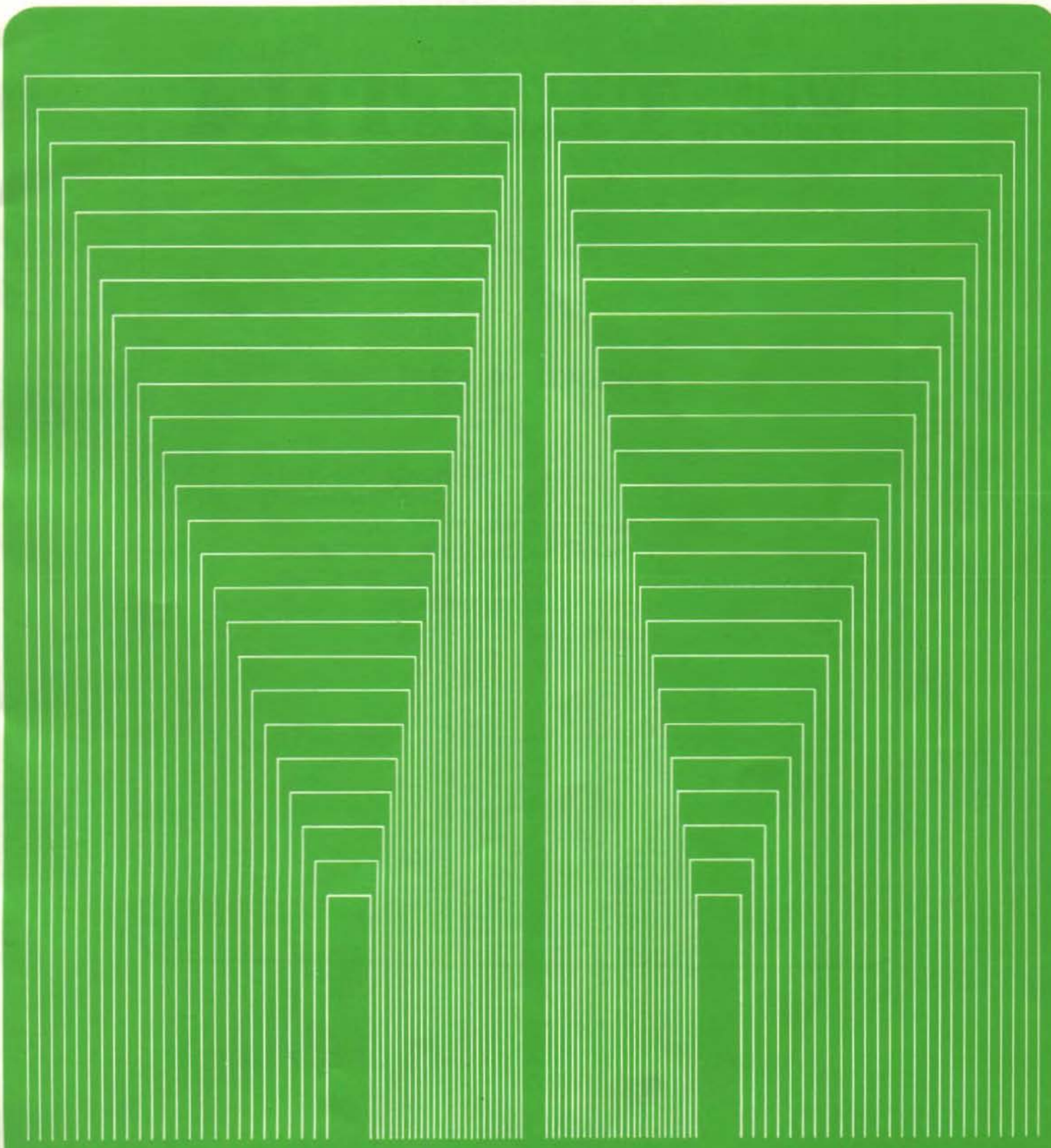
OLYMPUS RESEARCH MICROSCOPES

INSTRUCTION MANUAL

MODELS **FHT & EHT** WITH **SW** ATTACHMENT



OLYMPUS

INSTRUCTION MANUAL

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MODELS

FHT & EHT WITH SW ATTACHMENT

TABLE OF CONTENTS

STANDARD EQUIPMENT

Before assembly, please check your standard outfit, which consists of the following items:

1. Model FHT

1) Binocular Tube Versions

Model No.	Eyepieces	Objectives	Stage	Condenser	Total magnification
FHT-521	Bi P7x, Bi WF 10x, Bi P15x, paired	Ach 4x, Ach 10x, Ach 40x, Ach 100x (oil)	FrS (Square mechanical stage with left & right hand coaxial controls)	N.A. 1.25	28x–1500x
FHT-522	Bi P7x, Bi High-Eyepoint WF 10x, Bi P15x, Bi K20x, paired	Ach 4x, Ach 10x, Fl 40x, Fl 100x (oil)		N.A. 1.40	28x–2000x
FHT-523	Bi P7x, Bi High-Eyepoint WF 10x, Bi P15x, Bi K20x, paired	Plan 4x, Plan 10x, Plan 40x, Plan 100x (oil)		N.A. 1.40	28x–2000x
FHT-523-SW	Bi SW10x, paired	Plan 4x, Plan 10x, Plan 20x, Plan 40x SW Plan 100x (oil)		N.A. 0.85 with aux. condenser lens	40x–1000x

2) Trinocular Tube Versions

Model No.	Eyepieces	Objectives	Stage	Condenser	Total magnification
FHT-531	Bi P7x, BiWF10x, Bi P15x, paired Photo eyepieces: FK2.5x, FK3.3x FK5x, FK6.7x, 1each	Ach 4x, Ach 10x, Ach 40x, Ach 100x (oil)	FrS (Square mechanical stage with left & right hand coaxial controls)	N.A. 1.25	28x–1500x
FHT-532	Bi P7x, Bi High-Eyepoint WF10x, Bi P15x, Bi K20x, paired Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1 each	Ach 4x, Ach 10x, Fl 40x, Fl 100x (oil)		N.A. 1.40	28x–2000x
FHT-533	Bi P7x, Bi High-Eyepoint WF 10x, Bi P15x, Bi K20x, paired Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1each	Plan 4x, Plan 10x, Plan 40x, Plan 100x (oil)		N.A. 1.40	28x–2000x
FHT-533-SW	SW10x paired Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1 each	Plan 4x, Plan 10x, Plan 20x, Plan 40x, SW Plan 100x (oil)		N.A. 0.85 with aux. condenser lens.	40x–1000x

Other items supplied with each version:

Spare Bulbs, 6V, 5A, TB-1 . . . . . 2pcs.
Filter (blue) . . . . . 1pc.
Filter Mount (provided only with achromatic/aplanatic condenser) 1pc.
Wooden Carrying Case . . . . . 1pc.
Certificate . . . . . 1pc.

