Instruction Manual

Model 2080: 8" Schmidt-Cassegrain
Model 2120: 10" Schmidt-Cassegrain

NOTE:

Separate, supplementary instructions, as appropriate, are included with this instruction manual for the following Meade telescopes:

— Models 2080/LX3, 2120/LX3

— Models 2080/LX5, 2120/LX5

— Models 2080/LX6, 2120/LX6

WARNING

NEVER ATTEMPT TO OBSERVE THE SUN THROUGH YOUR MEADE TELESCOPE! OBSERVING THE SUN, EVEN FOR THE SHORTEST FRACTION OF A SECOND, WILL CAUSE INSTANT AND IRREVERSIBLE EYE DAMAGE. WHEN OBSERVING DURING THE DAYTIME, DO NOT POINT THE TELESCOPE EVEN CLOSE TO THE SUN.

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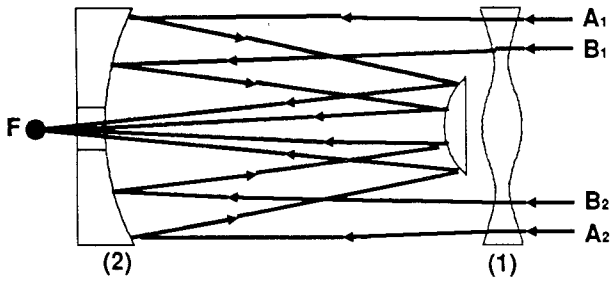
TABLE OF CONTENTS

Note

Instructions for the use of optional accessories are not included in this manual. For details in this regard, see the Meade "Accessories Catalog and Observer's Guide."

THE SYSTEM 2000 SCHMIDT-CASSEGRAIN OPTICAL SYSTEM

(Diagram not to scale)



In the Schmidt-Cassegrain design of the Meade 8-inch Model 2080 shown, light enters from the right, passes through a thin lens with 2-sided aspheric correction (1) ("correcting plate"), proceeds to a spherical primary (2) and then to a convex aspheric secondary mirror (3). The convex secondary mirror multiplies the effective focal length of the promary mirror and results in a focus at F, with light passing through a central perforation in the primary mirror.

The 8-inch Model 2080 telescope includes an oversize 8.25-inch diameter primary mirror, yielding a fully illuminated field-of-view significantly wider than is possible with a standard 8-inch diameter primary. Because the Schmidt correcting plate near its edge acts, in effect, as a negative lens, light impinging near the circumference of the correcting plate is lost unless the primary mirror size compensates for this light diverging from the corrector. (Note in the diagram that light rays A1 and A2 would be lost except for the oversize primary mirror.) In fact, the oversize primary of the Model 2080 results in about 6 percent more light reaching the focal surface of the telescope.

MEADE MODELS 2080 AND 2120
8" AND 10" SCHMIDT-CASSEGRAIN TELESCOPES

PRECAUTIONARY WARNING! Be sure to read this manual, or at minimum, the introductory assembly and operational procedures contained herein (pages 5 to 15) before attempting to use your Model 2080 or 2120.

INTRODUCTION

The Meade Model 2080 8" Schmidt-Cassegrain Telescope and Model 2120 10" Schmidt-Cassegrain Telescope are instruments of advanced mirror-lens design for astronomical and terrestrial applications. Optically and mechanically, the Models 2080 and 2120 are perhaps the most sophisticated and precisely manufactured telescopes ever made available to the serious amateur. The Models 2080 and 2120 enable the visual astronomer to reach out for detailed observations of the Solar System (the planets: Jupiter, Saturn, Mars) and beyond to distant nebulae, star clusters, galaxies. The astrophotographer will find a virtually limitless range of possibilities since, with the precision Meade worm-gear motor drive system, long exposure guided photography becomes not a distant goal, but an achievable reality. The capabilities of the instrument are essentially limited not by the telescope, but by the acquired skills of the observer and photographer. Do take the time to read this manual thoroughly so that you will be fully acquainted with the many important features of the telescope, as well as with the auxiliary equipment and accessories available for advanced applications.

The Models 2080 and 2120 are, with the exception of a few assembly operations and features, almost identical operationally. Most standard and optional accessories are interchangeable between the two telescopes. As such, the instructions in this manual generally apply to both telescopes; when exceptions to this rule occur, they are clearly pointed out.

THE BASIC MODEL 2080 TELESCOPE: STANDARD EQUIPMENT

This manual is used with other Schmidt-Cassegrain telescope models and the listed standard equipment may not be the same.

The Meade Model 2080 telescope is packed in a urethane foam-lined carrying case. If the telescope was shipped to you, this carrying case was in turn placed in a thick wall corrugated carton, lined on all 6 sides with styrofoam sheets.

(NOTE: We recommend that you keep all packing materials for either the Model 2080 or Model 2120. If it is ever necessary for you to return your telescope to the Meade factory for servicing, these materials will help to assure that no shipping damage will occur).

Packed in the carrying case is the complete basic Model 2080 consisting of the 8" Schmidt-Cassegrain optical tube assembly and fork mount. Accessories included as standard equipment are normally also packed within the carrying case.

The Model 2080 (or foreign Model 2080F) includes the following standard equipment:

- 8" Schmidt-Cassegrain optical tube and fork mount with motor drive
- 1 Eyepiece (1-1/4" O.D.): MA 25mm (80X)
- Eyepiece Holder (1-1/4")
- Diagonal Prism (1-1/4")
- 6x30mm Viewfinder with bracket
- Dust Covers
- 3-Knob screws for attaching Model 2080 Telescope to Equatorial Wedge
- Hex wrench set (3 pcs.)
- Carrying Case
- Power Cord

THE BASIC MODEL 2120 TELESCOPE: STANDARD EQUIPMENT

The Model 2120 is packed for shipment in 2 cartons: Carton No. 1 includes the complete 10" Optical Tube Assembly with fork arms attached; Carton No. 2 includes the motor drive base (and 4 bolts for attachment of the motor drive base to the fork arms), viewfinder, viewfinder bracket, accessories, power cord and hardware package, all packed within the carrying case.

The Model 2120 (or foreign Model 2120F) includes the following standard equipment:

- 10" Schmidt-Cassegrain optical tube and fork mount with motor drive
- 1 Eyepiece (1-1/4" O.D.): MA 25mm (100X)
- Eyepiece holder (1-1/4")
- Diagonal prism (1-1/4")
- 8x50mm viewfinder with bracket
- Dust Covers
- 3-Socket capscrews for attaching Model 2120 telescope to the equatorial wedge
- Hex wrench set (5 pcs.)
- Carrying Case
- Power Cord

(Note to foreign users) 8" and 10" Schmidt-Cassegrain models supplied to countries outside the U.S.A. are identical in all respects to the telescopes offered domestically, with the exception of the power cord and the electrical connector (located in the base of the telescope fork mount). The power cord plugs directly into the base of the telescope (see "Electric Motor Drive" pg. 23), but you may have to supply your own adapter in order to plug into your local electrical outlet. In this case, be sure that the adapter is of a "3-prong" type so that the telescope is properly grounded at all times during operation.

SETTING UP THE MODEL 2080

The basic Model 2080 telescope is shipped as a completely assembled instrument. For safety in shipment, the 6x30mm viewfinder is packed separately. (See "The Viewfinder," page 11). After removing the telescope from its shipping carton and carrying case, familiarize yourself with the various controls and accessories (see Fig. 1).

The eyepiece holder threads directly onto the rear-cell thread of the Models 2080 and 2120. The diagonal prism slides into the eyepiece holder and, in turn, accepts the supplied 1-1/4" O.D. eyepiece. For astronomical observations, the diagonal prism generally provides a more comfortable right-angle viewing position. Alternately, an eyepiece may be inserted directly into the eyepiece holder for straight-through observations. Note in this case, however, that the image will appear inverted and reversed left-for-right. With the diagonal prism, telescopic images appear correctly oriented up-and-down, but still reversed left-for-right. For terrestrial applications, where a fully corrected image orientation is desired, both up-and-down and left-for-right, the optional #924 Erecting Prism (1-1/4" O.D.) should be ordered separately. Eyepieces and the diagonal prism are held in their respective places on the telescope by a moderate tightening of the thumbscrews on the diagonal prism and eyepiece holder.

ASSEMBLY AND SET-UP OF THE MODEL 2120

The basic Model 2120 telescope is shipped with the optical tube assembly (with fork arms attached) in one carton, and with the motor drive base in a separate carton. The only assembly operations required are the following:

1. Attaching the fork arms to the motor drive base.
2. Attaching the viewfinder and viewfinder bracket to the optical tube.

<u>To remove the optical tube from the shipping carton</u>, (1) lift off the lid of the carton; (2) place the carton on end with the eyepiece end at the bottom; (3) remove packing material from the top of the carton; (4) pull the tube assembly toward you and out of the carton.

