

Tube Assembly Layout

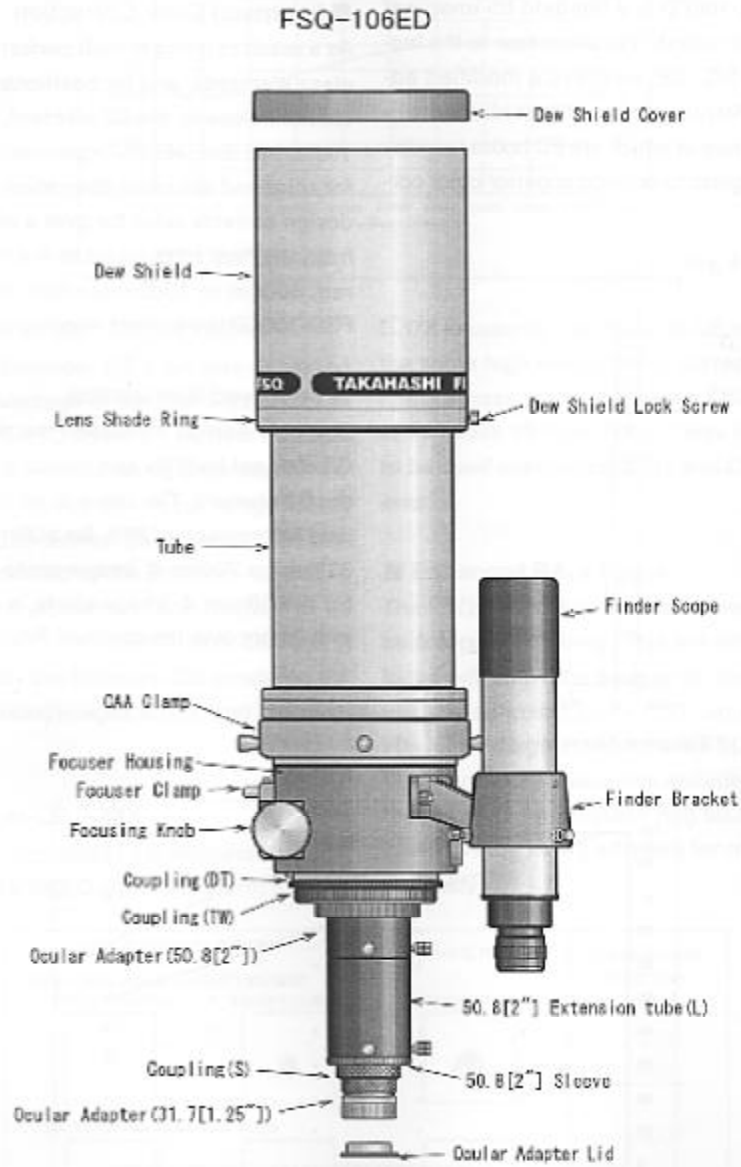


Fig. 1

What is the FSQ-106ED?

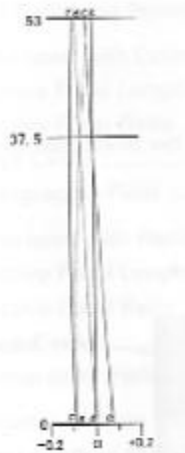
The FSQ-106ED is a flat-field f/5 imaging/visual astrograph; the successor to the legendary FSQ-106, employs a modified advanced Petzval design of four elements in 4-group, two of which are ED (extra low dispersion) glass to provide superior color correction.

■ Improved Color Correction

As a result of using to high performance ED glass elements, and by positioning the G3 element close to the G2 element, the FSQ-106ED has dramatically improved correction for color and spherical aberration. The new design corrects color for over a wide range from the near ultra-violet to the near infrared, 400nm to 1000nm, which makes the FSQ-106ED the perfect imaging platform.

■ Improved Illumination

The new design increased the size of the G3 element by 50% and placed it colose to the G2 element. The result in an increase in field illumination of 20% for a 35mm frame, 33% for a 70mm ϕ image circle and 34% for the 88mm ϕ image circle, a great improvement over the standard Petzval design.



