Fluorite Apochromat

FS-102NSV

INSTRUCTION MANUAL

TAKAHASHI

Table of Contents

SPECIFICATIONS

Effective Aperture	102mm
Focal Length	820mm
Focal Ratio	1: 8.0
Focal Length with reducer	610mm
Focal Ratio with reducer	1: 6.0
Resoving Power	1.14"
Limiting Magnitude	12.0
Light Gathering Power	212X
Image Circle with reducer	ϕ 51mm
Photographic Field with reducer	4.8°
Diameter of Main Tube	156mm
Total Length of Main Tube	880mm
[When the lens shade is retracted]	740mm
Weight of Main Tube Assembly	abt. 4.6kg
Finder Scope	7x50 6.3°

Tube Assembly Layout

FS-102NSV

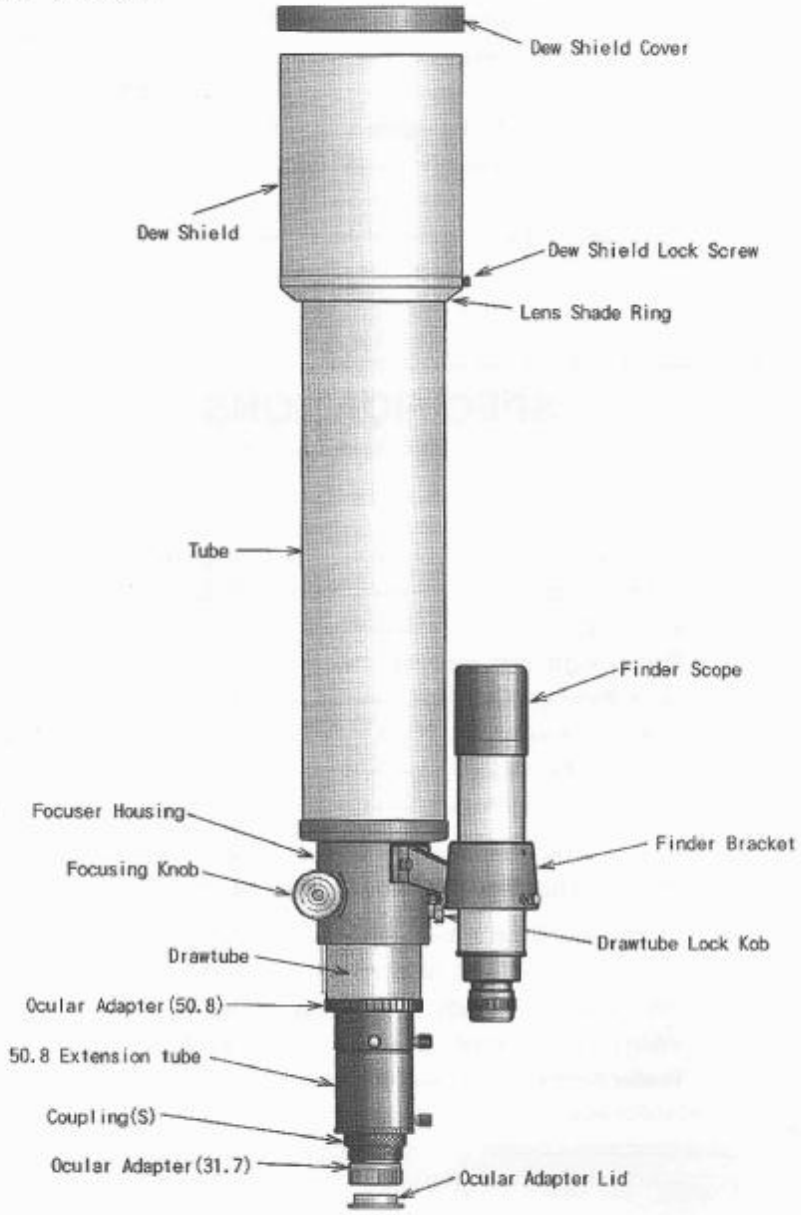


Fig.1

Attaching The Finder And Tube Assembly

Your telescope is shipped with the finder unattached. Use the following instruction to assemble and align the finder.

