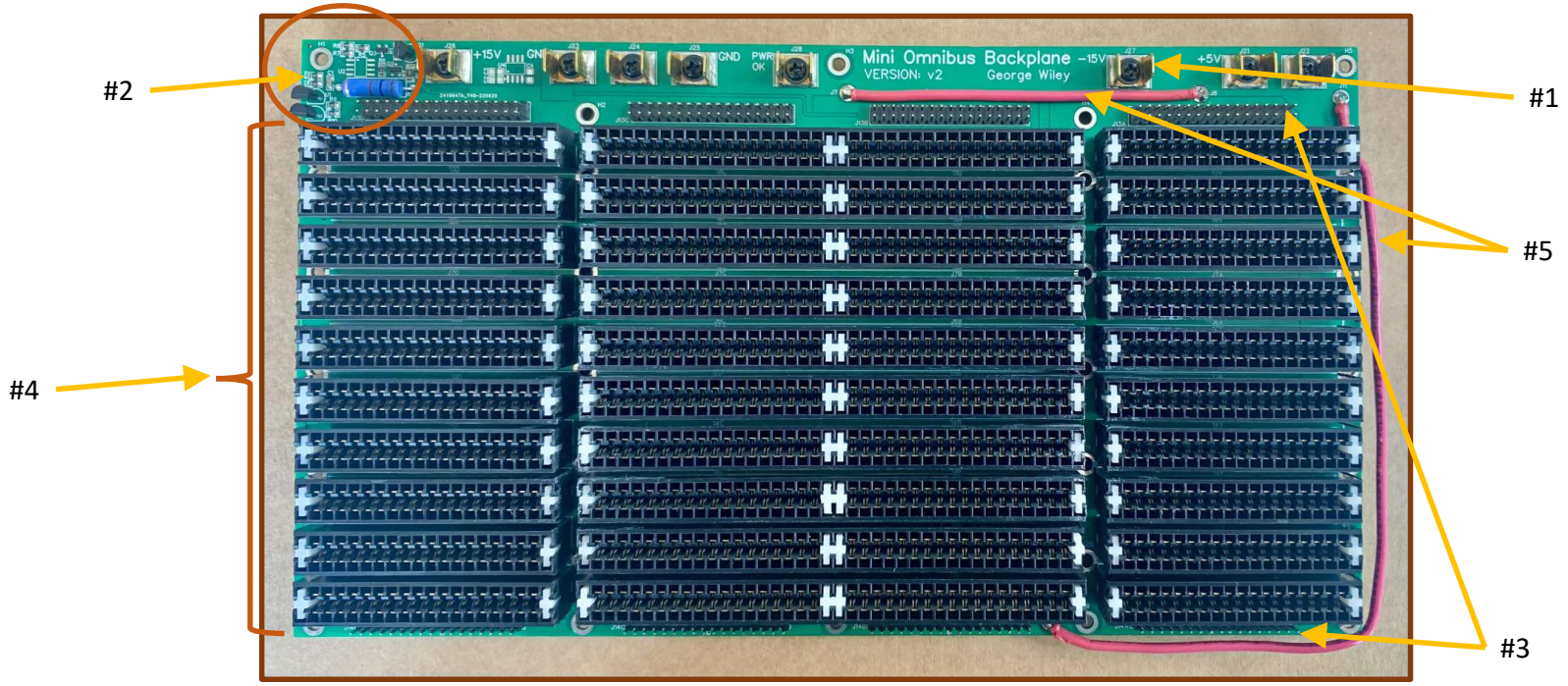
The single shims will probably fit rather loosely in the connector and should be glued so they remain in place. A tiny sub-drop of epoxy should hold the shim in place. Be very careful not to get any glue on the connector contacts.