2. Model EHT

1) Binocular Tube Version

Model No.	Eyepieces	Objectives	Stage	Condenser	Total magnification
EHT-421	Bi P7x, Bi WF10x, Bi P15x, paired	Ach 4x, Ach 10x, Ach 40x, Ach 100x (oil)	CrS-VH (Square mechanical stage with coaxial low drive controls)	N.A. 1.25	28x–1500x
EHT-422	Bi P7x, Bi High-Eyepoint WF10x, Bi P15x, Bi K20x, paired	Ach 4x, Ach 10x Fl 40x, Fl 100x (oil)		N.A. 1.40	28x–2000x
EHT-423	Bi P7x, Bi High-Eyepoint WF10x, Bi P15x, Bi K20x, paired	Plan 4x, Plan 10x, Plan 40x, Plan 100x (oil)		N.A. 1.40	28x–2000x
EHT-423-SW	Bi SW10x, paired	Plan 4x, Plan 10x, Plan 20x, Plan 40x, SWPlan 100x (oil)		N.A. 0.85 with aux. condenser lens	40x–1000x

2) Trinocular Tube Version

Model No.	Eyepieces	Objectives	Stage	Condenser	Total magnification
EHT-431	Bi P7x, Bi WF 10x, Bi P15x, paired. Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1 each	Ach 4x, Ach 10x, Ach 40x, Ach 100x (oil)	CrS-VH (Square mechanical stage with low drive controls)	N.A. 1.25	28x–1500x
EHT-432	Bi P7x, Bi High-Eyepoint WF10x, Bi P15x, Bi K20x, paired. Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1 each	Ach 4x, Ach 10x, Fl 40x, Fl 100x (oil)		N.A. 1.40	28x–2000x
EHT–433	Bi P7x, Bi High-Eyepoint WF10x, Bi P15x, Bi K20x, paired. Photo eyepieces: FK2.5x, FK3.3x, FK5x, FK6.7x, 1 each	Plan 4x, Plan 10x, Plan 40x, Plan 100x (oil)		N.A. 1.40	28x–2000–
EHT-433-SW	Bi SW 10x, paired. Photo eyepieces: FK2.5x, FK3.3x FK5x, FK6.7x, 1 each	Plan 4x, Plan 10x, Plan 20x, Plan 40x, SWPlan 100x (oil)		N.A. 0.85 with aux. condenser lens	40x–1000x

Other items supplied with each version:

Spare Bulbs, 6V, 5A, TB-1 . . . . . 2pcs.
Filter (blue) . . . . . 1pc.
Filter Mount (provided only with achromatic/aplanatic condenser) 1pc.
Wooden Carrying Case . . . . . 1pc.
Certificate . . . . . 1pc.

SPECIFICATIONS

		FHT	EHT
Microscope Stand	Focusing	Vertical stage movement, coaxial coarse and fine adjustments, with automatic pre-focusing lever.	Vertical stage movement, separate coarse and fine adjustments, with automatic pre-focusing lever.
	Coarse adjustment	Devetail slideways, rack and pinion type; adjustment range 32.5mm	
	Fine adjustment	Adjustment ragne 1.2mm, graduated in increments of 1 micron.	Adjustment range 1.2mm, graduated in increments of 2 microns.
	Light source	Tungsten lamp, 6V, 5A, with centering device and built-in transformer. Auxiliary lenses for low, medium and high power objectives.	
	Revolving nosepiece	Quintuple, on ball bearings. Engravings, coded A to E, to facilitate objective insertion.	
	Condenser mount	With condenser centering device and rack-and-pinion height adjustment. Height displacement 23.5mm.	
Observation Tubes	Binocular tube	Tube inclination 45°, rotatable 360°, both eyepiece tubes provided with diopter and tube length adjustments, except Bi-SW observation tube inclined 30°, and diopter difference can be adjusted by the SW eyepiece tube. Interpupillary distance adjustment from 56mm to 74mm.	
	Trinocular tube	Tube inclination 45°, rotatable 360°, both eyepiece tubes provided with diopter and tube length adjustments, except Tr-SW observation tube inclined 30°, and diopter difference can be adjusted by the SW eyepiece tube. Interpupillary distance adjustment from 56mm to 74mm, with photo tube. Light path selector lever.	
Stages		FrS Rotatable graduated mechanical stage with horizontal drive controls, movement range 44mm x 76mm. Vernier scales reading to 0.1mm	CrS-VH Rotatable graduated mechanical stage with low drive controls, movement range 52mm x 76mm. Vernier scales reading to 0.1mm.
Condensers	Achromatic/ aplanatic condenser	N.A. 1.40, with decenterable aperture iris diaphragm and graduated scale.	
	Abbe condenser	N.A. 1.25, with aperture iris diaphragm and swing-out filter mount.	
	CD-4 condenser	N.A. 0.85, for super widefield of view, with variable aperture iris diaphragm, filter holder and auxiliary condenser lens.	

Photo Eyepieces FK

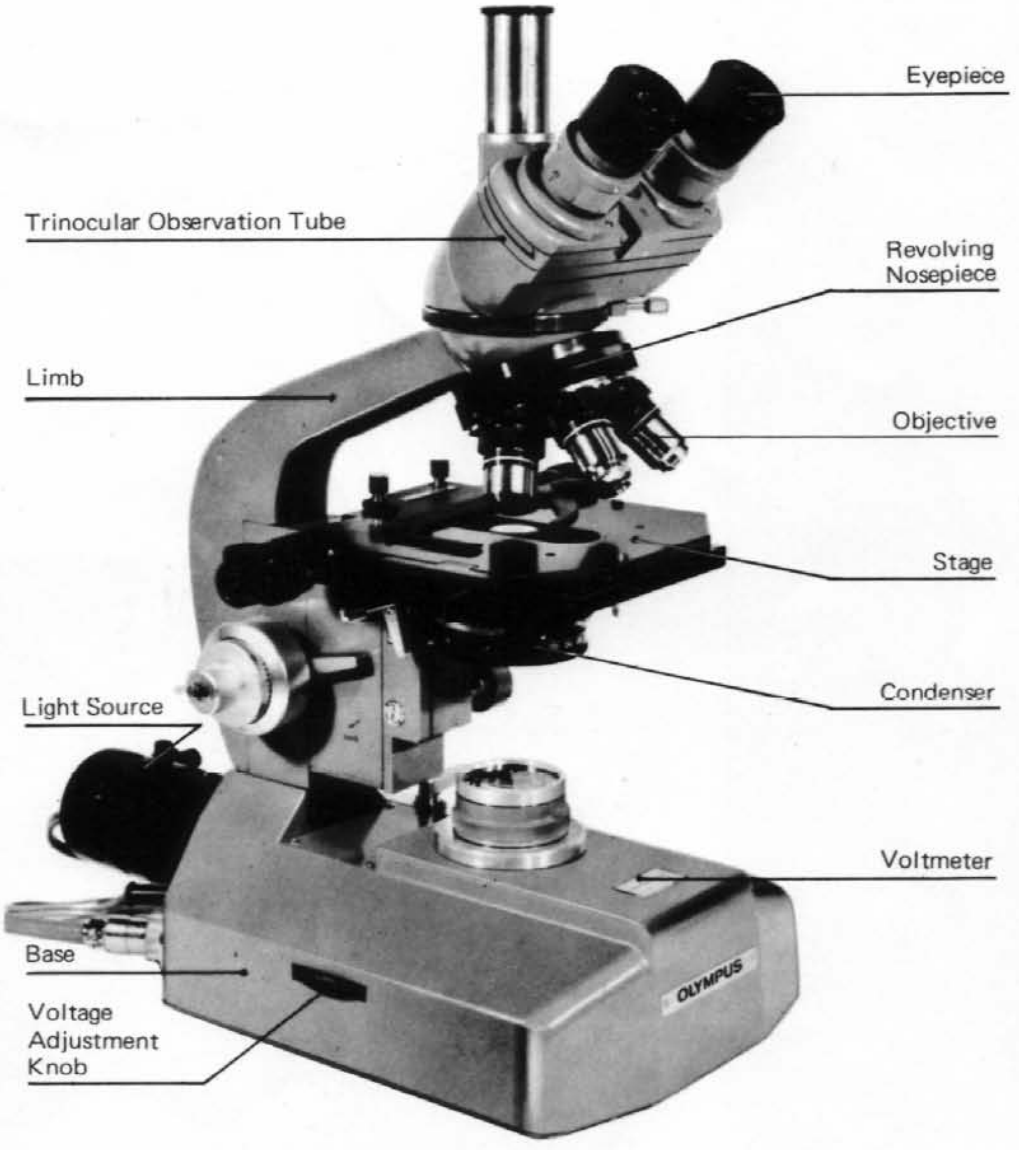
The new photo eyepieces FK are specially designed for photomicrography with the Olympus Photomicrographic System Camera Model PM-10 (optional). The eyepiece powers available are 2.5x, 3.3x, 5x and 6.7x. Each magnification is computed to focus an image at a projection length of 125mm — the same plane as the 35mm film plane, thus compensating spherical aberration. The respective magnifications are engraved on the FK eyepieces: Total magnification of a picture when the FK eyepiece is used, is formulated as follows:

Total magnification with 35mm film = Objective power x FK eyepiece power.

The formula below, however, will be applied in case the camera adapter with relay lens, model PM-DL, is used for larger format camera backs:

Total magnification of large format picture = Objective power x FK eyepiece power x3.

IDENTIFICATION OF VARIOUS COMPONENTS



FHT-533

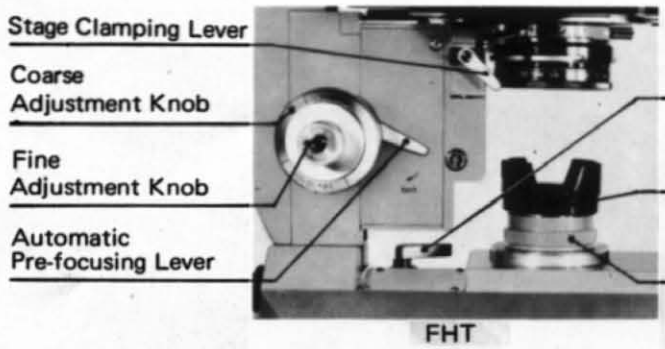
IV

DESCRIPTION OF EACH COMPONENT

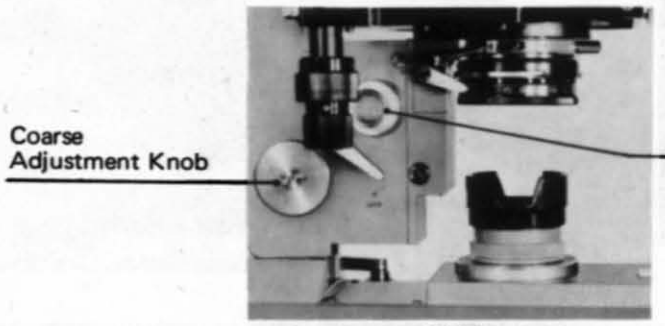
A. Microscope Stand

1. Limb and Focusing Mechanism

The limb is securely attached to the sturdy base and supports the observation tube, stage, condenser, revolving nosepiece and focusing mechanism. The focusing mechanism includes the coarse and fine adjustments and an automatic pre-focusing lever. This lever is provided to prevent possible contact between specimen and objective as well as to simplify coarse focusing. The lever is locked after coarse focus has been accomplished. This prevents further upward travel of the stage and automatically provides a limiting stop if the stage is lowered then raised again. The automatic pre-focusing lever does not restrict fine focusing.
The filter mount is placed on the light exit of the illuminator base.



FHT



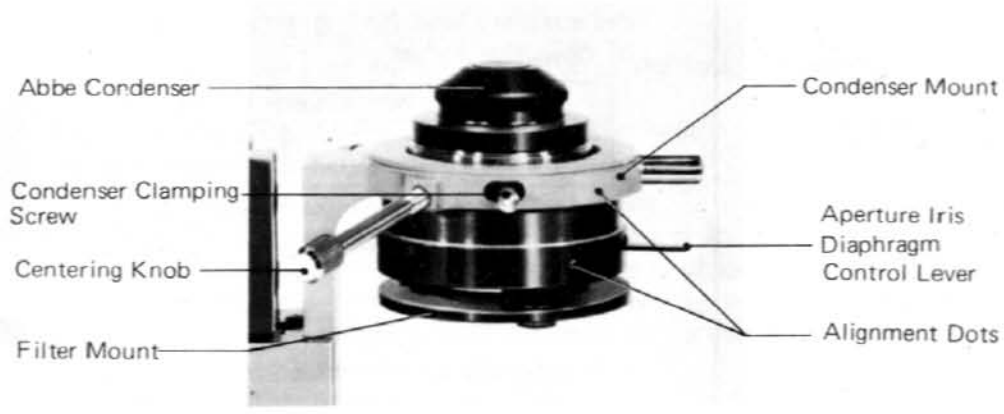
EHT

2. Condenser

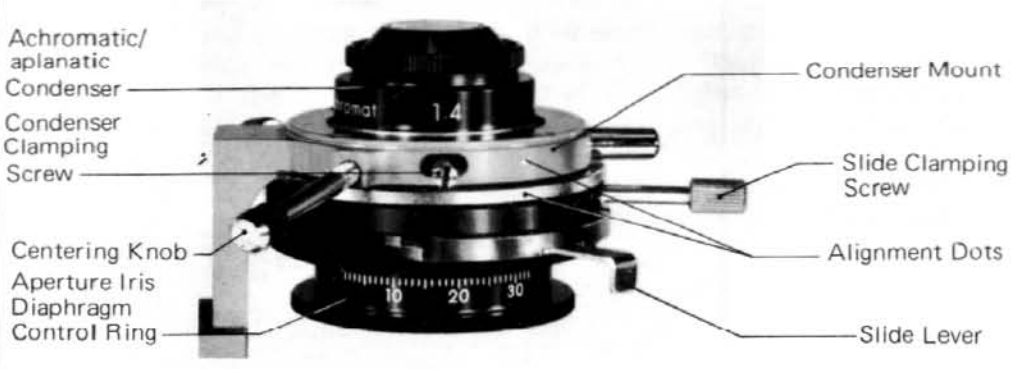
The condenser may be mounted on the condenser mount by first inserting the condenser into the condenser mount from below, aligning the positioning dots on the condenser and condenser mount, and then clamping with the clamping screw. Condenser centration can be accomplished by means of two centering knobs. Vertical movement of the condenser can be adjusted by the condenser height adjustment knob. The condenser has an excellent resolving power, dry or oil immersion, from 4x to 100x magnification objectives. When using the 100x objective, the distance between condenser and specimen should be filled with immersion oil.
Note: For use with the achromatic/aplanatic condenser N.A. 1.40, the filter mount is placed on the light exit of the illuminator base, while either the Abbe N.A. 1.25 or N.A. 0.85 condenser incorporates its own filter mount. When the N.A. 0.85 condenser is used for super widefield observation, keep the auxiliary condenser lens slipped on the light exit on the base.
The slide clamping screw permits simultaneous locking of slide and

rotation of condenser and the slide lever allows decentering and rotating the aperture iris diaphragm for oblique illumination.

