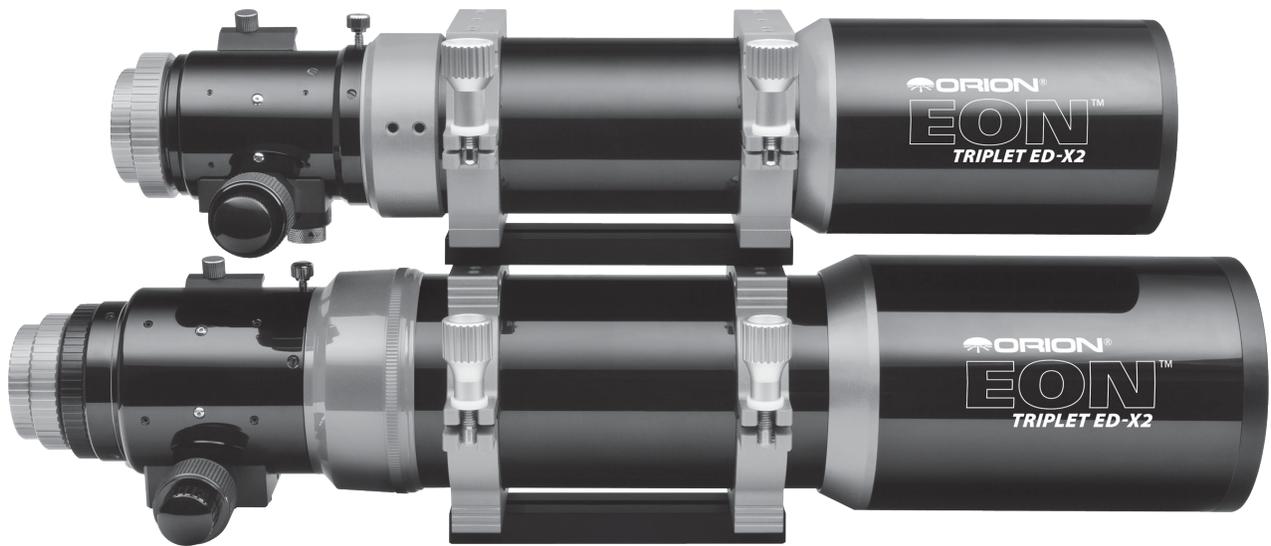


Orion® EON™ 85mm and 104mm ED-X2 Triplet Apochromatic Refractors

#10089 EON 85mm ED-X2

#10090 EON 104mm ED-X2



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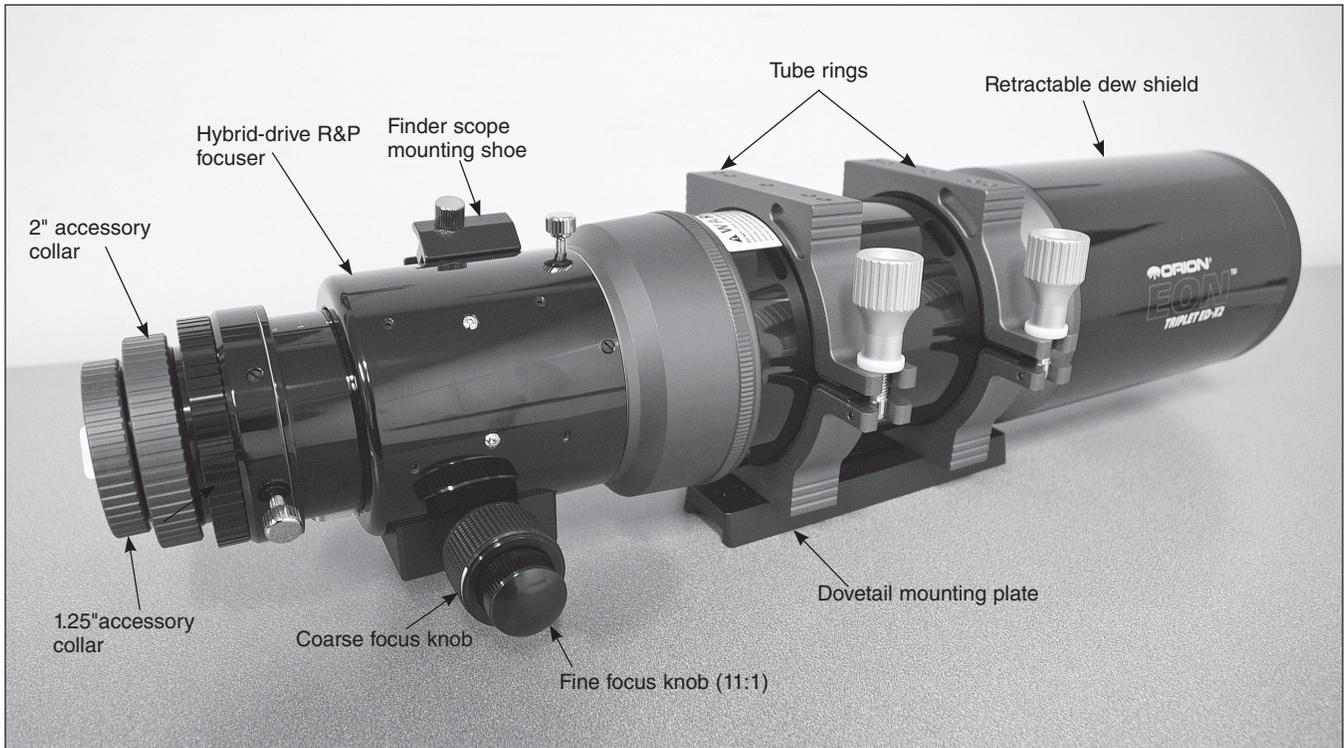


