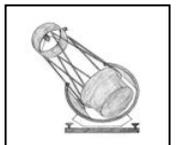


# **NGT-6**

## **Owner's Manual**

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**U.S.A.**





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# Introduction

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The NGT—Next Generation Telescope—is the result of years of research and development. The split-ring design used in the NGT has been implemented in some of the world's largest telescopes, and this design also enables us to provide you with an observatory-quality telescope in an easily transportable package.

We make every effort to ensure that each NGT 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.

## Warning

Sunlight magnified through the NGT can cause instantaneous and permanent blindness, severe burns and even fire. Keep the dust cover in place when the NGT is not in use.

## Collimation

Each NGT is collimated before shipment and should require only minor adjustment from time-to-time. See [page 13](#) for further information on collimation.

## Optional Accessories

The following accessories extend the capabilities of your NGT-6. They can be ordered at any time, and you will find them easy to install.

### **Truss Rod Sliding Counterweight**

The counterweight slides along a Serrurier truss rod to counter the weight of additional equipment. One is included as standard equipment.

### **Truss Rod Light Shroud**

A lightweight, dew resistant, black fabric sleeve to block stray light, dust and air currents.

### **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-miniMAX Computer with 3900+ Object Database**

This unit is slightly larger than the NGC-microMAX, with a database which adds the brighter NGC and IC objects, the Sun and planets. Though not necessary to its operation, a polar align feature greatly eases the task of polar aligning the telescope. This unit is standard equipment unless ordered with one of the other optional computer units.

### **NGC-MAX Computer with 12000+ Object Database**

This is our top-of-the-line in dedicated setting circle computers. In addition to those objects found in the NGC-miniMAX database, the NGC-MAX database contains nearly a thousand stars, the entire NGC catalog, and most of the IC catalog. 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 THE SKY™.

### **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!

## Unpackaging the Telescope

The NGT-6 is mostly pre-assembled at the factory. Follow the steps below to unpackage and assemble your NGT-6.



1. Carefully remove all components from the shipping carton. Refer to the packing list ([page 6](#)) to insure that nothing is missing from your order. To be safe, lift the telescope out by the triangular base.



2. Carefully lift the nose assembly out of the tub and remove the protective wrapping around the bottom edge. Unscrew the leveling discs on the feet screws and remove the packing foam. Remove the protective wrapping around the drive ring.



3. Install the rubber feet (found in the accessories box). Install the truss rods and nose assembly per the instructions on [page 7](#).
4. Insert one end of the right ascension and declination cables into the hand control unit and the other ends into the motors per instructions on [page 10](#).
5. Install the eyepiece, counterweight and optional shroud as necessary and balance the telescope.
6. Remove the secondary mirror protective cover. Remove the primary mirror dust cover. Carefully remove the temporary protective tissue covering the mirror and discard it. Replace the mirror dust cover.
7. Save the box and packaging material as desired for future transport.

## Shipping Damage

Please inspect the NGT-6 immediately after delivery. If you notice any damage, contact JMI directly. If possible, make a note on the delivery document with the signature of the delivery person. The original packaging material will be required for JMI to file any claims with the shipper so please do not discard it.

## Packing List

Refer to this list as you unpack your NGT-6. We recommend that you check off each item as you unpack and ensure that nothing is missing before you begin to assemble your telescope.

### Standard Equipment

- Nose assembly
- Diagonal mirror and holder
- 1¼" RCF-1 focuser
- 26mm 1.25-inch Plössl eyepiece
- star pointer finder
- Six (6) Serrurier truss rods
- Truss rod sliding counterweights
- Tub/ring assembly
- Primary mirror
- Primary mirror dust cover
- 3-point flotation mirror cell
- Tub/mirror counterweight
- Base/rocker assembly
- Right ascension motor
- Declination motor
- Dual-axis hand control with 9vDC battery

### Optional Equipment

- MOTOFOCUS
- Additional truss rod sliding counterweights
- Truss rod light shroud
- NGC-MAX computer system
  - NGC-MAX
  - NGC-miniMAX
  - NGC-microMAX
  - Encoder cable
  - RA and Dec Encoders
- SGT-MAX
  - Serial cable
  - Bbox serial interface (unless telescope was ordered with NGC-MAX)
  - TheSky™ software
  - RA and Dec Encoders
- Tripod mount



# Features of the NGT-6

Please carefully review this section of the manual before attempting to assemble or use your NGT-6.

