

# TEC APO140



*"This telescope is closer to optical perfection more than any instrument I have ever used before."  
R. Renzi, Italy.*

OWNER'S MANUAL 2013

**IMPORTANT - PLEASE READ THIS MANUAL BEFORE  
USING YOUR TELESCOPE**

**SAFETY PRECAUTION**

**Do not look at the sun through the telescope!**

Viewing the sun through the telescope without special equipment (Solar Filter, Herschel Wedge) will cause permanent visual impairment and damage to telescope components.

**Do not disassemble!**

Disassembly of the telescope could result in personal injury and telescope malfunction.

**Do not use hairdryer to remove dew condensation from the front lens!**

**CONTACT INFORMATION**

If you have any questions or need assistance - please contact us:

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 Web site [www.telescopengineering.com](http://www.telescopengineering.com)  
 User's group <http://groups.yahoo.com/group/tec-scopes>  
 Address Telescope Engineering Co. • 15730 West 6th Ave., Golden CO, 80401. USA

**TEC APO 140 TECHNICAL SPECIFICATIONS**

Clear aperture	5.5" / 140 mm
Focal length	980 mm
Focal ratio	7.0
Image scale	3.5 arc min/mm
Resolution (theor.)	0.8 arc sec
Focuser TEC	4" / 96mm ID
Eyepiece holder	2" Collet type (no plastic parts)
Focusing range	4.5" / 114 mm
One turn focus travel:	
Coarse	18.3 mm
Fine (small knob)	1.8 mm
Back focus distance	6.70" / 170 mm
Focuser load capacity	12 lb / 5.5kg
Tube assembly dia.	5.9" / 150 mm
Dew shield dia.	7.0" / 178 mm
OTA length (shortest)	34" / 860 mm
OTA weight	19 lb / 8.6 kg (for tube ring add 2lb)
Weight with case	18 lb / 8.2 kg incl. keys
Price 2013	\$5700
Includes :	Optical tube assembly, front cover, plug.

Note: All prices, specifications and availability subject to change without notice.



## OPTIONAL EQUIPMENT (see [www.telescopengineering.com](http://www.telescopengineering.com) for up to date prices)

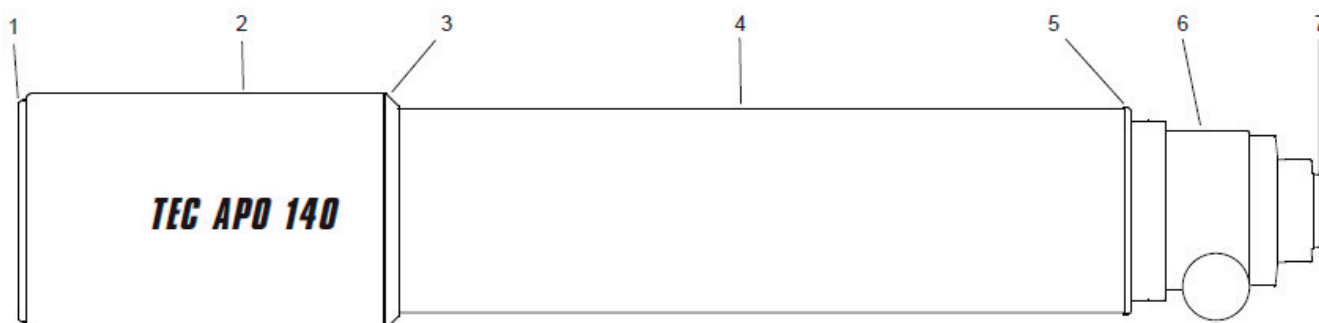
Tube rings	\$280
Finderscope bracket with base	\$120
TEC 9" narrowed dovetail plate	\$70
TEC 12" narrowed dovetail plate	\$90
7X50 VIXEN finderscope with illuminated eyepiece	\$190
10x60 Baader Planetarium VARIO finder w. prism & illum. EP	\$290
Eyepiece Turret	\$500
Field Flatteners	\$750
Transportation case (hard case made in Germany)	\$460

## OVERVIEW

The APO140 ED is TEC's first production model of apochromatic refractor and it is our "best seller" telescope, since start in the end of 2002 about 600 telescopes have been sold.

