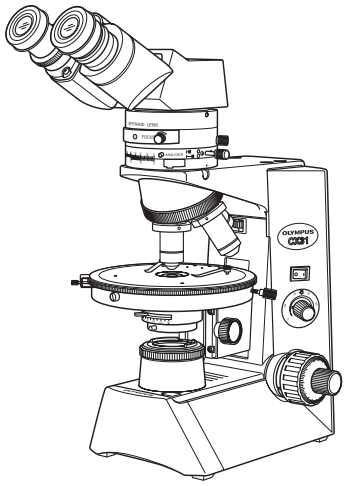
OLYMPUS



INSTRUCTIONS

CX31-P

POLARIZING MICROSCOPE

This instruction manual is for the Olympus Polarizing Microscopes Model CX31-P. To ensure the safety, obtain optimum performance and to familiarize yourself fully with the use of this microscope, we recommend that you study this manual thoroughly before operating the microscope. Retain this instruction manual in an easily accessible place near the work desk for future reference.

This publication is printed on 100% recycled paper

AX7250

CONTENTS

Correct assembly and adjustments are critical for the microscope to manifest its full performance. If you are going to assemble the microscope by yourself, please read Chapter 9, "ASSEMBLY" (Pages 23 to 26). For the assemblies of the modules for which instruction manuals are available, refer to their instruction manuals.

IMPORTANT

⚠ SAFETY PRECAUTIONS

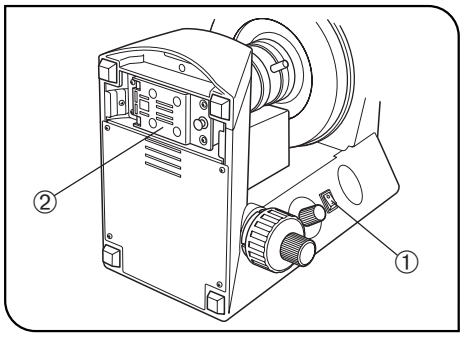


Fig. 1

1. After the equipment has been used in an observation of a specimen that is accompanied with a potential of infection, clean the parts coming in contact with the specimen to prevent infection.
   - When moving the microscope, be sure to remove the specimen to prevent it from dropping and scattering, and hold the microscope by the positions shown in Fig. 2 on the next page.
   - In case the specimen is damaged by mistake, promptly take the action for preventing infection.
   - The microscope becomes unstable when its height is increased by attached modules. In this case, be sure to take countermeasures for preventing it from toppling down and dropping the specimen.
2. To avoid potential shock hazards and burns when replacing the lamp bulb, set the main switch ① to "O" (OFF) then disconnect the power cord from the wall outlet in advance and, whenever you replace the bulb during use or right after use, allow the lamp replacement cover ② and bulb to cool before touching.
3. Install the microscope on a sturdy, level table or bench so as not to block the air vents on the underside of the base. Do not place the microscope on a soft surface into which the microscope may sink, as this could result in blocking the air vents and cause overheating or a fire.
4. Always use the power cord provided by Olympus. If no power cord is provided, please select the proper power cord by referring to the section "PROPER SELECTION OF THE POWER SUPPLY CORD" at the end of this instruction manual. If the proper power cord is not used, product safety performance cannot be warranted.
5. When installing the microscope, route the power cord away from the microscope frame. Should the power cord come in contact with a hot part, the power cord could melt and cause electric shock.
6. Always ensure that the grounding terminal of the microscope and that of the wall outlet are properly connected. If the equipment is not grounded, Olympus can no longer warrant the electrical safety performance of the equipment.
7. Never set the main switch ① to "I" (ON) while a metallic object is present in the air vents of the microscope, as this could result in electrical shock, personal injury and equipment damage.
8. After operation or in case of abnormality, be sure to disconnect the power cord from the connector on the microscope or from the wall power outlet

Safety Symbols

The following symbols are found on the microscope. Study the meaning of the symbols and always use the equipment in the safest possible manner.

Symbol	Explanation
	IIndicates that the surface becomes hot, and should not be touched with bare hands.
	Before use, carefully read the instruction manual. Improper use could result in personal injury to the user and/or damage to the equipment.
I	Indicates that the main switch is ON.
O	Indicates that the main switch is OFF.

Warning Label

A warning indication label is attached to every part where special precaution is required when handling and using the microscope. Always heed the warnings.

Warning label position	Bottom of microscope frame	[Warning against high temperature in lamp bulb replacement] 

If the warning label is stained or peeled off, contact Olympus.

1 Getting Ready

1. A microscope is a precision instrument. Handle it with care and avoid subjecting it to sudden or severe impact.
2. Do not use the microscope where it is subjected to direct sunlight, high temperature and humidity, dust or vibrations. (For the operating conditions, see chapter 6, "SPECIFICATIONS" on page 19.)
3. Always use the tension adjustment ring to adjust the rotation tension of the coarse adjustment knob.
4. The microscope is ventilated by natural convection. Be sure to leave enough spaces (10 cm or more) around it when installing it.
5. When carrying the microscope, hold it by the bottom of the base ① and finger hook on the rear ② as shown on the left and carry carefully.

★**To prevent damage, do not hold the microscope by the stage or observation tube. Before carrying, remove the specimen and filters to prevent them from dropping.**

★**If the microscope is displaced by sliding on the desktop, the rubber feet may be damaged or separated from the bottom.**

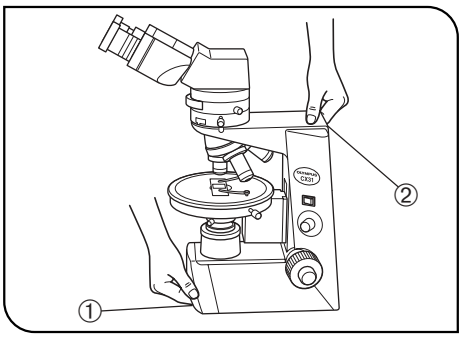


Fig. 2

2 Maintenance and Storage

1. Clean all glass components by wiping gently with gauze. To remove fingerprints or oil smudges, wipe with gauze slightly moistened with a mixture of ether (70%) and alcohol (30%).

⚠**Since solvents such as ether and alcohol are highly flammable, they must be handled carefully. Be sure to keep these chemicals away from open flames or potential sources of electrical sparks — for example, electrical equipment that is being switched on or off. Also remember to always use these chemicals only in a well-ventilated room.**

2. Do not attempt to use organic solvents to clean the microscope components other than the glass components. To clean them, use a lint-free, soft cloth slightly moistened with a diluted neutral detergent.
3. Do not disassemble any part of the microscope as this could result in malfunction or reduced performance.
4. When not using the microscope, ensure that the frame is cooled down and store it in a dry locker or cover it with a dust cover.

3 Caution

If the microscope is used in a manner not specified by this manual, the safety of the user may be imperiled. In addition, the equipment may also be damaged. Always use the equipment as outlined in this instruction manual.

The following symbols are used to set off text in this instruction manual.

⚠ : Indicates that failure to follow the instructions in the warning could result in bodily harm to the user and/or damage to equipment (including objects in the vicinity of the equipment).

★ : Indicates that failure to follow the instructions could result in damage to equipment.

◎ : Indicates commentary (for ease of operation and maintenance).

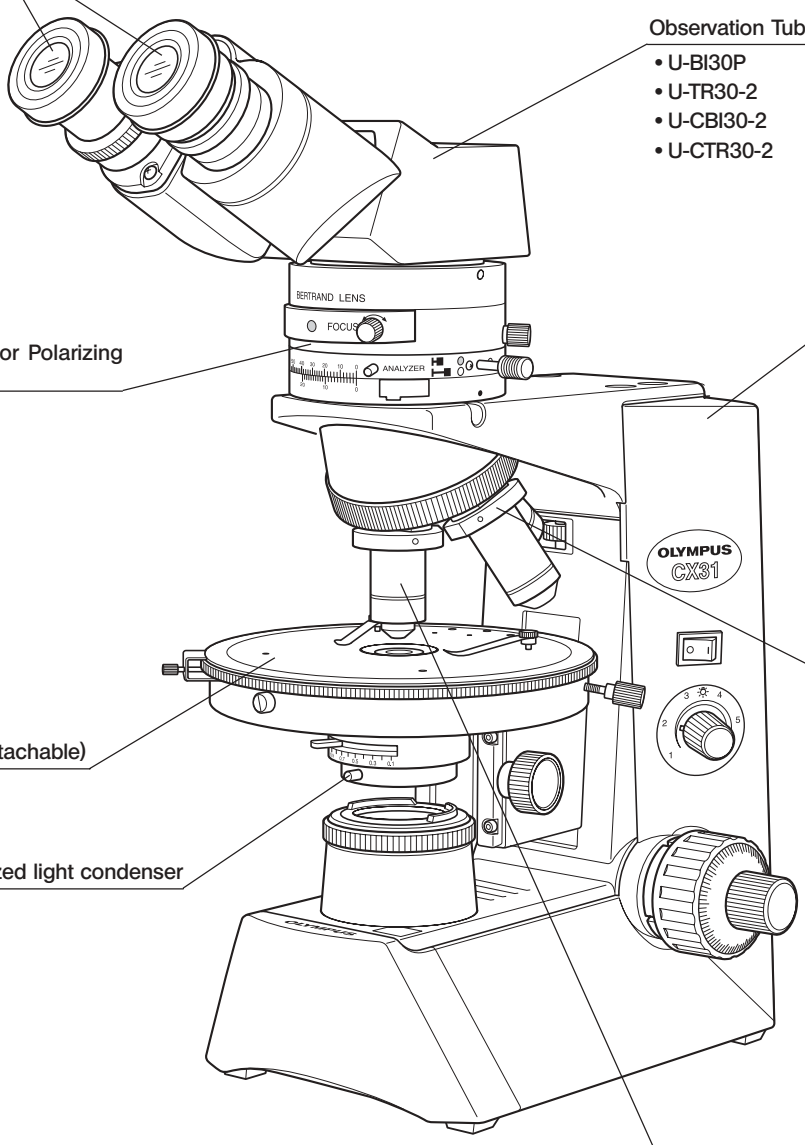
This device complies with the requirements of directive 98/79/EC concerning in vitro diagnostic medical devices. CE marking means the conformity to the directive.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1 MODULE NOMENCLATURE

◎The modules shown below are merely the typical examples. For other applicable modules that are not shown, please consult the latest catalogues or Olympus.



