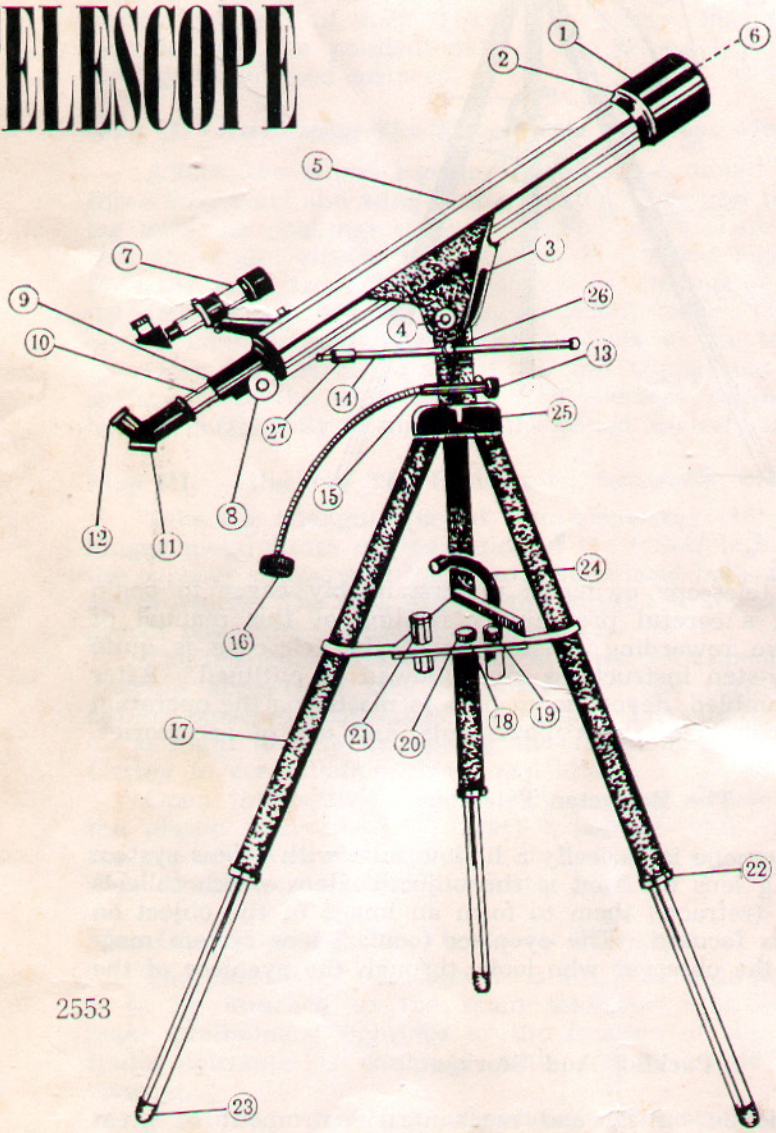
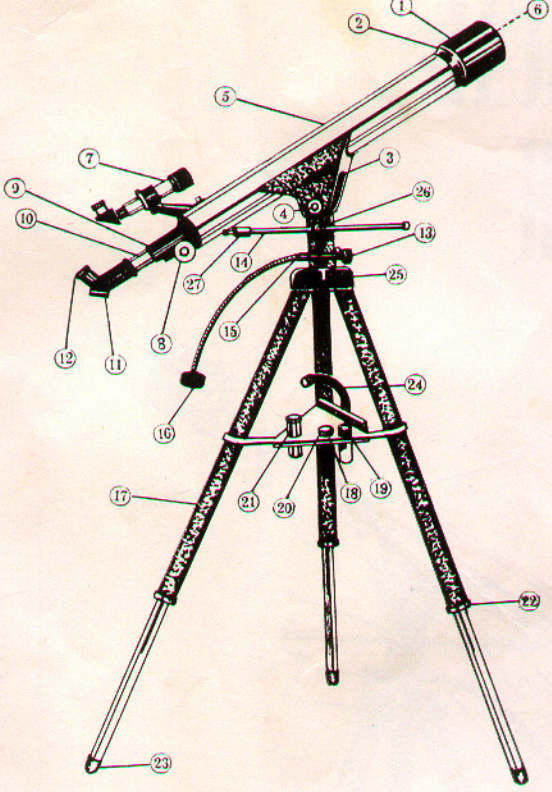
ASTRONOMICAL REFRACTOR TELESCOPE



