APPENDIX E:
MAINTAINING YOUR LX200

1. Keeping Your Telescope Clean

Prevention is the best recommendation that a telescope owner can follow to keep astronomical equipment in top working order. Proper measures taken during observation and when storing equipment between observing runs can add many years of trouble free use.

Dust and moisture are the two main enemies to your instrument. When observing, it is advisable to use a proper fitting dew shield. The dew shield not only prevents dew from forming, and dust from settling on the corrector plate lens, it prevents stray light from reducing image contrast.

Although dew shields go a long way to prevent moisture build-up, there can be times when the telescope optics will have a uniform coating of moist dew. This is not particularly harmful, as long as the instrument is allowed to let the dew evaporate. This can be done with a hair dryer, or just setting up the telescope indoors with the dust covers removed. It is also advisable that you let the foam lined case for the LX200 dry out indoors for a day if the night was moist. Packing your telescope away in a moist case can result in giving it a steam bath later.

CAUTION: Anytime the LX200 is being stored or transported, be sure to release the R.A. and Dec. locks, to prevent serious damage to the drive gears.

CAUTION: Never attempt to wipe down optics that are covered with dew. Dust and dirt may be trapped with the collected dew, and upon wiping the optics you may scratch them. After the dew has evaporated you will most likely find them in fine condition for the next observing session.

If you live in a very moist climate, you may find it necessary to use silica desiccant stored in the telescope's case to ward off moisture and the possibility of fungus growing on and within the coatings of the optics. Replace the desiccant as often as necessary.

Those living in coastal areas or tropic zones should also cover the electronic ports on the power panel and the keypad with gaffers tape to reduce corrosion on the metal contacts. Apply a dab of a water displacement solution (*i.e.* WD-40) with a small brush on all interior metal contacts and the input cord metal contacts. The keypad and all separate accessories should be kept in sealable plastic bags with silica desiccant.

A thick layer of dust will attract and absorb moisture on all exposed surfaces. Left unattended, it can cause damaging corrosion. To keep dust at bay when observing, the telescope can be set up on a small section of indoor/outdoor carpet. If you are observing for more than one night in a row, the telescope can be left set up but covered with a large plastic bag (such as the one supplied with the telescope). The rear cell opening of the LX200 can also be sealed off to the elements by threading on the optional accessory Skylight 1A Dust Seal. Eyepieces, diagonals, and other accessories are best kept in plastic bags and stored in cases, such as the Meade #50 Accessory Case.

All of the non optical surfaces of the LX200 should be cleaned routinely with a soft rag and alcohol to prevent corrosion. The cast metal surfaces and the individual exposed screws can also be kept looking new and corrosion free by wiping them down with a water displacement solution. Take care not to smear the solution onto any optical surface, and to wipe up any excess solution with a clean dry cloth. The painted tube can be polished with a liquid car polish and a soft rag.

Surprisingly, **the most common telescope maintenance error is cleaning the optics too often**. A little dust on any of the optical surfaces causes virtually zero degradation of optical performance. It should be of no concern whatsoever to see some small particles on the inside or outside of telescope optics. Should the optics get more dust on them than you would care for, simply use a photographic grade camel hair brush with very gentle strokes. You can also blow off dust with an ear syringe (available from a local pharmacy).

There is a point, however, when the optics must be cleaned. This is when you can easily tell that there is a thin layer of fine particulates that make the optics look very slightly hazy. To clean the optics we must suggest that you make your own lens cleaning solutions, since it is impossible to know all of the ingredients used in commercial lens cleaners. Pure isopropyl alcohol (90% or better) will clean most residual film build-up on optical surfaces (and metal surfaces too).

Organic materials (*e.g.*, fingerprints) on the front lens may be removed with a solution of 3 parts distilled water to 1 part isopropyl alcohol. A single drop of biodegradable dishwashing soap may be added per pint of solution. Use soft, white facial tissues and make short, gentle strokes. Change tissues often.

CAUTION: Do not use scented, colored, or lotioned tissues or damage could result to the optics.

Sprayer bottles are a convenient dispenser of lens cleaning solutions onto the tissues. Use soft, white facial tissues and make short, gentle strokes. Change tissues often. If the optics are small (such as viewfinders or eyepieces), the tissue can be rolled to the appropriate thickness and then broken in half to create two cleaning wands. It is advised that you avoid many of the so-called lens cleaning papers (many which contain fiberglass), lens cloths, or chamois.

Before attempting to clean an optical surface with a liquid solution, it is very important that as much dust as possible is removed by using forced air and/or gentle strokes with a photographic grade camel hair brush. The forced air can come from a rubber ear syringe, or canned compressed air from a photographic supply store. Be sure to hold the canned air in a vertical position and try spraying compressed air on your hand before aiming at the optics to see if any of the propellant (solid material) comes out. Propellant is very difficult to remove from optics, so take care not to tip the can when using it. If you have access to a compressor hose, be sure that it is filtered to prevent oil from being sprayed on the optics.

