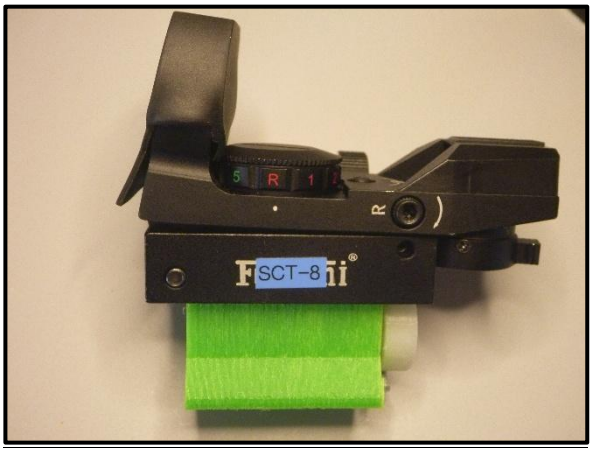
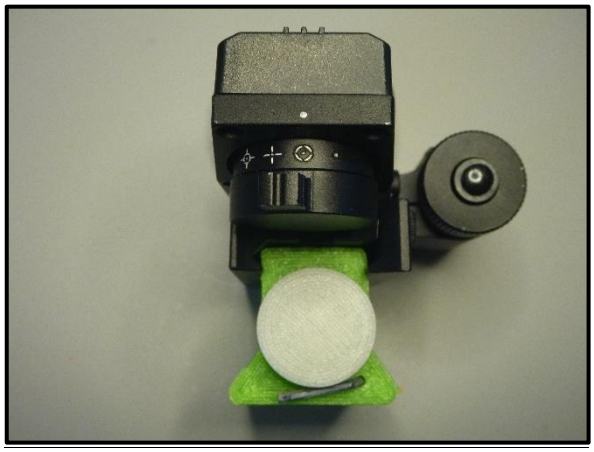
Nearly Perfect Finderscope





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.

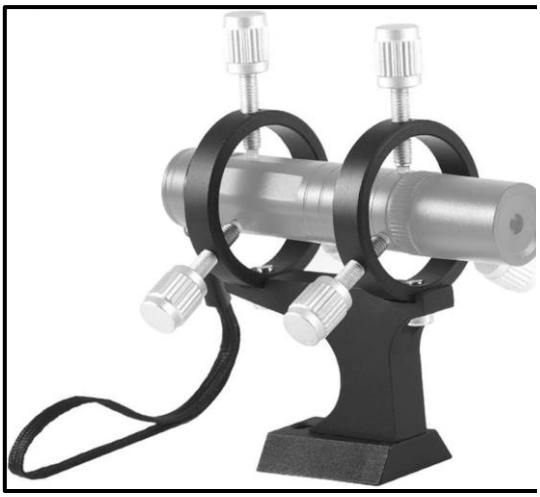
Classic Finder

- 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.

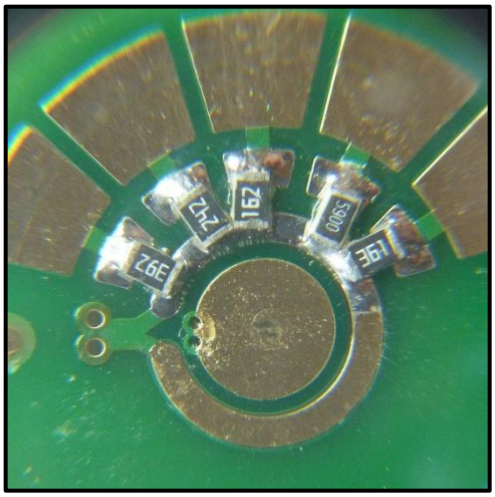
SMD Resistor configuration

Original Configuration	New Configuration	New Config Comments
Position 1 = 3,900 Ω	Position 1 = 100,000 Ω	Low Intensity
Position 2 = 2,400 Ω	Position 2 = 43,000 Ω	Dark Sky
Position 3 = 1,600 Ω	Position 3 = 20,000 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 10x. The new finder range is from 430Ω to 100,000Ω, a range of over 200x. 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.
- 8400PCS Resistor Kit ($30) – Replacement Resistors.
- 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.