INSTRUCTIONS

SZH10

ZOOM STEREO MICROSCOPE

WARNING

This instruction manual has been written for use of the Zoom Stereo Microscope Model SZH10. We recommend that you read it carefully in order to familiarize yourself fully with the use of this microscope so that you can obtain optimum performance.

This instruction manual gives an explanation of the standard equipment of the Model SZH-111, the photo tube SZH-PT and Aperture Stop (AS) Unit SZH-AS. Separate instruction manuals are provided for various optional attachments.

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OBSERVE THE FOLLOWING POINTS CAREFULLY:

1. Operation

① Always handle the microscope with care, and avoid rough handling and impacts.

② Avoid exposure to direct sunlight, high temperature and humidity, dust and vibration.
(Ambient temperature for operation: 0°C to 40°C or 32°F to 104°F)

③ For consistent high performance the following points are of importance:

Operation	Relevant section	Care in handling
Focus	Focusing knobs ① (Fig. 1)	1. Avoid forcing the microscope body beyond the upper and lower limits of the focusing range. Do not rotate the coarse or fine focusing knobs after reading the limits of the focusing range (otherwise the internal mechanism may be damaged). 2. Both the coarse and fine focusing rotate simultaneously when either of them is rotated. Restricting simultaneous rotation of the knobs by an external force is detrimental to the internal mechanism of the microscope.
Zoom magnification change	Zoom magnification change knobs ② (Fig. 1)	• Do not apply excessive force to the zoom magnification change knobs reaching the end of the zooming range.
		• Do not rotate the right and left hand zoom magnification knobs simultaneously in opposite directions. Otherwise the optical performance may be affected.

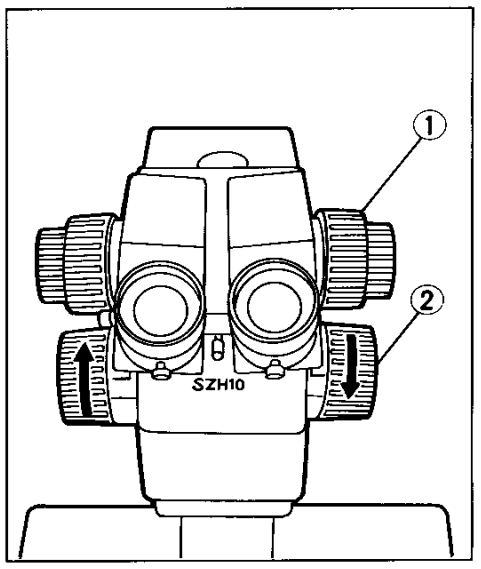
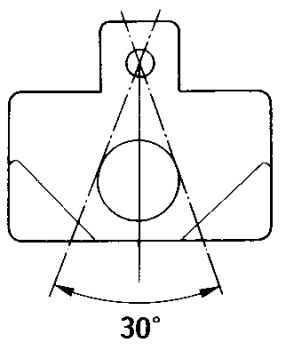


Fig. 1

④ Mounting position of the microscope body

1) Microscope body (Fig. 2)



Pivotal angle of microscope body

Fig. 2

2) Number of intermediate attachments which can be stacked on the microscope body

- The number of intermediate attachments stacked on top of the microscope body is limited to 2 at a time. (Fig. 3)
- Inclination of the desk surface should be within 3° against the horizontal.
- Maintain the stability of the connected units, realizing that the SZH-P400 pillar is 400 mm high and the SZH-P600 pillar is 600 mm high (both are optionally available).

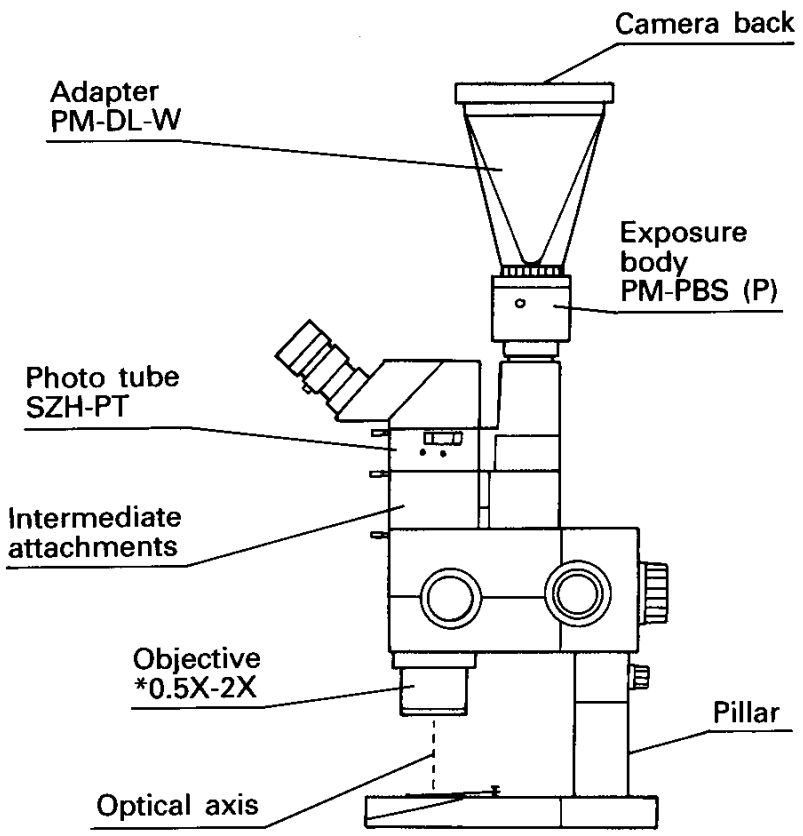


Fig. 3

***Either 400 mm or 600 mm pillar is required when a 0.5X objective is used.**

2. Maintenance

① All glass surfaces must always be kept clean. Fine dust on optical surfaces should be blown off by means of a hand blower. Carefully wipe off oil or fingerprints on the lens surfaces with gauze moistened with a small amount of xylene or a mixture of alcohol and ether (3:7).

② Do not use organic solutions to wipe the surfaces of other components. Plastic parts, especially, should be cleaned with a neutral detergent.

③ Do not disassemble any part of the microscope.

⑤ When not in use, the microscope should be covered with the vinyl dust cover provided.

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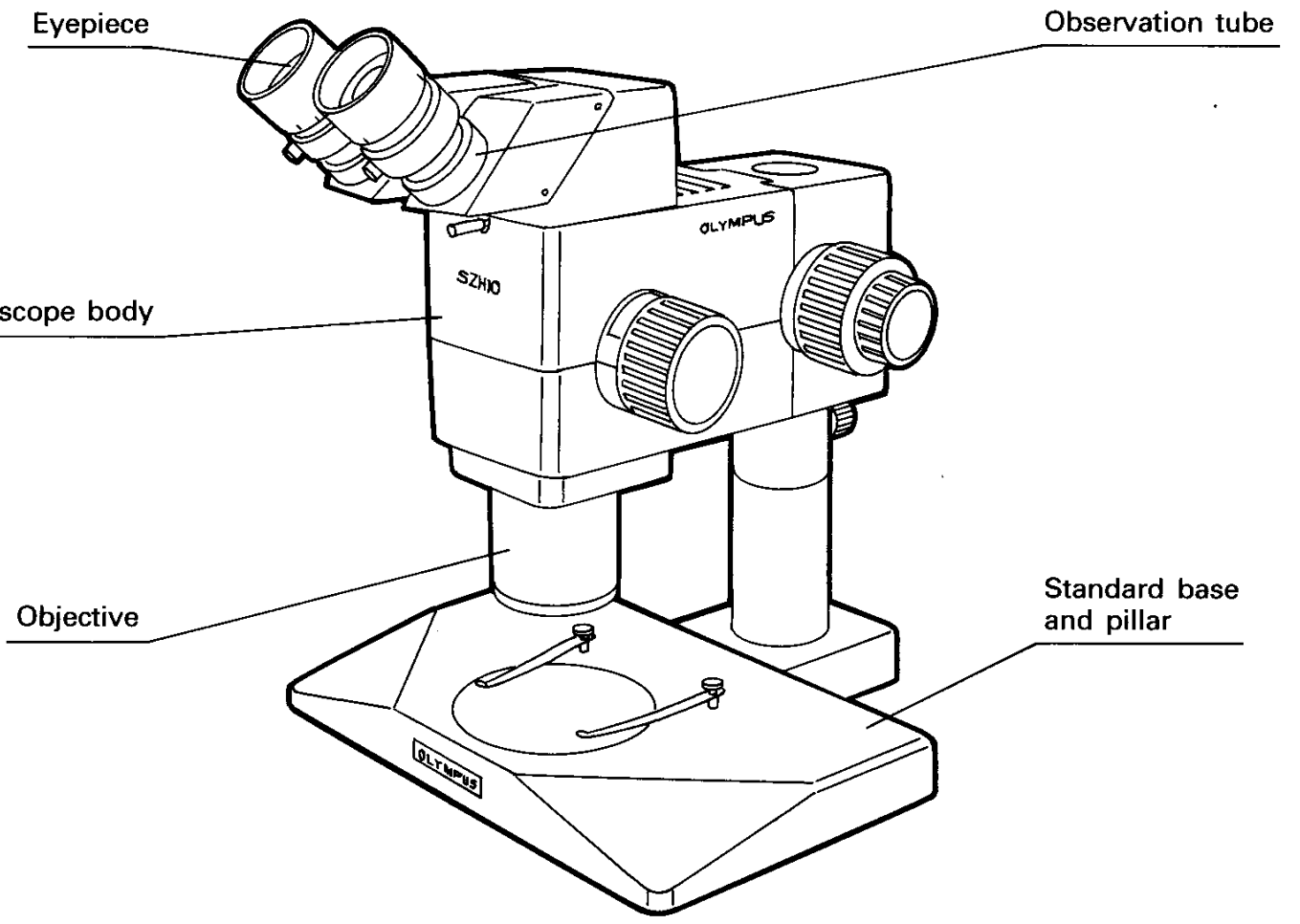
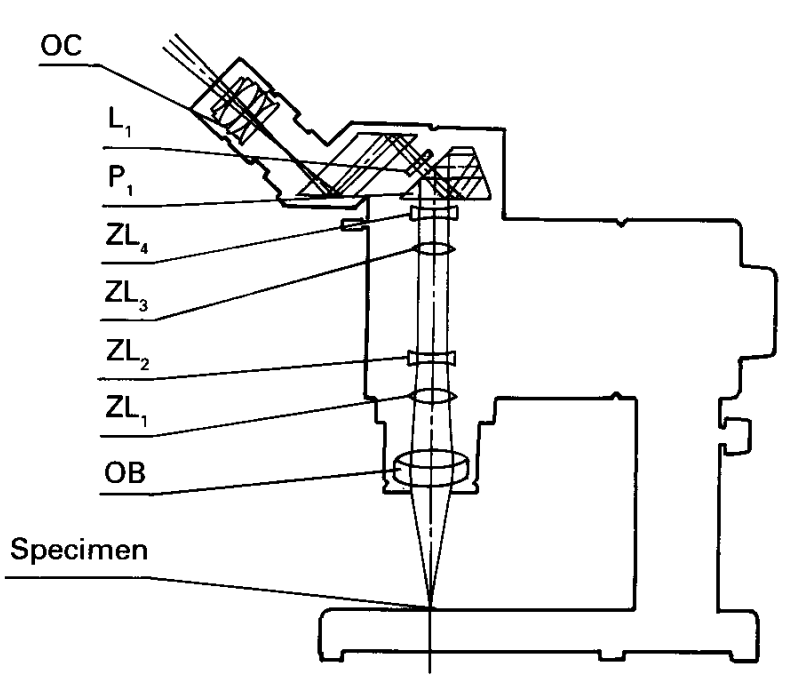
1 STANDARD CONFIGURATIONS

