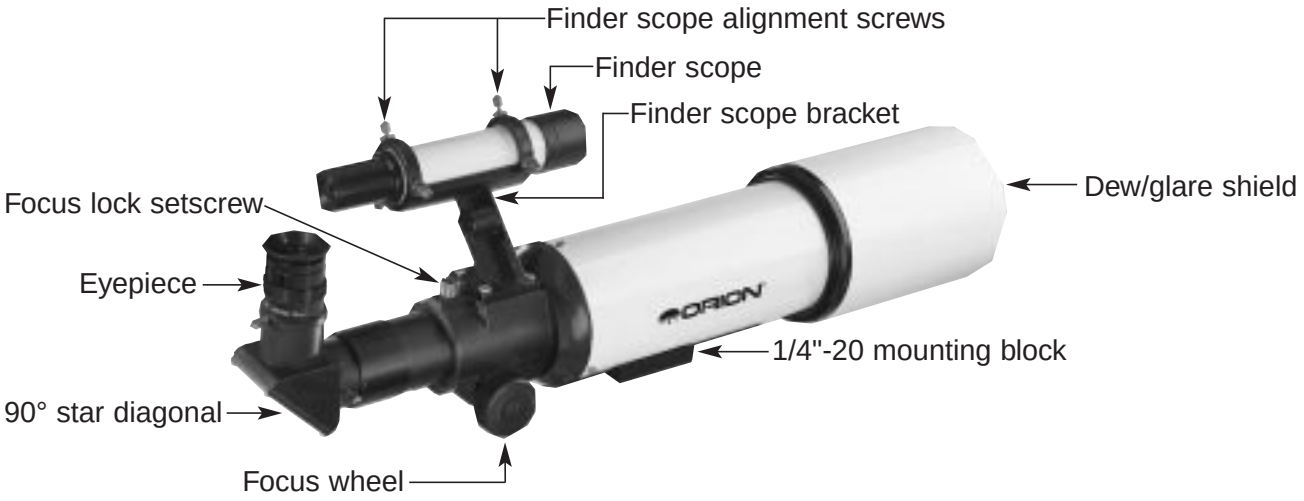
Orion® ShortTube™ 90

90mm Rich-Field Refracting Telescope

#9069

Welcome to a new world of adventure! Your Orion ShortTube 90 is a fine-quality instrument designed for both daytime terrestrial viewing and nighttime stargazing. Compact, portable, and easy to use, this versatile scope will provide many hours of enjoyment for the whole family.

These instructions will help you set up and properly use and care for your telescope. Please read them over thoroughly before getting started.



The ShortTube 90mm Refractor

WARNING: ***Never look at the sun with your telescope (or even with just your eyes) without a professionally made solar filter. Permanent eye damage or blindness could result. Young children should use this telescope only with adult supervision.***

Avoid using the type of solar filter that screws into an eyepiece. They are susceptible to cracking under the intense heat that builds up near the focus point, and could cause severe retinal damage. Use only the type of solar filter that covers the front of the telescope. Be sure also to cover the front of the finder scope with aluminum foil or another opaque material to prevent physical damage to the internal components of the scope itself as well as to your eyes.

Parts List

Qty.	Description
1	Optical tube assembly
1	26mm (19x) Plössl eyepiece (1.25")
1	90° star diagonal
1	6x30 finder scope
1	Objective lens cap

Getting Started

The ShortTube 90 comes nearly fully assembled from the factory. The telescope's optics have been installed and collimated, so you should not have to make any adjustments to them. Open the box and inspect the contents to make sure all of the parts listed above are present.

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P.O. Box 1815, Santa Cruz, CA 95061

Please keep the original shipping box! In the unlikely event you should need to ship the telescope back to Orion for warranty repair service, you should use the original packaging. The box also makes a very good container for storing the telescope when it is not in use.

Installing the Accessories

Slide the 6x30 finder scope into its mounting bracket (preinstalled on the optical tube) and gently tighten the six alignment screws. Insert the 90° star diagonal into the focuser drawtube and secure with the knurled setscrew. Slide the eyepiece into the diagonal and tighten the setscrew on the diagonal.

Mounting the Telescope on a Tripod

The ShortTube 90 can be mounted on any standard camera tripod that has a 1/4"-20 stud. The stud threads into the small block on the underside of the telescope's optical tube. Alternatively, the telescope can be attached to an equatorial mount equipped with a 1/4"-20 adapter. An equatorial mount is desirable for astronomical viewing because it allows easy manual tracking of celestial objects as the Earth rotates. Also, the setting circles on the mount enable you to locate objects by their celestial coordinates (right ascension and declination), which can be found in many observing books and star atlases.

