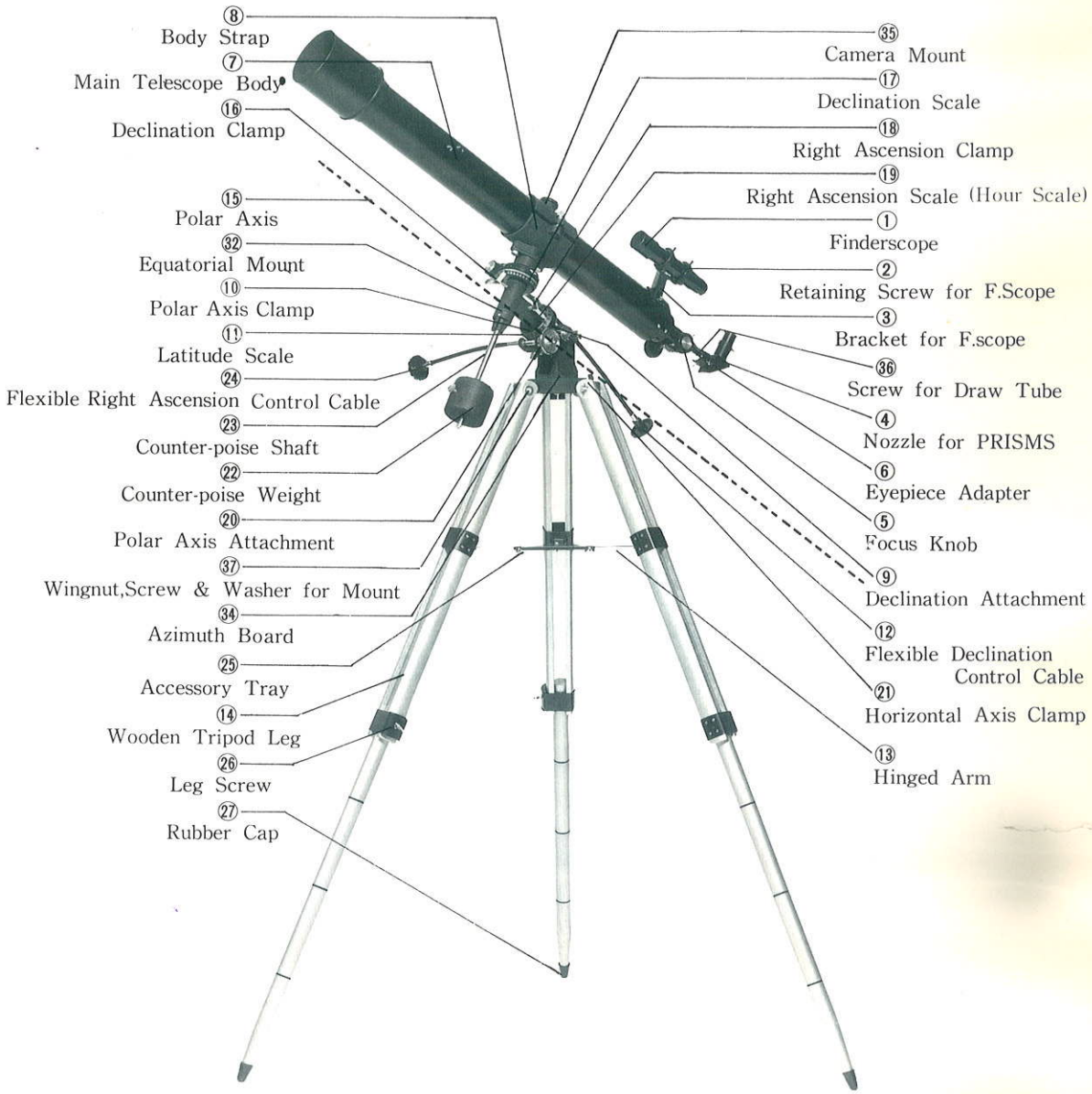
INSTRUCTIONS

400 POWER EQUATORIAL REFRACTOR TELESCOPE

D=80MM F=1000MM

PARTS DIAGRAM



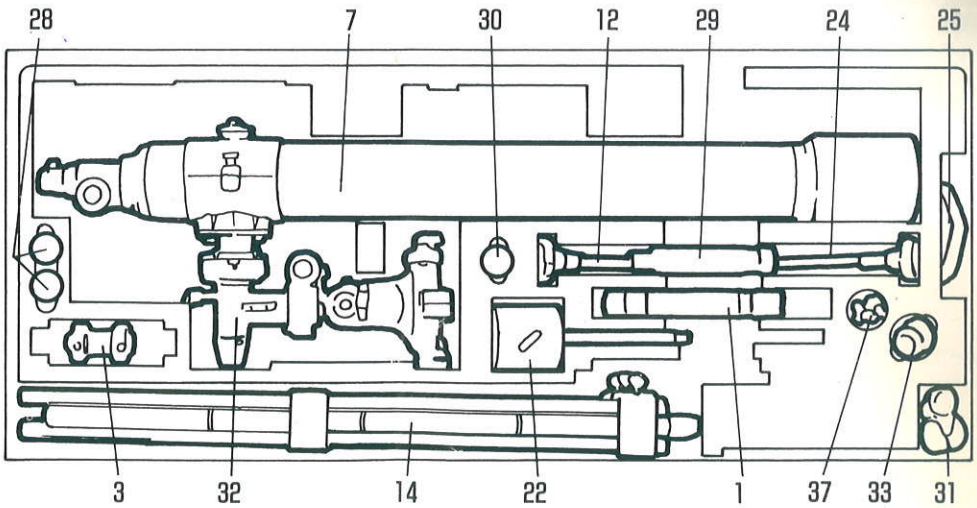
IT IS RECOMMENDED TO STUDY THE INSTRUCTIONS BEFORE ASSEMBLY. CAREFULLY REMOVE ALL PARTS FROM THE BOX AND LAY THEM OUT IN AN OPEN AREA TO MAKE SURE YOU HAVE ALL THE PARTS LISTED BELOW.

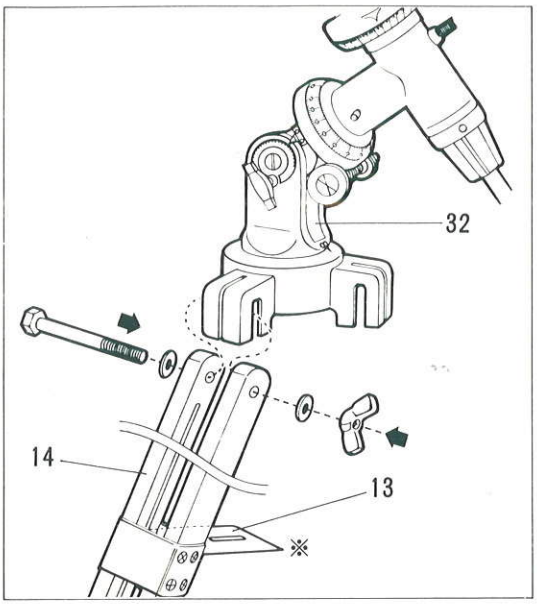
ASSEMBLING IN DAYLIGHT HOURS IS BEST IN ORDER TO BECOME COMPLETELY FAMILIAR WITH ITS OPERATION.

PARTS DIAGRAM

1. Finderscope
2. Retaining Screw for Finderscope
3. Bracket for Finderscope
4. Nozzle for Prisms
5. Focusing Knob
6. Eyepiece Adapter
7. Main Telescope Body
8. Body Strap
9. Declination Attachment
10. Polar Axis Clamp
11. Latitude Scale
12. Flexible Declination Control Cable (Longer)
13. Hinged Arm
14. Wooden Tripod
15. Polar Axis
16. Declination Clamp
17. Declination Scale
18. Right Ascension Clamp
19. Right Ascension Scale (Hour Scale)
20. Polar Axis Attachment
21. Horizontal Axis Clamp
22. Counter-poise Weight
23. Counter-poise Shaft
24. Flexible Right Ascension Control Cable (Shorter)
25. Accessory Tray
26. Leg Screw
27. Rubber Cap
28. Eyepiece
29. 2X Barlow Lens
30. Moon glass
31. Erecting Prism
32. Equatorial Mount
33. Diagonal Prism
34. Azimuth Board
35. Camera Mount
36. Screw for Draw Tube
37. Bolt, Wingnut, Washer for Mount

