

# Rack and pinion stage module for Galileo Microscope



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## Summary

A stage module moved by rack and pinion gears for better control over the default stage module.

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This mod addresses some useability downsides with the dual M5 screw movement of the standard module. The independent rack and pinion movement for x and y prevents the binding issue of the two interconnected knobs, and the new gears incorporate springs in order to eliminate backlash and shake inherent with the design of the basic module.

Despite being more complex, it is also easier to assemble and maintain.

There is a basic version and a variant with fine movement knobs, if in doubt, print the latter, there is always time to remove the fine movement knobs if you change your mind, and replace them with the blank plugs which are also provided, going the other way wastes a lot of plastic.

## Bill of Materials

**This mod replaces the entire stage module, you will be able to recover only the clips and screws of the stage, therefore they are not listed in the BOM, you may also be able to recycle the PTFE tube if you can cut it and use it for the short backers, but you will still need more anyways.**

One set of printed parts, printed using the same settings as the rest of the microscope.

- 7x M3 locknuts.
- 5x M3x10 SHCS screws for adjusting the rails (longer screws will also work)
- 2x M3x16 SHCS screws for holding the knobs
- 2x M3x20 SHCS screws and another 2x M3 locknuts if you use the fine movement variant.
- About 70 cm of PTFE tube
- 6x 8x20 mm bed leveling springs
- super glue

**CAREFUL!** Unlike the anti backlash on the focuser knob, in this case 8x25 mm springs will not work

## Assembling

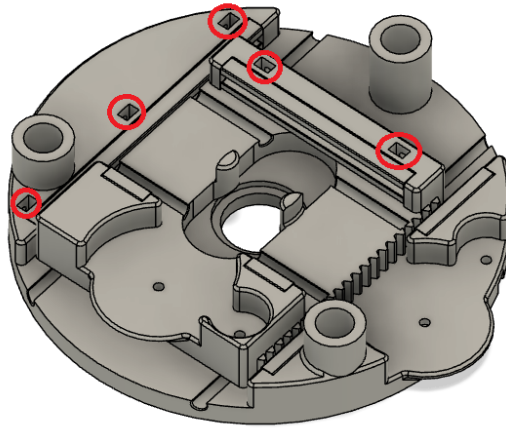
Remove the sacrificial layers from the following components, poking trough them with an M3 screw, and paying attention to remove any burr.

- module
- lower plate
- Upper half of the big knobs
- Fine kobs

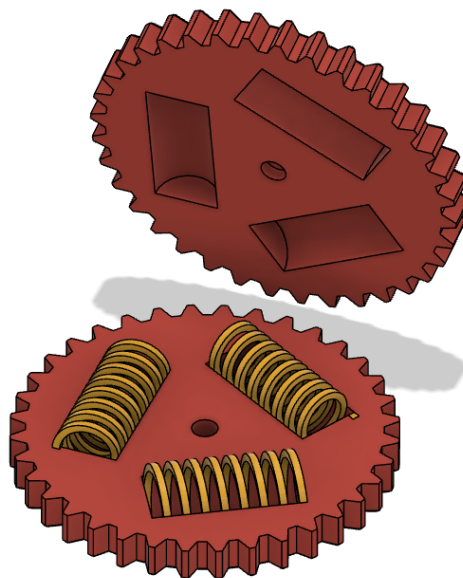
Insert PTFE in all the pieces with a slot for it.

The slots in the module and upper plate are open on the ends, meaning that the PTFE will tend to slide out, after you test fitted and cut to measure, add a few drops of superglue in the slots and press the ptfe on it so it will not budge.

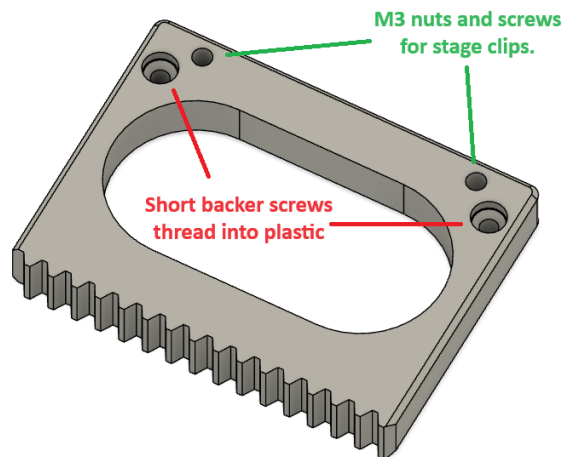
Add the M3 locknuts in the slots on the module and lower plate, and the screws, but to not tighten them yet, give them just a couple of turns so that neither the screws nor the nuts can fall out any more.



