M421 E 07.5.NF.1 (2/3)

Nikon

Universal Design Microscope UDM

ECLIPSE LV100DA-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 LV100DA-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 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 2A Motorized Universal Epi Illuminator 2A" calls your attention on the following: You can see the positions of this symbol on Page 8 and 12. • The lamp house becomes 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 microscope 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-UEPI2A Motorized Universal Epi Illuminator 2A (model name: LV-UEPI2A)
- 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).
- Power supply (It is used to turn on the episcopic illumination and the diascopic illumination simultaneously.)
  Nikon TE2-PS100W Power Supply (model name: TE2-PS100W)
  This power supply is connected to the lamp house for the episcopic illumination to turn on the episcopic illumination and the diascopic illumination simultaneously.

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

WARNING

7. To use an external light source

To perform an epi-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 Inensilight C-HGFIE HG Precentered Illuminator (model name: C-HGFIE, electric operation type) or X-Cite 120 PC (electric operation type) made by EXFO Electro Optical Engineering Inc.
  If a manual operation type light source is attached, you cannot control the shutter and the brightness on the microscope. Make sure to use the light source specified above.

Note that if the light source described above is used with the 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 microscope and the lamp house. If the air vents are blocked, the temperature of the microscope 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-UEPI2A epi illuminator, an UV filter automatically enters the optical path when the microscopy method 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.

12. Cautions on operating the motorized units

The product can be controlled on a PC with “NIS-Elements,” the software for digital cameras, when a digital camera is used with the product. To avoid unexpected injuries, note the following when operating this product with a PC.
Before operating the product, check all moving parts for your safety.

- If you touch the nosepiece, objectives, or parts on the stage during operation, it may cause injury to hands or fingers. Do not touch these devices or parts when operating.

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 loose accuracy when exposed to even a weak physical shock.

2. Do not wet the microscope

If the microscope 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 "○" 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

The 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 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 loose accuracy when exposed to even a weak physical shock.)
- When moving the microscope, first remove the stage and the lamp house. Then, securely hold the microscope by the root of the arm from the back.
  (Information) The microscope with the stage, eyepiece tube, lamp house, and other parts attached, weighs approximately. 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. Cable routing

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.

8. 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 "○" 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.

9. Notes on handling a filter cube

When using the product configured with the illuminator LV-UEPI2A, 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

10. Software setup works after assembly

When the microscope is assembled or the configuration of the microscope is changed, perform the software setup works for various settings of the microscope via a PC by using the software, "LVSetup," in "LV Series Support Tools" provided with this product.
In the setup works, information for the parts and devices (objectives, filter cubes, illuminator, and so on) is registered into the memory in the microscope and interlock controls for such devices are specified. Make sure to perform the setup works to use the microscope correctly.
For details about the operation and the setup works of the "LVSetup," refer to the "LV Series Support Tools software manual."

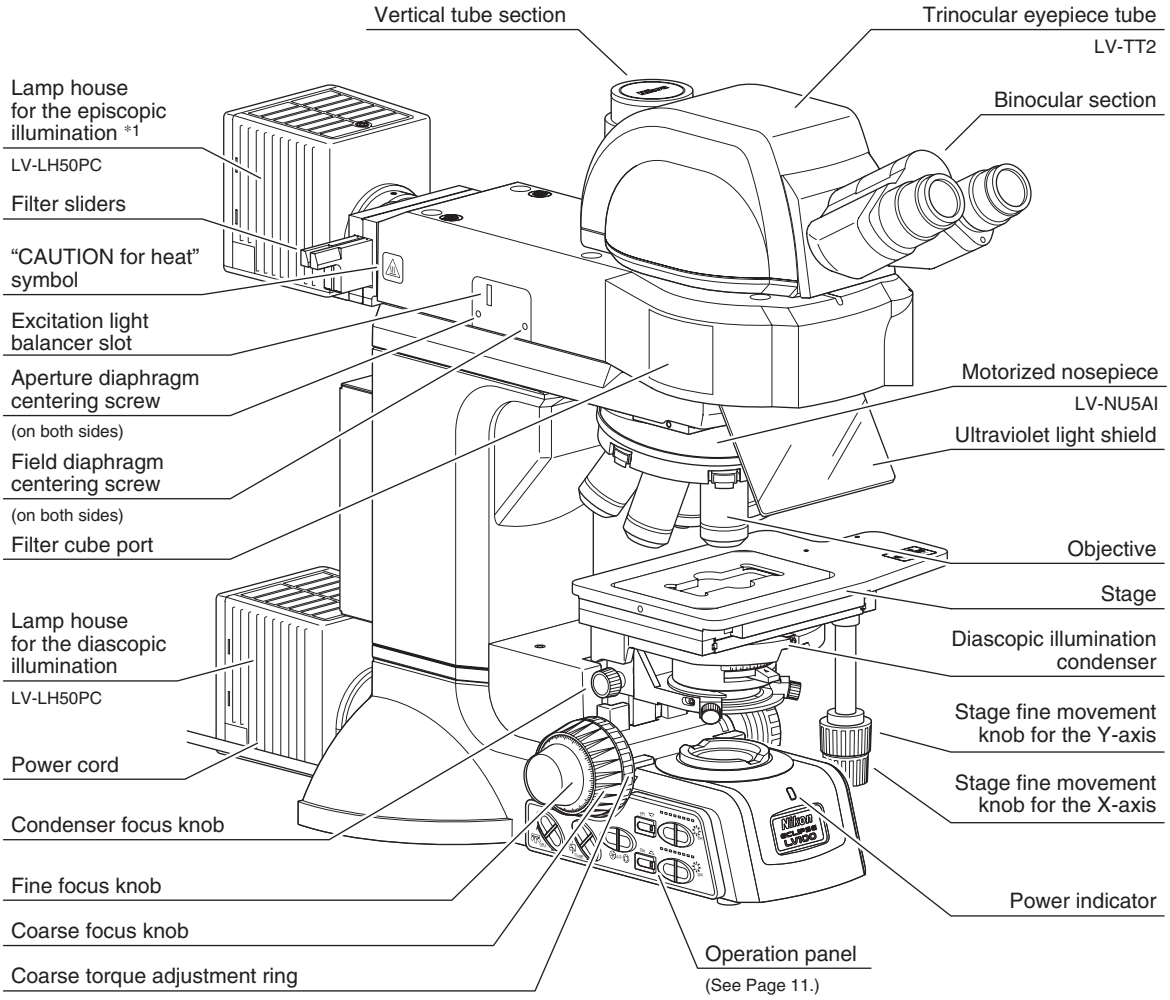
CONTENTS

I Part Name

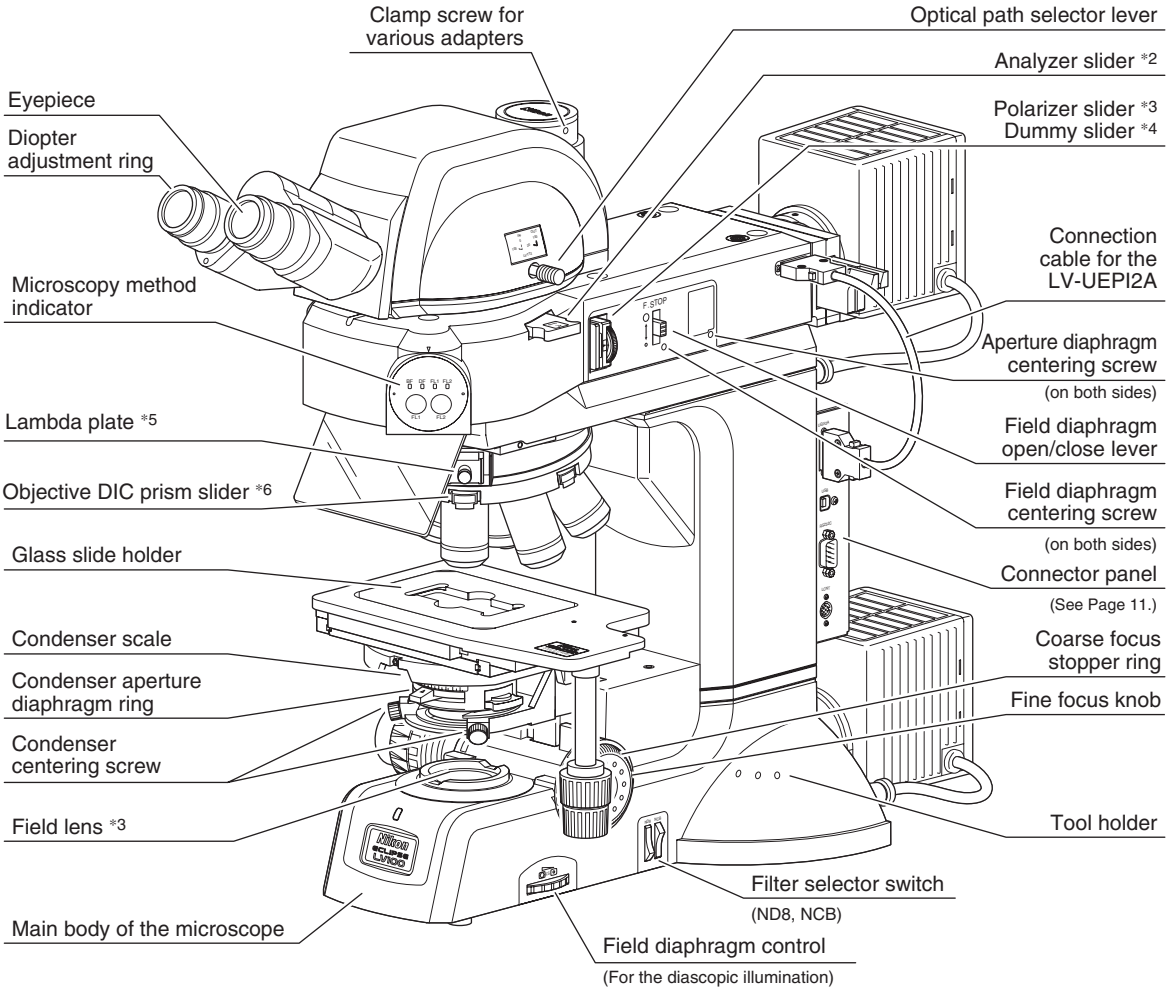
1 Configuration of the Product and Control Names

▶ Front left side of the microscope

This drawing depicts the ECLIPSE LV100DA-U microscope configured with the LV-UEPI2A epi illuminator, the LV-TT2 eyepiece tube, the LV-NU5AI motorized nosepiece, the 3x2 stage, the glass slide holder, the diascopic illumination condenser (the slide condenser), the lamp house for the episcopic illumination, the lamp house for the diascopic illumination, and attachments for the DIC microscopy.



▶ Front right side of the microscope



*1: To turn on the episcopic illumination and the diascopic illumination simultaneously, connect the lamp cable of the lamp house for the episcopic illumination to an external power supply. (See Page 10.)
If the brightness of the halogen lamp is less than the desired brightness for the epi-fl microscopy or so on, attach an external light source equipped with a mercury lamp with the fiber adapter and the light guide fiber. (See Page 10.)

*2: This part is used for the DIC microscopy or the polarization microscopy under the episcopic illumination or the diascopic illumination.

*3: To perform the DIC microscopy or the polarization microscopy under the episcopic illumination, attach the polarizer slider to the slot on the epi illuminator. To perform the DIC microscopy or the polarization microscopy under the diascopic illumination, attach the polarizer for the diascopic illumination to the field lens part.

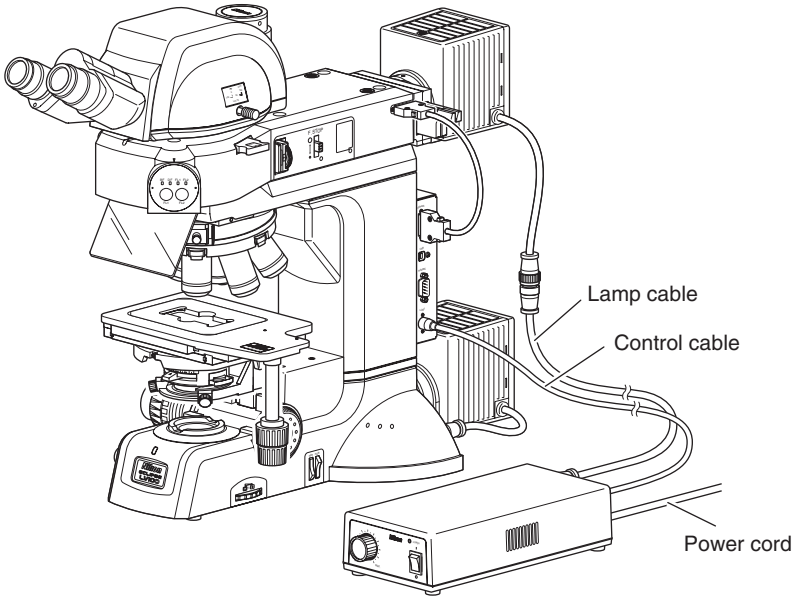
*4: To perform the sensitive color DIC microscopy or the sensitive color polarization microscopy under the episcopic illumination, insert the lambda plate slider.

*5: This is used to perform the sensitive color DIC microscopy or the sensitive color polarization microscopy under the diascopic illumination.

*6: This is used to perform the DIC microscopy.

2 To Perform Epi/Dia Simultaneous Illumination

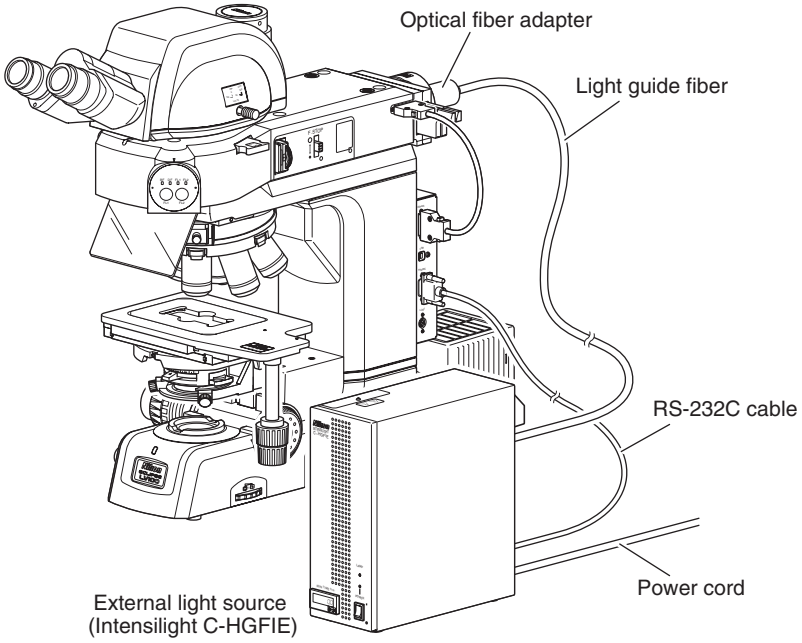
The drawing below depicts the LV100DA-U microscope configuration to use the episcopic illumination and the diascopic illumination simultaneously. To turn on the both illumination simultaneously, the lamp house for the episcopic illumination must be connected to an external power supply (TE2-PS100W).



Power supply (TE2-PS100W)

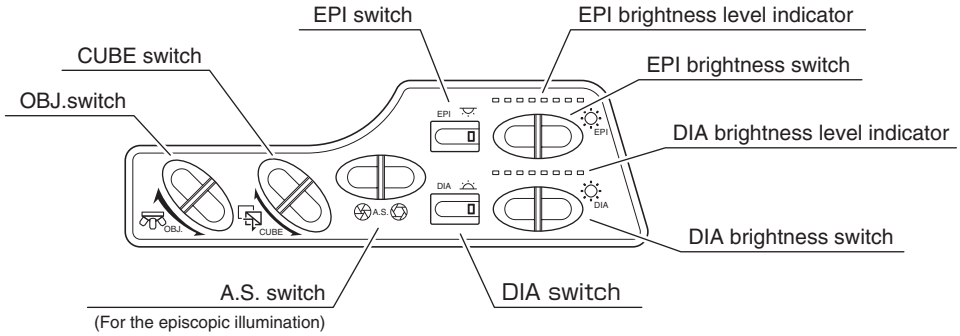
3 To Use an External Light Source

The drawing below depicts the LV100DA-U microscope with the LV-UEPI2A epi illuminator, the LV-HGFA optical fiber adapter, the light guide fiber, and the external light source (Intensilight C-HGFIE). To perform the epi-fl microscopy, this configuration is used.



4 Operation Panel

On the operation panel, there are switches to operate electric operation parts in the microscope.



OBJ. switch:
It is used to rotate the nosepiece and change objectives.

CUBE switch:
It is used to rotate the filter cube turret in the LV-UEPI2A and change microscopy methods.

A.S. switch:
It is used to adjust the opening of the aperture diaphragm in the LV-UEPI2A.

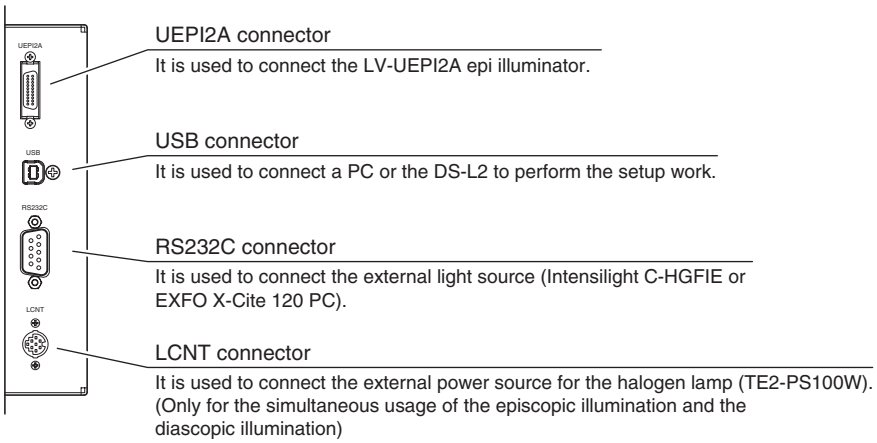
EPI switch / DIA switch:
They are used to turn on/off the lamps for the illumination. When the external light source is used, these switches are used to open/close the shutter in the light source. When one of the lamps for the illumination is lit or when the shutter in the light source is opened, the indicator for the corresponding switch is lit.

EPI / DIA brightness level indicator:
They display the brightnesses of the lamps.

EPI / DIA brightness switch:
They are used to adjust the lamp brightnesses. When a halogen lamp is used for the illumination, its brightness can be adjusted with continuous settings. When the external light source is used, its brightness can be adjusted in five steps.

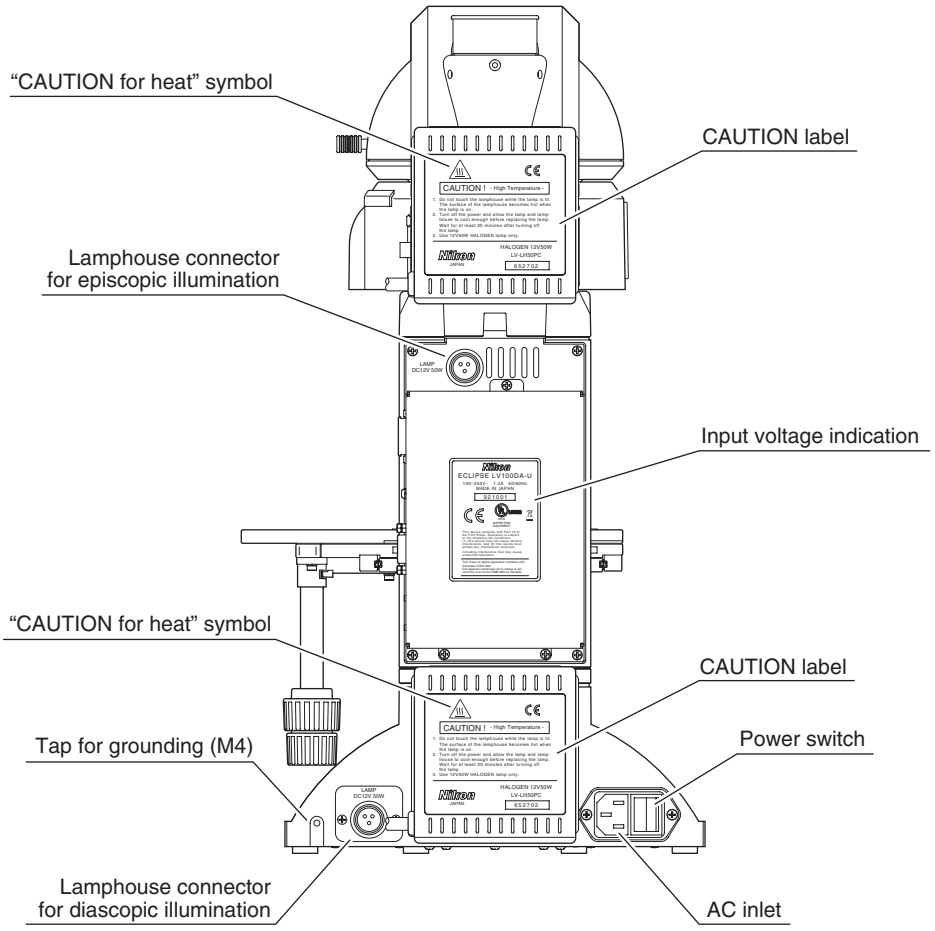
5 Connector panel

On the connector panel, there are connectors for electric operation parts and a PC.



