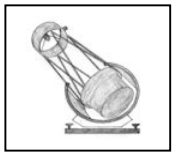
WARNING

Viewing the sun without proper equipment can cause permanent blindness.

RB-66

Owner's Manual

JMI Telescopes
Jim's Mobile, Inc.
8550 W 14th Ave
Lakewood, CO 80215
U.S.A.



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JMI Telescopes
Jim's Mobile, Inc.
Phone **(303) 233-5353**
Fax **(303) 233-5359**
Order Line **(800) 247-0304**
Web Site **jmitelescopes.com**
Email **support@jmitelescopes.com**

Introduction

The RB (Reverse Binocular) telescope system is an innovative dual-telescope binocular system in a single transportable package. It is covered by U.S. Patent No. D499,436 with another U.S. Patent Pending.

We make every effort to ensure that each RB-66 is built to be the best. We hope that your new telescope gives you many thousands of hours of enjoyment, and that your pleasure in this precision instrument matches the pride we take in our work.

Checking for Shipping Damage

We do everything we can to secure the equipment during shipping and we also use the best shipping company, based on our experience with shipping delicate equipment. However, we recommend that you immediately do a visual inspection of the packaging and product for possible damage. If you notice any damage, make a notation on the delivery document (with the signature of the delivery person) if possible then contact JMI directly.

Getting Started

We want you to begin enjoying your RB-66 as soon as possible, however you should first carefully read the instructions in "Setting Up the RB-66", particularly the instructions for "Removing the Shipping Brace" (see page 5).

The binocular is designed to be easily disassembled, transported, and reassembled to let you take advantage of the dark skies away from city lights as well as celestial phenomena not visible from your home base. Once you are familiar with the steps, assembly can take less than one minute.

Warning

Sunlight magnified through the RB-66 can cause instantaneous and permanent blindness, severe burns or fire. Keep the aperture covers in place when the RB is not in use.

Collimation

Each RB-66 is collimated before shipment and should require only minor adjustment from time-to-time. The instrument's top cover must be removed in order to collimate the primary mirrors. The mirror cells are held in place by a large brass thumbnut at the rear of the cell, in the center of the three collimation screws. Loosen this nut slightly before doing any collimation adjustments. As with all Newtonians, some minor collimation adjustments will need to be made from time to time (see page 10). If you make a collimation adjustment you will need to realign the two tubes by using the alignment motors (see page 14). If the two optical systems are not collimated properly, it may be difficult to converge the two images into one.

Optional Accessories

The following accessories extend the capabilities of your RB-66. They can be ordered at any time, and you will find them easy to use or install.

Carrying Case

The optional carrying case includes crush-resistant die-cut foam contoured to safely hold your telescope and wheels for easy transport. An efficient design gives a surprisingly small overall size.

Solar Filters
Optional glass solar filters are available for viewing the sun. These filters are placed in the aperture openings. (Please see the warning above regarding solar viewing with a telescope.)

NGC-microMAX Computer with 245 Object Database
A small, lightweight unit with an eight-character red LED display that provides a real-time display of the telescope's Right Ascension and Declination. A guide feature assists the user in locating any of the 245 objects in its database, including 90 stars, the entire Messier catalog and 28 user-definable objects.

NGC-MAX Computer with 12000+ Object Database
In addition to the Sun and planets, the NGC-MAX database contains nearly a thousand stars, the entire NGC catalog, and most of the IC catalog. A polar align feature greatly eases the task of polar aligning the telescope. An identification feature will search the internal database for the object nearest the telescope's current pointing position, assisting with identification of unfamiliar objects or suggesting possible new targets. A serial port allows a personal computer to obtain information about the telescope's current position—useful for applications such as Software Bisque's THESKY™.

SGT-MAX Desktop Planetarium with NGT Interface
This IBM PC compatible software beautifully represents the night sky on your computer screen, showing the position of the telescope and guiding you to any object. It provides extremely detailed information on each object, shows common names of objects, and allows you to toggle constellation lines on or off. The SGT-MAX plots current planetary positions, can zoom from 235° to one arc-minute fields of view, and is completely mouse-driveable. The software is available in assorted database sizes from 55,000 to over 19,000,000 objects!

Pocket PC Bracket
This bracket attaches to the base to hold a pocket PC for guiding the binocular using Software Bisque's THESKY™.

Specifications

Feature	Description
Type	Dual Newtonian reflectors
Mount	Alt-Az mount attached to a Celestron Tripod
Mirrors	6" f/5 primary mirrors, 1.6" diagonal secondary mirrors
Focusers	Modified RCF-mini1 with motor
Eyepieces	20mm wide angle
Clearance Between Optical Tubes	9.5"
Eyepiece Spacing	Variable from 2" to 3.25"
Optical Alignment	Motorized x and y axis for optical tube alignment
Finder	Star Pointer
Power	6 volts DC 4.5 amp-hour battery with 110vAC/60Hz charger (optional 220vAC/50Hz charger available)
Binocular Weight	Approx. 49-1/2 pounds
Tripod Weight	Approx. 9-1/2 pounds
Binocular Height	30.25" (top of tripod to top of binocular locked in vertical position)
Binocular Width	24.5"
Binocular Depth	11" (folded)

Setting Up the RB-66

A shipping brace has been installed on the RB-66 to prevent optical tube shifting during shipment. You will need to remove the brace before operating the tube alignment motors. Review the procedures under "Setting Up the Instrument" (page 6) for instructions on removing the binocular from the case and removing the top cover, before following the instructions for "Removing the Shipping Brace" below.

