Flatfield Super Quadruplet

FSQ-85ED

INSTRUCTION MANUAL

TAKAHASHI

[F]

Thank you for your purchase of the TAKAHASHI FSQ-85ED Flat-Field Super Quadruplet refractor. This is a state-of-the-art 4-element in 3-group highly portable astrograph which employs two premium ED elements for a high order color correction. In order to use the FSQ-85ED to the limit of its capabilities, please read this manual and familiarize yourself with its operation, its parts and their function before using this instrument.

⚠ WARNING

NEVER ATTEMPT TO OBSERVE THE SUN THROUGH THIS TELESCOPE WITHOUT A FULL APERTURE SOLAR FILTER DESIGNED FOR THIS PURPOSE. FAILURE TO DO SO COULD CAUSE INSTANT BLINDNESS. COVER THE FINDER WITH AN OPAQUE COVER TO PREVENT ANY LIGHT FROM COMING THROUGH. AN UNCOVERED FINDER CAN ALSO CAUSE SERIOUS DAMAGE TO THE EYE. KEEP CHILDREN AWAY FROM THE TELESCOPE DURING DAYTIME.



⚠ CAUTION

- If the tube assembly will be placed on an equatorial mount, be careful to set the tube holder parallel to the ground This will prevent injury to fingers and will prevent it from falling to the ground. When placing the tube assembly in the saddle, always hold the tube with one hand to keep it from falling off the saddle on to the ground.
- Always lay the tube assembly on a completely flat surface that totally supports it to protect it from rolling off.
- Keep the tube assembly out of direct sunlight to protect it. Direct sunlight could heat up the tube to a temperature that could damage the lens elements.
- Always focus the instrument for best focus using the focuser for the best possible image.

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SPECIFICATIONS

Optical System	Modified Petzval Quadruplet
Effective Aperture	85mm
Focal Length	450mm
Image Circle	ϕ 44mm
Resoving Power	1.36″
Limiting Magnitude	11.4mag
Light Gathering Power	147X
When used with Extender-ED 1.5X	
Effective Focal Length	680mm
Effective Focal Ratio	8.0
Image Circle	ϕ 44mm
Photographic Field	3.7°
Back focus	154.8mm
Metal back	117.5mm
When used with Reducer-QE 0.73X	
Effective Focal Length	372mm
Effective Focal Ratio	3.8
Image Circle	ϕ 44mm
Photographic Field	7.7°
Back focus	82.0mm
Metal back	72.2mm
Diameter of Main Tube	95mm
Total Length of Main Tube	615mm(when dew shield is extended) 525mm(when dew shield is retracted)
Weight of Main Tube Assembly	3.1kg
Finder Scope	6x30 8°

Tube Assembly Layout

FSQ- 85ED (Baby Q)

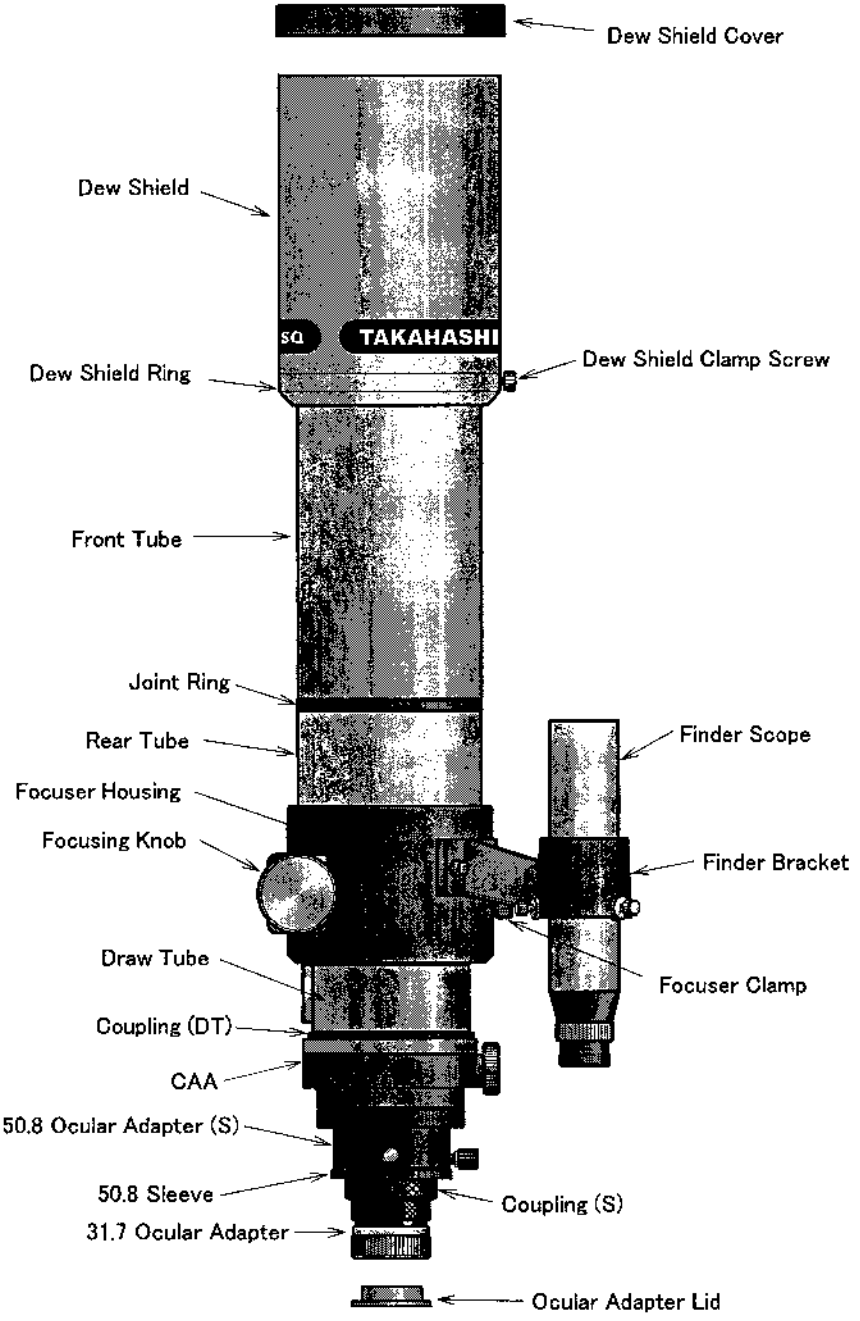


Fig. 1

Attaching The Finder And Tube Assembly

If you have purchased FSQ-85ED as a set or purchased the finder and bracket separately, they have been shipped unattached to the tube assembly.
Use the following instructions to attach and align the finder with the main optics.

■ Attaching the Finder

Place the finder bracket over the two holes on the left side of the focuser and attach the bracket with Allen screws supplied with the finder bracket. Make certain that the screws are tightened sufficiently to keep the finder from moving thereby misaligning the finder.

Before inserting the finder into the finder bracket, using standard cellophane tape, place a double layer of this tape around the finder where the three set screws located in the front of the finder bracket will come into contact with the finder. This will help prevent the finder tube from being scratched by the screws. Loosen the front and rear finder screws. Carefully insert the finder into the bracket and hold the finder as parallel as possible to the tube assembly when the finder bracket screws are tightened around the finder. This will make alignment easier. Refer to Fig.2 & 3.