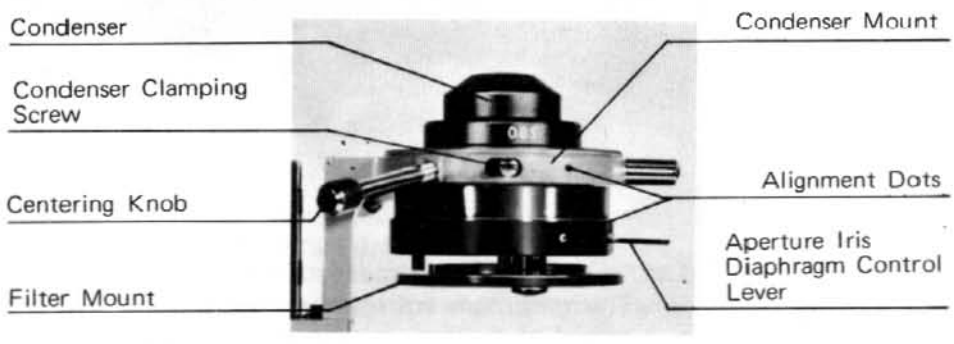
■ **Abbe Condenser, N.A. 1.25**



■ **Achromatic/aplanatic Condenser, N.A. 1.4**



■ **CD-4 Condenser, N.A. 0.85**

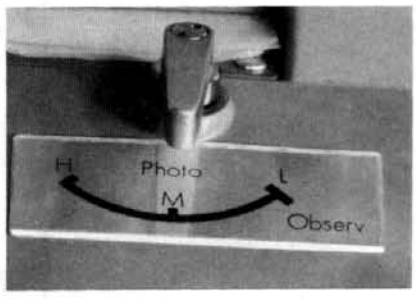


3. Microscope Base and Light Source

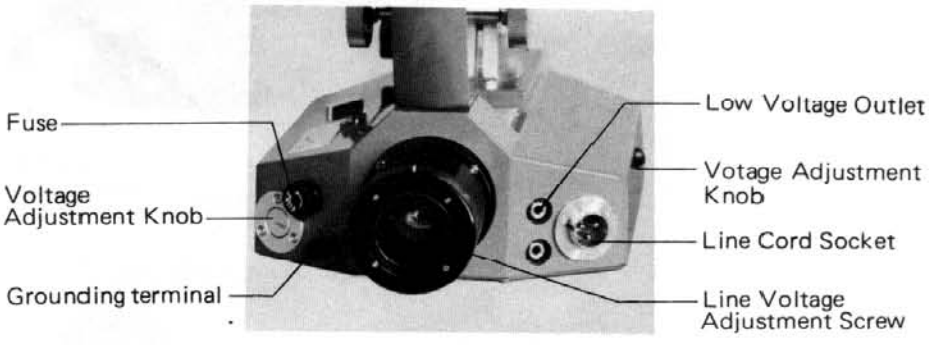
1) Microscope Base

The lamp house is built onto the base. The lamp socket is clamped to the lamp house with a clamping screw. The light path is selected with the auxiliary lens shifting lever for high, medium and low magnification of objective in use :

	Lever Position	
Objective	For Observation	For Photomicrography
4x	Observ.	L
10x		M
20x-100x		H



It is generally recommended to set the lever to the position marked with "Observ." (equivalent to position L) for brightfield observation with all the objectives from 4x through 100x. In phase contrast or darkfield observation, where intenser light is required, however, it is recommended to set it to position M or H according to objective magnification as in case with photomicrography.



o Voltage Adjustment

The minimum voltage required for the light source can be varied by means of the line voltage adjustment screw provided at the back of the microscope base in accordance with the line voltage and frequency, since a silicon controlled rectifier (SCR) is adopted in the dimmer circuitry.

At the bottom of the base is a voltage selector switch, which can be turned with a coin, to correspond with the voltage of main supply (110V, 120V, 220V or 240V). The transformer is built in the base and switched on and off with the voltage adjustment knob, which also controls the bulb voltage from 0 to 10V.

2) Light Source

The light source consists of lamp house ① and lamp socket ②. The lamp socket is provided with two coaxial lamp centering knobs ③. The lamp socket can be moved back and forth along the optical axis to eliminate uneven illumination in the field of view.

a. Electric Connection

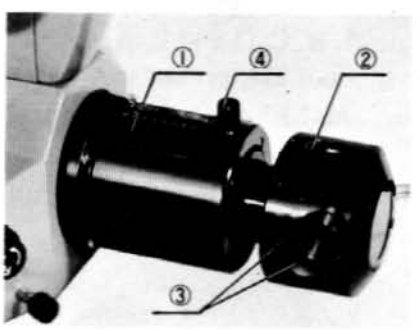
1) Insert the jacks of the lamp cord into the low voltage outlet at the back of microscope base.
2) Insert the plugs of the line cord into the line cord socket and the AC power outlet respectively.

b. Adjustment of Line Voltage

1) Turn the voltage adjustment knob clockwise to position ON.
2) If the bulb is dimmly lit, the line voltage is proper, and you have only to manipulate the voltage adjustment knob in order to obtain optimum light intensity, with no need to further proceed to the following procedure 3).
3) Even after the voltage adjustment knob is turned on, if the bulb does not light or lights up bright immediately after switching on, rotate gradually the line voltage adjustment screw (at the back of the base) with a coin, until the lamp dims.

○ According to the fluctuations of line voltage and frequency (50/60Hz), minimum voltage required for lighting the bulb varies; if the bulb does not light at all or lights up immediately after switching on, re-adjustment of the line voltage screw is necessary to dim the bulb.

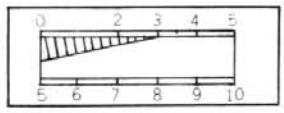
Note: For light intensity adjustment after dimming the bulb, use the voltage adjustment knob on the side of the base.



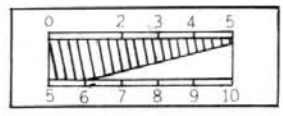
c. Attach the lamp socket.

1) Loosen the clamping screw ④.
2) Insert the lamp socket ② into the lamp house ①.
3) Tighten the clamping screw to secure the socket.

4. Low Voltage Indication



Meter indicates 3V.



Meter indicates 6V.

As the voltage adjustment knob is turned clockwise, the red zone advances as shown above. Use the upper scale of the meter to read from 0 to 5V, and the lower scale to read from 5V to 10V. Avoid prolonged use at voltages above 6V.

