



Nikon

Universal Design Microscope UDM

ECLIPSE LV100D-U

Instructions

Thank you for purchasing the Nikon product.



This instruction manual is written for the users of the Nikon Universal Design Microscope UDM ECLIPSE LV100D-U.

To ensure correct usage, read this manual carefully before operating the product.


- It is prohibited to reproduce or transmit this manual in part or whole without Nikon's expressed permission.
- The contents of this manual are subject to change without notice.
- Although every effort has been made to ensure the accuracy of this manual, if you note any points that are unclear or incorrect, contact your nearest Nikon representative.
- Some of the products described in this manual may not be included in the set you have purchased.
- Also be sure to read the manuals for any other products that you are using with this system.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING and CAUTION Symbols Used in This Manual

Although this product is designed and manufactured to be completely safe during use, incorrect usage or failure to follow the safety instructions provided may cause personal injury or property damage. To ensure correct usage, read this manual carefully before using the product. Do not discard this manual and keep it handy for easy reference. Safety instructions in this manual are marked with the following symbols to highlight their importance. For your safety, always follow the instructions marked with these symbols.

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

Meaning of Symbols Used on the Product

Symbol	Meaning
	Caution for heat This marking on the back of the lamp house and near the lamp house clamp screw of the "LV-UEPI 2 Motorized Universal Epi Illuminator 2A" calls your attention on the following: You can see the positions of this symbol on Page 9 and 12. <ul style="list-style-type: none">• The lamp house become extremely hot while the lamp is on and immediately after it is turned off.• Do not touch the lamp house during and immediately after lighting to prevent the risk of burns.• Make sure that the lamp house is sufficiently cool before the lamp replacement.



WARNING

1. Intended product use

The product should only be used for microscopic observation. Do not use this microscope for other purpose. In addition, do not try to put a large specimen on the stage if the specimen is larger than the stage.

2. Do not disassemble

Disassembling the microscope or the microscope system may result in electric shock or malfunctions. Damage or injury that may occur due to mishandling is unwarranted. Never attempt to disassemble any part other than the parts described in this manual. If you experience problems with the microscope or the microscope system, contact your nearest Nikon representative.

3. Read the instructions carefully

To ensure safety, carefully read this manual and the manuals for other equipment used with this microscope. In particular, observe all warnings and cautions given at the beginning of each manual.

To use an external light source

When an external light source, such as a mercury lamp or a xenon lamp, is used, you must take great care of the lamp. Read the instruction manual for the light source and follow the instructions and cautions for it.

4. Ratings of the power supply

The power supply circuit in this product is designed for AC power of 100 to 240 VAC and 50/60 Hz. Before connecting the power cord, check that the power supply to be used conforms to the voltage and frequency described above. Use of a non-conforming power line may result in equipment malfunction, failure, or fire.

5. Power cord

Be sure to use the specified power cord for the product. Using a wrong power cord may result in malfunctions or fire. The product is classified as subject to Class I protection against electrical shock. Make sure it is connected to an appropriate ground terminal (protective earth terminal). To prevent electrical shock, always turn off the power switch (press it to the “○” position) for the product before attaching or detaching the power cord. For specifications of the power cord, refer to “VII. Specifications.”

6. Specified light source

Use this product with a specified light source. The specified light source devices are as follows:

- Illuminator (for the epi-illumination):
Nikon LV-UEPI2 Universal Epi Illuminator 2 (model name: LV-UEPI2)
- Lamp house (for the epi-illumination and the dia-illumination)
Nikon LV-LH50PC Precentered Lamp House 12V 50W (model name: LV-LH50PC)
- Lamp
Nikon LV-HL50W 12V 50W LONGLIFE halogen lamp (model name: LV-HL50W), or non-Nikon 12V 50W SHORTLIFE halogen lamp (model name: OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027).

If you wish to buy these lamps, please contact your nearest Nikon representative.



WARNING

7. To use an external light source

To perform an w-fl microscopy with the LV-UEPI2A epi illuminator, the brightness of the specified light source may be less than the desired brightness. In this case, the light source described below can be used for the LV-UEPI2A epi illuminator.

- Light source

Nikon Intensilight C-HGFI HG Precentered Illuminator (model name: C-HGFI, manual operation type),

Nikon Intensilight C-HGFIE HG Precentered Illuminator (model name: C-HGFIE, electric operation type),

X-Cite 120 (manual operation type) made by EXFO Electro Optical Engineering Inc., or

X-Cite 120 PC (electric operation type) made by EXFO Electro Optical Engineering Inc.

Note that if the light source described above is used with this product, the product is not approved as a UL listed product.

8. Heat from the light source

The lamp and the lamp house become extremely hot. To avoid burns, do not touch the lamp house while the lamp is lit or for thirty minutes after it is turned off. Furthermore, to avoid the risk of fire, do not place fabric, paper, or highly flammable volatile materials (such as gasoline, petroleum benzine, paint thinner, or alcohol) near the lamp house while the lamp is lit or for about thirty minutes after it is turned off.

9. Air vents

Do not block the air vents on the product and the lamp house. If the air vents are blocked, the temperature inside the product will rise. And it results in damage or fire.

10. Ultraviolet light from an external light source

If you use an external light source other than the specified ones and that has a mercury lamp, a xenon lamp, or so on, the light source radiates ultraviolet light, which is harmful to the eyes and skin, from the emission port. Direct viewing of light from these lamps may result in snow blindness at a light case or blindness at the worst case. To prevent injury, follow the guidelines below:

1) Place a UVC collector lens into the optical path of the microscope unless the UV excitation light is necessary.

On the LV-UEPI2 epi illuminator, an UV filter automatically enters the optical path when the microscopy selector knob is turned to the bright-field microscopy or the dark-field microscopy. The UV filter is removed from the optical path when the microscopy method is turned to the epi-fl microscopy 1 method (FL1) or the epi-fl microscopy 2 method (FL2).

2) When performing the epi-fl microscopy by using the UV excitation light, attach the filter cube dedicated to the UV excitation light. If you must see the objective or its surroundings, be sure to see through the ultraviolet light shield.

3) Use the light source with the microscope.

The light source device is required to be connected to the microscope whenever the light source device is energized. Do not turn on the light source if it is not connected to the microscope, and do not disconnect the light source from the microscope while the light source is lit.

When disconnecting the light source from the microscope, turn off the power to the light source, and then unplug the power cord from the wall outlet.

11. Reflection

Lustrous specimens reflect the illumination. Do not observe the illuminated surface of a specimen for a long time because the strong reflection may hurt your eyes. Make sure to see the specimen through the ultraviolet light shield.



CAUTION

1. Handle with care

This product is a precision optical instrument. Handle the microscope system with care to avoid shock on impact.

In particular, objectives may lose accuracy when exposed to even a weak physical shock.

2. Do not wet the microscope

If the product gets wet, a short circuit may cause malfunction or abnormal heating of the microscope. If you accidentally spill water on the microscope, immediately turn off the power switch (flip it to the “O” side) and unplug the power cord from the wall outlet. Then, wipe off the water with a piece of dry cloth. If water enters a component, immediately suspend use of this product, disconnect the power cord from the outlet, and contact your nearest Nikon representative.

3. Weak electromagnetic waves

The product emits weak electromagnetic waves. The accuracy of any precision electronic equipment may be adversely affected if positioned too close. To prevent bad influences, locate such electronic equipment away from the microscope system. If a TV or radio reception is affected, move the TV or radio set farther from the product.

4. Installation location

This microscope is a precision optical instrument. So, the usage or storage in an inappropriate environment may result in malfunctions or poor performance.

Consider the following factors when selecting an installation location:

- Avoid a brightly lit location, such as exposed to direct sunlight or directly under a room light. If there is excessive ambient light, the image quality deteriorates.
- Always install the product with a surrounding clear area of 10 cm or more.
- Install the product in a location that is free from considerable dust or dirt.
- Install the product on a flat surface with little vibration.
- Install the product on a sturdy desk or table for the base of the microscope system.
- Do not install the product in a hot and humid location.
- Select a layout that allows easy removal of the power cord from the product's AC inlet in the event of an emergency.
- For details about the operating environment and storage environment, see “VII. Specifications.”

5. Cautions on moving the microscope

- This product is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may lose accuracy when exposed to even a weak physical shock.)
- When moving the product, first remove the stage and the lamp house. Then, securely hold the product by the root of the arm from the back.
(Information) Microscope main body, stage, eyepiece tube, lamp house, and other parts attached, weighs approximate. 20 kg.
- Do not hold the focus knobs, eyepiece tube, lamp house, sub-stage, or so on, when carrying the microscope. They may come off and may cause serious injury or malfunction.
- Before carrying the stage, attach fixing metals for transportation to fix the stage plate.
- Be careful not to pinch your hands or fingers during transportation.

6. Cautions on assembling the microscope

- Be careful not to pinch your fingers or hands during assembly.
- Scratches or fingerprints on the lenses will adversely affect the image. Be careful not to scratch or touch the lens surfaces.



CAUTION

7. Cautions when replacing lamps

- To prevent burn injuries, wait at least 30 minutes after the lamp is turned off to give it sufficient time to cool down when replacing lamps.
- To prevent electrical shock and damage to the microscope, always turn off the power switch (flip it to the “O” side) and unplug the power cord from the outlet before attaching or detaching the lamp house.
- Never touch the glass surface of the lamp with bare hands. Doing so will cause fingerprints, grease, etc. to burn onto the lamp surface, reducing the illumination. If you do get any fingerprints or dirt on the lamp, wipe them clean.
- Make sure the lamp house cover is securely fitted to the lamp house after replacing lamps. Never turn on the lamp with the lamp house cover removed.
- When you dispose of the replaced lamp, do not break it up. Instead, dispose of the used lamp as special industrial waste or dispose of it according to the local regulations and rules.

8. Notes on handling a filter cube

When using the product configured with the illuminator LV-UEPI2, a filter cube can be attached to enable epi-fl microscopy. Note the following precautions for handling a filter cube.

- Interference filters (especially excitation light filters, which are exposed to strong light) deteriorate over time. Replace them depending on their total operating hours.
- Filter characteristics may alter if the filter is exposed to high humidity. To prevent changes or degradation of filter characteristics, avoid using or storing the filters under conditions of high humidity or high temperature and avoid subjecting the filters to rapid temperature changes. When a filter is not in use, store it in a desiccator or hermetically sealed container with a drying agent.
- The filters attached in the nine types of filter cubes listed below have sharper wavelength characteristics than standard filters. However, due to their sophisticated coatings, they must be handled with special care. In particular, take care to avoid abrasion from cleaning. Observe the procedures described in “1. Cleaning Lenses and Filters” of “VI. Care and Maintenance.”

Single band filter cubes: DAPI, FITC, TxRed, GFP

Multi band filter cubes: F-R, F-T, D-F, D-F-R, D-F-T

9. Cable routing

Make sure the cables are routed properly. Do not bring the cables into contact with the lamp house for the diasopic illumination.

If a cable comes into contact with the lamp house, the cable sheath may melt and it results in an electrical shock or fire.

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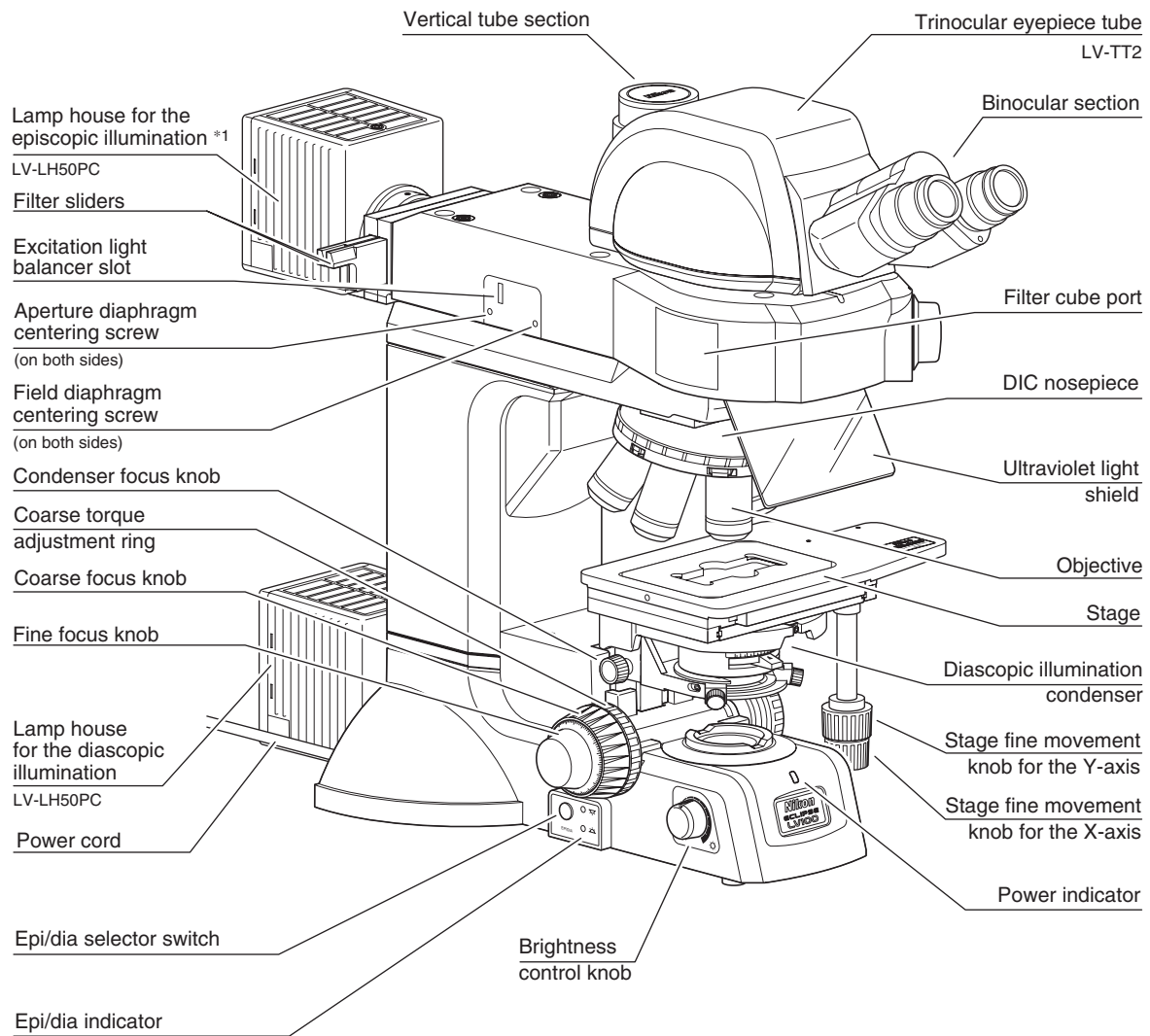
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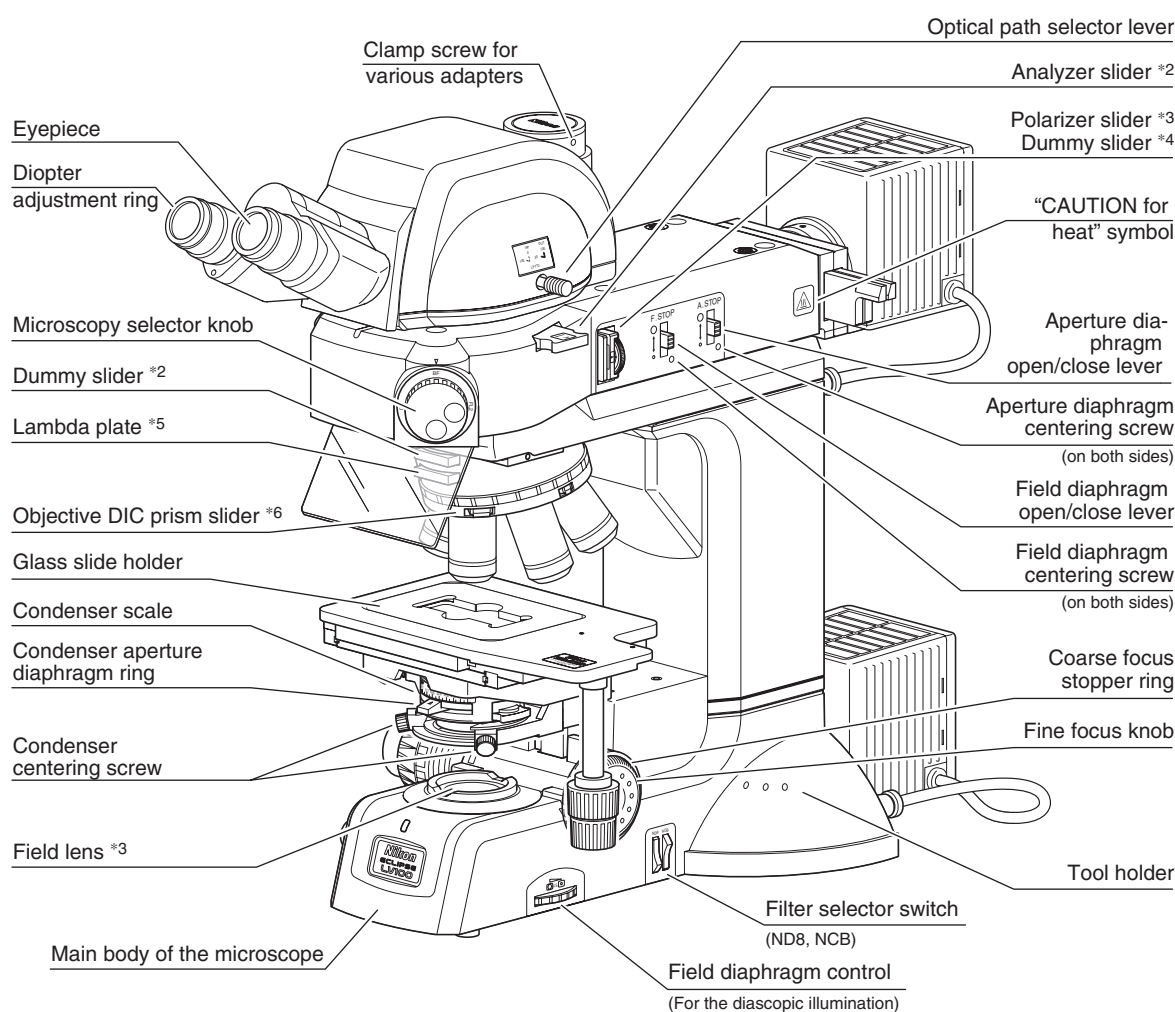
1 Configuration of the Product and Control Names

► Front left side of the microscope

This drawing depicts the ECLIPSE LV100D-U microscope configured with the LV-UEPI2 epi illuminator, the LV-TT2 eyepiece tube, the D-ND6 motorized nosepiece, the 3x2 stage, the glass slide holder, the diascope illumination condenser (the slide condenser), the lamp house for the episcopic illumination, the lamp house for the diascope illumination, and attachments for the DIC microscopy.



► Front right side of the microscope



*1: To turn on the episcope illumination and the diascope illumination simultaneously, connect the lamp cable of the lamp house for the episcope illumination with the external power device. (See Page 10.) If the brightness of the halogen lamp is less than the desired brightness for the epi-fl microscopy or so on, you can use an external light source that has a mercury lamp. (See Page 10.)

*2: The analyzer is used for the DIC microscopy or the polarization microscopy.

*3: Attach the polarizer slider to a slot of the epi illuminator for the DIC microscopy or the polarization microscopy under the episcope illumination. Attach the polarizer for the diascope illumination to the field lens part for the DIC microscopy or the polarization microscopy under the diascope illumination.

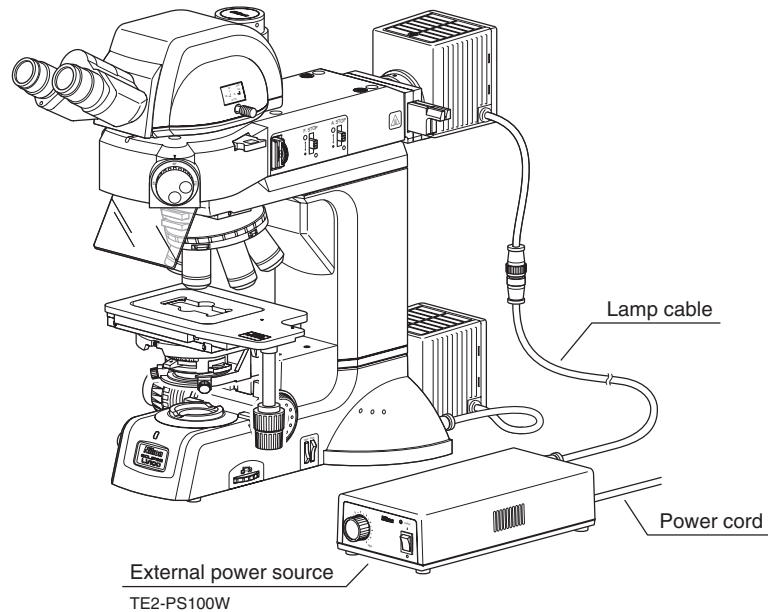
*4: Use the lambda plate slider for the sensitive color DIC microscopy or the sensitive color polarization microscopy under the episcope illumination.

*5: Insert the lambda plate into the nosepiece for the sensitive color DIC microscopy or the sensitive color polarization microscopy under the diascope illumination.

*6: This part is used for the DIC microscopy.

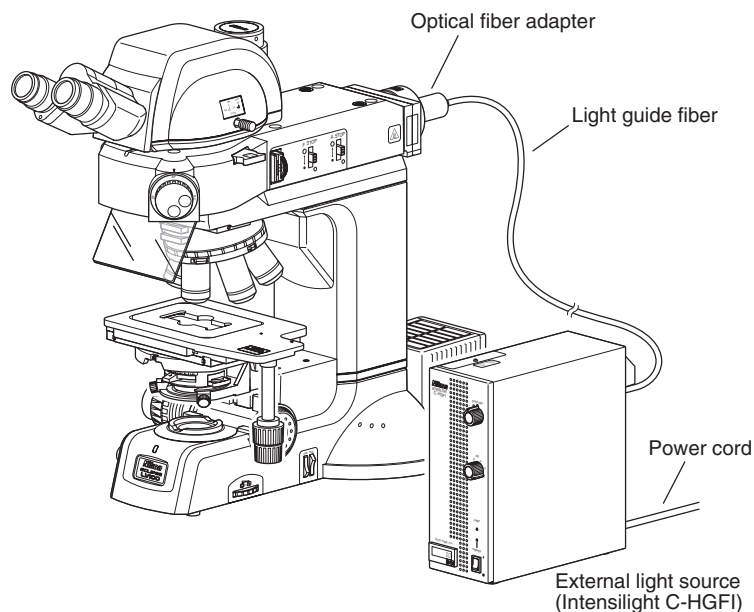
2 Turning on the Epi Illumination and the Dia Illumination Simultaneously

The drawing below depicts the configuration when the epi illumination and the dia illumination are turned on simultaneously. To turn them on simultaneously, connect the lamp house for the epi illumination to the external power source (TE2-PS100W).



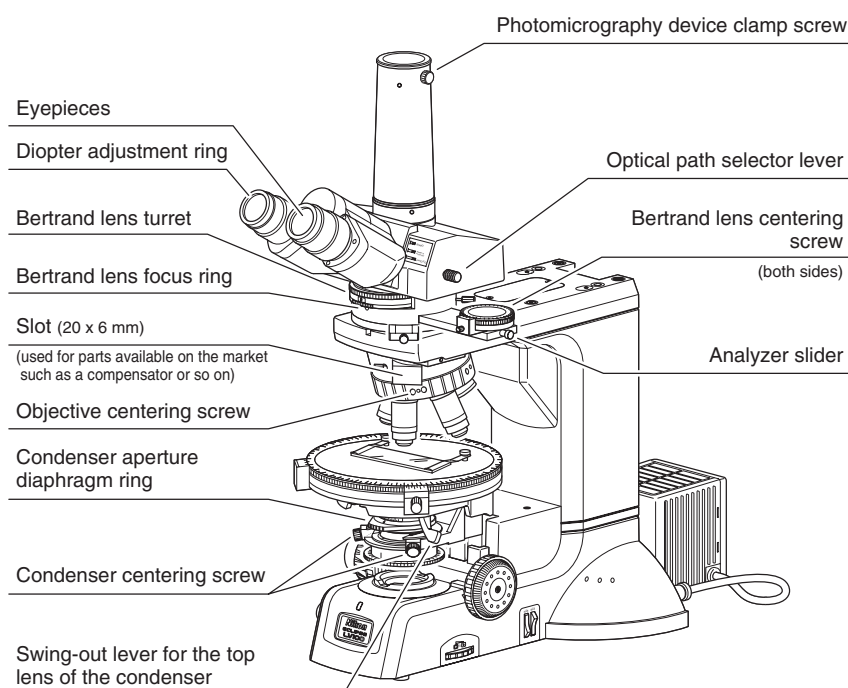
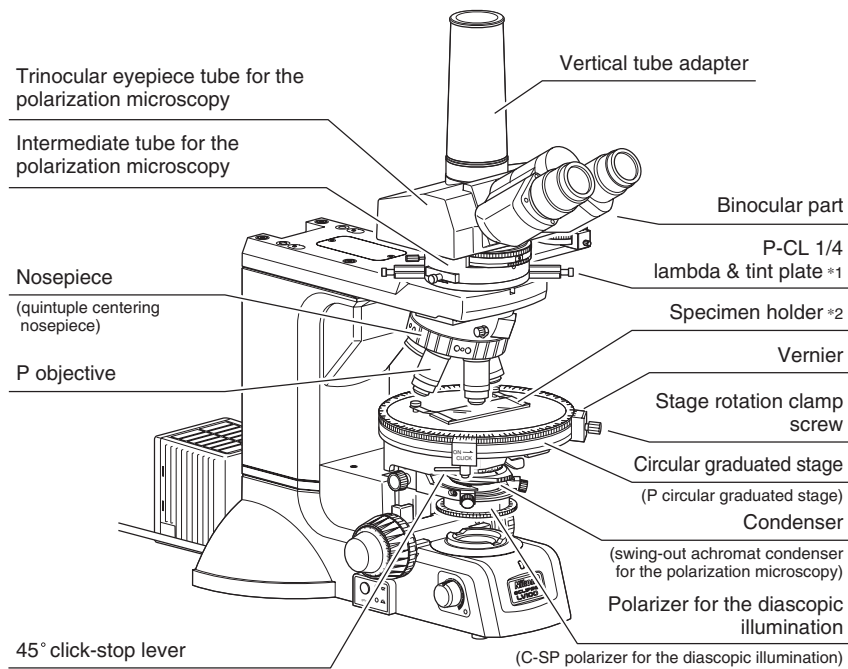
3 Using an External Light Source

The drawing below depicts the LV100D-U microscope with the LV-UEPI2 epi illuminator, the LV-HGFA optical fiber adapter, the light guide fiber, and the external light source (Intensilight C-HGFI). To perform the epi-fl microscopy, this configuration is used.



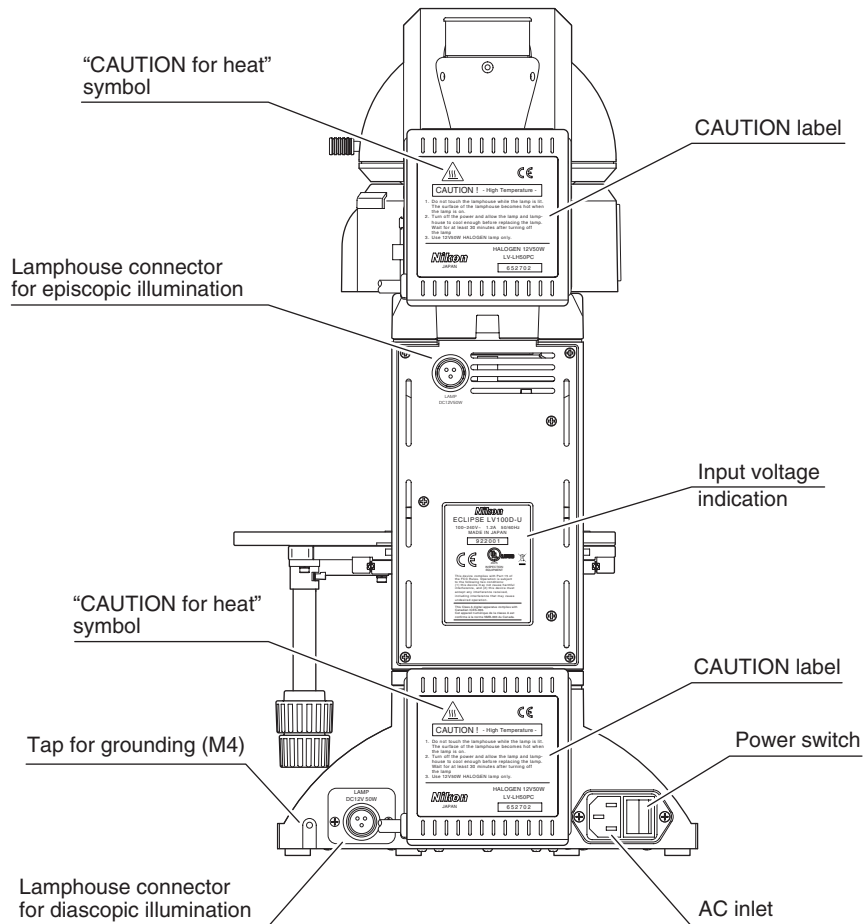
4 Performing the Orthoscopic Microscopy or the Conoscopic Microscopy

The figure below depicts the LV100D-U configured with the intermediate tube for the polarization microscopy, the trinocular eyepiece tube for the polarization microscopy, the centering nosepiece, and the P circular graduated stage. By using these components, the polarization microscopy with high accuracy can be performed, which is suitable for applications such as measurement of the polarization characteristics.



5 Rear View

This drawing depicts the Eclipse LV100D-U microscope configured with the LV-UEPI2 epi illuminator, the LV-TT2 eyepiece tube, the 3x2 stage, the lamp house for the episcopic illumination, and the lamp house for the diascopic illumination





Microscopy Method

This chapter explains the procedure of each microscopy.

See the table below for the microscopies available with the product, as well as the optional accessories required for each microscopy.

- See “IV. Assembly,” when the product has not been assembled yet.
- For detailed information about operations of parts of the product, refer to “III. Operation of Each Part.”

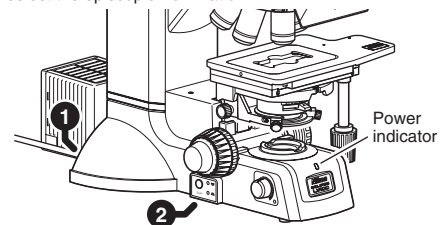
Microscopy	Microscopy Method	Required accessories (optional)
Bright-field microscopy under the episcopic illumination	p.14	–
Dark-field microscopy under the episcopic illumination	p.16	Quintuple BD nosepiece (L-NBD5) and BD objective
Polarization microscopy under the episcopic illumination (simplified/sensitive color)	p.17	Polarizer slider, analyzer slider (or PA block for the simplified polarization microscopy), and lambda plate slider (for the sensitive color microscopy)
Differential interference contrast microscopy under the episcopic illumination	p.19	Polarizer slider (equipped with the 1/4 lambda plate), analyzer slider, lambda plate slider (for the sensitive color microscopy), sextuple DIC nosepiece (D-ND6), DIC prism (LV-DIC A, B/LV-DIHC A, B), and LU objective for industrial microscopes
Epi-fl microscopy	p.21	External light source, filter cube (up to two cubes can be attached), and fluorescence excitation balancer (optional)
Bright-field microscopy under the diascope illumination	p.23	Condenser lens
Polarization microscopy under the diascope illumination (simplified/sensitive color)	p.25	Condenser lens, polarizer for the diascope illumination, analyzer slider, and lambda plate slider (for the sensitive color microscopy)
Dark-field microscopy under the diascope illumination	p.26	LV-CUD Universal Condenser, dark-field annular diaphragm, and objective with a numerical aperture of 0.7 or less
Phase contrast microscopy under the diascope illumination	p.27	LV-CUD Universal Condenser, Ph annular diaphragm (suitable for the objective), and Ph objective
Differential interference contrast microscopy under the diascope illumination	p.29	Universal condenser (LV-CUD), sextuple DIC nosepiece (D-ND6), DIC objective, condenser DIC prism (suitable for the objective), objective DIC prism (suitable for the objective), rotatable polarizer for the diascope illumination (D-DP), analyzer slider, and lambda plate slider (for the sensitive color microscopy)
Orthoscopic microscopy	p.31	Intermediate tube for the polarization microscopy, binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube, P circular graduated stage (LV-SRP), quintuple centering nosepiece (P-N), P objective, swing-out achromat condenser for the polarization microscopy, polarizer for the diascope illumination, and various examination plates
Conoscopic microscopy	p.32	Intermediate tube for the polarization microscopy, binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube, P circular graduated stage (LV-SRP), quintuple centering nosepiece (P-N), P objective, swing-out achromat condenser for the polarization microscopy, and polarizer for the diascope illumination

1 Bright-field Microscopy under the Epi Illumination

1 Turn on the power switch and select the episcopic illumination.

- 1 Turn on the power switch. (See Page 33.)
The power indicator on the microscope base is lit.
- 2 Press the epi/dia selector switch to turn on the epi indicator. (See Page 34.)
The halogen lamp on the episcopic illumination side is lit.