Figure 1. Features and parts of the EON ED-X2 Triplet Apochromatic Refractors (EON 104mm shown).

Contents

1. Parts List
2. Features and Functions
3. Operating the EON ED-X2
4. Care & Maintenance
6. Specifications

Congratulations on your purchase of an Orion EON ED-X2 Triplet Apochromatic Refractor! The EON 85mm and 104mm ED-X2 have been designed with exceptionally high quality, precision ED optics and superior mechanical construction, making them ideally suited to both high-performance imaging or visual stargazing pursuits. These instructions will familiarize you with the features of your instrument and how to use it.

WARNING: Do NOT look at the Sun without a professionally made solar filter on the telescope; serious eye damage may result if you look at the Sun with any unfiltered optical instrument. Do not leave the telescope unsupervised around children. Always cover the lenses when leaving the telescope in direct sunlight.

1. Parts List

- 2 • EON 85mm or 104mm ED-X2 Triplet optical tube assembly
- 3 • Aluminum objective cap
- 4 • 2" to 1.25" accessory adapter
- 5 • Dovetail finder scope base, mounting screws
- 6 • Tube rings (pair)
- 6 • 1/4"-20 socket head cap screws (x4)
- Allen wrench, 2.5mm
- Dovetail mounting bar (7")
- Hard case with custom foam interior

The EON 85mm and 104mm ED-X2 Triplet apochromatic refractors come ready for use from the factory. Your telescope's optics have been assembled and precisely collimated at the factory, so they should not require any adjustments. Please keep the original shipping box. In the unlikely event that you need to ship the telescope back to Orion for warranty repair service, you should use the original packaging

2. Features and Functions

Your EON ED-X2 Triplet has premium features designed to maximize the performance of the scope and its convenience of use. Most notably, the air-spaced three-element objective lens comprises two elements precision crafted from Japanese-made Ohara extra-low dispersion (“ED”) glass – one element of FPL-53 and one element of FPL-51 fluoro-crown optical glass – which together deliver true apochromatic performance, eliminating chromatic aberration for impeccably clean, sharp, high-resolution images.

Please refer to **Figure 1** to become familiar with the telescope’s features.