		SZH10-				
		111	121	131	141	151
Zoom microscope body SZH-ZB10	Zoom magnification change by binocular zoom optical axes in parallel rays. Zoom drive: Horizontal axial drive control knobs Zoom ratio: 10 to 1, adjustable with a knob incorporating click stop feature Click stop: Click stops engage every position of the magnification indicated in the window of zoom magnification change handle (0.7, 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7) Objective mount: Tapped for screw-in objectives Focusing: Rack-and-pinion drive using roller guides, controlled by coaxial coarse and fine focusing knobs (coarse focusing knob provided with tension adjusting mechanism), counter-balancing mechanism incorporated for microscope body vertical movement compensation Focusing range: 50 mm	○	○	○	○	○
Observation tube SZH-BI45N	Binocular, inclined 45°, interpupillary distance adjustment range between 50 mm and 76 mm, round dovetail joint with positioning pins	○	○	○	○	○
Standard base and pillar SZH-ST	Pillar height: 250 mm Base dimensions: 300 mm (W) x 260 mm (D) x 30 mm (H)	○				○
Stage plate	Black and white SP-BW-2	○				○
	Clear SP-C		○	○	○	
Transmitted light illuminator SZH-ILLK	6V 20W halogen bulb, light intensity continuously variable 45-LBD2-N and 45LP filters Oblique illumination available. Illuminating area is 40 mm diam.		○			
Transmitted light illuminator SZH-ILLB	6V 20W halogen bulb (Koehler illumination); light intensity continuously variable 45-LBD2-N and 45LP filters Accommodation for mounting 45 mm-diam. additional filters. Filter slider built-in. Illumination modes available for high/low contrast, oblique and darkfield. Light path selection in 3 positions. Auxiliary output terminal (for light source of the SZH-ILLC-2 illuminator, etc.) 6V 20W max. Illuminating area is 40 mm diam.			○		
Transmitted light brightfield/ darkfield illuminator SZH-ILLD	12V 50W halogen bulb; light intensity continuously variable 45-LBD2-N filter built-in. Accommodation for mounting additional 45 mm-diam. Filters. Selection between brightfield and darkfield illumination. Auxiliary output terminal, 6V 200W max. Illuminating area is 34 mm diam.				○	
Coaxial vertical illuminator SZH-ILLC-2	6V 20W halogen bulb: 20 KB-W filter & quarter wave plate Magnification factor: 1.25X. Provided with depolarizers					○
Objective	DF Plan 0.5X (N.A. 0.042; W.D. 198 mm)					
	DF Plan 0.75X (N.A. 0.063; W.D. 113 mm)					
	DF Plan Apo 1X (N.A. 0.087; W.D. 81 mm)	○	○	○	○	○
	DF Plan 1.5X (N.A. 0.125; W.D. 48 mm)					
	DF Plan 2X (N.A. 0.167; W.D. 39 mm)					
Eyepieces	GWH10X-D (Field number 24) GWH10X-CD (Field number 24)	○	○	○	○	○
Photo tube SZH-PT	Directs 20% of light to observation tube and 80% to camera; or 100% to observation tube Accommodation for mounting photomicrographic equipment including Olympus photomicrographic system PM-10, video camera, 16 mm time-lapse cine camera and OM-System camera back Magnification factor 1X			○		
Photo eyepiece	NFK 2.5X LD			○		
Transformer TL-2						○
Bulb socket LS20HM			○	○		
Halogen bulbs	6V 20WHAL 2 pcs.		○	○		○
	12V 50WHAL-L 2 pcs.				○	
Power cord UYCP			○	○	○	
Aperture stop unit SZH-AS	Aperture adjustment: Lever-controlled, synchronized movement of right and left aperture iris diaphragm	(option)	(option)	(option)	(option)	(option)

2 NOMENCLATURE



3 LIGHT PATH DIAGRAM



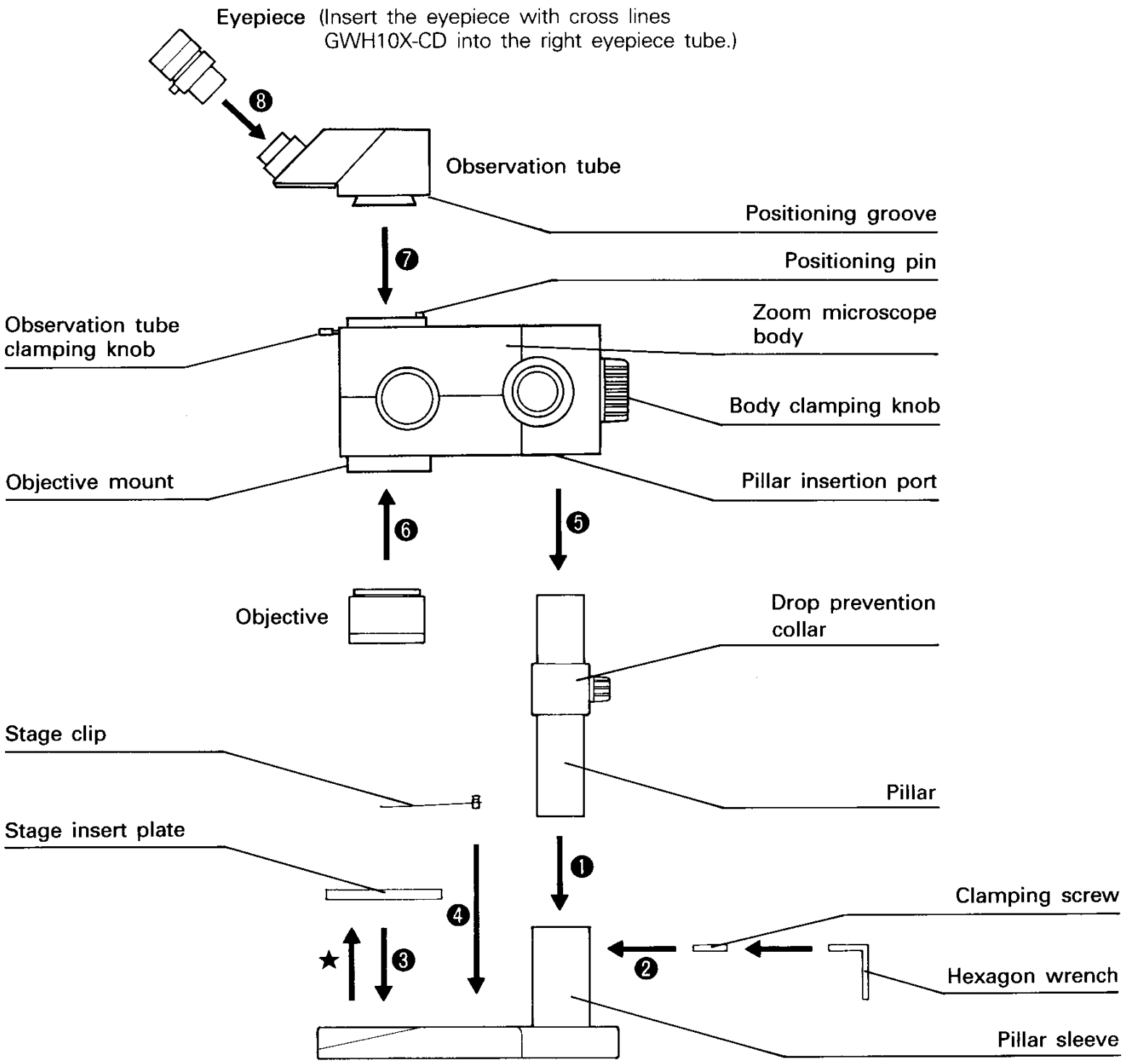
A light beam from the specimen enters the objective OB and proceeds through the zoom lens groups ZL_1 through ZL_4. When the beam reaches the upright-image-forming Dach prism P_1, it is deflected 45° toward the image-forming lens L_1 and further to the eyepiece OC.

