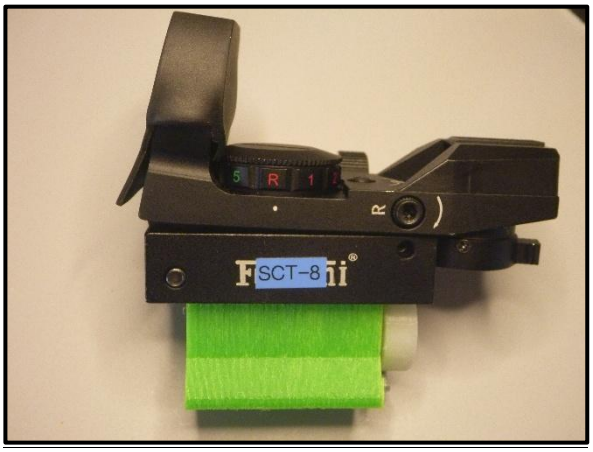
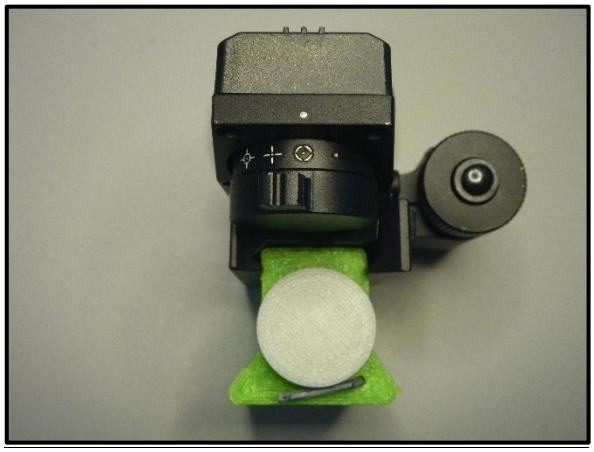
Nearly Perfect Finderscope





Introduction

There are three different categories of finders for telescopes, the classical finder that is really just a small telescope, the Red Dot Finder (there are many variations) that has a zero-magnification factor, and the laser finder.

Classic Finder



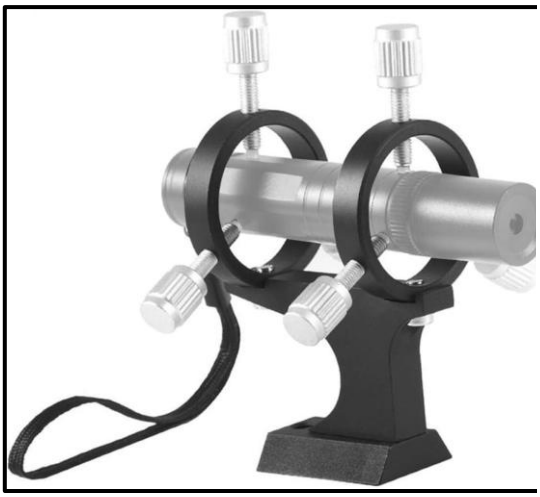
- Pro: Can see dimmer stars
- Con: Can flip/rotate image
- Con: Can be awkward to use
- Con: Can require odd positions to look through finder
- Con: Difficult to align

Red Dot Finder



- Pro: Intuitive to use
- Pro: Easier to navigate with
- Con: Many times, too bright for dim stars
- Con: Can require odd positions to look through finder
- Con: Requires tool to align

Laser Finder



- Pro: Easy to use
- Pro: Easier to navigate with
- Pro: Does not require as many odd positions to use
- Pro: Can see exactly where in the sky you are looking
- Con: Some astronomers find these offensive
- Con: Can't be used until it is dark
- Con: Can be difficult to align
- Con: Need a mounting solution

Nearly Perfect Finderscope





The Search

In my quest for the perfect finder, I have found that the laser is easiest for me to use; however, lasers cannot be seen and used until it is quite dark. Recently while looking for a replacement laser as a finder scope, I stumbled upon a finder that combined both the red-dot design and a laser for a reasonable price ($42). This seemed to be a good solution that would work for daytime, evening and night use.

There were some issues that had to be resolved with this finder:

- **Red Dot was too bright** – The red dot is designed to be used during the day. Although there are 5 levels of brightness that can be selected, even the lowest level overwhelms any star that might be targeted.
- **Mounting** – The finder is designed to mount on a gun, not a telescope, so an adapter mount would need to be designed to make it compatible with a typical dovetail mount.
- **Adjustment** – Previous lasers used were able to be adjusted by hand; this model requires Allen wrenches for adjustment like most other finders of this design.

The Solutions

I have tried to find solutions to each of the issues identified above.

