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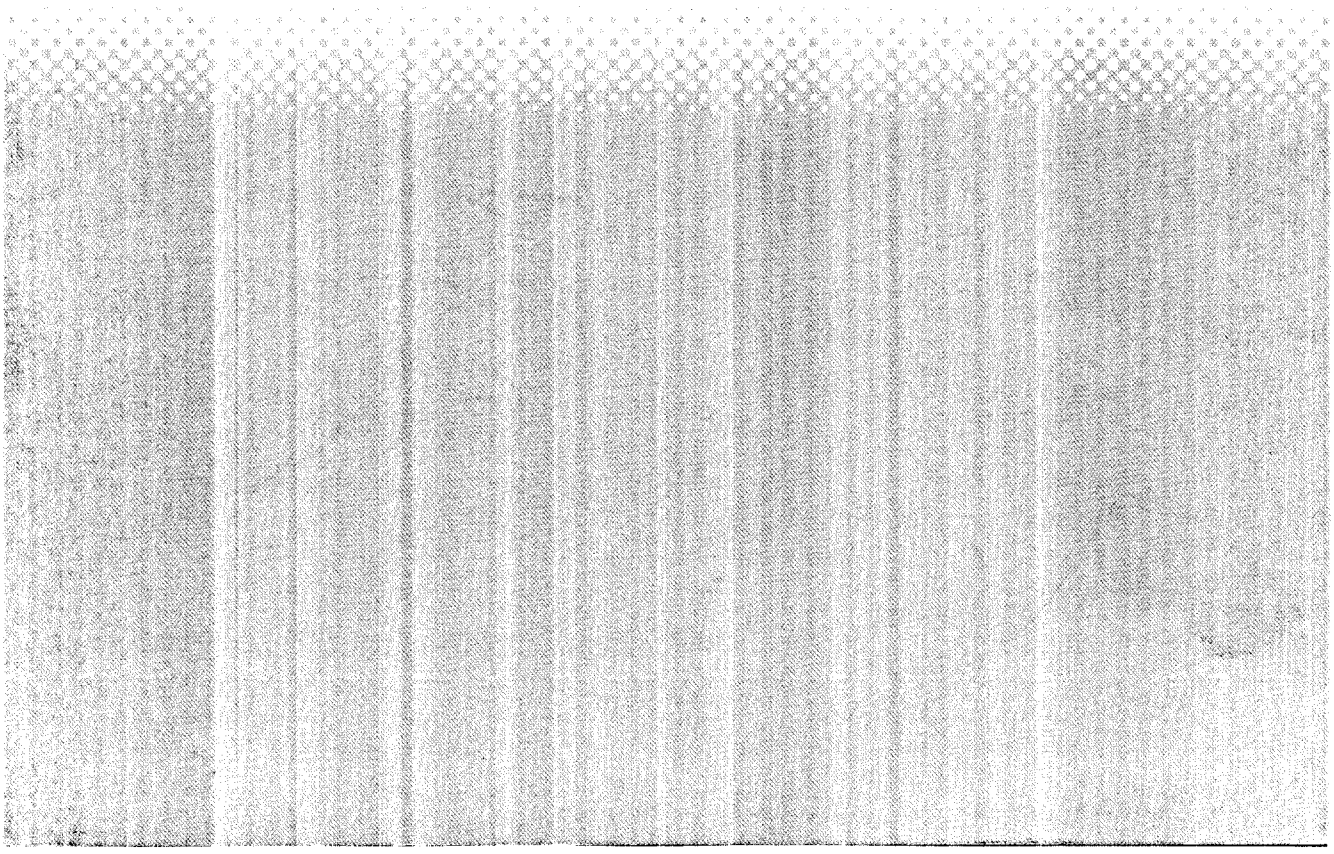
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Find the *Nikon Epiphot 200* at our website: *Click HERE*

Nikon

Inverted Metallurgical Microscope

EPIPHOT 200



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This instruction manual is for the users of Nikon's inverted metallurgical microscope EPIPHOT 200.
FOR YOUR SAFETY and correct operation, read this manual carefully before usage.
Keep this manual near the microscope.
Never throw it away

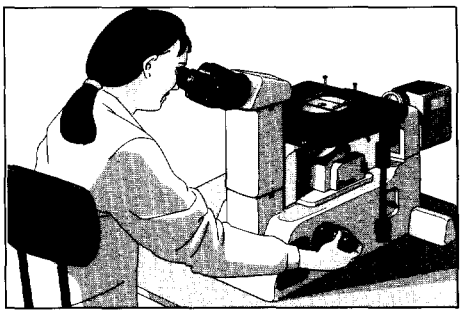
Nikon reserves the right to make such alterations in design as may be considered necessary in the light of experience. For this reason, particulars and illustrations in this handbook may not conform in every detail to models in current production.

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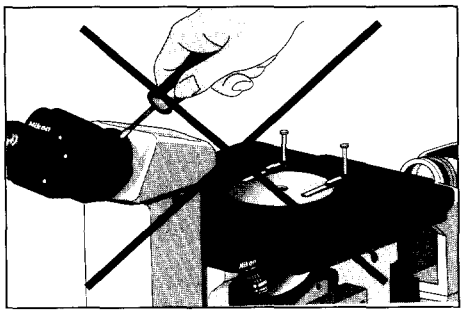
1. Purpose

Use this microscope only for microscopic observation. Do not use it for any other purposes or applications.



2. Never Attempt to Disassemble.

Disassembling the microscope may cause you electrical shocks or damage to the instrument or both. Parts of the instrument that may be disassembled are mentioned in this manual. Do not take apart any other parts. If any malfunction is noticed about the microscope, contact your nearest Nikon representative.

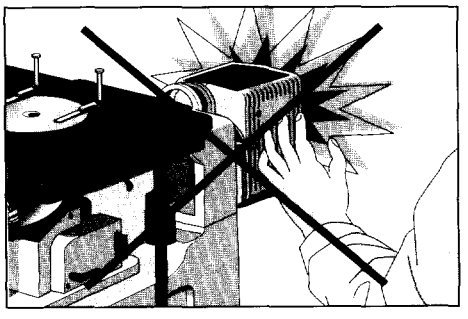


3. Heat at the Light Source

The lamp and the lamphouse are very hot during and right after the illumination. Do not touch them while they are hot. Be careful not to get burnt.

※ *The warning label on the back of the 12V-100W lamphouse is a reminder for the above cautions.*

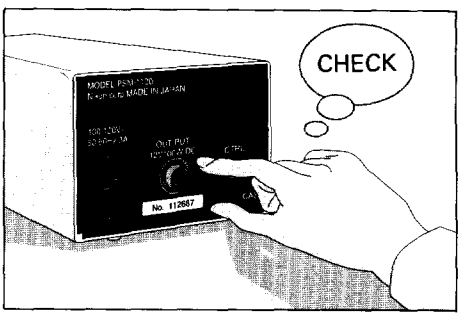
- Do not touch the lamphouse within 30 minutes after turning off the power switch.
- Do not bring highly inflammable substances (such as gasoline, benzine, thinner, alcohol, cloth and paper) near the lamphouse. They may catch fire.



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4. Check the Input Voltage

Confirm that the input voltage range of the power supply unit of the microscope corresponds to that of the available line voltage to be used. If they don't, never turn on the power switch. Contact your nearest Nikon representative.



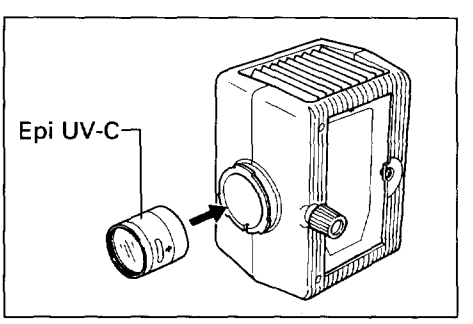
5. Check the Light Source.

The power supply unit of the microscope is for the halogen lamps mentioned in the table below. The table shows how to form appropriate light sources that can be illuminated by the above power supply unit. Form each light source as the table specifies. The use of other light sources may result in damage.

Specified Lamps	Specified Lamphouse Adapters	Specified Lamphouses
Halogen lamp 12V-100W LONGLIFE (OSRAM HLX64623 or PHILIPS 7724)	12V-100W lamphouse adapter for X100S	12V-100W lamphouse 2 with pre-centered socket
Halogen lamp 12V-50W (OSRAM HLX64610 or PHILIPS 7027)	12V-50W lamphouse for U-epi 10	12V-50W lamphouse adapter for U-epi 10

6. Use of a Hg or Xe Lamp <WARNING>

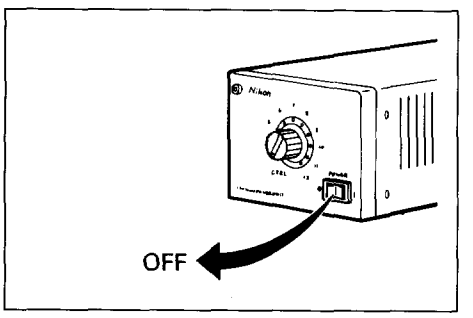
When using a high-intensity light source (Hg or Xe), and performing brightfield, darkfield, simplified polarization, differential interference contrast or other microscopy (except epi-fluorescence microscopy), use ONLY the collector lens indicated "Epi UV-C".
If you don't use this particular collector lens or if you use no collector lens for the above forms of microscopic observation, you may be in danger of losing your eyesight due to the influence of the ultraviolet light involved.



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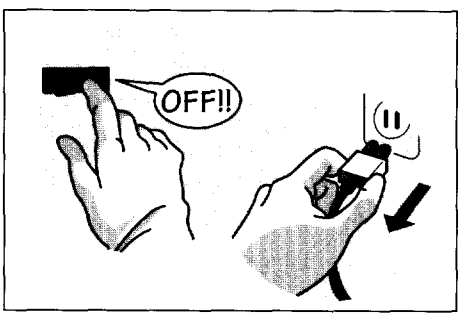
7. Connection or Disconnection of Cables

Turn off the power switch of the power supply unit of the microscope before connecting or disconnecting the ex-control cable or the lamphouse cable or both.



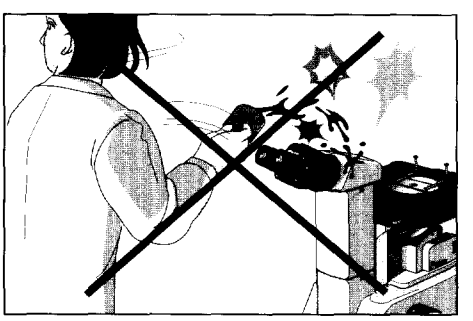
8. Cautions when Replacing the Lamp

- Wait until the lamp and the lamphouse cool down sufficiently before replacing the lamp.
- Turn off the power switch and unplug the power connector to avoid electrical shocks or damage to the instrument.



9. Short Circuit and Abnormal Heating

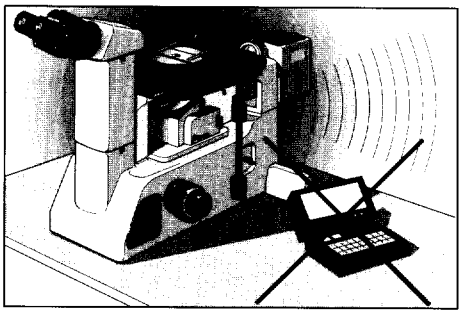
Do not spill water onto the microscope. Water in the microscope from outside may result in short circuits or abnormal heating.



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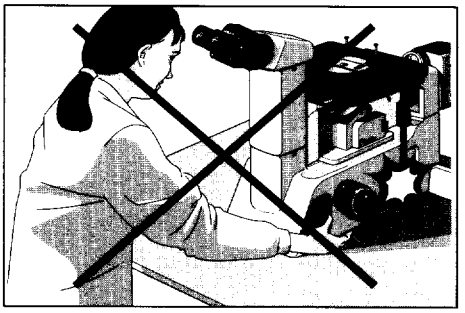
10. Weak Electromagnetic Wave

This microscope generates weak electro-magnetic waves. Do not bring precision electronic devices near the instrument. Move radios or TV sets away from the microscope when their reception is affected.



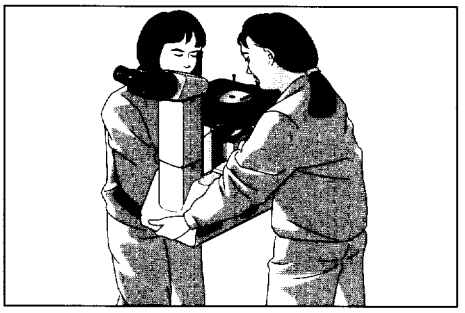
11. Cautions when Installing the Microscope

Be careful not to get your hands or fingers caught under the microscope.
The accuracy of the microscope is influenced by the environment in which it is used or stored. Avoid using the microscope in an inadequate environment. An environment inadequate to the use of the microscope may result in malfunction. (For futher details, see 'Where to Install' on page 3.)



12. Cautions when Carrying the Microscope

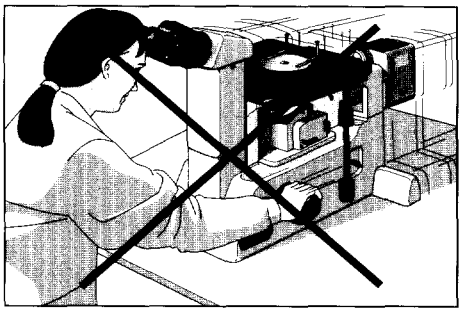
- This microscope is a high precision optical instrument. Handle it with enough care. Do not give shocks or impacts to it. The accuracy of some parts of the microscope such as objectives may be affected even by weak impacts.
- Let two persons support the microscope base by both sides to carry the microscope. The body of the microscope weighs approxi-mately 28kg in its standard operational form.



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12. Cautions when Carrying the Microscope (cont'd)

- Never attempt to move the microscope by holding the focus knob, eyepiece tube, intermediate eyepiece tube, lamphouse, stage or the like. Such an attempt may cause some of these parts to be pulled off the body and damage the instrument.
- When moving the microscope on the desk, do not drag it. Lift it and place it down gently on the desk again.



