Nikon

Microscope

ECLIPSE E200 POL

Instructions

Thank you for purchasing this Nikon product. This instruction manual is for the users of the Nikon Microscope ECLIPSE E200 POL describing basic operation of the microscope.
To ensure correct usage, please read this manual thoroughly before using the microscope.

- It is prohibited to reproduce or transmit this manual in any form without the prior consent of Nikon.
- The instructions and specifications in this manual are subject to change without notice.
- Although every effort has been made to ensure the accuracy of this manual, if you find that any part of this manual is unclear or incorrect, contact your nearest Nikon representative.
- Some ECLIPSE E200 POL microscope sets may come with different components and accessories from those shown in this manual.
- Also read the manuals for the products used with the microscope, for example, the Nikon photomicrographic equipment.

Safety Precautions

Warning and Caution Symbols Used in This Manual

Though Nikon products are designed to provide you with utmost safety during use, incorrect usage or disregard of the instructions may cause personal injury or property damage and will lead to the forfeiture of all claims against warranty. For your own safety, read the instruction manual carefully and thoroughly before using the product. Do not discard this manual. Always keep it near the product for easy reference.
Inside this instruction manual, safety instructions are indicated with the symbols shown below. Be sure to follow the instructions marked with these symbols for your safety.

Symbol	Meaning
 **WARNING**	Disregarding instructions marked with this symbol may lead to death or serious injury.
 **CAUTION**	Disregarding instructions marked with this symbol may lead to injury or property damage.

Meaning of Symbols Used on the Equipment

The symbol appearing on the product indicates the need for caution at all times during use.
Always refer to the instruction manual and read the relevant instructions before manipulating any part to which the symbol has been affixed.

Symbol	Meaning
	**Caution! Biohazard** This symbol label attached on the stand reminds you of the following: • WARNING: Contact of a living body sample to the microscope, presents a biohazard risk. • To avoid biohazard contamination, do not touch the contaminated portion with your bare hands. • Decontaminate the contaminated portion according to the standard procedure of your laboratory.
	**Caution for heat** This symbol label attached near the field lens unit (the lamp is set underneath the field lens unit) reminds you of the following: • Lamp and its surrounding areas (including the field lens unit) become very hot during and immediately after illumination. • Risk of burns. Do not touch the lamp or surrounding areas during and immediately after illumination. • Make sure the lamp and its surrounding areas have cooled sufficiently before attempting to replace the lamp.
	**Caution** This symbol label attached near the AC inlet reminds you of the following: • Check the input voltage before turning on the microscope. (The input voltage is given on the "nameplate" and above the AC inlet.) • If the input voltage shown differs from the local voltage level, do not turn on the microscope. Do the following instead: Different voltage on the nameplate — Contact your nearest Nikon representative. Different voltage above the AC inlet — Change the input voltage setting; refer to P.35.

WARNING

1. Intended use of the equipment

This microscope is intended mainly for use in microscopic observation of rock and mineral or polymer materials or substance of living body, using polarized light illumination.
It is designed for the main purposes of analysis of the optical character, in laboratories or hospitals, of such samples within the fields of mineralogy, high polymer chemistry, medicine.

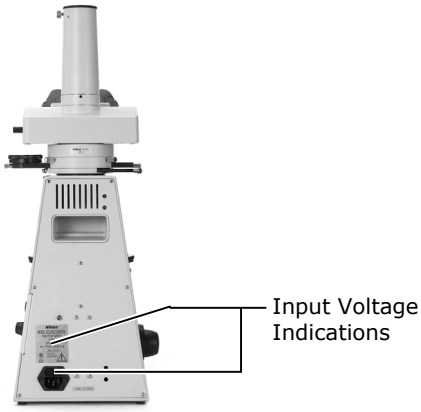
2. Do not disassemble.

Disassembly may cause malfunction and/or electrical shock, and will lead to the forfeiture of all claims against warranty. Do not disassemble any part other than those described in this manual. If you experience any problem with the microscope, notify your nearest Nikon representative.

3. Check the input voltage.

The input voltage is indicated in two places at the rear of the microscope: on the nameplate and above the AC inlet. Confirm that these input voltage indications correspond to the voltage provided in your region. If not, follow one of the instructions below. The use of microscopes with the different input voltage indications will cause overcurrent and overheating, which may result in fire or severe damage to the microscope.

- **If the voltage indication on the nameplate differs:**
  ➔ Do not plug in the microscope. Contact your nearest Nikon representative.
- **If the voltage indication above the AC inlet differs:**
  ➔ Refer to p. 35 and change the input voltage setting before turning on the power switch.
  - For the microscope with the nameplate showing [100/110/120 V ~]:
    The voltage can be set to: AC 100 V, 110 V or 120 V.
  - For the microscope with the nameplate showing [220/230/240 V ~]:
    The voltage can be set to: AC 220 V, 230 V or 240 V.



4. Use the specified lamp, fuse, and power cord.

Use the specified lamp and fuse. Use the power cord provided. Using an incorrect lamp, fuse, or power cord may damage the instrument or cause a fire. (Also see p. 50 on power cord.)
If using an extension cord, only use a cord that includes a protective earth (PE) wire.

- Specified Lamp
  Halogen lamp 6 V-20 W (PHILIPS 7388 or OSRAM HLX64250) or
  Halogen lamp 6 V-30 W (PHILIPS 5761)
- Specified Fuse
  250 V, 1 A, time-lag low-breaking type, 5x20 miniature fuse x2

VI

WARNING

5. Heat at the light source

The lamp becomes hot during use. Do not remove the field lens unit while the lamp is on, and be sure the lamp has been off for 30 minutes before touching it.

- When changing the lamp bulb, make sure that the lamp is cool enough to touch (the light should be off at least 30 minutes).
- Do not touch the lamp while it is on or until the lamp has been off for 30 minutes, as doing so could result in burns.
- Never bring cloth, paper or flammable volatile substances such as gasoline, petroleum benzine, acetone, thinner, or alcohol near a hot lamp, as a fire could result.

6. Hazardous sample

This microscope is mainly for use in microscopic observation of rock and mineral or polymer materials or substance of living body, using polarized light illumination.
When handling a living body sample, check to determine whether the sample is hazardous.
Handle hazardous samples according to the standard procedure of your laboratory.
If the sample is of an infectious nature, wear rubber gloves to avoid infection, and be careful not to touch a sample. In the event of contact of a sample to the microscope, decontaminate the contaminated portion according to the standard procedure of your laboratory.

CAUTION

1. Turn off power switch before assembling the microscope, replacing the lamp or fuse, and plugging in or unplugging the power cord.

Turn off the power switch before you plug or unplug the power cord to prevent electrical shock or fire. Also turn off the power switch and then unplug the power cord before assembling the microscope, and before changing the lamp or fuse. To turn off the power, turn the power switch to ○.

2. Keep the microscope free of moisture and foreign matter.

Keep the microscope free of moisture to prevent short circuiting that could result in overheating or other malfunctions. If water splashes on the microscope, immediately turn off the power switch (turn the switch to ○) and unplug the power cord. Then, wipe off the water with a dry cloth. Short circuiting can also result when foreign matter is trapped inside the microscope. If foreign matter or water has entered the microscope, do not use the microscope and contact your nearest Nikon representative.

3. Disposal of the microscope

To avoid biohazard risk, dispose of the microscope as the contaminated equipment according to the standard procedure of your laboratory.

Notes on Handling the System

(1) Installation

This microscope is a precision instrument. Using the microscope in an unfavorable environment could result in malfunctions or degraded performance. Consider the following conditions when choosing the installation location.

- Observation conditions are better if light from windows and bright room light can be avoided.
- Install the microscope in a location with a room temperature of 0° to 40°C and with a maximum relative humidity of 85%. High temperature and humidity are to be avoided because they promote mold growth and condensation, which may damage the microscope.
- Dirt and dust degrade optical performance and are to be avoided.
- Vibrations in the environment will degrade the image. Install the microscope in a location free of vibrations.
- Install the microscope on a solid table and keep the microscope level.
- Select a layout that allows easy detachment of the power cord from the AC inlet of this microscope in the event of emergency.
- This microscope emits a weak electromagnetic wave. Do not place a precision electronic device near the microscope as precision could be degraded. Also, avoid placing a radio or TV near the microscope as reception of sound and images may be hampered.

(2) Carrying the Microscope

This microscope is a precision instrument. Handle it gently. Strong shocks and forcible operation will damage the instrument. Shocks to the objectives, especially, could degrade image precision.

- When carrying the microscope, hold it at its upper rear and lower front ends.
- Do not hold the focus knobs, the eyepiece tube, or the stage. These parts could easily come off and could result in malfunctions.

(3) Handling the Lamp

Do not touch the glass part of the lamp with bare hands. Wear gloves or use a cloth when handling the lamp so as not to leave fingerprints on the surface. Wipe off any fingerprints or stains using a clean cloth moistened with alcohol. Fingerprints will etch into the hot surface of the lamp and reduce the brightness, damage the lamp or reduce its service life.

Handle the lamp gently. Shocks and vibrations will damage the lamp or reduce its service life.

When changing the lamp, be sure that the contact is not damaged. If the contact is damaged, the lamp may not light up or may overheat. Insert the lamp's contact pins fully into the socket holes. If the pins are loose, the lamp could come off or result in a contact failure, which will cause overheating or smoke. Also, make sure that the field lens unit is securely attached.

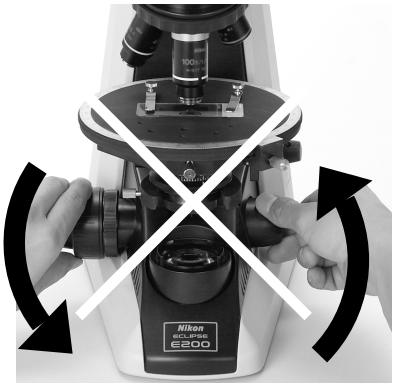
Do not break the used lamps; instead dispose of them as special industrial waste or according to the laws applicable to your municipal waste system.

(4) Refocusing

When changing specimens using the refocusing mechanism, gently lower the stage by hand taking care not to hit the field lens with the condenser holder (p. 15).

(5) Focus Knobs

Do not turn the right and left focus knobs simultaneously in opposite directions. Do not turn the coarse focus knob any further after the stage has been moved up or down to its limit. These operations will damage the focusing mechanism.
(The coarse focus knob has a protection device. The knob turns freely for a while after it has reached its upper limit.)



Do not turn the knobs in opposite directions.

(6) Oil-Immersion Observation

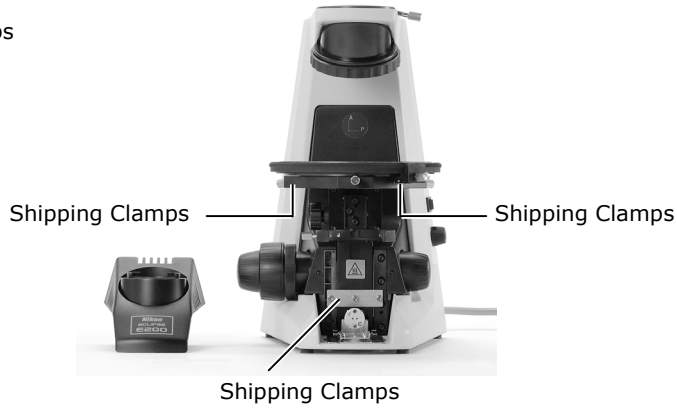
Use only a minimum quantity of oil. If too much oil is applied, surplus oil could flow out to the stage and the condenser which could lead to degraded performance.

WARNING

When using petroleum benzine or absolute alcohol to wipe off immersion oil or to clean the lenses, follow the instructions provided by their manufacturers. Absolute alcohol and petroleum benzine are inflammable. Take great care when handling them.

(7) Shipping Clamps

The microscope is held tightly by the clamps during shipment. Be sure to remove the clamps before use. For details, see p. 35.



VI

Contents

I Nomenclature of Each Part

The microscope is made up of the following components.

