

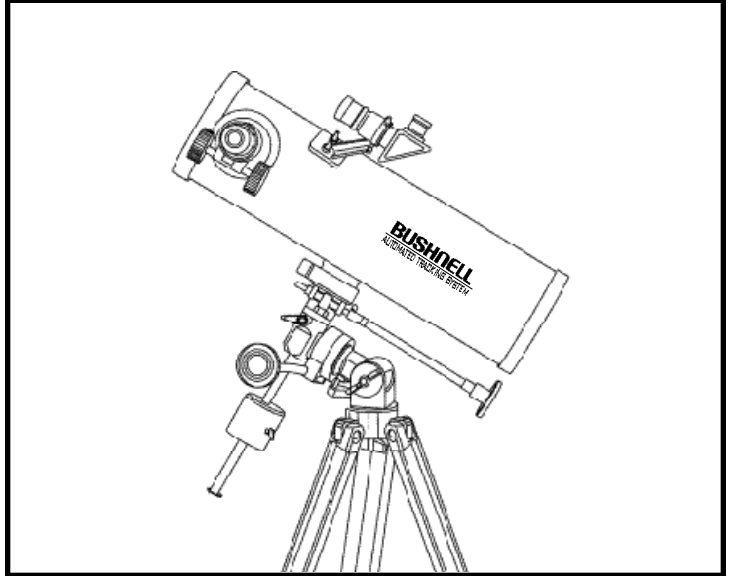
Bushnell®

AUTOMATED TRACKING SYSTEM

NORTH™ STAR

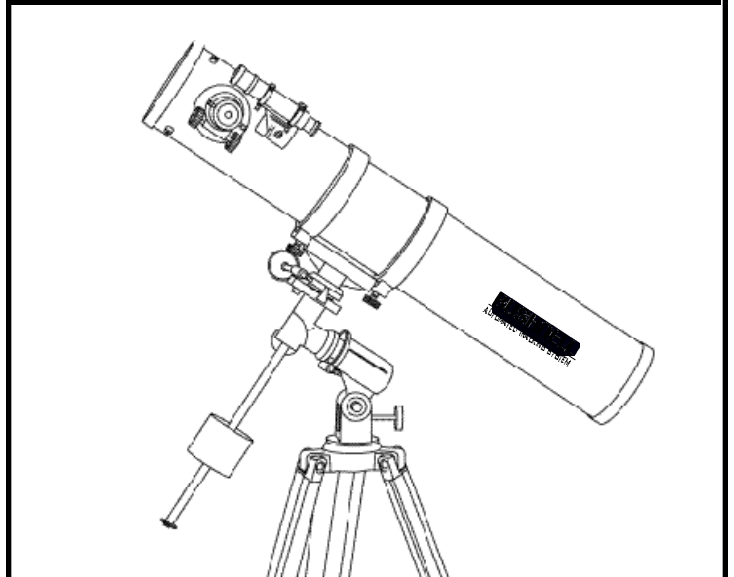
Lit. #: 91-0216/03-01

78-7876 76MM REFLECTOR



INSTRUCTION MANUAL

78-7846 114MM REFLECTOR





WHERE DO I START?

Your Bushnell telescope can bring the wonders of the universe to your eye. While this manual is intended to assist you in the set-up and basic use of this instrument, it does not cover everything you might like to know about astronomy. Although Northstar will give a respectable tour of the night sky, it is recommended you obtain a very simple star chart and a flashlight with a red bulb or red cellophane over the end. For objects other than stars and constellations, a basic guide to astronomy is a must. Some recommended sources appear on our website at www.bushnell.com. Also on our website will be current events in the sky for suggested viewing. But, some of the standbys that you can see are:

The Moon—A wonderful view of our lunar neighbor can be enjoyed with any magnification. Try viewing at different phases of the moon. Lunar highlands, lunar maria (lowlands called "seas" for their dark coloration), craters, ridges and mountains will astound you.

Saturn—Even at the lowest power you should be able to see Saturn's rings and moons. This is one of the most satisfying objects in the sky to see simply because it looks like it does in pictures. Imagine seeing what you've seen in textbooks or NASA images from your backyard!

Jupiter—The largest planet in our solar system is spectacular. Most noted features are its dark stripes or bands both above and below its equator. These are the north and south equatorial belts. Also interesting are Jupiter's four major moons. Pay close attention to their positions from night to night. They appear to be lined up on either side of Jupiter.

Mars—The Great Red Planet appears as a reddish-orange disk. Look at different times of the year and try to catch a glimpse of the white polar ice caps.