Eyepieces
- WH10X
- WH10X-H
- CROSS WH10X
- WHB10X
- WHBX10X-H

Observation Tube
- U-BI30P
- U-TR30-2
- U-CBI30-2
- U-CTR30-2

Microscope Frame
- CX31PF

Intermediate Tube for Polarizing Observation
- U-PA
- U-OPA
- U-KPA

Centering Adapter for Objective Lens
- U-CTAD (4-piece set)

Rotary stage (Not detachable)

Polarized light condenser

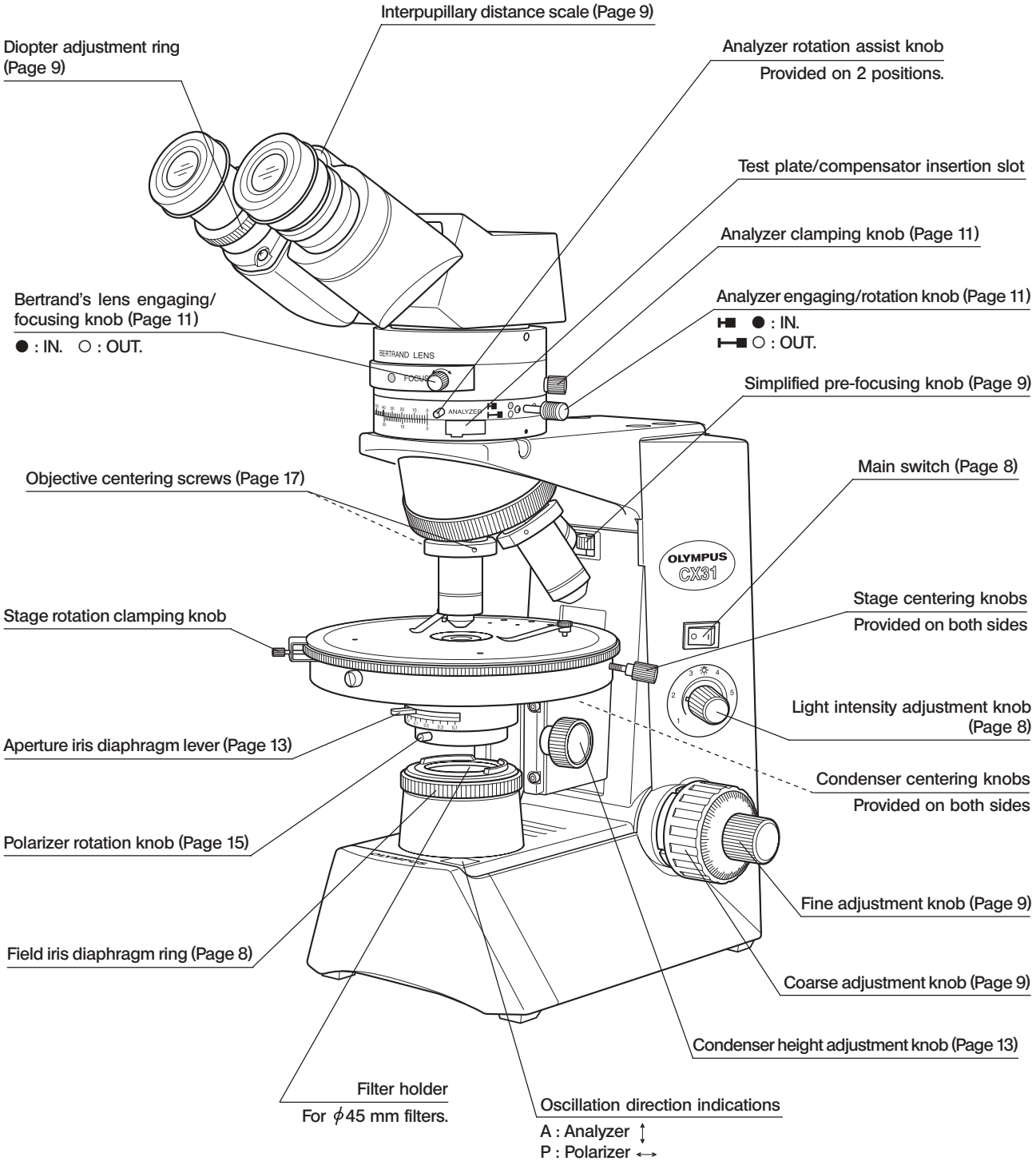
Polarized Light Objective
- Plan4X-P
- Ach10X/20X/40X/100XO-P
- UPlanFI4X/10X/20X/40X/100XO-P

◎Other applicable modules
- Mechanical Stage U-FMP
- Rotary Analyzer for Polarized Light U-AN360P-2
- Sensitive Tint Plate U-TP530
- Quarter-Wave Plate U-TP137
- Test Plate Adapter U-TAD
- Transmitted Light Analyzer U-ANT
- Gout Analyzer U-GAN
- Compensators (6 models)

2 CONTROLS

◎If you have not yet assembled the microscope, read Chapter 9, "ASSEMBLY" (pages 23 to 26) first.

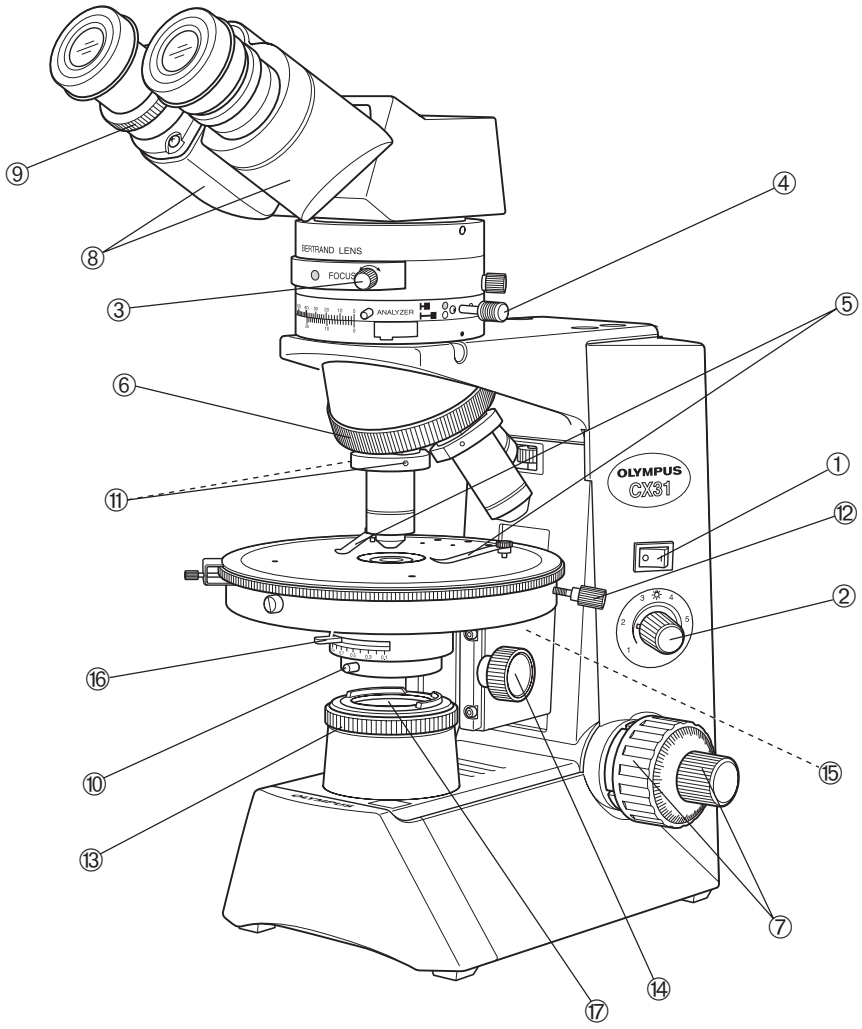
• The illustration shows the microscope together with the U-BI30P binocular observation tube for polarizing observation U-PA intermediate tube for polarizing observation and U-CTAD centering adapter for objective lens.



3 SUMMARY OF POLARIZED LIGHT OBSERVATION PROCEDURE

◎This chapter describes the procedure for polarized light observation using the U-PA intermediate tube for polarizing observation. For the procedure using the U-OPA or U-KPA, refer to the instruction manual for the intermediate tube in use.
* The operations marked * are not required when the U-CTAD centering adapter for objective lens is not used.

	(Controls Used)	(Page)
Set the main switch to " I " (ON).	① Main switch	(P. 8)
	② Light intensity adjustment knob	(P. 8)
Disengage the Bertrand's lens.	③ Bertrand's lens engaging/focusing knob	(P. 11)
Disengage the analyzer.	④ Analyzer engaging/rotation knob	(P. 11)
Place the specimen on the stage.	⑤ Specimen holder	
Engage the reference objective in the light path.	⑥ Revolving nosepiece	
Bring the specimen into focus.	⑦ Coarse/fine focus adjustment knobs	(P. 9)
Adjust the brightness.	② Light intensity adjustment knob	(P. 8)
Adjust the interpupillary distance. Adjust the diopter.	⑧ Binocular tube	(P. 9)
	⑨ Diopter adjustment ring	(P. 9)
Adjust the analyzer and polarizer oscillation directions.	④ Analyzer engaging/rotation knob	(P. 11)
	⑩ Polarizer rotation knob	(P. 15)
* Center the reference objective.	⑪ Objective centering screws	(P. 17)
Center the stage.	⑫ Stage centering knob	(P. 16)
* Center other objectives.	⑪ Objective centering screws	(P. 17)
Center the field iris diaphragm.	⑬ Field iris diaphragm ring	(P. 8)
	⑭ Condenser height adjustment knob	(P. 13)
	⑮ Condenser centering knob	(P. 13)
Engage the objective to be used in the light path, engage the analyzer and/or Bertrand's lens according to the purpose of observation, and bring the specimen into focus.	⑥ Revolving nosepiece	
	④ Analyzer engaging/rotation knob	(P. 11)
	③ Bertrand's lens engaging/focusing knob	(P. 11)
	⑦ Coarse/fine focus adjustment knobs	(P. 9)
Adjust the aperture and field iris diaphragms.	⑯ Aperture iris diaphragm lever	(P.13)
	⑬ Field iris diaphragm ring	(P. 8)
Engage the required filters.	⑰ Filter holder	(P. 8)
Adjust the brightness.	② Light intensity adjustment knob	(P. 8)
Start observation.		