(1) Basic unit

(2) Eyepieces

(3) Eyepiece tube

(4) Objectives
Objectives with various magnifying powers are available.

(5) Condenser
Used for condensing light. The condenser should be positioned slightly lower than its upper limit.
Adjust the aperture diaphragm ring according to the objective.

(6) Polarizing intermediate tube
Used with the analyzer slider and the P-CL plate attached.
Equipped with the Bertrand lens.

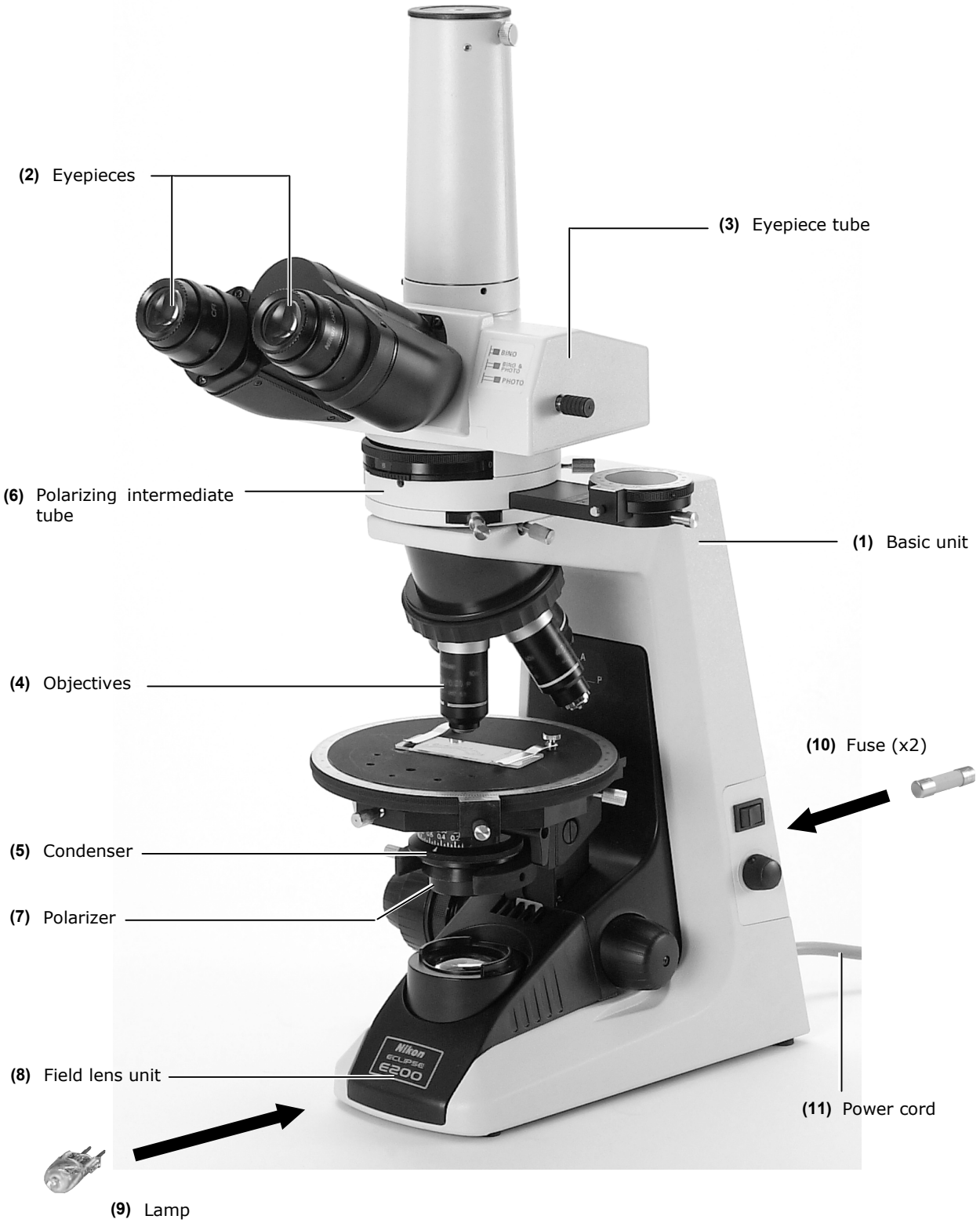
(7) Polarizer
Adjust the vibration direction together with the analyzer before use.

(8) Field lens unit
Draw out the field lens unit when changing lamp.

(9) Lamp
Halogen lamp 6 V-20 W or 6 V-30 W is used.

(10) Fuse
Two 250 V 1 A time-lag low-breaking type fuses are used.

(11) Power cord
Use the power cord provided.


(2) Eyepieces
(3) Eyepiece tube
(6) Polarizing intermediate tube
(1) Basic unit
(4) Objectives
(10) Fuse (x2)
(5) Condenser
(7) Polarizer
(8) Field lens unit
(11) Power cord
(9) Lamp
Nikon
ECLIPSE
E200

II Switches and Controls

(1) Diopter ring
Adjust the diopter ring to compensate for the difference between your right and left eyesight.

(2) Bertrand lens turret
Insert the Bertrand lens into the optical path when performing the conoscopic observation.

(3) Bertrand lens focus ring
Used to focus on the conoscopic image.

(4) Revolving nosepiece
Holds up to four objectives.

(5) Standard screw hole mark
The marked objective screw hole is the standard hole of the nosepiece. Attach here, the objective with the highest magnification.

(6) Specimen clip
Holds the specimen.

(7) Condenser aperture scale
Indicates the numerical aperture.

(8) Swing-out condenser
Swing-out the top lens when performing the orthoscopic observation with the 4x objective.

(9) Condenser aperture diaphragm ring
Usually, set to 70 to 80% of the numerical aperture of the objective.

(10) Polarizer
Insert into the bottom of the condenser.

(11) Stage rotation clamp screw
Fixes the stage in position.

(12) P-CL 1/4 λ and tint plate
Insert into the polarizing intermediate tube.

(13) Eyepiece tube clamp screw
Turn with the supplied hexagonal wrench to fix the eyepiece tube.

(14) Analyzer slider
Insert into the polarizing intermediate tube.

(15) Intermediate tube clamp screw
This is the eyepiece tube clamp screw of the microscope. It is used to fix the intermediate tube in place.

(16) Orientation plate
Shows the vibration directions of the polarizer and the analyzer.

(17) Circular graduated stage
Rotates 360 degrees. Equipped with the graduations which equally divides the circumference in 360.

(18) Power switch
Press the l side to turn on the power and to light the lamp. Press the ○ side to turn off the power and to distinguish the lamp.

(19) Brightness control dial
Turn clockwise to increase the voltage to make the viewfield bright. Turn counterclockwise to decrease the voltage and to darken the viewfield.

(20) Fine focus knob
Used for focusing. There is no coarse focus knob on the opposite side of the condenser focus knob.

(21) Condenser top lens swing-out knob
Used to swing-out the top lens of the condenser.

(22) Vernier
Enables to readout the angles in 0.1 degrees.

(23) Bertrand lens centering screw
Used to center the conoscopic image.

(24) Coarse focus knob torque adjustment ring
Used to adjust the tension (torque) of the coarse focus knob.

(25) Coarse focus knob
There are both coarse and fine focus knobs on the side with the condenser focus knob.

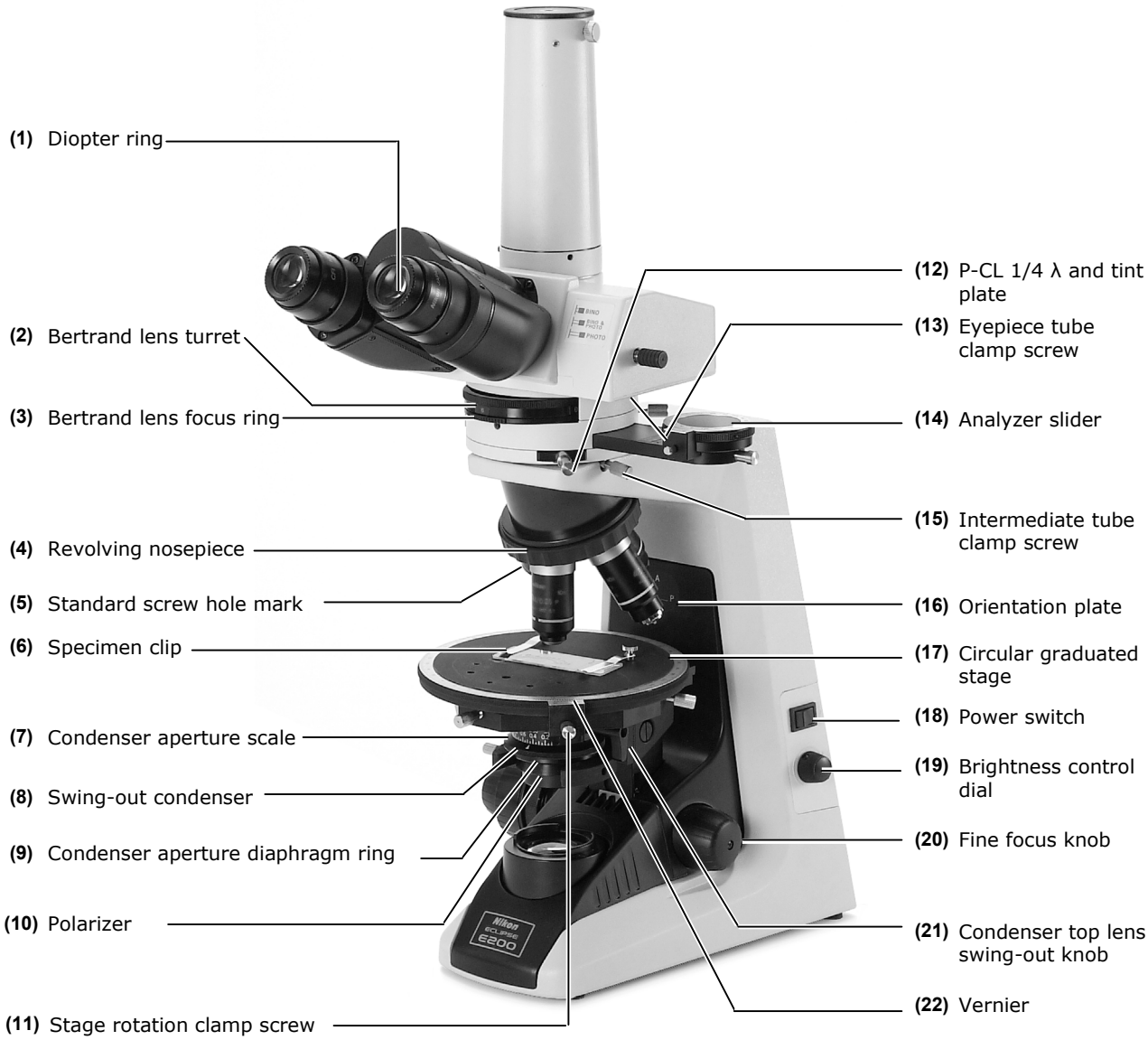
(26) Condenser focus knob
Located on the same side as the coarse stage focus knob.

