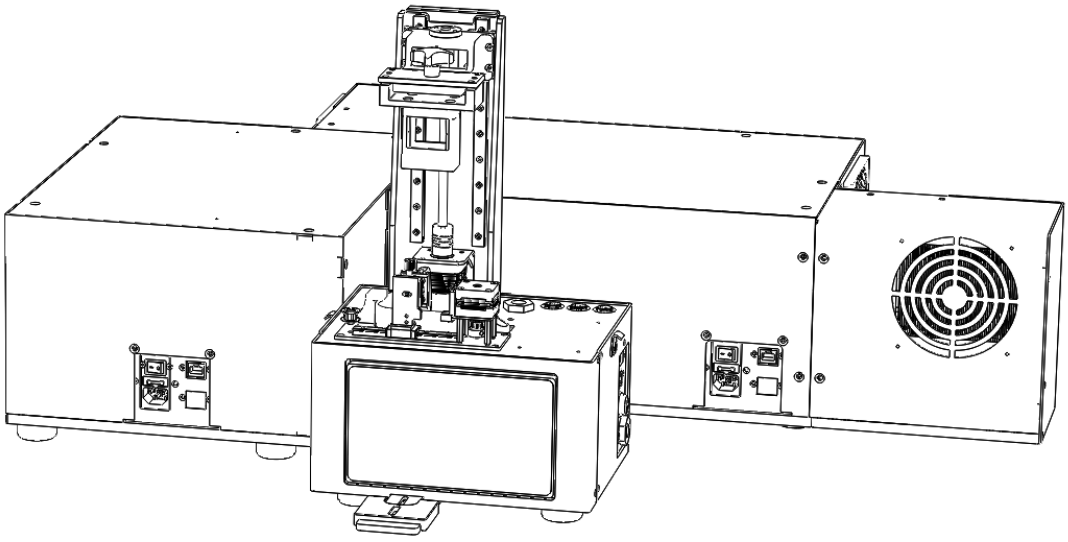
MonoPrinter.com

MONO3Z4 (4CH) Initial Assembly & Alignment

Rev. 1.1



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Revision History

Rev. 1.0	11-18-2020	Initial draft
Rev. 1.1	06-23-2022	Update based on Mono3Z-V2 design

Please read thoroughly and contact us if you have any further questions or suggestions at info@monoprinter.com

1. Preview of the final setup after assembly and alignment

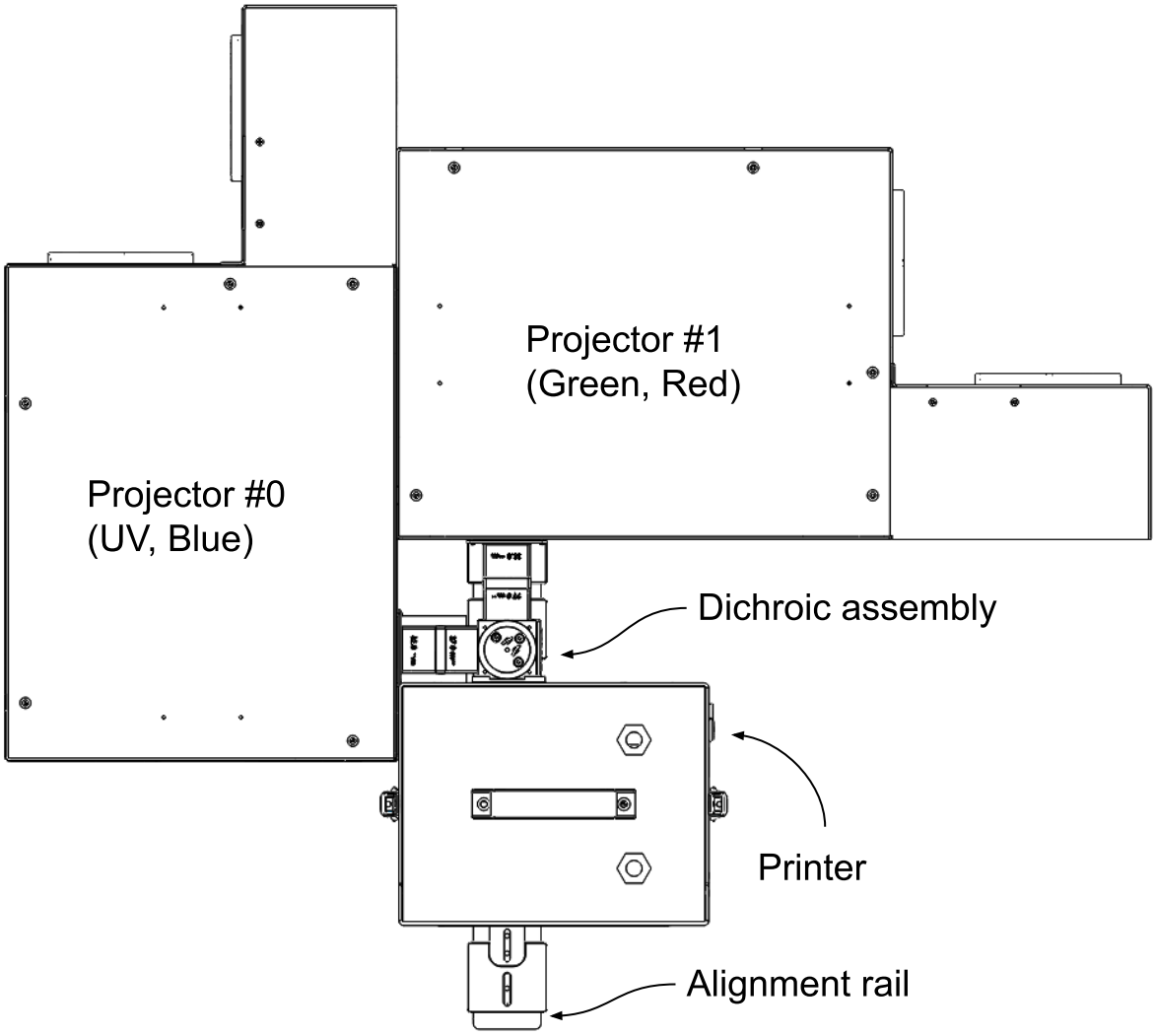


Fig. 1. Diagram of fully assembled 4CH printer

- After the system is fully assembled and aligned, the system should look like Fig. 1. All details will be followed.

2. Identify each sub-assembly part

- The 4CH printer consists of 4 sub-assembly parts: Projector #0, Projector #1, Printer, Alignment rail, and Dichroic assembly.
- Identify each sub-assembly and check everything is in good condition.

