

Meade DS-10 Owner's Manual

Deep Space 10" f/4.5 Newtonian Reflector

I. UNPACKING AND ASSEMBLY: MODEL DS-10

Prior to assembly of your Deep-Space telescope, you should familiarize yourself with the names of the various parts of the instrument. See Fig. 1. *In the following, part numbers in parenthesis refer to Fig. 1.*

Your telescope has been carefully packed to insure safe arrival. When reassembling the tube assembly and mount, you need only use a screwdriver and pliers or crescent wrench.

Packing of DS-10: The Model DS-10 is shipped in 4 cartons, as follows:

- Carton #1: Optical tube with secondary mirror and secondary mirror holder attached.
- Carton #2: Primary mirror, mounted in mirror cell; hardware for mirror cell.
- Carton #3: Equatorial Mount; focuser; eyepiece; hardware package; tripod legs.
- Carton #4: 1 piece--25 lb. counterweight.

Note that if you have ordered optional accessories to be shipped with your telescope, these accessories may be packed in one of the above cartons, or may be packed in separate, additional cartons, depending on the size of the accessories. *Do not discard any packing materials until you have fully assembled the telescope and have located all items of your order.*

Assembly of the Equatorial Mount: The equatorial head is packed completely assembled with the pier attached. The only assembly required is the addition of the three tripod legs. Use the three $\frac{1}{4}$ " x 1" screws with washers and $\frac{1}{4}$ " wing nuts to attach each tripod leg to the pier. (For extra stability, use the $\frac{1}{4}$ " hex nuts instead of wing nuts and tighten with pliers or wrench.)

Latitude Adjustment: The mount is shipped with the latitude angle unset. In order for the telescope to track accurately, the polar axis should be adjusted to your latitude. Basically, this operation involves loosening the Latitude Locking Bolt (15) and turning the equatorial mount so that the angle of the polar axis to the horizontal equals your latitude (see Fig. 1). Look up your latitude and set the angle of the polar axis using a protractor. (Most road maps show latitudes.) Lock the latitude angle in place by firmly tightening the bolt (15). For now, don't worry if the latitude angle is not set accurately. Just set the telescope polar axis at roughly the correct angle. More precise latitude adjustment is discussed below. Extra tightening and support of the latitude angle is provided by the 2 hex set screws located on each side of the pier cap (22). After setting the latitude angle tighten these set screws with the proper hex wrench.

Counterweight: Slide the counterweight (10) onto the declination shaft, after removing the safety ring (12). *Be sure to firmly tighten the counterweight set-screw with the Allen hex wrench supplied.* The counterweight balances the entire weight of the telescope and should never be removed with the main tube attached. For now, simply place the counterweight on the declination shaft. Exact positioning of the counterweight will be explained later. Replace the safety ring (12).

Assembly of the Optical Tube: After removing the main optical tube from its shipping carton, attach the focuser to the tube. Fasteners are supplied with both the standard #67 Focuser, and with the optional Deluxe #680 Focuser, for this purpose. When attaching the focuser to the main tube, tighten the nuts to a "firm feel." *Do not over-tighten.* Be sure that a washer is placed between each nut and the inside surface of the main tube.

The primary mirror is factory mounted in its holding cell prior to shipment. Remove the primary mirror-in-cell from its shipping carton, and, with the main tube lying flat on a smooth surface, place the mirror cell (4), Fig. 1, into position by sliding the 3 studs protruding from the main tube through the 3 holes located around the circumference of the mirror cell. Lock the cell into place with the washers and wing nuts included in the primary mirror carton.

Note: If you ordered optional features (e.g. viewfinder, photo-guide telescope, etc.) for your DS-10, attachment of these accessories to the optical tube is discussed below under "Optional Equipment."

Attaching the Optical Tube to the Mount: With the focuser and primary mirror-in-cell now attached to the optical tube, and with the mount fully assembled (tripod legs attached, latitude angle roughly set, counterweight in place), you are now ready to place the optical tube onto the mount.

Two radius blocks (6), Fig. 1, are factory-attached to the main tube. Each of these radius blocks has a threaded stud protruding from it. Place the main tube onto the saddle plate (21) of the mount, with the 2 studs passing through the holes at each end of the saddle plate. Tighten down the tube against the saddle plate, using the 2 wing nuts and washers provided.