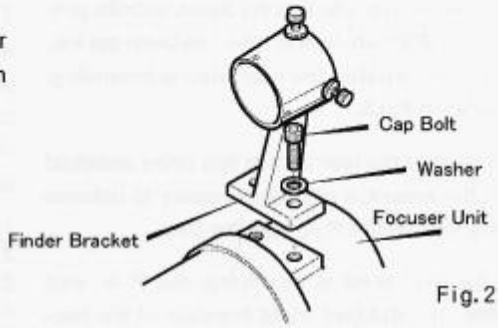


Fig. 2

■ Attaching The Finder Scope

Place the finder holder leg on the finder base on the tube assembly and lock it firmly with two cap-bolts provided. Set the finder as parallel to the tube as possible. Failure to do so will make alignment difficult.

The cap screw covers the threaded hole for the reticle illuminator, which provides for easier centering of objects in the main telescope. Refer to the Fig.2,3.

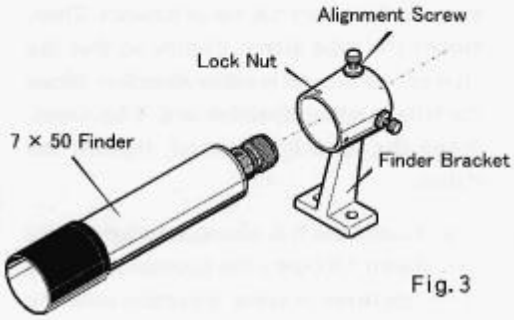


Fig. 3

■Setting the main tube assembly onto the equatorial mount

Set the tube holder onto the head of the mount with two cap-bolts as in the Fig.4 and lock the tube with a lock nut after balancing the tube. The tube holder can be used with all Takahashi mounts. If astrophotography is one of uses, the heavier duty the mount, the better.

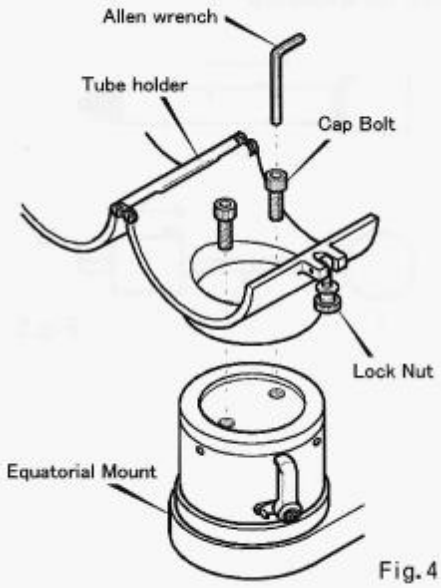


Fig. 4

The correct way to attach the tube holder to the mount is to use the two cap bolts provided. After an optical tube has been set into the tube holder, the next step is balancing. Refer to Fig.5.

Now that the instrument has been attached to the mount, it will be necessary to balance the load in the R.A. and the Dec.

The first step is to clamp the R.A. and unclamp the Dec. Hold the tube of the telescope in the event it is out of balance. Then, loosen the tube clamp slightly so that the tube can be moved in either direction. Move the tube in either direction until it balances. When the tube is balanced, tighten the clamp.

Next, loosen the R.A. clamp, and tighten the Dec. clamp. Unclamp the counter-weight(s) and slide them in either direction until the package is balanced.

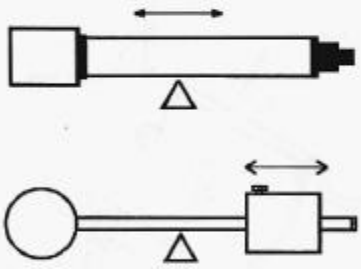


Fig.5

● How To Retract The Lens Shade

The Lens Shade of the FS-102NS is retractable. When the FS-102NS is to be transported, retract the lens shade until it rests on the satin chrome ring installed in the tube assembly for that purpose. The shade can be extended when the FS-102NS is used.