Removing the Shipping Brace

The brace is connected to both of the optical frames and the center bar of the binocular. Use the following instructions to remove the brace and prepare the binocular for use.

1. Remove the RB-66 from its case or box (see "Setting Up the Instrument" on the next page).

2. Remove the two thumbscrews securing the carrying handle to the binocular and lift the handle off the posts. (You will note that the two small thumbscrews normally securing the sides of the covers, toward the front of the binocular, have been removed to prevent damage during shipment.)

3. Gently separate the top cover from the scope by lifting it up out of the aluminum railing channel.

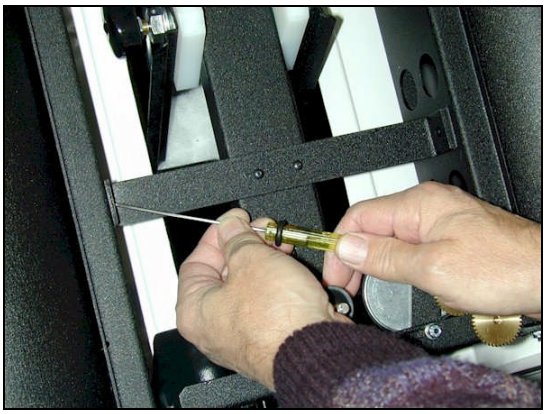
4. Use the provided 5/64" Allen wrench to remove the four (4) button head screws that secure the brace to the scope. There is one screw at either end and two in the center.

5. The two alignment motors have been disconnected to prevent accidental operation during shipment. Re-connect the power cables to the alignment motors. The cables are tied to the brace next to the motors that they belong to.

6. Replace the top cover and handle.

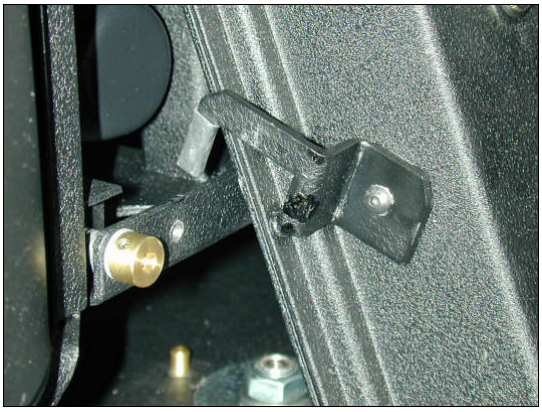
7. Install the two small thumbscrews (6-32 x 7/16 with caps) that secure the top cover. You will find two holes near the front, on both sides of the aluminum railing. These holes line up with holes in the cover. The thumbscrews are shipped in the hardware pack.

The brace will not need to be reinstalled for normal transport to dark sites. However, if you need to ship the instrument through a third party (the kind that throws boxes and drops packages off the end of conveyor belts!) you will need to reinstall the shipping brace and leave the two cover thumbscrews off.



Setting Up the Instrument

When removing the RB-66 from the carrying case, take care not to touch the two focuser diagonals. The best way to do this is to first lift the base plate a little to release it from its friction grip brackets then lift the whole scope out of the case using the black handle on the top of the instrument (see picture at right). The carrying case is optional but highly recommended if you plan on moving the binocular any distance. The telescope accessory package is shipped with the tripod. This accessory pack contains the (optional) guiding computer, two eyepieces, finder, azimuth encoder assembly, a 6-volt charger, various tools and some replacement small parts.



Place the binocular on a flat surface and look for the vertical lock (left) just below and to the left of the main power plug on the diagonal pillar stand of the alt/az mount. Lift the lock upward to release it. On the base plate you will find the azimuth bolt, washer, thrust bearing and locknut assembly (shown at the bottom center of the picture). Remove these items to separate the two halves of the base plate. The bottom section can then be attached to the tripod. After the tripod is ready you can set the binocular on the tripod by putting the threaded bolt through the center hole in the bottom plate and reinstalling the washer/bearing/nut assembly. (Please Note: The bottom section of the base plate, and the corresponding hardware, may be shipped with the tripod.)

Removal of Covers and Tubes

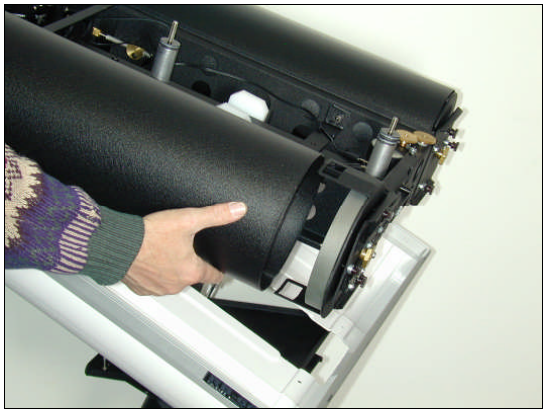
To remove the handle, simply unscrew the two thumb knobs (right) and lift it off the two posts.