Balancing: Most problems encountered while using a telescope are caused by improper balancing. Objects become hard to find and, once located, are easily lost because the telescope does not move properly. If you ordered the optional electric motor drive for your DS-10, but the drive does not track correctly, it is probably because the telescope is not balanced.

To balance the telescope, place both the main tube (3) and declination shaft (11) in a horizontal position. Slide the counterweight (10) along the declination shaft until the telescope is balanced in rotation around the polar axis. Be sure to lock the counterweight in place with the hex wrench provided, and again make certain that the safety ring (12) is in position at the end of the declination shaft. After adjusting the telescope balance in this way, you should now be able to move the instrument to any orientation, without losing telescope balance. When accessories are added to the main tube, re-balancing will generally be necessary.

Collimation of the Optical System: Your telescope is now ready for use, except for one final adjustment. For good performance the optical system (consisting of the 10" primary mirror and smaller secondary mirror) must be properly aligned, or collimated.

NOTE: Your optical tube was assembled and collimated at the Meade Instruments factory prior to shipment, and you *probably* do not need to make *any* collimation adjustments, except for Step 4 below. But check out all of the following steps anyway, since you will then know that the instrument is operating at its *maximum* capability. This fine-tuning need only be done during the first use of the telescope, unless the instrument is badly jarred in transport from one observing location to another.

The collimation procedure for the Meade DS-10 is slightly different from that of other Newtonian reflecting telescopes, because of the "fast" f/4.5 focal ratio of the DS-10 primary mirror. In typical Newtonian reflectors with more conventional focal ratios, when the observer looks down the focuser tube (without an eyepiece in the focuser drawtube), the images of the secondary mirror, primary mirror, the focuser tube, and the observer's eye appear *centered* relative to each other. However, with the short focal-ratio primary mirror of the DS-10, correct collimation requires that the diagonal mirror be offset in 2 directions: (1) away from the focuser and (2) towards the primary mirror, in equal amounts. This offset is approximately 3/16-inch in each direction. Note *that these offsets have been performed at the factory prior to shipment of your DS-10 to you*. It is only necessary for you to confirm below that the telescope has not been badly jarred out of collimation, and to perform the final fine-tuning of Step 4, below.

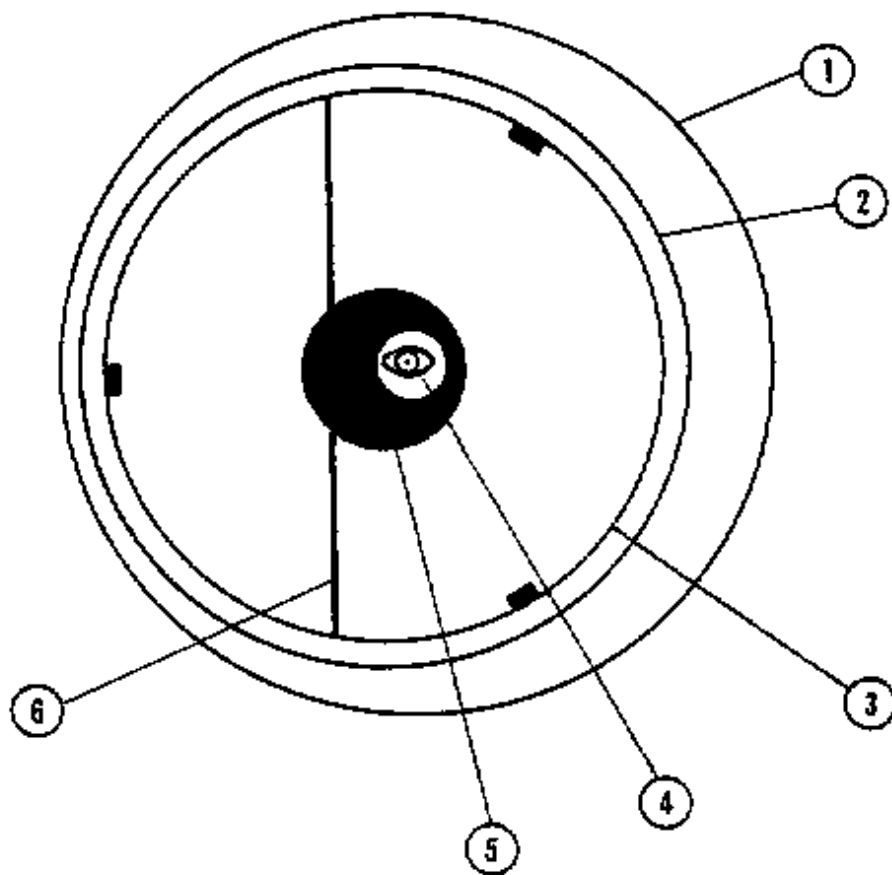


FIG. 2: Collimation of the DS-10 Optical System

1. Focuser drawtube
2. Secondary mirror
3. Reflection of primary mirror
4. Observer's eye
5. Reflection of secondary mirror
6. Single-strut vane