As the beam passes between the objective OB and the zoom lens ZL_1, the zoom lens ZL_2 and Dach prism P_1, respectively in the form of parallel rays, various optional intermediate tubes can be attahed.

4 ASSEMBLY

The diagram below illustrates the sequential procedure of assembly. The numbers indicate the assembly order of each component.

★ **Keep all connecting surfaces clean and avoid scratching glass surfaces.**



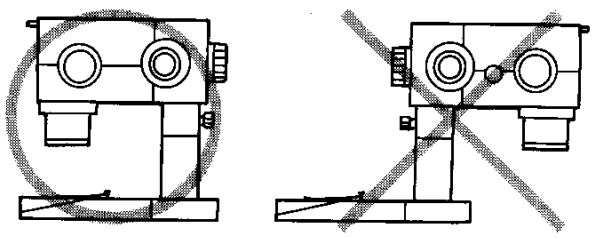


Fig. 4

Explanation for Assembly

❺ Mounting the zoom microscope body

1) First loosen the microscope body clamping knob completely, and while holding the microscope body with both hands, insert the pillar into the microscope body from below.
   ★ **Insert the pillar slowly and do not apply excessive force.**
2) Slowly lower the microscope body until it reaches the drop prevention collar, then tighten the body clamping knob.
   ★ **The microscope body must be on the same side as the stage plate in the stand, and its pivotal angle must be limited to a 30° sector as shown in Fig. 4.**
   If the microscope body is placed on the wrong side, the assembly will turn over.
3) If the specimen is thin (with objectives between 0.75X and 2X) it is possible to keep the crop prevention collar next to the pillar sleeve.

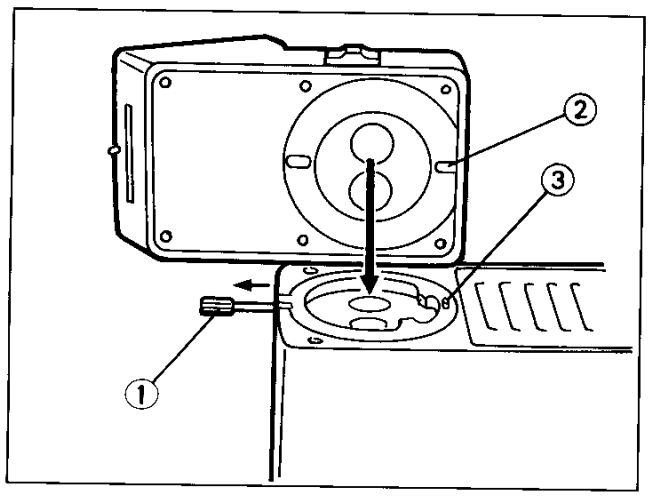


Fig. 5

❼ Mounting the observation tube

1) Completely loosen the observation tube clamping knob ①. (Fig. 5)
2) Align the positioning pin ③ to the groove ②, insert the circular dovetail mount of the observation tube into the mounting port at the top of the microscope body, then fasten the tube with the clamping knob ①.
   ★ **The observation tube can be mounted 180° from this position.**

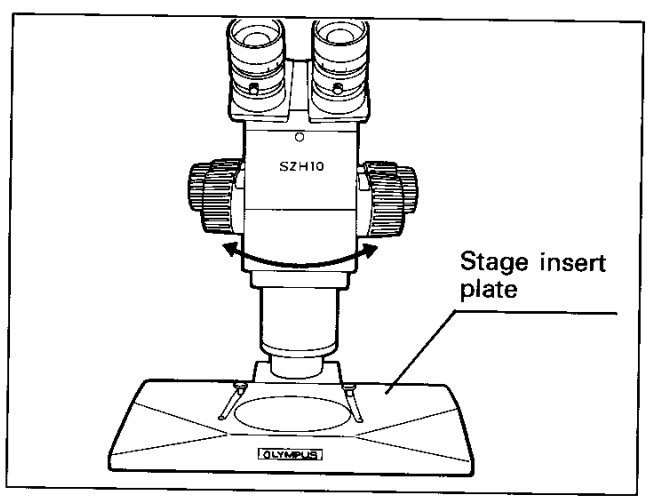


Fig. 6

■ Microscope body position on the stand

When the drop prevention collar is securely clamped, loosen the body clamping knob. Slightly rotating the microscope body to the right and left, align the center of the objective mount to the center of the stage plate in the stand, then clamp the microscope body. (Fig. 6)

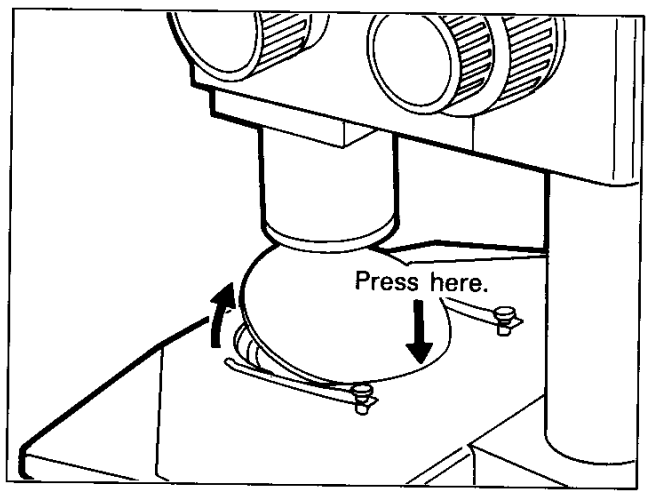
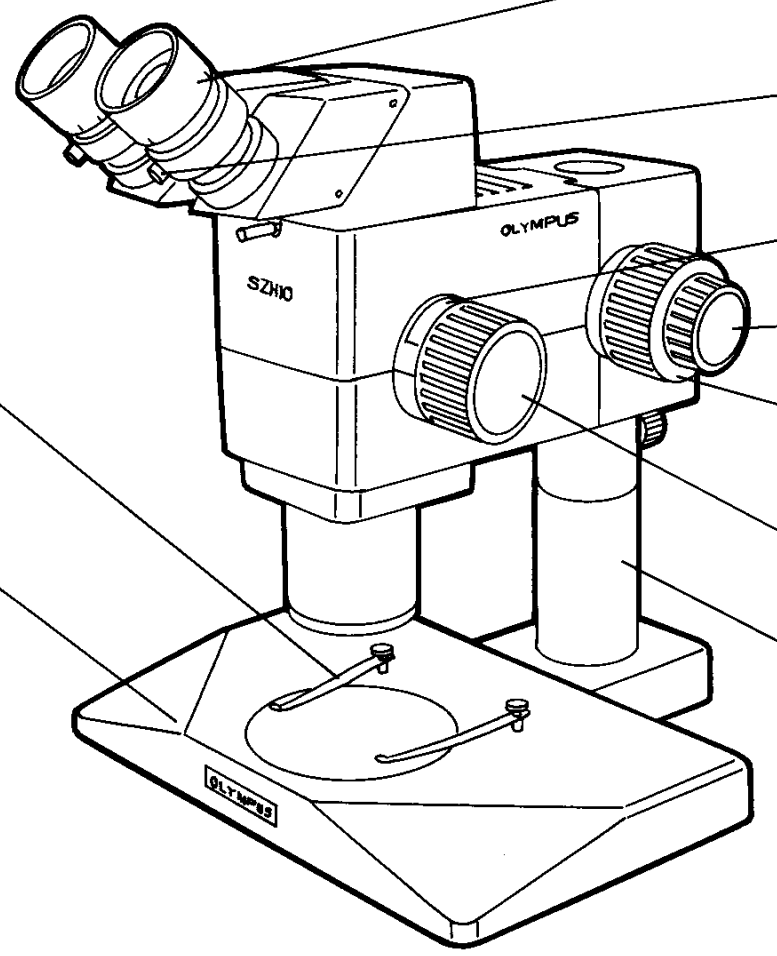


Fig. 7

■ Removal of the stage plate

Press the stage plate at the edge nearest to the pillar and the opposite end will rise from the base. (Fig. 7)

5 IDENTIFICATION AND FUNCTION OF MAIN COMPONENTS



Diopter adjustment ring

Adjustment range: +2 to –8 diopter

Diopter ring lock screw

Zoom magnification indicator window

(0.7X ~ 7X)