Observation method	Objective	Bertrand's lens
Orthoscopy	4x to 100x	OUT
Conoscopy	20x to 100x	IN

◎In general biological microscopy, the analyzer, Bertrand's lens and test plate are not necessary and should be disengaged from the light path.
When higher brightness is required. remove the polarizer rotation knob seat ⑩ by pulling it downward and take out the polarizer from inside it.

◎Make a photocopy of the observation procedure pages and post it near your microscope.

4 OPERATION

4-1 Microscope Frame

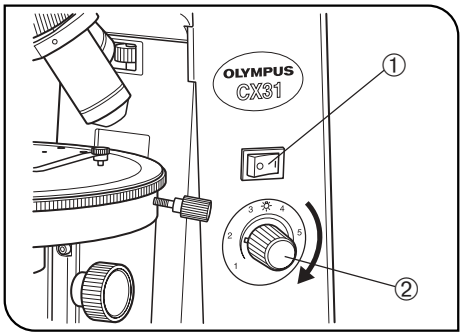


Fig. 3

1 Turning the Lamp ON (Fig. 3)

1. Set the main switch ① to " I " (ON).
2. Rotating the light intensity adjustment knob ② in the direction of the arrow increases brightness and rotating it in the opposite direction decreases brightness. The figures around the knob indicate the reference voltage values.

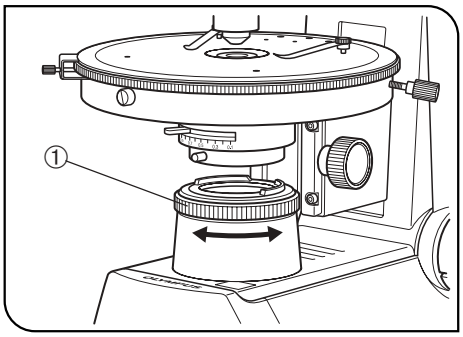


Fig. 4

2 Field Iris Diaphragm (Fig. 4)

Rotate the field iris diaphragm ring ① according to the objective power so that the image of the diaphragm circumscribes the field of view. This restricts the diameter of the beam of light entering the objective and thus excludes extraneous light, improving image contrast.

★ **When the 100X objective is used, the iris diaphragm is not visible in the field. In this case, minimize the diaphragm diameter.**

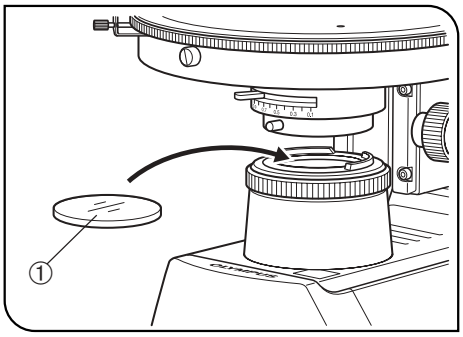


Fig. 5

3 Using the Filters (Fig. 5)

• Drop one or stacked ϕ45 mm filter(s) ① into the window lens on the frame.

◎ For the filter models, consult the latest catalogues or Olympus.

4-2 Focusing Module

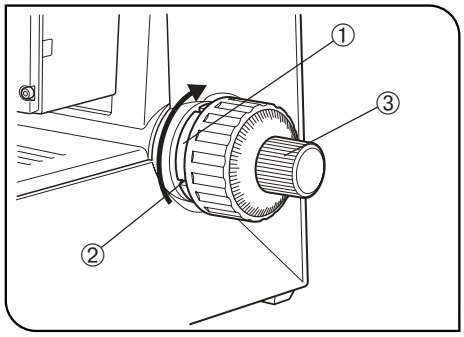


Fig. 6

1 Adjusting the Coarse Adjustment Knob Rotation Tension (Fig. 6)

1. The tension of the coarse focus adjustment knob is adjustable. Insert the tip of a large flat-blade screwdriver into the groove ② on the tension adjustment ring ① and rotate the ring. Rotating it clockwise (in the direction of the arrow) increases the tension and counterclockwise decreases the tension.
2. If the stage descends on its own or if the specimen gets out of focus quickly even when it is brought into focus using the fine adjustment knob ③, it means that the tension of the coarse adjustment knob is too low. Turn the ring ① in the direction of the arrow to increase the tension.

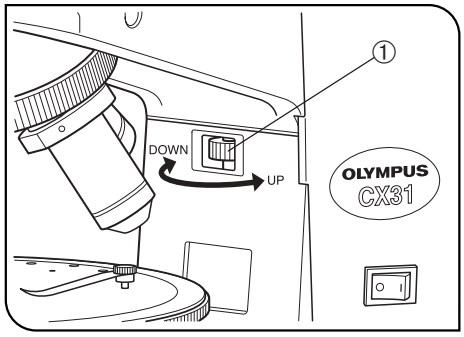


Fig. 7

2 Using the Simplified Pre-focusing Knob (Fig. 7)

★ This mechanism does not work when the U-CTAD centering adapter for objective lens is used.

◎The pre-focusing knob controls the mechanism for preventing collision between the specimen and objective.

1. After bringing the specimen into focus, turn the pre-focusing knob ① of the focusing module so that the pre-focusing mechanism hits the stage holder.
2. To provide a certain margin for focusing, turn the knob by about a half turn backward from the stopped position.

★ If the function of this mechanism is not required, set the pre-focusing knob ① at the UP-end position.

4-3 Observation Tube

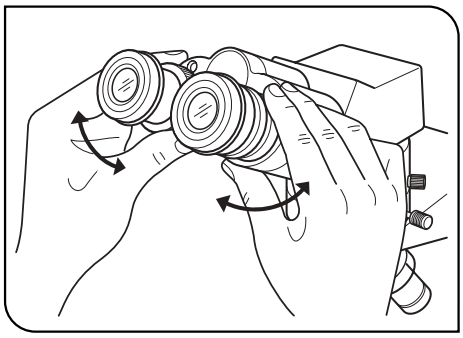


Fig. 8

1 Adjusting the Interpupillary Distance (Fig. 8)

While looking through the eyepieces, move both eyepieces until the left and right fields of view coincide completely. The position of index dot • indicates the interpupillary distance value.

◎Note your interpupillary distance so that it can be quickly duplicated.

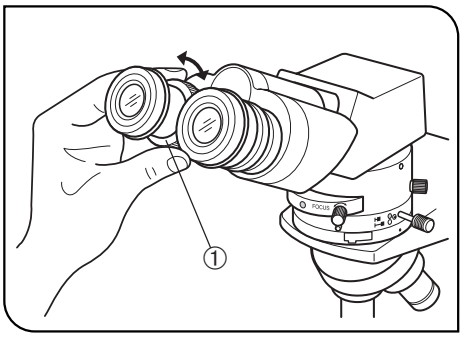


Fig. 9

2 Adjusting the Diopter (Fig. 9)

1. While looking through the right eyepiece with your right eye, turn the coarse and fine focus adjustment knobs to bring the specimen into focus.
2. While looking through the left eyepiece with your left eye, rotate only the diopter adjustment ring ① to focus on the specimen.

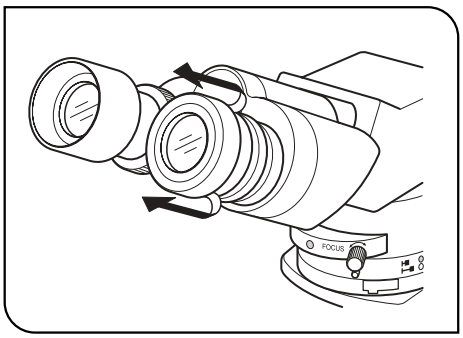


Fig. 10

3 Using the Eye Shades (Fig. 10)

When Wearing Eyeglasses

Use with the eye shades in the normal, folded-down position. This will prevent the eyeglasses from being scratched.

When Not Wearing Eyeglasses

Extend the folded eye shades in the direction of the arrow to prevent extraneous light from entering between the eyepieces and eyes.

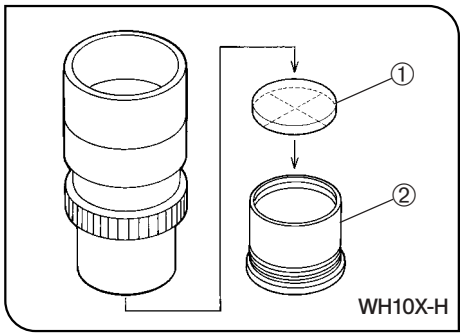


Fig. 11

4 Using the Eyepiece Micrometer Disk (Figs. 11 & 12)

◎When the WH10X-H (or WH10X) eyepieces are used, an eyepiece micrometer disk can be inserted in one of them. When the eyepiece does not have a helicoid mechanism, however, it is hard to focus on the micrometer disk if the operator has poor eyesight.

To insert an eyepiece micrometer disk in the CROSS WH10X, replace the built-in cross with the eyepiece micrometer disk.

Use an eyepiece micrometer disk with a diameter of ϕ24 mm and thickness of 1.5 mm.

Following Fig. 11, unscrew the micrometer-mounting frame ② from the eyepiece and place a micrometer disk ① into the mounting frame. The engraving on the eyepiece micrometer disk should face downward in the micrometer-mounting frame.

Screw the micrometer-mounting frame back into the eyepiece.

◎When the WHB10X-H (or WHB10X) eyepieces are used, an eyepiece micrometer disk with a diameter of ϕ20.4 mm and thickness of 1 mm can be inserted in one of them using the 20.4RH reticle holders ③ (2-piece set).

When the reticle holders are used, the field number becomes 19.5.

1. Place an eyepiece micrometer disk ④ in one of the reticle holders ③ so that the engraving on the eyepiece micrometer disk faces downward.
2. Screw the reticle holder ③ containing the eyepiece micrometer disk ④ into the bottom of the eyepiece.
   At the end of screwing, turn the reticle holder by hooking your nail on its notch ⑤ to screw it all the way in.
3. To provide the other eyepiece with the same field number, screw in the other reticle holder, without eyepiece micrometer disk, into the bottom of the other eyepiece.