6 Rear View

This drawing depicts the Eclipse LV100DA-U microscope configured with the LV-UEPI2A 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



II Microscopy Method

CAUTION

Before performing microscopy

- Before using the microscope, please set up the LV100DA-U using “LVSetup” on a PC contained in “LV Series Support Tools.”
- In this chapter, the microscopy is described with the interlock control of LVSetup set to the Default mode. When the interlock control mode is set to the Optional mode, the microscope may behave differently from the ways that are described in this chapter.
- The interlock control of each electrically-driven device can be enabled using LVSetup. When this function is enabled, the corresponding electrical devices are set to the predetermined conditions in accordance with the microscopy method or objective. If the interlock control is disabled, please be sure to operate each device manually.
- For operations of LVSetup, see “LV Series Setup Tools Software Manual.”
- Motorized units can be controlled on a PC with “NIS-Elements,” the software for digital cameras, when a digital camera is used with the product. For details, see the instruction manual for the “NIS-Elements.”

This chapter explains the procedure of each microscopy.

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

Microscopy methods list

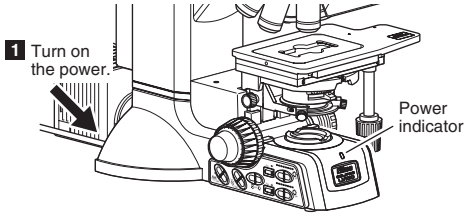
See the table below for the microscopies available with the product, as well as the optional accessories required for each microscopy.

Microscopy	Microscopy Method	Required accessories (optional)
Bright-field microscopy under the epi-illumination	p.15	—
Dark-field microscopy under the epi-illumination	p.17	BD objective
Polarization microscopy under the episcopic illumination (simplified/sensitive color)	p.18	Polarizer slider and analyzer slider (The PA block can be used for the simplified polarization.), lambda plate slider (for the sensitive color)
Differential interference contrast microscopy under the epi-illumination	p.20	**Senarmont method** Polarizer slider (equipped with the 1/4 lambda plate), analyzer slider, and lambda plate slider (for the sensitive color) DIC prism slider (suitable for the objective) LU objective for industrial microscopes (Objectives marked “LU” are suitable for DIC microscopy.)
	p.22	**Prism slide method** Motorized universal quintuple nosepiece (LV-NU5A or LV-NU5AC), polarizer slider, analyzer slider, lambda plate slider (for the sensitive color), DIC prism slider (L-DIC/L-DIHC), and LU objective for industrial microscopes (Objectives marked “LU” are suitable for DIC microscopy.)
Epi-fl microscopy	p.24	Filter cube (Up to two cubes can be attached.) Fluorescence excitation light balancer (optional)
Bright-field microscopy under the dia-illumination	p.26	Condenser lens and additional lens (when the universal condenser is used, for the 2x to 4x objectives)
Polarization microscopy under the diascopic illumination (simplified/sensitive color)	p.28	Condenser lens, polarizer for the diascopic illumination, analyzer, and lambda plate (for the sensitive color)
Dark-field microscopy under the dia illumination	p.29	Universal condenser, dark-field annular diaphragm (or dark-field condenser) diaphragm, and objective with a numerical aperture of 0.7 or less
Phase contrast microscopy under the dia illumination	p.30	Universal condenser, Ph annular diaphragm (suitable for the objective), and Ph objective
Differential interference contrast microscopy under the dia illumination	p.32	Universal condenser, rotatable polarizer for the diascopic illumination, analyzer, condenser DIC prism (suitable for the objective), objective DIC prism (suitable for the objective), DIC objective for biologic microscopes, and lambda plate (for the sensitive color)

1 Bright-field Microscopy under the Epi Illumination

1 Turn on the power switch.

When the power to the microscope is turned on, the microscope starts initialization. And then, the power indicator on the microscope base is lit. (See Page 34.)



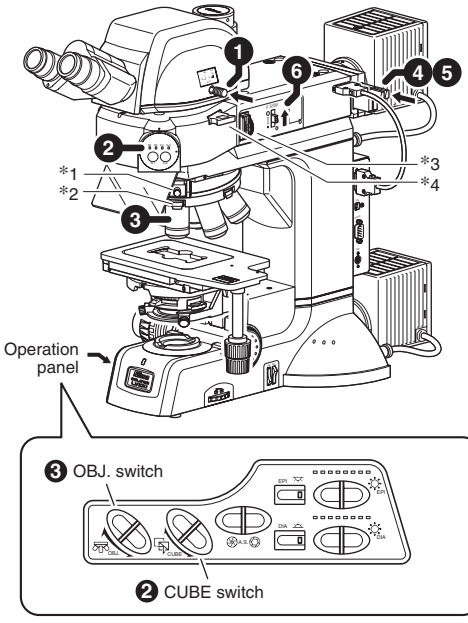
2 Set the microscope for the bright-field microscopy under the epi illumination.

If accessories for the DIC microscopy under the episcopic/diascopic illumination (*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 48.)
2. Press the CUBE switch on the operation panel and light up the “BF (bright-field)” position of the microscopy method indicator. (See Page 37.)

   The episcopic illumination lamp is turned on with the predetermined light quantity, and the aperture diaphragm for the episcopic illumination is adjusted to the predetermined size automatically by the interlock control function.
3. Press the OBJ. switch on the operation panel and locate the 10x objective into the optical path. (See Page 43.)
4. Locate the NCB11 filter into the optical path and compensate the color temperature. (See Page 44.)
5. Adjust the brightness with ND filters. (See Page 44.)
6. Move the open/close lever to the upper position to fully open the field diaphragm for the episcopic illumination. (See Page 50.)

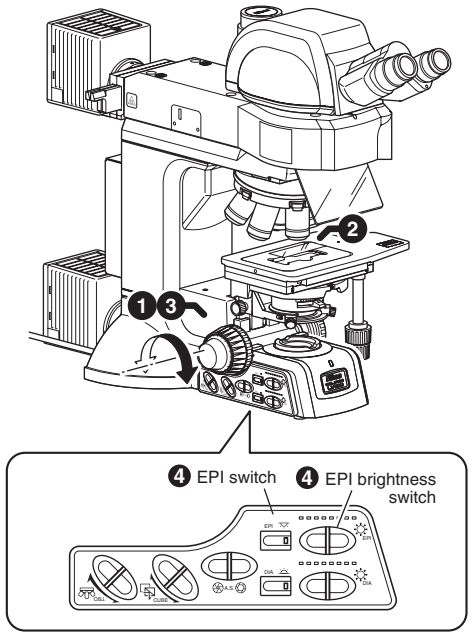
2 Set the microscope for the bright-field microscopy under the epi illumination.



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 46.)
2. Set the specimen onto the stage.
3. Turn the coarse/fine focus knobs and focus on the specimen. (See Page 46.)
4. Turn on the episcopic illumination lamp with the EPI switch on the operation panel and adjust the brightness of the lamp with the EPI brightness switch. (See Pages 41 and 42.)

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

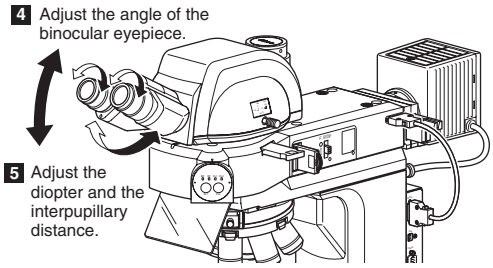


4 Adjust the angle of the binocular eyepiece. (for the LV-TT2)

(See Page 48.)

5 Adjust the diopter and the interpupillary distance.

(See Page 49.)



6 Set the desired magnification and observe the specimen.

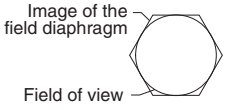
1 Press the OBJ. switch on the operation panel and locate the objective of desired magnification into the optical path. (See Page 43.)

The episcopic illumination lamp is turned on with the predetermined light quantity, and the aperture diaphragm for the episcopic illumination is adjusted to the predetermined size automatically by the interlock control function.

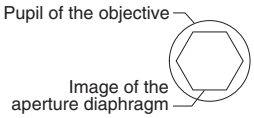
2 Turn the coarse/fine focus knobs to bring the specimen into focus. (See Page 46.)

3 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

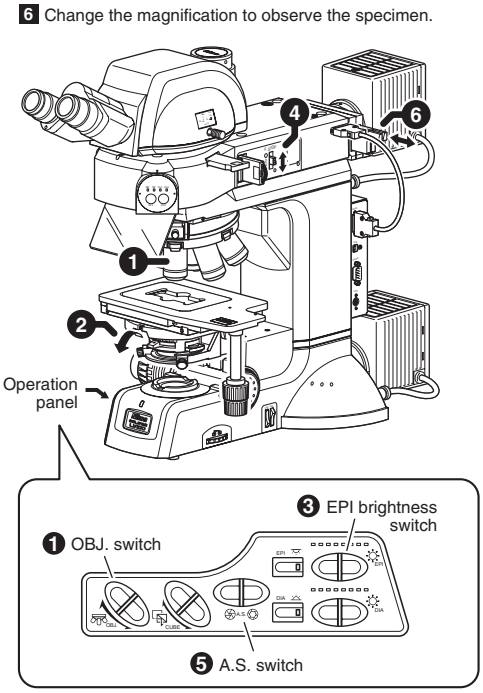
4 Use the field diaphragm open/close lever so that the field diaphragm image circumscribes the field of view. (See Page 50.)



5 Press the A.S. switch on the operation panel to adjust the opening of the aperture diaphragm for the episcopic illumination. (See Page 51.)



6 Adjust the brightness with ND filters. (See Page 44.)



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 epi illumination.

The following accessories must be attached to perform the dark-field microscopy under the epi illumination.

- BD objective (See Page 93.)

* Set up the microscope according to the "LVSetup" and set information of objectives correctly.

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

(See Pages 15 and 16.)

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

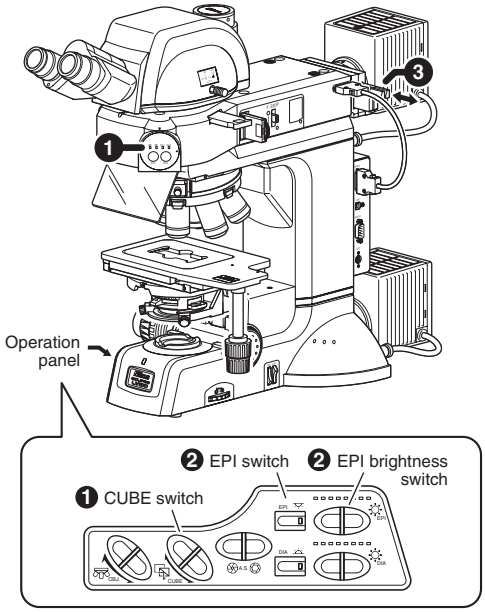
1 Press the CUBE switch on the operation panel and light up the "DF (dark-field)" position of the microscopy method indicator. (See Page 37.)

The episcopic illumination lamp is turned on with the predetermined brightness by the interlock control function, and the aperture diaphragm and the field diaphragm are fully opened. (However, the position of the field diaphragm open/close lever is not changed.)

2 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination.(See Page 42.)

To turn on and turn off the illumination, use the EPI switch.

3 Adjust the brightness with ND filters. (See Page 44.)



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

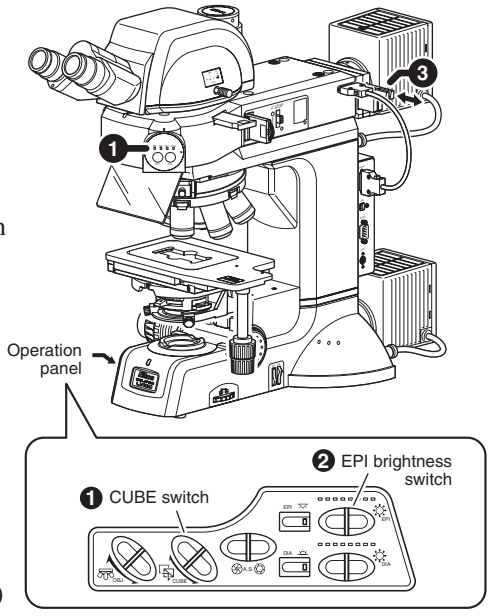
1 Press the CUBE switch on the operation panel and light up the "BF (bright-field)" position of the microscopy method indicator. (See Page 37.)

The episcopic illumination lamp is turned on with the predetermined brightness by the interlock control function, and the aperture diaphragm and the field diaphragm automatically return to the previous positions. (The field diaphragm open/close lever position does not change.)

2 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42)

To turn on and off the illumination, use the EPI switch.

3 Adjust the brightness with ND filters. (See Page 44.)



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

1 Attach the accessories required for the polarization microscopy under the epi illumination.

The following accessories must be attached to the LV-UEPI2A to perform the polarization microscopy under the epi illumination.

- Polarizer slider (See Page 83.)
- Analyzer slider (See Page 83.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 83.)

* 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 84.)

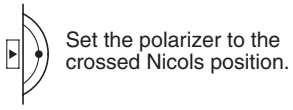
2 Focus on the specimen with the bright-field microscopy under the epi illumination.

(See Pages 15 and 16.)

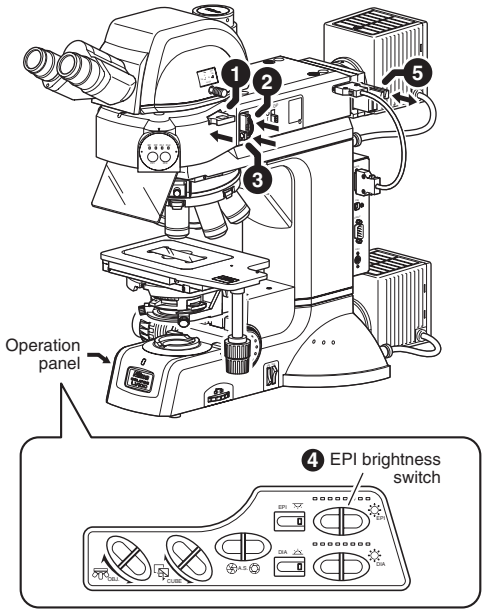
3 Set the microscope for the polarization microscopy under the epi illumination.

1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 60.)

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, you can get the crossed Nicols position by placing the PA block (LV-PAB) into the optical path instead of the analyzer and the polarizer. (See Page 61.)
For the sensitive color polarization microscopy, the lambda plate must be placed between the analyzer and the polarizer. The PA block (LV-PAB) cannot be used for the sensitive color polarization microscopy.



3 For the sensitive microscopy, push in the lambda plate slider to locate the lambda plate into the optical path. (See Page 62.)

4 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

5 Adjust the brightness with ND filters. (See Page 44.)

About sensitive color polarization microscopy under the epi 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.

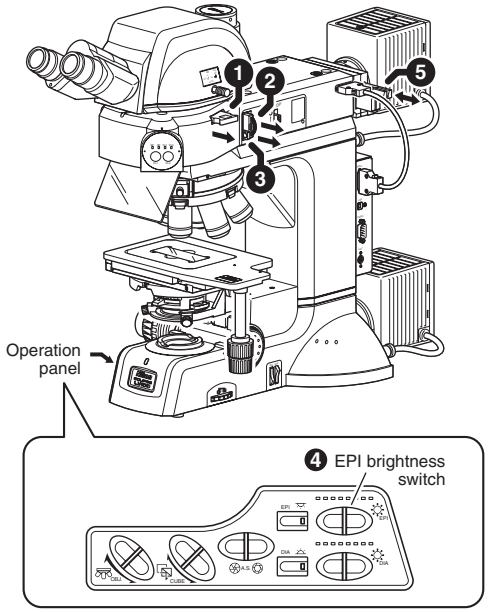
1 Pull out the analyzer slider and move the analyzer away from the optical path.
(See Page 60.)

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 62.)

4 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

5 Adjust the brightness with ND filters.
(See Page 44.)



4 Differential Interference Contrast Microscopy under the Epi Illumination (Senarmont Method)

Methods of the differential interference contrast (DIC) microscopy vary among the nosepiece configuration. For the standard LV-NU5AI nosepiece, the Senarmont method is used for the DIC microscopy under the epi illumination.

1 Attach the accessories required for the Senarmont method of the DIC microscopy .

The accessories required for the Senarmont method of the DIC microscopy under the episcopic illumination are as follows:

- U5AI nosepiece (LV-NU5AI) (See Page 79.)
- LU objective (See Page 93.)
- Polarizer slider (equipped with the 1/4 lambda plate) (See Page 83.)
- Analyzer slider (See Page 83.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 81.)
- DIC prism slider (for the sensitive color microscopy) (See Page 83.)

* For details on selecting the DIC prism, see Page 64, “20. DIC Prism (For the Episcopic Illumination/Senarmont Method)” of “III. Operation of Each Part.”

* Set up the microscope according to the "LVSetup" and set information of objectives correctly.

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

(See Pages 15 and 16.)

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

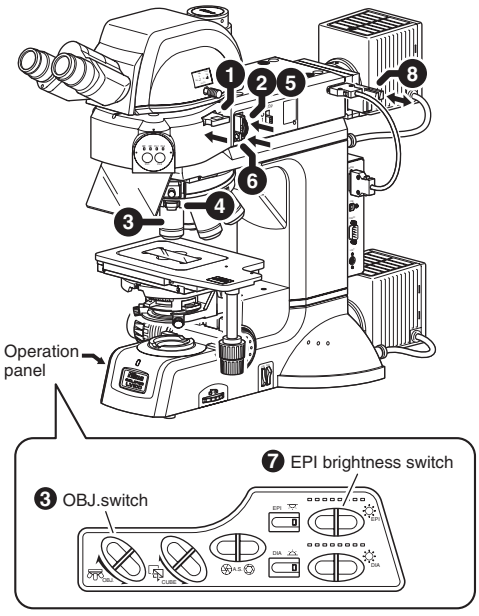
1 Push in the analyzer slider to place the analyzer into the optical path. (See Page 60.)

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.)

Set the polarizer to the crossed Nicols position.

3 Press the OBJ. switch on the operation panel to place the objective of a desired magnification into the optical path. (See Page 43.)
The aperture diaphragm for the episcopic illumination is adjusted to the predetermined size by the interlock control function.

4 Push in the DIC prism slider to place the DIC prism into the optical path. (See Page 64.)



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 To perform the sensitive color microscopy, push in the lambda plate slider to place the lambda plate into the optical path. (See Page 62.)

7 Adjust the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

8 Adjust the brightness with ND filters. (See Page 44.)

4 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 60.)

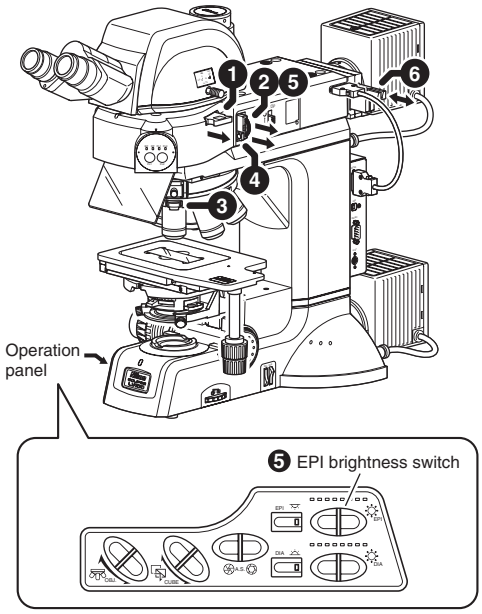
2 Pull out the polarizer slider to remove the polarizer from the optical path. (See Page 57.)

3 Pull out the DIC slider to remove the DIC prism from the optical path. (See Page 64.)

4 Pull out the lambda plate slider to remove the lambda plate from the optical path.
(See Page 62.)

5 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

6 Adjust the brightness with ND filters.
(See Page 44.)



5 Differential Interference Contrast Microscopy under the Epi Illumination (Prism Slide Method)

Methods of the differential interference contrast (DIC) microscopy vary among the nosepiece configuration. For motorized universal quintuple nosepieces, the LV-NU5A and the LV-NU5AC, the prism slide method is used for the DIC microscopy under the epi illumination.

1 Attach the accessories required for the prism slide method of the DIC microscopy under the episcopic illumination.

The accessories required for the prism slide method of the DIC microscopy under the episcopic illumination are as follows:

- Motorized universal quintuple nosepiece (LV-NU5A or LV-NU5AC) (See Page 79.)
- LU objective (See Page 93.)
- Polarizer slider (for the episcopic illumination) (See Page 83.)
- Analyzer slider (See Page 83.)
- Lambda plate slider (for the sensitive color microscopy) (See Page 81.)
- DIC slider (L-DIC/L-DIHC, attached to the DIN slot of the nosepiece) (See Page 83.)

* Set up the microscope according to the "LVSetup" and set information of objectives correctly.

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

(See Pages 15 and 16.)

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 60.)