1. Remove the cap of the dew shield.
2. Loosen the two lock screws.
3. Extend the dew shield.
4. Turn the locking screws until they make contact.

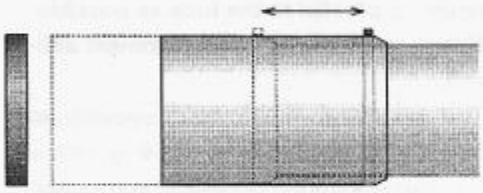


Fig.6

[Caut ion]

Remove the lens shade cap before moving the Lens shade. The fit is tight enough to blow the lens shade cap off of the Lens shade and it allows the lens shade to move easier.

■ Compression Ring

Remove the ocular adapter cover after the locking ring has been loosened by turning it counter clockwise. Then, insert the desired ocular or 31.7 diagonal into the adapter and tighten the ocular ring by turning it clockwise.

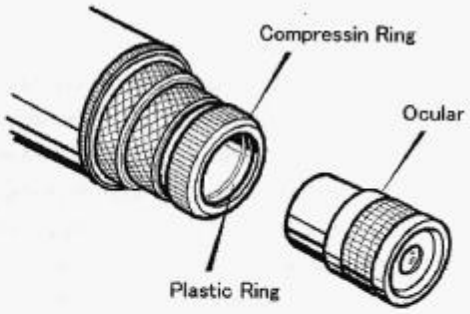


Fig. 7

■ Connection the System Parts

The adapters and the rings are provided on the visual back to connect various system parts. Carefully study the system chart in this book before connecting any system parts. Connection of the incorrect parts may prevent the telescope from coming to a sharp focus or any focus at all. Refer to the Fig. 8,9 for a standard connection.

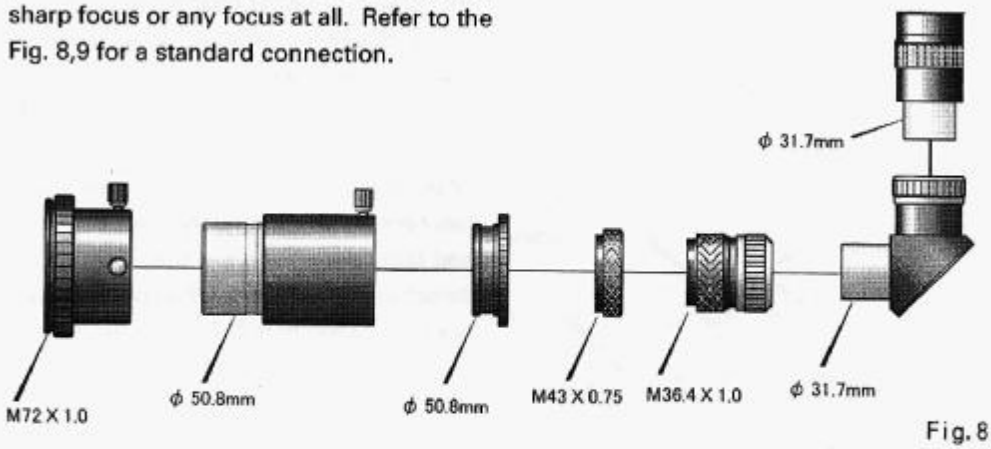


Fig. 8

■ Focusing

After inserting the ocular into the telecope, it is necessary to achieve the best possible focus. Remember the atomsphere will limit the highest magnification that can be used on any given night. Using the lowest power ocular; focus the image and then increase the magnification by using shorter and shorter focal length oculars until the desired magnification is reached. This procedure allows the centering of an object at high magnification. Please familiarize yourself with the following.

● Focusing System

The FS-102NSV uses a rack-and-pinion focusing system. This system permits rapid focusing. By turning the focusing knob clockwise, the focuser will move out and by turning the knob counter-clockwise, the focuser will move in. Refer to Fig.10.