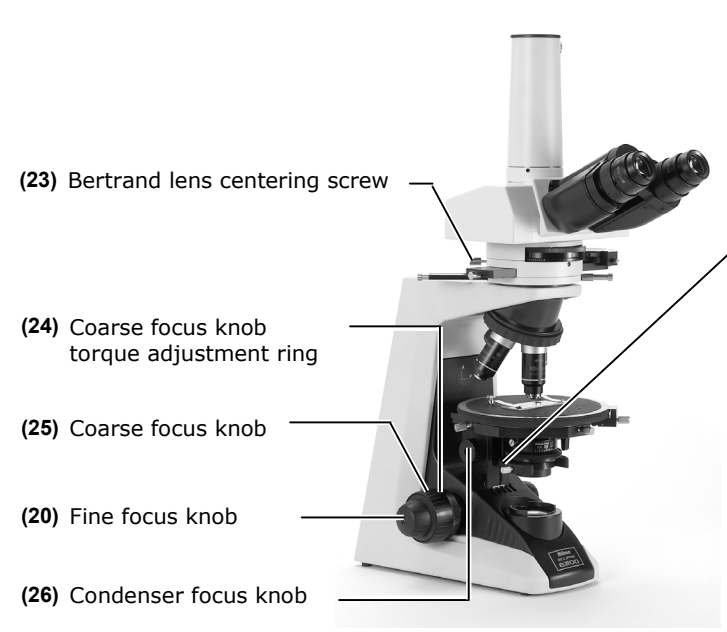
(27) Condenser clamp screw

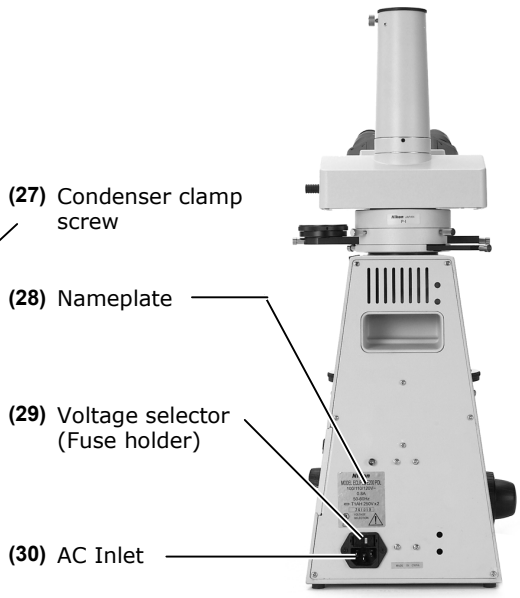
(28) Nameplate
Indicates the input voltage.

(29) Voltage selector (Fuse holder)
Match with the voltage provided in your region.

(30) AC Inlet
Plug in the power cord. Turn off the power switch before plugging in the power cord.


(1) Diopter ring
(2) Bertrand lens turret
(3) Bertrand lens focus ring
(4) Revolving nosepiece
(5) Standard screw hole mark
(6) Specimen clip
(7) Condenser aperture scale
(8) Swing-out condenser
(9) Condenser aperture diaphragm ring
(10) Polarizer
(11) Stage rotation clamp screw
(12) P-CL 1/4 λ and tint plate
(13) Eyepiece tube clamp screw
(14) Analyzer slider
(15) Intermediate tube clamp screw
(16) Orientation plate
(17) Circular graduated stage
(18) Power switch
(19) Brightness control dial
(20) Fine focus knob
(21) Condenser top lens swing-out knob
(22) Vernier


(23) Bertrand lens centering screw
(24) Coarse focus knob torque adjustment ring
(25) Coarse focus knob
(20) Fine focus knob
(26) Condenser focus knob


(27) Condenser clamp screw
(28) Nameplate
(29) Voltage selector (Fuse holder)
(30) AC Inlet

III A Quick Microscopic Procedure

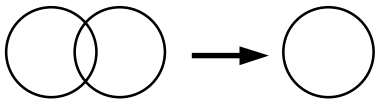
Turn on the lamp and adjust interpupillary distance.

1 Turn on the power switch.

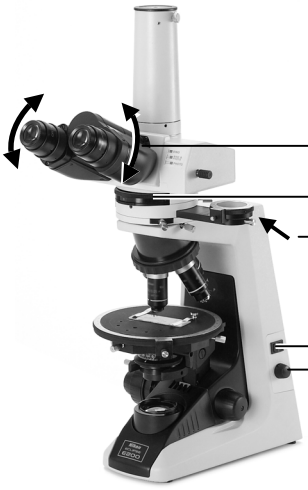
2 Push the analyzer slider left.

3 Turn to position "0".

4 Widen or narrow to merge the viewfields into one.



Viewfields



5 Adjust brightness too.

Focus with 10x objective.

1 Match the bottom edge of the diopter ring with the engraved base line.

2 Place specimen slide on the stage. (Coverglass up.)

3 Swing the 10x in the optical path.

Use this knob for focusing.

Slightly lower the condenser from its uppermost position.

Adjust the diopter.

1 Use your right eye.

And focus on the crosshairs with this ring.

2 Use your right eye.

And focus on both the crosshairs and the specimen.

3 Use your left eye.

And focus with this ring.

Magnify the image and observe!

1 Check the magnifying power.

2 Move the ring to the 70-80% of the objective. N.A.

3 Observe.

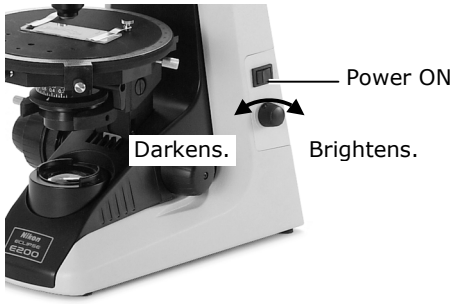
Turn off the power.

Wait till the microscope cools down before storing.

IV Microscopy (Detailed Procedure)

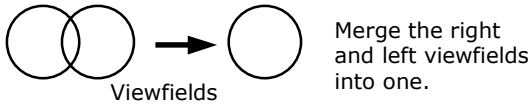
1 Lamp Illumination

Turn on the power switch (turn to |) and the lamp will come on. Turn the brightness control dial to adjust the brightness of the viewfield. (Turning the dial clockwise increases the brightness; turning the dial counterclockwise decreases it.)



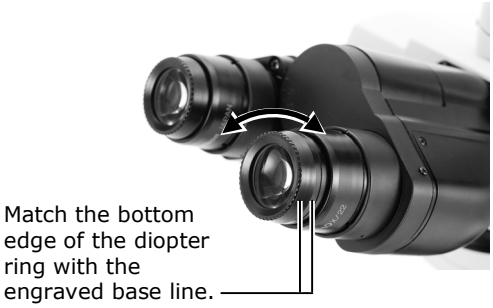
2 Interpupillary Distance Adjustment

Adjust the distance between the eyepieces to merge the right and left viewfields into one. (This is an adjustment to match the distance between eyepieces with the distance between your eyes).



3 Align the Diopter Ring with the Engraved Base Line

Turn the diopter ring on the right eyepiece to align its bottom edge with the engraved base line. Turn and align the diopter ring on the left eyepiece in the same way.



4 Specimen Mounting

Place specimen slide on the stage with the coverglass facing upward and fix with the specimen clips.

Try !!

Replacing a Specimen Using the Refocusing Mechanism

Try focusing on the specimen with 40x or higher magnification objective. You will find the specimen is brought very near to the objective.*1 It will be very difficult to change the specimen without moving the focus knob. In a case like this, use the refocusing mechanism for easy specimen replacement.

(1) Use one hand to gently press down the stage.*2

(2) While holding the stage at that position, change the specimen.

(3) Gradually release the stage so that it rises slowly. The stage will return to the focal position.

Make sure not to hit the field lens.

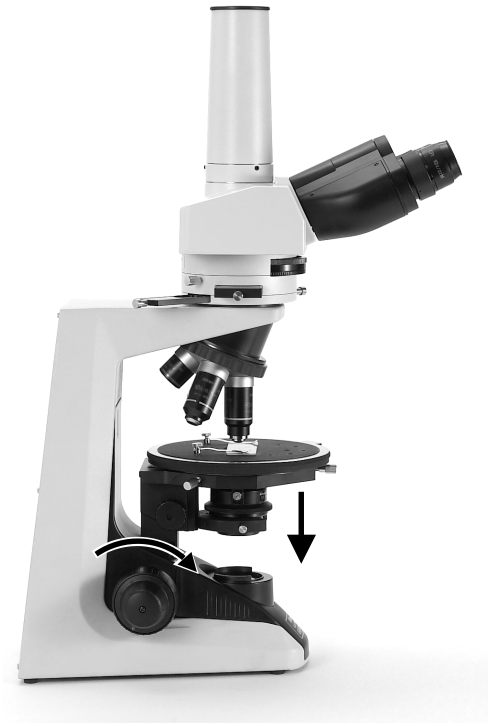
*1: The distance between the front of the objective and the specimen when the specimen is in focus is called the "working distance" of the objective. For details, see p. 42.

*2: When lowering the stage, take great care not to hit the field lens with the condenser and the parts under the condenser.

5 Focus with the 10x Objective

Rotate the revolving nosepiece to bring the 10x objective into the optical path. (The objective will click into place when rotated into position.)
Bring the specimen image into focus by turning the coarse focus and then fine focus knob.

- Direction of stage movement relative to focus knob rotation is shown in the figure.
- There is no coarse focus knob on the opposite side of condenser focus knobs.
- Do not turn the right and left focus knobs simultaneously in the opposite directions. Do not turn the coarse focus knob further after the stage has reached its lower or upper limit. These operations could result in a malfunction.



Try !!

Focusing

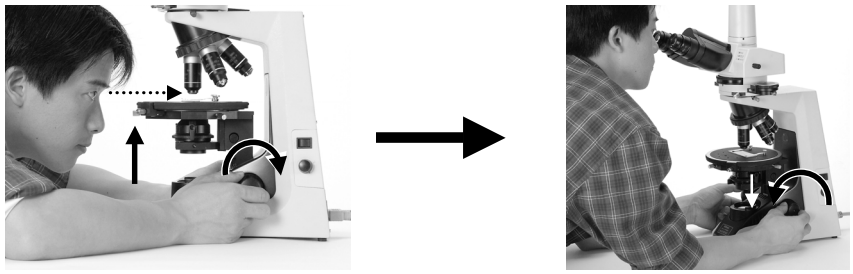
Turning the focus knobs recklessly is a long and hard way to focus on the image. If you are using a high power objective, you may even damage the specimen by pressing it against the objective. Before breaking the coverglasses or damaging the objectives, read the following and find the correct way to focus on the specimen.

(1) Put the 10x (or 4x) objective in the optical path.

(2) Turn the coarse focus knob to raise the stage to its upper limit. *1

(3) Looking into the eyepieces, slowly rotate the coarse focus knob to lower the stage. When the specimen image appears, stop rotating the knob.

(4) Rotate the fine focus knob and precisely focus on the image.
When you want to observe the image with a high power objective, first focus on the image using a 10x (or 4x) objective. Then change to a high power objective and rotate the fine focus knob for precise focusing.



First raise the stage...

Then look into the eyepieces and lower the stage.

Hints

1. **When rotating the coarse focus knob while looking into the eyepieces, be sure to turn it only in the direction that lowers the stage.**
2. **When raising the stage using the coarse focus knob, take your eyes off the eyepieces and look at the gap between the upper surface of the specimen and the front of the objective from the side.**
3. **First focus with a low power objective. Then change to a high power objective.**

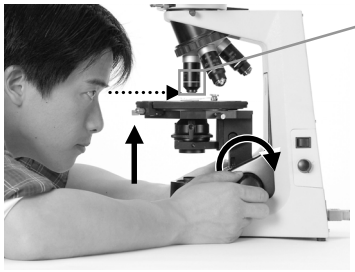
*1: Since the working distances of 10x and 4x objectives are large (p. 42), these objectives do not touch the specimen even when the stage is raised to its upper limit provided that the slide and coverglasses of a standard thickness are used. (The standard thickness for slides is 1.2 mm and that for coverglass is 0.17 mm.)

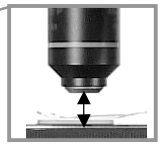
Try !!

Using the Working Distance for Focusing

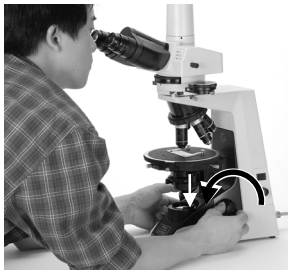
Each objective has its working distance indicated on its side. The working distance is the distance between the front of the objective and the specimen when the specimen image is in focus. If you have difficulties in focusing with the standard procedure described on p. 17, try one of the following methods using the working distance for focusing.