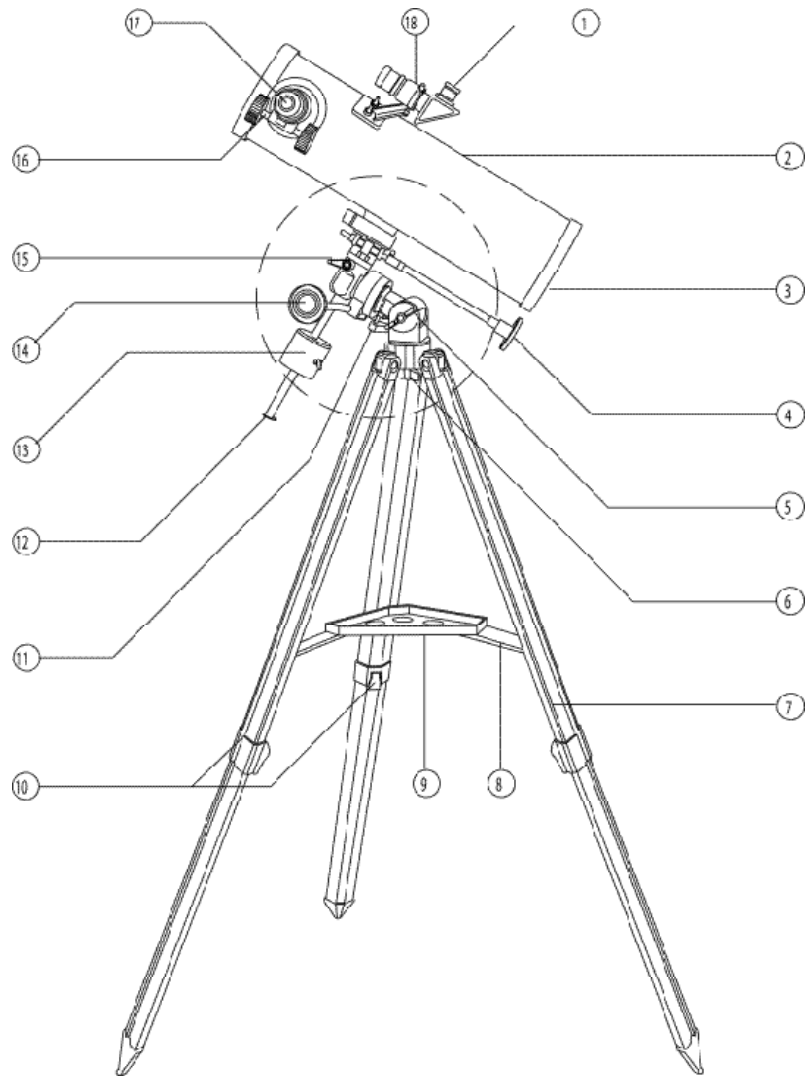
Venus—Just like the moon, Venus changed phases from month to month. Some views of brilliant Venus appear as if you were looking at a distant crescent moon.

Nebulae—The Great Orion Nebula is a very well known night sky object. This and many others are brought to you by this telescope.

Star Clusters—View millions of stars densely packed in a cluster that resembles a ball.

Galaxies—One of the greatest and most interesting galaxies is our neighbor, the Andromeda Galaxy. Enjoy this and many others.

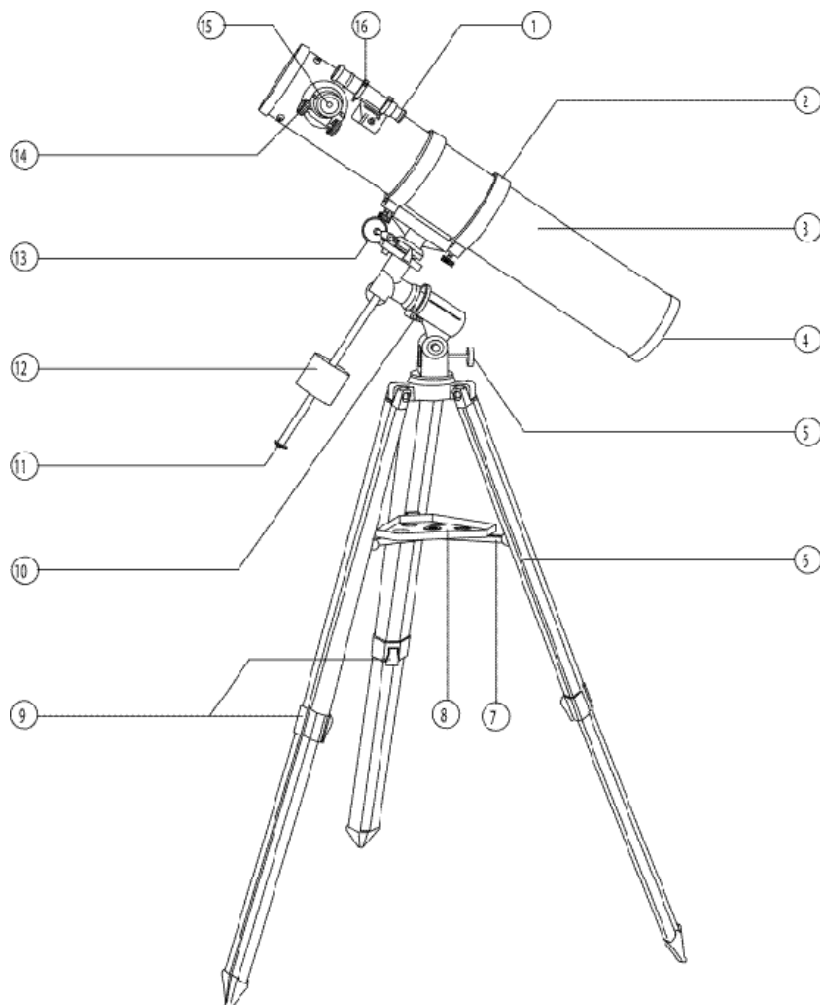
78-7876 76MM REFLECTOR



TELESCOPE PARTS DIAGRAM

- | | |
|---------------------------------|--|
| 1. Wide Field Finderscope | 10. Quick-Release Tripod Leg Lever |
| 2. Telescope Main Tube | 11. Declination Lock Knob |
| 3. Primary Mirror (Internal) | 12. Counterweight Shaft |
| 4. Fine Adjustment Cables | 13. Counterweight |
| 5. Latitude Lock Knob | 14. Fine Adjustment Cables |
| 6. Horizontal Axis Lock Knob | 15. Right Ascension Lock Knob |
| 7. Tripod Leg | 16. Rack and Pinion Focusing Mechanism |
| 8. Accessory Tray Brace | 17. Eyepiece |
| 9. Quick-Release Accessory Tray | 18. Finderscope Mount |

