OPERATION AND MAINTENANCE

INSTRUCTIONS FOR QUANTUM TELESCOPES

Congratulations! You are the owner of what is very possibly the finest astronomical telescope ever produced. Thousands of man hours have gone into the design and production of this instrument. It has been produced from the finest materials procurable and assembled by skilled craftsmen. With proper use and a minimum of maintenance, your Quantum telescope will provide a lifetime of pleasure and satisfaction.

NOTICE!

Before taking out any components, note the orientation of all foam blocks and packing cusions. If for any reason you ever have to send any unit back to our plant or ship it anywhere, always replace all packing supports just as you found them.

Close attention to this procedure remains important to help prevent damage to the case or its contents during shipment. For normal handling and transport while you use the instrument, you may omit the extra blocks and cushions and store them inside the shipping carton for safekeeping.

FAMILIARIZATION WITH THE QUANTUM TELESCOPE

TAKING THE TELESCOPE FROM ITS CASE

After unlatching and opening the case but before removing any equipment, pay close attention to how it is packed. Always replace the instrument or component just the way you found it, so excessive strain or damage won't occur during transportation.

To remove the Quantum Four from its case, grasp the lower part of its side arm, and lift the unit straight out, holding it horizontal until clear of the case. Avoid grasping such parts as the control knobs or finder because this could misalign them. The Four and assembled Six tend to balance in a horizontal carrying position with one or both hands under the side arm. With the instrument (or Six mount) clear of the case, you may set it on any secure flat surface, such as a sturdy table or bench.

MOUNTING CONTROLS

With the telescope base resting on the table, scrutiny of the side arm will show two knobs. The upper knob has two knurled areas; a larger diameter one nearest the arm, which is a permanently set and locked declination shaft cover, and a smaller more outstanding part, which is the barrel detachment knob. Don't attempt to move the larger knurled collar, for this has been set at the factory and needs no attention.

OPTICAL BARREL DETACHMENT KNOB

The smaller portion of the upper knob turns a captive stud with a $\frac{1}{4}$-20 right-hand thread to attach and detach the barrel assembly. When performing this, support the barrel with one hand while turning the knob. Unscrewing the knob will make it extend from the declination shaft cover, whereupon pushing it back will thrust the barrel holder clear of the arm to reveal the dowel pins which establish alignment with the declination circle. Always make sure these pins enter their corresponding holes in the barrel holder when attaching the assembly. The stud projects beyond the pins when pushed in, so you can start the thread in the barrel holder before aligning the holes with the pins.

DECLINATION SLOW MOTION KNOB

The lower knob on the side arm operates the declination (elevation) slow motion at 30 to 1 ratio to provide continuous fine control. This knob must rotate freely when grasping the barrel to move it over large elevation angles, so avoid touching or hindering it when slewing in

declination. NOTE: To equalize wear on the declination drive disc, rotate the slow motion knob to move the disc 180 degrees whenever you detach the barrel assembly.

RIGHT ASCENSION SLOW MOTION KNOB

This is the knob located on the horizontal bottom part of the arm (turntable), which provides fine control in right ascension or azimuth. Because it works at a slower ratio of 40 to 1, the knob won't spin freely when slewing, so you must push the lever under it clockwise against spring pressure to disconnect the slow motion. Release of the lever allows the spring to re-engage the knob, and a glance under the edge of the turntable will show the pinion moving in and out of contact with the drive disc as you push the lever.

OPTICAL BARREL ASSEMBLY AND CONTROLS

LENS CAP

The protective cover over the front lens comes off by pulling it forward. We advise you to keep the lens cap in place when not using the telescope to guard the corrector.

DEWCAP

This useful optional accessory is a sleeve which slides forward over the outside of the barrel to form a shelter for the front lens on calm, damp nights. It will retard fogging of the glass most effectively if you warm it by placing your hands around the outside occasionally.

FOCUS KNOB

You will find this on the right side of the control box that houses the built-in diagonal and Barlow lens. We ship the instrument with its primary mirror set all the way to the rear because the optical system has the greatest resistance to physical shock that way. Therefore, as you receive it, the Quantum is adjusted to view objects at its shortest focusing distance, which is 15 feet for the Four and 30 feet through the Six. Clockwise rotation of the focus knob moves the primary mirror forward to allow observation at longer ranges; it takes about 19 turns to reach infinity through the Four and 16 for the Six. CAUTION: Don't force the rotation of the knob against its stops, for this could jam the mechanism and require return of the unit. NOTE FOR QUANTUM 100 and 150 OWNERS: The rear face focus knobs on these models act directly on the focus rods. To advance the primary mirror for longer range observation through the 100 or 150, turn the focus knob counter-clockwise.