Gently lift the top section of the cover up and out of the railing channel (left). There are places for two small screws (that also hold the cover down) at the front of the side railing on either side. The scope is shipped without these screws in place to prevent damage to the tubes during shipping. When replacing the top cover you should install these two screws (found in the hardware pack).

To remove the bottom section of the cover, first locate the four larger thumbscrews that hold the cover to the frame. There are two above and two below (right).

Drop the cover down as shown (left). You may have to wiggle it side to side a little to get around the thumbnuts that secure the handlebars in their up or down position.

Each optical tube is held in place by a small screw with an internal nut (right). Remove the screws, being careful not to drop the nut down onto the mirror.



At the rear, the tube is held in place by fitting around the outside of the two mirror cell handles. When removing the tube, slide it forward just enough to clear the mirror cell handles (left). If you go any farther, the secondary mirror stalk (support) will contact the edge of the focuser cutout in the tube.

Swing the tube out to the side (right) and carefully let the secondary mirror move through the cutout without contacting the tube.

Installing the Azimuth Encoder

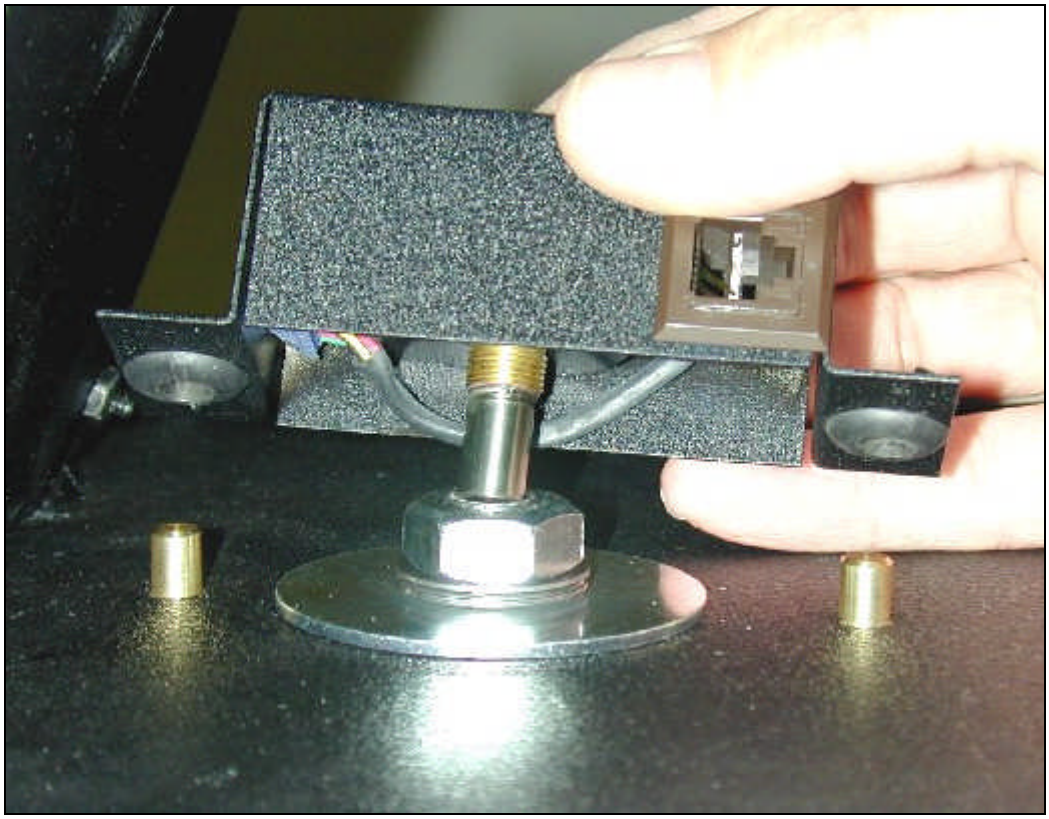
The RB-66 may be shipped without the azimuth encoder installed. Once installed, there is no need to remove it unless you wish to separate the top and bottom plates for easier installation in the dark. You can accomplish this by securing the bottom plate to the tripod. When you are ready to attach the binocular to the tripod, simply place the top plate over the bolt in the bottom plate and install the washers, bearing and nut.

1. First note the sequence of items below the azimuth nut. From bottom to top they are wide fender washer, thrust bearing, small flat washer and then the nut. This nut only needs to be finger tight to produce smooth turning of the azimuth base. You can leave it adjustable or use a drop of blue 242 Loctite thread locker to secure it in the position of your choice.

2. The encoder has a vinyl sleeve around the shaft that fits into a hole in the center of the azimuth bolt. As shown in the picture place the encoder shaft in the hole while also aligning the two grommets over the two brass pins.