1 Turn on the power switch and select the episcopic illumination.

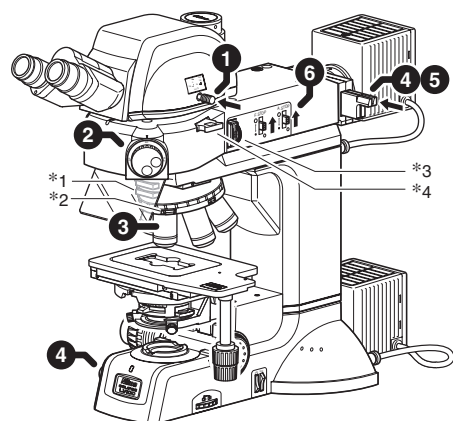


2 Set the microscope for the bright-field microscopy under the epi illumination.

If accessories for DIC microscopy (*1 to *4) are in place, pull them out of the optical path.

- 1 Push in the optical path selector lever and select 100% for the binocular eyepiece. (See Page 40.)
- 2 Rotate the microscopy selector knob to the “BF (bright-field)” position. (See Page 37.)
- 3 Locate the 10x objective into the optical path. (See Page 48.)
- 4 Locate the NCB11 filter into the optical path and compensate color temperature. (See Page 49.)
- 5 Adjust the brightness roughly with the brightness control knob and ND filters. (See Pages 34 and 49.)
- 6 Move up the field diaphragm open/close lever and the aperture diaphragm open/close lever to fully open the field diaphragm and the aperture diaphragm for the episcopic illumination. (See Page 50 and 51.)

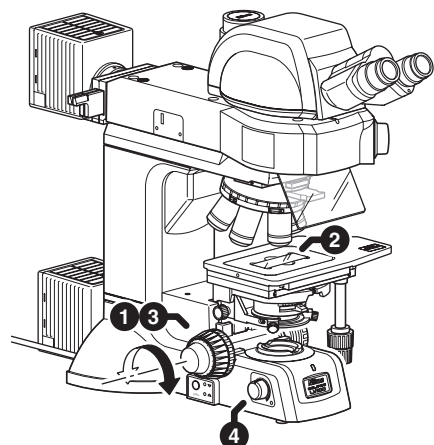
2 Set the microscope for the bright-field microscopy under the epi illumination.



3 Set the specimen onto the stage and adjust the focus and the brightness.

- 1 Lower the stage by turning the coarse/fine focus knobs. (See Page 44.)
- 2 Set the specimen onto the stage.
- 3 Turn the coarse/fine focus knobs and focus on the specimen. (See Page 44.)
- 4 Operate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)

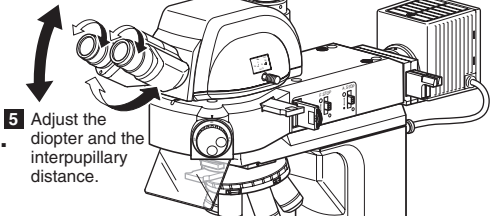
3 Set the specimen onto the stage and adjust the focus and the brightness.



4 Adjust the angle of the binocular eyepiece.
(for the LV-TT2)

(See Page 40.)

4 Adjust the angle of the binocular eyepiece.



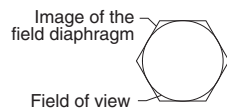
5 Adjust the diopter and the interpupillary distance.

(See Page 42 and 43.)

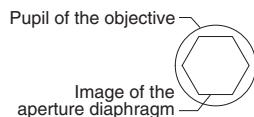
5 Adjust the diopter and the interpupillary distance.

6 Set the desired magnification and observe the specimen.

- 1** Locate the objective of desired magnification into the optical path. (See Page 48.)
- 2** Turn the coarse/fine focus knobs to bring the specimen into focus. (See Page 44.)
- 3** Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 4** Use the field diaphragm open/close lever so that the field diaphragm image circumscribes the field of view. (See Page 50.)

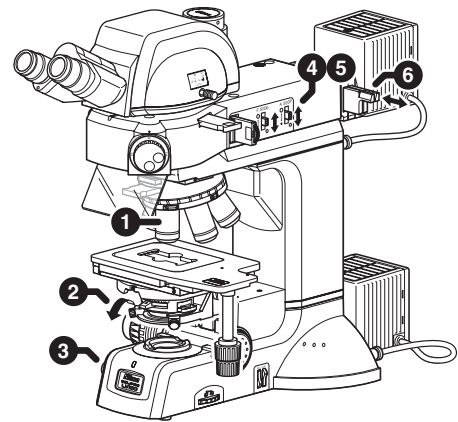


- 5** Use the aperture diaphragm open/close lever so that the aperture diaphragm image is 70 to 80% of the numerical aperture of the objective. (See Page 51.)



- 6** Adjust the brightness with ND filters. (See Page 49.)

6 Change the magnification to observe the specimen.



Helpful tips

It may be difficult to focus on a specimen with small contrast, such on a polished surface. In a case like this, reduce the opening of the field diaphragm so that its image can be seen in the viewfield, and try to focus on the frame of the diaphragm image. When the frame is in focus, the specimen is in focus just as well.

2 Dark-field Microscopy under the Epi Illumination

1 Attach the accessories required for the dark-field microscopy under the episcopic illumination to the microscope.

The devices and accessories required for the dark-field microscopy under the episcopic illumination are as follows:

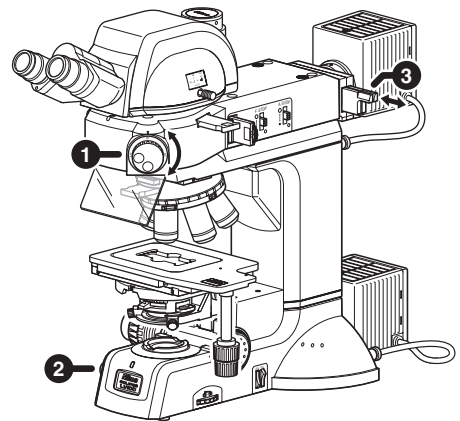
- Nosepiece for the dark-field microscopy (quintuple BD nosepiece) (See Page 85.)
- BD objective (See Page 100.)

2 Focus on the specimen with the bright-field microscopy under the epi illumination.

(See Pages 14 and 15.)

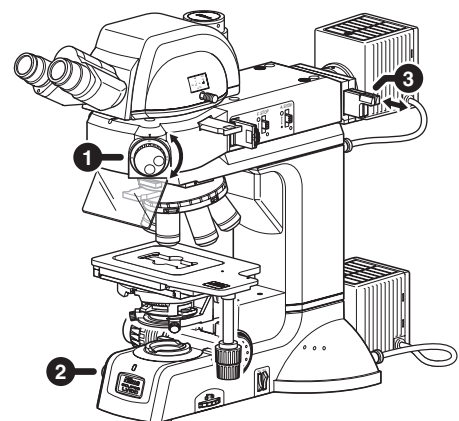
3 Set the microscope for the dark-field microscopy under the epi illumination.

- 1 Rotate the microscopy selector knob to the “DF (dark-field)” position. (See Page 37.)
The aperture diaphragm and the field diaphragm are fully opened. (However, the positions of the open/close levers are not changed.)
- 2 Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 3 Adjust the brightness with ND filters. (See Page 49.)



4 Return to the bright-field microscopy under the epi illumination.

- 1 Rotate the microscopy selector knob to the “BF (bright-field)” position. (See Page 37.)
The aperture diaphragm and the field diaphragm automatically return to the previous positions. (The open/close lever positions do not change.)
- 2 Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 3 Adjust the brightness with ND filters. (See Page 49.)



3 Polarization Microscopy under the Epi Illumination (Simplified/Sensitive Color)

1 Attach the accessories required for the polarization microscopy under the episcopic illumination to the microscope.

The devices and accessories required for the simplified/sensitive color polarization microscopy under the episcopic illumination are as follows:

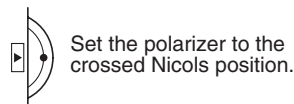
- Polarizer slider (for the episcopic illumination) (See Page 88.)
- Analyzer slider (See Page 88.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 88.)

* If only the simplified polarization microscopy is performed, the PA block (LV-PAB) can be used instead of the analyzer and the polarizer. (See Page 89.)

2 Focus on the specimen with the bright-field microscopy under the epi illumination. (See Pages 14 to 15.)

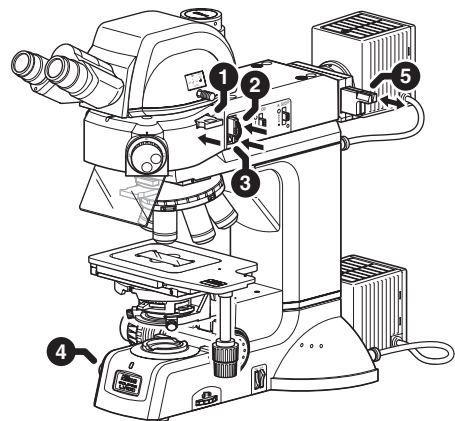
3 Set the microscope for the polarization microscopy under the epi illumination.

- 1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 61.)
- 2 Push in the polarizer slider to locate the polarizer into the optical path, and get the crossed Nicols position by aligning the index. (See Page 57.)



* For the simplified polarization microscopy, a crossed Nicols position can be set by placing the PA block (LV-PAB) into the optical path instead of the analyzer and the polarizer. (See Page 62.) For the sensitive color polarization microscopy, the lambda plate must be placed between the analyzer and the polarizer. The PA block cannot be used for the sensitive color polarization microscopy.

- 3 Push in the lambda plate slider to locate the lambda plate into the optical path. (See Page 63.)
- 4 Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 5 Adjust the brightness with ND filters. (See Page 49.)

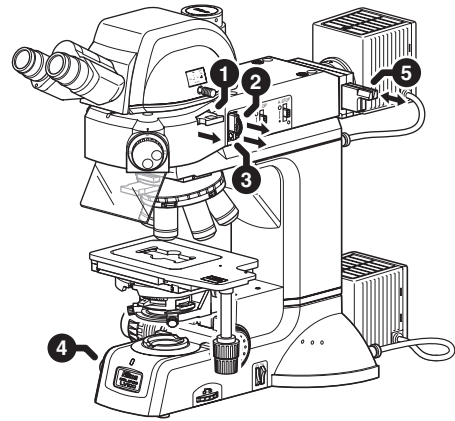


Polarization microscopy under the episcopic illumination

Turn the polarizer rotation ring to adjust the polarization while observing the image.

4**Return to the bright-field microscopy under the epi illumination.**

- 1** Pull out the analyzer slider and move the analyzer away from the optical path.
(See Page 61.)
- 2** Pull out the polarizer slider and move the polarizer away from the optical path.
(See Page 57.)
- 3** Pull out the lambda plate slider to remove the lambda plate from the optical path.
(See Page 63.)
- 4** Rotate the brightness control knob to adjust the brightness of the episcopic illumination.
(See Page 34.)
- 5** Adjust the brightness with ND filters.
(See Page 49.)



4 Differential Interference Contrast Microscopy under the Epi Illumination

1 Attach the accessories required for the differential interference contrast (DIC) microscopy under the episcopic illumination to the microscope.

The devices and accessories required for the DIC microscopy under the episcopic illumination are as follows:

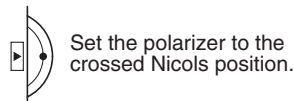
- Sextuple DIC nosepiece (D-ND6) (See Page 85.)
- LU objective for industrial microscopes (See Page 100.)
- Polarizer slider (equipped with the 1/4 lambda plate, for the episcopic illumination) (See Page 88.)
- Analyzer slider (See Page 88.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 88.)
- DIC prism (mounted on the nosepiece) (See Page 86.)

2 Focus on the specimen with the bright-field microscopy under the episcopic illumination.

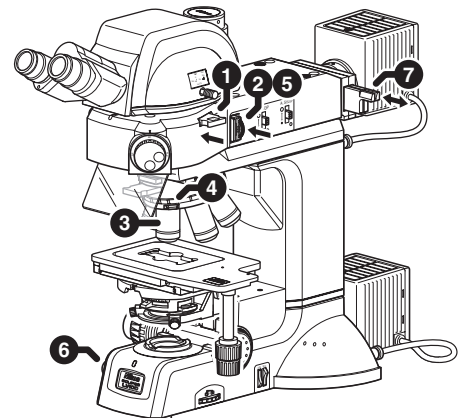
(See Pages 14 and 15.)

3 Set the microscope for the DIC microscopy under the episcopic illumination.

- 1 Push in the analyzer slider to place the analyzer into the optical path. (See Page 61.)
- 2 Push in the polarizer slider to place the polarizer and the 1/4 lambda plate into the optical path, and set the crossed Nicols position by aligning the index. (See Page 57.)

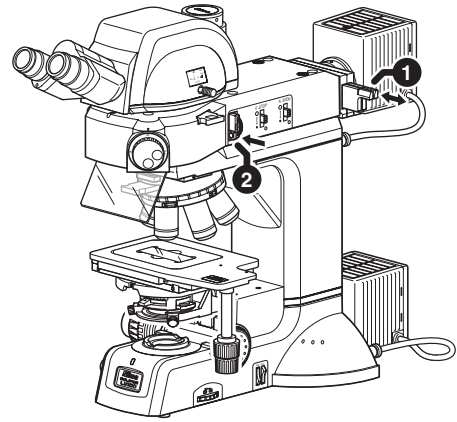


- 3 Rotate the nosepiece to place the objective of a desired magnification into the optical path. (See Page 48.)
- 4 Attach the DIC slider to the slot on the nosepiece to place the DIC prism into the optical path. (See Page 65.)
- 5 Rotate the rotation ring of the polarizer slider to adjust the contrast. (See Page 57.) The polarizer slider is equipped with the 1/4 lambda plate so that the contrast can be adjusted by adjusting the orientation of the polarizer.
- 6 Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 7 Adjust the brightness with ND filters. (See Page 49.)

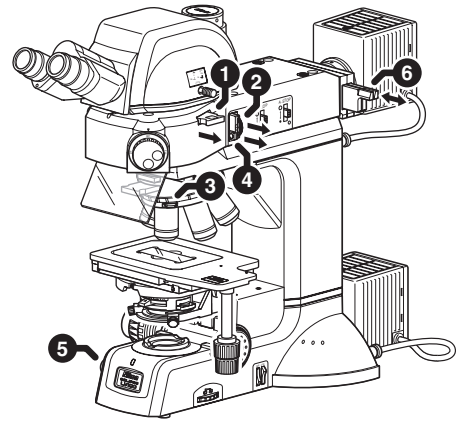


4**If necessary, perform the color contrast microscopy.**

- 1 Place the NCB filter into the optical path. (See Page 49.)
- 2 Push in the lambda plate slider to place the lambda plate into the optical path. (See Page 63.)
This microscopy method makes the background color of the field of view a sensitive color and enables the microscopy with a high color contrast. If the refraction index or the thickness of the specimen changes, interference color corresponding to the amount of change is seen.

**5****Return to the bright-field microscopy under the episcopic illumination.**

- 1 Pull out the analyzer slider to remove the analyzer from the optical path. (See Page 61.)
- 2 Pull out the polarizer slider to remove the polarizer from the optical path. (See Page 57.)
- 3 Detach the DIC slider to remove the DIC prism from the optical path. (See Page 65.)
- 4 Pull out the lambda plate slider to remove the lambda plate from the optical path. (See Page 63.)
- 5 Rotate the brightness control knob to adjust the brightness of the episcopic illumination. (See Page 34.)
- 6 Adjust the brightness with ND filters. (See Page 49.)



5 Epi-fl Microscopy

1 Attach the accessories required for the epi-fl microscopy to the microscope.

The devices and accessories required for the epi-fl microscopy are as follows:

- Filter cube for fluorescence observation (attached to the LV-UEPI2) (See Page 89.)
- External light source (Intensilight C-HGFI/C-HGFIE, or EXFO X-Cite 120/X-Cite 120 PC, used when the brightness of the halogen lamp is insufficient) (See Page 94.)

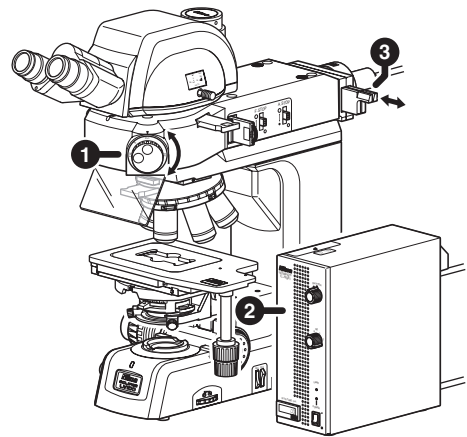
2 Find the target and focus on it by bright-field or dark-field microscopy under the epi-illumination.

(See Pages 14 to 16.)

3 Set the microscope for the epi-fl microscopy.

- 1 Rotate the microscopy selector knob to the “FL1” or “FL2” position. (See Page 37.)
- 2 Open the shutter with the external light source and adjust the brightness of the illumination.

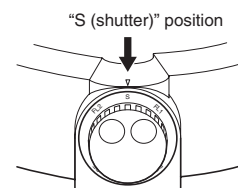
For the operation procedure, refer to the instruction manual for the external light source.
- 3 Adjust the brightness with ND filters. (See Page 49.)



About the shutter of the light source

When the microscopy selector knob of the LV-UEPI2 is turned to the “S” position, the shutter closes the optical path of the illumination.

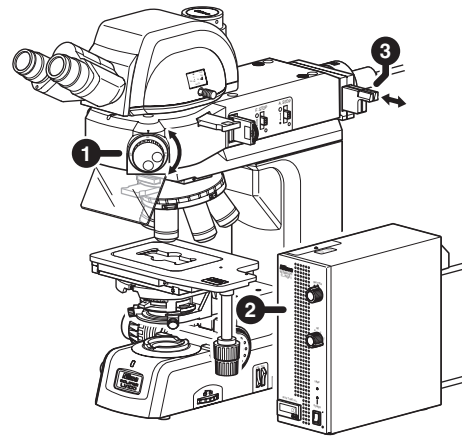
To prevent fading of the specimen, make sure to close the shutter when you don't observe the specimen.



4

Return to the bright-field or dark-field microscopy under the epi illumination.

- 1 Rotate the microscopy selector knob to the “BF (bright-field)” or “DF (dark-field)” position. (See Page 37.)
- 2 Open the shutter with the external light source and adjust the brightness of the illumination. For the operation procedure, refer to the instruction manual for the external light source.
- 3 Adjust the brightness with ND filters. (See Page 49.)



About the UV filter mounted in the LV-UEPI2

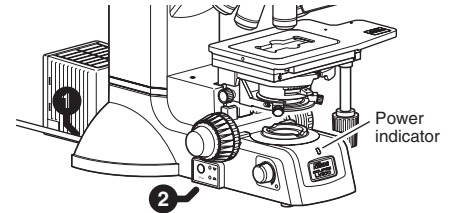
When the filter cube turret of the LV-UEPI2 is set to BF or DF position, the UV filter is also located in the optical path of the microscope, and when the turret is set to FL1 or FL2, the UV filter is removed from the optical path.

6 Bright-field Microscopy under the Dia Illumination

1 Turn on the power switch and select the dia illumination.

- 1 Turn on the power switch. (See Page 33.)
The power indicator on the microscope base is lit.
- 2 Press the epi/dia selector switch to turn on the dia indicator. (See Page 34.)
The halogen lamp on the diascope illumination side is lit.

1 Turn on the power switch and select the dia illumination.

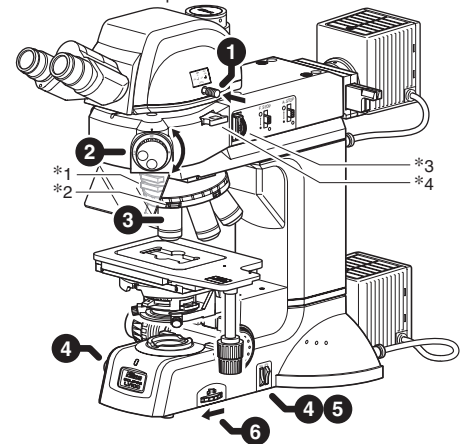


2 Set up the microscope for the bright-field microscopy under the diascope illumination.

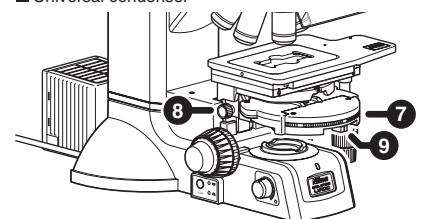
If accessories (*1 to *4) for the DIC microscopy under the episcopic illumination are in place, remove them from the optical path.

- 1 Push in the optical path selector lever and make the distribution of light for the binocular part 100%. (See Page 40.)
- 2 Rotate the microscopy selector knob to the “DF (dark-field)” position. (See Page 37.)
When the diascope illumination is used, be sure to set the LV-UEPI2 to “DF.”
- 3 Locate the 10x objective into the optical path. (See Page 48.)
- 4 Locate the NCB11 filter into the optical path and compensate the color temperature. (See Page 49.)
- 5 Adjust the brightness of the diascope illumination roughly with the brightness control knob and ND filters. (See Pages 34 and 49.)
- 6 Rotate the field diaphragm control toward you and fully open the field diaphragm for the diascope illumination. (See Page 53.)
- 7 To use the universal condenser, set the condenser turret to the “O” position. (See Page 54.)
- 8 Rotate the condenser focus knob to focus the condenser. (See Page 52.)
- 9 Rotate the condenser aperture diaphragm ring toward the left to fully open the condenser aperture diaphragm. (See Page 53.)

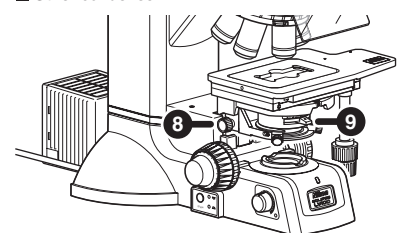
2 Set the microscope for the bright-field microscopy under the diascope illumination



■ Universal condenser

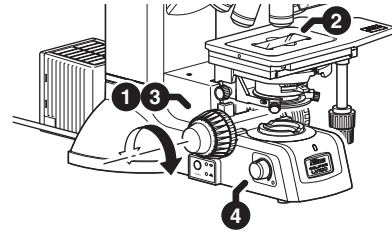


■ Other condenser

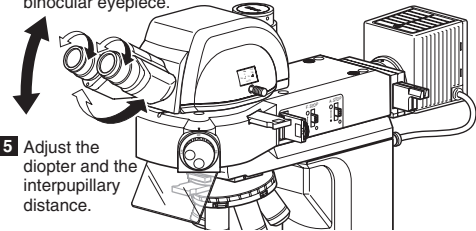


3**Place the specimen onto the stage, focus on it, and adjust its brightness.**

- 1 Lower the stage by turning the coarse/fine focus knobs. (See Page 44.)
- 2 Set the specimen onto the stage.
To use the glass slide, be sure to set the specimen in place with the cover glass facing up.
- 3 Rotate the coarse/fine focus knobs and focus on the specimen. (See Page 44.)
- 4 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)

3 Set the specimen onto the stage and adjust the focus.**4****Adjust the angle of the binocular eyepiece.**

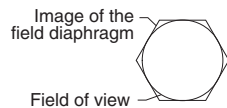
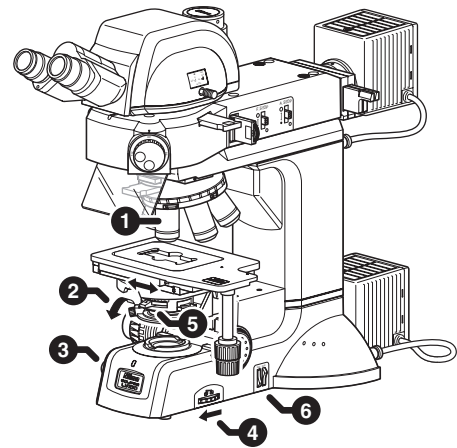
(See Page 40.)

4 Adjust the angle of the binocular eyepiece.**5****Adjust the diopter and the interpupillary distance.**

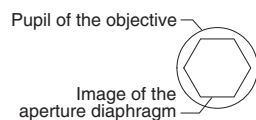
(See Page 42 and 43.)

5 Adjust the diopter and the interpupillary distance.**6****Set the desired magnification and observe the specimen.**

- 1 Rotate the nosepiece to move the objective of a desired magnification into the optical path. (See Page 48.)
- 2 Turn the coarse/fine focus knobs to bring the specimen into focus. (See Page 44.)
- 3 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 4 Use the field diaphragm ring so that the field diaphragm image circumscribes the field of view. (See Page 53.)

**6** Change the magnification to observe the specimen.

- 5 Stop down the condenser aperture diaphragm with the condenser aperture diaphragm ring to about 70% to 80% of the numerical aperture of the objective. (See Page 53.)



- 6 Adjust the brightness with ND filters. (See Page 49.)

7 Polarization Microscopy under the Dia Illumination (Simplified/Sensitive Color)

1 Attach the accessories required for the polarization microscopy under the diascope illumination to the microscope.

The devices and accessories required for the simplified/sensitive color polarization microscopy under the diascope illumination are as follows:

- Condenser lens (See Page 84.)
- Polarizer for the diascope illumination (See Page 101.)
- Analyzer slider (See Pages 86 and 88.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 86.)

2 Focus on the specimen with the bright-field microscopy under the diascope illumination.

(See Pages 23 and 24.)

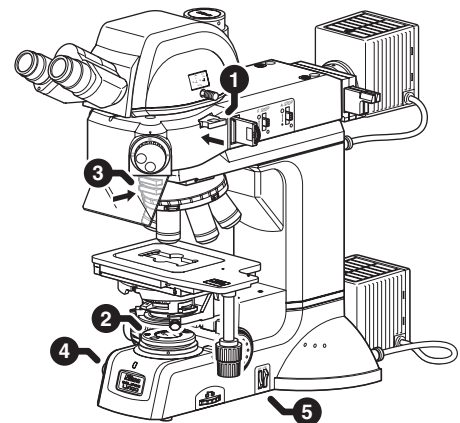
3 Set the microscope for the polarization microscopy under the diascope illumination.

- 1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 61.)
- 2 Locate the polarizer for the diascope illumination and make a crossed Nicols position. (See Page 59.)



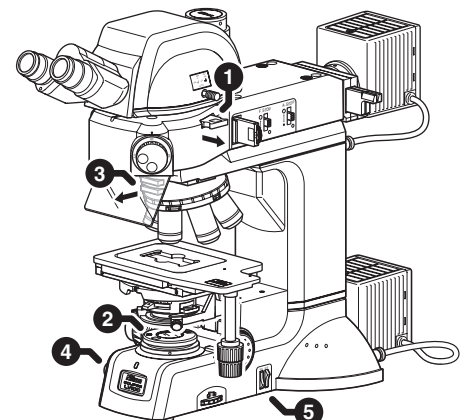
Set the polarizer to the crossed Nicols position.

- 3 To perform the sensitive color polarization microscopy, push in the lambda plate to locate the lambda plate into the optical path. (See Page 64.)
- 4 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 5 Adjust the brightness with the ND filter. (See Page 49.)



4 Return to the bright-field microscopy under the diascope illumination.

- 1 Pull out the analyzer slider and move the analyzer away from the optical path. (See Page 61.)
- 2 Move the diascope polarizer away from the optical path. (See Page 59.)
- 3 Pull out the lambda plate and move the lambda plate away from the optical path. (See Page 64.)
- 4 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 5 Adjust the brightness with ND filters. (See Page 49.)



8 Dark-field Microscopy under the Dia Illumination

1 Attach the accessories required for the dark-field microscopy under the diascope illumination to the microscope.

The devices and accessories required for the dark-field microscopy under the diascope illumination are as follows:

- Universal condenser (dry) (See Page 84 and the instruction manual for the LV-CUD)
- Dark-field annular diaphragm (attached to the inside of the universal condenser) (See the instruction manual for the LV-CUD)
- Objectives with a numerical aperture of 0.7 or less (with a magnification of 4x or more) (See Page 100.)

2 Focus on the specimen with the bright-field microscopy under the diascope illumination.

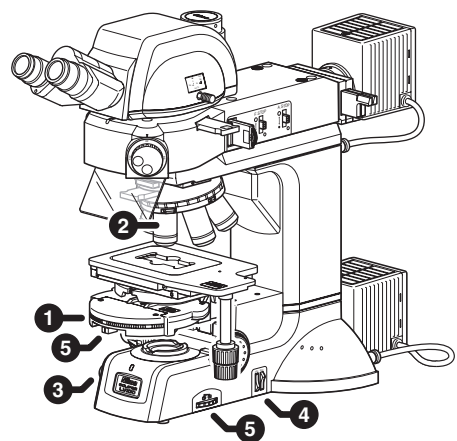
(See Pages 23 and 24.)

3 Set the microscope for the dark-field microscopy under the diascope illumination.

- 1 Rotate the condenser turret of the universal condenser to the “DF” position. (See Page 54.)
- 2 Rotate the nosepiece to move the objective of a desired magnification into the optical path. (See Page 48.)

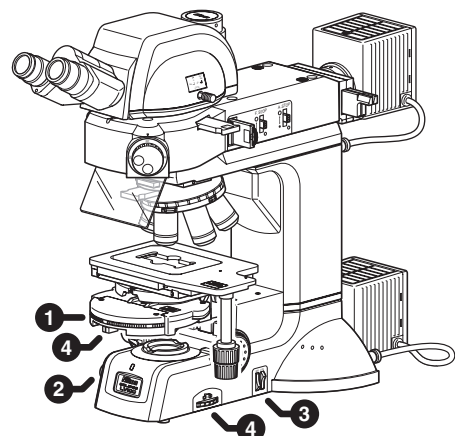
The objective of a magnification of 4x or more and a numerical aperture of 0.7 or less is usable to the dark-field microscopy.

- 3 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 4 Adjust the brightness with ND filters. (See Page 49.)
- 5 Fully open the field diaphragm and the aperture diaphragm. (See Pages 53.)



4 Return to the bright-field microscopy under the diascope illumination.

- 1 Rotate the condenser turret of the universal condenser to the “O” position. (See Page 54.)
- 2 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 3 Adjust the brightness with ND filters. (See Page 49.)
- 4 Adjust the field diaphragm and the aperture diaphragm. (See Pages 53.)



9 Phase Contrast Microscopy under the Dia Illumination

Note on the phase contrast microscopy under the Diascopic illumination

The view of a phase contrast image depends on the phase contrast characteristics or the shape of the specimen and the characteristic of the objective.

For details about the phase contrast microscopy, refer to the LV-CUD Instruction manual.

Note that the “Ph” symbol in the device name stands for “phase contrast.”