Fine focusing knob

Movable range: 50 mm

Coarse focusing knob

Movable range: 50 mm

Zoom magnification knob

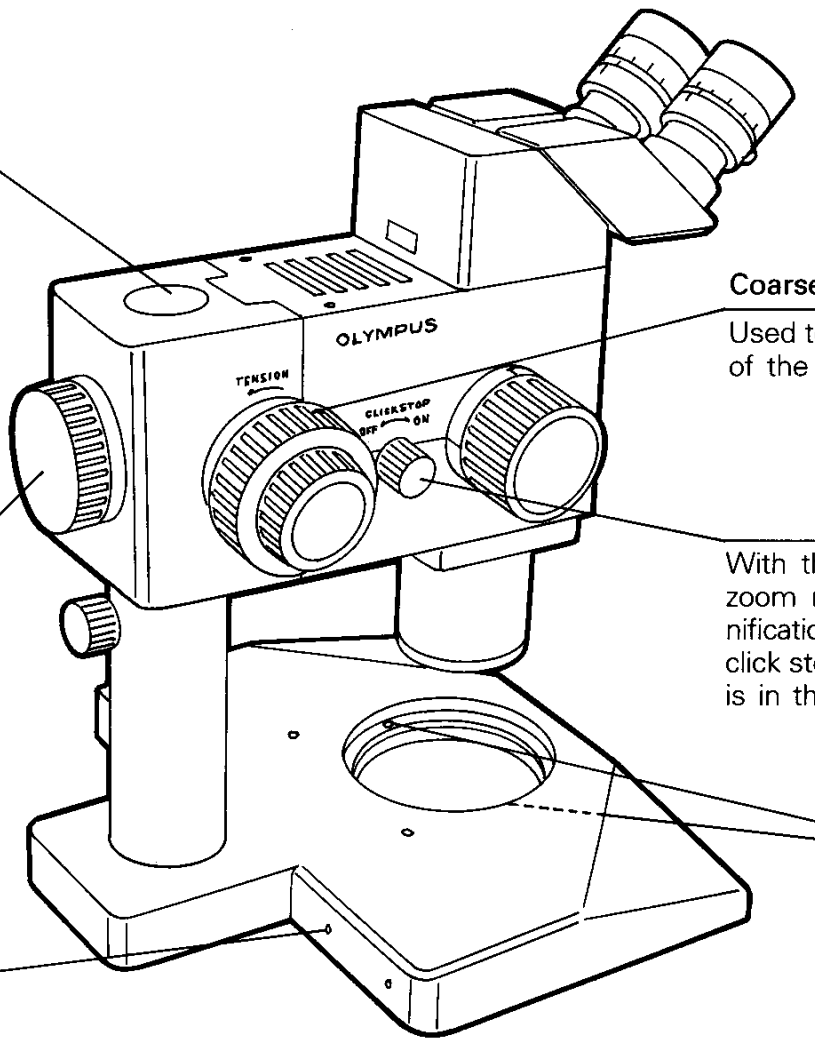
Drop prevention collar

Clamp the ring to prevent the microscope body from dropping. A vertical illuminator can be mounted.

Stage clip

Holds specimens in position.

Hand rest



Pillar

Standard length: 250 mm

Pillars optionally available measure 400 mm and 600 mm in length.

Coarse focusing knob tension adjusting knob

Used to adjust the tension (rotational resistance) of the coarse focusing knob.

Click stop knob

With this knob placed in the ON position, the zoom magnification knob stops at every magnification indication appearing in the window. The click stop function is disengaged when this knob is in the OFF position.

Body clamping knob

Clamps the body to the pillar.

Tapped holes

4 mm in diam. in 2 places, for mounting a stage adapter.

Tapped holes

4 mm in diam. in 4 places, for mounting a stage manipulator, or other accessories.

6 SUMMARY OF PUTTING THE MICROSCOPE IN OPERATION

Preparation

1. Check and tighten the connection of each component, especially the observation tube. (Page 4)
2. Adjust the position of the microscope body. (Page 4)
3. Adjust the tension of the coarse focusing knob. (Page 7)
4. Prepare desired illuminators.

Operating Procedure

1. Place a specimen on the stage.
2. Make diopter adjustment.* (Page 7)
3. Adjust interpupillary distance. (Page 7)
4. Start with lowest zoom magnification.
5. Bring the microscope into focus by rotating the coarse focusing knob.
6. Go to maximum zoom magnification.
7. Refocus.
8. Select zoom magnification as desired.
9. Precisely focus the microscope on the specimen with the fine focusing knob.
10. When the optional aperture stop unit SZH-AS is in use, move its adjusting lever until desired iris diaphragm opening is obtained.

*Regarding the proper use and installation of eyeshield and reticles, please refer to pages 7 and 8.

7 OPERATION

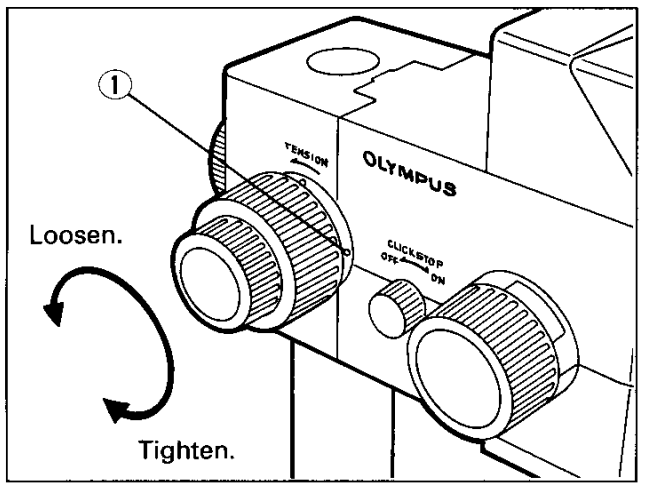


Fig. 8

1. Tension Adjustment of the Coarse Focusing Knob
Insert a screwdriver's tip in one of the holes in the tension adjusting ring ① and rotate the ring to adjust the tension of the coarse focusing knob for either heavy or light movement. Rotate the ring in the direction of ARROW to increase the tension or in the opposite direction to decrease it. (Fig. 8)

★ **If the tension is insufficient, the microscope body may drop under its own weight. Always maintain an appropriate tension to prevent the microscope body from dropping accidentally.**

Caution:

If the adjustment is too tense, a precise focusing is impossible and damage to the microscope mechanism could result. Never rotate the fine focusing knob quickly when the coarse focusing knob is under great tension.

When focusing by holding both the right and left coarse or fine focusing knobs, never attempt to rotate these knobs in the directions opposite to each other. Doing so could cause damage to the internal mechanism.

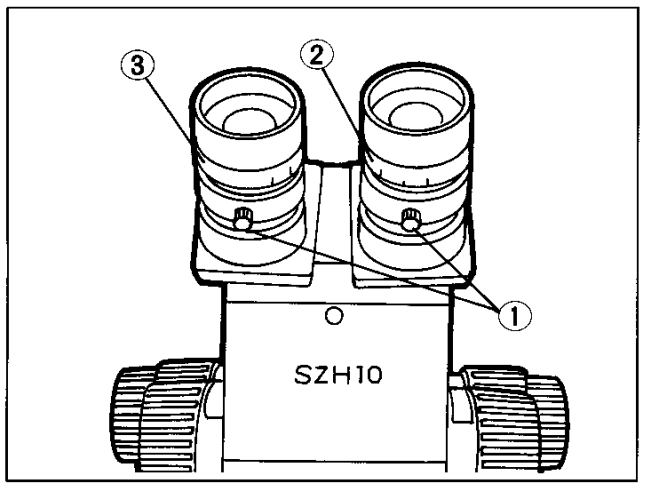


Fig. 9

2. Use of the Eyepiece

A. Diopter adjustment (Fig. 9)

1) Before diopter adjustment, unlock the diopter adjustment ring by rotating the lock screw ① counterclockwise 180°.

2) Adjust diopter.

a) If a focusing reticle is used:
Looking through the right eyepiece, adjust the diopter ring ② (Fig. 9) until the double cross lines are most clearly visible. (Fig. 10)

b) If no focusing reticle is used:
Looking through the right eyepiece, rotate the diopter ring ② until an image of the field of view is most clearly seen. (Figs. 9, 11)

3) Bring the specimen into focus, by rotating the focusing knobs so that the reticle (or the image of the field) and the specimen are in sharp focus simultaneously.

4) Looking through the left eyepiece, with the left eye, rotate the diopter ring ③ to focus on the specimen. (Fig. 9)

5) After focusing adjustment, clamp the diopter lock screw ①. (Fig. 9)

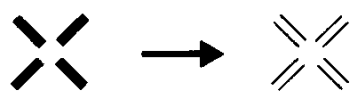


Fig. 10

Fig. 11

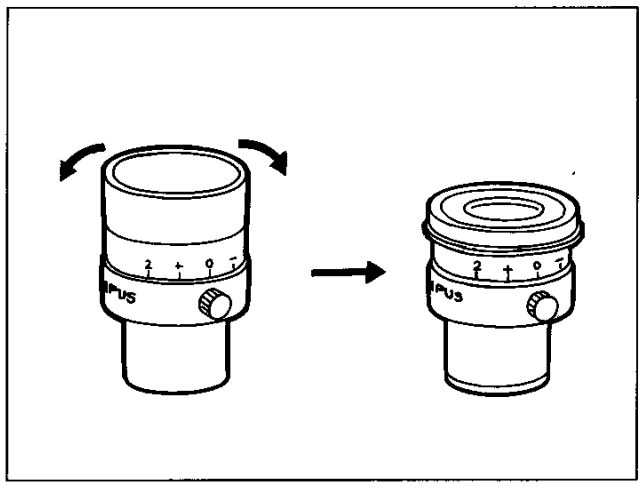


Fig. 12

B. Eyepiece shield (Fig. 12)

1) If the observer does not wear eyeglasses he can keep his eyes closer to the eyepiece shields during observation.