3. Push the whole unit down until the bottom of the grommets touches the base. You can now plug in the encoder cable.

4. To remove the encoder, gently pull it back up out of the hole and off the brass pins.

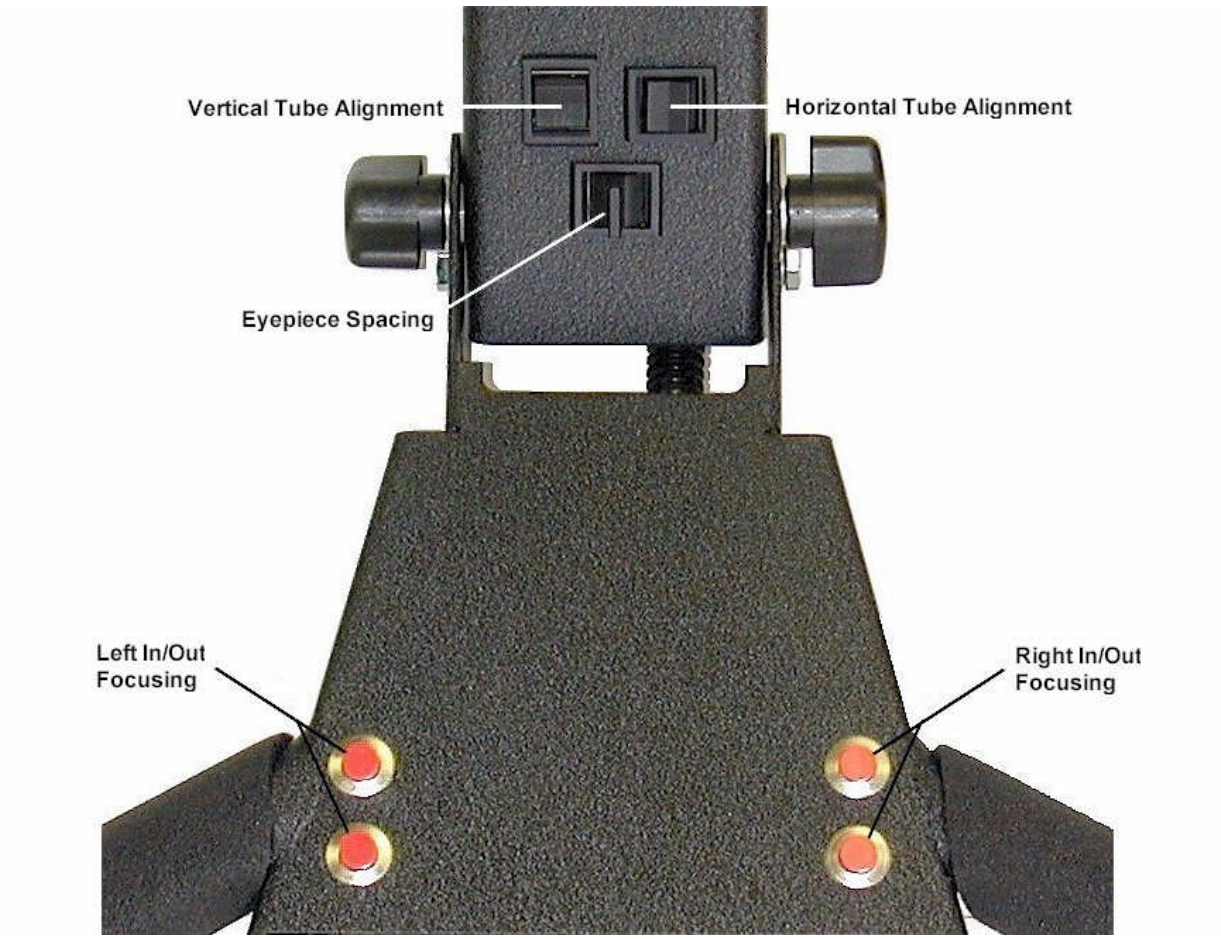


Initializing the Digital Setting Circles

The RB-66 has a vertical stop built into the stand. Set the computer to a VERTICAL alignment and simply move the RB-66 towards the vertical position until it hits the positive stop. Refer to the *MAX Computer Manual* for more information on using the computer.

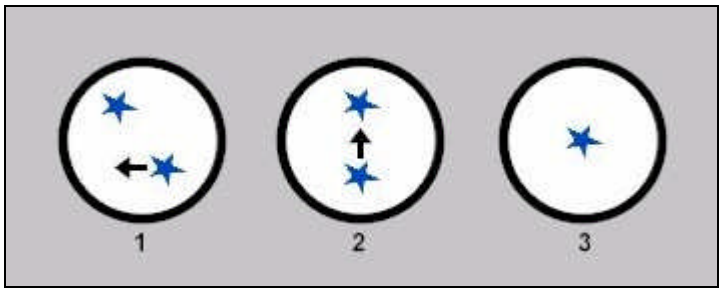
Using the RB-66 Motors

The function of each button on the handlebars is shown below. Should you ever have to remove the handle bars they are held onto the center beam by one 1/4-20 bolt and you must unplug the six motor cables before you take it off. As the cables come out of the handlebars they are in a three-tiered vertical arraignment. The top (and longest) cables go to the rear motors. The center cables go to the eyepiece spacing motors, which move the focuser drawtubes in and out. The bottom cables go to the motors that drive the lead screw that pushes the focuser sliding plate. The main power plug goes to the power jack in the center of the base stand. Should a short ever occur it will trip the fuse (side of stand). If this happens, wait a few seconds and then reset the fuse switch. If you ever need to access the battery there are six screws that hold the plate onto the back of the stand. The battery is behind this plate.