Spherical Aberration

Fig. 2

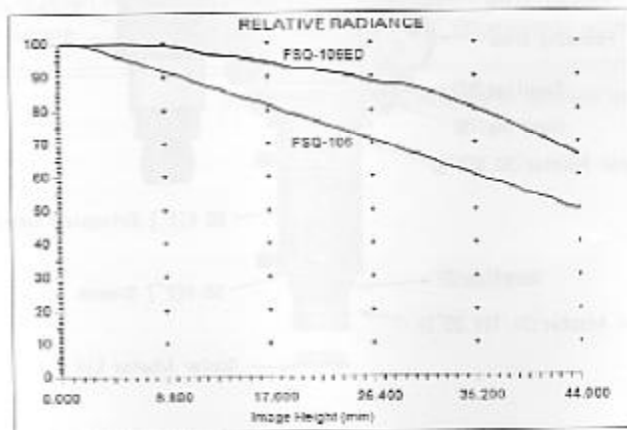


Fig. 3

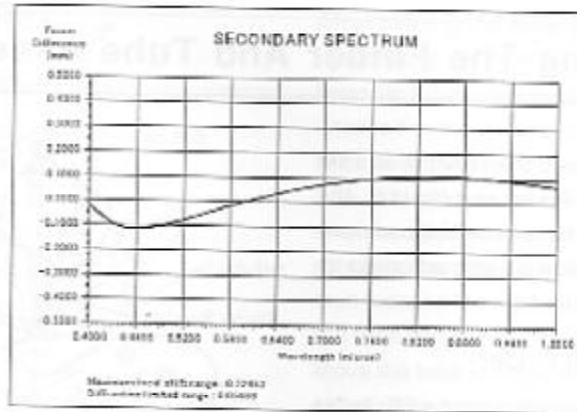


Fig. 4

■ Improved High Magnification

The new Extender-QE 1.6X was designed to take advantage of the new capabilities of the FSQ-106ED design. The new 50.8mm (2") five-element corrector, flattener, and extender increases the focal length from 530mm f/5 to 850mm f/8 flawlessly. The correction provided by the Extender-QE allows the highest possible magnification to be used. The 30% increase in color correction provided by the Extender-QE produces diffraction limited images at high and low magnification.

■ Reducer-QE 0.73X

This newly designed f/3.6 dedicated reducer for the FSQ-106ED is a 4-element in 3-group

0.37X accessory. The Reducer-QE maintains the same high level of color correction and field flatness produced by the FSQ-106ED at its native f/5 focal ratio. It was designed to be used with digital SLR's and CCD cameras.

■ Enhanced Back Focus

The FSQ-106ED has been designed with a back focus of 178mm. This enhanced back focus will allow the imager or observer to use any combination of CCD camera, binocular viewer or diagonal with their FSQ-106ED. The standard accessories include a prime focus tube, compression ring 50.8mm (2") and 31.7mm (1 1/4") adapters for maximum flexibility.

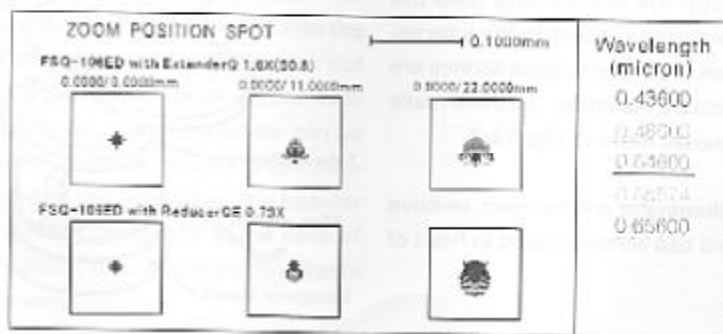


Fig. 5

Attaching The Finder And Tube Assembly

If you have purchased the TSA-102 as a set or purchased the finder and bracket, the finder and bracket have been shipped unattached. Use the following instructions to attach and align the finder.

■ Attaching the Finder

Place the finder bracket over the two holes on the left side of the focuser and attach the bracket with the Allen screws supplied with the finder bracket. Make certain that the screws are tightened sufficiently to keep the finder bracket 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 bracket screws. Loosen the front and rear finder bracket 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. 6 & 7.

If a finder illuminator will be used, remove the chromed cap screw located in front of eyepiece.

