Wall Switch Enclosure Summary

(designed using Autodesk Inventor)



Prototype 3D Printed Enclosure (Middle shows off Shapeways quality)

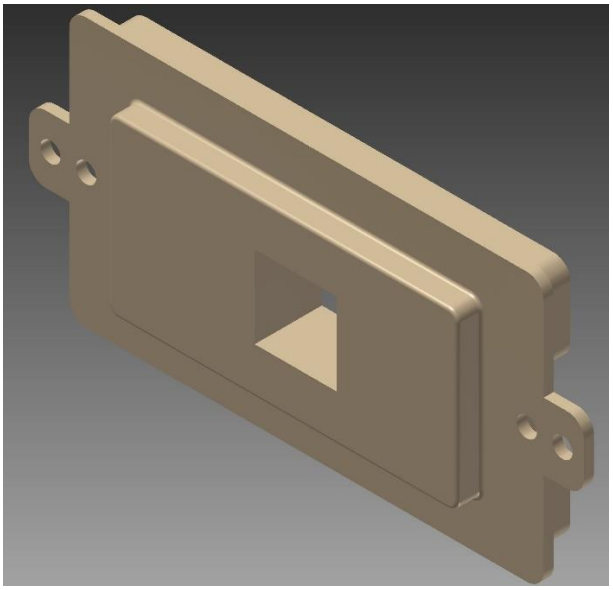
The enclosure design includes a front piece with one side of the piece designed to fit inside a Decora switch plate, and the other side of the piece to match the dimensions of the PCB, including mounting holes, and fit within the interior walls of the junction box. The back piece is a cavity to enclose the PCB and associated components, and is to be screwed into the front piece at 4 locations with the PCB is sandwiched between the two. The back piece also has holes for wire egress from the enclosure – a 16 AWG 120VAC hot wire (to be black), a 120VAC 18 AWG neutral wire (to be white), and a 16 AWG 120VAC switched output wire (to be red).

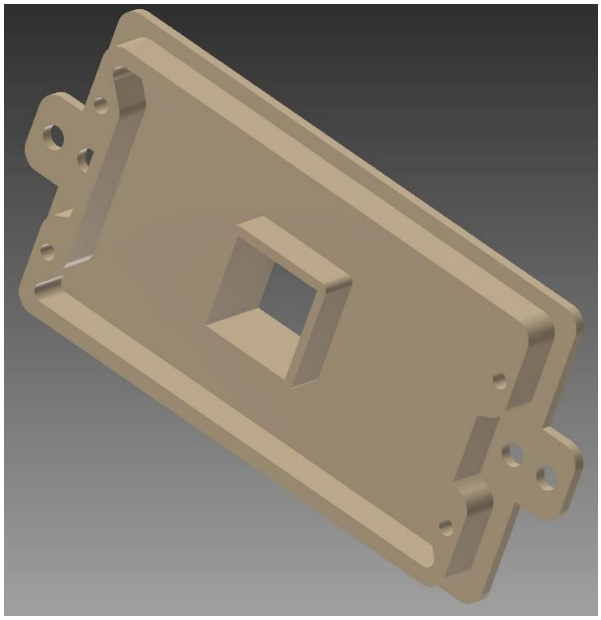

The design starts with the dimensions of a standard single gang US junction box, and the dimensions/shape of a rectangular hole in a Decora switch plate cover. Since the front piece must screw into the junction box, it was designed first. Simplifying the design, the following steps were taken:

Front Enclosure Piece

- Create a plate that will sit on the junction box, and screw into the junction box, with adequate thickness for strength. Include two holes on the plate for screwing into the junction box, and two holes for the Decora switch plate to be screwed to the Wall Switch.
- On one side of the plate, extrude a shape matching the X-Y-Z dimensions, and corner fillets to just fit into a Decora switch plate. Extrude a hole in the Decora extrusion to fit the capacitive touch button/display, and extend a border of that hole to the PCB (no way to even get a paper clip to the PCB that way).

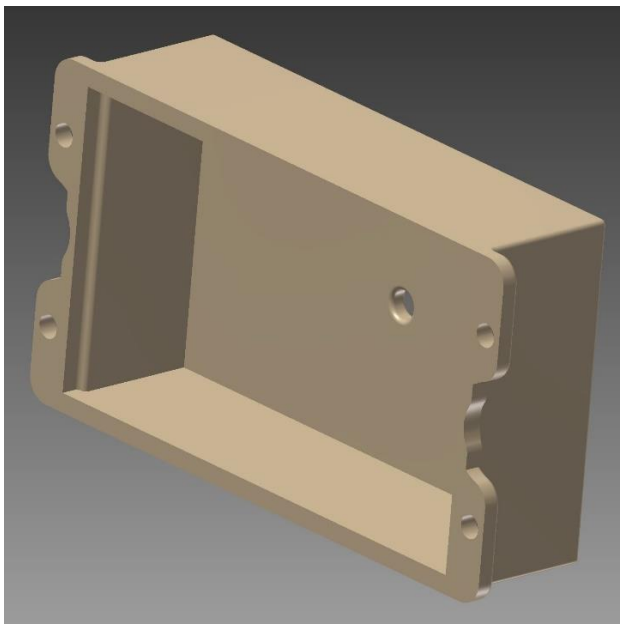
- On the other side of that plate, extrude a shape that fits into the junction box with adequate clearance of the inside walls, and is tall enough to handle the height of the Particle Photon side of the PCB. Include holes in the wall of this extrusion that match the PCB's mounting holes.
- Fillet as desired for smoothness of edges, reducing the amount of filament or resin that might be needed.

