Pick and Place User Manual

This manual will show how to get Hyrel Hydra FDM/PnP working.

Prerequisite: Understand how to print regular FDM plastic on the Hydra.

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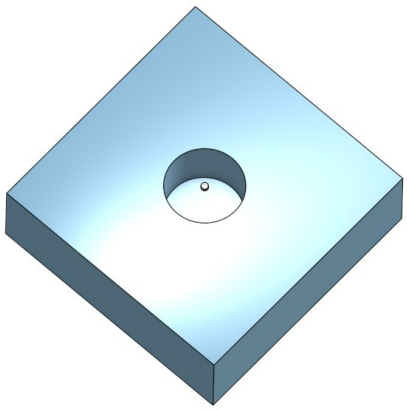
I. 3D Modeling

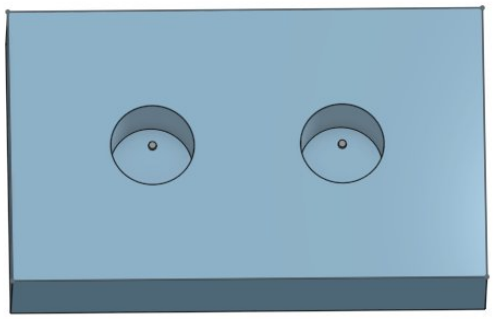
Modeling a FDM/PNP part with CAD program can be done just like modeling any other part. With the difference that a hole and a location pointer for the part needs to be made on the model. The following picture example would use Onshape CAD program, but the concept can be implemented on any other CAD program.

On the example below, a 3.2 mm diameter cylindrical magnet with 3.1 mm height needs to be implemented inside a 15 x 15 x 7 mm box. A hole inside the model is made with the shape and dimension of the magnet. The dot on the top of the hole specifies when and where the magnet should be placed inside.

The dot/pointer should be a cylinder modeled as a separate part from the main body. It should also be on the middle of the placing location on the last layer of the hole. the diameter of the the dot needs to be 2 times your printing layer height and extruded 1 layer height (e.g. layer height: 0.2 mm, diameter: 0,4 mm, extruded 0.2 mm).



For a multiple pick and place parts, the pointers needs to be made for each of the hole as separate parts.



If all is done correctly, you should have at least 2 parts; 1 for the main body, and 1 for each of the pointers. Continue exporting all the parts individually, and the model should be able to be sliced on Slic3r.

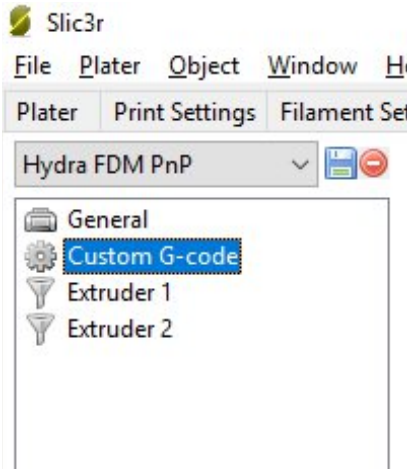
II. **Slicing**

Slicing the model will be done on Slic3r program. There are several steps to make sure that the pointers are recognized by the Slic3r as a different part.

1. Import the main body part to Slic3r. It is recommended to not adjust the position and orientation of the model yet.
2. Choose the right printer settings for printing: Hydra FDM PnP

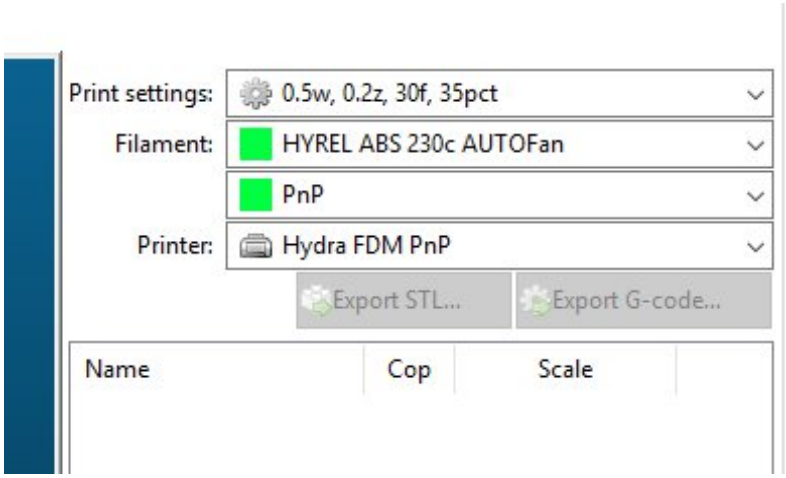
   If the printer setting is not available, create a new or modify an existing 1 head FDM printer settings with the following modification.

   change number of extruders as 2 . Set the first extruder as your FDM extruder and configure it as neede. Change the nozzle diameter of the second extruder into your default layer height (0.2 mm if consistent with previous examples).