2) Eyeglass wearers may fold back the shields as indicated in Fig. 12.

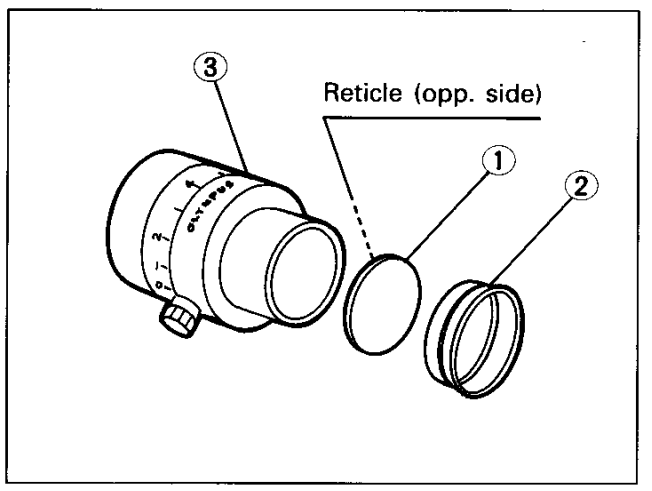


Fig. 13

C. Use of the reticle

1) Make sure the reticle ① is clean, then insert it into the ring ②, with the engraved cross lines facing up. (Fig. 13)
2) Screw the combination reticle ① and ring ② completely into the lower end of the eyepiece ③ all the way.
3) To remove the reticle, reverse the above procedure. Wrap the removed reticle in clean and soft paper for storage. (Fig. 13)

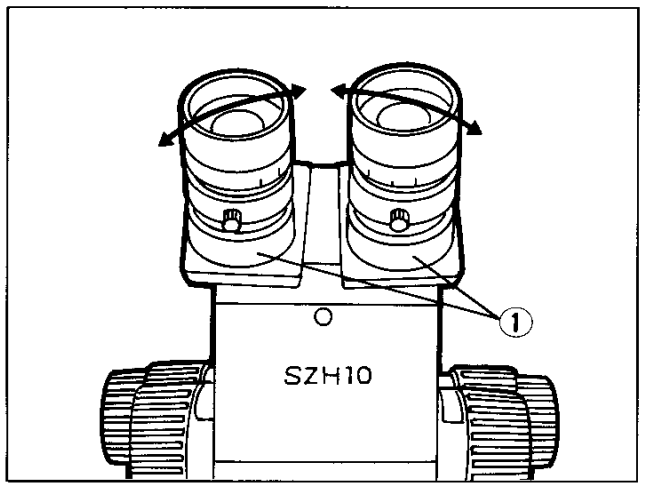


Fig. 14

3. Interpupillary Distance Adjustment

Hold the right and left eyepiece tubes ① and push or pull the tubes in the arrow directions until perfect binocular vision is obtained. (Fig. 14)

★ **Hold the eyepiece tubes with both hands for this adjustment.**

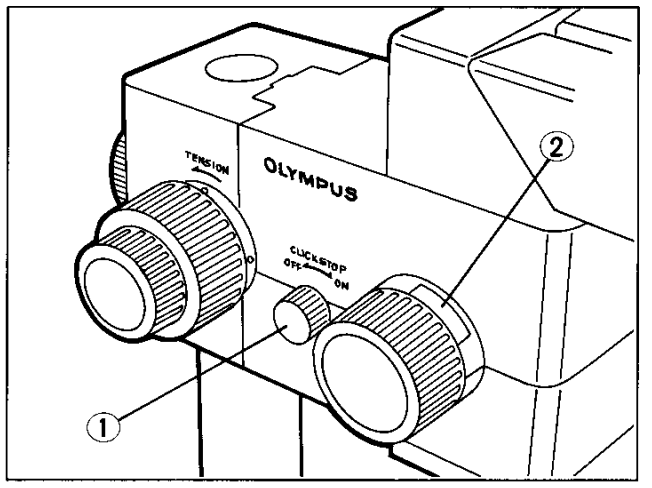


Fig. 15

4. Engagement and Disengagement of the Zoom Magnification Knob Click Stop Function

The click stop function allows the zoom magnification knob to be stopped at each indicated magnitude. This function can be engaged or disengaged as follows:

1) To engage the function, rotate the click stop knob ① fully clockwise. The zoom magnification knob then stops at every position corresponding to the magnitude indicated in the window ②.
2) To disengage the function, rotate the click stop knob fully counterclockwise. The magnitude is then continuously variable.

★ For operating instructions on the illumination bases (SZH-ILLK, SZH-ILLB, SZH-ILLD), refer to the separate instruction manual. Note that when the SZH-ILLK or SZH-ILLB is used in combination with a 1X objective, vignetting at the periphery of the field of view may occur at 0.7 zoom magnification.

8 OPTICAL DATA

1. Total magnifications and field-of-view diameters

Objective / Eyepiece	Mag.	0.5X	0.75X	1X	1.5X	2X
	W.D. (mm)	198	113	81	48.5	39
GWH10X-D (field number 24)	Total mag.	3.75X – 35X	5.25X – 52.5X	7X – 70X	10.5X – 105X	14X – 140X
	Field of view (mm)	68.6 – 6.86	45.7 – 4.57	34.3 – 3.43	22.9 – 2.29	17.1 – 1.71
GWH15X (16)	Total mag.	5.25X – 52.5X	7.875X – 78.75X	10.5X – 105X	15.75X – 157.5X	21X – 210X
	Field of view (mm)	45.7 – 4.57	30.5 – 3.05	22.9 – 2.29	15.2 – 1.52	11.4 – 1.14
G20X-H (12)	Total mag.	7X – 70X	10.5X – 105X	14X – 140X	21X – 210X	28X – 280X
	Field of view (mm)	34.3 – 3.43	22.9 – 2.29	17.1 – 1.71	11.4 – 1.14	8.57 – 0.857
GWH30X (6.5)	Total mag.	10.5X – 105X	15.75X – 157.5X	21X – 210X	31.5X – 315X	42X – 420X
	Field of view (mm)	18.6 – 1.86	12.4 – 1.24	9.29 – 0.929	6.19 – 0.619	4.64 – 0.464

2. Depth of focus (Iris diaphragm opening of aperture stop unit: any position between Max. and Min.)
Eyepiece 10X

(mm)

Objective / Zoom	0.5X	0.75X	1X	1.5X	2X
0.7X	23.65 — 44.2	10.51 — 19.65	5.91 — 11.05	2.36 — 4.91	1.48 — 2.76
2.5X	1.99 — 3.6	0.89 — 1.6	0.49 — 0.9	0.22 — 0.4	0.12 — 0.225
7X	0.286 — 0.414	0.127 — 0.184	0.07 — 0.1	0.032 — 0.046	0.018 — 0.026

9 USE OF PHOTO TUBE SZH-PT

The photo tube SZH-PT is used to connect the photomicrographic equipment PM-10, the photomicrographic camera PM-6, and OM-System camera back on the microscope.