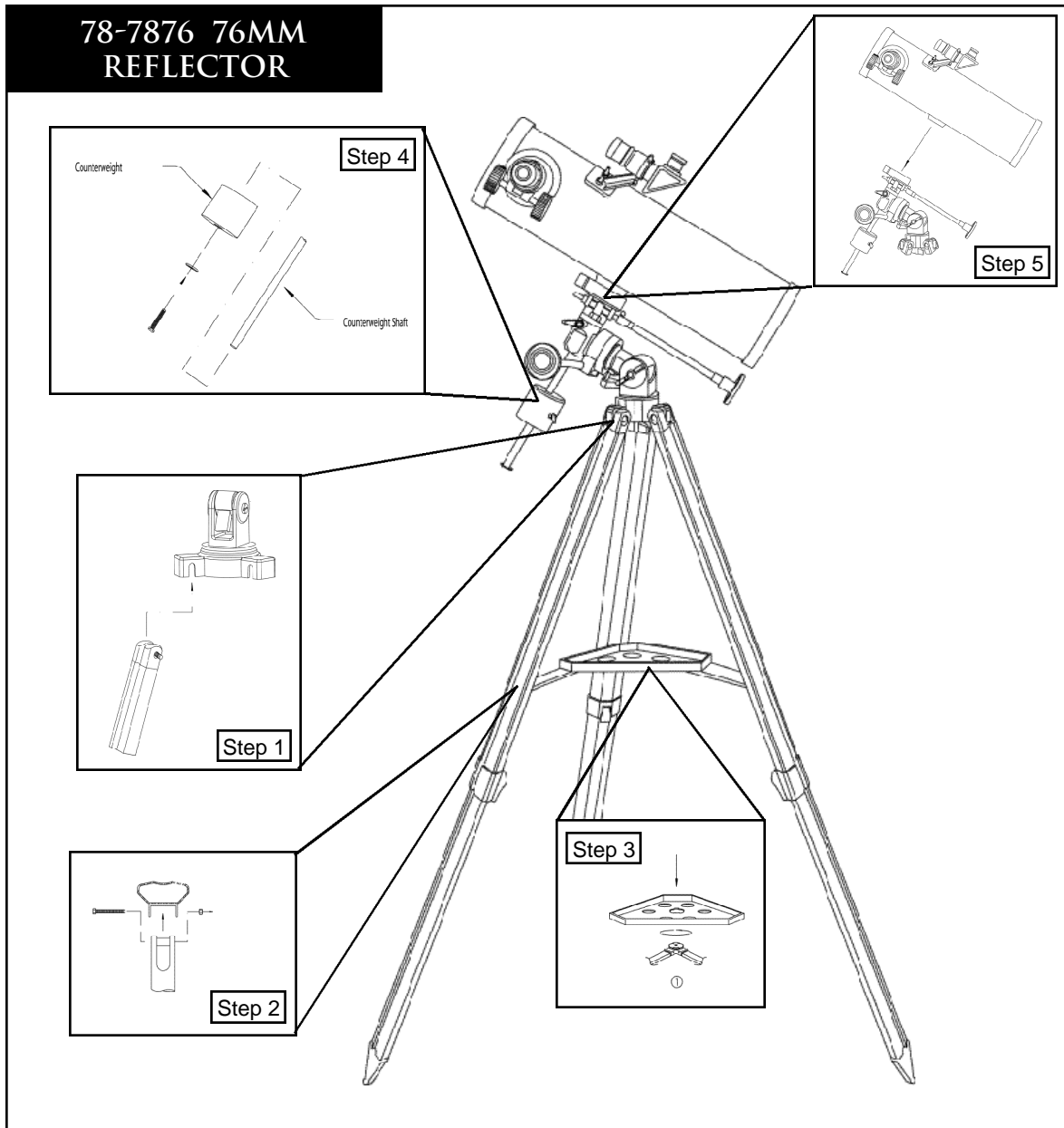
78-7846 114MM REFLECTOR



TELESCOPE PARTS DIAGRAM

- | | |
|---------------------------------|--|
| 1. Wide Field Finderscope | 9. Quick-Release Tripod Leg Lever |
| 2. Cradles | 10. Declination Lock Knob |
| 3. Telescope Main Tube | 11. Counterweight Shaft |
| 4. Primary Mirror (Internal) | 12. Counterweight |
| 5. Latitude Lock Knob | 13. Fine Adjustment Cables |
| 6. Tripod Leg | 14. Rack and Pinion Focusing Mechanism |
| 7. Accessory Tray Brace | 15. Eyepiece |
| 8. Quick-Release Accessory Tray | 16. Finderscope Mount |