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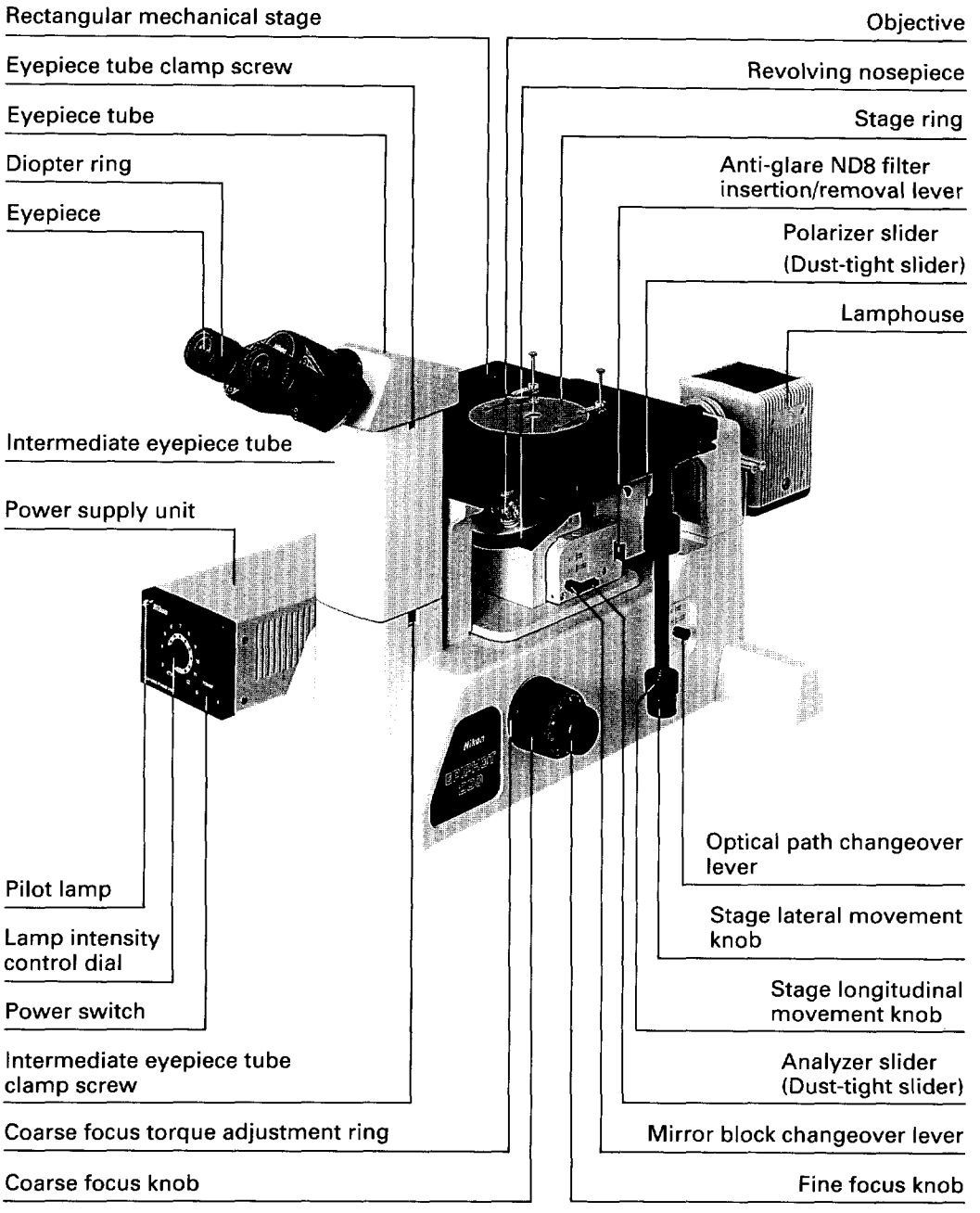
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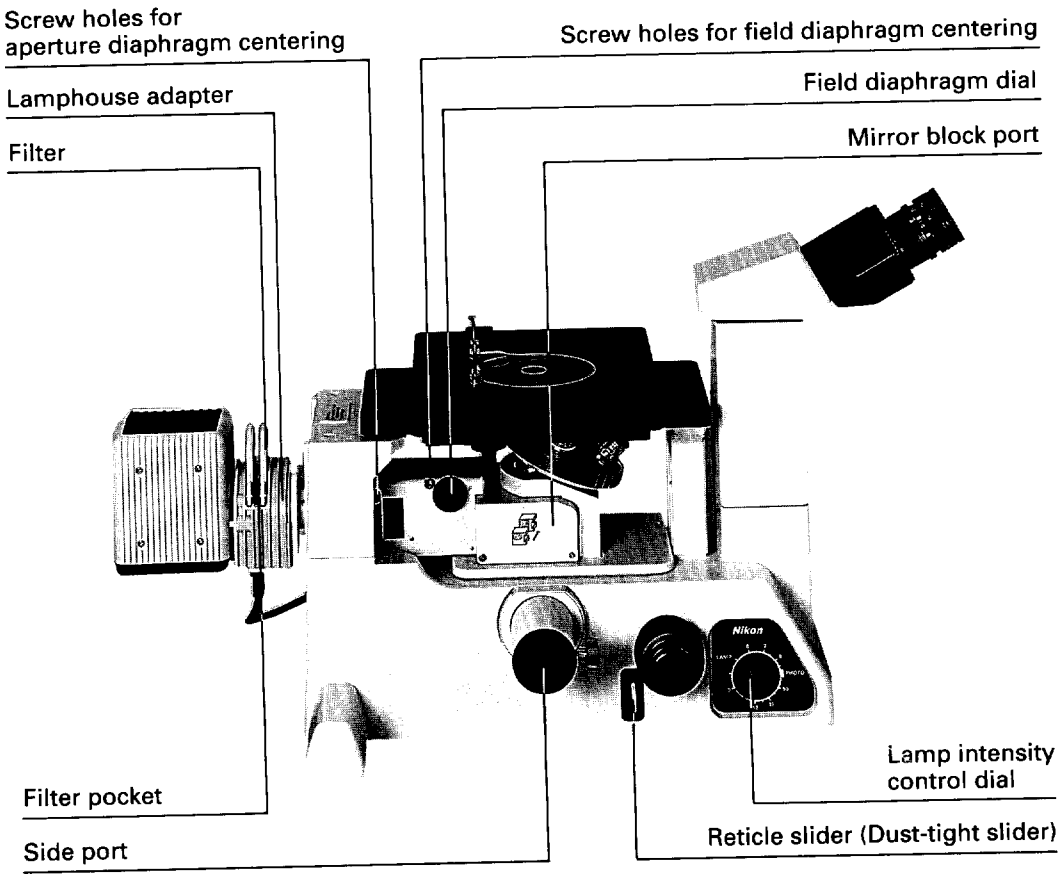
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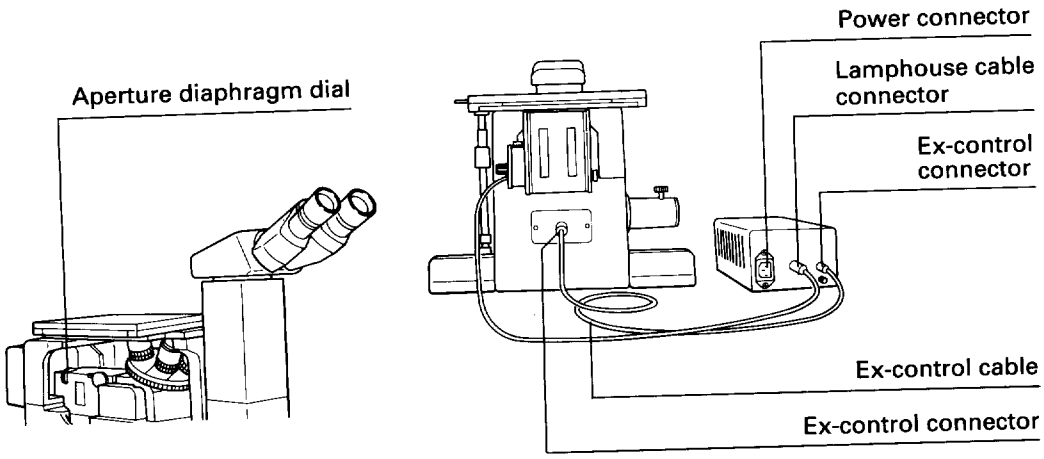
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I NOMENCLATURE



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II ASSEMBLY

Assemble the following parts and components in the order of their numbers given as below.
Tools required for assembly: One hexagonal screwdriver, one hexagonal wrench, a pair of centering tools (these three are supplied with the the microscope) and one screwdriver for cross-recessed head screws.

This microscope is a precision instrument. Handle it with enough care.
Do not give it strong impacts. Do not operate it forcibly. They both may cause malfunction.

Where to Install

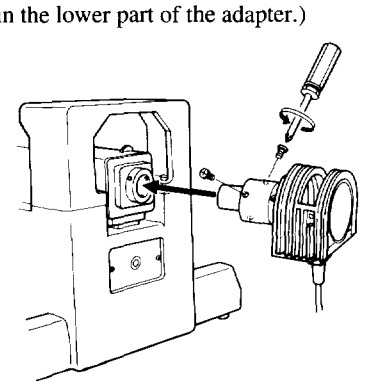
- Do not install the microscope in a bright environment where it is exposed to direct sunlight or where it is placed right beneath the room lamps. Bright surrounding light around the microscope blurs the clarity of the specimen image.
- Install the microscope in a place free from dust or dirt.
- Install the microscope flat on a level surface free from vibration.
- Install the microscope in the following environment:
  Room temperature: 0 to 40°C
  Relative humidity: 85% or below

High temperature and high humidity may cause mold and dew formation on the lenses. They may also degrade the performance of the microscope or result in malfunction.

① Lamphouse Adapter

★ **When using 12V-100W Halogen Lamp as a Light Sourse**
(See page 8 as to when 12V-50W halogen lamp is used as a light source or when the metal halide light source is used.)

Insert the lamphouse adapter into the sleeve in the back of the microscope. Three cross-recessed head screws are supplied with the adapter.
Insert two of them into the two screw holes in the upper part of the adapter. Tighten these two screws with a screwdriver. (The two tightened screws provide the adapter with enough strength without the third screw tightened into the screw hole in the lower part of the adapter.)



② Lamp and Lamphouse

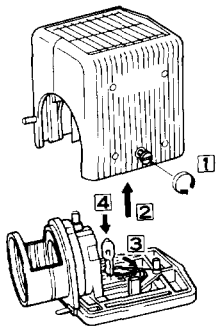
★ **When using 12V-100W Halogen Lamp as a Light Sourse**
(See page 8 as to when 12V-50W halogen lamp is used as a light source or when the metal halide light source is used.)

CAUTIONS

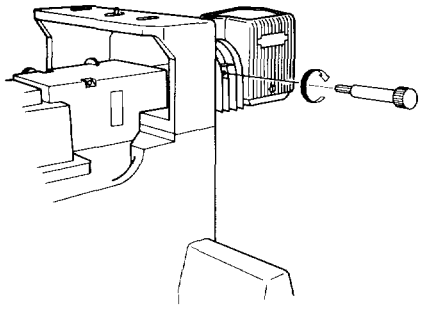
- Use 12V-100W halogen lamp (specified in 'Electrical Specifications' on page 54) and the Nikon 12V-100W lamphouse 2 with pre-centered socket.
- Wait until the lamp and the lamphouse cool down sufficiently before replacing the lamp.
- Turn off the power switch and unplug the power connector before replacing the lamp. This avoids electrical shocks or damage to the microscope.
- Do not touch with bare hands the glass surface of the lamp to be mounted. Dirt or fingerprints on the surface may degrade the illuminating capacity of the lamp. If fingerprints or dirt are left on the surface, wipe them off and keep the lamp always clean.
- Insert the 12V-100W lamphouse firmly into the microscope base before fixing this lamphouse.
- Remove the filter holders before detaching the 12V-100W lamphouse.

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Loosen the clamp screw on the side of the lamphouse cover with a coin or the like [1], and detach the cover [2].
Press down the lamp clamp lever. While pressing it down, insert the lamp into the socket until the lamp pins reach the limits in the pinholes ([3] and [4]). Be careful not to tilt the lamp when releasing the clamp lever.
Put the cover back, and tighten the clamp screw on the cover.

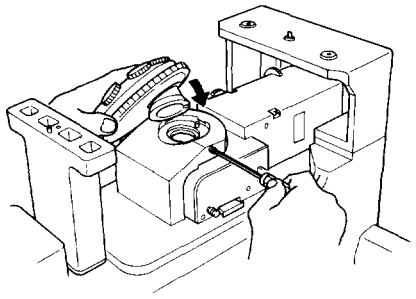


Sufficiently loosen the lamphouse clamp screw on the lamphouse adapter. Insert the lamphouse into the adapter until it reaches the limit. Tighten the clamp screw with the centering tool.



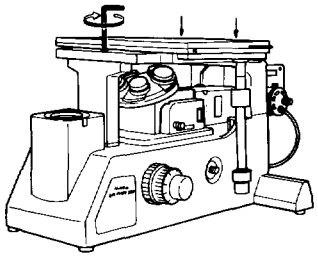
③ Revolving Nosepiece

Sufficiently loosen the nosepiece clamp screw with the hexagonal screwdriver. Fit the circular dovetail of the nosepiece to the corresponding mount in the microscope base. Ensuring that the outer circumference of the nosepiece's dovetail is in contact with the claws on the mount, tighten the clamp screw with the supplied centering tool.



④ Stage

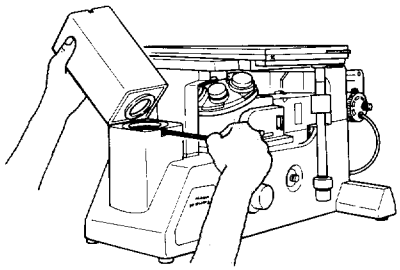
- The stage attachment base of the microscope has two pins. Place the stage onto the attachment base so that the two pins fit into the pinhole and the groove on the bottom of the stage plate. Tighten the three screws supplied with the stage. Use the hexagonal wrench to tighten these screws. If the stage is fixed in the opposite direction, the stage movement knobs are located at the front left. (Note that the figure shows the stage movement knobs are located at the rear right.)
- Fit the stage ring onto the stage. Screw in the two specimen clips on the stage.



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⑤ Intermediate Eyepiece Tube

Loosen the intermediate eyepiece tube clamp screw with the hexagonal screwdriver. Face the plaque-attached side of the intermediate eyepiece tube toward the stage. Slightly tilt the eyepiece tube, fit it into the corresponding circular dovetail mount in the microscope base, and tighten the clamp screw.

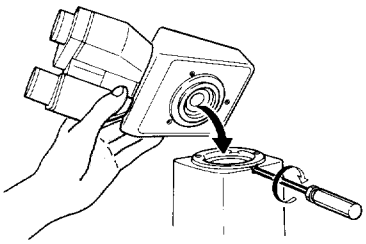


Note

Make sure that the serial number of the intermediate eyepiece tube corresponds to that of the microscope base. The latter is on the plaque attached to the back of the microscope base.

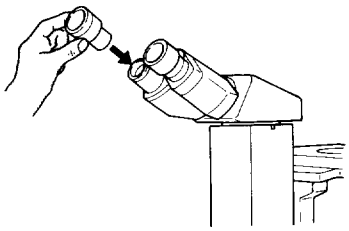
⑥ Eyepiece Tube

Sufficiently loosen the clamp screw at the top of the intermediate eyepiece tube with the hexagonal screwdriver. Slightly tilt the eyepiece tube, fit it into the corresponding circular dovetail mount on the tube, and tighten the clamp screw.