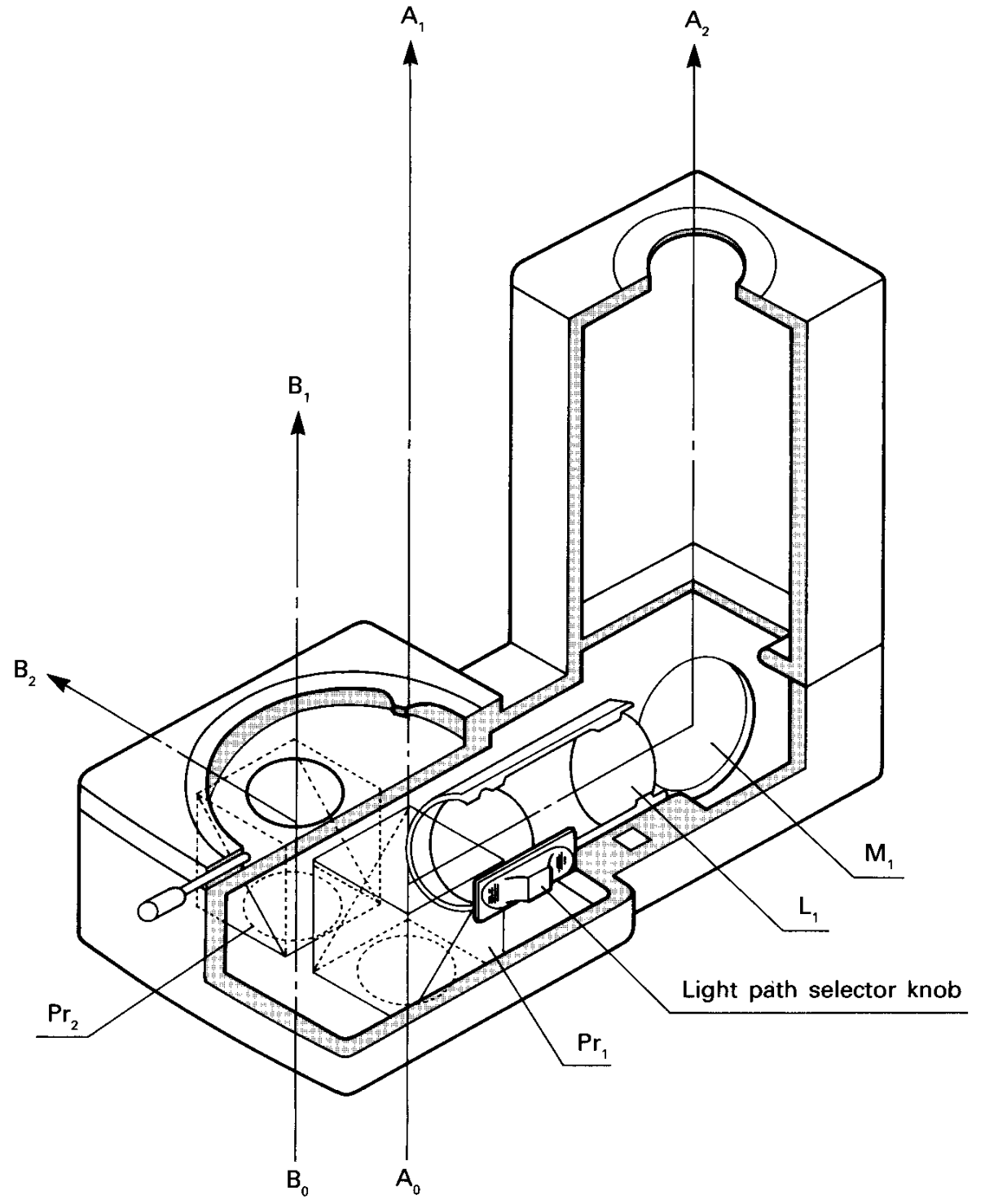
1. Light Path Diagram

The prism Pr_1 on the right-hand side reflects 80% of the right light beam A_0 by 90°. Then, the beam A_0 passes through the lens L_1 and mirror M_1 and enters the photo eyepiece NFK as A_2, while 20% of the light beam that passes through the prism Pr_1 enters the observation tube as A_1.

The prism Pr_2 reflects the left light beam B_0 by 90°, as parallel rays B_2, while 20% of the light passes through the prism Pr_2 and enters the observation tube as B_1.

When the prisms Pr_1 and Pr_2 are moved out of the left and right light beams (A_0, B_0) by means of the light path selector knob, 100% of the light enters the observation tube.

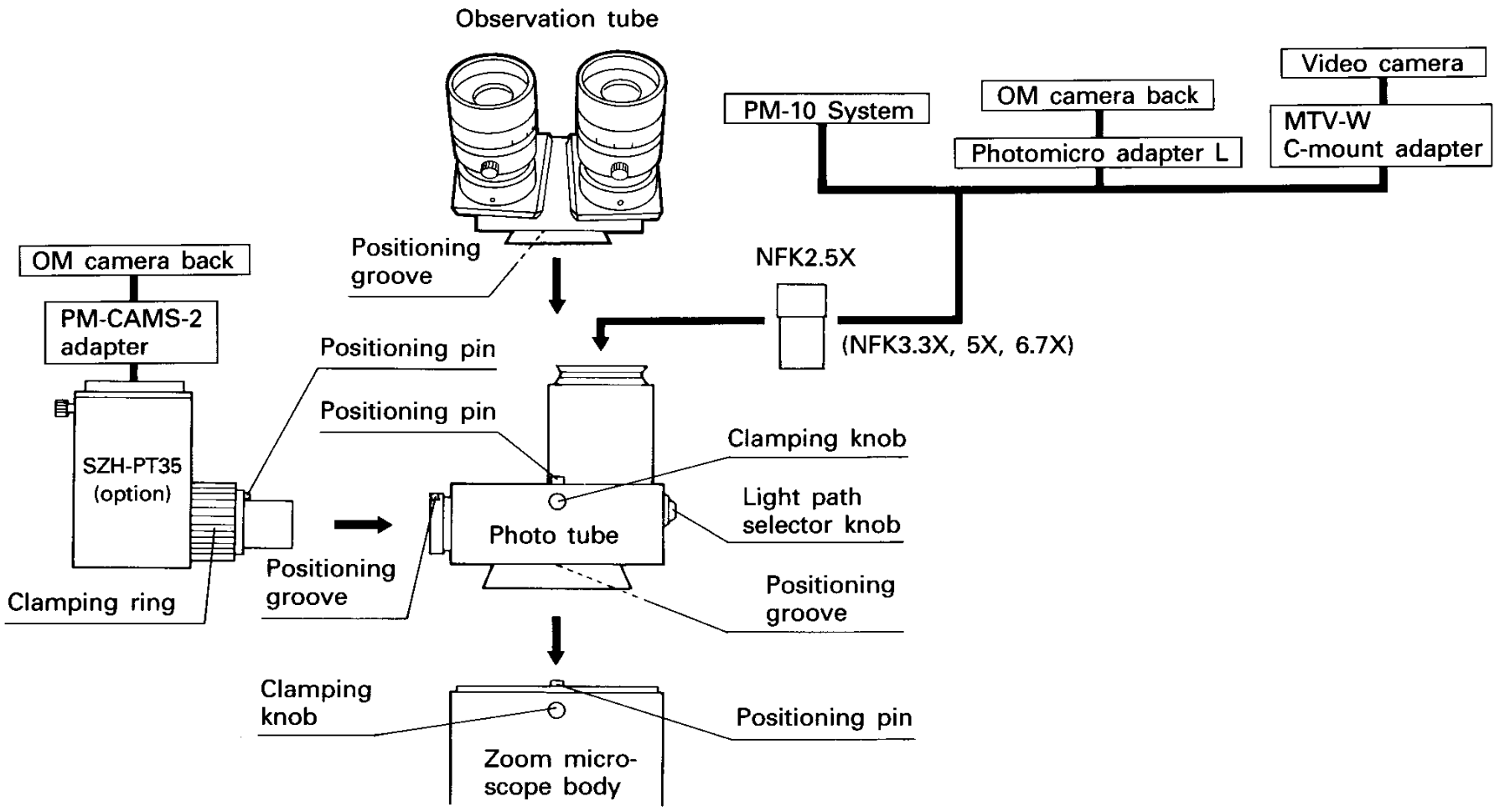
★ **It is recommended to use the NFK2.5X-LD photo eyepiece when a photomicrograph is taken with the light beam A_2.**



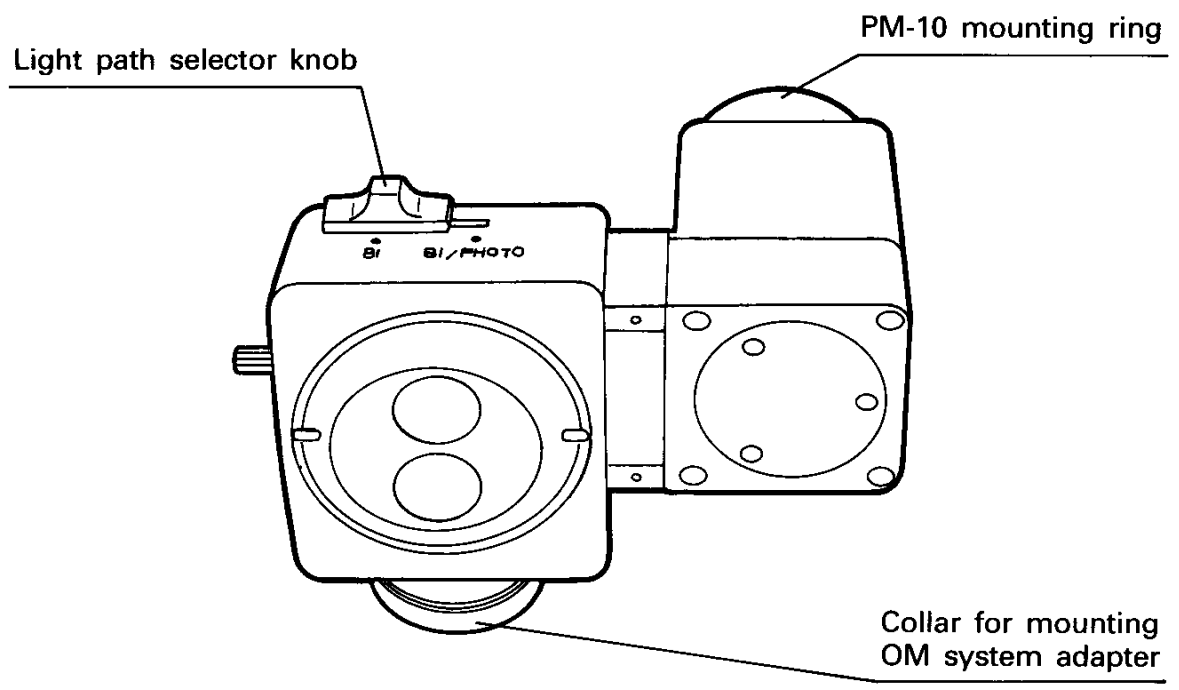
2. Assembly

★ Refer to the mounting of the observation tube at page 4.