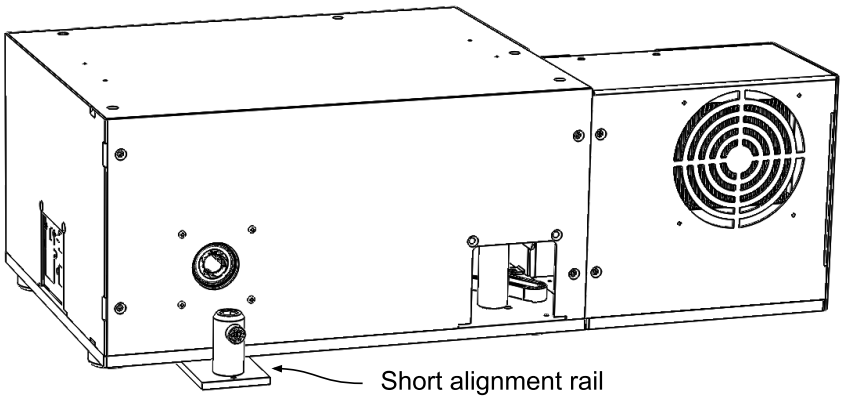


Fig. 2. Projector #0

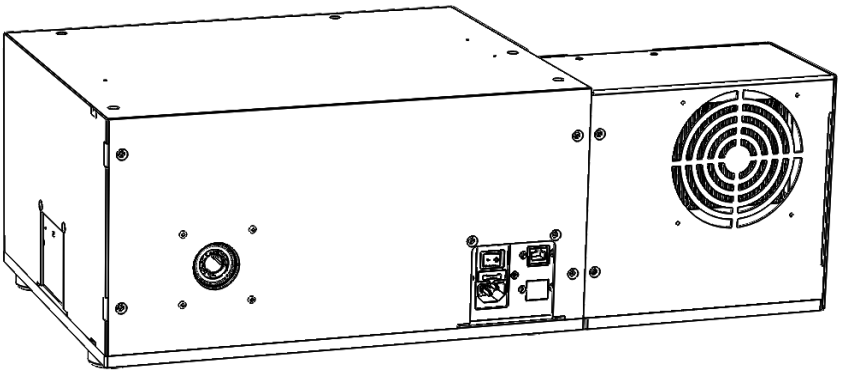


Fig. 3. Projector #1

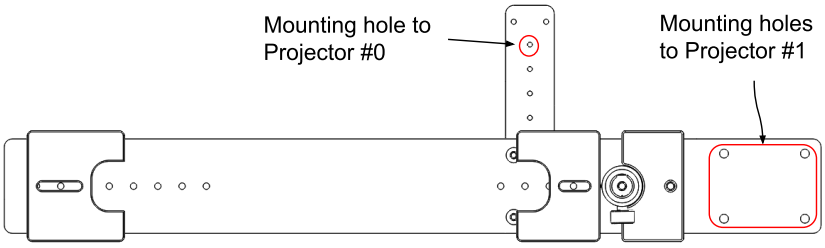


Fig. 4. Alignment rail

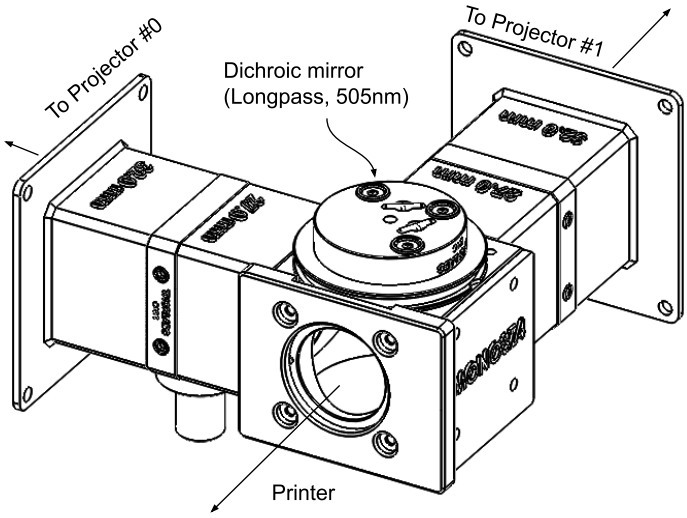


Fig. 5. Dichroic assembly

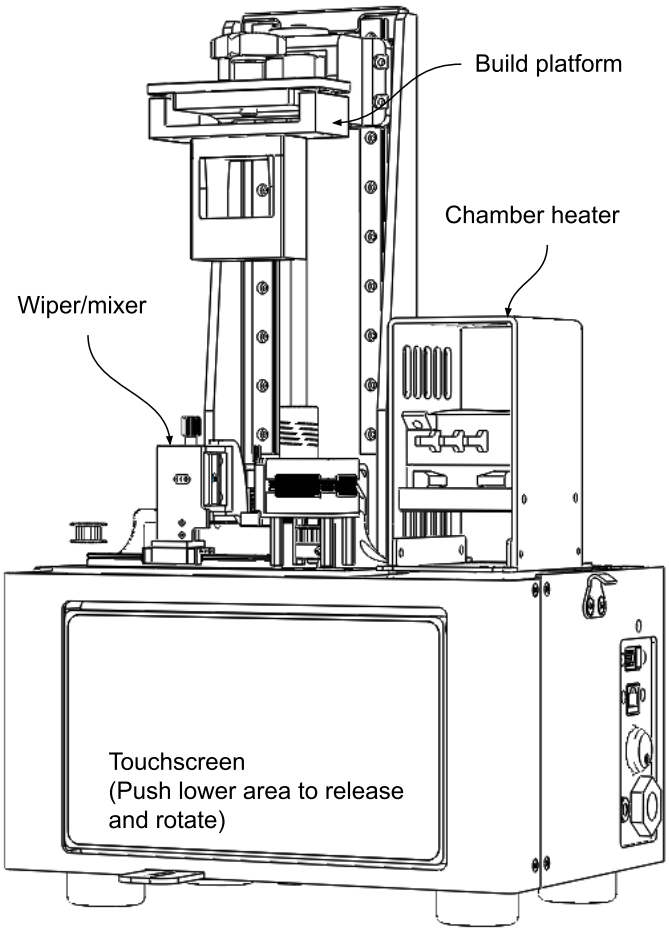


Fig. 6. Printer with heater and mixer assembled

3. Assemble the alignment rail to Projector #1

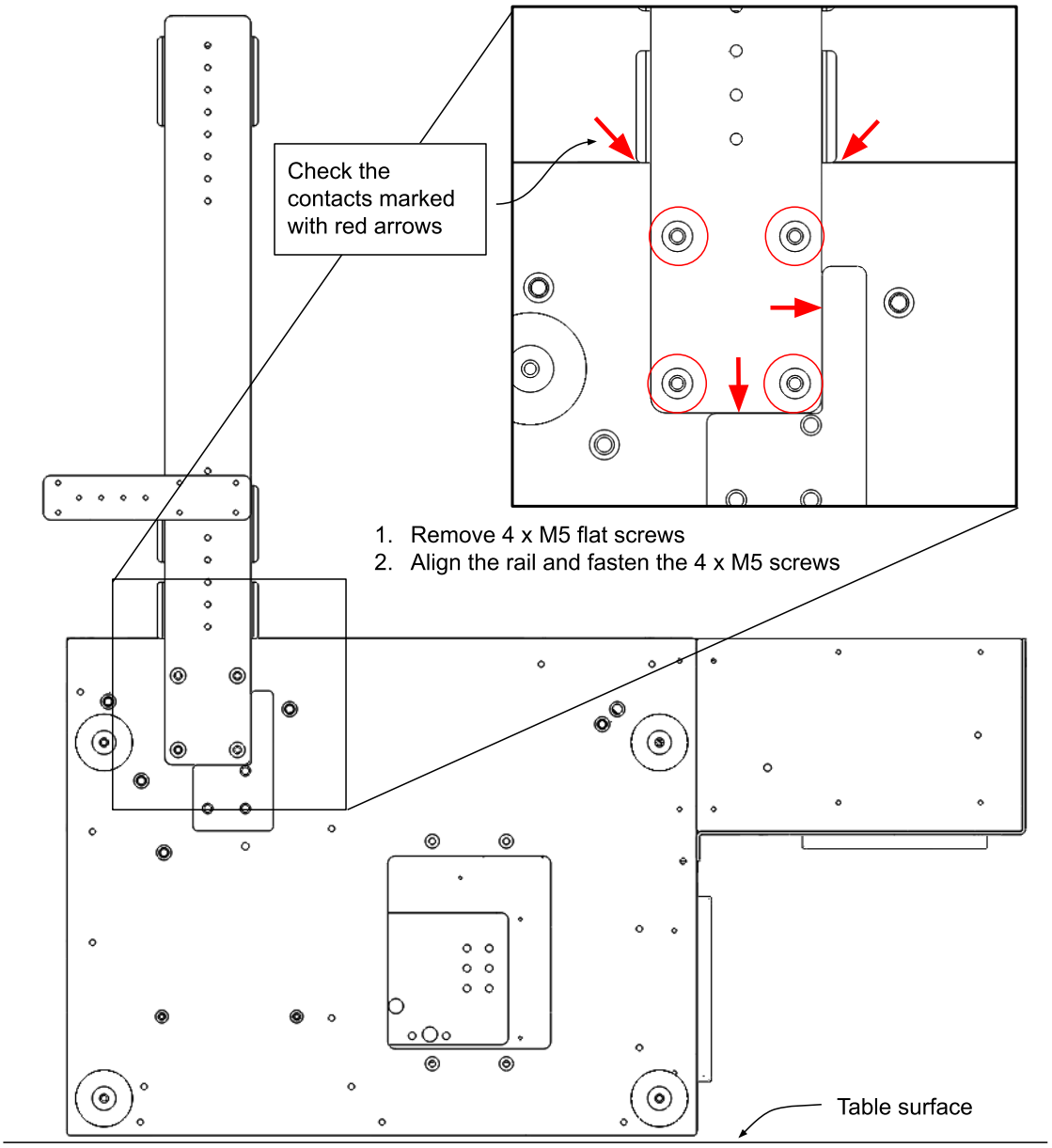


Fig. 7. Assembly of the alignment rail

- 4 x M5 flat screws are installed at the bottom of Projector #1. Remove them first.
- Place the alignment rail while checking the contacts of alignment structures (red arrows)
- Tighten the M5 screws.