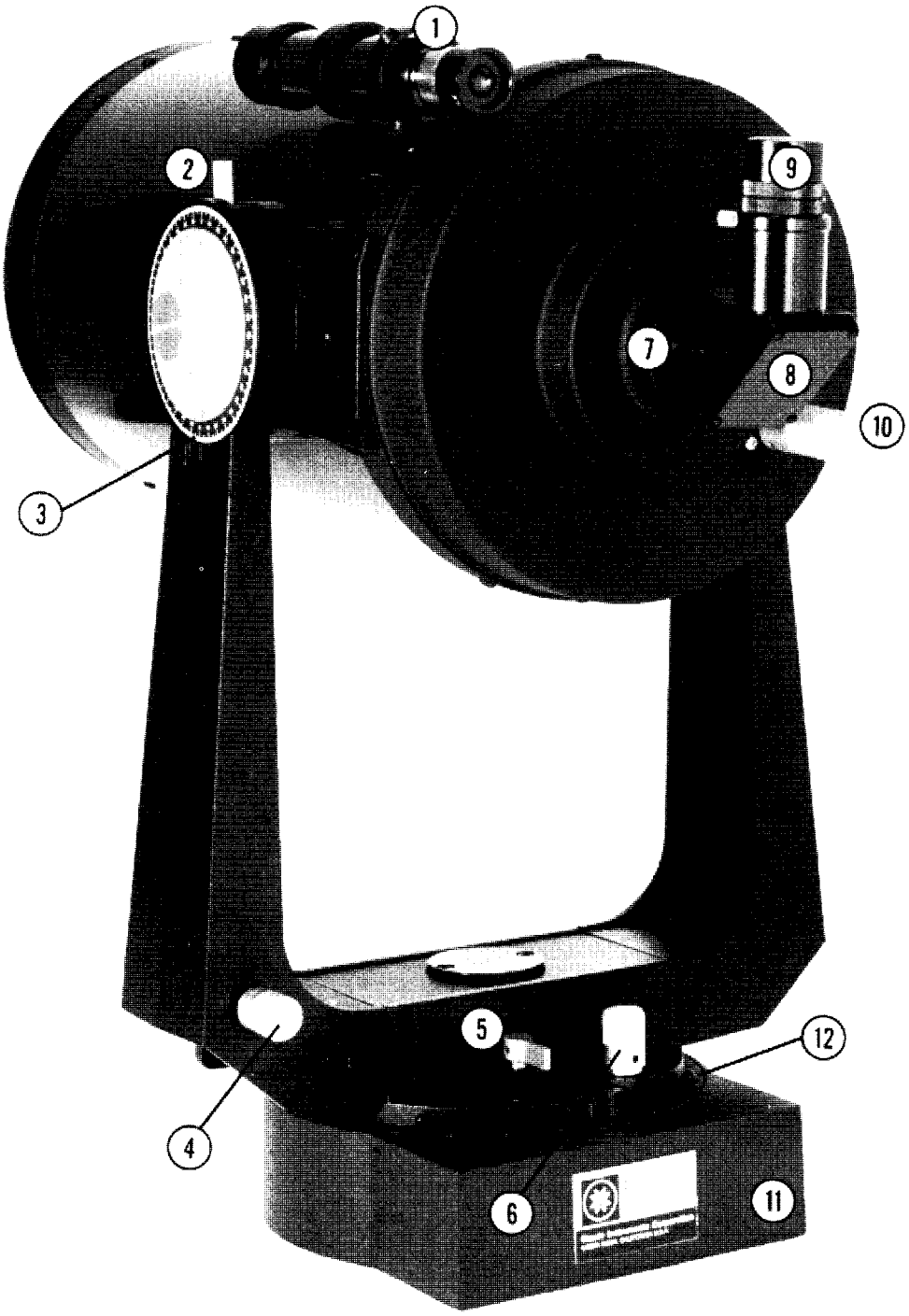


Fig. 1: Meade Models 2080 and 2120

(1) Viewfinder
(2) Declination Lock
(3) Declination Setting Circle
(4) Declination Slow-Motion Control
(5) R.A. Lock
(6) R.A. Slow-Motion Control
(7) Eyepiece Holder
(8) Diagonal Prism
(9) Eyepiece
(10) Focus Knob
(11) Drive Base
(12) R.A. Setting Circle

To attach the fork arms to the motor drive base: (1) place the optical tube flat on a carpeted floor; (2) remove the threaded metal rod that has been used to tie the fork arms together for safety in shipment (this rod may be set aside for re-use in case of future commercial shipment); (3) remove the 4 bolts (2 on each side) from the flat sides of the motor drive base (these bolts will be used to attach the fork arms to the drive base); (4) note that the flat surfaces at the bottoms of the fork arms are numbered. These numbers will aid you in joining the correct fork arm to the correct side of the drive base. Thus, join the No. 1 fork arm to the No. 1 side of the drive base, and the No. 2 fork arm to the No. 2 side of the drive base; (5) thread in by hand the 4 attaching bolts through the fork arms (2 through each fork arm) and into the drive base, to get the bolts well started. Then use the long arm of the hex wrench provided to screw in the bolts the rest of the way. For final tightening, use the short arm of the hex wrench. These bolts should be tightened to a good firm tightness. Once attached, the fork arms may be left permanently attached to the drive base and the complete optical tube/fork mount/drive base system may be stored as an assembled unit in the carrying case. (The only exception to this statement is in shipment of the telescope by commercial freight carrier, in which case the drive base should be removed and the telescope shipped exactly in the manner in which you received it).

To store your telescope in its carrying case, you may find the following procedure most convenient:

1. Stand the case on end with the lid open.
2. Place the telescope inside the case with the flat side of the drive base at the bottom.
3. If the 8x50 viewfinder (see "The Viewfinder: Model 2120", page 12) is mounted on the telescope, you will note that it will prohibit your closing the lid of the case. Therefore,
4. Push the fork arm on the side of the viewfinder towards the back (or bottom) of the case. You will note that the viewfinder is now far enough back so that the lid, when closed, will not touch the viewfinder.
5. Tuck in the 2 pieces of blue foam (provided with shipment) along the base of each fork arm so that the instrument will not move inside the case. You can now store the instrument or place it in your car for transport to an observing site.

CAUTION

DO NOT ATTEMPT TO TURN THE FOCUSER KNOB OF THE OPTICAL TUBE UNTIL YOU HAVE READ THIS NOTE!

Next to the base of the focuser knob you will see a red-colored slotted head bolt. This bolt is used only for safety in shipment. Remove this bolt before attempting to turn the focuser knob. In its place, insert the rubber plug provided as a dust protector (this rubber plug is included with your hardware package).

Your focuser is now operational.

Warning! The Model 2120 should never be commercially shipped without this red-colored head bolt secured in place. This is essential during commercial transport where rough handling may occur. For your personal transport and storage, you will never need to use this bolt again.

TO COMMERCIALLY RE-SHIP THE MODEL 2120, BE SURE TO FOLLOW THIS PROCEDURE:

1. Turn the focuser knob clockwise continuously until it stops. This will bring the primary mirror all the way back in the tube.
2. Remove the rubber plug and insert the red-headed bolt. Thread it in to a firm snug feel. Do not overtighten. (If you have misplaced the red-headed bolt, you may use any other bolt that is 1/4-20x1" long).

Please note that commercial shipment of the Model 2120 telescope without this safety bolt in place is done at owner's risk and your freight insurance may be voided if shipping damage results.

TELESCOPE OPERATION: YOUR FIRST OBSERVATIONS THROUGH THE MODEL 2080 OR 2120

With the telescope standing upright on its motor drive base, as shown in Fig. 1, and with the diagonal prism and MA 25mm eyepiece in place, you are ready to make observations through the telescope. Even without the viewfinder, terrestrial objects will be fairly easy to locate and center in the telescope's field of view with the MA 25mm eyepiece, simply by "gunsighting" along the side of the main telescope tube).

IMPORTANT NOTE: NEVER POINT THE TELESCOPE DIRECTLY AT THE SUN, OR ATTEMPT TO OBSERVE THE SUN, EITHER THROUGH THE MAIN TELESCOPE OR THE VIEWFINDER, WITHOUT PROPER PROFESSIONAL EQUIPMENT. INSTANT AND IRREVERSIBLE DAMAGE TO YOUR EYE MAY OTHERWISE RESULT!

By unlocking the R.A. lock (5) Fig. 1, the telescope may be turned rapidly through wide angles in Right Ascension (R.A.). The reason for the terminology "Right Ascension" and its complementary term, "Declination" will be made clear further on in this manual. For now, "Right Ascension" simply means "horizontal" and "Declination" means "vertical". Fine adjustments in R.A. are made by turning the R.A. control knob (6), Fig. 1, while the R.A. lock is in the "unlocked" position.

DO NOT ATTEMPT TO MOVE THE TELESCOPE MANUALLY IN A HORIZONTAL DIRECTION WHEN THE R.A. LOCK IS IN THE "LOCKED" POSITION.

The R.A. control knob may be turned, if desired, with the R.A. lock in a "partially locked" position. In this way, a comfortable "drag" in R.A. is created. But do not attempt to operate the R.A. control knob with the telescope fully locked in R.A., as such operation may result in damage to the internal gear system.

Releasing the Declination lock (2), Fig. 1, permits sweeping the telescope rapidly through wide angles in Declination.

DO NOT ATTEMPT TO MOVE THE TELESCOPE MANUALLY IN A VERTICAL DIRECTION WHEN THE DECLINATION LOCK IS IN THE "LOCKED" POSITION.

To use the Declination fine-adjust, or slow motion control, lock the telescope in Declination using the Declination lock (2), Fig. 1, and turn the Declination slow-motion knob (4).

NOTE THAT THIS DECLINATION SLOW-MOTION CONTROL HAS A FIXED TRAVEL LENGTH, LIMITED BY THE MOTION OF A TANGENT ARM (LOCATED INSIDE THE FORK TINE). DO NOT FORCE THE DECLINATION SLOW-MOTION KNOB WHEN THE TANGENT ARM HAS REACHED THE END OF ITS TRAVEL. IN THIS CASE, TURN THE DEC. KNOB TO RETURN THE TANGENT ARM TO THE MID-POINT IN ITS TRAVEL RANGE, UNLOCK THE DECLINATION LOCK AND RE-CENTER THE TELESCOPE TUBE MANUALLY.

With the above mechanical operations in mind, select an easy to find terrestrial object as your first telescope subject — for example, a house or building perhaps one-half mile distant.

Unlock the Dec. lock (2), Fig. 1, and R.A. lock (5), center the object in the telescopic field of view and then re-lock the Dec. and R.A. locks. Precise image centering is accomplished by using the Dec. and R.A. slow motion controls, (4) and (6).

FOCUSING

The focus knob (10), Fig. 1, is located at the "4 o'clock" position as you face the rear cell of the telescope. Focusing is accomplished internally by a precise motion of the telescope primary mirror so that, as you turn the focus knob, there are no externally moving parts.

Focusing the telescope from its nearest possible focus point (on an object about 25 ft. away with the Model 2080, or about 50 ft. with the Model 2120) to an object at infinity requires a fairly large number of rotations of the focus knob. The focuser is designed to provide an extremely sensitive means of bringing an object into precise, sharp focus. After a specific object has been brought into focus, closer objects require turning the focus knob clockwise; more distant objects require turning the focus knob counterclockwise.

It is possible that you may notice a slight shifting of the image as you focus, particularly at high powers. This image shift is caused by very small lateral motions of the primary mirror as it moves toward or away from the secondary mirror during the focusing procedure.

MAGNIFICATIONS

The magnification, or power, of the telescope depends on two optional characteristics: the focal length of the main telescope and the focal length of the eyepiece used during a particular observation. The focal length of the Model 2080 telescope is fixed at 2000mm; the focal length of the Model 2120 telescope is fixed at 2500mm. To calculate the power in use with a particular eyepiece, divide the focal length of the eyepiece into the focal length of the main telescope. For example, using the MA 25mm eyepiece supplied with the Model 2080, the power is calculated as follows:

$$\text{Power} = \frac{2000\text{mm}}{25\text{mm}} = 80\text{X}$$

The type of eyepiece (whether "MA" Modified Achromatic, "OR" Orthoscopic, "ER" Erfle, etc.) has no bearing on magnifying power but does affect such optical characteristics as field of view, flatness of field and color correction.

The maximum practical magnification is determined by the nature of the object being observed and, most importantly, by the prevailing atmospheric conditions. Under very steady atmospheric "seeing," the Model 2080 may be used at powers up to about 500X on astronomical objects, the Model 2120 up to about 600X. Generally, however, lower powers of perhaps 250X to 350X will be the maximum permissible, consistent with high image resolution. When unsteady air conditions prevail (as witnessed by rapid "twinkling" of the stars), extremely high-power eyepieces result in "empty magnification," where the object detail observed is actually diminished by the excessive power.

See page 30 for additional information on eyepieces.