★ Read the instruction manual for the PM-10 System.



3. Explanation of the Control Unit of the Photo Tube



4. Photomicrography

Refer to the instruction manual for the PM-10 system for photomicrography.

Preparation

Look through the eyepieces to confirm the diopter adjustment. (Page 7)

Operating Procedure

1. Move the light path selector knob to the BI/PHOTO position. (Page 13)
2. Bring the portion of the specimen to be photographed into the field of view. (Page 14)
3. Focus on the specimen using the coarse and fine focusing knobs.
   ★ **In case of color photomicrography, the color temperature of the light source must be matched or balanced to the color temperature designated by the color film in use.**

Condition / Illuminator	Voltage	Filter
SZH-ILLC-2	Max.	20KB-W
SZH-ILLK SZH-ILLB SZH-ILLD	Max.	45-LBD2-N

(The table at left shows the use of filters, provided with the respective illuminators.
For more accurate color temperature regulation, the color temperature module PM-CTR, optionally available, is recommended.)

4. Release the shutter.

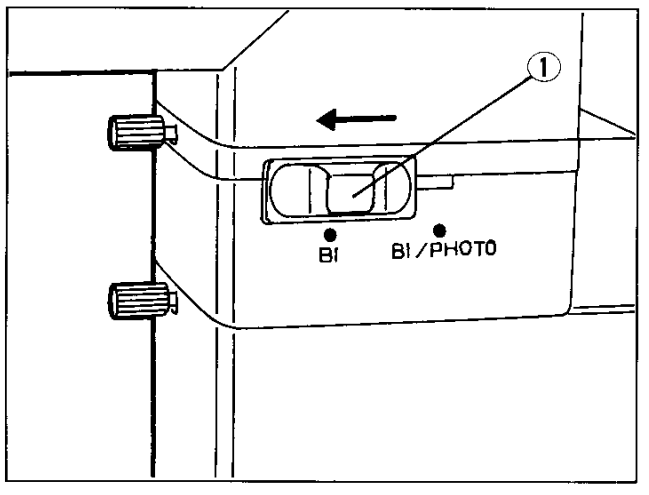


Fig. 16

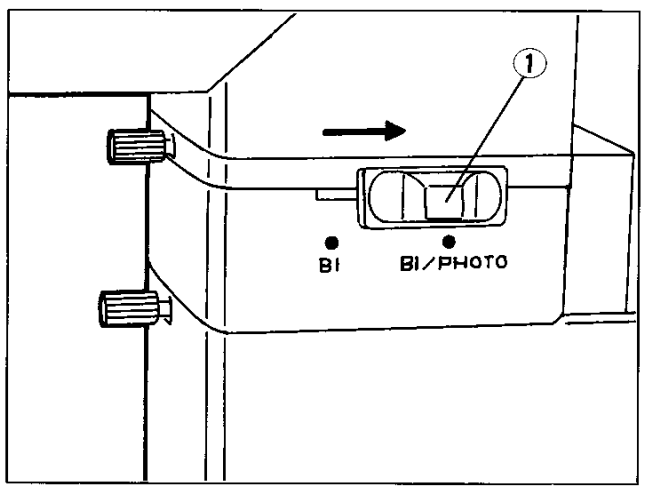


Fig. 17

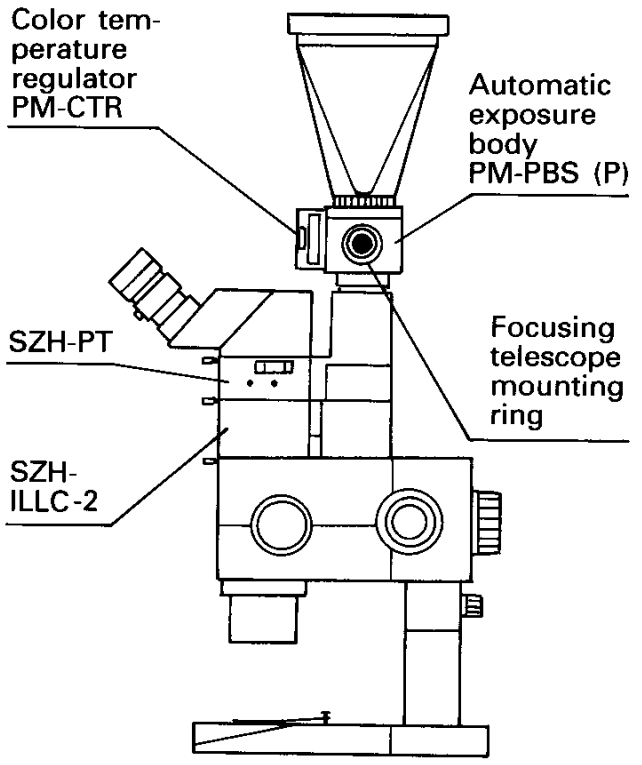


Fig. 18

5. Operation

1) Light path selection

- For observation with 100% of light from the light source, move the light path selector knob ① to the BI position. (Fig. 16)
- For observation with 20% of light and photomicrographjy with 80% of light, move the light path knob to the BI/PHOTO position. (Fig. 17)

2) Focus

Since this microscope is designed to maintain parfocality between observation and photomicrography, there is no need to focus again for photomicrography after focus adjustment is completed for observation. If you wish to focus more accurately for photomicrography, mount the automatic exposure body PM-PBS (P) on the microscope photo tube as shown in Fig. 18, then adjust focus with the focusing telescope and a focusing magnifier FT.

★ **To accurately focus with the focusing magnifier for observation at low magnifications, fold the eye shiled and connect the FT to the eyepiece.**

At the lowest zoom magnification (0.7X), slight vignetting will be seen in the focusing telescope of the automatic exposure body. However, this will not affect photomicrography performance.

6. Optical Characteristics

1) Image magnification on film plane (β) = Objective mag. x Zoom mag. x NFK mag.
x Constant (0.8 for 35 mm film or 2.4 for large format film)

e.g. NFK2.5X, Objective DF Plan 1X, and Zoom mag. 7:

35 mm film: $\beta = 1 \times 7 \times 2.5 \times 0.8 = 14X$

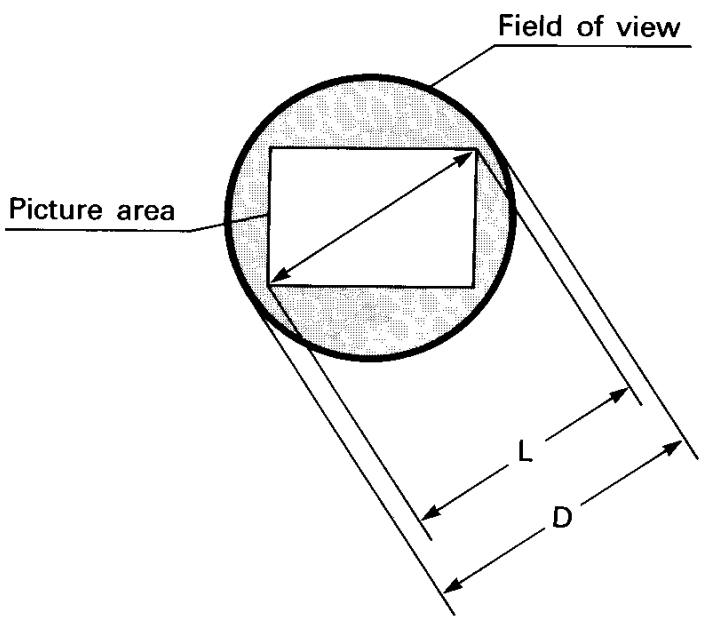
Large format film: $\beta = 1 \times 7 \times 2.5 \times 2.4 = 42X$

2) Picture area
(Diagonal of the picture area: Diameter of the field of view) (Fig. 19)

Format \ NFK photo eyepiece		2.5X	3.3X	5X	6.7X
35 mm	$\frac{\text{Diagonal of picture area}}{\text{Diameter of field of view}}$	92%	70%	46%	34%
4" x 5" 100 mm x 120 mm	$\frac{\text{Diagonal of picture area}}{\text{Diameter of field of view}}$	110%	84%	55%	41%
3-1/4" x 4-1/4" (Polaroid) 73 mm x 95 mm	$\frac{\text{Diagonal of picture area}}{\text{Diameter of field of view}}$	85%	64%	42%	32%

e.g. NFK 2.5X (on 35 mm film)

$$\frac{L}{D} = 0.92$$



D: Diameter of the field of view
L: Diagonal of the picture area

Fig. 19

10 USE OF APERTURE STOP UNIT SZH-AS (OPTION)

The SZH-AS unit is an intermediate attachment for aperture adjustment specially designed for use with the SZH10 microscope. The unit is mounted on the zoom microscope body SZH-ZB10 when used.
By changing the iris diaphragm opening of this unit, observer can adjust the brightness of the image for best observation as well as the depth of focus which need be increased when photographing a microscopic image.