■ Attaching the Tube Assembly to The Equatorial Mount

The FSQ-85ED is heavier at the focuser end of the instrument. Therefore, an offset plate

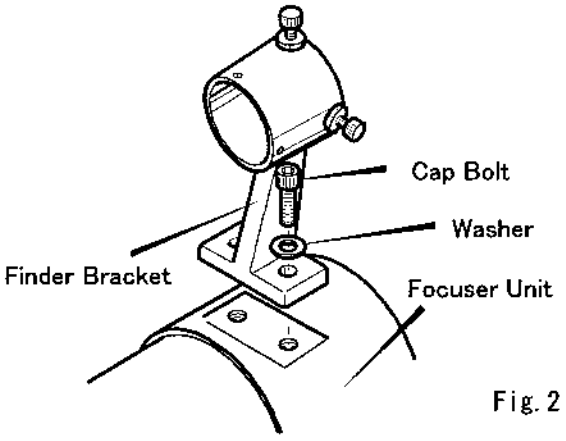


Fig. 2

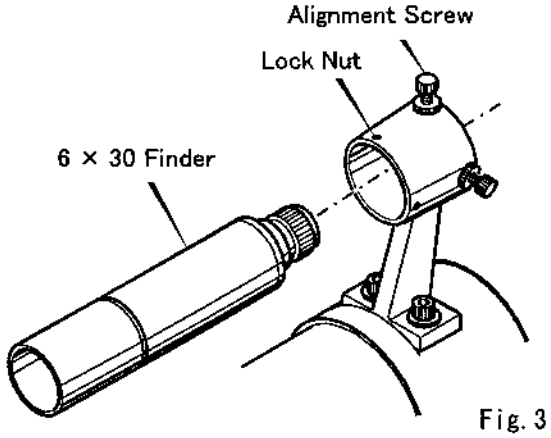


Fig. 3

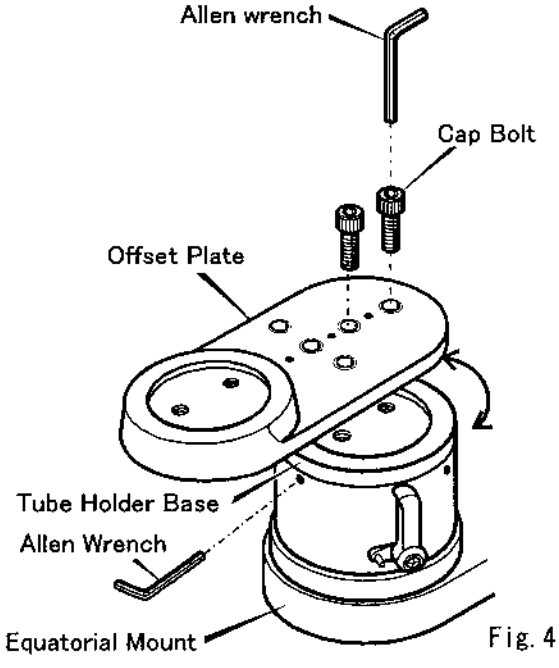


Fig. 4

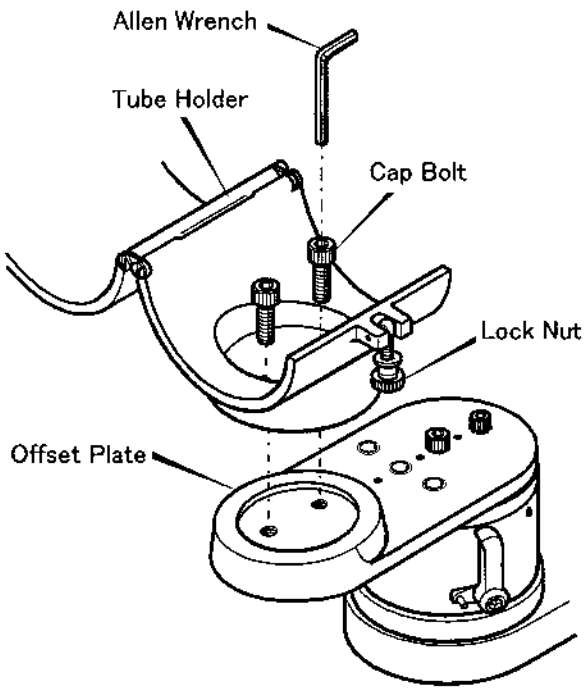


Fig. 5

is suplied with each tube holder. Attach the offset plate with the supplied Allen screws to the mount. Refer to Fig. 3.

The tube holder can be turned 90° in the event the tube holder is attached to the mount without the offset plate or to the offset plate.

In order to balance the scope, you can select one of three different positions to attach the tube holder to the offset plate using a combination of the five different holes. Once attached, the tube may be placed into the tube holder and then secured by closing the top half over the bottom half and tightening the large locking thumb screw. This tube holder can be used on any current Takahashi mount. [The FSQ-85ED can be used with the EM-11 or heavier duty EM-200 mount with great ease.]

After placing the tube assembly into the tube holder, the next step is balancing. Refer to Fig.7. Now that the telescope 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 and then loosend 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.

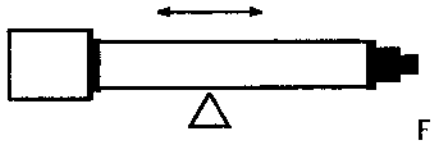


Fig. 6

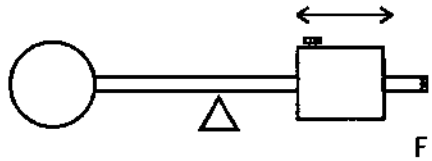


Fig. 7

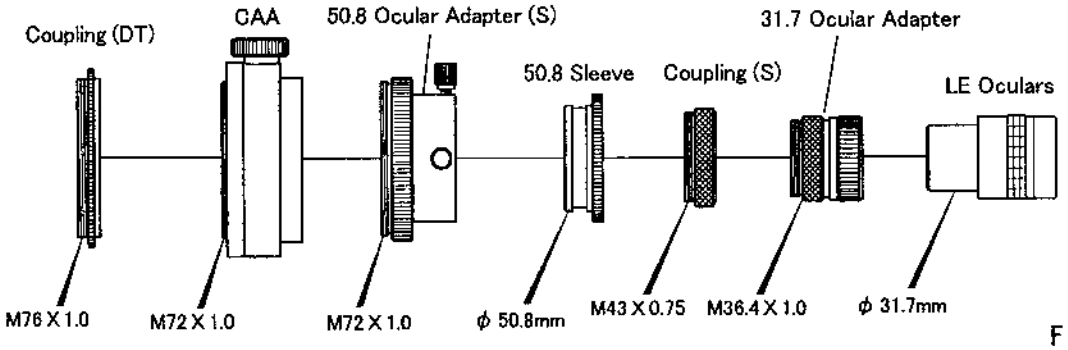


Fig. 8

■ 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. Connecting the parts incorrectly may prevent the telescope from coming to a sharp focus or any focus at all. Refer to the Fig. 8 for a standard connection.

■ 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.