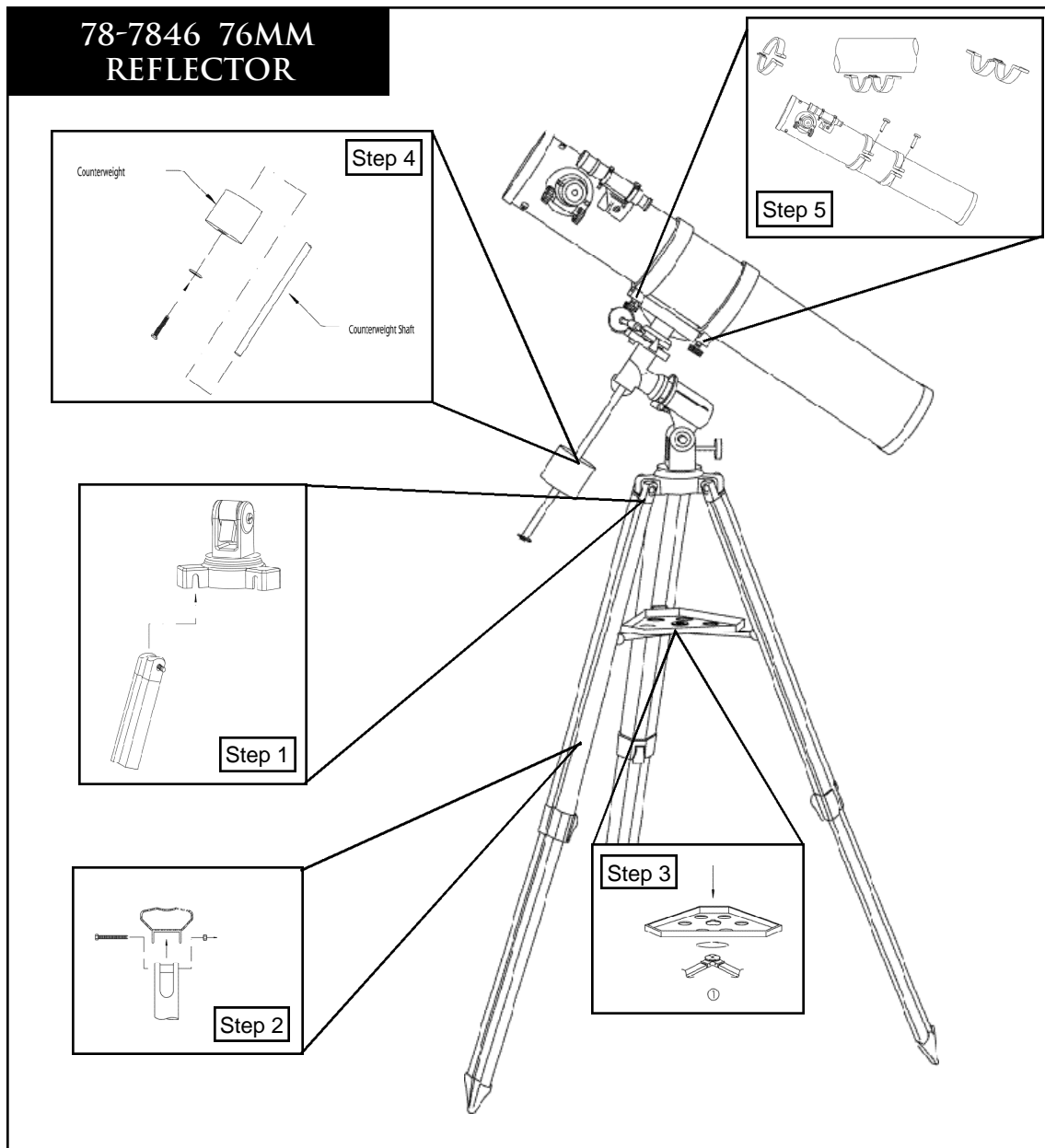
QUICK ASSEMBLY DIAGRAM



IMPORTANT:

READ THROUGH
ASSEMBLY INSTRUCTION
BEFORE YOU ASSEMBLE
YOUR TELESCOPE.

QUICK ASSEMBLY DIAGRAM



PARTS LIST

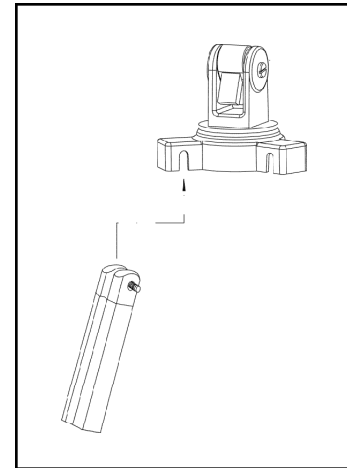
- Adjustable Aluminum Tripod Assembly (Three Legs)
- Quick Release Accessory Tray
- Reflector Telescope Assembly
- Equatorial Mount
- Wide Field Finderscope
- 20mm 1.25" Diameter Eyepiece
- 4mm 1.25" Diameter Eyepiece
- Barlow Lens

DETAILED ASSEMBLY

Remove all components from the carton and identify all components. READ THROUGH ASSEMBLY INSTRUCTION BEFORE YOU ASSEMBLE YOUR TELESCOPE.

Attach Telescope and Finderscope

1. Locate the pre-assembled *Telescope Main Tube* and *Equatorial Mount*. Note: Before assembling tripod legs to *Equatorial Mount*, make sure the *Accessory Tray Braces* face inward. Loosen long bolts at the top of *Tripod Leg*. Carefully remove *Telescope Main Tube* from *Cradles*. Position the mount over the *Tripod Leg* as shown (fig. 2). and secure *Equatorial Mount* to *Tripod Leg*. Repeat on the remaining two *Tripod Legs*. Once you have attached all *Tripod Legs* to the mount, securely tighten all wing nuts and place *Telescope Main Tube* back into *Cradles*.
2. Locate the *Finderscope* with pre-assembled *Finderscope Mount*. Remove the two nuts located near the front of the telescope (closest to the eyepiece) and place the *Finderscope* and *Finderscope Mount* over the exposed screws. Replace the nuts, and securely tighten the *Finderscope* and *Finderscope Mount* in place.