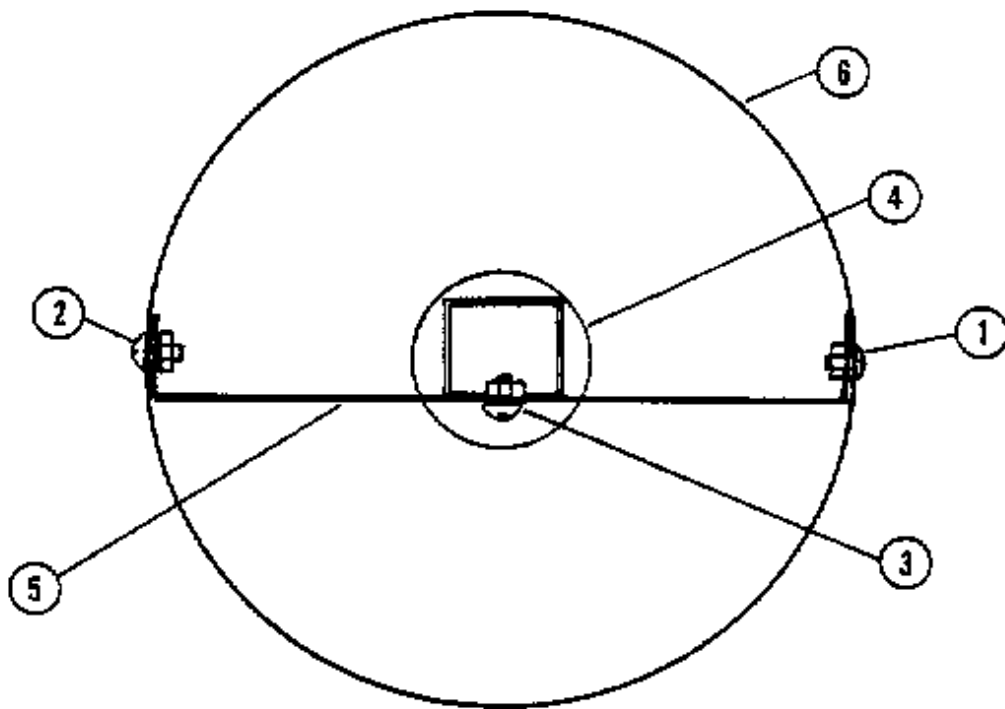


FIG. 3: The Secondary Mirror System (Looking down the optical tube toward the primary mirror)

1. Bolt holding single-strut vane (right)
2. Bolt holding single-strut vane (left)
3. Bolt-fastening secondary mirror holder
4. Secondary mirror
5. Single-strut vane
6. Main optical tube

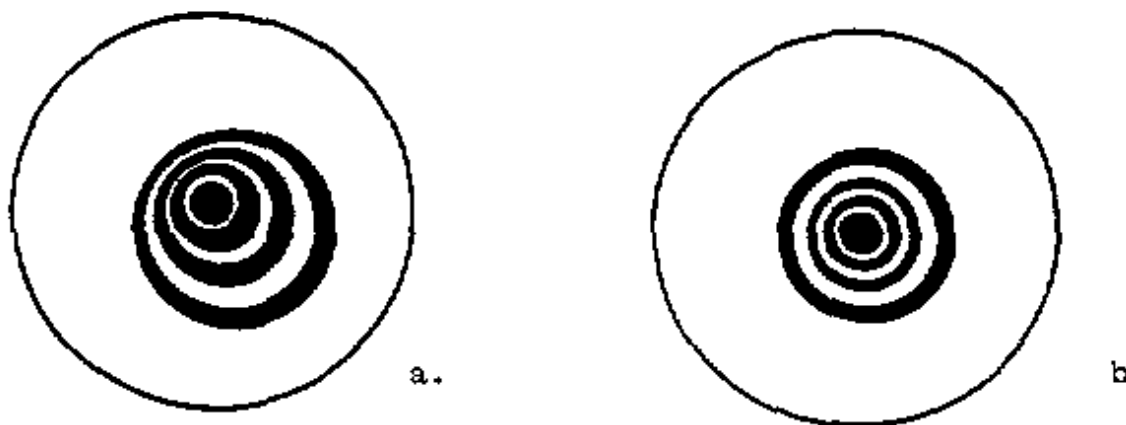


FIG. 4: Out-of-Focus Star Image

Fig. 2 shows a correctly collimated DS-10 telescope, as it appears when viewed through the focuser with the eyepiece removed. To check and, *if necessary*, set the optical collimation follow these steps:

Step 1: Observe through the focuser, without an eyepiece, and with your body oriented so that the telescope's primary mirror is to your left, and the open-end of the telescope tube is to your right. The secondary mirror

(circle 2, Fig. 2) should appear slightly offset to the left, as shown in Fig. 2. If the secondary mirror does *not* appear correctly offset, then slightly loosen the secondary-mirror-holder's attaching screw (see (3), Fig. 3), and move the secondary mirror so that this mirror appears offset as shown in Fig. 2.

Step 2: Center the primary mirror (circle 3, Fig. 2) in the secondary mirror. This centering, if necessary, is accomplished by loosening slightly screws (1) and (2), Fig. 3, so that the single-strut steel vane, (5), Fig. 3 may be pivoted up or down. In addition, loosening screw (3), Fig. 3, permits lateral centering of the primary mirror in the secondary mirror. Re-tighten all screws when the required centering is accomplished.

Step 3: Turn the wing nuts located on the back side of the primary mirror cell (see Fig. 5), so that the dark circle, (5) Fig. 2, is centered relative to the primary mirror, (3) Fig. 2. (These wing nuts adjust the tilt-angle of the primary mirror.)

Step 4: After Steps 1-3 have been followed, your DS-10 telescope will be well-collimated. Final "fine-tuning" of the collimation must be performed while observing a star through the telescope, with an eyepiece in place. Center a fairly bright star in the telescope's field of view. Then defocus the star image. It will then appear as in Fig. 4, with several rings surrounding the central star. If Step 3 was performed accurately, these rings will be round and concentric; if not, adjust the wing nuts of the primary mirror cell until the rings are well-centered, as in Fig. 4b. (In any case, it is not necessary to re-do Steps 1 and 2.) With this centering accomplished, collimation is completed.

II. USE OF THE TELESCOPE

Lining up the Telescope with the Pole: The Meade Model DS-10 utilizes an equatorial mount, a type of mounting which greatly facilitates the tracking of astronomical objects. To use the telescope properly, the equatorial mount must be roughly aligned with the North Celestial Pole before each observing session. This polar alignment need require no more than 30 seconds for visual telescopic observations. If photographs are to be taken through the telescope, it is advisable to exercise greater care in lining up with the Pole, particularly if the photographs are to be of long exposure. Polar alignment consists of two operations:

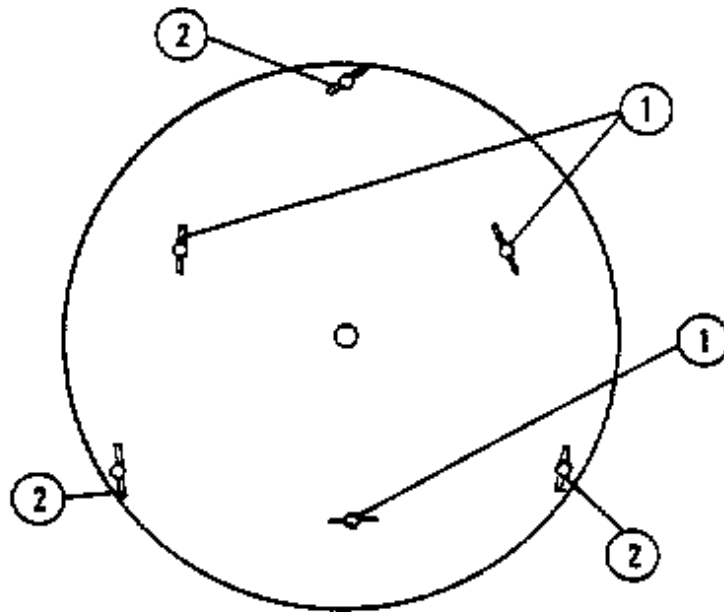


FIG. 5: Primary Mirror Cell (As seen from behind the primary mirror.)