Assemble the knobs by placing springs in the slots of the lower half, then leaning the upper half on it, and with the help of any flat tool (I used the back of a knife, but be safe) compress the springs so that they snap in the upper slots too. The spring pressure should be enough to keep the two sides together. If you have troubles keeping the wheels aligned while you compress the springs, you can pass the M3x16 screw in them and a temporary M3 nut.



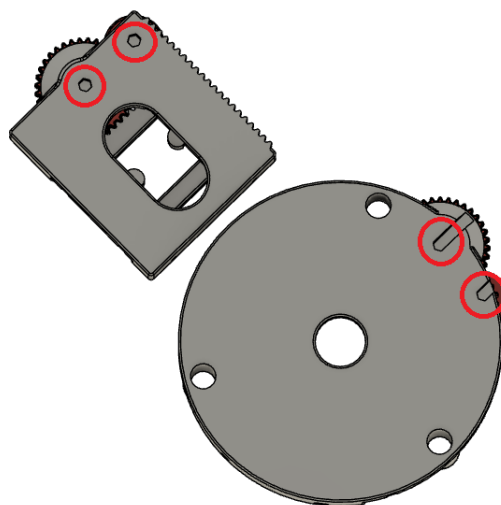
Prepare the upper plate by adding 2 M3x8 screws in the large holes, thread them in the plastic, until the head pokes out by a bit less than 1 mm, these will serve as stoppers for the slides, so they must be about the same height but not taller. Install also the clips using the M3 screws and nuts that should be included with them.



Insert the backers in the module and upper plate, they should snap fit and will be held in place by the plates, if they are loose, you can use a tiny bit of paper to shim them. They must be level with the rack on the lower and upper plates to prevent it from tilting as the wheel moves past the centerpoint. If you need to shim them, you should pay attention that they don't stick out too much that the wheel can't engage, nor too little that the plates can tilt.

Insert the rail in the back of the lower plate, followed by the upper plate which should slide in place freely.

Insert the lower knob in the module, aligning the teeth with the rack on the upper plate. Secure it with the locknut on the bottom of the lower plate and the M3x16 screw. You may add some grease on the bottom of the knob, but do not grease the teeth especially if you will use the fine focusing version, or you will get greasy fingers when you turn it.



Now it is time to tighten the screws on the back of the rail. Start by tightening them equally until they are in contact with the back of the rail

(you will see a tiny gap forming between the rail and its seat), then by another couple of turns. Test the sliding of the upper plate, it must move freely but with zero wobble. Tighten and let go the screws, and the screw holding the knob, until you are happy with the results.

**IMPORTANT!** Look at the plate movement from the side too, a consequence of the anti backlash split of the knobs is that the plate may tend to pull up on one side. The compression applied by the screws prevents this too, and I found that the best result is achieved by keeping the side which pulls up a bit tighter than the other.

If you are assembling the fine movement version, install now the fine movement knobs using the M3x20 and M3 locknuts.

You may notice that there may be a combination of spots where the knobs run better on each other and on the rack. The system will not use one full turn of either of the knobs, so there is no harm in trying different orientations to look for the "alignment of the sweetspots".

Install the backers and rail in the module body, followed by the lower plate and knobs, with the same procedure and cares used for the previous stage.

## This remix is based on



**GALILEO Modular Microscope**

by XVIlarcano

## Model files



**lower-rail.stl**

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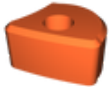
**knob-lower-x2.stl**

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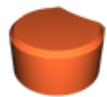
**upper-rail.stl**

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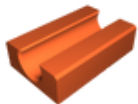
**plug-lower.stl**

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**plug-upper.stl**

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**upper-backer-x2.stl**

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**knob-upper-x2.stl**

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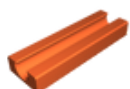
**module.stl**

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**lower-plate.stl**

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**lower-backer-x2.stl**

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**lower-plate-fine.stl**

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**fine-knob-x2.stl**



**module-fine.stl**



**upper-plate.stl**

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