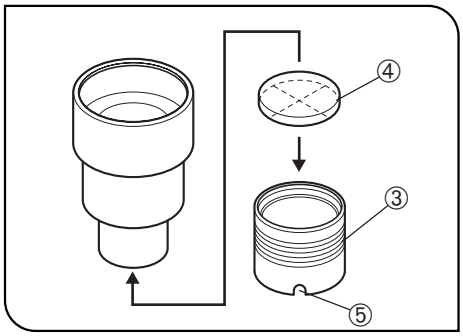


Fig. 12

4-4 Intermediate Tube for Polarizing Observation (U-PA)

◎For the description on the U-OPA or U-KPA intermediate tube for polarizing observation, refer to the instruction manual provided with it.

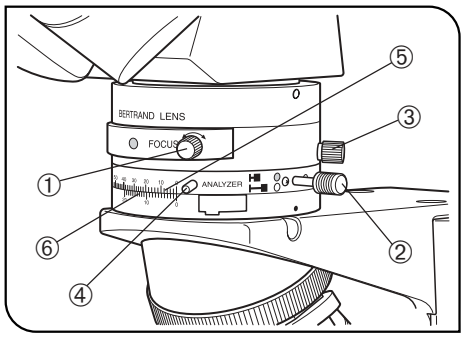


Fig. 13

1 Using the Bertrand's Lens (Fig. 13)

1. To engage the Bertrand's lens into the light path, slide the Bertrand's lens engaging/focusing knob ① horizontally so that the ● (IN) indication comes on the front.
   The Bertrand's lens can be disengaged from the light path by bringing the O (OUT) indication on the front.
2. To adjust the focus of the conoscopic image, turn the Bertrand's lens engaging/focusing knob ①.

2 Using the Analyzer (Fig. 13)

1. To engage the analyzer in the light path, push in the analyzer engaging/rotation knob ② (● position).
   The analyzer can be disengaged from the light path by pulling out the knob (O position).
2. Loosening the analyzer clamping knob ③ makes it possible to rotate the analyzer by up to 180°.
   The analyzer can be rotated using the analyzer engaging/rotation knob ② or analyzer rotation assist knob ④.
   The rotation angle can be read on the rotation scale ⑤. Readout down to 6' is possible by using the vernier ⑥.

4-5 Rotary Stage

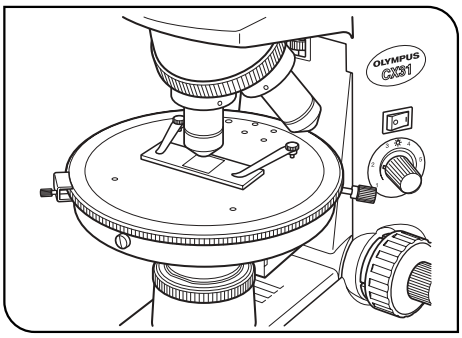


Fig. 14

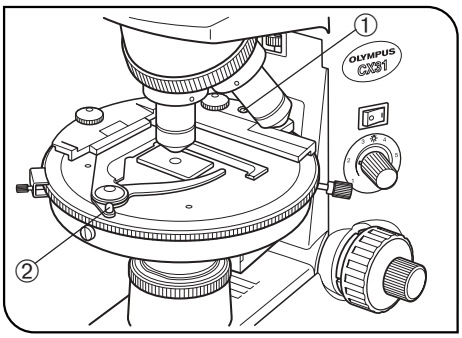


Fig. 15

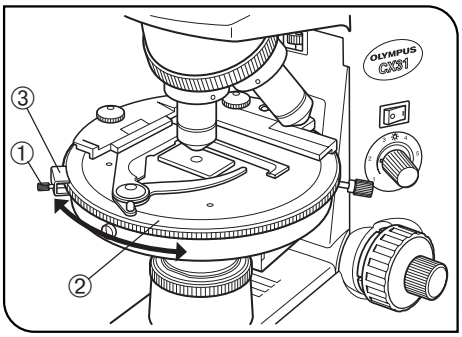


Fig. 16

1 Placing Specimen on the Stage

When the specimen holder is used **(Fig. 14)**

Place the specimen on the center and hold it with the specimen holder.

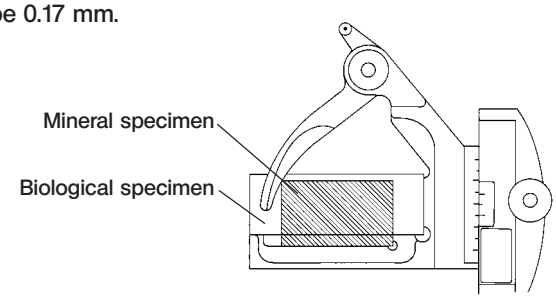
When the mechanical stage (U-FMP) is used **(Fig. 15)**

How to attach the mechanical stage

Fit the guide pins on the bottom of the U-FMP into the holes on the stage top, and tighten the clamping screw ① of the U-FMP using an Allen wrench.

- While expanding the clamping lever ② of the specimen holder, set the specimen in place by sliding it on the stage.

★**Use a slide glass for mineral specimen (28 x 48 mm) or that for biological specimen (26 x 76 mm). The cover glass thickness should be 0.17 mm.**



2 Rotating the Stage (Fig. 16)

Loosen the stage rotation clamping knob ① to allow the stage to be rotated horizontally by up to 360°.

The rotation angle can be read on the scale on the circumference ② (360° partial scale, minimum graduation 1°). Readout down to 6' is possible by using the vernier ③.

4-6 Condenser

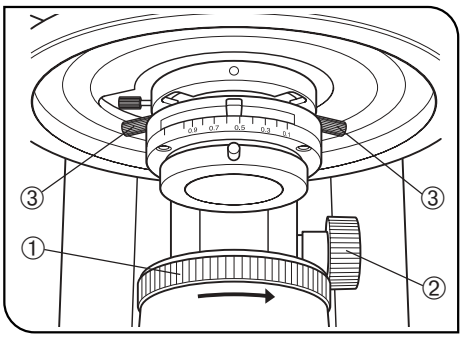


Fig. 17

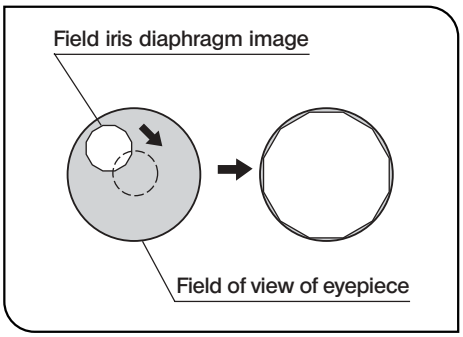


Fig. 18

1 Centering the Field Iris Diaphragm (Figs. 17 & 18)

◎When using the U-CTAD centering adapter for objective lens, perform the operation in 3 Adjusting the Centering Adapter for Objective Lens in section 5-1 (page 17) before proceeding to the following steps.

1. Engage the 10X objective in the light path, bring the specimen into focus and rotate the field iris diaphragm ring ① counterclockwise to stop down the field iris diaphragm slightly.
2. Turn the condenser height adjustment knob ② so that the image of the field iris diaphragm is focused on the specimen surface.
3. Turn the two condenser centering knobs ③ alternately to make the image of the diaphragm concentric with the field.
4. Open the field iris diaphragm so that its image inscribes the field of view. If the image is eccentric, adjust the centering knobs again.
5. Enlarge the iris diaphragm image until it just circumscribes the field of view.

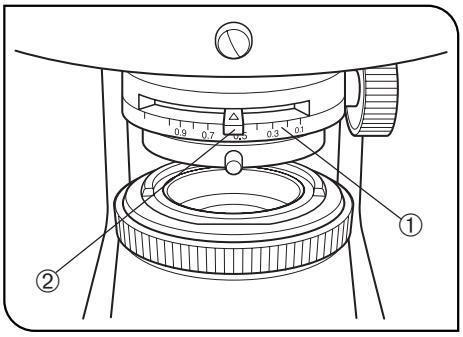


Fig. 19

2 Using the Aperture Iris Diaphragm (Fig. 19)

◎The aperture iris diaphragm adjusts the numerical aperture of the illumination system. Aligning the numerical aperture ① of the illumination system with that of the objective in use improves the contrast and resolution as well as the focal depth of the observed image.

How to adjust the aperture iris diaphragm

Set the aperture iris diaphragm lever ② of the condenser so that its numerical aperture ① matches the NA data indicated on the objective. As the aperture iris diaphragm lever has a certain width, set it so that the numerical aperture matches at the center of this width.

When the 100X oil-immersion objective is used, set the aperture iris diaphragm lever ② to a numerical aperture of 0.9.

◎As microscopic specimens in general have low contrast, it may be optimum to set the aperture iris diaphragm to between 70% and 80% of the aperture number of the objective.

★**Stopping down the aperture iris diaphragm excessively may result in production of ghost.**

4-7 Immersion Objective

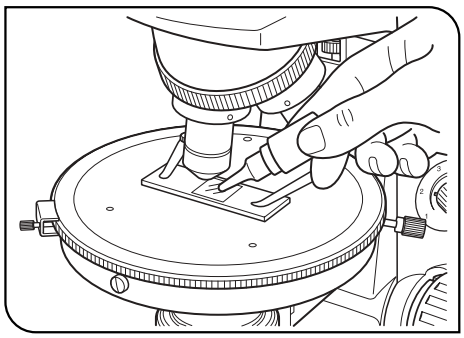


Fig. 20

1 Using the Immersion Objective (Fig. 20)

★ **Always use immersion oil supplied by Olympus.**
Using oil other than designated may degrade the condenser lens surface.

1. Focus on the specimen using all objectives, starting from the lowest-power objective to higher-power objective.
2. Before engaging the immersion objective in the light path, place a drop of immersion oil, provided with the 100x objective set, onto the specimen.
3. Rotate the revolving nosepiece to engage the immersion objective and turn the fine adjustment knob to bring the specimen into focus.

★ **Since air bubbles in the oil will affect the image quality, make sure that the oil is free of bubbles.**
To remove bubbles, rotate the revolving nosepiece slightly to move the objective in the oil by one reciprocation or two.

◎With the 1.25 condenser, the rated numerical aperture (NA) is the value when oil is placed between the slide glass and the top lens of condenser. If oil is not attached there, the NA is about 0.9.

4. After use, remove oil from the objective front lens by wiping with gauze slightly moistened with an ether (70%)/alcohol (30%) mixture.