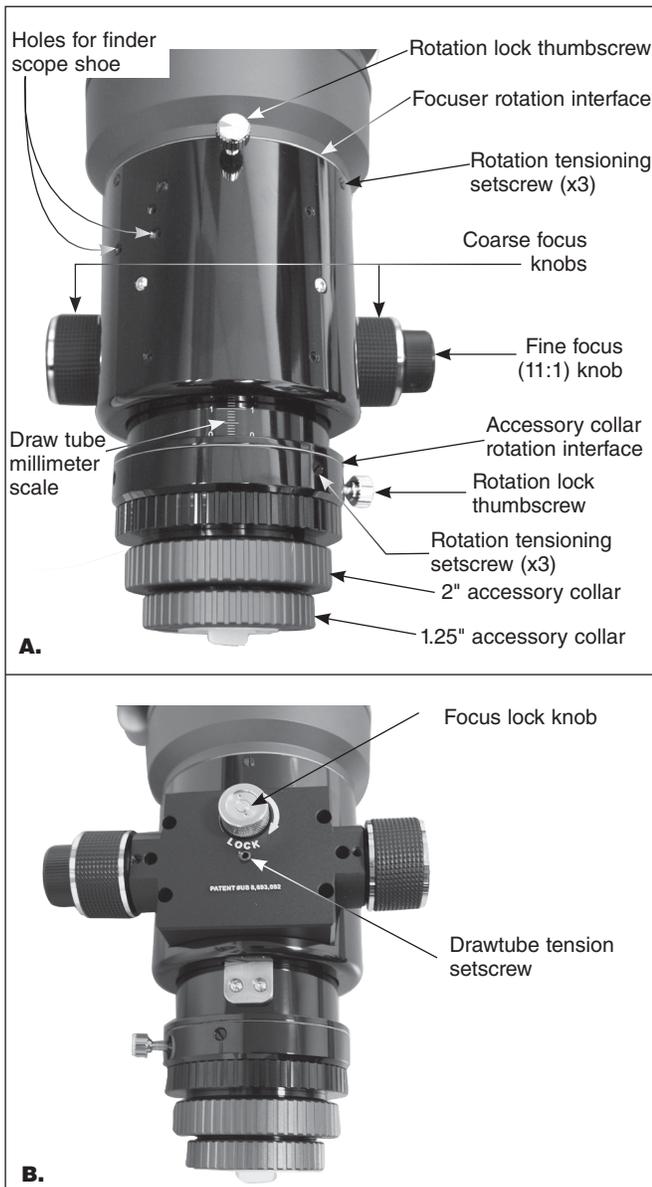


Figure 2. The top (A) and underside (B) of the hybrid drive dual-speed focuser (EON 104mm focuser shown).

Retractable Dew Shield

The dew shield of the EON 85mm and 104mm is retractable, allowing the telescope to become more compact for storage. To extend the dew shield, simply pull it forward until it stops. There is no thumbscrew to loosen or tighten. Extend the dew shield while observing or imaging to block extraneous light and to forestall the formation of dew on the exposed surface of the objective lens.

Dual-Speed Hybrid-Drive Focuser

Both the EON 85mm and EON 104mm ED-X2 telescopes feature a patented hybrid drive rack-and-pinion focuser. Its diagonal gearing provides exceptionally smooth, backlash-free focus motion and excellent rigidity for holding heavy imaging trains—up to 17.6 lbs.—without flexure or slippage. The 2.7" focuser of the EON 104 and the 2" focuser of the EON 85 ensure that even full-frame imaging sensors will have a generously large fully illuminated field.

The dual-speed (11:1) focusing mechanism will keep your target object crisp and sharp. For quick focusing, the two large focus knobs provide a coarse focus. For more precise focusing, as needed for applications such as high-power planetary observing and imaging with a CCD or digital camera, the smaller focus knob on the right side (**Figure 2A**) offers an 11:1 fine focus adjustment (~11 turns of the fine focus knob equal 1 turn of the coarse focus knob). If you find that the focus motion feels too stiff or if, on the contrary, the drawtube slips easily under the weight of your eyepiece or camera, you can make adjustments to the focuser tension with the drawtube tension set screw located on the bottom side of the focuser (**Figure 2B**). Use the included 2.5mm Allen wrench to adjust it until the focuser motion feels smooth and the drawtube holds in place under load when you have obtained focus. It may be necessary to make adjustments when the weight of your accessories changes significantly.

The 2" accessory collar on the focuser has a robust twist-lock mechanism and an internal compression ring for securing a diagonal, field flattener, camera adapter, or other 2" accessories. The twist-lock mechanism provides an extremely secure attachment and obviates the need for thumbscrews, which can sometimes fall out and get lost. Each scope also comes with a 2"-to-1.25" step down adapter, which has the same convenient twist-lock mechanism and compression ring. This adapter is required for 1.25" accessories.