Scope has number of features that in given combination are rarely found in one scope:

- Compact, lightweight tube assembly with retractable baffle and precision adjustable tube rings.
- Case for telescope has "carry-on" dimensions for most airlines (since these dimensions could change, please double check weight/dimensional limitation prior to your flight).
- Telescope objective being "oiled triplet" by design transmits more light than any other type of objectives; combination of "oiled \\" design and modern coating that makes lenses almost invisible.
- Precision rotatable focuser with coarse and fine focusing, with 2" eyepiece holder.
- The focuser features a specially designed collet made of metal which is insensitive to temperature and holds loads with high precision when concentricity of focuser tube and axis of the eyepiece or camera attained automatically by definition.



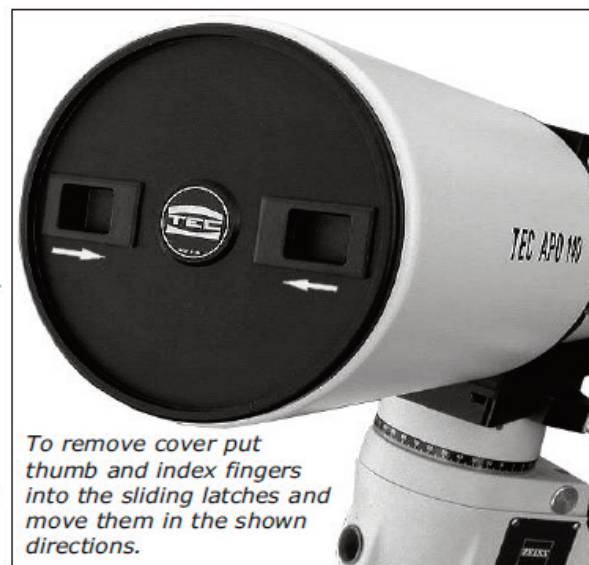
The parts of the telescope and their functions are identified and described below.

1 **Front Cover.** - made of Aluminum, push-pull type. It protects the optics and holds the baffle during transportation.

2 **Retractable Sliding Baffle.** This feature makes the OTA shorter for handling and transportation. The open end of the baffle is rounded to improve aerodynamics of the front end of telescope. Rounded edge creates less turbulence compared to straight cut baffles

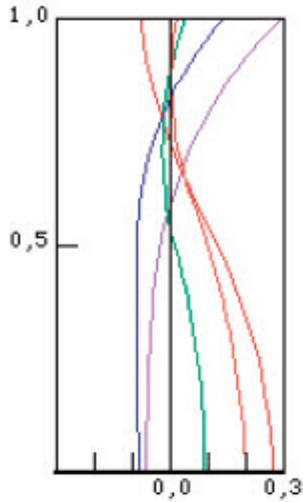
3 **Baffle flange.** It holds the baffle with four 4-40 Button Head Screws.

4 **Tube assembly.** The tube interior is coated with a special light absorbent coating and has 4 sharp edged baffles, which block internal reflections.



## OPTICS

The APO140 is an Aplanatic Oiled Triplet refractor with ED glass (FPL-53) as a middle element. The color correction is optimized for visual use with focus shift less than 0.02% from 436nm

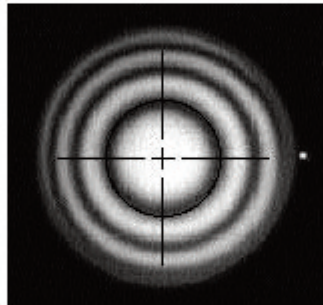
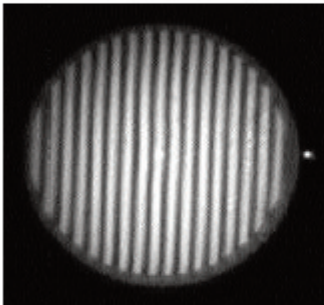


436nm  
480nm  
546nm  
656nm  
800nm



to 1000nm. Calculated Strehl for the e-line (546nm) is 0.99. Interferometry of the first run lenses showed that the average Strehl is close to the calculated value with a very smooth wave front and RMS error of less than 1/50 wave.

The oiled design has only two air-to-glass surfaces. The result is a higher contrast image because of much less scatter and veiling glare due to internal reflections compared to air-spaced objectives.