⚠Caution in use of immersion oil

If immersion oil enters your eyes or contacts your skin, immediately take the following treatment.

Eyes: Rinse with fresh water (for 15 minutes or more).

Skin: Rise with water and soap.

If the appearance of the eyes or skin is altered or pain persists, immediately see your doctor.

5 POLARIZED LIGHT OBSERVATION

5-1 Preparation

As the microscope cannot manifest full performance in polarized light observation if the optical adjustments are not perfect, be sure to perform the following adjustments before observation. Disengage the specimen, quarter-wave plate, sensitive tint plate, etc. from the light path before proceeding.

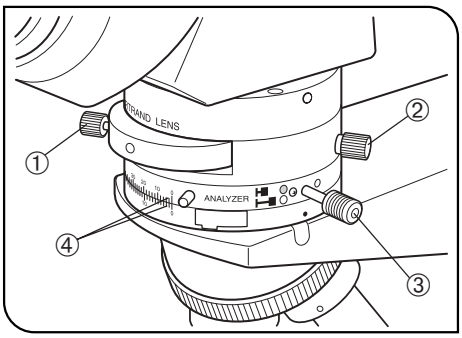


Fig. 21

1 Cross-Nicol Adjustment (Figs. 21 & 22)

1. Set the Bertrand's lens engaging/focusing knob ① to O (out) to disengage the Bertrand's lens from the light path.
2. Loosen the analyzer clamping knob ②, push in the analyzer engaging/rotation knob ③ and then turn it to align "0" of the rotary scale ④ with "0".
3. Tighten the clamping knob ②.
4. Slide the polarizer rotation knob ⑤ slightly in the horizontal direction to make the field of view darkest.

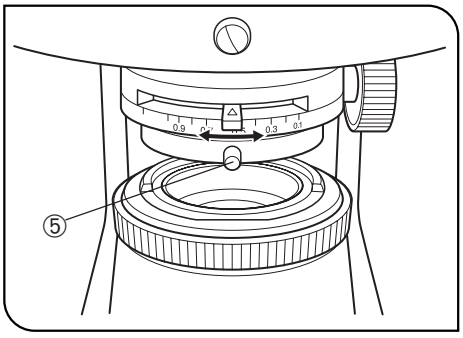
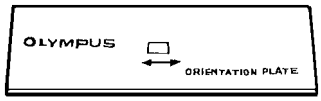


Fig. 22

Polarization light oscillation direction adjustment

★When the U-CBI30-2 and U-CTR30-2 observation tubes is used, the cross lines rotate during the interpupillary distance adjustment so the following adjustment becomes meaningless.

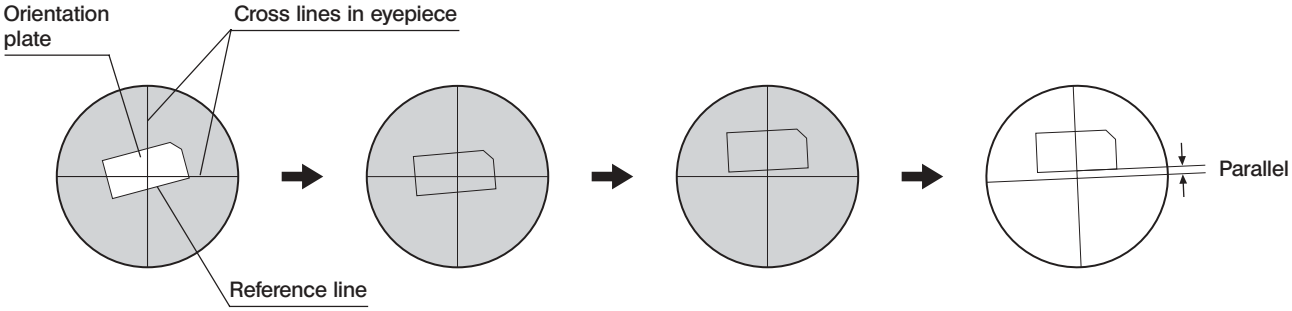
◎When it is required to align the cross lines in an eyepiece with the polarized light oscillation direction, use the oriented plate (U-PJ) for the adjustment.



Orientation Plate (U-PJ)

1. Place the orientation plate on the stage, disengage the analyzer from the light path and adjust the focus using a low-power objective.

2. Align the center of the reference plane of the orientation plate with the cross lines of the eyepiece, and engage the analyzer in the light path to achieve the cross-Nicol condition.
3. While observing the oriented plate, rotate the stage till the orientation plate looks darkest, and clamp the stage rotation there. Rotate the stage so that the bottom edge of the dark orientation plate is adjacent to the cross line.
4. Disengage the analyzer from the light path for the brightfield, and loosen the observation tube clamping screw slightly.
5. Rotate the observation tube so that the cross line in the eyepiece is in parallel with the bottom edge of the orientation plate, and tighten the observation tube clamping screw.



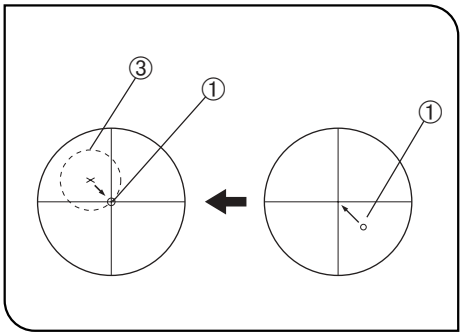


Fig. 23

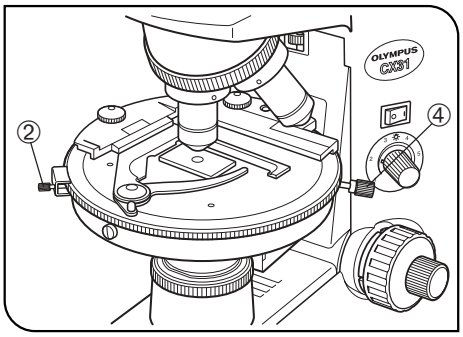


Fig. 24

2 Centering the Rotary Stage (Figs. 23 & 24)

◎When using the U-CTAD centering adapter for objective lens, perform the operation in "3 Adjusting the Centering Adapter for Objective Lens" on the next page before proceeding to the following steps.

◎When the U-CTAD centering adapter for objective lens is not used, switching the objective may deviates the rotation center of the rotary stage from the center of the field of view. If strict alignment is required, adjust centering every time after switching the objective.

1. Place the specimen on the stage.
2. Find a mark ① on the specimen and bring that to the center of cross lines in the cross-eyepiece.
3. Loosen the stage rotation clamping knob ②, rotate the stage and turn the two stage centering knobs ④ to bring the center of the virtual circle ③, drawn by the rotation of the stage, to the center of the cross lines.
4. Move the specimen alone and bring a second mark to the center of the cross lines.

◎Repeat steps 3 and 4 a few times until the center of stage rotation coincides with the center of the eyepiece cross lines.

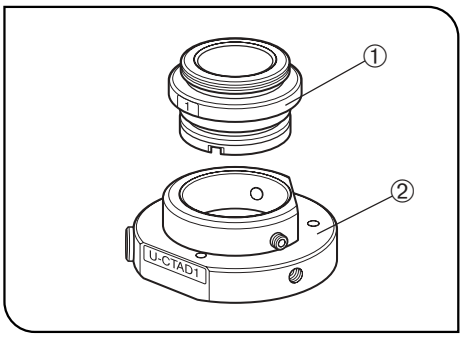


Fig. 25

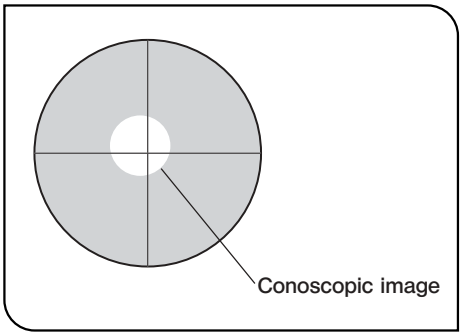


Fig. 26

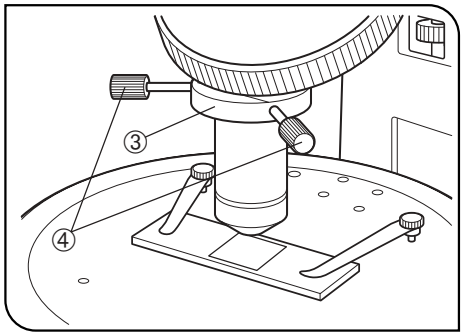


Fig. 27

3 Adjusting the Centering Adapter for Objective Lens (Figs. 25 to 27)

◎This adjustment brings the center of conoscopic image accurately on the center of the field of view. It also ensures the rotation center of the rotary stage to be matched perfectly after objective switching.

★The accuracy of the centering adapter for objective lens is guaranteed using the fixed combination of mount ① and centering seat ② by giving the same identification numbers. Do not change the combination. (Example: 1 and U-CTAD1.)

1 Remove the specimen and engage the objective to be used in conoscopic observation (one of 10x to 40x objectives) in the light path.

2. To set the reference light axis, engage the analyzer in the light path and set to the cross-Nicol condition.

3. Set the Bertrand's lens engaging/focusing knob to the ● (IN) position and observe the conoscopic image.
   To facilitate viewing of conoscopic image by brightening it, rotate the analyzer slightly from the cross-Nicol position.

4. Insert the two centering knobs ④ provided with the centering adapter for objective lens ③ into the two centering holes and turn the knobs so that the center of the conoscopic image comes on the center of the cross lines.

5. Set the Bertrand's lens engaging/focusing knob to the ○ (OUT) position and disengage the analyzer from the light path.

6. Place the specimen on the stage and perform the operation in "**2** Centering the Rotary Stage".

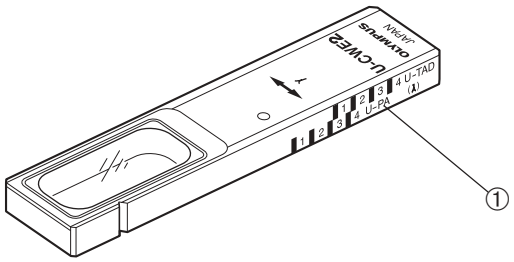
7. Engage an objective other than the reference objective: and, without centering the rotary stage, turn only the centering knobs of the centering adapter for objective lens so that the rotation center coincides with the center of field even when the rotary stage is rotated.