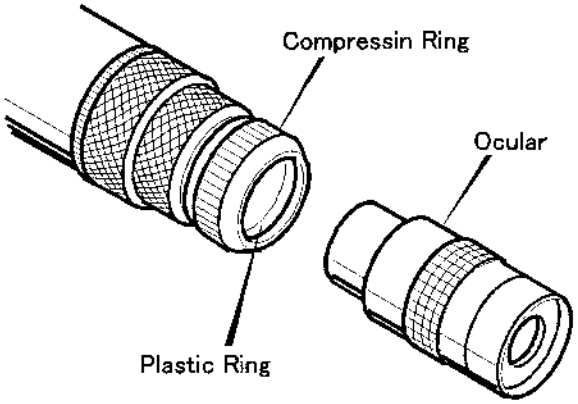


Fig. 9

■ How To Retract The Lens Shade

The lens shade of the FSQ-85ED is retractable. When the FSQ-85ED is to be transported, retract the lens shade until it rests on the ring installed in the tube assembly for that purpose. The shade can be extended when the FSQ-85ED 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.

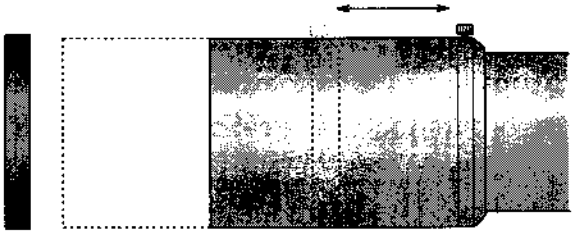


Fig. 10

[Caution]

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. Refer to Fig.10.

■ Focusing

After inserting an ocular into the telescope, it is necessary to achieve the best possible focus. Remember the atmosphere will limit the highest magnification that can be used on any given night. Using the low 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 familarize yourself with the following.

● Focusing System

The FSQ-85ED uses a rack and pinion focuser. This focuser alllows the imager/observer to focus rapidly. Turning the focuser clockwise will move the draw tube outwards, while turning it counter-clockwise will move the draw tube inwards. Refer to Fig. 11.

This focuser has Takahashi Micro Edge Focuser as standard. Turning the MEF's black knob will allow for fine focusing for imaging or observing at high magnification.

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

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

Begin the focusing process by choosing a bright star in a convenient 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 defect but rather a diffraction pattern which is an indication of diffraction limited optics.

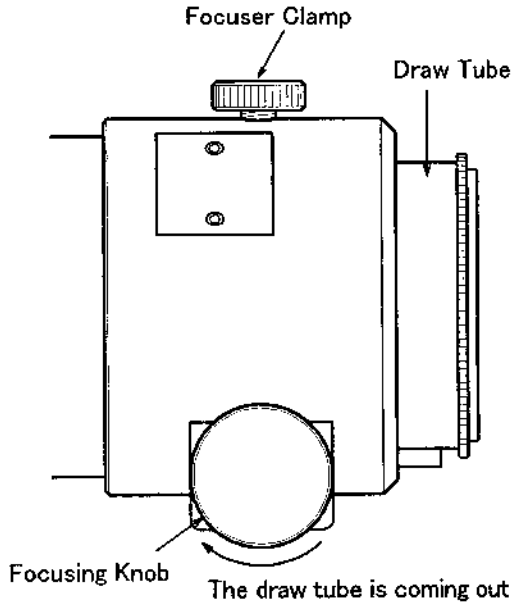


Fig. 11

● Focuser Clamp

The focuser clamp is located on the top of the focuser. Turning it clockwise will tighten the focuser, while turning it counter-clockwise will loosen the focuser. Do not overtighten the clamp. When the best focus has been achieved, tighten the clamp so that the best focus can be kept. Whenever you move the draw tube, never fail to loosen the clamp. If the draw tube is forcibly moved, it will cause to damage gearing system. Refer to Fig. 12.

● Camera Angle Adjuster and Micro Edge Focuser [MEF]

The FSQ-85ED uses an oversized camera angle adjuster to allow heavier cameras to be used with the telescope. The camera angle adjuster allows the camera or ocular to be turned 360° to properly position the camera or ocular. The Micro Edge Focuser is provided for fine focusing. Refer to Fig.12.

■ Finder Alignment

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 8° field of view allows the easy centering of an object to be viewed or imaged.

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 telescope be in alignment. The following procedure can be used to align the finder.

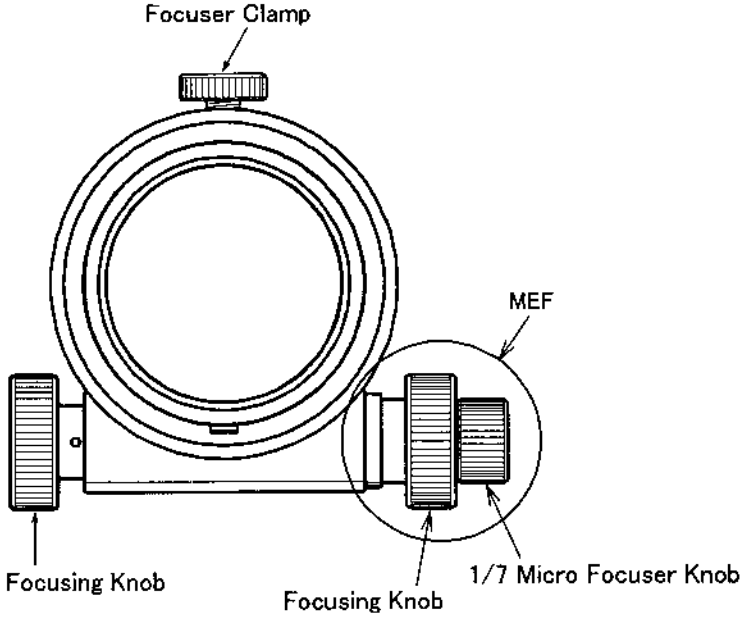
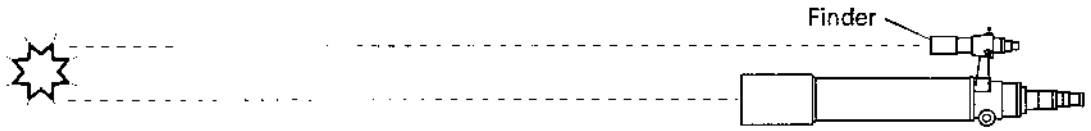


Fig. 12



◆ 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.

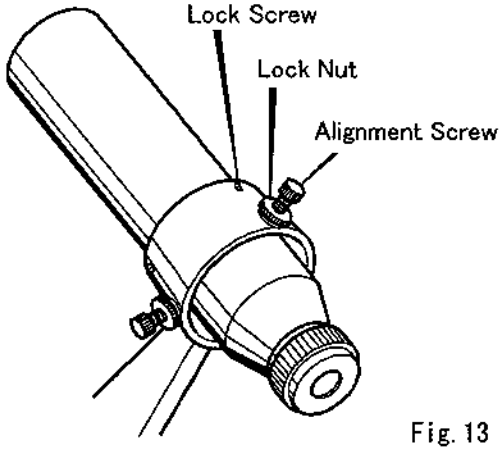


Fig. 13

◆ Adjusting Screw Procedure

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

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.14.

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

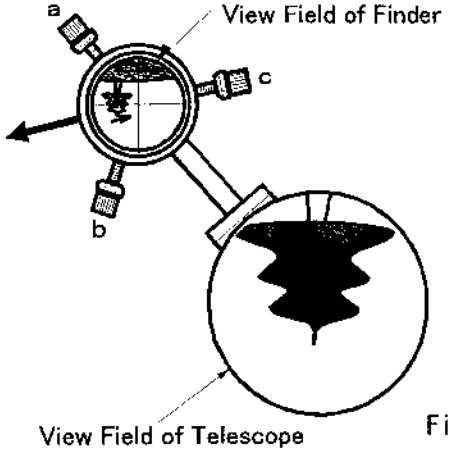


Fig. 14

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.