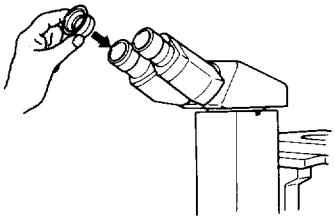
⑦ Eyepiece

Use eyepieces of identical magnification for the right and left eyes.
Insert each eyepiece into the eyepiece sleeve fitting the three grooves of each eyepiece in the corresponding protrusions in the eyepiece sleeve.



★ Rubber eyeguards (option)

Insert each rubber eyeguard into the groove in the outer circumference of the eyepiece.

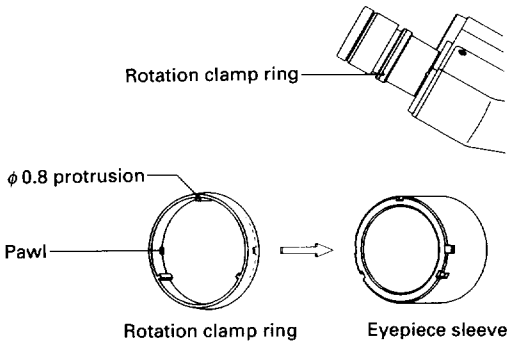


★ Rotation clamp rings

The rotation clamp ring is attached to the eyepiece sleeve to prevent the rotation of the eyepiece. When removing one of the eyepieces, do not hold the ring and forcibly pull it out together with the eyepiece. The ring must be detached when earlier-made eyepieces are attached. Pay attention to the following when attaching the ring again.

★ Attaching the rotation clamp ring

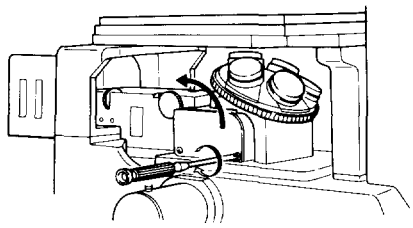
Hold the ring facing its ϕ 0.8 protrusion toward you. There are two pawls on the ring and two grooves on the sleeve. Attach the ring to the sleeve to fit the pawls into the grooves.



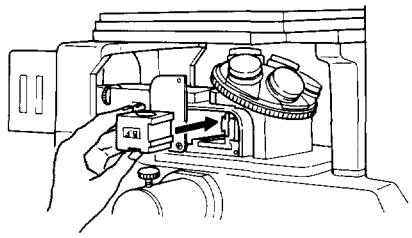
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⑧ Mirror Block

- Use the hexagonal screwdriver to remove one of the two screws fixing the cover of the mirror block port. Then, turn the cover to the left.



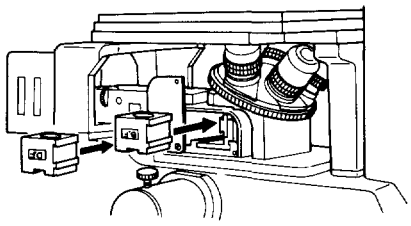
- Hold the brightfield mirror block (indicated B.F.) upside down. Fit the mirror block to the dovetail mount inside the port, and push it in until it reaches the second click stop.



- Hold the darkfield mirror block (indicated D.F.) also upside down. Fit the mirror block to the same mount, and push it in until it reaches the first click stop.
- Put the cover back as before, and tighten the screw to fix it.

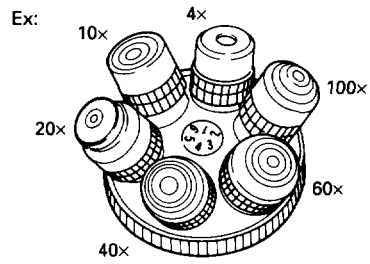
Note

With the front of the microscope facing you, attach the darkfield mirror block (indicated D.F.) to the left half of the mount in the mirror block port. If attached to the right half, it may cause malfunction.



⑨ Objective

Detach the stage ring from the stage. Screw the objectives into the holes in the revolving nosepiece from above so that the magnification of the mounted objectives increases as the nosepiece is rotated clockwise.



⑩ Power Supply Unit

Note

For 100-120V area

Use only the power supply unit model "PSM-1120" provided by Nikon Corporation.

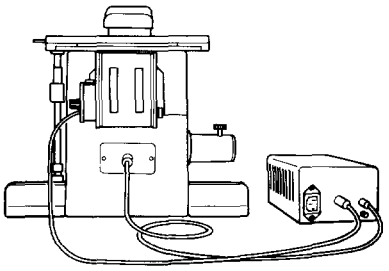
For 220-240V area

Use only the power supply unit model "PSM-2120" provided by Nikon Corporation.

- Plug the end of the lamphouse cable from the lamphouse adapter into the 'OUTPUT' connector of the power supply unit. Screw in the lock ring to the limit to fix the end of the cable.
- Plug one end of the ex-control cable into the connector on the back of the microscope base. Plug the other end of the cable into the CTRL connector on the back of the power supply unit. There is no need to connect this cable when adjusting the lamp intensity only with the lamp intensity control dial of the power supply unit.

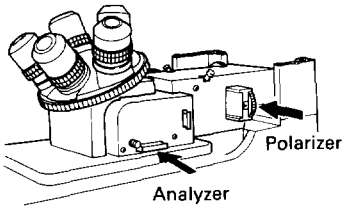
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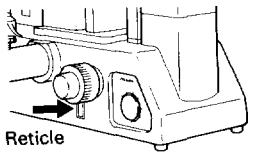
- Plug one end (socket) of the power cable into the AC IN connector of the power supply unit. Insert the other end (plug) of the cable into an AC IN line receptacle.



⑪ Analyzer, Polarizer and Reticles

- Hold each slider with its indications facing up or toward you, and insert it into the corresponding port.
- When not in use, insert their corresponding dust-tight sliders respectively into the above ports. This prevents dust or dirt coming into the microscope base.
- The polarizer slider with or without the first order red compensator can be inserted into its port either from the right or left side of the microscope. It is advisable to insert the slider from the side where the stage movement knobs are not located. This makes the operation of the polarizer easier.

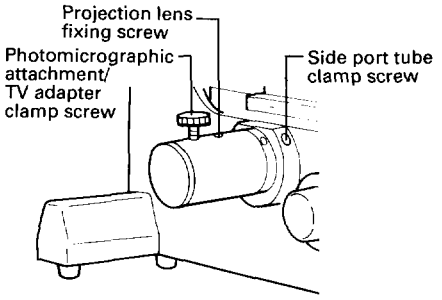




⑫ Photomicrographic Attachment (option)

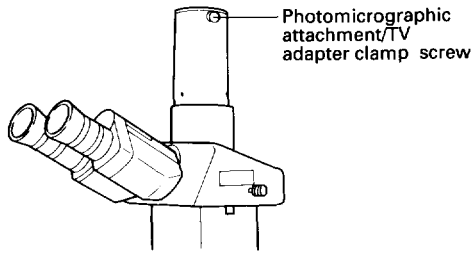
Refer to the instruction manual of your photomicrographic attachment on its assembly and on how to perform photomicrography with it.
It can be mounted to the side port or to the trinocular eyepiece tube of the microscope.

- **Mounting a photomicrographic attachment to the side port**
  - Fix the viewfinder, the FM mount, the camera box and the like to the main unit of the photomicrographic attachment by referring to its manual.
  - Detach the cap from the side port. Insert a PL projection lens into the side port, and push in the projection lens until it reaches the limit. Slightly tighten the projection lens fixing screw with the hexagonal screwdriver to fix the lens.
  - Face the viewfinder of the assembled attachment toward the front. Insert the assembled attachment into the side port. Confirm that the attachment reached the limit, tighten the photomicrographic attachment/TV adapter clamp screw.



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- **Mounting a photomicrographic attachment to the trinocular eyepiece tube**
  - Detach the cap from the vertical tube of the trinocular eyepiece tube. Drop a PL projection lens into the vertical tube. Confirm that the projection lens reaches the limit.
  - Face the viewfinder port of the main unit of the attachment toward the front. Insert the main unit into the vertical tube. Confirm that the unit reached the limit, tighten the photomicrographic attachment/TV adapter clamp screw.
  - Fix the viewfinder, the FM mount, the camera box and the like to the main unit by referring to the manual of the attachment.



⑬ TV Camera (option)

Refer to the instruction manual of your TV camera on its operation or on how to connect it to its power supply.
It can be mounted to the side port or to the trinocular eyepiece. Since the two mounting procedures are almost identical, how to mount it to the side port is explained. Depending on the types of projection lenses to be used, it is mounted in three different ways.

- **Use of a 1×TV relay lens**
  - Detach the cap from the side port, and insert the relay lens into the side port. Push in the lens until it reaches the limit. Tighten the projection lens fixing screw with the hexagonal screwdriver to fix the lens. (Since the trinocular eyepiece tube has no similar fixing screws, the projection lens is only dropped into its vertical tube.)
  - Attach the C-mount or the ENG-mount adapter to the TV camera, and insert the camera-attached adapter into the side port. Confirm that it reached the limit, tighten the photomicrographic attachment/TV adapter clamp screw.

- **Use of a TV relay lens (0.45×, 0.6× or zoom)**
  - Attach a zoom mount adapter for the C-mount or the ENG mount to the end of the zoom lens with the hexagonal screwdriver.
  - Attach the TV camera to the zoom lens, and insert the camera-attached lens into the side port. Confirm that it reached the limit, tighten the photomicrographic attachment/ TV adapter clamp screw.

- **Use of the Direct C-mount Adapter**
  - Use the hexagonal screwdriver to loosen the two side port tube clamp screws. Then, pull out the side port tube. (Loosen the three screws of the trinocular eyepiece tube to pull out the top of its vertical tube. An additional 2.5mm hexagonal wrench or a hexagonal screwdriver is needed for these screws.)
  - Then, insert the direct C-mount adapter into the side port, and tighten the above two clamp screws with the hexagonal screw-driver. (Tighten the above three screws of the trinocular eyepiece tube to attach the direct C-mount adapter to its vertical tube.)

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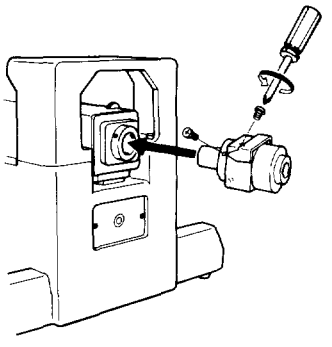
⑭ Use of the Other Light Sources

★ **When using a 12V-50W halogen lamp, pay attention to the following:**

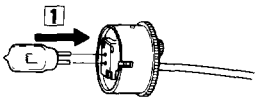
CAUTIONS

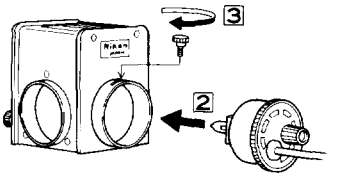
- **Use 12V-50W halogen lamps (specified in 'Electrical Specifications' on page 54) and the Nikon 12V-50W lamphouse for U-epi 10.**
- **Wait until the lamp and the lamphouse cool down sufficiently before replacing the lamp.**
- **Turn off the power switch and unplug the power connector before replacing the lamp. This avoids electrical shocks or damage to the microscope.**
- **Do not touch with bare hands the glass surface of the lamp to be mounted. Dirt or fingerprints on the lamp surface may degrade the illuminating capacity of the lamp. If dirt or fingerprints are left on the surface, wipe them off and keep the lamp always clean.**

- Lamphouse Adapter
  Insert the lamphouse adapter into the sleeve in the back of the microscope. Three cross-recessed screws are supplied with the adapter. Insert two of them into the two upper screw holes in the adapter. Tighten these two screws with a screwdriver. (The two tightened screws provide the adapter with enough strength without the third screw tightened in the screw hole in the lower part of the adapter.)

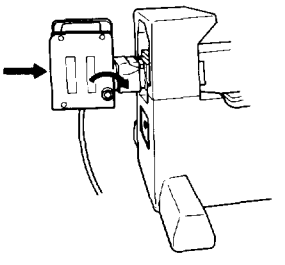


- Lamp and Lamphouse
  Insert the lamp firmly into the socket pinholes [1]. Fit the socket sleeve into the lamphouse [2], and clamp the sleeve with the socket sleeve clamp screw [3].





Sufficiently loosen the lamphouse clamp screw, insert the lamphouse into the adapter, and fix the lamphouse with the clamp screw.



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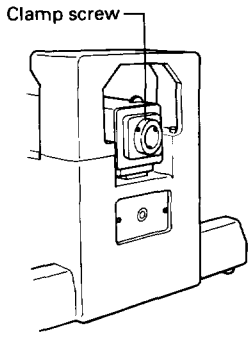
★ Use of the Metal Halide Light Source

Insert the end of the fiber into the fiber adapter until it reaches the limit. Fix this end of the fiber with the clamp screw supplied with the fiber adapter.

Note

Do not apply excessive force to the clamp screws.

Insert the fiber-attached fiber adapter into the sleeve in the back of the microscope. Fix the adapter with the clamp screw supplied with the sleeve.
Refer to the instruction manual of the metal halide light source on the assembly and use of this light source.



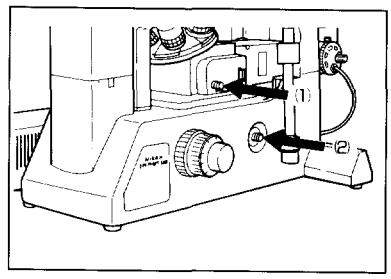
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III PREPARATION

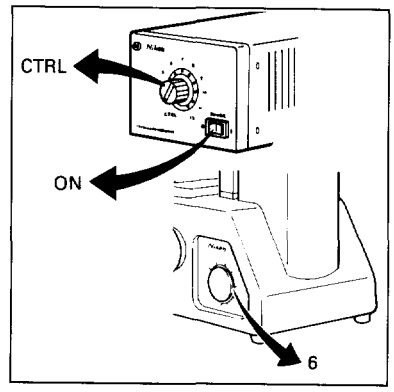
1. Diopter Adjustment

(1) Push in the mirror block changeover lever to put the brightfield mirror block (indicated B.F.) in the optical path.

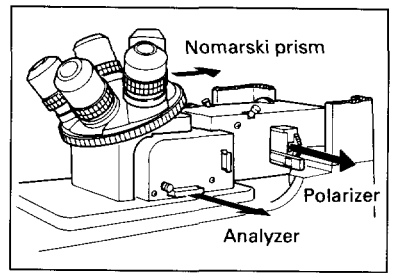
(2) Push in the optical path changeover lever to provide 100% light output to the eyepiece tube.



(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 6V.