Method 1:
While looking at the microscope from the side, rotate the coarse focus knob to bring the specimen close to the objective. When the distance between the specimen and the front of the objective becomes slightly smaller than the working distance, take your hands off the coarse focus knob. The specimen is now almost in focus. Look into the eyepieces and rotate the fine focus knob in the direction that lowers the stage.





Raise the stage until this distance is slightly smaller than the working distance.



Lower the stage with the fine focus knob to find the focal point.

Method 2:
Swing the 40x objective into the optical path. While looking at the microscope from the side, rotate the coarse focus knob until the specimen almost touches the objective (about 0.5 mm apart from the front of the objective). The specimen is now almost in focus. Switch to the 10x objective, look into the eyepieces, and rotate the fine focus knob slightly to find the focal point. Be careful not to hit the objective with the specimen.

6 Eyepiece Diopter Adjustments

Adjust the diopter rings on the eyepieces according to the difference between your left and right eyesight. This adjustment enables the user to take full advantage of the high-quality objectives, including their parfocality.

Method 1: When using an eyepiece with crosshairs

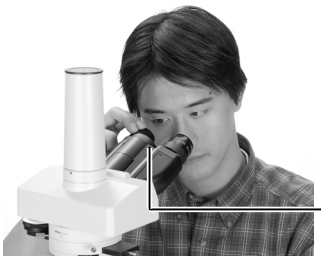
Slightly lower the condenser from its uppermost position.

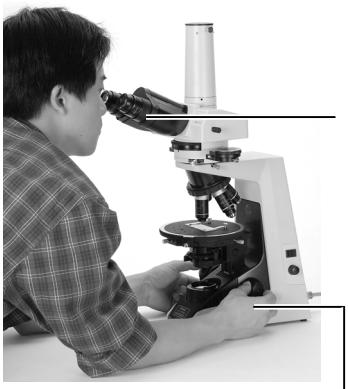
(1) Swing the 10x (or 4x) objective in the optical path. Rotate the coarse and then fine focus knobs to bring the specimen in focus.

(2) While looking into the right eyepiece (with crosshairs) with your right eye, focus on the crosshairs by rotating the right diopter ring and not using the focus knob.

(3) Turn the fine focus knob to focus both on the specimen and the crosshairs.

(4) While looking into the left eyepiece with your left eye, focus on the specimen by rotating the left diopter ring and not using the focus knob.





Use your left eye.

Method 2: When there is no crosshairs on your eyepiece.

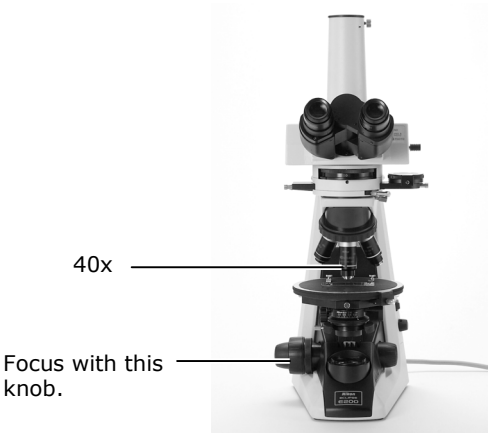
Slightly lower the condenser from its uppermost position.

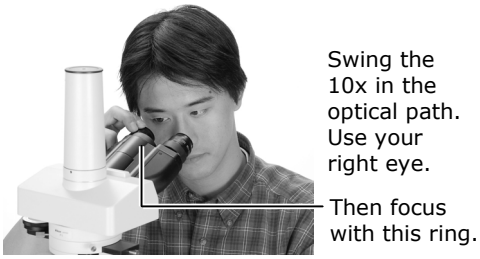
(1) Swing the 40x objective in the optical path. Rotate the coarse and then fine focus knobs to bring the specimen in focus.

(2) Switch back to the 10x (or 4x) objective. While looking into the right eyepiece with your right eye, focus on the specimen by rotating the right diopter ring and not using the focus knob.

(3) While looking into the left eyepiece with your left eye, focus on the specimen by rotating the left diopter ring and not using the focus knob.

(4) Repeat the steps (1) to (3).





7 Objective Selection

Rotate the revolving nosepiece to the desired objective magnification.
(The objective will click into place when rotated into position.)
Adjust the aperture diaphragm lever according to the selected objective.

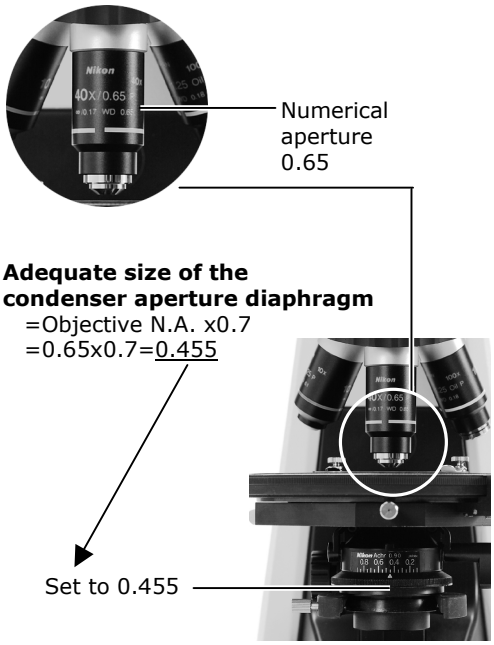
8 Aperture Diaphragm Adjustment

● Orthoscopic Microscopy

The aperture diaphragm is important because it is related to the resolution, contrast, depth of focus and brightness of the optical image. Turning the condenser aperture diaphragm ring changes the size of the aperture diaphragm. As the aperture diaphragm is stopped down, resolution and brightness are reduced while contrast and depth of focus are increased. Conversely, as the aperture diaphragm is opened, resolution and brightness are increased while contrast and depth of focus are reduced. It is not possible to adjust one pair of characteristics without affecting the other. Generally, a satisfactory image with appropriate contrast can be obtained with an aperture setting that is 70% to 80% of the numerical aperture of the objective. The numerical aperture is indicated on the barrel of each objective.

An indication of 40x / 0.65 means that the magnification is 40x and the numerical aperture is 0.65.

If the aperture diaphragm is stopped down too far, the resolution is reduced; therefore, except when viewing a nearly transparent specimen, we do not recommend stopping down the aperture to less than 60% of the numerical aperture of the objective.



- **Adjusting the size of the aperture diaphragm according to the condenser scale**
  Since the condenser scale indicates the numerical aperture, adjust the aperture diaphragm ring according to the scale. (Normally, the index on the aperture diaphragm ring should be aligned with the scale line corresponding to 70% to 80% of the numerical aperture of the objective.)
- **Adjusting the size of the aperture diaphragm using the Bertrand lens**
  Insert the Bertrand lens into the optical path (by placing in position "B"). Turn the diaphragm control ring to stop down the aperture diaphragm to its minimum setting. Turn the Bertrand lens focus ring to focus on the aperture diaphragm. Turn the diaphragm control ring to adjust the aperture diaphragm. (This is normally adjusted to 70-80% of the field of view.)

● Conoscopic Microscopy

In the case of conoscopic microscopy, the condenser aperture diaphragm functions as a field diaphragm on the conoscopic image surface. Stop down the diaphragm until it circumscribes the circumference of the field of view of the conoscopic image (pupil of the objective).

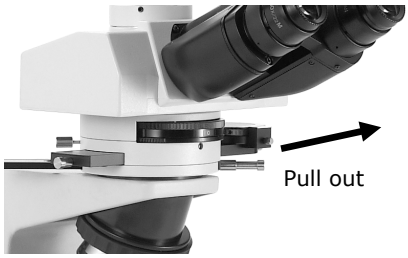
● Orthoscopic Observation/Conoscopic Observation

The following provides an explanation of the characteristic observation method of polarizing microscopes along with the microscopy procedure. If normal microscopy has not yet been completed, refer to the previous section and complete normal microscopy.

Orthoscopic Observation

In this method, the specimen is observed with the polarizer and analyzer placed in the optical path. In this case, the shape of the specimen is visible (direction of optical axis) and the optical properties relative to the direction of the thickness of the specimen can be observed.

- Operation
  Pull out the analyzer slider to the right and move the analyzer into the optical path.

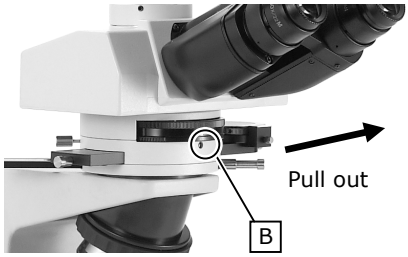


Analyzer in the optical path

Conoscopic Observation

In this method, in addition to the polarizer and analyzer, the Bertrand lens is also moved into the optical path when observing a specimen. Specimens can be observed from various angles with diascopic light in the form of a single image. Differing from orthoscopic observation, however, the shape of the specimen itself is not visible with this observation.

- Operation
  Pull out the analyzer slider to the right and move the analyzer into the optical path. Place the Bertrand lens turret of the intermediate tube in position "B" to move the Bertrand lens into the optical path. (Refer to p. 25 for details regarding the focusing procedure.) Place the P-CL 1/4λ & tint plate in the hollow position.
  Use an objective having a large numerical aperture (high magnification: normally 40x or higher).



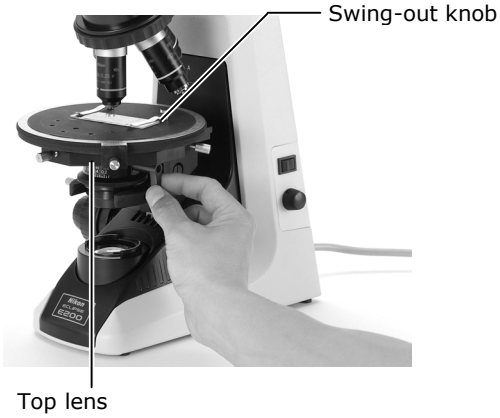
Analyzer and Bertrand lens in the optical path

The settings of each part in orthoscopic microscopy and conoscopic microscopy are summarized below.

	Orthoscopic Observation		Conoscopic Observation
Purpose of observation	To investigate the vibration direction and birefringence of observation light by observing the extinction and interference color due to the specimen.		To distinguish between uniaxial and biaxial properties and observe the optic-axial angle and optical characteristics in minerals.
Top lens of the condenser	10x or higher	IN	IN
	4x or lower	OUT	
Bertrand lens	OUT (Turret position: O)		IN (Turret position: B)
Aperture diaphragm	10x or higher	70 - 80% of the numerical aperture of the objective	Circumscribed the circumference of the conoscopic viewfield (or fully opened)
	4x or lower	Fully opened	

9 Swing-Out the Top Lens of the Condenser

The top lens of the swing-out condenser can be moved outside the optical path with the swing-out knob.
During normal orthoscopic microscopy or conoscopic microscopy, the top lens is used while positioned in the optical path. During orthoscopic microscopy using a low-power objective of 4x or lower, swing out the top lens.
During measurement of retardation or evaluation by interference color, swing out the top lens (the condenser aperture diaphragm may be stopped down) and illuminate with light that is as parallel to the optical axis as possible.



10 Filters

Filters of ϕ45mm can be placed on the top of the field lens.

11 Orientation of Polarizing Plates (Polarizer and Analyzer)

(1) Push in the analyzer slider to the right and move the analyzer out of the optical path.

(2) Focus on the specimen.

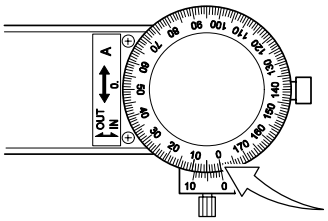
(3) Pull out the analyzer knob and move the analyzer into the optical path.

(4) Turn the analyzer rotation ring and align at the "0" position on the analyzer scale.

(5) Insert the polarizer beneath the condenser.

(6) Move the specimen out of the optical path.