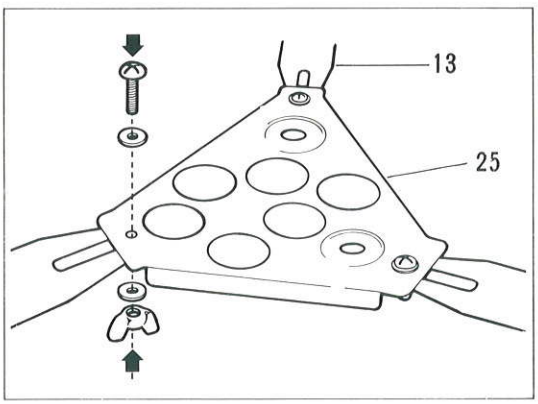
PACKING DIAGRAM





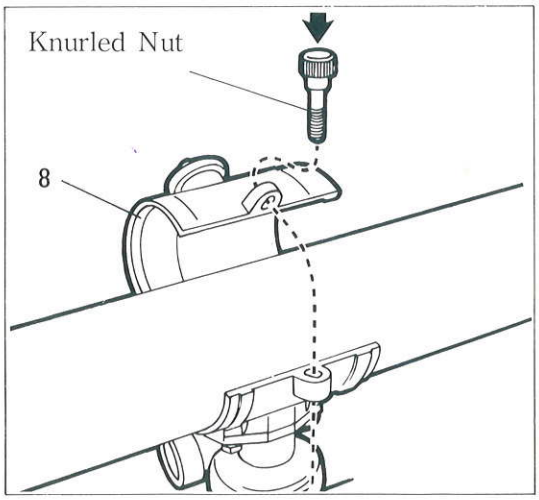
(1) ASSEMBLY OF TRIPODS

Loosen the Leg Screws (26) and slide out the inner sections equal lengths and tighten the Leg Screws. Align holes in tripod legs with slit provided at the base of the mount (32).
Attach each leg with large 3" bolt, washers and wingnut making sure the Hinged Arm (13) to be faced inside.



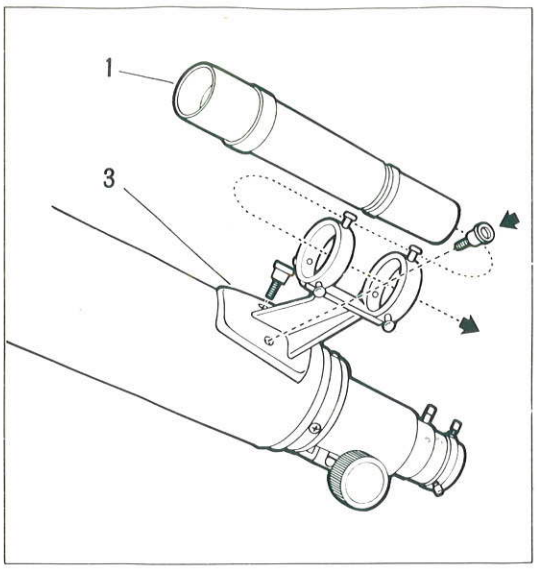
(2) ASSEMBLY OF ACCESSORY TRAY

Extend one Hinged Arm (13) on the tripod leg and position it under the small hole in a corner of the Accessory Tray (25) and tighten it with small screw, washers and wingnut.
Repeat to attach the other two hinged arms to the tray.



(3) ATTACHMENT OF MAIN BODY

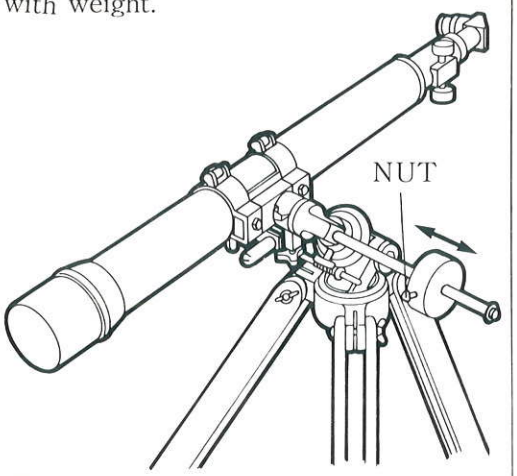
Remove vinyl bag covering the Main Body (7) by unscrewing the knurled nut. After securely tightening both the Right Ascension Clamp (18) and Declination Clamp (16), position the main body by adjusting point of eyepiece and the balance of body, then fix it with knurled nut.