Focusing

The ShortTube 90 is equipped with a precision rack-and-pinion focuser. When you first look in the eyepiece, the image you see may be fuzzy, or out of focus. If so, gently turn one of the large focusing wheels with your fingers until the image becomes sharp. Be sure to first loosen the knurled focus lock setscrew on the top of the focuser. You will have to readjust the focus when aiming at subjects of varying distances, or after changing eyepieces.

Aligning the Finder Scope

The ShortTube 90 comes with a 6x30 achromatic finder scope. (The 6 means six-times magnification, and the 30 indicates a 30mm-diameter front lens.) The finder scope makes it easier to locate the subject you want to observe in the telescope, because the finder scope has a much wider field of view. Images viewed in the finder scope will appear upside down, which is normal for astronomical finder scopes.

Before you can properly use the finder scope, it must be precisely aligned with the telescope, so they both point to exactly the same spot. Alignment is easiest to do in daylight, rather than at night under the stars. First, insert the eyepiece into the main telescope's focuser. Then point the telescope at a discrete object such as the top of a telephone pole or a street sign that is at least a quarter-mile away. Move the telescope so the target object appears in the very center of the field of view when you look into the eyepiece.

Now look through the finder scope. Is the object centered in the finder scope's field of view, i.e., on the crosshairs? If not, hopefully it will be visible somewhere in the field of view, so only fine adjustment of the six alignment screws will be needed. Otherwise you'll have to make coarser adjustments to the alignment screws to redirect the aim of the finder scope. Make sure to loosen the knurled lock nut on each alignment screw before adjusting it.

Use the six alignment screws to center the object on the crosshairs of the finder scope. Then look again into the main telescope's eyepiece and see if it is still centered there as well. If it isn't, repeat the entire process, making sure not to move the main telescope while adjusting the alignment of the finder scope.

Finder scopes can come out of alignment during transport of the telescope, so check the alignment before each observing session. Note that the image seen through the finder scope appears upside-down. This is normal for astronomical finder scopes.

Terrestrial Viewing

For terrestrial observing, you may wish to replace the standard-equipment 90° star diagonal with an optional 45° correct-image diagonal (Orion part #8790). The 90° star diagonal is preferred for astronomical use, but gives an image that is reversed left-to-right, which doesn't really matter when viewing celestial objects. For daytime terrestrial use, however, you will want a properly oriented image, so use of the 45° correct-image diagonal is recommended.

For terrestrial applications, we recommend mounting the ShortTube 90 on an altazimuth-style camera tripod (such as the Orion Paragon HD-F2) or telescope mount (Orion AZ-3 mount), which allow simple vertical (altitude) and horizontal (azimuth) motions. For most astronomical telescope mounts, you will need a 1/4"-20 adapter to couple the scope to the mount head. Camera tripods come already equipped with a 1/4"-20 post, so no adapter is needed.

With the eyepiece inserted and secured in the diagonal, simply point the telescope at the subject you want to observe and center it on crosshairs of the finder scope (which you've previously aligned with the telescope, as explained in the preceding section). Then look into the eyepiece of the main telescope and the subject should be in the center of the field of view. If the view is blurry, adjust the focus with the focus wheel until the image appears sharp.

For higher magnification, additional eyepieces of shorter focal length can be purchased. But remember, increasing the magnification decreases the field of view and the image brightness.

Astronomical Viewing

The ShortTube 90 excels for astronomical observation. Its unobstructed 90mm aperture and short 500mm focal length (f/5.6) provide bright, expansive views of star fields and celestial objects residing within our solar system and beyond.

For casual stargazing, an altazimuth mount such as the Orion AZ-3 mount will do the job just fine. But an equatorial mount, such as the Orion SkyView Deluxe EQ mount, is designed to make it easier to manually "track" the motion of celestial objects with just one slow-motion cable. Furthermore, with an equatorial mount you can add an optional motor drive to track the stars automatically — a great convenience.

When selecting a location for nighttime stargazing, make it as far away from city lights as possible. Light-polluted skies greatly reduce what can be seen with the telescope. Also, give your eyes at least 20 minutes to dark-adapt to the night sky. You'll be surprised at how many more stars you will see! Use a red flashlight, such as the Orion RedBeam LED Flashlight to see what you're doing at the telescope, or to read star charts. Red light will not spoil your dark-adapted night vision as readily as white light will.

To find celestial objects with your telescope, you first need to become reasonably familiar with the night sky. Unless you know how to recognize the constellation Orion, for instance, you won't have much luck locating the Orion Nebula. A simple planisphere, or star wheel, can be a valuable tool for learning the constellations and seeing which ones are visible in the sky on a given night.