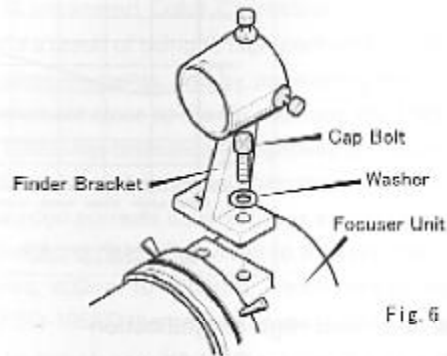


Fig. 6

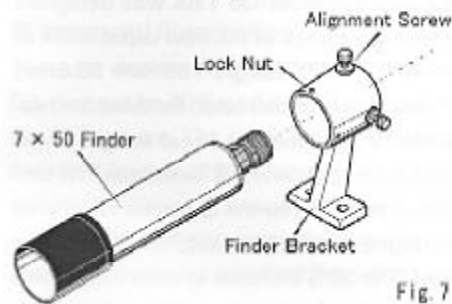


Fig. 7

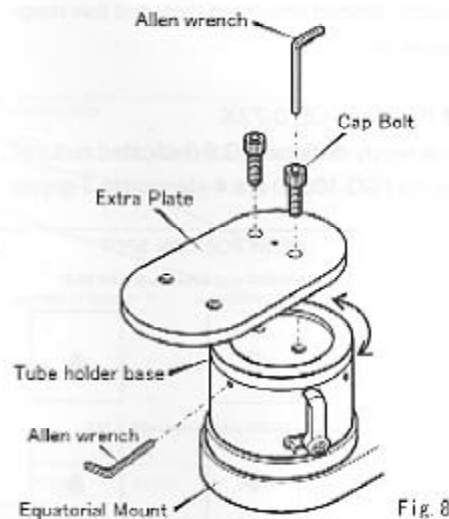


Fig. 8

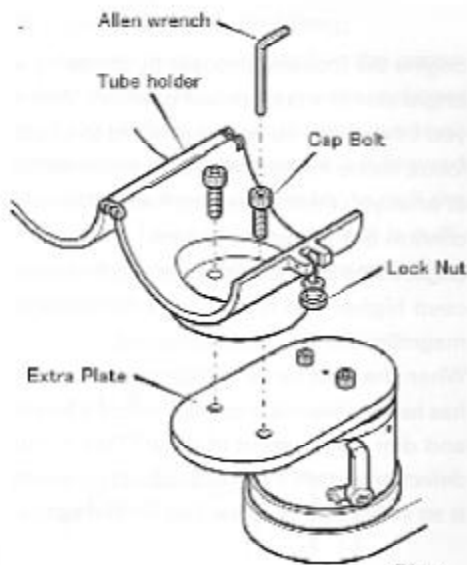


FIG 9

■ Attaching the Tube Assembly to The Equatorial Mount

The FSQ-106ED uses the heavy-duty focuser unit, which makes the focuser portion heavier. To make well balancing the tube ass'y, the specially designed tube holder is used and to attach the tube holder, an extra plate is used between the tube holder and the mount. Attach the plate on the mount as shown in Fig.8. Then, attach the tube holder on the plate using the 8mm Allen screws supplied with the tube holder. The tube assembly can then be placed into the tube holder and secured with the lock nut after the calm shell has been closed over the tube assembly. This tube holder can be used with all Takahashi mounts. If astro imaging is one of the uses, then the heavier duty the mount, the better. In the case of the FSQ-106ED, this would be Takahashi EM-200 mount.

After placing the tube assembly into the tube holder, the next step is balancing. Refer to Fig.9. 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 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.

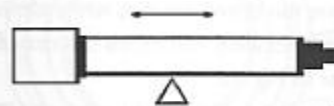


Fig. 10

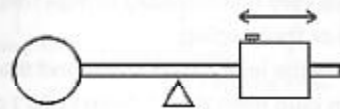


Fig. 11

■ Focusing

After inserting the 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 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 FSQ-106ED uses a rack-and-pinion focuser. This focuser enables the observer to focus rapidly. Turning the focuser clockwise will move the drawtube out, while turning it counter-clockwise will move the drawtube in. Refer to Fig. 12.

This focuser has Takahashi original 1/7 micro edge focuser built-in. Turning the small knob clockwise or counter-clockwise can achieve very fine focusing at high magnification or for imaging.

Remove the lens shade cover and the aluminum plug from the 31.7mm (1.25") 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.

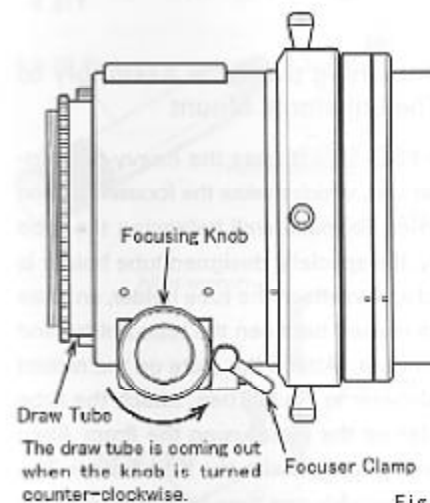


Fig. 12

● Focuser Draw Tube Clamp

The focuser clamp is located on the underside of the focuser. It is the handle as shown in Fig.13. Pulling it toward, the focus knob tightens the clamp and pushing it forward loosens it. It is not necessary to pull the clamp with force since a light pull is sufficient to hold any load. Do not over tighten this clamp.

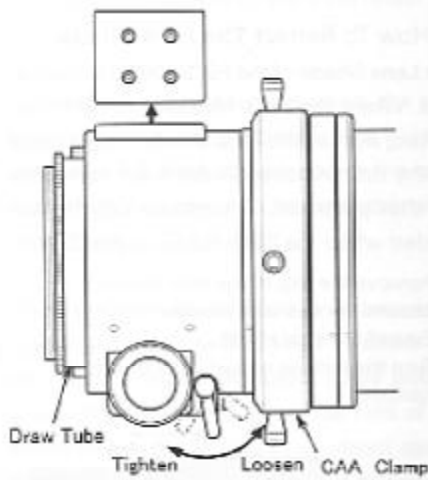


Fig. 13

● Camera Angle Adjuster

The FSQ-106ED uses a newly designed camera angle adjuster allows the focuser to turn 360° to properly position an imaging package or visual device.

When the large locking ring is loosened, the entire focuser can be rotated to accomplish this re-positioning. If a finder is mounted and a quick release bracket is used, the package can be rotated and then the finder re-attached. If a quick release bracket is not used, be careful to keep the finder from running into the telescope.

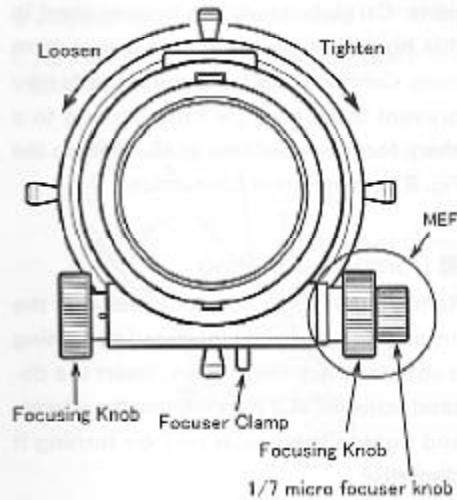


Fig. 14

⚠ Caution

Never loosen the four screws (M3 hexagon hole bolts) under any circumstances because these screws hold the flat bearing. Should they be loosened, the focuser becomes loose.

