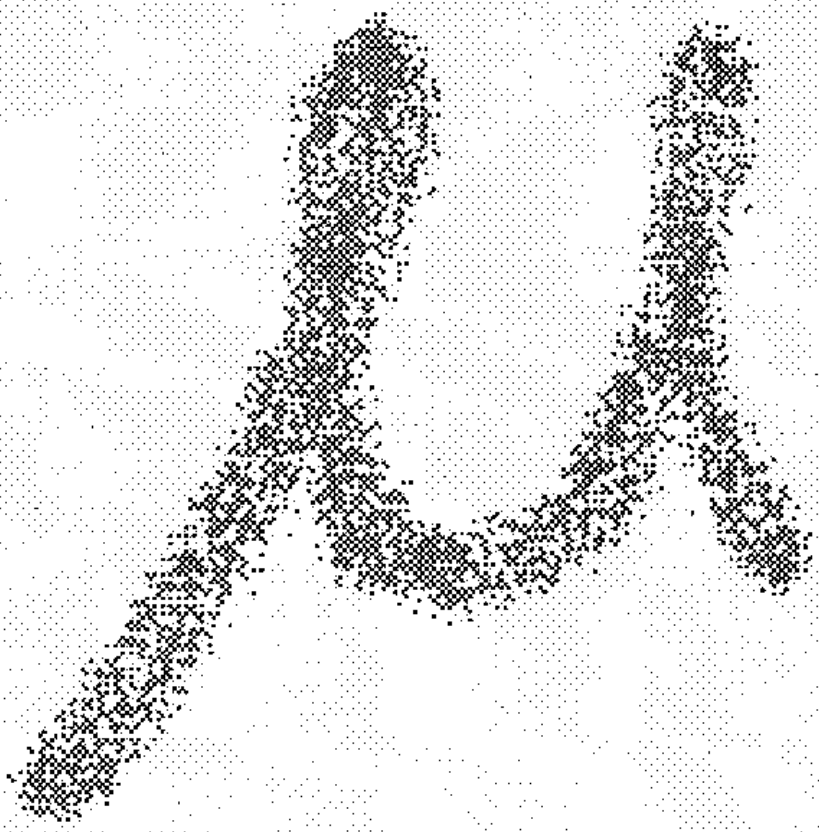
Mewlon-210

Instruction Manual



TAKAHASHI

TABLE OF CONTENTS

Page

I Introduction

Unpacking instruction ——— 3
General Specifications ——— 4
Layout of tube assembly ——— 5
Features of Mewlon-210 ——— 6~7

II Before starting observation

Mounting your Mewlon- 210 ——— 9
Let's view landscapes ——— 10
Visual Back ——— 11~12

III Adjustment

Aligning the finder scope ——— 14~15
Collimating the optical axis ——— 16~17

IV Observation

Visual observation ——— 19~20
Astrophotography ——— 21~23

V For good usage

Accessories ——— 25~26
Care and maintenance for your Mewlon-210 ——— 27
Trouble shooting ——— 28
Photo/Visual system chart ——— 29

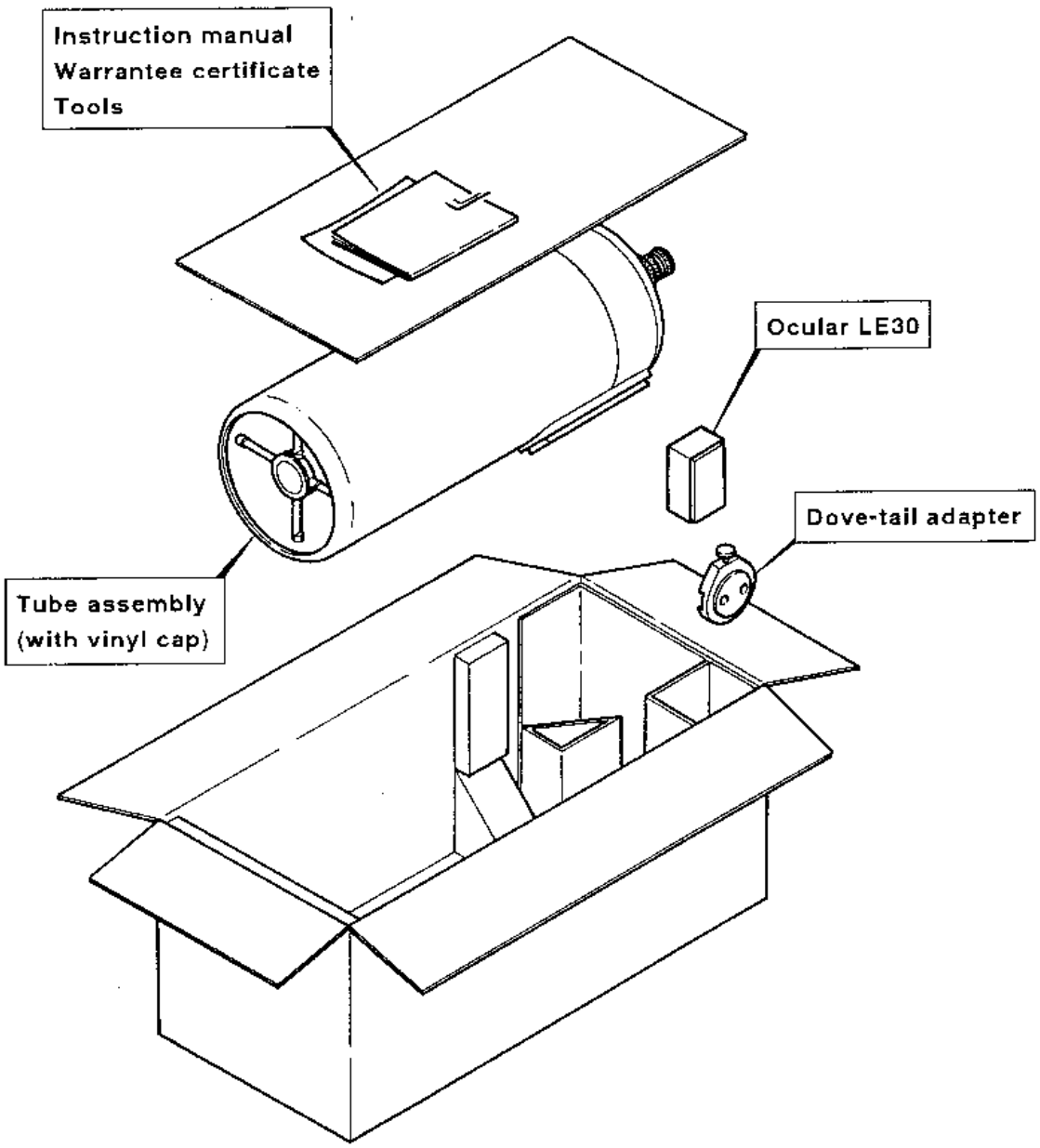
I

Introduction

Unpacking instruction

When unpacking, make sure if all the contents are in order.