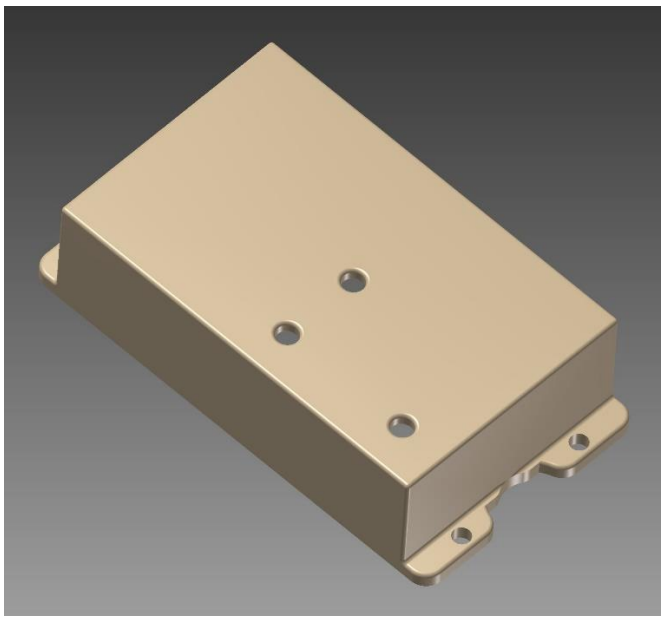




Back Enclosure Piece

- Create a rectangular plate shape that will exactly match the size of the PCB and the junction-box side of the front part of enclosure. Include mounting holes so that the back plate can be bolted to the front enclosure piece, with the PCB sandwiched in the middle.
- On that plate, extrude a rectangular shape, hollowed in the middle, that has sufficient wall thickness for good strength, that is tall enough and to enclose the components on the back side of the PCB.
- Place a cover rectangular plate on that hollow rectangle with sufficient thickness for strength, and include 3 holes for wire ingress.
- Fillet as desired for smoothness of edges, reducing the amount of filament or resin that might be needed.



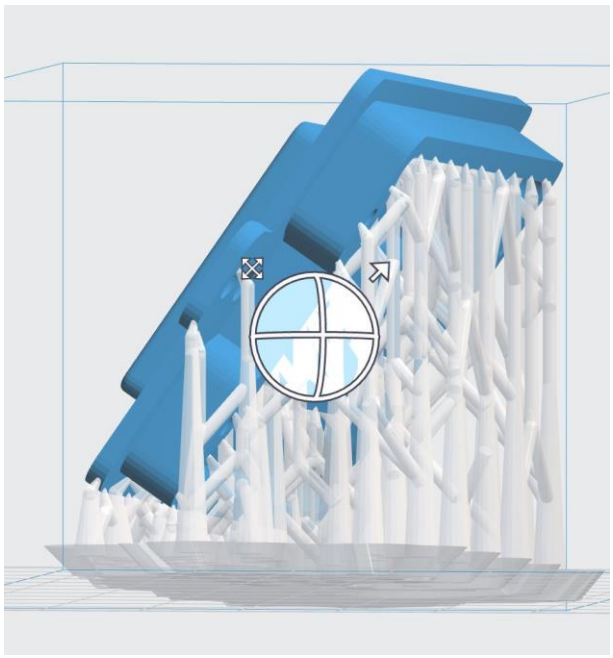


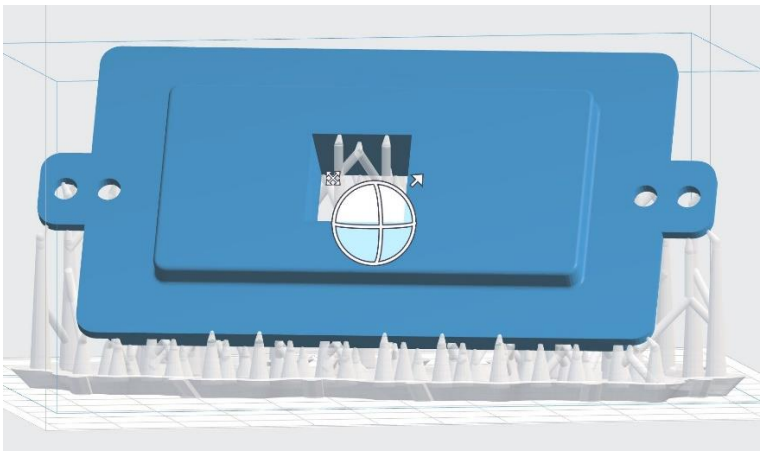
The front, because it is externally facing and is desired to be attractive, needs a fine white finish and it was expected that a run-of-the-mill 3D printer would be of too low a quality. That left 2 options. Go to Shapeways for a stellar but

very expensive print ($30+ dollars just for the front), or a stereo-lithography printer like the one offered by Formlabs (which happens to be available at my local TechShop – about $13).

The back, because it is never seen, is to be printed on my Type A Machines Series 1 at minimal cost.

When printing the front on the Formlabs, the support structure created by the Formlabs slicer took some tinkering. If you printed with the job flat, you get unattractive dimples that couldn't be easily removed. However, if you put the piece on angle, and had Formlabs generate the supports on the back of the piece, a very good print was obtained.





When printing the back on the Type A Series 1, the supports generated by the Cura slicer used with the machine did not do a good enough job. So, a support structure was added to the part in Autodesk Inventor. (The same was done for the front – designing a custom support for filament printing - but results were nowhere near as good as those on the Formlabs Form2).