A good star chart or atlas, like the Orion DeepMap 600, can come in handy for helping locate interesting objects among the dizzying multitude of stars overhead. Except for the Moon and the brighter planets, it is pretty time-consuming and frustrating to hunt for objects randomly, without knowing where to look. It is best to have specific targets in mind before you begin looking through the eyepiece.

A. The Moon

The Moon, with its rocky, cratered surface, is one of the easiest and most interesting subjects to observe with your telescope. The myriad craters, rilles, and jagged mountain formations offer endless fascination. The best time to observe the Moon is during a partial phase, that

is, when the Moon is not full. During partial phases, shadows cast by crater walls and mountain peaks along the border between the dark and light portions of the lunar disk highlight the surface relief. A full Moon is too bright and devoid of surface shadows to yield a pleasing view. Try using a Moon filter to dim the Moon when it is too bright; it simply threads onto the bottom of the eyepiece.

B. The Planets

The planets don't stay put like stars do (planets don't have fixed R.A. and Dec. coordinates), so you will have to refer to charts published monthly on our website, www.telescope.com, or in *Astronomy, Sky & Telescope,* or other astronomy references to locate them. Venus, Mars, Jupiter, and Saturn are the brightest objects in the sky after the Sun and the Moon. All four of these planets are not normally visible in the sky at one time, but chances are one or two of them will be.

JUPITER The largest planet, Jupiter, is a great subject to observe. You can see the disk of the giant planet and watch the ever-changing positions of its four largest moons, Io, Callisto, Europa, and Ganymede. If atmospheric conditions are good, you may be able to resolve thin cloud bands on the planet's disk.

SATURN The ringed planet is a breathtaking sight when it is well positioned. The tilt angle of the rings varies over a period of many years; sometimes they are seen edge-on, while at other times they are broadside and look like giant "ears" on each side of Saturn's disk. A steady atmosphere (good seeing) is necessary for a good view. You may probably see a tiny, bright "star" close by; that's Saturn's brightest moon, Titan.

VENUS At its brightest, Venus is the most luminous object in the sky, excluding the Sun and the Moon. It is so bright that sometimes it is visible to the naked eye during full daylight! Ironically, Venus appears as a thin crescent, not a full disk, when at its peak brightness. Because it is so close to the Sun, it never wanders too far from the morning or evening horizon. No surface markings can be seen on Venus, which is always shrouded in dense clouds.

MARS If atmospheric conditions are good, you may be able to see some subtle surface detail on the Red Planet, possibly even the polar ice cap. Mars makes a close approach to Earth every two years; during those approaches its disk is larger and thus more favorable for viewing.

C. Stars

Stars will appear like twinkling points of light in the telescope. Even the largest telescopes cannot magnify stars to appear as anything more than points of light! You can, however, enjoy the different colors of the stars and locate many pretty double and multiple stars. The famous "Double-Double" in the constellation Lyra and the gorgeous two-color double star Albireo in Cygnus are favorites. Defocusing the image of a star slightly can help bring out its color.

D. Deep-Sky Objects

Under dark skies, you can observe a number of brighter deep-sky objects with your ShortTube 90, including gaseous nebulas, open and globular star clusters, and the brighter galaxies. Most deep-sky objects are very faint, so it is important that you find an observing site well away from light pollution. Take plenty of time to let your eyes adjust to the darkness. Don't expect these objects to appear like the photographs you see in books and magazines; most will look like dim gray "ghosts." (Our eyes are not sensitive enough to see color in deep-sky objects except in few of the brightest ones.) But as you become more experienced and your observing skills improve, you will be able to coax out more and more intricate details.

Do You Wear Eyeglasses?

If you wear eyeglasses, you may be able to keep them on while you observe, if your eyepieces have enough "eye relief" to allow you to see the whole field of view. You can find out by looking through the eyepiece first with your glasses on and then with them off, and see if the glasses restrict the view to only a portion of the full field. If they do, you can easily observe with your glasses off by just refocusing the telescope the needed amount.

Calculating Magnification (Power)

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:

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

For example, the ShortTube 90, which has a focal length of 500mm, used in combination with a 26mm eyepiece, yields a power of

$$\textbf{500 ÷ 26 = 19x.}$$

Every telescope has a useful limit of power of about 45x-60x per inch of aperture. Claims of higher power by some telescope manufacturers are a misleading advertising gimmick and should be dismissed. Keep in mind that at higher powers, an image will always be dimmer and less sharp (this is a fundamental law of optics). The steadiness of the air (the "seeing") will limit how much magnification an image can tolerate.

Always start viewing with your lowest-power (longest focal length) eyepiece in the telescope. After you have located and looked at 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 well-resolved image will show more detail and provide a more enjoyable view than a dim and fuzzy, overmagnified image.