Note: An ocular LE30 is provided only with the complete set. When you buy the tube assembly only, it is not included.



General Specifications

Optical System

Configuration ——— Dall-Kirkham
Effective aperture ——— 210mm
Effective focal length ——— 2415mm
Effective focal ratio ——— 1:11.5

1. Primary mirror
   Mirror ——— elliptical surface
   Aperture ——— 220mm
   Focal ratio ——— 1:2.9
   Material ——— Pyrex
   Reflecting plane ——— aluminized mono-coating

2. Secondary mirror
   Mirror ——— spherical surface
   Aperture ——— 65mm
   Magnifying power ——— 4.0×
   Material ——— Pyrex
   Reflecting plane ——— aluminized multi-coating

Optical performance

1. Resolving power ——— 0.55″
2. Light gathering power ——— 900×
3. Limiting magnitude ——— 13.4

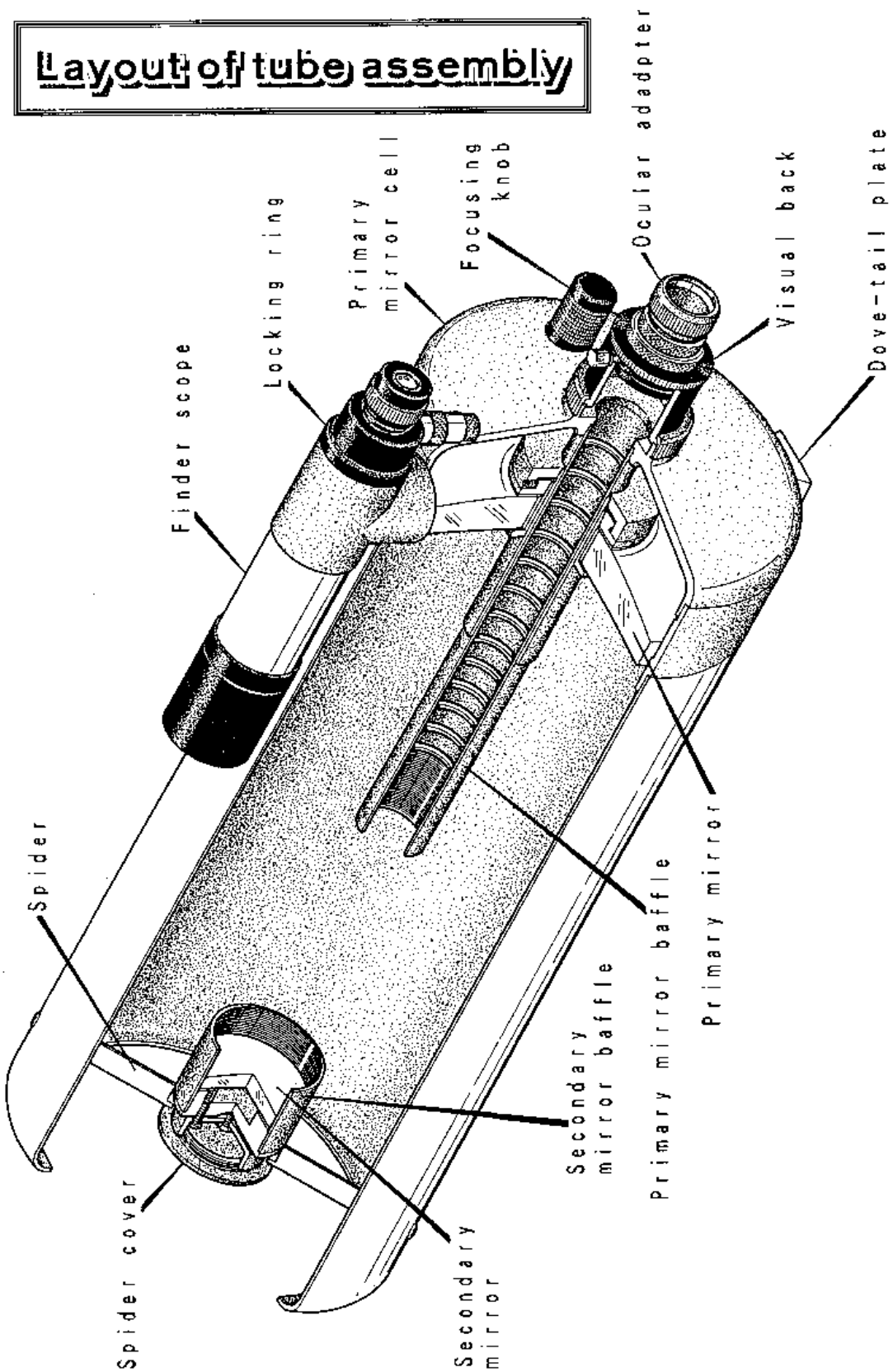
Measurement and weight

1. Diameter of main tube ——— 244mm
2. Total length of main tube ——— 700mm
3. Weight of main tube ——— abt. 8.1kgs

Accessories

Finder scope ——— 7×50 6.3°
(reticle illuminator acceptable)
Dove-tail adapter ——— with M8×16 cap-bolt
Setting tools ——— Allen wrench (1.5mm & 2.5mm)
Instruction manual
Warrantee certificate

Layout of tube assembly



Features of Mewlon-210

Dall Kirkham telescope is one of the Cassegrain optical systems, with a concave elliptical mirror for the primary and with a convex spherical mirror for the secondary. The Mewlon is a new concept telescope that is made in mass production by virtue of the Takahashi's high polishing technology in having made a great number of various non-spherical reflecting optical systems.

Designing concept

The Mewlon-210 is designed mainly based on the visual performance that is the basic function of an astronomical telescope. Therefore, this optical system can be used better for visual observation than for taking deep-sky astrophotograph which reqires sharp images over the wide photo field.
In the view field, this optical system can produce so good images as a Newtonian can do. Therefore, this can be said to be an ideal telescope to do the planetary observation as well as to do the lunar observation. Thus, the Mewlon-210 has been developed as a very compact and highly easy-to-use telescope by simplifying the aim of the use.

Performance

The Dall Kirkham telescope is a well known and excellent optical system from the old times. However, it has been hardly produced as a commercial telescope because of difficulty of making its primary mirror of a concave elliptical surface. The image focused in the center is very sharp without any aberration like as in a Newtonian telescope. The images toward the edge are generally fine within the view field, although it is sometimes said that some amount of coma aberration is visible.

In the astrophotography, especially in highly magnified lunar and planetary photography, you can expect a good result with your Mewlon-210. When it is compared with a traditional Cassegrain telescope, the Dall Kirkham telescope can be easily assembled and aligned in the process of production.
This optical system as a highly precision telescope can maintain stable performance. As mentioned before, it is so suitable expecially for lunar and planetary observation because its long focal length by a spherical convex secondary mirror (a parabolic convex mirror in a Cassegrain) can easily produce high magnification.