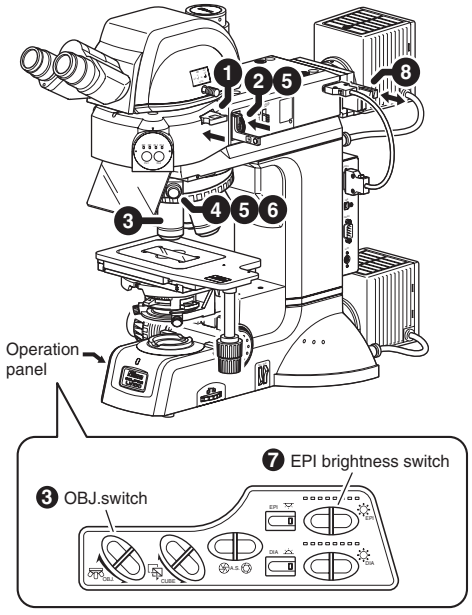
2 Push in the polarizer slider to place the polarizer into the optical path, and set the crossed Nicols position by aligning the index. (See Page 57.)

Set the polarizer to the crossed Nicols position.

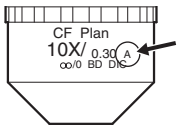
* The crossed Nicols position can be set by placing the PA block (LV-PAB) into the optical path instead of the analyzer and the polarizer. (See Page 61.)

3 Press the OBJ. switch on the operation panel to place the objective of a desired magnification into the optical path. (See Page 43.)
The aperture diaphragm for the episcopic illumination is adjusted to the predetermined size by the interlock control function.

4 Push in the DIC slider to place the DIC prism into the optical path. (See Page 65.)



5 Set the prism selector knob of the DIC slider to the position (A or B) indicated on the body of the objective. (See Page 65.)



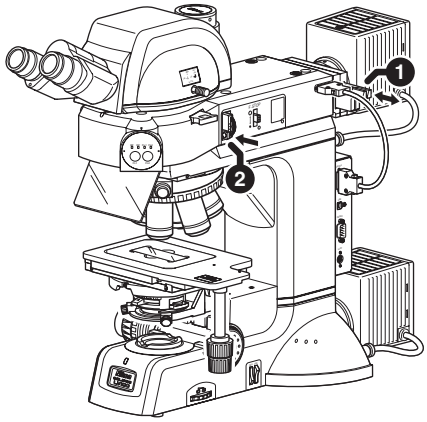
Set the prism selector knob to the position indicated on the objective.

6 Rotate the prism position knob at the end of the DIC prism to set an interference color. (See Page 65.)
You can also perform the sensitive color DIC microscopy by operating the prism position knob.

7 Adjust the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

8 Adjust the brightness with ND filters. (See Page 44.)

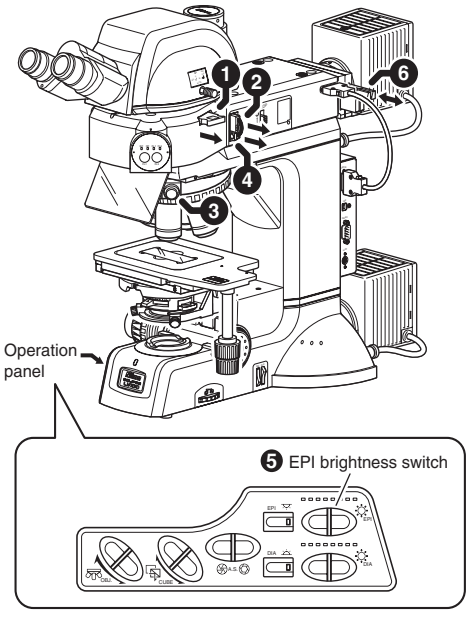
4 For the color contrast microscopy, perform the following.



1 Place the NCB filter into the optical path. (See Page 44.)

2 Push in the lambda plate slider to place the lambda plate into the optical path. (See Page 62.)
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 60.)

2 Pull out the polarizer slider to remove the polarizer from the optical path. (See Page 57.)

3 Pull out 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 62.)

5 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

6 Adjust the brightness with ND filters. (See Page 44.)

6 Epi-fl Microscopy

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

The following accessories must be attached to perform the epi-fl microscopy.

- Filter cube for the epi-fl microscopy (attached to the LV-UEPI2A) (See Page 84.)
- External light source (Intensilight C-HGFIE or EXFO X-Cite 120 PC, used when the brightness of the halogen lamp is insufficient.) (See Page 89.)

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

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

(See Pages 15 to 17.)

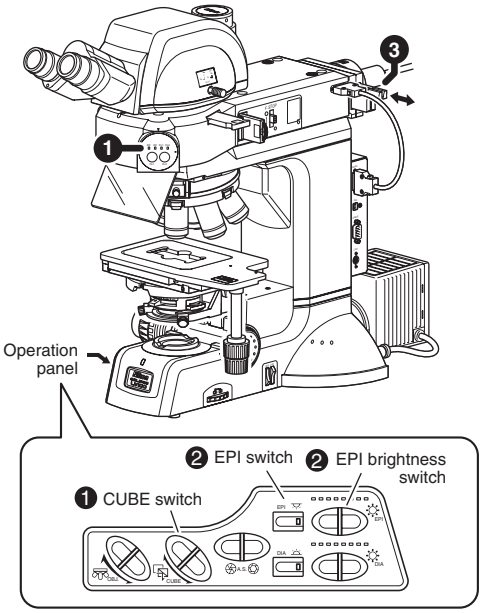
3 Set the microscope for the epi-fl microscopy.

1 Press the CUBE switch on the operation panel and light up the "FL1" or "FL2" position of the microscopy method indicator. (See Page 37.)

The light source is adjusted to the predetermined light quantity, and the aperture diaphragm for the episcopic illumination is adjusted to the predetermined size automatically by the interlock control function.

2 Open or close the shutter of the light source with the EPI switch on the operation panel, and adjust the brightness with the EPI brightness switch. (See Pages 41 and 42.)

3 Adjust the brightness with ND filters. (See Page 44.)



About the shutter of the light source

To prevent fading of the specimen, make sure to close the shutter when you don't observe the specimen. The shutter of the light source can be opened and closed with the EPI switch on the operation panel.

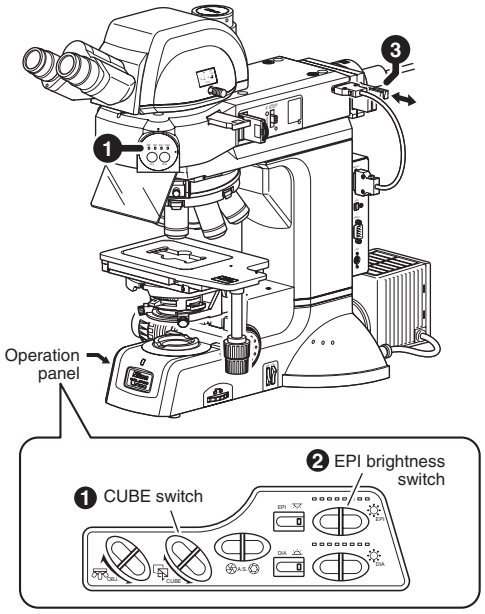
4 Return to the bright-field or dark-field microscopy under the epi illumination.

1 Press the CUBE switch on the operation panel and light up the “BF (bright-field)” or “DF (dark-field)” position of the microscopy method indicator. (See Page 37.)

The light source is adjusted to the predetermined light quantity, and the aperture diaphragm for the episcopic illumination is adjusted to the predetermined size automatically by the interlock control function.

2 Operate the EPI brightness switch on the operation panel to adjust the brightness of the episcopic illumination. (See Page 42.)

3 Adjust the brightness with ND filters. (See Page 44.)



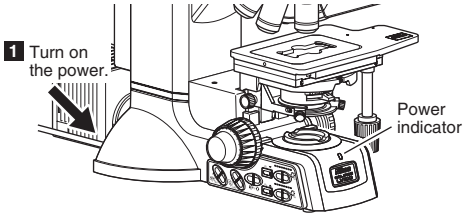
About the UV filter mounted in the LV-UEPI2A

When the filter cube turret 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.

7 Bright-field Microscopy under the Dia Illumination

1 Turn on the power switch.

When the power to the microscope is turned on, the microscope starts initialization. And then, the power indicator on the microscope base is lit. (See Page 34.)

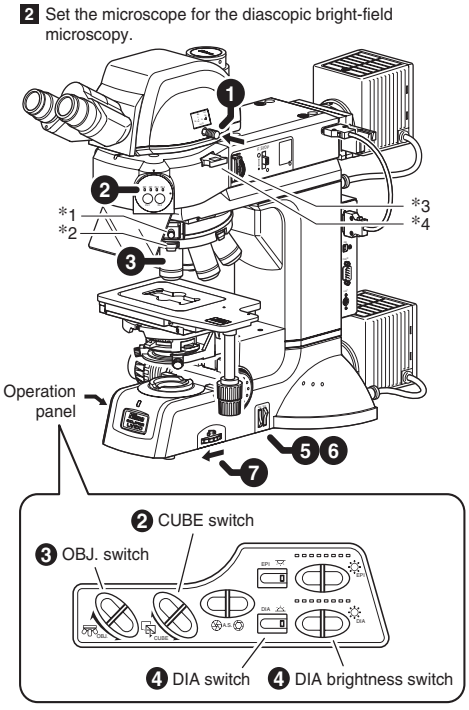


2 Set the microscope for the bright-field microscopy under the diascopic illumination.

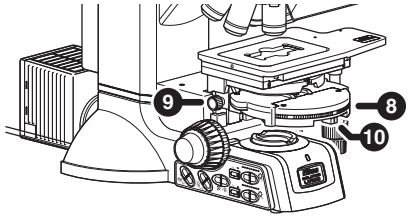
If accessories (*1 to *4) for the DIC microscopy under the episcopic illumination are in place, remove them from the optical path.

1. Push in the optical path selector lever and make the distribution of light for the binocular part 100%. (See Page 48.)
2. Press the CUBE switch on the operation panel and light up the “DF (dark-field)” position of the microscopy method indicator. (See Page 37.)

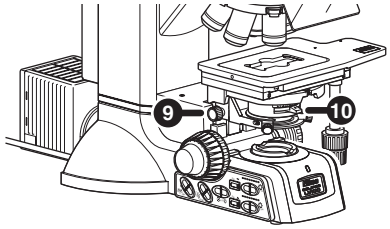
   To use the diascopic illumination, be sure to set the LV-UEPI2A to “DF.”
3. Press the OBJ. switch on the operation panel and locate the 10x objective into the optical path. (See Page 43.)
4. Press the DIA switch on the operation panel to light up the diascopic illumination lamp, and adjust the brightness with the DIA brightness switch. (See Page 42.)
5. Locate the NCB11 filter into the optical path and compensate the color temperature. (See Page 44.)
6. Adjust the brightness with ND filters. (See Page 44.)
7. Rotate the field diaphragm control toward you and fully open the field diaphragm for the diascopic illumination. (See Page 54.)
8. To use the universal condenser, set the condenser turret to the “O” position. (See Page 55.)
9. Rotate the condenser focus knob to focus the condenser. (See Page 53.)
10. Rotate the condenser aperture diaphragm ring toward the left to fully open the condenser aperture diaphragm. (See Page 54.)



■ Universal condenser



■ Other condenser



3 Place the specimen onto the stage and focus on it.

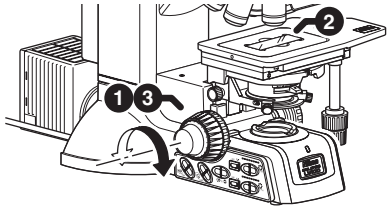
1 Lower the stage by turning the coarse/fine focus knobs. (See Page 46.)

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 Turn the coarse/fine focus knobs and focus on the specimen. (See Page 46.)

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

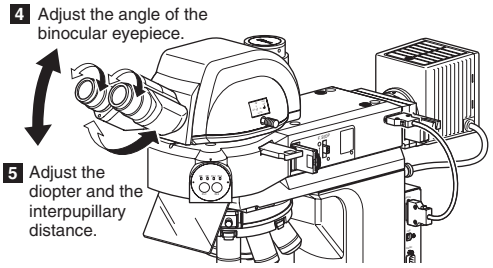


4 Adjust the angle of the binocular eyepiece. (for the LV-TT2)

(See Page 48.)

5 Adjust the diopter and the interpupillary distance.

(See Page 49.)



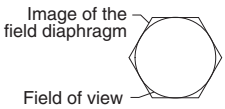
6 Set the desired magnification and observe the specimen.

1 Press the OBJ. switch on the operation panel and locate the objective of desired magnification into the optical path. (See Page 43.)

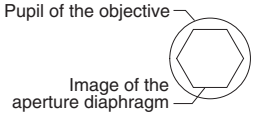
2 Turn the coarse/fine focus knobs to bring the specimen into focus. (See Page 46.)

3 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

4 Use the field diaphragm ring so that the field diaphragm image circumscribes the field of view. (See Page 54.)

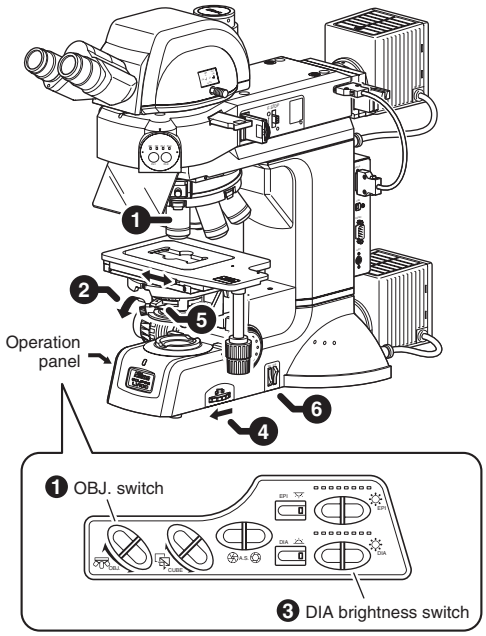


5 Stop down the condenser aperture diaphragm with the condenser aperture diaphragm ring to about 70% to 80% of the numerical aperture of the objective. (See Page 54.)



6 Adjust the brightness with ND filters. (See Page 44.)

6 Change the magnification to observe the specimen.



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

1 Attach the accessories required for the polarization microscopy under the dia illumination.

The following accessories must be attached to perform the simplified/sensitive color polarization microscopy under the dia illumination.

- Diascopic slider (See Page 94.)
- Analyzer slider (See Page 83.)
- Lambda plate holder (for the sensitive color microscopy) (See Page 80.)

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

(See Pages 26, to 27.)

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

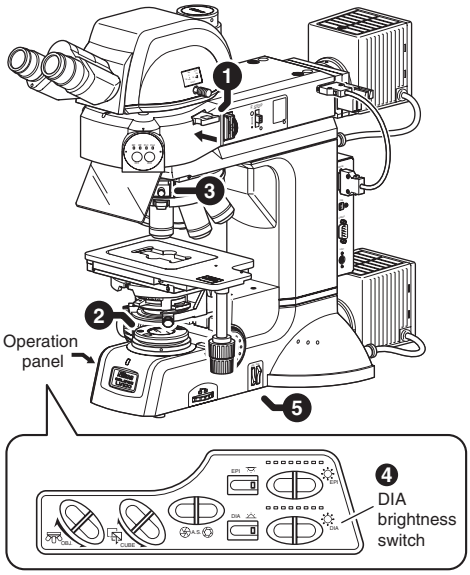
1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 60.)

2 Locate the polarizer for the diascopic illumination and make a crossed Nicols position. (See Pages 58 and 59.)

3 To perform the sensitive color polarization microscopy, push in the lambda plate slider to locate the lambda plate into the optical path. (See Page 63.)

4 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

5 Adjust the brightness with the ND filter. (See Page 44.)



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

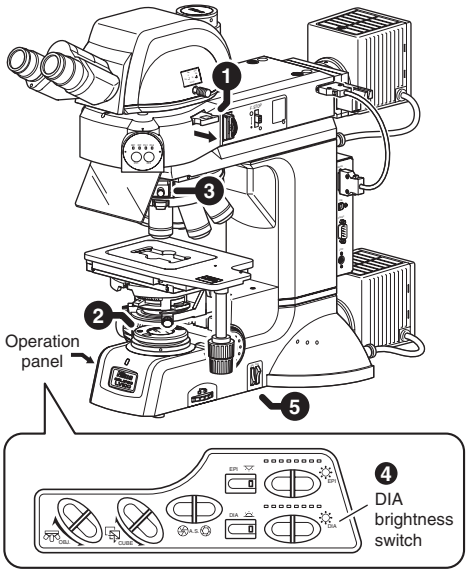
1 Pull out the analyzer slider and move the analyzer away from the optical path. (See Page 60.)

2 Move the diascopic polarizer away from the optical path. (See Pages 58 and 59.)

3 Pull out the lambda plate slider and move the lambda plate away from the optical path. (See Page 63.)

4 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

5 Adjust the brightness with ND filters. (See Page 44.)



9 Dark-field Microscopy under the Dia Illumination

1 **Attach the accessories required for the dark-field microscopy under the dia illumination.**

The following accessories must be attached to perform the simplified/sensitive color dark-field microscopy under the dia illumination.

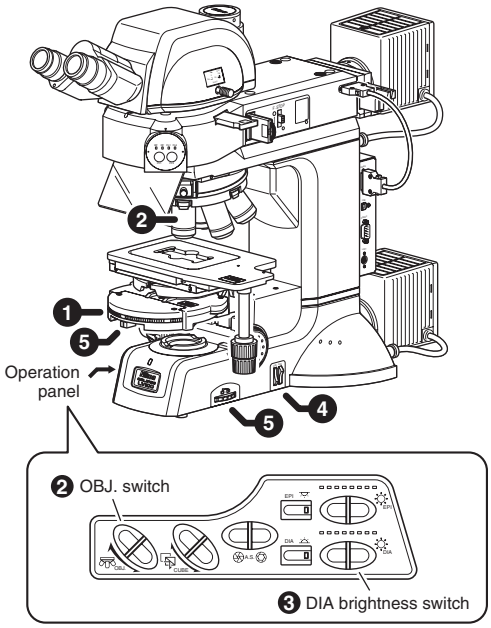
- Universal condenser (dry) and dark-field annular diaphragm (See Page 78 and the LV-CUD instruction manual.), or dark-field condenser (See Page 78.)

2 **Focus on the specimen with the bright-field microscopy under the diascopic illumination.** (See Pages 26 to 27.)

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

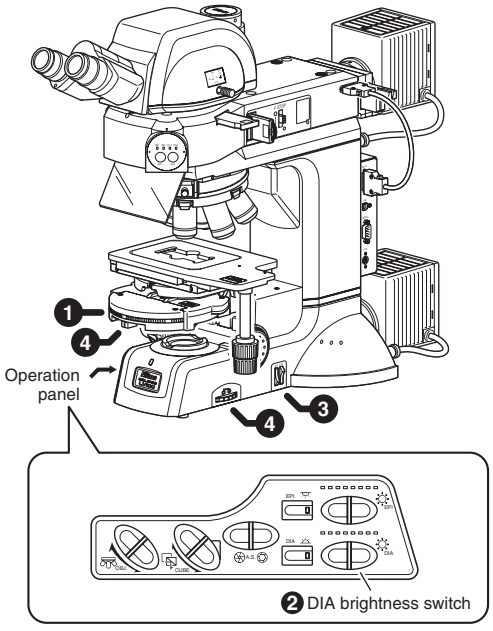
1. Rotate the condenser turret of the universal condenser to the "DF" position. (See Page 55.)
2. Press the OBJ. switch on the operation panel and locate the desired objective into the optical path. (See Page 43.)

   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. Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)
4. Adjust the brightness with ND filters. (See Page 44.)
5. Fully open the field diaphragm and the aperture diaphragm. (See Page 54.)



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

1. Rotate the condenser turret of the universal condenser to the "O" position. (See Page 55.)
2. Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)
3. Adjust the brightness with ND filters. (See Page 44.)
4. Adjust the field diaphragm and the aperture diaphragm. (See Page 54.)



10 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 dia illumination.

The following accessories must be attached to perform the phase contrast microscopy under the dia illumination.

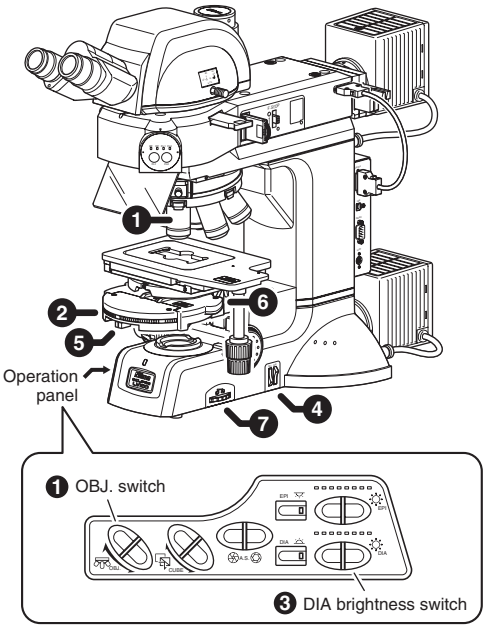
- Universal condenser (dry) (See Page 78 and the LV-CUD instruction manual.)
- Ph objective (See Page 93.)
- Ph annular diaphragm (attached inside the universal condenser) (See the LV-CUD instruction manual.)
  Attach the Ph annular diaphragm corresponding to the objective's Ph code into the universal condenser. For details, see the LV-CUD instruction manual.

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

(See Pages 26 to 27.)

* If the specimen is transparent, it may be difficult for the bright-field microscopy to focus on the specimen. To observe a transparent specimen, switch the microscopy to the phase contrast microscopy according to the following procedure and then focus on the specimen.