Observation

■ Visual Applications

◆ Determining Magnification

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

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

Therefore, the shorter focal length oculars will produce the higher magnification. On some nights of exceptional seeing, it is a fun to use highest possible magnification to view the Moon and planets.
In general, the limit of magnification will be highest 20X and lowest 1.4X respectively to the effective aperture.
In case of FSQ-85ED, the highest will be 170X and the lowest 12X. Therefor, most of Takahashi LE oculars can be used with FSQ-85ED except LE 50mm.

◆ Compression Ring Star Diagonal

The 31.7(1.25") diagonal prism is inserted into the compression ring adapter at the end of the focuser and tighten it until it holds the diagonal prism in place. Then the ocular can be inserted into the compression ring adapter of the diagonal prism and holded firmly by tightening the compression ring.

◆ Lunar observation

The moon is an excellent object for beginners and advanced amateur astronomers as well. The entire Moon can be viewed at about 50X, but on a 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 in 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 birhgtness decreases. The ultra high contrast images produced by the FSQ-85ED will amaze the observer.

◆ Planetary observation

The FSQ-85ED is particularly suited for planetary observation by using the Extender-ED 1.5X. The high contrast, very sharp images will reveal a wealth of planetary detail.
In order to see this fine detail, the night should be very steady. If the stars at the zenith twinkle a good bit, the planets will look sharp at low magnification. When the star at the zenith is steady, then high magnification can be used to reveal a wealth of the detail. Maginifications of 100X per inch can be used. These nights of steady seeing will also produce fine images using a digital SLR or a CCD camera.

◆ Observation of deep sky objects

In general, observing deep sky objects requires a low power, wide field ocular which produces the maximum brightness. On the other hand, observing globular clusters and small nebulae 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).

■ Astro Imaging

Focusing is the most critical element of making great astro images. Once critical focus has been achieved, then outstanding images can be made. It is a good practice to recheck critical focus before the image is made.

◆ Eyepiece Projection Imaging

When you want to make lunar or planetary images the TCA-4 is designed to make eyepiece projection images easier. The TCA-4 will accept any Takahashi LE ocular and variable feature sliding tube gives the imager latitude in determining the size of the final image.

◆ 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 moderately 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

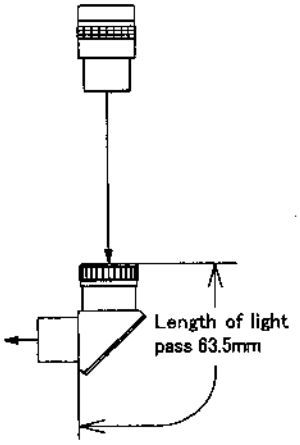
When taking high magnification photographs of the Moon and planets, pay careful attention to balance. Rebalance the telescope when the object is placed in the center of the camera.

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

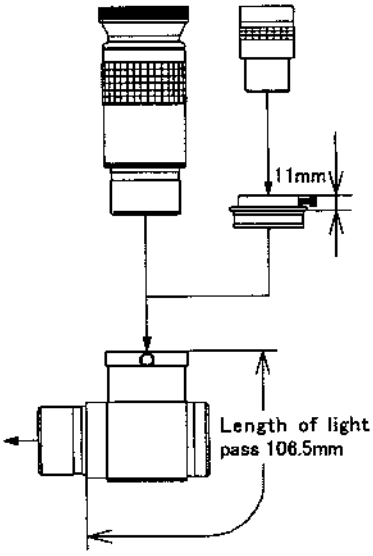
■ 31.7 Compression Ring Diagonal and Diagonal Mirror

Each diagonal requires a different amount of back focus. The 31.7 diagonal requires less back focus. Therefore, the focuser will have to be racked out further. Refer to Figs. 15 & 16.



31.7 Diagonal Prism

Fig. 15



Diagonal Mirror

Fig. 16

■ Extender-ED 1.5X

This newly designed dedicated extender enables the user to extend the focal length of the FSQ-85ED is from 450mm to 680mm (1.5X) and allows the maximum magnification to be raised to 259X when using the Takahashi HI LE-2.8mm ED ocular and is great for lunar and planetary observations. The Extender-ED 1.5X can also be coupled to a DSLR/SLR or CCD camera for narrow field imaging.

Focal length: 680mm
Focal ratio: f/8.0
Image circle: ϕ 44mm
Field of view: 3.7°

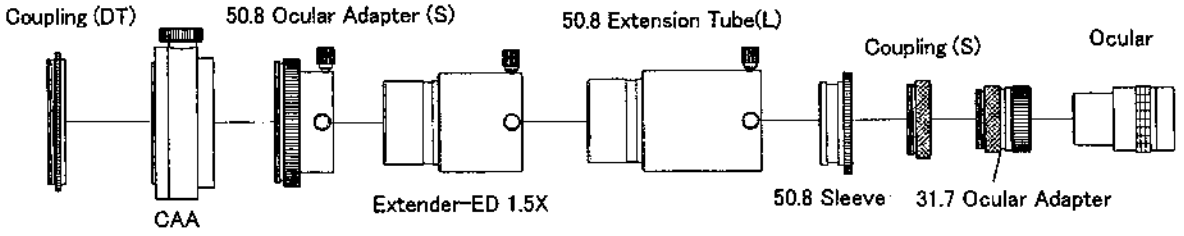


Fig. 17

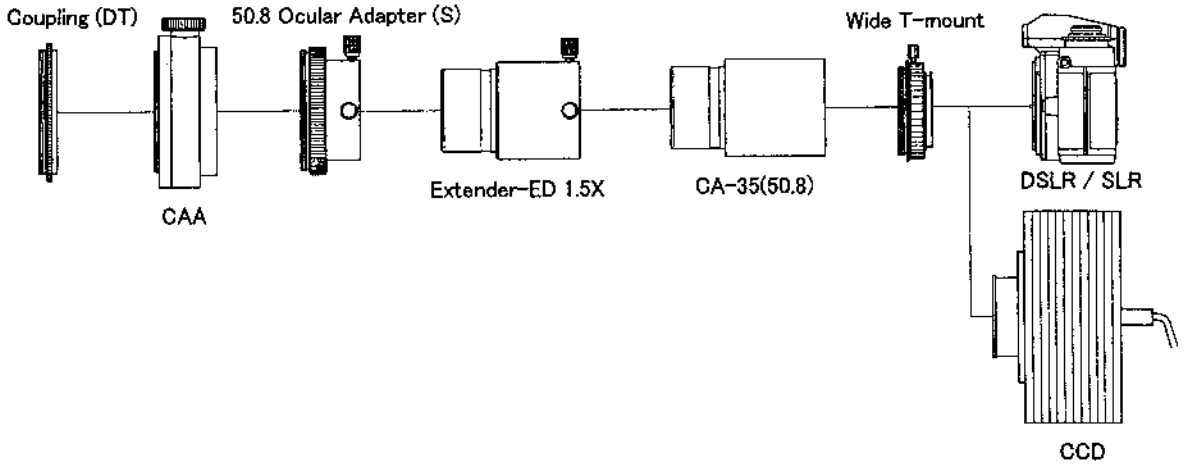


Fig. 18

■ 2X Barlow Lens

This Barlow lens was originally designed for the FS Series and it can be used for the TSA for visual use. This short Barlow can be used with the 31.7 diagonal or Diagonal Mirror.