2553

1) Dew cap
2) Objective cell
3) Mount
4) Screw
5) Main telescope tube
6) Dust cap
7) Right angle viewfinder telescope
8) Micro focusing knob
9) Eye end
10) Focusing draw tube
11) Star diagonal prism
12) Eyepiece (ocular)
13) Azimuth lock knob
14) Altitude "slow motion" slide bar
15) Azimuth "slow motion"
16) Flexible handle for azimuth
17) Metal tripod
18) Illuminated metal equipment tray
19) Image erecter
20) Moon filter
21) Barlow lens
22) Tripod leg adjustment screws
23) Rubber caps
24) Adjustable illuminator
25) Telescope mount base
26) Altitude lock knob
27) Altitude slow motion control

- 2.4" Objective Lens
- Altazimuth Mount
- Altitude Slow Motion Control



While the new telescope owner is understandably eager to begin his sky explorations, a careful preliminary reading of this manual of instructions will prove rewarding. Assembly of the telescope is quite simple if the step-by-step instructions are followed as outlined. After the instrument is assembled, devote some time to mastering the operation of the telescope: focusing, telescope movements, and use of accessories.

The Refractor Telescope

The refractor telescope is basically a hollow tube with a lens system at each end. The big lens up front is the objective lens which collects light rays and bends (refracts) them to form an image of the object on which the telescope is focused. The eyepiece (ocular) lens system magnifies this image for the observer who looks through the eyepiece of the telescope.

Packing And Storage

Your telescope is an optical and mechanical instrument of great precision. Handled with care and respect, it will provide many years of excellent service. To protect the components of your precision-engineered telescope during shipment and storage, packets of silica gel, which absorb potentially harmful moisture, have been placed in the telescope case. These packets should be left in the case to protect the instrument whenever the telescope is to be stored for any length of time.

ASSEMBLING THE TELESCOPE

Note: The numbers referred to in the assembly instructions that follow are the numbers of the telescope parts as marked in the accompanying diagram.

Step I. Adjusting The Tripod

Take the tripod legs (17) from the telescope case and adjust them all to the same length by sliding out the inner shaft of each tripod leg. Lock the sliding shaft by tightening the thumb screw (22) located on the outside member of each tripod leg. Notice that rubber caps (23) are provided for the pointed ends of the tripod legs in order to prevent damage to polished surfaces.

Step II. Assembling The Tripod And Telescope Mount

Attach the tripod legs to the telescope mount with the aid of the three long bolts and wing nuts provided. Position the top of each tripod leg over the openings in the telescope mount base (25). Make certain that the metal straps (brackets) on the tripod legs are facing inward. Pass the bolts through the openings in the top of the tripod legs and through the holes in the telescope mount base. Tighten the wing nuts on the bolts to fasten the tripod securely to the telescope mount base.

Open the tripod legs and set the tripod and telescope on a flat surface. Use the wing nuts on the telescope mount base to adjust the tension sufficiently to maintain the tripod securely in position.

Step III. Attaching The Illuminated Accessory Tray

Take the triangular metal equipment tray (18) and attach it to the hinged metal straps on the inside of the tripod legs. Attach the tray to the support straps with the short, round-head bolts and wing nuts which are provided. The long slots in the support straps are designed to permit proper positioning of the accessory tray.

The triangular accessory tray is fitted with openings in which various viewing accessories may be inserted. The tray is equipped with a battery-powered adjustable illuminator. The illuminator may be turned on at night to help in reading star maps, making time checks, and referring to constellation charts and atlases.

Open the battery compartment on the accessory tray and remove the plastic sleeve inside. Insert a pair of "AA" penlight batteries in the plastic sleeve and replace it in the battery compartment. An on-off slide switch controls the illuminator.

Step IV. Attaching The Viewfinder Telescope

The viewfinder telescope (7) is a 5 x 24 wide-field instrument which is to be attached to the main telescope tube where it is used to make preliminary sightings of the location of sky objects. The viewfinder telescope is equipped with a right angle eyepiece for easier viewing.

A pair of projecting knurled-head screws near the eyepiece end of the telescope mark the place where the viewfinder telescope is to be attached. Remove the knurled-head screws and position the base of the viewfinder telescope so that the holes in the viewfinder mount are positioned over the tapped holes in the main telescope tube. Fasten the viewfinder telescope in place with the knurled-head screws previously removed.

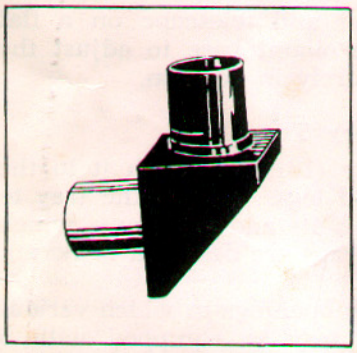
The viewfinder telescope is focused by turning the eyepiece ring of the viewfinder until the image observed is sharp and clear. As in all optical instruments of this type, the image is reversed from right to left. This creates no problem in astronomical viewing.