1 Attach the accessories required for the phase contrast microscopy under the diascopic illumination to the microscope.

The devices and accessories required for the phase contrast microscopy under the diascopic illumination are as follows:

- Universal condenser (dry) (See Page 84 and the instruction manual for the LV-CUD)
- Ph objective (See Page 100.)
- Ph annular diaphragm (attached to the inside of the universal condenser) (See the instruction manual for the LV-CUD)

Select the Ph annular diaphragm suitable for the Ph code indicated on the objective and attach it to the inside of the universal condenser. For details, see the instruction manual for the LV-CUD.

2 Focus on the specimen with the bright-field microscopy under the diascopic illumination.

(See Pages 23 and 24.)

- * Focusing on a transparent specimen may be difficult for the bright-field microscopy. In this case, switch to the phase contrast microscopy according to the following procedure and focus on the specimen.

3 Set up the microscope for the phase contrast microscopy under the diascopic illumination.

- 1 Rotate the nosepiece to move the Ph objective into the optical path. (See Page 48.)

Check the Ph code indicated on the body part of the Ph objective.

- 2 Set the condenser turret of the universal condenser to the “Ph1,” the “Ph2,” or the “Ph3” position, which is corresponding to the objective’s Ph code, and locate the Ph annular diaphragm into the optical path. (See Page 54.)

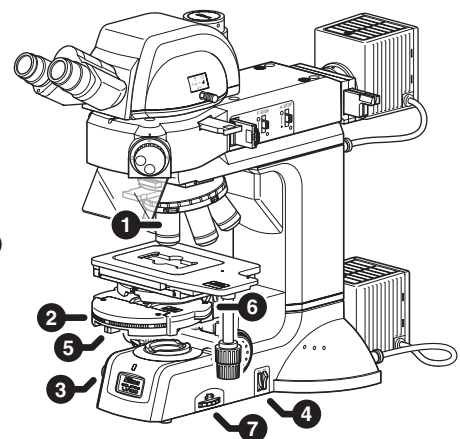
- 3 Rotate the brightness control knob to adjust the brightness of the diascopic illumination. (See Page 34.)

- 4 Adjust the brightness with ND filters. (See Page 49.)

- 5 Fully open the field diaphragm of the condenser. (See Page 53.)

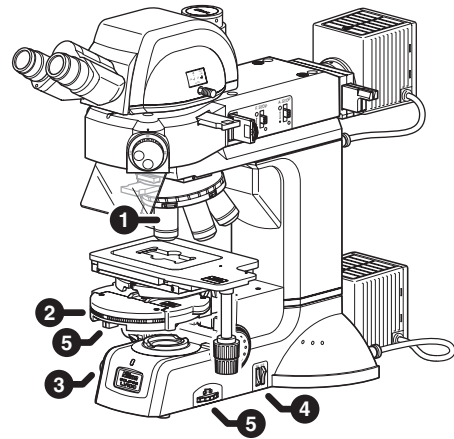
- 6 Center the Ph annular diaphragm. For the centering procedure, see the instruction manual for the LV-CUD.

- 7 Adjust the size of the field diaphragm so that the field diaphragm image circumscribes or inscribes the field of view. (See Page 53.)



4**Return to the bright-field microscopy under the diasopic illumination.**

- 1** Rotate the nosepiece to move the objective with a desired magnification into the optical path. (See Page 48.)
- 2** Rotate the condenser turret of the universal condenser to the “O” position. (See Page 54.)
- 3** Rotate the brightness control knob to adjust the brightness of the diasopic illumination. (See Page 34.)
- 4** Adjust the brightness with ND filters. (See Page 49.)
- 5** Adjust the field diaphragm and the aperture diaphragm. (See Pages 53.)



10 Differential Interference Contrast Microscopy under the Dia Illumination

1 Attach the accessories required for the differential interference contrast (DIC) microscopy under the diascope illumination to the microscope.

The devices and accessories required for the DIC microscopy under the diascope illumination are as follows:

- Universal condenser (dry) (See Page 84 and the instruction manual for the LV-CUD.)
- Sextuple DIC nosepiece (D-ND6) (See Page 85.)
- DIC objective (See Page 100.)
- Rotatable polarizer for the diascope illumination (equipped with the 1/4 lambda plate) (See Page 101.)
- Analyzer slider (See Page 86 and 88.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 86.)
- Condenser DIC prism (See the instruction manual for the LV-CUD.)
- Objective DIC prism (See Page 86.)

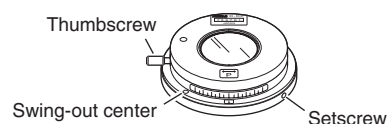
2 Focus on the specimen with the bright-field microscopy under the diascope illumination.

(See Pages 23 and 24.)

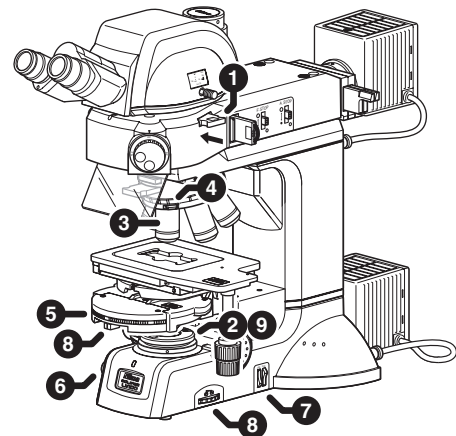
- * Focusing on a transparent specimen may be difficult for the bright-field microscopy. In this case, switch to the differential interference contrast phase contrast microscopy according to the following procedure and focus on the specimen.

3 Set the microscope for the DIC microscopy under the diascope illumination.

- 1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 61.)
- 2 Attach the rotatable polarizer for the diascope illumination and rotate the upper part of the polarizer to make a crossed Nicols position. (See Page 60.)



- 3 Rotate the nosepiece to move the objective into the optical path. (See Page 48.)
- 4 Insert the DIC slider into the slot of the nosepiece to locate the objective DIC prism into the optical path. (See Page 66.)
- 5 Set the condenser turret to the "N1," "N2," or "NR" position to locate the condenser DIC prism suitable for the objective into the optical path. (See Page 54.)
- 6 Rotate the brightness control knob to adjust the brightness of the diascope illumination. (See Page 34.)
- 7 Adjust the brightness with ND filters. (See Page 49.)
- 8 Adjust the field diaphragm and the aperture diaphragm.
 - Decrease the size of the field diaphragm so that it inscribes or circumscribes the viewfield. (See Page 53.)
 - Generally, decrease the size of the aperture diaphragm to approximately 70 to 80% of the numerical aperture of the objective. (See Page 53.)

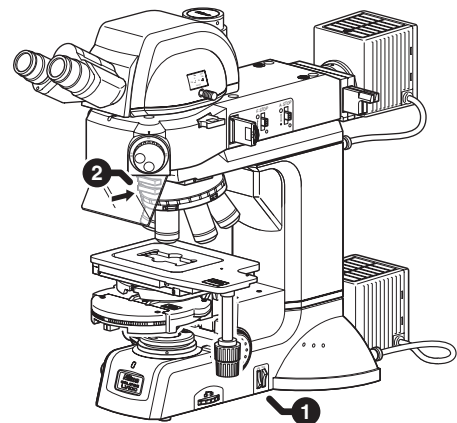


- 9 Adjust the orientation of the polarizer by rotating the top part of the polarizer for the diascopic illumination to adjust the contrast of DIC contrast images. (See Page 60.)
 - The background of the field of view can be adjusted to a gray sensitive color. This adjustment improves the contrast of the image.
 - The direction of the contrast is the shearing direction (45 degrees, from the left far side to the right near side, viewed from the top of the microscope).

Rotate the specimen or the stage to get an adequate gradation in the shearing direction.

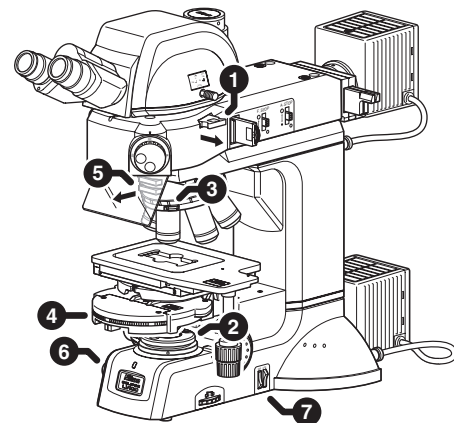
4 If necessary, perform the sensitive color microscopy.

- 1 Place the NCB filter into the optical path. (See Page 49.)
 - 2 Push in the lambda plate to locate the lambda plate into the optical path. (See Page 64.)
- The background of the field of view becomes a sensitive color. The color improves the color contrast of the image and is useful for observations. As the refractive index or the thickness of the specimen varies, the interference color of the specimen changes.



5 Return to the bright-field microscopy under the diascopic illumination.

- 1 Pull out the analyzer slider to move the analyzer away from the optical path. (See Page 61.)
- 2 Move the rotatable polarizer for the diascopic illumination away from the optical path. (See Page 60.)
- 3 Pull out the objective DIC prism slider to move the objective DIC prism away from the optical path. (See Page 66.)
- 4 Set the condenser turret to the "O" position to move the condenser DIC prism away from the optical path. (See Page 54.)
- 5 Pull out the lambda plate slider and move the lambda plate away from the optical path. (See Page 64.)
- 6 Rotate the brightness control knob to adjust the brightness of the diascopic illumination. (See Page 34.)
- 7 Adjust the brightness with ND filters. (See Page 49.)



11 Orthoscopic Microscopy

Details on the orthoscopic microscopy

This method is a polarization microscopy under the diascope illumination. The specimen is observed under the diascope illumination with the polarizer and the analyzer placed in the optical path.

The shape of the specimen in the direction of the optical axis and its optical properties in the direction of the thickness can be observed. The vibration direction of the light and the property of the refraction can be measured with observing light extinction or interference colors of specimens using the circular graduated stage.

1 Attach the devices and accessories required for the orthoscopic microscopy.

The devices and accessories required for the orthoscopic microscopy are as follows:

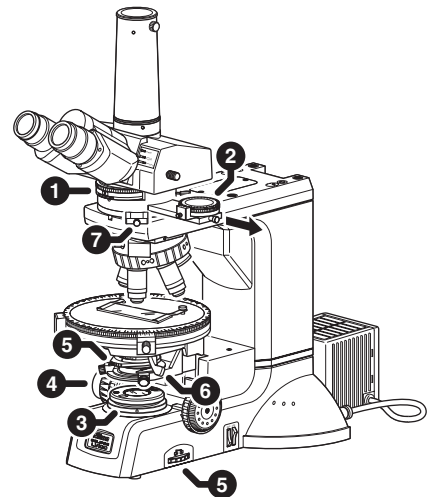
- Intermediate tube for the polarization microscopy (equipped with the analyzer and the Bertrand lens) (See Page 98.)
- Binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube (See Page 99.)
- P circular graduated stage (LV-SRP) (See Page 82.)
- Quintuple centering nosepiece (P-N) (See Page 85.)
- P objective (See Page 100.)
- Swing-out achromat condenser for the polarization microscopy (See Page 84.)
- Polarizer for the diascope illumination (See Page 101.)
- Various examination plates (See Page 77.)

2 Focus on the specimen with the bright-field microscopy under the diascope illumination.

(See Pages 23 to 24.)

3 Set the microscope for the orthoscopic microscopy.

- 1 Rotate the Bertrand lens turret to the "O" position to remove the Bertrand lens from the optical path. (See Page 76.)
- 2 Pull out the analyzer slider to place the analyzer into the optical path. (See Page 75.)
Rotate the rotation ring on the analyzer to the "O" position.
- 3 Attach the polarizer for the diascope illumination to the field lens part to set the orientation of the polarizer and the analyzer. (See Page 59.)
- 4 Adjust the focus again. (See Page 44.)
- 5 Adjust the aperture diaphragm and the field diaphragm as that for the bright-field microscopy under the diascope illumination. (See Pages 52 and 53.)
- 6 Adjust the top lens of the swing-out achromat condenser for the polarization microscopy according to the magnification of the used objective. (See Page 55.)
- 7 Measure retardation in various ranges with various examination plates. (See Page 77.)



12 Conoscopic Microscopy

Details on the conoscopic microscopy

This method is a polarization microscopy under the diascopic illumination. The specimen is observed with the polarizer, the analyzer, and the Bertrand lens placed in the optical path.

The shape of the specimen cannot be observed with the conoscopic microscopy. But, the specimen can be observed from various angles with diascopic light in the form of a single image. You can distinguish the property of the specimen between uniaxial and biaxial and can observe the optical axial angle and optical characteristics of the specimen.

1 Attach the devices and accessories required for the conoscopic microscopy.

The devices and accessories required for the conoscopic microscopy are as follows:

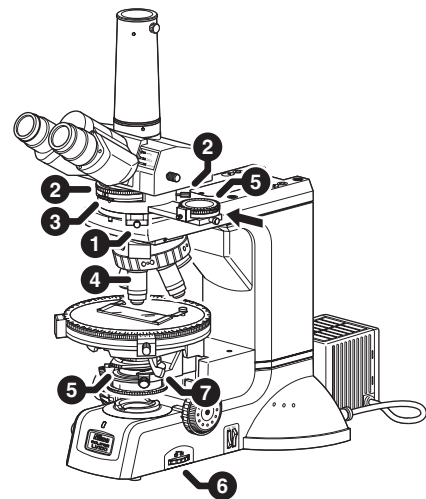
- Intermediate tube for the polarization microscopy (equipped with the analyzer and the Bertrand lens) (See Page 98.)
- Binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube (See Page 99.)
- P circular graduated stage (LV-SRP) (See Page 82.)
- Quintuple centering nosepiece (P-N) (See Page 85.)
- P objective (See Page 100.)
- Swing-out achromat condenser for the polarization microscopy (See Page 84.)
- Polarizer for the diascopic illumination (See Page 101.)

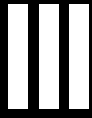
2 Perform the orthoscopic microscopy.

(See Page 31.)

3 Set the microscope for the conoscopic microscopy.

- 1 Remove the examination plate from the optical path. (See Page 77.)
- 2 Rotate the Bertrand lens turret to the "B" position to place the Bertrand lens into the optical path. (See Page 76.)
- 3 Focus and center the Bertrand lens. (See Page 76.)
- 4 Select an objective having a large numerical aperture (high magnification: normally 40x or higher) and place it into the optical path.
- 5 Adjust the aperture diaphragm so that it circumscribes the conoscopic view field or fully open it. (See Page 53.)
- 6 Adjust the field diaphragm so that it circumscribes the conoscopic view field. (See Page 53.)
- 7 Place the top lens of the swing-out achromat condenser for the polarization microscopy into the optical path. (See Page 55.)





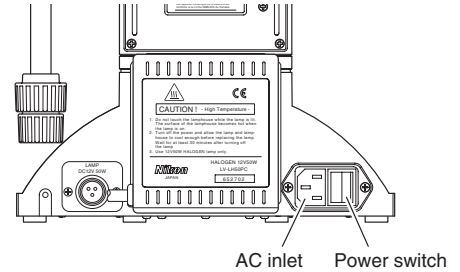
Operation of Each Part

1 Power on/off

▶ Power of the microscope

The power switch for the product is located beside the AC inlet on the rear of the microscope body. To turn on the product, push the power switch to the “I” side. To turn off the microscope, push the power switch to the “O” side.

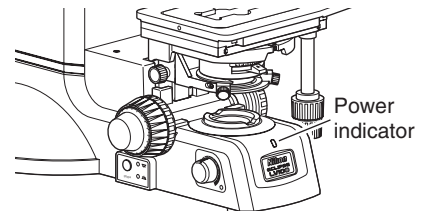
The power indicator on the base part is lit when the power is turned on.



▶ Power supply for the lamp

The product has a built-in power supply circuit for the halogen lamp. When the specified lamp house (LV-LH50PC) is used, the lamp is lit in connection with the power supply for the lamp.

- * Actual operation to turn on the lamp is switching lamps with the epi/dia selector switch and adjusting the brightness with the brightness control knob. (See Page 34.)



Power indicator

The color of the power indicator changes in accordance with the halogen lamp condition. When the halogen lamp is lit, the indicator is green. When the brightness control knob is set to the OFF position, the indicator is orange.

2 Illumination

▶ Selecting the epi illumination or the dia illumination

When the specified lamp house LV-LH50PC is used, the epi/dia selector switch on the left side of the microscope can be used to select either the episcopic illumination or the diascope illumination. Each time the switch is pressed, the illumination is switched and the indicator of the used illumination is lit.

When the LV-UEPI2 epi illuminator is used, the microscopy selector dial must be set to "DF (dark-field)" to use the diascope illumination.

▶ Brightness control and illumination on/off

When the specified lamp house LV-LH50PC is used, the illumination selected by the epi/dia selector switch can be controlled by rotating the brightness control knob.

* When an external light source is used, the brightness is controlled by the external light source or ND filters on the product.

A switch is included in the brightness control knob to turn on/off the lamp. When the specified lamp house LV-LH50PC is used, to turn off the light, rotate the brightness control knob to the far side (counterclockwise) and set it to the OFF position.

* When using the external light source, turn on/off the lamp with the light source device.

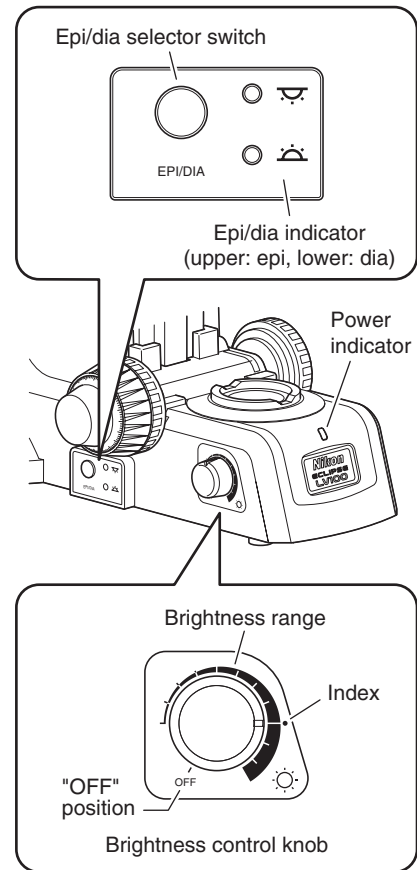
Color temperature shift affected by the brightness control

Adjusting brightness with the brightness control knob will affect the lamp color temperature and alter the color balance of the image.

When accurate color reproduction is critical, set the brightness control knob to the index as shown above and place the NCB11 filter into the optical path. In this condition, the voltage applied to the lamp is approximately 9 V and the color reproduction is improved maximally. To adjust the brightness of the illumination, use ND filters.

▶ Power indicator

The color of the power indicator changes in accordance with the halogen lamp condition. When the halogen lamp is lit, the indicator is green. When the brightness control knob is set to the OFF position, the indicator is orange.



External power supply

To turn on the episcopic illumination and the diascopic illumination simultaneously, normally connect the lamp house on the episcopic illumination side to an external power supply (TE2-PS100W). Operate the external power supply as follows:

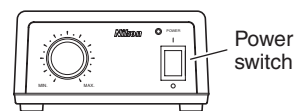
- 1 Before turning on the power supply, check that the lamp house is connected to the power supply correctly (see Page 93) and the EXTERNAL switch on the rear of the power supply is set to the OFF position.

The EXTERNAL switch is used to control the external power supply with a PC and so on. Normally set the switch to the OFF position.

- 2 Press the power switch on the front of the power supply to the "I" side to turn on the power supply. The POWER indicator is lit and the lamp is turned on.

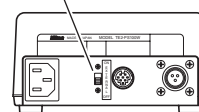
- 3 Rotate the brightness control knob to adjust the brightness of the lamp.

- 4 To turn off the lamp, press the power switch to the "O" side and turn off the power supply.



Front of TE2-PS100W

EXTERNAL switch



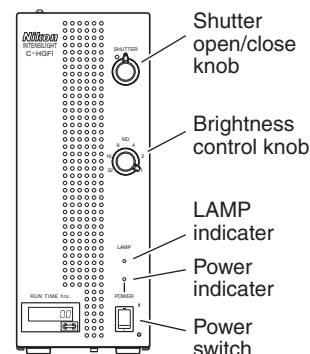
Rear of TE2-PS100W

External light source

When using the external light source (Intensilight C-HGFI/C-HGFIE or EXFO X-Cite 120/X-Cite 120 PC), turn on the power as follows:

- 1 Check that the product is connected to the external light source correctly (Pages 94 to 96).
- 2 Press the power switch to the "I" side to turn on the external light source and wait until the external light source starts normally.

- **Intensilight C-HGFI/C-HGFIE:** the POWER indicator is lit and the LAMP indicator blinks when the external light source is turned on. When the external light source starts normally, the LAMP indicator stops blinking and lights up.
- **EXFO X-Cite 120/X-Cite 120 PC:** the backlight of the LCD blinks when the external light source is turned on. When the external light source starts normally, the backlight stops blinking and lights up.



Front of Intensilight C-HGFI

When the external light source is motorized, it does not communicate until it starts normally. Be sure to wait until the external light source starts normally.

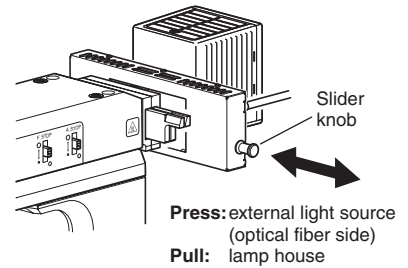
- 3 To turn off the external light source, press the power switch to the "O" side and turn off the power of the external light source.

- It will take a few minutes for the external light source to become the ready condition. Check that the external light source starts normally and then turn on the product.
- To use the external light source, carefully read the instruction manual and follow the instructions and cautions for it.

**Double light source adapter
(only for the episcopic illumination)**

The double light source adapter is used to attach the halogen lamp and an external light source together as the episcopic illumination. The specimen can be observed by switching the light sources with they turned on.

To switch the light sources, slide the adapter to the click-stop position with the slide knob on the right of the adapter. Press the knob and slide the adapter leftwards to place the external light source into the optical path. Pull the knob and slide the adapter rightwards to place the halogen lamp into the optical path.

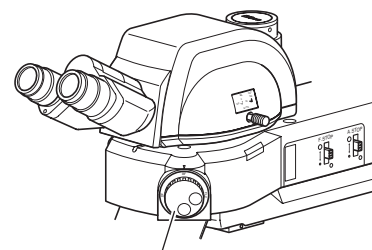


3 Selecting the Microscopy Method

► Switching the microscopies when the epi illumination is used

The microscopy selector knob is located on the front of the epi illuminator LV-UEPI2. Rotate the microscopy selector knob to rotate the turret inside the illuminator and switch microscopy methods that use the epi illumination.

The microscopy selector knob has five click-stop positions, BF, DF, FL1, S, and FL2, which correspond to the microscopy methods listed below.



Microscopy selector knob

Position	Microscopy Method
BF	Bright-field microscopy under the epi illumination This position is used to perform the bright-field microscopy under the epi illumination. It is also used for the simplified/sensitive color polarization microscopies and the DIC microscopy under the epi illumination. The UV filter is placed into the optical path when the BF position is selected.
DF	Dark-field microscopy under the epi illumination/microscopies under the dia illumination When the knob is rotated to the DF position, the epi illumination has a dark field, and the aperture diaphragm and the field diaphragm are fully opened automatically. (However, the diaphragm open/close lever position does not change.) When the knob is turned to another position from the DF position, the aperture diaphragm and the field diaphragm are restored to their previous conditions before the dark-field microscopy. The UV filter is placed into the optical path when the DF position is selected. * Turn the microscopy selector knob to this position for the diascope microscopy.
FL1	Epi-fl microscopy 1 The filter cube inserted into the "FL1" position in the illuminator is placed into the optical path. And, the UV filter is removed from the optical path.
S	Shutter The shutter stops the optical path of the illumination. This click-stop position is located between FL1 and FL2, so that the shutter is readily available to prevent fading of the specimen.
FL2	Epi-fl microscopy 2 The filter cube inserted into the "FL2" position in the illuminator is placed into the optical path. And, the UV filter is removed from the optical path.

If the knob is turned to the FL1 or FL2 position but no filter cube is installed on the turret in the illuminator, nothing can be seen.

For details about the microscopies available with this product, see the table on the Pages 38 and 39.

Details on the microscopy under the episcopic illumination

The following microscopy method can be performed with this microscope.

Microscopy Method	LV-UEPI2 Turret Position	Accessories	Remarks
Bright-field microscopy under the epi illumination	BF	–	This is the normal bright-field microscopy under the epi illumination. The UV filter is located in the optical path.
Dark-field microscopy under the epi illumination	DF	BD quintuple nosepiece (L-NBD5) and BD objective	The UV filter is located in the optical path. And the aperture diaphragm and the field diaphragm are fully opened. (The position of the open/close lever does not change.)
Simplified polarization microscopy under the epi illumination	BF	Polarizer slider and analyzer slider	Attach the analyzer and polarizer under the bright-field microscopy condition and make the crossed Nicols position.
	FL1	PA block	The PA block is equipped with the polarizer and the analyzer at the crossed Nicols position.
Sensitive color polarization microscopy under the epi illumination	BF	Polarizer slider, analyzer slider, and lambda plate slider	Insert the lambda plate under the simplified polarization microscopy condition to perform the sensitive color polarization microscopy. The PA block cannot be used for the sensitive color polarization microscopy.
DIC-microscopy under the epi illumination	BF	Polarizer slider (equipped with the 1/4 lambda plate), analyzer slider, sextuple DIC nosepiece (D-ND6), LU objective for industrial microscopes, DIC prism (LV-DIC A/B, LV-DIHC A/B), and lambda plate slider	Attach the analyzer and polarizer with the 1/4 lambda plate under the bright-field microscopy condition and make the crossed Nicols position. Insert the DIC prism. And then, perform the DIC microscopy. The contrast of DIC contrast images can be adjusted by rotating the orientation of the polarizer. Attach the lambda plate to perform the sensitive color microscopy.
Epi-fl microscopy	FL1 or FL2	Filter cube, external light source, and excitation light balancer (option)	The filter cube inserted into the “FL1” or “FL2” position is placed into the optical path. And, the UV filter is removed from the optical path.

Details on the microscopy under the diascope illumination

The following microscopy method can be performed.

Illumination/Microscopy Method	LV-JUEPI2 Turret Position	Accessories	Remarks
Bright-field microscopy under the diascope illumination	DF *	Condenser lens	Set the bright-field microscopy under the episcopic illumination condition. And then, switch to the diascope illumination to make the bright-field microscopy under the diascope illumination condition
Simplified polarization microscopy under the diascope illumination	DF *	Condenser lens, polarizer for the diascope illumination, and analyzer	Set the bright-field microscopy under the diascope illumination condition. And then, attach the polarizer for the diascope illumination and the analyzer to make the crossed Nicols position.
Sensitive color polarization microscopy under the diascope illumination	DF *	Condenser lens, polarizer for the diascope illumination, analyzer, and lambda plate	Set the simplified polarization microscopy under the diascope illumination condition. And then, attach the lambda plate to make the sensitive color polarization microscopy under the diascope illumination condition.
Dark-field microscopy under the diascope illumination	DF *	Universal Condenser (LV-CUD), dark-field annular diaphragm, and objectives with a numerical aperture of 0.7 or less	Attach the universal condenser and set the bright-field microscopy under the diascope illumination condition. And then, place the dark-field annular diaphragm into the optical path.
Phase contrast microscopy under the diascope illumination	DF *	Universal Condenser (LV-CUD), Ph annular diaphragm (suitable for objectives), and Ph objective	Attach the universal condenser and set the bright-field microscopy under the diascope illumination condition. And then, place the Ph annular diaphragm and the Ph objective into the optical path to make the phase contrast microscopy under the diascope illumination condition.
DIC microscopy under the diascope illumination	DF *	Universal Condenser (LV-CUD), sextuple DIC nosepiece (D-ND6), DIC objective, condenser DIC prism, objective DIC prism, rotatable polarizer for the diascope illumination (D-DP), analyzer slider, and lambda plate (for the sensitive color microscopy)	Attach the universal condenser and set the bright-field microscopy under the diascope illumination condition. And then, place the rotatable polarizer for the diascope illumination, the analyzer, the condenser DIC prism, the objective DIC prism, and the DIC objective into the optical path to make the DIC microscopy under the diascope illumination condition. For the sensitive color microscopy, attach the lambda plate to the nosepiece.
Orthoscopic microscopy	DF *	Intermediate tube for the polarization microscopy, binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube, P circular graduated stage (LV-SRP), quintuple centering nosepiece (P-N), P objective, swing-out achromat condenser for the polarization microscopy, polarizer for the diascope illumination, and various examination plates	Attach the parts required for the polarization microscopy. And then, place the polarizer and the analyzer into the optical path to make the crossed Nicols position. For the orthoscopic microscopy, attach the tint plate to the intermediate tube to measure retardation.
Conoscopic microscopy	DF *	Intermediate tube for the polarization microscopy, binocular eyepiece tube for the polarization microscopy or trinocular eyepiece tube, P circular graduated stage (LV-SRP), quintuple centering nosepiece (P-N), P objective, swing-out achromat condenser for the polarization microscopy, and polarizer for the diascope illumination	Set the orthoscopic microscopy condition. And then, attach the Bertrand lens to the intermediate tube to set the conoscopic microscopy condition. For the conoscopic microscopy, the examination plate is not required.

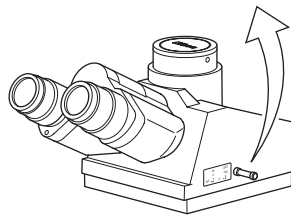
* The diascope illumination is lit.

4 Eyepiece Tube

▶ Optical path selection

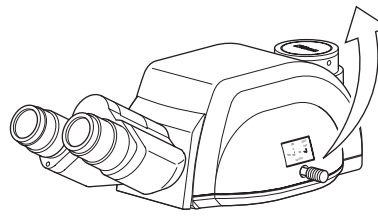
The distribution of light for the binocular part and the vertical tube can be selected with the optical path selector lever.

Lever position	Distribution of light	
	Binocular part	Vertical tube
IN	100 %	0 %
OUT	0 %	100 %



Eyepiece tube LV-TI3

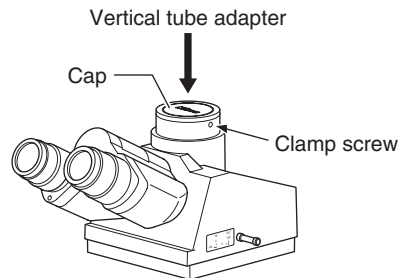
Lever position	Distribution of light	
	Binocular part	Vertical tube
IN	100 %	0 %
OUT	20 %	80 %



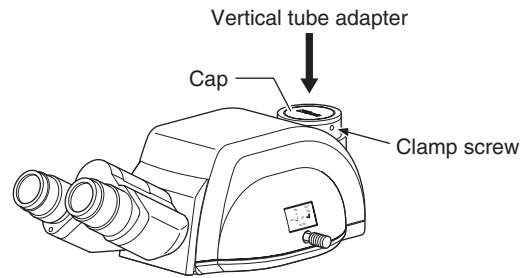
Eyepiece tube LV-TT2

▶ Vertical tube adapter

To attach a photomicrography or a camera onto the vertical tube, you must use an optional adapter, a TV adapter or a C-mount adapter. Insert the adapter into the vertical tube and secure it with the clamp screw using a hexagonal screwdriver.



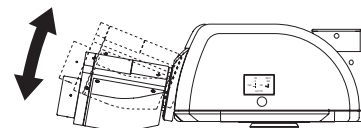
Eyepiece tube LV-TI3



Eyepiece tube LV-TT2

▶ Angle adjustment of the binocular part (only for the LV-TT2)

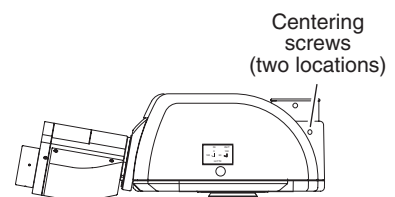
You can adjust the angle of the binocular part of the LV-TT2. Adjust the angle for your height and comfort.