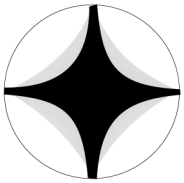
(7) Move the Bertrand lens into the optical path. The pupil of the objective will then be visible through the eyepiece. Turn the polarizer and adjust so that the dark cross image appears in the pupil as shown in the figure in the conoscopic observation. This is so-called crossed Nicols position, where the directions of the polarizer and analyzer coincide with those of the orientation plate on the pillar of the microscope base (the polarizer is in the X direction: P and the analyzer is in the Y direction: A).



Analyzer scale: 0

Orientation plate

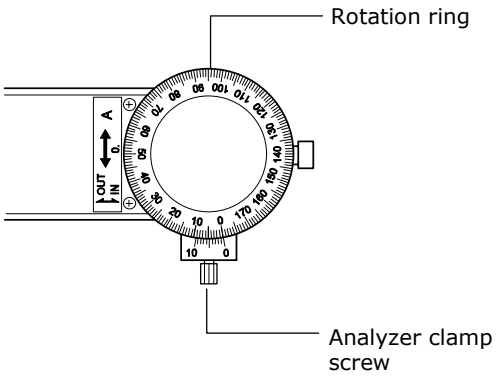
Polarizer



Dark cross image

It should be noted that the X direction may be explained as that of the analyzer and Y direction as that of the polarizer in some commercially available technical manuals and reference books.

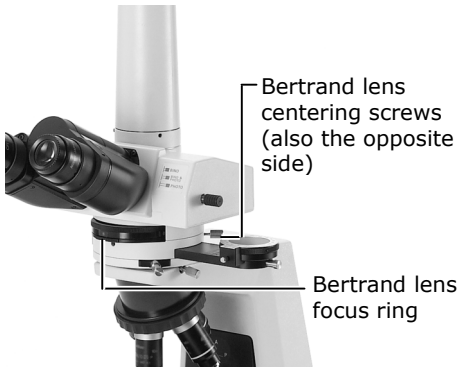
The analyzer can be rotated by first loosening the analyzer clamp screw and then turning the rotation ring . The angle of rotation can be read to 0.1 degrees over a range of 0-360 degrees with the vernier.
The analyzer can be moved out of the optical path by pushing in the analyzer slider to the left . Although the analyzer is designed, as a standard, to be inserted from the right relative to the intermediate tube, it can also be inserted from the left. In this case, it may be somewhat difficult to read the angle of rotation since the readings on the scale, etc. are backward.



Since the intermediate tube contains a built-in depolarizer, it is not necessary to be concerned about the relationship between the orientation of the polarizing plate and photomicrographic devices.

12 Focusing and Centering the Bertrand Lens

When changing the objectives, turn the Bertrand lens focus ring under the Bertrand lens turret of the intermediate tube and focus the Bertrand lens. Centering the Bertrand lens is performed with two centering screws. Center the condenser aperture diaphragm image with the centering screws.

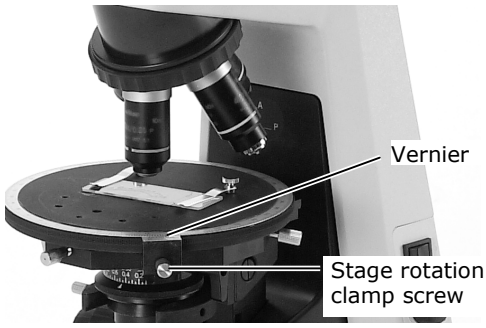


13 P-CL 1/4λ & tint Plate

The P-CL 1/4λ & tint plate has a hole in the center. By pushing it into the slot, the sensitive tint plate (530 nm) is brought into the optical path. Pulling it out brings the 1/4λ plate into the optical path. This plate is used for recognition of very weak birefringence and the determination of X' and Y' of the specimen.

14 Circular Graduated Stage for Polarizing Microscope

Loosening the stage rotation clamp screw can rotate the stage. The angle of rotation can be read to 0.1 degrees using the vernier.



● Centering the stage

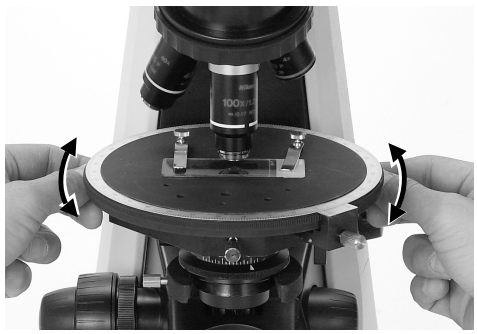
(1) Focus on the specimen with 10x objective. Remove the analyzer from the optical path. Match the rotating center of the stage and the intersection point of the eyepiece crosshairs in the following way.

<1> Move the slide glass on the stage to move a distinct point on the specimen (such as a grain) to the center of the intersection point of the eyepiece crosshairs.

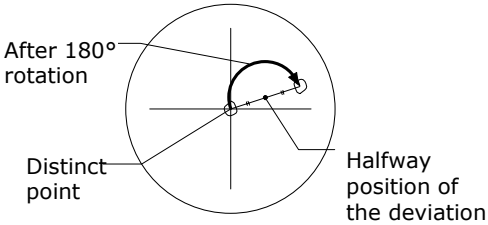
<2> Loosen the stage rotation clamp screw and rotate the stage for 180 degrees.

<3> If the distinct point shifts away from the center, rotate two stage centering screws so that the intersection point of the eyepiece crosshairs moves halfway toward the distinct point.

<4> Repeat steps <2> and <3> several times.



(2) Bring the next large magnification objective into the optical path and perform the centering in the same way. Then bring the next large magnification objective and do the same till the centering procedure is performed on all the objectives in order including the objective of the highest magnification. (In the normal set, 40x objective is the next large objective of the 10x objective. The 100x objective is available in option.)



(3) From the above procedure, the rotating center of the stage and the intersection point of the eyepiece crosshairs coincides when observed with the highest magnification objective. (When the objective of other magnification is used, the rotating center deviates a little from the intersection point of the eyepiece crosshairs but stays inside the viewfield.)

15 P-CS Sénarmont Compensator

The P-CS Sénarmont compensator is used by inserting into the slot of the intermediate tube in place of the P-CL 1/4λ & tint plate.
It can be used to measure retardation up to 1λ according to the following procedure.

It is normal to bring the top lens of the condenser into the optical path when observing at a magnification of 10x or greater. Measuring the retardation or evaluating by interference color, however, stop down the condenser aperture diaphragm or swing out the top lens even for a magnification of 10x or higher (with the aperture diaphragm fully opened), and illuminate with light that is as parallel to the optical axis as possible.

(1) Determination of Extinction Position
Rotate the stage with the specimen under the crossed Nicols to find the direction where the part of the specimen to be measured appears darkest.

(2) Determination of Subtraction Position
Rotate the stage 45° from the extinction position to the diagonal position. Insert the P-CL 1/4λ & tint plate into the optical path and confirm that the interference color of the section of the specimen to be measured changes toward the lower order side. If the interference color changes toward the higher order side, rotate the stage another 90°.

(3) Measurement
Place the GIF filter on the field lens and replace the P-CL 1/4λ & tint plate with the P-CS Sénarmont compensator. Rotate the analyzer so that the section of the specimen to be measured becomes darkest. When the rotation angle of the analyzer at that time is taken to be theta (q) degrees, then retardation (R) (nm) is determined with the following formula:

$R = \frac{\theta}{180}\lambda$ (λ : wavelength used)

The value of λ when using the GIF filter is 546 nm.

16 P-CQ Quartz Wedge

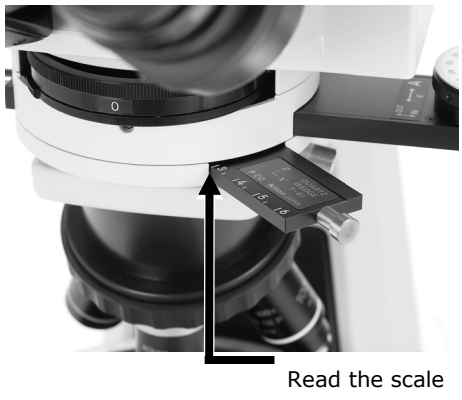
The P-CQ quartz wedge is used by inserting it into the slot of the intermediate tube in place of the P-CL 1/4λ & tint plate. The quartz wedge is engraved with a scale and can be used for rough measurement of retardation in the range of 1λ-6λ.

It is normal to bring the top lens of the condenser into the optical path when observing at a magnification of 10x or greater. Measuring the retardation or evaluating by interference color, however, you need to stop down the condenser aperture diaphragm, or to swing out the top lens even for a magnification of 10x or higher (with the aperture diaphragm fully opened), to illuminate with light that is as parallel to the optical axis as possible.

(1) Determination of Extinction Position
Rotate the stage with the specimen under the crossed Nicols to find the direction where the part of the specimen to be measured appears darkest.

(2) Determination of Subtraction Position
Rotate the stage 45° from the extinction position to the diagonal position (direction where the specimen appears brightest). Insert the P-CQ quartz wedge into the slot of the intermediate tube and confirm that the interference color of the section of the specimen to be measured changes toward the lower order side. If the interference color changes toward the higher order side, rotate the stage another 90°.

(3) Measurement
Move the section of the specimen to be measured to the center of the crosshairs of the eyepiece. Next, slide the P-CQ quartz wedge along the slot and observe that the interference color sequentially changes. Stop sliding the quartz wedge where the dark stripe covers the section of the specimen to be measured. Reading the value from the quartz wedge scale at that time can make a rough measurement of retardation. Retardation can be measured even more accurately by using the P-CS Sénarmont compensator in combination with the P-CQ quartz wedge.



17 Trinocular Eyepiece Tube

● Optical path selection

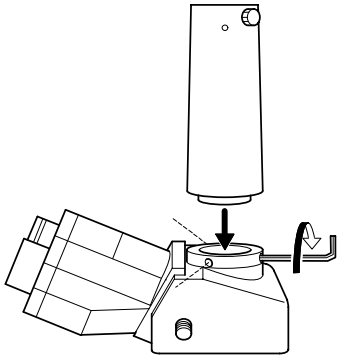
The optical path selection lever can be used to select the way to divide the amount of light between the binocular part and the vertical tube.

Lever Position	Light proportion Binocular part	:	Vertical tube
Push in.	100	:	0
Pull out one step.	20	:	80
Pull out two steps.	0	:	100

Your microscope may come with an eyepiece tube with optical path switched between 100% eyepiece and 100% vertical tube.

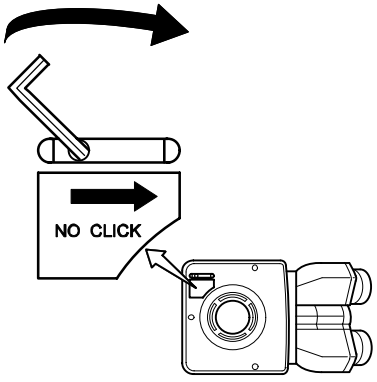
● Vertical tube adapter

A photomicrographic vertical tube adapter is provided as standard equipment that allows a photomicrographic equipment to be installed. To install the adapter, insert it into the vertical tube and clamp three screws with the provided screwdriver. Replace this adapter with the optional TV vertical tube adapter when using a TV camera.
Your microscope may come with an eyepiece tube without the photomicrographic tube adapter.



● Optical path selection lever clicking

There is a switch identified by "NO CLICK" on the bottom surface of the eyepiece tube. Turn the switch in the direction of the arrow with the hexagonal screwdriver provided to disengage the clicking action of the optical path selection lever. Disengaging the clicking action minimizes small vibrations produced by operating the lever.
Your microscope may come with an eyepiece tube without this function.