The outside surfaces of front and rear lenses are coated with 7 layers of antireflective coating, that reduce light reflection to an average the 0.25% in range of 400-700nm. Shown on the left is a sample of interferometry of typical objective with appr. RMS less than 1/50 and wave front error less than 1/10. The lenses are tested during manufacturing with different methods including: test plates, autocollimation test with an artificial

star, interferometry, however we do not supply test results to avoid any kind of misinterpretations or "numbers" competition between customers.

Each objective is assembled in a precision thermocompensation cell (1), that contains: Three Lenses Sealed Construction (2) with a special oil between lenses and Threaded Ring (3). The Threaded Ring of each objective is engraved with the serial number of the OTA.

The optics are collimated at the shop during assembly and do not require any additional adjustments. Collimating, assembling and sealing require special equipment and techniques and must be done only by a qualified technician.

**WARNING: NEVER TRY TO DISASSEMBLE THE OBJECTIVE! DISSASSEMBLY OF THE OBJECTIVE WILL RESULT IN SERIOUS DAMAGE**

**TO THE MOST EXPENSIVE PART OF YOUR TELESCOPE - THE OPTICS!**

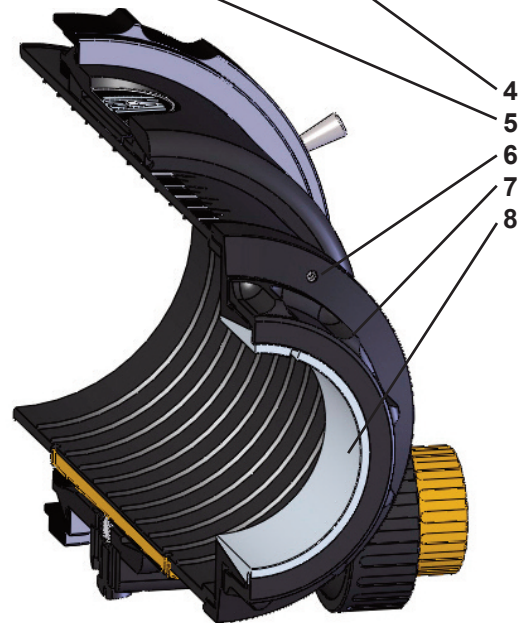
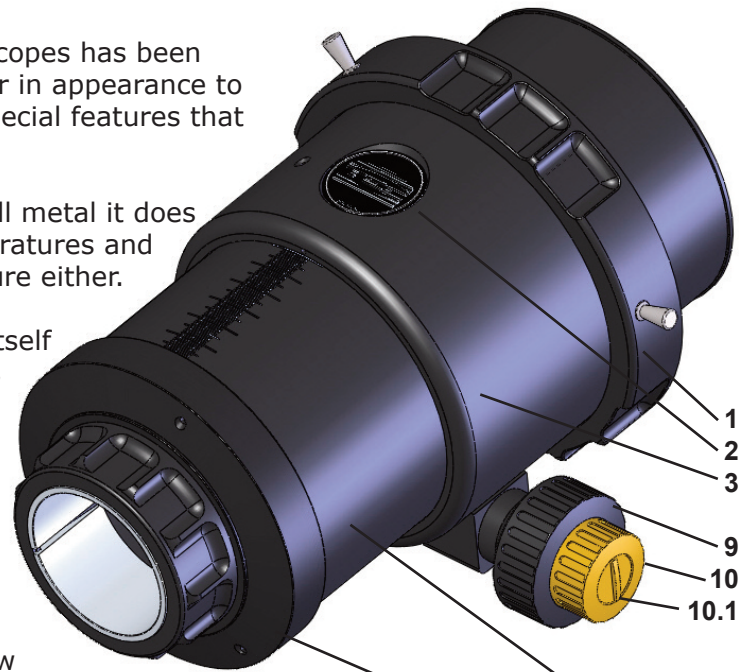




## TEC LARGE FOCUSER

The TEC focuser for APO140 and larger telescopes has been designed and made in our shop. While similar in appearance to other focusers on the market, it has a few special features that were required for today's imaging:

- It is all metal 2" collet type holder; being all metal it does not change holding force under colder temperatures and would not be damaged from sun heat exposure either.
- Holding capacity (axial load) of TEC collet itself is over 3 times the telescope weight - thanks to special design of the collet. Compared to traditional thumb screw holders the collet type holder keeps item's axis strictly concentric to focuser axis by definition.
- Focuser draw tube is held in the focuser housing all the way around that also makes the axis of draw tube strictly concentric to the optical axis of the telescope. Holding draw tube in such a way makes focuser more robust, it has virtually no play under radial load, 7lb weight shifts fully extended draw tube for less than 20mk.
- The planetary mechanism ratio is 1:10 and one turn of the fine focusing knob moves focuser tube 1.8mm.
- The TEC focuser is "dry" - no oiling is required on the draw tube - this will keep focuser draw tube free from dirt.