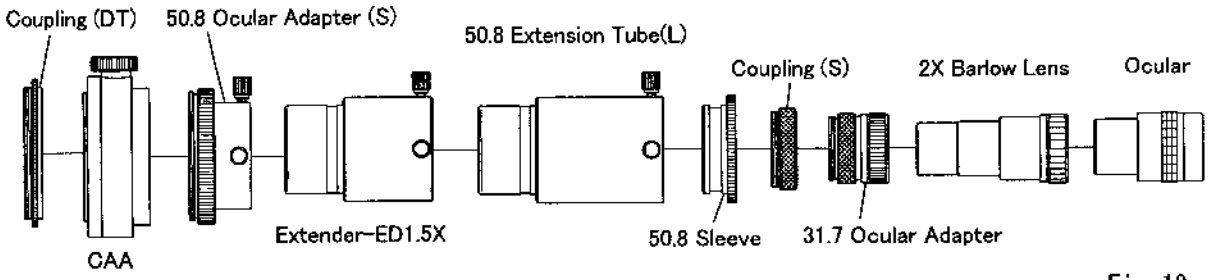


Fig. 19

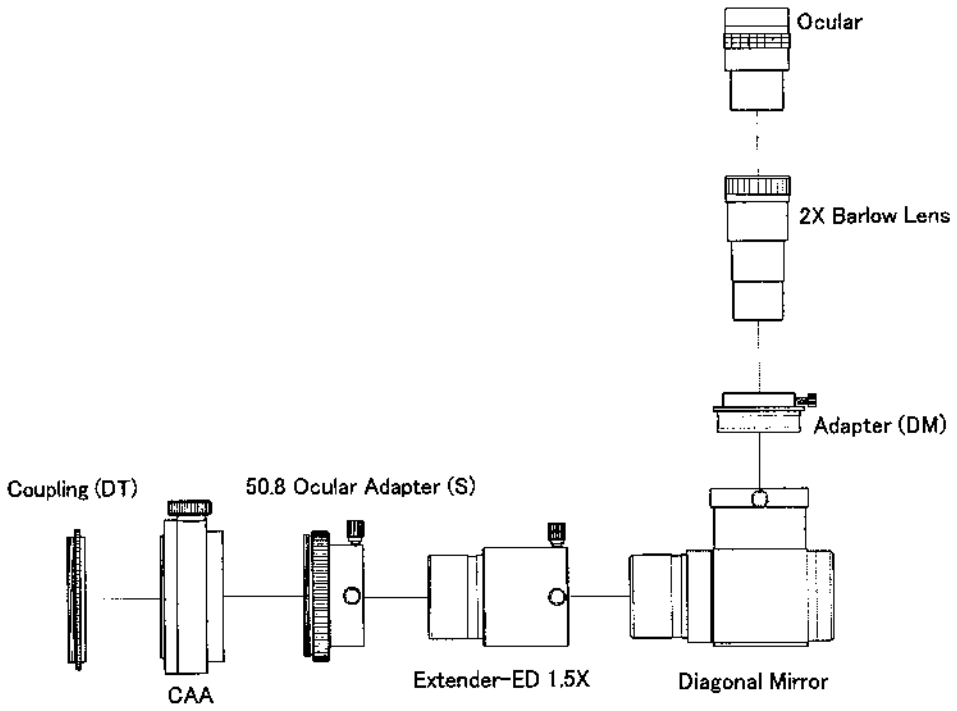


Fig. 20

■ Reducer-QE 0.73X

This new reducer can be used for wide field imaging at a faster focal ratio of f/3.8 and a wider field of 7.7° .

Focal length: 327mm
Focal ratio: f/3.8
Image circle: ϕ 44mm

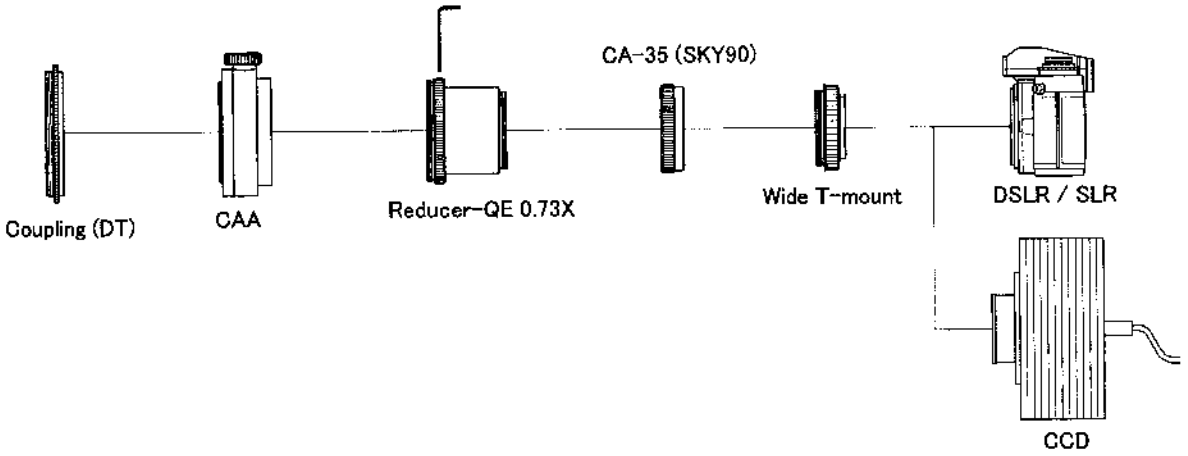


Fig. 21

■ CA-35

The CA-35 is used to connect a DSLR/SLR or CCD camera to the FSQ-85ED. The CA-35 (SKY-90) is used for this purpose with the appropriate connectors. Refer to Fig. 15.

a. Prime focus
   → CA-35 (50.8) or CA-35 (TSA-102)

b. With the Reducer-QE 0.73X
   → CA-35 (SKY90)

c With the Extender-ED 1.5X
   → CA-35 (50.8)

Refer to Fig. 22-24.