STAR DIAGONAL CONTROL KNOB

On the rear face of the control box are the two knobs fitted with indicator pins. The one at the very bottom operates the built-in star diagonal. For all observation through the top mounted eyepiece, the pin on this knob must point straight up to place the diagonal properly. Rotation of the knob to swing its pin to the left moves the mirror aside, which allows access to the axial light for straight through viewing or photography. Always check the position of this control before you start to observe.

BARLOW LENS CONTROL KNOB

The knob located at the upper right operates the built-in Barlow lens. To move this negative amplifier under the eyepiece, turn the knob clockwise to bring its indicator pin vertical. This increases the magnification by 1.75 times and requires just over $\frac{1}{2}$ turn counterclockwise of the focus knob to reset the focus. Conversely, when you swing the indicator pin to the left to remove the Barlow lens, it takes the same $\frac{1}{2}$ turn of the focus knob clockwise to readjust. If you pull out the ocular part way, this can provide a little more power. Just be careful not to cock the eyepiece, as it can happen if you draw it out too far. Take out the eyepiece, and look down the holder while working the control. This will show how the lens moves back and forth without ever entering the axial light path. It has no effect on the axial image.

AXIAL HOLE CAP

To gain access to the axial image for photography or straight through viewing, unscrew the knurled plug in the center of the rear of the control box. While you have it off, swing the diagonal control back and forth to see how the diagonal mirror moves.

FINDER

This low power right angle telescope has the same field orientation as the main system, and we have collimated it at infinity before delivery. For this reason, it will appear to be out of alignment when you view objects at 100 yards or less. The best way to learn how to find targets close up is to start at long distance and work your way in to see how the parallax increases at shorter ranges. To focus the finder, undo the setscrew on its eyepiece holder slightly while holding the ocular, and slide the eyepiece; then reset the screw. If scrutiny of an object at least a mile away shows the finder to be out of line, you can adjust the nylon tipped screws in the brackets with a 3/32 Allen wrench. Pay close attention to the clearance between the prism housing and the barrel on the Four. The 8x50 finder on the Six comes with an extra tube extension

to convert it to straight through sighting, and you must unscrew the short adapter to change over. The prism diagonal works only with the short tube.

TABLETOP EQUATORIAL ORIENTATION

The optional legs and base leg adapter enable you to orient the mount in the equatorial position from 30 degrees to 45 degrees latitude on a level surface. To install the kit, begin by bolting the curved side leg holder to the bottom of the base, using any two of the 3/8-16 tapped holes. The raised parts of the adapter go next to the base to allow clearance to screw in the solid legs, while the telescoping adjustable center leg threads into the tapped hole in the middle of the base. For added security against having the unit topple poleward, slide the center leg counterweight on before attaching the leg to the base, and tighten its setscrew gently to avoid denting the leg.

This tabletop equatorial kit can operate somewhat outside the 30 to 45 degree latitude range by placing blocks under the center or side legs.

Once you have the legs on, start the orientation procedure by adjusting the telescope barrel to 90 degrees declination, which enables you to sight through the polar axis. Position the instrument on the table so its barrel points North, and slew in right ascension to bring the finder and eyepiece topside.

Next, maneuver the entire assembly while sighting along the barrel toward Polaris, and adjust the altitude by regulating the length of the center leg until you have the star in the finder field. Finish your fine adjustments while observing through the finder to bring Polaris to the intersection of the cross line, after which, check to see that it appears in the high power field of the main telescope. At this stage, your polar axis is aimed at the pole star, and although Polaris isn't located at the actual celestial pole, this is close enough for visual observation and short exposure photography. Prepare to observe by slewing 180 degrees in Right Ascension and 90 degrees in declination, and proceed from there.

ELECTRIC DRIVE

Once you have alignment on or near the celestial pole, you may use the built-in electric drive to follow any astronomical object. To start the drive, plug the rectangular end of the power cord into the socket in the telescope base (it goes just one way), and connect the other end to your 110V-60 Hz source. The normal interval to take up slack in the gear train is 10 to 15 seconds, after which tracking will begin. All slewing and slow motion adjustments may be done with the drive running.