Operation

The handling of your Mewlon-210 is so simple. At first, set the dove-tail plate under the main tube into the dove-tail adapter attached on the equatorial mount. The finder is so firmly attached on the tube that you can hold the tube by the finder when you set the tube into the dove-tail adapter.

Your Mewlon-210 is a Cassegrain type so that the length of the tube is far shorter than that of a Newtonian telescope with the same aperture and the same focal length. Moreover, it is very compact and light-weighted, which permits you to use a relatively smaller equatorial mount. Because of this, the whole system becomes totally compact and easy-to-use.

The optical axis alignment can be made with the three screws provided in the secondary mirror section. Once aligned, the optical axis will become hardly out of order except when a great shock is given to the telescope.

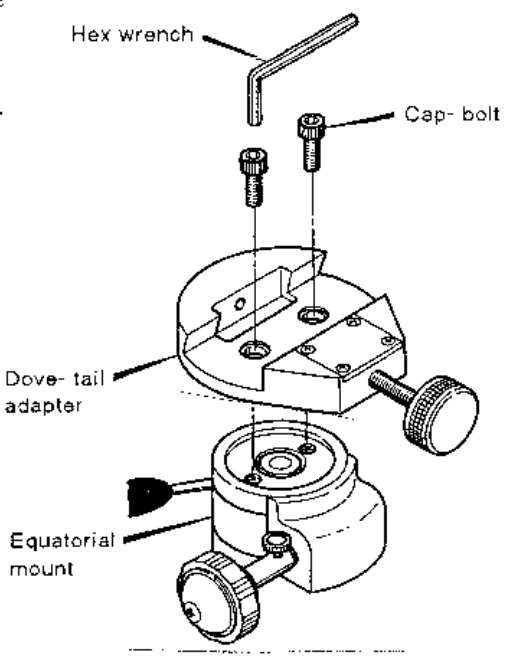
Focusing is made by the mirror shifting method, turning the focusing knob clockwise or counter-clockwise. This system will permit you to focus smoothly with your fingers when a camera is attached on the visual back, without giving an extra load of a camera as in the lack-and-pinion focusing system.

Ⅱ

Before starting observation

Mounting your Mewlon-210

1. In order to attach the main tube on the equatorial mount, set the dove-tail adapter firmly on the mount with two M8 × 16 bolts provided with the adapter.



2. Loosen the clamp of the Declination and turn the dove-tail adapter as shown in the fig.1.

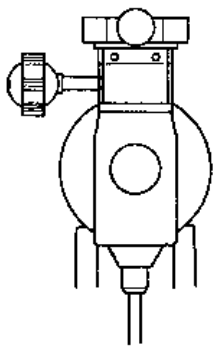


fig. 1

3. The main tube is so designed that it can be carried at ease, holding its finder scope. Hold the tube with one hand and grip the finder scope with the other hand as shown in the fig.2. Set the tube in place, mating the dove-tail adapter and the dove-tail plate. Then, lock the tube firmly with the locking handle.

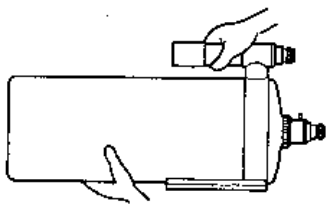


fig.2

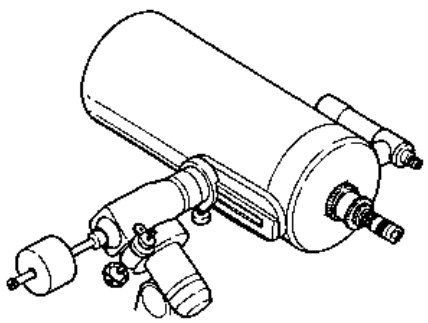


fig.3

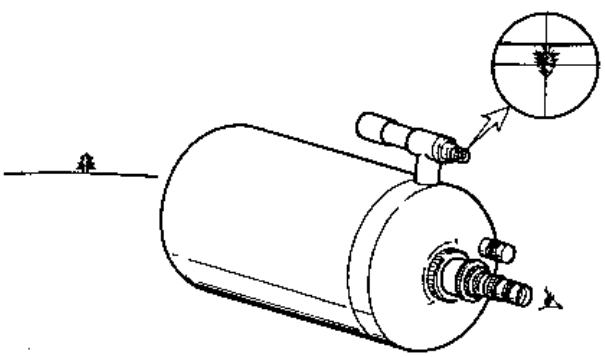
4. Check the balancing of the tube at its horizontal position, making the Declination clamp free and make the balancing of the tube, moving the tube forward and backward on the dove-tail adapter. In visual observation, set the dove-tail plate onto the edge of the dove-tail adapter as shown in the fig.3. Then, the tube will balance roughly. After balancing, set the tube firmly by turning the handle of the dove-tail adapter.

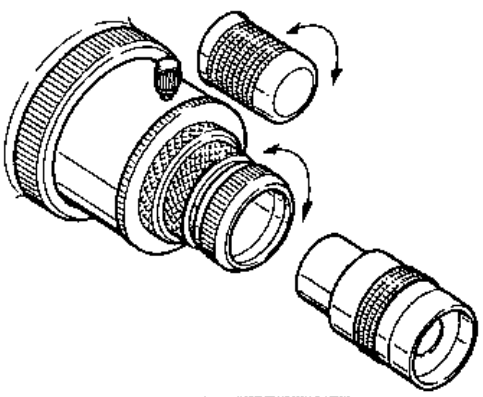
Let's view landscapes

After set-up your telescope, let's start to view landscapes in the daytime before you see some of astronomical objects. This will teach you basically how to use your telescope and equatorial mount. Then, you will be able to enjoy your observation without any trouble actually in the night.

1. Take out the caps of the main tube, of the finder scope, and of the visual back.
2. Make balancing both in the R.A. and Declination. For further details for balancing, refer to the explanation for the equatorial mount.
3. Set the tube to move freely, loosening the clamps for the R.A. and the Declination. Center a clearly visible object in the distance (at least 40m away) at the cross point of the finder reticle, looking at the finder view field and lock the clamps.

When you take a view of land, it is not necessary for you to make polar alignment for your telescope and to use the motor driving.