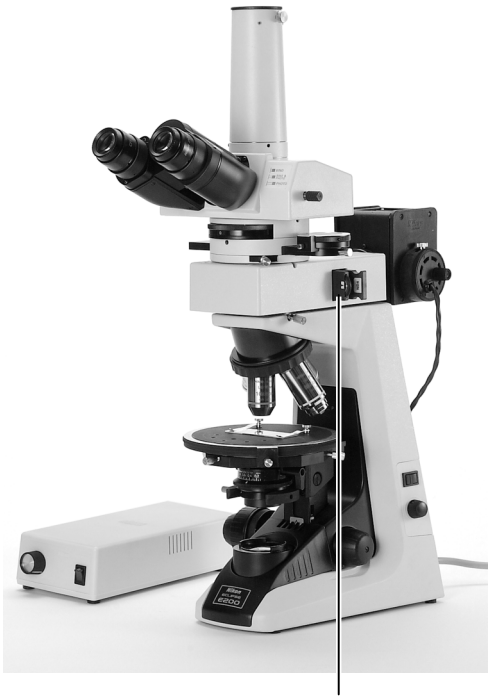
18 Turning Off the Lamp

Turning off the power switch (turn to ○) switches off the lamp.
When storing the microscope:

- Unplug the power cord.
- Wait until the field lens unit is cool enough to touch.
- Return the binocular part to its lowest position.
- Cover the microscope with the vinyl dust cover. (Before covering the microscope, make sure that the field lens unit is cool enough to touch.)
- When carrying the microscope, hold it at its upper rear and lower front ends.

19 Epi-illuminator

When the microscope is used together with the epi-illuminator, insert the polarizer slider into the filter-holder slot far from the light source.



Insert the polarizer here.

V Miscellaneous Operations

1 Oil-Immersion Observation

The "Oil" mark on the side of an objective indicates that it is an oil-immersion type objective. (The oil-immersion objective also has a black band around the barrel end.) An oil-immersion objective is used with the immersion oil applied between the front of the objective and the coverglass.

● Example of Oil-Immersion

Rotate the revolving nosepiece to move the objective out of position. Add a drop of oil to the specimen. Slowly rotate the revolving nosepiece to bring the objective back into position.

● Eliminate Air Bubbles

Make sure that air bubbles are not trapped during oil application. Air bubbles degrade the image. To see if any air bubbles are trapped in the oil, remove one eyepiece, or put the Bertrand lens in the optical path, and fully open the aperture diaphragm. Then check the objective pupil (a bright round part).
Do any of the following to eliminate air bubbles:

- Rotate the revolving nosepiece to move the objective back and forth.
- Add another drop of oil.
- Wipe off the oil and apply again.

● Handling of the Immersion Oil

Use a minimum quantity of oil. If too much oil is applied, surplus oil could flow out onto the stage and the condenser and degrade performance.
After completing oil-immersion observation, be sure to clean the objective, condenser, and any other parts that may be stained by oil. Any oil residue left on the lenses of oil-immersion type objectives or adhesion of oils on the front lens of dry type objectives will degrade image quality.
Use petroleum benzine to wipe off oil and finish with absolute alcohol (ethyl or methyl alcohol). If petroleum benzine is not available, use methyl alcohol instead. In that case, wipe off the oil several times (generally 3 or 4 times) as the detergency of methyl alcohol is weaker than petroleum benzine.

2 Adjusting the Torque of the Coarse Focus Knob

WARNING

When handling petroleum benzine and absolute alcohol, be sure to follow the instructions provided by the manufacturers. Since they are highly flammable take great care when handling them.

● Cautions on Handling the Immersion Oil

- Close the container cap tightly after use. Make sure that the cap is closed tight after refilling the container. Check the cap periodically to make sure it has not come loose, allowing oil to leak out.
- Do not press the container hard. Oil could splash out.
- If you find an oil drips around the container, wipe them off.
- Avoid contact of immersion oil with eyes or skin. In the event of contact with eyes or skin, take one of the following measures although Nikon immersion oil does not contain any toxic ingredients.

  ◊ **Contact with skin:** **Rinse your skin thoroughly with soap and water.**

  ◊ **Contact with eye:** **Rinse your eye thoroughly with water (more than 15 minutes) and see a doctor.**

- Do not leave immersion oil in the sun (ultraviolet rays can damage it).

2 Adjusting the Torque of the Coarse Focus Knob

The tension (torque) of the coarse focus knob rotation can be adjusted. To increase the tension, turn the coarse focus knob torque adjustment ring counterclockwise. The torque adjustment ring is located at the back of the coarse focus knob. To decrease the tension, turn the ring clockwise. Do not decrease the tension too much. If it is too loose, the stage will fall under its own weight.

Coarse focus knob torque adjustment ring

3 Upper Limit Bolt

The upper limit bolt is used to prevent the specimen touching the objective when a 40x or larger-power objective (objectives with a small working distance) is used. Using the upper limit bolt, the stage does not move up from a certain position. Attach the bolt as follows.

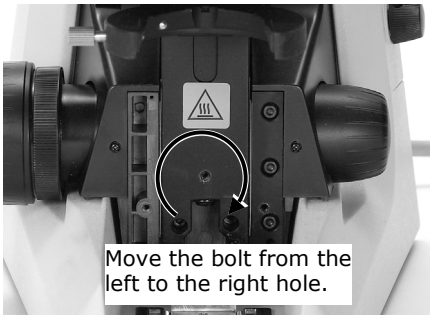
(1) Bring an objective with 40x or larger power into the optical path. Focus on the specimen.

(2) Lower the stage to slightly below the position set in step (1).

(3) Remove the field lens unit.

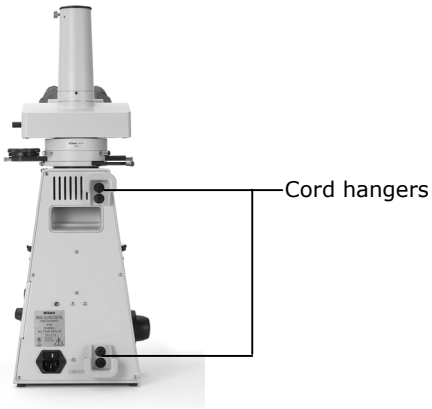
(4) A hexagonal socket head bolt is located in the left hole at the lower part of the focusing mechanism. Remove the bolt using a supplied hexagonal wrench and screw it into the right hole.

Note: The upper limit bolt may not work well depending on the thickness of the specimen or the microscope itself. The specimen may touch the 40x objective or the stage may be stopped by the limit before the specimen image is in focus. Check that the bolt works before relying on it.



4 Cord Hangers

Push the cord hangers (optional) into the holes on the rear of the microscope. The hangers can be used for winding the power cord around when the microscope is not in use. To remove the hangers, use a screwdriver.



VI Assembly

Read the "Safety Precations" in this manual before assembling the microscope. Be sure to follow the instructions written therein. Also, make sure that the power switch is off (turned to ○) before assembly to prevent electrical shock.

Tools Required for Assembly

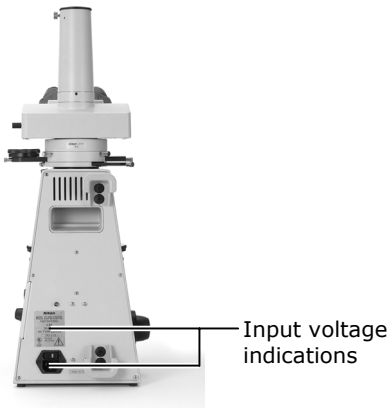
Hexagonal wrench (two hexagonal wrenches are provided with the microscope), flatblade screwdriver

1 Assembly

1 Input Voltage Check

The input voltage is indicated in two places at the rear of the microscope: on the nameplate and above the AC inlet. Confirm that these input voltage indications correspond to the voltage provided in your region. If not, follow one of the instructions below. The use of microscopes with the different input voltage indications will cause overcurrent and overheating, which may result in fire or severe damage to the microscope.

- **If the voltage indication on the nameplate differs:**
  Do not plug in the microscope. Contact your nearest Nikon representative.
- **If the voltage indication above the AC inlet differs:**
  Change the input voltage setting before turning on the power switch.
  - For the microscope with the nameplate showing [100/110/120 V ~]:
    The voltage can be set to: AC 100 V, 110 V or 120 V.
  - For the microscope with the nameplate showing [220/230/240 V ~]:
    The voltage can be set to: AC 220 V, 230 V or 240 V.



1 Assembly

- **Changing the Voltage Setting**

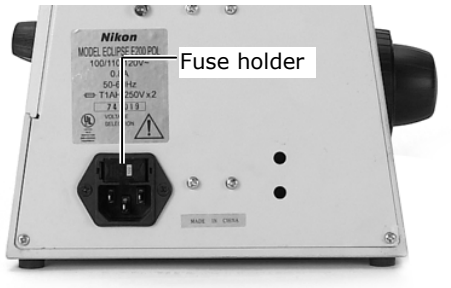
(1) Turn off the power switch (turn to ○) and unplug the power cord.

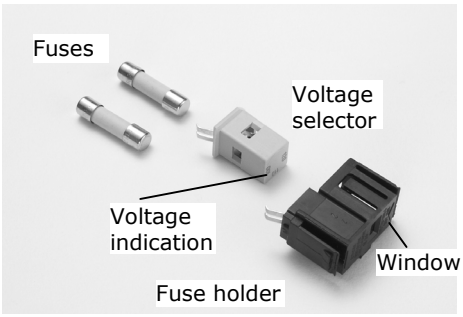
(2) Remove the fuse holder using the flatblade precision screwdriver. (Use the tip of the screwdriver to push the two lock plates toward the center of the fuse holder. The fuse folder pops out from the AC inlet.)

(3) Wear gloves and remove two fuses and the voltage selector from the fuse holder.

(4) Attach the voltage selector to the fuse holder so that the indication of the voltage provided in your region appears in the window of the fuse holder.

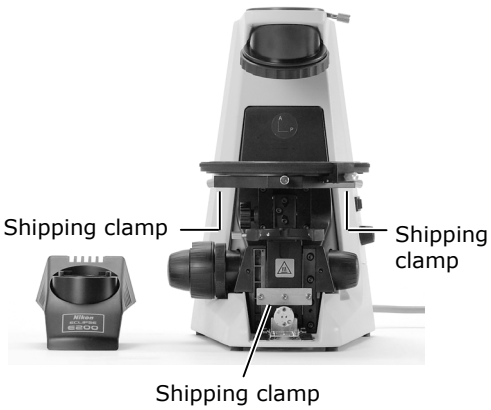
(5) Put the fuses and the fuse holder back in place. Be sure to push both sides of the fuse holder firmly till it clicks into place.





2 Removal of Shipping Clamps

- **Stage:**
  Remove two bolts from the bottom of the stage.
- **Focusing Mechanism:**
  Remove the field lens unit to expose a plate retaining the vertical movement of the focusing mechanism. The plate is fastened with 3 bolts. Remove the bolts and the plate.

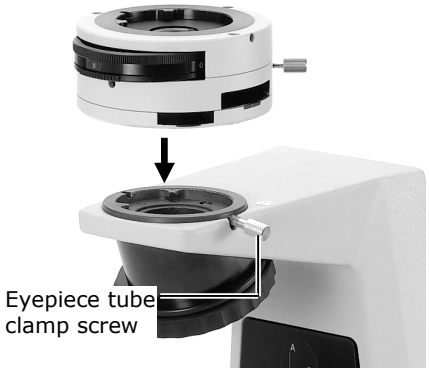


VI

3 Attaching the Intermediate Tube

Fully loosen the eyepiece tube clamp screw on the microscope arm.
Tilt the intermediate tube and fit it on the circular mount of the microscope arm so that the positioning pin on the intermediate tube matches the positioning groove on the mount. Tighten the eyepiece tube clamp screw to fix.

When tightening the clamp screw, lightly press the intermediate tube clockwise to remove the unsteadiness.



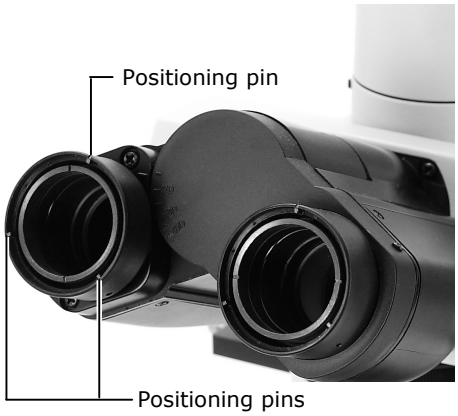
4 Attaching the Eyepiece Tube and the Eyepieces

Eyepiece tube

Fully loosen the eyepiece tube clamp screw on the intermediate tube using the hexagonal wrench.
Tilt the eyepiece tube and fit it on the circular mount so that the positioning pin on the eyepiece tube matches the positioning groove on the mount. Tighten the eyepiece clamp screw to fix.