- The alignment rail should be as vertical as possible. If it's not installed correctly, the dichroic assembly won't fit properly.

4. Alignment between Projectors #0 and #1

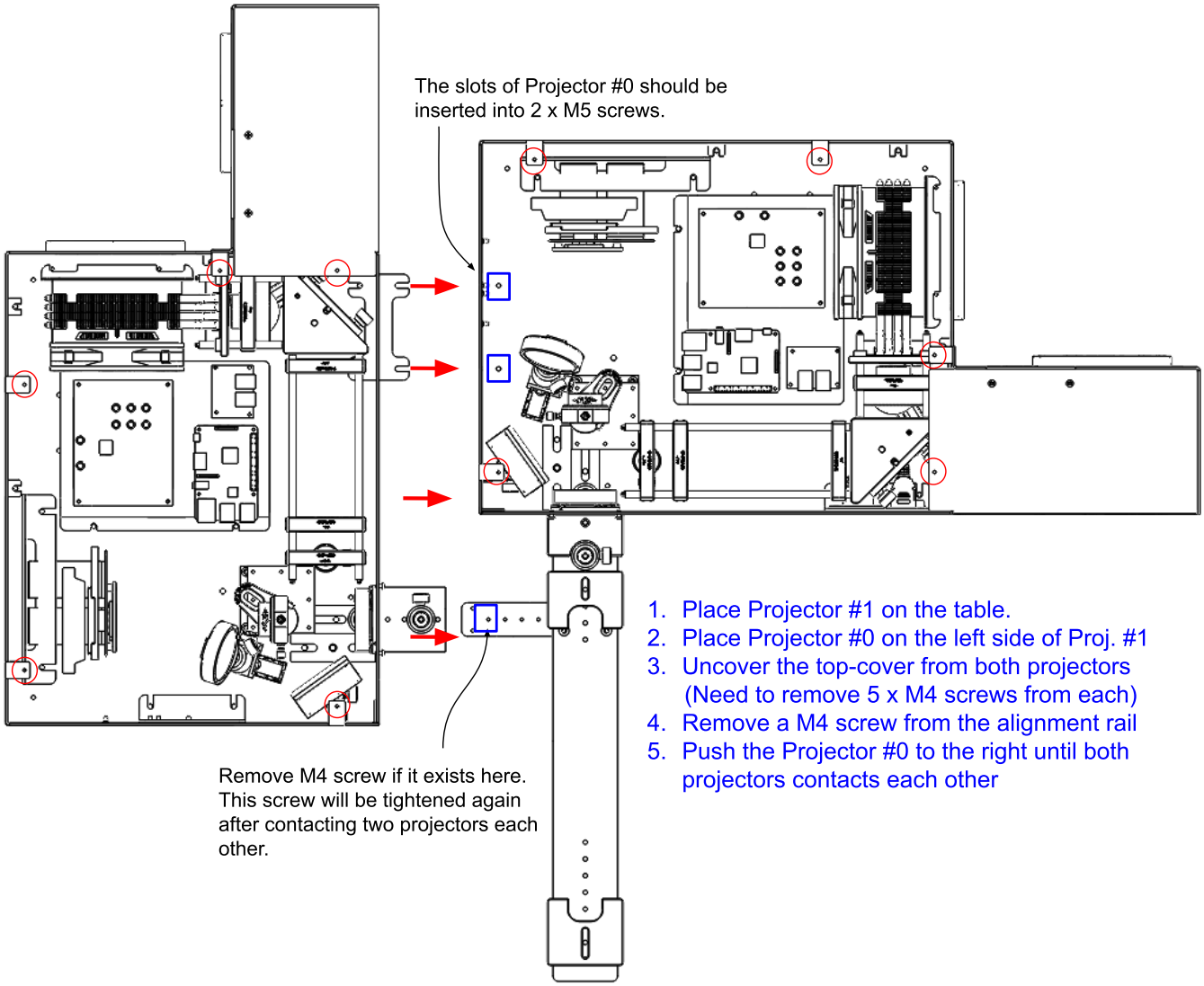


Fig. 8. Remove the top cover from both projectors

- Follow the 5 steps shown in Fig. 8
- After contacting two projectors each other, the M4 screw (M4 x 10, socket screw) should be tightened again. If the alignment rail is not correctly assembled in Step 3, the M4 screw hole won't be aligned well. If so, go back to Step 3 and check the installation of the alignment rail.
- If the M4 hole is well aligned, tighten all three screws (1 x M4, 2 x M5 screws inside Projector #1)