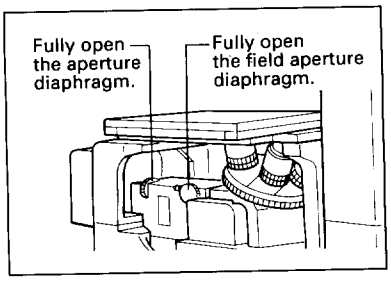


(4) If any Nomarski prism, the polarizer and the analyser are in the optical path, remove them from there.



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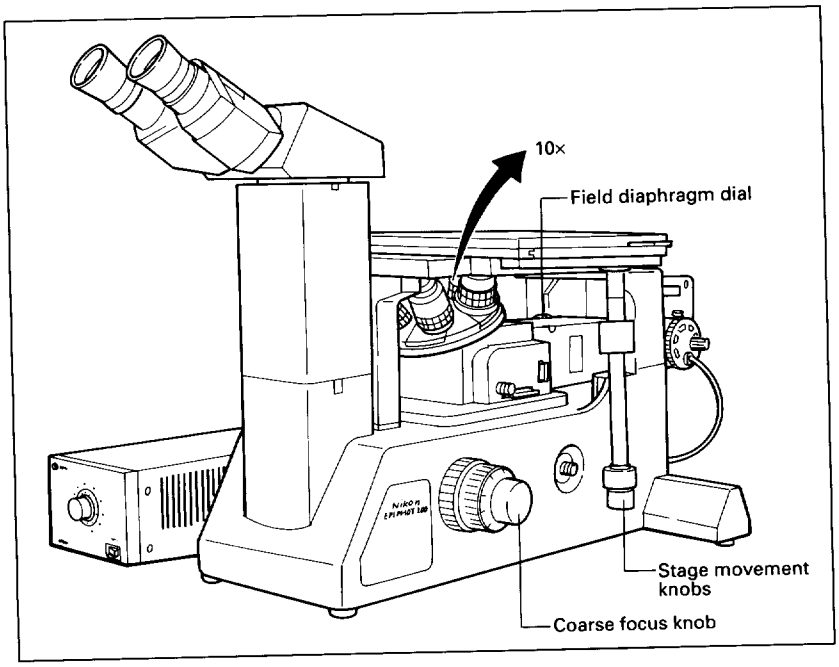
(5) Fully open the aperture and field aperture diaphragms.



(6) Rotate the coarse focus knob to lower the revolving nosepiece to the limit. Rotate the nosepiece to put the 10× objective in the optical path. Then, rotate the stage movement knobs to locate the center of the opening in the stage ring almost right above the top of that objective.

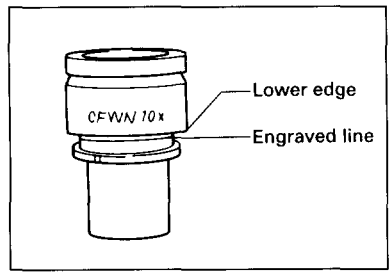
(7) Place a flat, high reflectance specimen facedown on the stage to face its surface to be observed downward.

(8) Rotate the coarse and fine focus knobs to focus on the specimen. For easier focusing, stop down the field diaphragm and focus on the diaphragm image.



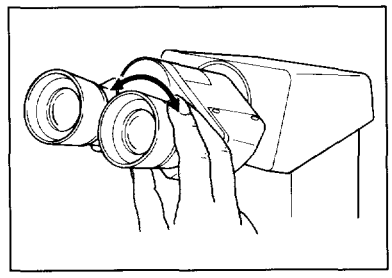
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(9) Rotate the diopter correction ring on each eyepiece to align its lower edge with the engraved line around the shaft. (The zero position is achieved for diopter correction when the two rings are thus adjusted.)



(10) Switch to the 50× objective, and rotate the coarse focus and fine focus knobs to focus on the specimen.

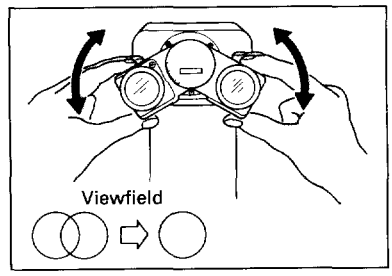
(11) Switch to the 10× objective. Then, rotate each diopter correction ring respectively for the right and left eyepieces to focus on the specimen. Do not touch the coarse or fine focus knob to focus on the specimen.



- Repeat the above procedures (10) and (11) twice to increase the accuracy of diopter adjustment.
- The above adjustment compensates for the diopter difference between the operator's eyes, enabling him to easily perform observation through the binocular eyepieces. It also maintains the eyepiece tube length correctly and helps Nikon's high quality objectives to fully exhibit their performance. Due also to the correct tube length, the specimen focused with one objective is still almost in focus when the revolving nosepiece is turned to the other objectives.

2. Interpupillary Distance Adjustment

While observing the two viewfields through the binocular eyepieces, adjust the interpupillary distance to make them coincide.



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3. 12V-50W Halogen Lamp Centering

A 12V-50W halogen lamp needs to be centered before usage. When using a 12V-100W halogen lamp, proceed to the next section since its socket is precentered.

(1) Push in the mirror block changeover lever to put the brightfield mirror block in the optical path.

(2) Push in the optical path changeover lever to provide the 100% light output to the eyepiece tube.

(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 6V.

(4) If any Nomarski prism, the polarizer and the analyzer are in the optical path, remove them from there.

(5) Fully open the aperture and field diaphragms.

(6) Rotate the revolving nosepiece to switch to the 10× objective. Rotate the stage movement knobs to locate the center of the opening in the stage ring almost right above the top of that objective.

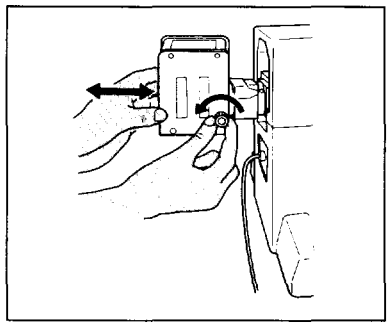
(7) Place a flat, high reflectance specimen facedown on the stage to face its surface to be observed downward.

(8) Rotate the coarse focus and fine focus knobs to focus on the specimen.
Stop down the field diaphragm and focus on the diaphragm image to make the focusing easier.

(9) Loosen the eyepiece tube clamp screw, turn the eyepiece tube to the left, and tighten the clamp screw. (If access to the lamphouse is easy from the front of the microscope with the eyepiece tube facing the front, it is not necessary to change the direction of the eyepiece tube.)

(10) Remove one eyepiece, look into the eyepiece sleeve, and the objective's exit pupil is visible as a bright circle. Also visible is the diffuser plate built in the illuminator.

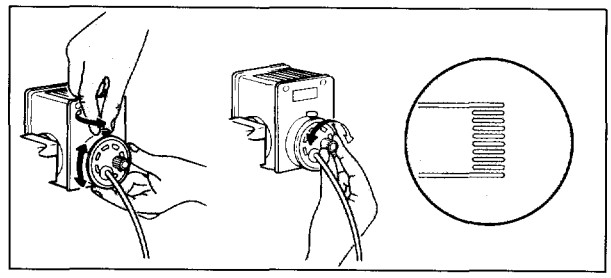
(11) Loosen the lamphouse clamp screw, slowly move the lamphouse back or forth, and fix it when the filament image comes into focus on the diffuser plate.



(12) Loosen the eyepiece tube clamp screw, turn the eyepiece tube to the right, and tighten the clamp screw. (If access to the lamphouse is easy from the front of the microscope with the eyepiece tube facing the front, it is not necesssary to change the direction of the eyepiece tube.)

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(13) Loosen the lamp socket sleeve clamp screw, and rotate the lamp socket to adjust the longitudinal direction of the lamp. Rotate the lamp lateral centering screw to adjust the lateral direction of the lamp. Adjust the above two directions of the lamp to move the filament image into the center of the objective's exit pupil. Then, tighten the clamp screw to fix the lamp socket, and turn the direction of the eyepiece tube to the front as before.



4. Field Diaphragm Centering

(1) Push in the mirror block changeover lever to put the brightfield mirror block in the optical path.

(2) Push in the optical path changeover lever to provide 100% light output to the eyepiece tube.

(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 6V.

(4) If any Nomarski prism, the polarizer and the analyzer are in the optical path, remove them from there.

(5) Fully open the aperture and field diaphragms.

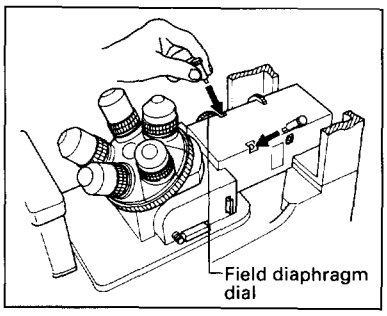
(6) Rotate the revolving nosepiece to put the 10× objective in the optical path. Rotate the stage movement knobs to locate the center of the opening in the stage ring almost right above the top of that objective.

(7) Place a flat, high reflectance specimen facedown on the stage to face its surface to be observed downward.

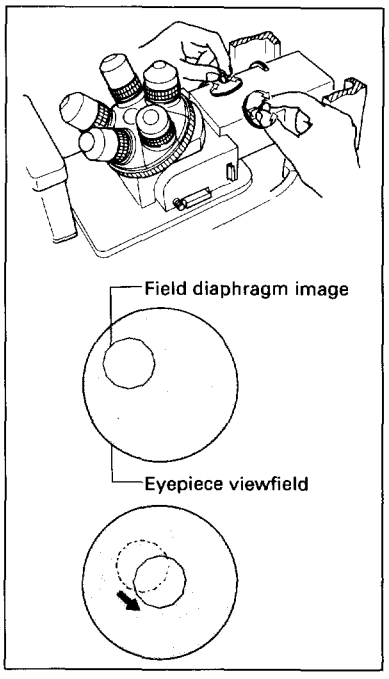
(8) Rotate the coarse focus and fine focus knobs to focus on the specimen.
Stop down the field diaphragm and focus on the diaphragm image to make the focusing easier.

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(9) Insert the two centering tools into the holes for field diaphragm centering.



(10) Stop down the field diaphragm to make the field diaphragm image smaller than the eyepiece viewfield. Rotate the centering tools to center the field diaphragm until the diaphragm image and the eyepiece viewfield are concentric.



Note

The centering tools reach the limit when they are rotated to the right. Do not rotate them further to the right with excessive force. If rotated forcibly, they may be damaged.

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5. Aperture Diaphragm Centering

(1) Push in the mirror block changeover lever to put the brightfield mirror block in the optical path.

(2) Push in the optical path changeover lever to provide 100% light output to the eyepiece tube.

(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 6V.

(4) If any Nomarski prism, the polarizer and the analyzer are in the optical path, remove them from there.

(5) Fully open the aperture and field diaphragms.

(6) Rotate the revolving nosepice to switch to the 10× objective. Rotate the stage movement knobs to locate the center of the opening in the stage ring almost right above the top of that objective.

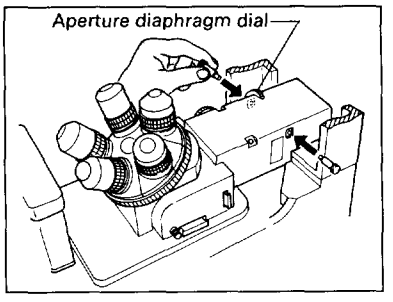
(7) Place a flat, high reflectance specimen facedown on the stage to face its surface to be observed downward.

(8) Rotate the coarse focus and fine foucs knobs to focus on the specimen.
Stop down the field diaphragm and focus on the diaphragm image to make the focusing easier.

(9) Switch from the 10× objective to the 50× objective, and focus on the specimen again.

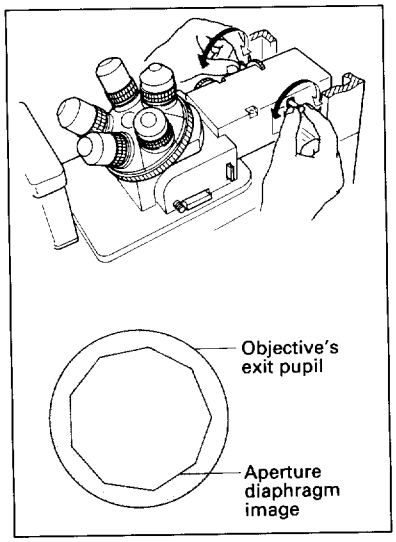
(10) Insert the two centering tools into the holes for aperture diaphragm centering.

(11) Remove one eyepiece, look into the eyepiece sleeve, and the objective's exit pupil is visible as a bright circle. Also visible are the diffuser plate built in the illuminator and the filament image on the diffuser plate.



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(12) Stop down the aperture diaphragm to the minimum, and the aperture diaphragm image becomes visible on the objective's exit pupil. Rotate the centering tools to center the aperture diaphragm until the aperture diaphragm image and the exit pupil are concentric.



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IV MICROSCOPIC PROCEDURE

★ MICRSCOPY that can be performed with EPIPHOT 200.

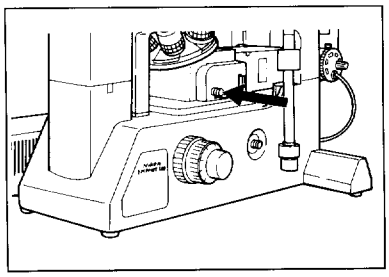
Required set	Microscopy	
• **Brightfield set**	**Brightfield**	⇒ See page p. 20
• **Darkfield set also required** (Set includes darkfield mirror block, BD quintuple nosepiece and BD objectives.)	**Darkfield**	⇒ See page p. 23
• **Differential interference contrast set also required** (Set includes polarizer, analyzer, first order red compensator, Nomarski prisms, universal quintuple nosepiece, and DIC objectives.)	**Differential interference contrast**	⇒ See page p. 25
• **Simplified polarization set also required** (Set includes polarizer, analyzer and first order red compensator.)	**Simplified brightfield polarization**	⇒ See page p. 27
	Sensitive brightfield polarization	⇒ See page p. 27

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1. Brightfield Microscopy

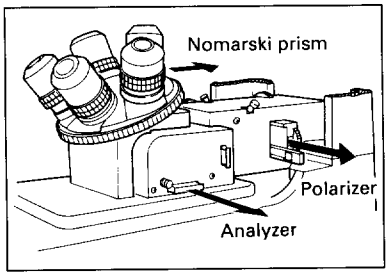
(1) Push in the mirror block changeover lever to the click stop to put the brightfield mirror block (indicated B.F.) in the optical path.

CONFIRM that with the front of the microscope facing you, the brightfield mirror block has been attached on the right half of the mount inside the mirror block port.

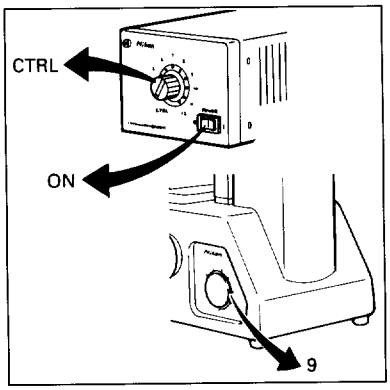


(2) If the polarizer, analyzer and the first order red compensator are in the the optical path, remove them from there.
When using the universal revolving nosepiece, detach any Nomarski prism slider from that nosepiece.