THE RIGHT ASCENSION CIRCLE

This is the 24 hour dial you can see around the edge of the turntable, over which the turntable and clear index move when you slew or rotate the slow motion knob. It remains clutched to the electric drive, so you can set it to your local star time by pushing on its exposed periphery with your finger tips. A good way to set it is by acquiring a bright star, such as Vega or Regulus, whose coordinates you can look up on a current star map, after which you adjust the circle so it indicates the same reading. From then on, the dial will remain in step with the sky as long as the drive runs. It follows from this that the drive, circle, and turntable all rotate together under the impetus of the electric synchronous motor, and no movement of the index takes place as long as you track the object. The index travels over the circle only when you change to another area of the sky.

GENERAL COMMENTS ON BASIC OBSERVATION

For the beginning amateur astronomer, the best way to start is by standing the telescope on a sturdy table. In this position, the telescope can be positioned both horizontally and vertically through the use of the manual slow motion controls. Even though the Quantum mounting has setting circles and electric equatorial drive, the novice should not feel compelled to use them immediately.

Don't begin by trying to observe through a window, for the glass is almost certain to degrade the image badly. Some older polished plate and thermopane is surprisingly good, but you cannot count on this. Experience and reasoning has shown that the best place to set up is outside in an area as far from building roofs, pavement, and outdoor lights as practicality will allow.

If you have never used a high power telescope before, one of the first things you will notice will be the mirage (turbulence) which appears as a heat wave effect. The longer the distance to the object being observed, the more air you must look through and the greater disturbance. For this important reason we advise the use of low magnification when observing terrestrial objects as higher power magnifies the air turbulence in addition to the object. We mention this to correct the most common misconception; namely, the belief in the need for the highest possible power. Experienced observers always use the minimum magnification that will yield a clear view of all the available image detail. Understandably, under optimum conditions greater powers can be used.

Under conditions where a noticeable temperature difference exists between the places of storage and use, you should give the instrument a chance to recover from the "shock." The time needed depends upon

the size of the telescope and the temperature contrast. For example, a small telescope like the Quantum Four may require upwards of an hour to reach equilibrium over a 40 degree F. temperature range (72 degrees F to 32 degrees F). Any telescope must be at ambient temperature if it is to perform to its full potential. In cold weather, experienced observers store their telescopes in unheated areas to shorten or eliminate cool down time. An instrument not yet out of "temperature shock" reveals itself by the vertical streak seen in a defocused star image.

PHOTOGRAPHY

ATTACHING THE CAMERA

First, unscrew the axial hole plug (cap); then thread the T-mount camera swivel coupling in its place. Second, attach the appropriate T-ring camera adapter to the camera body and third, thread the camera, with adapter, to the swivel coupling. Finally, loosen the set screw on the coupling, orient the camera, and retighten the set screw.

FOCUSING

In order for an image to be formed at the focal plane of the camera, the star diagonal must be removed from the light path. As indicated previously, this is accomplished by turning the star diagonal control knob counterclockwise so that its indicating pin point to the left. Focusing is accomplished by turning the focus knob until the image, as seen on the camera focusing screen, is sharp and clear.

MAKING AN EXPOSURE

To secure sharp images on your negatives, the image formed at the focal plane of the camera must remain motionless during the exposure. The primary source of motion is the camera itself. When the shutter is released, the camera's reflex mirror "bounces" up, out of the light path and the camera's shutter transverses the focal plane to make the exposure. Both of these operations introduce vibration into the system which results in image motion at the focal plane. The amount of vibration induced depends upon the camera used, some producing much less than others. Some cameras have independent shutter and reflex mirror controls which allow the reflex mirror to be "lock-up" prior to releasing the shutter. This greatly reduces the amount of vibration and cameras with this feature are highly recommended. Since there is no such thing as a totally vibrationless camera shutter, we recommend that where possible a black card, placed in front of but not touching the telescope, be used to make the exposure, thereby eliminating its

vibration altogether! Otherwise, a suitable cable release should be used to trip the shutter.