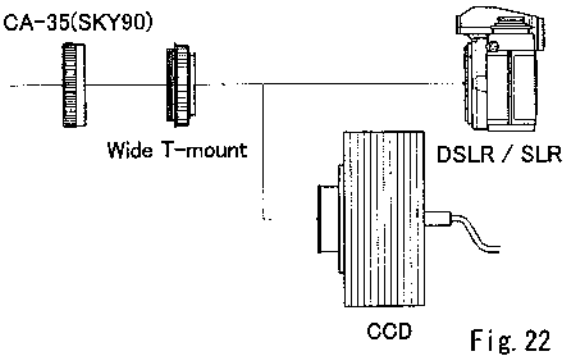


Fig. 22

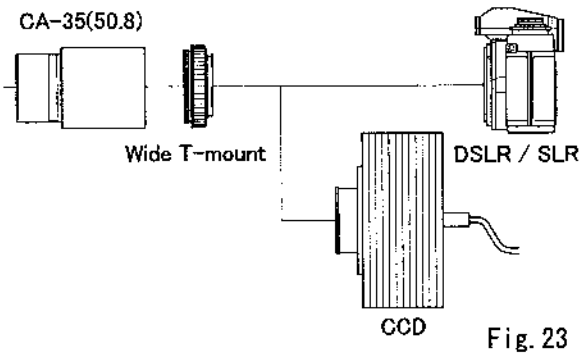


Fig. 23

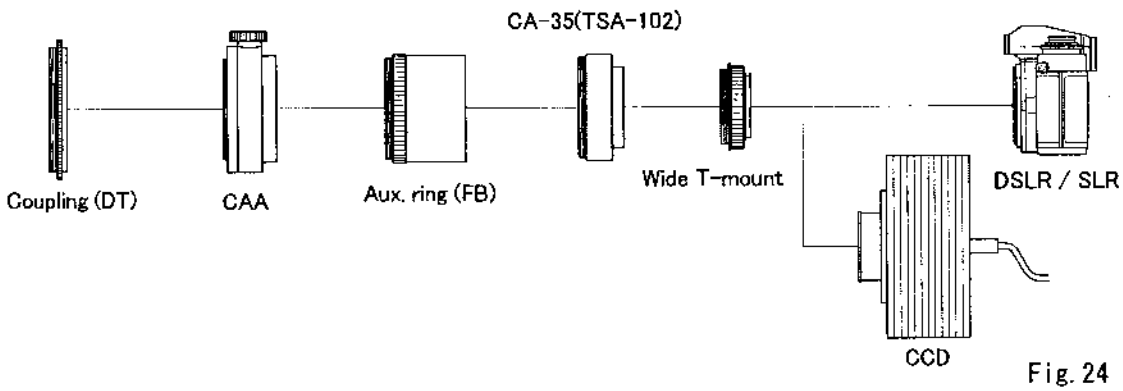


Fig. 24

■ T-mount & Wide T-mount

The T-mount adapters are used to connect a DSLR/SLR to the TCA-4 eyepiece projection device. Refer to Fig. 25.
The wide T-mount adapters are used to connect a DSLR/SLR or CCD camera to the FSQ-85ED at prime focus, with the Reducer-QE and the Extender-ED 1.5X.

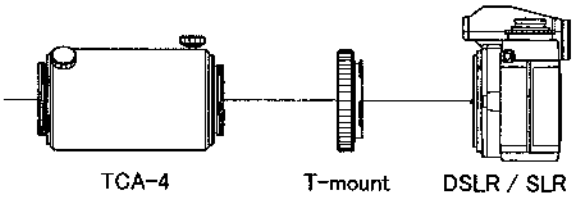


Fig. 25

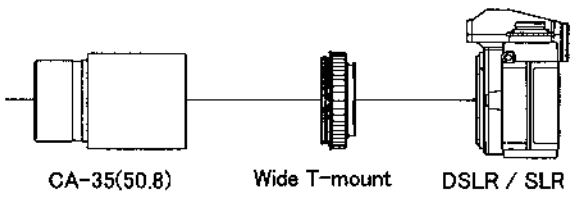


Fig. 26

⚠ Caution

If the connecting part of Wide T-mount, and T-mount have scratches or directs, a camera may not be attached correctly. This will cause star images worse. If the star images are taken unevenly or shifted, it is causes by those mentioned in the above. Take a good care before attaching a photographic set-up.

■ TCA-4

This variable eyepiece projection device attaches easily to the FSQ-85ED for high quality and high magnification photography of the surface of the Moon and planets. It can be used with a film, DSLR and CCD camera. Refer to Fig. 27.

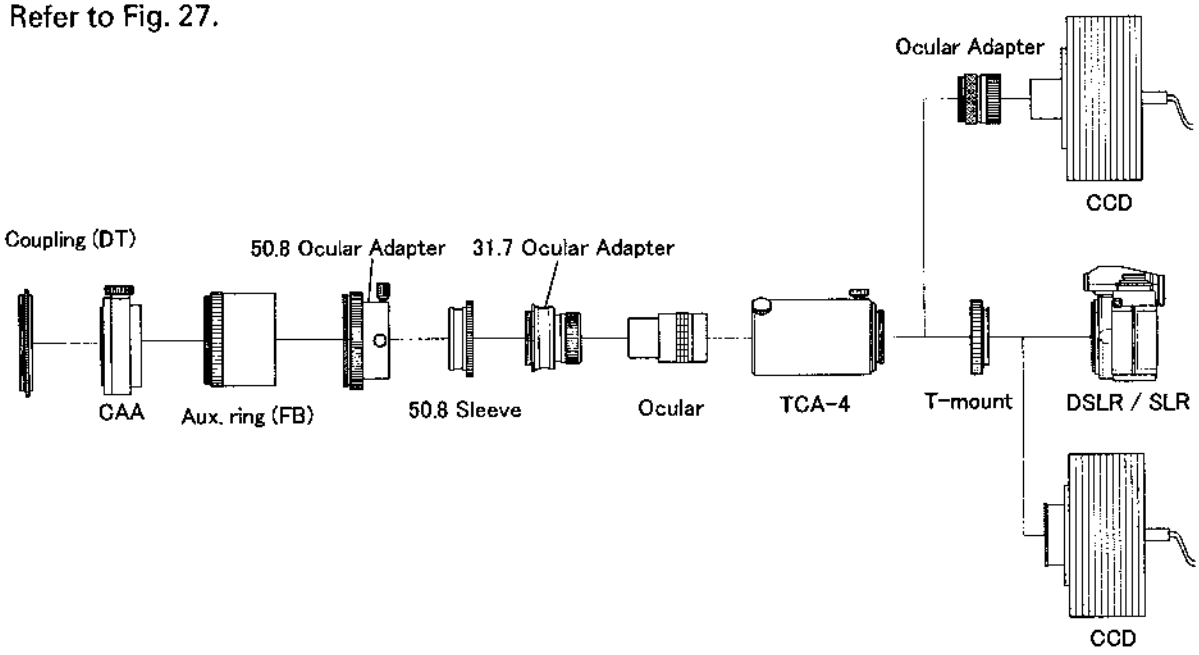


Fig. 27

■ FQR-1

The finder quick release bracket allows the user to easily remove and attach the finder after it has been aligned with the main optics. The Takahashi FQR-1, optionally available, is one example of this convenient bracket.

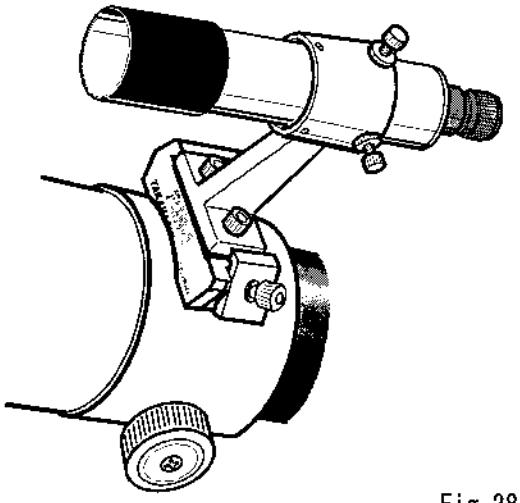


Fig. 28

■ CCD Camera

In general, a CCD camera can be attached by way of 31.7mm(1.25")/50.8mm(2") sleeve or T-thread (42mm P=0.75). A CCD camera which can be attached by T-mount can be attached to FSQ-85ED with a combination of CA-35 and Wide T-mount as same manner for 35mm SLR/DSLR.

The FSQ-85ED has a long back focus (178mm), which will allow to attach various photo set-ups.