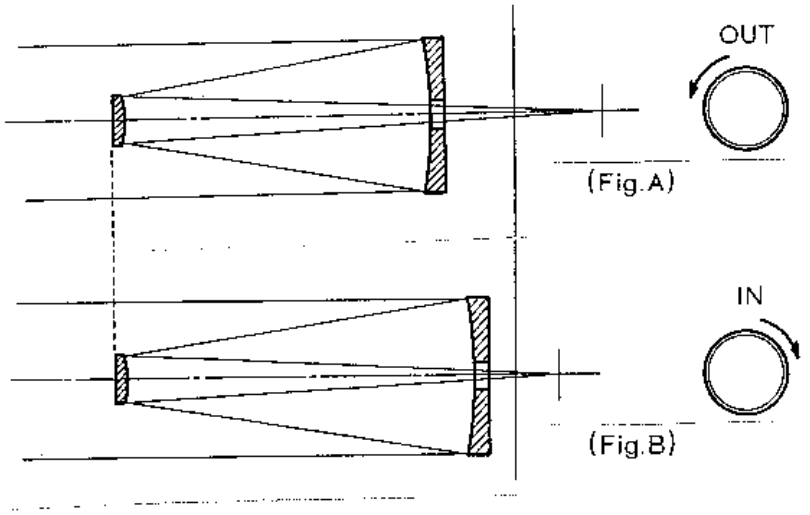
4. Try to view some objects with a low power ocular (an ocular with a long focal length), setting it into the ocular adapter. At first, images in the view field may be seen vague because they may be out of focus. Turn the focusing knob clockwise first. If images are not focused in this way, turn the knob counter-clockwise. Then, the images will be sharply focused. Now, confirm if the object centered at the cross point of the finder reticle is the same one at the center of the view field of the main scope. If not, align the optical axis, referring to the "finder alignment".

Caution : NEVER ATTEMPT TO LOOK AT THE SUN. INTENSE BEAM OF THE SUN WILL BURN YOUR EYE.

Visual Back

Focusing

Focusing of this optical system made by moving the primary mirror forward and backward with the focusing knob. The focal point has relation with the moving direction of the primary mirror as shown in the diagram below.

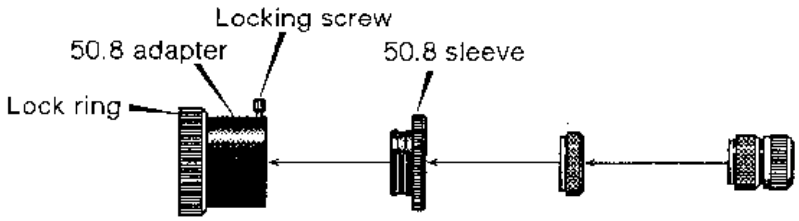


When the focusing knob is turned clockwise(IN), the primary mirror is moved toward its cell and then, the focal point is moved inward. (Fig.B) When the focusing knob is turned counter-clockwise(OUT), the primary mirror is moved toward the secondary one and then, the focal point is moved outward.(Fig.A)

Focusing varies the distance between the primary mirror and the secondary one, making the effective focal length altered. When you calculate magnification, however, you can use the effective length of 2415mm.

How to use visual back (50.8 adapter)

The inside diameter of the 50.8 adapter is 50.8mm (2 ″) so that a 2 ″ ocular can be set. You can set a 2 ″ ocular in and out quickly just by loosening the locking screws of the adapter. The system parts of the visual back are shown in the chart below.



At the inside edge of the 50.8 sleeve, ϕ 43mm thread is provided to connect a prime focus ring and other accessories. The 50.8 sleeve is available as an optical accessory. If you would use the adapter with an accessory, you will be able to set the accessory quickly whenever you like to use it.
A lock ring is provided with the 50.8 adapter. You can turn the adapter, loosening the ring. It is convenient to set the camera angle in astrophotography and to change the viewing angle of a diagonal prism, etc. Be careful not to drop out the 50.8 sleeve with an accessory, loosening too much the locking screw.

III

Adjustment

Aligning the finder scope

The view field of a telescope is so highly magnified and narrow that you can hardly catch, in the view field, the object you like to see. To help you to find the object at ease in the view field of your telescope, the finder scope with wide view field is provided with your telescope.

To see the same object in the view fields of the main scope and the finder scope, you must align the optical axes of the main scope and of the finder scope. They must be parallel each other as shown in the fig.7.
The finder of your Mewlon-210 is so made that it can be used for carrying handle permanently fixed on the main tube. Because of this structure, the optical alignment of the finder can be made by shifting the visual back of the finder with the adjusting screws. Once aligned, the optical axis of the finder will not become out of order.

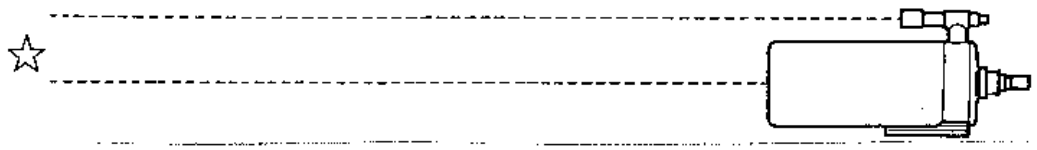
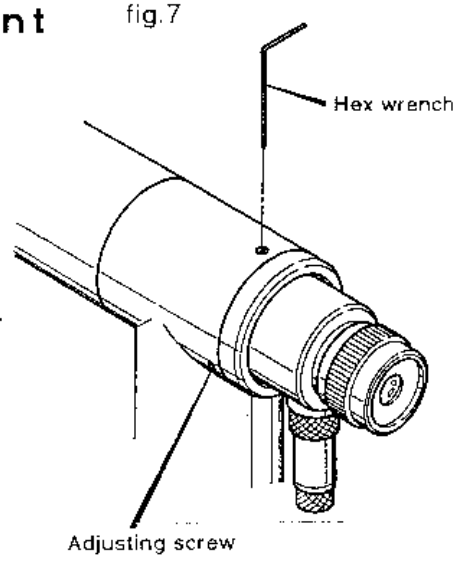
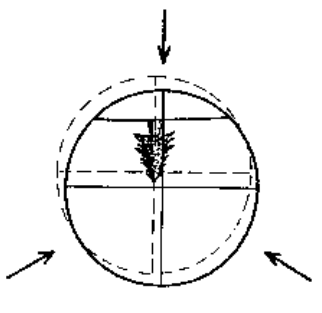


fig.7

The process for alignment

1. Set a low power ocular into the ocular adapter of the telescope and catch, in the center of the view field, the object in the distance of at least 130m away (otherwise not focused).
2. At first, loosen the lock ring and then loosen all three adjusting screws well enough so as to move the visual back freely.
3. Hold the visual back with one hand and adjust the position of the visual back roughly so as to see the object, caught in the center of the view field of the main scope, at cross point of the reticle. Then, fasten the lock ring in half way with other hand.
4. With a hex wrench provided, turn the three adjusting screws and place the object exactly at the cross point. Then, fasten the lock ring firmly to set the visual back in place.





You are now recommended to do these process in the daytime so that you can start your sky watching quickly in the night.

Reticle Illuminator

A reticle illuminator is provided with the 7 ×50 finder scope so that you can easily center the object, seeing the reticle illuminated brightly in red against the dark sky.