## Overview

The NGT-6 is a 6" f/5 split-ring equatorial Newtonian telescope. The upper-nose assembly is solid aluminum. The new reverse Crayford focuser, specially designed for the NGT-6, is a high-quality, light-weight, all-metal focuser. It has leveling screws that have been set at the factory for proper collimation alignment. The composite fiberglass and nylon truss rods give rigid support for the nose assembly.

Note that the entire optical tube assembly can be rotated for comfortable viewing. It is recommended that you rotate the nose assembly by turning the upper portion of the tub, instead of the nose assembly itself, in order to maintain collimation and alignment.



## Truss Rod Installation and Removal

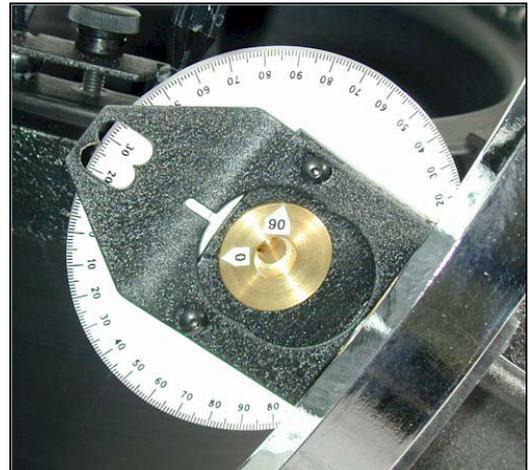
Before attempting to connect the nose assembly, loosen the three retainer plates on the top of the tub assembly and insert the ball ends under the plates and twist them parallel with the rim of the tub. Tighten the plates so that the rod ends are held in place (Figure B).

Attach the nose assembly by pressing the top ends of the truss rods over the nipples in the configuration show in Figure A. Note that one of the screws holding the truss rods is marked for focuser placement. Place the nose assembly so the focuser is over this indexed screw. Each pair of nipples support rods from adjacent retainer plates so that the two rods inserted into each plate will form a V shape.

To disconnect the tops ends of the rods, grasp the rod near the point of attachment and apply outward pressure while twisting. Carefully place the nose assembly in a secure place. The truss rods can then be removed by loosening the screws which allow the retainer plates to be rotated, freeing the ball ends of the truss rods.

## Declination Setting Circle

The declination setting circle includes 0 and 90 degree marks for the initial alignment required by guiding computers. In Figure C you can see the center hole on the declination axis, designed to accept the optional optical encoder which is necessary for computer guiding



**Figure C**  
Mechanical Declination Setting Circle



**Figure D**  
Declination Drive Tension-Adjusting Knob

## Declination Tension Adjustment

To properly adjust the tension of the declination drive, release the declination tension-adjusting knob (Figure D) until the telescope moves freely. Next, tighten it slightly until you feel a slight amount of friction and the telescope remains in place when you let go. When properly set, the telescope will hold its position any place in the sky (assuming that it has been balanced properly). It will track the stars while still being free enough to be moved by hand. Finding the correct amount of tension may take a little practice.

## Polar Sight Tube

A polar sight tube has been included for aligning on Polaris, the North Star. It can give you a fast, easy and fairly good polar alignment. The sight tube is hinged to allow for quick rotation into position for use (Figure E) and back out of the way in the storage position.



**Figure E**  
Polar Sight Tube



**Figure F**  
Right Ascension Tension-Adjusting Knob

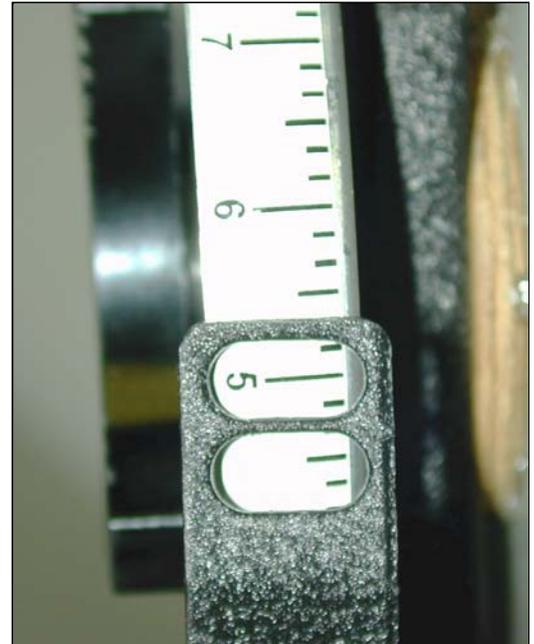
## Right Ascension Adjustment

The right ascension tension-adjusting knob (Figure F) is for proper adjustment of tracking tension. Like the declination adjustment, it should be set so that the scope will retain its position relative to the sky by continuing to track in right ascension, while still allowing manual movement of the telescope. Again, it may take a little practice to become familiar with this adjustment.