Lamp Replacement

(1) Loosen the socket clamping screw and slide out the socket.
(2) Remove the bulb by slightly depressing it against the seat and then rotating it in a counterclockwise direction.
(3) Insert a replacement bulb in reversed order.
Before use, wipe off thoroughly any fingerprints or stains on the bulb.

5. Revolving Nosepiece

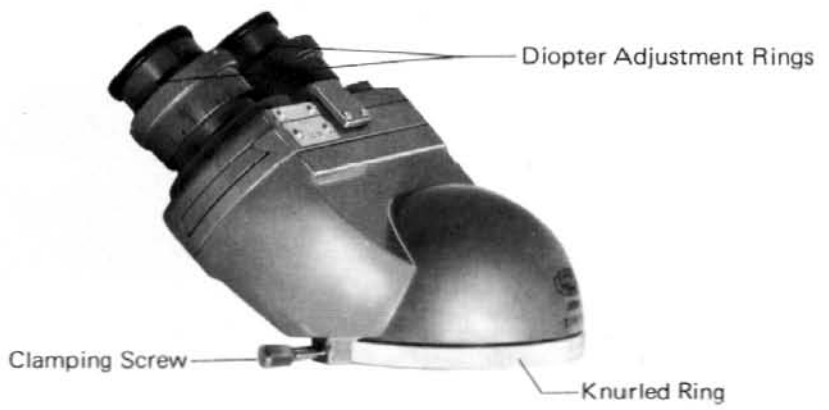
The quintuple revolving nosepiece rotates on ball bearings.
A knurled ring is provided for slip-free and smooth rotation.
Each objective clicks into position accurately, maintaining proper optical alignment. Also each objective hole is coded with the letters A, B, C, D and E in order to indicate where the objectives should be mounted, as "A" is for 4x, "B" for 10x, "C" for 20x, "D" for 40x and "E" for 100x. In addition, the observer can easily tell what power objective is being used by the color band engraved on each objective during observation.

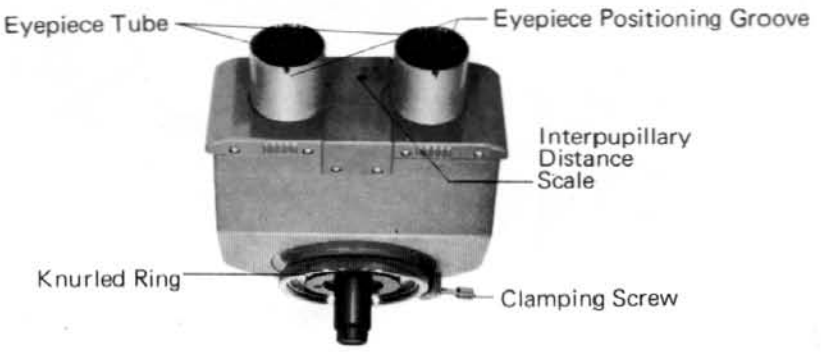
Magnification	4x	10x	20x	40x	100x
Color band	Red	Orange	Yellow	Brilliant green	Light blue

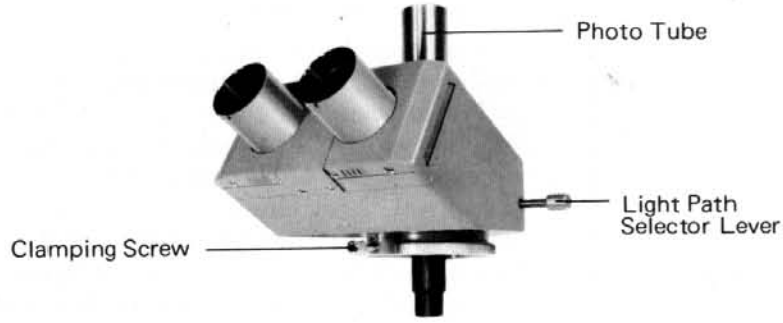
* The stage must be mounted on the microscope prior to the mounting of objectives on the revolving nosepiece.

B. Observation Tubes

The observation tubes are inclined 45° (except Bi-SW and Tr-SW both inclined 30°) and rotatable 360°. The tubes can be clamped in any direction with the clamping screw provided.
For adjustment of interpupillary distance, hold the right and left eyepiece tubes with both hands and push the tubes together or pull them apart laterally, whichever is required, while looking at an image through the eyepieces with both eyes, until perfect binocular vision is obtained. It is good practice to memorize the individual interpupillary distance setting. A scale for this purpose is located between the eyepiece tubes. (The mechanical tube length of the SW observation tubes is 160mm when this scale is set at 62.) The eyepiece tubes are provided with diopter and tube length adjustment rings. A light path selector lever to direct the light to observation tube or photo tube, is provided with the trinocular observation tube.







C. Stages

1. Square Mechanical Stage FrS

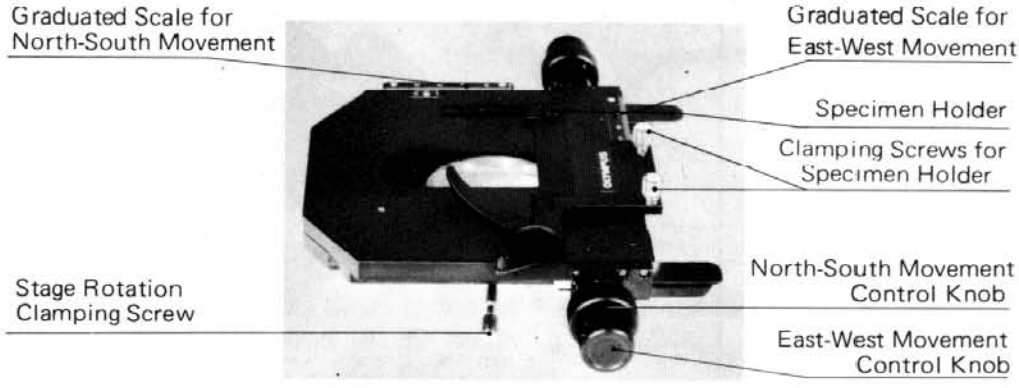
This is a square coaxial drive control mechanical stage with interchangeable mount. The specimen is moved by means of horizontal drive controls on both sides of the stage. The larger control knob is for north-south (Y) movement of the specimen, and the smaller control knob is for east-west (X) movement.

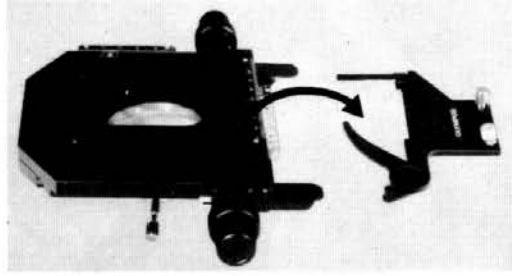
The working range of the specimen holder is:

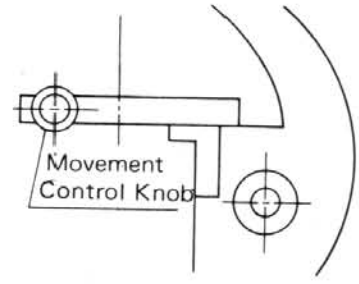
North-south excursion 44mm

East-west excursion 76mm

Each control is provided with a scale (0–50 for Y excursion, 50–120 for X excursion) and a vernier, reading to 0.1mm. Stage rotation can be clamped by a clamping screw. The stage may be used as a plain stage by removing the specimen holder assembly.