Remove the lens shade cover and the aluminum plug from the 31.7mm compression ring adapter. Insert the diagonal into the compression ring adapter. Carefully tighten the compression ring until it begins to make contact with the barrel of diagonal. It is not necessary to overtighten the ring to hold the diagonal.

Then insert the ocular into the compression ring of the diagonal, repeating previous process. Be careful not to overtighten the compression ring.

Begin the focusing process by choosing a bright star in a covenient position. When you think that you have achieved the best focus, move the focuser inside and outside of what you think is the best focus. This will confirm the critical procedure.

Begin with a low power ocular and then proceed higher and higher until the desired magnification has been achieved.

When the best focus at high magnification has been achieved, you may notice a bright and dim ring around the star. This is not a defect but rather a diffraction pattern which is an indication of diffraction limited optics.

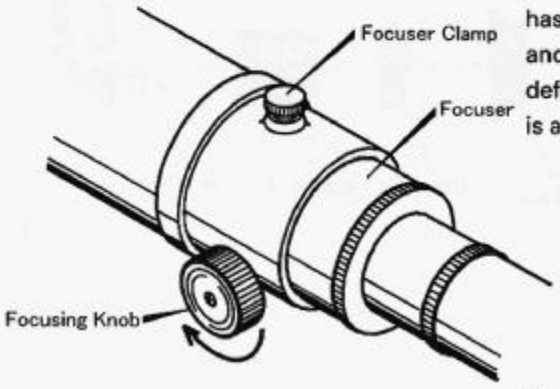


Fig. 9

Finder Alignment

Fig. 10

Before the finder is placed in the finder holder, use plastic clear tape and tape the finder with two layers to prevent the tube from being scratched by the front finder set screws.

A finder is a useful tool. It permits the precise centering of an object in the field of view. The 6.3° field of view allows the easy centering of an object to be viewed or photographed.

The Takahashi finder uses an interrupted crosshair which is designed to allow the easy centering of an object to be photographed or observed. The wide field of the finder makes the finding of an object easier, therefore, it is important that the finder and the telescoep be in alignment. The following procedure can be used to align the finder.

◆ Alignment Procedure

1. Place a low power eyepiece in the telescope and center a bright star in a convenient part of the sky. Do not forget to engage the motor drive to keep the star centered. If this procedure is done in daylight, use an object that is at least one mile away. Loosen the lock nuts on the finder bracket and slightly move the star to the center of the field using the adjusting alignment screws.
2. Then use a higher magnification eyepiece and repeat the procedure by centering the object in the field of view of the telescope and then the finder. Continue this process until the highest possible magnification has been used.

◆ Adjusting Screw Procedure

1. Turn all the lock nuts until they reach the head of the alignment screws.

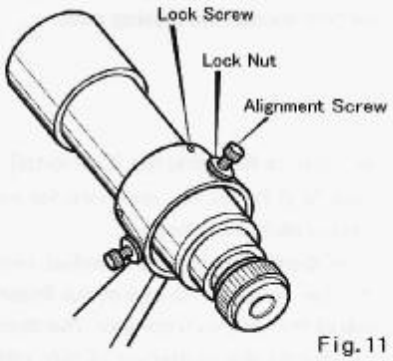


Fig. 11

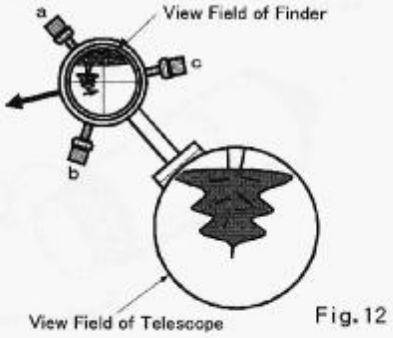


Fig. 12

2. In order to move the crosshair in the direction of the arrow, first loosen screw (a) and tighten (push) the finder with screw (c). This procedure will move the crosshair in the desire direction. The top of the finder will move in the opposite direction and the object will move in the direction of the smaller arrow. Refer to Fig.12.