When beginning obsevations on a particular object, start with a low power eyepiece; get the object well-centered in the field of view and sharply focused. Then try the next step up in magnification. If the image starts to become fuzzy as you work into higher magnifications, then back down to a lower power — the atmospheric steadiness is not sufficient to support high powers at the time you are observing. Keep in mind that a bright, clearly resolved but smaller image will show far more detail than a dimmer, poorly resolved larger image.

Because of certain characteristics of the human eye (in particular, eye pupil diameter) and because of optical considerations inherent in the design of a telescope, there exists minimum practical power levels also. Generally speaking, the lowest usable power is approximately 4X per inch of telescope aperture, or about 32X in the case of the 8" aperture Model 2080, about 40X in the case of the 10" Model 2120. During the daytime, when human eye pupil diameter is reduced, the minimum practical power with the Model 2080 is increased to about 60X and to about 75X with the Model 2120; powers lower than this level should be avoided during daytime observations. A reasonable magnification range for daytime terrestrial observations through the Model 2080 is from about 80X to 190X; through the Model 2120 from about 100X to 200X.

Accessories are available both to increase and decrease the operating eyepiece power of the telescope. See your Meade dealer for information on accessories.

THE VIEWFINDER: MODEL 2080

The standard 6X30mm viewfinder is shipped in its mounting bracket with each Model 2080 telescope. Mounting screws for the viewfinder bracket have been threaded into the top of the main telescope's rear cell, at the hole positions where the viewfinder bracket will be seated. See Fig. 2A.

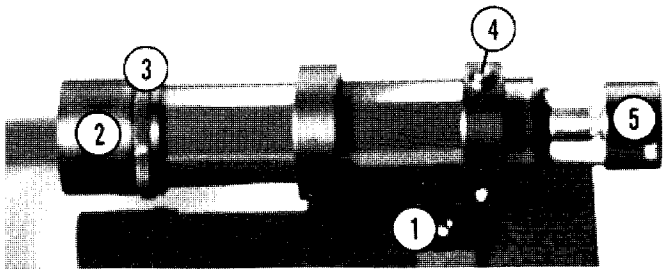


Fig. 2A: 6X30mm Viewfinder for Model 2080
(1) Mounting Screw
(2) Objective Lens Cell
(3) Knurled Collar
(4) Collimation Screw
(5) Eyepiece

To attach the viewfinder, remove the 2 viewfinder mounting screws from the rear cell, using one of the hex wrenches provided with the telescope; place the viewfinder with bracket over these mounting holes and then replace the 2 mounting screws to securely attach the viewfinder bracket to the rear cell. Tightening these mounting screws to a "firm feel" is sufficient; avoid over-tightening, which might cause the rear cell threads to strip.

WARNING: Never use set screws on any part of the optical tube assembly, except those factory-supplied set screws included with the basic telescope or with optional accessories. Longer non-standard set screws may protrude too far into the optical tube and cause serious damage to the primary mirror.

The 6x30mm viewfinder has been factory pre-focused at infinity. Should this focusing need adjustment for your eyes, loosen the knurled collar at the objective lens-end of the viewfinder (see (3), Fig. 2A), enabling rotation of the objective lens cell forward or backward for precise focusing. Then tighten down the knurled collar against the objective lens cell to lock the focus in place. Note that no focusing is possible or necessary at the eyepiece end of the viewfinder.

The optional 6x30mm right-angle viewfinder fits into the same mounting bracket as the standard 6x30mm viewfinder. To insert the 6x30mm right-angle finder into the bracket, first unthread the objective lens cell and knurled ring from the finder, insert the finder tube into the bracket and reattach the knurled ring and objective lens cell. Focusing may be fixed following the same procedure outlined in the preceding paragraph.

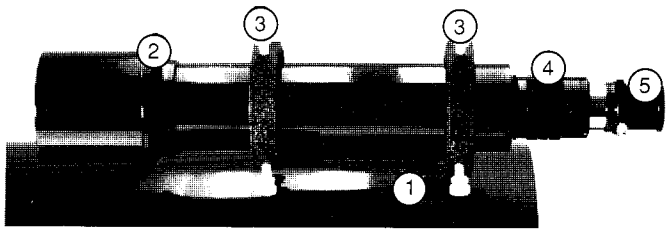
The viewfinder will require alignment, or collimation, to the main telescope. Using the 25mm eyepiece, point the main telescope at some easy to find land object (e.g. the top of a telephone pole or corner of a building) at least 200 yards distant. Center a well-defined object in the main telescope. Then, using one of the hex wrenches provided, tighten or loosen, as appropriate, the viewfinder's 3 collimation screws (see (4), Fig. 2A) until the crosshairs of the viewfinder are precisely centered on the object already centered in the main telescope. With this collimation accomplished, objects located first in the wide-field viewfinder will then be centered in the main telescope's field of view.

Once attached, the viewfinder may be left permanently mounted onto the telescope's rear cell. The viewfinder need not be removed when storing the telescope in its carrying case.

THE VIEWFINDER: MODEL 2120

Each Model 2120 is supplied as standard equipment with an 8x50mm straight-through viewfinder. The bracket for this viewfinder is packed separately from the finder itself, and 6 nylon thumbscrews for collimation are pre-threaded into the viewfinder bracket. Mounting screws for attachment of the finder bracket to the main telescope have been threaded into the top of the main telescope's rear cell, at the hole positions where the viewfinder bracket will be seated. See Fig. 2B.

Fig. 2B: 8X50mm Viewfinder for Model 2120.
(1) Mounting Screw
(2) Objective Lens Cell
(3) Collimation Screws
(4) Focuser
(5) Eyepiece



To attach the viewfinder, remove the 2 viewfinder mounting screws from the rear cell using one of the hex wrenches provided with the telescope; place the viewfinder with bracket over these mounting holes and then replace the 2 mounting screws to securely attach the viewfinder bracket to the rear cell. Tightening these mounting screws to a "firm feel" is sufficient; avoid over-tightening, which might cause the rear cell threads to strip.

WARNING: Never use set screws on any part of the optical tube assembly, except those factory supplied set screws included with the basie telescope or with optional accessories. Longer, non-standard set screws may protrude too far into the optical tube and cause serious damage to the primary mirror.

Focusing the finder is accomplished with the helicoid mechanism located near the finder's eyepiece. Note: if the eyepiece is ever removed from the finder, be careful not to touch in any way the crosshairs of the eyepiece, which are exposed at the barrel end of the eyepiece!

Collimation, or alignment, of the Model 2120's viewfinder is accomplished in the same way as described above for the Model 2080, except that no hex wrench is required: simply turn the 6 nylon thumbscrews to achieve correct alignment.

Once attached, the viewfinder may be left permanently mounted onto the telescope's rear cell; the viewfinder need not be removed when storing the telescope in its carrying case, if the procedure described previously is employed (see "Assembly and Set-up of the Model 2120", page 6).

THE FIELD TRIPOD

The Field Tripods for the Meade Models 2080 and 2120 telescopes are supplied as completely assembled units, except for the spreader bar (#4, Fig. 3) and the 6 lock knobs (2 knobs for each of the 3 tripod legs) used to adjust the height of the tripod. These knobs are packed separately for safety in shipment.

Note that, except for 6 additional threaded holes located on the top surface of the Model 2120's field tripod, the field tripods for Models 2080 and 2120 are identical. These threaded holes serve as additional mounting points when the Equatorial Wedge of the Model 2120 is attached to the field tripod. This function will be made clear below.

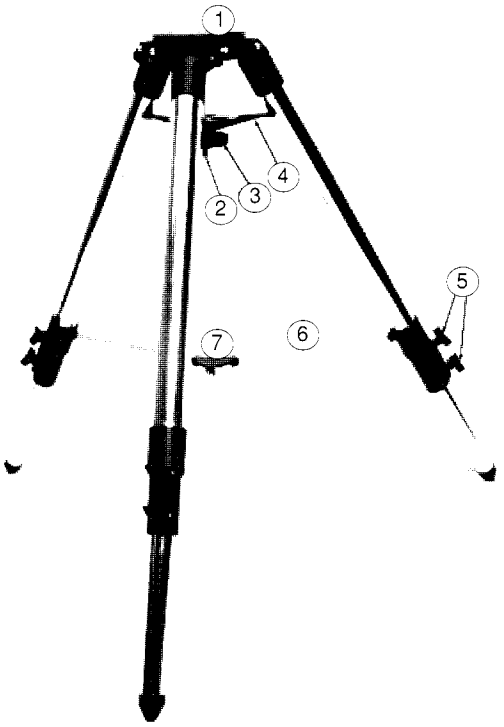


Fig. 3: Field Tripod

(1) Head
(2) Threaded Rod
(3) Tension Knob
(4) Spreader Bar
(5) Lock Knobs
(6) Extension Strut
(7) Hub

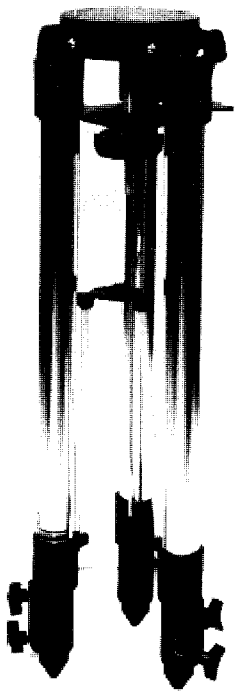


Fig. 4: Field Tripod (collapsed)

For terrestrial observations, the base of the Model 2080's fork mount may be attached to the field tripod, using the optional Altazimuth Adapter. (Because of the additional weight of the Model 2120, we do not normally recommend use of the Model 2120 with the Altazimuth Adapter). The Model 2080 telescope in this way is mounted in an "altazimuth" ("altitude-azimuth," or "vertical-horizontal") format, ideal for non-astronomical applications. The telescope in this set-up moves along vertical and horizontal axes, corresponding respectively to the Declination and Right Ascension axes in an astronomical observing mode. The telescope may, of course, be used for astronomical observations when set-up in the altazimuth mode, but the electric motor drive will in this case be non-functional from a practical point of view.

Alternately, the field tripod of the Model 2080 or 2120 is normally used in conjunction with the appropriate equatorial wedge (see next section) for serious astronomical applications. The equatorial wedge permits alignment of the telescope's Polar Axis with the Celestial Pole, so that the electric motor drive becomes operational.

After removing the field tripod from its shipping carton, stand the tripod vertically, with the tripod feet down and with the tripod still fully collapsed (see Fig. 4). Grasp two of the tripod legs and, with the full weight of the tripod on the third leg, gently pull the legs apart to a fully open position.