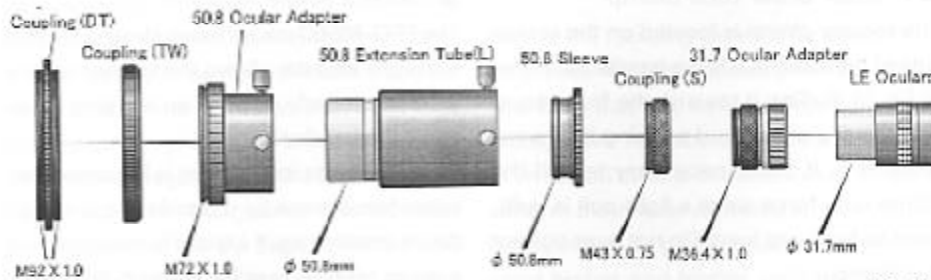


Fig. 15

■ 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 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.

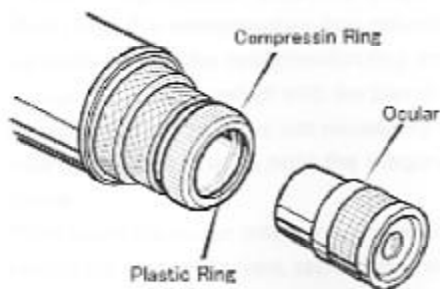


Fig. 16

■ How To Retract The Lens Shade

The Lens Shade of the FSQ-106ED is retractable. When the FSQ-106ED 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-106ED 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.

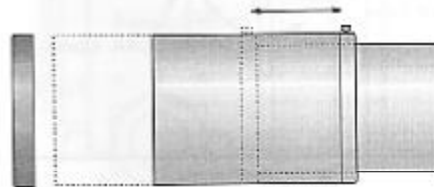


Fig. 17

[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.

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.

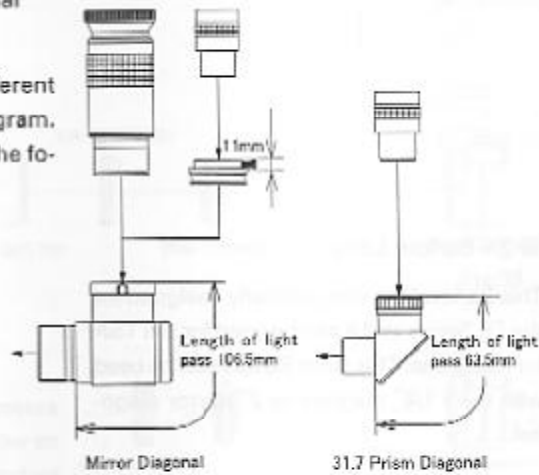


Fig. 22

Fig. 23

■ Extender-Q 1.6X (50.8)

The FSQ-106ED is a short focus photo/visual astrograph. Nonetheless, due to the very high quality of the optics, the instrument can be used for high magnification lunar and planetary observations. The Extender-Q 1.6X (50.8) is designed to increase the focal length sufficiently to produce the higher magnifications necessary for this type of observing.