(4) ATTACHMENT OF FINDERSCOPE

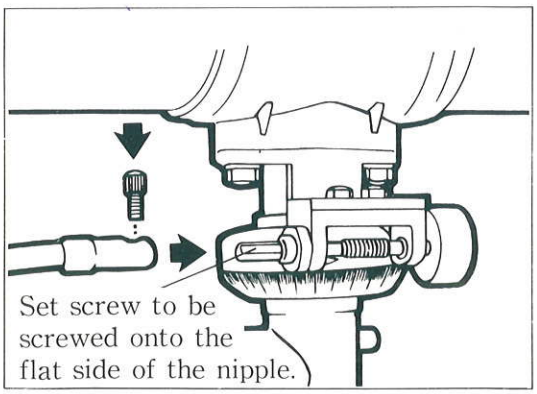
Insert the Finderscope (1) into circle part of Bracket (3) and hold it temporarily with 2 of 3 the retaining screws. Unscrew 2 screws for bracket attached to the body and mount the bracket as shown and fix it with 2 screws.
Tighten 3 retaining screws to fix Finderscope.

Slide the weight to find the ideal position to keep main body level with weight.



(5) ATTACHMENT OF COUNTER-POISE WEIGHT

Insert Counter-poise Weight (22) into the Shaft (23) and fix it with the nut attached to the weight. Then screw the shaft into the hole provided at the bottom of Equatorial Mount.
The purpose of weight is to move the body to any direction smoothly therefore, the weight should be fixed balancing with other parts.
* The weight is rather heavy so please take care when you install. *



(6) ATTACHMENT OF FLEXIBLE CONTROL CABLES

Attach Flexible Declination Control Cable (12) to Declination Attachment (9) and Right Ascension Control Cable (24) to the Attachment (20) and tighten them with set screws.

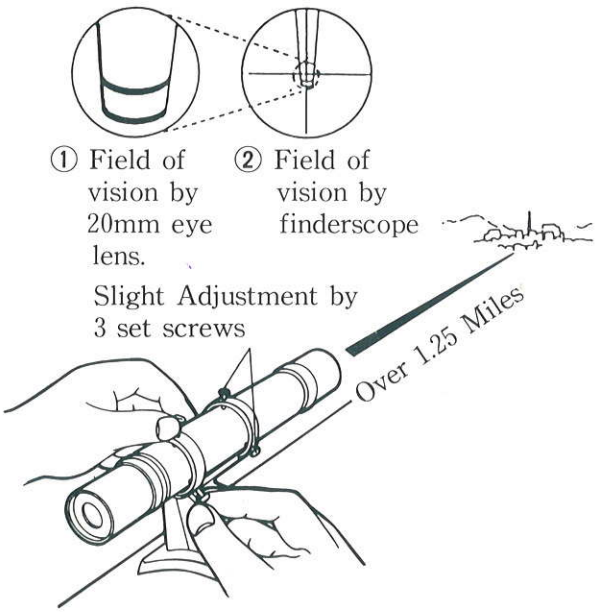
EXPLANATION OF PARTS AND OPERATION OF EACH PART

*** Function of Finderscope ***

The finderscope to be accurately positioned to have reasonable alignment with telescope.
Finderscope is designed to easily find the object you want to observe.
Just simply put the object into the cross-hair intersect of the Finderscope.

*** Aligning the Finderscope ***

In the daytime, aim the telescope at a distant object by sighting along the main tube. The further away the object the better.
Focus the telescope by pulling the draw tube outward until it stops.
Rotate the Focus Knob (5) until the subject comes into focus using the 20mm eye lens.
When the object is centered in the eyepiece, recheck the clamp screws for tightness. Now, by using the 3 adjusting screws, adjust the finderscope so that the cross-hairs intersect the same point of the same object that is seen in the center of the eye lens of the main telescope.

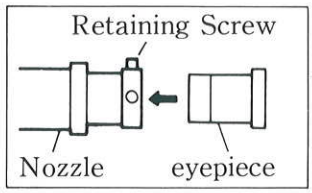


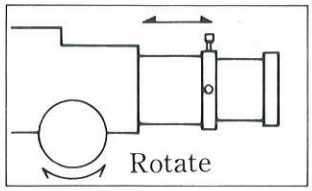
*** Eyepiece ***

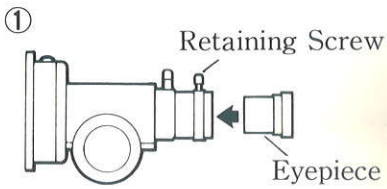
3 different eyepiece are provided with this telescope. The numbers 5,12 or 20 indicated on each eyepiece shows its focal length. The power of telescope is 1000mm so that magnification power is obtained by dividing it with the focal length of each eyepiece. For example,
5mm eyepiece - 1000÷5=200X.
In case of 20mm, it is 50X.