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



1 Press the OBJ. switch on the operation panel and locate the Ph objective into the optical path. (See Page 43.)

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 55.)

3 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

4 Adjust the brightness with ND filters. (See Page 44.)

5 Fully open the field diaphragm of the condenser. (See Page 54.)

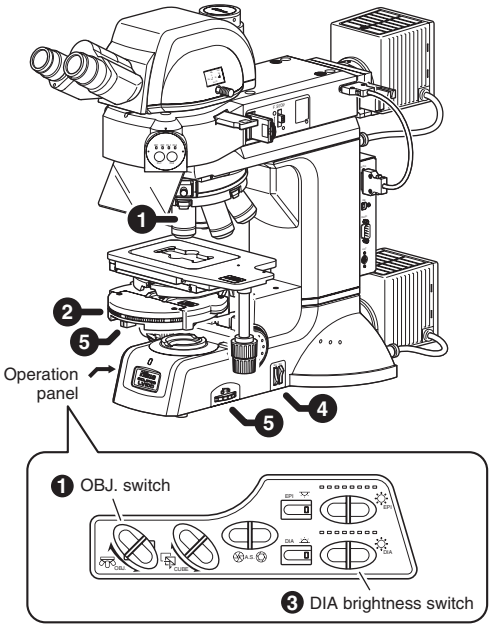
6 Center the Ph annular diaphragm.

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 54.)

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

1. Press the OBJ. switch on the operation panel and locate the objective of a desired magnification into the optical path. (See Page 43.)
2. Rotate the condenser turret of the universal condenser to the “O” position. (See Page 55.)
3. Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)
4. Adjust the brightness with ND filters. (See Page 44.)
5. Adjust the field diaphragm and the aperture diaphragm. (See Page 54.)



11 Differential Interference Contrast Microscopy under the Dia Illumination

The Senarmont method is used for the DIC microscopy under the dia illumination.

1 Attach the accessories required for the DIC microscopy under the dia illumination.

The following accessories must be attached to perform the DIC microscopy under the dia illumination.

- Universal condenser (dry) (See Page 78 and the LV-CUD instruction manual.)
- Rotatable polarizer for the diascopic illumination (See Page 94.)
- Analyzer (See Page 83.)
- DIC objective for biologic microscopes (See Page 93.)
- Condenser DIC prism (attached inside the universal condenser) (See Page 66 and the LV-CUD instruction manual.)
- Objective DIC prism (attached to the nosepiece) (See Page 81.)
- Lambda plate holder (for the sensitive color microscopy) (See Page 80.)

* Set up the microscope according to the "LVSetup" and set information of objectives correctly.

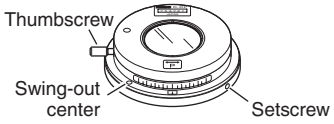
2 Focus on the specimen with the bright-field microscopy under the diascopic illumination.

(See Pages 26 to 27.)

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

1 Push in the analyzer slider to locate the analyzer into the optical path. (See Page 60.)

2 Attach the rotatable polarizer for the diascopic illumination and rotate the upper part of the polarizer to make a crossed Nicols position. (See Page 59.)



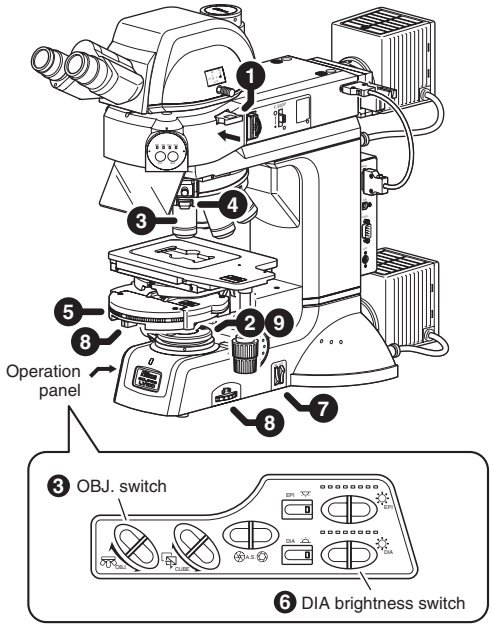
3 Press the OBJ. switch on the operation panel and locate the objective for the DIC microscopy into the optical path. (See Page 43.)

4 Attach the objective DIC prism slider to 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 55.)

6 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

7 Adjust the brightness with ND filters. (See Page 44.)



8 Adjust the field diaphragm and the aperture diaphragm.
- Generally, decrease the size of the aperture diaphragm to approximately 70 to 80% of the numerical aperture of the objective. (See Page 54.)
- Decrease the size of the field diaphragm so that it inscribes or circumscribes the viewfield. (See Page 54.)

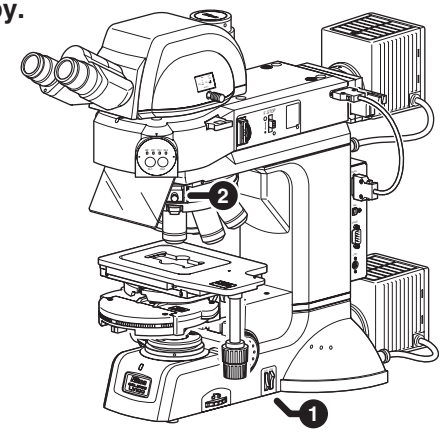
9 Adjust the orientation of the polarizer by rotating the rotatable polarizer for the diascopic illumination and adjust the contrast of DIC contrast images. (See Page 59.)
- The background of the field of view can be adjusted to a gray sensitive color. This adjustment improves the contrast of the image.
- 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 44.)

2 Push in the lambda plate slider to locate the lambda plate into the optical path. (See Page 63.)

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 60.)

2 Swing out the upper part of the rotatable polarizer for the diascopic illumination to move the polarizer away from the optical path. (See Page 59.)

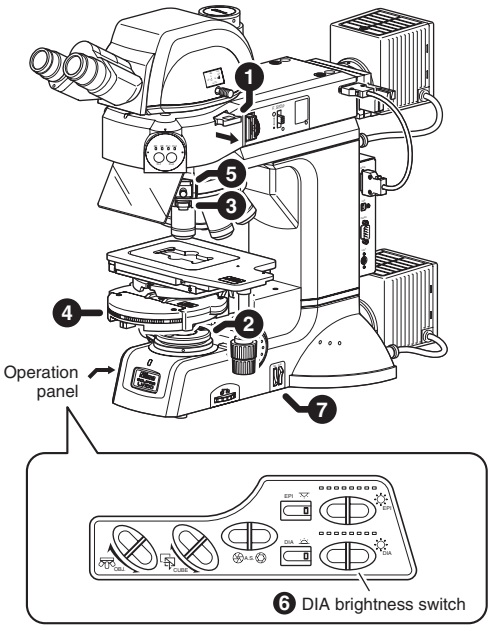
3 Pull out the DIC slider to move the objective DIC prism away from the optical path. (See Page 66.)

4 Set the condenser turret to the “O” position to move the condenser DIC prism away from the optical path. (See Page 55.)

5 Pull out the lambda plate slider and move the lambda plate away from the optical path. (See Page 63.)

6 Operate the DIA brightness switch on the operation panel to adjust the brightness of the diascopic illumination. (See Page 42.)

7 Adjust the brightness with the ND filter. (See Page 44.)



III Operation of Each Part

CAUTION

- Before using the microscope, please set up the entire system of the microscope with a PC using “LVSetup” contained in “LV Series Support Tools.”
- For details about operations of the “LVSetup,” see “LV Series Support Tools software manual.”
- When the digital camera for microscopes is used, motorized units of this product can be operated using the software for the digital camera “NIS-Elements.” For details, see the instruction manual for the “NIS-Elements.” The items that can be controlled using the “NIS-Elements” are marked with NIS-Elements compatible.

1 Power On/Off

CAUTION

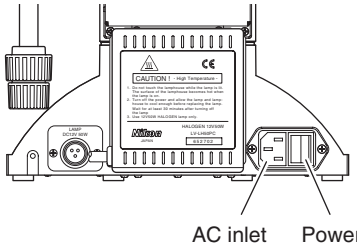
When an external power supply and/or an external light source is connected to the product, perform the following: Turn on the external device. Check that the external device starts normally. Turn on the power of the product.

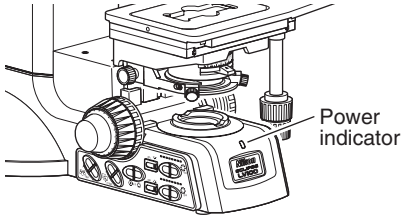
▶ Power supply of the microscope main body

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

- **Initialization of the microscope**

When the product is turn on, a long beep sounds, the power indicator blinks, and the initialization of the product starts. In the initialization, the product communicates with each electrical device. Each device is set to the predetermined initial conditions. When the initialization ends, a short beep sounds. The power indicator lights up to show the normal condition of the product. (When the lamp is off, the indicator color is orange. When the lamp is on, the indicator color is green.)





It takes about 15 to 20 seconds to initialize the microscope. The time for the initialization varies depending on the settings of the setup.

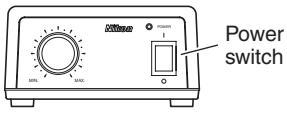
▶ Microscopy method setting at the initial condition

When the microscopy method at the initial condition has been set with LVSetup, the microscope starts with the predetermined microscopy method settings when the power of the product is turned on. When the microscopy method at the initial condition has been disabled with “LVSetup,” the product starts with the same microscopy method settings used at the last time.

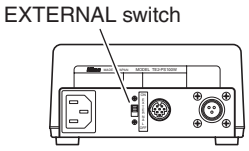
Power supply of the external power supply

When the lamp house is connected to the external power supply (TE2-PS100W), please turn on the power as follows.

1. Check that the lamp house has been properly connected to the external power supply. (See Page 88.)
2. Verify that the EXTERNAL switch on the back of the power supply has been set to the ON side.
3. Turn the power switch on the front of the external power source to the " I " side to turn on the power source.
   Be sure to turn on the power supply first, and then turn on the product.
4. Turn on the product.



TE2-PS100W front

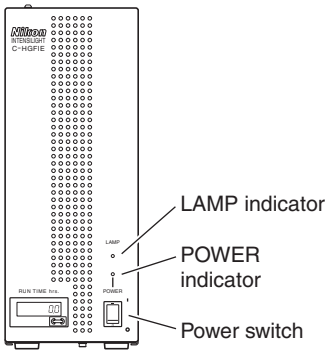


TE2-PS100W rear

Power supply of the external light source

When the external light source (Intensilight C-HGFIE or EXFO X-Cite 120 PC) is used, follow the procedure below to turn on the power.

1. Verify that the product has been properly connected to the external light source. (See Pages 89 and 90.)
2. Turn the power switch on the front of the light source to the " I " side to turn on the light source.
   Be sure to turn on the light source first. And then turn on the product.
   - **Intensilight C-HGFIE:** When the product is turned on, the POWER indicator lights up and the LAMP indicator blinks. When the product starts normally, the LAMP indicator lights up.
   - **EXFO X-Cite 120 PC:** When the operation is turned on, the back light of the LCD blinks. When the operation starts normally, the back light of the LCD lights up.
     The external light source cannot receive any communication command until starting up normally. Therefore, if the product is turned on during the initialization of the external light source, the external light source will not be detected by the product. Be sure to wait until the external light source starts up.
3. Turn on the product.



Intensilight C-HGFIE front view

- *It will take a few minutes for the external light source to become the ready condition. The product must be turned on after making sure that the external light source starts normally.*
- *To use the external light source, carefully read the instruction manual and make sure to follow the instructions.*

2 Setting Up the Microscope

When you use the product for the first time and when an objective or a device of the product is changed, you must connect a PC to the product and perform the setup work with the designated software for various settings.

CAUTION If you don't perform the setup work, the product does not work correctly. Be sure to setup the product as follows.

▶ Setup procedure

To perform the setup work, operate a PC and run the software, the "LVSetup" option in "LV Series Support Tools," provided with this product.

For details about operations and setup works of "LVSetup," see "LV Series Support Tools software manual."

3 Selecting the Microscopy Method

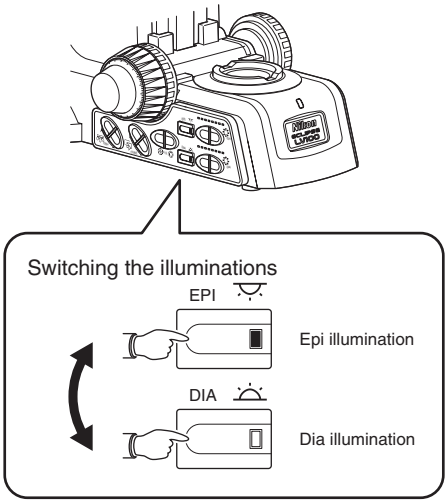
▶ Switching between the epi illumination and the dia illumination

To switch between the epi illumination and the dia illumination, operate the EPI switch and the DIA switch of the operation panel.

Use the EPI switch to turn on or off the epi illumination. Use the DIA switch to turn on or off the dia illumination. When the illumination is turned on, the power indicator is lit (or blinks).

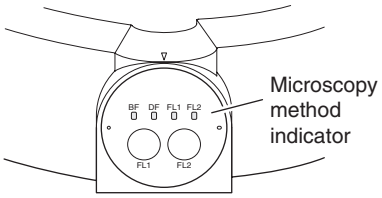
When the standard halogen lamp is used, only the lamp latest turned on lights up. Press the switch of the lighted lamp again to turn off the lamp.

* For details about the operation of the illumination, see “4. Illumination.”

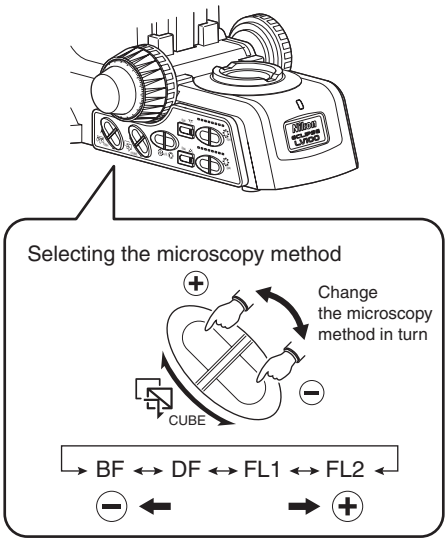


▶ Switching the microscopies when the epi illumination is used

To change the microscopy method, operate the CUBE switch on the operation panel. When the CUBE switch is pressed, the filter cube turret inside the LV-UEPI2A rotates and the microscopy method is changed. The current microscopy method is displayed with the microscopy method indicator on the front of the LV-UEPI2A.



* To use the diascopic illumination, set the epi illuminator to "DF" (dark-field). (excluding when the episcopic illumination and the diascopic illumination are turned on simultaneously)



Details on the microscopy methods under the episcopic illumination

The following microscopy methods can be performed with this microscope.

Microscopy Method	LV-UEPI2A 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 of the LV-UEPI2A.
Dark-field microscopy under the epi illumination	DF	BD objective	The UV filter is located in the optical path of the LV-UEPI2A. And the aperture diaphragm and the field diaphragm are fully opened. (The position of the open/close lever does not change.)
DIC microscopy under the epi illumination (Senarmont method)	BF	Polarizer slider, analyzer slider, objective DIC prism, LU objective (recommended), and lambda plate slider	Attach the analyzer and polarizer 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 due to the Senarmont method. Attach the lambda plate to get high color contrast images in the microscopy.
DIC microscopy under the epi illumination (prism slide method)	BF	Polarizer slider, analyzer slider, universal nosepiece (LV-NU5A/NU5AC), DIC prism, LU objective (recommended), and lambda plate slider	Set the bright-field microscopy condition. And then, place the polarizer and the analyzer into the optical path to make the crossed Nicols position. And insert the DIC prism to perform the DIC microscopy. The contrast of DIC contrast images can be adjusted by adjusting the position of the DIC prism due to the prism slide method.Z Attach the lambda plate to get high color contrast images in the microscopy.
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. The PA block is equipped with the polarizer and the analyzer at the crossed Nicols position.
	FL1	PA block	
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 under the epi illumination condition to perform the sensitive color polarization microscopy. The PA block cannot be used for the sensitive color polarization microscopy.
Epi-fl microscopy	FL1 or FL2	Filter cube for the epi-fl microscopy, external light source, and excitation light balancer (option)	The filter cube is placed into the optical path. And, the UV filter is removed from the optical path. When any filter cube is not attached, no image can be observed.

Details on the microscopy methods under the diascopic illumination

The following microscopy methods can be performed.

Illumination/Microscopy Method	LV-UEPI2 Turret Position	Accessories	Remarks
Bright-field microscopy under the diascopic illumination	DF *	Condenser lens	Set the bright-field microscopy under the episcopic illumination condition. And then, switch to the diascopic illumination to make the bright-field microscopy under the diascopic illumination condition.
Simplified polarization microscopy under the diascopic illumination	DF *	Polarizer for the diascopic illumination and analyzer	Set the bright-field microscopy under the diascopic illumination condition. And then, attach the polarizer for the diascopic illumination and the analyzer to make the crossed Nicols position.
Sensitive color polarization microscopy under the diascopic illumination	DF *	Polarizer for the diascopic illumination, analyzer slider, and lambda plate slider	Set the simplified polarization microscopy under the diascopic illumination condition. And then, attach the lambda plate to make the sensitive color polarization microscopy under the diascopic illumination condition.
Dark-field microscopy under the diascopic illumination	DF *	Universal condenser and dark-field annular diaphragm	Attach the universal condenser and set the bright-field microscopy under the diascopic illumination condition. And then, place the dark-field annular diaphragm into the optical path.
Phase contrast microscopy under the diascopic illumination	DF *	Universal Condenser, Ph annular diaphramg, and Ph objective	Attach the universal condenser and set the bright-field microscopy under the diascopic illumination condition. And then, place the Ph annular diaphragm and the Ph objective into the optical path to center the Ph annular diaphragm.
DIC microscopy under the diascopic illumination	DF *	Universal Condenser, rotatable polarizer for the diascopic illumination, analyzer slider, condenser DIC prism, objective DIC prism, DIC objective for the biologic microscope, and lambda plate slider	Attach the universal condenser and set the bright-field microscopy under the diascopic illumination condition. And then, place the rotatable polarizer for the diascopic illumination, the analyzer, the condenser DIC prism, the objective DIC prism, the DIC objective for biologic microscopes, and the lambda plate into the optical path to make the DIC microscopy under the diascopic illumination condition. The contrast of DIC images can be adjusted by rotating the rotatable polarizer for the diascopic illumination.

* The diascopic illumination is lit.

Interlock control linked to the microscopy method

CAUTION

To perform the interlock function properly, you must register the microscope configuration and the objective information correctly.

The interlock control is a function to change the electrically-driven devices of the microscope to the pre-determined condition referring to the microscopy method and the objective when the microscopy method or the objective is changed.

When the interlock control is enabled with “LVSetup,” the illumination on/off status and the opening of the aperture diaphragm for the episcopic illumination are changed in connection with the objective and the microscopy method. The light quantity and the aperture diaphragm opening changes differently depending on the interlock control setting, “Default mode” or “Optional mode,” as described below.

- **Default mode**
  The light quantity is set to the predetermined value. The aperture diaphragm for the epi-illumination is automatically adjusted to 75% of the numerical aperture of the objective.
- **Optional mode**
  The light quantity and the aperture diaphragm for the epi-illumination are set to form a diameter and a value that has been set with “LVSetup.”

Use “LVSetup” of “LV Series Support Tools” to set the interlock control. For detail information, see “LV Series Support Tools software manual.”

Modification from the registered condition (User offset)

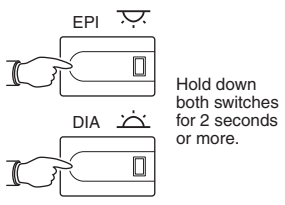
When the light quantity or the aperture diaphragm for the episcopic illumination is modified from the registered condition, the EPI switch or the DIA switch indicator starts blinking, indicating that it is not in the registered condition. This modification is referred to as “User offset” hereafter.
The condition of “User offset” is registered in the microscope memory: therefore, the post-modified condition is restored when the registered combination of the microscopy and the objective is selected, even after another microscopy or objective is selected or the power is turned off.

CAUTION

Even if the interlock control mode is changed, the user offset settings are kept. Therefore, if the interlock control mode is changed with “LVSetup” under conditions of user offset, the microscope system condition may differ from user intension. To change the interlock control mode, perform the following if necessary and reset the user offset settings beforehand. For information to change the interlock control mode, refer to the “LV Series Support Tools software manual.”

To clear “User offset”

To clear the “User offset” condition and return to the registered conditions of the illumination and the aperture diaphragm for the episcopic illumination, hold down the EPI switch and the DIA switch for two seconds or longer. When the registered conditions are restored, a short beep sounds and the switch indicator turns on.