5. Attach the dichroic assembly and printer

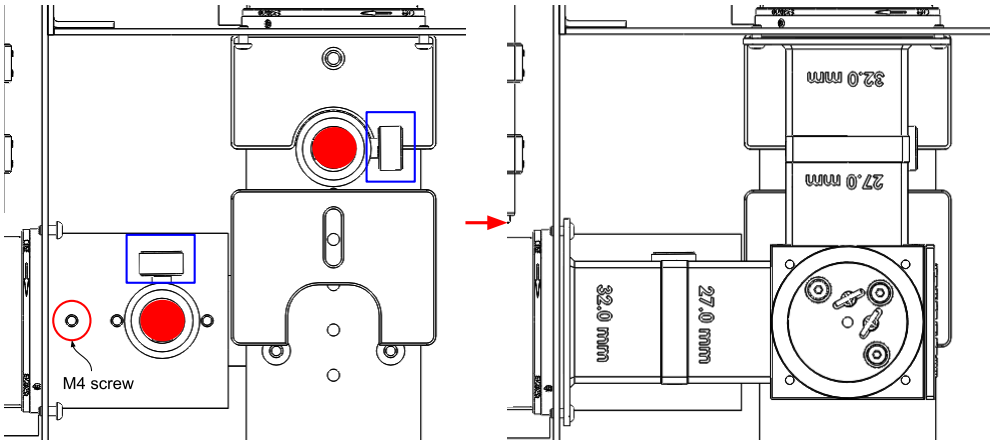


Fig. 9. Assembly of the dichroic mirror

- In the previous step, the M4 screw should be tightened
- The dichroic assembly has two ½" posts and they should be inserted into the corresponding post holder (red filled circles).
- If the alignment process (step 3-4) is not correctly done, the ½" posts won't fit well. Check if they are inserted into the post holders smoothly.
- After the posts are inserted, then tighten thumb screws (blue boxes) to fix the position.

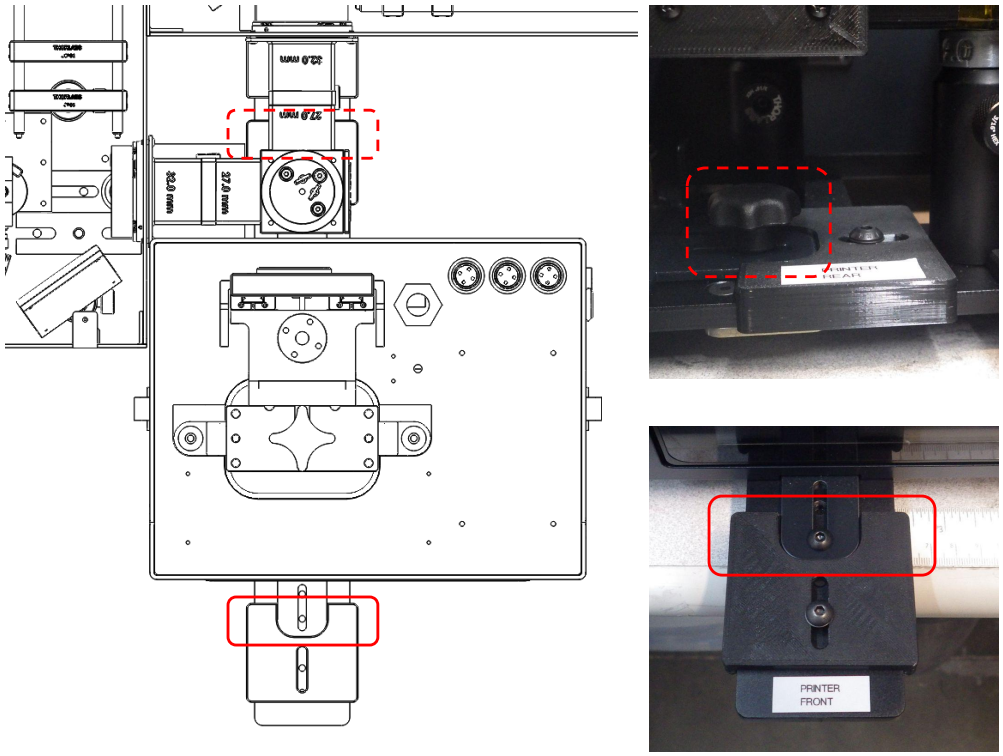


Fig. 10. Attach the printer to the system

- Before attaching the printer, the alignment rail should have two screws (1 x M5 screw, 1 x hand screw). Remove them. They will be used to fix the printer position.
- Place the printer and align its front and rear flaps to the alignment guides.
- Push the flaps and make sure they are fully inserted.
- Tighten two screws on the front and rear flaps to fix the position.