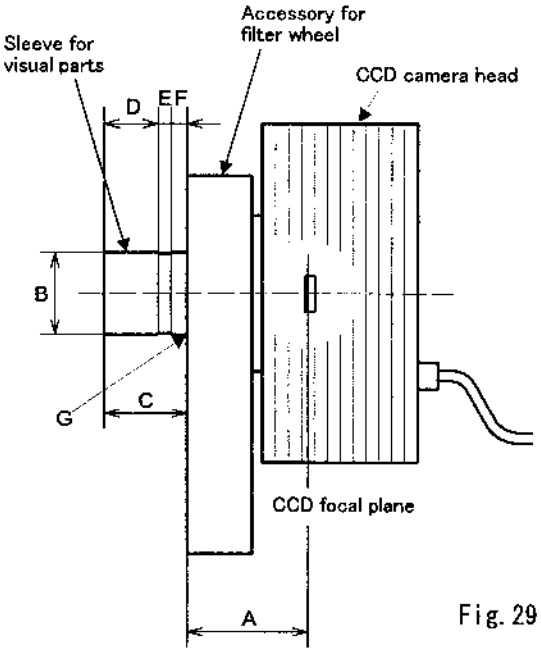


Fig. 29

A. Plane sleeve connector
[CCD's focal plane (1mm)]
B. Outer diameter of the sleeve
[31.7(1.25″) or 50.8(2″)]
C. Full length of sleeve
D.
E. ┤ Position of sleeve's groove
F. ┘
G. Diameter and pitch of sleeve's thread

Care & Maintenance

◆ Before attempting to clean your optics, contact your local distributor for precise instructions on the procedure.

◆ 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.

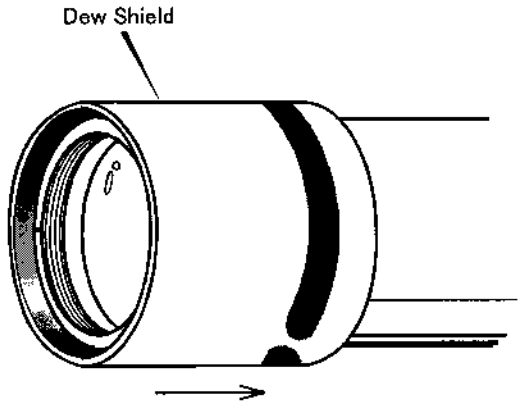


Fig. 30

◆ **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 certain 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. 30.

◆ The collimation device is provided at the cell, but it is very difficult for a user to collimate the optical axis because of quadruplet design.

Under no circumstances should it be touched. The optical axis is perfectly collimated at the factory before shipment and there will little chance to be decollimated in normal use. Should it be decollimated by a strong shock during transport, ask your local distributor.

Additional Precautions

- Keep the telescope away from large fluctuations in temperature. When the instrument is brought out from a warm room to colder air, dew may form.

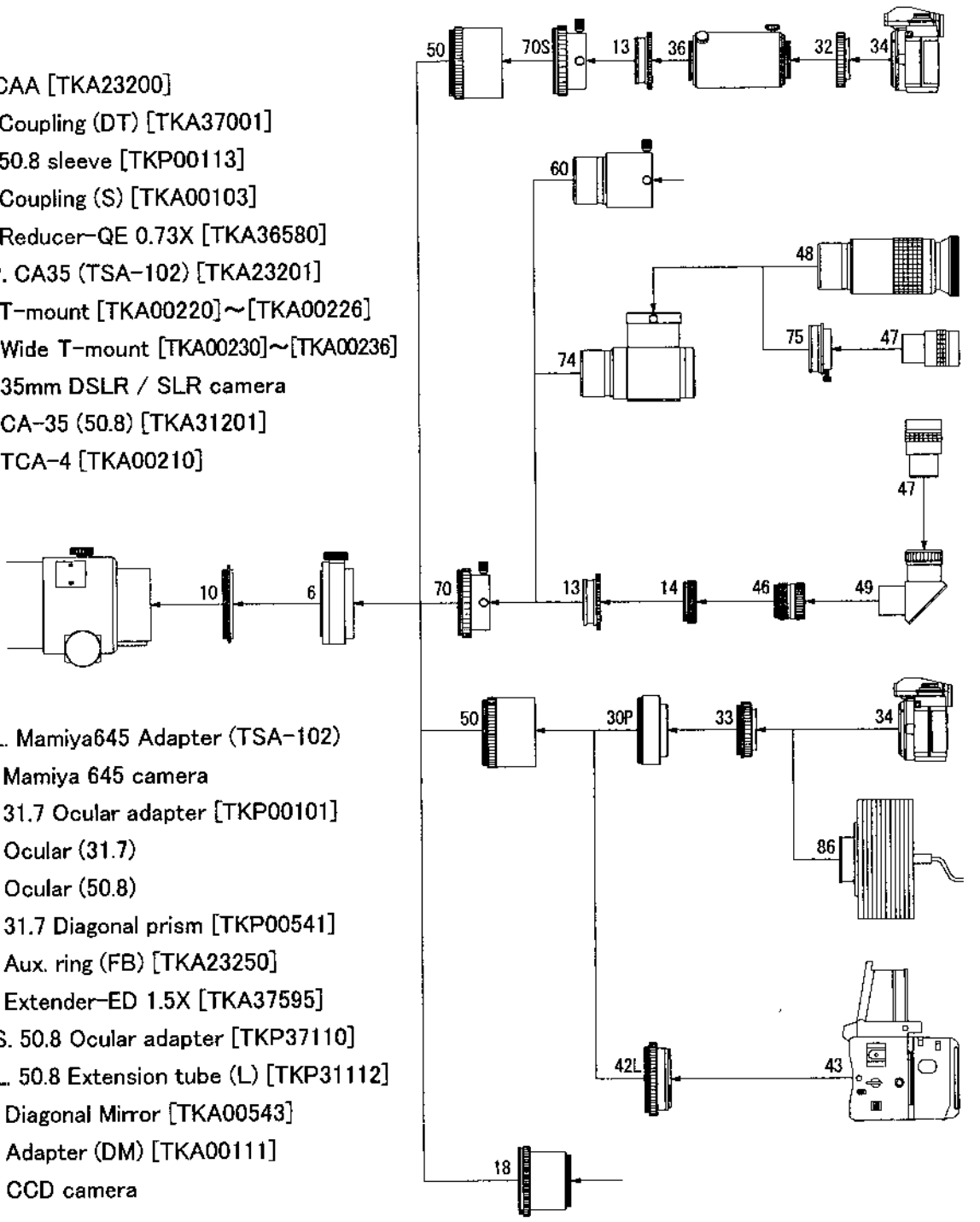
- Store the telescope in a cool dry environment. Any dew should be removed by blowing it with a hair dryer with the heating element turned off, which means the air will be at room temperature. This flow of cool, room temperature air, will dry the dew and not leave a residue. Additionally, it is a good idea to store the telescope with a desicant [drying agent] near the objective to keep any moisture away from the objective.

- As mentioned previousely, never use canned air due to the fact that the propellant is a refrigerant which could cause damage to the front element. If the element must be cleaned, make certain it is done in a cool room.

- Under no circumstances should the lenses be disassembled. The lenses have been properly aligned and set in place by skilled optical technician with special tools. Doing so will void any warranty on the tube assembly.