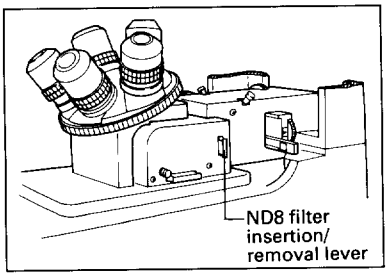
※ *During normal observation, the Nomarski prisms S1A, S1B, S1C or S1E can be left in the optical path. But remove them from the revolving nosepice when performing photomicrography or when observing a specimen with much finer details.*



(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 9V.

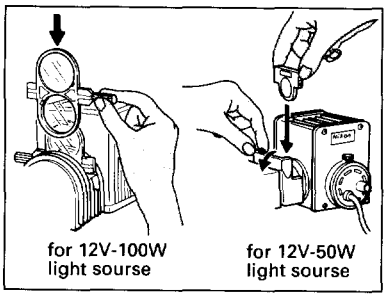


(4) Push in the anti-glare ND8 filter insertion/ removal lever to put the ND8 filter in the optical path.

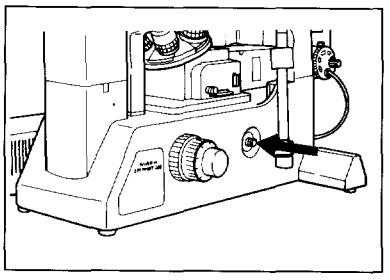


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(5) Insert the NCB11 filter and ND filters into the optical path. Select ND filters capable of properly adjusting the reflectance of the specimen.

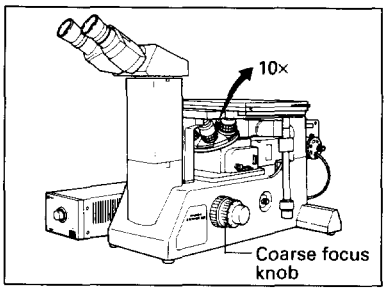


(6) Push in the optical changeover lever to provide the 100% light output to the eyepiece tube.



(7) Rotate the coarse focus knob to lower the revolving nosepiece. Then, rotate the nosepiece to put the 10× objective in the optical path.

(8) Place a flat, high reflectance specimen facedown on the stage to face its surface to be observed downward. Observe the specimen through the eyepieces, and rotate the coarse focus and fine focus knobs to focus on the specimen.



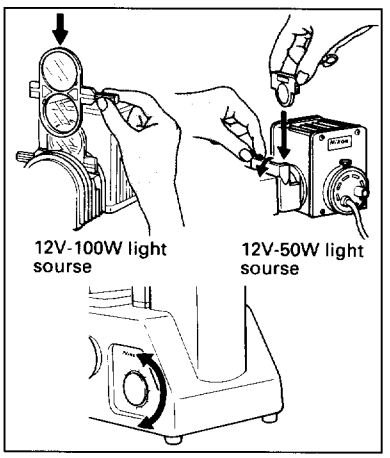
(9) Switch to the desired objective and focus on the specimen.

Note

- **Each of Nikon's 50× or higher magnification objectives (except ELWD) is equipped with a safety mechanism. However, the top lens of such an objective projects slightly beyond the metal rim around the lens. Pay enough attention to the rotation of the revolving nosepiece so as not to hit high magnification objectives against the specimen or the stage.**
- **When the stage is moved laterally or longitudinally, some of the objectives mounted to the revolving nosepiece may hit against the metal parts attached to the reverse side of the stage. Carefully rotate the nosepiece so as not to hit those objectives against the metal parts.**

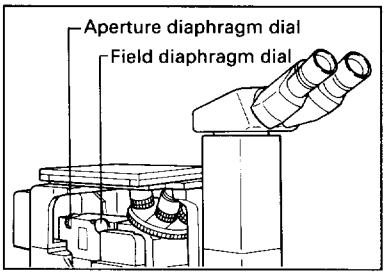
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(10) Adjust the brightness with the ND filters and the lamp intensity control dial.



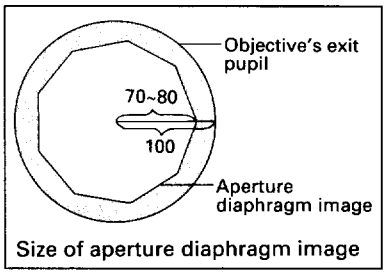
(11) Turn the field diaphragm dial to stop down the field diaphragm. Stop it down until the diaphragm image almost inscribes or circumscribes the viewfield.

※ *The field diaphragm restricts the illumination light only to the specimen's area to be illuminated for observation. If the specimen is illuminated wider than necessary because the field diaphragm is not adjusted properly, stray light will enter the viewfield, generate flare, and blur the image contrast. Correct adjustment of this diaphragm is therefore very important especially in photomicrography. Generally, it is stopped down to such an extent that the specimen's illuminated area is slightly larger than the actual dimensions of the film format.*



(12) Turn the aperture diaphragm dial to adjust the aperture diaphragm.

※ *The aperture diaphragm is used to adjust the illumination system's numerical aperture, and plays an important role in determining image resolution, contrast and depth of focus. Remove one of the eyepieces from the eyepiece tube, look into the eyepiece sleeve, and the objective's exit pupil is visible as a bright circle. Generally, a good image of appropriate contrast can be obtained when the aperture diaphragm is stopped down to 70 ~ 80% of that exit pupil.*

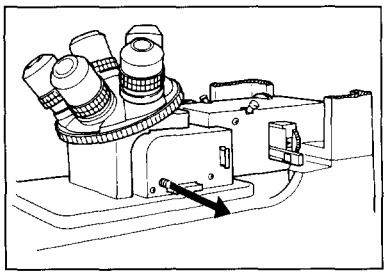


Size of aperture diaphragm image

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2. Darkfield Microscopy

(1) Pull out the mirror block changeover lever to the click stop to put the darkfield mirror block (indicated D.F.) in the optical path.



Note

- **Confirm without fail that the darkfield mirror block has been attached to the left half of the mount inside the mirror block port. Do not pull out the changeover lever forcibly when this mirror block is on the right half of the mount. This may cause malfunction.**
- **Glare may enter the viewfield when rotating the revolving nosepiece or removing the darkfield mirror block from the optical path during darkfield microscopy. Keep your eyes off the eyepieces during such times as the glare may hurt your eyes.**

(2) If any Nomarski prism, the polarizer, the analyzer, the first order red compensator, and the reticle are in the optical path, remove them from there.

※ *During normal observation, the Nomarski prisms S1A, S1B, S1C or S1E can be left in the optical path. But remove them from the revolving nosepiece when performing photomicrography or when observing a specimen with much finer details.*

(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the light intensity control dial on the microscope base at maximum.

(4) Push in the anti-glare ND8 filter insertion/removal lever to put the the ND8 filter in the optical path.

(5) Insert the NCB11 filter into the optical path.

(6) Rotate the aperture diaphragm dial to fully open the aperture diaphragm.

(7) Push in the optical path changeover lever to provide the 100% light output to the eyepiece tube.

(8) Rotate the coarse focus knob to lower the revolving nosepiece. Rotate the revolving nosepiece to put the 10× objective in the optical path.

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(9) Place the specimen facedown on the stage to face its surface to be observed downward. While observing the specimen through the eyepieces, rotate the coarse and fine focus knobs to focus on the specimen.
It is also possible to change over to darkfield microscopy after focusing the specimen by the brightfield microscopy. (Refer to 'Changing over between Brightfield and Darkfield Microscopy' explained below.)

(10) Switch to the desired objective and focus on the specimen.

Note

- **Each of Nikon's 50× or higher magnification objectives (except ELWD) is equipped with a safety mechanism. However, the top lens of such an objective projects slightly beyond the metal rim around the lens. Pay enough attention to the rotation of the revolving nosepiece so as not to hit high magnification objectives against the specimen or the stage.**
- **When the stage is moved laterally or longitudinally, some of the objectives mounted to the revolving nosepiece may hit against the metal parts attached to the reverse side of the stage. Carefully rotate the nosepiece so as not to hit those objectives against the metal parts.**

(11) Adjust the brightness with ND filters and the lamp intensity control dial.
※ *It is impossible to perform darkfield microscopy when the EPI quintuple nosepiece is used.*

★ Changing over between Brightfield and Darkfield Microscopy

(1) Push in the anti-glare ND8 filter insertion/removal lever to put the ND filter in the optical path.

(2) From brightfield to darkfield microscopy
① Pull out the mirror block changeover lever to put the darkfield mirror block (indicated D.F.) in the optical path. As the lever is pulled out, the field diaphragm is fully opened.
② Fully open the aperture diaphragm.
③ Adjust the brightness with ND filters and the lamp intensity control dial.

(3) From darkfield to brightfield microscopy
① Push in the mirror block changeover lever to put the brightfield mirror block (indicated B.F.) in the optical path. As the lever is pushed in, the fully opened field diaphragm is stopped down as set by the field diaphragm dial.

Note

- **Keep your eyes off the eyepieces when removing the darkfield mirror block from the optical path. Glare may enter the viewfield at such a time.**

② Rotate the aperture diaphragm dial to adjust the aperture diaphragm.
③ Adjust the brightness with ND filters and the lamp intensity control dial.

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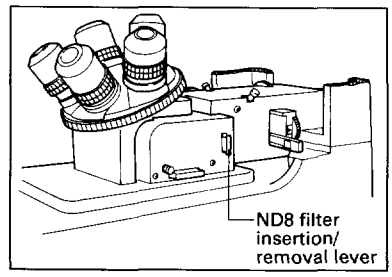
3. Differential Interference Contrast Microscopy

(1) Push in the mirror block changeover lever to the click stop to put the brightfield mirror block (indicated B.F.) in the optical path.

(2) Mount the polarizer slider withe the first order red compensator, and the analyzer slider, ensuring that they are out of the optical path.

(3) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 9V.

(4) Pull out the anti-glare ND8 filter insertion/ removal lever to remove the ND8 filter from the optical path.



(5) Insert the NCB11 filter into the optical path.

(6) Push in the optical path changeover lever to provide the 100% light output to the eyepiece tube.

(7) Rotate the coarse focus knob to lower the revolving nosepiece. Rotate the nosepiece to put the 10× objective in the optical path.

(8) Place the specimen facedown on the stage to face its surface to be observed downward. While observing the specimen through the binocular eyepieces, rotate the coarse focus and fine focus knobs to focus the on the specimen.

(9) Switch to the desired objective and focus on the specimen.

Note

- **Each of Nikon's 50× or higher magnification objectives (except ELWD) is equipped with a safety mechanism. However, the top lens of such an objective projects slightly beyond the metal rim around the lens. Pay enough attention to the rotation of the revolving nosepiece so as not to hit high magnification objectives against the specimen or the stage.**
- **When the stage is moved laterally or longitudinally, some of the objectives mounted to the revolving nosepiece may hit the metal parts attached to the reverse side of the stage. Carefully rotate the nosepiece so as not hit those objectives against the metal parts.**

(10) Turn the aperture and field diaphragm dials to adjust the aperture and field diaphragms.

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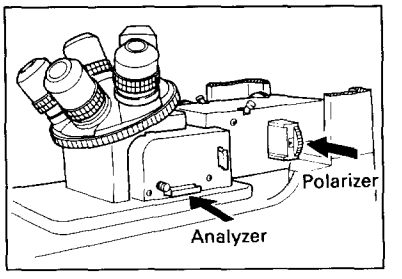
(11) Insert the analyzer and the polarizer into the optical path.

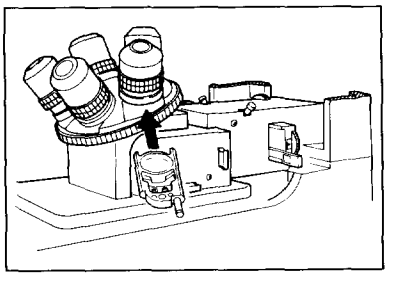
(12) Insert a Nomarski prism into the revolving nosepiece until it reaches the limit. Use a Nomarski prism which corresponds to the objective to be used. (The alphabetical indication found next to the NA on each objective should be identical to that of the Nomarski prism to be used.)

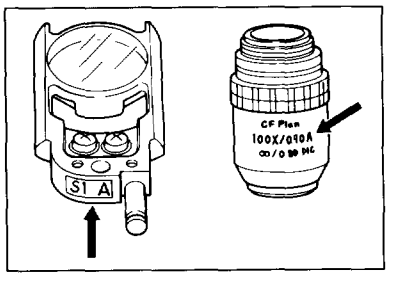
Indication on Nomarski prism	Objectives that can be used
A	BD Plan DIC 10×/20×/50×/100×
B	BD Plan DIC 5×
C	ELWD BD Plan DIC 50×/100×
E	ELWD BD Plan DIC 20×

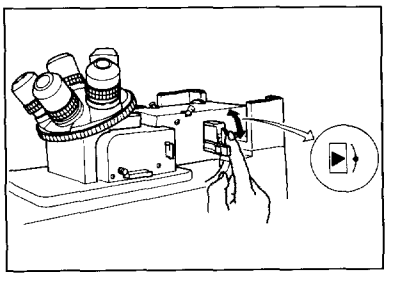
The indication such as "S1", "S2" found before the alphabetical indication on each Nomarski prism shows the difference in the shearing amount. You can increase the image contrast by exchanging the Nomarski prism to those having the shearing amount that matches the specimen. (Although, this may not work on some specimen.)

(13) Turn the polarizer dial and align its white dot index (●) with the triangle index (►) on the slider to attain the crossed Nicols position. (The direction of the analyzer has been factory-adjusted.)









(14) Adjust the brightness with ND filters and the lamp intensity control dial.

※ *The resulting dark background (without the first order red compensator in the optical path), produces an interference image similar to that obtained through brightfield phase contrast observation. The gradual rotation of the polarizer changes the background to the so-called sensitive gray for optimal image contrast. This image now appears in relief, much like the shadowing observed with an electron microscope, and clearly shows the phase contrast distribution over the entire specimen like a 'bird's eye' view.*
The insertion of the first order red compensator into the optical path when the background is dark (that is, at the time of the crossed Nicols position), turns the background to sensitive red-violet for optimal color contrast. Changing the background to sky-blue color by the rotation of the polarizer, with the first order red compensator still in the optical path, produces an interference image similar to that obtained through darkfield phase contrast observation.
For a specimen with considerable phase contrast differences caused by its uneven surface, the background can be changed to another color to achieve the desired contrast.

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4. Simplified Brightfield Polarization Microscopy and Sensitive Polarization Microscopy

(1) Push in the mirror block changeover lever to the click stop to put the brightfield mirror block (indicated B.F.) in the optical path.