DETERMINING EXPOSURE TIMES

Telescopes function as uncoupled lenses; that is, they have no link to the aperture control of through the lens meters or the aperture mechanism of a shutter speed preferred automatic exposure system. Therefore, all through the lens metering SLR cameras must operate in the stop down mode as described in the instruction manuals for these units, and fully automated cameras of the shutter speed preferred type must be set to their manual mode and match needle procedures followed. An aperture preferred automatic camera will function properly on terrestrial subjects in terms of exposure; however, it incurs a penalty of vibration due to the swing of its mirror, unless it has the ability to monitor the light reaching the film during the exposure (Olympus OM-2). In essence, no meter has application to astrophotography; except for the Sun and Moon, there is simply not enough light to measure.

Taking terrestrial pictures without a meter is surprisingly easy by following the basic photographic rule which states that shutter speed equals film speed on a sunlit object at F 16, one half the film speed in open shade, and one quarter the film index in deep shade. By bracketing on these values, you are assured of getting a useful image. The basic photographic rule doesn't apply to astrophotography, and practitioners of this endeavor must experiment constantly and keep detailed records.

INSTRUMENT STORAGE AND CARE

Give your Quantum the respectful treatment merited by any precision instrument by observing the following rules:

Never force anything; for example, the fit of the eyepiece in the adapter tube may be snug, and the ocular won't slip into its proper place unless you have it correctly straight. If it binds, remove the eyepiece and try again.

Don't leave the telescope set up without its eyepiece in the adapter or with the axial hole open. This will minimize the intrusion of dirt and insects. In case of internal contamination, you will have to return the unit to our shop for cleaning; and if you live outside the United States, the air freight and customs fees will amount to far more than the cost of service.

The best place to keep your telescope when it is not in use is in its case. Store the case in a dry place, as dampness has caused more damage to instruments than any other agency. Damp, unventilated

storage is certain to result in mildew (fungus) growing on the glass elements; and if allowed to proceed, this will etch the optical surfaces and necessitate repolishing and recoating to restore, which is costly. Under primitive conditions in the tropics or near the ocean, keep the cased unit off the ground and under some sort of roof or canopy where ventilation can reach it. After each use in salt air, wipe the outer mechanical surfaces with a cloth dampened with fresh water to remove the salt; otherwise, the polished metal areas will pit and corrode. If you plan to stay at a seashore cottage, place all of your optical goods into one closet where you can keep a 15 or 25 watt bulb lighted to maintain some warmth and comparative dryness. This simple expedient has worked successfully under truly horrendous humidity in tropical locations. In essence, the seemingly inconsequential matter of storing an exquisite optical machine requires your serious consideration.

A useful kit to clean the main corrector lens, finder objective, and eyelenses of the oculars consists of the following:

3 oz. or 4.5 oz Ear Syringe (Get this at your local pharmacy)
Small plastic squeeze bottle of Eastman lens cleaner (available at most camera stores)
Fresh Kleenex or lens tissue

Under average conditions, you shouldn't need to wipe any optical surface oftener than once a month. The exceptions are if someone puts a finger mark on the glass (remove immediately) and after use in salt air to prevent loss of image contrast due to salt specks on the corrector lens.

To clean an optical surface, proceed as follows:

First, take the rubber ear syringe and squirt air across the lens to sweep loose grit from it. Get into the habit of doing this routinely after each observing session, as it will minimize the frequency of having to do the subsequent steps. Second, pull a fresh untouched tissue and form it into a mop without handling the working area (pull the four corners together). Third, hold the bottle of lens cleaner over the up ended mop and drip a few drops on the tissue (never on the lens, as this can get fluid inside the lens cell). Fourth, fog the lens with your breath and immediately wipe with soft circular gathering motions. This will leave some streaks, so follow up by fogging the lens with your breath and another mop used without the cleaner. The fogging serves an important function; it takes the "bite" out of the otherwise dry paper fibers of the tissue and it shows where the streaks are on the lens. Finally, a few more squirts of air from the syringe will take away the lint.

We guarantee the Quantum for 10 years against defects of materials or workmanship. However, we do reserve the right to use our judgment as to whether the unit has undergone abuse. Any servicing required that is not your fault or the result of normal wear, will be done without charge except for shipping and handling. Routine internal cleaning and overhaul charges will be based on current shop time and materials costs.

Please notify us promptly if you have any problem.

CAUTION!

Never aim this or any other Maksutov Cassegrain telescope at the uneclipsed Sun without a dense filter covering the front lens. To do so will incur risk of injury to the observer as well as damage to the main system and eyepiece.