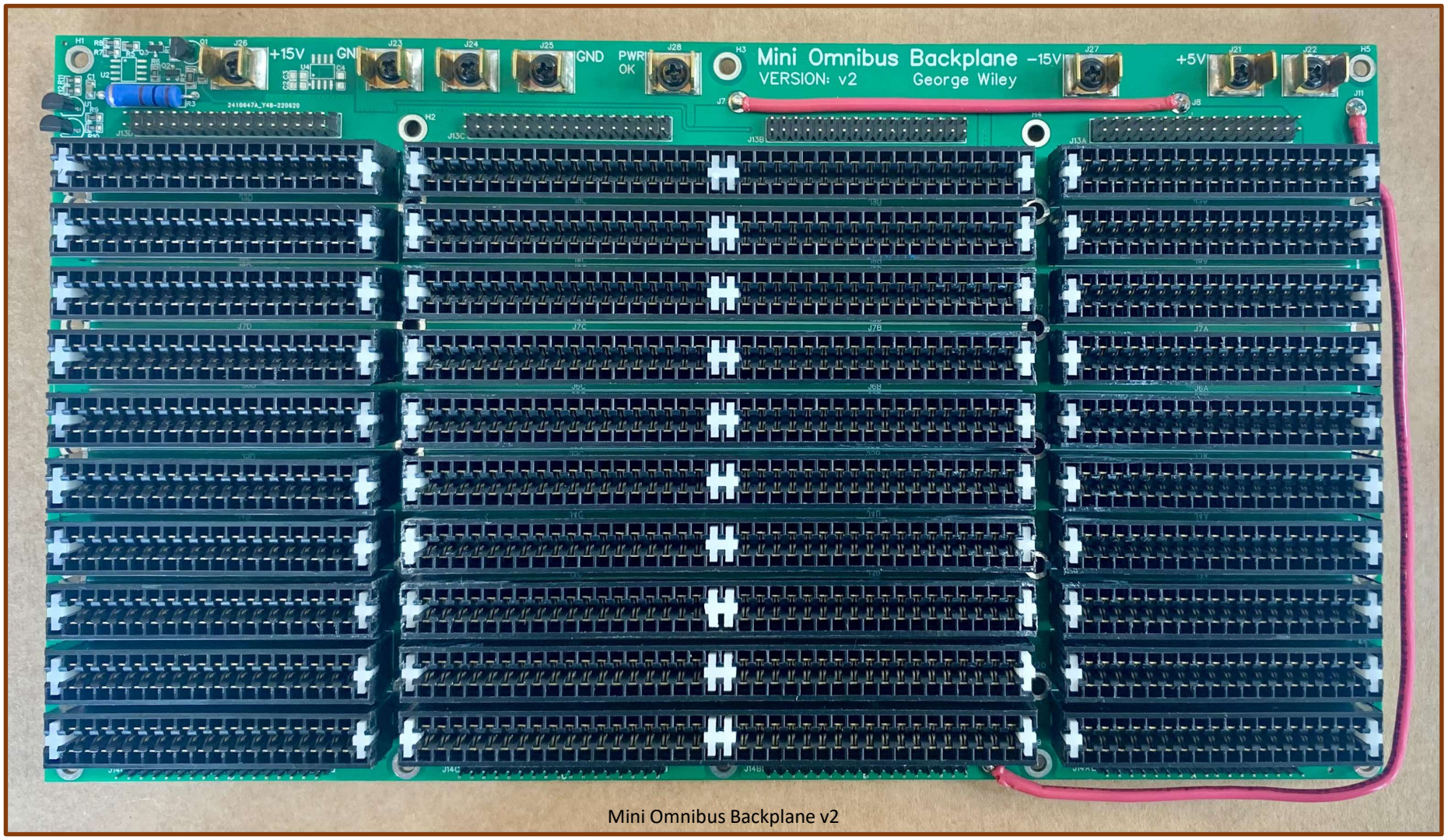
Order of Assembly

Generally, install the shortest components first and the tallest go last.

1. The exception is to solder the Quick Fit terminals first because this requires a lot of heat and easy access to the terminals to apply heat and solder.
2. Next are the 2 watt resistor (R3), the transistor (Q1), and the MC34164 undervoltage sensors. Tne SMT components are already installed.
3. Next are the 34-pin headers: J13A, J13B, J13C, J13D, J14A, J14B, J14C, J14D.
4. Next are the edge connectors. Solder one terminal from each end first. Make certain the connector is aligned perfectly and reflow the joint at either end of both if a slight correction is necessary. When you're certain that all connectors are aligned correctly, then solder the remaining connector pins.
5. Last are the two AWG 14 jumper wires. The short wire between J7 and J8 could be installed at any time but the longer wire between J11 and J12 will get in the way if it's attached early in the assembly process. I made the longer wire long enough so I could easily access the screw heads along the right and bottom edges of the backplane.



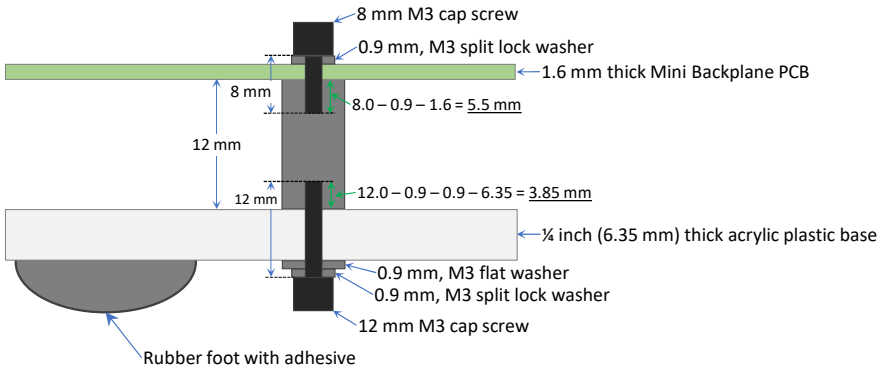
Complete Assembly, not yet mounted



Mini Omnibus Backplane v2

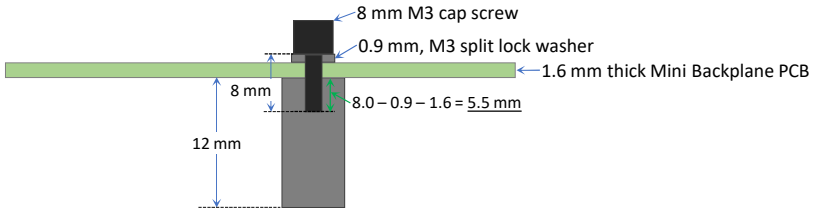
Backplane Mounting on ¼" Acrylic Base

Use M3 hardware to mount the backplane to an acrylic base. M3 cap screws have a small diameter head which is necessary to fit between the A & B and C & D connectors. Adhesive tall rubber feet prevent the screws on the bottom of the acrylic sheet from scratching the desktop.