6. Cable connections (Power and network)

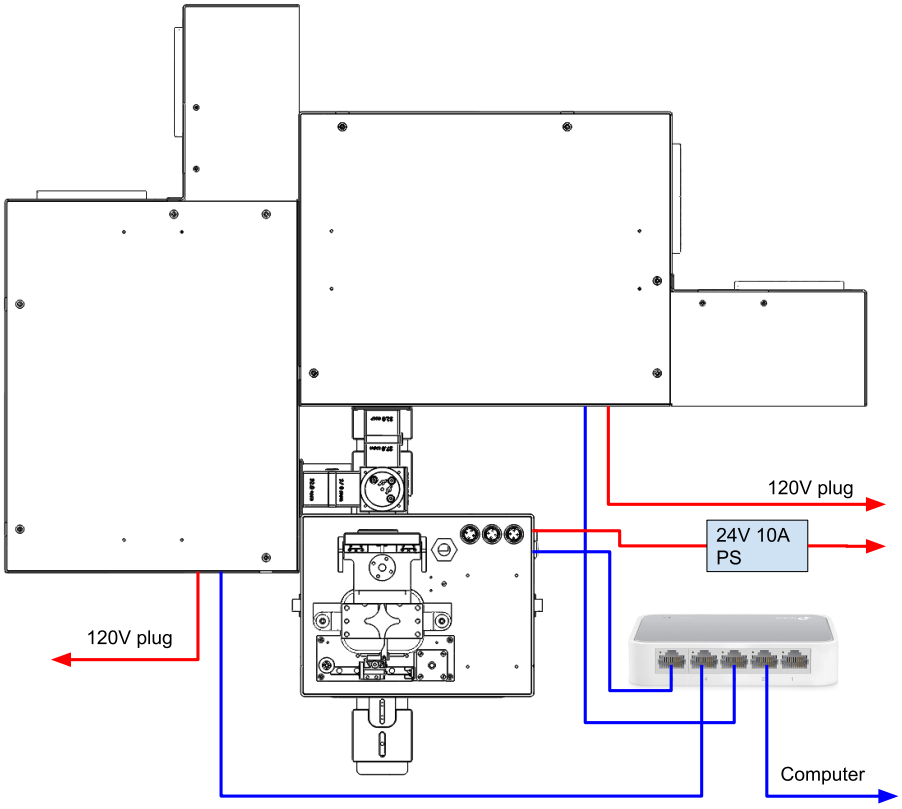


Fig. 11. Cable connections

- Find a network switch (with 5V power supply), 24V 12A power supply (for printer), 2 x power cords, 3 x ethernet cables.
- Connect both network and power cables as shown in Fig. 11.
- There is no specific position for ethernet cables on the network switch.
- (Optional) connect between the network switch and a computer using 4th ethernet cable. This will be needed when I need to remotely connect the printer and projectors through your computer. ***RealVNC*** and ***AnyDesk*** should be installed on the computer.

  RealVNC viewer: https://www.realvnc.com/en/connect/download/viewer/windows/
  AnyDesk: https://anydesk.com/en/downloads/windows

  Please let us know your ***AnyDesk address*** (9 digits) when you need remote support.

7. **Turn on projectors first, then turn on the printer.**
   - This turning-on sequence will help detect two projectors from the printer.

8. **Go to control page and perform homing first**

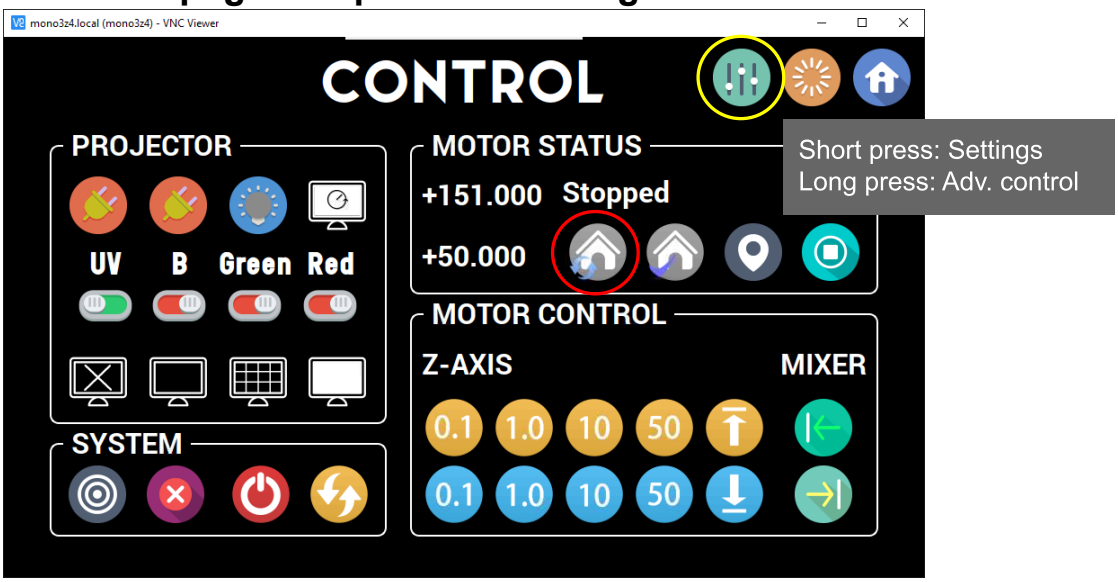


Fig. 12. Control page

- After about 1 minute, the system will be booted up. Then press CONTROL to move to the control page as shown above.
- Perform homing (red circle). Then the current platform position will be 151.000 (mm) and the mixer position will be 50.000 (mm)
- Then press and hold the setting button (yellow circle) to move to the advanced control page

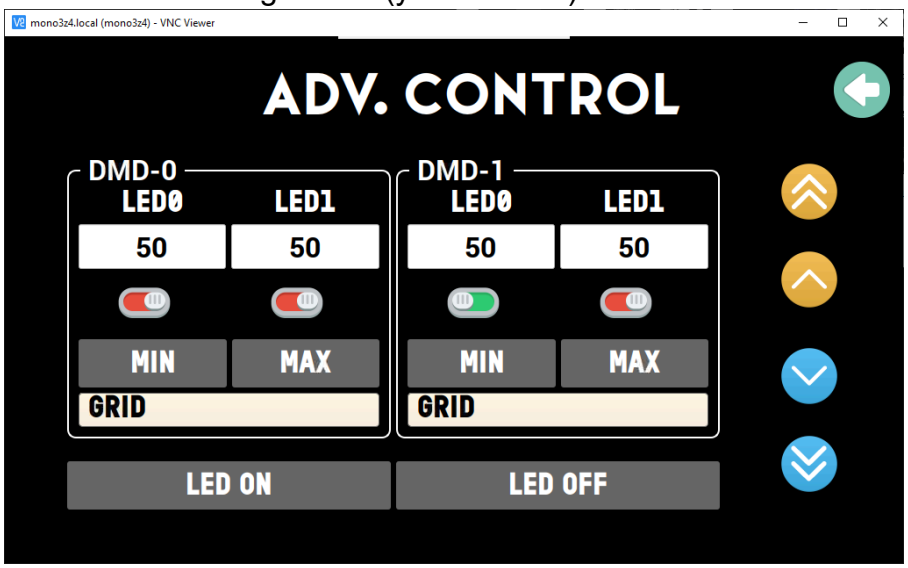
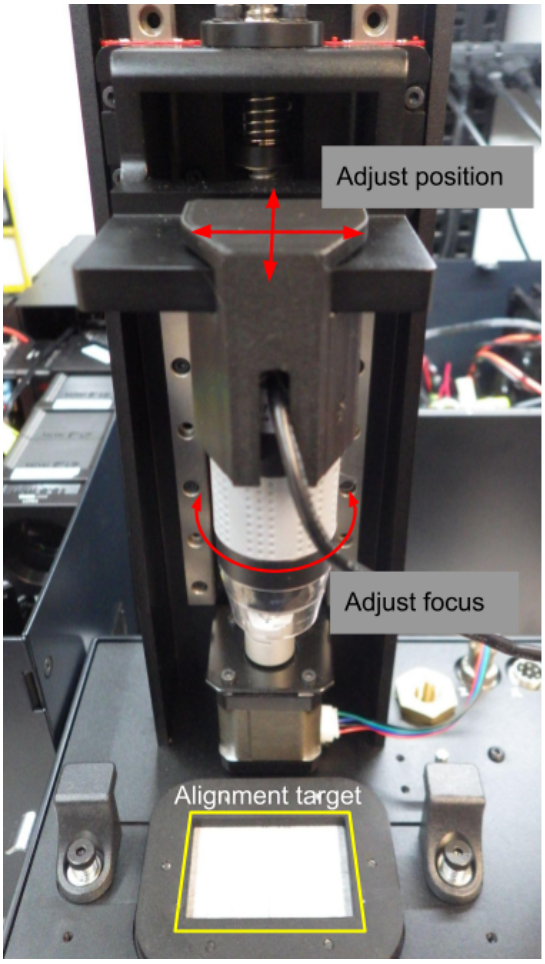
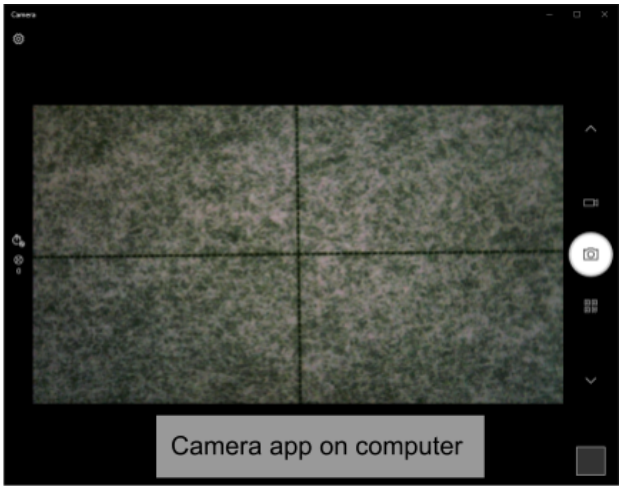