(1) Wing nuts for tilting primary mirror. (Steps 3 & 4 of collimation procedure.)

(2) Wing nuts for locking the mirror cell into the main optical tube.

1. Turning the entire telescope and mount horizontally until the Polar Axis points to due-North, and
2. Tilting the Polar Axis at an angle equal to your latitude.

Approximately equivalent to Steps 1 and 2 above is simply turning the entire telescope and mounting so that the telescope Polar Axis points at the North Star. This method is completely satisfactory for all visual observations.

Operation of the Telescope: Once the telescope Polar Axis is aligned with the Pole, this alignment should remain unchanged throughout the observing session. To move from object to object, the observer turns the telescope in declination and/or right ascension until the desired object is in the field of view. If you ordered an optional viewfinder (see "Optional Equipment," below) with your DS-10, this small "sighting scope" will be helpful in the location of astronomical objects. If your telescope is not equipped with a viewfinder, then simply sight along the main tube (using a low-power eyepiece); with a little practice, this technique is more than satisfactory.

The declination lock (7) should be tightened sufficiently to keep the telescope from moving, but it is not necessary that the telescope be rigidly locked in declination. This lock provides a comfortable "drag" in declination, so that the telescope will not turn too easily around this axis. On DS-10's *not* equipped with motor drive, the R.A. lock, located on top of the polar casting (18), may similarly be used to cause a smooth "drag" in right ascension.

Tracking Astronomical Objects: If your DS-10 is not equipped with the optional electric motor drive, then the tracking of astronomical objects is performed simply by moving the telescope manually about the telescope's polar axis, only. With the telescope mount aligned to the Pole, as described above, it is not necessary to move the telescope in declination, in order to follow celestial objects. Once an object is centered in the telescope's field of view, tracking an object (in order to compensate for its apparent motion caused by the Earth's rotation) is performed by motion only about the telescope's polar axis.

If your telescope is equipped with the optional electric motor drive, you may, once the telescope has been aligned with the Pole, plug in the electric motor drive for fully automatic tracking. The motor will start running as soon as the telescope is plugged into a standard AC outlet. Because the stars move slowly, you will not be able to detect the telescope's motion caused by the motor drive. With the drive plugged in, an object in the telescope's field of view will appear to "stand still." When the drive is unplugged, the object will move out of the field rapidly.

The drive system has a built-in automatic clutch, so that even when the drive is plugged in, you may still move the telescope manually at will in any direction. When you release manual contact with the telescope, the drive will automatically resume tracking.

Eyepieces and Focusing: The focal point of the DS-10 telescope has been intentionally set beyond the normal travel of the standard focusing mechanism. By setting the focal point in such a position, it is not necessary to move the primary mirror for so-called "prime-focus" astrophotography, as will be discussed below. However, *in order to use standard eyepieces for normal visual observations through the DS-10, it is necessary to use an eyepiece extender tube to achieve correct focus.* This eyepiece extender tube is included as standard equipment with the telescope and positions an eyepiece further out from the focuser so that correct focus can be reached.

Note: With some eyepieces of about 25mm focal length or longer, it may be necessary to pull the eyepiece out slightly from the extender tube in order to reach correct focus.

To use an eyepiece for visual observations through the DS-10, place the extender tube into the focuser first, followed by placement of the eyepiece into the extender tube. Tighten the lock screw in the extender tube to hold the eyepiece firmly in position.

The eyepiece normally included as standard equipment with the DS-10 is a Kellner 25mm, yielding 46X. For higher or lower powers, different eyepieces may be used, either individually or in conjunction with a Barlow lens (see "Optional Equipment"). When trying to locate astronomical objects, begin with a lower-power eyepiece in any case: it will present a wider field of view for easier object locating. Then, if desired, switch to higher power eyepieces once the object has been centered in the telescopic field.

DO NOT OBSERVE THE SUN WITH YOUR MEADE REFLECTING TELESCOPE!

Observation of the Sun without the proper professional equipment can cause serious and irreversible eye damage. Under no conditions should the observer point the telescope directly at the Sun, or attempt to observe the Sun through the telescope, without obtaining equipment specifically designed for this purpose.

III. OBSERVING NOTES

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 - 15 minutes.
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 main mirror to regain its true and correct figure. 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. "Stopping-Down" the Telescope: In using the DS-10 for lunar and planetary observations, particularly if atmospheric "seeing" conditions are unsteady, it is often helpful to reduce the effective aperture of the telescope. In this way the telescope's effective focal ratio is increased, generally permitting the resolution of finer lunar and planetary detail.