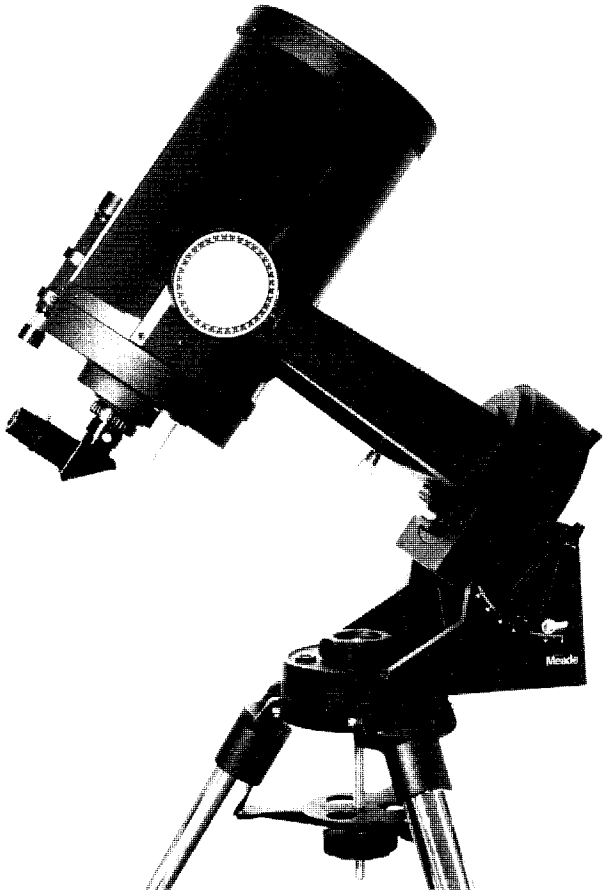


Fig. 5: The Model 2080 Mounted on Equatorial Wedge and Field Tripod

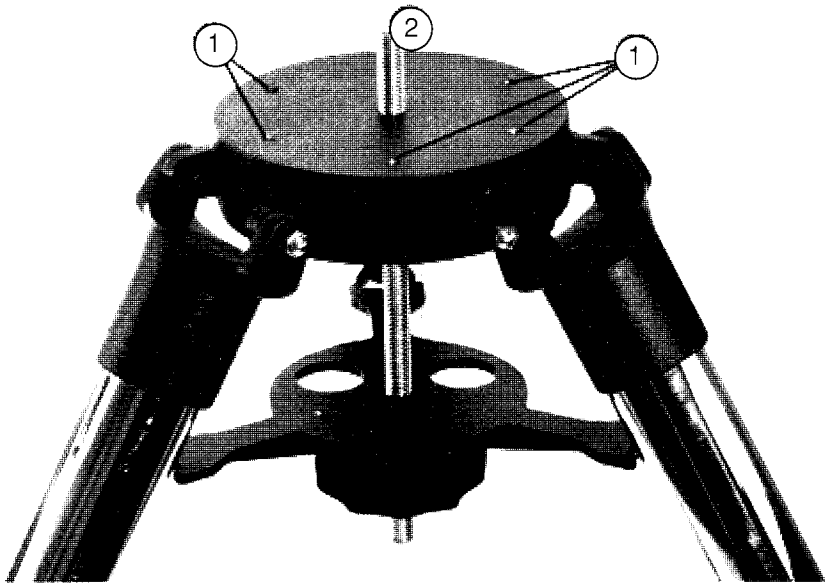


Fig. 6: Field Tripod Head
(1) Threaded Holes (Model 2120 Tripods Only)
(2) Threaded Rod

Thread in the 6 lock-knobs (2 on each tripod leg) near the foot of each tripod leg. Refer to Fig. 3. These lock-knobs are used to fix the height of the inner, extendable tripod leg sections. Note: "Firm feel" tightening is sufficient; over-tightening may result in stripping of the knob threads.

Unthread the tension knob (see (3), Fig. 3) from the threaded rod. Then, turn the threaded rod (2) so that about 1-1/2" of its length protrudes up through the head (1) of the field tripod.

Underneath the head (1) of the field tripod is a hex lock-nut which should be tightened to fix the position of the threaded rod.

Slide the spreader bar onto the threaded rod. The spreader bar should be positioned so that the 3 arms of the spreader bar are lined up with the 3 tripod legs.

Replace and tighten the tension knob (3). Firm tightening of the tension knob is sufficient to result in rigid positioning of the tripod legs. It is not necessary to use extreme force in tightening this knob.

The field tripod is now ready to accept the equatorial wedge.

To vary the tripod height, loosen the 6 lock-knobs and slide the 3 inner tripod leg sections out to the desired height.

To collapse the tripod for storage follow these steps:

1. Loosen the tension knob (see (3), Fig. 3) sufficiently to allow the spreader bar (4) to rotate 60° from its assembled position, so that one spreader bar arm is located between each adjacent pair of tripod legs.
2. Leave the tension knob near the bottom end of the threaded rod (2) with the spreader bar resting on the tension knob,
3. At the base of the tripod is a 3-vane extension strut system, with a circular hub at its center. To collapse the tripod, grasp the tripod head (1) with one hand and, with the other hand, pull directly "up" on the central hub of the extension strut system. This operation will cause the tripod legs to move inward to a collapsed position.

PRECAUTIONARY NOTES

1. If the tripod does not seem to extend or collapse easily, do not force the tripod legs in or out. By following the instructions above, the tripod will function properly, but if you are unclear on the proper procedure, forcing the tripod into an incorrect position may damage the extension strut system.

2. Do not overtighten the 6 lock-knobs used to fix the inner tripod leg sections at various heights. "Firm feel" tightening is sufficient.

THE EQUATORIAL WEDGE

The Equatorial Wedge permits use of the Model 2080 or 2120 telescope in an astronomical, or "equatorial", mode. The wedge fits onto the field tripod, described above, and accepts the base of the Model 2080 and 2120 fork mount. See Fig. 5.

NOTE: The Meade equatorial wedge is designed solely for use in conjunction with the Meade field tripod. The wedge should never be used without the field tripod, e.g. by placing the wedge alone on a table top and then mounting the telescope on the wedge. The Model 2080 or 2120 telescope, placed onto the equatorial wedge alone without the field tripod attached to the wedge may become seriously imbalanced, to the point where the telescope may actually tip over.

Except for the tilt plate (1), Fig. 8, appropriate to each model, the equatorial wedges for the Models 2080 and 2120 are otherwise identical.

The equatorial wedges appropriate to either the Model 2080 or 2120 are of modern design, with several important features incorporated to simplify and facilitate telescope operation. After using the wedge for your telescope, you will find that the functional design features included are of very significant value in routine telescope operations. Some of these features include:

1. Attachment of the wedge to the field tripod by means of only one manual knob. (For photographic applications with the Model 2120 where extreme steadiness is required, 3 additional hex-head screws are provided).

2. Quick azimuth adjustment by loosening the manual knob described above.

3. Bubble level for rapid tripod/wedge leveling.

4. Etched latitude scale for fast adjustment of the latitude angle.

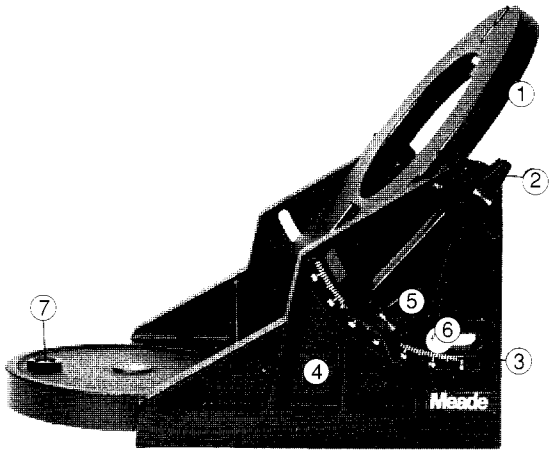


Fig. 7A: Equatorial Wedge for 2080
(1) Tilt-Plate
(2) Attachment Knob
(3) LatitudeScale
(4) Wedge Body
(5) Tilt Angle Adjustment Knob
(6) Fine Latitude Adjustment Mechanism
(7) Bubble Level

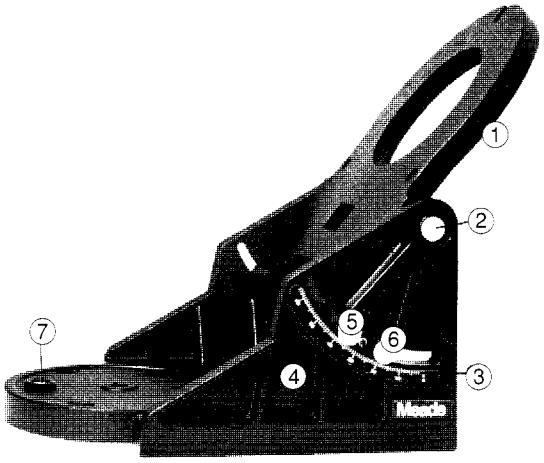


Fig. 7B: Equatorial Wedge for 2120
(1) Tilt-Plate
(2) Attachment Screw
(3) Latitude Scale
(4) Wedge Body
(5) Tilt Angle Adjustment Screw
(6) Fine Latitude Adjustment Mechanism
(7) Bubble Level

To assemble the equatorial wedge, follow this procedure (note that all required wedge hardware and manual knobs are shipped within the wedge carton):

1. The wedge consists of two basic parts: the wedge body and the tilt-plate, as shown in Figs. 7A and 7B. Attached the tilt-plate to the wedge body by means of the hex-screws (Model 2120) or knobs (Model 2080) provided. Two screws (or knobs), with washers, should be used on each side of the wedge body so that a total of 4 screws (or knobs) attach the tilt plate to the wedge body.

2. Place the wedge onto the field tripod with the central threaded rod of the tripod fitting through the center hole in the floor of the wedge. Thread the 2-1/2" diameter manual knob onto the threaded rod of the tripod and firmly tighten the manual knob.

3. Model 2120 owners: When engaging the long-exposure astrophotography with your telescope, it is advisable to thread in the 3 additional socket screws through the wedge floor and into the top of the field tripod. These screws fit through the oval-shaped slots in the wedge floor; the wedge must first be turned horizontally on the field tripod so that the oval slots lie over any 3 of the 6 threaded holes on the top surface of the tripod head. Tighten the 3 socket screws with the hex wrench provided. Note, however, that for normal visual observations through the Model 2120, use of these socket screws is not required; the manual knob (Step (2) above) is generally sufficient for rigid attachment of the wedge to the tripod.

The 3 additional socket screws are not provided with the Model 2080, nor does the Model 2080's wedge have provision for the attachment of these screws, since firm tightening of the manual knob is more than sufficient, even in the most demanding applications.

A fine latitude adjustment mechanism (necessary only for precision astrophotographic polar alignment) is included in one slot on the side of the wedge for the Mode 2080; two of these mechanisms (one at each side of the wedge) are provided with the wedge for the Model 2120. Loosen the hex-screw at the side of the wedge and slide each mechanism so that the 1-inch long screw (located just inside the vertical wedge wall) presses up against the bottom surface of the tilt-plate.