*** Focus Adjustment ***

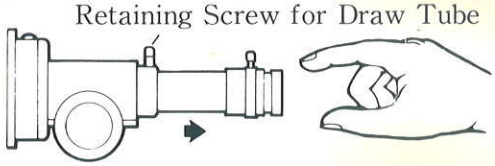
Unscrew of retaining screw at the Nozzle (4) and insert eyepiece then tighten it. Pull the draw tube outward unscrewing the retaining screw of draw tube for rough focusing. Then, obtain precise focus by rotating the Focus Knob (5).



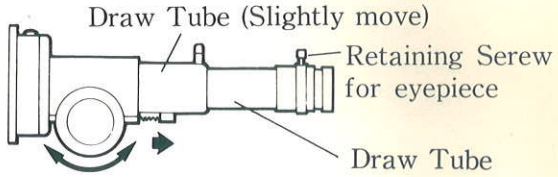




② Rough Focus Adjustment



③ Precise Focus Adjustment



*** Accessory Tray ***

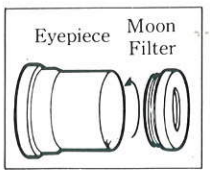
The tray serves not only to keep small accessories for observation but also to stabilize the tripod.

*** 2X Barlow Lens ***

The use of the Barlow Lens DOUBLES the magnifying power of any eyepiece that is used with it. The extreme magnification power is obtainable however, the field of view will be much smaller, and the image will not be as bright and as sharp.

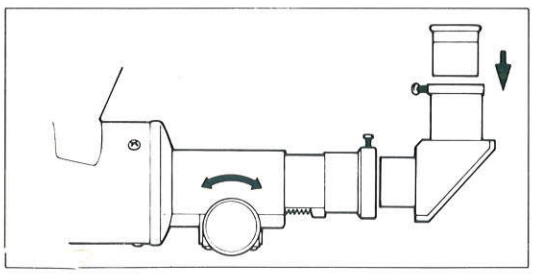
*** Moon Filter ***

The filter controls dazzle and protects your eyes when you observe the moon.



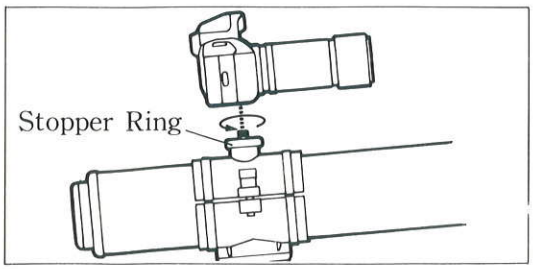
*** Diagonal Prism ***

The diagonal prism is a device containing a right angle prism. It bends the light gathered by the objective lens at right angles and provides more comfortable viewing. When the prism is used, the image may be anywhere from right side up but reversed from left to right to completely upside down, depending on the angle to which it is turned.



*** Camera Mount ***

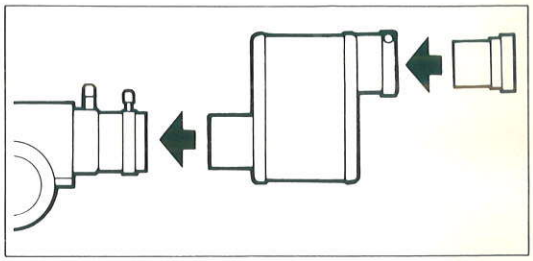
Any camera with a standard tripod mounting socket (1/4X 20 threads) can be mounted on the Camera Mount (35) located on top of the Body Strap (8).