4 Illumination

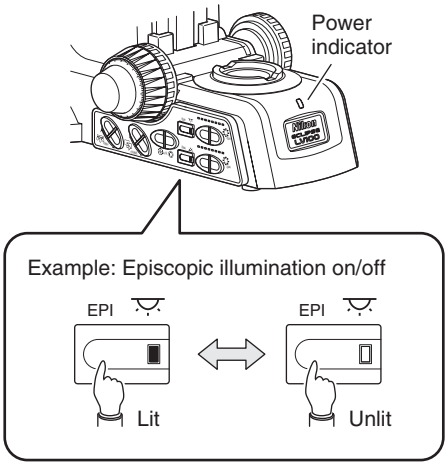
Illumination on/off

NIS-Elements compatible

Use the EPI switch and the DIA switch on the operation panel to turn on and off the illumination. The EPI switch and the DIA switch turn on/off the episcopic illumination and diascopic illumination respectively. The switch indicator lights up (or blinks) when the illumination is on.

For the standard halogen lamp, only one lamp which button is pressed later lights up. Press the same switch again to turn off the lamp.

Independent switches are provided to control the illumination on/off and brightness. Thus, the lamp can be turned on or off while maintaining the set brightness setting, for example.



- **Operations when the episcopic illumination and the diascopic illumination are both lit**
  When an external power source device is used to turn on the episcopic illumination and the diascopic illumination simultaneously, the lamps of the episcopic illumination and the diascopic illumination can be independently controlled by using the EPI switch and the DIA switch.

- **Operating an external light source**
  When an external light source device (Intensilight C-HGFIE or EXFO X-Cite 120 PC) is used for the episcopic illumination, the EPI switch is able to open/close the shutter of the light source device. For a light source with a mercury lamp or such, its lamp cannot be frequently turned on or off. Therefore, when you wish to turn on or off the lamp on the light source, operate the power switch on the light source.

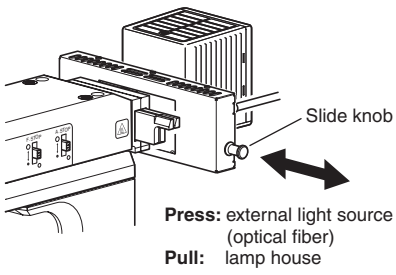
Power indicator

The power indicator light changes its color depending on the lighting illuminator(s). The indicator lights up in green when either the episcopic illumination or the diascopic illumination is lit, and it lights up in orange when they are unlit.

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 exteranl light source into the optical path. Pull the knob and slide the adapter rightwards to place the halogen lamp into the optical path.



Antiglare function

The antiglare function is automatically activated whenever the microscopy method is changed (the filter cube turret rotates) or the objective is switched (the nosepiece rotates). When such operations are performed from the operation panel, the lamp turns off (or the shutter of the external light source closes, when used), and the microscopy or the objective switches before the lamp turns on (or the shutter of the external light source opens, when used).

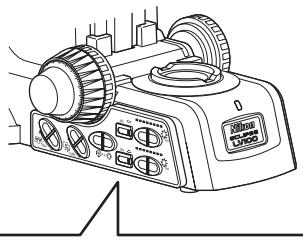
Brightness control

NIS-Elements compatible

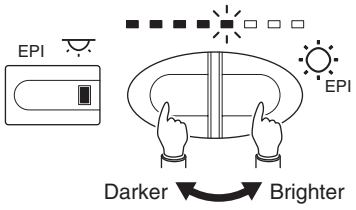
To control the brightness, use the EPI or DIA brightness switch. Independent switches are available each for the episcopic illumination and diascopic illumination to control the brightness, and the current brightness is indicated with the eight-step level indicator respectively.

- **Brightness control for the halogen lamp**
  The brightness can be controlled with the brightness switch for the standard halogen lamp. (The indicator display shows the brightness in eight steps.)

- **Brightness control for an external light source**
  When an external light source (Intensilight C-HGFIE or EXFO X-Cite 120 PC) is connected with this product, the brightness switch on this product can be used to control the brightness of the external light source (iris control function) in five levels.



Example: Brightness control for the episcopic illumination



Interlock control linked to the illumination

When the interlock control is enabled with “LVSetup,” the lamp pn/off state and the light quantity are changed to the registered conditions in conjunction with the microscopy method and the objective.

When the interlock control is set to the “Default mode,” the light quantity is adjusted to the fixed value that has been set in the system. When the interlock control is set to the “Optional mode,” the light quantity is adjusted to an arbitrary value that has been set with “LVSetup.”

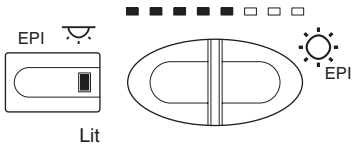
The interlock control is one of the functions of “LVSetup.” For detail information, see “LV Series Support Tools software manual.”

- **Modification from the registered condition**
  When the light quantity is modified from the registered condition, the EPI switch or the DIA switch indicator starts blinking, indicating that it is not in the registered condition.

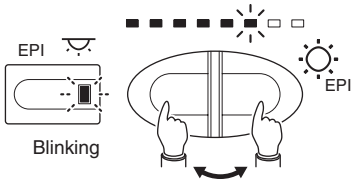
  This adjustment amount, “User offset,” is stored in the microscope memory: therefore, the post-adjustment state is restored when the registered combination of the microscopy and the objective is selected, even after another microscopy or objective is selected or the power is cycled.

- **To return to the registered condition**
  To bring the light quantity and the epi-illumination aperture diaphragm to the registered conditions, hold down the EPI switch and the DIA switch for two seconds or longer. When the registered conditions are restored, a short beep sounds and the switch indicator turns on.

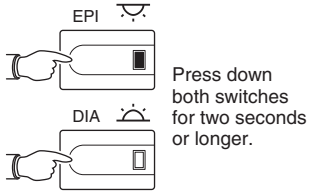
(1) Registered condition



(2) Brightness adjustment from the registered condition



(3) Return to the registered condition (1).



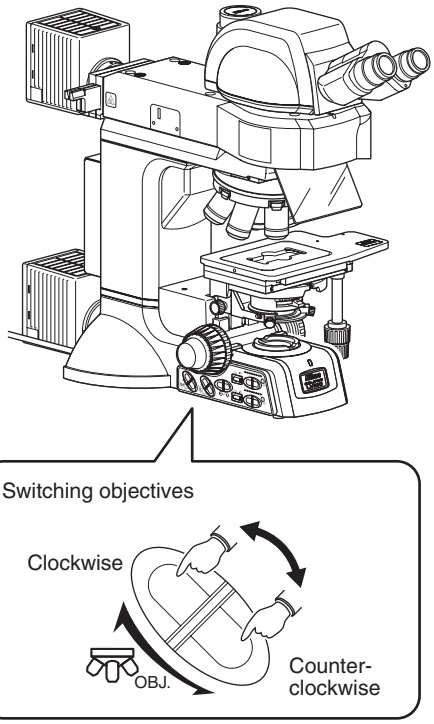
5 Objective

▶ Rotating the nosepiece

NIS-Elements compatible

To change the objective by rotating the electrical nosepiece, press the OBJ. switch on the operation panel.

The OBJ. switch is divided into two parts. Press the upper switch to rotate the electrical nosepiece in the clockwise direction (when seen from above), and press the lower button to rotate the electrical nosepiece in the counterclockwise direction (when seen from above).



▶ Interlock control linked to the objective selection

When the interlock control is enabled with "LVSetup," the illumination on/off status and the opening of the aperture diaphragm for the episcopic illumination are changed in connection with the objective switching. The light quantity and the aperture diaphragm opening changes differently depending on the interlock control setting, "Default mode" or "Optional mode," as described below.

- **Default mode**
  The light quantity is set to the pre-determined value. The aperture diaphragm for the epi-illumination is automatically adjusted to 75% of the numerical aperture of the objective.
- **Optional mode**
  The light quantity and the aperture diaphragm for the epi-illumination are set to form a diameter and a value that has been set with "LVSetup."

Use "LVSetup" of "LV Series Support Tools" to set the interlock control. For detail information, see "LV Series Setup Tools software manual."

▶ Setting restrictions for objective switching

A low-magnification objective has a long depth of focus, occasionally resulting in the specimen and the objective being close to each other. If the lens is switched to a high-magnification objective in such a condition, the tip of the lens may touch the specimen.

To avoid such interference, switching the objective can be prohibited when the following conditions are met.

- The preceding objective has a magnification of 5x or less.
- The objective's working distance (W.D.) after switching is less than 1 mm.

Use "LVSetup" of "LV Series Support Tools" for this setting. For detail information, see "LV Series Setup Tools software manual."

6 Filter

▶ Filter for the episcopic illumination

Two filter sliders are located near the rear side of the epi illuminator. Each slider can hold two filters. Push in or pull out the filter sliders to locate the desired filters.
See Page 83 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 diascopic illumination

Following two filters are mounted in the base unit of the microscope.
The switches for inserting and retracting the filters are provided on the right side of the microscope. Lower the switch to insert the filter in the optical path, and raise the switch to remove it from the optical path.

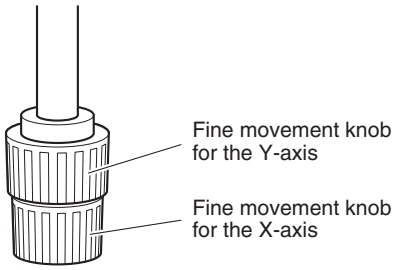
Filters	Usage
NCB11 (neutral color balancing filter)	For color balancing and color photomicrography
ND8 (ND filter)	For brightness control (transmittance: 12.5%)

7 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.

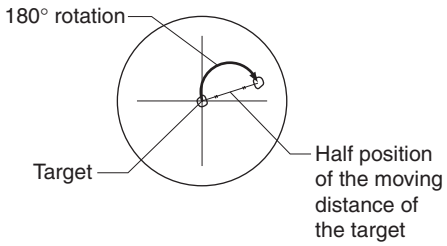
- **Rotating the stage**

For the circular graduated stage, loosen the clamp screw on the front of the stage to turn the stage by hand. For the 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 with the center of the field of view. Center the 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**.



8 Coarse Focus Knob and Fine Focus Knob

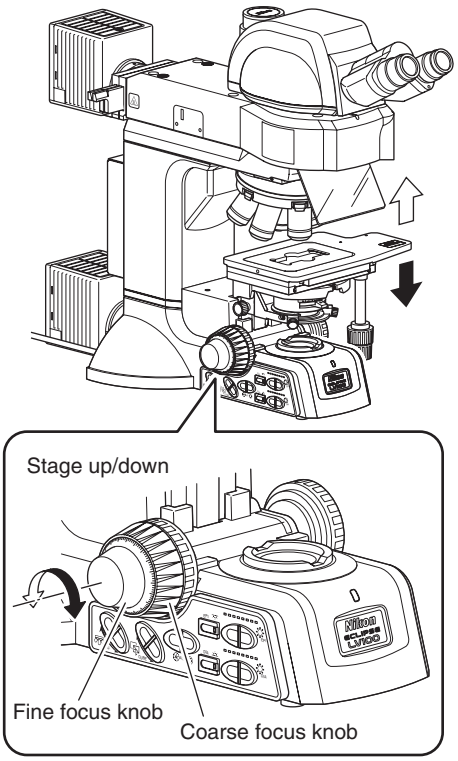
▶ Knob rotation and stage vertical movement

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.*

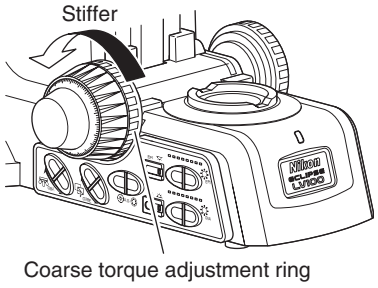


▶ Stiffness adjustment for the coarse focus knob

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

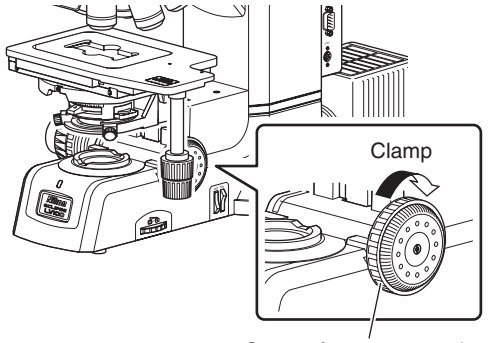
The coarse focus stopper restricts the movement of the coarse focus knob so that the stage cannot be raised higher than the position the operator specifies. When the coarse focus stopper ring is rotated in the direction of the arrow (labeled “CLAMP →”) on the microscope base, the stage cannot move higher than that position. (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.

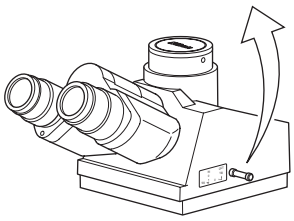
9 Eyepiece Tube

▶ Optical path selection

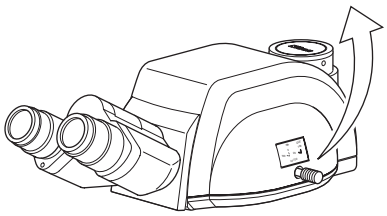
The distribution of light for the binocular part and the vertical tube can be selected with the optical path selector lever.

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

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



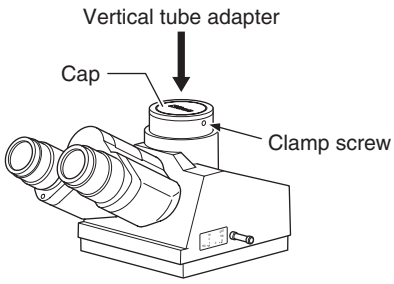
Eyepiece tube LV-TI3



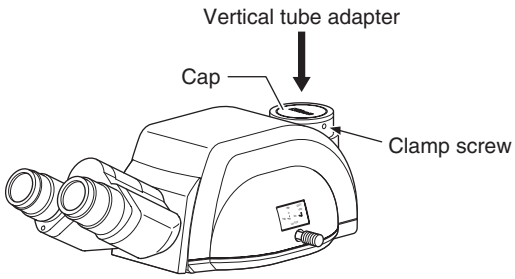
Eyepiece tube LV-TT2

▶ 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.



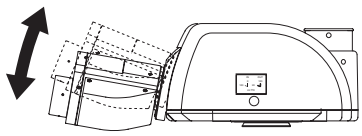
Eyepiece tube LV-TI3



Eyepiece tube LV-TT2

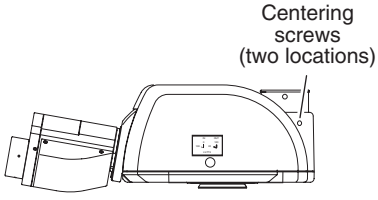
▶ Angle adjustment of the binocular part (only the LV-TT2)

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



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

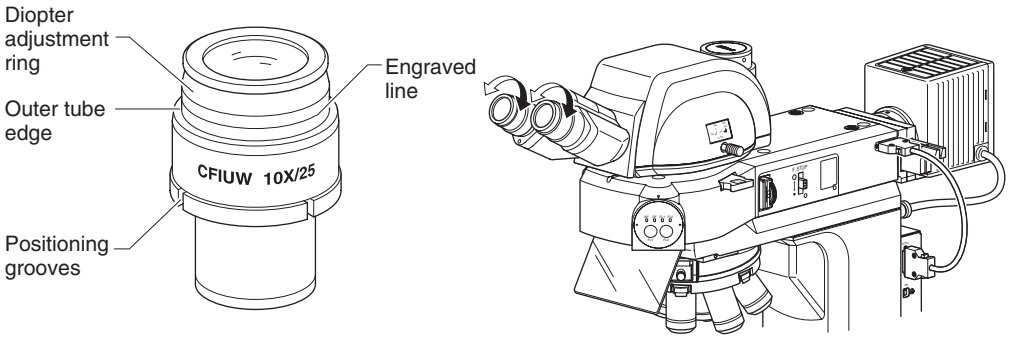
The binocular part and the vertical tube of the eyepiece tube are centered before the shipping, so usually they can be used without an adjustment.
But some cameras may have their CCD centers shifted from the center of the mount part. In such a case, you can adjust the vertical tube center by rotating two centering screws on the back of the vertical tube.



10 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 15 and 16 for the bright-field microscopy under the episcopic illumination (or Pages 26 and 27 for the bright-field microscopy under the diascopic 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.S
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.



Diopter adjustment standard position

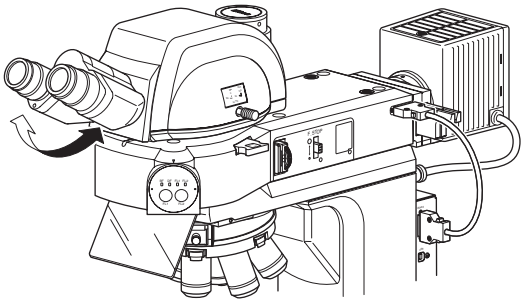
11 Interpupillary Distance Adjustment

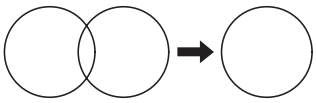
Before performing the interpupillary distance adjustment, follow the procedure described in Pages 15 and 16 for the bright-field microscopy under the episcopic illumination (or Pages 26 and 27 for the bright-field microscopy under the diascopic illumination), and focus on the specimen with the 10x objective.

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.

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

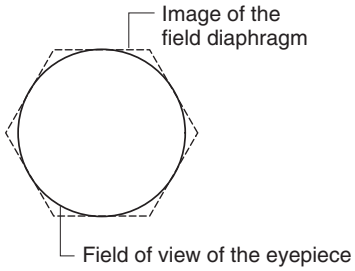
▶ Field diaphragm

The field diaphragm restricts the illumination light to the area on the specimen to be observed. The field diaphragm open/close lever 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.

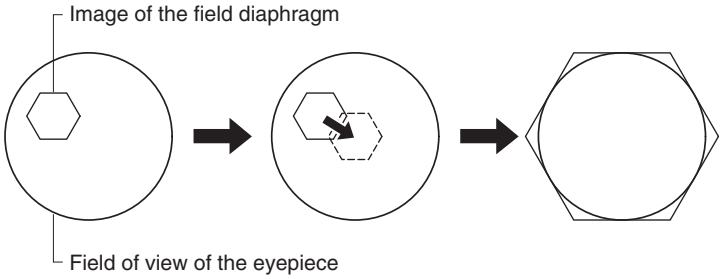
In case of photomicrography, the setting of the field diaphragm becomes very important. Generally, the field diaphragm should be set to an area slightly larger than the area to be exposed on film, that is, the photographed area.

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 15 and 16 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-UEPI2A 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

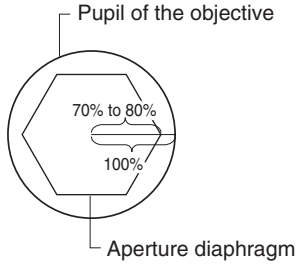
NIS-Elements compatible

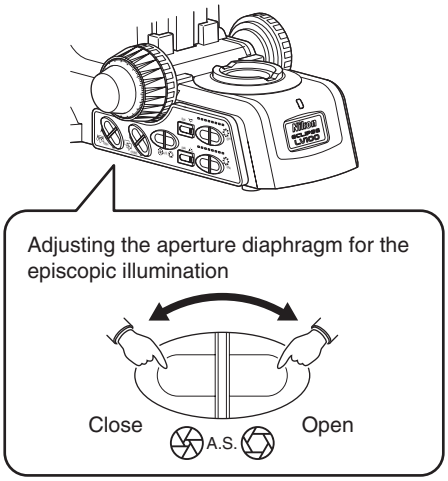
The aperture diaphragm controls the numerical aperture of the illumination system, closely related to the resolution of the optical image, contrast, and depth of focus. Generally, the aperture diaphragm should be adjusted to about 70 to 80% of the numerical aperture of the objective.

The aperture diaphragm of the LV-UEPI2A is electrically driven, thus the size of the aperture diaphragm can be controlled by the A.S. switch on the control panel.

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.

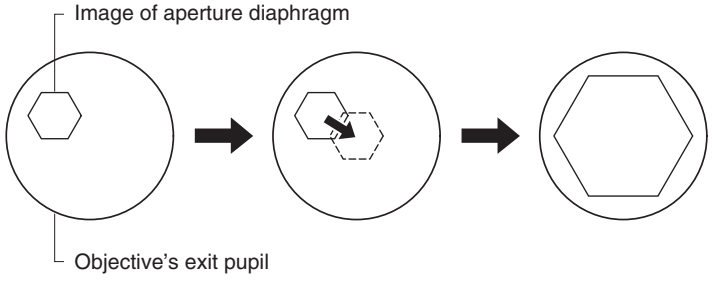
When the reflectance of the specimen is low, the diaphragm image may not be seen. In this case, change to a specimen of a near-polished surface.





Centering procedure for the aperture diaphragm

1. Follow the procedure described in Pages 15 and 16 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 with the A.S. switch on the operation panel.
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 A.S. switch and the centering screws so that the aperture diaphragm image inscribes the pupil of the objective.
6. When starting observation, adjust the A.S. switch so that the aperture diaphragm image is 70 to 80% of the numerical aperture of the objective. (Perform this adjustment for each objective.)
   When the interlock control of LVSetup is enabled, the aperture diaphragm can be automatically adjusted to the registered condition to match the objective and the microscopy selected.
   To bring the aperture diaphragm to the registered conditions, hold down the EPI switch and the DIA switch for two seconds or longer. A short beep sounds to notify that the aperture diaphragm and the light quantity are restored to the registered conditions.



- **Interlock control of the aperture diaphragm for the episcopic illumination**
  When the interlock control is enabled with “LVSetup,” the opening of the aperture diaphragm for the episcopic illumination is changed in connection with the microscopy switching and the objective switching.