To make fine latitude adjustments, follow this procedure: (1) loosen slightly the screws or knobs (5), on each side of the wedge, as shown in Fig. 7A or 7B; (2) turn the screw pressing against the bottom of the tilt-plate so that the tilt-plate moves in latitude angle; (3) re-tighten the screws or knobs.

Use of the fine latitude mechanisms on the wedge for the Model 2120 requires that both mechanisms be adjusted as just described.

MOUNTING THE TELESCOPE ON THE WEDGE

With the Model 2080, three knobs are supplied with the telescope for mounting the telescope's drive base to the tilt-plate of the wedge. (With the Model 2120, three socket screws are provided for this purpose).

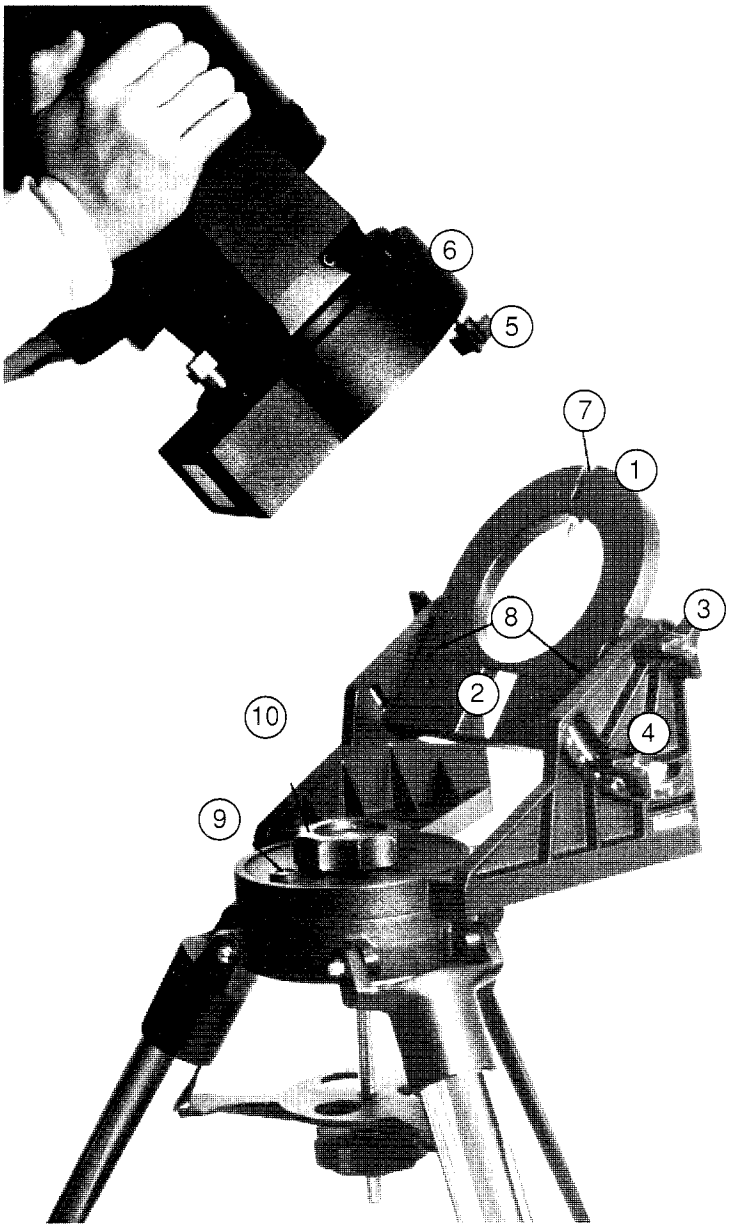


Fig. 8: Placing the Telescope on the Wedge.
(1) Tilt-Plate
(2) Aperture for Power Cord
(3) Wedge Body-to-Tilt Plate Plate Attachment Knob
(4) Tilt Angle Adjustment Knob
(5) Knob for attaching telescope to Tilt-Plate
(6) Drive Base
(7) Slot for Knob (5)
(8) Holes for additional attachment knobs
(9) Bubble level
(10) Manual Knob for attaching Wedge to Field Tripod

Thread one of these knobs (or screws, as appropriate) partially into the hole on the underside of the drive base, located at the curved-end of the drive base. See Fig. 8. This knob or screw should be threaded in about 3 full turns, not fully threaded into the hole.

Check that the knobs or screws (5) at the side of the wedge, Fig. 7A or 7B, are firmly tightened before placing the telescope onto the wedge.

Grasping the 2 fork arms of the telescope firmly, place the telescope onto the tilt plate of the wedge by sliding the knob (Model 2080) or screw (Model 2120) into the slot at the top of the curved-end of the wedge tilt-plate.

Insert the 2 remaining knobs for Model 2080, or socket screws for Model 2120, through the underside of the tilt plate and into the underside of the drive base. Tighten down all 3 knobs or screws to a firm feel. Extreme force is <u>not</u> necessary in this regard.

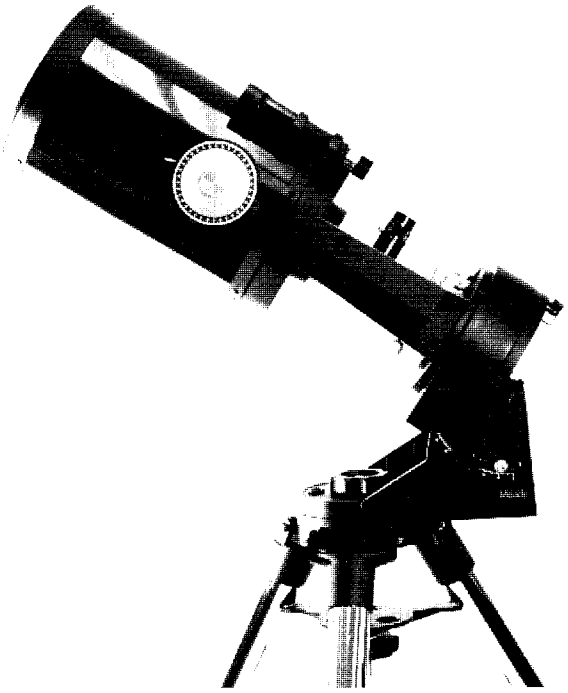


Fig. 9: Lining Up With the Celestial Pole

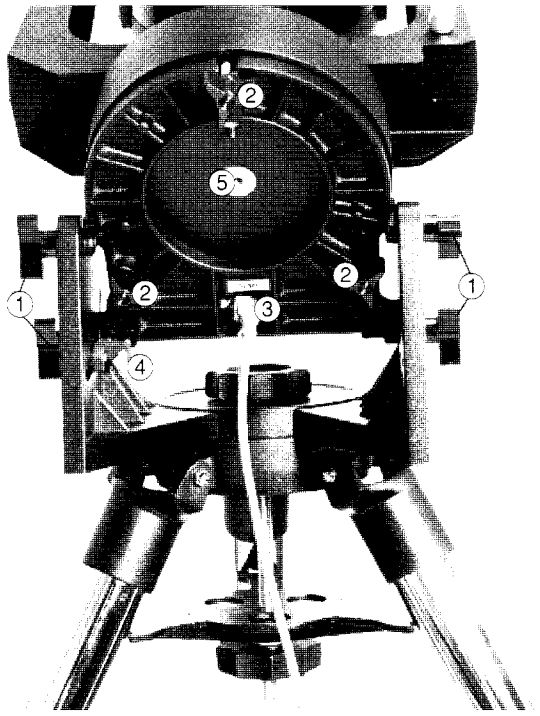


Fig. 10: Rear View of the Complete Telescope/ Wedge/Field Tripod.
(1) Tilt-Plate Attachment Knobs
(2) Telescope-to-Tilt Plate Attachment Knobs
(3) Power Cord Connector Plug
(4) Latitude Fine-Adjustment Mechanism
(5) 1/4-20 Photo-Tripod Attachment Hole

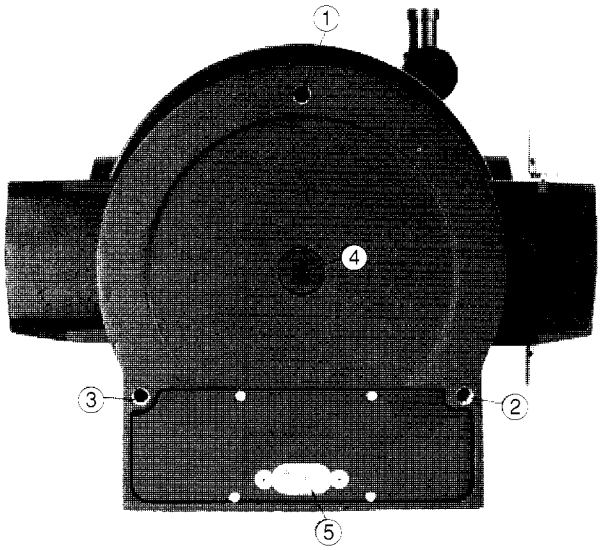


Fig. 11: Underside of the Drive Base
(1), (2) and (3) Wedge Attachment Holes
(4) 1/4-20 Photo-Tripod Attachment Hole
(5) Power Cord Socket

The telescope is now fully mounted onto the wedge and field tripod. Adjustments in wedge latitude angle and/or azimuth orientation may be made with the telescope in place. Further details on telescope polar alignment are given below under "Lining Up with the Celestial Pole."

CAUTION: When changing the latitude angle of the wedge/telescope system, be sure to grasp the telescope firmly before loosening the knobs or screws (4), Fig. 8. When these knobs or screws are loosened, the telescope and fork mount will fall rapidly if not held by hand.

CELESTIAL COORDINATES: DECLINATION AND RIGHT ASCENSION

Analogous to the Earth-based coordinate system of latitude and longitude, celestial objects are mapped according to a coordinate system on the "celestial sphere," the imaginery sphere on which all stars appear to be placed. The Poles of the celestial coordinate system are defined as those 2 points where the Earth's rotational axis, if extended to infinity, North and South, intersect the celestial sphere. Thus, the North Celestial Pole is that point in the sky where an extension of the Earth's axis through the North Pole intersects the celestial sphere. In fact, this point in the sky is located near the North Star, or Polaris.

On the surface of the Earth, "lines of longitude" are drawn between the North and South Poles. Similarly, "lines of latitude" are drawn in an East-West direction, parallel to the Earth's equator. The celestial equator is simply a projection of the Earth's equator onto the celestial sphere. Just as on the surface of the Earth, imaginary lines have been drawn on the celestial sphere to form a coordinate grid. Celestial object positions on the Earth's surface are specified by their latitude and longitude.

The celestial equivalent to Earth latitude is called "Declination," or simply "Dec," and is measured in degrees, minutes or seconds north ("+") or south ("-") of the celestial equator. Thus any point on the celestial equator (which passes, for example, through the constellations Orion, Rigo and Aquarius) is specified as having 0°0'0" Declination. The Declination of the star Polaris, located very near the North Celestial Pole, is +89.2°.