A simple way to "stop-down" the DS-10 is to cut a 6" or 7" hole in a piece of cardboard, and tape this cardboard mask to the front of the telescope. (We recommend attaching the tape to the rubber end-ring of the telescope, and not to the tube body itself, to avoid marring the tube's painted finish when the tape is removed.)

If local atmospheric conditions are not conducive to good astronomical "seeing" (as evidenced by rapid twinkling of the stars), the above-mentioned stop-down mask--may also improve the observations of deep-space objects, e.g. nebulosity's and galaxies. In general, however, if your local atmosphere is fairly steady, you will probably want to use the full 10-inch aperture of the DS-10 on these latter objects, in order to achieve **maximum** image brightness.

IV. CARE OF THE OPTICS

With the reasonable care due any fine instrument, your Meade telescope will last a lifetime. If the eyepiece lenses become dirty, try brushing them with a camel's hair or other soft brush. If you must wipe the lenses, do it gently with a soft cloth so as not to scratch the glass.

The thin aluminum coatings on the primary and secondary mirrors may last up to ten years without deteriorating; they will last a shorter period in polluted or salt air. In any case, re-coating the mirrors is not a particularly expensive process. A little dust on the mirrors has an insignificant effect on performance; perhaps the most common error is to clean the mirrors more often than necessary. When the main mirror becomes excessively dirty, clean as follows:

1. With the mirror resting face up on a towel in a sink, turn on the cold water and play a stream of water on its face. This will loosen some of the particles and wash off unattached dust. Dip a wad of cotton in mild solution of detergent ($\frac{1}{2}$ teaspoon detergent to 1 pint of water). Then gently swab the entire surface. Keep the water going while swabbing to wash off the detergent solution as you clean. Very important: do not let the surface dry or bead, as water marks will be formed. Keep the stream of water going.
2. After swabbing the surface with detergent solution, cover the mirror with a stream of water. Make ready three wads of cotton for the following: Dip one-half of a cotton swab into isopropyl alcohol. At the time you place the swab on the surface of the mirror, turn off the water. Now swab the entire surface. Caution: Do not turn the swab over or dissolved skin oils will deposit on the mirror. Immediately take a dry swab and wipe gently. Keep changing cotton swabs until the surface is totally dry.

V. OPTIONAL EQUIPMENT

The Meade DS-10 telescope is shipped as a complete astronomical instrument. Many optional accessories and systems may be ordered, however, permitting a very wide range of additional visual and photographic applications.

Electric Motor Drive: The Model 787 Electric Motor Drive System may be ordered at any time, for direct attachment to the Model DS-10 telescope. If you ordered the motor drive at the same time as you ordered your telescope, the drive was already installed at the factory, prior to shipment. The drive system is normally equipped with a synchronous timing motor of 115 volts A.C./60 Hertz, for use in the United States and Canada. (Alternately, for use in foreign countries, 220 volt/50 Hz units are available, including reversed drives for operation in the Southern Hemisphere.) With the electric motor drive installed on your DS-10, astronomical tracking is fully automatic: simply align the telescope to the Pole (see Section II, "Lining up the Telescope with the Pole", above), plug in the electric drive to a standard AC outlet, and the telescope will immediately begin to follow celestial objects at the correct rate.

Because the stars move slowly, you will not be able to detect the telescope's motion caused by the motor drive. With the drive plugged in, an object in the telescope's field of view will appear to "stand still." When the drive is unplugged, the object will move out of the field rapidly.

The drive system has a built-in automatic clutch, so that even when the drive is plugged in, you may still move the telescope manually at will in any direction. When you release manual contact with the telescope, the drive automatically resumes tracking.

Viewfinders: Optional viewfinders of any aperture are best located at the "one o'clock" position, as shown in Fig. 6. This position results in easier balancing of the complete telescope system.

Alignment of a viewfinder is most easily performed on a fixed terrestrial object. Center the main telescope on a well-defined, sharp object, and then, using the viewfinder bracket's alignment screws, place the crosshairs of the finder so that they too are centered on the object. Thereafter, objects may be sighted first in the finder, then viewed through the main telescope.