3. In a similar fashion the direction of the movement of the finder is made by adjusting the three screws.

Learn the relationship between the movement of the three adjusting screws. If the finder cannot be moved in the desired direction, loosen the locking nuts.

◆ Reticle Illuminator [Optional]

The 7x50 finder has provision for an optional reticle illuminator.

If an illuminator will be installed, remove the cap screw at the end of the finder and install the reticle illuminator. The illuminator makes the centering of dim objects easier.

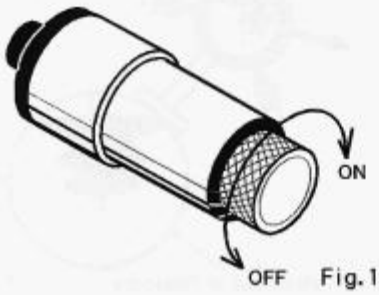


Fig. 13

In order to turn the illuminator on, turn the knob clockwise. The knob will click when the illuminator turns on. As the knob is turned, the reticle will brighten. Adjust the knob to the desired brightness. Turn the knob counter-clockwise past the click to turn the illuminator off. Refer to Fig.13.

◆ Replacing The Battery

Before changing the batteries in the illuminator, please be certain to turn it off. Unscrew the battery holder as shown in Fig.14. Remove the old batteries and insert new one after they have been wiped with a clean dry cloth. Check the polarity of the batteries before inserting them into the holder. Use two silver [V76-PK] or equivalent batteries.

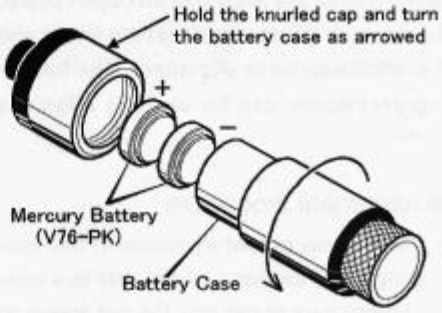


Fig. 14

Observation

■ Visual Observation

◆ Determining Magnification

The magnification of any ocular used with the telescope can be calculated by using the following fomura.

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

Therefore, shorter focal length eyepieces will produce the higher magnification. On a night of very good seeing, the FS-102NSV telescopes can be used at 100X per inch of aperture, and on some nights of exceptional seeing, 120X more. These rare nights of exceptional seeing will reveal fine planetary filaments and small craterlets on the moon. At the lower end, about 10X per inch or so will produce breathtaking wide field view of nebulae and comets.

◆ Compression Ring Star Diagonals

A 90° diagonal prism is optionally available from Takahashi. This permits easy viewing of objects at the zenith. The 31.7 standard diagonal prism is set into the compression ring adapter at the end of the telescope and then the ring is tightened just enough to hold the diagonal prism. Then, the ocular is placed into the compression ring on the prism and held by the same procedure.

◆ Lunar observation

The Moon is an excellent object for beginners and advanced amature astro nomers as well. The entire Moon can be viewed at about 50X, but on clear night near full Moon, it is best to use a 58 green, 3N5 or variable polarizing filter to view the entire disk.

Using higher magnification on the Moon is any phase to see detail will allow the observer to see smaller and smaller detail, ray structures, and rilles. For this type of observation the filter is normally removed because as the magnification goes up, the image brightness decreases. The ultra high contrast images produced by the FS-102NSV will amaze the observer.

In order for the observer to enjoy a variation of magnified observation without troublesome attaching and detaching oculars, 5-turret ocular holder is optionally available. Refer to the system chart.

◆ Planetary observation

The FS-102NSV refractors are particularly suited for planetary observation. Their ultra high contrast and sharp images will reveal a wealth of detail.

Good nights of planetary observation require the steadiest of seeing. View a star at the zenith, and see how much the image appears to twinkle. If the star twinkles a

good bit, the planets will look good at relatively low magnifications. On the other hand, on nights when the twinkle is almost gone, push the instrument up to and past the 100X per inch. Also these good nights will produce amazing photos, especially if Fuji Velvia film is used. First rate images have been produced at effective focal ratios of f/15 or more.