(fig. 2)

Attach Accessory Tray

1. Fold down the accessory tray braces and place the Quick Release Accessory Tray on top of braces.
2. Turn accessory tray until it snaps into place.
3. Adjust tripod leg height to suit by opening tripod leg lever and extending tripod legs to desired height. Clamp Tripod Leg lever closed when complete.

Attach Control Cables, Counterweight and Eyepieces

1. Locate the *Fine Adjustment Cable*. Loosen the silver screws located at the end of the *Fine Adjustment Cable* and attach the *Fine Adjustment Cable* to the silver post found on the *Equatorial Mount*.
2. Locate the *Counterweight* and *Counterweight Shaft*. Loosen the thumb screw located on the *Counterweight* and slide the *Counterweight* onto the *Counterweight Shaft*, then and tighten thumb screw to secure the *Counterweight*. Thread the *Counterweight Shaft* into the hole located directly below the *Declination Lock Knob*. Make sure that the shaft is securely locked into mount.
3. Insert *Eyepiece* into focusing tube to begin viewing.

HOW TO USE YOUR NEW TELESCOPE

Selecting an Eyepiece

1. You should always start viewing with the lowest power eyepiece, which in this case is the 20 mm lens. Note: the base power of each eyepiece is determined by the focal length of the telescope objective lens. A formula can be used to determine the power of each eyepiece: telescope OBJECTIVE lens focal length divided by EYEPIECE focal length = MAGNIFICATION (e.g. Using the 20 mm lens, a sample calculation would look like this: $750 \text{ mm} / 20\text{mm} = 38\text{x}$ or 38 power. Telescope models will vary in focal length).
2. Included with this telescope is a Barlow lens. Barlow lenses are used to double or triple the power of your telescope. Place your Barlow between the focusing tube and the eyepiece. Using the example above, your 3x Barlow lens would give you a total power of 114x or 114 power. ($38 \times 3 = 114\text{x}$ or 114 power). The magnification calculation would look like this: $750 \text{ mm} / 20\text{mm} = 38 \text{ power}$. $38 \text{ power} \times 3 = 114 \text{ power}$.

Focusing Telescope

1. After selecting the desired eyepiece, aim main telescope tube at a land-based target at least 200 yards away (e.g. a telephone pole or building).
2. Fully extend focusing tube by turning Rack and Pinion Focusing Mechanism.
3. While looking through selected eyepiece (in this case the 20 mm), slowly retract focusing tube by turning Rack and Pinion Focusing Mechanism until object comes into focus.

Aligning Finderscope

1. Look through Main Telescope Tube and establish a well-defined target. (see Focusing Telescope section)
2. Looking through Wide Field Finderscope, alternate tightening each Finderscope Adjustment Screw until crosshairs of Wide Field Finderscope are precisely centered on the same object already centered in Main Telescope Tube's field of view.
3. Now, objects located first with the Wide Field Finderscope will be centered in the field of view of the main telescope.



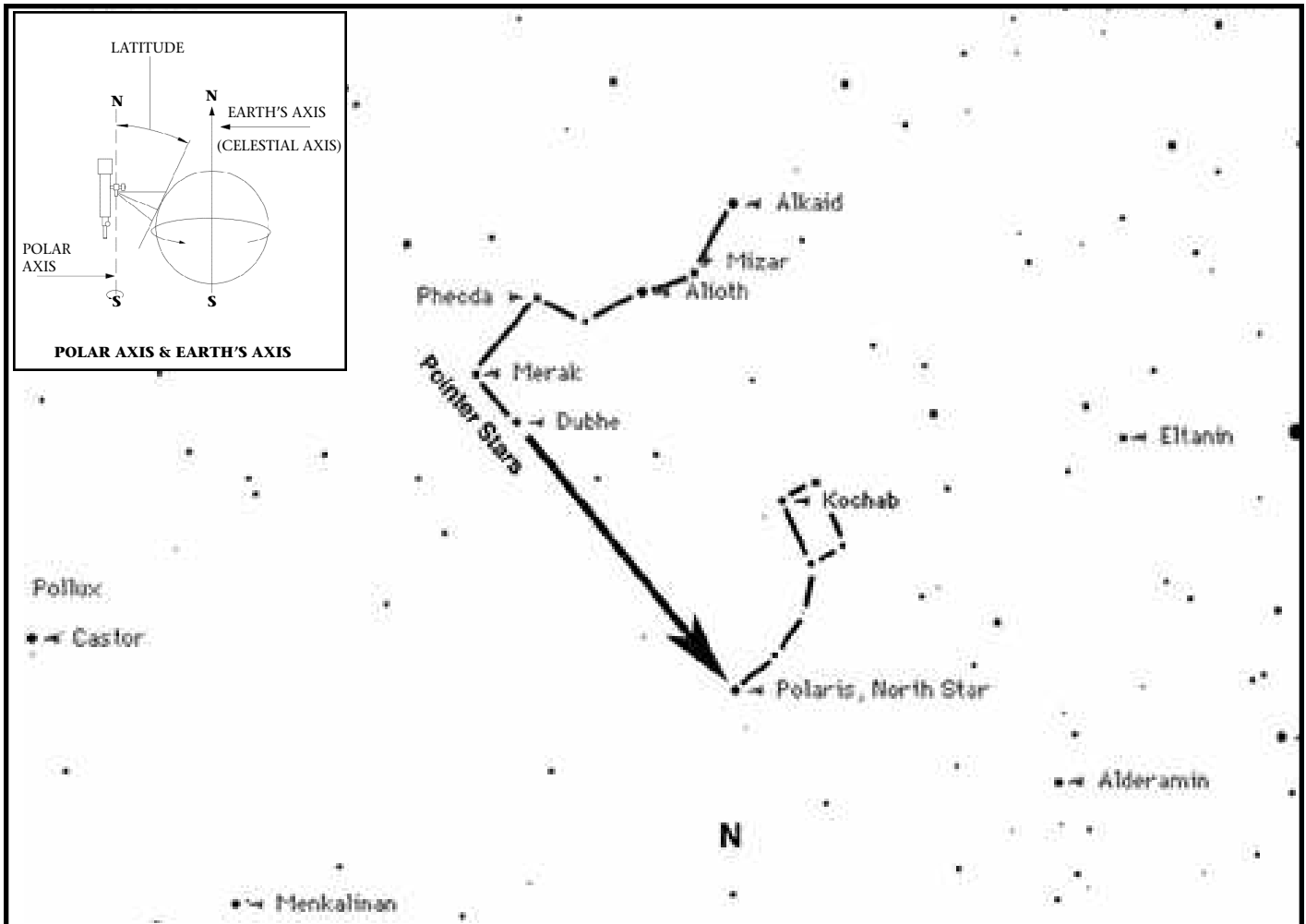
HOW TO USE YOUR NEW TELESCOPE (CONTINUED)