The celestial equivalent to Earth longitude is called "Right Ascension," or "R.A." and is measured in hours, minutes and seconds from an arbitrarily defined "zero" line of R.A. passing through the constellation Pegasus. Right Ascension coordinates range from $0^{hr}0^{min}0^{sec}$ up to (but not including) $24^{hr}0^{min}0^{sec}$. Thus there are 24 primary lines of R.A., located at 15 degree intervals along the celestial equator. Objects located further and further east of the prime ($0^h0^m0^s$) Right Ascension grid line carry increasing R.A. coordinates.

With all celestial objects therefore capable of being specified in position by their celestial coordinates of Right Ascension and Declination, the task of finding objects (in particular, faint objects) in the telescope is vastly simplified. The setting circles of the Models 2080 and 2120 may be dialed, in effect, to read the object coordinates and the object found without resorting to visual location techniques. However, these setting circles may be used to advantage only if the telescope is first properly aligned with the North Celestial Pole.

LINING UP WITH THE CELESTIAL POLE

Objects in the sky appear to revolve around the celestial pole. (Actually, celestial objects are essentially "fixed," and their apparent motion is caused by the Earth's axial rotation). During any 24 hour period, stars make one complete revolution about the pole, describing concentric circles with the pole at the center. By lining up the telescope's polar axis with the North Celestial Pole (or for observers located in Earth's Southern Hemisphere with the South Celestial Pole) astronomical objects may be followed, or tracked, simply by moving the telescope about one axis, the polar axis. In the case of the Meade Models 2080 and 2120, this tracking may be accomplished automatically with the electric motor drive.

If the telescope is reasonably well aligned with the pole, therefore, very little use of the telescope's Declination slow motion control is necessary — virtually all of the required telescope tracking will be in Right Ascension. (If the telescope were perfectly aligned with the pole, no Declination tracking of stellar objects would be required). For the purposes of casual visual telescopic observations, lining up the telescope's polar axis to within a degree or two of the pole is more than sufficient: with this level of pointing accuracy, the telescope's motor drive will track accurately and keep objects in the telescopic field of view for perhaps 20 to 30 minutes.

To line up the Model 2080 or 2120 with the Pole, follow this procedure:

Model 2080:

1. Using the bubble level located on the floor of the wedge, adjust the tripod legs so that the telescope/wedge/tripod system reads "level."
2. After grasping the telescope firmly, loosen the tilt plate knobs (5), Fig. 7A, so that the telescope may be moved in latitude angle. Set the tilt-plate angle so that the latitude scale (3), correctly reads your latitude (use the center of the knob as the pointer). Firmly re-tighten the knobs (5). (The fine latitude adjustment (6) may be moved along the wedge slot and out of the way for now).
3. Loosen the Dec. lock (2), Fig. 1, and rotate the telescope tube in Declination so that the telescope's optical axis is lined up with its polar axis; i.e. parallel to the fork arms. See Fig. 9. Careful eye-alignment of these 2 axes is sufficient. Tighten the Dec. lock.
4. Loosen the manual knob (10), Fig. 8 a half-turn and rotate the telescope/wedge combination horizontally until the telescope itself, oriented as in Step (3), is pointing due North. Gun-sighting along the telescope tube on Polaris, the North Star, will be helpful in this regard. Then re-tighten the manual knob (10). The telescope is now approximately aligned with the Pole and for casual observations, this alignment procedure is adequate.
5. For more precise polar alignment during extended use of the telescope at one observing session, now insert the 25mm eyepiece into the telescope and keep the optical tube oriented as shown in Fig. 9. By a combination of the 2 wedge motions described above (Step 2), latitude angle and Step (4) azimuth, or horizontal motion), center Polaris in the field of the telescope. Use of the latitude fine adjustment (see "The Equatorial Wedge," above) may be helpful in this operation. Be sure to retighten the knobs (5), Fig. 7A, and the manual knob (1), Fig. 8, upon conclusion of the alignment.

Model 2120: The polar alignment procedure for the Model 2120 is identical to that of the Model 2080. If the 3 socket screws are used to provide extra rigidity in attaching the wedge to the tripod (see "The Equatorial Wedge"), it will be necessary to loosen the screws as well as the manual knob (10), Fig. 8, to rotate the telescope/wedge combination horizontally, i.e. in azimuth. With these socket screws and the manual knob slightly loosened, azimuth adjustment ± about 5° is possible. Therefore, the North-pointing procedure (Step (4) above) must first be roughly accomplished by turning the entire telescope/wedge/tripod combination. The final North-pointing operation may then be performed by rotating the telescope/wedge combination only, on the tripod.

As an aside procedure, during your first use of the telescope, you should check the calibration of the Declination setting circles (see (3), Fig. 1), located at the top of each fork arm. After performing the polar alignment procedure, center the star Polaris in the telescope field. Loosen slightly the knurled central hub of each Declination setting circle. Now turn each circle until it reads 89.2°, the Declination of Polaris, and then tighten down the knurled knobs, avoiding any motion of the circles.

Once the latitude angle of the wedge has been fixed and locked-in, according to the above procedure, it is not necessary to repeat this operation each time the telescope is used, unless you move a considerable distance North or South from your original observing position. (Approximately 70 miles movement in North-South observing position is equivalent to 1° in latitude change). The wedge may be detached from the field tripod and, so long as the latitude angle setting is not altered, it will retain the correct latitude setting when replaced on the tripod.

It should be emphasized that precise alignment of the telescope's polar axis to the celestial pole for casual visual observations is not necessary. Don't allow a time-consuming effort at lining up with the pole to interfere with your basic enjoyment of the telescope. For long-exposure photography, however, the ground rules are quite different, and precise polar alignment is not only advisable, but almost essential.

PRECISE POLAR ALIGNMENT

Unless you intend to engage in long-exposure astrophotography, it is not necessary to follow the precise polar alignment procedure described in this section.

Notwithstanding the precision and sophistication of the drive system supplied with the Meade Models 2080 and 2120, the fewer tracking corrections required during the course of a long-exposure photograph, the better. (For our purposes, "long-exposure" means any photograph of about 10 minutes duration or longer). In particular, the number of Declination corrections required is a direct function of the precision of polar alignment.

The procedure described here should be implemented only after the alignment procedures of the preceding section have first been carried out.

Precise polar alignment requires the use of a crosshair eyepiece. The Meade MA 12mm Illuminated Reticle Eyepiece is well-suited in this application, but you will want to increase the effective magnification through the use of a 2X or 3X Barlow lens. Then follow this procedure:

1. Place the illuminated reticle eyepiece (or eyepiece/Barlow combination) into the eyepiece holder of the telescope.

2. Point the telescope with the motor drive running, at a moderately bright star near where the meridian (the North-South line passing through your local zenith) and the celestial equator intersect. For best results, the star should be located within ± 30 minutes in R.A. of the meridian and within ± 5° of the celestial equator.

3. Note the extent of the star's drift in Declination (disregard drift in Right Ascention):
   a. If the star drifts South, the telescope's polar axis is pointing too far East.
   b. If the star drifts North, the telescope's polar axis is pointing too far West.

4. Move the wedge in azimuth (horizontally) to effect the appropriate change in polar alignment. Reposition the telescope's East-West polar axis orientation until there is no further North-South drift by the star. Track the star for a period of time to be certain that its Declination drift has ceased.

5. Next, point the telescope at another moderately bright star near the Eastern horizon, but still near the celestial equator. For best results, the star should be about 20° or 30° above the Eastern horizon and within ± 5° of the celestial equator.

6. Again note the extent of the star's drift in Declination:
   a. If the star drifts South, the telescope's polar axis is pointing too low.
   b. If the star drifts North, the telescope's polar axis is pointing too high.

7. Use the latitude angle fine-adjust control on the wedge to effect the appropriate change in latitude angle, based on your observations above. Again, track the star for a period of time to be certain that Declination drift has ceased.

The above procedure results in very accurate polar alignment, and minimizes the need for tracking corrections during astrophotography.

POLAR ALIGNMENT AT LOW LATITUDES

The Meade equatorial wedge permits polar alignment in a latitude range of 11° to 64°. However, the wedge and field tripod may still be employed at latitudes within ± 10° of the Earth's equator. In this latitude range, the latitude fine-adjust mechanism(s) of the wedge should be removed. By so doing, latitude angle setting to 0° may be achieved.

ELECTRIC MOTOR DRIVE

Supplied as standard equipment with the Models 2080 and 2120 is an extremely accurate worm gear drive system, operating from a 115 volt/60Hz synchronous electric motor. (Foreign models may include a 220v-240v/50Hz motor; drives for Southern Hemisphere operation are reversed in direction from their Northern Hemisphere counterparts). The power cord for the Models 2080 and 2120 plugs into the bottom of the telescope's drive base, through apertures in the wedge mounting plate (or the table tripod for the Model 2080). See Figs. 10 and 11.

CAUTION: If an extension cord is required for your operation of the telescope, be sure it is of the 3-prong type. Do not defeat the safety purpose of the supplied 3-prong cord by using a 2-prong extension cord or 2-prong adapter plug.

With the telescope set up in the equatorial mode (accomplished with the wedge/field tripod combination), plug the power cord into a power outlet. Immediately, if you put your ear to the drive base of the telescope, you will be able to hear the low level noise created by the running motor. The drive system turns the fork mount of the telescope through one complete revolution every 24 hours, and results in the stars "standing still" as you view them through the telescope eyepiece. The motor drive also drives the R.A. setting circle, as described in the next section.

The motion of the telescope caused by the drive system is not obvious if you look at the telescope (in fact, it is not even perceptible), but while observing through the telescope, it is a very significant motion indeed. To check this point, with a star centered in the telescope field and the electric motor drive running, unplug the power cord: the star will immediately begin to drift out of the field of view; at higher powers, the effect is even more pronounced.

To actuate operation of the electric motor drive, the R.A. lock (see (5), Fig. 1) must be in the "locked" position. As you move from object to object, unlocking and re-locking the R.A. lock each time, the motor drive automatically re-actuates each time the R.A. lock is locked.

NOTE: DO NOT ATTEMPT TO TURN THE R.A. SLOW-MOTION CONTROL KNOB WHEN THE R.A. LOCK IS IN THE "LOCKED" POSITION. SUCH AN OPERATION WILL CAUSE INTERNAL DAMAGE TO THE GEARS OF THE R.A. SLOW-MOTION CONTROL. IN ADDITION, DO NOT ATTEMPT TO TURN THE TELESCOPE MANUALLY ON ITS FORK MOUNT IN R.A. WHEN THE R.A. LOCK IS "LOCKED," AS SUCH OPERATION WILL CAUSE RAPID WEAR OF THE INTERNAL CLUTCH SYSTEM.