5-2 Orthoscopic Observation

◎Use an objective between 4x to 100x.

1. When the U-PA intermediate tube for polarizing observation is used, set the Bertrand's lens engaging/focusing knob to the ○ (OUT) position to disengage the Bertrand's lens from the light path.
2. Engage the analyzer in the light path and start observation. (Cross-Nicol position)
3. Rotate the stage to set the observation target position of the specimen dark (off position) and then rotate the stage by 45° from there to set to the diagonal position. The retardation (R) value should be measured in this position.
4. The test plate (U-TP137 quarter-wave plate, U-TP530 sensitive tint plate) is used to produce sensitive colors and inserted in the test plate slot. Push the plate all the way into the slot to engage the plate in the light path, and pull it till the click-stop position to disengage it from the light path.

   For the usage of other compensators, refer to their instruction manuals.
   When the U-CWE quartz wedge is used, use the U-CWE2 that has the U-PA indication on the retardation reference indication ①.



5-3 Conoscopic Observation

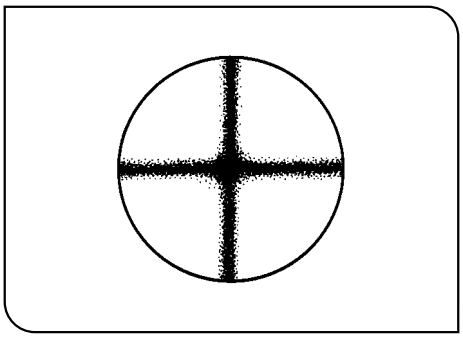


Fig. 28

◎Use an objective between 20x to 100x.

1. Engage the analyzer in the light path and set to the cross-Nicol position.
2. When the U-PA intermediate tube for polarizing observation is used, set the Bertrand's lens engaging/focusing knob to the ● (IN) position to engage the Bertrand's lens in the light path.
3. Engage an objective between 20x to 100x in the light path.
4. Open the aperture iris diaphragm.
5. Turn the Bertrand's engaging/focusing knob to focus on the conoscopic image as accurately as possible.

◎When the U-KPA or U-OPA intermediate tube is used, remove an eyepiece from the sleeve and look through it to view the conoscopic image.

◎The image contrast may be improved by placing the interference filter (45IF546) on the filter holder on the base of the microscope.

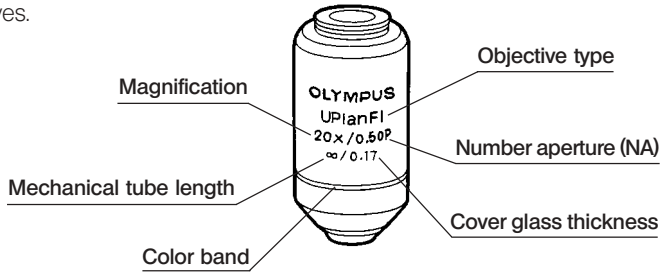
◎If the peripheral part of the conoscopic image is dark, move the condenser up and down to find the height at which the peripheral part is brightest.

6 SPECIFICATIONS

Item		Specifications	
Optical system		UIS (Universal Infinity System) optical system (infinity correction)	
	Objectives	Polarized light objectives of the Ach-P series and UPlanFl-P series.	
	Eyepieces	WH10X,WH10-X, CROSS WH10X. Field number 22. Micrometer disk can be inserted.	WHB10X, WHB10-X. Field number 20. Micrometer disk can be inserted.
Observation tube	Binocular tube	U-BI30P: FN 22. Interpupillary distance adjustment range 50 to 76 mm.	U-CBI302: FN 20. Interpupillary distance adjustment range 48 to 75 mm.
	Trinocular tube	U-TR30-2: FN 22. Light split ratio (Binocular: Straight) = 100:0, 20:80, 0:100.Interpupillary distance adjustment range 50 to 76 mm.	U-CTR30-2: FN 20. Light split ratio (Binocular: Straight) fixed at 50:50. Interpupillary distance adjustment range 48 to 75 mm.
Intermediate tube for polarizing observation (U-PA)	Bertrand's lens	Focusing possible.	
	Orthoscopy/ conoscopy switching	According to Bertrand's lens engagement.Knob on the right position: ● IN. Knob on the left position: ○ OUT.	
	Analyzer	Built in. Engagement/disengagement possible. 180° rotatable. Clamping at desired position possible. Scale with 90 divisions (2° minimum graduations, readout down to 6' possible by using the vernier).	
	Test plate, compensator slot	Sensitive tint plate (U-TP530), quarter-wave plate (U-TP137) and various compensators are mountable.	
Microscope frame	Light source	6 V, 30 W halogen bulb. Precentering/prefocusing system, with field iris diaphragm. Built-in power supply: 100-120/220-240 V ∿, 0.85/0.45 A, 50/60 Hz.	
	Condenser	Strain-free condenser for polarized light. Top lens fixed. Polarizer 360° rotatable and detachable. NA 0.9 (1.25 when immersed in oil). Aperture iris diaphragm ϕ1.5 to ϕ29, lever system.	
	Stage	Rotary stage for polarized light, with 2-point centering mechanism. 360° horizontal rotation can be clamped at a desired position. 360° scale provided (1° minimum graduations, readout down to 6' possible by using the vernier). ◎ Auxiliary specimen holder (provided) can be mounted. ◎ Mechanical stage with cross movements (U-FMP) (optional) can be mounted.	
	Revolving nosepiece	Quadruple positions, arm fixed, inner oriented. ◎ Centering adapter for objective lens (U-CTAD) (optional) can be mounted.	
	Focusing mechanism	Stage height adjustment using roller guides (rack & pinion).Coarse adjustment stroke: 36.8 mm per turn. Total stroke: 25 mm. Pre-focusing knob provided, coarse adjustment knob rotation tension adjustable. Fine adjustment knob with 2.5 μm graduated scale.	
Operating environment		• Indoor use. • Altitude: Max. 2000 meters • Ambient temperature: 5° to 40°C (41° to 104° F) • Maximum relative humidity: 80% for temperatures up to 31°C (88°F), decreasing linearly through 70% at 34°C (93°F), 60% at 37°C (99°F), to 50% relative humidity at 40°C (104°F). • Supply voltage fluctuations: ±10%. • Pollution degree: 2 (in accordance with IEC60664) • Installation/Overvoltage category: II (in accordance with IEC60664)	

7 OPTICAL CHARACTERISTICS

The following table shows the optical characteristics of combinations of eyepieces and objectives. The figure on the right shows the performance data engraved on the objectives.



Optical Characteristics / Objectives	Magnification	NA	WD (mm)	Cover Glass Thick-ness	Resolution (μm)	Eyepieces WH10X (FN 22) Total Mag.	Focal Depth (μm)	Field of View	Remark
Plan-P Strain-free Plan Achromat for polarized light (FN 22)	4X	0.10	22.0	–	3.36	40X	180	5.5	
Ach-P Strain-free Achromat for polarized light (FN 22)	10X	0.25	6.1	–	1.34	100X	28.0	2.2	
	20X	0.40	3.0	0.17	0.84	200X	6.09	1.1	
	40X	0.65	0.45	0.17	0.52	400X	3.04	0.55	
	100XO	1.25	0.13	–	0.27	1000X	0.69	0.22	Oil immersed
UPlanFI-P Strain-free Universal high-class plan semi-apochromat for polarized light (FN 26.5)	4X	0.13	13.0	–	2.58	40X	127.0	5.5	
	10X	0.30	3.1	–	1.12	100X	22.4	2.2	
	20X	0.50	1.6	0.17	0.67	200X	7.00	1.1	
	40X	0.75	0.51	0.17	0.45	400X	2.52	0.55	
	100XO	1.30	0.10	0.17	0.26	1000X	0.66	0.22	Oil immersed

Legend

Working distance (WD): Distance between the top surface of cover glass and the objective front lens.

Numerical aperture (NA): The figure corresponding to the F-number of the camera. This is associated with the resolution and larger NA means higher resolution.

Resolution: Ability of an objective for identifying adjacent two lines in the image, which is expressed in terms of the minimum distance between two points on the specimen surface.

Focal depth(Object side): The depth range of a specimen, in which focusing is obtained at a time. Stopping down the aperture iris diaphragm increases the focal depth and increasing the objective NA decreases it.

Field number (FN): The diameter of the image observed through an eyepiece, represented in millimeters.

Actual field of view: Diameter of the field of view, expressed as the size on the specimen surface.

Total power (Total magnification): Product of:Objective magnification x Eyepiece magnification.

8 TROUBLESHOOTING GUIDE

Under certain conditions, performance of the microscope may be adversely affected by factors other than defects. If problems occur, please review the following list and take remedial action as needed. If you cannot solve the problem after checking the entire list, please contact Olympus for assistance.