Understanding the Equatorial Mount

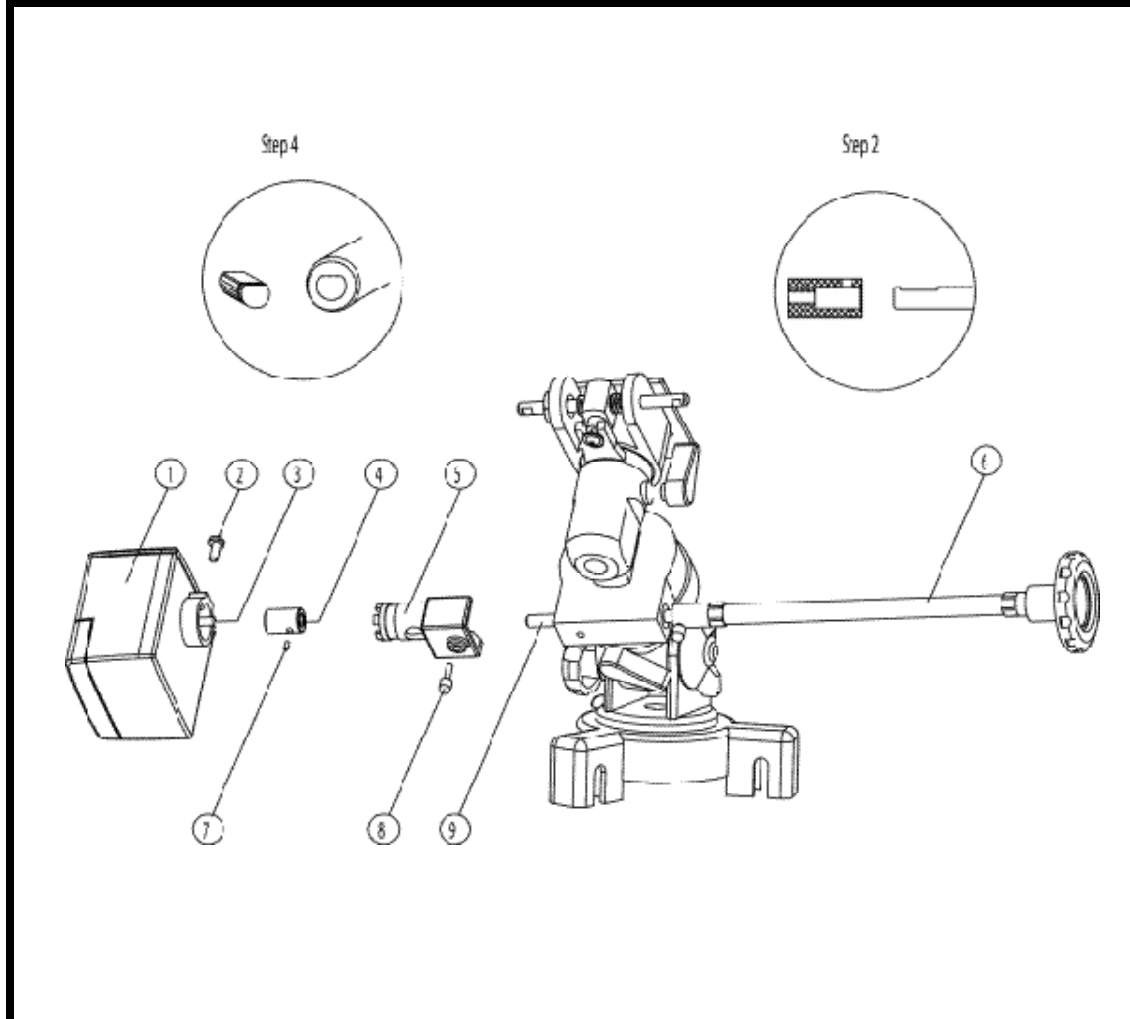
The Equatorial Mount is designed to move in any direction. It can be set to allow manual controls to track the movements of celestial bodies across the sky. This is referred to as diurnal movement: movement of celestial bodies in the direction opposite to that of the earth's rotation and around the earth's axis.