(2) Mount the polarizer, first order red compensator and the analyzer, ensuring that they are out of the optical path.

(3) If Nomarski prisms have been inserted into the universal revolving nosepiece, remove them from that nosepiece.

(4) Turn on the power switch of the power supply unit, and rotate its lamp intensity control dial to "CTRL". Set the lamp intensity control dial on the microscope base at approximately 9V.

(5) Pull out the anti-glare ND8 filter insertion/removal lever to remove the ND8 filter from the optical path.

(6) Insert the NCB11 filter into the optical path.

(7) Push in the optical changeover lever to provide the 100% light output to the eyepiece tube.

(8) Rotate the coarse focus knob to lower the revolving nosepice. Rotate the nosepiece to put the 10× objective in the optical path.

(9) Place the specimen facedown on the stage to face its surface to be observed downward. While observing the specimen through the eyepieces, rotate the coarse focus and fine focus knobs to focus on the specimen.

(10) Switch to the desired objective and focus on the specimen.

Note

- **Each of Nikon's 50× or higher magnification objectives (except ELWD) is equipped with a safety mechanism. However, the top lens of such an objective projects slightly beyond the metal rim around the lens. Pay enough attention to the rotation of the revolving nosepice so as not to hit high magnification objectives against the specimen or the stage.**
- **When the stage is moved laterally or longitudinally, some of the objectives mounted to the revolving nosepiece may hit against the metal parts attached to the reverse side of the stage. Carefully rotate the nosepiece so as not to hit those objectives against the metal parts.**

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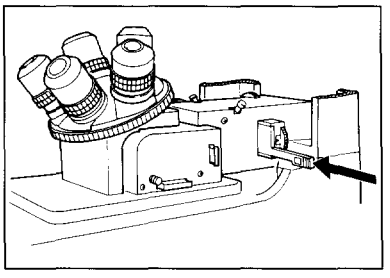
(11) Adjust both the aperture and field diaphragms.

(12) Insert the polarizer and the analyzer into the optical path. Keep the first order red compensator out of the optical path.

(13) With the first order red compensator still out of the optical path, turn the polarizer dial and aligh its white dot index (●) with the triangle index (►) on the slider to attain the crossed Nicols position. This enables simplified brightfield polarization microscopy to be performed.

(14) Adjust the brightness with ND filter and the lamp intensity control dial.

(15) Insert the first order red compensator into the optical path. This enables sensitive polarization microscopy to be performed.



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V OPERATION OF EACH PART

1. Filter

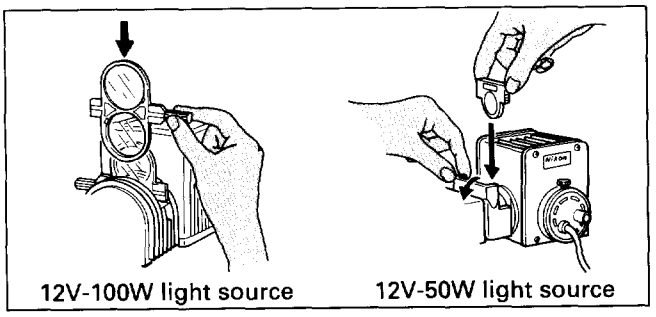
The table below illustrates the functions of the filters mentioned in this manual, their names, what they are used for, and where they are used.

Type	Name	What they are used for.	Where they are used.
Color *temperature* compensation	NCB11	General microscopy & color photomicrography	Filter holders
Light reduction	ND2 (reduces light to 1/2.)	Brightness control for general microscopy & photomicrography	
	ND4 (reduces light to 1/4.)		
	ND8 (reduces light to 1/8.)		
Anti-glare	ND8	Anti-glare filter in *brightfield* microscopy. Acts as ND8 in brightfield. Acts also as transparent glass in darkfield.	Anti-glare ND8 filter insertion/ removal lever built in micro-scope arm.
Green interference	GIF	Monochrome photomicrography & contrast adjustment	Filter holder

The above filters are used as follows:.

- Filter holder
  Filter holders are inserted into the lamphouse adapters.

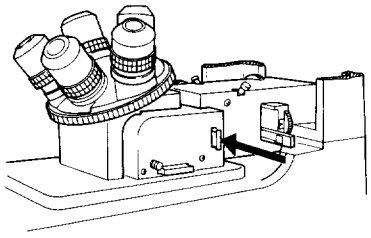
Note **Filter holders for the 12V-100W lamphouse and those for the 12V-50W lamphouse are different in shape. Note the difference and use proper filter holders.**



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- Anti-glare ND8 filter insertion/removal lever
  Push in the insertion/removal lever to the limit to put the ND8 filter in the optical path.
  When the use of this filter is not needed, pull out the lever to the limit.

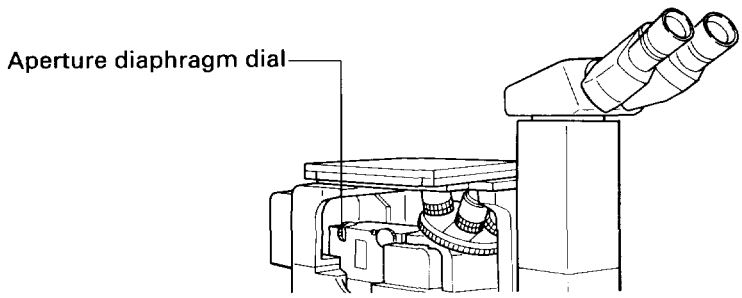
Note **Push in or pull out the insertion/removal lever always to the limit.**



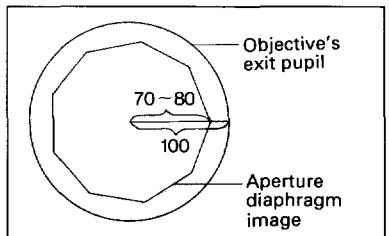
ND8 filter in the optical path

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2. Aperture Diaphragm



In general, stop down the aperture diaphragm to 70 ~ 80% of the numerical aperture of the objective.
To adjust the size of the aperture diaphragm, remove one eyepiece and look into the eyepiece sleeve. The objective's exit pupil is visible as a bright circle there. Open or stop down the aperture diaphragm, and the aperture diaphragm image is visible on that exit pupil. Adjust the size of that image to the 70 ~ 80% of the exit pupil.



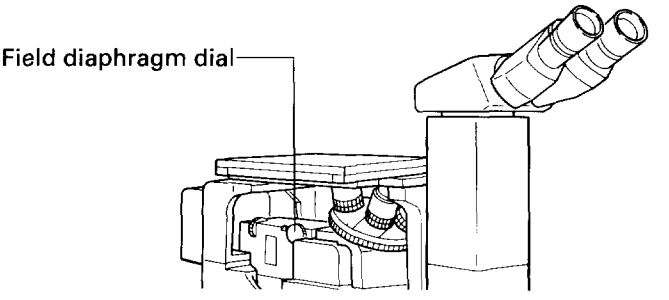
The size of aperture diaphragm

※ *The aperture diaphragm is used to adjust the numerical aperture (N.A.) of the illumination system, and plays an important role in determining image resolution, contrast and depth of focus. Since resolution deteriorates when the aperture diaphragm is stopped down more than necessary, do not stop it down to 60% or below of the N.A. of the objective except when observing a special specimen.*

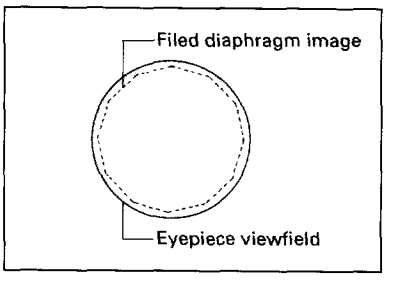
※ *The aperture diaphragm image may not be visible when an uneven specimen or a low reflectance specimen is observed. Replace such a specimen with a flat, high reflectance one, and adjust the aperture diaphragm accordingly.*

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3. Field Diaphragm



Stop down the field diaphragm until the field diaphragm image almost inscribes or circumscribes the viewfield.



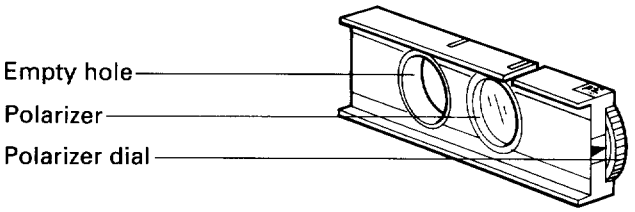
Turn the field diaphragm dial to open or stop down this diaphragm.

※ *The field diaphragm restricts the illumination light only to the specimen's area to be illuminated for observation. If the specimen is illuminated wider than necessary, stray light will enter the viewfield, generate flare, and blur the image contrast. Correct adjustment of this diaphragm is therefore very important especially in photomicrography. Generally, stop down to such an extent that the specimen's illuminated area is slightly larger than the actual dimensions of the film format.*

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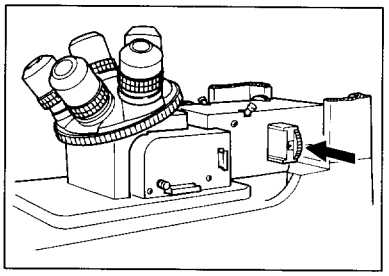
4. Polarizer Slider

The polarizer slider is used in combination with the first order red compensator and the analyzer in differential interference contrast and simplified polarization microscopy.

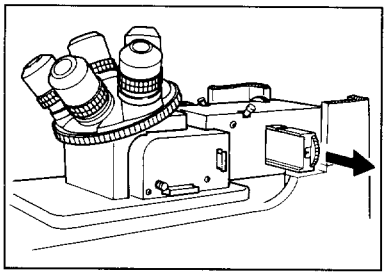


- Push in the polarizer slider to the second click stop to put the polarizer in the optical path.

  The polarizer slider can be inserted into its port either from the right or the left side of the microscope. It is advisable to insert it from the side where the stage movement knobs are not located. This makes the operation of the inserted slider easier because of the absence of the stage movement knobs. (When inserting the slider, hold it facing its directional indexes toward you.)

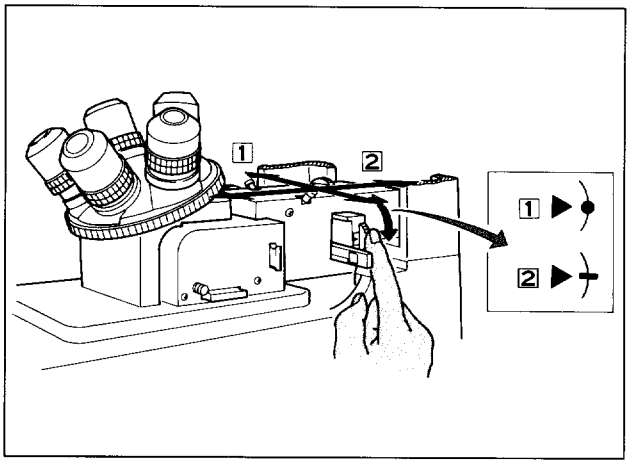


- When changing over to brightfield or darkfield microscopy, pull out the slider to the first click stop to put the empty hole in the optical path.



- Turn the dial on the end of the slider to set the directions of the polarizer.

※ *Remove the polarizer from the optical path when it is not used. It may be discolored if it is left in the optical path for a long period of time. But this won't affect the characteristics of the polarizer.*

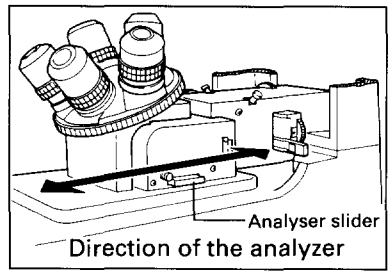


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5. Analyzer Slider

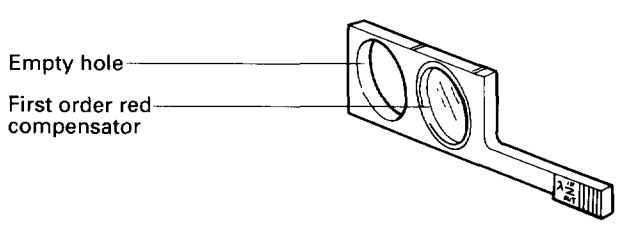
The analyzer slider is used in combination with the polarizer (and a Nomarski prism) in simplified polarization, sensitive polarization and differential interferece contrast microscopy. Remove the supplied dust-proof slider from the microscope and insert the analyzer slider instead.

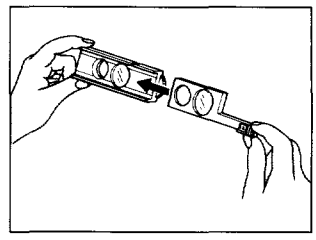
- Push in the analyzer slider to the second click stop to put the analyzer in the optical path.
- Pull out the analyzer slider to the first click stop to change over to brightfield or darkfield microscopy.
- The direction of the analyzer is shown by the arrow in Figure right.



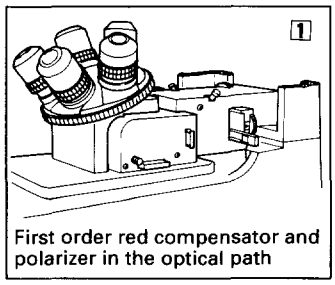
6. First Order Red Compensator Slider

The first order red compensator slider is attached to the polarizer slider, and is used in sensitive polarization and differential interference contrast microscopy.

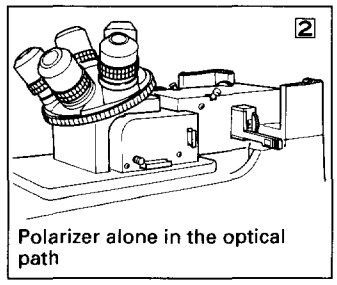




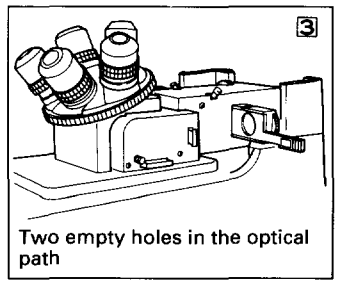
- When performing sensitive polarization or differential interference contrast microscopy, push in the first order red compensator slider together with the polarizer slider to the limit to put the first order red compensator in the optical path. (Figure below-[1])
- When altering the compensation range in differential interference contrast microscopy or when changing over from sensitive polarization to simplified polarization microscopy, pull out only the first order red compensator slider to the first click stop to put its empty hole in the optical path. (Figure below-[2])
- When changing over from sensitive polarization and differential interference contrast microscopy to brightfield or darkfield microscopy, pull out the first order red compensator slider together with the polarizer slider to the first click stop to put the empty holes of the two sliders in the optical path. (Figure below-[3])



First order red compensator and polarizer in the optical path



Polarizer alone in the optical path



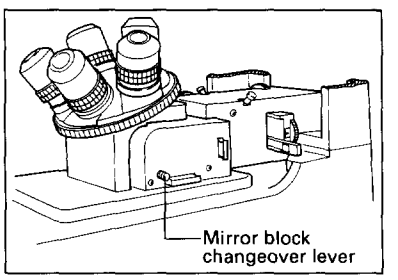
Two empty holes in the optical path

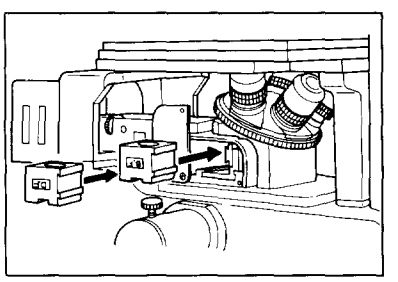
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7. Mirror Block

The brightfield mirror block (indicated B.F.), the darkfield mirror block (indicated D.F.) and the epi-fluorescence filter blocks (respectively indicated B, G, V, etc) are available. Two blocks can be mounted at one time.