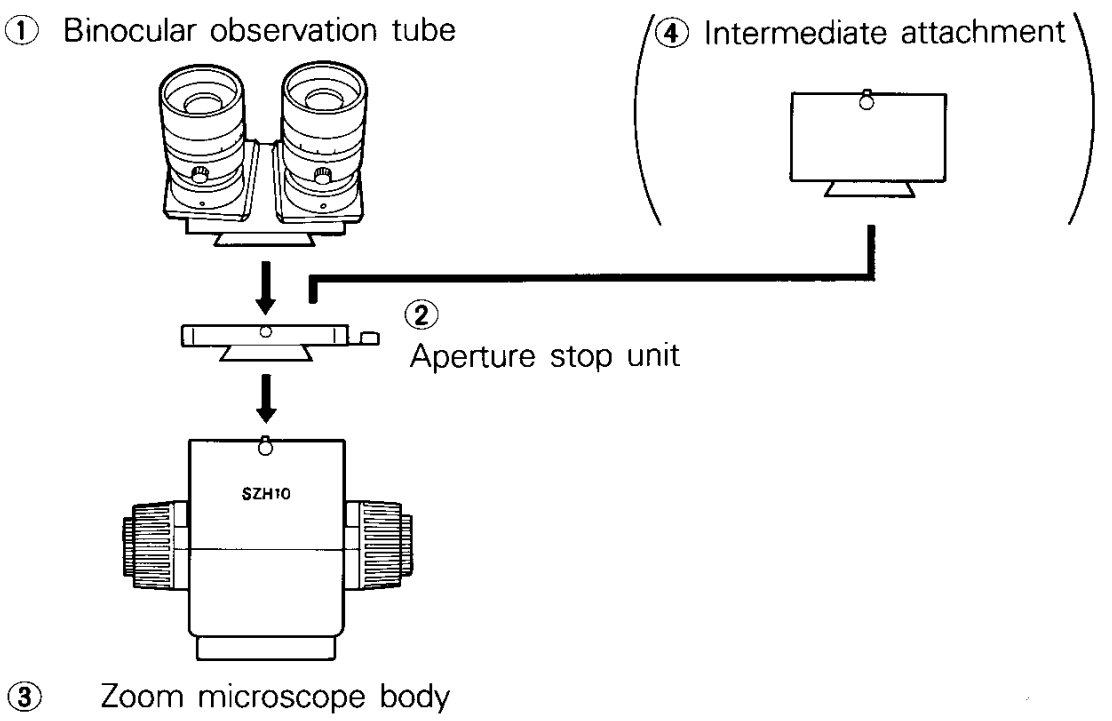
★ **This unit is compatible with the following microscope components and attachments:**
Microscope body SZH-ZB10
Binocular observation tubes of SZH series
Intermediate attachments of SZH series

★ **A maximum of two other intermediate attachments can be additionally mounted when this unit is mounted on the SZH10 microscope.**

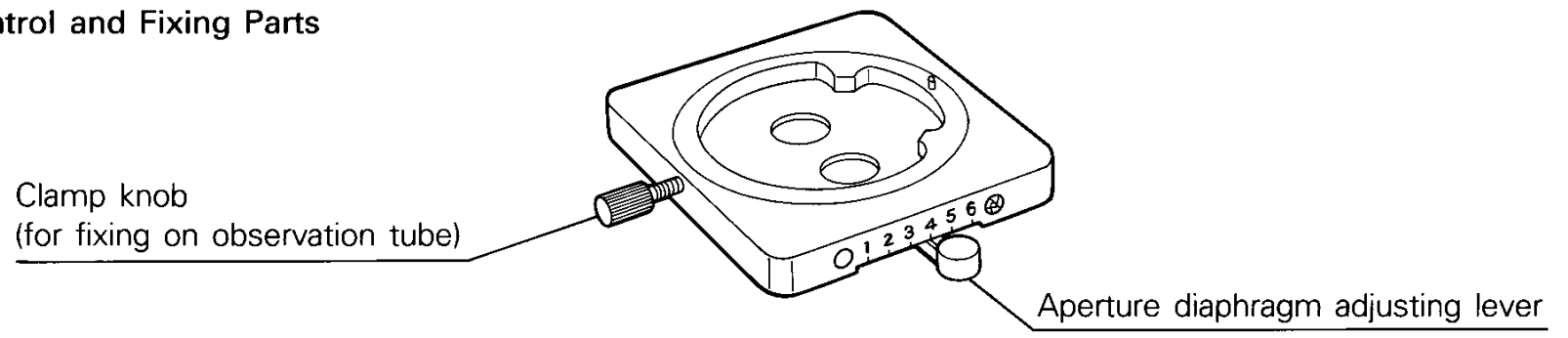
★ **This unit can be mounted only on the zoom microscope body SZH-ZB10. It cannot be mounted on any intermediate attachment.**

1. Assembly

Refer to ❼ Mounting the observation tube on page 4 for the mounting procedure of the aperture stop unit.



2. Control and Fixing Parts



3. How to Use

1) Move the aperture diaphragm adjusting lever leftward (toward the ◯ mark) to increase the aperture or rightward (toward the ⊗ mark) to stop down the aperture.
2) As the iris diaphragms open, the depth of focus becomes shallow and the resolving power increases; as the diaphragms is stopped down, the depth of focus increases but the resolving power decreases.
3) The graduated scale above the adjusting lever can be used as a guideline for repeatable settings.
   ★ **At the maximum aperture setting, the periphery of the visual field sometimes becomes dark when the microscope zooms to a high magnitude (4X or higher). In such a case, increase the aperture as necessary.**
   ★ **During observation using the aperture stop unit in combination with the coaxial vertical illuminator SZH-ILLC-2, a vignetting may occur if the aperture is stopped down to the minimum. Use an intermediate setting (at graduation 3 on the scale) in such a case of observation.**

11 TROUBLESHOOTING GUIDE

Phenomenon	Cause	Remedy
1. Incomplete binocular vision	Interpupillary distance is not correctly adjusted.	Adjust it correctly using both hands. (p. 8)
	Diopter adjustment is incomplete.	Complete diopter adjustment. (p. 7)
	Right and left eyepieces are not matched.	Use a pair of matched eyepieces.
2. Field of view is cut off or illuminated unevenly.	Light path selector knob is stopped midway.	Click it into proper position. (p. 11)
	Binocular tube and intermediate tube are not correctly mounted.	Mount them correctly. (2nd cover, p. 13)
3. Dust is visible in the field of view.	Dust on the specimen	Remove dust.
	Dust on eyepiece	
4. Excessive image contrast	Aperture is stopped down excessively (when the aperture stop unit is used).	Open the aperture to proper diameter. (p. 8)
5. Resolution problems: • Image is not sharp. • Insufficient contrast	Objective is not correctly mounted.	Mount it correctly.
	Dust on objective front lens	Remove dust with air blower.
	Dust on top lens of zoom microscopy body	Clean lens surfaces.
	Dust on lower lens of zoom microscopy body	
6. Specimen image blurs when zoom magnification is changed.	Diopter ring is not correctly adjusted.	Adjust diopter ring correctly. (p. 7)
	Not in complete focus on specimen	Focus specimen correctly. (p. 7)
7. Coarse focusing knobs rotates with too much resistance.	Tension adjusting ring is too tight.	Loosen tension for proper operation. (p. 7)
8. Zoom microscope body drops or specimen goes out of focus during observation.	Tension adjusting ring is too loose.	Tighten them properly. (p. 7)

OLYMPUS

OLYMPUS OPTICAL CO., LTD.

43-2, Hatagaya 2-chome, Shibuya-ku, Tokyo, Japan

OLYMPUS OPTICAL CO., (EUROPA) GMBH.

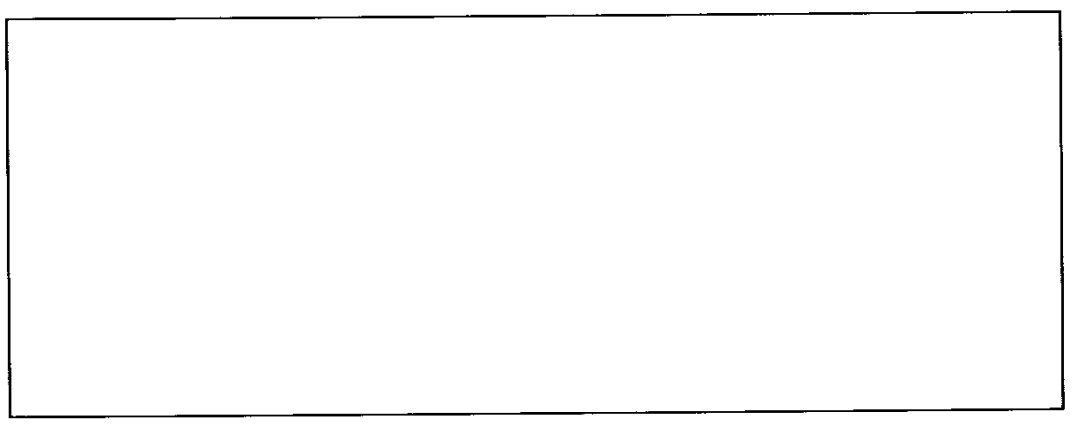
(Premises/Goods delivery) Wendenstrasse 14-16, 20097 Hamburg, Germany
(Letters) Postfach 10 49 08, 20034 Hamburg, Germany

OLYMPUS AMERICA INC.

2 Corporate Center Drive, Melville, N.Y. 11747-3157, USA

OLYMPUS OPTICAL CO. (U.K.) LTD.

2-8 Honduras Street, London EC1YOTX, United Kingdom



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