Aligning the Optical Tubes

When you look through the RB-66 you may see that the images are not aligned. As shown on the next page, you should move the images to a vertical alignment first (looking back and forth between the binocular view and a relaxed unaided view), using the Horizontal button, and then move the images together with the Vertical button. The human eye will tend to merge the images by itself if you tried to do this with a horizontal alignment first. Fight the urge and do the vertical alignment first so you won't be looking at your image with crossed eyes, which will cause eye strain.



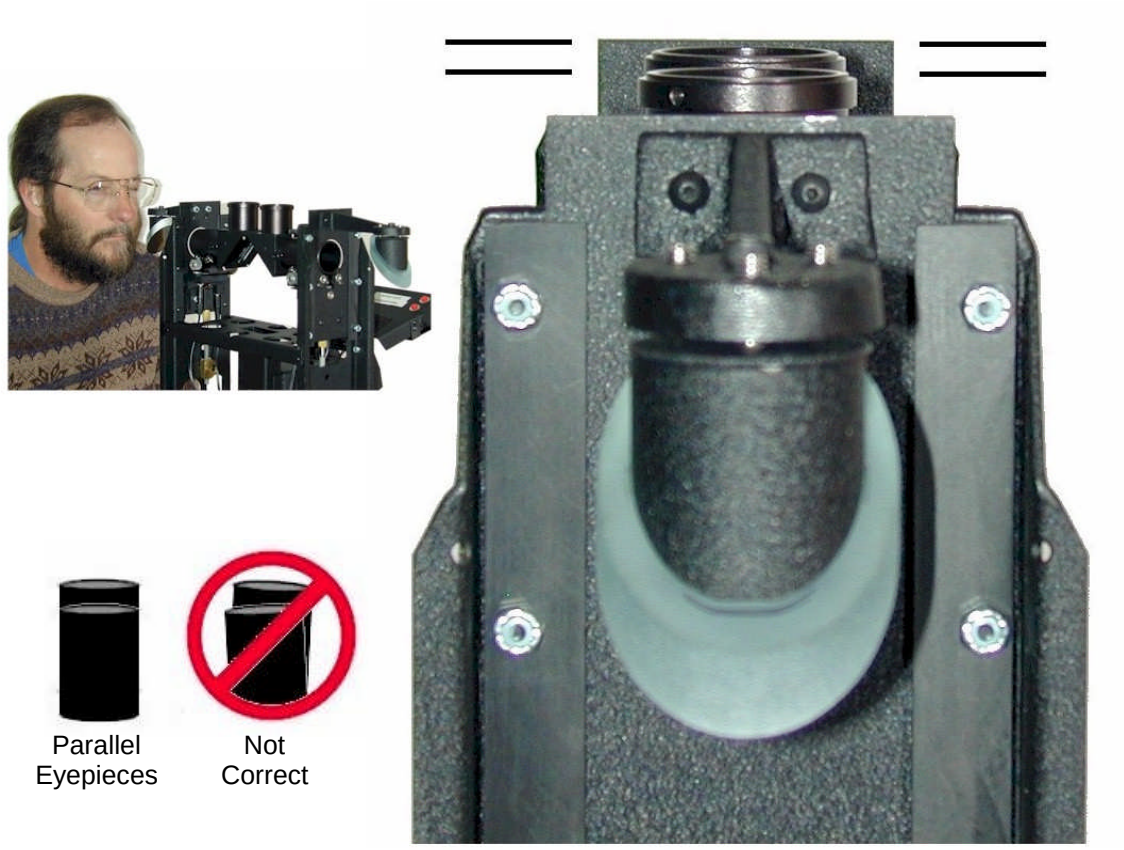
Steps in Aligning the Optical Tubes

Realigning the Focuser Diagonals

While you should never have to touch the focuser diagonals there may be times when they are accidentally moved and need to be realigned. The procedure is simple, it just involves a little time.

1. Remove both the upper and lower sections of the white (or black) plastic RB-66 cover.
2. Remove both of the black optical tubes.
3. Turn the telescope to the vertical position.
4. Sight along the top of the scope as shown in the inset picture.
5. The two lines on the side view picture represent the plane of the front of the focuser slide plate and the plane of the diagonal eyepiece receptacle. Turn the diagonals until these planes are all parallel.

Improperly adjusted diagonals will cause the images to be rotated with respect to each other.