Fig. 13. Advanced control page

9. Mount USB camera into the z-axis





1. Remove the hand screw from the build platform
2. Install the USB microscope to the build platform
3. Plug the camera's USB to the computer
4. Launch a camera app on the computer
5. Place the alignment target
6. Adjust camera's position to roughly align the center
7. Adjust camera's focus to see the line cleary

Fig. 14. Mount of USB camera and alignment target

- The z-axis position is not critical, but the maximum height (151 mm) will give the largest field of view.
- Run camera App and set the resolution to the maximum (2 MP with included USB camera)

10. Overview of the alignment between two projectors

- Alignment will be done with advanced controls and USB camera images.
- Adjust the LED intensity using DAC (intensity) values. For alignment, the intensity value of 0-100 will be reasonable (Max: 2200). UV will be dim, so 100-200 will be needed.
- Turn on the Green grid pattern and align it to the alignment target first.
- At this moment, the Green is fixed and you only need to adjust Blue for alignment.
- Turn on the Blue grid pattern and align it to the Green grid.
- Check if both Green and Blue are aligned with each other by turning on two color grid patterns.

11. Turn on the Green grid pattern and align it to the paper grid

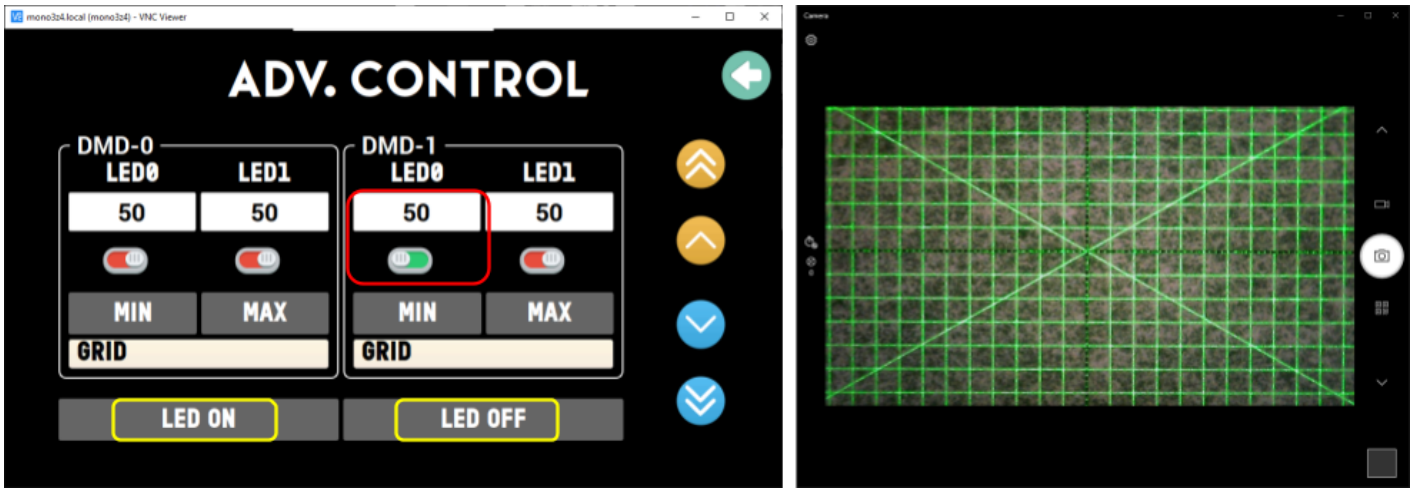


Fig. 15. Green grid pattern projection

- On the adv. control page, set the intensity to 50 and only select DMD-1 >> LED0 which is green. From left to right, each LED represents UV, Blue, Green, and Red.
- You should turn off the LED (LED OFF button) manually when the alignment is done.
- Press the LED ON button and you will see a grid pattern on the camera app.
- Try to move the alignment target to match central cross lines between the target and green grid projection.