## FOCUSER PARTS

1. Focuser locking collar with 3 pegs
2. TEC logo
3. Focuser housing
4. Focuser draw tube
5. Draw tube end cap
6. End cap locking screws (3X)
7. Collet locking nut
8. Collet sleeve
9. Coarse focus knobs (CFK)
10. Fine focus knob (FFK)
- 10.1 Fine Focus Lock knob (FFLK)
11. Left knob set screw
12. Pinion shaft housing
13. Pinion shaft housing threaded holes (4X)
14. Pinion housing screws (3X).





## FOCUSER PARTS DESCRIPTION

Focuser locking collar (1) connected to the OTA flange (not shown) and holds focuser on the end of telescope. Loosening it will allow you to rotate the focuser to any position.

**NOTE:** The focuser can be completely removed by unscrewing the locking collar completely and then pulling the focuser from the OTA flange. This should only be done in rare special circumstances. Please contact TEC before removing focuser for any reason.

Focuser draw tube (4) has laser engraved mm scale, inside it is painted with flat black paint and has number of knife-edge baffles to reduce internal reflections at low angles. Draw tube end cap (5) with Collet locking nut ((7) and Collet sleeve (8) are assembled as one unit. This unit can be removed by loosening three 6-32 set screws (6) and unscrewing it completely. The Field Flattener for wide field imaging could then be screwed onto the focuser draw tube end.

The Collet sleeve is made of Aluminum, its surface is tumbled and left un-anodized to avoid scratching the barrel of eyepiece or other equipment, also coefficient of friction of unanodized aluminum is higher than for anodized aluminum.

**NOTE: keep the Collet locking nut tightened at all times to avoid dropping /damaging your equipment!**

Coarse focusing knobs (9), here and further CFK and Fine focusing knob (10), FFK have special shape slots cuts around of cylindrical surface for better tactile feeling during focusing.

Left focusing knob can be removed by loosening set screw (11), a Robofocus or other brand of electrical motors can be installed instead, use 4-40 threaded holes (13) for motor bracket installation.

Please note: the pinion shaft diameter is 1/4".

The movement and feel of the CFK (9) and FFK (10) is preset by TEC before shipping; however, the "Feel" may be adjusted to your liking. By increasing the friction between the CFK and FFK the load carrying and holding capacity will also be increased.

To increase the friction felt and increase the load carrying capacity, first, using your left hand, grip the FFK, then with your right hand, loosen the Fine Focus Lock Knob, FFLK (10.1) by turning it counterclockwise. Next, while holding the CFK, turn the FFK by approximately 10 degrees clockwise (about 1/2 the angle between two slotted cuts on the coarse focus knob). Finish by resetting the FFLK by gripping the FFK and turn in the FFLK clockwise and tighten it.

Please note, the steps to loosen up the "feel" is the same as above with the exception of turning the FFK 5-10 degrees counterclockwise. Please note, while giving a looser feel, this will reduce the load capacity and holding capacity of the focuser, particularly pointing at the zenith. Moreover, the holding capacity of the focuser can be increased up to full lock-up if needed.

Pinion shaft housing (12) attached to the focuser housing (3) with 4-40 socket head cup screws (14). Position of the pinion housing with pinion shaft relatively to the rack (installed on the focuser draw tube), is precisely adjusted by TEC during assembly. **Please avoid unscrewing these screws.**

The Focuser housing (3) also has two 8-32 threaded holes for finder base installation (these holes are on the left from TEC logo) not shown on given sketch. If finder base is to be installed on the focuser housing, make sure the screws being used are of correct length to avoid scratching/damaging internal parts of the focuser housing.