By aligning the telescope's polar axis at celestial North, you will place the telescope in parallel with the earth's axis and thus be able to locate stars in the sky based on star atlas information.

1. Set up the telescope at night. Loosen the Declination Lock Knob and rotate the telescope around the declination axis until the arrow on the declination scale points to 90 degrees. Tighten the Declination Lock Knob.
2. Look up the latitude of your area in any geographical atlas. Loosen the Latitude Lock Knob and set the latitude scale to the correct latitude for your area. Aim the Finderscope at Polaris. You will probably notice that Polaris is not dead center in the Finderscope's field of view. This is probably because your telescope is not absolutely level with the ground. Loosen the Horizontal Axis Lock Knob again and turn the telescope so that it is directly aimed at Polaris. Tighten both the Horizontal Axis Lock Knob and Latitude Lock Knob. Polaris is 1 degree from the North celestial pole. Therefore, the sighting of stars will have to be slightly adjusted as you locate them in the heavens.



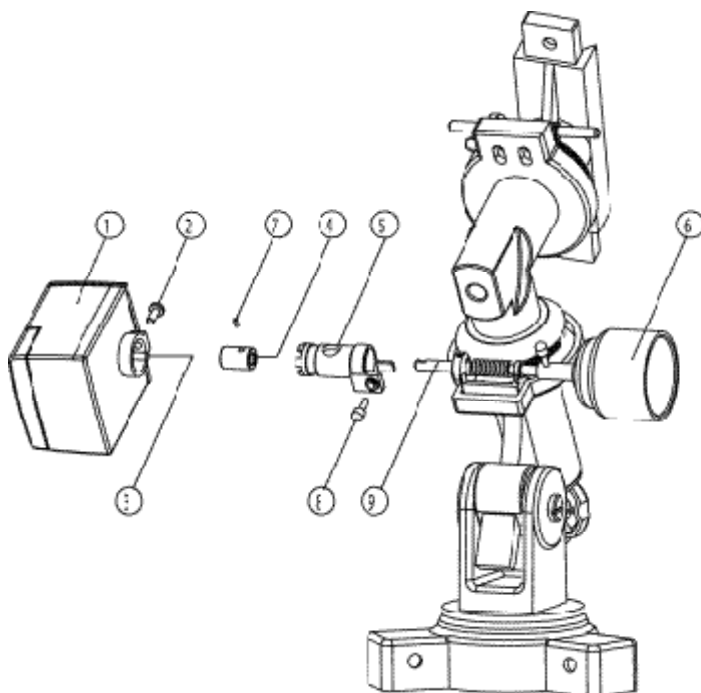
78-7876 76MM REFLECTOR



TELESCOPE PARTS DIAGRAM

- | | |
|--------------------------------|--------------------------------|
| 1. ATS Motor Housing | 6. Fine Adjustment Cable |
| 2. ATS Drive Shaft – set screw | 7. Gear coupler – set screw |
| 3. ATS Drive Shaft | 8. Plastic Adapter – set screw |
| 4. Gear Coupler | 9. Right ascension axis shaft |
| 5. Plastic Adapter | |

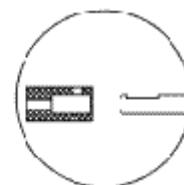
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Step 4



Step 2



TELESCOPE PARTS DIAGRAM

- | | |
|--------------------------------|--------------------------------|
| 1. ATS Motor Housing | 6. Fine Adjustment Cable |
| 2. ATS Drive Shaft – set screw | 7. Gear coupler – set screw |
| 3. ATS Drive Shaft | 8. Plastic Adapter – set screw |
| 4. Gear Coupler | 9. Right ascension axis shaft |
| 5. Plastic Adapter | |

AUTOMATED TRACKING SYSTEM INSTALLATION

1. Mount the **plastic adapter** on the mount as shown. Please note your telescope model number and refer to the appropriate diagram. Tighten set screw.
2. Using the **fine adjustment cable**, rotate shaft until the flat side of shaft is visible through the opening in the side of the **plastic adapter**.
3. Attach **gear coupler** to shaft as shown and tighten set screw.
4. Using the **fine adjustment cable**, rotate shaft until the flat side of the **gear coupler** cavity matches the position of the flat side of the **Automated Tracking System shaft**. Make certain the notches of the **plastic adapter** and the notches on the backside of the Automated Tracking System (ATS) securely interface. (Note: The buttons on the ATS should be on top as shown.)
5. Tighten the set screw to firmly affix the ATS and the **plastic adapter**.

AUTOMATED TRACKING SYSTEM OPERATION

Once you have assembled your telescope and aligned the equatorial mount with the North Star (see "Understanding the Equatorial Mount" section), you can begin enjoying the benefit of the Automated Tracking System. The functions of the system are outlined below:

AUTOTRACK--By pushing this button, you activate the Automated Tracking System and your telescope begins to move with the night sky. Push and hold this button to turn the unit off. The default motion is set for the Northern Hemisphere.