Realigning the Drawtubes

During the course of using the eye-spacing motors, they may become unsynchronized in their positions (Figure 1). It will appear obvious that even when both tubes are focused, the eyepieces are at different heights. Because the eye-spacing motors may be running at slightly different speeds, you will occasionally have to reset them. Simply line up both drawtubes so that the inside edge of the drawtube is flush with the sliding focus plate (Figure 2). This can easily be accomplished by unplugging one drawtube motor and running the other until it is flush. Next, do the same to the other side. There are two power cables going to the focuser. The upper cable is for eye spacing. The lower cable runs the focus motor.

Figure 1 — Uneven Eyepiece Position

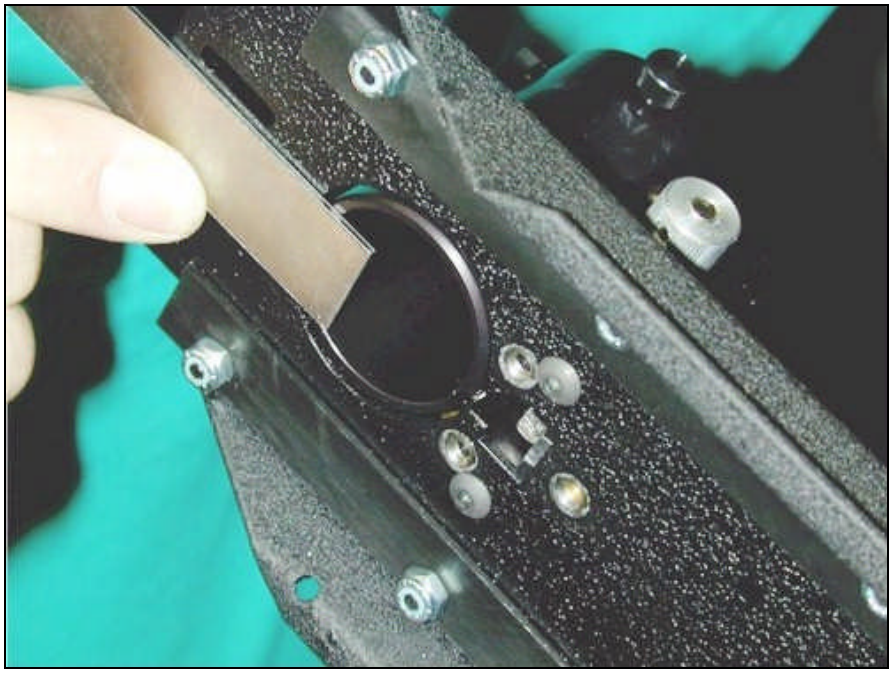


Figure 2 — Inside View of Drawtube Bottom and Sliding Plate

Maintaining the RB-66

The following maintenance routines will preserve the accuracy and reliability of your telescope and help prolong its life.

Cleaning Front-Surface Mirrors

Never wipe a dry mirror with a lens tissue or other material, as this will scratch the surface coating.

Follow these steps to properly clean the RB mirrors and preserve their life. Do not clean the mirrors too frequently. If properly handled and protected from dirt, the mirrors should require cleaning only once or twice a year. The mirrors can be cleaned without removing them from the cell, however the cells should dry completely before they are returned to the binocular.

First, gather the following materials:

- Soft, absorbent cotton balls.
  Be sure the cotton is 100% pure (such as Red Cross). Other cottons may contain wood pulp or other foreign matter that will scratch the mirror surfaces.
- Mild detergent (such as Dawn)
- Distilled water
- Acetone, ethanol or compressed air in a can.
  Observe all cautions and warnings on the labels. Acetone and its vapors are harmful. Rubber gloves are recommended to prevent absorption of acetone through the skin. Acetone is available at most paint or hardware stores. (If acetone is used, remove the central dots prior to cleaning, as the acetone will dissolve the adhesive causing it to run and stain the mirror surface. The dots are required for collimation. Replace them after cleaning.) Ethanol—also known as ethyl alcohol, 200-proof alcohol or drinking alcohol—may be substituted for acetone. Do not use rubbing alcohol on your mirror surface, as it adversely reacts to the aluminized surface and can ruin the mirror coating over time. Compressed air can also be used as long as you are careful to keep any propellant from being discharged onto the mirror.
- A tub large enough to allow the mirror to be fully immersed.

Use the Following Procedure for Each Mirror

Fill the tub with a solution of lukewarm distilled water and mild soap. Rinse the mirror by pouring distilled water over the mirror, flooding the surface to remove loose dirt and dust—if large particles are not removed they will scratch the mirror during the cleaning process. Next, immerse the mirror in the tub and allow it to soak for 1.5 to 2 hours. Let the liquid do the work as much as possible to minimize contact with the mirror surface. Soaking overnight with pure distilled water will loosen almost any particles and will not hurt the glass or mirror surface.

After the mirror soaks, raise it to within 1cm (1/2-inch) of the water's surface and use the cotton balls to remove any remaining particles. It is best to roll the cotton ball over the mirror's surface—with the leading edge rolling upward—allowing the particles to be lifted away. Replace the cotton ball after one rotation, thus preventing the dirtied cotton from contacting the mirror surface. Do not apply pressure to the cotton—simply allow the weight of the wet cotton to do the work. Clean the entire surface of the mirror in this fashion. You may find it easiest to work from the mirror's center, spiraling outward.