**Please contact TEC if you have question about the length of the finder base screws.**

### **WARNING:**

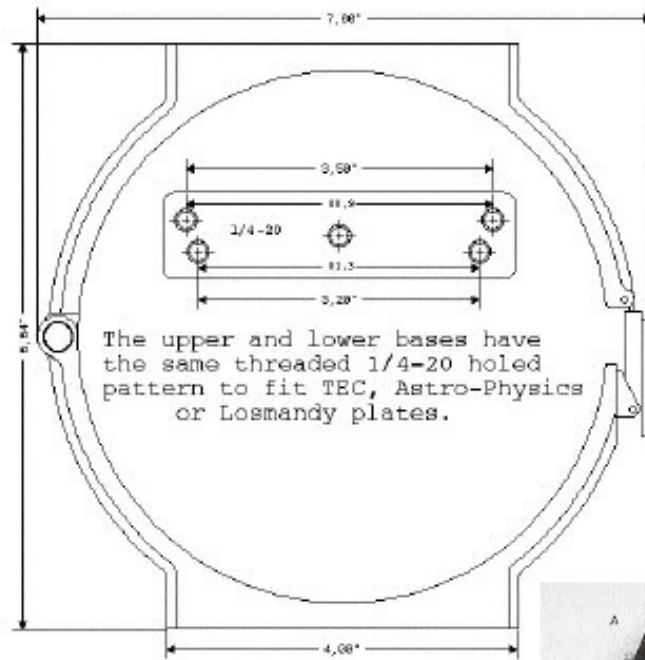
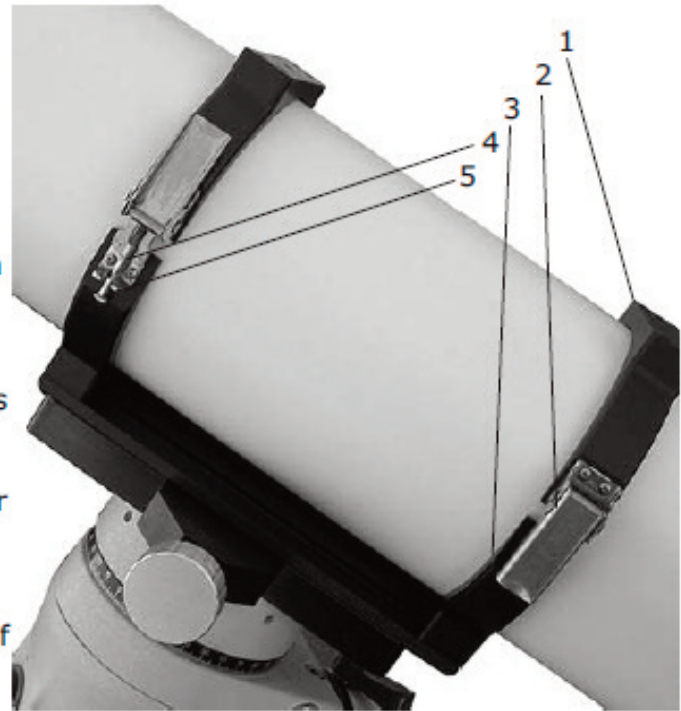
**Do not ever try to disassemble the focuser for any reason, it can not be done without proper tools and without knowing its internal structure. Attempt to disassemble focuser may end with focuser parts damage and loosing warrantee. Contact TEC if you have any issues or question about the focuser.**



## ACCESSORIES

### TUBE RINGS

CNC machined, black anodized aluminum, compact and lightweight design with stainless steel latches (set of two rings weights 750g). Ring dimensions and hole pattern are shown in the sketch below. Each ring contains: Upper Base (1); Latch (2); and Lower Base (3). Latches for the scopes of the third and fourth run are adjustable. The screw (5) has a Phillips type head for easy adjustment, the small nut (4) will hold screw in place after adjustment. Rings can be attached to the mount with either TEC Dovetail plate, AP or Losmandy plates. **NOTE:** From user feedback - it is better and more safe to keep rings on the OTA all the time if possible - this way there is no chance of



OTA inside the rings, as would be the case if longer plates were being used.