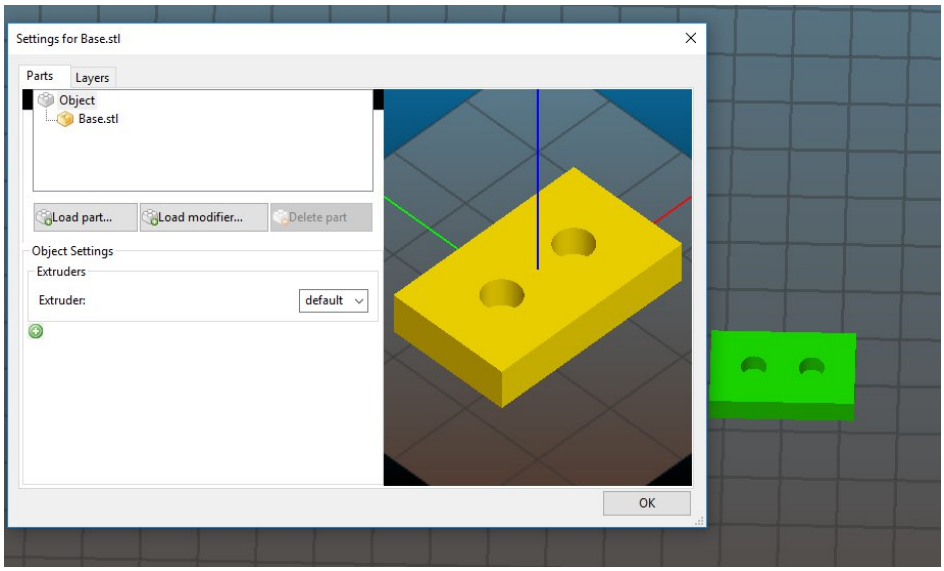


   Go to Custom G-code section and change insert ";Do PNP Stuff" on the tool change G-code.

3. Choose the right Filament setting for your FDM head, the filament setting for PnP head can be anything with 0 set on the temperature. If all selected correctly, you should have a print settings similar to this:

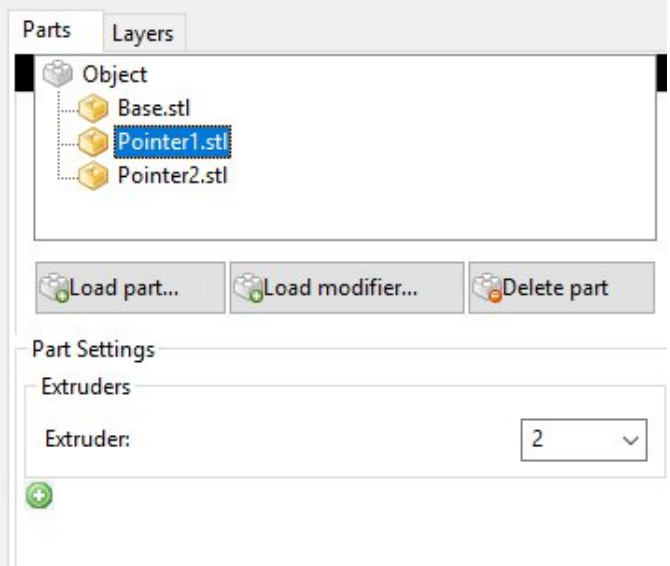


4. Import the pointers. This can be done by double clicking your main part where a window such as shown below will pop up.

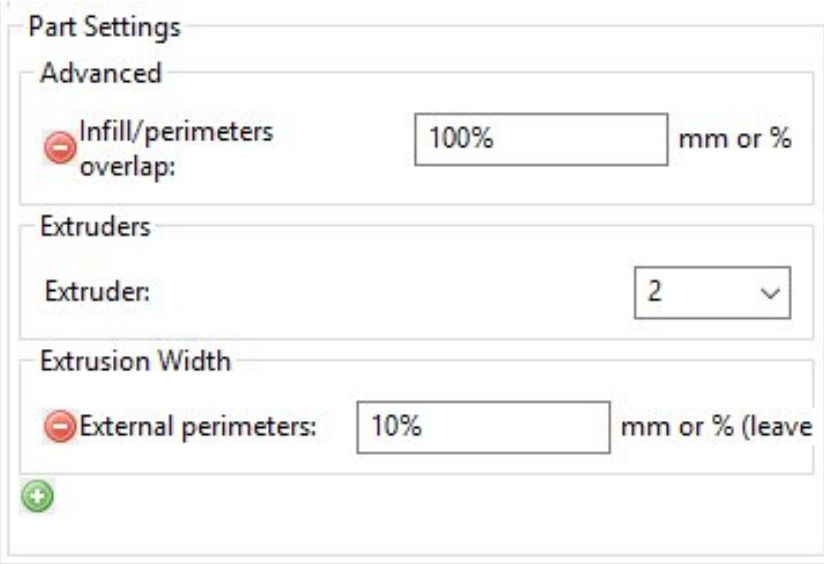


click on load part, and import all your pointers STL files.