When tightening the clamp screw, lightly press the eyepiece tube clockwise to remove the unsteadiness.

Eyepieces
Use the eyepieces with the same magnification for both eyes. On the right sleeve, attach the eyepiece with crosshairs. Insert the eyepiece into the sleeve matching the grooves on the eyepiece with the positioning projections on the sleeve.
If you have the rubber eye guards (options), set them on the eyepieces so that they fit on the grooves at the rim of the eyepieces.
Your eyepiece tube may not have the positioning pins, positioning projections or rubber eye guards.



5 Attaching the Analyzer Slider

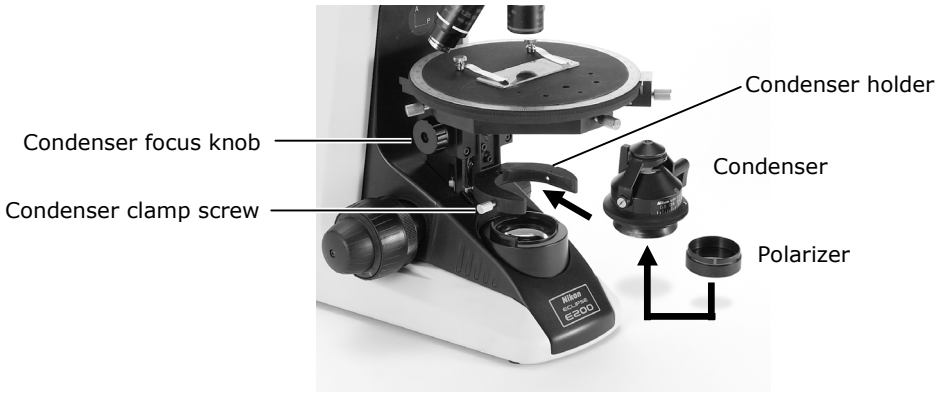
Rotate and remove the stopper screw at the end of the slider opposite of the rotation ring. Insert the slider into the intermediate tube from the right side. Return the stopper screw to the slider.
Usually, the rotation ring is placed on the right side of the microscope. If the slider is inserted from the left side, the rotation ring can be set on the left side of the microscope but it may become a little difficult to read out the rotation angle of the analyzer.

6 Attaching the Objectives

Remove the specimen from the stage and fully lower the stage.
The objective of the highest magnification is to be screwed on to the hole marked with the circle sticker (standard screw hole marking). Attach the remaining objectives in an order that when the nosepiece is turned clockwise when seen from above, the magnification of the objective increases.
Whenever attaching or removing the objective, be sure to remove the specimen, lower the stage and use both hands so that it may not drop.

7 Attaching the Condenser

Lower the condenser holder to the limit using the condenser focus knob.
Insert the condenser to the condenser holder so that its nameplate faces forward. Fix the condenser by tightening the condenser clamp screw at the left side.
Raise the condenser till the limit.
Insert the polarizer to the bottom of the condenser.
When observing the specimen, lower the condenser a little from its uppermost position so that the diffuser image of the light source is not visible.



8 Connecting the Power Cord

Turn off the power switch of the microscope (turn to ○). Connect one end (socket) of the supplied power cord to the AC inlet on the rear of the microscope. Connect the other end (plug) to an AC line receptacle with the ground conductor (earth conductor). Make sure that the power cord is securely connected.

- Note that the microscope should be installed near the AC line receptacle and the AC line receptacle should be placed within your reach.
- Use the power cord provided. The use of other cords may damage the instrument or cause a fire hazard.
- If using an extension cord, use only a cord that includes a protective earth (PE) wire.

This completes the assembly of the microscope.

9 Other Accessories

For installation of other accessories such as the epi-illuminator and the photomicrographic equipment, see the manual provided for each product.

2 Replacement of Consumable Materials

1 Replacing the Lamp

WARNING

- **To avoid electrical shock or damage to the instrument, turn off the power switch (turn to ○) and unplug the power cord before lamp replacement.**
- **Use the specified lamp. Using a different kind of lamp may damage the instrument or cause a fire hazard.**

  Specified Lamp:
  Halogen lamp 6 V-20 W (PHILIPS 7388 or OSRAM HLX 64250)
  or Halogen lamp 6 V-30 W (PHILIPS 5761)

CAUTION

- **The lamp is hot when in use. To avoid burn injury, turn off the microscope and wait at least 30 minutes (until the lamp is cool enough to touch) before attempting to change the lamp.**
- **Make sure that the contacts of the lamp and socket are not damaged before installing a new lamp. If the contacts are damaged, they may cause poor illumination or overheating.**
- **Insert the lamp's contact pins fully into the socket holes. If the pins are loose, the lamp could come loose or result in a contact failure, which will cause overheating or smoke.**
- **Be sure to put the field lens unit back in place after replacing the lamp. Never turn on the lamp without the field lens unit.**
- **Do not touch the glass part of the lamp using your bare hands. Wear gloves or use a cloth when handling the lamp to protect the surface from fingerprints. Wipe off any fingerprints or stains using a clean cloth moistened with alcohol. Fingerprints will etch into the hot surface of the lamp and reduce the brightness, damage the lamp or reduce its service life.**
- **Handle the lamp gently. Shocks and vibrations will damage the lamp or reduce its service life.**

2 Replacement of Consumable Materials

(1) Turn off the power switch (turn to ○) and unplug the power cord.

(2) Wait about 30 minutes until the lamp and its surroundings are cool enough to touch.

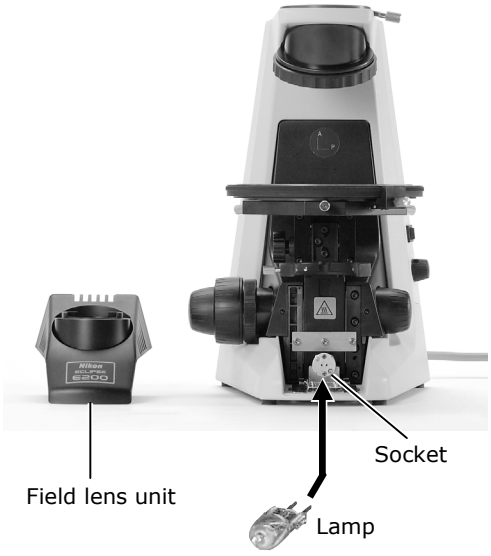
(3) Hold the field lens unit at the vertical grooves on both sides and pull it toward you to remove it.

(4) Remove the old lamp.

(5) Hold a new lamp wearing gloves or using a cloth. Insert the lamp's contact pins fully into the socket holes straight and securely.

(6) Put the field lens unit back in place.

(7) Plug the power cord.



2 Replacing the Fuse

WARNING

- **To avoid electrical shock or damage to the instrument, turn off the power switch (turn to ○) and unplug the power cord before replacing the fuse.**
- **Use the specified fuse. Using a different fuse may damage the instrument or cause a fire hazard.**
  Specified Fuse: 250 V 1 A, time-lag, low-breaking type, 5x20 miniature fuse x2

CAUTION

- **Make sure that the contact of the fuse is not damaged before installing a new fuse. If the contact is damaged, a malfunction or overheating may result.**
- **Attach the fuse to the fuse holder securely. If not, the fuse may come loose or a contact failure may occur, resulting in overheating or smoke.**
- **Put back the fuse holder securely to its original position.**

● **Changing the Voltage Setting**

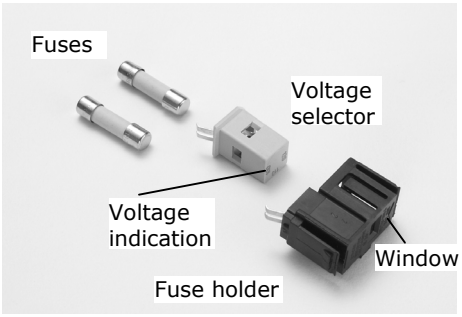
(1) Turn off the power switch (turn to ○) and unplug the power cord.

(2) Remove the fuse holder using the flatblade precision screwdriver. (Use the tip of the screwdriver to push the two lock plates toward the center of the fuse holder. The fuse folder pops out from the AC inlet.)

(3) Wear gloves and remove two fuses and the voltage selector from the fuse holder.

(4) Attach the voltage selector to the fuse holder so that the indication of the voltage provided in your region appears in the window of the fuse holder.

(5) Put the fuses and the fuse holder back in place. Be sure to push both sides of the fuse holder firmly till it clicks into place.



VII Optical Characteristics

1 Combinations of 10x Eyepiece with CFI P Objectives

Objective Magnification	Total Magnification	Numerical Aperture	Real Viewfield*	Depth of Focus	Resolving Power	Working Distance
4×	40×	0.1	5.5 mm(5 mm)	63.2 μm	2.8 μm	30 mm
10×	100×	0.25	2.2 mm(2 mm)	10.1 μm	1.1 μm	6.1 mm
40×	400×	0.65	0.55 mm(0.5mm)	1.2 μm	0.4 μm	0.65 mm
100×	1000×	1.25	0.22 mm(0.2 mm)	0.4 μm	0.2 μm	0.18 mm

* The figures in the parenthesis are for eyepieces of field no. 20.
The figures out of the brackets are for eyepieces of field no. 22.

2 Microscope Terminology

(1) Total Magnification

The total magnification of a microscope is the individual magnifying power of the objective multiplied by that of the eyepiece.

(2) Numerical aperture (N.A.)

The numerical aperture is an important factor in determining the efficiency of the condenser and objective. It is represented by the formula:

$N.A. = n \sin \alpha$

where n is the refractive index of the medium (air, immersion oil, etc.) between the objective lens and the specimen or condenser, and α is half of the maximum angle at which light enters or leaves the lens from or to a focused object point on the optical axis.

(3) Resolving Power

The ability of an optical system to discriminate between two discrete objects separated by a minute distance. The more minute the distance, the higher the resolving power of the optical system. In relation to the numerical aperture, the resolving power is represented by the following formula:

$$\text{Resolving power} = \frac{\lambda}{2 \times N.A.}$$

where λ is the used wavelength of light. (The resolving power in the above table is indicated for λ = 0.55 μm.)

(4) Working Distance (W.D.)

The clearance between the front of the objective and the upper surface of the coverglass, when a specimen image is sharply focused. Generally, the higher the magnifying power of the objective, the shorter the working distance.

(5) Field Number of the Eyepiece

The diameter of the opening of the fieldstop inside the eyepiece measured in mm. When an eyepiece has an indication of "10x / 22", it means that the magnification is 10x and the field number is 22 for that eyepiece.

(6) Real Viewfield

The diameter in mm of the field of view observable through the eyepiece.
Real viewfield = field number of eyepiece / magnification of objective

(7) Depth of Focus

The depth (thickness) of the specimen image in focus, extending above and below the focused image plane. The larger the N.A. of the objective, the shallower the depth of focus.

$$\text{Depth of focus } [\mu m] = \frac{n\lambda}{2 \times N.A.^2} + \frac{n}{7 \times M \times N.A.} \times 1000$$

Above is an approximation assuming the resolving power of an eye as 2 minutes.
λ is the wavelength of light used. (The depth of focus in the table on P. 42 is indicated for λ = 0.55 μm.)
n is the refractive index of a medium between the objective lens and the specimen or condenser. (n = 1, when the medium is air, and n = about 1.5 when the medium is oil.)
M is the total magnification (= the individual magnifying power of the objective x that of the eyepiece).

VIII Troubleshooting Tables

If difficulties should be encountered in the course of operation, please recheck the symptoms, referring to the tables below, before contacting your nearest Nikon representative. If the problem is still not solved after referring to Troubleshooting Tables, please contact your nearest Nikon representative.