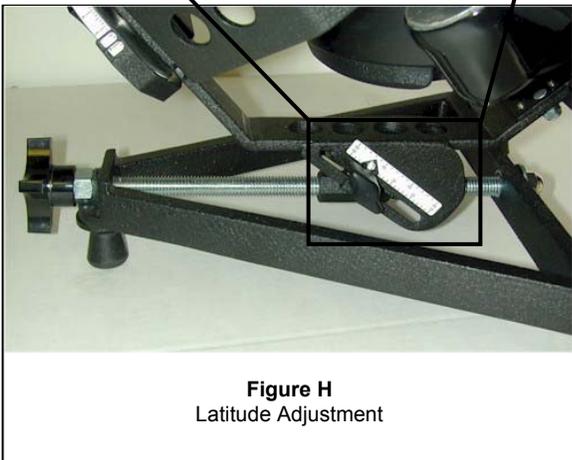
The RA motor is spring loaded to keep the gears from binding and to remove the backlash common to all gears. It can be adjusted with a set screw located behind the motor's worm gear near one end of the spring. A very small amount of play is needed for the telescope to track properly.

## Right Ascension Setting Circle

Figure G shows the right ascension setting circle found on the south end of the telescope.



**Figure G**  
Right Ascension Mechanical Setting Circle



**Figure H**  
Latitude Adjustment

## Latitude Adjustment

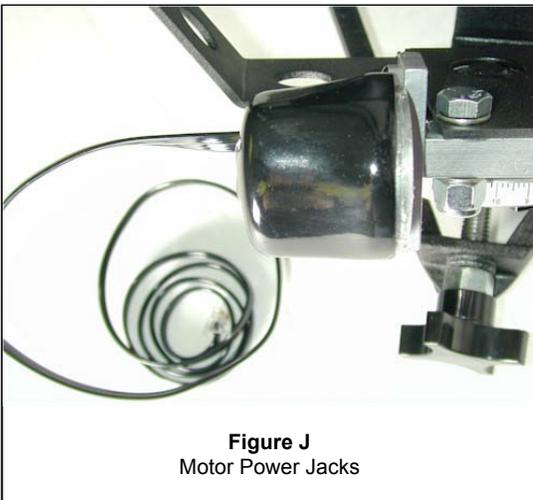
In Figure H you can see the elevation adjustment knob. This knob is rotated to lift or lower the instrument as needed. The scale is used for setting the telescope for your latitude (which can be found on any good map). When the pointer has been set, the two thumb screws should be tightened to hold it in that position. You will notice that there are two scales and two positions where the rocker can be mounted onto the base of the telescope frame. In the top position you will use the top latitude scale and have a latitude range from 43° to 58°. When the telescope is lowered to the bottom hole you can read the latitude on the bottom scale giving a range from 25° to 45°.

## Leveling

The telescope includes a bubble level and leveling feet. Once level, the feet can be locked into position with the locking discs (Figure I) just as you would with a locking nut.



**Figure I**  
Leveling Feet



**Figure J**  
Motor Power Jacks

## Power Connections

The hand control cables with telephone style plugs are easily inserted and removed from the power jacks for the right ascension and declination motors (Figure J).



**Figure K**  
Hand Control

## Hand Control

The hand control is a quartz controlled drive system. The right ascension motor cable should be plugged into the jack nearest the power switch (the left cable in Figure K). The declination jack is the one farthest away from the power switch (the right cable in Figure K). There is a red light that indicates when the power is on and the telescope is tracking. Should there be any interruption of the connecting cables, this light will blink, indicating that the motor is not running. The telescope hand unit will move the telescope in the direction of the arrows on the four control buttons by pressing any one of the buttons. The default correction rate is slow (0.35x) and designed for astrophotographic guiding, not slewing. If the object needs to be re-centered, a higher speed (4x) is available by simply pressing and holding down the button for the direction you wish to move then pressing the opposite button. For Southern Hemisphere operation, press the North and South buttons while turning the unit on. The hand unit is powered by a 9-volt battery. You should always use an alkaline battery for best performance.