FWD/REV (FORWARD/REVERSE)--By pushing this button you automatically reverse the direction of the Automated Tracking System. This can be used to switch tracking direction for the Southern Hemisphere or to back up the telescope in its tracking motion.

SPEED--The speed buttons (UP AND DOWN) will increase the speed in the direction of tracking or decrease the speed in the direction of tracking.

LED INDICATOR--The green LED light on the ATS when lit indicates that the ATS is operating. When fresh batteries are required, the green LED will change to red.

CHANGING BATTERIES

The ATS requires a 9-volt alkaline battery (user-supplied). To install or replace, simply remove the battery door located under the Bushnell logo, attach battery to clamps, and replace battery door.

NOTE: PROPER ALIGNMENT OF THE EQUATORIAL MOUNT AND FRESH ALKALINE BATTERIES WILL ENSURE THE BEST AUTOMATED TRACKING SYSTEM SUCCESS.

ENJOYING YOUR NEW TELESCOPE

1. First determine your targeted object. Any bright object in the night sky is a good starting point. One of the favorite starting points in astronomy is the moon. This is an object sure to please any budding astronomer or experienced veteran. When you have developed proficiency at this level, other objects become good targets. Saturn, Mars, Jupiter, and Venus are good second steps to take.
2. The first thing you need to do after assembling the telescope as planned is center the desired object in the finderscope's crosshairs. Provided you did a reasonable job aligning the finderscope, a quick look through the main telescope tube at low power should reveal the same image. With the lowest power eyepiece (the one with the largest number printed on it) you should be able to focus the same image that you saw through the finderscope. Avoid the temptation to move directly to the highest power. The low power eyepiece will give you a wider field of view, and brighter image—thus making it very easy to find your target object. At this point with a focused image in both scopes, you've passed the first obstacle. If you don't see an image after attempting to focus it in, you might consider aligning your finderscope again. Once you pass this step, you will enjoy the time spent ensuring a good alignment. Every object you center in the finderscope will be easily found in the main telescope tube, which is important for continuing your exploration of the night sky.
3. The low power eyepieces are perfect for viewing the full moon, planets, star clusters, nebulae, and even constellations. These should build your foundation. However, for more detail, try bumping up in magnification to higher power eyepieces on some of these objects. During calm and crisp nights, the light/dark separation line on the moon (called the "Terminator") is marvelous at high power. You can see mountains, ridges and craters jump out at you due to the highlights. Similarly, you can move up to higher magnifications on the planets and nebulae. Star clusters and stars are best viewed through the low power no matter what.
4. The recurring astronomical theater we call the night sky is an ever-changing billboard. In other words, not the same movie plays all the time. Rather, the positions of the stars change not only hourly as they seem to rise and set, but also throughout the year. As the earth orbits the sun our perspective on the stars changes on a yearly cycle about that orbit. The reason the sky seems to move daily just as the sun and the moon "move" across our sky, is that the earth is rotating about its axis. As a result you may notice that after a few minutes or a few seconds depending on what power you are viewing at, the objects in your telescope will move. At higher magnifications especially, you will notice that the moon or Jupiter will "race" right out of the field of view. To compensate, just move your telescope to "track" it in the necessary path.

HELPFUL HINTS

1. Your telescope is a very sensitive instrument. For best results and fewer vibrations set your telescope up on a level location on the ground rather than your concrete driveway or your wooden deck. This will provide a more stable foundation for viewing, especially if you've drawn a crowd with your new telescope.
2. If possible view from a location that has relatively few lights. This will allow you to see much fainter objects. You'd be surprised how much more you'll see from your local lake or park when compared to a backyard in the city.
3. Using your telescope out a window is NEVER recommended.
4. View objects that are high in the sky if possible. Waiting until the object rises well above the horizon will provide a brighter and crisper image. Objects on the horizon are viewed through several layers of earth's atmosphere. Ever wonder why the moon appears orange as it sets on the horizon. It's because you are looking through a considerable more amount of atmosphere than you would directly overhead. (Note: If objects high in the sky are distorted or wavy, you are probably viewing on a very humid night.) During nights of unstable atmosphere, viewing through a telescope can be frustrating if not impossible. Astronomers refer to crisp, clear nights as nights of "good seeing."

TELESCOPE LIFETIME LIMITED WARRANTY

Your Bushnell® telescope is warranted to be free of defects in materials and workmanship for the lifetime of the original owner. The Lifetime Limited Warranty is an expression of our confidence in the materials and mechanical workmanship of our products and is your assurance of a lifetime of dependable service.

If your telescope contains electrical components the electronic components are warranted to be free of defects in materials and workmanship for one year after the date of purchase.

In the event of a defect under this warranty, we will, at our option, repair or replace the product, provided that you return the product postage prepaid. This warranty does not cover damages caused by misuse or improper handling, installation or maintenance of the product.

Any return made under this warranty
must be accompanied by the items listed below:

- 1) A check in the amount of \$15.00 to cover the cost of handling
- 2) Name and address for product return
- 3) An explanation of the defect
- 4) Product should be well packed in a sturdy outside shipping carton to prevent damage in transit and return postage prepaid to the address listed below:

IN U.S.A. Send To:

Bushnell Performance Optics
8500 Marshall Drive
Lenexa, Kansas 66214

IN CANADA Send To:

Bushnell Performance Optics
25A East Pearce Street, Unit 1
Richmond Hill, Ontario L4B 2M9

For products purchased outside the United States and Canada please contact your local dealer for applicable warranty information. This warranty gives you specific legal rights. You may have other rights which vary from country to country.

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