# Introduction

The battery breakout PCB is designed to connect to the voltage taps of each LiFePO4 battery. The PCB is mounted to the 3D printed battery enclosure. This is the smallest and simplest board currently on the pod. The PCB is known as the Device Under Test (DUT).

# Estimated Time

10 minutes per board

# Prerequisites

Attend the Badgerloop Soldering and PCB workshop or receive approval from an electrical lead. This board is all through-hole components, so only basic soldering is required. It is critical that all solder joints provide a solid electrical and mechanical connection.

# Required Equipment

* P4\_HV\_Breakout\_001\_REVA PCBs (Qty up to 6) (DUT)
* Soldering iron (this can be done with the Hanko Station in MEHQ)
* Solder
* Side cutters (snips)
* PCB BOM
  + Right angle, 25-pin DSUB connector (1 per board)
  + JST-XH connectors (4 per board)
  + 4-40 Screws, 4-40 Washers
  + 8-pin 0.1” header (note, this can be cut from a longer 0.1” header using side cutters)
* Microscope / Magnifying Glass / Calipers (optional)

# Visual Inspection

A simple visual inspection of the DUT includes:

1. Board thickness Design \_\_\_\_\_\_ Measured: \_\_\_\_\_
2. Board dimensions Design \_\_\_\_\_\_ Measured: \_\_\_\_\_
3. Warpage: Verified \_\_\_\_\_
4. Short circuit, bridge, open circuit, voids Verified \_\_\_\_\_
5. Surface quality (scratches, scrapes, burrs, etc.) Verified \_\_\_\_\_
6. Holes and Vias hole drilled, plating present Verified \_\_\_\_\_
7. Add a serial number to the DUT with permanent marker. Boards should be numbered with this format: <Abbreviated Name>-<Number>-<Revision> for example the first board would be labeled BOB-001-A for Breakout Board, 001-006 for the unique identifier and A for the revision.

# Fit Check

This DUT contains components with unverified component footprints. It’s good practice to verify major components fit in the DUT before soldering down components.

1. Verify fit for the right-angle dsub into J1 Verified \_\_\_\_\_
2. Verify fit for the JST-XH connectors into P1-P4 Verified \_\_\_\_\_
3. Verify fit for the 8-pin 0.1” header Verified \_\_\_\_\_

# Soldering

1. Power on the soldering iron and wait until the output light turns on.
2. Remove J1 (if present) as its standard to solder on the smallest components first. Insert the JST-XH connectors into P1-P4
3. Snip excess leads from the connector (leaving ~2mm exposed on the underside of the board)
4. Place the tip of the soldering iron on pin 1 of P1 and apply solder.
5. Ensure that the JST connector stays flush to the board. If it’s not, if you only have pin 1 soldered, you can reheat the joint and adjust the position. It’s much more difficult to heat up multiple joints at the same time if a component needs to be adjusted.
6. Apply solder to pin 3 of P1, then pin 2, then pin 4.
   1. It’s useful to apply solder to every other pin, reducing the likelihood of melting a the connectors
7. Repeat steps 2-6 for P2-P4
8. Insert J1. Snip excess leads from the connector (leaving ~2mm exposed on the underside of the board)
9. Solder pin 1 and pin 25. Ensure the connector is flush to the PCB. Reheat and adjust as necessary.
10. Insert J5 and solder pin 1. Verify the component is flush to the PCB.
11. Solder pin 8. Then solder pins 2, 4, 6, 3, 5, 7.

### Soldering Inspection

1. Verify there are no shorts between adjacent solder joints
2. Verify all solder joints have the appropriate amount of solder.

# Testing

This board is relatively simple, so the electrical testing is relatively short. For other PCBs, the electrical testing section will be more in-depth

## Electrical Testing

1. Using a digital multimeter set to continuity mode, verify there are no shorts between pins. It’s useful to be on “beep mode”.
   1. My strategy is to hold the red multimeter lead on pin one, then contact all other pins. Then move the red multimeter lead to pin 2, then contact all other pins.
   2. Verified \_\_\_\_\_

## Integration testing

Integration testing involves testing the interfaces between the DUT and any other PCB, connector and mechanical enclosure the DUT will nominally interact with.

1. Verify the voltage taps from the batteries connect to the P1-P4 Verified \_\_\_\_\_
2. Verify the proper mating connector for J1 fits. Verified \_\_\_\_\_
   1. Perform a continuity check between the JST and the solder cup on the mating connector.
3. Insert the DUT into the 3D printed enclosure and verify mechanical fit Verified \_\_\_\_\_