**Figure L**  
Mirror Cell Counterweight

## Primary Mirror Installation and Removal

The primary mirror can be easily removed and reinstalled. To remove the mirror, point the telescope towards Zenith. Using a wrench, loosen and remove the center locknut (see Figure L) while holding the counterweight upwards against the bottom of the tub. After removing the nut, let the counterweight slide gently down the threaded shaft and place it aside. You can now pull the mirror cell out of the tub by lifting it straight up by its handles. Reverse the process to install the mirror cell. Collimation should be checked every time you remove the primary mirror.

Please note that the three outer collimation screws and the center mounting screw create a push-pull system for collimation where the outer screws push against the mirror cell and the center screw pulls it down against the outer screws. Any adjustment of the three outer screws will modify collimation. See [page 13](#) for information regarding collimation.



## Optional NGC Computer

If you suspect that your NGT is not tracking properly, check the following items: Is the telescope polar aligned? Is the Latitude set correctly for your location? Is the telescope tracking in the correct direction for the Hemisphere where you reside? Are the tension knobs adjusted properly? Are the drive ring and drive roller surfaces clean?

The NGT-6 can be outfitted with encoders and a computer for finding objects in the sky. The first mechanical setting required by guiding computers (in the two-star alignment or GQ mode) is at zero declination. This position is critical, as are the two star alignments. See may wish to download the document *The Importance of the Initial NGC Alignment* from our web site ([jimsmobile.com](http://jimsmobile.com)) for more information.

# Maintaining the NGT-6

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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 NGT mirror and preserve its life. Do not clean the mirror too frequently. If properly handled and protected from dirt, the mirror should require cleaning only once or twice a year. The mirror can be cleaned without removing it from the cell, however the cell should dry completely before it is returned to the telescope.

First, gather the following materials:

- A large box of 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 surface.
- 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 dot prior to cleaning, as the acetone will dissolve the adhesive causing it to run and stain the mirror surface. The dot is required for collimation. Replace it 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 immerse.

Fill the tub with a solution of lukewarm distilled water and mild soap. Rinse the mirror by pouring distilled water, 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 the NGT-6

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 (i.e. showing a larger image).

In a Newtonian reflector such as the NGT, 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 NGT owner to align the secondary and primary mirrors of the telescope. The (eyepiece) focuser is permanently set at JMI prior to shipment, and should require no further adjustment.

The NGT is carefully collimated at the factory. Alignment between the focusing assembly and the diagonal (secondary mirror) is set to maintain a high degree of accuracy indefinitely, and rarely requires adjustment unless the focuser and/or diagonal are tampered with or severely jarred. If adjustment does become necessary, it is unlikely that the axial placement or the tilt of the diagonal will require correction.

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

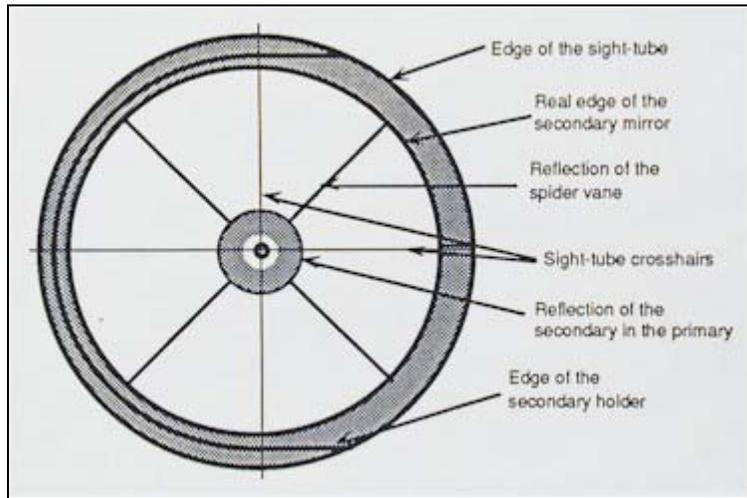
A sight-tube with accurate crosshairs is essential to collimation of a Newtonian reflector. Accurate placement of the secondary mirror is the first step in collimating and absolutely crucial to the performance of the NGT. Although a Newtonian reflector's diagonal (secondary) mirror can be slightly off without dramatically affecting collimation it should be aligned as accurately as possible. 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 nut 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 retaining nut.