▶ Centering the vertical tube (only for the LV-TT2)

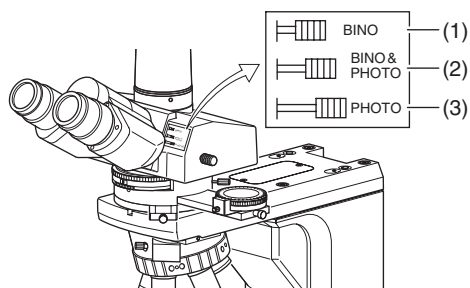
The binocular part and the vertical tube of the eyepiece tube are centered before the shipping, so usually they can be used without an adjustment.

But some cameras may have their CCD centers shifted from the center of the mount part. In such a case, you can adjust the vertical tube center by rotating two centering screws on the back of the vertical tube.



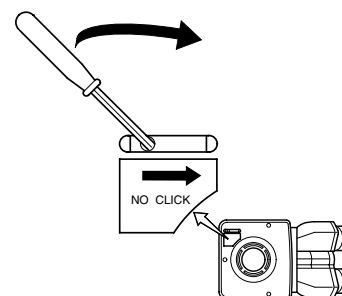
► **Switching the optical path of the trinocular eyepiece tube for the polarization microscopy**

For the trinocular eyepiece tube for the polarization microscopy, the distribution of light to the binocular part and the vertical tube part can be selected from three levels.



Lever position	Distribution of light	
	Binocular part	Vertical tube
(1)	100 %	0 %
(2)	20 %	80 %
(3)	0 %	100 %

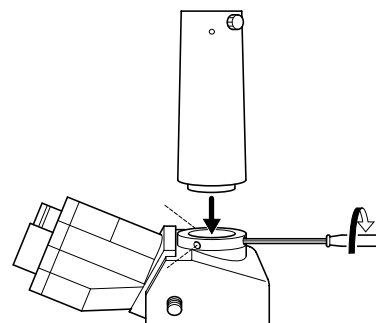
There is the switch marked with “NO CLICK” on the eyepiece tube attaching part of the trinocular eyepiece tube for the polarization microscopy. Slide this switch in the direction of the arrow with the tip of a pointed tool to disable clicking for the optical path switching lever. Set the switch to this position if you need to eliminate the slight vibrations resulting from the clicking action.



► **Vertical tube adapter of the trinocular eyepiece tube for the polarization microscopy**

The TV vertical tube adapter or the TV vertical tube adapter 0.55X can be mounted on the vertical tube section of the trinocular eyepiece tube.

To mount the adapter, remove the cap from the vertical tube section of the trinocular eyepiece tube, insert the vertical tube adapter, and fix it with three screws on the vertical tube section with the attached tool.



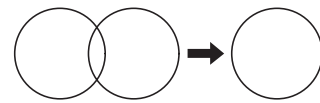
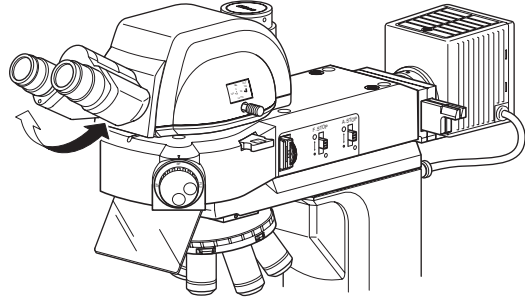
5 Interpupillary Distance Adjustment

Before performing the interpupillary distance adjustment, follow the procedure described in Pages 14 and 15 for the bright-field microscopy under the episcopic illumination (or Pages 23 and 24 for the bright-field microscopy under the diasopic illumination), and focus on the specimen with the 10x objective.

Adjust the interpupillary distance so that the viewfields for both eyes come together.

This will facilitate the observation with both eyes.

The binocular part has a scale for interpupillary distance. It is recommended to memorize or record your interpupillary distance, so that the distance between the eyepieces can be adjusted with ease next time.

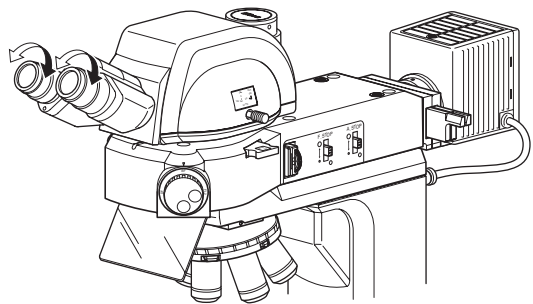
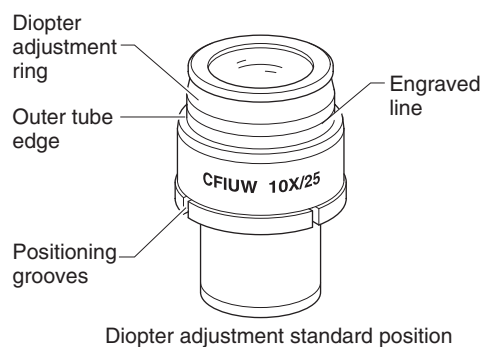


Converge until the right and left view fields coincide.

6 Diopter Adjustment

Diopter adjustment compensates for the difference in visual acuity between the right and left eyes. This adjustment improves binocular observation and minimizes focal deviation when switching objectives. Make sure to adjust the diopter adjustment rings on both eyepieces.

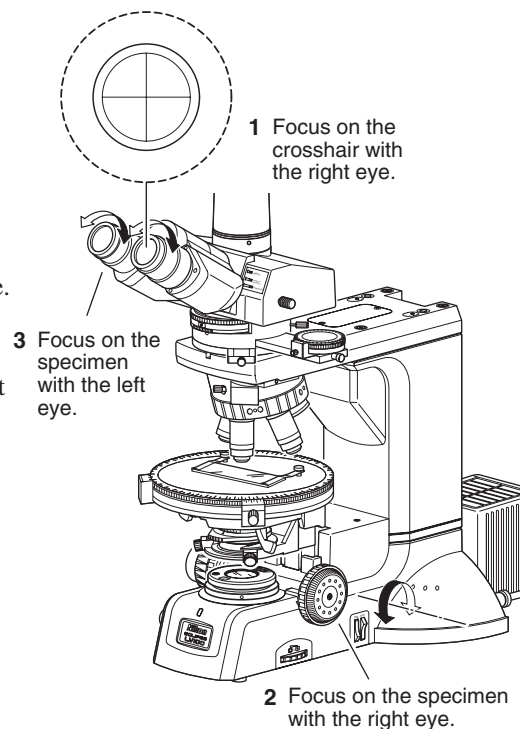
- 1 Rotate the diopter adjustment rings of the eyepieces and align their engraved lines with the edges of the outer tubes of the eyepieces (They are the standard positions for the diopter rings.)
- 2 Follow the procedure described in Pages 14 and 15 for the bright-field microscopy under the episcopic illumination (or Pages 23 and 24 for the bright-field microscopy under the diasopic illumination), and focus the specimen with the 10x objective.
- 3 Locate the 50x objective into the optical path. Rotate the coarse/fine focus knobs to focus on the specimen.
- 4 Locate the 5x or 10x objective into the optical path.
- 5 Focus on the specimen with the diopter adjustment rings not with the coarse/fine focus knobs. Look through the left eyepiece with your left eye and the right eyepiece with your right eye to focus on the specimen.
- 6 Repeat the steps 3 to 5 using the 50x objective and the 5x or 10x objective, until the focus shift is eliminated even when the lens magnification is changed.



▶ Adjusting the diopter of the trinocular eyepiece tube for the polarization microscopy

In the case of a polarization microscope, since an eyepiece containing crosshairs is used for the right eye, the procedure for adjusting the diopter differs from that of an ordinary microscope.

- 1 Observe the right eyepiece with the right eye. Turn the diopter adjustment ring to bring the crosshair in the eyepiece into focus.
- 2 Still observe the right eyepiece with the right eye. Turn the fine/coarse focus adjustment knob to bring the specimen on the stage into focus.
- 3 Observe the left eyepiece with the left eye. Turn the diopter adjustment ring on the eyepiece to bring the specimen into focus. (not the fine/coarse focus adjustment knob)



7 Coarse Focus Knob and Fine Focus Knob

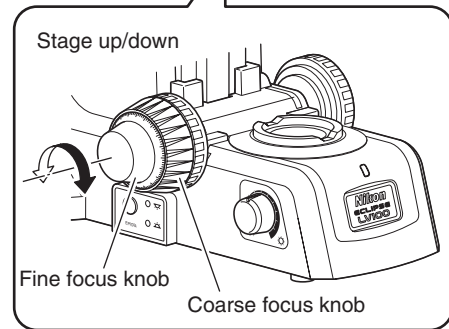
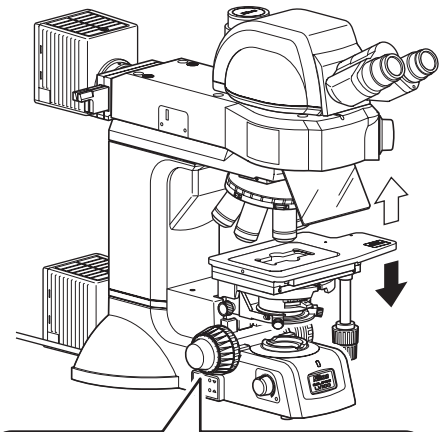
► Knob rotation and stage vertical movement

The relationship between the direction of coarse/fine focus knob rotation and the stage vertical movement is shown in the right figure.

- One revolution of the coarse focus knob drives the stage approximately 14.0 mm.
- One revolution of the fine focus knob drives the stage approximately 0.1 mm.
- The fine focus knob is marked in 1 μm .
- The coarse/fine focus stroke (the vertical movable range of the stage) is 40 mm. The stroke from the reference position (upper surface of the stage) differs depending on the stage model.

Do not attempt following operations, because doing so may cause the product failure.

- *Rotating the left and right knobs in opposite directions at the same time.*
- *Keep rotating the coarse/fine knobs after hitting the rotation limits.*

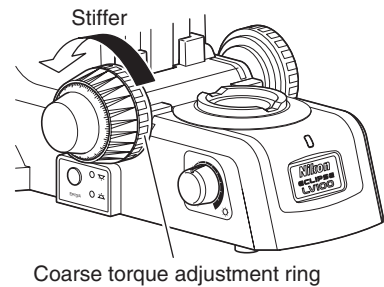


► Stiffness adjustment for the coarse focus knob

The rotational stiffness of the coarse focus knob can be adjusted as follows.

To make it stiffer, rotate the coarse torque adjustment ring behind the coarse focus knob in the direction of the arrow ("TORQUE →") that is described on the microscope base.

To make it looser, rotate the ring in the opposite direction.



► Coarse focus stopper

The coarse focus stopper restricts the movement of the coarse focus knob so that the stage cannot be raised higher than the position the operator specifies. When the coarse focus stopper ring is rotated in the direction of the arrow (labeled “CLAMP →”) on the microscope base, the stage cannot be moved higher than that position with the coarse focus knob. (This function does not limit the stage movement by the fine focus knob.)

For example, once the coarse focus knob is clamped in place at the focus position, a rough focus can be attained the next time simply by raising the stage until the coarse focus knob cannot be turned any further.

When the coarse focus stopper is not used, be sure to keep the stopper loosened by rotating it in the opposite direction of the arrow. (Rotate the stopper ring to reach the limit in the direction opposite from the arrow that is marked on the microscope base.)

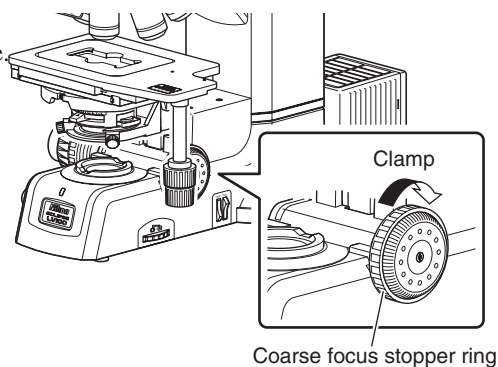
Example:

When a specimen is focused, rotate the coarse focus stopper ring as far as it goes in the direction of the arrow (labeled “CLAMP →”) on the microscope base. The rotation for tightening is approximately three quarter turn.

The coarse focus stopper is now clamped in position.

When exchanging specimens, use only the coarse focus knob to lower the stage.

After the specimen replacement, use only the coarse focus knob to slowly raise the stage until it hits the limit. The specimen should be roughly in focus when the stage has been raised as far as it goes. Use the fine focus knob to bring the specimen into perfect focus.



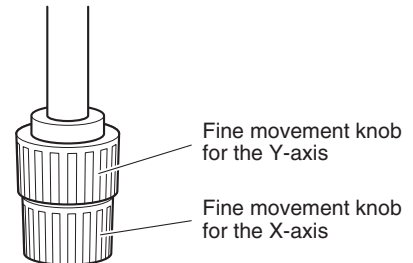
8 Stage

► Stage operation

The 3x2 stage, the 6x4 stage, the 6x6 stage, the rectangular stage, and the rotatable rectangular stage are equipped with stage fine movement knobs.

The upper knob is used for the Y-axis and the lower knob is used for the X-axis. These knobs are provided to finely move the specimen.

* If you move the stage plate directly by hands, the stage will be damaged. Make sure to use these fine movement knobs to move the stage.



► Glass slide usage

To observe a specimen by using a glass slide on the 3x2 stage, replace the stage glass to an optional glass slide holder.

Loosen the clamp screw on the left side of the stage to remove the standard stage glass. And then, mount the glass slide holder and secure it by the clamp screw.

* When a high NA condenser such as a slide condenser is used, do not use the standard stage glass. They can collide with each other. Make sure to use the glass slide holder.

► Stage rotation

The specimen can be observed in any direction by rotating the stage when placed on the circular graduated stage (P circular graduated stage or P-GS2 G Stage 2) or the rotatable rectangular stage.

CAUTION

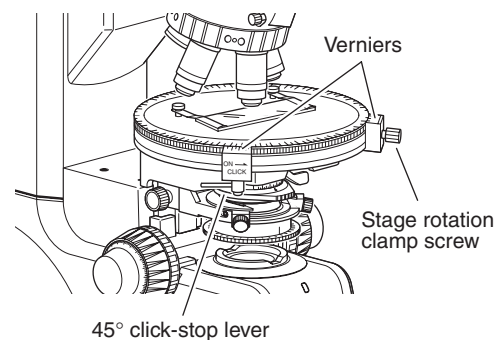
Do not try to put a large specimen on the stage if the specimen is larger than the stage.

- **P circular graduated stage/P-GS2 G Stage 2**

For the circular graduated stage, loosen the clamp screw on the front of the stage to turn the stage by hand. The angle of rotation can be read to 0.1 degrees with the two vernier scales.

- **Rotatable rectangular stage**

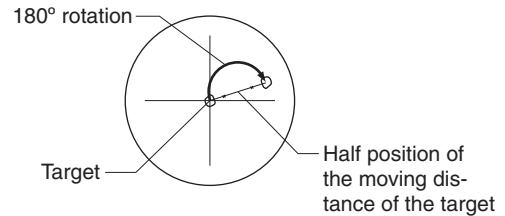
For rotatable rectangular stage, loosen the clamp screw on the bottom of the stage to turn the stage by hand.



► **Centering the circular graduated stage**

The rotation center of the circular graduated stage must be aligned to the center of the field of view. Center the circular graduated stage according to the following procedure.

- 1 Search and focus on the target of the specimen with the 10x objective.
- 2 Move the target to the center of the viewfield by operating the stage knobs.
- 3 Turn the stage by 180 degrees.
- 4 When the target is shifted from the center, adjust the stage centering screws (two positions) with the hexagonal screwdriver to move the target to the half position of the moving distance of the target from the center of the viewfield.



A stage centering screw is provided to each side rear of the elevating section.

- 5 Repeat steps 2 to 4 for two or three times to achieve a proper position.
- 6 Switch the objective to the one of a high magnification (40x or such) and repeat steps 2 to 5.

Centering the circular graduated stage is very important operation to perform the orthoscopic microscopy and the conosopic microscopy with the intermediate tube for the polarization microscopy. The eyepiece of the binocular/trinocular eyepiece tube contains crosshairs for proper adjustment.

► **45 degrees click-stop lever (only for the P circular graduated stage)**

For the P circular graduated stage, the click-stop position can be provided to the stage by 45 degrees of the rotation.

Turning the 45 degrees click-stop lever towards the front until it stops causes the click-stop function to move in 45 degrees increments from the position where the lever was rotated. This makes it possible to move easily and accurately from the extinction position to the diagonal position.

Turning the lever towards the back until it stops releases the click-stop function. Release the click-stop function where the stage has dropped into a click position. If the click-stop function is released where the stage is not at this position, the first 45 degrees increment will not be accurate the next time the click-stop function is operated.

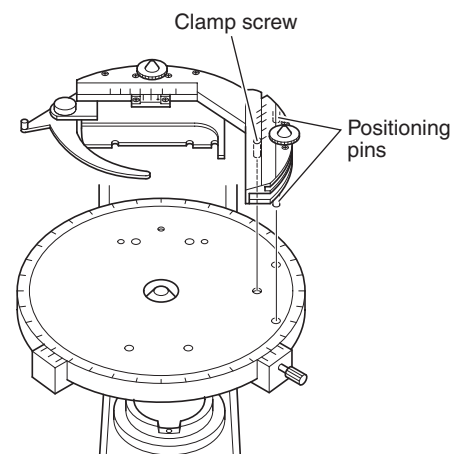
► **Attachable mechanical stage (optional) (for the P circular graduated stage or P-GS2 G Stage 2)**

The attachable mechanical stage can be attached to the rotatable stage (P circular graduated stage or P-GS2 G Stage 2).

The attachable mechanical stage is installed by inserting the two pins on the bottom into the two pinholes on the stage surface. Tighten the clamp screw using the supplied hexagonal wrench.

To move the specimen position under observation, rotate the knob on the stage. You can adjust the position in the X-direction and Y-direction individually. (Travel range: 35 x 25 mm) The travel amount can be read to 0.1 mm with the two vernier scales.

Specimens are fixed with a lever. So you can change specimens with easy operation.



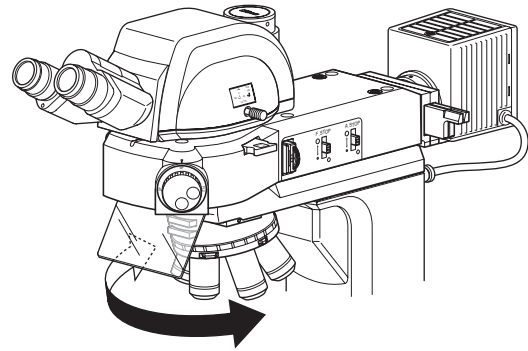
9 Objective

▶ Rotating the nosepiece

Rotate the nosepiece to the click-stop position by hand to switch objectives.

When rotating the nosepiece, check the height of the stage to prevent the objective from touching to the specimen or the stage.

Normally, attach the objectives so that the magnification increases as the nosepiece is turned clockwise as viewed from above.



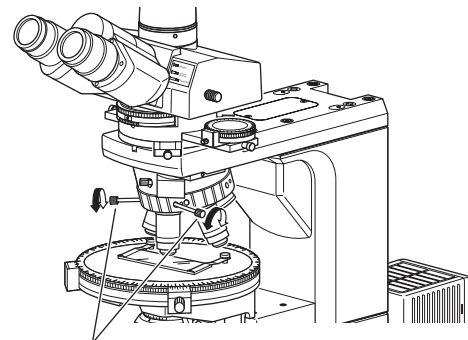
Rotating the nosepiece to the click-stop position

▶ Centering the objective (when the centering nosepiece is used)

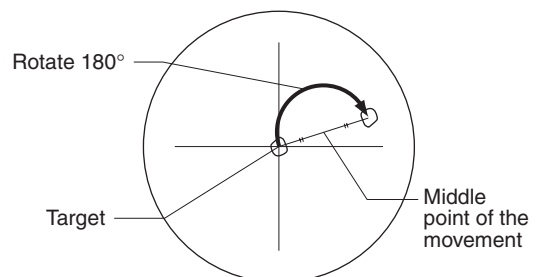
To perform the polarization microscopy, the center of the objective optical path must be aligned to the rotation center of the circular graduated stage. When the centering nosepiece (P-N) is used, objectives can be centered according to the following procedure.

Necessary tools: two centering tools (provided with the nosepiece)

- 1 Before centering objectives, select the 10x objective and focus on the specimen.
- 2 Bring an appropriate target such as granules that can be easily used as a marker in the specimen to the center of the crosshairs of the eyepiece.
- 3 Insert the centering tools into the centering screws on the nosepiece.
- 4 Rotate the stage about 180 degrees. Move the objective using the centering tools so that the center of the crosshairs moves by one-half the amount of movement of the target.
- 5 Move the specimen and bring the target to the center of the crosshairs.
- 6 Repeat this procedure several times. Carry out this centering procedure for each objective.



Objective centering tools



10 Filter

▶ Filter for the episcopic illumination

Two filter sliders are located near the rear side of the epi illuminator LV-UEPI2. Each slider can hold two filters. Push in or pull out the filter sliders to locate the desired filters.

See Page 88 for the filter attaching method.

Filters	Usage
NCB11 (neutral color balancing filter)	For color balancing and color photomicrography
ND4 (ND filter)	For brightness control (transmittance: 25%)
ND16 (ND filter)	For brightness control (transmittance: 6%)
GIF (green interference filter)	For contrast control
IF (interference filter)	For interference

▶ Filter for the diasopic illumination

Following two filters are mounted in the base unit of the product.

The switches for inserting and retracting the filters are provided on the right side of the product.

Lower the switch to insert the filter in the optical path, and raise the switch to remove it from the optical path.

Filters	Usage
NCB11 (neutral color balancing filter)	For color balancing and color photomicrography
ND8 (ND filter)	For brightness control (transmittance: 12.5%)

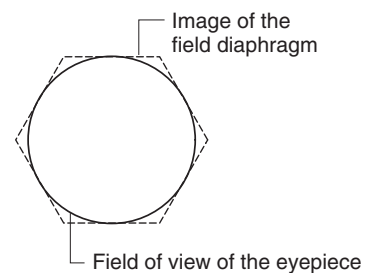
11 Adjustment for the Episcopic Illumination (Field Diaphragm and Aperture Diaphragm)

► Field diaphragm

The field diaphragm restricts the illumination light to the area on the specimen to be observed. If a broader area than necessary is illuminated, stray light may enter the optical system, creating flaring, and reducing the contrast of the optical image.

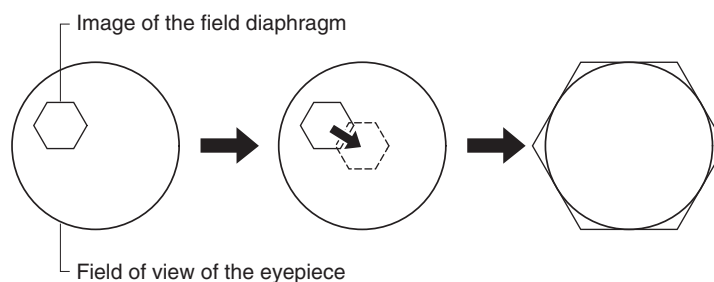
The field diaphragm open/close lever of the LV-UEPI2 changes the opening of the field diaphragm. Adjust the opening of the diaphragm until it circumscribes the field of view. For photomicrography, field diaphragm should be set to an area slightly larger than the area to be exposed on film.

* The adjustment of the field diaphragm opening should be performed after centering the diaphragm.



Centering procedure for the field diaphragm

- 1 Follow the procedure described in Pages 14 and 15 for the bright-field microscopy under the episcopic illumination, and focus on the specimen with the 10x objective.
- 2 Lower the field diaphragm open/close lever and reduce the opening of the field diaphragm.
- 3 Insert a hexagonal wrench into the field diaphragm centering holes on both sides of the LV-UEPI2 and turn the internal adjustment screws to bring the field diaphragm image to the center of the field of view.
- 4 Adjust the field diaphragm image with the field diaphragm open/close lever and centering screws so that it inscribes the field of view.
- 5 To observe the specimen, raise the field diaphragm open/close lever so that the field diaphragm image circumscribes the field of view.

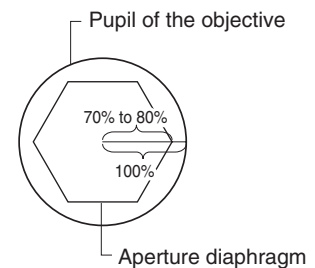


▶ Aperture diaphragm

The aperture diaphragm controls the numerical aperture of the illumination system, closely related to the resolution of the optical image, contrast, and depth of focus. Generally, the aperture diaphragm should be adjusted to about 70 to 80% of the numerical aperture of the objective.

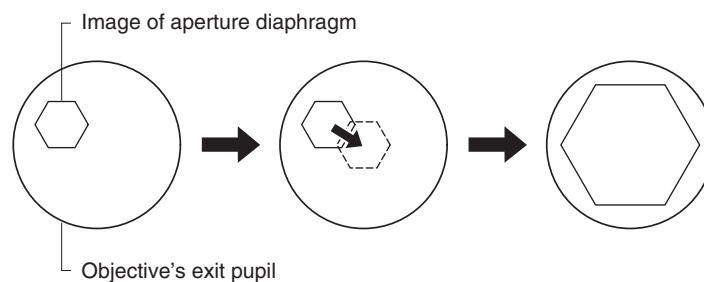
The size of the aperture diaphragm can be controlled by the aperture diaphragm open/close lever of the LV-UEPI2. Remove one of the eyepieces, and then adjust the aperture diaphragm opening while observing the exit pupil of the objective (the bright area when the aperture diaphragm is fully opened) in the eyepiece tube.

When the reflectance of the specimen is low, the diaphragm image may not be seen. In this case, change to a specimen of a near-polished surface.



Centering procedure for the aperture diaphragm

- 1 Follow the procedure described in Pages 14 and 15 for the bright-field microscopy under the episcopic illumination, and focus on the specimen with the 10x objective.
- 2 Remove one eyepiece, and verify that the aperture diaphragm image is seen in the pupil of the objective in the eyepiece tube.
- 3 Stop down the aperture diaphragm by moving down the aperture diaphragm open/close lever.
- 4 Insert a hexagonal wrench into the aperture diaphragm centering holes on both sides and turn the internal adjustment screws to bring the aperture diaphragm image to the pupil center of the objective.
- 5 Operate the open/close lever and the centering screws so that the aperture diaphragm image inscribes the pupil of the objective.
- 6 When starting observation, adjust the aperture diaphragm open/close lever so that the aperture diaphragm image is 70 to 80% of the numerical aperture of the objective. (Perform this adjustment for each objective.)

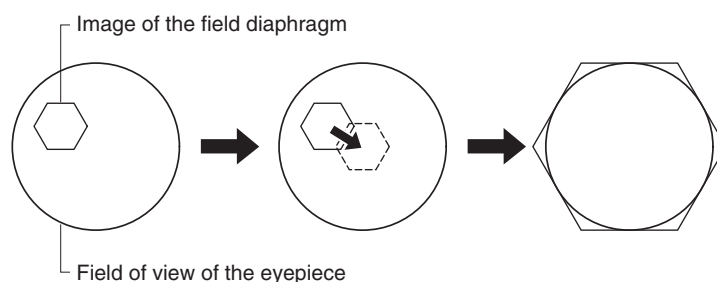
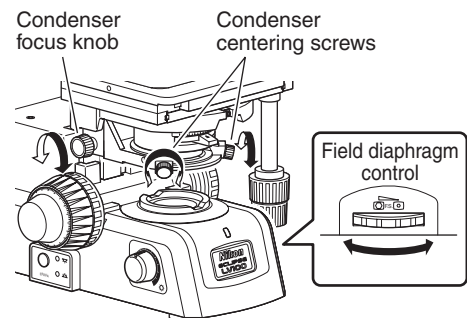


12 Adjustment for the Diascopic Illumination (Focusing and Centering the Condenser and Adjusting the Field Diaphragm and Aperture Diaphragm)

► Focusing and centering the condenser

When this product is used for the first time or after the condenser lens is replaced, focus and center the condenser so that the light through the condenser is focused on the correct position of the specimen surface (at the center of the optical path).

- 1 Follow the procedure described in Pages 23 and 24 for the bright-field microscopy under the diascopic illumination, and focus on the specimen with the 10x objective.
- 2 Turn the field diaphragm control on the microscope base to reduce the opening of the field diaphragm.
- 3 Turn the condenser focus knob to form the field diaphragm image on the specimen surface.
- 4 Turn the two condenser centering screws on both sides so that the field diaphragm image is positioned in the center of the field of view.
- 5 Locate the 50x objective into the optical path. Turn the fine focus knob to focus on the specimen.
- 6 Turn the condenser focus knob to form the field diaphragm image on the specimen surface.
- 7 Adjust the field diaphragm control and the condenser centering screws so that the field diaphragm image inscribes the field of view.
- 8 To observe the specimen, turn the field diaphragm control so that the field diaphragm image circumscribes the field of view. (Adjust the diaphragm image every time when objectives are changed.)



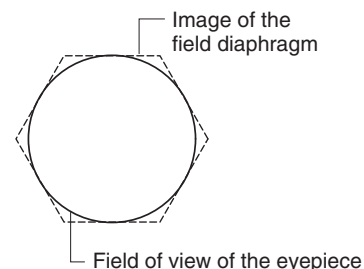
Field diaphragm

The field diaphragm restricts the illumination light to the area on the specimen to be observed. The field diaphragm control on the right side of the microscope base changes the opening of the field diaphragm. Adjust the opening of the diaphragm until it circumscribes the field of view.

If a broader area than necessary is illuminated, stray light may enter the optical system, creating flaring, and reducing the contrast of the optical image.

For photomicrography, the setting of the field diaphragm becomes very important. Generally, the field diaphragm should be set to an area slightly larger than the area to be exposed on film, that is, the photographed area.

Perform the field diaphragm adjustment after completing focusing and centering for the condenser lens.

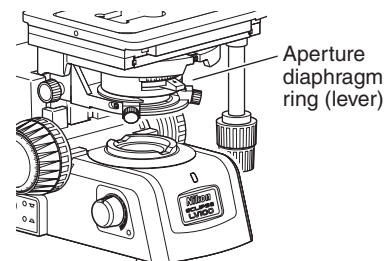
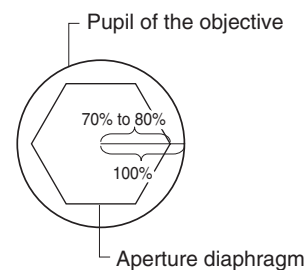


Aperture diaphragm

The aperture diaphragm controls the numerical aperture of the illumination system, closely related to the resolution of the optical image, contrast, and depth of focus.

Rotating the aperture diaphragm ring (lever) on the condenser for the diasopic illumination will change the opening of the aperture diaphragm. Generally, the aperture diaphragm should be adjusted to about 70 to 80% of the numerical aperture of the objective.

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



- **Adjusting the size of the aperture diaphragm according to the condenser scale**

The scales for the condenser are provided as numerical apertures. Normally, the index on the aperture diaphragm ring should be aligned with the scale line corresponding to 70% to 80% of the numerical aperture of the objective.

- **Adjusting the size of the aperture diaphragm using the Bertrand lens**

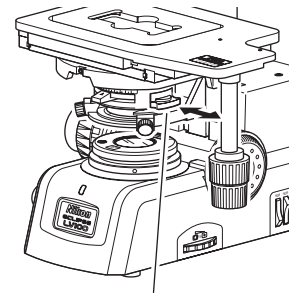
When the intermediate tube for the polarization microscopy is used, the aperture diaphragm can be adjusted with the Bertrand lens. Turn the diaphragm control ring of the condenser to stop down the aperture diaphragm to its minimum setting. Insert the Bertrand lens into the optical path (by placing in position "B"). Turn the Bertrand lens focus ring to focus on the aperture diaphragm image. Turn the diaphragm control ring to adjust the aperture diaphragm. (This is normally adjusted to 70 to 80% of the view field.)