- Push in the mirror block changeover lever to put the mirror block on the right in the optical path. Pull out the lever to put the mirror block on the left in the optical path.
- With the front of the microscope facing you, attach the brightfield mirror block on the right hand half of the mount inside the mirror block port. Attach the darkfield mirror block on the left half of the same mount.
- Never attach the darkfield mirror block on the right hand half of the mount. If attached there and used, it may cause malfunction.



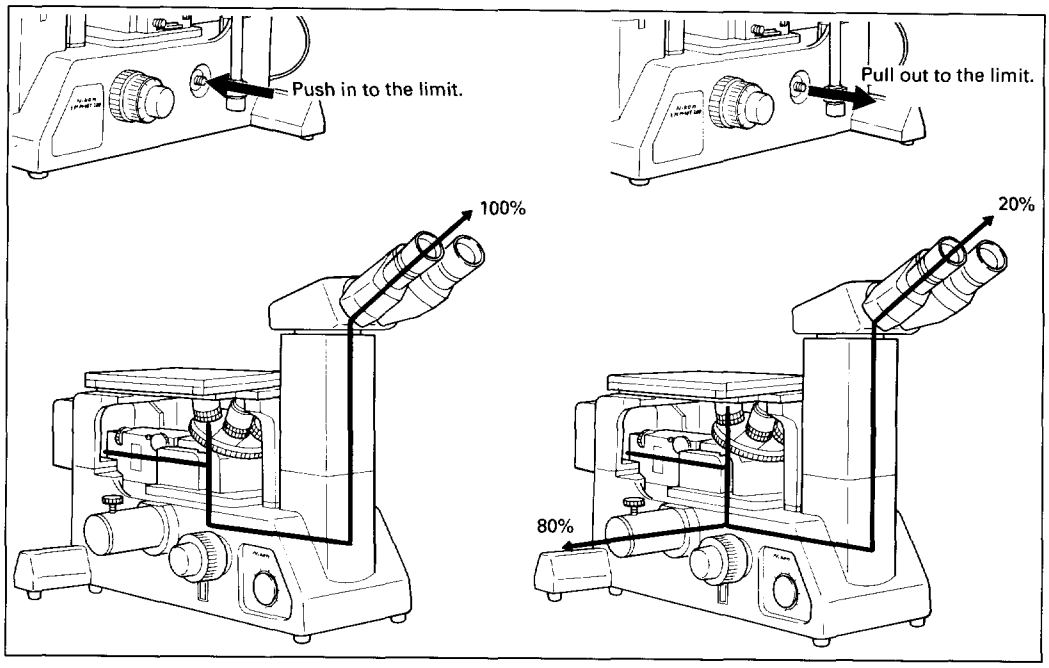


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8. Side Port

- A photomicrographic attachment or a TV camera can be mounted to the side port.
- Push in or pull out the optical path changeover lever to change the light output ratio accordingly for the side port and the eyepieces. Pull out the optical changeover lever to the limit, and the light output is divided into 80% and 20% for the side port and the eyepieces respectively.

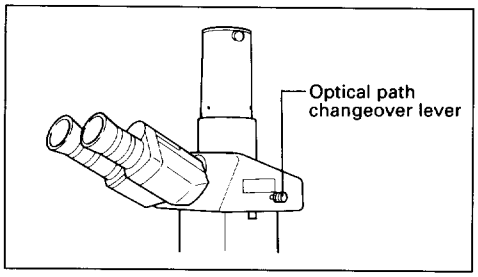
Note **Push in or pull out the changeover lever always to the limit.**



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9. Eyepiece Tube

- Eyepiece tubes for the Nikon OPTIPHOT-2 Microscope can be used for this EPIPHOT 200 inverted microscope.
  When using a trinocular eyepiece tube to mount a photomicrographic attachment or a TV camera to its vertical tube, push in or pull out the optical path changeover lever on the trinocular eyepiece tube to divide the light output accordingly for the eyepieces and the vertical tube.

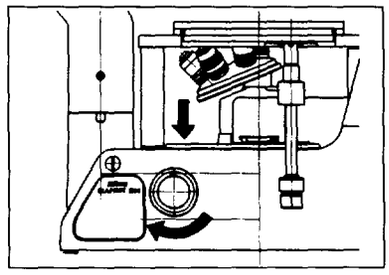


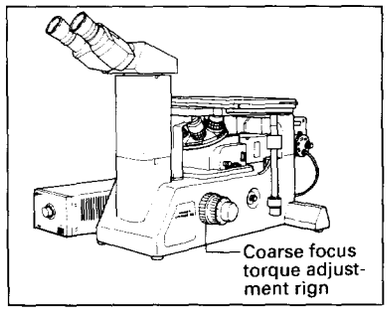
- The binocular eyepieces of the tilting eyepiece tube can be tilted to suit the operator's observation posture.

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10. Focusing Device

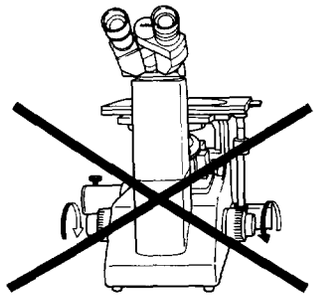
- The rotation of the coarse focus and fine focus knobs moves the revolving nosepiece vertically. Rotate them to focus on the specimen. The relation between the direction of their rotation and the nosepiece movement is shown in Figure right.
- One rotation of the fine focus knob moves the nosepiece 0.1mm. The minimum reading of the scale on this knob is 1μm.
- Rotate the coarse focus torque adjustment ring to adjust the tension in the coarse focus knob. Rotating the adjustment ring counterclockwise increases the tension.





Note

Never rotate simultaneously the right and left focus knobs in opposite directions. If rotated this way, they may cause malfunction.



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11. Rectangular Mechanical Stage

- This stage has a handle arm with a universal joint which enables the arm to be angled in all directions. When moving the stage, angle the arm to positions convenient for you to rotate the stage movement knobs. The hand movement between the focus knobs and the stage movement knobs is also made easier and faster.
- Two stage rings, each with a central opening, are used for specimens of different dimensions. One has a ϕ 20 opening, and the other a ϕ 40 opening.

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12. Grain Reticle

- Insert the grain reticle slider into the scale port. Adjust its position in the direction in which it slides until the reticle patterns is located in the center of the viewfield.
- Following two reticles are contained in the slider:
  - Austenite reticle (for measuring the grain size of steel austenite)
    Compare the specimen with the eight reticle patters numbered ① to ⑧.
    Use the 10× objective to obtain the grain size. When using the 20× objective, read the pattern second to the next high numbered one. When using the 5× objective, read the pattern second to the next low numbered one.
  - Grid (for testing nonferrous inclusion in steel)
    This grid can be used as a simplified length scale. It has 20 vertical and 20 horizontal lines. The spacing between any two vertical or two horizontal lines is 0.5mm on the reticle surface. This spacing, when observed through the eyepieces with the 10× objective in the optical path, represents 0.05mm on the specimen surface.

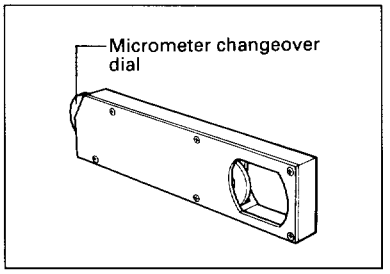
Note

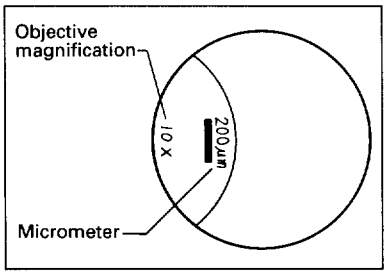
- **When inserting the scale slider into the port, hold the slider facing its side with indications toward you.**
- **The reticle image is not visible through the side port. When the image is to be inprinted on a photograph or on a TV camera, mount a photomicrographic attachment or a TV camera to the trinocular eyepiece tube.**
- **Reticle patterns may not be clearly visible on a dark background as in the case of darkfield microscopy.**

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13. Micrometer Reticle

- The micrometer reticle slider contains 5 different micrometers respectively for the 5×,10×, 20×, 50× and 100× objectives. Turn the micrometer changeover dial on the left end of the slider to switch to the micrometer that matches the magnification of the objective in the optical path.
- Insert the reticle slider into the scale port. Adjust its position in the direction in which it slides until the micrometer is located to the right hand side of the viewfield.
- The magnification of the corresponding objective is indicated on the left side of each micrometer pattern. Turn the micrometer changeover dial to switch to the micrometer which matches the objective in the optical path.
- When the reticle is to be inprinted on a photograph, adjust the position of the slider in the direction in which it slides until the scale is located within the viewfinder photomask of the photomicrographic attachment.
- When using a TV camera, watch the monitor screen and adjust the position of the slider in the direction in which it slides until the scale is located within the projected area.





Note

- **When inserting the reticle slider into the port, hold the slider facing its side with indications toward you.**
- **The reticle image is not visible through the side port. When the image is to be inprinted on a photograph or on a TV camera, mount a photomicrographic attachment or a TV camera to the trinocular eyepiece tube.**
- **Reticle patterns may not be clearly visible on a dark background as in the case of darkfield microscopy.**
- **Do not touch the glass parts of the slider. Do not apply excessive force to them either.**
- **Remove dirt or dust on the glass parts with a blower or a soft brush.**

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14. Optical System

- Use CF objectives always in combination with CF eyepieces.
- Each of Nikon's 50× or higer magnification objectives (except ELWD) is equipped with a safety mechanism. However, the top lens of such an objective projects slightly beyond the metal rim around the lens. Carefully rotate the revolving nosepiece so as not to hit high magnification objectives against the specimen or the stage.
- CF PL projection lenses are designed only for use in photomicrography. Do not use them as eyepieces.
- Eyepieces tend to collect dirt or dust. Both may appear as shadows or impair image contrast or resolution. Keep eyepieces always clean.
- Always keep the sliders inserted in the polarizer, analyzer and reticle ports to avoid dusts and dirts entering inside the microscope, impairing inner optical system.

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VI PHOTOMICROGRAPHY

Use Nikon's photomicrographic attachment MICROFLEX-FX Series for this EPIPHOT 200 inverted microscope.

1. Combining CF Objectives with CF PL Projection Lenses

Use CF objectives always in combination with CF PL projection lenses.
To obtain identical total magnification, combine a high magnification CF objective with a low magnification CF PL projection lens for higher resolution and enhanced contrast.

2. Selecting Lamp Voltages and Filters

The color temperatures of a light source vary with lamp voltages. The results of color photomicrography depend considerably on how to select appropriate lamp voltages and filters.

(1) Performing daylight-type photomicrography

Set the lamp intensity control dial at 9V, and insert the NCB11 ※ filter into the optical path. Adjust the brightness with ND filters.

※ *The NCB11 filter is designed to compensate the color temperature to suit the standard color film. Since each film has slightly different color development, use color compensation filters (CC filters) whenever appropriate in combination with the NCB11 filter.*

(2) Performing monochrome photomicrography

Remove the NCB11 filter from the optical path.
Adjust the contrast with the GIF and other similar filters.

3. Exposure Time

Desirable exposure time is between a fouth and a fifteenth of a second(1/4 ~ 1/15 sec.). When performing color photomicrography, adjust the brightness with ND filters. Do not change the lamp voltage to adjust the brightness.

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4. Adjusting the Field and Aperture Diaphragms

Stop down the field diaphragm until the diaphragm image is slightly larger than the diagonal dimensions of the film format. Stopping down the field diaphragm restricts excessive light which causes flare generation. Stop down the aperture diaphragm to 70 ~ 80% of the numerical aperture of the objective in the optical path. Stopping down this diaphragm increases depth of focus and enhances contrast, but reduces resolution.

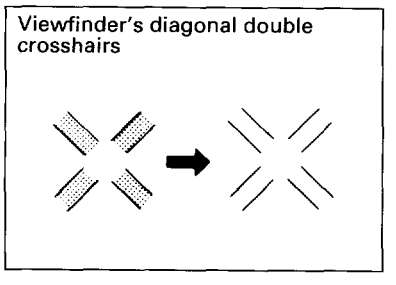
5. Focusing

When mounting a photomicrographic attachment to the side port, perform focusing always through the viewfinder of the photomicrographic attachment. When the photomicrographic attachment is used in combination with a trinocular eyepiece tube and eyepieces with a built-in photomask, focusing through the eyepieces may be impossible depending on the type of the trinocular eyepiece tube to be used. (See the table below.)

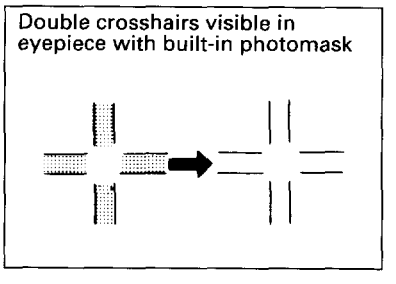
Trinocular eyepiece tube T2 for OPTIPHOT-2 Trinocular eyepiece tube UW2 for OPTIPHOT-2 Tilting tinocular eyepiece tube (UW) for OPTIPHOT-2	Focus through eyepieces or through viewfinder of photomicrographic attachment
Trinocular eyepiece tube F2 for OPTIPHOT-2	Focus through viewfinder of photomicrographic attachment

① Compensate for Diopter Difference

- When using the viewfinder, rotate its diopter correction ring to focus on the viewfinder's diagonal double crosshairs so that the lines can be seen clearly apart.



- When focusing through the eyepieces, insert an eyepiece with a built-in photomask into one of the eyepiece sleeves for your 'focus eye', that is, the right or left eye with which focus adjustment is made. Rotate the diopter correction ring of that eyepiece to focus on the double crosshairs. Then, rotate the coarse focus and fine focus knobs to focus the specimen image on the crosshairs already in focus.



