

## Mini Optical Alignment Mechanism & Workbench



yba2cuo3

[VIEW IN BROWSER](#)

updated 2. 11. 2024 | published 2. 11. 2024

### Summary

This is a handy Mini Optical Alignment Mechanism for 360° adjustments in the X-Y direction and a  $\pm 10^\circ$  tilt in the Z.

[Learning](#) > [Other 3D Objects for Learning](#)

Tags: [engineering](#) [laser](#) [classroom](#) [scienceproject](#) [scienceeducation](#) [wormgear](#) [teachingtool](#) [optical](#) [physicsproject](#) [physicsexperiment](#) [mathematicaldesgin](#) [physicsdemonstration](#) [educationalproject](#) [positioner](#) [educationaltools](#) [lightshow](#) [physicslab](#) [classroomtools](#) [physicsdemo](#) [physicsclass](#) [opticalworkbench](#) [laserart](#)

This **MiniOptical Alignment Mechanism** is a practical adjustment instrument designed to enable the precise positioning of lasers & optical components in all three dimensional spaces; i.e. X, Y, and Z. It includes a generic mounting platform for compatibility with a wide range of optical devices (with the use of an appropriate adapter); a dedicated mount for a 6mm dia. laser diode and a 25mm dia. mirror mount. The worm gear mechanism allows for smooth and accurate adjustments, ensuring optimal

alignment in any test scenario. The design makes it an essential tool for any project requiring reliable positioning of optical components, from scientific or classroom experiments, to hobbyist projects, it delivers a cost-effective solution in a compact easy-to-use system.

## **STAY TUNED FOR UPCOMING PROJECTS INVOLVING THIS OPTICAL ALIGNMENT MECHANISM!**

**Project Challenge #1:** [Lissajous Figure Laser Light-Show Pattern Generator & Projector by yba2cuo3 | Download free STL model | Printables.com](#)

### **Features**

- Adaptable Mini-Optical Workbench for Demonstration & Experimentation;
- 360° Fine-Tunable Alignment Mechanism in the X-Y direction using Worm Gears;
- $\pm 10^\circ$  Z-Tilt Adjustment using 3-sided pivot springs & screws;
- 6mm dia. Laser Diode Mount;
- 25mm dia. Mirror Mount;
- Generic Component Mount to fit other optical components with custom adapters.
- Dimensions: 165x165x40mm

It is designed to be used with this mini-optical workbench: [Mini Optical Workbench by yba2cuo3 | Download free STL model | Printables.com](#)

### **Print Settings**

- **Printer brand:** Prusa
- **Model:** i3 MK2S
- **Supports:** Yes
- **Resolution:** 0.15mm OPTIMAL
- **Infill:** 20%
- **Brim:** Yes - 10 to 20mm
- **Filament brand:** Doesn't matter
- **Filament material:** PLA
- **Filament color:** Doesn't matter

### **Construction**

The construction is relatively simple, making use of M3 hardware. A list of assembly material is provided below, along with where it's used. Also check the description associated with each file for more assembly details.

### **Assembly Tips:**

- Don't forget to insert the small printed sleeve inside the worm gear shaft hole to prevent wobbling;
- There are 3 elongated mounting holes in the Mini Optical Workbench. This is where the worm gear screw/shaft goes. The slot allows for the adjustment of the worm gear distance to the worm with the ability to achieve a smooth & consistent rotation between both parts. When tightening the shaft nut, make sure that it is tight enough to prevent lateral or up & down movement of the gear, but not too tight which would prevent the free rotation of the gear;
- The worm contact location on the worm gear can also be adjusted slightly; i.e. either ahead or behind the gear, by moving the position of the collars on the worm shaft;
- Make sure that there is minimum play between the collars & pillow blocks but not too tight also to allow the free rotation of the worm.
- If everything is properly adjusted, the worm & gear should turn freely without any skipping of teeth or seizing.

### **List of Required Assembly Hardware**

All HW is Stainless Steel Button Head Hex Socket Head Cap Screws and Nuts, unless specified otherwise.