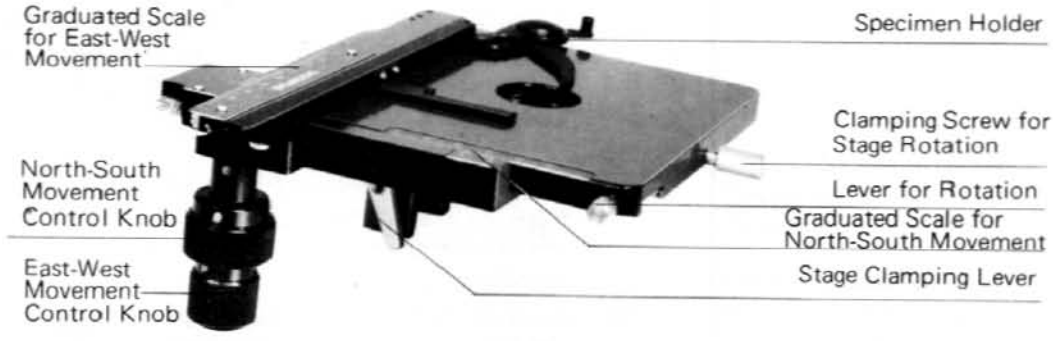




* The stage may be mounted on the microscope in reversed position, as shown in the picture above, right, to obtain increased rotation.

2. Square Mechanical Stage with Low Drive Controls CrS-VH

The specimen is moved by means of coaxial low drive control knobs which are provided on the stage vertically.
The working range of the specimen holder is:
North-south excursion 52mm
East-west excursion 76mm
Each control is provided with a scale (0–60 for Y excursion, 60–130 for X excursion) and a vernier, reading to 0.1mm.
Stage rotation: After bring the specimen slide in position, move the center of the specimen slide into the optical axis, then rotate the stage horizontally. The stage rotation can be clamped by means of a clamping screw.
The stage may be used as a plain stage by removing the specimen holder.



3. Square Mechanical Stage with Low Drive Controls Cs-VH

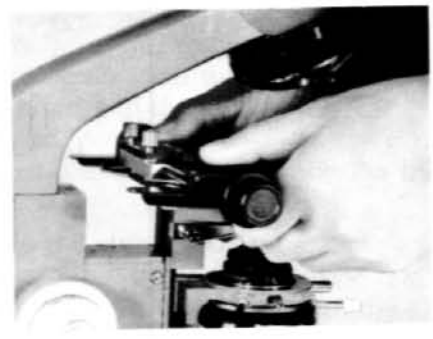
This mechanical stage is operated by coaxial low drive controls on rack-and-pinion for north-south and east-west movements. The working range of the specimen holder is the same as that of the CrS-VH.

4. Square Coaxial Mechanical Stage CS

The mechanical stage CS is operated by coaxial horizontal control knobs with rack-and-pinion for north-south movement and a lead screw for east-west movement.

5. Mount the Mechanical Stage

1) Lower the condenser mount as far as possible with the condenser height adjustment knob.
2) Lower the stage dovetail slide all the way with the coarse adjustment knobs.
3) Insert the dovetail mount of the stage slowly into the stage dovetail slide all the way down, and lock the stage with the locking lever provided on the dovetail mount of the stage.



V

OPERATING THE MICROSCOPE

A. Interpupillary Distance and Diopter Adjustments

In order to obtain perfect binocular vision through the eyepieces, it is necessary to adjust interpupillary distance and diopter difference in eye acuity; otherwise, long time observation would put considerable strain on the observer's eyes.

1. Interpupillary Distance Adjustment

(1) Hold the right and left eyepiece tubes with both hands and push the tubes together, or pull them apart laterally, whichever is required, while looking through the eyepieces with both eyes, until perfect binocular vision is obtained.

(2) Memorize your interpupillary distance setting. Scale ① is provided for this purpose, located between the eyepiece tubes.

* This interpupillary distance adjustment is necessary each time observers are changed. Re-focusing is also necessary whenever the interpupillary distance is changed.

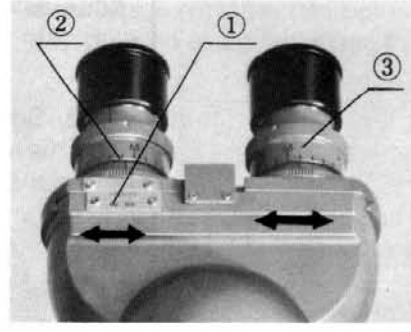
2. Diopter Adjustment

a. For FHT and EHT

(1) Rotate the diopter ring ② on the right eyepiece tube to match the scale on the ring to your interpupillary distance setting which you obtained from scale ① as described in the preceding paragraph 1–(2).

(2) Look at the image through the right eyepiece with your right eye and focus on the specimen with the fine adjustment knobs.

(3) Next, look at the image through the left eyepiece with your left eye and rotate the diopter ring ③ to focus on the specimen without using the coarse and fine adjustment knobs.



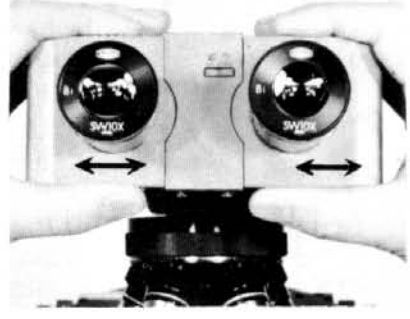
b. For FHT-SW and EHT-SW

Each SW eyepiece is provided with diopter ring for adjustment of your diopter difference.

(1) Rotate the diopter ring on the right eyepiece tube to obtain a clear image of the field of view in the eyepiece.

(2) Look at the image through the right eyepiece with your right eye and focus on the specimen with the fine adjustment knobs.

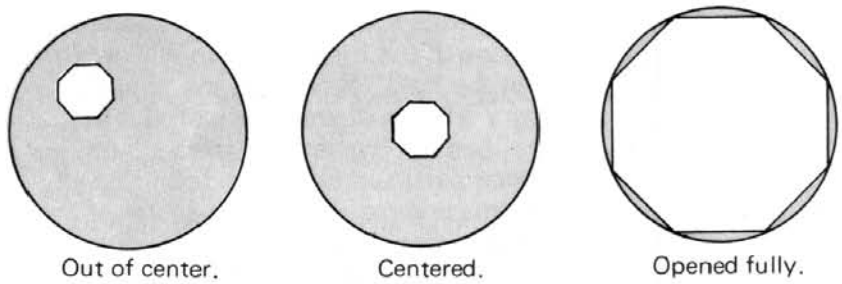
(3) Next,look at the image through the left eyepiece with your left eye and rotate the diopter ring to focus on the specimen without using the coarse and fine adjustment knobs.