- **Aperture diaphragm for the conoscopic microscopy**

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

► **Slide condenser**

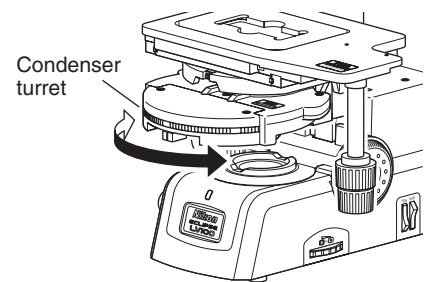
When the slide condenser is used, vignetting in the field is seen with the 2.5x objective: therefore, the slider should be kept inserted. When the 5x or higher objective is used, the slider should be pulled.



Slider

► **Universal condenser**

The universal condenser has a condenser turret for switching the optical elements (modules) inside the condenser. Rotate the condenser turret to change microscopy methods under the diascope illumination. There are seven click-stop positions on the condenser turret, which a label corresponding to each module is affixed on. To place the desired module into the optical path completely, rotate the condenser turret to the click-stop position where the label corresponding to the desired module faces front.



Condenser turret

Label	Module	Application
0	Empty hole (no module)	Select this module for the bright-field microscopy under the diascope illumination.
Ph1 ~ Ph3	Ph annular diaphragm	Select one of the modules corresponding to the Ph code of the objective for the Ph microscopy under the diascope illumination. To observe a specimen, center the diaphragm for the phase plate ring of the objective. *1
2-4x	2-4x auxiliary lens	Select this module to perform the bright-field microscopy under the diascope illumination with the 2x to 4x objectives.
DF	Dark field annular diaphragm	Select this module to perform the dark-field microscopy under the diascope illumination.
N1, N2, NR	Condenser DIC prism	Select one of the modules corresponding to the objective to perform the DIC microscopy under the diascope illumination. *2

*1 For details about centering the Ph annular diaphragm, see the instruction manual for the LV-CUD.

*2 For the combination between the prisms and objectives, see page 67.

For details about the universal condenser operation, the microscopes with the universal condenser, and the module installation into the condenser, see the instruction manual for the LV-CUD.

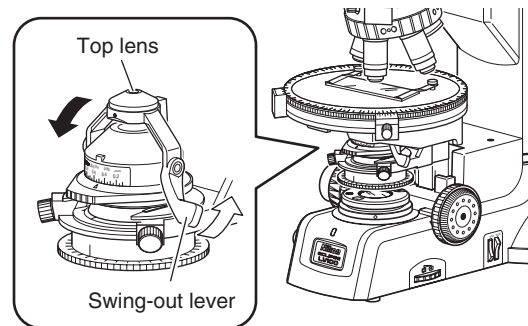
► Swing-out achromat condenser for the polarization microscopy

The swing-out achromat condenser for the polarization microscopy is used to perform the orthoscopic microscopy or the conoscopic microscopy with the intermediate tube for the polarization microscopy.

The top lens of the swing-out achromat condenser for the polarization microscopy can be moved outside the optical path with the swing-out lever.

During normal bright-field microscopy or orthoscopic microscopy using a low-power objective of 4x or lower, swing out the top lens. During microscopies using an objective of 10x or higher or conoscopic microscopy, the top lens is placed into the optical path.

During measurement of retardation or evaluation by interference color, swing out the top lens (the condenser aperture diaphragm may be stopped down) and illuminate with light that is as parallel to the optical axis as possible.



Depending on the type of objective, the indicated numerical aperture of the objective may not be achieved. For example, when an objective with an N.A. of 1.4 is used, the maximum aperture of the swing-out condenser will be only about 65% of the objective's N.A., even when the condenser aperture diaphragm is wide open.

13 Polarizer Sliders for the Episcopic Illumination

► Placing the polarizer into the optical path

The three polarizer sliders as shown below can be used for the product.

Polarizer	Application
LV-PO polarizer	Polarization microscopy under the episcopic illumination (simplified/sensitive color)
LV-UPO polarizer	Polarization microscopy under the episcopic illumination
LV-UVPO UV polarizer	Epi-fl microscopy

- **LV-PO polarizer**

The polarizer is used to perform the polarization microscopy under the episcopic illumination. For the simplified polarization microscopy under the episcopic illumination, use the polarizer with the analyzer slider. For the sensitive color polarization microscopy under the episcopic illumination, use the polarizer with the analyzer slider and the lambda plate slider.

- **LV-UPO polarizer (equipped with the 1/4 lambda plate)**

The polarizer is used to perform the DIC microscopy under the episcopic illumination. For the DIC microscopy under the episcopic illumination, use the polarizer with the sextuple DIC nosepiece (D-ND6), LU Plan Fluor Epi objective, analyzer slider, and DIC prism.

The contrast of the differential interference contrast images can be adjusted by adjusting the orientation of the polarizer. For the sensitive color DIC microscopy, insert the lambda plate slider into the slot on the nosepiece in the DIC microscopy under the episcopic illumination condition.

- **LV-UVPO UV polarizer**

The polarizer is used to change the excitation light to a linearly polarized light for the epi-fl microscopy under the UV excitation light. As the polarizer deteriorates over time, change it if necessary.

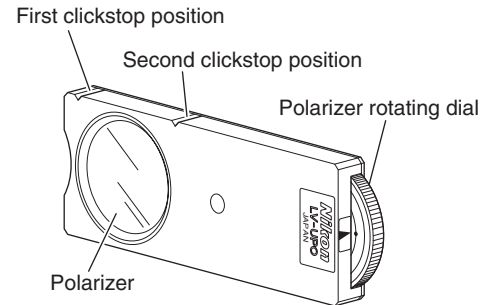
► **Placing the polarizer into the optical path**

• **Attaching the polarizer**

Remove the vertically oriented cover at the right side of the illuminator. And then, insert the polarizer slider into the rear slot with its orientation indication facing toward the eyepieces. Insert the dummy slider into the front slot. (See Page 88.)

• **Placing the element into the optical path**

When the polarizer slider is pushed into the first click-stop position, the empty hole is placed into the optical path. And when the polarizer slider is pushed into the second click-stop position, the polarizer is placed into the optical path. The orientation of the polarizer can be set by turning the polarizer rotation ring.



► **Removing the polarizer from the optical path**

When the polarizer is placed in the optical path and you wish to remove the polarizer from the optical path, pull the polarizer slider toward the right to the first click-stop position. (The empty hole will be placed into the optical path.)

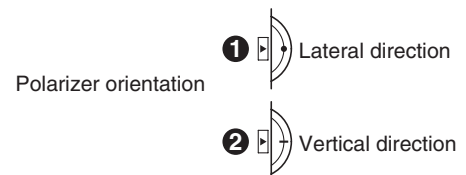
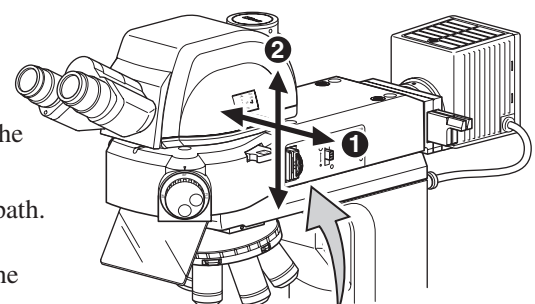
► **Orientation adjustment for the polarizer**

The orientation of the polarizer can be changed by turning the polarizer rotation ring. Perform the following to make a crossed Nicols position with the polarizer and the analyzer.

Place the polarizer and the analyzer in the optical path. And then, place a specimen with a flat and plain surface onto the stage. Set up the microscope for the simplified polarization microscopy under the epi illumination.

Remove one eyepiece from the eyepiece tube and look inside the open sleeve. You can see the pupil of the objective as a bright circle.

Turn the polarizer rotation ring in either direction until a dark cross appears in the viewfield as shown in the figure. This is the crossed Nicols position. (Matching the marks on the polarizer rotation ring as shown in ① on the illustration will bring about the crossed Nicols position as well.)



When using the intermediate tube for the polarization microscopy and the epi illuminator together, remove the analyzer of the epi illuminator, set the rotation ring on the analyzer of the intermediate tube for the polarization microscopy to “O”, and perform the adjustments described above. For operating the intermediate tube for the polarization microscopy, see Page 75, “Intermediate tube for the polarization microscopy.”

14 Polarizer for the Diascopic Illumination

► Polarizer for the diascopic illumination

The following two types of polarizers for the diascopic illumination can be used for the product.

Polarizer	Application	Remark
C-SP polarizer for the diascopic illumination	Polarization microscopy under the diascopic illumination (simplified/sensitive color), orthoscopic microscopy, and conoscopic microscopy	Provided with the swing-out mechanism
D-DP DIC rotatable polarizer	DIC microscopy under the diascopic illumination	Equipped with the 1/4 lambda plate, provided with the swing-out mechanism

- **C-SP polarizer for the diascopic illumination**

This polarizer is used to perform the polarization microscopy under the diascopic illumination, the orthoscopic microscopy, and the conoscopic microscopy.

The polarization microscopy under the episcopic illumination can be performed with this polarizer and the analyzer slider attached to the epi illuminator (LV-UEPI2) or the . When the sextuple DIC nosepiece (D-ND6) is attached, the sensitive color microscopy under the diascopic illumination can be performed by attaching the lambda plate to the nosepiece.

Additionally, the orthoscopic microscopy or the conoscopic microscopy can be performed by using this polarizer, the intermediate tube for the polarization microscopy, binocular or trinocular eyepiece tube for the polarization microscopy, P circular graduated stage, quintuple centering nosepiece (P-N), P objective, and the swing-out achromat condenser for the polarization microscopy.

- **D-DP rotatable polarizer for the diascopic illumination (equipped with the 1/4 lambda plate)**

This polarizer is used to perform the DIC microscopy under the diascopic illumination.

The DIC microscopy under the diascopic illumination can be performed by using this polarizer, the universal condenser (LV-CUD), condenser DIC prism, objective DIC prism, sextuple DIC nosepiece (D-ND6), analyzer slider, and the lambda plate for the diascopic illumination. The contrast of DIC images can be adjusted by rotating the upper part of the rotatable polarizer for the diascopic illumination and adjusting its orientation.

Polarizer for the diascope illumination (C-SP)

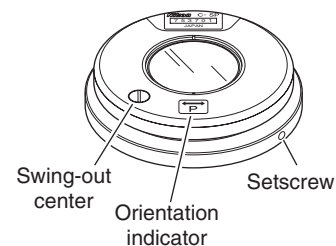
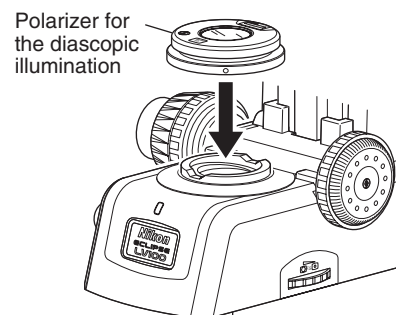
Place the polarizer over the field lens at the microscope base with the polarizer orientation mark facing the front.

The orientation of the polarizer can be changed by turning the whole polarizer. Perform the following to make a crossed Nicols position with the polarizer and the analyzer.

- 1** Place the polarizer and analyzer into the optical path and fully open the aperture diaphragm.
- 2** Remove one eyepiece from the eyepiece tube and look inside the open sleeve. You can see the pupil of the objective as a bright circle and can see black patterns in the circle.
- 3** Turn the whole polarizer for the diascope illumination in either direction until a dark cross appears in the viewfield as shown in the figure. This is the crossed Nicols position.
- 4** Secure the polarizer for the diascope illumination by tightening the setscrew.

The polarizer for the diascope illumination can be temporarily removed from the optical path by swinging out the upper part of the polarizer. When the polarizer is not needed for the microscopy, it can be removed easily with the mechanism.

To place the polarizer into the optical path, reversely rotate the upper part of the polarizer to the click-stop position.



Dark cross



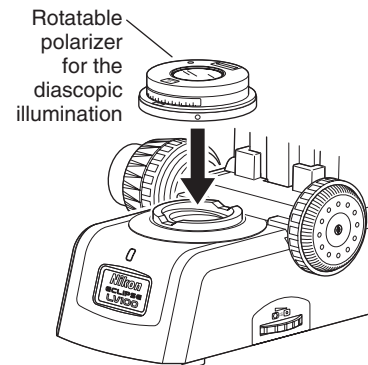
Removing the polarizer from the optical path

▶ Rotatable polarizer for the diascope illumination (D-DP)

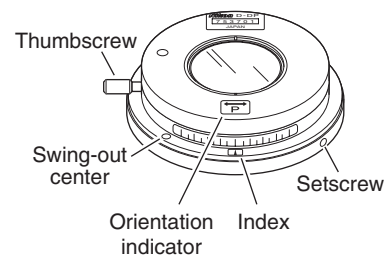
Place the rotatable polarizer for the diascope illumination over the field lens at the microscope base with the polarizer index facing the front and secure it with the clamp screw.

The orientation of the polarizer can be adjusted by loosening the clamp screw on the side and rotating the upper part. The orientation can be secured by tightening the clamp screw.

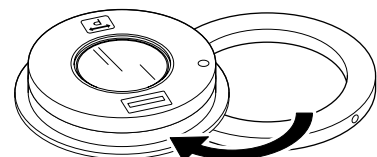
Normally, to perform the DIC microscopy, adjust the orientation of the polarizer according to the following procedure so that the polarizer and the analyzer are at the crossed Nicols position when the orientation indicator is located at the index.



- 1 Set the system for the bright-field microscopy for the diascope illumination. Then, focus and center the condenser.
- 2 Focus on the specimen.
- 3 Place the analyzer into the optical path.
- 4 Adjust the orientation of the rotatable polarizer for the diascope illumination by loosening the setscrew. And, tighten the setscrew with the index facing the front of the microscope.
- 5 Loosen the thumbscrew and rotate the upper part of the rotatable polarizer for the diascope illumination to align the orientation indicator with the index.
- 6 Fully open the aperture diaphragm.
- 7 Remove one eyepiece from the eyepiece tube and look inside the open sleeve. You can see the pupil of the objective as a bright circle and can see black patterns in the circle.
- 8 Loosen the setscrew on the rotatable polarizer for the diascope illumination with the hexagonal screwdriver.
- 9 Rotate the rotatable polarizer for the diascope illumination until the dark cross is seen in the pupil of the objective as shown in the right figure. The position that the dark cross is seen is called the crossed Nicols. Normally, the field of view at the crossed Nicols position is the darkest.
- 10 Tighten the setscrew to secure the rotatable polarizer for the diascope illumination.



Dark cross



Removing the polarizer from the optical path

The polarizer for the diascope illumination can be temporarily removed from the optical path by swinging out the upper part of the polarizer. When the polarizer is not needed for the microscopy, it can be removed easily with the mechanism.

To place the polarizer into the optical path, reversely rotate the upper part of the polarizer to the click-stop position.

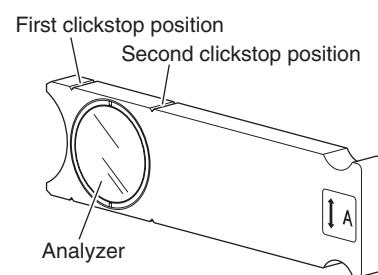
15 Analyzer Slider

Attach the analyzer slider to the epi illuminator (LV-UEPI2) or the sextuple DIC nosepiece (D-ND6).

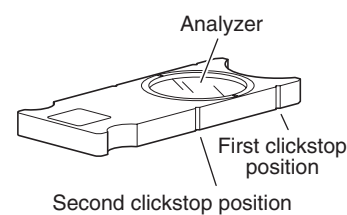
The simplified polarization microscopy under the episcopic illumination can be performed when the analyzer slider is used with the polarizer slider, and the simplified polarization microscopy under the diascope illumination can be performed when the analyzer slider is used with the polarizer for the diascope illumination. Additionally, the sensitive color polarization microscopy under the episcopic illumination can be performed when the lambda plate is attached to the configuration for the simplified polarization microscopy under the episcopic illumination, and the sensitive color polarization microscopy under the diascope illumination can be performed when the lambda plate is attached to the configuration for the simplified polarization microscopy under the diascope illumination.

The DIC microscopy under the epi/dia illumination can be performed when the DIC prism is attached to the configuration for the simplified polarization microscopy under the epi/dia illumination, and the sensitive color DIC microscopy under the epi/dia illumination can be performed when the lambda plate is attached to the configuration of the DIC microscopy under the epi/dia illumination.

When the universal condenser (LV-CUD) and the sextuple DIC nosepiece are attached, the DIC microscopy under the diascope illumination (Senarmont method) can be performed by using the analyzer slider, the rotatable polarizer for the diascope illumination (D-DP), and the condenser/objective DIC prism. Additionally, the DIC microscopy can be performed under the high color balance when the lambda plate is attached to the configuration for the DIC microscopy under the diascope illumination.



Analyzer slider for the epi illuminator



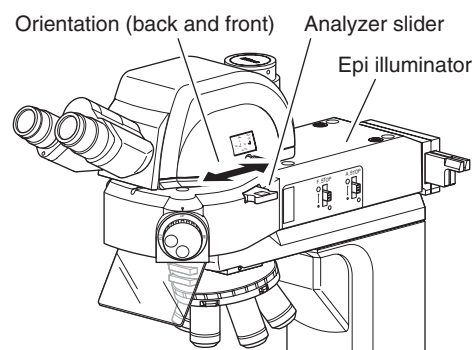
Analyzer slider for the nosepiece

▶ Attaching the analyzer slider to the epi illuminator (LV-UEPI2) and operating

Remove the cover of the slot for the analyzer on the right of the epi illuminator. And then, insert the analyzer slider (LV-FLAN) into the slot with its mark facing up. (See Page 88.)

When the analyzer slider is pushed into the first click-stop position, the empty hole is placed into the optical path. And when the analyzer slider is pushed into the second click-stop position, the analyzer is placed into the optical path.

The orientation of the analyzer is the back and front of the microscope shown in the right figure.

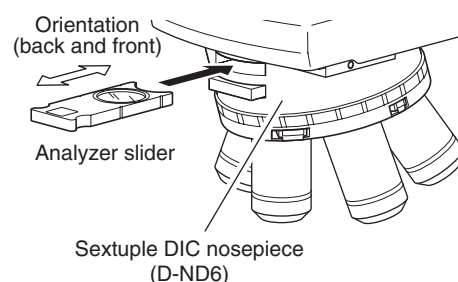


▶ Attaching the analyzer slider to the sextuple DIC nosepiece (D-ND6) and operating

Insert the DIC analyzer (D-DA) into the upper slot for the analyzer on the front of the nosepiece with its mark facing up. (See Page 86.)

When the analyzer slider is pushed into the first click-stop position, the empty hole is placed into the optical path. And when the analyzer slider is pushed into the second click-stop position, the analyzer is placed into the optical path.

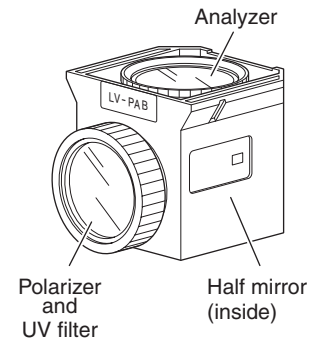
The orientation of the analyzer is the back and front of the microscope.



16 PA Block

Use of the LV-PAB PA block can achieve the crossed Nicols position under the episcopic illumination without applying the polarizer slider or the analyzer slider.

* When the PA block is attached, only the simplified polarization microscopy under the episcopic illumination can be performed. The sensitive color polarization microscopy and the DIC microscopy cannot be performed.



▶ Structure of the PA block

The PA block has the same shape with the filter cube for the epi-fl microscopy. The UV filter and the polarizer are mounted on the entrance side, and the analyzer is mounted on the exit side. The polarizer and the analyzer have been adjusted to the crossed Nicols position.

▶ PA block installation

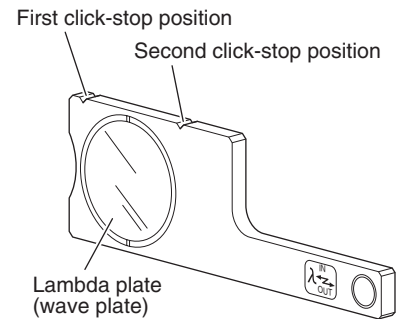
The PA block is installed in the FL1 position of the LV-UEPI2 filter cube turret. See page 89 in “IV. Assembly” for the installation method.

▶ To use the PA block

To place the PA block into the optical path, rotate the microscopy selector knob of the LV-UEPI2 to the “FL1” position. (See Page 37.)

17 Lambda Plate Slider for the Episcopic Illumination

The sensitive color polarization microscopy under the episcopic illumination can be performed when the lambda plate slider is inserted into the slot on the epi illuminator (LV-UEPI2) under the configuration of the polarization microscopy under the episcopic illumination. The sensitive color DIC microscopy under the episcopic illumination can be performed when the lambda plate slider is inserted into the slot on the epi illuminator (LV-UEPI2) under the configuration of the DIC microscopy under the episcopic illumination.



▶ Placing the lambda plate into the optical path

The slot for the lambda plate is provided to the front of the slot for the polarizer of the LV-UEPI2A. Remove the dummy slider and insert the lambda plate into the place. (See Page 88.)

When the slider is removed and you wish to place the empty hole into the optical path, push the slider into the first click-stop position. To place the lambda plate into the optical path, push the slider into the second click-stop position.

▶ Removing the lambda plate from the optical path

When the lambda plate is placed in the optical path and you wish to remove the lambda plate from the optical path, pull the slider toward the right to the first click-stop position.

18 Lambda Plate Slider for the Diascopic Illumination

The sensitive color polarization microscopy under the diascopic illumination can be performed when the lambda plate is inserted into the slot on the sextuple DIC nosepiece (D-ND6) under the configuration of the polarization microscopy under the diascopic illumination. The sensitive color DIC microscopy under the diascopic illumination can be performed when the lambda plate is inserted into the slot on the sextuple DIC nosepiece (D-ND6) under the configuration of the DIC microscopy under the diascopic illumination.

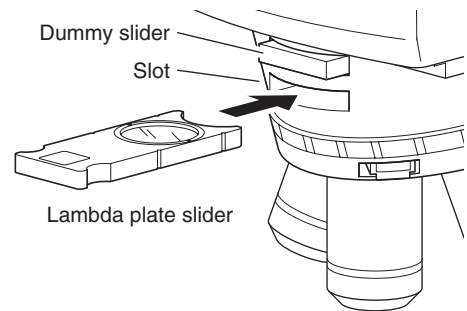
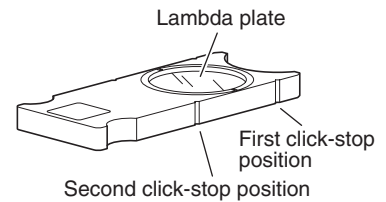
▶ Placing the lambda plate into the optical path

Attach the lambda plate slider to the slot specific to the lambda plate slider on the sextuple DIC nosepiece (D-ND6). (See Page 86.)

When the slider is removed and you wish to place the empty hole into the optical path, push the slider into the first click-stop position. To place the lambda plate into the optical path, push the slider into the second click-stop position.

▶ Removing the lambda plate slider from the optical path

When the lambda plate is placed in the optical path and you wish to remove the lambda plate from the optical path, pull the slider to the first click-stop position.



19 DIC Prism (For the Episcopic Illumination)

To perform the DIC microscopy under the episcopic illumination, attach the LU objective for industrial microscopes to the sextuple DIC nosepiece (D-ND6,) attach the polarizer slider for the episcopic illumination (LV-UPO) equipped with the 1/4 lambda plate and the analyzer slider and set them at the crossed Nicols position, and then attach the DIC prism (DIC slider) suitable for the objectives to the sextuple DIC nosepiece (D-ND6).

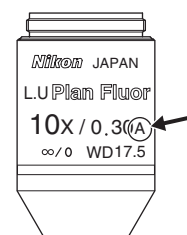
Objectives for the DIC microscopy under the episcopic illumination

To perform the DIC microscopy under the episcopic illumination, attach the LU objective for industrial microscopes to the sextuple DIC nosepiece (D-ND6). The microscopy cannot be performed in other combinations.

▶ Selecting the DIC slider

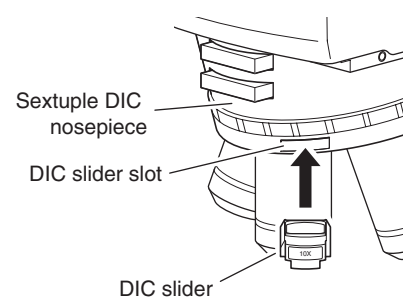
Check the DIC prism position indicated on the objective body and select the DIC slider suitable for the objective. On the LU objective for industrial microscopes, a letter “A” or “B” is indicated next to the magnification and the N.A. value. The letter indicates the DIC prism position of the objective.

DIC slider	Objective and application
LV-DIC A	For the objective of position A
LV-DIC B	For the objective of position B
LV-DIHC A	For the objective of position A, high contrast
LV-DIHC B	For the objective of position B, high contrast



▶ Attaching the DIC slider and placing it into the optical path

Select the DIC slider suitable for the objective and insert the slider into the slot for objectives on the nosepiece. To place the DIC prism into the optical path, insert the DIC slider to the limited position. To remove the DIC prism from the optical path, detach the DIC slider from the nosepiece.



▶ Interference color

You can change the interference color continuously by adjusting the orientation of the polarizer.

Interference color	Characteristics
Dark color	Observations similar to the dark-field microscopy can be performed.
Gray	You can observe the phase contrast distribution of the whole specimen with a bird's eye view.
Sensitive red-violet	Observations with the highest color contrast can be performed.

20 DIC Prism (For the Diascopic Illumination)

To perform the DIC microscopy under the diascopic illumination, use the universal condenser (LV-CUD) and the sextuple DIC nosepiece (D-ND6). Set the rotatable polarizer for the diascopic illumination (equipped with the 1/4 lambda plate) and the analyzer at the crossed Nicols position and insert the DIC prism into the front and rear of the specimen.

The DIC prism to be attached to the condenser is named “condenser DIC prism” and the DIC prism to be attached to the nosepiece is named “objective DIC prism.” Select a DIC prism suitable for objective magnification and observation purpose according to the table on next page.

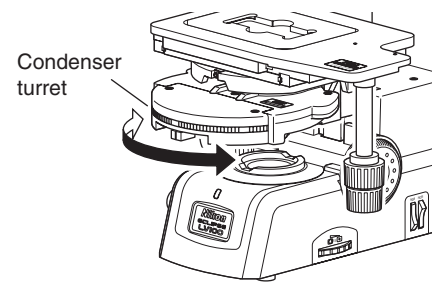
Objectives for the DIC microscopy under the diascopic illumination

Use the DIC objective for biologic microscopies shown in the table on Page 67 to perform the DIC microscopy under the diascopic illumination.

▶ Inserting the condenser DIC prism

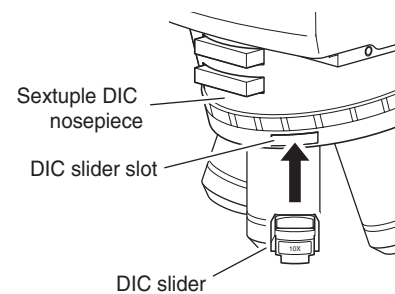
Attach the condenser DIC prism to the inside of the universal condenser. To place the condenser DIC prism into the optical path, rotate the condenser turret. There are three types of condenser DIC prisms (N1 Dry, N2 Dry, and NR Dry). For selecting the DIC prism suitable for the used objective, refer to the list on the Page 67.

* For the procedure of attaching the condenser DIC prism, see the instruction manual for the LV-CUD.



▶ Attaching the objective DIC prism and placing it into the optical path

Attach the objective DIC prism (DIC slider) to the slot for the objectives on the nosepiece. To place the DIC prism into the optical path, insert the DIC slider to the limited position. To remove the DIC prism from the optical path, detach the DIC slider from the nosepiece.



▶ Interference color

You can change the interference color continuously by adjusting the orientation of the polarizer.

Interference color	Characteristics
Dark color	Observations similar to the dark-field microscopy can be performed.
Gray	You can observe the phase contrast distribution of the whole specimen with a bird's eye view.
Sensitive red-violet	Observations with the highest color contrast can be performed.

Combination of the DIC prisms for the DIC microscopy under the diascopic illumination and the objectives

The combination of the DIC prisms differs depending on the used objective. Be careful that the DIC contrast images cannot be obtained or the contrast is reduced excessively if the combination is wrong.

To obtain the images with the higher contrast or resolution for the observation purpose, use the special prism. However, the contrast and the resolution are contradictory in principle. (When the contrast is increased, the resolution is reduced.) Select the combination suitable for the purpose.

Combination of the DIC prisms for the DIC microscopy under the diascopic illumination and the objectives

Name of objective		Standard combination		Combination when contrast is important		Combination when resolution is important	
		Name of objective DIC prism	Name of condenser DIC prism	Name of objective DIC prism	Name of condenser DIC prism	Name of objective DIC prism	Name of condenser DIC prism
10X	Plan Apo 10XA	10X	N1 Dry				
	Plan Fluor 10X/10XA						
	S Fluor 10X						
	Fluor 10X W						
Plan Fluor 10X W							
20X	Plan Fluor 20X/20XA	20X		20X-C			
	Plan Fluor 20X MI						
	Plan Apo 20X/20XA						
	Plan Apo VC 20X						
	S Fluor 20X						
Fluor 20X W							
40X	Plan Fluor 40X/40XA	40X I		40X I-C			
	Plan Apo 40X						
	S Fluor 40X						
	Plan NCG 40X						
	Plan Fluor 40X Oil	40X II					
S Fluor 40X Oil							
Fluor 40X W	40X III						
Plan Apo 40X Oil							
Apo 40X W NIR							
60X	Plan Apo 60X A Oil	60X I	N2 Dry				
	Plan Apo 60X						
	Fluor 60X W						
	Plan Apo VC 60X oil						
	APO 60XW NIR						
	APO TIRF 60X Oil						
Plan Fluor 60X/60XA Oil iris	60X II						
Plan Apo TIRF 60X Oil							
Plan Apo 60X WI C							
1) Plan Apo VC 60X WI	60X IV						
Plan Fluor 60X A							
2) Plan Apo VC 60XA WI							
100X	Plan Apo VC 100X oil	100X I					
	APO TIRF 100X Oil						
	3) Plan Apo 100X NCG Oil						
	Plan Fluor 100x						
	Plan Fluor 100X /100XA Oil	100X II					
Plan Fluor 100X /100XA Oil iris							
Plan Apo 100X Oil							
Plan Apo TIRF 100X Oil							
4) Plan Apo 100X NCG Oil							
Plan 100X W							

For Identifying the Objective

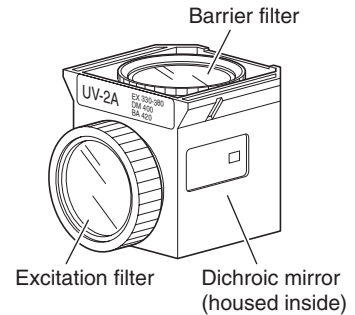
- 1) Magnification "60X/1.20" indicated on the objective.
- 2) Magnification "60XA/1.20" indicated on the objective.
- 3) "DIC" not indicated or "DIC H/N2" indicated on the objective.
- 4) "DIC N2" indicated on the objective.

21 Filter Cube for Fluorescence Observation

The LV-UEPI2 can accommodate up to two filter cubes for the epi-fl microscopy.

A filter cube consists of three types of optical components: an excitation light filter (EX filter), a barrier filter (BA filter), and a dichroic mirror (DM). Taking the following as a guideline, select a combination of filters that is suitable for your purpose and for the characteristics of the specimen and the fluorophore.

- Even in the same excitation method, a variety of combination of the excitation light filter and the barrier filter can be selected.
- Each excitation light filter (EX filter), barrier filter (BA filter), and dichroic mirror (DM) can be purchased separately.
- The excitation light filter is exposed to strong lights. Therefore it may deteriorate under use. It is recommended to replace it at a proper interval.
- See Page 89, “4. Filter cubes” of “IV. Assembly” for the filter cube installation method.



Light source for the epi-fl microscopy

To perform the epi-fl microscopy, the standard light source (a halogen lamp) may not be able to provide the sufficient brightness. In such case, use an external light source for the episcopic illumination that is suitable for the excitation method.