Focal length	850mm
Focal ratio	f/8
Image circle	ϕ 44mm

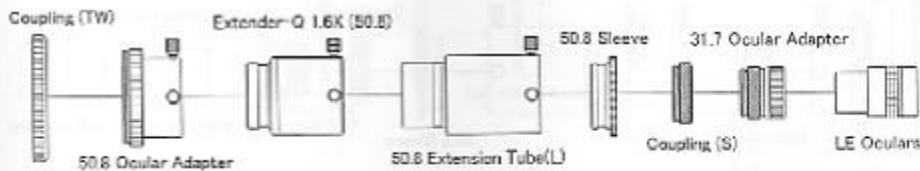
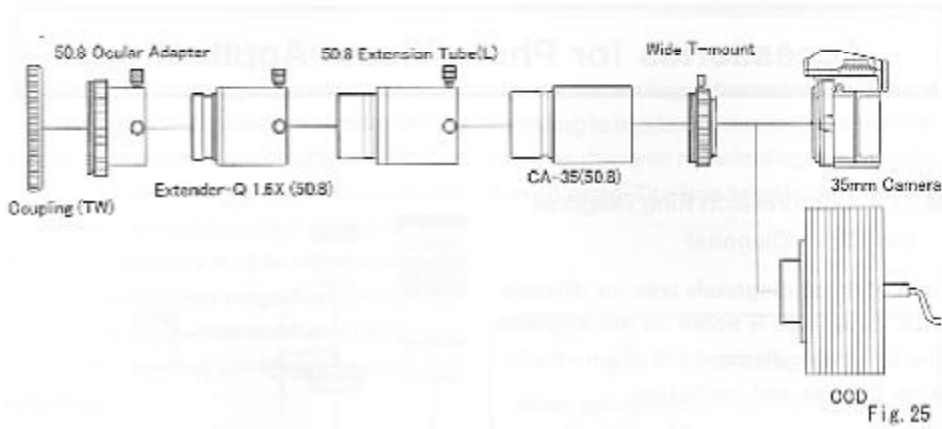
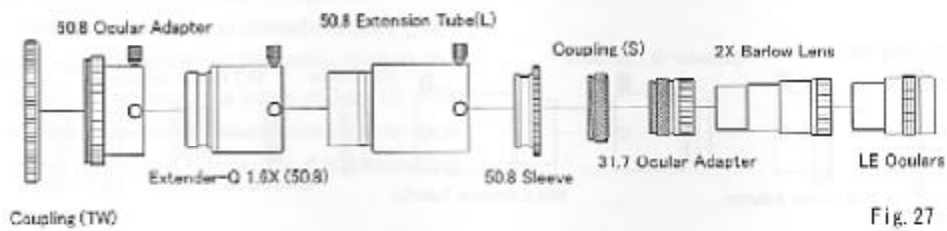
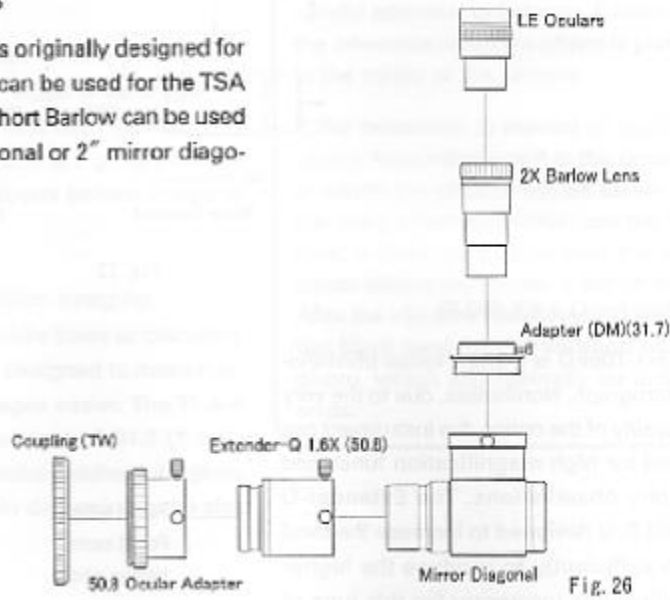


Fig. 24



■ 2X Barlow Lens

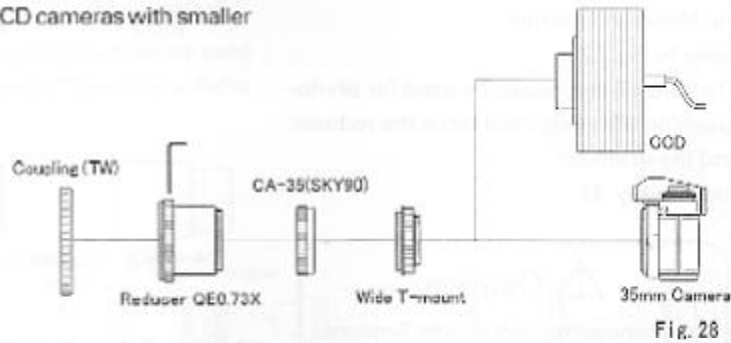
This Barlow lens was originally designed for the FS Series and it can be used for the TSA for visual use. This short Barlow can be used with the 1 1/4" diagonal or 2" mirror diagonal.



■ Reducer-QE 0.73X

This newly developed reducer uses 4 multi-coated elements to produce a flat field with a faster focal ratio. The stars still remain as small as useful for CCD cameras with smaller chips.

Focal length 610mm
 Focal ratio f/3.6
 Image circle ϕ 44mm

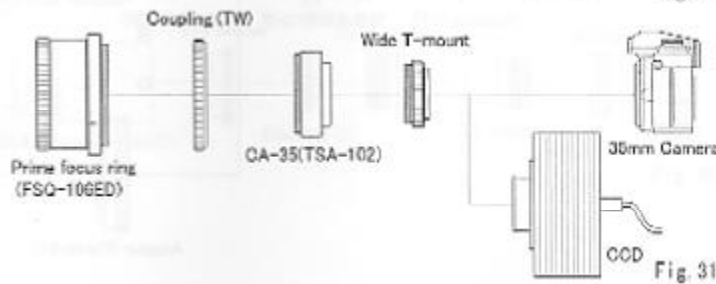
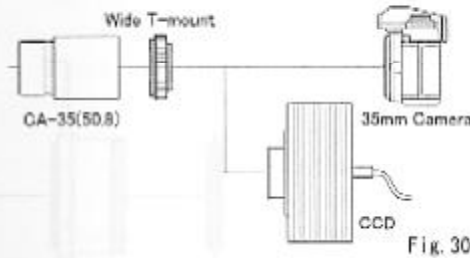
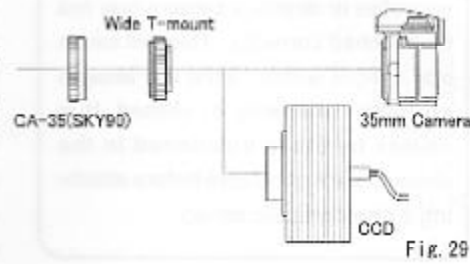


■ CA-35

There are three different 35mm camera adapters (CA-35) available that will allow an SLR/DSLR and CCD camera to be attached to the FSQ-106ED.

