

As Hardware Subsystem Co-lead, I'm covering the basics of processes and ideas that went into making the Fall 2018 Version of the High Current Hardware Box.

Velcro

Velcro is fuzzy side on the component and hook side on the box. The fuzzy side can hold onto bits of wire and other little pieces of material. Keeping the fuzzy side on the components means there's less chance of debris getting caught in a component.

Stripping Wires

Stripping wires is essential to making any wired connection. Usually, wires follow a standard gauge size, AWG, and can be stripped by matching the wire with the appropriate stripper. The blade of the stripper has a series of holes with numbers that correspond to wire gauge. Place the wire into that hole and squeeze the stripper and then give it a turn once around the wire. Pull the insulation off and the wire should be stripped. If the wire isn't a standard gauge, which quite a few are, then there is another stripping technique that is very similar to the first technique. Get a wire stripper that doesn't have the multiple holes. This usually has a yellow handle and the entire exposed metal acts like a blade but there is a notch for wires to be stripped with. Place the notch around the wire and squeeze slightly. You'd want to cut into only the insulation but it is easy to cut some wires in the process. Practice makes this easier. Squeeze through the insulation and then spin the wire strippers around the wire the pull the insulation off.

XT Connectors

XT connectors are used in a large majority of our electrical connections. There's two types, XT-60 and XT-90. The number means the number of amps each connector can handle. The XT-90s are larger in size. XT-60s are the most used connector and they can easily fit a "10" gauge wire. Those are wires that say 10 gauge on the package but aren't actually a standard 10 gauge size, or 10 AWG.

Soldering wires to XT connectors. I will be discussing the process of soldering wires to an XT-60 connector, but the same process should apply to XT-90s. Admittedly, I don't have much experience with XT-90s but I've soldered a lot of XT-60s.

First thing you'll want to do is figure out what kind of connector you have, a male or female. Male connectors have plugs that go into female connectors. The type is determined by the metal plugs within the connector itself and not the plastic housing. If you're choosing a connector, remember that power flows from female to male.

After determining the type of connector, you'll want to figure out which wire goes where on the connector. Wires are soldered to the little "cups" on the connector. Each side of the connector is marked with a "+" or a "-" on the side of the plastic casing. The "+" is always on the flat side while the "-" is always on the tapered side. The "+" side is for hot wires, which are usually red. The "-" side is for ground wires, which are usually black.

Finally on to actually soldering wires to the connectors. Strip the wires to about $\frac{1}{2}$ inch of exposed wire on the end. I usually twist the wire together with my fingers to make it fit into the cup easier. A Helping Hand is extremely helpful during soldering. Place the stripped end of wire into the cup of the connector. If you're soldering to a male connector, plug a female end into the other side to prevent the plugs from moving.

Next up soldering iron, turn the soldering iron on and make sure to wet the sponge, paper towel or whatever you use to clean the tip of the iron. Clean soldering tips make soldering easier. When the soldering iron is done heating up, tin the tip. Place solder onto the tip to coat it in solder. This makes soldering easier.

Now, Place the tip onto the wire, which should be in the cup. There is likely a pool of solder forming where the tips and wire connect. Start putting more solder into the pool. After a while, the solder should stop forming a bubble but then it will start to flow into all the nooks and crannies of the wire and cup. Keep adding solder until it looks flat and shiny. Remove the tip at this point. The connection should be secure now and very hot. Be very careful. Repeat the process with the other connection cup. Don't forget to add heat shrink to cover the joints. Make sure the heat shrink goes all the way up into the the connector.

Water Cooling Pipes

Keeping pipes secure means no leaking in the system. First, secure the pressure fitting to the water block. Tighten it to the water block by hand then tighten it a little bit more with a wrench. The pipes attach with a pressure fitting. They don't need that much tightening to be a secure connection.

Making Splitters or Multiple Wires in one XT Connector

Strip one wire longer than usual, like 1 inch of exposed wire. Then wrap other wires around the stripped wire. Wrap them around the part closest to the insulation. Solder them all together then place the longest end into the connection cup.

Picking Components for The High Current Box

Components are chosen for their function but needed to be rated for voltage and current. Our systems use DC current and as such components need to be made for that. For the box we developed and made, our components had to be rated 50 volts and around 100 amps. Voltage and current ratings are really important for any system but if I remember properly, current ratings are more important than voltage ratings.