Problem	Cause	Remedy	Page
1. Optical system			
a) The field is dark even when the lamp bulb is on.	The Bertrand's lens is in the light path.	Disengage it from the light path.	11
	The analyzer is set to the cross-Nicol position.	Disengage the analyzer from the light path.	11
b) The field of view is cut off or not regularly illuminated.	The revolving nosepiece is not set to a click position.	Set it into a click position.	–
	The test plate is inserted midway.		
	The field iris diaphragm is eccentric.	Center it properly.	13
	The field iris diaphragm is stopped down too much.	Open it to an optimum size.	8/13
	The objective, eyepieces, condenser and/or window lens are dirty.	Clean them thoroughly.	2
c) Dust or stains are visible in observation field.	The window lens on the base is dirty.	Clean them thoroughly.	2
	The top lens of the condenser is dirty.		
	The specimen is dirty.		
	The eyepieces are dirty.		
d) Observation image glares.	The condenser is too low.	Raise it.	13
	The aperture iris diaphragm is stopped down too much.	Open the aperture.	13
e) Observation image is poor. • The image is not sharp. • The contrast is low. • Details are solid and unclear.	The objective is not engaged correctly in the light path.	Set the revolving nosepiece correctly into a click position.	–
	The objective front lens is dirty.	Clean it thoroughly.	2
	Immersion oil is not used with an immersion objective.	Use immersion oil.	14
	Bubbles are mixed in the immersion oil.	Remove the bubbles.	14
	The specified immersion oil is not used.	Use the immersion oil supplied by Olympus.	14
	The specimen is dirty.	Clean them thoroughly.	2
	The eyepieces and/or condenser are dirty.		
f) Part of image is defocused or image looks like it's flowing.	The objective is not properly engaged in the light path	Set the revolving nosepiece correctly into a click position.	–
	The specimen is not set properly on the stage.	Set the specimen correctly on the stage and secure using the specimen holder.	12
g) The cross-Nicol condition cannot be obtained.	The analyzer is disengaged from the light path.	Engage it in the light path.	11
h) The conoscopic image cannot be observed.	The Bertrand's lens is disengaged from the light path.	Engage it in the light path.	11

Problem	Cause	Remedy	Page
2. Focus adjustment mechanism			
a) The tension of coarse adjustment knob it too high.	The coarse adjustment knob rotation tension adjustment ring is set too tight.	Loosen the ring to adjust to proper tension.	9
b) The stage lowers by its own weight or focusing is lost due to slippage of the knob.	The coarse adjustment knob rotation tension adjustment ring is set too loose.	Tighten the ring to adjust to proper tension.	9
c) Coarse focus adjustment cannot raise the stage high enough.	The pre-focusing knob limits the stage at a low position.	Raise the limiting position of the pre-focusing knob.	9
d) Coarse focus adjustment cannot lower the stage low enough.	The condenser holder is too low.	Raise the condenser holder.	13
e) Objective hits the specimen before accurate focusing is obtained.	The specimen is upside down.	Set the specimen correctly.	–
3. Binocular observation tube			
a) Fields of view of two eyes do not match.	The interpupillary distance is not adjusted properly.	Adjust it properly.	9
	Diopter compensation for the two eyes is not set.	Adjust it correctly.	9
	The left and right eyepieces are different.	Do not stare at the image immediately after placing your eyes on the eyepieces. First take a look at the entire field of view. Removing your eyes once from the eyepieces and placing them again may also work.	–
4. Stage			
a) Rotating the stage renders the specimen invisible.	The rotary stage or centering adapter for objective lens is not centered.	Center them.	16/17
5. Objective switching mechanism			
a) Objective hits the specimen when an objective is switched to a higher-magnification objective.	The specimen is upside down.	Set the specimen correctly.	–
	The cover glass is too thick.	Use a cover glass with thickness of 0.17 mm.	12
6. Electrical system			
a) Lamp bulb does not light.	Lamp bulb is not mounted.	Attach a bulb.	24
	Lamp bulb is blown.	Replace the bulb.	24
	The power cord is unplugged.	Plug it securely.	26
b) Lamp bulb blows easily.	The specified bulb is not used.	Replace with a designated bulb	24

9 ASSEMBLY

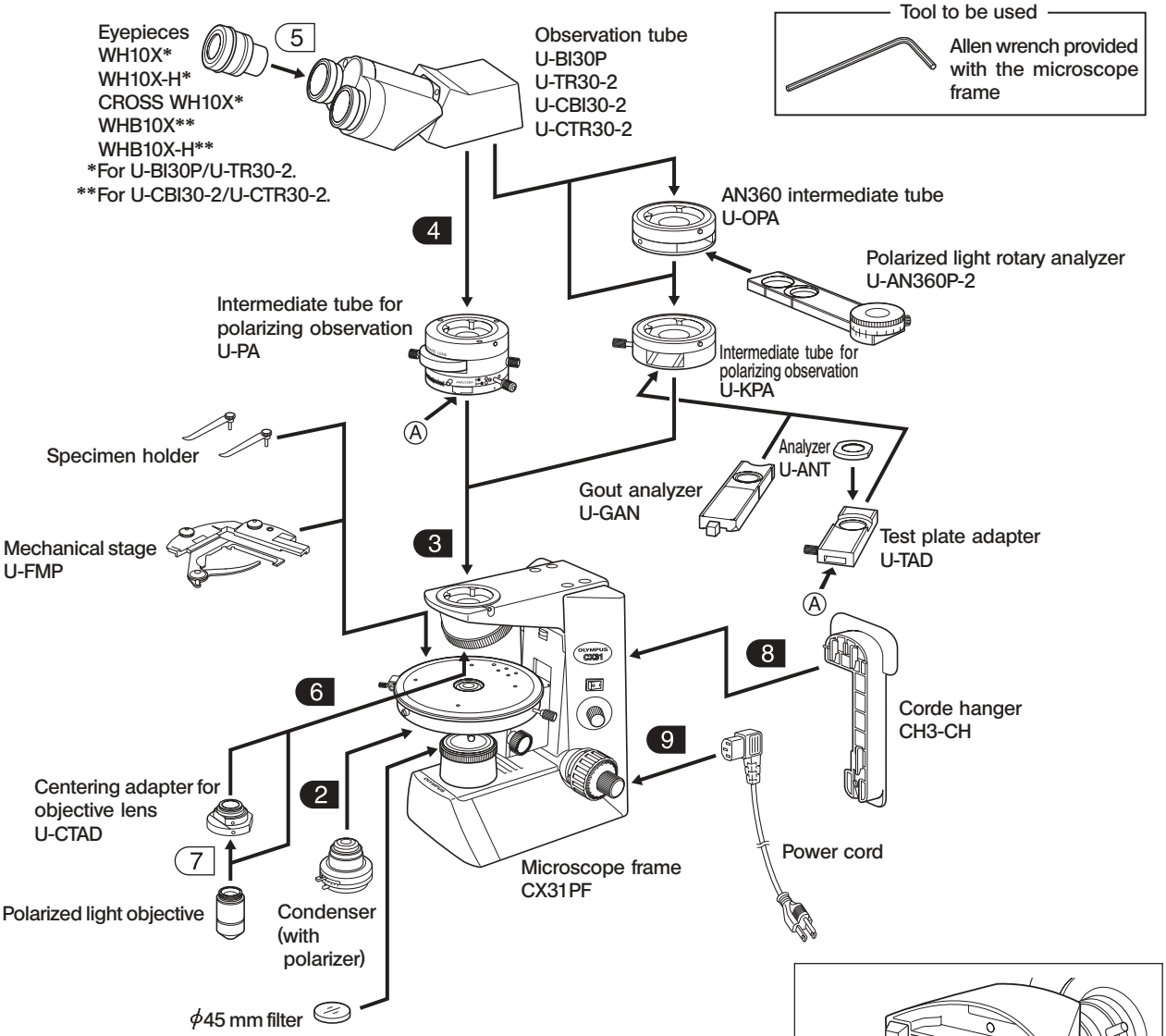
9-1 Assembly Diagram

The diagram below shows the sequence of assembly of the various modules. The numbers indicate the order of assembly.

The module model numbers shown in the following diagram are merely the typical examples. For the modules with which the model numbers are not given, please consult the latest catalogues or Olympus.

★**When assembling the microscope, make sure that all parts are free of dust and dirt, and avoid scratching any parts or touching glass surfaces.**

Assembly steps enclosed in ■ will be detailed on the subsequent pages.



Modules applicable to Ⓐ

- Sensitive tint plate U-TP530
- Quarter-wave plate U-TP137
- Compensator
  U-CBE, U-CTB,
  U-CBR1, U-CBR2,
  U-CWE2 (U-CWE), U-CSE

(Note) The U-CWE cannot be used for the U-PA.

9-2 Detailed Assembly Procedures

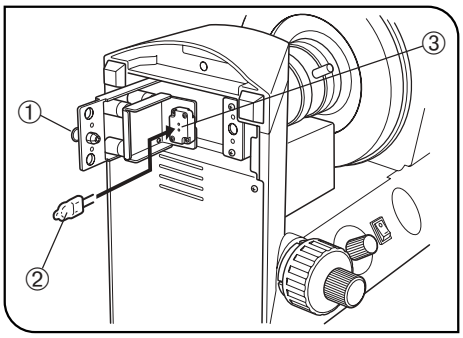


Fig. 29

1 Installing/Replacing the Lamp Bulb (Fig. 29)

1. Place the microscope frame on the back and pull the lock knob ① on the bottom to open the lamp bulb replacement cover.
2. Hold the halogen lamp bulb ② without taking it out of the polyethylene bag so as not to stain the bulb with fingerprints or stains, and push the bulb all the way into the pin holes on the socket ③. After attaching, remove the polyethylene bag from it.

〈Applicable lamp bulb〉

6 V, 30 W halogen bulb: 6V30WHAL (Philips Type 5761)

⚠Always use the designated bulb. Using a bulb other than a specified one may lead to a fire hazard.

⚠Fingerprints or stains on the lamp bulb reduce its service life. When it is contaminated, wipe with a cloth slightly moistened with alcohol.

3. With the lock knob left in the pulled-out position, close the lamp bulb replacement cover. Then push in the lock knob to lock the cover.

★The cover cannot be closed if the lock knob is in the pushed-in position. Make sure that it is in the pulled-out position before closing the cover.

Caution for Bulb Replacement During Use or Right After Use

⚠The bulb, lamp socket and areas near these will be extremely hot during and right after use. Set the main switch to "O" (OFF), disconnect the power cord from the wall outlet, then allow the old bulb and lamp socket to cool before replacing the bulb with a new bulb of the designated type.

★When replacing the bulb that is blown in the middle of observation, remove the parts that may drop such as the eyepieces, filter and specimen from the microscope frame, and tilt down the microscope frame by 90°.

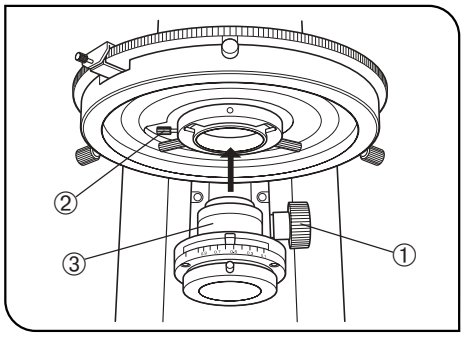


Fig. 30

2 Attaching the Condenser (Fig. 30)

1. Rotate the coarse adjustment knob to raise the stage to the upper limit. Then, rotate the condenser height adjustment knob ① to lower the condenser holder ② slightly, and then loosen the condenser clamping knob ②.
2. Insert the condenser ③ into the condenser holder. Set the condenser's aperture scale to the front position and tighten its clamping screw.
3. Rotate the condenser height adjustment knob to move the condenser holder to the upper limit.