- **Mounting & Adjustment** – Designing and 3D printing an adapter for the finder so it goes in a dovetail was easy enough to do, and while I can't eliminate the need for the Allen wrenches, a solution was developed that stores the needed wrenches in the mount, so they are easily accessible and not easily lost.

- **Red Dot Brightness** – Replace various SMD resistors on the existing finder with new resistors as specified in the table below.

NOTE: I have updated the resistors used in the new configuration since the video for this was made, use the configuration in the cart below, not what is mentioned in the video, this new configuration provides even a larger range of dim levels

SMD Resistor configuration

Original Configuration	New Configuration	New Config Comments
Position 1 = 3,900 Ω	Position 1 = 470,000 Ω	Low Intensity
Position 2 = 2,400 Ω	Position 2 = 300,000 Ω	Dark Sky
Position 3 = 1,600 Ω	Position 3 = 200,000 Ω	Night Use
Position 4 = 590 Ω	Position 4 = 10,000 Ω	Dusk Use
Position 5 = 360 Ω	Position 5 = 430 Ω	Daytime Use

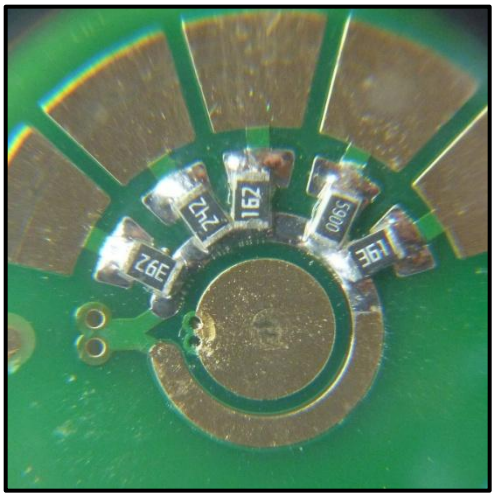
The Modifications

The following changes were made:

- Replace Resistors – SMD resistors replaced as noted earlier
- Dovetail Mount – Designed and 3D printed
- Allen Key Modifications – Cut Allen keys to proper length to fit in dovetail mount. Addition of Allen key head for easier use. Allen keys are magnetically held in place by strong magnets added to the dovetail mount









Conclusion

The resulting finder from this project is nearly a perfect finder for astronomical use. The 5 settings on the red-dot finder range in brightness to where the finder can be used in mid-day and has enough dim levels so that it will not overwhelm stars at night. The original range of this finder was from 360Ω to 3,900Ω, a range of 10.8x. The new finder range is from 430Ω to 470,000Ω, a range of 1,093x. While I was unable to eliminate the need for Allen wrenches to align the laser and the finder with the Optical Tube Assembly (OTA), the Allen wrenches are conveniently magnetically stored within the base of the finder mount so they are readily available and not easily lost.

Equipment Used

The following equipment was used in designing and making this device. Most items can be easily substituted.

- Feyachi Reflex Sight for Rifle ($42) – The sight & laser combination.
- FNIRSI HS-03 Cordless Soldering Iron ($62) – Used to solder on SMD resistors.
- LRT 858D 700W Digital Hot Air Rework Station ($38) – Make taking off SMD resistors much easier.
- 1,500pcs 0805 SMD Resistor Kit ($7)
- Snap Ring Pliers ($10) – Makes removing the circuit retention ring much easier.
- SainSmart 2-in-1 Magnetic Helping Hands Station ($68) – Work station (not necessary)
- Artecho Neutral Glow paint ($19) – Paint for small Allen wrench (not necessary)
- Sn42/Bi58 Lead-Free Solder Paste ($10) – Solder for replacing SMD resistors
- CAIG Laboratories DeoxIT contact cleaner ($14) – For cleanup of work (Optional)
- Rhinocats 60pcs (5mm x 3mm) small magnets ($6) – Magnetic holder for Allen wrenches
- SUNLU PETG print filament (Varies) ($25) – Only about 15g of filament needed to print
- Digital Multimeter ($12) – For checking the circuit resistance when completed (Optional)

- Liquid Flux ($6) – For soldering replacement resistors.

Hints and Tricks

Here are some things to consider if you decide to do this project on your own.