The telescope must be used with either a diagonal or extension tube (both sold separately) in order for an eyepiece to reach focus. In most cases, you will be using a 90° star diagonal for visual use with an eyepiece.

Engraved Millimeter Scale

The drawtube of the EON's focuser features a laser-engraved millimeter scale on top, which aids in providing repeatable focus. When precise focus is achieved, noting the value on the scale where the drawtube meets the focuser housing will allow you to return to approximately the same point, such as when focusing the same camera in subsequent imaging sessions. Using the scale can save time compared to finding the focus-

ing point “from scratch.” The EON 85mm and 104mm ED-X2 have 98mm and 96mm of drawtube travel, respectively.

Focuser Rotation

The focusers on the EON 85mm and 104mm ED-X2 are fully rotatable. Rotating the focuser can be useful for framing an imaging target on a camera’s sensor, or for orienting the focus knobs in a comfortable position depending on where the telescope is pointing. The EON 85mm ED-X2 has one rotation interface, between the focuser and the optical tube, while the EON 104mm ED-X2 has two rotation interfaces, one just behind the tapered collar where the focuser meets the optical tube and the other at the back end of the focuser housing, as shown in the figure (see **Figure 2A**). The rotation mecha-

nisms have three recessed setscrews that must be slightly loosened to permit rotation, as well as a thumbscrew lock.

To rotate the focuser, loosen the rotation lock thumbscrew (**Figure 2B**) a half turn or so counterclockwise. Gently rotate the focuser to the desired orientation, then lock it in place by turning the lock thumbscrew clockwise. If you find the focuser is difficult to rotate, you may have to very slightly loosen the three rotation tensioning setscrews around the focuser with a small flat-blade screwdriver. If, on the other hand, you feel too much “play” in the focuser when the thumbscrew is loosened, you may need to tighten these setscrews a bit.

NOTE: Upon receipt of your telescope, grasp the focuser then loosen the focuser rotation lock thumbscrew and attempt to rotate the focuser. If it rotates too freely or feels loose, you’ll need to tighten the three focuser rotation setscrews using a small flat screwdriver until you feel resistance when rotating the focuser. Do the same for the rotation interface near the 2" accessory collar. If you do not plan to use one (or either) of the rotation interfaces, we recommend tightening down the three setscrews as well as the thumbscrew lock.

Finder Scope Dovetail Shoe

Your EON ED-X2 comes with a dovetail finder scope shoe that allows attachment of an optional Orion finder scope, reflex sight, mini guide scope, or the Orion Dual Finder Scope bracket. It attaches to the top left surface of the focuser with two screws, which are included. (If more than two screws are included, use the two shortest screws. Also, the included nuts are not needed.) Locate the two holes as shown in **Figure 3A**. If they have setscrews in them, you will need to remove them with a 2mm Allen wrench before you can install the finder scope shoe. Use a small Philips screwdriver to install the finder scope shoe with the two screws provided (**Figure 3B**). Make sure the shoe is oriented so that the notch is facing to the rear.

Tube Rings and Mounting Plate

Your EON ED-X2 refractor comes with a pair of heavy duty, CNC-machined, clamp-style tube rings. Each has a flat boss on the top and bottom with five ¼"-20 threaded holes for attachment of mounting plates. Also included is a 7" universal mounting plate made of machined and anodized aluminum. Four ¼"-20 socket head cap screws are also provided.

Hard Case

The hard case that comes with your EON ED-X2 should be used to transport and store the telescope when it’s not in use, to keep the instrument clean and protected from damage.

3. Operating the EON ED-X2

The EON 85mm and 104mm ED-X2 refractors are versatile telescopes designed for both high-performance imaging and visual pursuits. Their moderately fast focal ratios and premium ED air-spaced triplet optics—incorporating both FPL-51 and FPL-53 Ohara ED glass elements—combine to make them especially superb instruments for imaging with CCD or DSLR cameras.