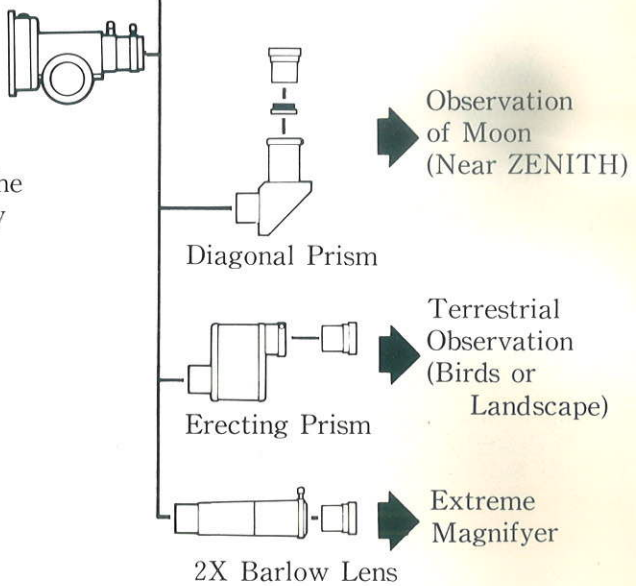
Mount the camera in adequate position then tighten it with stopper ring.

*** Erecting Prism ***

This prism to be attached to eyepiece adaptor for terrestrial viewing since the image seen through the telescope is upside down and left to right. It is good for observing of birds or landscape.



REFERENCE FOR EXCHANGE OF LENS AND PRISM IN ACCORDANCE WITH PURPOSE OF OBSERVATION.



* EQUATORIAL USE *

* Setting up the Equatorial Mount.

After confirming the top of the tripod is level in all directions, set the telescope's main body vertically above the polar axis body and as nearly to the polar axis (15) as possible. Loosen the Azimuth Clamp Screw (21) and swing the Equatorial Mount (32) right or left to set the polar axis reasonably correct in azimuth by directing the polar axis body toward the true north pole which lies about 1° from Polaris or use a compass deviation at the point of Observation. Lock azimuth clamp srew.

Adjust the latitude angle of the polar axis body to conform with the geographical latitude position of the place of observation. Check your location in an Atlas or call your country surveyor.

The well aligned finderscope will help you to locate a star or planet. Use the flexible controls to bring the object to the intersection of the cross-hairs of the finderscope. The same object will be in the wide view eyepiece of the telescope.

Move the telescope by adjusting hour and declination angles to center star. IMPORTANT: DO NOT CHANGE AZIMUTH OR POLAR AXIS (LATITUDE) POSITION.

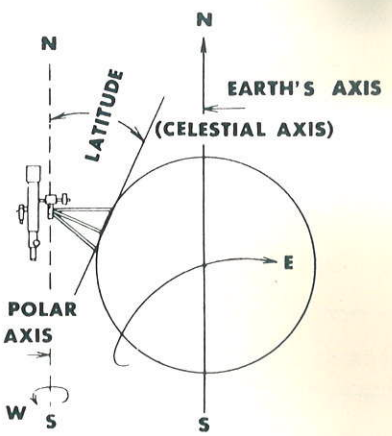
Assuming that the latitude angle of the polar axis is correct, there is a simple method to refine the setting. Center a star in the field of view of the wide view (50X) eyepiece. If the polar axis is not set in azimuth correctly, it will be necessary to move the declination and hour adjustments to keep the star centered. If the declination was toward the north assuming you are located in the nothern hemisphere, the upper end of polar axis is pointing too far westward. If the correction is in the opposite direction, the polar axis is pointing too far eastward.

Loosen azimuth clamp screw, shift the polar axis in azimuth in the direction indica ted and make a new test. Two or three tests should put the polar axis in correct adjustment. Stars in widely separated parts of the sky to be used for each trial. NOTE: DUE TO RAPID MOTION IN DECLINATION, THE MOON IS NOT A PRACTICAL OBJECT FOR THESE ADJUSTMENTS.

When the azimuth, latitude and declination setting have been properly adjusted, a star will remain in the field of view for a considerable length of time. For continuous tracking, it is only necessary to advance hour axis with flexible control. When the proper settings have been completed, it is suggested that a mark be scratched on the tripod flange and the mounting pillar of the polar axis body, opposite the azimuth clamp screw.

* USE OF THE SETTING CIRCLE *

Since this equatorial telescope is designed to move in any direction, it can be set to track the apparent movements of celestrial bodies across the sky. This is referred to as diurnal movement. This diurnal movement of celestrial bodies is in the direction opposite to that of the earth's rotation and is around the earth's axis or celestrial axis as shown.



POLAR AXIS AND EARTH'S AXIS

By simply aiming the telescope polar axis at celestial North, you will automatically place the telescope in parallel with the earth's axis and thus be able to locate stars in the sky based on information in star charts and star atlases. In other words you aim your telescope dead center in the celestial sphere..... that point in the sky that is like the hub of a wheel and does not appear to move. The angle of declination is simply 90° minus the angle away from this hub. Celestial North is 90°.
If you were at the North Pole, you would point your telescope straight up to aim at celestial north.