- a. Prime focus
 --> CA-35 (50.8/2") or CA-35 (TSA-102)
- b. With the Reducer-QE 0.73X
 --> CA-35 (SKY-90)
- c. With the Extender-QE 1.6X
 --> CA-35 (50.8/2")

Refer to Fig 29-31.



■ T-mount & Wide T-mount

The T-mount is used to connect to the TCA-4 eyepiece projection adapter for high magnification photography and CCD images of the Moon and planets.

Refer to Fig. 32.

The Wide T-mount can be used for photographing with the prime focus, the reducer, and the extender.

Refer to Fig. 33.

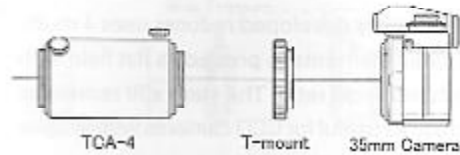


Fig. 32

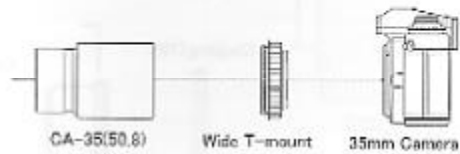


Fig. 33

⚠ Caution

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

■ Prime Focus Aux. Ring

Prime Focus Aux. Ring, optionally available, will be used when the Pentax 67 camera or the mamiya 645 camera is attached. This ring is more rigid than a CA-35(50.8). So when a heavy camera such as a digital SLR camera or a CCD is attached, this ring is useful. Refer to the photo/visual system chart. When you like to turn your camera attached to the ring, loosen the set screws by an Allen wrench.

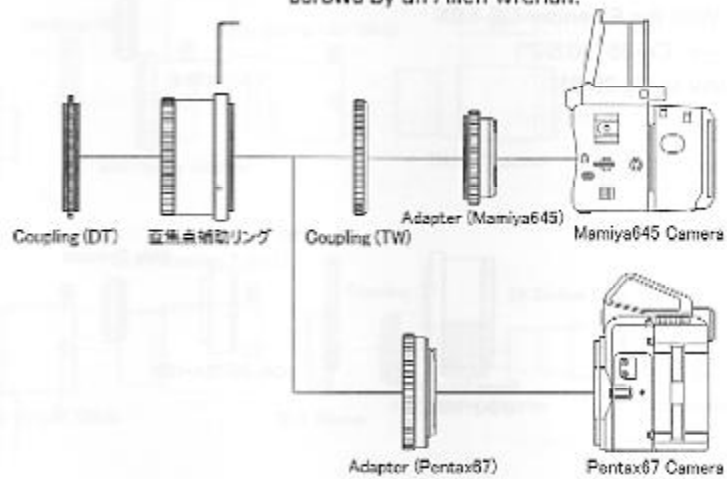


Fig. 34

■ TCA-4

This variable eyepiece device attaches easily to the FSQ-106ED for high quality and high magnification photography of the surface of the Moon and planets. It can be used with a film, digital and CCD camera. Refer to Fig. 35.

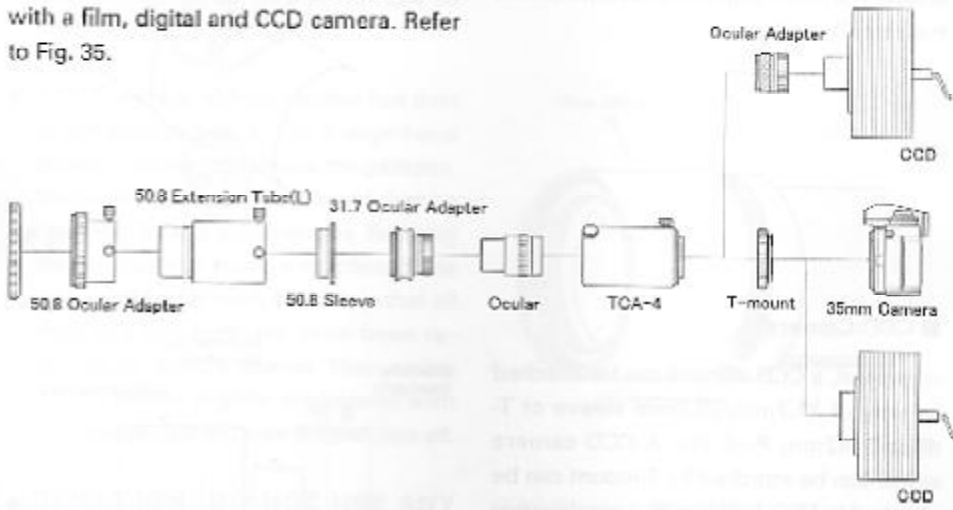


Fig. 35

■ Digital camera Adapter

LE-DCA is an adapter to attach your digital SLR camera to FSQ-106ED. With the collimating method you can take lunar and planetary images with your camera, using Takahashi LE oculars except LE-50mm.