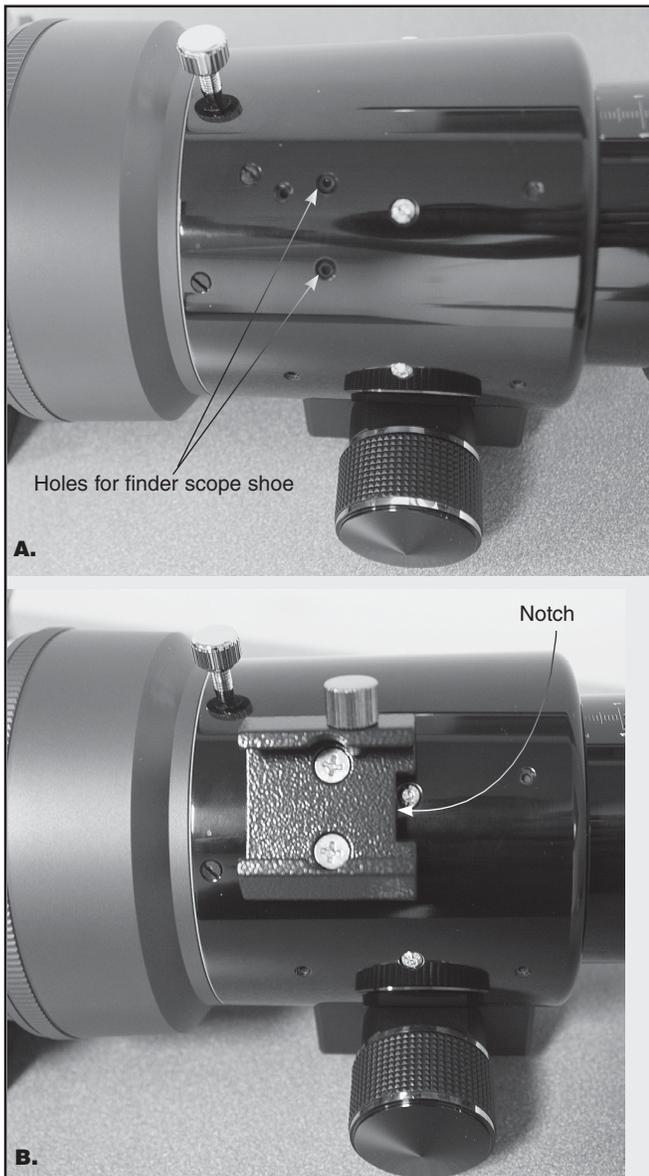


Figure 3. Locate the two threaded holes on the focuser, as shown in (A), then attach the finder scope shoe with the provided flat-head machine screws, as shown in (B).

Now that you have become familiar with the different features and functions of the telescope, you are ready to begin using it outside under a starry sky. Be sure to allow the telescope to equilibrate to the outdoor temperature for at least 1/2 hour before using it; this ensures the best image quality.

Connecting the EON ED-X2 to a Telescope Mount

The EON ED-X2 refractors come with a pair of sturdy, hinged and felt-lined tube rings and a Vixen style dovetail mounting bar. The tube rings have a large clamp knob to secure them tightly on the telescope tube.

Balancing the telescope can be done by moving the telescope forward or backward within the tube rings, or by sliding the dovetail mounting plate forward or backward in your mount's saddle

Observing with the EON ED-X2

To observe with the EON 85mm or 104mm ED-X2 refractors you will need either a 1.25" or 2" diagonal and an eyepiece, each sold separately. Because the optics are made with high-quality ED glass, the eyepieces you choose should also have excellent, fully multi-coated optics to leverage the full performance of the telescope. It is desirable to have a range of eyepieces of different focal lengths, to allow viewing over a range of magnifications.

To calculate the magnification, or power, of a telescope, simply divide the focal length of the telescope by the focal length of the eyepiece:

$$\text{Magnification} = \frac{\text{Telescope Focal Length (mm)}}{\text{Eyepiece Focal Length (mm)}}$$

If outside viewing conditions are ideal, a telescope with good optics can achieve a magnification of about 50x per inch of aperture. Keep in mind that at higher powers, an image will always be dimmer and less sharp (this is a fundamental law of optics). In most cases the steadiness of the air (the "seeing") will limit how much magnification the scope can tolerate, rather than the telescope itself. Always start viewing with your lowest-power (longest focal length) eyepiece in the telescope. After you have located and observed the object with it, you can try switching to a higher power eyepiece to ferret out more detail, if atmospheric conditions permit. If the image you see is not crisp and steady, reduce the magnification by switching to a longer focal length eyepiece. As a general rule, a small but