SETTING CIRCLES

Setting circles included with the Models 2080 and 2120 permit the location of faint celestial objects not easily found by direct visual observation. Located on the top surface of the telescope's drive base, the R.A. circle (12), Fig. 1, is 8" in diameter. Identical Declination circles (3), Fig. 1, are located at the top of each fork tine. With the telescope pointed at the North Celestial Pole, the Dec. circle should read 90° (understood to mean +90°). Objects located below the 0-0 line of the Dec. circle carry minus Declination coordinates. Each division of the Dec. represents a 1° increment. The R.A. circle runs from 0^{hr} to (but not including) 24^{hr}, and reads in increments of 5^{min}.

Note that the R.A. circle is double-indexed; i.e., there are 2 series of numbers running in opposite directions around the circumference of the R.A. circle. The outer series of numbers (increasing counterclockwise) applies to observers located in the Earth's Northern Hemisphere; the inner series of numbers (increasing clockwise) applies to observers located in the Earth's Southern Hemisphere.

With the telescope aligned to the pole, center an object of known R.A. in the telescopic field. Then turn the R.A. circle, which can be rotated manually, until the R.A. coordinate of the object is correctly indicated by the R.A. pointer. As long as the telescope's motor drive remains "ON," the R.A. pointer will then correctly indicate the R.A. of any object at which the telescope is pointed throughout the duration of the observing session.

To use the circles to locate a particular object, first look up the celestial coordinates (R.A. and Dec.) of the object in a star atlas. Then loosen the R.A. lock and turn the telescope to read the correct R.A. of the desired

object; lock the R.A. lock onto the object. Next, turn the telescope in Declination to read the correct Declination of the object. If the procedure has been followed carefully, and if the telescope was well-aligned with the pole, the desired object should now be in the telescopic field of a low-power eyepiece.

If you do not immediately see the object you are seeking, try searching the adjacent sky area, using the R.A. and Dec. slow-motion controls to scan the surrounding region. Keep in mind that, with the 25mm eyepiece, the field of view of the Model 2080 is about 1/2° and the field of the Model 2120 about 0.4°. Because of its much wider field, the viewfinder may be of significant assistance in locating and centering objects, after the setting circles have been used to locate the approximate position of the object.

Pinpoint application of the setting circles requires that the telescope be precisely aligned with the pole. Refer to the preceding section on "Precise Polar Alignment", page 22, for further details.

The setting circles may also be utilized in the absence of a power source for the motor drive. In this case, however, it is necessary to manually reset to the R.A. of the object you are observing just before going to the next object.

OBSERVING WITH THE TELESCOPE

The Meade Models 2080 and 2120 Schmidt-Cassegrain telescopes permit an extremely wide array of serious observational opportunities. Even in normal city conditions, with all of the related air and light pollution, there are a good many interesting celestial objects to observe. But to be sure, there is no substitute for the clear, steady, dark skies generally found only away from urban environments, or on mountaintops: objects previously viewed only in the city take on added detail or are seen in wider extension, or even become visible at all for the first time.

The amateur astronomer is faced typically with two broadly defined problems when viewing astronomical objects through the Earth's atmosphere: first is the clarity, or transparency, of the air and, secondly the steadiness of the air. This latter characteristic is often referred to as the quality of "seeing." Amateur astronomers talk almost constantly about the "seeing conditions," since, perhaps ironically, even the clearest, darkest skies may be almost worthless for serious observations if the air is not steady. This steadiness of the atmosphere is most readily gauged by observing the "twinkling" of the stars: rapid twinkling implies air motion in the Earth's atmosphere, and under these conditions resolution of fine detail (on the surface of Jupiter, for instance) will generally be limited. When the air is steady, stars appear to the naked eye as untwinkling points of unchanging brightness and it is in such a situation that the full potential of the telescope may be realized: higher powers may be used to advantage, closer double stars are resolved as distinct points and fine detail may be observed on the Moon and planets.

Several basic guidelines should be followed for best results in using your telescope:

1. Try not to touch the eyepiece while observing. Any vibrations resulting from such contact will immediately cause the image to move.

2. Allow your eyes to become "dark-adapted" prior to making serious observations. Night adaptation generally requires about 10 to 15 minutes for most people.

3. Let the telescope "cool down" to the outside environmental temperature before making observations. Temperature differentials between a warm house and cold outside air require about 30 minutes for the telescope's optics to regain their true and correct figures. During this period, the telescope will not perform well. A good idea is to take the telescope outside 30 minutes before you want to start observing.

4. If you wear glasses and do not suffer from astigmatism, take your glasses off when observing through the telescope. You can re-focus the image to suit your own eyes. Observers with astigmatism, however, should keep their glasses on since the telescope cannot correct for this eye defect.

5. Avoid setting up the telescope inside a room and observing through an open window (or, worse yet, through a closed window!). The air currents caused by inside/outside temperature differences will make quality optical performance impossible.

6. Perhaps most importantly of all, avoid "overpowering" your telescope. The maximum usable magnification at any given time is governed by the seeing conditions. If the telescopic image starts to become fuzzy as you increase in power, drop down to a reduced magnification. A smaller but brighter and sharper image is far preferable to a larger but fuzzy and indistinct one.

7. As you use your telescope more and more, you will find that you are seeing finer detail: observing through a large aperture telescope is an acquired skill. Celestial observing will become increasingly rewarding as your eye becomes better trained to the detection of subtle nuances of resolution.

CLEANING THE OPTICS

Perhaps the most common telescope maintenance error is cleaning the optics too often. A little dust on the surface of the correcting plate causes negligible degradation of optical performance: don't clean the outside surface of this lens unless really necessary. To remove small particles on the corrector lens surface, use a camel's hair brush (**gently**!) or blow off with an ear syringe (available from a local pharmacy). If further cleaning is required, a photographic lens cleaner may be used. In any case, DO NOT clean the correcting plate by taking strong circular wipes with a piece of cloth or other material: use a white "Kleenex"-type tissue and make short, gentle, radial wipes (from the center outward). Change tissues several times when cleaning the entire plate.

If grease or other organic materials (e.g. fingerprints) are in evidence on the outer surface of the corrector lens, the following homemade cleansing solution works well: 2 parts distilled water, 1 part isopropyl alcohol, and 1 drop of biodegradable liquid dishwashing detergent per pint of solution. Use only a small amount of solution and taken gentle, radial swipes, changing tissues several times to clean the corrector lens.

The above solution may also be used to clean correctors with the special High Transmission Coating (Magnesium Flouride). If your optics are so coated, take special care in cleaning to avoid scratches.

The aluminized surfaces of the Models 2080 and 2120 will probably never need re-aluminizing, if you are careful to replace the dust caps at the eye-end and corrector-end when the telescope is not in use. These dust caps also serve the important purpose of keeping dust and other contaminants off the surfaces of the corrector lens.

WARNING: Do not, in any case, remove the correcting plate from its machined housing for cleaning or other purposes. You will almost certainly not be able to replace the corrector in its proper rotational orientation and serious degradation of optical performance may result.

ALIGNMENT (COLLIMATION) OF THE OPTICAL SYSTEM

The optical collimation of any astronomical telescope used for serious purposes is important, but in the cases of the Schmidt-Cassegrain design of the Models 2080 and 2120, such collimation is absolutely essential for good performance. Take special care to read and understand this section well so that your telescope will perform fully to its capabilities.

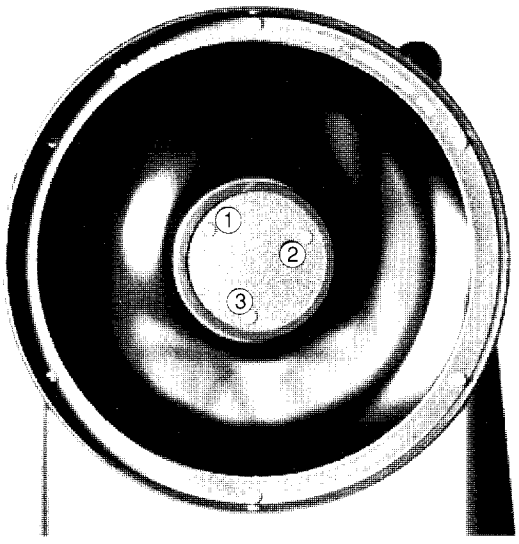


Fig. 12: Collimation of the Optical System
(1), (2), (3) Set screws for adjusting collimation.

All Meade Schmidt-Cassegrains are precisely collimated at the factory before packing and shipment and it is probable that you will not need to make any optical adjustments before making observations. However, if the telescope sustained rough handling in shipment, you may need to recollimate the optical system. Such recollimation is not a difficult procedure, in any case.

To check the collimation of your telescope, locate in the telescope a moderately bright (first or second magnitude) star near the zenith; alternately, a terrestrial "hot spot," such as reflected sunlight from a distant car bumper or telephone pole insulator will suffice. This test is simplified if the telescope is in thermal equilibrium. If the telescope has been moved through temperature extremes (e.g. taken from a warm house into cold outside air), allow 30 to 45 minutes for the telescope to "cool down."

To perform the test, center the point source (e.g. star image) in the telescopic field with a low power eyepiece, such as the 25mm eyepiece normally supplied as standard equipment. Defocus the image to fill about 1/4 of the field of view. You will see in the out-of-focus image a circle of light, with the darker circular shadow of the secondary mirror somewhere within. If the darker shadow is well-centered within the lighter circle, your telescope is well collimated, but continue to read this section for the more sensitive high-power tests to be described below. If the darker shadow is not so centered, follow this procedure:

1. Note that the only optical alignment adjustment of the Models 2080 and 2120 that is ever necessary or possible is the tilt-angle adjustment of the secondary mirror. Adjustment of this tilt-angle is achieved by turning the 3 set screws shown in Fig. 12, located at the edge of the outer surface of the secondary mirror housing.

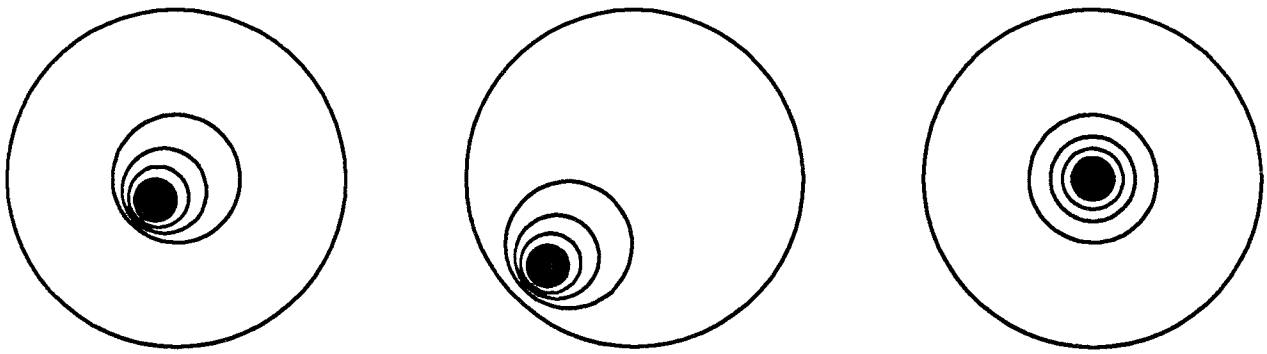
DO NOT FORCE THE 3 COLLIMATION SCREWS PAST THEIR NORMAL TRAVEL AND DO NOT ROTATE ANY SCREW OR SCREWS MORE THAN 2 TURNS IN A COUNTERCLOCKWISE DIRECTION (i.e. NO MORE THAN 2 FULL TURNS IN THE "LOOSENING" DIRECTION), OR ELSE THE SECONDARY MIRROR MAY BECOME LOOSENED FROM ITS SUPPORT. NOTE THAT THE SECONDARY MIRROR COLLIMATION ADJUSTMENTS ARE VERY SENSITIVE: GENERALLY, TURNING A COLLIMATION SCREW 1/2-TURN WILL HAVE DRAMATIC EFFECTS ON COLLIMATION.