Lift the mirror out of the tub and place it at an angle to drain as you rinse. Rinse with distilled water to remove all soap solution from the mirror surface.

Finally, before the mirror can dry, rinse again with acetone or ethanol or use compressed air to chase the water beads from the surface. Acetone and ethanol will evaporate to leave a pristine surface. (If necessary, remove any remaining water spots by dabbing them lightly with clean, dry Red Cross cotton. Dab, but do not wipe.)

If you have not removed the mirror from the mirror cell, be sure to allow the cell to dry completely before returning it to the telescope. A blow dryer can help speed the drying process.

Collimating a Newtonian

Collimating is the process of aligning the optical components of the telescope for optimum performance. When a telescope is in need of collimating, you are likely to note that a star in the center of the eyepiece field will not focus precisely and will appear to be non-circular (elliptical or fan-shaped) when the image is out of focus.

In a Newtonian reflector such as the optical tubes included in the Reverse Binoculars, there are three components to align: the eyepiece, the secondary mirror, and the primary mirror. All three must be accurately aligned with respect to each other. Information in this section will enable the RB owner to align the secondary and primary mirrors of each optical tube. See "Using the RB-66 Motors" (page 10) for information on focuser and optical tube alignments.

Under normal conditions you should only need to collimate the primary mirrors, so you can skip the first step below. Remember that changes in collimation will require realignment of the optical tubes.

The following instructions include illustrations for a Newtonian with a spider-type secondary mirror support. The RB-66 includes a single-stalk secondary mirror holder, so keep this in mind when comparing what you see with the examples.

The First Step in Collimating—Use of the Sight-Tube

A sight-tube with accurate crosshairs is essential in the first step of collimating a Newtonian reflector. The sight-tube is used to achieve accurate placement of the secondary.

First, adjust axial placement of the secondary by placing the sight-tube in the focuser and moving it in or out until the outside edge of the secondary mirror is just inside the bottom edge or rim of the sight-tube. The two circular images should be concentric. If the secondary is high or low, loosen the retaining screw and nut combination and move the secondary axially (toward or away from the primary) until concentricity is achieved.

Next, adjust the rotation of the secondary by rotating left or right until the reflection of the primary mirror as seen in the secondary mirror is perfectly centered left to right. Gently tighten the secondary center screw.

Finally, adjust the tilt by loosening one or two of the three screws on top of the secondary mirror cell, and carefully tightening the opposite one or two. (If you loosen one screw, you must tighten two; if you loosen two, you must tighten one.) The goal is to adjust the tilt of the secondary such that the bull's-eye, or target, on the primary mirror appears centered in the crosshairs of the sight-tube. When the secondary is properly adjusted, you will see the following (as described from the outside of the field of view toward the center):

- The rim of the sight-tube.
- The outside edge of the secondary mirror, concentric with the rim of the sight-tube all the way round.
- The reflection of the primary mirror perfectly centered in the secondary.
- The bull's-eye of the primary centered in the crosshairs of the sight-tube.