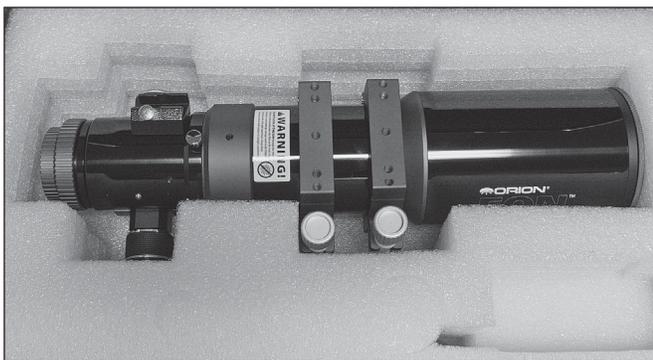


Figure 4. The foam-lined hard case keeps your EON telescope clean and well protected.

well-resolved image will show more detail and provide a more enjoyable view than a dim and fuzzy, over-magnified image.

Astrophotography with the EON ED-X2

Both EON ED-X2 Triplet Apochromatic refractors are outstanding instruments for astro-imaging. As for any triplet refractor, an optional field flattener is recommended when imaging with cameras having an APS-C sized sensor or larger, to provide an optimally flat field out to the periphery of the sensor. (For imaging sensors smaller than APS-C used with the EON, a field flattener may not provide any noticeable benefit.) For the EON 85mm ED-X2, when used with a field flattener such as the Orion #8893 Field Flattener for Small Refractors, you will also need a 2" extension adapter such as the #52026 Orion 2" Precision Centering Extension Adapter (sold separately) for a camera to reach focus. For the EON 104mm ED-X2, when used with the dedicated #5302 Orion 2" Field Flattener for EON 104mm ED-X2, no additional extension is needed for astrophotography with a DSLR. For some CCD cameras additional extension may be required.

To attach a DSLR camera, you will also need the appropriate T-ring for the make and model of your camera.

The hybrid-drive rack-and-pinion focuser of your EON ED-X2 is capable of handling an imaging train weighing up to 17.6 lbs. The drawtube tension can be adjusted to be tighter, as described earlier, if the focuser drawtube slips under a heavy load. Once critical focus is achieved for the object you are shooting, you can lock the drawtube in that position by turning the focus lock knob clockwise all the way (**Figure 2B**).

4. Care & Maintenance

Give your telescope reasonable care and it will last a lifetime. When not in use, keep the telescope in its padded case (**Figure 4**), and keep the objective dust cover on, as well as the small plastic plug on the 1.25" adapter. Store it indoors or in a dry garage. Do not leave the telescope outside except when using it. If a scratch appears on the tube, it will not harm the telescope. Smudges on the tube can be wiped off with standard household cleaners.

Dealing with Dew

When you are ready to pack up your telescope at the end of the night, avoid immediately storing it if you encountered heavy dew and the telescope is damp. Instead, bring the telescope inside and allow the moisture on the telescope to evaporate. If dew forms on the objective lens, then leave the dust cover off of the telescope until all the moisture has evaporated. Once the telescope has completely dried out, place it back in its case.

Cleaning Optical Surfaces

In general, your telescope will only need to be cleaned on a very minimal basis. Dust particles on the objective lens do not affect the optical quality of your EON. Loose dust can simply be blown off with air, using a compressed air can or blower bulb. Any remaining dust is best left alone, unless the build-up is extreme. Fingerprints and water marks should be cleaned

from your telescope's objective lens. Any quality optical lens tissue and cleaning fluid specifically designed for multi-coated optics can be used to clean the telescope's objective lens as well as the lenses of your eyepieces and finder scope. Never use regular glass cleaner, or cleaning fluid designed for eyeglasses.