◆ Observation for nebulae and star clusters

In general, observing nebulae and star clusters requires a low power, wide field ocular which will take advantage of the telescopes light gathering power. On the other hand, observing globular clusters and small neburae requires high magnification. This is particularly true in cities with high sky brightness. High magnification will help reduce the sky background and hence improve the contrast necessary to view the object(s).

■ Astrophotography

Focus is the most critical part of any astrophoto. Once critical focus has been achieved, then a fine astro photo can be made. Serious astrophotographers will always recheck critical focus before each photo is made.

◆ Eyepiece Projection Photography

When you want to take photos of the planets or the Moon, the TCA-4 is designed to make this easier.

When the image of the planet is properly illuminated, then increase the magnification to the limit of the seeing.

◆ Seeing

It is important that high magnification images of the Moon and planets require good seeing. The method for determining the quality of seeing on a scale of 1 to 10, with 10 being perfectly steady seeing is to look to the zenith at a bright star. If it is twinkling rapidly, the seeing is between 1 to 4. If the twinkling is moderate this is 5-6. If the star twinkles slowly to no twinkling, we have the 7 to 10 night. The less twinkle the better.

⚠ Cautions

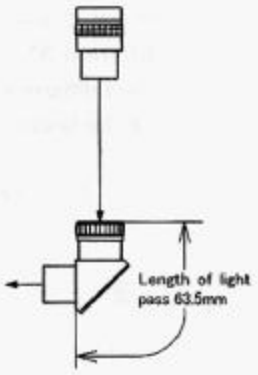
When taking high magnification photographs of the Moon and planets, pay careful attention to balance. Rebalance the telescope when the object is placed in the center of the camera.

If the telescope is moved to another object, then rebalance it in the position in which the photos will be taken. Do not use the camera shutter; use the "hat trick" a black card place over the lens shade before the shutter is set on bulb. After the vibration has stopped, remove the black card for the duration of the photo, which will normally be in seconds.

Accessories for Photo/Visual Application

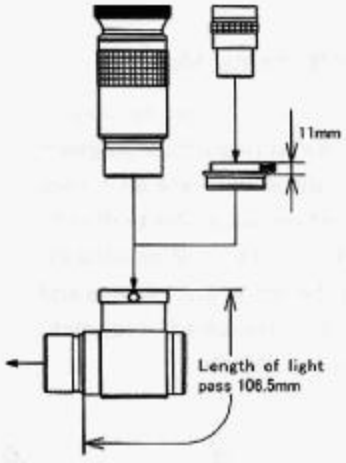
■ 31.7 Compression Ring Diagonal and Mirror Diagonal

Both of these diagonals take up different back focus. This is noted on the diagram. The 31.7 prism diagonal will require the focuser to be racked out further.