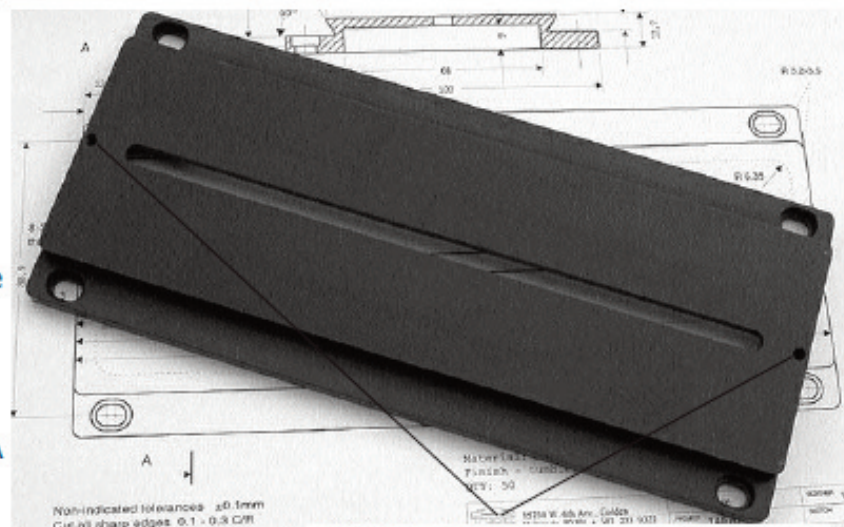
The TEC Dovetail Plate is compatible with Losmandy, WYO or Casady Saddle systems. Two 8-32 security screws must be installed on each end of the Plate; these security screws prevent the dovetail and OTA from accidentally slipping off the dovetail holder.

scratching the tube.

### DOVETAIL PLATE

The Dovetail Plate, like all other accessories for this telescope, is CNC machined for lightness (320g) and rigidity from aluminum stock, and then black anodized for a tough, corrosion-free surface.

Though having the same width and hole pattern as Losmandy plates, the TEC Dovetail Plate is only 9" long. The shorter length not only allows it to be lighter, but also provides you the convenience of being able to retract the Front baffle (for storage) without having to move the



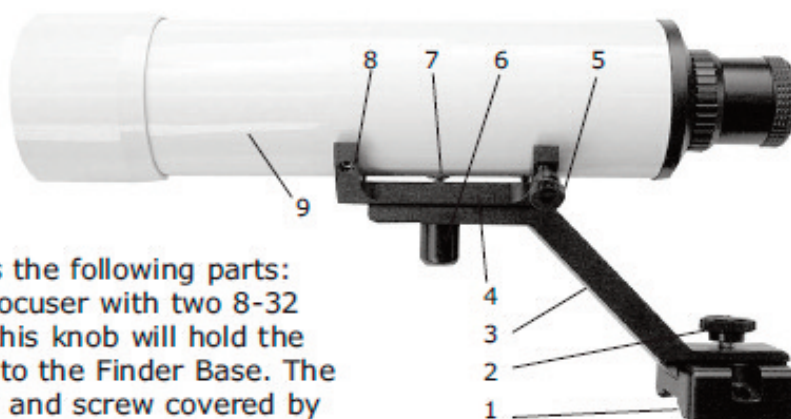
8-32 threaded holes for security screws

## TEC FINDERSCOPE BRACKET

The TEC Finderscope Bracket is designed to hold a traditional 50mm optical finder or a Red Dot sight.

This new design requires only 2 thumb screws for alignment. It looks and works in a much more elegant way.

The Finderscope Bracket contains the following parts: Finder Base (1), that attaches to the focuser with two 8-32 screws; Holding Knob (2), tightening this knob will hold the Finder Arm (3) with Finder Holder (4) to the Finder Base. The Finder (9) is spring-loaded with spring and screw covered by

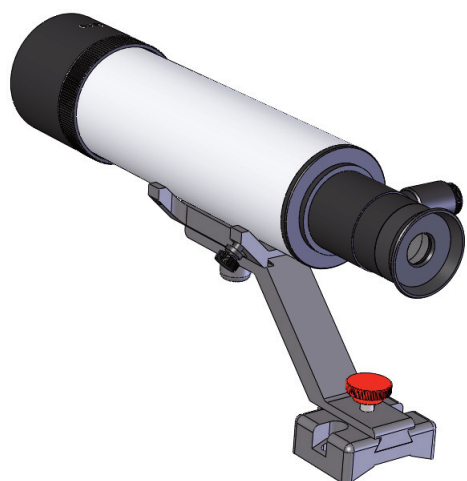


Spring Cover (6). The Finder holder has two 10-32 set screws (8) on the objective side and two 10-32 Alignment Thumb Screws (5). A special insert (7) must be installed in the finder's body. TEC performs this installation for free in any brands. Please note that finder's diameter should not be larger than 2".