Once you are confident that you have removed most of the dust and large particles, begin cleaning with the mixture described above. Pour or spray enough solution onto a pillow or wand of tissue until it is quite wet. If you are cleaning a corrector plate, use radial strokes with a smooth pillow of tissue, starting from the center out, using no pressure. If you are cleaning small optical surfaces, use the rolled wands of tissue starting from the edges then spiraling in to the center, again using no pressure. Never pour or spray the solution onto the corrector plate or eyepieces themselves, as the liquid may go behind or in between lenses, where it is difficult or impossible to reach. Never attempt to disassemble an eyepiece to clean the inner elements, as you will certainly not be able to properly center and re-assemble the optical train.

Use dry tissue to make the final clean up, again using no pressure. If there is still some sort of residue, repeat the procedure using the three part formula described above, again using the same cleaning techniques.

The inside surface of the corrector plate and secondary mirror may at some point become dirty due to particles falling inside the tube when removing or replacing the rear dust cover or threading on accessories. To reduce the chance of interior contamination, the Meade Skylight 1A Dust Seal is very effective. If the Dust Seal is not used, it helps to have the rear cell pointed downward when replacing the rear dust cover or attaching accessories.

Another more serious, but not damaging problem is the possibility of a hazy (usually uneven) film building up on the inside of the corrector plate. This can be caused by

environmental pollutants, or temperature changes reacting with the interior paint, causing outgassing or water condensation, or combinations thereof.

It is possible to clean the interior of the optical system yourself or to have it done professionally. In the case of the former, take great care in handling the optics. Any impact or rough handling can damage the surfaces, which may require complete optical replacement at Meade Instruments at substantial cost. Meade Instruments assumes no liability for damage incurred to the telescope by the customer.

The cleaning techniques described above are used while cleaning the interior of the optical system, with one exception: **Do not apply cleaning solutions to the front surface mirrored optics. Only use the soft camel hair brush and the suggested ear syringe for removing particles.** The corrector plate can be cleaned in the normal manner.

To remove the corrector plate, follow the instructions below:

a. Remove the six (8" and 12" models) or the eight (10" model) stainless steel screws that hold the corrector plate retaining ring with the raised white lettering in place. This should be done with the Drive Base placed flat on a work bench, and the optical tube assembly pointed up at a 45-degree angle with the declination lock secure to prevent accidental dislodging of the corrector plate.

b. Remove the plastic retaining ring and locate the two white alignment marks, one at the edge of the corrector plate lens and one beside it on the black metal front cell. These two marks line up and serve as the precise rotational position of the corrector plate in the optical train. If no marks exist, make them yourself with a small paintbrush and some white paint, so that when you return the corrector plate to the front cell you are putting it back in the same position that you took it off.

c. Remove the corrector plate from the telescope, holding it by the plastic central secondary housing. Gently flip it over so that the secondary mirror is facing you, then reinsert the corrector plate back into the front cell. This will allow you full access to clean the interior optical surfaces without touching them with your fingers.

d. When cleaning is complete, replace the corrector plate in it's original position, carefully lining up the rotational index marks described in paragraph b, above. Then replace the retainer. Partially thread in all of the stainless steel screws, then, one at a time, snug the screws down to prevent the corrector plate from rotating in the front cell. Take care not to overtighten the screws as it will stress the corrector plate lens.

e. A final check of the optical system is to inspect for proper collimation (alignment) of the optics.

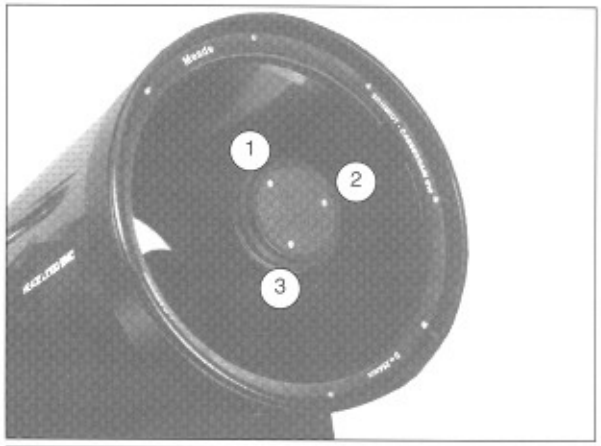

Fig. 26: Collimation of the Optical System. (1), (2), (3) Set screws for adjusting collimation.