2. While observing the defocused star image, note the direction in which the darker shadow is offset within the lighter circle. Using the telescope's slow-motion controls, move the defocused image to the edge of the field of view, in the same direction as the darker shadow is offset.

3. Tighten the screw or screws in the same direction as the darker shadow is off-center, loosen the other screw or screws. Continue this process until the defocused image is brought back to the center of the telescopic field.

4. Now proceed to a higher power (e.g. 9mm) eyepiece and repeat the above test. Any lack of concentricity at this point will require only extremely slight adjustments of the 3 set screws.

5. As a final check on collimation, examine the star image in-focus with a fairly high-power (9mm or shorter focal length) eyepiece, under good seeing conditions. The star point should appear as a small central dot (the so-called "Airy disc") with one diffraction ring surrrounding it. Make very small adjustments of the 3 set screws, if necessary, to center the Airy disc in the diffraction ring. With this final adjustment performed, your telescope is collimated.



(a) (b) (c)

Fig. 13

Summary of the Collimation Procedure: (a) Note if the darker shadow is de-centered, as shown (a, Fig. 13), inside the lighter circles; (b) use the telescope's controls to move the image to the edge of the field (b, Fig. 13), in the same direction as the darker shadow is off-center; (c) tighten and/or loosen, as appropriate, the secondary housing's 3 collimation set screws to bring the image back to the center of the field (c, Fig. 13): repeat (a) and (b) if necessary.

DEWING OF THE CORRECTING PLATE

Because of the correcting plate's proximity to the open air, it is possible in most climates that dew may form on the outer surface of the glass during observations. One simple remedy for this dewing is to use a portable hair blow-drier; just a few "light" swipes of the warm air will clear the dew for a period of time.

If the above approach is not satisfactory, the correcting plate's outer surface may be hand cleaned. BUT BE CAREFUL! The correcting plate should be completely free of dirt and abrasive particles before wiping the glass. Use only a clean, white Kleenex tissue and wipe radially outward from the center of the lens to the edge. Change tissues often. Avoid using circular motions when wiping and apply only the minimum pressure required to do the job. Hard wiping of the correcing plate will introduce fine scratches into the glass.

If dewing is a continual problem, a Dew Shield (see previous description in this manual) may be required. The Dew Shield effectively recesses the correcting plate from night air, and significantly inhibits dew formation.

If you find that dew has formed on the correcting plate after bringing the telescope indoors from an observing session, allow the warm indoor air to dissipate the dew before placing the telescope back in its carrying case. Do not wipe off the dew in this instance as it will evaporate naturally.

ADJUSTING THE RIGHT-ASCENSION LOCK

After a period of time, it is possible that the R.A. lock (see (5), Fig. 1) of the telescope will not tighten sufficiently due to internal wear of the clutch mechanism. In such an event, remove the R.A. lock lever using one of the hex wrenches supplied with the telescope. Then, with a pair of pliers, tighten the shaft protruding outward from the motor drive base until you cannot easily rotate the fork mount in R.A. (Take care in this operation not to damage the cosmetic finish of your telescope). Replace the R.A. lock lever so that its handle points straight out from the cross-bar connecting the fork arm.

ADJUSTING THE DECLINATION LOCK

Continual use of the Declination lock (see (2), Fig. 1) may cause this lock to loosen. To retighten the lock, first turn the manual Declination slow motion knob (4), Fig. 1, so that the Declination tangent arm (located inside the left-hand fork arm) is about in the middle of its travel. Put the Declination lock lever in the "unlocked" position, and insert the appropriate hex wrench into the notched-out section of the left-hand fork arm. Tighten the hex-head nut located just inside the notch. See Fig. 14. Caution: a little tightening of this nut goes a long way; generally, only one turn of the nut is required to fully retighten the Declination lock.

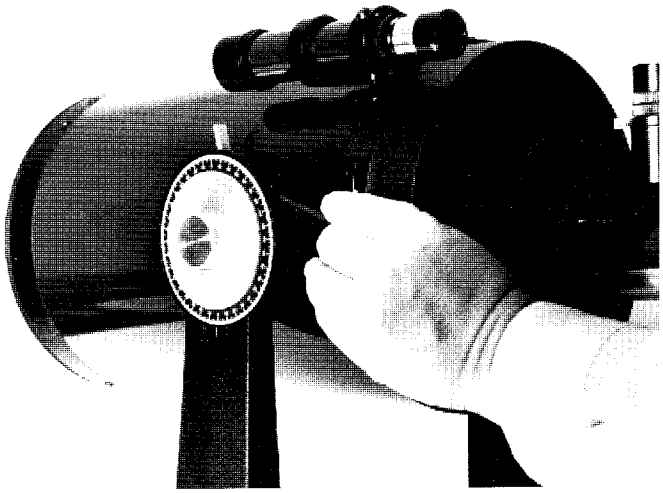


Fig. 14: Adjusting the Declination Lock.

A NOTE ON THE "FLASHLIGHT" TEST

Approximately 94% of the light impinging on the primary mirror of the Model 2080 or 2120 is reflected by the mirror; about 6% of the light is scattered. Similarly, the correcting plate of either model transmits about 95% of the light impinging at each surface; about 5% of the light impinging each surface is scattered.

If a flashlight or other high-intensity light source is pointed down the main telescope tube under dark conditions, the total amount of scattered light will be very considerable. As a result, the optics of the telescope will appear to be of very poor surface quality. This same statement may be made of any high quality optical surfaces when given this grossly misleading "test."

FACTORY SERVICING AND REPAIRS

Meade Models 2080 and 2120 have been designed and manufactured for years of trouble-free operation and repairs should rarely be necessary. If a problem does occur, first write our call our Customer Service Department. Do not return the telescope for servicing until you have communicated with us in this way, since the great majority of problems can be handled without return of the telescope to us. When telephoning or writing, please explain in detail the exact nature of the problem so that we may offer a prompt remedial procedure. Be sure to include your full name, address and phone number.

Basic Specifications: Models 2080 and 2120

	Model 2080	Model 2120
Optical Design	Schmidt-Cassegrain Catadioptric	Schmidt-Cassegrain Catadioptric
Clear Aperture	203mm (8")	254mm (10")
Primary Mirror Diameter	209.6mm (8.25")	263.5mm (10.375")
Focal Length	2000mm (80")	2500mm (100")
Focal Ratio (photographic speed)	f/10	f/10
Near Focus (approximate)	25'	50'
Resolution	0.56 arc secs.	0.45 arc secs.
Limiting Visual Magnitude (approx.)	13.9	14.5
Limiting Photographic Magnitude (approx.)	16.5	17.0
Image scale	0.72°/inch	0.57°/inch
Maximum Practical Visual Power	500x	625x
35mm Angular Film Coverage	0.69° x 0.98°	0.55° x 0.78°
Optical Tube Size	9.1" Dia. x 16" Long	11.75" Dia. x 22" Long
Secondary Mirror Obstruction	14%	13.7%
Standard Accessories:		
Viewfinder	6 x 30mm	8 x 50mm
Eyepiece	MA25mm (80X)	MA25mm (100X)
Eyepiece Holder	1-1/4"	1-1/4"
Diagonal Prism	1-1/4"	1-1/4"
Telescope Mounting	Fork-type, double tine	Fork-type, double tine
Setting Circle Diameters	Dec.: 4"; R.A.: 8"	Dec.: 4"; R.A.: 8"
Motor Drive Gear Diameter	5-3/4"	5-3/4"
Manual Slow-Motion Controls	Dec. and R.A.	Dec. and R.A.
Equatorial Wedge (optional) Latitude Range	11° to 64°	11° to 64°
Field Tripod (optional) Height	30" min.; 44" manx	30" min.; 44" manx
Net Telescope Weight (approx.)	25 lbs.	46 lbs.
Shipping Weight (approx.)	48 lbs.	77 lbs.
Carry Case Dimensions	30" x 16" x 12"	35" x 20" x 16"

The following table lists the powers obtained and actual field of view for optional eyepieces.

Eyepiece/Apparent Field	Model 2080 Power/Actual Field	Model 2120 Power/Actual Field
Series 2 Modified Achromatic Eyepieces (3-elements; 1-1/4" O.D.)		
40mm/36°	50/0.72°	63/0.57
Series 2 Orthoscopic Eyepieces (4-elements; 1-1/4" O.D.)		
4mm/45°	500/0.09°	625/0.07°
6mm/45°	333/0.14°	417/0.11°
9mm/45°	222/0.20°	278/0.16°
12.5mm/45°	160/0.28°	200/0.23°
18mm/45°	111/0.41°	139/0.32°
25mm/45°	80/0.56°	100/0.45°
Super Plossl Eyepieces (5-elements; 1-1/4" O.D., except as noted)		
6.4mm/52°	313/0.17°	391/0.13°
9.7mm/52°	206/0.25°	258/0.20°
12.4mm/52°	161/0.32°	202/0.26°
15mm/52°	133/0.39°	167/0.31°
20mm/52°	100/0.52°	125/0.42°
26mm/52°	77/0.68°	96/0.54°
32mm/52°	63/0.83°	78/0.67°
40mm/44°	50/0.88°	63/0.70°
56mm/52° (2" O.D.)	36/1.46°	45/1.16°
Super Wide Angle Eyepieces (6-elements; 1-1/4" O.D., except as noted)		
13.8mm/67°	145/0.46°	181/0.37°
18mm/67°	111/0.60°	139/0.48°
24.5mm/67°	82/0.82°	102/0.66°
32mm/67° (2" O.D.)	63/1.07°	78/0.86°
40mm/67° (2" O.D.)	50/1.34°	63/1.07°
Ultra Wide Angle Eyepieces (8-elements; 1-1/4" O.D., except as noted)		
4.7mm/84°	426/0.20°	532/0.16°
6.7mm/84°	299/0.28°	373/0.23°
8.8mm/84° (1-1/4" - 2" O.D.)	227/0.37°	284/0.30°
14mm/84° (1-1/4" - 2" O.D.)	143/0.59°	179/0.47°