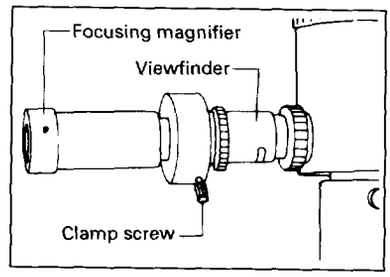
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② According to the magnifications of the objectives in use, perform focusing as described below.

- High magnification objectives (50× or higher)
  Rotate the diopter correction ring to focus on the (diagonal) double crosshairs. Then, slowly rotate the fine focus knob of the microscope until both the crosshairs and specimen image come into focus together.

- Intermediate magnification objectives (10× or 20×)
  Focus on the double crosshairs and the specimen image in the same manner as fousing with a high magnification objective. Then, turn your face slightly to right and left to see the relative positions of the crosshairs and the specimen image from different angles (utilization of parallax). Rotate the fine focus knob until their relative position becomes stable.

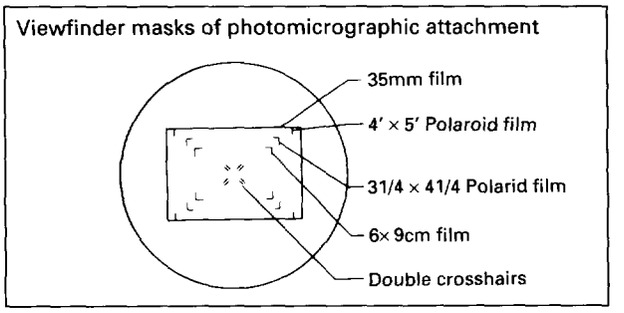
- Low magnification objectives (5× or below)
  Attach a focusing magnifier to the viewfinder (or to an eyepiece with a built-in photomask). Observe the (diagonal) double crosshairs through the magnifier. Move the magnifier back or forth to bring the double crosshairs into focus. Then, rotate the fine focus knob until both the crosshairs and specimen image come into focus together.



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6. Composing the Frame

Rotate the stage movement knobs to locate the specimen within one of the four viewfinder masks which corresponds to your film format.



Note

Use the viewfinder mask of the photomicrographic attachment to compose the precise frame even when performing focusing through the eyepieces.

7. Dealing with Vibration

Install the microscope on a robustly built, vibration-resistant desk or on a vibration-resistant mount.

8. Others

Refer to the instruction manual of your photomicrographic attachment on its operation.

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VII TROUBLESHOOTING TABLE

Inappropriate use of the microscope may render its functions ineffective. Should any of the following symptoms arise, recheck the use, referring to the tables below.

1. Optical

Symptoms	Causes	Actions to take
Viewfield vignetting, unevenly bright viewfield or viewfield not visible.	• 12V-50W lamp not correctly centered.	Center it correctly (P. 14)
	• Optical path changeover lever in intermediate position.	Move it to the limit. (P. 36)
	• Revolving nosepiece not in click stop position (Objective not in optical path).	Rotate it to click stop. (Put it in optical path.)
	• Polarizer or first order red compensator in intermediate position (not in click stop position).	Move the polarizer or first order red compen-sator to the correct position. (P. 33)
	• Anti-glare ND8 filter or analyzer in intermediate position.	Move to the limit (p. 30. 34)
	• Micrometer reticle or grain reticle in intermediate position.	Move to the correct position. (P. 40. 41)
	• Field diaphragm stopped down more than necessary.	Open it properly. (P. 20)
	• Dirt or dust on lenses (objectives or eyepieces) or on specimen.	Clean them.
	• Revolving nosepiece not correctly mounted.	Remount it correctly (P. 4)
	• Mirror block in intermediate position.	Remount it correctly (P. 6)
	• Filters or lamp not correctly mounted.	Remount filters or lamp correctly.(P.3, 22)
Dirt or dust visible in viewfield.	• Dirt or dust on lenses (objectives or eyepieces) or on specimen.	Clean them.
	• Dirt or dust on micrometer reticle or grain reticle.	Clean them.
	• Dirt or dust on specimen.	Clean it.
Image not sharply visible (poor contrast, or low resolution).	• Dirt or dust on lenses (objectives or eyepieces) or on specimen.	Clean them.
	• Incorrect illumination.	Use illumination correctly.
	• Dirt or dust on lens right beneath the bottom of intermediate eyepiece tube or on upper part of intermediate eyepiece tube.	Clean them.
	• Dirt or dust on entrance lens of eyepiece tube.	Clean it.
Image quality deteriorated.	• Aperture diaphragm stopped down more than necessary.	Open it properly. (P. 31)

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Symptoms	Causes	Actions
Partially focused image.	• Specimen surface to be observed not totally attached to stage surface.	Fix specimen so that its surface totally attaches the stage surface.
	• Stage ring not correctly fitted to stage surface.	Refit it to stage correctly.
	• Stage not correctly mounted.	Remount it correctly. (P. 4)
	• Revolving nosepiece not in click stop position.	Rotate it to click stop.
	• Revolving nosepiece incorrectly mounted. Nosepiece clamp not tight.	Remount nosepiece to the limit and clamp it firmly. (P. 4)
	• Objectives not correcly mounted.	Screw them in to the limit.
Image shifts during focusing.	• Revolving nosepiece not correctly mounted. Nosepiece clamp not tight.	Remount the nosepiece to the limit and clamp it. (P. 4)
	• Objectives not correctly mounted.	Screw them in to the limit.
	• Optical path changeover lever in intermediate position.	Move it to the limit. (P. 36)
Yellowish image.	• NCB11 filter not used.	Use NCB11 filter. (P. 21)
	• Lamp voltage too low.	Rotate light intensity control dial to raise voltage.
Viewfield too bright.	• ND filters not used.	Use ND filters. (P. 22)
	• Lamp voltage too high.	Rotate light intensity control dial to reduce voltage.
Inadequete brightness.	• Lamp voltage too low.	Rotate light intesity control dial to raise voltage.
	• Aperture diaphragm stopped down more than necessary.	Open it properly. (P. 22)
	• Optical changeover lever on trinocular eyepiece the tube not operated to provide 100% light output for eyepieces.	Operate the lever to provide eyepieces with 100% light output.
	• Optical changeover lever on microscope base operated to provide light output for side port.	Push in the lever to provide eyepieces with 100% light output. (P. 36)

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2. Operational

Symptoms	Causes	Actions
High magnification objectives touch specimen when switched from low magnification objectives.	• Eyepiece diopter not correctly adjusted.	Adjust eyepiece diopter correctly. (P. 11)
Parfocality decreases when switched to other objectives.	• Eyepiece diopter not correctly adjusted.	Adjust eyepiece diopter correctly. (P. 11)
Image movement not smooth when specimen is moved.	• Top of objective in contact with stage ring.	Change specimen and stage position.
Binocular images not coincidnet.	• Interpulillary distance not correctly adjusted.	Adjust it correctly. (P. 13)
Excessive eye fatigue during observation.	• Diopter difference not correctly adjusted.	Adjust it correctly. (P. 11)
	• Brightness not optimal.	Use ND filters or change lamp voltage.

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3. Electrical

Symptoms	Causes	Actions
Lamp does not light though power switch is turned on.	• No electricity.	Connect power cable to AC IN line receptacle.
	• Lamphouse cable not connected to power supply unit.	Connect it to the power supply unit. (P. 6)
	• Lamp not mounted.	Mount one. (P. 3)
	• Lamp blown.	Replace the lamp. (P. 3)
Lamp blows easily.	• Specified lamp not used.	Use specifield lamp. (See 'Electrical Specifications' on page 54).
Insufficient brightness.	• Specified lamp not used.	Use specified lamp. (See 'Electrical Specifications' on page 54).
Lamp intensity control dial on microscope base doesn't function.	• Lamp intensity control dial on power supply unit not rotated to "CTRL".	Rotate dial to "CTRL". (P. 11)
	• Ex-control cable not connected to power supply unit.	Connect it. (P. 6)
Lamp flickering or unstable lamp intensity.	• Lamp is about to blow.	Replace lamp. (P. 3)
	• Cables not firmly plugged into connectors.	Plug them firmly into connectors.
	• Lamp not inserted into socket firmly.	Insert lamp into socket to the limit. (P. 3)

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4. Photomicrographic

Symptoms	Causes	Actions
Image not sharp.	• Inappropriate focusing.	• Look into viewfinder and rotate diopter correction ring to focus on double crosshairs. Turn your face slightly to right and left to see relative positions of crosshairs and specimen image from different angles (utilization of parallax). Rotate fine focus knob until the relative position becomes stable. • Use focusing magnifier for low magnification objective. (P. 44, 45)
	• Focus shifts especially when using high magnification objective for long exposure time.	• Install microscope on vibration-resistant mount or robustly-built desk to eliminate external vibration. • Operate microscope in a place free from vibration, such as caused by other persons.
	• Influence of instantaneus vibration.	• Use ND and other similar filters to extend exposure time (between 1/4 and 1/15 second for color film). • Reduce lamp voltage to extend exposure time for monochrome film. Note that film's spectral characteristics slightly vary with reduced color temperatures.
	• Cover glass attached to specimen.	• Do not use cover glass.
Image blurs.	• Grease, dust, dirt or finger-prints on optical system.	• Clean top of objective, uppermost part of eyepiece, specimen, projection lens or the like. Pay uninterrupted attention to cleaning and custody of optical system. When not in use, put cover on microscope.
Photo taken uneven.	• Adjustment of illumination system incomplete. Photomicrography is more affected by incomplete illumination system than microscopic observation is.	• Readjust it correctly. (P. 14~16) • Immediately replace old, blackend lamp. (P. 3, 4)
Contrast not sufficient.	• Aperture diaphragm opened too wide.	• Stop down diaphragm to 70 ~ 80% of objective's numerical aperture to obtain good photomicrographic results. (P. 31)
	• Use of filters inappropriate.	• Use GIF filter to enhance contrast on monochrome film.
	• Use of field diaphragm inappropriate.	• Stop down diaphragm slightly larger than diagonal dimensions of film format. (P. 44)
	• Specimen with little or no contrast.	• Change over to darkfield or differential interference contrast microscopy to optically give contrast to specimen. (P. 23, 24) • Use fine particle, high contrast B&W film (such as Mini Copy Film) for the specimen with little contrast. • Use high latitude, fine particle film (such as Neopan F) for normal specimens.

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Symptoms	Causes	Actions
Insufficient resolution.	• Numerical aperture too low.	• Use objective with high numerical aperture. • To obtain identical total magnification, use of higher magnification objective gives higher resolution and contrast to the image.
	• Photo enlarged excessively.	• Upper limit of effective total magnification is between 500 and 1000 times of objective's numerical aperture. Photograph blurs if taken beyond this range.
Ghost or flare.	• Light enters through viewfinder from outside.	• Darken surrounding environment or cover viewfinder with cap.
	• Stray light enters.	• Do not expose microscope or specimen to hazardous, strong light such as direct sunlight.
Unable to perform good color photo-micrography.	• Use of filters inappropriate.	• Use NCB11 filter. (P. 21)
	• Inappropriate film used (its emulsion also in-appropriate).	• Spectral sensitivity of daylight-type film differs considerably from type to type or from manufacturer to manufacturer. • Varieties of film of identical brand often exhibit different color development due to difference in emulsion used. Note emulsion number of each film for such difference.
	• Light source voltage not as specified.	• Perform photomicrography at specified voltage. (P. 43)
	• Inadequate exposure time (failure in film reciprocy).	• Color development is adversely affected by inadequate exposure time as it causes failure in film reciprocy. Use an exposure time display meter and ND filters to adjust exposure time which suits film characteristics. Or use color compensation filters to compensate for film reciprocy failure. (Refer to Data Sheet on the film.)
	• Influence of developing process.	• It is a good idea to consult with developing house about film characteristics when preparing color prints.

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VIII CARE AND MAINTENANCE

1. Lens Cleaning

- Use a soft brush to brush off dust on the lens surface, or use a piece of gauze to wipe it off.
- Use absolute alcohol only when removing fingerprints or greasy or oily dirt on the lens surface. Slightly moist a soft, clean cotton cloth, lens tissue or a piece of gauze with absolute alcohol (such as ethyl or methyl alcohol) to remove fingerprints or such sticky dirt.
- Use petroleum benzine alone to clean immersion oil on the lens surface.
- Do not use petroleum benzine to clean the eyepiece tube entrance lens.

※ Absolute alcohol and petroleum benzine are highly inflammable. Never use them near naked fire. Pay enough attention to their handling particularly when turning on or off the power switch of the power supply unit of the microscope.

2. Cleaning Painted Surfaces or Parts

- Do not use organic solvents (such as alcohol, ether, thinner and the like) to clean the painted surfaces, plastic or printed parts of the microscope. It is a very good idea to use a silicon cloth to clean these surfaces or parts.

3. Storage

- Store the microscope in a dry place where mold will not be formed easily.
- Keep the objectives and eyepieces in a container (such as a desiccator) with a desiccant in it.
- Put a vinyl cover on the microscope to prevent dust.

4. Periodic Inspection

- It is a very good idea to periodically check up the microscope to best maintain its performance. Consult with your Nikon representative about it.

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ELECTRICAL SPECIFICATIONS

■ EPIPHOT 200

Input ratings	12V DC, 8.5A	
Rated current	3A	
Halogen lamp	•12V-100W Halogen light source	
	Lamp rating:	12V-100W LONGLLIFE
	Lamp type:	OSRAM HLX64623 or PHILIPS 7724
	Lamphouse adapter:	12V-100W lamphouse adapter for X100S
	Lamphouse:	12V-100W lamphouse 2 with precentered socket
	•12V-50W Halogen light source	
	Lamp rating:	12V-50W
	Lamp type:	OSRAM HLX64610 or PHILIPS 7027
	Lamphouse adapter:	12V-50W lamphouse adapter for U-epi 10
	Lamphouse:	12-50W lamphouse for U-epi 10
Operating environment	Ambient temperature:	0°C to 40°C
	Relative humidity:	85% max.

■ PSM-1120 (Power Supply Unit for 100-120V Input Voltage)

Input ratings	100–120V ~, 3A, 50/60Hz
Output ratings	12V DC, 100W
Protection class	Class I
Conforming standards	This product conforms to UL1262.
Power supply cord instruction	Use only the following cord set. UL Listed, detachable cord set. 3-conductor grounding type SVT, No. 18 AWG rated a minimum 125V, 7A.

■ PSM-2120 (Power Supply Unit for 220-240V Input Voltage)

Input ratings	220-240V~, 2A, 50/60Hz
Output ratings	12V DC, 100W
Protection class	Class I
Conforming standards	This product conforms to EN60950 and DIN VDE 0411.
Power supply cord instruction	Use only approved 3-pole power supply cord type H05VV-F or H0VVH2-F, min. 0.75mm² Class I equipment should be connected to PE (protective earth) terminal. In case of using the extension cord, use only the power supply cord included PE wire.

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