Turn the volume knob clockwise and then switch on with a click. Turn further and the illumination becomes brighter. Turn the volume knob reversely counter-clockwise and the illumination is getting dimmer and switched off with a click. Refer to the fig.8. Adjust the brightness of the illumination so as to see the star and the reticle together at ease, looking into the finder scope.

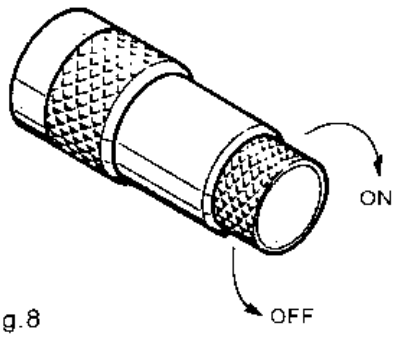


fig.8

Replacing the battery in the illuminator

In case the battery must be replaced, take out the case, turning it counter-clockwise as shown fig.9. Before replacing the batteris, clean the surface of the battery well and put them into the case, checking its polarity. Use two pieces of the mercury cell MR44 H-C (or equivalent). Refer to the fig.9.

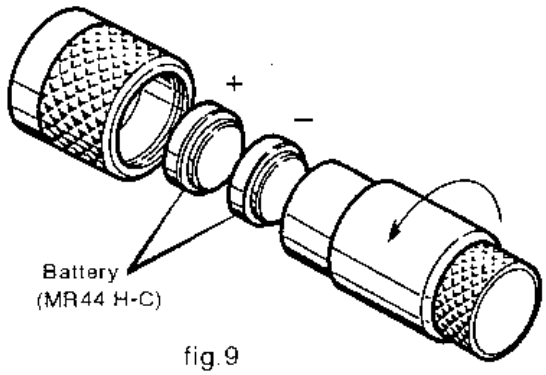


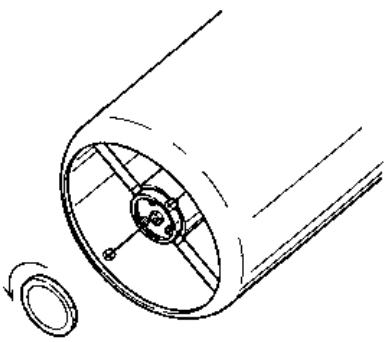
fig.9

Collimating the optical axis

Collimating the optical axis of your Mewlon-210 can be made only at the place of the secondary mirror. Therefore, you will have no such troublesome works as in the Newtonian telescope. The secondary mirror is an expanding optical system so that it is so sensitive to the collimation that a slight movement of the adjusting screw can make the optical axis out of order, resulting in the images degraded greatly.

Your Mewlon-210 was well checked, at the assembly stage in the factory, with the collimator, using the simulation star image. Its optical axis has been completely adjusted before shipment. The optical axis of your telescope is very hard to be out of order, once collimated, but it might be out of order during transportation. Therefore, in order to use your telescope in its best condition, you have to keep always its optical axis well collimated.
Before you start to do your astronomical observation, never fail to check if the optical axis is in order. If it should be found out of order, do the collimation mentioned as follows. You should make the collimation after your telescope is left in the outside for more than one hour, actually seeing the star.

1. Select a star brighter(mag.2 ~3) and higher in the sky and center it at the view field. When defocused in and out from the focal point, the inner and outer images are seen such the diffraction rings as shown in the fig.10. If the optical axis is correctly adjusted, the center dot, the inner ring, the intermediate ring, and the outer ring, all form a concentric circle in the inner and outer images. In case the optical axis is out of order, the center of the circle is seen off. Then, correction is required. (When the focusing knob is turned to 'OUT' position from the focal point, you can see the inner image. Toward 'IN' position, you can see the outer image.)



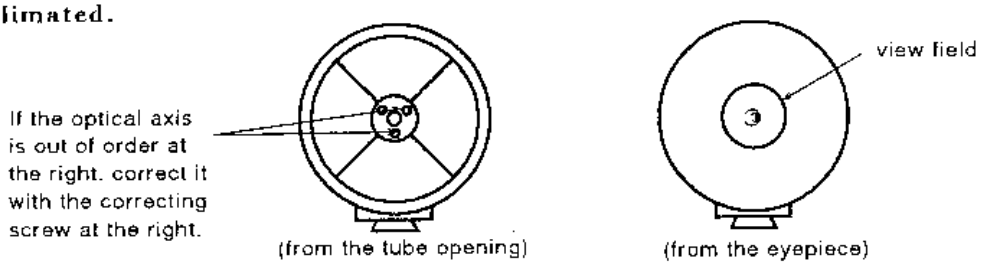
Collimated	 Diffraction pattern	 Pre- focus	In focus
Decollimated			

fig.10

2. To collimate the optical axis, adjust three correcting screws by 2.5mm hex wrench provided.

The three correcting screws are provided on the secondary mirror holder plate. When the optical axis is out of order as shown below, adjust the screws at the right(fig.11), slightly loosening the other screws first and then tightening the screw. When the adjusting screws are positioned like in the fig.12, adjust the two screws at the right side with the same procedure.

If the optical axis is corrected too much to the other side, slightly loosen the other screws and then tighten the screw. Repeat this corrective works until the optical axis is centered. When the center dot, the inner, the intermediate, and the outer rings are all seen in a concentric circle even when a star image is defocused largely, the optical axis is perfectly collimated.

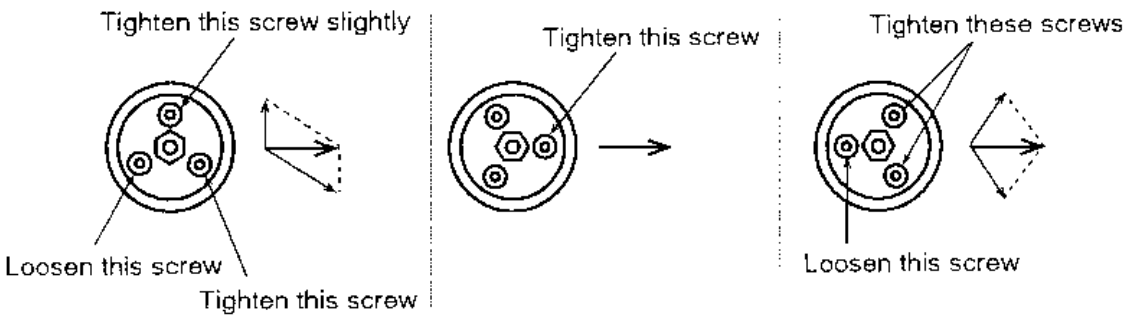


*If all three screws are loosened too much in a time, the secondary mirror might come out. So, loosen these screws little by little with care. Before you finish your correcting works, make sure of all the screws being well tightened, keeping the secondary mirror attached firmly in place.