31.7 Prism Diagonal

Fig. 17



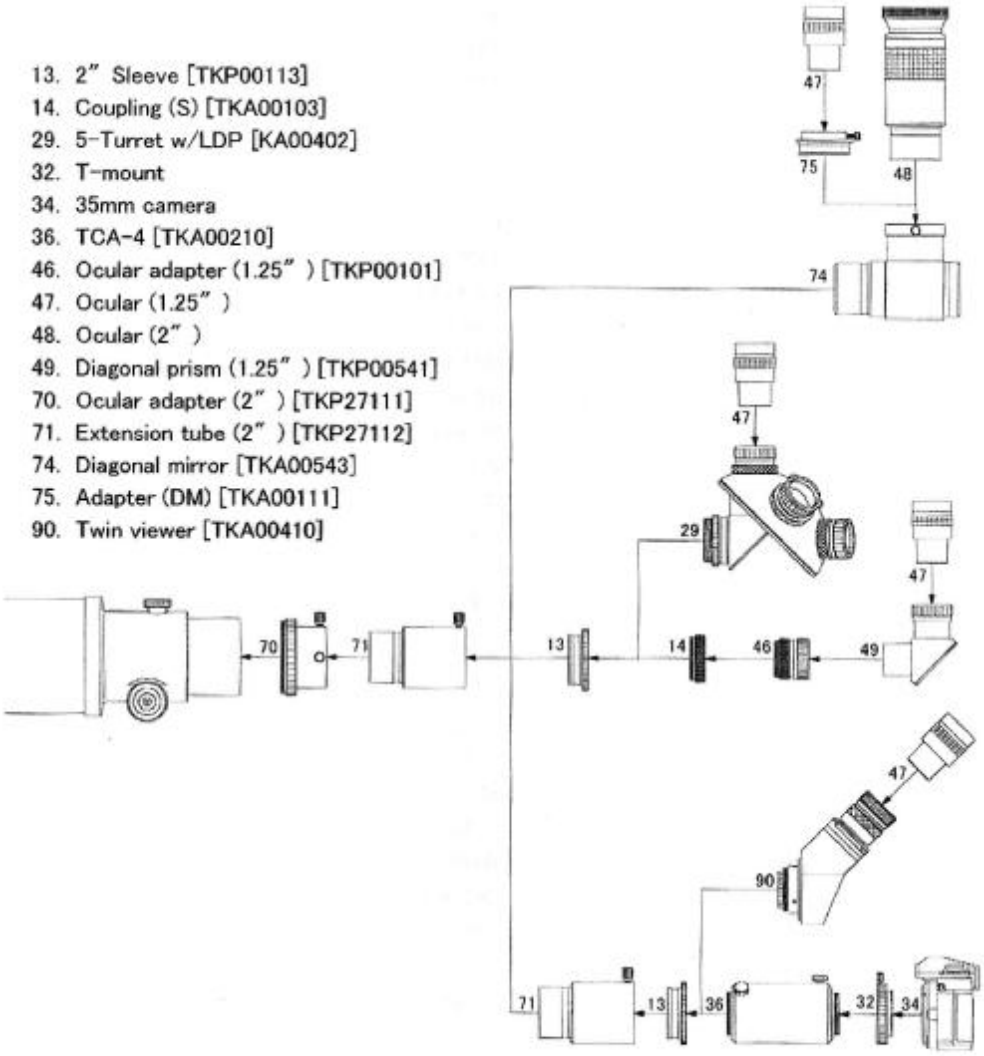
Mirror Diagonal

Fig. 18

System Chart

■ Photo/Visual System Chart

13. 2" Sleeve [TKP00113]
14. Coupling (S) [TKA00103]
29. 5-Turret w/LDP [KA00402]
32. T-mount
34. 35mm camera
36. TCA-4 [TKA00210]
46. Ocular adapter (1.25") [TKP00101]
47. Ocular (1.25")
48. Ocular (2")
49. Diagonal prism (1.25") [TKP00541]
70. Ocular adapter (2") [TKP27111]
71. Extension tube (2") [TKP27112]
74. Diagonal mirror [TKA00543]
75. Adapter (DM) [TKA00111]
90. Twin viewer [TKA00410]



What is Fluorite?

Calcium fluorite (CaF2) is a naturally occurring crystal. Its very low refractive index makes it the best of materials to use in the manufacture of apochromatic telescopes. Unfortunately, the natural crystal contains impurities and as a result, displays some properties that make it unsuited for use in a telescope.

Comparative Diagrame(non-coated)

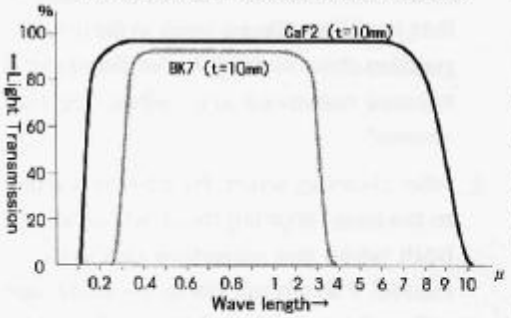


Fig. 22

Now thanks to modern technology, fluorite crystals are grown in an oven. This process produces a totally pure mono crystal structre that does not display any of the unsuitable properties of the natural crystal and has the same very low refractive index. Now, calcium fluorite crystal can be hard multicoated for maximum light transmission and durability.