- **Circuit Board Retention Ring** – has two slots that the snap ring pliers can be used to remove the retention ring. You may be able to use a very small flat head screwdriver to do this also, but it will be a bit more work getting it to rotate. Also take note how this retention ring is facing when in place.
- **Circuit Board Orientation** – Make sure to take note of the orientation of the circuit board relative to the setting values to make sure it is oriented the same when you put it back in the compartment.
- **SMD Resistors**
  - Removal – Using the Hot Air Rework Station, I remove all of the resistors before putting in the replacements. Make sure you keep track of what the sequence of resistors should be on the circuit board before starting the removal process.
  - Soldering Replacement Resistors – I have found the best technique for this is to first try solder the resistors without addition of the solder and just using liquid flux to see if the residual solder will be enough; if not, use solder paste (sparingly). I have also found the technique of using fine needle tweezers positioned above the resistor and below the circuit board (pinching them in position together) works best to keep the SMD resistor from moving around when soldering it.
- **Digital Multimeter** – If you have one, use it to verify the SMD resistors are soldered properly; otherwise, you will need to place the circuit back in for testing.
- **Testing the Finder** – The two lowest settings are very dim; you may not be able to see them in a normally lit room, so you may need to go to a dark closet for testing these two settings.
- **How to Read SMD Resistor Values with Code Chart** - Handy reference for identifying the resistors ratings before removal.

Nearly Perfect Finderscope

Postscript

After posting this project on the internet I received this response from one of our local astronomers. It makes a good point that you can do this project much cheaper than I indicate in the instructions, I wanted to provide full information on the equipment I used, Jimmy points there are other options. (I did update my original instructions to match the resistor kit he uses).

Jimmy Ray,

For those who want a smaller amount of SMD resistors, the unit uses size: 0805 and are $7 for 1500 assorted values (https://wwwamazon.com/dp/B096Z5DQWQ?ref=ppx_yo2ov_dt_b_fed_asin_title&th=1)

Specs:

- 1500 Pieces, Total 60 Values (each 25 pcs) 0Ω -10MΩ
- Type: 0805 Mount Type: Surface Mount (SMD SMT), Tol: 0.01(±1%), Power: 1/8W 0.125W
- Resistance Values (each Value 25pcs):0Ω 1Ω 2.2Ω 3.3Ω 4.7Ω 5.1Ω 10Ω 15Ω 22Ω 33Ω 47Ω 51Ω 62Ω 82Ω 100Ω 120Ω 150Ω 180Ω 200Ω 220Ω 240Ω 270Ω 300Ω 330Ω 470Ω 510Ω 560Ω 680Ω 820Ω 1kΩ 1.2kΩ 1.5kΩ 1.8kΩ 2kΩ 2.2kΩ 3kΩ 3.3kΩ 4.7kΩ 5.1kΩ 5.6kΩ 7.5kΩ 10kΩ 12kΩ 15kΩ 18kΩ 20kΩ 22kΩ 33kΩ 43kΩ 47kΩ 51kΩ 75kΩ 100kΩ 200kΩ 300kΩ 390kΩ 470kΩ 680kΩ 1mΩ 10mΩ

Notes from the project:

- This resistor "Kit" does not have a 43 ohm so I used a 47 ohm instead (Careful you don't reverse the 47 ohm and 4.7K resistors (Don't ask how I know this)) otherwise you get dim, dimmer, BRIGHT, dim, dimmer ;-)
- Since I didn't have a hot air type soldering station like James, I found if I laid the tip of my pencil soldering point alongside and across both sides of the resistor at the same time they come right off.
- Placing the new ones was a matter of soldering one end then after all were in place, running the iron tip along the common terminal points to finish up the job.
- As James points out, pay close attention to the reassembly as it is easy to get things in backwards (or off 90 deg)

Easy and fun project! (All in, ~$60)
Thanks again James,
Jimmy Ray

Nearly Perfect Finderscope

Gird Your Loins

The use of lasers for astronomy can be a hotly debated topics for astronomers. No doubt you will run across someone with a fanatic and may have a violent reaction to anyone using lasers in astronomy. Here I would like to provide some pointers on what points may be made, and how to defuse a potential confrontation.

It should be pointed out that both sides of this opinion have legitim arguments, and each person is entitled to their own option. Don't bother trying to convince someone who appears to be itching for a fight on this. Here are some points that you may encounter:

- They are illegal in many countries: True, don't use them in those countries.
- Pointing a laser in the eye can damage their eye: Class IIIA lasers (<5mW) are classified as "low but real risk", so please never point a laser at anyone.
- Pointing a laser at an airplane is illegal: Yep, never point a laser at a plane.
- Lasers can cause problems for astrophotographers: When a group from the astronomy club go out, we have separate areas for imagers and observers to help litigate the use of flashlights and lasers by observers.
- Lasers are another distraction in the night sky: At this point many astronomers use GoTo mounts. Really the only time you use finders and lasers are when you are calibrating the mount, or when pointing out to someone where the object is; so these really are not used often.

Bottom Line: Practice good etiquette when using a laser. Locate yourself away from imagers and at the outer areas of an observing group. Only use the laser when you need it don't leave it on for extended periods of time. Never point a laser at a person or airplane. Follow these guidelines and you shouldn't have any issues.