When attaching the finder base to the focuser housing make sure to use screws of the proper length.



Finder base



### WARNING:

**If the screws are too long, they will contact the draw tube and damage its anodized surface !**

Shown in the above picture is the Astro-Physics Finder bracket with Orion 9x50 finder. This combination is less expensive and does not require insert installation.

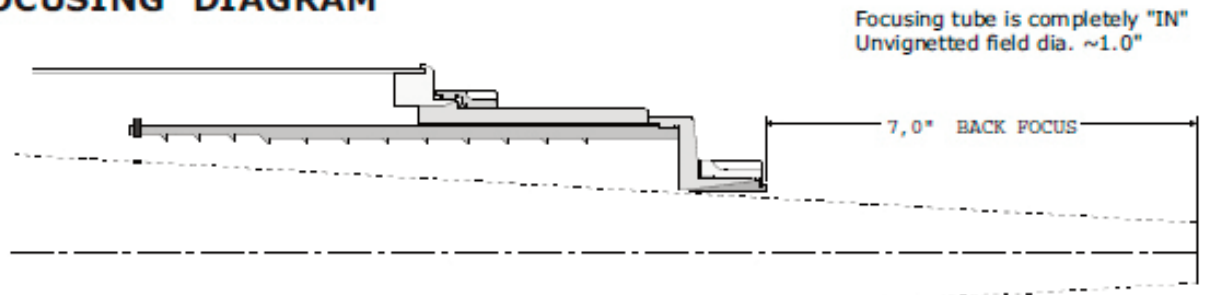
The Red Dot sights could also be installed. This installation requires fewer parts: only a Finder Base and a Finder Arm with knob.