  When the interlock control is set to the “Default mode,” the aperture diaphragm for the episcopic illumination is adjusted to 75% of the numerical aperture of the objective. When the interlock control of “LVSetup” is set to the “Optional mode,” the opening of the aperture diaphragm for the episcopic illumination can be set freely for each objective.

  The interlock control is one of the functions of “LVSetup.” For detail information, see “LV Series Support Tools software manual.”

Modification from the registered condition

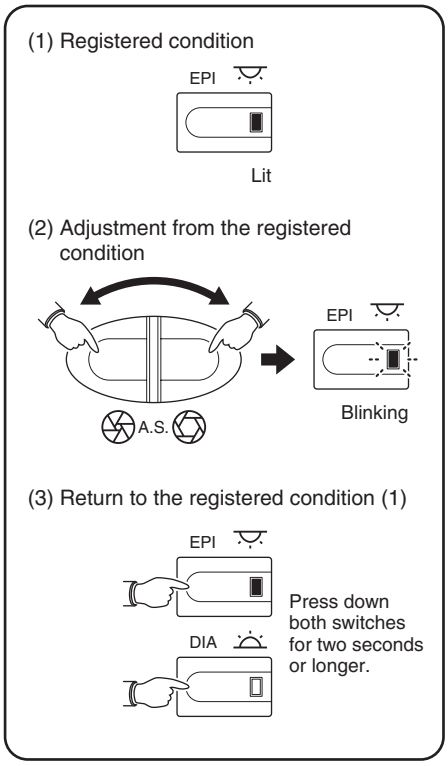
When the aperture diaphragm for the episcopic illumination is modified from the registered condition, the EPI switch indicator starts blinking.

This adjustment amount, “User offset,” is stored in the microscope memory: therefore, the post-adjustment state is restored when the registered combination of the microscopy and the objective is selected, even after another microscopy or objective is selected or the power is cycled.

To return to the registered condition

To bring the aperture diaphragm for the episcopic illumination to the registered conditions, hold down the EPI switch and the DIA switch for two seconds or longer.

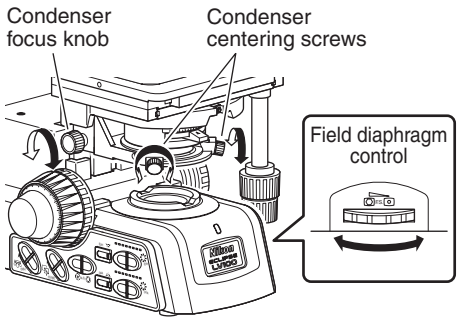
When the registered conditions are restored, a short beep sounds and the EPI switch indicator turns on.



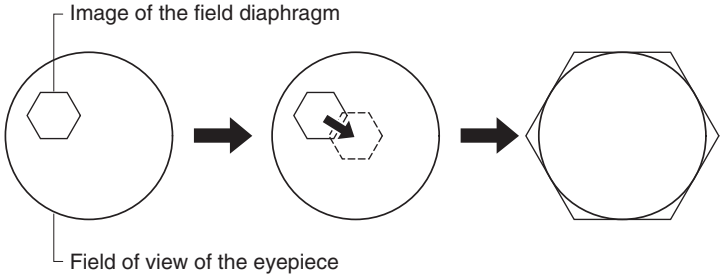
13 Adjustment for the Diascopic Illumination (Focusing and Centering the Condenser and Adjusting the Field Diaphragm and Aperture Diaphragm)

▶ Focusing and centering the condenser

When this microscope 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 26 and 27 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 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.)



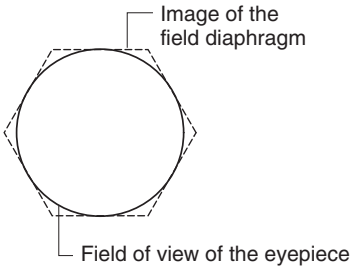
Field diaphragm

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 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.

In case of 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.



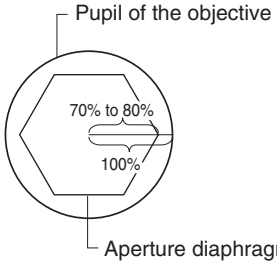
Aperture diaphragm

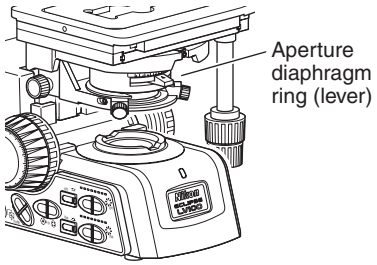
The aperture diaphragm controls the numerical aperture of the illumination system, closely related to the resolution of the optical image, contrast, and depth of focus.

Rotating the aperture diaphragm ring (lever) on the condenser for the diascopic 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.

The scales for the condenser are provided as numerical apertures. Check the value for adjustment.

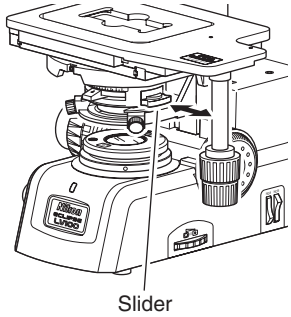
Perform the field diaphragm adjustment after completing focusing and centering the condenser lens.





Slide condenser

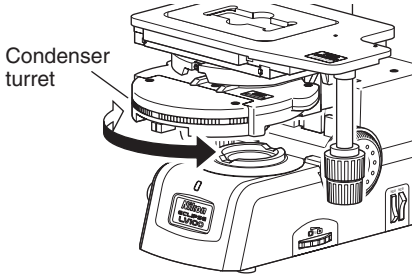
When the slide condenser is used, vignetting in the field is seen with the 2.5x objective: therefore, the slider should be kept inserted. When the 5x or higher objective is used, the slider should be pulled.



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 diascopic 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.



Label	Module	Application
0	Empty hole (no module)	Select this module for the bright-field microscopy under the diascopic 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 diascopic 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 diascopic illumination with the 2x to 4x objectives.
DF	Dark field annular diaphragm	Select this module to perform the dark-field microscopy under the diascopic illumination.
N1, N2, NR	Condenser DIC prism	Select one of the modules corresponding to the objective to perform the DIC microscopy under the diascopic 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 62.

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

14 Polarizer Slider (for the Episcopic Illumination)

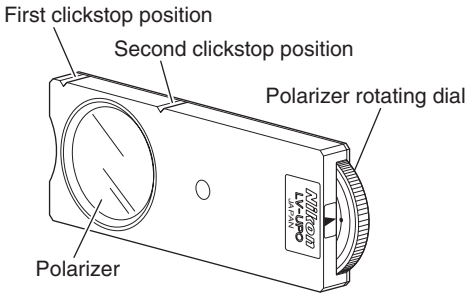
Polarizer sliders

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

Polarizer	Application	Remark
LV-PO polarizer	Polarization microscopy under the episcopic illumination (simplified/sensitive color) DIC microscopy under the episcopic illumination (prism slide method)	
LV-UPO polarizer	DIC microscopy under the episcopic illumination (Senarmont method)	Equipped with the 1/4 lambda plate
LV-UVPO UV polarizer	Epi-fl microscopy	

- **LV-PO polarizer**
  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.
  When the motorized universal quintuple nosepiece (LV-NU5A or LV-NU5AC) is attached, the prism slide method of the DIC microscopy under the episcopic illumination can be performed by using the polarizer with the analyzer slider and the DIC slider.
- **LV-UPO polarizer (equipped with the 1/4 lambda plate)**
  The LV-UPO is used to perform the Senarmont method of DIC microscopy when used with the analyzer and the DIC slider. The contrast of the DIC contrast image can be adjusted with the polarizer orientation.
- **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

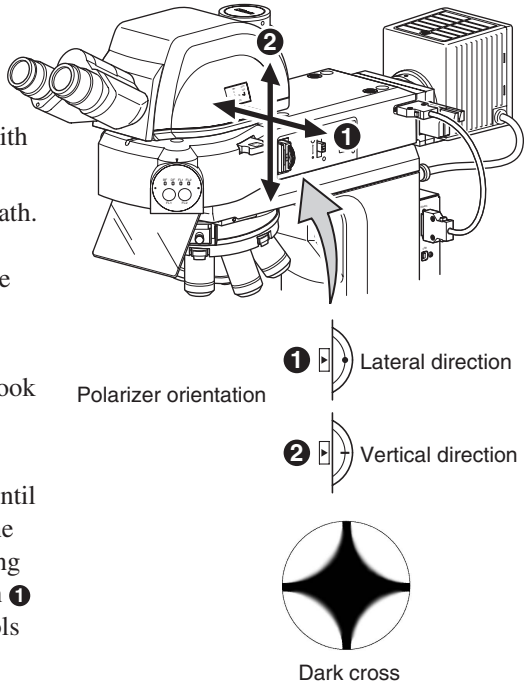


- **Attaching the polarizer:** Remove the vertically oriented cover at the right side of the illuminator. And then, insert the polarizer slider into the rear slot with its orientation indication facing toward the eyepieces. Insert the dummy slider or the lambda plate slider into the front slot. (See Page 83.)
- **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 tgÀêfollowing 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 ❶ on the illustration will bring about the crossed Nicols position as well.)

15 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)	Provided with the swing-out mechanism
D-DP rotatable polarizer for the diascopic illumination	DIC microscopy under the diascopic illumination	Equipped with the 1/4 lambda plate Provided with the swing-out mechanism

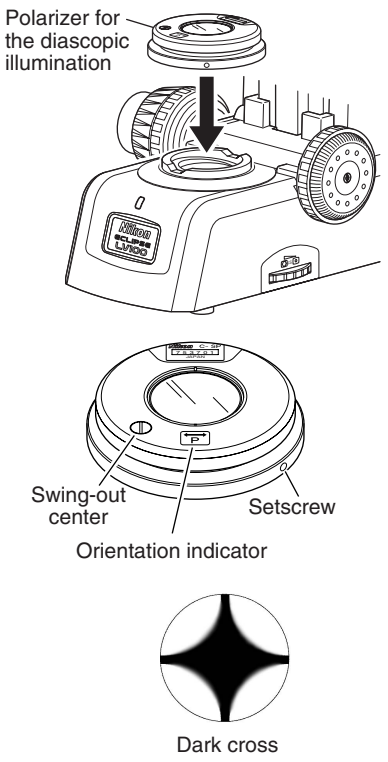
- **C-SP polarizer for the diascopic illumination**
  The simplified polarization microscopy under the diascopic illumination can be performed with the C-SP polarizer for the diascopic illumination and the analyzer slider. The sensitive color polarization microscopy under the diascopic illumination can be performed with the C-SP polarizer for the diascopic illumination, the analyzer slider, and the lambda plate slider for the diascopic illumination.
- **D-DP rotatable polarizer for the diascopic illumination (equipped with the 1/4 lambda plate)**
  When the D-DP rotatable polarizer for the diascopic illumination is attached, the DIC microscopy under the diascopic illumination can be performed with the universal condenser, the analyzer slider, the condenser DIC prism, the objective DIC prism and the lambda plate slider for the diascopic illumination. The contrast of the DIC contrast image can be adjusted with the polarizer orientation.

Attaching the C-SP polarizer for the diascopic illumination and adjusting the orientaion

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 diascopic 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 diascopic illumination by tightening the setscrew.

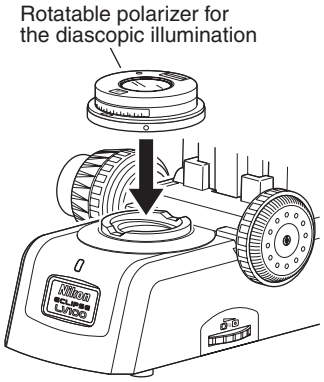


Attaching the D-DP polarizer for the diascopic illumination and adjusting the orientaion

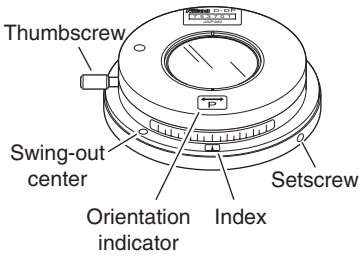
Place the rotatable polarizer for the diascopic illumination over the field lens at the microscope base with the polarizer index facing the front and secure it with the clamp screw.

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 palarizer 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 diascopic 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 diascopic illumination by loosening the setcrew. 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 diascopic 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 diascopic illumination with the hexagonal screwdriver.
9. Rotate the rotatable polarizer for the diascopic 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.

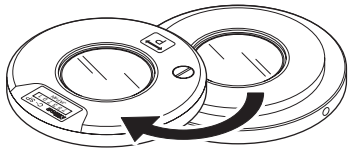


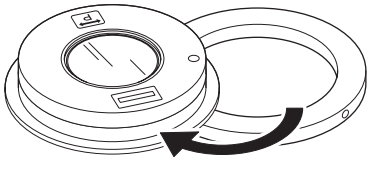

Dark cross

Swinging out the polarizer

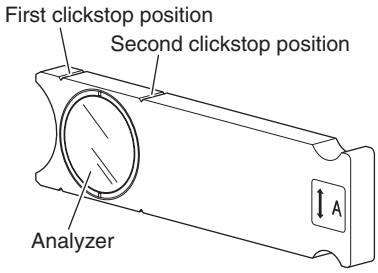
The polarizer for the diascopic illumination can be temporarily removed from the optical path by swinging out the upper part of the polarizer. When the polarizer is not needed for the microscopy, it can be removed easily with the mechanism.

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


Polarizer for the diascopic illumination


Rotatable polarizer for the diascopic illumination

16 Analyzer Slider



The polarization microscopy under the episcopic illumination can be performed when the analyzer slider is used with the polarizer slider for the episcopic illumination, and the polarization microscopy under the episcopic illumination can be performed when the analyzer slider is used with the polarizer for the diascopic 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 polarization microscopy under the episcopic illumination, and the sensitive color polarization microscopy under the diascopic illumination can be performed when the lambda plate is attached to the configuration for the polarization microscopy under the diascopic illumination.
The DIC microscopy under the episcopic illumination can be performed when the analyzer slider is used with the LV-UPO polarizer slider for the episcopic illumination equipped with the1/4 lambda plate and the objective DIC prism, and the sensitive color DIC microscopy under the episcopic illumination can be performed when the lambda plate slider is attached to the configuration of the DIC microscopy under the episcopic illumination.
The DIC microscopy under the diascopic illumination can be performed when the universal condenser, the analyzer slider, D-DP rotatable polarizer for the diascopic illumination equipped with the 1/4 lambda plate, the condenser DIC prism, and the objective DIC prism are attached to the microscope. Additionally, the sensitive color DIC microscopy under the diascopic illumination can be performed when the lambda plate slider is attached to the configuration for the DIC microscopy under the diascopic illumination.

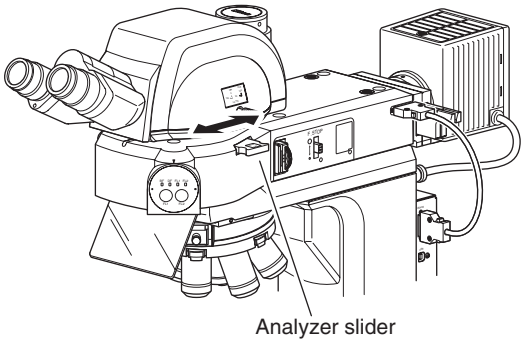
▶ Placing the analyzer into the optical path

- **Attaching the analyzer slider:** Remove the horizontally oriented cover on the right side of the illuminator. And then, insert the analyzer slider into the horizontal slot with its mark facing up. (See Page 83.)
- **Placing the element into the optical path:** 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.

  * See the arrow in the figure below for the analyzer orientation.

▶ Removing the analyzer from the optical path

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



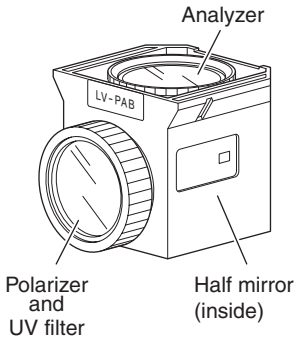
▶ Analyzer orientation

The orientation of the analyzer is the forward and backward of the microscope as shown in the right figure.

17 PA Block

When the microscopy under the episcopic illumination is performed, even if the polarizer slider and the analyzer slider are not used, crossed Nicols position can easily be obtained by placing LV-PAB PA block into the optical path.

* When the PA block is used, the simplified polarization microscopy under the episcopic illumination or the prism slide method of the DIC microscopy under the episcopic illumination can be performed. The sensitive color polarization microscopy or the Senarmont method of 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

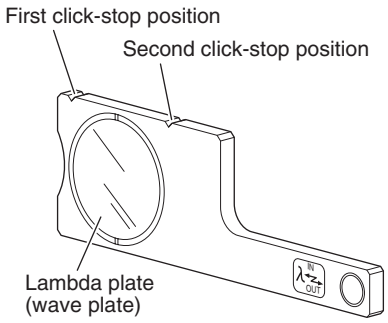
The PA block is installed in the FL1 position of the LV-UEPI2A filter cube turret. See Page 84 in “IV. Assembly” for the installation method.

▶ To use the PA block

To place the PA block into the optical path, press the CUBE switch on the operation panel and light up the turret position indicator “FL1.” (See Page 37.)

18 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 and the lambda plate is placed into the optical path in 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 and the lambda plate is placed into the optical path in 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 83.)

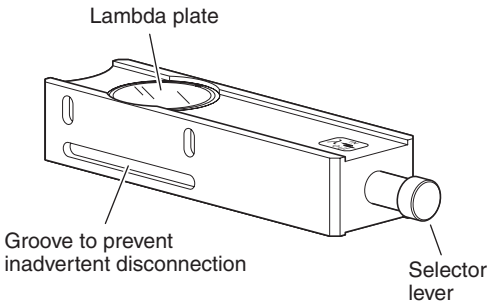
When the slider is pushed into the first click-stop position, the empty hole is placed into the optical path. And when the slider is pushed into the second click-stop position, the lambda plate is placed into the optical path.

▶ 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.

19 Lambda Plate Slider for the Diascopic Illumination

The sensitive color polarization microscopy under the diascopic illumination can be performed when the lambda plate slider is inserted into the slot on the nosepiece and the lambda plate is placed into the optical path in 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 slider is inserted into the slot on the nosepiece and the lambda plate is placed into the optical path in the configuration of the DIC microscopy under the diascopic illumination.

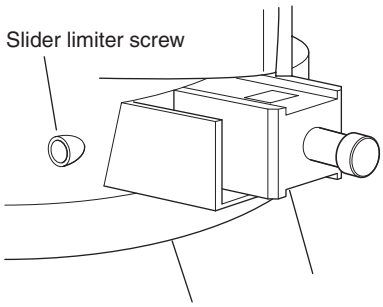


▶ Attaching/removing the lambda plate

Attach the lambda plate to the slot for the lambda plate slider of the LV-NU5AI. (see Page 80.)

Loosen the slider limiter screw with the hexagonal screwdriver provided with the microscope and insert the lambda plate slider into the slot. And then, tighten the slider limiter screw until it is inserted into the groove.

To remove the lambda plate slider from the nosepiece, loosen the slider limiter screw sufficiently with the hexagonal screwdriver and pull out the llambda plate slider.



▶ Placing the lambda plate into the optical path

When the lambda plate slider is pushed into the second click-stop position, the lambda plate is placed into the optical path.

▶ Removing the lambda plate from the optical path

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

20 DIC Prism (For the Episcopic Illumination/Senarmont Method)

When the DIC microscopy under the episcopic illumination is performed, applicable microscopy method differs depending on the used nosepiece. When the LV-NU5AI is used, the Senarmont method is applicable.

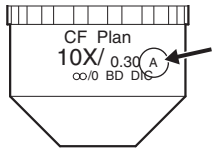
** Use the objectives for industrial microscopes marked with "LU."*

To perform the Senarmont method of the DIC microscopy under the episcopic illumination, 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 LV-NU5AI. Additionally, attach the lambda plate slider to perform the sensitive color DIC microscopy.

▶ Selecting the DIC slider

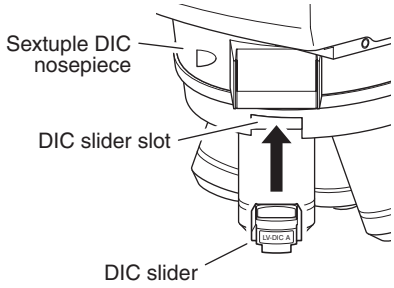
Check the DIC prism position indicated on the objective body and select the DIC slider suitable for the objective. On the right figure, the symbol "A" is marked at the right of the magnification and the NA value. The symbol indicates the DIC prism position for the objective.

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.

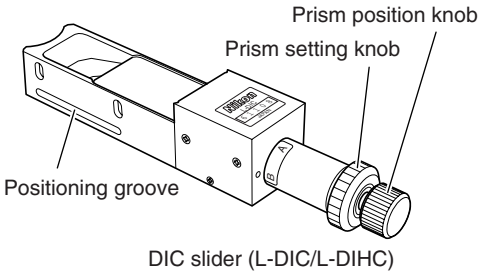
Interference color	Characteristics
Dark color	Observations similar to the dark-field microscopy can be performed.
Gray	You can observe the phase contrast distribution of the whole specimen with a bird's eye view.
Sensitive red-violet	Observations with the highest color contrast can be performed.