1 Optical

Troubles	Causes	Corrective Measures
Darkness at the periphery, no viewfield seen, or uneven viewfield brightness.	Revolving nosepiece not in click-stop position (objective not centered in the optical path).	Revolve to click-stop position (swing the objective correctly into the optical path).
	Condenser position too low.	Position the condenser slightly lower than the upper limit. (P. 38)
	Condenser not installed correctly.	Install correctly. (P. 38)
	Field lens unit not installed correctly.	Install correctly. (P. 40)
	Lamp not installed correctly.	Install correctly. (P. 39)
	Dirt or dust on the lens (condenser, objective, field lens, eyepiece, specimen)	Clean the lens. (P. 49)
	Optical path selection lever on the trinocular eyepiece tube is not in click position. Optical path selection lever on the trinocular eyepiece tube is not set for 100% binocular part.	Set the lever correctly for 100% binocular part.
	Filter is out of position.	Set correctly on the field lens.
	The top lens of the swing-out condenser is not set in correct position.	Swing in or out till the limit.
	Bertland lens in the optical path.	Remove it.
	P-CL, P-CS or P-CQ sliders not set correctly.	Set them in correct position.
	Analyzer slider in intermediate position.	Set correctly.

1 Optical

Troubles	Causes	Corrective Measures
Dirt or dust in the viewfield.	Condenser position too low or too high.	Position the condenser slightly lower than the upper limit. (P. 38)
	Aperture diaphragm closed too far.	Open properly. (P. 21)
	Dirt or dust on the lens (condenser, objective, field lens, eyepiece, specimen).	Clean the lens. (P. 49)

Troubles	Causes	Corrective Measures
Poor image quality (low resolution, contrast too low or too high)	Condenser position too low.	Position the condenser slightly lower than the upper limit. (P. 38)
	Cover glass too thick or thin.	Use a cover glass of the specified thickness (0.17 mm).
	Slide upside down.	Turn over the slide so that the cover glass faces up.
	No cover glass attached to the slide.	Attach a cover glass 0.17 mm thick.
	No immersion oil used on the front lens of the oil-immersion objective.	Apply Nikon immersion oil to the objective. (P. 31)
	Nikon immersion oil is not used for oil-immersion observation.	Use Nikon immersion oil. (P. 31)
	Air bubbles in immersion oil.	Remove bubbles. (P. 31)
	Immersion oil found on dry type objective (especially 40x objective).	Clean the objective. (P. 31)
	Aperture diaphragm closed too far.	Close or open properly. (P. 21)
	Correction ring on the objective not adjusted. (Only for the objective with correction ring.)	Adjust to match the thickness of the cover-glass.
	Dirt or dust on the lens (condenser, objective, field lens, eyepiece, specimen).	Clean the lens. (P. 49)
	Objective for covered specimen is used to observe no-covered specimen.	Use no-cover-glass objective. Note:Indication on the objective ∞/0.17 : for covered specimen ∞/0 : for no-covered specimen ∞/– :for covered and no-covered specimen

1 Optical

Troubles	Causes	Corrective Measures
Image not focused on one side.	Revolving nosepiece not in click-stop position.	Revolve to click-stop position.
	Specimen rises from stage surface.	Stabilize it using the specimen clips.

Troubles	Causes	Corrective Measures
Image shifts during focus.	Revolving nosepiece not in click-stop position.	Revolve to click-stop position.
	Specimen rises from stage surface.	Stabilize it using the specimen clips.
	Field lens unit not installed correctly.	Install correctly. (P. 40)

Troubles	Causes	Corrective Measures
Image tinged yellow.	Blue filter not used.	Use NCB11 filter.
	Lamp voltage too low.	Adjust the voltage by rotating the brightness control dial. (P. 14)

Troubles	Causes	Corrective Measures
Image too bright.	Lamp voltage too high.	Adjust the voltage by rotating the brightness control dial. (P. 14)

Troubles	Causes	Corrective Measures
Insufficient brightness.	Lamp voltage too low.	Adjust the voltage by rotating the brightness control dial. (P. 14)
	Aperture diaphragm closed too far.	Open properly. (P. 21)
	Condenser position too low.	Position the condenser slightly lower than the upper limit. (P. 38)
	Incorrect input voltage.	Using the voltage selector, select the voltage that corresponds to the voltage provided in your region. (P. 35)

(Also see the causes and corrective measures for electrical problems.)

2 Mechanical Problems

Troubles	Causes	Corrective Measures
Image cannot be focused with high-power objectives.	Slide upside down.	Turn over the slide so that the cover glass faces up.
	Cover glass too thick.	Use a cover glass of the specified thickness (0.17 mm).

Troubles	Causes	Corrective Measures
High-power objective contacts slide when changed over from low power.	Slide upside down.	Turn over the slide so that the cover glass faces up.
	Cover glass too thick.	Use a cover glass of the specified thickness (0.17 mm).
	Diopter not adjusted correctly.	Adjust. (P. 19)
	Loose objective.	Screw in till the limit.
	Note: Do not turn the nosepiece directly from 4x to 100x. Be sure to focus correctly on the specimen with 10x objective before switching to higher magnification.	

Troubles	Causes	Corrective Measures
Difference in focal point too large when switching from one objective to another.	Diopter not adjusted correctly.	Adjust. (P. 19)
	Loose objective.	Screw in till the limit.

Troubles	Causes	Corrective Measures
Binocular images not integrated.	Interpupillary distance not adjusted correctly.	Adjust. (P. 14)
	Diopter not adjusted correctly.	Adjust. (P. 19)

Troubles	Causes	Corrective Measures
Excessive eye fatigue.	Interpupillary distance not adjusted correctly.	Adjust. (P. 14)
	Diopter not adjusted correctly.	Adjust. (P. 19)
	Inadequate brightness or illumination.	Adjust brightness using the control dial. (P. 14)

3 Electrical Problems

Troubles	Causes	Corrective Measures
Lamp does not light when switched on.	No electrical power.	Check power cord connection. (P. 38)
	No power cord connected to microscope.	Plug in the power cord to the AC inlet. (P. 38)
	Lamp bulb not inserted.	Insert correctly. (P. 39)
	Lamp bulb burnt out.	Replace bulb. (P. 39)
	Incorrect lamp used.	Use the specified lamp. (P. 39)
	Fuse blown out.	Replace fuse. (P. 41)

Troubles	Causes	Corrective Measures
Flickering or unstable lamp brightness.	Lamp bulb about to fail.	Replace bulb. (P. 39)
	Power cord not correctly connected.	Connect correctly. (P. 38)
	Bulb not correctly inserted into socket.	Insert correctly. (P. 39)

Troubles	Causes	Corrective Measures
Sudden lamp failure.	Incorrect lamp used.	Use the specified lamp. (P. 39)
	Incorrect input voltage.	Select the voltage that corresponds to the voltage provided in your region using the voltage selector. (P. 35)

IX Care and Maintenance

1 Cleaning the Lenses

- Dust is best removed using a soft brush or gauze.
- More persistent dirt, such as fingerprints, grease and oil, may be removed with lens tissue (or soft cotton, gauze) lightly moistened with absolute alcohol (anhydrous ethyl alcohol or methyl alcohol; do not use rubbing alcohol).
- To clean immersion oil off the oil-immersion type objective, use lens tissue, soft cotton or gauze lightly moistened with petroleum benzine. If petroleum benzine is not available, use methyl alcohol. In this case, you need to wipe three or four times because the detergency of the methyl
- Absolute alcohol and petroleum benzine are quite flammable. Take great care when handling them and when turning the power switch on and off. Be very careful with fire.

2 Cleaning the Microscope

- We recommend that you use a silicon cloth to clean the microscope.
- For persistent dirt, dampen a piece of gauze with neutral detergent and wipe lightly.
- Using organic solvent could result in discoloration of the plastic parts.

3 Disinfecting the Microscope

- We recommend that you use 70% medical alcohol for normal disinfection of the microscope.
- In case of contact of a living body sample onto the microscope, determine whether the sample is hazardous. If the sample is hazardous, follow the standard procedure of your laboratory.
- Using organic solvent could result in discoloration of the plastic parts.

4 When Not in Use

- When the microscope is not in use, cover with the vinyl dust cover, and store it in a dry place where mold is not likely to form.
- Make sure that the power switch is off (turned to ○) and the lamp is cool enough to touch before covering with the vinyl dust cover.
- We especially recommend that the objectives and eyepieces be kept in a container (such as a desiccator) with desiccant in it.

5 Periodical Inspections

- To maintain the performance of the microscope, periodical inspections and maintenance are recommended.
- For details, contact your nearest Nikon representative.

(1) Model Name: ECLIPSE E200 POL (Microscope basic unit)

(2) Dimension and Weight: 227(W) x 382(D) x 415(H) mm, 10 kg

(3) Optical System: CF infinity corrected optical system
Second objective focal length f = 200 mm
Built-in diascopic illumination system (Simplified Kohler's illumination system)

(4) Focusing Mechanism:

Fine focus knob graduation:	2 μm / graduation
Fine focus knob travel:	0.2 mm up or down / revolution
Coarse focus knob travel:	about 37.7 mm up or down / revolution
Stage vertical movable range:	1.5 mm upward and 25 mm downward from the focal plane.

(5) Stage: 360° rotatable with rotation clamp screw.
0.1° vernier equipped

(6) Revolving Nosepiece: 4-hole fixed type, with standard screw hole mark

(7) Electrical Specifications:

- **Lamp Rating:** Halogen lamp 6 V-20 W (PHILIPS 7388 or OSRAM HLX 64250) or
  Halogen lamp 6 V-30 W (PHILIPS 5761)
- **Average lamp lifetime:** Halogen lamp 6 V-20 W : 100hrs.
  Halogen lamp 6 V-30 W : 100hrs.
- **Output Rating:** 6 V 5 A max.
- **Input Rating:** Model for 100, 110, and 120 V Areas
  - Input voltage: Select from 100 V, 110 V or 120 V AC by relocating the fuse holder in the AC inlet.
  - Frequency: 50/60 Hz
  - Voltage fluctuation: ±10%
  - Rated current: 0.8 A max.
  - Fuse rating: 250 V, 1 A, time-lag low-breaking type, 5x20 miniature fuse x2
  - Power cord: Use only the following power supply cord. Using the wrong power cord could result in danger or fire. The protection Class I equipment should be connected to PE (protective earth) terminal.
    - UL listed detachable power cord set. 3-conductor grounding type SVT, No.18 AWG, 3 m long maximum, rated at 125 V AC minimum.

Model for 220, 230, 240 V Areas

- Input voltage: Select from 220 V, 230 V or 240 V AC by relocating the fuse holder in the AC inlet.
- Frequency: 50/60 Hz
- Voltage fluctuation: ±10%
- Rated current: 0.4 A max.
- Fuse rating: 250 V, 1 A, time-lag low-breaking type, 5x20 miniature fuse x2
- Power cord: Use only the following power supply cord. Using the wrong power cord could result in danger or fire. The protection Class I equipment should be connected to PE (protective earth) terminal.
  - Approved according to EU/EN standards, 3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 V AC minimum.

- **Protection Class:** Class I

(8) Operating Environmental Conditions

- Room Temperature: 0 to 40°C
- Relative Humidity: 85% max., non-condensing
- Altitude: 2000 m max.
- Pollution: Degree 2
- Installation Category (Overvoltage Category): Category II
- For indoor use only.

(9) Storage and Transport Environmental Conditions

- Temperature: -20 to +60°C
- Humidity: 90%RH max., non-condensing

(10) Conforming Standards

- The model for 100, 110, and 120 V areas is a UL-listed product.
- The model for 220, 230 and 240 V areas meets EU IVD Directive (In vitro diagnostic medical device directive) requirements.
  (GM approved: In vitro diagnostic medical device)
- The model for 220, 230 and 240 V areas meets EU LV Directive (Low voltage directive) requirements.
- The model for 220, 230 and 240 V areas meets EU EMC Directive requirements. (EN61326)

(The model for 100, 110, and 120 V areas is not covered by the FCC.)

CE