Mounting without Acrylic Base

Although the thick acrylic base provides the best support for both insertion and removal of boards, it is also possible to use the backplane with the nylon standoffs as supporting feet. The 30 nylon standoffs secured only to the PCB will still provide good support when Omnibus boards are inserted but will not prevent the backplane from flexing when boards are removed.



Using the Backplane

Single 10 Slot Backplane

Can be the backplane of a simple minimal 10-slot Omnibus system. The J13 and J14 headers can be used to connect a logic analyzer for debugging. The POWER OK signal can be driven from the on-board circuit (be sure that zero-ohm SMT jumper R4 is installed) or POWER OK can be driven from an external source and connected via J28 (be sure that zero-ohm SMT jumper R4 is removed). POWER OK should be driven from only a single source, either on-board or off-board.

Double Backplane, 20 Omnibus slots, or 10 x n slots

It's possible to cascade two mini backplanes to form a 20-slot system by installing four short 34-pin flat cables with IDC connectors between the J13 connectors of the front backplane and the J14 connectors of the rear backplane. The J13 and J14 connectors do not carry power so it is necessary to also make robust connections between the Quick Fit terminals J21 through J27 of the two backplanes. In theory it is possible to cascade more than two backplanes to form larger systems that have multiples of ten slots. This has not been tested or analyzed in detail.

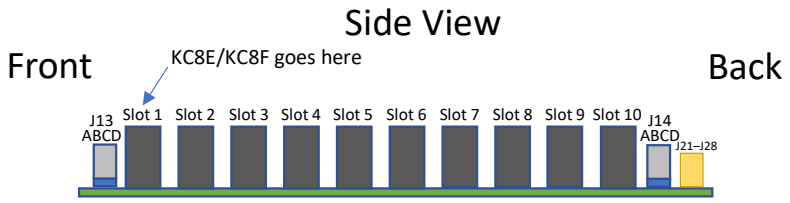
The POWER OK signal can be driven from the on-board circuit of only one backplane in the cascaded configuration. Be sure that the zero-ohm SMT jumper R4 is installed in that backplane and removed in the other backplanes in this configuration because POWER OK should be driven from only a single source. POWER OK can be also driven from an external source and connected via J28 of any of the backplanes in the cascaded configuration (be sure that zero-ohm SMT jumper R4 is removed from all backplanes). The POWER OK signal is connected through the J13 and J14 flat cables so that a single POWER OK signal is connected to all slots in a system having cascaded backplanes.

Replacement for a bad Omnibus Backplane

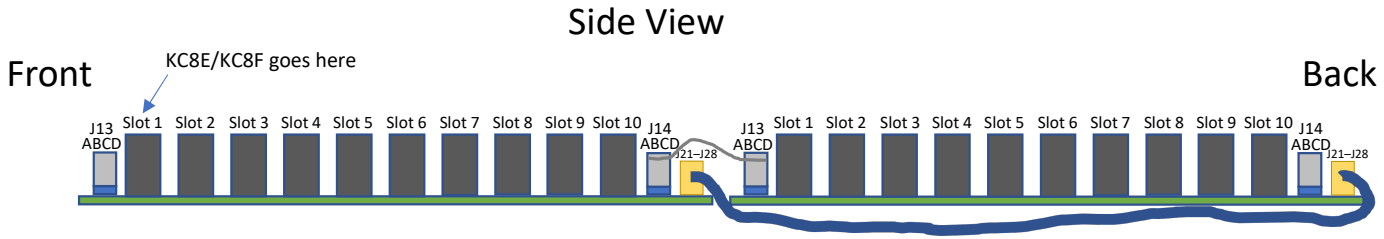
Although the dimensions of the Mini Omnibus Backplane are not identical to a real DEC Omnibus backplane, it is intended that the Mini Omnibus Backplane be able to be a substitute for a bad backplane. An Omnibus Bridge v2 PCB has been designed to connect to the J13 or J14 headers and plug into to the good backplane in a system being repaired. Four Omnibus Bridge v2 PCBs and short 34-pin cables are required. In this situation the POWER OK signal is most likely driven by a circuit in the power supply of the system being repaired so be sure that the zero-ohm SMT jumper R4 is removed from the Mini Omnibus Backplane.

Backplane Configurations

Single 10 Slot Backplane



Double Backplane, 20 Omnibus slots, or 10 x n slots



Replacement for a bad Omnibus Backplane