*Sometimes a star image goes out of view field, if the screws are moved. When a star image goes out of the center during your corrective works, continue your works, replacing the star image at the center.

*The center of the diffraction ring might hardly be seen by the center obstruction of the secondary mirror.

*The correcting screws are not always positioned at the direction of off-centering of the optical axis. Refer to the diagram below, where the examples how to adjust the correcting screws are shown.



Ⅳ

Observation

Visual Observation

Your Mewlon-210 is highly capable for a wide range of observing the moon, planets, star clusters, and nebulae, but NOT suited for solar observation.

In order for you to use your telescope at its best performance, you are recommended to operate your telescope in the nights when seeing is fine and after your telescope is well adapted to the outside temperature.

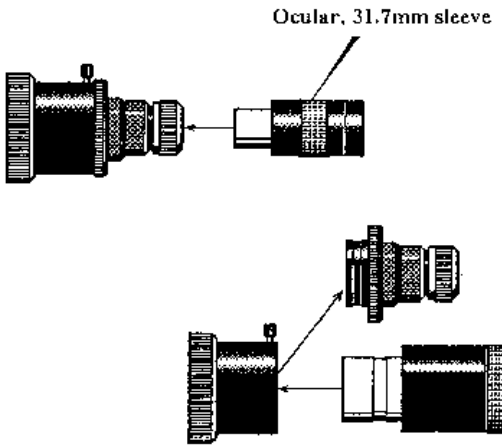
1. Magnification

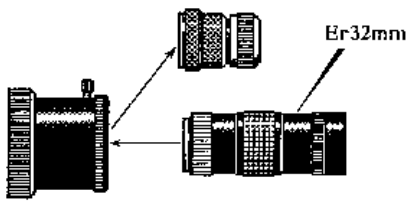
Magnification can be obtained with the following formula.

$$\frac{\text{(the focal length of a telescope)}}{\text{(the focal length of an ocular)}} = M$$

Therefore, the shorter the focal length of an ocular is used, the higher the magnification becomes. Reversely, the longer the focal length of an ocular is used, the lower the magnification can be obtained. It is said in general that the upper limit of the magnification is 20 × to the aperture in 'cm' of a telescope and the lower limit is 1.4 × to it. The former is the highest effective magnification and the later the lowest effective magnification. Therefore, the highest effective magnification of your Mewlon-210 will be 420 × and the lowest 30 ×.

The focusing of this optical system is made by moving the primary mirror forward and backward so that the distance between the primary mirror and the secondary one varies according to the focal point, altering the focal length. When you calculate the magnification of your Mewlon-210, however, you may use the basic effective focal length of 2415mm. For example, the magnification of your Mewlon-210 will be 80.5 × when you use LE30mm ocular.





2. Lunar Observation

The moon is an ideal target to observe by beginners to well-experenced amature astronomers. When you see the whole of the moon, it is suitable for you to see it at about 50 × magnification by LE50mm or Or40mm oculars from TAKAHASHI.

The moon near its full phase has a considerable amount of the light, which might harm your eye, if you will continue your observation for a long time. Be careful not to see such moon for a long time through your telescope.

There are a lot of craters and valleys on the moon. To view these complicate lays of the moon land will give you a pleasure. To observe it in detail, you are going to do it at higher magnification of 10 × to the aperture(cm) of your telescope. With your Mewlon-210, the ideal magnification to observe the moon will be 210 ×. Use the LE12.5mm ocular. When the "seeing" is fine, try to view the moon at the highest effective magnification. (by the LE5mm ocular) Then, you will be able to see more in details of the craters and the lays which you have not noticed yet on the moon.

3. Planetary Observation

It must be necessary for you to observe planets only when the seeing is fine, because you must see the very small images of the planets at the highest effective magnification by your telescope.

When the seeing is extra fine, try to observe the planets at the higher magnification than the highest effective magnification. Then, you will find something different of the planets. On the contrary when the seeing is no good, you had better try to view the planets at lower magnification, which sometimes give you better images of the planets.

4. Observation for nebulae and star clusters

When you like to observe nebulae and star clusters, use low power oculars, which make the view field wider and brighter suitable for your observation for nebulae and star clusters. To observe globular clusters and galaxies with very small view-diameter, use high power oculars. Under the light-polluted sky, observe these faint objects at higher magnification, which sometimes give you better images.

Astrophotography

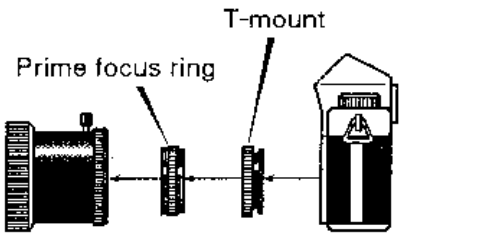
Besides visual observation, your Mewlon-210 will give you another pleasure to take the photos of various objects in the night sky. To make the best use of your Mewlon-210, read the following instruction very carefully, referring to the system chart illustrated in order.

1. With the prime focus

This is a method to take the photo of star images on the film placed at the focal point. In other words, your telescope can be used like a tele-photo lens.

When you take a deep-sky photo with the prime focus, you need a long time exposure because of the long focal length and slow focal ratio. Therefore, you have to use a heavy duty and highly accurate mount. Moreover, a super sensitive film may be required to make the exposure time shorter. Then, you will be able to obtain a good result in your astrophotography.

As the image of the moon can be taken on the film as large as 1/10th of the focal length, the image of the half moon will be just taken vertically on the 35mm film. Taking astrophotograph with the prime focus, use a 35mm camera which can be set to the visual back of your telescope with a TSC Prime Focus Ring and a T-mount.



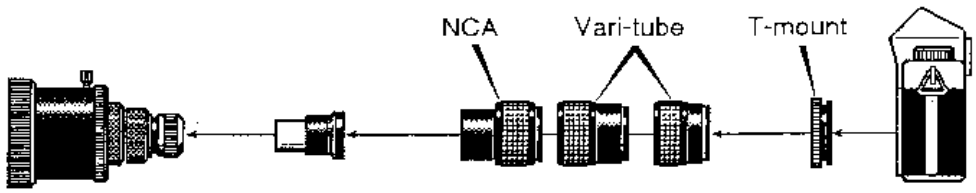
2. **Magnified Astrophotography with oculars for the moon and the planets**

When you like to take the photo of the craters on the moon and the planets, you need to use the optional parts mentioned below because the scale of the image to be taken with the prime focus is too small.

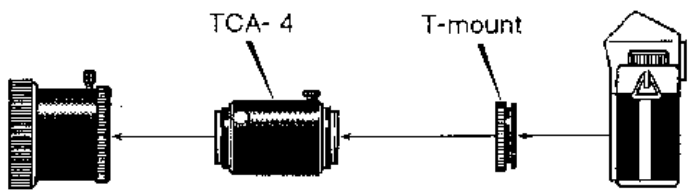
In case of the planets, you must determine the magnification to have the image of the planets as large as 1mm on the film. If the amount of light of a planet is large enough, make magnification as high as possible. The exposure time must be set for less than 5 seconds for less failure of your photographing. In case of the moon, you can enjoy a wide variation of your photographing with a wide selection of the magnification.