Before cleaning with fluid and tissue, however, blow any loose particles off the lens with a blower bulb or compressed air, or lightly brush the lens with a soft camel hair brush. Apply some cleaning fluid to a tissue, never directly on the optics. Wipe the lens gently in a circular motion, then remove any excess fluid with a fresh lens tissue. Oily fingerprints and smudges may be removed using this method. Use caution; rubbing too hard may scratch the lens! Clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

6. Specifications

EON 85mm ED-X2

Optical tube:	Seamless aluminum
Optics:	Air-spaced triplet, with one element FPL-51 and one element FPL-53 fluoro-crown ED glass Ohara)
Lens cell:	Machined aluminum
Aperture:	85mm (3.3")
Tube color:	Gloss black, with red-anodized satin trim
Focal length:	560mm
F-ratio:	6.6
Lens coatings:	Fully multi-coated (all air-to-glass surfaces multi-layer coated)
Tube baffles:	Multiple knife edge baffles
Tube length, dew shield retracted:	17-3/4" / 451mm
Tube length, dew shield extended:	20-1/4" / 514mm
Weight: (with tube rings and dovetail bar attached)	9.25 lbs. / 4.2kg
Tube rings:	Split, felt lining, five 1/4"-20 holes on upper and lower bosses
Focuser:	2" hybrid drive rack-and-pinion, 11:1 dual speed, rotatable
Drawtube travel:	3.9" / 98mm
Rotatable focuser:	Yes
Dew shield:	Retractable
Finder scope:	Optional; dovetail finder scope shoe included
2" accessory collar:	Twist-lock, brass compression ring
1.25" adapter:	Twist-lock, brass compression ring; threaded for 2" filters
Dovetail mounting plate:	7" narrow (Vixen style)
Objective dust cover:	Aluminum, thread fit
Diagonal:	Not included
Eyepiece:	Not included
Field flattener:	Optional
Case:	Hard case with die-cut foam interior; outer dimensions 22.5"L x 8"H x 12.5"W

EON 104mm ED-X2

Optical tube: Seamless aluminum

Optics: Air-spaced triplet, with one element FPL-51 and one element FPL-53 fluoro-crown ED glass Ohara)

Lens cell: Machined aluminum

Aperture: 104mm (4.1")

Tube color: Gloss black, with red-anodized satin trim

Focal length: 650mm

F-ratio: 6.25

Lens coatings: Fully multi-coated (all air-to-glass surfaces multi-layer coated)

Tube baffles: Multiple knife edge baffles

Tube length, dew shield retracted: 22-1/2" / 572mm

Tube length, dew shield extended: 25-1/2" / 648mm

Weight: (with tube rings and dovetail bar attached) 14.5 lbs. / 6.6kg

Tube rings: Split, felt lining, five 1/4"-20 holes on upper and lower bosses

Focuser: 2.7" hybrid drive rack-and-pinion, 11:1 dual speed, rotatable

Drawtube travel: 3.8" / 96mm

Drawtube lock: Yes

Dew shield: Retractable

Finder scope: Optional; dovetail finder scope shoe included

2" accessory collar: Twist-lock, brass compression ring

1.25" adapter: Twist-lock, brass compression ring; threaded for 2" filters

Dovetail mounting plate: 7" narrow (Vixen style)

Objective dust cover: Aluminum, press fit

Diagonal: Not included

Eyepiece: Not included

Field flattener: Optional

Case: Hard case with die-cut foam interior; outer dimensions 28"L x 9.25"H x 9.25"W

Eyepiece: Not included

Field flattener: Optional

Case: Hard case with die-cut foam interior; outer dimensions 28"L x 9.25"H x 9.25"W

One-Year Limited Warranty

This Orion product is warranted against defects in materials or workmanship for a period of one year from the date of purchase. This warranty is for the benefit of the original retail purchaser only. During this warranty period Orion Telescopes & Binoculars will repair or replace, at Orion's option, any warranted instrument that proves to be defective, provided it is returned postage paid. Proof of purchase (such as a copy of the original receipt) is required. This warranty is only valid in the country of purchase.

This warranty does not apply if, in Orion's judgment, the instrument has been abused, mishandled, or modified, nor does it apply to normal wear and tear. This warranty gives you specific legal rights. It is not intended to remove or restrict your other legal rights under applicable local consumer law; your state or national statutory consumer rights governing the sale of consumer goods remain fully applicable.

For further warranty information, please visit www.OrionTelescopes.com/warranty.



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