### Common (per Worm Gear Assembly)

Qty	Description	Where Used
2	M3 washer	Worm gear shaft washer - under screw head & nut
1	M3 Nyloc nut	Worm gear shaft nut - install under workbench
4	M3x8 screw	Pillow blocks
2	M3x8 screw	Collars used on worm to restrict travel
1	M3x8 screw	Knob at end of worm
1	M3x16 screw	Worm gear shaft
3	M3x16 screw	For Z-adjust. Secures worm gear to laser, mirror or generic mount
3	4mm Spring	Ball point pen Compression Spring for Z-adjust. Wire Diameter 0.4mm x Outer Diameter 4mm x Length 15mm. Note: You can cut your ball point spring to the appropriate length. Check: <a href="#">Amazon-spring</a>

### Laser Mount

Qty	Description	Where Used
2	M3x8 screw	For Laser mount (top)
1	6mm, 5mW Laser Diode	For Alignment of optical components. The wire leads will need to be soldered to the USB-c PCB; i.e. red wire to Vcc (or V marking on PCB) & blue (or black) to GND (or G). Check: <a href="#">Amazon-Laser</a>
2	M3x8 screw	For installing the USB-c PCB on the Laser Bottom Mount
1	USB-c PCB	Female Socket for powering the +5VDC Laser. Use a standard +5VDC USB AC adapter. Check: <a href="#">Amazon-USBc</a>

### Mirror Mount (per)

Qty	Description	Where Used
2	M3x8 screw	For Mirror mount top
1	25mm Mirror	For Alignment. Check: <a href="#">Amazon-Mirror</a>
1	Tape	Double sided tape for securing mirrors on mounts

### Post Processing Tools

### Generic Component Mount (per)

Qty	Description	Where Used
1.	Deburring tool	For removing excess plastic from printed parts
2.	Hand Drill or Drill Press (optional)	For mounting generic components with custom adapter. You will need to design your own custom adapter to fit your special parts.
3.	2.5mm or 3/64" drill bit	For enlarging holes for M3 tap (optional) you want to test.

### DISCLAIMER:

This project incorporates a **Class 3R (IIIa) laser** with a power output of **5mW**. This laser is designed for safe use under controlled conditions.



## Safety Precautions:

- **Do not stare into the laser beam directly.**
- **Avoid pointing the laser at reflective surfaces or at eyes.**
- **Keep out of reach of children.**
- **Use of protective eyewear is recommended for prolonged exposure.**

By using this product, you acknowledge and accept all associated risks and responsibilities.

## Model files



### Assembly

1 file



**mini\_optical-alignment-mechanism.obj**



### Common (Worm Gear Assembly)

5 files



**worm\_gear.stl**



**worm.stl**



**dual\_worm\_pillow\_block.stl**



**gear\_shaft\_sleeve\_v2.stl**



**dual\_collar.stl**

☐ For preventing the worm from moving in the pillow blocks.



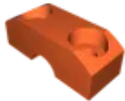
## Laser Mount

2 files



**laser\_mount\_bottom\_wusb\_pbc\_mount\_v4.stl**

☐ Holds both laser & USBc PCB



**laser\_mount\_top.stl**

☐ Holds the laser.



## Mirror Mount

3 files



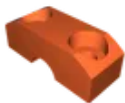
**mirror-mount-fix.stl**

☐ Mirror gets attached on bottom side with double-sided tape



**mirror\_mount\_bottom.stl**

☐ Holds the shaft of the mirror mount



**mirror\_mount\_top.stl**

☐ Holds the shaft of the mirror mount



## Generic Mount

1 file



### generic\_alignment\_mount.stl

☐ Generic mount so you can add your own custom component adapter

## License



This work is licensed under a  
[Creative Commons \(4.0 International License\)](#)

**Attribution—Noncommercial—Share Alike**

- 
- ✗ | Sharing without ATTRIBUTION
  - ✓ | Remix Culture allowed
  - ✗ | Commercial Use
  - ✗ | Free Cultural Works
  - ✗ | Meets Open Definition