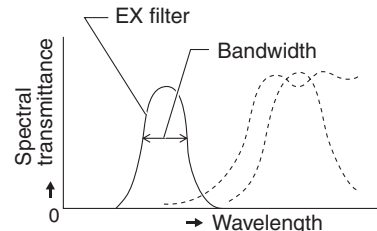
** Please take note that if an external light source is attached onto this microscope, the microscope system will not be treated as a UL-listed product. Nikon recommends that the light source to be installed onto this microscope should have been tested by a safety certification organization.*

▶ **Selecting the excitation light filter (EX filter)**

An excitation light filter transmits lights selectively and blocks other lights. The transmitted lights are called excitation lights. They are used to excite the fluorophore in the specimen and fluorescent lights are emitted from the specimen. The wavelength range of lights that can pass through the filter is called the bandwidth.

The bandwidth of the excitation light filter determines the brightness of the fluorescent image, the occurrence of autofluorescence (fluorescence resulting from substances other than the fluorophores), and degree of fading. When the filter has a wide bandwidth, a large amount of excitation lights will be irradiated on the specimen. In this case, the image becomes bright but the amount of autofluorescence becomes large and fading of the specimen occurs soon. On the contrary, when the filter has a narrow bandwidth, a small amount of excitation lights will be irradiated on the specimen. In this case, the image becomes dark but the amount of autofluorescence becomes small and fading of the specimen occurs late. For specimens with pronounced autofluorescence, use an excitation light filter with a narrow bandwidth. (The resulting fluorescent image will be darker, however.)

The excitation light filter is exposed to strong lights. Therefore it may deteriorate under use. Please replace it at a proper interval based on the hours used.



	Narrow	Bandwidth of excitation filter	Wide
Brightness of fluorescence image	Dark		Bright
Occurrence of self-fluorescence	Less frequent		Frequent
Degree of fading	Small		Large

▶ Selecting the barrier filter (BA filter)

A barrier filter transmits only fluorescent lights emitted by the specimen but blocks the excitation lights. This filter makes it possible to observe the fluorescent image without unnecessary light (that is, on a dark background).

There are two types of barrier filters: LP filters (long-pass filters), which block all lights that are shorter than a certain boundary wavelength and allow all lights to pass that are longer than the boundary wavelength, and BP filters (band-pass filters), which allow only lights in a certain bandwidth to pass. Please use a proper filter depending on the purpose.

• LP filters (long-pass filters)

A long pass filter transmits lights that have longer wavelength than a certain wavelength but blocks lights that have shorter wavelength. The boundary wavelength is called the cut-on wavelength.

- 1) An excitation light is a light that is irradiated to the specimen. The fluorophore in the specimen absorbs the excitation light energy. As a result, fluorescent lights are emitted from the fluorophore instead. When a specimen is labeled with a fluorophore that emits fluorescent lights of very close wavelengths to the excitation light, select a barrier filter with the shortest cut-on wavelength permitted by performance requirements for efficient fluorescent microscopy. A longer cut-on wavelength tends to result in a more complete separation between an excitation light and fluorescent lights, rendering a darker background of the fluorescent image. With the recent advancement in filter performance, however, filters with shorter cut-on wavelengths can be used for this purpose and they are used more often than before.
- 2) An LP filter is used for a specimen labeled with multiple wavelengths where fluorescent images for all the wavelengths are desired.

However, the usual combination of a dichroic mirror, an excitation light filter, and a barrier filter of LP filter type, may not be sufficient to excite a fluorophore that emits fluorescent lights of longer wavelength (for example, the TRIC when the specimen is labeled with the FITC and the TRITC), making the fluorescent image for the TRITC very dark. In a case like this, a multi-band filter is recommended.

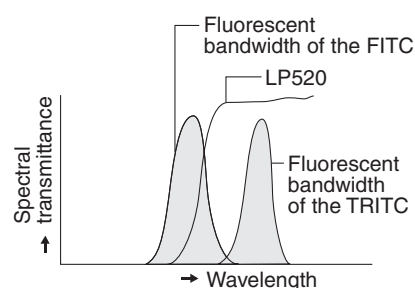
• BP filters (band-pass filters)

A BP filter transmits lights of a certain bandwidth.

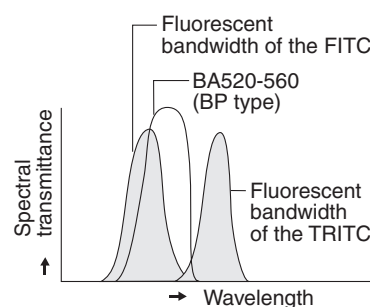
This type of filter is used to observe a fluorescent image only emitted by a certain fluorophore when the specimen is labeled with multiple fluorophore. (For example, when a specimen is labeled with the FITC and the TRITC and you wish to observe a fluorescent image only emitted by the FITC, use a filter of BA520-560.)

However, you cannot distinguish the autofluorescence from the other fluorescences in the image transmitted through the BP filter because the image will only be of one color (green, in the above example).

When you wish to distinguish the autofluorescence by a subtle difference of hue, an LP filter is more useful.



Both the FITC fluorescent image and the TRITC fluorescent image are visible.



Only the fluorescent image emitted by the FITC is visible.

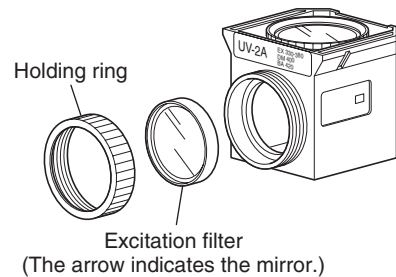
▶ Replacing excitation light filters, barrier filters, and dichroic mirrors

The excitation light filter, the barrier filter, and the dichroic mirror in the filter cube can be replaced with other elements. When handling these elements, put on gloves and do not touch the surface of filters and mirrors with bare hands. And be careful not to let dust or fingerprints get on them.

• Replacing excitation light filters

The excitation light filter is secured by a screwed type holding ring to the filter cube.

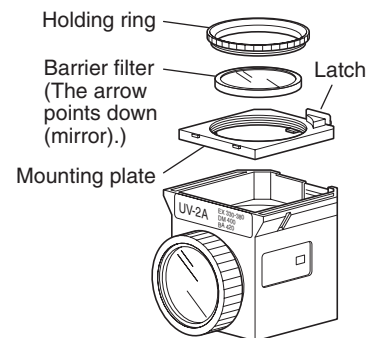
- 1 Rotate the holding ring in counterclockwise direction to remove it.
- 2 Replace the excitation light filter with a new one and secure it with the holding ring.
When attaching the excitation light filter, make sure to place the filter with its arrow mark on the rim facing to the dichroic mirror side.
If a filter made by other manufacturer is used, check and see the filter orientation with the indication on the rim of the filter before securing it.



• Replacing barrier filters

The barrier filter is secured by a screw type holding ring to the mounting plate at the top of the filter cube.

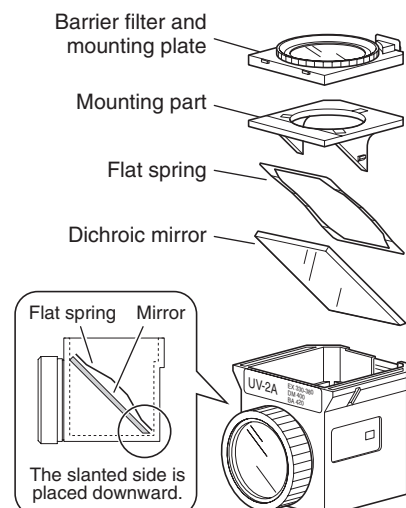
- 1 Press the latch to inside and detach the mounting plate with the barrier filter.
- 2 Rotate the holding ring to remove it from the mounting plate.
- 3 Replace the barrier filter with a new one and secure it in the reverse order.
When attaching the barrier filter, make sure to place the filter with its arrow mark on the rim facing down (to the dichroic mirror side).
If a filter made by other manufacturer is used, check and see the filter orientation with the indication on the rim of the filter before securing it.



• Replacing dichroic mirrors

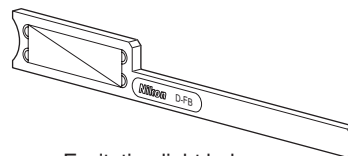
A dichroic mirror is fixed with a flat spring and a mounting hardware inside the filter cube.

- 1 Detach the mounting plate with the barrier filter.
- 2 Pull the mounting hardware upward to remove it. (It is clamped with latches on both sides.)
- 3 Remove the flat spring and the dichroic mirror.
- 4 Set a new dichroic mirror and attach the flat spring and the dichroic mirror in their original positions.
The edge of the dichroic mirror is slanted on one side to distinguish the reflection surface. The slanted edge should be placed in a downward direction to fit the bottom of the filter cube.
And, the flat spring should be placed to hold the both sides of the dichroic mirror.
- 5 Put the mounting hardware and the barrier filter back to their original positions.



22 Excitation Light Balancer

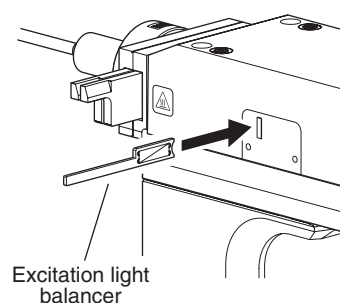
When the illuminator LV-UEPI2 is used, the optional D-FB excitation light balancer can be attached for the epi-fl microscopy to observe a specimen labeled with multiple wavelengths. The excitation light balancer enables the continuous change of the wavelength characteristics for the excitation light without replacing filter cubes. The excitation light balancer is used in concert with a dual-band characteristic filter cube.



Excitation light balancer

▶ Using the excitation light balancer

Remove the vertically oriented cover on the left side of the illuminator. And then, insert the excitation light balancer into the slot with its mark facing back. When the excitation light balancer is inserted to the limit position, it enters into the optical path. You can adjust the excitation light by sliding the excitation light balancer horizontally.

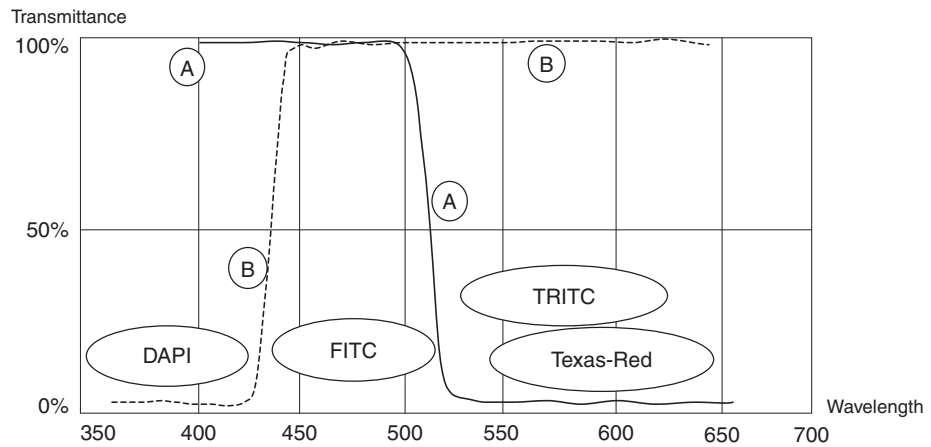
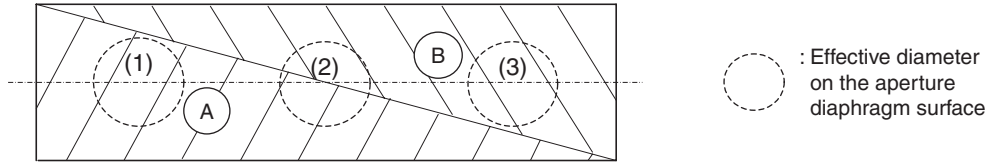


▶ Objective

To use the excitation light balancer, use the following objectives in combination. If another objective is used, uneven image may be observed in the viewfield.

Plan Fluor	40x/0.75	40xH/1.3	100xH/1.3
S Fluor	40x/0.9	40xH/1.3	100xH/1.3
Plan Apo	40x/0.95	60xH/1.3	100xH/1.4

Details on the excitation light balancer



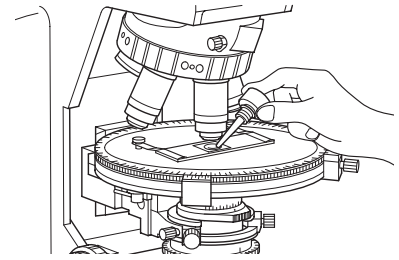
The transmittance for the FITC is designed to keep approximately 100%, because the FITC is usually dark fluorescent image.

Optical path position	DAPI	FITC	TRITC / Texas-Red
(1)	100%	100%	0%
Between (1) and (2)	Variable (100% to 50%)	100%	Variable (0% to 50%)
(2)	50%	100%	50%
Between (2) and (3)	Variable (50% to 0%)	100%	Variable (50% to 100%)
(3)	0%	100%	100%

23 Oil Immersion Operation

The oil immersion operation can be performed with only the objective for the biologic microscope that “Oil” is marked on its body. Do not use other objectives for the oil immersion operation.

Objectives marked “oil” are oil-immersion type objectives. These objectives are used with immersion oil (option) between the specimen and the tip of the objective. Bubbles in the oil will adversely affect the viewing of the image. Be careful to prevent bubbles from forming. To check for air bubbles, fully open the field diaphragm and aperture diaphragm, remove the eyepiece, and examine the pupil (bright round section) of the objective inside the eyepiece tube. If it is difficult to ascertain the presence of bubbles, attach an optional centering telescope with an optional adapter, then check for air bubbles while turning the eyepiece section of the centering telescope to adjust focus. If you detect bubbles, remove them by one of the following methods:



- Turn the nosepiece slightly to move the oil-immersed objective back and forth once or twice. (In the case of the condenser, gently turn the condenser focus knob to move the condenser up and down slightly.)
- Apply more oil.
- Remove the oil and replace it with new oil.

Use as little oil as possible (just enough to fill the space between the tip of the objective and the specimen, or between the tip of the condenser and the specimen). If too much oil is applied, the excess oil will flow onto the stage or around the condenser.

► Wipe off oil

Any oil remaining on the oil-immersion objective or adhering to the dry-type objective will noticeably degrade image quality. After use, thoroughly wipe off all oil, and make sure that no oil remains on the tips of other objectives. Oil on the condenser should also be wiped away carefully after use.

Use petroleum benzine to wipe off immersion oil. For optimum results, we recommend following up petroleum benzine with absolute alcohol (ethyl or methyl alcohol).

If petroleum benzine is unavailable, use methyl alcohol. However, methyl alcohol does not clean as well as petroleum benzine, it will be necessary to wipe the surface repeatedly. (Usually, three- or four-times wipe is sufficient to clean the lenses.)



WARNING

When using petroleum benzine or absolute alcohol, always follow the instructions provided by the manufacturer. These liquids are highly flammable and must be kept away from flames and sparks.

24 Water Immersion Operation

The water immersion operation can be performed with only the objective for the biologic microscope that “WI” or “W” is marked on its body. Do not use other objectives for the oil immersion operation.

Objectives marked “WI” or “W” are water-immersion type objectives. These objectives are used with immersion water (distilled water or physiological saline) applied between the specimen and the tip of the objective. Microscopy procedures are the same as for oil-immersion type objectives. Since water evaporates readily, monitor the immersion water during observation. Avoid using too much water, since excess water will flow onto the stage and around the condenser, promoting corrosion.

► Wipe off water

After use, wipe off water from the tip of the objective, then follow up by wiping with absolute alcohol.

If you observe water stains, apply a small amount of neutral detergent and wipe gently, then follow up with absolute alcohol.

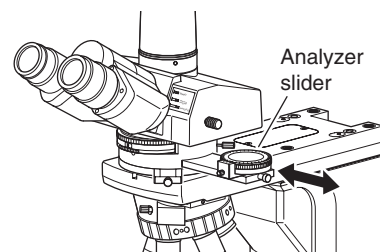
25 Intermediate Tube for the Polarization Microscopy

▶ Attaching and detaching the analyzer

The intermediate tube for the polarization microscopy has the analyzer slider. The analyzer can be placed into the optical path with the operation of the slider.

To place the analyzer into the optical path, pull out the slider. To remove the analyzer from the optical path, push in the slider.

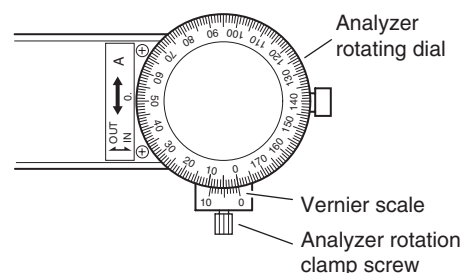
The analyzer is designed to be inserted from the right side of the intermediate tube for the polarization microscopy in normal use, but it can be inserted from the left. In the later case, its scale displays the opposite way. Be careful.



▶ Rotating the analyzer

The analyzer slider has a rotating dial. The orientation of the analyzer can be rotated with it. To adjust the analyzer, loosen the analyzer rotation clamp screw and rotate the rotating dial.

The angle of rotation can be read from 0 to 180 degrees in steps of 0.1 degrees with the two vernier scales.



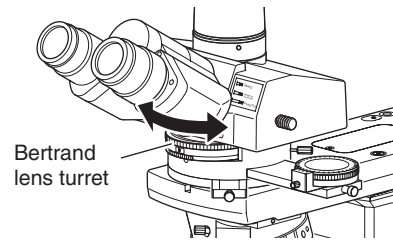
The intermediate tube also has a de-polarizer. You can use the photomicrography device or so on independently of the orientation of the polarizer.

► Setting the Bertrand lens

The intermediate tube for the polarization microscopy has the Bertrand lens. The Bertrand lens can be placed into the optical path to perform the conosccope observation.

Put the Bertrand lens turret in the “B” position to move the Bertrand lens into the optical path.

Put the Bertrand lens turret in the “O” position to remove the Bertrand lens from the optical path.



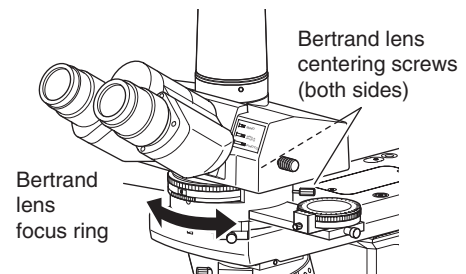
► Focusing and centering the Bertrand lens

The objective pupil positions vary by magnification and type. So, each time objectives are switched, the Bertrand lens must be adjusted.

Besides, the Bertrand lens must be centered so that it is aligned to the optical path of the objective. Note that you need not center the Bertrand lens each time in the case that you have centered the objective already. (See Page 48.)

In this adjustment, the aperture diaphragm image is used in the same manner as the condenser lens adjustment. Do as follows:

- 1** Follow the procedure described in Pages 23 and 24 for the bright-field microscopy under the diasopic illumination, and focus on the specimen.
And focus and center the condenser. (Page 52.)
- 2** Place the Bertrand lens into the optical path.
- 3** Stop down the aperture diaphragm of the condenser to get a diaphragm image into view.
- 4** Perform the focusing for the Bertrand lens.
Adjust the Bertrand lens focus ring on the intermediate tube for the polarization microscopy to get a clear image of the diaphragm.
- 5** Fully stop down the aperture diaphragm of the condenser.
- 6** Center the objective.
Rotate two centering screws on the intermediate tube for the polarization microscopy so that the diaphragm image comes to the center of the field of view.



26 Using Examination Plates

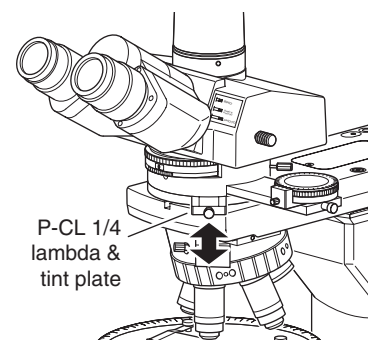
The intermediate tube for the polarization microscopy has a slot for examination plates. It is used not only for the standard P-CL 1/4 lambda & tint plate but also for the optional P-CS Senarmont compensator, the PCW quartz wedge, or so on to perform the retardation measurement.

To use an objective of 10x or higher magnification in standard observation, place the top lens of the swing-out achromat condenser for the polarization microscopy into the optical path. To perform the retardation measurement or to perform evaluation by interference color, the illumination light must be as parallel to the optical axis as possible. So, the condenser aperture diaphragm must be stopped down or the top lens of the swing-out achromat condenser for the polarization microscopy must be swung out (the aperture diaphragm is fully opened), even if an objective of 10x or higher is used.

► P-CL 1/4 lambda & tint plate

The P-CL 1/4 lambda & tint plate has an empty hole in the center. By pushing it into the slot, the sensitive color plate (530 nm) is placed into the optical path. Pulling it out places the 1/4 lambda plate into the optical path.

This plate is used for recognition of very weak birefringence and the determination of X' and Z' of the specimen.



► P-CS Senarmont compensator

The P-CQ quartz wedge is used by inserting it into the slot of the intermediate tube for the polarization microscopy in place of the P-CL 1/4 lambda & tint plate. You can measure retardation of light up to 1 lambda with the following steps.

1 Determination of an extinction position

Rotate the stage with the specimen under the crossed Nicols to find the direction where the part of the specimen to be measured appears darkest.

2 Determination of a subtraction position

Rotate the stage 45 degree from the extinction position to place a diagonal position. Insert the P-CL 1/4 lambda & tint plate into the optical path and confirm that the interference color of the section of the specimen to be measured changes toward the lower order side. If the interference color changes toward the higher order side, rotate the stage another 90 degree.

3 Measurement

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

$$R = \frac{\theta}{180} \lambda \quad (\lambda: \text{wavelength to be used})$$

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

► **P-CQ quartz wedge**

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

1 Determination of an extinction position

Rotate the stage with the specimen under the crossed Nicols to find the direction where the part of the specimen to be measured appears darkest.

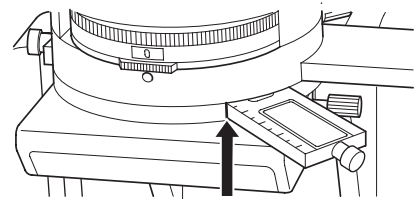
2 Determination of a subtraction position

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

3 Measurement

Move the section of the specimen to be measured to the center of the crosshairs of the eyepiece. Next, slide the P-CQ quartz wedge along the slot and observe that the interference color sequentially changes. Stop sliding the quartz wedge where the dark stripe covers the section of the specimen to be measured. Reading the value from the quartz wedge scale at that time can make a rough measurement of retardation.

Retardation can be measured even more accurately by using the P-CS Senarmont compensator in combination with the P-CQ quartz wedge.





Read the scale.

IV

Assembly



WARNING

- Before assembling the microscope, be sure to read the  WARNING and  CAUTION at the beginning of this instruction manual and follow the instructions written therein.
- To prevent electrical shocks and fire, turn off the power switch (flip it to the “○” side) when assembling the microscope.



CAUTION

- Be careful not to pinch your fingers or hands during assembly.
- Scratches or fingerprints on the lenses will adversely affect the microscopy image. Be careful not to scratch or touch the lens surfaces. If lenses are contaminated with fingerprint or such, clean them according to the procedure described in “VI. Care and Maintenance.”
- This product is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may lose accuracy when exposed to even a weak physical shock.)

► Required tools

- Two hexagonal screwdrivers (2 mm) (provided with the product)
- Hexagonal wrench (3 mm) (provided with the product)

When these tools are not used, place them in the tool holder at the right side of the product base.

► Installation location

This product is a precision optical instrument. So, the usage or storage in an inappropriate environment may result in malfunctions or poor performance. Consider the following factors when selecting an installation location:

- Avoid a brightly lit location, such as exposed to direct sunlight or directly under a room light. If there is excessive ambient light, the image quality deteriorates.
- Always install the microscope with a surrounding clear area of 10 cm or more.
- Install the microscope in a location that is free from considerable dust or dirt.
- Install the microscope on a flat surface with little vibration.
- Install the microscope on a sturdy desk or table that is able to bear the weight of the instrument.
- Do not install the microscope in a hot and humid location.
- Arrange a layout that allows easy removal of the power cord from the inlet of the product in the event of an emergency.
- For details about the operating environment and storage environment, see “VII. Specifications.”

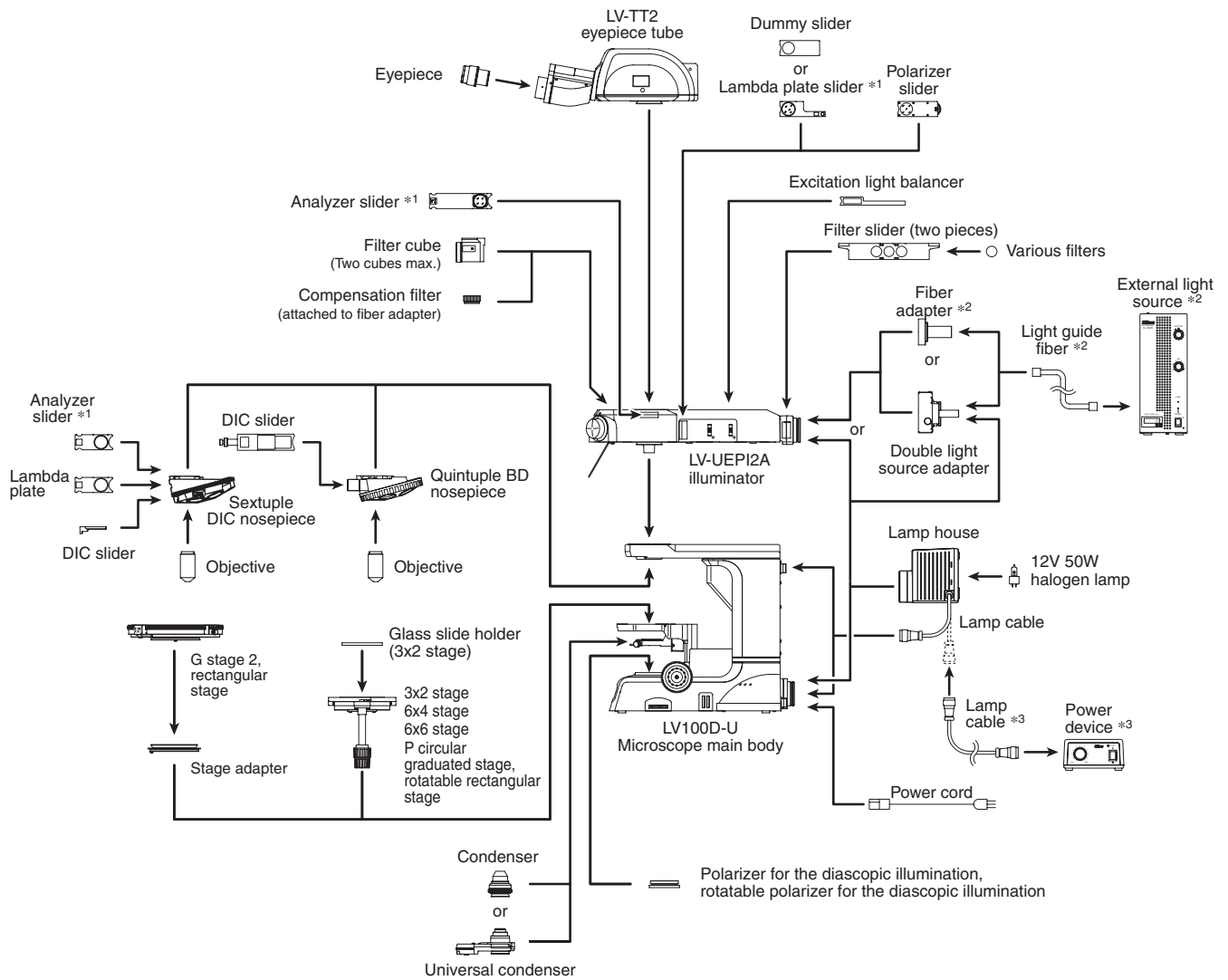
► Combination of the illuminator and the light source

This product is UL-listed only in the combination of the illuminator and the light source (the lamp house and the lamp) describe below. Please take note that if a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a UL-listed product.

- Illuminator: LV-UEPI2 Motorized Universal Epi Illuminator 2
- Lamp house: LV-LH50PC Precentered Lamp House
(both for the episcopic illumination and for the diasopic illumination)
- Lamp: LV-HL50W 12V 50W LONGLIFE halogen lamp, or non-Nikon 12V 50W SHORTLIFE halogen lamp (model name: OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027)

► Assembling the ECLIPSE LV100D-U

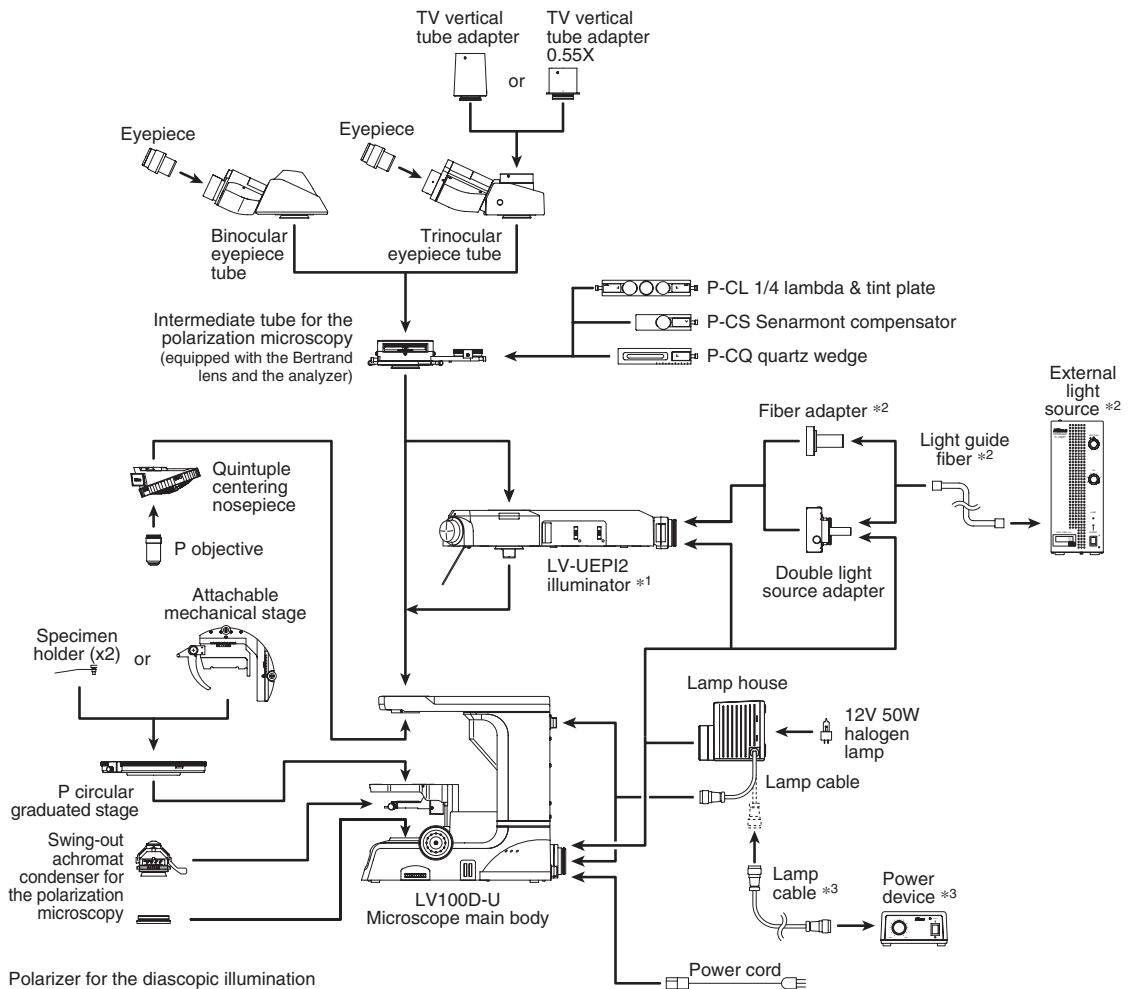
The example below shows the system configuration for the microscopes under the episcopic or the diascope illumination.