Photography with the ShortTube 90

With the proper adapters, the ShortTube 90 becomes a 500mm f/5.6 telephoto lens for a 35mm single-lens reflex (SLR) camera. You can take impressive pictures in daylight with the telescope/camera combination mounted on a sturdy camera tripod. For astrophotography, the telescope with camera attached should be mounted on an equatorial mount equipped with at least one motor drive to track the motion of the stars.

You will need both a T-ring for your camera and a 1.25" Universal Camera Adapter to couple your camera to the back end of the telescope. Remove the nosepiece from the camera adapter; the body of the adapter will not be needed here. Connect the T-ring to your camera body (remove any camera lenses first), and connect the nosepiece of the camera adapter to the T-ring. Now, insert the entire assembly into the focuser's drawtube (remove the eyepiece and diagonal), and secure with the setscrew on the drawtube. Be sure to tighten the setscrew, or your camera could fall to the ground!

Use the camera's viewfinder to frame the picture. Use the telescope's focuser to focus the image. Tighten the focus lock setscrew to make sure the camera does not slip out of focus.

You may want to consider using a remote shutter release instead of the shutter release on the camera. Touching the camera can vibrate the system and blur the resulting photographic image. Also, be sure to use a solid tripod.

Care & Maintenance

Give your telescope reasonable care and it will last a lifetime. Store it indoors or in a dry garage. Do not leave the telescope outside except when using it. The optical tube is aluminum and has a smooth painted surface that should resist scratches and smudges. If a scratch does appear on the tube, it will not harm the telescope. If you wish,

you can apply some white auto touch-up paint to the scratch. Smudges on the tube can be wiped off with standard household cleaners such as Windex or Formula 409.

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 the 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! On larger lenses, clean only a small area at a time, using a fresh lens tissue on each area. Never reuse tissues.

Do not disassemble the telescope, eyepieces, or other optical components included with the telescope for any reason, or your warranty will be void! Cleaning of inaccessible optical surfaces should be performed by experienced opticians. Call Orion for information.

Specifications

Objective lens: 90mm aperture, achromatic air-spaced doublet, fully antireflection coated

Focal length: 500mm

Focal ratio: f/5.6

Weight of optical tube assembly: 5 lbs.

Mounting provision: 1/4"-20 threaded mounting block

Finder scope: 6x magnification, 30mm aperture, achromatic, crosshairs

Eyepiece: 26mm (19x) Plössl, 1.25" barrel diameter, fully coated

Diagonal: 90° star diagonal, mirror-type, 1.25" barrel diameter

Suggested Accessories

Full descriptions of the following accessories are available in the Orion print catalog or online catalog (www.telescope.com).

- Paragon HD-F2 Tripod (#5370): Portable yet sturdy camera tripod.
- AZ-3 Altazimuth Mount (#9018): Telescope mount with dual slow-motion controls.
- 1/4"-20 Adapter for AZ-3 Mount (#10100): Couples telescope to mount.
- SkyView Deluxe Equatorial Mount (#9400): Excellent mount for astronomical use.
- 1/4"-20 Adapter for SkyView Deluxe Mount (#3800): Needed to use SVD Mount.
- AccuTrack SVD DC Motor Drive (#7825): Provides hands-free tracking for the SVD Mount.
- 45° Correct-Image Diagonal (#8790): Gives a correctly oriented image; recommended for terrestrial use.
- RedBeam LED Flashlight (#5744): Preserves dark-adapted night vision.
- DeepMap 600 (#4150): Great pocket reference featuring the 600 best celestial objects to view.
- Moon Filter (#5662): Reduces lunar glare, bringing out more surface detail.
- T-ring: Camera model specific. Required for through-the-telescope photography. Call for assistance.
- Universal Camera Adapter (1.25") (#5264): Required for through-the-telescope photography.
- Soft Case for ShortTube 90 (#15166): Protects the telescope for transporting.
- Sirius Plössl 1.25" Eyepieces: Recommended eyepieces for additional magnifications.
- Shorty 2x Barlow (1.25") (#8711): Doubles the magnification of any eyepiece.
- 6-Piece Optics Cleaning Kit (#5825): Everything you need to keep optics sparkling.
- Starter Set of Four 1.25" Color Filters (#5514): Helps bring out subtle detail in planets.
- Solar Filter for ShortTube 90 (#7730): Required for safe viewing of the Sun.

One-Year Limited Warranty

The Orion ShortTube™ 90mm Refractor 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 to: Orion Warranty Repair, 89 Hangar Way, Watsonville, CA 95076. Proof of purchase (such as a copy of the original receipt) is required.

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, and you may also have other rights, which vary from state to state. For further warranty service information, contact: Customer Service Department, Orion Telescopes & Binoculars, P. O. Box 1815, Santa Cruz, CA 95061; (800) 676-1343.

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