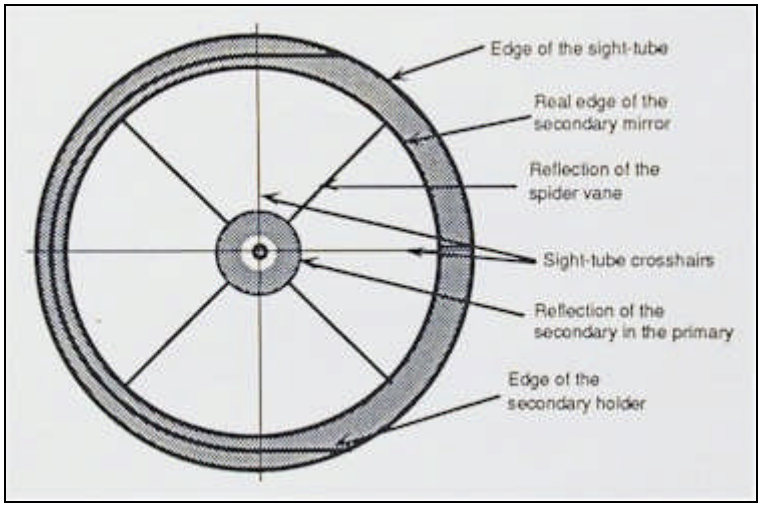


Image visible in the sight-tube

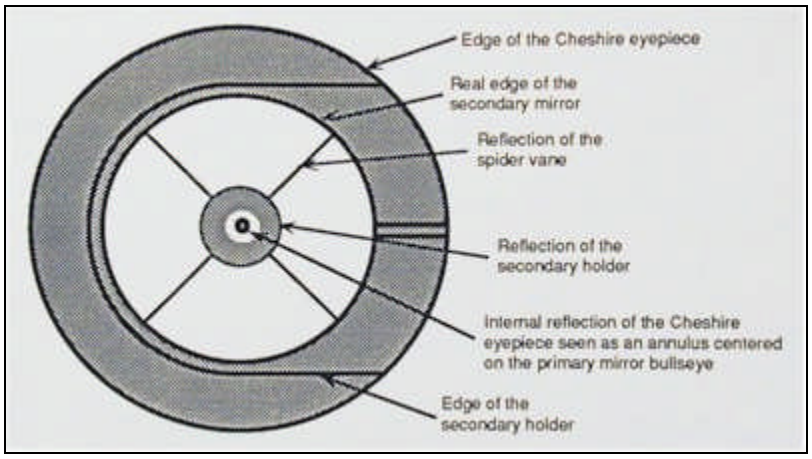
If the view does not match this description and illustration, then repeat the three adjustment steps until the view is correct.

The Second Step in Collimating—Use of the Cheshire Eyepiece

A Cheshire eyepiece is extremely useful for the next step in collimating, although the auto-collimator or star test can accomplish the same thing. Once the secondary mirror is adjusted by means of the sight-tube, insert the Cheshire eyepiece in the focuser. Do not push it all the way: the cutaway in the eyepiece must be exposed to a light source. (A red flashlight works well in the field at night.)

If you look through the eyepiece you will see the following (aside from the bull's-eye on the primary mirror):

- The reflection of the primary mirror in the diagonal.
- A generally dark field.
- A brightly lit annulus, or ring, in the center of the field.
- A dark spot, or bull's-eye, in the center of the annulus.



Detail of the image visible in the Cheshire eyepiece

Your goal is to bring the bull's-eye of the primary mirror into alignment with the central dot imaged by the Cheshire. Accomplish this by adjusting the three collimating bolts of the primary mirror cell. Adjust in small increments while checking the alignment. First, loosen the center brass nut to make it possible to turn the collimating bolts. (Tighten the brass nut again when collimation is complete.) Continue to make adjustments until the bull's-eye of the primary mirror appears within the central dot of the annulus. When you have achieved this, the telescope is collimated. (See the following illustration.)

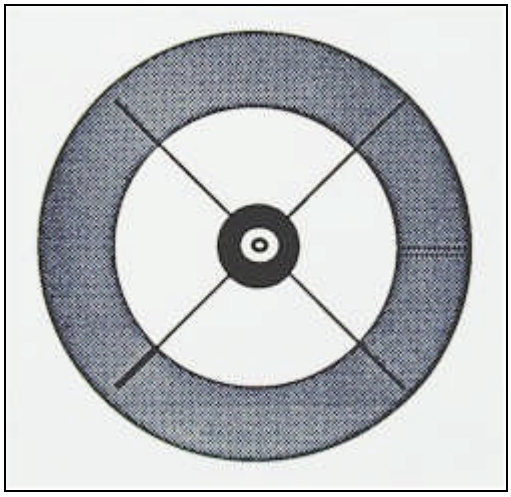


Image visible in Cheshire eyepiece when the system is properly collimated

If, after repeated adjustments you still cannot adjust the primary mirror into collimation, the problem is likely to be misalignment of the secondary. Check the secondary to determine whether it must be raised, lowered, rotated or tilted. While this process may require several repetitions the first few times, you will find that, with practice, you can quickly determine what adjustments to make to the secondary mirror by observing the location of the bull's-eye with respect to the central dot. Once you are familiar with the process, fine-tuning the collimation can be accomplished in just a few minutes.

Use of the Auto-Collimator

An auto-collimator eyepiece is available from Tectron, along with three tools and an instruction booklet. By following instructions provided with the auto-collimator, you can make final, ever-so-slight adjustments to the secondary mirror, if necessary. The auto-collimator is not intended, however, for use in making adjustments to the primary mirror. To adjust the primary mirror, follow the steps outlined in the section above, "Use of the Cheshire Eyepiece."

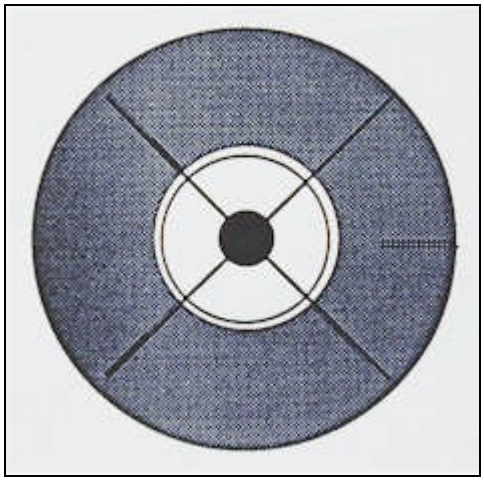


Image seen in the auto-collimator eyepiece when the system is properly collimated

General Maintenance

The top and bottom covers can be cleaned with a mild detergent. Unless you are using the instrument in extremely dirty condition or without the covers you should not need to clean anything inside (other than the mirrors) except possibly the threads on the focus motor lead screws. If it becomes necessary, clean the threads then add a small amount of grease.