- *1 For the episcopic illumination, use the lambda plate slider on the epi illumination side. For the diascope illumination, use the lambda plate on the nosepiece side.
- *2 Use this part if the brightness of the specified light source is less than the desired brightness for the epi-illumination or so on.
- *3 To turn on the episcopic illumination and the diascope illumination simultaneously, connect this part with the lamp house on the episcopic illumination side.

► **Assembling when the intermediate tube for the polarization microscopy is used**

The example below shows the system configuration for the orthoscopic microscopy or the conoscopic microscopy performed with the intermediate tube for the polarization microscopy.



*1 For filters to be attached to the LV-UEPI2, see the figure on Page 80.

*2 Use this part if the brightness of the specified light source is less than the desired brightness for the epifluorescence microscopy or so on.

*3 To turn on the episcopic illumination and the diascopic illumination simultaneously, connect this part with the lamp house on the episcopic illumination side.

1 Assembling the Stage Unit

1. Attaching the stage

- **3x2 stage, 6x4 stage, and 6x6 stage:**

When the LV-S32 3x2 stage, the LV-S64 6x4 stage, or the LVS6 6x6 stage is used with this product, attach the stage to the attaching hole of the substage and fix it with four M4 screws provided with the microscope.

- **P circular graduated stage and rotatable rectangular stage:**

When the LV-SRP P circular graduated stage or the C-SRR rotatable rectangular stage is used, attach the stage to the circular dovetail joint (female) of the substage. Align the positioning pin on the bottom of the stage with the groove of the substage, insert the truncated cone joint of the stage into the substage, and fix it with the stage clamp screw.

The stage can be centered with the stage clamp screw on the front of the substage and the centering screws on both sides.

Attaching the condenser upper limit positioning plate

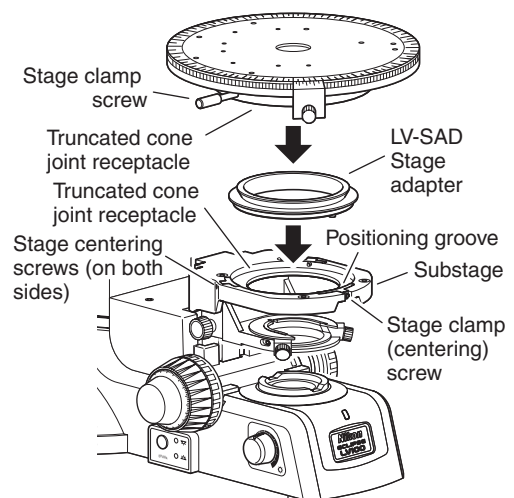
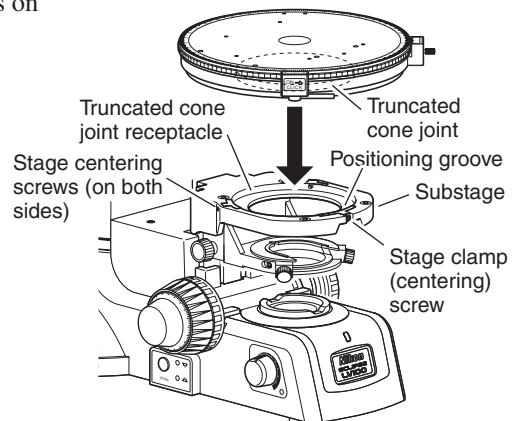
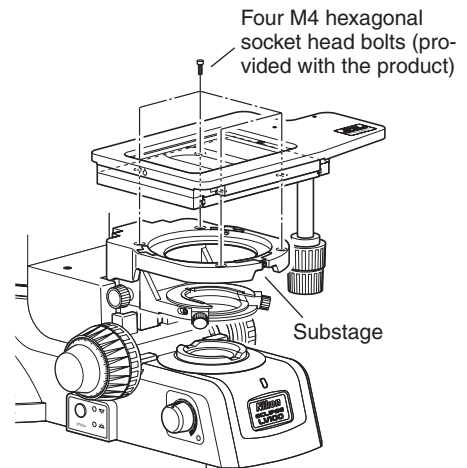
When the rotatable mechanical stage is used, attach the condenser upper limit positioning plate to the positioning boss part on the top of the condenser holder (refer to Page 83).

- **G stage 2 and rectangular stage:**

When the P-GS2 G stage 2 or the rectangular stage is used, attach the LV-SAD stage adapter. Align the positioning pin on the bottom of the stage adapter with the groove of the substage, insert the truncated cone joint of the stage adapter into the substage, and fix it with the stage clamp screw.

And attach the stage to the truncated cone joint of the stage adapter and fix it with the stage clamp screw.

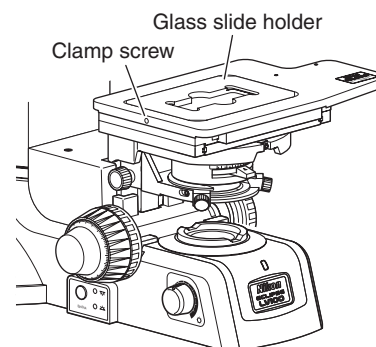
The stage can be centered with the stage clamp screw on the front of the substage and the centering screws on both sides.



2. Attaching the stage glass or the glass slide holder

The 3x2 stage comes with a stage glass as standard equipment. When a glass slide or a high NA condenser is used for the observation of the specimen, an optional glass slide holder must be attached in place of the stage glass. Refer to the following to attach the stage glass or the glass slide holder.

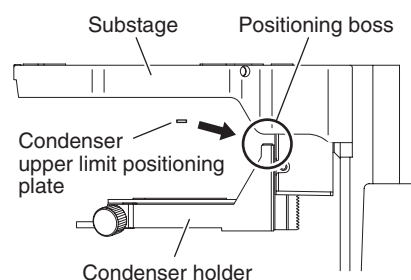
- 1 Loosen the clamp screw on the left side of the stage upper plate by using the hexagonal wrench.
- 2 Place the stage glass (or the glass slide holder) onto the stage and fit it in position so that it is level.
- 3 Tighten the clamp screw to fix the stage glass (or the glass slide holder).
Take care not to lift up the stage glass by tightening the clamp screw too much.



3. Attaching the condenser upper limit positioning plate

If the rotatable rectangular stage is directly attached, the condenser may hit the stage because the rotatable rectangular stage is thinner than other stages by 1 mm. To attach the rotatable rectangular stage, the provided condenser upper limit positioning plate must be attached to the condenser holder to prevent the condenser from touching the stage.

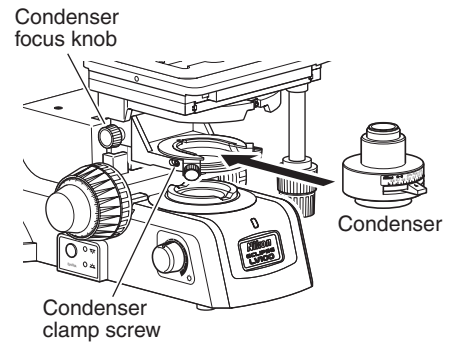
When attaching the condenser upper limit positioning plate, move up the substage to the upper limit and move down the condenser holder to the lower limit. The positioning boss can be seen on the top of the condenser holder. Attach the plate onto the boss. (Refer to the right figure.) The positioning boss is equipped with a magnet so that any tool is not required.



2 Attaching the Condenser

Attach the condenser as described below.

- 1 Rotate the coarse focus knob until the stage is raised to the uppermost position.
- 2 Turn the condenser focus knob until the condenser holder is lowered to the limit position.
- 3 Insert the condenser into the condenser holder with fitting the truncated cone joints on both sides.
When a scale is labeled on the condenser, the scale must face toward the front.
- 4 Tighten the clamp screw on the left side of the condenser holder to fix the condenser.
Use the hexagonal wrench to tighten the clamp screw.



To use a high numerical aperture (NA) condenser

To use a high NA condenser such as a slide condenser, remove the standard stage glass on the stage and then attach the glass slide holder in place. A high NA condenser and the standard stage glass can collide with each other. Be sure to change the stage glass to the glass slide holder.

► **Selecting the condenser**

The table below shows applicable condensers for each stage. Select the condenser according to the following table.

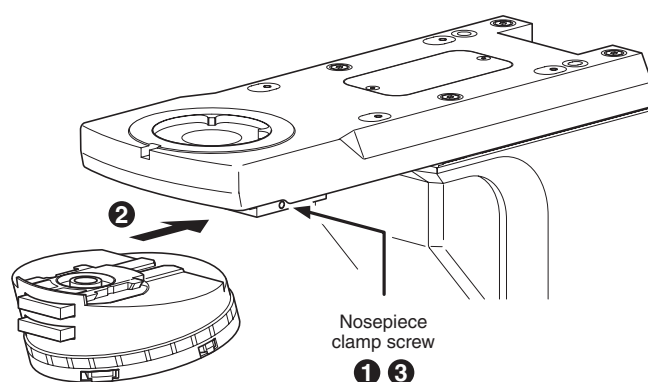
Stage	Applicable condenser
3x2 stage	Abbe condenser, achromat condenser, LWD condenser, 2-100x slide achromat condenser, low magnification condenser, and LV-CUD universal condenser *A glass slide holder is used for all condensers except for the LWD condenser.
Rectangular stage Rotatable rectangular stage	Abbe condenser, achromat condenser, LWD condenser, 2-100x slide achromat condenser, low magnification condenser, LV-CUD universal condenser, dark-field condenser (dry), swing-out achromat condenser for the polarization microscopy, and achromatic aplanat condenser
6x4 stage	LWD condenser

3 Attaching the Nosepiece

1. Attaching the nosepiece

Attach the nosepiece to the bottom of the arm section.

- 1 Fully loosen the nosepiece clamp screw located on the right side of the microscope arm using the hexagonal screwdriver.
- 2 Insert the nosepiece from the front with aligning it to the groove at the bottom of the microscope arm and slide it toward the back as far as it goes.
- 3 Fix the nosepiece with the nosepiece clamp screw.



2. Removing the nosepiece

To remove the nosepiece, reverse the attaching procedure. At this time, lower the stage fully, and remove the specimen and all objectives. Then hold the nosepiece by hand to prevent falling.

3. Attaching the lambda plate and the analyzer slider

There are two slots on the front of the sextuple DIC nosepiece (D-ND6). The lambda plate and the analyzer slider can be attached to the slots.

- **Attaching the lambda plate:**

The lambda plate is also called “wave plate” and improves the color contrast to perform the sensitive color polarization microscopy or the sensitive color DIC microscopy.

To perform the polarization microscopy or the DIC microscopy under the diascope illumination, attach the lambda plate.

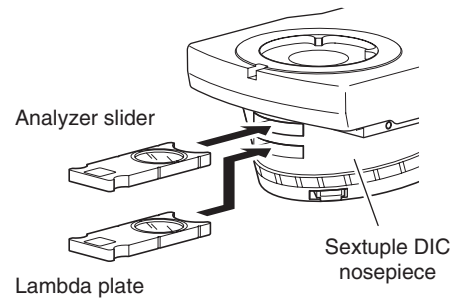
Attach the lambda plate to the slot for the lambda plate (marked with “λ”) of the sextuple DIC nosepiece.

- **Attaching the analyzer slider:**

The analyzer must be used with the polarizer. To perform the polarization microscopy under the diascope illumination or the DIC microscopy, insert the analyzer slider into the slot for the analyzer (marked with “A”) on the nosepiece.

Attach the lambda plate to the slot for the lambda plate (marked with “λ”) of the sextuple DIC nosepiece.

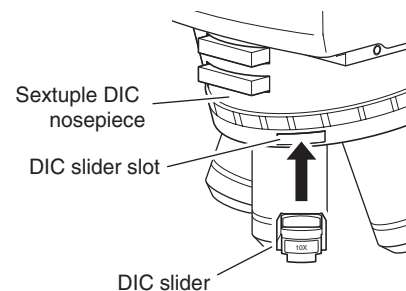
* When the epi illuminator or the polarizing intermediate tube is used, normally the analyzer slider is attached to the devices. In this case, attach the dummy slider to the slot for the analyzer on the nosepiece.



4. Attaching the DIC prism

The sextuple DIC nosepiece (D-ND6) has a slot for the objective. The slot is used to attach the DIC slider. To perform the DIC microscopy, attach the DIC slider suitable for the objective to the slot.

When performing the DIC microscopy, attach the DIC prism to the objective side and the condenser side for the diascope illumination, and attach the DIC prism to only the objective side for the episcopic illumination. Refer to the list on Pages 65 and 67. Select the DIC slider suitable for the characteristics of the used objective and the illumination method.

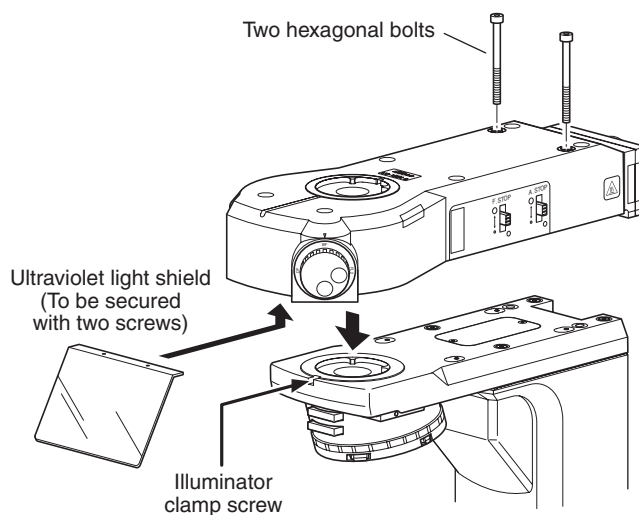


- *Select the DIC slider suitable for the objective. After attaching the objective, attach the DIC slider.*
- *For details on selecting the DIC slider, see “19. DIC Prism (For the Episcopic Illumination)” and “20. DIC Prism (For the Diascopic Illumination)” of “III. Operation of Each Part.”*
- *For the DIC microscopy under the diascope illumination, the universal condenser (LV-CUD) must be attached and the DIC prism must be inserted into the condenser side (front side of the specimen). For detailed operation of the universal condenser, see the instruction manual for the LV-CUD.*

4 Attaching the Epi Illuminator

1. LV-UEPI2 main unit

- 1 Loosen sufficiently the illuminator clamp screw on the front of the arm section of the product using the hexagonal screwdriver.
- 2 Mount the LV-UEPI2 main unit onto the arm section and fix it by tightening the illuminator clamp screw.
- 3 Fix the LV-UEPI2 to the arm section using two hexagonal socket head bolts that are provided with the LV-UEPI2. Use the hexagonal wrench to tighten the bolts.
- 4 Cover the bolt-holes in step 3 with the protective stickers provided with the LV-UEPI2.
- 5 Attach the ultraviolet light shield to the front bottom of the LV-UEPI2 using the two screws provided with the LV-UEPI2.



Ultraviolet light shield

- *Under several microscopies, harmful lights or strong lights may be emitted from objectives. Make sure to attach the ultraviolet light shield when using the LV-UEPI2.*
- *Make sure to use the attached screws to fix the ultraviolet light shield. If other screws are used or only screws are attached without the light shield, malfunctions occur at the inner mechanism.*

2. Sliders (analyzer slider, polarizer slider, lambda plate slider, and dummy slider)

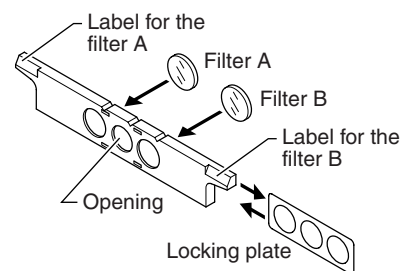
On the right side of the LV-UEPI2, there are slider slots for an analyzer slider, polarizer slider, and so on. To use sliders, remove the covers on the slider slots and insert the sliders.

When using the product without the sliders, attach the cover onto the slider slots.

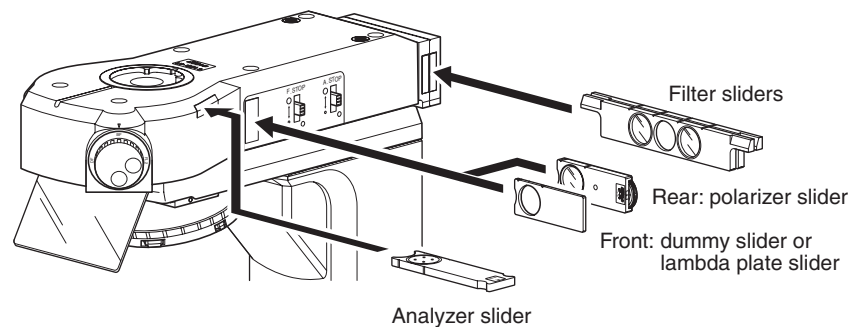
Note that the slots for the polarizer slider and the dummy slider share a single cover. So, when using only the polarizer slider, insert a dummy slider or a lambda plate slider in front of the polarizer slider.

3. Filter sliders and filters

- 1 Remove each filter slider from the epi illuminator.
(Two filter sliders can be used for the epi illuminator.)
- 2 Pull out the locking plate from the filter slider.
- 3 Insert the desired filter. (Two filters can be set on the filter slider.)
- 4 Reinstall the locking plate to its original position.
- 5 Affix labels to the appropriate lugs of the filter sliders.
- 6 Insert the filter slider into the epi illuminator.



ND4, ND16, and NCB filters are already set on the filter sliders at the factory. You can set an additional filter into an unoccupied position.



4. Filter cubes

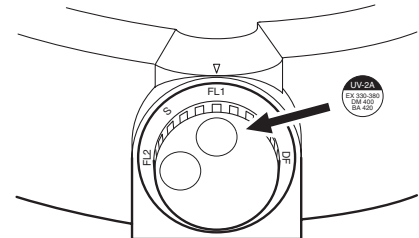
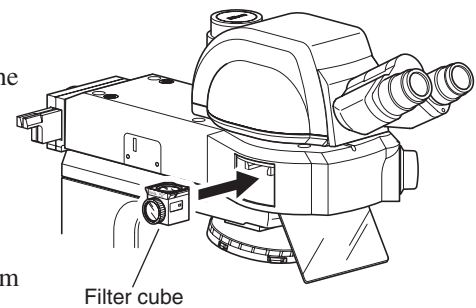
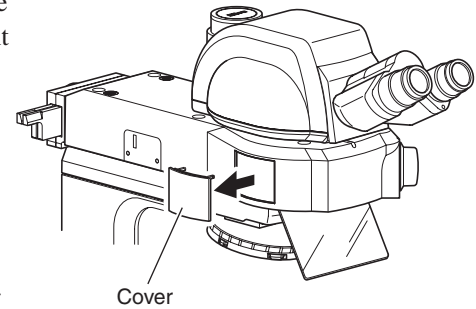
The filter cube turret of the LV-UEPI2 can accommodate two optical components such as filter cubes for the epi-fl microscopy or PA blocks (LV-PAB) for the simplified polarization microscopy.

- 1 Check that the shutter stops the optical path of the illumination and the product and the external light source are turned off.
- 2 Remove the cover on the left side of the Illuminator.
- 3 Check the position indicator of the filter cube turret in the LV-UEPI2. Rotate the microscopy selector knob so that the “FL1” position or the “FL2” position is placed at the opening.
- 4 Insert the desired filter cube along the dovetail of the filter cube turret and push it to the click-stop position.

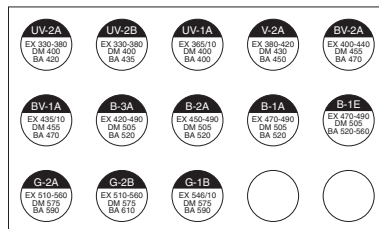
Make sure that the filter cube is inserted so that the excitation light filter faces out.

- 5 Attach the desired filter cubes to FL1 and FL2.
- And, put the cover back to its original position.
- 6 Check the stickers of excitation method supplied with the illuminator and find the corresponding stickers to the filter cubes just attached. Affix them to the “FL1” position and the “FL2” position on the microscopy selector knob.

If you cannot find the corresponding stickers, write the excitation methods on blank stickers and affix them.



Affix stickers to the microscopy selector knob.



Stickers of excitation method

5 Attaching the Lamp House and Replacing Lamps



CAUTION

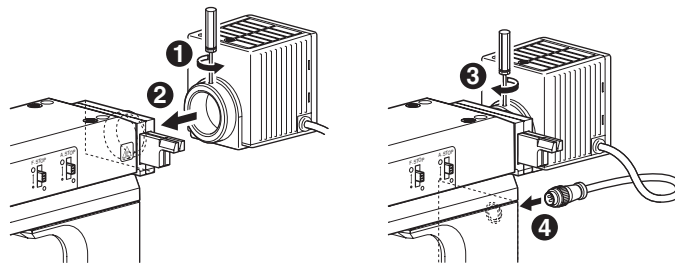
- To prevent electrical shock and damage to the microscope, always turn off the power switch (flip it to the “○” side) and unplug the power cord from the outlet before attaching or detaching the lamp house.
- To prevent burn injury, allow the lamp and the lamp house to cool down sufficiently (for at least 30 minutes after the lamp is turned off), before replacing lamps.
- Use the Nikon LV-LH50PC Halogen Lamp House for the lamp house.
- Use the Nikon LV-HL50W 12V 50W LONGLIFE Halogen Lamp or non-Nikon 12V 50W SHORTLIFE halogen lamp (model OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027) for the lamp. If you wish to buy these lamps, please contact your nearest Nikon representative.
- Never touch the glass surface of the lamp with bare hands. Doing so will cause fingerprints, grease, etc. to burn onto the lamp surface, reducing the illumination. If you do get any fingerprints or dirt on the lamp, wipe them clean.
- Make sure the lamp house cover is securely fitted to the lamp house after replacing lamps. Never turn on the lamp with the lamp house cover removed.
- When you dispose of the replaced lamp, do not break it up. Instead, dispose of the used lamp as special industrial waste or dispose of it according to the local regulations and rules.
- Make sure the cables are routed properly. Do not bring the cables into contact with the lamp house for the diascopic illumination. If a cable comes into contact with the lamp house, the cable sheath may melt and it results in an electrical shock or fire.

1. Attaching the lamp house

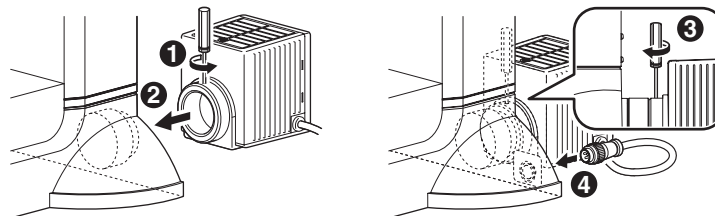
Before performing the following procedures, turn off the power supply for the microscope (press the “O” side) and unplug the power cord from the wall outlet.

- 1 Loosen the clamp screw sufficiently on the upper side of the lamp house connector by using the hexagonal screwdriver provided with the product.
- 2 Mount the lamp house to the connection port on the rear of the illuminator or on the rear of the product and insert the lamp house as far as it goes.
- 3 Using the hexagonal screwdriver supplied with the microscope, tighten the clamp screw on the upper side of the connector of the lamp house to secure it.
- 4 Plug the cable coming from the lamp house into the lamp connector on the rear of the product and tighten the ring of the connector to secure the connection.

For the epi-illumination



For the dia-illumination



To remove the lamp house, reverse the above procedure.

2. Replacing the lamp

Lamps can be replaced without having to detach the lamp house from the product.

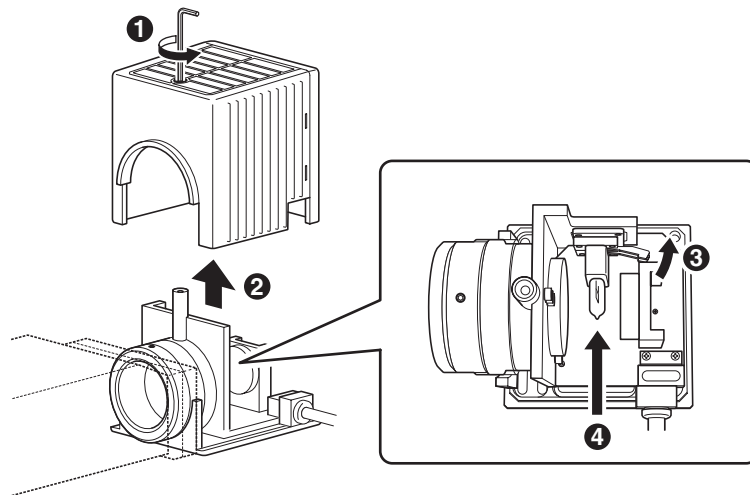
Before performing the following procedures, turn off the power supply for the product (press the “O” side) and unplug the power cord from the wall outlet. And check that the lamp and the lamp house are sufficiently cooled down.

- 1 Loosen the lamp house cover clamp screw using the hexagonal wrench.
- 2 Remove the lamp house cover.
- 3 Push down the lamp clamp lever and remove the old lamp.
- 4 With the lamp clamp lever held down, insert the electrodes of a new lamp into the holes of the socket. Insert the lamp as far as it goes, and then release the lamp clamp lever to secure the lamp.

Be careful not to touch the glass surface of the lamp with bare hands.

When releasing the lamp clamp lever, take care so that the lamp does not tilt.

- 5 Close the lamp house cover and secure it by tightening the clamp screw.



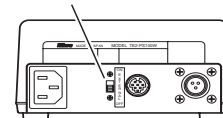
3. Connecting the external power device (only for the simultaneous illumination)

When the specified lamp house LV-LH50PC is used for both the episcopic illumination and the diascope illumination, the illuminations can be turned on simultaneously with an optional power device.

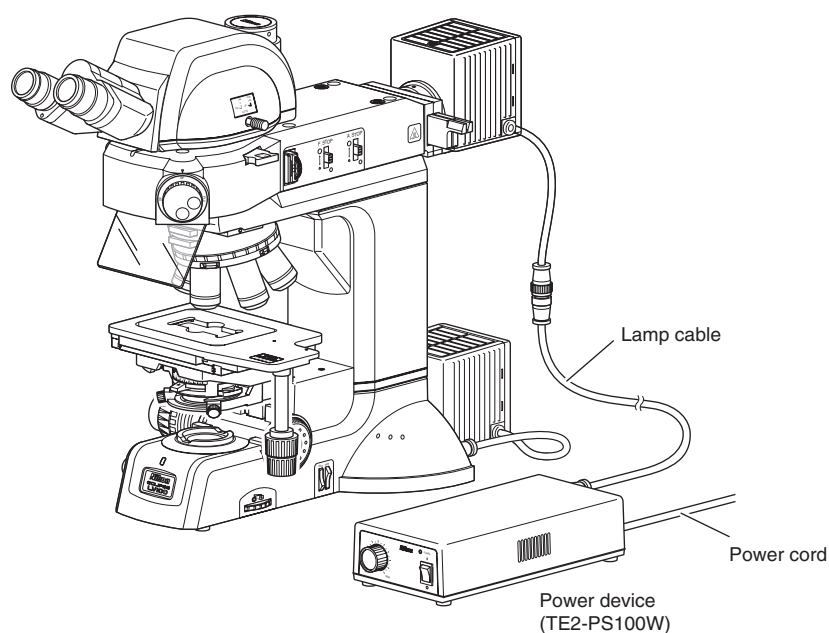
To turn on the episcopic illumination and the diascope illumination simultaneously, connect the optional power device (Nikon TE2-PS100W power supply) with the lamp house for the episcopic illumination.

- 1 Check to confirm that the EXTERNAL switch on the rear of the power device is set to the OFF position.
The EXTERNAL switch is used when the brightness of the lamp is adjusted with an external control device. Normally, set the switch to the OFF position.
- 2 Connect the lamp cable of the lamp house for the episcopic illumination and the OUTPUT connector of the power device using the lamp cable provided with the power device.

EXTERNAL switch



Rear of TE2-PS100W



Connection example of the external power device

6 Attaching the Optical Fiber Adapter and an External Light Source

To perform the epi-fl microscopy with the LV-UEPI2 epi illuminator, the specified light source brightness may be less than the desired brightness. In this case, a light source other than the specified ones, an external light source, can be used for the LV-UEPI2. The following external light source can be attached through the light guide fiber when an optional LV-HGFA HG optical fiber adapter is mounted on the light source mount part.

- External light source: Intensilight C-HGFI (HG precentered optical fiber light source, manual operation type)
Intensilight C-HGFIE (HG precentered optical fiber light source, electric operation type)
X-Cite 120 (optical fiber light source)
X-Cite 120 PC (electric operation type optical fiber light source)



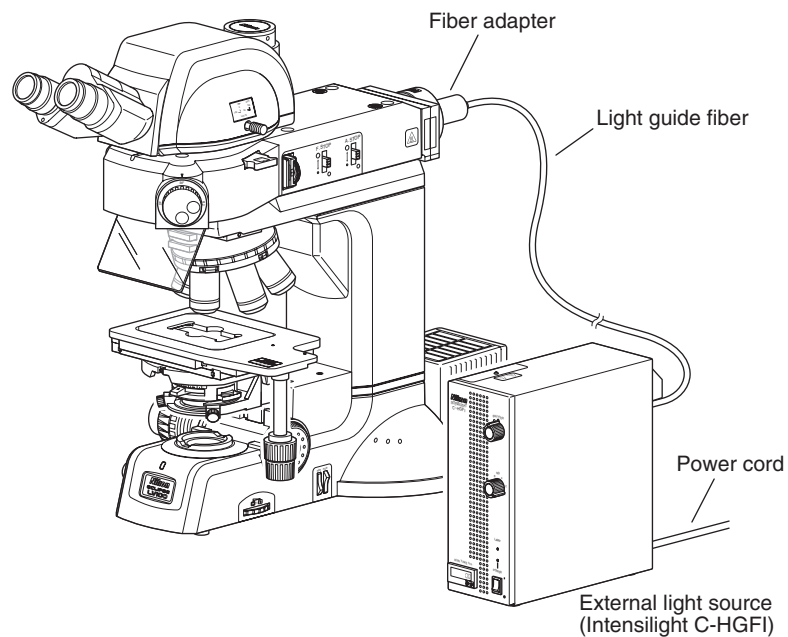
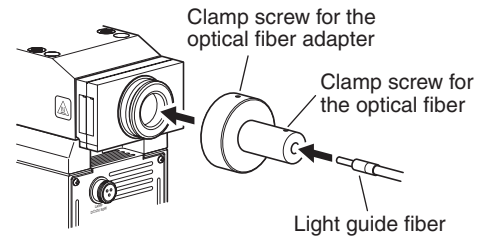
CAUTION

- Please take note that if a light source other than the specified light source is attached onto this microscope, the microscope system will not be treated as a UL-listed product.
- To use an external light source, carefully read the instruction manual and make sure to follow the instructions.
- A light source emits very strong light including ultraviolet light that is harmful to the eyes and skin. Never turn on the power for the light source before completion of assembling and connecting parts.
- To assemble and connect parts, check that the power supplies for the light source and product are turned off and that the power cable is unplugged from the wall outlet.
- When you use the diasopic illumination with this product, make sure the light guide fiber and cables are routed properly. Do not bring the light guide fiber and cables into contact with the lamp house for the diasopic illumination. If the light guide fiber or a cable comes into contact with the lamp house, the light guide fiber is broken or the cable sheath may melt resulting in an electrical shock or fire.

1. Attaching the optical fiber adapter and the light guide fiber

- 1 Loosen the optical fiber adapter clamp screw sufficiently by using the hexagonal screwdriver.
- 2 Mount the optical fiber adapter onto the light source mount part of the LV-UEPI2. Push in the adapter as far as it goes and fix it with the clamp screw.
- 3 Insert the light guide fiber tip through the hole of the fiber adapter, and then tighten the clamp screw to fix the light guide fiber by using the hexagonal screw driver.
- 4 Connect the light guide fiber to the light guide port on the light source.

For information about connecting the light guide fiber, refer to the instruction manual for the light source.