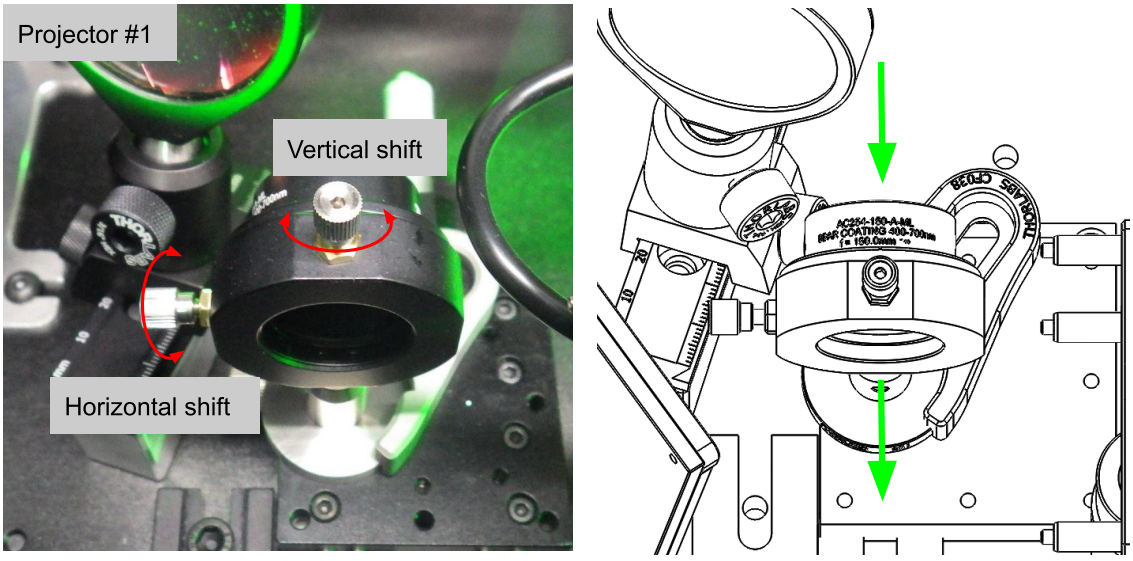


Fig. 16. Projector 1 adjuster and PC screen of USB camera

- If the Green grid is too far off from the target, you will need to adjust the Green grid by adjusting lens position as shown in Fig. 16.
- Use this adjustment only if the error is so big that you can't match the Green grid vs. target by adjusting the target position.

12. Turn on the Blue and Green grids together and align them

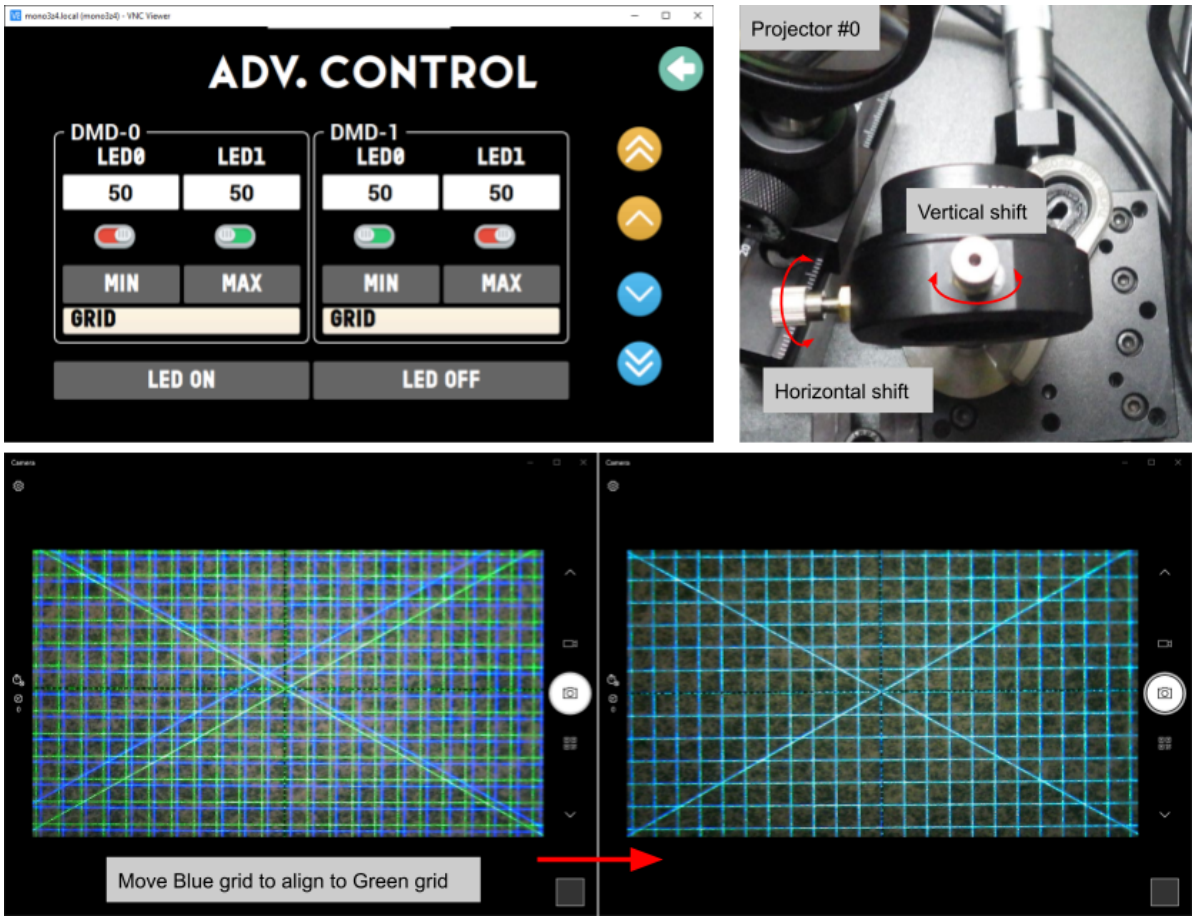


Fig. 17. Blue grid pattern projection and alignment

- Turn on both Blue and Green grid projections as above.
- The Blue grid should be misaligned to the Green grid at first.
- Use two adjusters on the lens mount inside Projector #0 while checking the camera screen.
- Most likely two grids will be easily aligned only using two adjusters.
- However, two grids are not parallel to each other and you can't align them only with the two adjusters, follow below steps to remove angle offset between them.

- If there is angle offset between two grids, you need to adjust dichroic mirror assembly to remove the angle offset.
- Caution: Use this section only if needed. When the alignment is off by adjusting dichroic mirrors, I'll need to look into restoring its alignment.