B. Center the Condenser and the Light Bulb

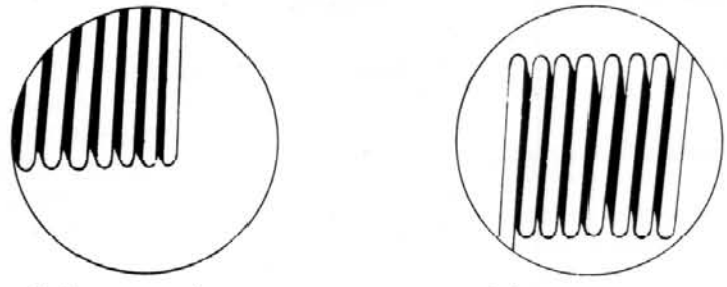
After all necessary components are attached to the microscope stand properly and securely, it is essential to center the condenser and the light bulb before the microscope is put in operation.

1. First, make sure that all electrical connections are done properly, then turn the switch in the microscope base to the ON position. The lamp will light up. By raising the voltage progressively, you can ascertain that the bulb is on.
   Adjust light intensity to suit your requirements.
2. Swing the auxiliary lens shifting lever on the illuminator base to position Observ.
3. Place a specimen on the stage and use the objective 10x to bring the specimen in focus.



Out of center. Centered. Opened fully.

4. Stop down the field iris diaphragm with the field iris diaphragm control provided on the microscope base. A slightly blurred image of the field iris diaphragm can now be seen in the field of view.
5. Move the condenser up and down with the condenser height adjustment knob to focus on the image of the field iris diaphragm.



Before centration. After centration.

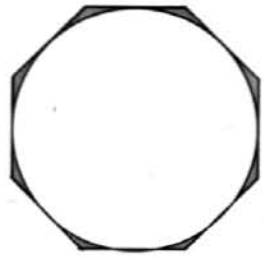
6. While widening the diameter of the field progressively, use the condenser centering knobs to bring the diaphragm image into the center of the field of view. If the polygonal image of the iris diaphragm becomes inscribed in the field it means that the field iris diaphragm is centered. Slightly increase the diameter of the field iris diaphragm until it is just outside the field of view.
7. Remove one of the eyepieces from the observation tube, and look into the eyepiece tube so that the filament image of the bulb at the rear focal plane of the objective can easily be seen.
8. Center the filament image with the two coaxial centering knobs on the lamp socket.

* Before re-insertion of the eyepiece into the observation tube, move your head to the right or left to ascertain that the filament image is in center at the rear focal plane of the objective while looking into the eyepiece tube.

If there is illumination irregularity seen in the field of view after centration of the bulb filament, loosen the clamping screw for positioning the lamp socket and move the lamp socket back and forth slowly and clamp with the clamping screw when even illumination is obtained.

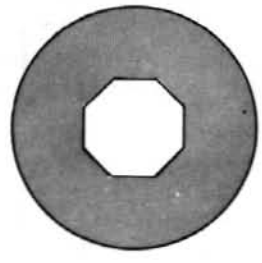
C. Use of Iris Diaphragms

A field iris diaphragm as well as an aperture iris diaphragm is provided on the microscope. The field iris diaphragm is built into the base and the aperture iris diaphragm is part of the condenser.



1. Field Iris Diaphragm

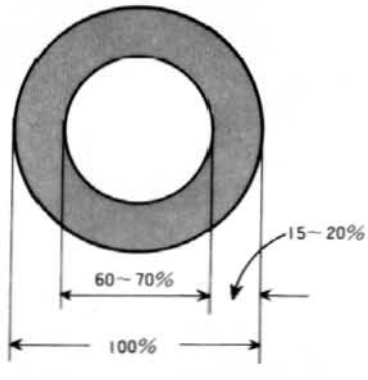
The field iris diaphragm controls the diameter of the ray bundle impinging on the specimen surface and thus increases image definition. Stop down the field iris diaphragm while looking through the eyepiece. An image of the iris diaphragm will appear within the field. Now open the field diaphragm until its diameter is just slightly larger than the diameter of the field of view.



* When particularly clearer definition of an image is required in the center of the field of view stop down the iris diaphragm as narrow as shown in the picture at bottom.
* The image of the field iris diaphragm is conjugated on the specimen's surface, so that the diameter of the field iris diaphragm changes according to the change of the objective power. By the same token with every change of the eyepiece the field number will be varied, which necessitates re-adjustment of the diameter at the field diaphragm.

2. Aperture Iris Diaphragm

An aperture iris diaphragm opened too wide impairs image contrast due to internal reflections and related factors. On the other hand, if the diaphragm is stopped down excessively, resolution is unduly reduced. It is therefore suggested to match the opening of the aperture iris diaphragm to the numerical aperture of the objective in use, in order to achieve maximum objective performance. For that purpose simply set the numerical aperture scale on the condenser to the numerical aperture of the objective in use.



However, since microscopic specimens generally are low in contrast, their image lacks contrast if the objective is used with its full numerical aperture. Therefore, it is occasionally preferable to stop down the aperture iris diaphragm slightly more than indicated by the objective N.A. This will result in increased image contrast, larger depth of focus and a flatter field. On the other hand, stopping down too much impairs resolution. An aperture setting of 0.6–0.7x the N.A. of the objective is recommended. If the N.A. of the objective is 1, for instance, you can set the scale to 0.6–0.7.

D. Tension Adjustment of Coarse Adjustment Knobs

While the coarse adjustment motion is normally stiff and heavy, it is freely adjustable for either heavy or light movement depending on the observer's preference. To adjust the tension hold the two coarse adjustment knobs with your both hands and rotate them in the opposite direction at the same time.

E. Parfocal Objectives

Since all objectives are parfocal, only a minimum of fine adjustment control is required when you change the objectives.

Focusing Procedure:

1) Operate the fine adjustment knob to bring the fine adjustment indicator line to the center of the fine adjustment range.
2) Place the 10x objective in position.
3) Bring the specimen as closely as possible to the objective with the coarse adjustment knobs.
4) While looking through the eyepiece, lower the stage slowly and focus on the specimen.
5) Turn the revolving nosepiece to bring the objective to be used into the light path.

F. Use of Immersion Optical Components

1. Immersion Objectives:

1) Focus on the specimen with a low-power objective.
2) Put a drop of immersion oil on both the specimen and the objective front lens.
3) Turn the revolving nosepiece to bring the immersion objective into the light path, and focus with the fine adjustment knob.

2. Immersion Condensers:

1) Remove the specimen from the mechanical stage and place a drop of immersion oil on the front lens of the condenser.
2) Place the specimen on the mechanical stage and slowly raise the condenser until firm contact with the underside of the specimen slide is made. Care should be taken to prevent oil bubbles from forming in the oil film between condenser and specimen slide.

3. After Use

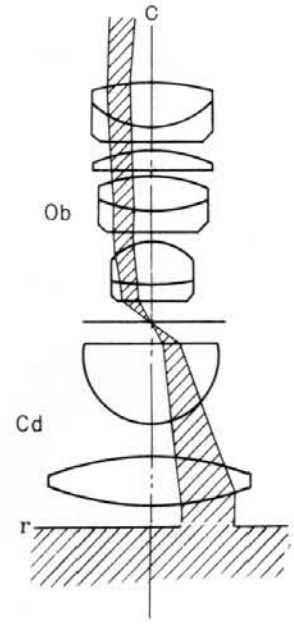
Carefully wipe off the immersion oil deposited on the lens surfaces with gauze moistened with xylene.