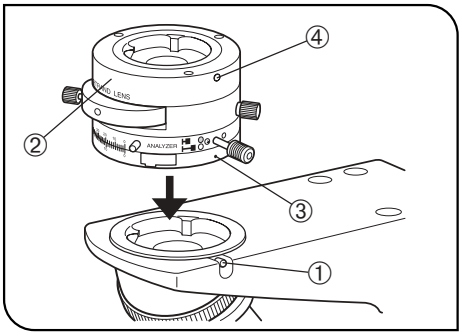


Fig. 31

3 Mounting the U-PA Intermediate Tube for Polarizing Observation (Fig. 31)

◎For the mounting method of other intermediate tube models, refer to their instruction manuals.

1. Fully loosen the observation tube clamping screw ① of the microscope frame using the Allen wrench provided with it.
2. Fit the circular dovetail at the bottom of the intermediate tube for polarizing observation ② into the observation tube mount by aligning the positioning index • ③ with the clamping screw position ① and tighten the clamping screw ①.

4 Mounting the Observation Tube (Fig. 31)

1. Fully loosen the observation tune clamping screw ④ of the intermediate tube for polarizing observation ② using the Allen wrench.
2. Fit the circular dovetail at the bottom of the observation tube into the observation tube mount of the attachment, bring the binocular tube at the operator's position and tighten the clamping screw ④.

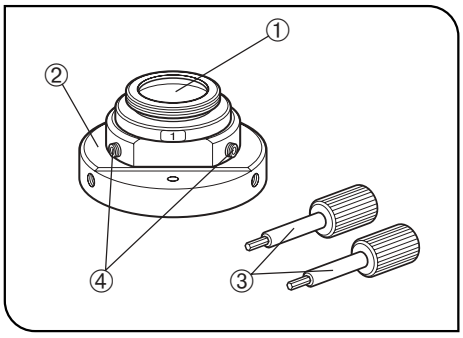


Fig. 32

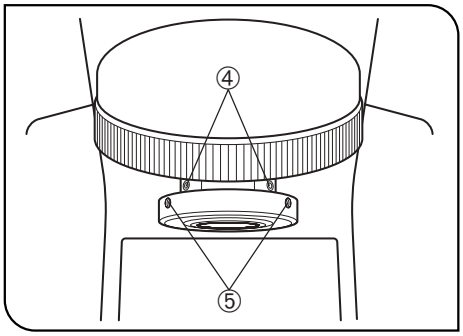


Fig. 33

6 Mounting the U-CTAD Centering Adapter for Objective Lens (Figs. 32 & 33)

★The accuracy of the centering adapter for objective lens is guaranteed using the fixed combination of mount ① and centering seat ② by giving the same identification numbers. Do not change the combination.
Also do not use the unit in combination with another centering adapter for objective lens.

1. Using the centering knobs ③ provided with the centering adapter for objective lens, loosen the two screws ④ clamping the mount ① and centering seat ② to separate them.
2. Screw the mount ① firmly into the revolving nosepiece.
3. Insert the centering seat having the same identification number as the mount attached to the revolving nosepiece, and tighten the two clamping screws ④. At this time, set the combination so that both of the two centering holes ⑤ are uniformly visible from the front. Otherwise, it would be impossible to attach another centering seat.

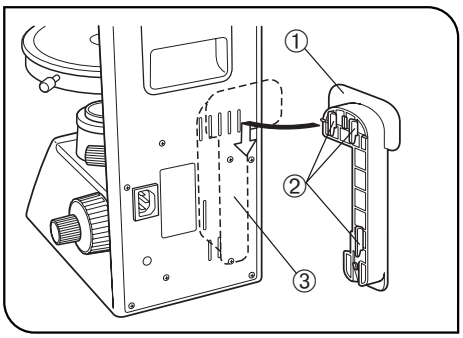


Fig. 34

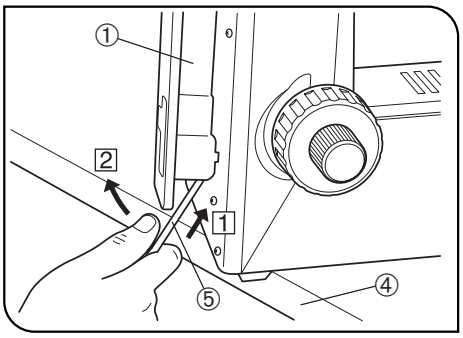


Fig. 35

8 Attaching the Cord Hanger (CH3-CH) (Figs. 34 & 35)

◎When the CH3-CH cord hanger is attached on the back of the microscope frame, the power cord can be wound around the cord hanger for storage.

Engage the hook ② of the cord hanger ① into the air vent groove on the back of the microscope frame by aligning the mount position, apply the cord hanger to bring it in close contact with the microscope frame and then slide the cord hanger down to fix.

★**When carrying the microscope, do not hold it by the cord hanger. Otherwise, the cord hanger would detach and cause the microscope to drop, which may also cause injury.**

Removal

To prevent electric shock, disconnect the power cord in advance and do not use a thin Allen wrench but always use the provided Allen wrench.

⚠**Place the microscope frame at the edge of the desktop ④, insert the Allen wrench ⑤ into the bottom of the cord hanger ① , push the Allen wrench in directions 1 and 2 to move the cord hanger upward and remove it.**

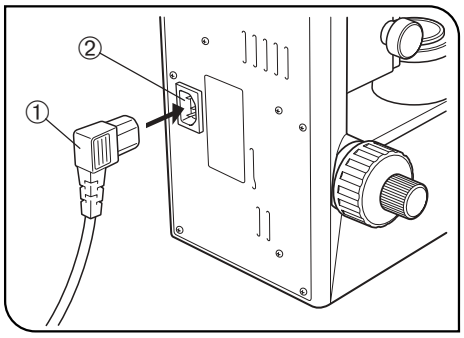


Fig. 36

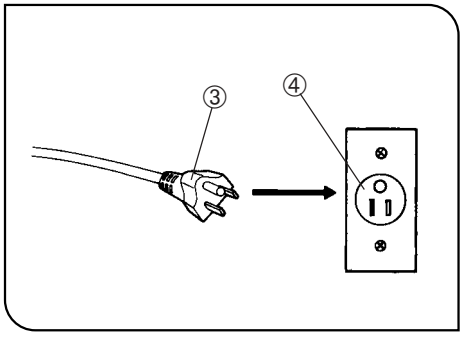


Fig. 37

9 Connecting the Power Cord (Figs. 36 & 37)

⚠**The power cord is vulnerable when bent or twisted. Never subject it to excessive force.**

⚠**Make sure that the main switch is set to "O" (OFF) before connecting the power cord.**

⚠**Always use the power cord provided by Olympus. If no power cord is provided, please select the proper power cord by referring to the section "PROPER SELECTION OF THE POWER SUPPLY CORD" at the end of this instruction manual.**

1. Connect the power cord's connector ① to connector ② firmly.

⚠**Be sure to supply power from a grounded, 3-conductor power outlet using the proper power cord. If the power outlet is not grounded properly, Olympus can no longer warrant the electrical safety performance of the equipment.**

2. Connect the power cord's plug ③ to a wall power outlet ④.

PROPER SELECTION OF THE POWER SUPPLY CORD

If no power supply cord is provided, please select the proper power supply cord for the equipment by referring to " Specifications " and " Certified Cord " below:

CAUTION: In case you use a non-approved power supply cord for Olympus products, Olympus can no longer warrant the electrical safety of the equipment.

Specifications

Voltage Rating	125V AC (for 100-120V AC area) or, 250V AC (for 220-240V AC area)
Current Rating	6A minimum
Temperature Rating	60°C minimum
Length	3.05 m maximum
Fittings Configuration	Grounding type attachment plug cap. Opposite terminates in molded-on IEC configuration appliance coupling.

Table 1 Certified Cord

A power supply cord should be certified by one of the agencies listed in Table 1 , or comprised of cordage marked with an agency marking per Table 1 or marked per Table 2. The fittings are to be marked with at least one of agencies listed in Table 1. In case you are unable to buy locally in your country the power supply cord which is approved by one of the agencies mentioned in Table 1, please use replacements approved by any other equivalent and authorized agencies in your country.

Country	Agency	Certification Mark	Country	Agency	Certification Mark
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	MITI	
Austria	ÖVE		Netherlands	KEMA	
Belgium	CEBEC		Norway	NEMKO	
Canada	CSA		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA BSI	
Germany	VDE		U.S.A.	UL	
Ireland	NSAI				

Table 2 HAR Flexible Cord

APPROVAL ORGANIZATIONS AND CORDAGE HARMONIZATION MARKING METHODS

Approval Organization	Printed or Embossed Harmonization Marking (May be located on jacket or insulation of internal wiring)		Alternative Marking Utilizing Black-Red-Yellow Thread (Length of color section in mm)		
			Black	Red	Yellow
Comite Electrotechnique Belge (CEBEC)	CEBEC	‹HAR›	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prüfstelle	‹VDE›	‹HAR›	30	10	10
Union Technique de l´Electricite´ (UTE)	USE	‹HAR›	30	10	30
Instituto Italiano del Marchio di Qualita´ (IMQ)	IEMMEQU	‹HAR›	10	30	50
British Approvals Service for Electric Cables (BASEC)	BASEC	‹HAR›	10	10	30
N.V. KEMA	KEMA-KEUR	‹HAR›	10	30	30
SEMKO AB Svenska Elektriska Materielkontrollanstalter	SEMKO	‹HAR›	10	10	50
Österreichischer Verband für Elektrotechnik (ÖVE)	‹ÖVE›	‹HAR›	30	10	50
Danmarks Elektriske Materialkontroll (DEMKO)	‹DEMKO›	‹HAR›	30	10	30
National Standards Authority of Ireland (NSAI)	‹NSAI›	‹HAR›	30	30	50
Norges Elektriske Materiellkontroll (NEMKO)	NEMKO	‹HAR›	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	‹UNED›	‹HAR›	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	‹HAR›	30	30	70
Instituto Portages da Qualidade (IPQ)	np	‹HAR›	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	‹HAR›	10	30	90
Elektriska Inspektoratet	SETI	‹HAR›	10	30	90

Underwriters Laboratories Inc. (UL)	SV, SVT, SJ or SJT, 3 X 18AWG
Canadian Standards Association (CSA)	SV, SVT, SJ or SJT, 3 X 18AWG

MEMO

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