21 DIC Prism (For the Episcopic Illumination/Prism Slide Method)

When the DIC microscopy under the episcopic illumination is performed, applicable microscopy method differs depending on the used nosepiece. When the motorized universal quintuple nosepiece (LV-NU5A or LV-NU5AC) is used, the Prism Slide method is applicable.
** Use the objectives for the industrial microscope marked with "LU."*

To perform the Prism Slide method of the DIC microscopy under the episcopic illumination, set the polarizer and the analyzer on the epi illuminator (LV-UEPI2A) at the crossed Nicols position and insert the DIC prism (DIC slider: L-DIC/L-DIHC*) into the motorized universal quintuple nosepiece (LV-NU5A or LV-NU5AC)

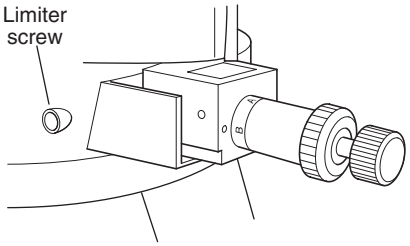
* L-DIHC: high contrast type



▶ Attaching/removing the DIC slider

Fully loosen the DIC slider limiter screw on the nosepiece with a hexagonal screwdriver. Insert the DIC slider into the DIN slot on the nosepiece and tighten the DIC slider limiter screw.

To remove the DIC slider from the nosepiece, fully loosen the limiter screw with a hexagonal screwdriver and pull out the DIC slider.

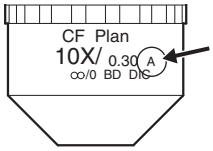


▶ Placing the DIC prism into the optical path

Push in the slider to the second click-stop position to locate the DIC prism into the optical path. Pull out the slider to the first click-stop position to remove the DIC prism from the optical path.

▶ Setting the DIC prism

The corresponding position of the prism selector knob for each objective is indicated on the objective body next to the magnification and the N.A. value. On the objective shown in the right figure, a letter "A" is indicated next to the magnification and the N.A. value. It indicates that the corresponding DIC prism position for this objective is "A." Thus, when you use this objective, turn the prism selector knob on the DIC slider to match the letter "A" with the white circle.



▶ Interference color

You can change the interference color continuously by rotating the prism position knob located at the tip of the DIC slider.

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.

22 DIC Prism for the Diascopic Illumination

To perform the DIC microscopy under the diascopic illumination, set the rotatable polarizer for the diascopic illumination equipped with the 1/4 lambda plate and the analyzer slider at the crossed Nicols position, and then insert the DIC prism into the front and back of the specimen. To perform the sensitive color DIC microscopy under the diascopic illumination, insert the lambda plate slider into the slot on the nosepiece in the configuration of the DIC microscopy under the diascopic illumination.
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." Refer to the table on page 67 to select the DIC prism suitable for the magnification of the used objective or the observation purpose.

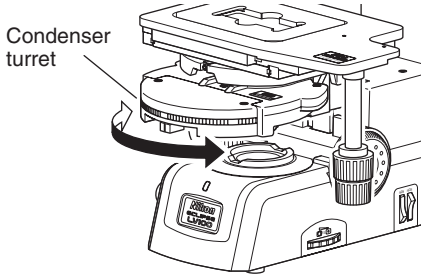
> ***Objectives for the DIC microscopy under the diascopic illumination***
> *To perform the DIC microscopy under the diascopic illumination, use the DIC objectives for biologic microscopes listed in the table on page 67. To attach the DIC objectives to the LV-NU5AI nosepiece, use the conversion adapter (LU nosepiece adapter M32-25).*

▶ Inserting the condenser DIC prism

Attach the condenser DIC prism inside the universal condenser beforehand. Rotate the condenser turret to place the condenser DIC prism into the optical path.

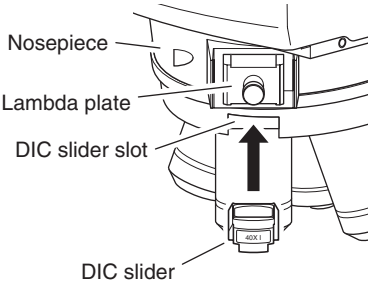
There are three types of condenser DIC prisms (N1 Dry, N2 Dry, and NR Dry). Refer to the table on Page 67 to select the DIC prism suitable for the used objective.

* 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 to 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.

Polarizer	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

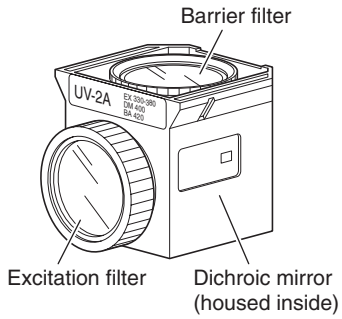
The combination of the DIC prisms differs depending on the used objective. Be careful that the DIC contrast images cannot be obtained or the contrast is reduced excessively if the combination is wrong.
To obtain the images with the higher contrast or resolution for the observation purpose, use the special 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

<table>
<tr><th colspan="2" rowspan="2">Objective</th><th colspan="2">Standard</th><th colspan="2">Contrast priority</th><th colspan="2">Resolution priority</th></tr>
<tr><th>Objective DIC prism</th><th>Condenser DIC prism</th><th>Objective DIC prism</th><th>Condenser DIC prism</th><th>Objective DIC prism</th><th>Condenser DIC prism</th></tr>
<tr><td>10X</td><td>Plan Apo 10XA
Plan Fluor 10X
S Fluor 10X
Fluor 10X W</td><td>10X</td><td>N1 Dry</td><td></td><td></td><td rowspan="5"></td><td rowspan="5"></td></tr>
<tr><td>20X</td><td>Plan Fluor 20X
Plan Fluor 20X MI
Plan Apo 20X
S Fluor 20X
Fluor 20X W</td><td>20X</td><td rowspan="8">N2 Dry</td><td>20X-C</td><td rowspan="3">N1 Dry</td></tr>
<tr><td>40X</td><td>Plan Fluor 40X
Plan Apo 40X
S Fluor 40X
Plan NCG 40X</td><td>40X I</td><td>40X I-C</td></tr>
<tr><td rowspan="2"></td><td>Plan Fluor 40X Oil
Fluor 40X Oil</td><td rowspan="2">40X II</td><td rowspan="4"></td></tr>
<tr><td>Fluor 40X W
Plan Apo 40X Oil</td></tr>
<tr><td>60X</td><td>Plan Apo 60X Oil A
Plan Apo 60X
Fluor 60X W
Plan Apo VC 60X H
CFI APO TIRF 60X Oil</td><td>60X I</td><td>60X I-R</td><td rowspan="4">NR Dry</td></tr>
<tr><td></td><td>Plan Fluor 60X Oil
Plan Apo TIRF 60X Oil
Plan Apo 60X WI
Plan Apo VC 60X WI
Plan Fluor 60X A</td><td>60X II</td><td>60X II-R</td></tr>
<tr><td>100X</td><td>Plan Apo VC 100X H
CFI APO TIRF
100X Oil
Plan Apo 100X NCG Oil</td><td>100X I</td><td>100X I-R</td></tr>
<tr><td></td><td>Plan Fluor 100X Oil
Plan Fluor 100X Oil, iris
Plan Apo 100X Oil
Plan Apo TIRF 100X
Plan Apo 100X NCG Oil</td><td>100X II</td><td>100X II-R</td></tr>
</table>

23 Filter Cube for Fluorescence Observation

The LV-UEPI2A 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.



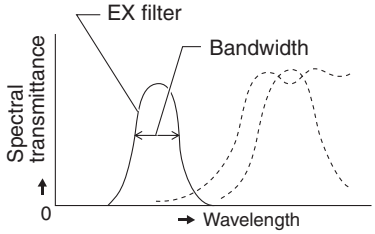
- Even in the same excitation method, a variety of combination of the excitation light filter and the barrier filter can be selected.
- Each excitation light filter (EX filter), barrier filter (BA filter), and dichroic mirror (DM) can be purchased separately.
- The excitation light filter is exposed to strong lights. Therefore it may deteriorate under use. It is recommended to replace it at a proper interval.
- See Page 84, “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.

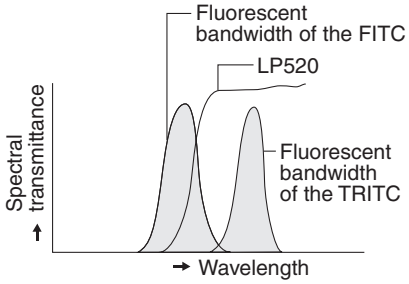
	Narrow	Bandwidth of excitation filter	Wide
Brightness of fluorescence image	Dark		Bright
Occurrence of self-fluorescence	Less frequent		Frequent
Degree of fading	Small		Large

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.

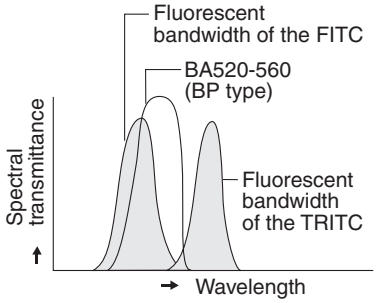


Both the FITC fluorescent image and the TRITC fluorescent image are visible.

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.



Only the fluorescent image emitted by the FITC is visible.

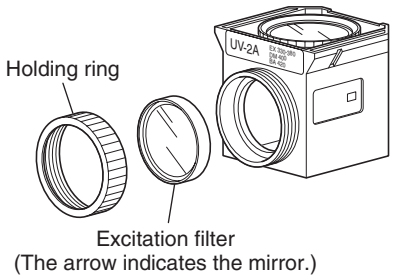
Replacing excitation light filters, barrier filters, and dichroic mirrors

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.

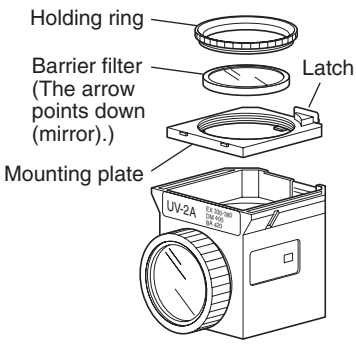
1. Rotate the holding ring in counterclockwise direction to remove it.
2. Replace the excitation light filter with a new one and secure it with the holding ring.
   When attaching the excitation light filter, make sure to place the filter with its arrow mark on the rim facing to the dichroic mirror side.
   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.

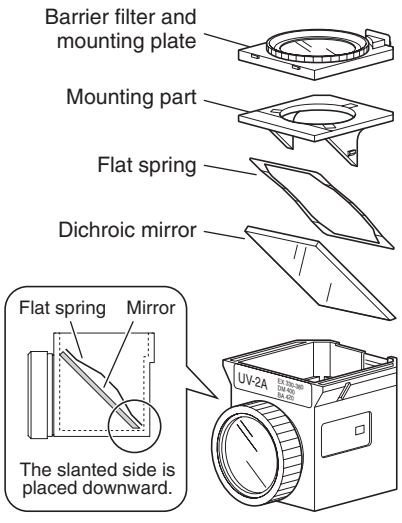
1. Press the latch to inside and detach the mounting plate with the barrier filter.
2. Rotate the holding ring to remove it from the mounting plate.
3. Replace the barrier filter with a new one and secure it in the reverse order.
   When attaching the barrier filter, make sure to place the filter with 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

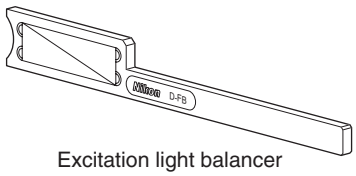
A dichroic mirror is fixed with a flat spring and a mounting hardware inside the filter cube.

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.



24 Excitation Light Balancer

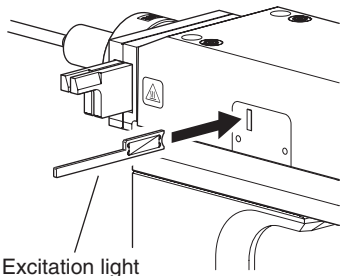
When the illuminator LV-UEPI2A is used, the optional D-FB excitation light balancer can be attached for the epi-fl microscopy to observe a specimen labeled with multiple wavelengths. The excitation light balancer enables the continuous change of the wavelength characteristics for the excitation light 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.

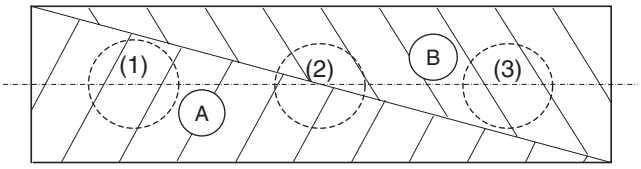

Excitation light balancer

▶ Objective

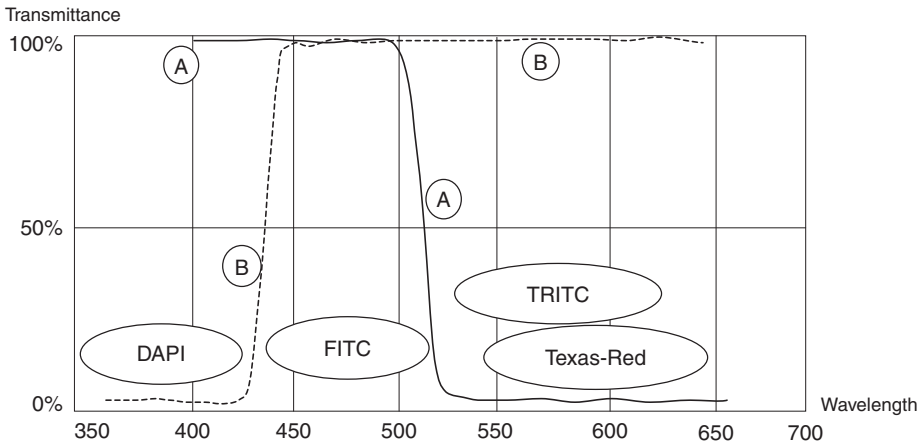
To use the excitation light balancer, use the following objectives in combination. If another objective is used, uneven image may be observed in the viewfield.

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



: Effective diameter on the aperture diaphragm surface



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%

IV Assembly

WARNING

- Before assembling the product, 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 loose accuracy when exposed to even a weak physical shock.)

CAUTION

- **Software setup work**
  When the product is assembled or the configuration of the microscope system is changed, perform the software setup works for various settings of the microscope via a PC by using the software, "LVSetup," in "LV Series Support Tools" provided with this product.
  In the setup works, information for the parts and devices (objectives, filter cubes, illuminator, and so on) is registered into the memory in the microscope and interlock controls for such devices are specified. Make sure to perform the setup works to use the microscope correctly. For details about the operation and the setup works of the "LVSetup," refer to the "LV Series Support Tools software manual."

Required tools

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

When these tools are not used, place them in the tool holder at the right side of the microscope 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 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 that is able to bear the weight of the instrument.
- Do not install the product 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.”

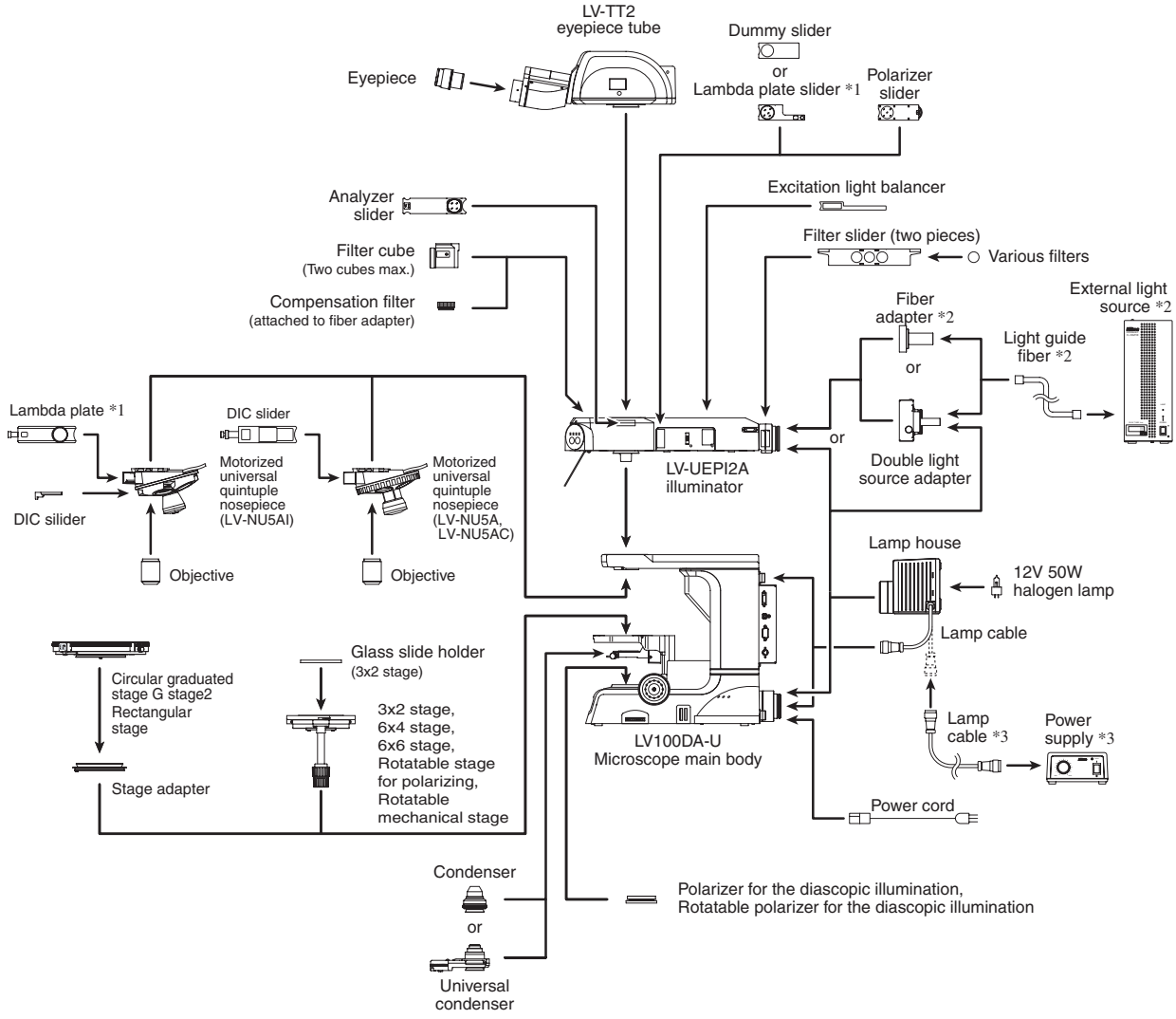
Combination of the illuminator and the light source

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-UEPI2A Motorized Universal Epi Illuminator 2A
- Lamp house: LV-LH50PC Precentered Lamp House
  (both for the episcopic illumination and for the diascopic 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 LV100DA-U

Assemble each part according to the following figure.



*1 For the episcopic illumination, use the lambda plate slider on the epi illuminator side. For the diascopic illumination, use the lambda plate slider on the nosepiece side.

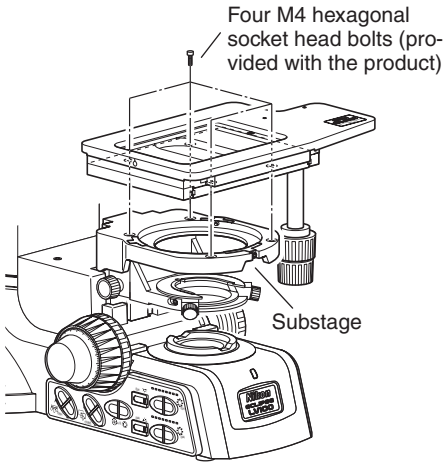
*2 It is installed if the brightness of the specified light source is less than the desired brightness for the episcopic microscopy or so on.

*3 When you wish to turn on the episcopic illumination and the diascopic illumination simultaneously, you must connect this part to the lamp house for the episcopic illumination.