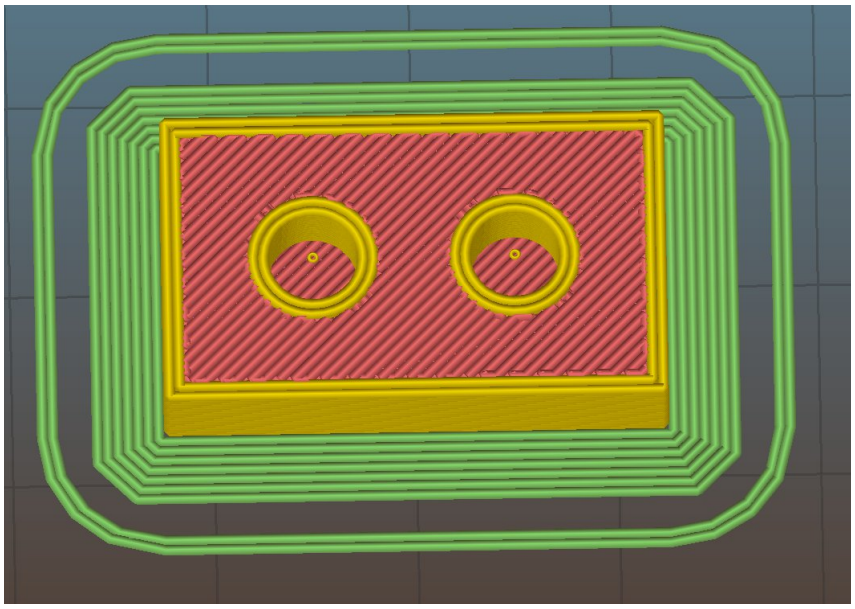
5. Change the extruder option on your main part to use extruder 1, and on your pointers to use extruder 2.



6. On the pointers STL files, click the green + button to add some custom options. This is necessary to make sure the Slic3r slices a really small part. Add Infill/perimeters overlap option, and Extrusion width: external perimeters option. Set the infill/perimeters overlap value into 100%, and the external perimeter extrusion into 10%



7. Now the model can be sliced. exit the part loader window and click export model as G-Code. Save the gcode file on the directory you want to save it. To check if the pointer got sliced correctly, go to layers tab on Slic3r, and move to the layer where you put the pointer. It should show a thin perimeter like shown here

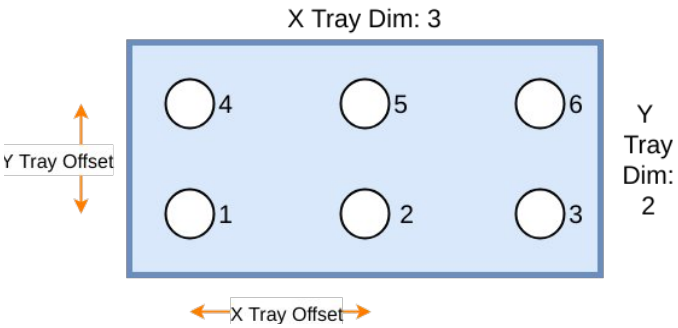


III. **Parsing**

Parsing the G-code is done using the PnP Parser software. The parsing process would change the gcode that contains changing tool head and extruding pointer perimeter into gcode that pick up parts from the parts tray and move it to the middle of the perimeter point.

The parser works with the concept that the parts that would be moved is placed on a tray of uniform parts equally spaced between one and another. The tray itself can be customly made by 3D printing. It needs to be on the same level with the build platform or higher and has equal distance on the X and Y axis. before parsing the gcode can be done, 11 custom options needsto be filled out.

- First X Tray Point and First Y Tray Point corresponds to the X-Y coordinates of where the first part to pick is located (Relative to the Pick and Place tip). To find this values, first home the print head. Once X and Y is 0, move the print head(s) manually using Repetrel control interface or other control interface. Move it until the Pick and Place tip is exactly on top of the first part to pick. Enter the X-Y value into the parser.
- X Tray Offset and Y Tray Offset are the offset of the part tray in X and Y direction. The parser would pick parts with the order: Bottom left, go all the way to the right (defined by Tray X Dim and Tray Y Dim), move back all the way back to the left and up by one , and repeat this until the last tray point.



- Head X Offset and Y Head Offset is the offset X and Y offset between the FDM head and the PnP head. This is needed because the sliced g-code is relative to the FDM head, including the pointers. So the offset is needed to correctly put the parts on the pointers. This can also be found manually by moving the FDM head to a certain position, take note of the coordinates, then move the PnP head to the exact same position and also take note of the coordinates. The offset would be the difference between this two coordinates.
- Main Head pos and PnP Head pos are the position of the head located on the Hydra print head mount. The most left position is 11 and it increase by one each right. So the position are 11, 12, 13, 14, 15. Put the position of these heads accordingly.
- Tray Item height is the Z position of where the Head should pick up the part. This is also needs to be found manually by first zeroing the Z position (proper bed leveling is a prerequisite). and then move the PnP head just right on top of the part to pick. Put in the Z position into the parser.

With all the settings inserted, you can save it into a regular text file with the Save button. To load an existing settings, use the Load button and choose your setting.

Now you can Load your G-Code, Click Parse, review your gcode, and Save the parsed gcode.