The viewfinder telescope should be adjusted so that it may be used to guide or sight the main telescope on some selected sky object. A star or planet centered in the cross hairs of the viewfinder should also be seen when the observer shifts his view to the eyepiece of the main telescope.

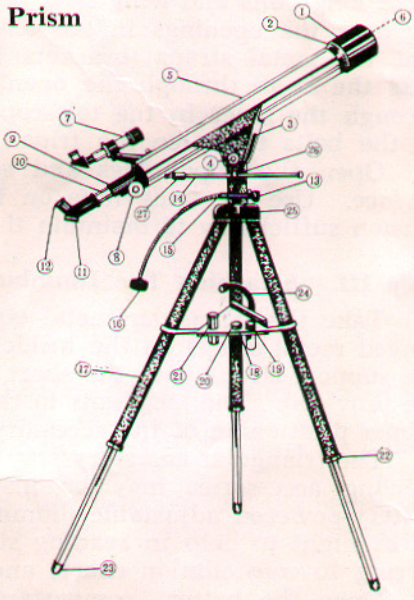
To line up the two telescopes, simply sight (during daylight hours) the main telescope on some distant vertical object: a fence post, utility pole, or the corner of a building. Use the locking clamps to hold the main telescope in position.

Sight through the viewfinder telescope at the same vertical object. If the fence post or utility pole is not centered in the cross hairs, use the adjusting screws in the mount of the viewfinder scope to move the viewfinder until the object appears dead center.

Step V. Installing The Star Diagonal Prism



Star diagonal prism



Take the star diagonal prism (11) from its storage box and examine it. The star diagonal consists of two short tubes at right angles to each other and mounted in a triangular block. Insert the chromed (small diameter) tube into the eye end of the main telescope tube (9) and fasten it in place with the aid of the set screw.

Telescope eyepieces are inserted in the open end of the star diagonal prism. Your telescope is equipped with a variable power zoom eyepiece of variable focal length from 7.5 mm. to 22.5 mm. and a standard high-power eyepiece with a focal length of 6 mm. Insert the zoom eyepiece into the open end of the star diagonal prism and secure it in place by tightening the set screw on the star diagonal.

Viewing through the star diagonal prism permits the observer to take a comfortable stance beside the telescope. Observation of the sky can then take place without assuming a cramped or uncomfortable posture as might be the case if it were necessary to peer through the telescope with the eyepiece inserted directly into the eye end of the instrument.

Step VI. Attaching The Flexible Shaft Control Handle

The flexible shaft control handle (16) is to be attached to the azimuth motion control shaft. The flexible handle consists of a flexible shaft with a knob at one end and a sleeve with a set screw at the other end.

Attach the flexible control handle to the projecting shaft (15) of the azimuth motion control. Position the sleeve at the end of the handle so that the set screw on the sleeve is positioned over the flat part of the azimuth control shaft. Tighten the set screw to secure the flexible handle to the azimuth conrol.

TELESCOPE OPERATING TECHNIQUES

I. Focusing The Telescope

With the star diagonal prism in place, insert the zoom eyepiece. Adjust the zoom control ring on the eyepiece to read 22.5 mm. This is the low power setting. Turn the micro-focusing knob (8) until the focusing draw tube (10) is racked all the way out. Aim the telescope at the object to be observed and slowly turn the micro-focusing knob to rack in the focusing assembly. Looking through the eyepiece, the observer will see the image appear. Turn the knob back and forth carefully until the sharpest and clearest image is obtained.

The quality of the telescope's image is related directly to the "seeing" conditions that may exist on any given night. The Earth's atmosphere is rarely still. The motion of air currents affects our vision even without the magnifying effect of the telescope. Everyone has seen the optical distortions caused by the wavering and rippling of air currents above a heated surface. On some nights this effect can cause telescope images to "dance" and "boil" until the sky-watcher is forced to abandon his attempts at observation.