To make full use of the setting circle with either the double or single index system, it is necessary to prepare your equatorial mounting for your particular place of observation by correcting any indexing error of the circles and their indicators in relation to your geographical location. It is not necessary to use your telescope for these adjustments. The correction procedures are simple and only require resonable care in making the adjustments.

1. Mark telescope body strap to show objective end.
2. Make sure that the tripod head is level in all directions.
3. Double-check the polar axis setting for the latitude and azimuth angles.
4. Remove the counter-poise weight from the shaft. Use the shaft to support a small level.
5. Level the declination axis while resting the level on the counter-poise shaft. Tighten the hour axis clamp screw.
6. Slip-turn the hour circle so that 0-0 mark of the hour circle is in line with the FIXED indicator.
7. Adjust moving indexes (by bending) so that they point figures 0-0, 0-12 of the hour circle.
8. Loosen the declination clamp screw and place the level in the telescope body strap. Move the strap until level. Lock the declination clamp screw. Read the degrees opposite the declination circle indicator.
9. Now, loosen the clamp screws, swing the strap to the opposite side of the tripod making sure that the objective end is pointing as before and repeat the leveling procedures. Do not change polar axis or azimuth settings and carefully bend the declination indicator. It probably will not be the same. Split the difference between these two readings and carefully bend the declination indicator to this correct setting. This eliminates the error of difference between two sides of telescope.
10. Loosen the declination hour clamp screw and swing the strap in north and south declination. The strap is "On The Meridian" which is very important in the calculations of hour angles of the stars. These calculations are always figured from your meridian.
11. Mount your telescope in the strap and clamp securely. Loosen the declination circle at 90°. Double-Check to make sure that 0-0 is opposite the fixed index and that the moving index opposite 0-12.

12. Your telescope is now in zero position and is pointing at the celestial equator and you are now ready to index directly to a star.

THE DOUBLE INDEX SYSTEM

With double indexing you index directly to sidereal time and then index directly to R.A. of the star.
(Example)

If you wish to find a star that is catalogued at 3:00 R.A. when it is 6:00 sidereal time, it is only necessary to slip-turn the hour circle to put sidereal time 6:00 of the outer hour circle in line with the MOVING index. Loosen the hour axis clamp screw and turn the telescope-the hour circle will move with it-in the needed direction to put 3:00 of the inner circle in line with the FIXED index. Loosen declination clamp screw and move telescope until proper declination angle is indicated and tighten clamp. Use the WIDE VIEW EYEPIECE 20mm to locate the star to the intersection of the cross-hairs of the finderscope. You can follow the star for a long time just by advancing the hour axis with the flexible control.

THE SINGLE INDEX SYSTEM

This system is good for a methodical person who enjoys doing things in the scientific way using necessary arithmetic involed.
(Example)

If it is 5:00 sidereal time and you want to find a star that is at R.A. 2:00. It is necessary to substract 2:00 R.A. from the 5:00 sidereal time. The result would be 3:00 west. Since our example gives a 3:00 west calculation the telescope is placed on the east side of the tripod at zero position. Slip-turn the hour circle so that 5:00 - outer circle - is opposite the hour circle indicator. Tighten the hour axis by clamp and the hour axis is advances to 8:00 with the flexible control. Use the WIDE VIEW EYEPIECE 20mm to locate the star to the intersection of the cross-hairs of the finderscope. Well, you can follow the star for a long time just by advancing the hour axis with the flexible control.

CALULATION OF HOUR ANGLE

If the sidereal time is the larger, substract R.A. The result will indicate hours west of the meridian. When it is necessary to substract time from R.A. the result is hours east of meridian.

USUALLY, IF THE RESULTS OF THE CALCULATIONS DETERMINE A "WEST" reading the telescope is placed on the east side of the tripod.
With a west calculation the hours increase from sidereal time.

If the results of the calculation determine on "EAST" reading the telescope is placed on the west side of the tripod. The settings are the same as before except that the hours will decrease from sidereal time so that it is necessary to substract rather than add.