NOTE: If you order a Meade viewfinder or photo-guide telescope for your DS-10 *after* receiving your telescope, be sure to mention, when ordering, that the finder will be used on the Meade DS-10. Due to the thick-wall main tube used on the DS-10, extra-long mounting screws are required for attaching finder or guide scope brackets to the main tube. By mentioning your telescope model no., we will know to ship these extra-long screws with your order.

Photo-Guide Telescopes: If a 2" or 2.4" photo-guide telescope is employed with the DS-10, this auxiliary telescope should be positioned on the main telescope at the "12 o'clock" position, as shown in Fig. 6. By straddling the declination axis with the guide telescope (Fig. 7), a **minimum** of extra balance weights will be required. (See below.)

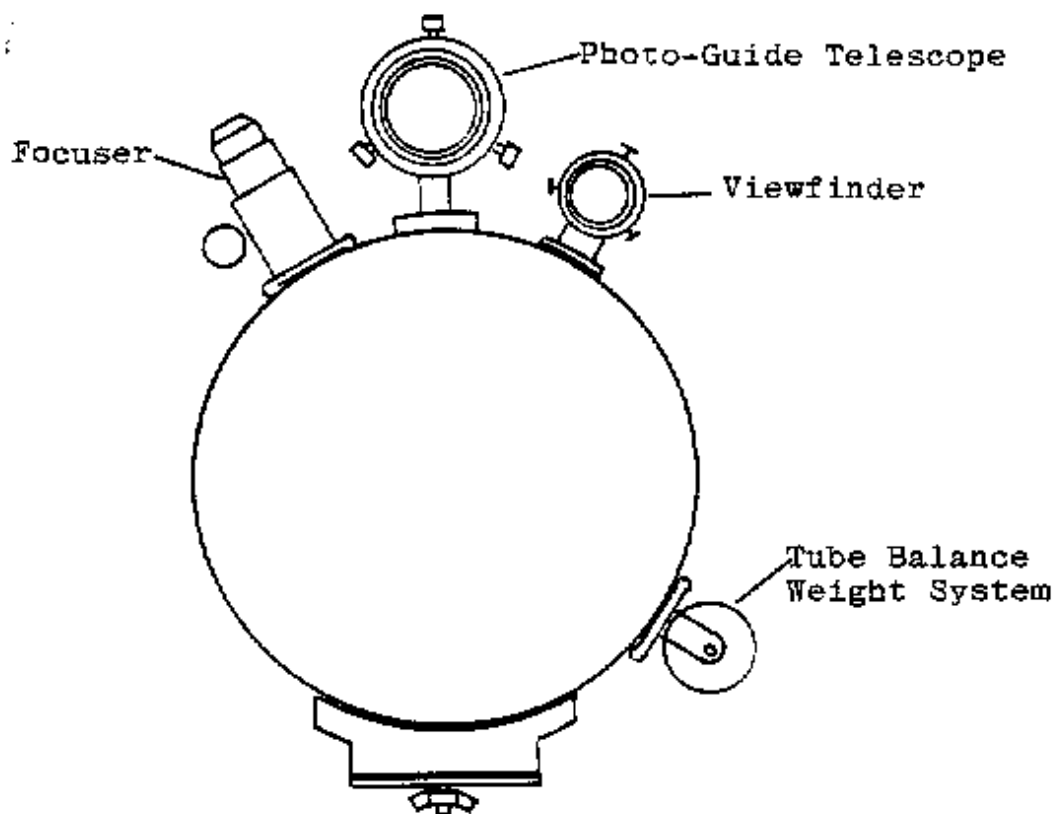


FIG. 6: Proper positioning of optional equipment on the main tube of the DS-10. Equipment is shown as it should appear when observer is looking down main tube toward primary mirror.