System Chart

■ Imaging / Visual System Chart



6. CAA [TKA23200]
10. Coupling (DT) [TKA37001]
13. 50.8 sleeve [TKP00113]
14. Coupling (S) [TKA00103]
18. Reducer-QE 0.73X [TKA36580]
30P. CA35 (TSA-102) [TKA23201]
32. T-mount [TKA00220]~[TKA00226]
33. Wide T-mount [TKA00230]~[TKA00236]
34. 35mm DSLR / SLR camera
35. CA-35 (50.8) [TKA31201]
36. TCA-4 [TKA00210]

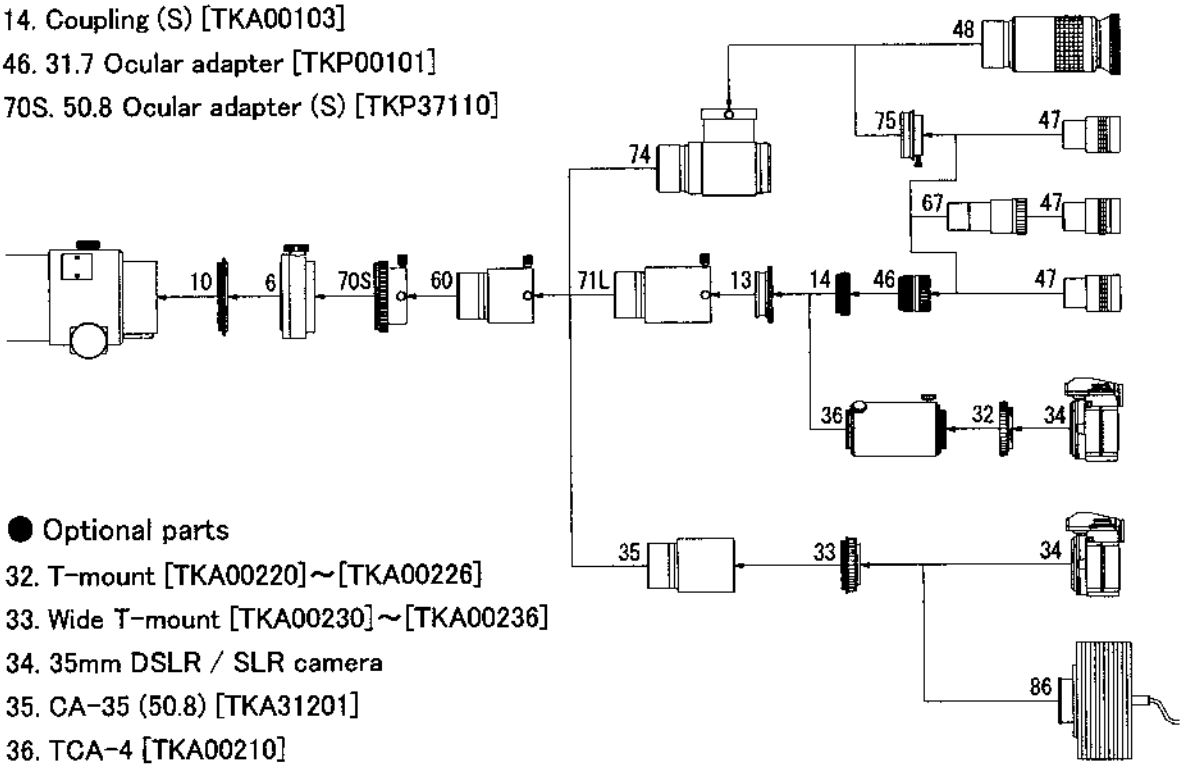
42L. Mamiya645 Adapter (TSA-102)
43. Mamiya 645 camera
46. 31.7 Ocular adapter [TKP00101]
47. Ocular (31.7)
48. Ocular (50.8)
49. 31.7 Diagonal prism [TKP00541]
50. Aux. ring (FB) [TKA23250]
60. Extender-ED 1.5X [TKA37595]
70S. 50.8 Ocular adapter [TKP37110]
71L. 50.8 Extension tube (L) [TKP31112]
74. Diagonal Mirror [TKA00543]
75. Adapter (DM) [TKA00111]
86. CCD camera

Note: Some 35mm DSLR / SLR cameras cannot be attached

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■ Extender-ED 1.5X System Chart

6. CAA [TKA23200]
10. Coupling (DT) [TKA37001]
13. 50.8 sleeve [TKP00113]
14. Coupling (S) [TKA00103]
46. 31.7 Ocular adapter [TKP00101]
70S. 50.8 Ocular adapter (S) [TKP37110]

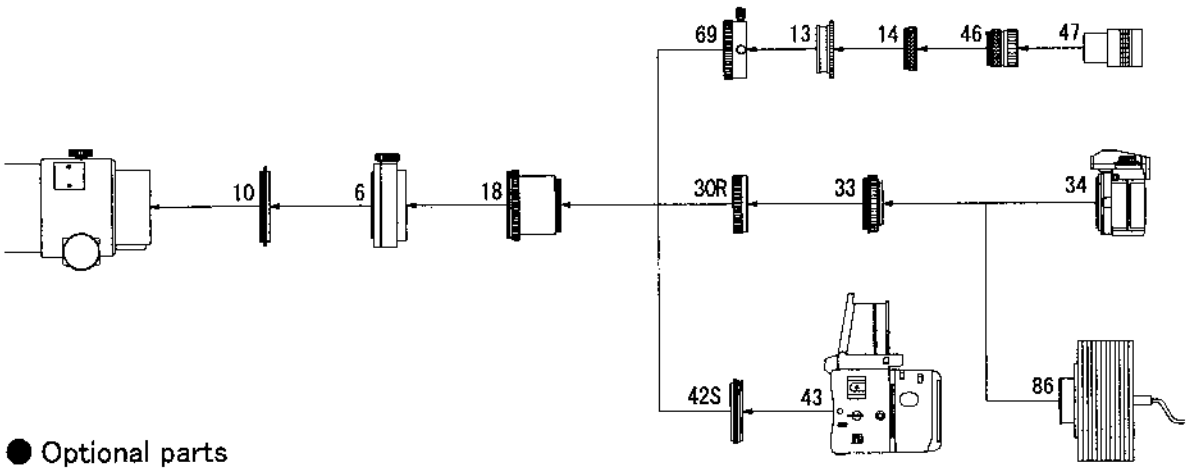


● Optional parts

32. T-mount [TKA00220]～[TKA00226]
33. Wide T-mount [TKA00230]～[TKA00236]
34. 35mm DSLR / SLR camera
35. CA-35 (50.8) [TKA31201]
36. TCA-4 [TKA00210]
47. Ocular (31.7)
48. Ocular (50.8)
60. Extender-ED 1.5X [TKA37595]
67. 31.7 2X Barlow Lens [TKA00597]
71L. 50.8 Extension tube (L) [TKP31112]
74. Diagonal Mirror [TKA00543]
75. Adapter (DM) [TKA00111]
86. CCD camera

■ Reducer-QE 0.73X System Chart

6. CAA [TKA23200]
10. Coupling (DT) [TKA37001]
13. 50.8 sleeve [TKP00113]
14. Coupling (S) [TKA00103]
46. 31.7 Ocular adapter [TKP00101]



● Optional parts

18. Reducer-QE 0.73X [TKA36580]
30R. CA-35(SKY90) [TKA35201]
33. Wide T-mount [TKA00230]～[TKA00236]
34. 35mm DSLR / SLR camera
42S. Mamiya645 Adapter (SKY90)
43. Mamiya645 camera
47. Ocular (31.7)
69. 50.8 Ocular adapter (SKY90) [TKP35110]
86. CCD camera

TAKAHASHI SEISAKUSHO Ltd.
41-7 Oharacyo Itabashi Tokyo 174-0061, JAPAN
PHONE:+81-3-3966-9491 FAX:+81-3-3966-9524
http://www.takahashijapan.com/