QUICKEST & EASIEST SYSTEM

This system requires neither necessary arithmetic nor necessary determination of sidereal time. It is only necessary to center a familiar star or planet in the field of the telescope by adjusting the hour and declination angles manually. Then slip-turn the hour circle to the R.A. as catalogued. Now, you have set your telescope corectly in sidereal time without arithmetic and you can index to other stars in that area of the sky by either double or single indexing.

SUN PROJECT SCREEN (OPTION)

Assemble the sun projection screen and attach it to the drawing focus tube.

VERY IMPORTANT : 1) The sun's image should be projected only onto the projection screen.

2) TO AVOID ANY CHANCE OF LOOKING THROUGH THE FINDERSCOPE, PUT ON THE COVER.

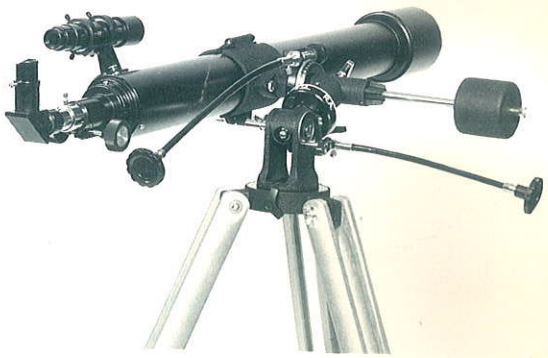
3) Remove the diagonal prism from the focus tube.

4) DO NOT LOOK THROUGH THE TELESCOPE AND DO NOT USE LENSES OR PRISM.

Point the telescope at the sun. The sun will from a shadow of the telescope on the ground. As you get closer to lining up the telescope with the sun, the telescope's shadow will become smaller and smaller. When you are aimed directly at the sun, the shadow will become a ring with a bright center. Insert the diagonal prism with 20mm eyepiece into the draw focus tube. MAKE SURE THE EYEPIECE IS FACING DOWNWARD TOWARD THE SUN SCREEN!
Using focus knob in the usual manner, you can focus the sun's image on the screen.

TERRESTRIAL USE

Since the image seen through the telescope is upside down and left to right, it is necessary to attach the Erecting Prism (31) to the eyepiece adapter for the observation of landscape or birdwatchihg.
Loosen the polar axis clamp and set the polar axis at right angles to the tripod (straight up) and tighten the clamp.
Loosen the declination clamp and adjust the telescope to be parallel to the ground then tighten the clamp.
Aim the telescope with the finderscope in the same method for astronomical viewing.
For the telescope movements, Left-Right--use Azimuth clamp screw and up-down - use declination clamp Screw. For the slight movements, use the flexible control cables.



* ASTROPHOTOGRAPHY *

Set up the telescope outdoors in cold weather at least 90 minutes before use. As it requires time exposures you will need a camera with time and bulb exposure settings. To obtain the best results, use the cable release.

* CARE OF LENSES *

1) Please avoid taking the telescope from cold outside air into a warm room as it will cause the objective lens to become covered with condensed moisture.
2) Place the telescope at a safe distance from a heat source and let it warm gradually until the moisture disappears.
3) The objective lens of your telescope has been highly polished and ground to minute tolerances therefore any stains left on the lenses should be carefully wiped off after the lenses are thoroughly bry.
4) To clean the lenses, put a few drops of ether or pure grain alcohol on a piece of clean cotton that has been washed several times and wipe the lenses very gently, avoiding a circular motion. Blow any remaining lint or dust off with a camelhair brush or an ear-type syringe.

SPECIFICATIONS

OPTICAL EFFECT

Objective Lnes	: Achromatic, crown-flint two-ply glass, hard-coated
Lens Clear Aperture	: 80mm
Focal Length	: 1000mm
Resolving Power	: 1.45"
Visual Magnitude	: 11.3M

ACCESSORIES

Eyepiece (OR=5mm/Ke=12mm/Ke=20mm)	3 pce.	Finderscope	1 pce.
Star Diagonal Prism	1 pce.	Accessory Tray	1 pce.
Erecting Prism	1 pce.	Illuminator (Pen Light)	1 pce.
Barlow Lens (Achromatic)	1 pce.	Flexble Control Cable	2 pce.
Moon Filter	1 pce.	Balance Weight	1 pce.

Eyepiece	Magnifications	Magnifications w/2x Barlow Len	Exit Pupil Aperture	Brightness
OR=5mm	200x	400x	0.4	0.16
Ke=12mm	83.3x	166.6x	0.96	0.921
Ke=20mm	50x	100x	1.6	1.56