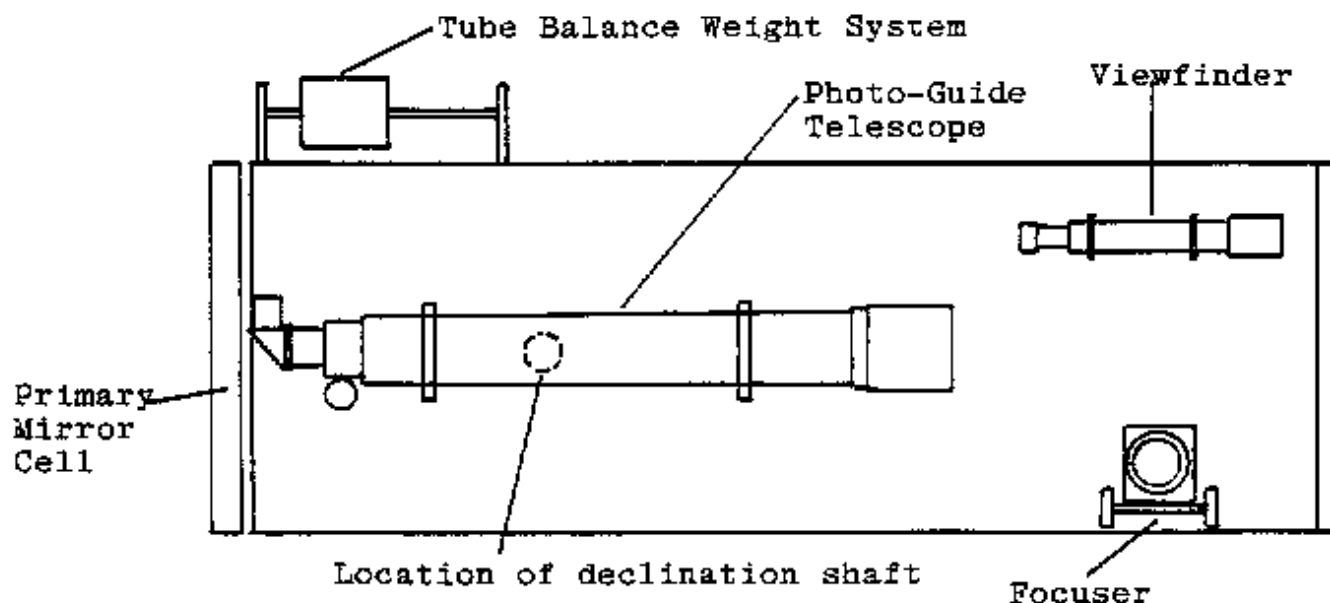


FIG. 7: Layout of optional equipment, as should appear from *top* of telescope's main tube.

Tube Balance Weight System: Occasionally, if the Model DS-10 telescope is fitted with several accessory options (e.g. viewfinder, deluxe focuser, guide telescope, and/or 35mm camera body), auxiliary balancing may be advisable. The tube balance weight system consists of a small sliding weight attached to a rod which in turn is fixed to the lower end of the main telescope tube. (See Figs. 6 and 7.)

Balancing of Optional Accessories: In lieu of a tube balance weight system, note that balance weights of your own devising may be easily added to the rear surface of the primary mirror cell. A simple piece of angle iron or scrap metal may be used for this purpose. Any auxiliary weight of this sort added to the telescope should be firmly fixed to the mirror cell (whether by screws, nails, or other fasteners), so that the weight will not fall off as the telescope is moved about the sky.

Dual-Axis Drive Corrector, Model 47M: The Dual-Axis-Drive Corrector for the DS-10 is the identical unit offered for Meade 6" and 8" reflecting telescopes. This drive corrector permits simultaneous electronic corrections in both right ascension and declination, for proper tracking during long exposure astrophotography. Detailed instructions for attaching the Dual-Axis Drive Corrector to the DS-10 are supplied with the drive corrector itself.

Barlow Lenses: A Barlow lens doubles or triples the effective magnifying-power that an eyepiece yields when used alone. The Meade #112 22X Telenegative Amplifier is well-suited to the applications of the DS-10. With most eyepieces, insert the eyepiece extender tube into the focuser first, followed by the Barlow lens, followed by an eyepiece.

NOTE: We do not normally recommend the use of the Meade #123 3X Telenegative Amplifier or #127 2X-3X Variable Telenegative-Amplifier on the DS-10. While these Barlows perform very well optically, they are not well-suited to the extender tube that must be used with most eyepieces on the DS-10.

Eyepieces: The DS-10 is supplied as standard equipment with a Kellner 25mm eyepiece yielding 46X. Many other eyepieces are available for higher or lower powers. For deep-space applications, the Meade Research-Grade Erfle 20mm eyepiece is probably the best choice obtainable; for lunar and planetary observations, eyepieces in the 4mm to 12.5mm range are advisable, for use both with and without a Barlow lens.

NOTE: Because the DS-10 has been designed for such a wide range of visual and photographic applications, it

may be necessary with certain eyepieces (particularly with longer focal length eyepieces) to pull the eyepiece barrel slightly out from the extender tube, in order to reach proper focus.

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