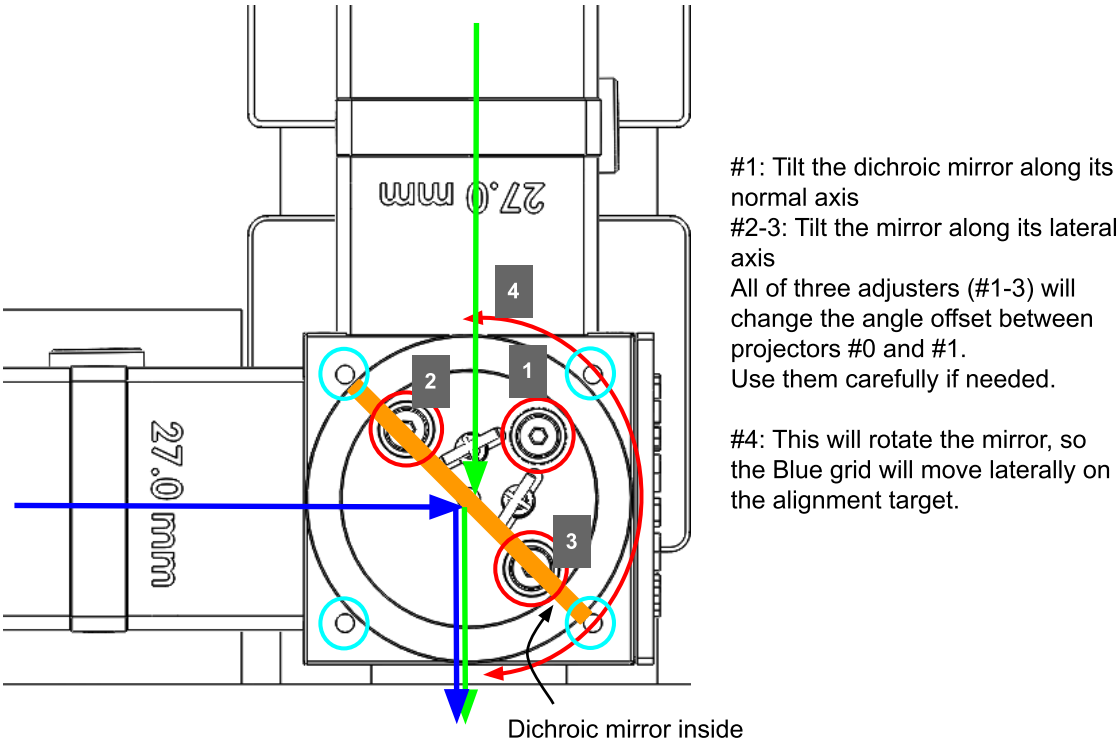


Fig. 18. Dichroic assembly adjusters

- To align the Blue grid to the paper grid, there are three adjusters are available; **Rotation (#4)**, **Tilt(#1)**, and **Yaw(#2,#3)** of the dichroic mount.
- To adjust the rotation, loosen 4 x Philips screws and then rotate it slightly. Then the Blue grid pattern will move horizontally.
- The rotation adjuster is very sensitive. Even when you tighten the Philips screws, it will be off again. Try to gently press the mount and then tighten the screws slowly while checking the Blue grid pattern.
- The Tilt adjuster will move the Blue grid pattern to diagonal direction.
- The effect of Yaw adjuster is very minimal, but if you need to adjust angles, this will rotate the Blue grid.
- General procedure will be:
    - Using the Tilt adjuster, align Top and Bottom lines
    - Using the Rotation adjuster, align Left and Right lines
    - If the left and right lines (vertical) are misaligned, use the Yaw adjuster to make the vertical lines to be parallel.
    - Using the Yaw adjuster will move the Blue grid patterns again. So repeat this step until you get the best result.

13. Turn on two color grid patterns and check the alignment

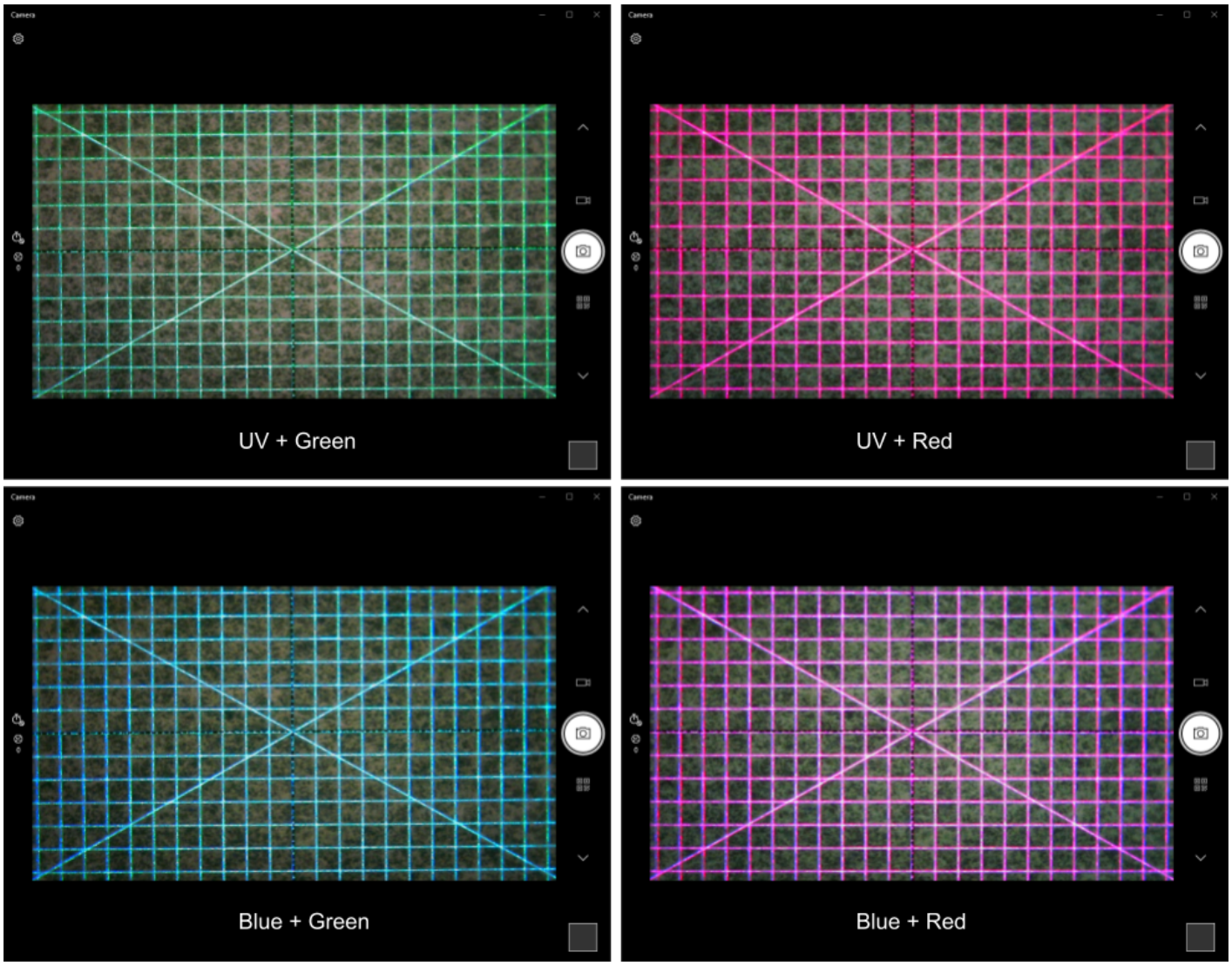


Fig. 18. USB camera images for two color projections

- Turn on two colors together and check the alignment accuracy.
- For quantitative analysis of the alignment, each frame might be read and intensity profiles could be compared between different colors.
- Try to align two colors as well as possible, then check the alignment level via actual printing using two colors.

14. Place the top covers of both projectos

- To avoid dust collection inside the projectors, place the top covers back.
- There is a chance that the covers interfere with the alignment. If you experience this issue, check the alignment before tightening cover screws.

15. Closing remarks.

- If you have any issues during installation, please contact us at info@monoprinter.com