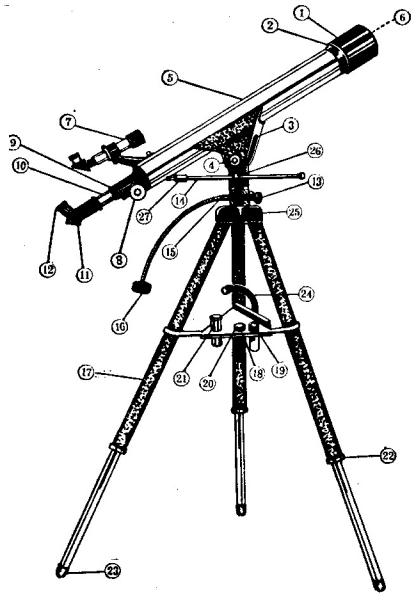
II Telescope Magnification

Telescope magnification is a function of the focal length of the eyepiece used. Your zoom eyepiece varies from 7.5 mm. (high power) to 22.5 mm. (low power) and all values in between. Merely turning the zoom control ring on the eyepiece varies the magnification from one end of its range to the other while the observer maintains sight of the image at all times. The zoom eyepiece thus offers an immense advantage over the single eyepiece system where in order to change magnification it is necessary to insert a different eyepiece for each new magnifying power with a consequent loss of view of the telescope image.

A standard 6 mm, eyepiece is provided for special high power observations. In use, this eyepiece is inserted into the star diagonal in place of the zoom eyepiece.

It is tempting to use magnification of the highest power but the best results are often obtained by using the minimum magnification possible. At low powers, larger areas of the sky can be observed and unfamiliar objects can be more readily found. In addition, at low powers objects can be seen more distinctly and with greater clarity and sharpness. High powers not only reduce the amount of light and the size of the field of view but they also intensify the distortions and waverings produced by disturbances in the atmosphere.

The 3X Barlow lens (21) is a device which when used in conjunction with any eyepiece triples the power of that eyepiece. Thus while a 22.5



mm. setting on the zoom eyepiece normally produces a magnification of 33 times, the use of the eyepiece in conjunction with the 3X Barlow lens will produce a boost in magnifying power to 99 times.

In using the Barlow lens, remove the eyepiece from the star diagonal prism and insert the Barlow lens tube into the open end of the star diagonal. Insert an eyepiece into the open end of the Barlow lens and secure the eyepiece by tightening the set screw on the Barlow tube.

III. Terrestrial (Land) Viewing

In using the telescope for viewing objects on land a special problem arises because the optical system of the telescope reverses and inverts the image seen by the observer. When the star diagonal is used, it produces an image which is right side up but still reversed from right to left. The lettering on signs, for instance, appears backward when viewed through the telescope.

The image erecter (19), provided as an accessory, will properly orient the image when the telescope is used for observations on land. To use the image erecter the star diagonal must be removed from the telescope's optical system.

To use the image erecter with the standard 6 mm. eyepiece, the short adapter ring must be screwed onto the image erecter to increase the focal length of the image erecter tube. When using the image erecter with the zoom eyepiece, the short adapter ring must be unscrewed from the tube of the image erecter.

For terrestrial observations, remove the star diagonal and insert the image erecter tube (with or without the adapter ring as indicated above) directly into the eye end of the telescope, securing it by means of the set screw. Carefully screw the proper eyepiece into the open end of the image erecter. The telescope is now ready for terrestrial viewing. Note that the star diagonal cannot be used when the image erecter is part of the telescope's optical system.



Image Erecter

The image erecter is designed for those situations where a properly oriented image is desirable. In normal astronomical observation, this is not necessary.

IV. Telescope Motions

The telescope is capable of two motions around its altazimuth mounting. First, the telescope can swing in a complete 360 degree circle (azimuth) around the base of the mount. Second, the telescope can be raised or lowered (altitude) as it pivots in the mount (3). By means of locking knobs, the telescope can be clamped or locked in position at any point in its movements around its altazimuth mounting.

Movement around the azimuth base of the mount is locked by the small knob (13) at the base of the telescope mount. Movement in altitude is controlled by the slide bar (14) and may be locked at any point simply by tightening the lock knob (26) on the slide bar.

However, even with the telescope locked in position, small controlled movements of the instrument called "slow motions" can still be made. Slow motion in altitude is controlled by the rotating cylinder (27) located towards the rear of the slide bar. Turning the cylinder in either direction will raise or lower the telescope in slow motion movements. Slow motion in azimuth (side-to-side movement) is controlled by turning the flexible shaft control handle (16).

By using the slow motions the observer can make minor adjustments in the telescope's position or "track" a star as it drifts across his field of view. Due to the motion of the Earth as it spins beneath the celestial sphere, sky objects drift out of the field of view. The telescope must be moved to follow these objects.