2. Collimation of the Optical System

The optical collimation (alignment) of any astronomical telescope used for serious purposes is important, but in cases of the Schmidt-Cassegrain design of the 8", 10", and 12" LX200, such collimation is absolutely essential for good performance. Take special care to read and understand this section well so that your LX200 will give you the best optical performance.

NOTE: The 7" LX200 does not require collimation.

For final optical tests, every Meade Schmidt-Cassegrain is precisely collimated at the factory before shipment. Our company is well aware that through shipment and normal handling, the optical alignment can be degraded. The design of the optical support system make the method of collimation easy to do. Even the uninitiated can make an alignment of the optics to the same high precision that is performed at the Meade Instruments Optical Laboratories.

To check the collimation of your LX200, center a bright star that is overhead, or use a reflected "hot spot" of reflected sunlight from a chrome car bumper or a telephone pole insulator, with the supplied 26mm eyepiece. To make a correct evaluation of the alignment it helps if the telescope has been allowed to either cool down or warm up to the ambient temperature where the instrument is set up. Temperature differences between the optics and the outside air can cause distortion in the images.

With the star or hot spot centered, de-focus the image. You will notice that the out of focus star image looks like a ring of light (the dark center of the ring is the shadow of the secondary mirror). Turn the focus knob until the ring of light fills about 1/8th of the eyepiece field. Take note that if you keep de-focusing the star past about 1/8th of a field, that the ring will look perfectly concentric (even on all sides) even if the optics are out of alignment, thus preventing you from seeing any misalignments. If the ring of light does not seem to be even on all sides, or if the dark center seems to be offset in the in the ring of light, follow the method below:

a. To make collimation easy, the only adjustments possible on the 8", 10", and 12" LX200 come from the three set screws (1, 2, and 3, Fig.26) located at the edge of the outer surface of the secondary mirror housing.

WARNING: DO NOT FORCE THE 3 COLLIMATION SCREWS PAST THEIR NORMAL TRAVEL AND DO NOT LOOSEN THEM MORE THAN 2 FULL TURNS (COUNTER-CLOCKWISE DIRECTION), OR THE SECONDARY MIRROR MAY COME LOOSE FROM ITS SUPPORT. YOU WILL FIND THAT THE ADJUSTMENTS ARE VERY SENSITIVE: USUALLY, ONLY TURNING A COLLIMATION SCREW 1/2 A TURN WILL GIVE DRAMATIC RESULTS.

b. While looking at the de-focused star image and noticing which direction the darker shadow is offset in the ring of light or noticing which part of the ring is the thinnest (1, Fig. 27), place your index finger in front of the telescope so that it touches one of the collimation set screws. You will see the shadow of your finger in the ring of light. Move your finger (or an assistants finger) around the edge of the black plastic secondary mirror support until you see the shadow of the finger crossing the thinnest part of the ring of light. At this point, look at the front of the telescope where your (or your assistants) finger is aiming. It will either be pointing directly at a set screw, or it will be between two set screws aiming at the set screw on the far side of the black plastic secondary mirror support. This is the set screw that you will adjust.

c. Using the telescope's slow motion controls, move the de-focused image to the edge of the eyepiece field of view (2, Fig. 27), in the same direction as the darker shadow is offset in the ring of light.

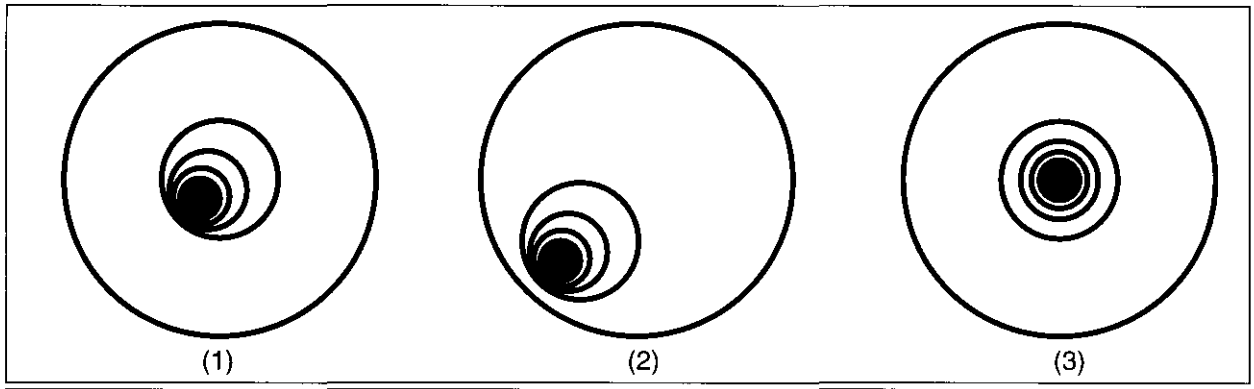

Fig. 27: De-focused Star Images.