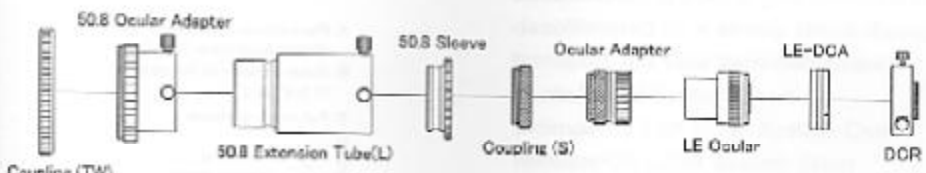


Fig. 36

■ FQR-1

FQR-1 is very convenient device to attach and detach the finder quickly. Once it is set on the focuser housing, you can attach and detach the finder quickly by thumb turn screw. The finder alignment remains almost the same in doing so.

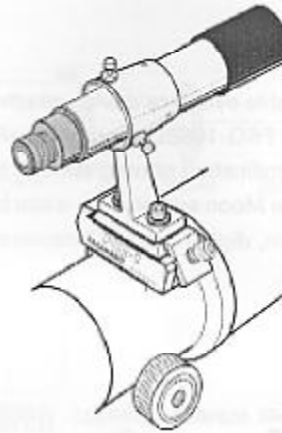
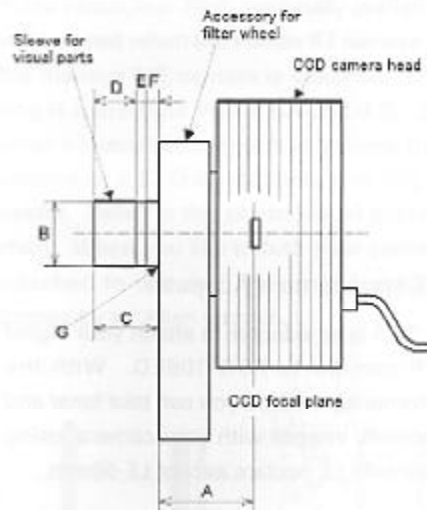


Fig. 37

■ CCD Camera

In general, a CCD camera can be attached by way of 31.7mm/50.8mm sleeve or T-thread (42mm P=0.75). A CCD camera which can be attached by T-mount can be attached to FSQ-106ED with a combination of CA-35 and Wide T-mount as same manner for 35mm SLR/DSLR.

The FSQ-106ED has a long back focus (178mm), which will allow to attach various photo set-ups.



- A. Plane sleeve connector
[CCD's focal plane (1mm)]
- B. Outer diameter of the sleeve
(1 1/4" or 2")
- C. Full length of sleeve
- D. Position of sleeve's groove
- E. Position of sleeve's groove
- F. Position of sleeve's groove
- G. Diameter and pitch of sleeve's thread

Fig. 38

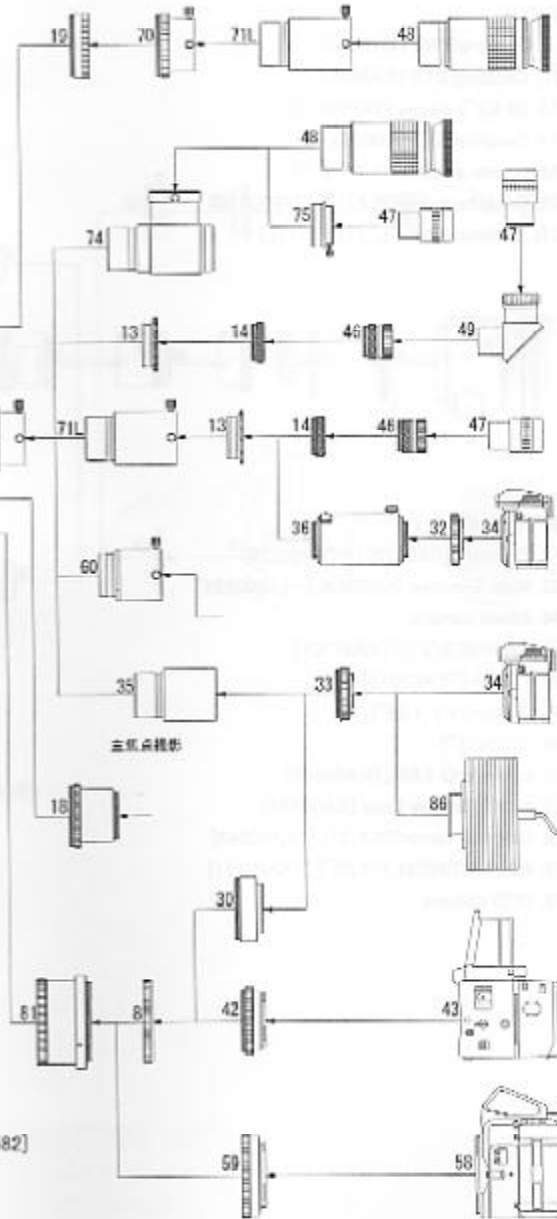
System Chart

■ Photo/ Visual System Chart

- 8. Coupling(TW)[TKA30003]
- 10. Coupling(DT)[TKA36001]
- 13. 50.8(2") sleeve [TKP00113]
- 14. Coupling(S)[TKA00100]
- 18. ReducerQE 0.73X [TKA36580]
- 19. Vari ring [TKA31581]
- 30. CA35(TSA-102) [TKA23201]