As the diagram shows, the band pass of fluorite of 1000 to over 100,000 angstroms eclipses by many magnitudes that of any optical glass. Additionally, the use of multicoatings further increases light transmission over any ED glass. These features make the fluorite objective the premier photo/visual instruments for deep sky or lunar and planetary applications in their size class.

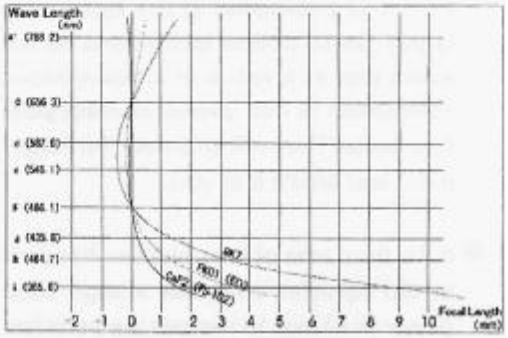


Fig. 23

When the fluorite instrument is taken out for an observing session, it will take about 30 minutes for the objective to temperature equalize for maximum performance. This fact is also true for any optical system used.

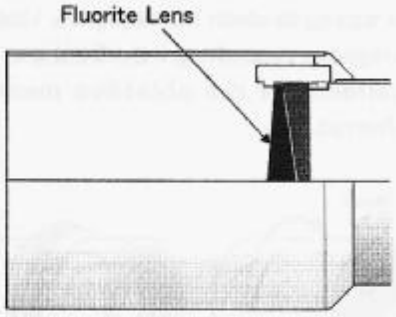


Fig. 24

Care & Maintenance

◆ The FS-102N/NS refractors have been precisely collimated at the factory by highly skilled optical technicians. In the event that as a result of a heavy blow, collimation is lost, please contact your distributor. They will collimate the instrument and return it to you.

◆ If the front lens of the objective has dust or dirt particles on it, use a large hand powered blower to remove the particles. Under no circumstances should dust be removed by any other means, rubbing the surface will cause scratches. If the lens must be cleaned, be certain that all dust and dirt particles have been removed by using a blower. Then, using cotton swabs slightly moistened with lens cleaner, gently clean the particles off.

◆ **REMEMBER, DO NOT USE ANY FORM OF CANNED AIR TO REMOVE THE PARTICLES.**

This product is very cold and could harm the front lens of the objective. Be cedrtain that the dew cap is removed before attempting to clean the objective. Use the following procedure, if the front and rear surfaces of the objective must be cleaned.

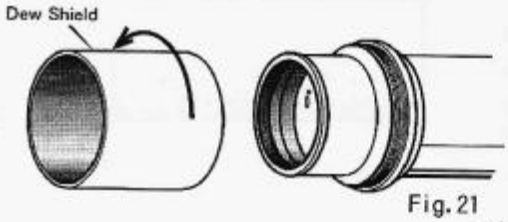


Fig. 21

1. Remove the dew shield from the cell by turning it counter-clockwise. In case of the dew shield is retractable, loosen the lock screws and remove it.
2. Remove the screws that attach the objective to the cell. These are the shorter screws with the larger heads. Always keep one hand on the objective as these screws are removed to keep it from falling. As you remove the objective cell, make two marks on the cell and base so that it will be placed back in its original position after cleaning. In the diagram the screws removed are called "pulling screws".
3. After cleaning, attach the objective again to the base, aligning the marks made on both when the objective cell was removed. If this is not done, the telescope will not be properly collimated. If you feel that you do not wish to do this procedure, contact your distributor. They can do this procedure and return the instrument to you.

Do not try to disassemble the lens cell for the lens cleaning. It will be impossible to collimate the objective without the special collimator.

If the telescope is used in condition of high humidity, be certain that it is taken indoors and dried out before it is stored. If the dew has not been dried and the instrument is stored, there will be a harmful residue left on the surfaces of the telescope. Leave the lens cap off until the objective lens is totally dried.