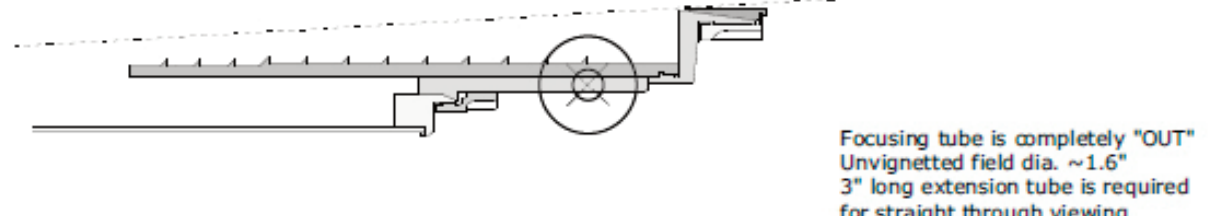




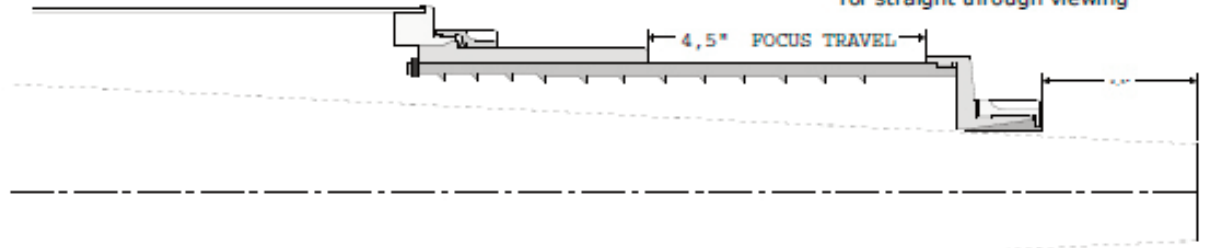
# FOCUSING DIAGRAM



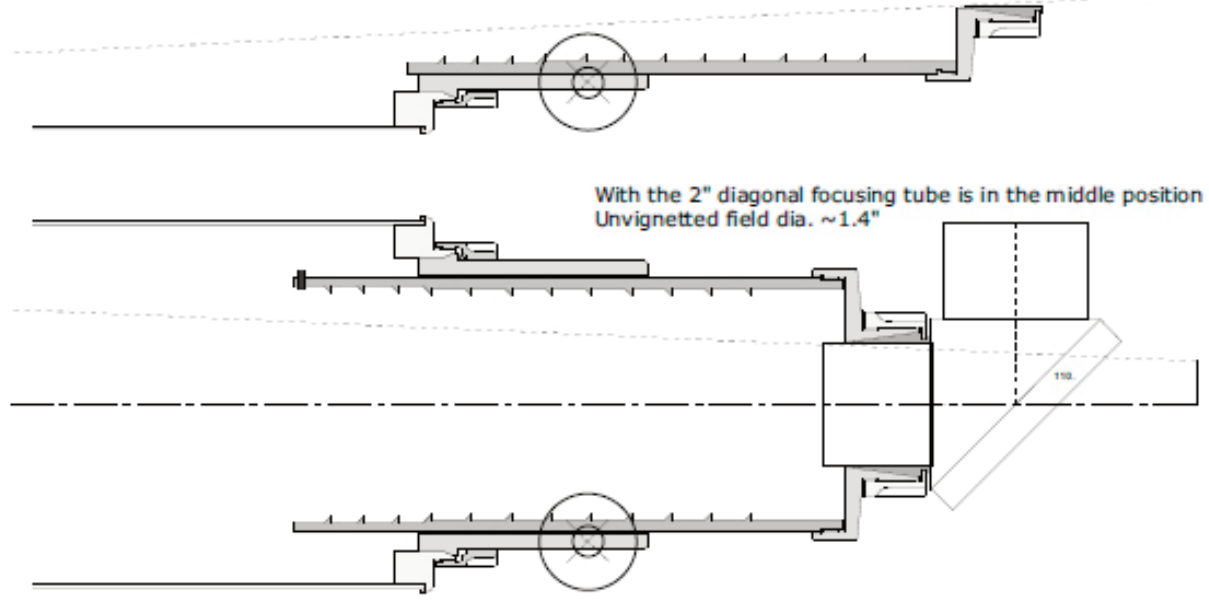
Focusing tube is completely "IN"  
Unvignetted field dia. ~1.0"



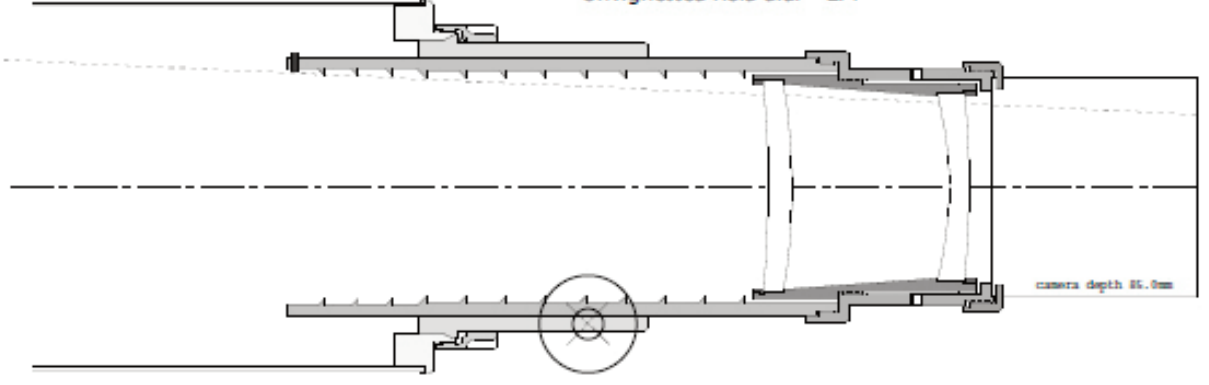
Focusing tube is completely "OUT"  
Unvignetted field dia. ~1.6"  
3" long extension tube is required  
for straight through viewing



With the 2" diagonal focusing tube is in the middle position  
Unvignetted field dia. ~1.4"



With the Field Flattener focusing tube is in the middle position  
Unvignetted field dia. ~2.4"



camera depth 85.0mm





## **CLEANING AND HANDLING YOUR TELESCOPE**

The tube assembly and front baffle are powder coated; to clean them use water with soap or mineral spirits (paint thinner); do not use Acetone or any other strong chemicals. Please contact us if you need the lens to be cleaned.

Handling the telescope around and it's transportation to the observing site requires careful handling. We recommend to keep the telescope in the case when it is not in use.

If you find any problems, or have any comments - please call us for assistance. Telescope Engineering Company is committed to serving it's customers after sale for unlimited time. See the info on the second page of this manual.

Remember - your feedback makes our telescopes better.

Yuri Petrunin, TEC President