- 32. T-mount [KA00220]~[KA00226]
- 33. Wide T-mount [KA00230]~[KA00236]
- 34. 35mm camera
- 35. CA35(50.8/2") [TKA31201]
- 36. TCA-4 [TKA00210]
- 42. Adapter(Mamiya645)
- 43. Mamiya645 camera
- 46. Ocular adapter(31.7/1.25")
- 47. Ocular(31.7/1.25")
- 48. Ocular(2")
- 49. Diagonal prism(31.7/1.25")[TKP00541]
- 58. Pentax67 camera
- 59. Adapter(Pentax67)
- 60. ExtenderQ 1.6X [TKA00595]
- 70. Ocular adapter(50.8/2") [TKP27110]
- 71L.Extension tube(L) [TKP31112]
- 74. Diagonal mirror(50.8/2") [TKA00543]
- 75. Adapter(DM)(31.7/1.25") [TKA00111]
- 81. Prime focus ring(FSQ-106ED) [TKA31582]
- 86. CCD camera

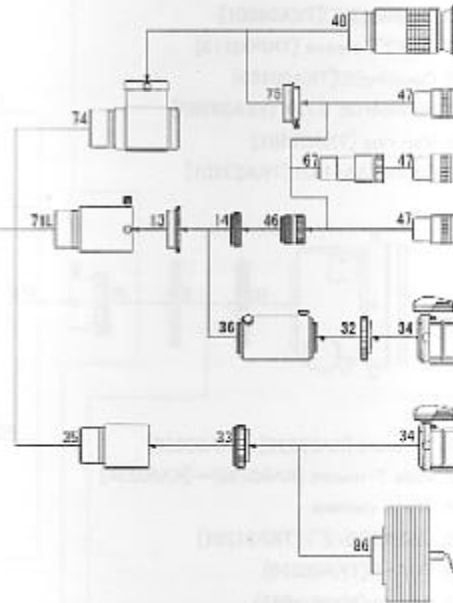


Additional Configurations

■ ExtenderQ 1.6X(50.8) System

Chart

- 8. Coupling(TW)[TKA30003]
- 10. Coupling(DT)[TKA36001]
- 13. 50.8(2") sleeve [TKP00113]
- 14. Coupling(S)[TKA00103]
- 46. Ocular adapter(31.7/1.25")
- 70. Ocular adapter(50.8/2") [TKP27110]
- 71L.Extension tube(L) [TKP31112]

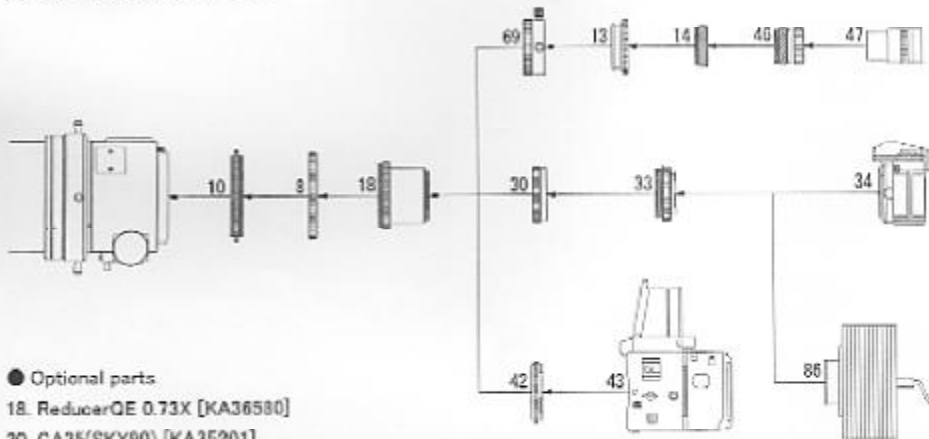


● **Optional parts**

- 32. T-mount [KA00220]~[KA00226]
- 33. Wide T-mount [KA00230]~[KA00236]
- 34. 35mm camera
- 35. CA35(50.8/2") [TKA31201]
- 36. TCA-4 [TKA00210]
- 47. Ocular(31.7/1.25")
- 48. Ocular(2")
- 60. ExtenderQ 1.6X [TKA00595]
- 67. 31.7 2XBarlow Lens [KA00597]
- 74. Diagonal mirror(50.8/2") [TKA00543]
- 75. Adapter(DM)(31.7/1.25") [TKA00111]
- 86. CCD camera

■ Reducer System Chart

- 8. Coupling(TW)[TKA30003]
- 10. Coupling(DT)[TKA36001]
- 13. 50.8(2") sleeve [TKP00113]
- 14. Coupling(S)[TKA00103]
- 46. Ocular adapter(31.7/1.25")



● Optional parts

- 18. ReducerQE 0.73X [KA36580]
- 30. CA35(SKY90) [KA35201]
- 33. Wide T-mount [KA00230]~[KA00236]
- 34. 35mm camera
- 42. Adapter(Mamiya645)
- 43. Mamiya645 camera
- 47. Ocular(31.7/1.25")
- 70. Ocular adapter(SKY90,50.8/2") [KP35110]
- 86. CCD camera