Never leave oil on the lens surfaces after use as oil remnants will seriously impair the performance of the lens systems.

G. Oblique Illumination

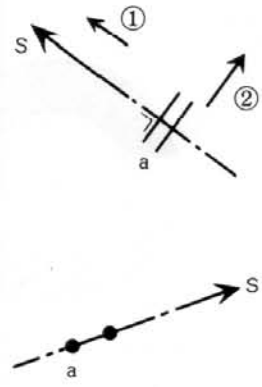
The achromatic/aplanatic condenser N.A. 1.40 has extremely high resolving power and will give the operator satisfactory results even when used dry. When using objectives 100x, the condenser should be immersed. The condenser can be used with all objectives from 4x and up. Oblique illumination will further improve resolving power.

1. With oblique illumination, the resolving power can be doubled. As against the normal (central) illumination where the light beams are parallel to the optical axis of the microscope, oblique illumination provides light bundles at an angle to the optical axis.
   The illuminating light proceeds from below with an inclination to the specimen, which will cause not only the normal transmitted beam but also more of the refracted light to enter the objective. This will double the resolving power as compared with central illumination. The drawing on the right hand side illustrates the oblique illumination system.
   The cross-hatched area represents the cone of light.



C: Optical axis Ob: Objectives
Cd: Condenser r: Iris diaphragm

2. Procedure
   1) Stop down the aperture iris diaphragm.
   2) Loosen the clamping screw and pull out the aperture diaphragm with the slide lever.
      The direction of diaphragm displacement should be at right angles to the specimen detail to be observed.
      For example, if it is desired to identify two parallel details very close to each other as two separate lines, the aperture diaphragm is moved at right angles to the details. If identification of two points is desired, the diaphragm is moved parallel to the straight line connecting the two points.
   3) Adjustment of the diaphragm slide and diaphragm diameter while looking through the eyepiece resolves the two lines or points and permits very detailed observation of the structure.



① Resolving power increases in this direction.

② Resolving power decreases in this direction.

a: Article to be identified
S: Sliding direction of iris

3. Observation of Overall Area Possible
   Oblique illumination is effective only when the illuminating light is directed at right angles to the specimen
   In order to identify individual specimen details, therefore, it is necessary to adapt the direction of diaphragm displacement perpendicular to the direction of the specimen detail to be observed.
   Diaphragm rotation through 150° is possible with the achromatic/aplanatic condenser. Stage rotation provides further possibility of directional adaptation.

H. Care for Storing

Moisture and dust are the most deadly factors to microscopes. Since both moisture and dust are found in most laboratories, microscopes should be kept in containers immediately after use. If this is not possible, they should be covered with the vinyl dust cover provided.
As for objectives and eyepieces, it is best to keep them in desiccators. Failing this, they should be kept in cases containing such desiccants as silica gel. After the eyepieces are removed from the microscope, the vacant eyepiece sleeves should be covered with protective caps. By no means should a microscope be disassembled for repairs. This should be left to the Olympus repair service.
Microscopes must always be kept clean. Fine dust on parts that cannot be reached by hand should be blown or wiped off by means of an air blower or a clean feather.

VI

OPTICAL CHARACTERISTICS

A. Eyepieces (P, WF, K) x Objectives (Ach, Fl, Plan)

Objective / Eyepiece	Name	Achromatic				Fluorite		Plan Achromatic				
	Magnification	4x	10x	40x	100x	40x	100x	4x	10x	20x	40x	100x
	Numerical Aperture (N.A.)	0.10	0.25	0.65	1.30	0.75	1.30	0.10	0.25	0.40	0.65	1.25
	Working Distance (mm)	19.87	5.40	0.39	0.11	0.49	0.10	5.50	7.18	0.78	0.22	0.14
	Focal Length	29.20	15.98	4.31	1.81	4.29	1.80	31.31	17.45	8.11	4.38	1.65
P7x (Field number 18.5)	Total Magnification	28x	70x	280x	700x	280x	700x	28x	70x	140x	280x	700x
	Depth of Focus (μ)	230.2	36.8	3.9	0.8	3.3	0.8	230.2	36.8	12.1	3.9	0.9
	Field of View (mm)	4.6	1.85	0.463	0.185	0.463	0.185	4.63	1.85	0.926	0.463	0.185
WF 10x (18.0)	Total Magnification	40x	100x	400x	1000x	400x	1000x	40x	100x	200x	400x	1000x
	Depth of Focus (μ)	174.7	27.9	3.1	0.7	2.5	0.7	174.7	27.9	9.3	3.1	0.7
	Field of View (mm)	4.5	1.8	0.45	0.18	0.45	0.18	4.5	1.8	0.9	0.45	0.18
P15x (9.5)	Total Magnification	60x	150x	600x	1500x	600x	1500x	60x	150x	300x	600x	1500x
	Depth of Focus (μ)	131.4	21.0	2.4	0.5	2.0	0.5	131.4	21.0	7.1	2.4	0.6
	Field of View (mm)	2.38	0.95	0.238	0.095	0.238	0.095	2.38	0.95	0.476	0.238	0.095
K20x (7.5)	Total Magnification	80x	200x	800x	2000x	800x	2000x	80x	200x	400x	800x	2000x
	Depth of Focus (μ)	109.8	17.6	2.1	0.5	1.7	0.5	109.8	17.6	6.0	2.1	0.6
	Field of View (mm)	1.88	0.75	0.188	0.075	0.188	0.075	1.88	0.75	0.376	0.188	0.075

B. Eyepieces (P, WF, K) x Objectives (Plan Ach, Apo)

Objective / Eyepiece	Name	Plan Achromatic		Apochromatic	
	Magnification	1.3x	2x	40x dry	40x oil
P7x (18.5)	Total Magnification	9.1x	14x	280x	280x
	Depth of Focus (μ)	2485	909	2.7	2.25
	Field of View (mm)	14.2	9.25	0.463	0.463
WF 10x (18.0)	Total Magnification	13x	20x	400x	400x
	Depth of Focus (μ)	1829.7	698.6	2.1	1.8
	Field of View (mm)	13.8	9.0	0.65	0.65
K 20x (7.5)	Total Magnification	26x	40x	800x	800x
	Depth of Focus (μ)	1150	435	1.37	1.09
	Field of View (mm)	5.77	3.75	0.188	0.188
P15x (9.5)	Total Magnification	19.5x	30x	600x	600x
	Depth of Focus (μ)	1370	519	1.65	1.29
	Field of View (mm)	7.3	4.75	0.238	0.238

C. Eyepiece (SW 10x) x Objectives (Plan Achromatic)

Objective / Eyepiece	Name	Plan Achromatic				
	Magnification	4x	10x	20x	40x	100x
SW 10x (26.5)	Total Magnification	40x	100x	200x	400x	1000x
	Depth of Focus (μ)	174.7	27.9	9.3	3.1	0.7
	Field of View (mm)	6.6	2.65	1.33	0.67	0.26

MEMO

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