YOUR FIRST ASTRONOMICAL OBSERVATIONS

What To Expect

The night sky affords the patient sky-watcher some fascinating glimpses into the true nature of our universe. In time, the keen observer can expect to see galaxies, nebulae, double stars, novae, comets, star clusters — the whole dazzling parade of heavenly objects.

In the beginning, however, the sky-watcher should concentrate on the easy objects: the Moon, the nearer planets, and some major stars. Even under low powers, the Moon is a wonderful object for study. Many details including craters, "seas", and mountain ranges are readily seen.

Planets, which are located at much greater distances from the Earth than is the Moon, appear in the telescope as circular discs of light. The careful observer, however, should be able to distinguish Saturn's ring system and the major moons of Jupiter.

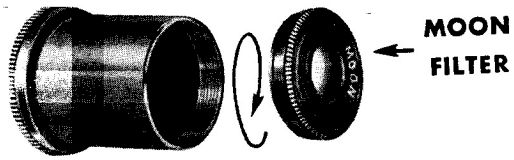
Galaxies and nebulae will appear as filmy blurs of light while the stars, even in the most powerful telescopes known to man, appear only as points of light.

The Telescope And The World Of Astronomy, the book included with your telescope, is your guide to the wonders of the sky. The book is a basic course in amateur astronomy and it will introduce you to the pleasures and delights to be found in training your telescope upon the vastness of the glittering heavens.

Observing The Moon

Moon observations are simple to make and very rewarding. Simply sight upon our satellite until it is centered in the viewfinder telescope and lock the telescope in position with the locking knobs. Using low power, focus carefully and use the slow motion controls to keep one area of the Moon in view.

Attaching the Moon filter



Best observations are made at the phases of the crescent or quarter Moon. When the Moon nears its full phase, the glare of the reflected sunlight may make good viewing difficult. At such times your Moon filter, included as an accessory should be used to reduce glare. The Moon filter is threaded and simply screws into the back of either telescope eyepiece. Remember to remove the filter when using the telescope for normal observations.

CAUTION!

THE TELESCOPE MUST NEVER BE USED TO LOOK DIRECTLY AT THE FACE OF THE SUN. NEVER LOOK THROUGH THE VIEWFINDER OR MAIN TELESCOPE AT THE SUN'S FACE. THIS CANNOT BE OVEREMPHASIZED! PERMANENT EYE DAMAGE CAN RESULT FROM EVEN A MOMENTARY GLIMPSE OF THE SUN THROUGH THE TELESCOPE!

Experienced observers who wish to view the Sun should use indirect projection techniques as outlined in the astronomy book included with the telescope. Sun projection screens are available from leading dealers.

Simple Maintenance Procedures

Proper and intelligent handling of equipment will prevent the occurrence of many problems. Telescopes should be stored in their cases and protected from dust when not in use. In setting up the telescope avoid jarring it or handling it roughly. Preventive maintenance is the best guarantee against future difficulty.

Lenses are the heart of the telescope's structure. Special care must be taken to protect all optical parts from damage. Dust caps should be placed over the lenses whenever the telescope is to be stored for any period of time. If dust is found on the optical surfaces, a soft camel's hair brush should be used to sweep it gently away. Never rub or polish a lens without dusting it thoroughly as a tiny particle of dust or grit on a cloth can scratch the surface of a lens.

After dusting the lens thoroughly, breathe on the surface of the glass and polish away the resulting film of moisture with a clean, lint-free cloth or a piece of lens tissue.

Eyepieces should be cared for and cleaned like any other optical element. Do not attempt to dismantle eyepieces as the lens system has been carefully aligned at the factory.

OPTICAL SPECIFICATIONS OF YOUR TELESCOPE

Objective Lens: Achromatic, Fraunhofer-type, Hard-coated for increased light transmission.

Clear Aperture (mm.)	60 millimeters
Clear Aperture (inches)	2.4 inches
Focal Length	750 millimeters
Focal Ratio (f. number)	12.5
Resolving Power (Dawes Limit)	1.8 seconds of arc
Resolution (Working Value)	3.2 seconds of arc
Faintest Visible Stars Observable	10.8 magnitude
Light-Gathering Power Compared To Naked Eye	91 times

Eyepiece: Variable Power Zoom Type

Focal Length	Magnification	Magnification With 3X Barlow Lens
Minimum: 22.5mm	Minimum: 33 times	Minimum: 99 times
Maximum: 7.5mm	Maximum: 100times	Maximum: 300 times

Eyepiece: Huygenian Mittenzwey 6 mm

Focal Length	Magnification	Magnification With 3X Barlow Lens
6 mm.	125 times	375 times