When the seeing is no good, you can not expect to take a good photo either of the moon or the planets. Before starting to take the astrophotos, make sure of the seeing condition in your visual observation. Recently, various kinds of films are available in the markets. So try to use as many of them as possible to obtain the best result of your astrophotographing.

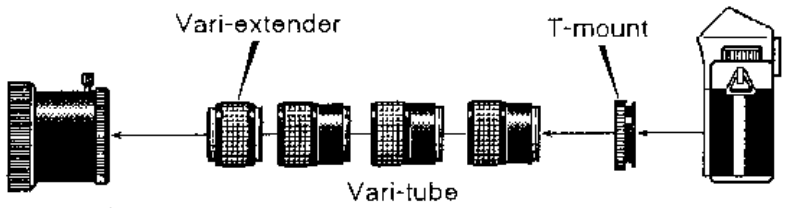
a. **NCA** Camera Adapter (for ϕ 24.5mm ocular only) is an adapter for taking magnified photographs and it can be attached to the visual back as illustrated below. Magnification can be changed with a combination use of its vari-tube and an ocular. It can be attached to a 35mm SLR camera with a T-mount.



b. **Camera adapter** (TCA-4) is an adapter for magnified photographing usable with ϕ 24.5mm oculars and ϕ 31.7mm oculars in common. You can change your visual set-up to the photo set-up quickly with this adapter. Also you can change the ocular in the adapter quickly to another one. Magnification can be altered as you like by sliding the magnifying tube. This adapter can be attached to a 35mm SLR camera with a T-mount.



c. **Vari-Extender** is also usable for magnified photographing. This is an optical system that can extend the focal length of your telescope and can change the magnification with its vari-tube. It is suitable for use to take the moon at the middle magnification. It can be attached to a 35mm SLR camera with a T-mount.

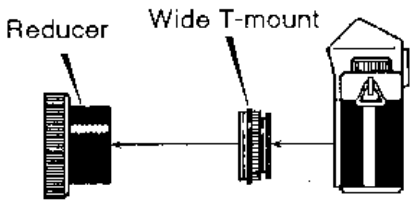


3. Photographing with the reducer

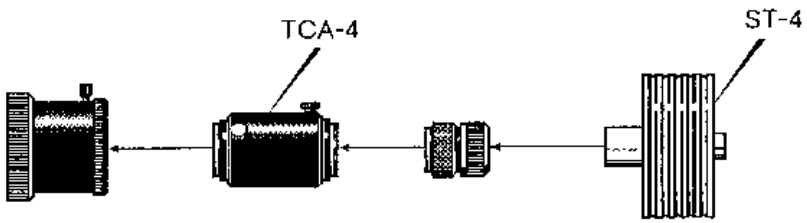
When you like to take deep-sky photography, use the reducer optionally available. This reducer makes the focal length shorter and the coma aberration lesser, permitting your telescope to be suitable for taking the photos of galaxies and planetary nebulae, etc. It can be attached to a 35mm SLR camera with a T-mount.

Optical specification when the reducer is used.

Effective focal length	1955.5mm
Effective focal ratio	1:9.3
Actual photo field	1.2°
Image circle	ϕ 39mm



4. CCD image camera



An ST-4 can be connected as shown in the above.

V
For good usage

Accessories

For a wide variation of the photo/visual applications, you can use a number of TAKAHASHI accessories with your Mewlon-210.

◆**Star Diagonal Prisms**

When you see some objects overhead in the sky, with an ocular setting it directly to the adapter, you have to look into your telescope at awkward pose. These prisms, available in three types, permit you to observe at confortable pose, bending the light pass at 90°.

1. Small size for ϕ 24.5mm oculars
2. Middle size for ϕ 31.7mm oculars
3. Large size for TAKAHASHI Or40mm and Er32mm oculars

Ocular adapters are available in two types.

1. For ϕ 24.5mm oculars
2. For ϕ 31.7mm oculars

No.2 adapter is provided with your Mewlon-210.

◆**T-mount** is necssary to connect your camera to the visual back of your Mewlon-210, when you are going to take an astro-photo. A number of the T-mounts are available for Canon, Canon EOS, Nikon, Olympus OM, Minolta, Minolta α, Pentax-K. When you need a T-mount for your camera, specify the name of your camera.

◆**NCA** is a simple adapter for a camera to take a magnified photo. Refer to the section of the astrophotography and to the photo/visual system chart.

◆**Camera adapter** (TCA-4) is another adapter for a camera convenient to take a magnified astrophoto. It can be used with ϕ 24.5mm and ϕ 31.7mm oculars in common. Refer to the section of the astrophotography on how to use it.

◆**Wide T-mount** is used with a 35mm SLR camera when taking deep-sky photograph withe the reducer. If you have a T-mount, you can have a wide T-mount just by exchange of an inner ring. Specify the name of your camera, if you like to make your T-mount to a wide T-mount.

◆**Prime Focus Ring** is available for taking astrophoto of images produced at the prime focus. Refer to the section of astrophotography.

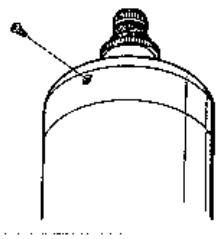
◆**Reducer** is optionally available for taking deep-sky photograph. It makes the focal length shorter and the coma aberration lesser. It needs a wide T-mount to connect it to a 35mm SLR camera. Refer to the section of the astrophotography.

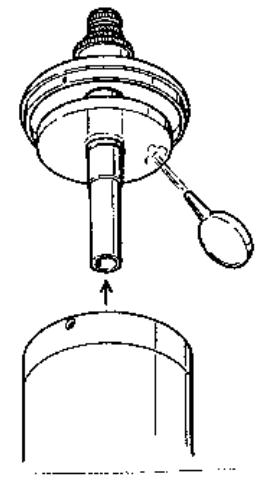
◆**Projection Oculars** are available in two kinds: PJ-20 and NP-12.
These oculars are suitable for taking the magnified photos of the moon and the planets.

PJ-20 with 20mm focal length is not suited for visual observation.
NP-12 with 12mm focal length is very good for visual observation with its excellent capability of reducing coma aberration.

Care and Maintenance for your telescope

The primary mirror of your Mewlon-210 is exposed directly to the open air. If the surface of the mirror is left covered with dusts and dew, it will become dim and make the contrast of images worse. With the following procedures, clean up dusts from the surface of the mirror by a blower at the regular interval. When you set the tube back on to the mirror, set it precisely in place with the cell. Then, the optical axis will be hardly out of order.