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 bullseye, 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 bullseye of the primary centered in the crosshairs of the sight-tube.



**Image visible in the sight-tube**

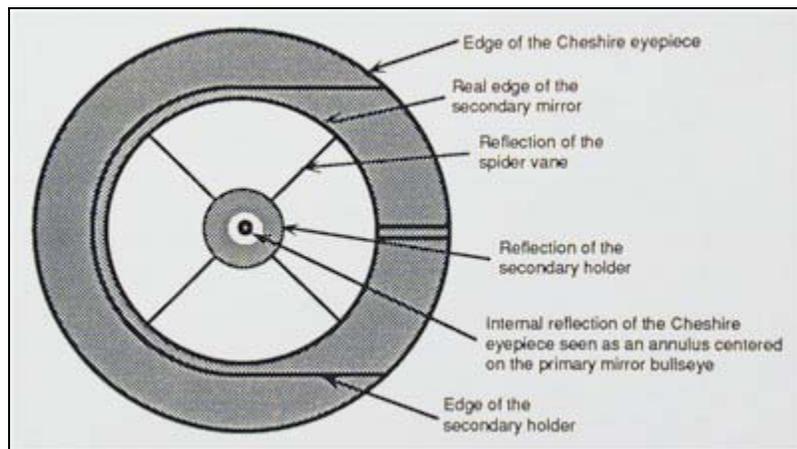
If the view does not match this description and illustration, then repeat the three adjustment steps until the view is correct. Please note that the illustrations in this manual show spider vanes which are not present on the NGT-6.

**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 bullseye 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 bullseye, in the center of the annulus.



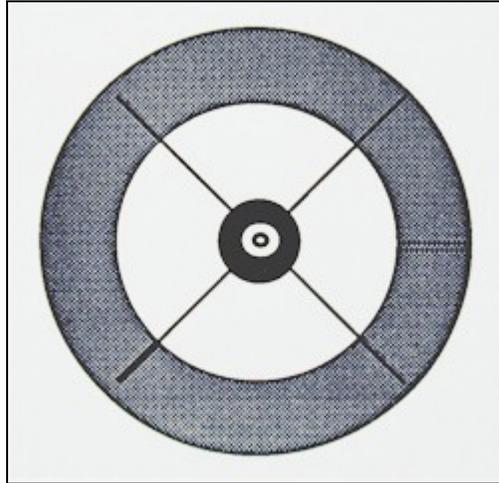
**Detail of the image visible in the Cheshire eyepiece**

Your goal is to bring the bullseye of the primary mirror into alignment with the central dot imaged by the Cheshire. Accomplish this by using the following steps to adjust the three collimating bolts of the primary mirror cell.

As shown in Figure K, the mirror cell is held in the tub by a center locknut which also holds the counterweight in place. Before attempting to collimate the telescope you must loosen this locknut a few turns to release the cell from its locked position against the collimation screws. Instead of releasing the cell completely, try to maintain just the

slightest bit of tension while turning the collimation screws. Turn the collimation screws slightly to move the bullseye toward the center of the annulus.

Continue to make adjustments until the bullseye 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.)

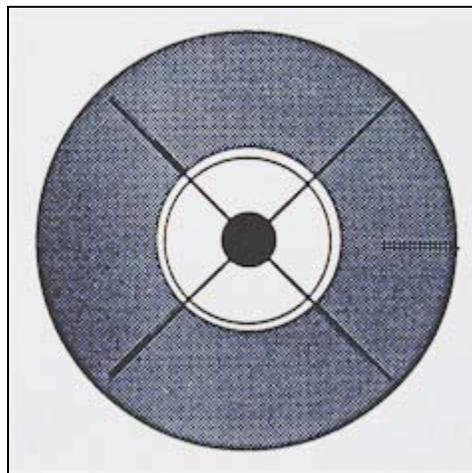


**Image visible in Cheshire eyepiece when the NGT is properly collimated**

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 bullseye with respect to the central dot as you rotate the nose assembly. 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 NGT is properly collimated**