d. Turn the set screw that you found with the pointing exercise while looking in the eyepiece. You will notice that the star image will move across the field. If while turning, the out-of-focus star image flies out of the eyepiece field, then you are turning the screw the wrong way. Turn the opposite direction and bring the image to the center of the field.

e. If while turning, you feel the screw get very loose, tighten the other two screws by even amounts. If while turning, the set screw gets too tight, unthread the other two by even amounts.

f. When you bring the image to center (3, Fig. 27), carefully examine the evenness of the ring of light (concentricity). If you find that the dark center is still off in the same direction, continue to make the adjustment in the original turning direction. If it is now off in the opposite direction, you have turned too far and you need to turn in the opposite direction. Always double check the image in the center of the field of the eyepiece.

g. You may find after your initial adjustment that the dark center is off in a new direction (*e.g.*, instead of side-to-side, it is off in an up-and-down direction). If this is the case follow steps b through f as described above to find the new adjustment screw.

h. Now try a higher power (*e.g.*, 9mm or less) eyepiece and repeat the above tests. Any lack of collimation at this point will require only very slight adjustments of the 3 set screws. You now have a good collimation.

i. As a final check on alignment, examine the star image in-focus with the higher power eyepiece as suggested above, under good seeing conditions (*e.g.*, steady atmospheric conditions). The star point should appear as a small central dot (the so-called "Airy disc") with a diffraction ring surrounding it. To give a final precision collimation, make extremely slight adjustments of the 3 set screws, if necessary, to center the Airy disc in the diffraction ring. You now have the best alignment of the optics possible.

3. Right Ascension Lock

After a period of time, it is possible that the R.A. lock (7, Fig. 1) of the LX200 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 drive base until you cannot easily rotate the fork arm in R.A. (Take care in this operation not to damage the cosmetic finish of your LX200). Replace the R.A. lock lever so that the handle points straight out from the cross-bar connecting the fork arm.

4. Behind the Power Panel

The LX200 power panel houses the back-up replaceable battery (1, Fig. 28) for the clock and calendar and a replaceable standard 1.0 amp slow-blow fuse (2, Fig. 28). The long-life lithium battery (Panasonic CR2032 3 vDC or Duracell DL2032B) is stored behind the front panel of the Drive Base. The battery does have to be changed every few years, and is done by unthreading the four phillips-head screws that secure the Front Panel to the Drive Base. Then with a thin flat-head screw driver, lift the small coin-size battery out of its holder. The new battery simply slides in place.

The 1.0 amp slow-blow fuse will sacrifice itself to protect the LX200 electronics in the event that the telescope is prevented from completing a GO TO function (*e.g.*, the tube runs into something that keeps it from slewing).

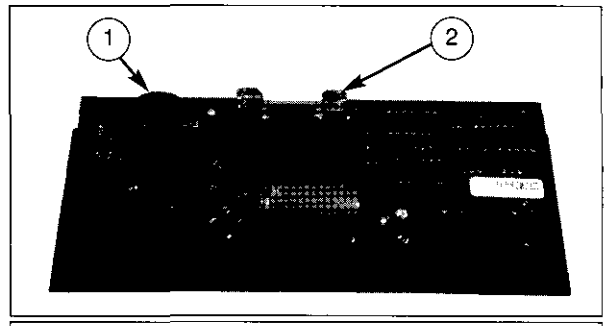

Fig. 28: Reverse Side of Power Panel. (1) Fuse; (2) Battery.

5. Factory Servicing and Repairs

Meade LX200 models have been designed and manufactured for years of trouble-free operation and repairs should rarely be necessary. If a problem does occur, first write or call our Customer Service Department. Do not return the telescope until you have communicated with us in this way, since the great majority of problems can be handled without the return of the telescope to us. However, should the occasion arise that the instrument requires factory servicing, a Meade Instruments Customer Service Representative will issue a Return Goods Authorization (RGA) number and give you full instructions on how to use it. Product returned without the RGA number may greatly delay any servicing or repairs. When telephoning or writing, please explain the exact nature of the problem so that we may offer a prompt remedial procedure. Be sure to include your full name, address, phone and fax numbers where you can be reached.

Should you live outside of the United States, contact your Authorized Meade Distributor.

You can reach the Meade Instruments Customer Service Department either by mail, phone, or fax at: Meade Instruments Corporation, 6001 Oak Canyon, Irvine, CA 92620-4205, telephone (949) 451-1450, or fax (949) 451-1460. Outside of the U.S.A., dial your International Access Code, then 1, then the ten digit number above in the 949 area code. Customer Service hours are 8:30 AM to 4:30 PM, Pacific Time, Monday through Friday.