Caution: The space between the outer edge of the primary mirror and the inner face of the tube is so small that great care must be taken not to hit each other when you take out the primary mirror.

1. Stand the tube assembly with its opening to the bottom on the level place.
2. Holding the visual back to stand the tube safely, take out the cell cap and three screws fixing the primary mirror cell.
3. Pull up the primary mirror slowly with great care not to touch the mirror on the inside wall of the tube. Especially watch these screw heads on the lower ring of the tube. And make sure of the long baffle tube coming out completely from the tube. When the cell is tightly set, draw it very slowly with great care.

Note:

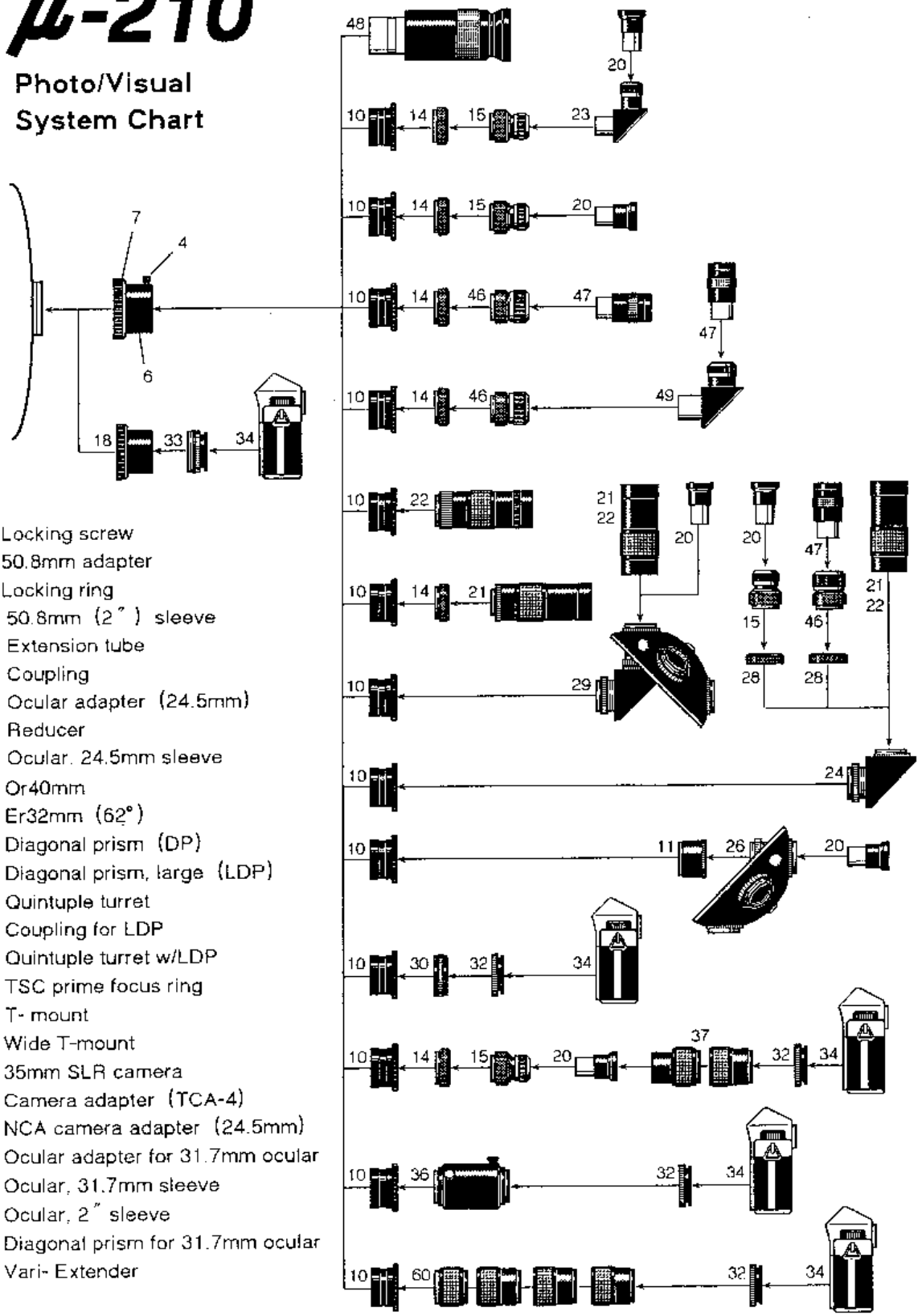
1. After used, put the caps on to the opening of the tube and the visual back to shut out dusts.
2. When the tube well cooled in the outside is brought into the warm room, dew will sometimes form on the inside wall of the tube. Therefore, bring the tube into the room after it is closed up tightly with the cap.
3. Dirt on the tube can be cleaned with car wax.
4. When the primary and the secondary mirrors become cloudy in white, they must be cleaned up or plated again. Ask the dealer for repair.

Trouble Shooting

Symptoms	Check	Action
Nothing can be seen.	Is the cap taken out?	Take out the cap.
	Is the ocular set in?	Nothing can be seen without the ocular. Set the ocular in the ocular adapter.
	Is not dew formed cloudy on the surface of the mirror or the ocular lens?	Do not try your observation in such places as grassy area and liver side where there may exist high humidity. If could not, make anti-dewing inside of the tube.
	Is the finder aligned?	If the finder is not aligned with the main scope, the desired object will not be caught in the view field. Do alignment at first.
	Is the telescope focused?	Focus with the focusing knob.
Star images are seen fuzzy.	Is not dew formed on the surface of the mirror or the ocular?	Dry out the dew, sending the wind with a fun and the like. Do not use hot air.
	Do you use your telescope in good combination?	Check the system chart and use the parts correctly as shown.
Star images are seen deformed.	Have your telescope adapted well enough to the outside air?	Use your telescope after it has been adapted to the air for at least one hour.
	Is the optical axis well collimated?	Collimate the optical axis correctly.
	Is the atmosphere stable?	Do not try your observation in such a night when scintillation and seeing are no good.

μ-210

Photo/Visual System Chart



4. Locking screw
6. 50.8mm adapter
7. Locking ring
10. 50.8mm (2″) sleeve
11. Extension tube
14. Coupling
15. Ocular adapter (24.5mm)
18. Reducer
20. Ocular, 24.5mm sleeve
21. Or40mm
22. Er32mm (62°)
23. Diagonal prism (DP)
24. Diagonal prism, large (LDP)
26. Quintuple turret
28. Coupling for LDP
29. Quintuple turret w/LDP
30. TSC prime focus ring
32. T- mount
33. Wide T-mount
34. 35mm SLR camera
36. Camera adapter (TCA-4)
37. NCA camera adapter (24.5mm)
46. Ocular adapter for 31.7mm ocular
47. Ocular, 31.7mm sleeve
48. Ocular, 2″ sleeve
49. Diagonal prism for 31.7mm ocular
60. Vari- Extender