External light source connection example

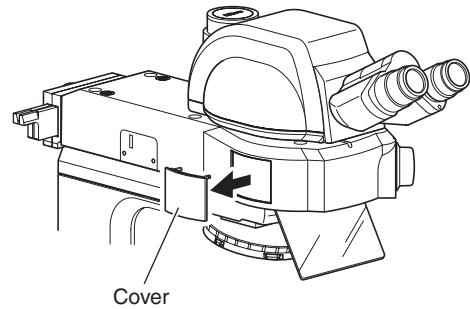
2. Attaching the compensation filter

A designated compensation filter comes with the HG fiber adapter. The compensation filter is used to compensate the color balance and brightness. If this filter is not used with, extremely strong light will be radiated during the bright-field microscopy. Make sure to attach the filter into the bright-field block in the LV-UEPI2 when the adapter is used.

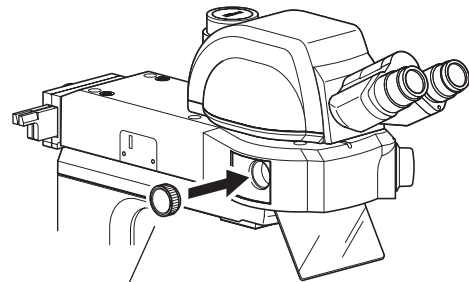
- 1 Check that the shutter stops the optical path of the illumination and the product and the external light source are turned off.
- 2 Remove the cover on the left side of the LV-UEPI2.
- 3 Check the position indicator of the filter cube turret in the LV-UEPI2. Rotate the microscopy selector knob so that the “BF” position is placed at the opening.
- 4 Screw in the compensation filter provided with the HG fiber adapter into the bright-field block in the LV-UEPI2.
- 5 Put the cover back to its original position.



Compensation filter



Cover



Compensation filter

7 Attaching the Double Light Source Adapter

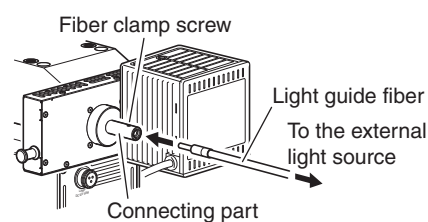
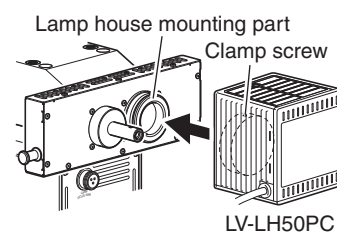
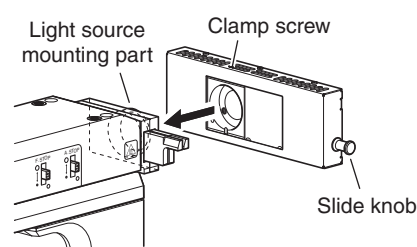
When the microscopy under the episcopic illumination is performed, the standard halogen lamp and the external light source can be attached together via the LVUEPI2-DLS double light source adapter. The light source can be switched with the halogen lamp and the external light source turned on.



CAUTION

Before using the double light source adapter, make sure that the clamp screws on each part are tightened securely.

- 1 Check that the product and the light source are turned off.
- 2 Insert the double light source adapter into the mounting part of the LV-UEPI2A as far as it goes and secure it by tightening the clamp screw with the hexagonal screwdriver provided with the product.
Attach the adapter with the clamp screw facing the top and the slide knob facing the right.
To tighten the clamp screw, insert the hexagonal screwdriver through the cooling slit into the adapter and tighten the clamp screw inside.
- 3 Insert the lamp house to the lamp house mounting part of the double light source adapter as far as it goes and secure it by tightening the clamp screw with the hexagonal screwdriver.
For the connection of the lamp cable, see Page 90, “5. Attaching the Lamp House and Replacing Lamps.”
- 4 Insert the tip of the light guide fiber into the light guide fiber connecting part of the product as far as it goes and secure it by tightening the clamp screw.
For the procedure of connecting the external light source and the light guide fiber, see the instruction manual for the light source.



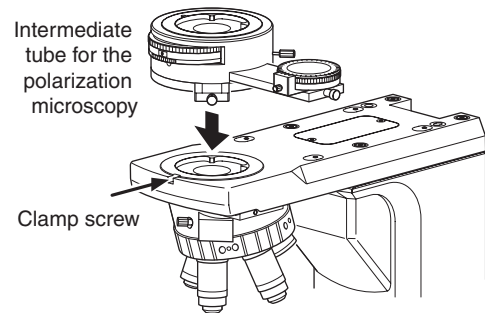
Attaching the ND filter

The double light source adapter can be used with the supplied ND filter. The field of view for the bright-field microscopy becomes too bright when an external light source (fiber illumination) is in use. Attach the ND filter to the episcopic illuminator referring to the instruction manual of “LVUEPI2-DLS Double Light Source Adapter”.

8 Attaching the Intermediate Tube for the Polarization Microscopy

When the orthoscopic microscopy or the conoscopic microscopy is performed, the intermediate tube for the polarization microscopy must be attached. When using the episcopic illumination for the microscopy, attach the intermediate tube for the polarization microscopy onto the epi illuminator.

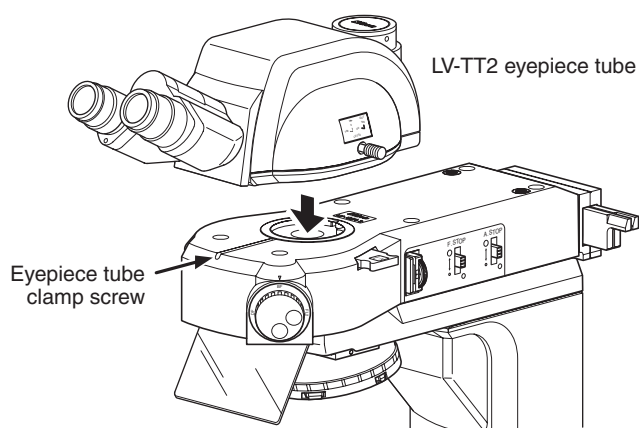
- 1 Loosen the clamp screw for the eyepiece on the arm section of the product (or the epi illuminator) sufficiently
For the clamp screw on the epi illuminator, loosen it with the tool provided with the product.
- 2 Fit the truncated cone joint of the intermediate tube for the polarization microscopy into the receptacle of the microscope arm (or of the epi illuminator). When fitting, insert the positioning pin on the intermediate tube for the polarization microscopy into the receiving groove on the arm (or the epi illuminator).
- 3 Secure the polarizing intermediate tube by tightening the clamp screw for the eyepiece.



Remove any looseness between the positioning pin and groove by pushing in the eyepiece tube while rotating in the clockwise direction.

9 Attaching the Eyepiece Tube

Fully loosen the eyepiece tube clamp screw on the epi illuminator with the hexagonal screwdriver. Attach the eyepiece tube onto the mount part on the epi illuminator and fix it with eyepiece tube clamp screw using the hexagonal screwdriver.



▶ Caution to remove the eyepiece tube

Hold the eyepiece tube by hand when loosening the clamp screw to prevent a sudden disconnection and falling.

10 Attaching Eyepieces

Attach eyepieces of the same magnification and the same field number.

There are positioning protrusions on the binocular part sleeve of the eyepiece tube. Align the notches of the eyepieces with the protrusions on the sleeve and slide the eyepieces into the eyepiece sockets.

11 Attaching Objectives

- 1 Lower the stage as far as it will go.
- 2 Screw in objectives into the nosepiece so that their magnification increase in the order of the clockwise rotation (as viewed from above the microscope) of the nosepiece.
- 3 To remove an objective, perform the following: remove the specimen from the stage, lower the stage completely, and hold the objective with both hands so that it does not fall during the removal.

Conversion adapter

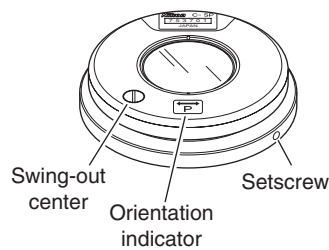
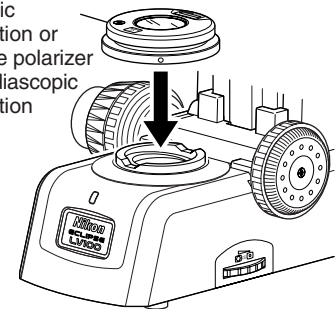
For objectives and nosepieces, there are two kinds of screw diameters (25mm and 32 mm). To attach the objective of 25 mm diameter to the nosepiece of 32 mm diameter sockets, use the conversion adapter, LU nosepiece adapter M32-25.

12 Attaching the Polarizer for the Diascopic Illumination

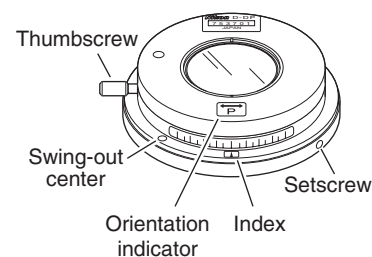
The polarizer for the diascopic illumination has two types. One is the C-SP diascopic polarizer equipped with only the polarizer and another is the D-DP rotatable diascopic polarizer equipped with the 1/4 lambda plate. The diascopic polarizer can perform the polarization microscopy under the diascopic illumination, and the rotatable diascopic polarizer can perform the polarization microscopy under the diascopic illumination and the DIC microscopy under the diascopic illumination. Select either of the polarizers according to the microscopy.

- 1 Check the position of the orientation indicator for the diascopic polarizer, or the position of the index for the rotatable diascopic polarizer.
- 2 Place the polarizer over the field lens at the microscope base with the orientation mark or the index facing the front.
- 3 Secure the polarizer by tightening the setscrew. When the polarizer is used, its orientation must be adjusted.

Polarizer for the diascopic illumination or rotatable polarizer for the diascopic illumination



C-SP diascopic polarizer



D-DP rotatable diascopic polarizer

Adjusting the orientation of the polarizer

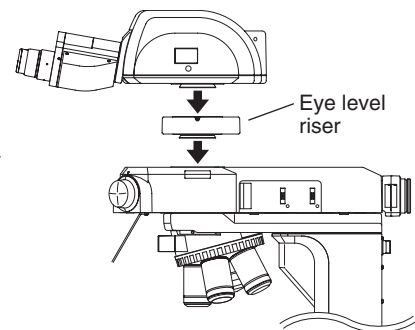
After attaching the diascopic polarizer, adjust the orientation of the polarizer to a right angle to the orientation of the analyzer. For the procedure for adjusting the orientation, see "14. Polarizer (For the Diascopic Illumination)" of "III. Operation of Each Part."

13 Attaching Eye Level Risers

Optional eye level risers can be used for the adjustment of the height of the eyepiece tube to fit the observer's eye point. Up to two eye level risers can be attached in piles. When one eye level riser is attached, the eyepiece height rises 25 mm.

▶ Attaching an eye level riser

- 1 Loosen the clamp screw for the eyepiece sufficiently, then insert the eye level riser with fitting the truncated cone joint of the eye level riser and the epi illuminator.
- 2 Secure the eye level riser by tightening the clamp screw.
- 3 Attach the eyepiece tube on the eye level riser.

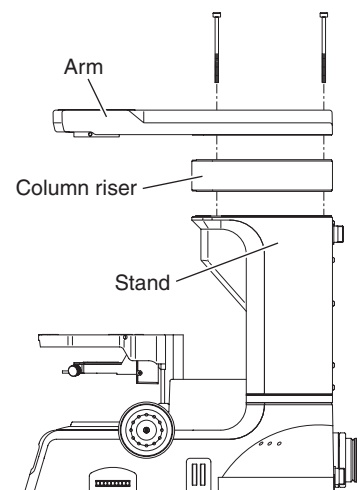


14 Attaching a Column Riser

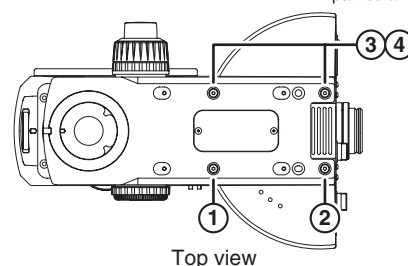
An optional column riser can be used for the adjustment of the distance between the objective and the stage when observing a thick specimen. It is attached between the arm and the stage of the microscope. When a column riser is attached, the objective height rises 35 mm.

▶ Attaching a column riser

- 1 Remove the illuminator, the eyepiece tube, and the nosepiece when they are attached on the microscope. Be careful not to drop them.
- 2 Remove four hexagonal socket head bolts, which fix the arm of the microscope to the stand. And then, remove the arm.
- 3 Mount the column riser and the arm onto the stand and fix them with four hexagonal socket head bolts attached with the column riser. Do not use the old hexagonal socket head bolts that were used to fix the arm. To assure the accuracy of the product, tighten the hexagonal socket head bolts in the order described in the figure on the right. (Do not use the old hexagonal socket head bolts that were used to fix the arm.)
- 4 Put the removed parts back to their original positions.



These two bolts are not in particular order.



15 Connecting the Power Cord



WARNING Make sure to use the specified power cord. Using a wrong power cord may result in malfunctions or fire. This product is classified as subject to Class I protection against electrical shock. Make sure it is connected to an appropriate ground terminal (protective earth terminal).
For specifications of the power cord, refer to “VII. Specifications.”

Turn off the power switch on the product (flip it to the “O” side).
Insert the plug of the power cord into the AC inlet on the back of the product. Then, securely plug the power cord to the wall outlet.

16 Installing Options

To install photomicrographic equipment or other separately sold accessory, refer to the system diagram and the instruction manual for each accessory.

17 Anti-static Treatment

Many parts of the microscope have anti-static finishes, which are very useful when observing electrostatically sensitive specimens. The anti-static parts include: the LV100D-U, the LV-UEPI2 epi illuminator, the LV-TT2 eyepiece tube, the L-W 10x eyepieces, the 3x2 stage, the ESD plate, the quintuple BD nosepiece the sextuple DIC nosepiece, and the objectives. The ground connection can be taken through the 3-conductor power cord of the microscope. However, if the power of the microscope is not used at all, for example an external light sources used instead, the ground connection can be taken by connecting the grounding line to the grounding tap at the rear of the microscope.

Improper use of the microscope may adversely affect performance, even if the microscope is not damaged. If any of the problems listed in the table below arise, take the countermeasures indicated.

1 Viewing Problems and Control Problems

Problem	Cause	Countermeasure
The viewfield is invisible, vignetted, or uneven in brightness.	The lamp is not attached correctly.	Install the lamp correctly. (p. 91 and p. 92)
	The optical path selector lever on the eyepiece tube is in an intermediate position.	Securely move the optical path selector lever to the position where 100% (or 20%) light goes through the binocular eyepiece. (p. 40)
	The optical path selector lever on the eyepiece tube is not placed to the position of 100% (or 20%) distribution to the binocular part.	
	A filter or a slider is in an intermediate position.	Move the filter or the slider to a click-stop position. (p. 49, 56 to 57, 61, 63 to 67)
	The field diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 50 and 53)
	The nosepiece is not attached correctly.	Install the nosepiece correctly. (p. 85)
	The rotation of the nosepiece is stopped at an incorrect position. (No objective is placed in the optical path.)	Rotate the nosepiece to the click-stop position. (Place the objective into the optical path.) (p. 48)
	The Bertrand lens is placed into the optical path.	Remove it from the optical path. (p. 76)
	The examination plate is not placed correctly.	Move it to the correct position. (p. 77)
Episcopic microscopy	The microscopy selector knob is stopped at an intermediate position.	Rotate the knob to the click-stop position. (p. 37)
	No filter cube is attached in place. Or, the filter cube is attached in a wrong position.	Attach the filter cube to the correct position. (p. 89)
	The filter cube selection is incorrect.	Use a filter cube with a correct combination. (p. 37, 62, 68 to 70, and 89)
Diascopic microscopy	The condenser position is too low.	Adjust the condenser focus knob so that the field diaphragm image is focused on the specimen surface. (p. 52)
	The condenser is not centered.	Center the condenser. (p. 52)
	The condenser is not attached correctly.	Install the condenser correctly. (p. 84)
	The condenser turret position of the universal condenser is located in an intermediate position.	Rotate it to the click-stop position. (p. 54)
	The top lens of the swing-out achromat condenser for the polarization microscopy is not located correctly.	Move it to the limited position. (p.55)
	The polarizer is not attached correctly.	Attach the polarizer to the correct position. (p.101)
	The upper part of the polarizer is stopped at an intermediate position.	Move the upper part of the polarizer to the click-stop position. (p.59 and 60)

Problem	Cause	Countermeasure	
Dirt or dust is seen in the viewfield.	The aperture diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 51 and 53)	
	Dirt or dust exists on the lens, eyepiece, filter, or specimen.	Clean the components. (p. 110)	
	Diascopic microscopy	The upper surface of the condenser is not clean.	Clean the components. (p. 110)
		The condenser position is too low.	Adjust the condenser focus knob so that the field diaphragm image is focused on the specimen surface. (p. 52)
The viewing is poor (too much or too little contrast, or poor resolution).	Dirt or dust exists on the lens, eyepiece, filter, or specimen.	Clean the components. (p. 110)	
	The used objective is not suitable for the microscopy.	Use the designated objective. (p. 38, 39, 48, and 100)	
	The aperture diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 51 and 53)	
	Epi-fl microscopy	The filter cube being used is not suited for the specimen.	Use a filter cube suited for the specimen. (p. 37, 62, 68, to 70, and 89)
		There is no cover glass in place.	Use a cover glass. (However, no cover glass is required when using an NCG objective.)
		The glass slide is fluorescing.	Use a nonfluorescent glass slide.
	Diascopic microscopy	The condenser position is too low.	Adjust the condenser focus knob so that the field diaphragm image is focused on the specimen surface. (p. 52)
		The focus is uneven.	The nosepiece is not attached correctly. (p. 85)
	The focus is uneven.	The nosepiece is not placed to a click-stop position. (The objective is not placed in the optical path).	Rotate the nosepiece to the click-stop position. (p. 48)
The specimen holder is slanted.		Attach the specimen holder correctly. (p. 83)	
The image is elongated. Or, the image shifts during focus.		The nosepiece is not attached correctly. (p. 85)	
The image is elongated. Or, the image shifts during focus.	The nosepiece is not placed to a click-stop position. (p. 48)	Rotate the nosepiece to the click-stop position. (p. 48)	
	The stage is tilting. (p. 82)	Attach the stage correctly. (p. 82)	
	The microscope is not installed on a flat surface.	Install the microscope on a flat and level surface.	
	Diascopic microscopy	The condenser has not been centered. (p. 52)	Center the condenser. (p. 52)
The image is tinged yellow.		The NCB11 filter is not used. (p. 49)	
The image is tinged yellow.	The lamp voltage is too low. (p. 34 and 49)	Locate the NCB 11 filter into the optical path. (p. 49)	
	The image is too bright.	The lamp voltage is too high. (p. 34 and 49)	
The image is too bright.	Adjust the brightness with the brightness control knob. Or, locate a ND filter into the optical path. (p. 34 and 49)		

Problem	Cause	Countermeasure
The brightness is insufficient. (Refer to the troubleshooting for the electric system too.)	The lamp voltage is too low.	Adjust the brightness with the brightness control knob. (p. 34)
	A ND filter is placed in the optical path.	Remove the ND filter from the optical path. (p. 49)
	The aperture diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 51 and 53)
	A polarizer, analyzer, or PA block is placed in the optical path although the bright-field microscopy is intended to be performed.	Remove the polarizer, the analyzer, or the PA block from the optical path. (p. 56 to 62)
	A halogen lamp is used for a dark specimen.	Replace the light source to brighter one. (p. 94)
	The used objective is not suitable for the microscopy.	Use the designated objective. (p. 38, 39, 48, and 100)
	The room is too bright. (for the dark-field microscopy or the epi-fl microscopy)	Darken the room.
Diascopic microscopy	The condenser position is too low.	Adjust the condenser focus knob so that the field diaphragm image is focused on the specimen surface. (p. 52)
The objective hits the specimen when switched from low to high magnification. The specimen goes out of focus when switching objectives.	The eyepiece diopters are not adjusted.	Adjust the diopters. (p. 43)
	The eyepieces are not attached correctly.	Mount the eyepieces correctly by aligning the positioning grooves. (p. 100)
	The specimen is placed upside-down.	Set the specimen on the stage with the cover glass facing up.
	The cover glass is too thick.	Use the specified type of cover glass (thickness: 0.17 mm).
The specimen does not move smoothly.	The specimen holder is not secured correctly on the stage.	Secure the specimen holder correctly. (p. 83)
When viewing through the binocular eyepiece, the image does not resolve into a single image.	The interpupillary distance is not adjusted.	Adjust the interpupillary distance. (p. 42)
	The eyepiece diopters are not adjusted.	Adjust the diopters. (p. 43)
Eye strain develops while viewing.	The interpupillary distance is not adjusted.	Adjust the distance. (p. 42)
	The eyepiece diopters are not adjusted.	Adjust the diopters. (p. 43)
	The brightness is not appropriate.	Adjust the brightness with the brightness control knob or ND filters. (p. 34 and 49)
	Eyepieces with different viewfield numbers are used for the left and right eyes.	Use eyepieces having the same viewfield number.
The coarse focus knob is heavy in rotation.	The coarse torque adjustment ring is tightened too much.	Loosen the torque adjustment ring adequately. (p. 44)
	The coarse focus stopper ring is locked to restrict the upper limit.	Turn the coarse focus stopper ring to release the stopper function. (p. 45)
The stage falls on its own weight and the image goes out of focus.	The coarse torque adjustment ring is loosened too much.	Tighten the torque adjustment ring adequately. (p. 44)
The stage cannot be raised by the coarse focus knob.	The coarse focus stopper ring is locked at the lower limit.	Turn the coarse focus stopper ring to release the stopper function. (p. 45)

Problem		Cause	Countermeasure
No interference color is seen in the DIC microscopy.		No polarizer is placed in the optical path.	Place it into the optical path. (p. 56 and 60)
		No analyzer is placed in the optical path.	Place it into the optical path. (p. 61)
		The analyzer and the polarizer are not at the crossed Nicols position.	Adjust the orientation of the polarizer to make the crossed Nicols position. (p. 57, 59, and 60)
		No DIC prism is placed in the optical path.	Place it into the optical path. (p. 65 to 67)
		The 1/4 lambda plate is not attached to the polarizer.	Place the polarizer equipped with a 1/4 lambda plate into the optical path. (p. 56 and 60)
		The combination of the objective and the DIC prism is wrong.	Place an appropriate objective into the optical path. (p. 65 to 67)
Uneven colors are seen or low contrast image is seen in the DIC microscopy.		A wrong type of objective is used.	Place an appropriate objective into the optical path (p. 65 to 67)
		The orientation of the polarizer is wrong.	Adjust the orientation of the polarizer correctly. (p. 57, 59 and 60)
		Dust exists on the objective, the condenser, or the specimen.	Clean it. (Pay great attention to dust for the DIC microscopy.) (p. 110)
		The combination of the objective and the DIC prism is wrong.	Place the DIC prism suitable for the objective into the optical path. (p. 65 to 67)
	Diascopic microscopy	The field diaphragm image is not focused on the specimen surface.	Focus the condenser. (p. 52)
No sensitive color is seen in the DIC microscopy or the polarization microscopy		No lambda plate is placed in the optical path.	Place it into the optical path (p. 63 and 64)
The contrast of the phase contrast microscopy is poor.	Diascopic microscopy	The Ph annular diaphragm of the condenser does not coincide with the phase plate ring of the objective.	Center the Ph annular diaphragm until it coincides with the phase plate ring. (Refer to the instruction manual for the LV-CUD.)
		The Ph annular diaphragm of the condenser is not suitable for the Ph code of the objective.	Place the Ph annular diaphragm specified by the Ph code of the objective. (p. 54)
		The field diaphragm image is not focused on the specimen surface.	Focus the condenser. (p. 52)

2 Electrical Problems

Problem	Cause	Countermeasure
The lamp does not light up even though the power switch is on.	The power cord is not connected at all, or is not connected securely.	Connect the power cord correctly. (p. 103)
	No lamp is attached.	Attach a lamp. (p. 90 to 92)
	The lamp is blown.	Replace the lamp with a new one. (p. 92)
	A wrong lamp is used.	Use the specified lamp. (See "VII. Specifications.")
The lamp flickers, or its brightness is unstable.	The lamp is about to blow.	Replace the lamp with a new one. (p. 92)
	The power cord or the cable of the lamp house is not connected securely.	Connect them correctly. (p. 91, 93 and 103)
	The lamp is not securely inserted into the socket.	Insert the lamp securely. (p. 92)
	The lamp house is not connected securely.	Connect the lamp house securely. (p. 91 and 93)

Nikon recommends daily care and maintenance for maintaining the performance as long as possible.

Do not let dust, fingerprint, etc. get on the lenses. Dirt on the lenses, filters, and the like will adversely affect the optical performance of the microscope.

If lenses are contaminated, clean them according to the procedure described in “1. Cleaning the lenses and Filters.” When cleaning, be sure to turn off the power switch (flip the switch to “○” side) to avoid malfunction.

▶ Daily care and maintenance

Clean the parts frequently manipulated by hands, such as eyepieces and glass plate according to the procedure described in “1. Cleaning Lenses and Filters” without removing them from the microscope. Nikon recommends cleaning them frequently.

Clean the objectives, filters, and the like to maintain the optical performance. When cleaning the objectives, remove them from the microscope. Clean them whenever they are contaminated.

Microscopes and stages are contaminated with use. When you find the microscope is contaminated, clean them according to the description in “2. Cleaning the Painted, Plastic, and Printed Parts.”

▶ Cleaning tool and supplies (consumables)

- **Cleaning tool**

Brush (with soft bristles) (Use a cleanroom wiper in a cleanroom.)

- **Cleaning supplies (consumables)**

Ethyl or methyl alcohol

Lens tissue (Use a cleanroom wiper in a cleanroom.)

1 Cleaning Lenses and Filters

Do not let dust, fingerprint, and so on, get on the lenses and filters. Dirt on the lenses, filters, etc. will adversely affect the view of image. If any lens gets dirty, clean it as described below.

- Either brush away dust with a soft brush, or else gently wipe it off with a piece of gauze.
- Only if there are fingerprints or grease on a lens, dampen lightly a piece of soft, clean cotton cloth, lens tissue, or gauze with absolute alcohol (ethyl or methyl) and gently wipe off the dirt.
- Absolute alcohol is highly flammable. Be careful when handling it, when around open flames, when turning the power switch on/off, and so on.
- Follow the instructions provided by the manufacturer when using absolute alcohol.

2 Cleaning the Painted Parts, Plastic Parts, and Printed Parts

Do not use organic solvents such as alcohol, ether, or paint thinner on painted components, plastic components, or printed components. Doing so could result in discoloration or in peeling of the printed characters. For persistent dirt, dampen a piece of gauze with neutral detergent and wipe gently.

3 Storage


- Store this product in a dry place where mold is not likely to form.
- Store the objectives and eyepieces in a desiccator or similar container with a drying agent.
- Put the dust-proof cover over this product to protect it from dust.
- Before putting on the dust-proof cover, turn off the power switch of the product (flip it to the “O” position) and wait until the lamp house gets cool sufficiently.

4 Regular Inspections

Periodical inspections of this product are recommended in order to maintain peak performance. Contact your nearest Nikon representative for details.

▶ LV100D-U

Model name	ECLIPSE LV100D-U
Optical system	CFI60 system (chromatic aberration free infinity optics system)
Illumination	Episcopic illumination: Built-in type lamp power supply, NCB11, ND4, and ND16 are installed. (exchangeable) Specified illuminator: LV-UEPI2 Motorized Universal Epi Illuminator 2 Diascopic illumination: Built-in type lamp power supply, fly's eye lens, NCB11 and ND8 are installed. (not exchangeable)
Built-in power supply for the illumination lamp	Output: One line (epi/dia selection type) Output voltage: 12 VDC, 50 W, 4.4 A maximum Voltage control range: 1 to 12 V (independent control for epi and dia) Lamp ratings: 12 VDC, 50 W halogen lamp Specified lamp: LV-HL50W 12 V 50 W LONGLIFE Halogen Lamp Specified lamp house: LV-LH50PC Precentered Lamp House
Focusing mechanism	Manual operation type single axis coarse/fine focus knob mechanism (left side with coarse/fine focus, right side with coarse focus, calibration marking for fine focus: 1 μm/markings) Stroke: 40 mm with coarse focus stopper mechanism Coarse focus knob: 14 mm/revolution Fine focus knob: 0.1 mm/revolution
Eyepiece	10x, field number: 22, 25
Input ratings	Input voltage: 100 to 240 VAC ±10%, 50/60 Hz Rated current: 1.2 A maximum
Power cord	When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type SVT, No.18 AWG, 3 m long maximum, rated at 125 VAC minimum When the supply voltage is 220 V to 240 V: Power cord set approved according to EU/EN standards, 3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 VAC minimum For Japan: Power cord set approved according to the Electrical Appliance and Material Safety Law (with the PSE mark) (3 conductor grounding Type VCTF 3x0.75 mm ² , 3 m long maximum, rated at 125 VAC minimum.)

Operating condition	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class I Indoor use only
Storage condition	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)
Safety standards compliance	<ul style="list-style-type: none"> • This is UL-listed product. (UL61010-1 2nd Edition) • This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15B of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de classe A est conforme à la norme NMB-003 du Canada. • This product meets Australian EMI. (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. (EN61326) <div style="text-align: right; margin-top: 10px;">  </div>

► LV-UEPI2

Model name	LV-UEPI2 Motorized Universal Epi Illuminator 2
Optical system	CFI60 system (chromatic aberration free infinity optics system)
Light source connection	1 (rear)
Illumination	Köhler illumination
Field number	25
Illumination method	Bright-field, dark-field, differential interference contrast*, simplified polarization*, sensitive color polarization*, epi-fl* (* needs options)
Illumination selection method	Four port turret rotation in conjunction with a shutter to provide dazzling light (noise terminator attached) Turret drive method: manual operation (with the front selector knob) Filter cube: up to two filter cubes can be installed (filter cubes for the bright-field and dark-field microscopy are fixed)
Field diaphragm	Adjustment: manual Variable range: 1.0 to 8.9 mm in diameter (bright-field microscopy) Projected magnification: 3.0x (on the eyepiece image plane) Full open diameter (for dark-field microscopy): 9.8 mm Centering range: 2.4 mm in diameter
Aperture diaphragm	Adjustment: manual Variable range: 1.2 to 8.9 mm in diameter (bright-field microscopy) Projected magnification: 1.55x (on the objective pupil plane) Full open diameter (for dark-field microscopy): 9.8 mm Centering range: 2.4 mm in diameter
Filters	Built-in filter: lemon skin filter, UV filter (only for bright-field and dark-field microscopy) ND filter: two manual type sliders Analyzer slot: right side Polarizer slot: two slots on right side, lambda plate attachable Excitation light balancer slot: left side
Operating condition	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage condition	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)

► **TE2-PS100W**

Model name	TE2-PS 100W Power Supply
Input ratings	100 to 240 VAC, 2.4 A, 50/60 Hz
Power cord	<p>When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type SVT, No.18 AWG, 3 m long maximum, rated at 125 VAC minimum</p> <p>When the supply voltage is 220 V to 240 V: Power cord set approved according to EU/EN standards, 3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 VAC minimum</p> <p>For Japan: Power cord set approved according to the Electrical Appliance and Material Safety Law (with the PSE mark) (3 conductor grounding Type VCTF 3x0.75 mm², 3 m long maximum, rated at 125 VAC minimum.)</p>
Output ratings	12 VDC, 100 W, 8.4 A
Built-in fuse rating	250 V T4A
Operating condition	<p>Temperature: 0°C to +40°C</p> <p>Humidity: 85% relative humidity maximum (no condensation)</p> <p>Altitude: 2000 m maximum</p> <p>Pollution degree: Degree 2</p> <p>Installation category: Category II</p> <p>Electric shock protection class: Class I</p> <p>Indoor use only</p>
Storage condition	<p>Temperature: -20°C to +60°C</p> <p>Humidity: 90% relative humidity maximum (no condensation)</p>
Others	UL listed, GS approved, and CE satisfied product