Using the rivet press

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INTRODUCTION

Professionally manufactured printed circuit boards (PCBs) are able to achieve electrically conductive pathways between top and bottom layers of the PCB by using a chemical process to adhere metal to the PCB. These conductive pathways are known as vias (for simply getting from one layer to another) and plated through holes (PTH; vias used explicitly for allowing through hole components to move a signal from one side to another). While we do not have access to this chemical process in the Maker-E, we are able to achieve vias and PTH by using small, hollow copper rivets. The rivets are installed using a rivet press.

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Step 1 — Background Info

- The rivet press uses mechanical force to “mushroom” or expand one end of a copper rivet against a PCB to form a secure connection.

- The press contains components with tiny pins that help align and press the rivets.

- If you have milled a PCB in the Maker-E, and your PCB contains plated through holes or vias, you will need to use the rivet press to complete your PCB. All vias and PTH should have a hole diameter of 1.5 mm and a pad diameter of 2.5 mm. Be sure your PCB design file in Ultiboard adheres to these requirements.

- Rivets should be installed prior to soldering any components on the PCB. The rivets have an inner diameter of 1.0 mm, and thus should accommodate many through hole components.
Step 2 — Prep your PCB

- You should have already cleaned up your PCB with steel wool after milling it on the PCB mill.

- However, if you have left your board exposed to the air for several days, or touched it repeatedly with your hands, it is possible it has oxidized and become tarnished. This will prevent good electrical conduction between the rivets and the copper, and also make soldering difficult.

- You should again use the fine gauge 0000 steel wool located in the PCB mill drawer to buff and polish both sides of your PCB. Be sure to do this on top of some paper so as not to scratch any benchtop surfaces.

- Using the steel wool will leave a lot of mess. Be sure to clean up your mess when you are done!
Step 3 — Locate Parts

- Locate the rivet press in the Maker-E. It is found on the bench across from the 3D printers in the Fabrication area.

- There should be a small container of copper rivets beside the rivet press. If you cannot find the rivets, please see a Maker-E tech.

- Open the container and remove a rivet.

Step 4 — Place Rivet on Press

- Place the rivet, flat side down, on top of the lower pin of the rivet press.
Step 5 — Place Board

- Locate a hole in your PCB which requires a rivet. Flip the board so that the bottom copper layer is facing down towards the pin. Align the pin in the center of the hole.

- With the PCB horizontal, push down firmly with equal pressure on all sides of the board until the flat rivet head is flush with the bottom copper layer of the PCB and the tube of the rivet is sticking up from the top copper layer of the PCB.

It is important to have the pre-formed, flat rivet head on the bottom layer of your PCB, as this head tends to be slightly wider than the head which the press creates. The pads on the top layer of the PCB can potentially be slightly misaligned with through holes, so having a smaller rivet head reduces the possibility of electrical shorts.
Step 6 — Press

- Now use the handle of the rivet press to slowly lower the press head until the pin sits inside of the rivet tube. If the pin does not align with the tube, please see the Lab Director.

- Press down slowly but firmly on the rivet press handle to crush the rivet tube and create a ring flush with the bottom copper layer.

- Release the rivet press handle. Your PCB will come up with the top of the press head. Use both hands to gently but firmly pull straight down on your PCB to remove it from the press.
Step 7 — Inspect

- Inspect the rivet you just installed. Confirm that the pressed side was crushed properly to produce a uniform ring.

- If proper pressure was applied during rivet installation the rivet should make good mechanical contact with both sides of your PCB, allowing for electrical conductivity.

- The top copper layer with pressed rivet head, highlighted in green. Note the slight misalignment between hole and pad.

- Bottom copper layer with pre-formed rivet head, highlighted in purple.
Step 8 — Populate remaining rivets

- Repeat this process to press rivets into all of the vias and PTH on your PCB.
In an ideal world, these mechanically pressed rivets would provide perfect conduction between top and bottom copper layers. Unfortunately, this is not always the case. Oxidation and corrosion, along with poor mechanical contact, can lead to breaks in conductivity.

As such, it is important to test all of your rivets for continuity. Most multimeters include a function to test for continuity with your PCB. The continuity function beeps when there is continuity (less than 10 ohms, typically) between the two probes.
Step 10 — Testing your PCB for continuity

- It is helpful to place your PCB in a(n) (insulated) vice so you can easily probe both sides at once.

- Important! You have to be very specific about how you perform a continuity check with a rivet. You need to verify continuity between the following:
  - Continuity between the **PAD/TRACE** on side A and the **PAD/TRACE** on side B.
  - If your via or through hole only has a trace on one side, then you need to verify continuity between the **RIVET** on side A and the **TRACE/PAD** on side B.

- **You cannot verify continuity if your probes are touching the rivet on both sides of the board! This will give you a false positive, as all you are doing is confirming the continuity of the rivet itself.** You need to check continuity between the **rivet** and the **copper**.
Step 11 — Soldering your rivets

- While not always necessary, it is often a good idea to solder your rivets to the copper clad. Ideally the mechanical press would do a fine job of ensuring conductivity.

- However, in our experience the connection between rivet and copper sometimes deteriorates to the point of essentially becoming an open circuit.

- You can refer to the soldering tutorial if you wish to solder your rivets.