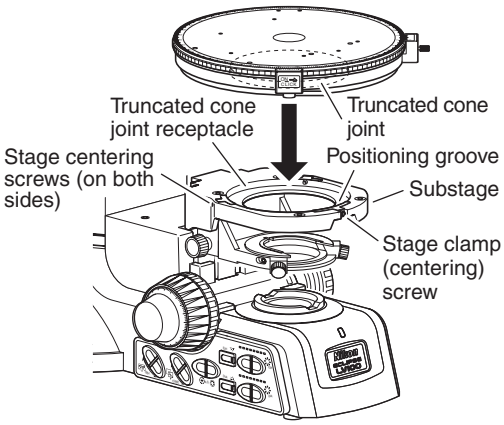
1 Assembling the Stage Unit

1. Attaching the stage

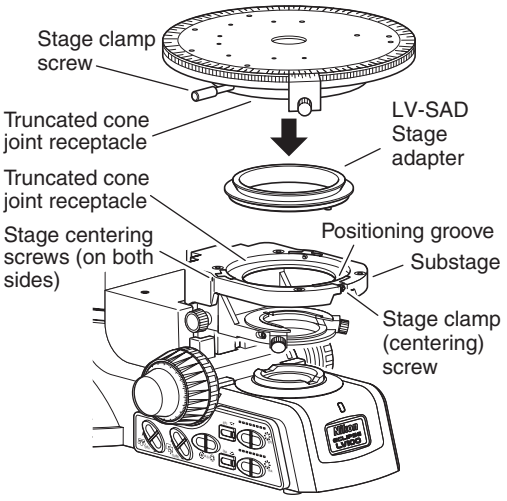
- **3x2 stage, 6x4 stage, and 6x6 stage:**
  When the LV-S32 3x2 stage, the LV-S64 6x4 stage, or the LVS6 6x6 stage is used with this product, attach the stage to the attaching hole of the substage and fix it with four M4 screws provided with the product.
- **Rotatable stage for polarizing and rotatable mechanical stage:**
  To attach the LV-SRP Rotatable Stage for Polarizing or the C-SRR Rotatable Mechanical Stage to the product, 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 77).*



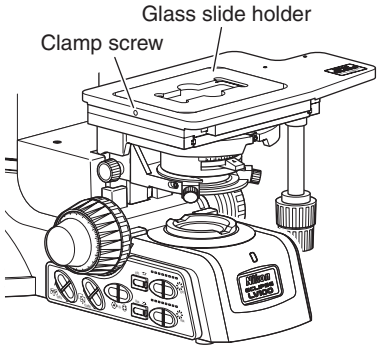
- **G stage 2 and rectangular stage:**
  To attach the P-GS2 G stage 2 or the rectangular stage for the product, attach the LV-SAD stage adapter.
  Align the positioning pin on the bottom of the stage adapter with the groove of the substage, insert the truncated cone joint of the stage adapter into the 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

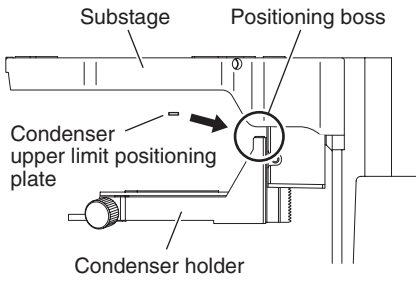
The 3x2 stage comes with a stage glass as standard equipment. When a glass slide or a high NA condenser is used for the observation of the specimen, an optional glass slide holder must be attached in place of the stage glass. Refer to the following to attach the stage glass or the glass slide holder.

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

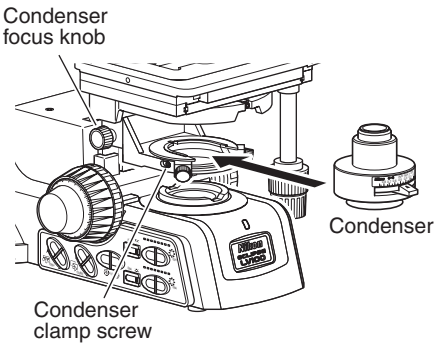
If the rotatable mechanical stage is directly attached, the condenser may hit the stage because the rotatable mechanical stage is thinner than other stages by 1 mm. To use the rotatable mechanical stage, attach the condenser upper limit positioning plate to the condenser holder to prevent the condenser from hitting the stage.
To attach the plate, move the substage to the upper limit and the condenser holder to the lower limit. And then, attach the plate onto the positioning boss located on the upper surface of the condenser holder. (Refer to the right figure.) No tool is required to attach the plate because the positioning boss is equipped with a magnet.



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 circular dovetail joints.
   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

Applicable condenser differs depending on the used stage. Refer to the following table to select a condenser.

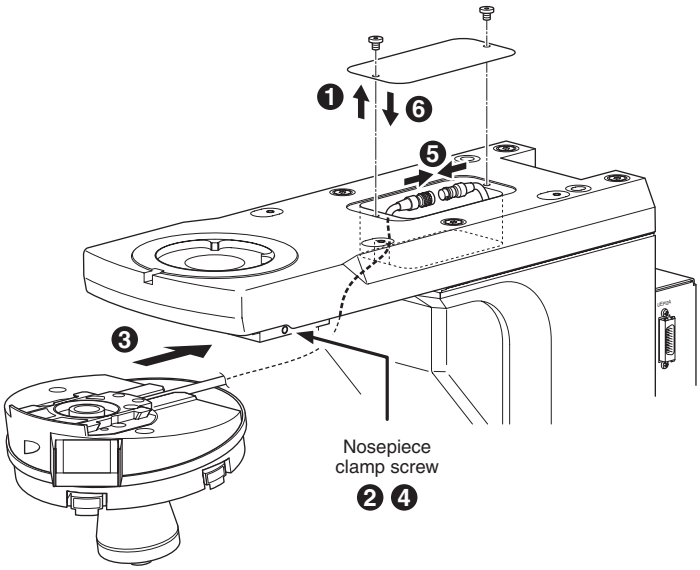
Stage	Applicable condenser
3x2 stage	Abbe condenser, achromatic condenser, LWD condenser, 2-100x slide achromatic condenser, low magnification condenser, and LV-CUD universal condenser *A glass slide holder is used for all condensers except for the LWD condenser.
Rectangular stage **Rotatable rectangular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

3 Attaching the Nosepiece

1. Attaching the motorized nosepiece

The motorized universal quintuple nosepiece (LV-NU5AI) is used for this microscope. The nosepiece must be attached before attaching the epi illuminator.

1 Remove the two M4 screws at the top of the microscope arm by using a hexagonal wrench and remove the cover at the connection port.
2 Fully loosen the nosepiece clamp screw located on the right side of the microscope arm using the hexagonal screwdriver.
3 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.
At this step, the cable of the nosepiece must be drawn into the microscope through the hole at the bottom of the arm.
4 Fix the nosepiece with the nosepiece clamp screw.
5 Connect the cable of the nosepiece to the cable inside the arm.
6 Put the cover back to its original position and fix it with the two M4 screws.



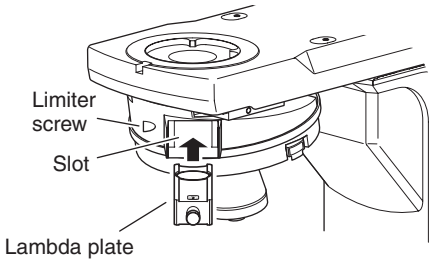
2. Removing the motorized nosepiece

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 slider for the diascopic illumination

To perform the sensitive color polarization microscopy under the diascopic illumination or the sensitive color DIC microscopy under the diascopic illumination, attach the lambda plate (LV-LP lambda plate) to the special slot on the nosepiece. 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. Attach the lambda plate according to the following procedure.

1 Loosen the limiter screw with the hexagonal screwdriver provided with the microscope.
2 Insert the lambda plate into the slot.
3 Tighten the limiter screw of the nosepiece so that it is inserted into the groove to prevent inadvertent disconnection of the lambda plate.



To remove the lambda plate from the nosepiece, loosen the slider limiter screw sufficiently with the hexagonal screwdriver and pull out the lambda plate.

To use the episcopic illumination, attach the lambda plate to the epi illuminator, For details, see Page 83.

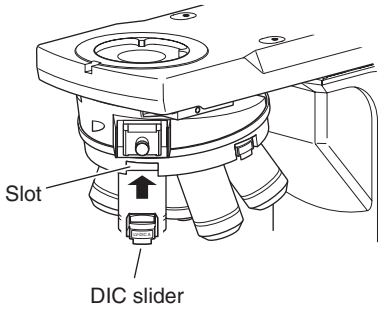
4. Attaching the DIC prism

Methods of the differential interference contrast (DIC) microscopy vary among the nosepiece configuration.

> *For details on selecting the DIC slider, see "20. DIC Prism (For the Episcopic Illumination/ Senarmont Method)," "21. DIC Prism (For the Diascopic Illumination/Prism Slide Method)," and "22. DIC Prism for the Diascopic Illumination" of "III. Opearation of Each Part."*

- **LV-NU5AI motorized nosepiece:**

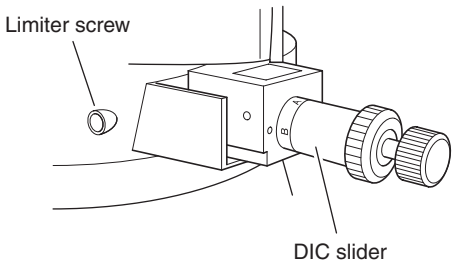
For the LV-NU5AI nosepiece, the Senarmont method is used for the DIC microscopy under the epi/dia illumination.
Select the objective DIC prism (DIC slider) suitable to the illumination method (epi/dia) and the characteristics of the objective.
Insert the DIC slider into the slot for objectives.
When the DIC slider is inserted as far as it goes, the DIC prism is placed into the optical path.



> - *Select the DIC slider suitable for the illumination method and the objectives. Attach the DIC slider after attaching the objectives.*
> - *To perform the DIC microscopy under the diascopic illumination, attach the LV-CUD universal condenser to the product and insert the DIC prism into the condenser side of the specimen. For details about operating the universal condenser, see the instruction manual for the LV-CUD.*

- **LV-NU5A/LV-NU5AC motorized nosepiece:**

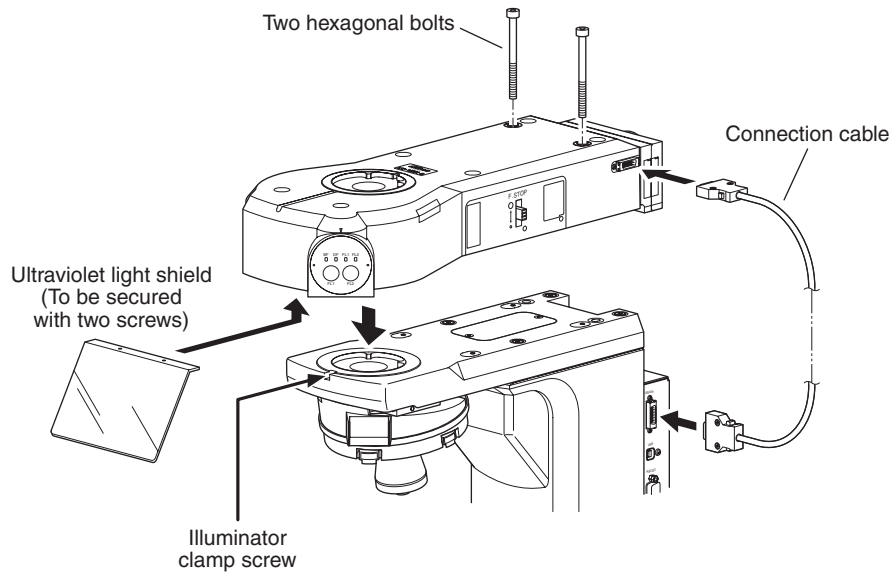
For the LV-NU5A and the LV-NU5AC, the prism slide method is used for the DIC microscopy under the epi illumination.
The DIC slider (L-DIC/L-DIHC) must be inserted into the slot of the nosepiece. Loosen the limiter screw with a hexgonal screwdriver, insert the DIC slider, and tighten the limiter screw.
To remove the DIC slider, loosen the limiter screw with a hexgonal screwdriver and pull out the DIC slider.



4 Attaching the Epi Illuminator

1. LV-UEPI2A main unit

1 Loosen sufficiently the illuminator clamp screw on the front of the product arm using the hexagonal screwdriver.
2 Mount the LV-UEPI2A main unit onto the microscope arm and fix it by tightening the illuminator clamp screw.
3 Fix the LV-UEPI2A to the arm using two hexagonal socket head bolts that are provided with the LV-UEPI2A. Use the hexagonal wrench to tighten the bolts.
4 Cover the bolt-holes in step **3** with the protective stickers provided with the LV-UEPI2A.
5 Attach the ultraviolet light shield to the front bottom of the LV-UEPI2A using the two screws provided with the LV-UEPI2A.
6 Connect the special cable to the connector on the side of the LV-UEPI2A and to the UEPI2A connector on the connector panel of the product.



* To disconnect the cable, pull the cable while pushing the protrusions on both sides of the connector.

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-UEPI2A.*
- *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, and dummy slider/lambda plate slider)

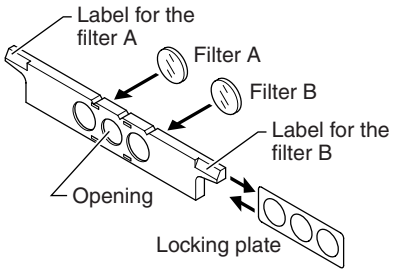
On the right side of the LV-UEPI2A, there are slider slots for an analyzer slider, polarizer slider, and so on. To use sliders, remove the covers on the slider slots and insert the sliders.

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

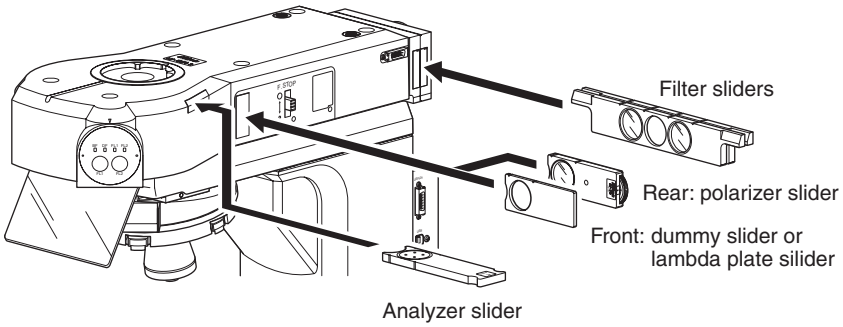
When you don't need any slider, attach the covers onto the slider slots.

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-UEPI2A can accommodate two optical components such as filter cubes for the epi-fl microscopy or PA blocks (LV-PAB).

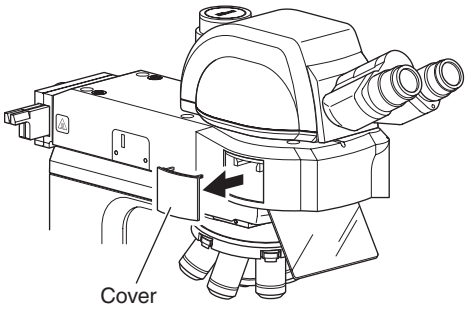
CAUTION

To attach the filter cubes, the product must be turned on with the LV-UEPI2A attached. So, this step must be performed after the assembly of the microscope.

1 Plug the power cord and turn on the product. (See Pages 34 and 98.)

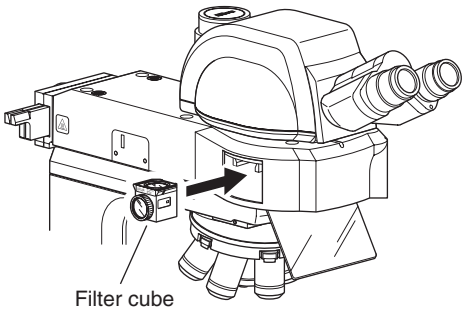
2 When the light source (the lamp house or the optical fiber light source) is attached to the microscope, turn off the light source. And if possible, turn off the power for the light source.

3 Remove the cover on the left side of the LV-UEPI2A.



4 Check the position indicator of the filter cube turret in the LV-UEPI2A. Operate the CUBE switch so that the “FL1” position or the “FL2” position is placed at the opening.
* To use a PA block (LV-PAB), attach it to the “FL1” position.

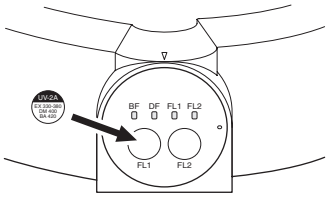
5 Insert the desired filter cube along the dovetail of the filter cube turret and push it to the click-stop position.
Make sure that the filter cube is inserted so that the excitation light filter faces out.



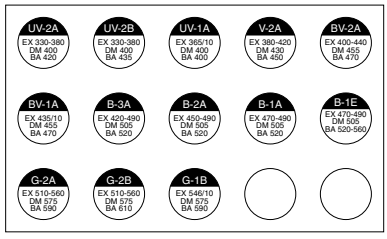
6 Repeat Steps **4** and **5** to attach the desired filter cubes to FL1 and FL2.

7 Put the cover back to its original position.

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



Affix stickers to the lower position of the microscopy method indicator.



Stickers of excitation method

5 Attaching the Lamp House and Replacing Lamps

CAUTION

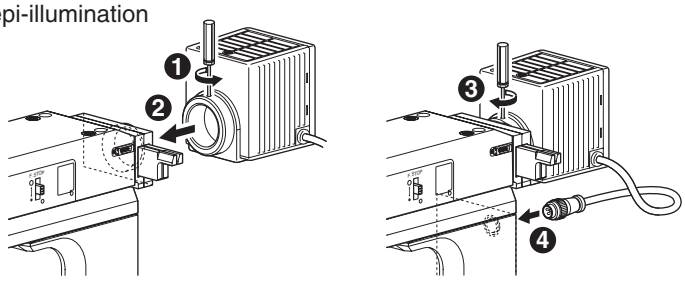
- To prevent electrical shock and damage to the microscope, always turn off the power switch (flip it to the "○" side) and unplug the power cord from the outlet before attaching or detaching the lamp house.
- To prevent burn injury, allow the lamp and the lamp house to cool down sufficiently (for at 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

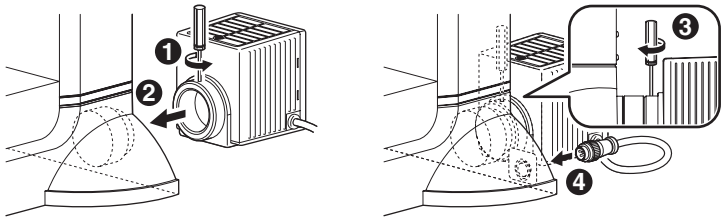
Before performing the following procedures, turn off the power supply for the microscope (press the "○" side) and unplug the power cord from the wall outlet.

1. Loosen the clamp screw sufficiently on the upper side of the lamp house connector by using the hexagonal screwdriver provided with the microscope.
2. Mount the lamp house to the connection port on the rear of the illuminator or on the rear of the microscope body 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 microscope and tighten the ring of the connector to secure the connection.

For the epi-illumination



For the dia-illumination



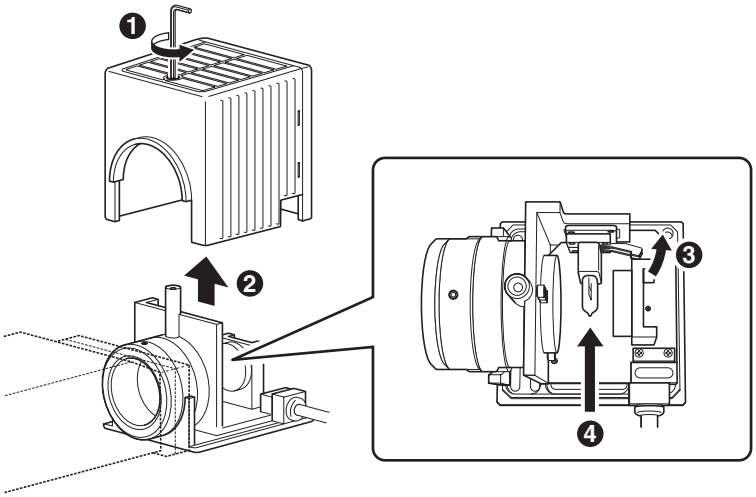
To remove the lamp house, reverse the above procedure.

2. Replacing the lamp

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

Before performing the following procedures, turn off the power supply for the microscope (press the "○" 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.

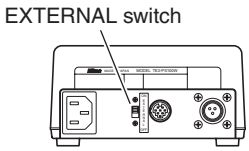


3. Connecting an external power supply (only for the simultaneous illumination)

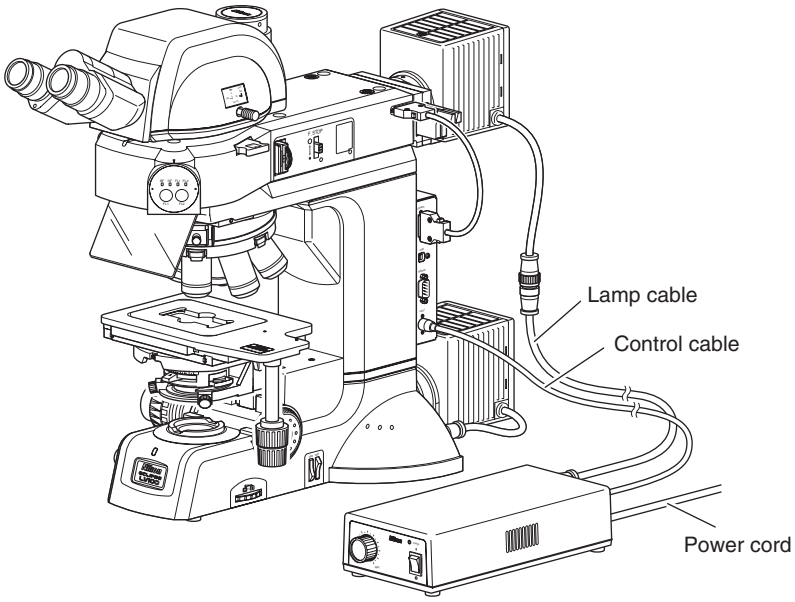
When the specified lamp house LV-LH50PC is used for both of the episcopic illumination and the diascopic illumination, the episcopic illumination and the diascopic illumination can be turned on simultaneously by using an optional power supply.

For this purpose, the optional power supply, Nikon TE2-PS100W, must be connected to the lamp house for the episcopic illumination.

1. Connect the lamp cable, which is provided with the power supply, to the lamp cable of the lamp house and to the OUTPUT connector on the power supply.
2. Connect the control cable, which is provided with the power supply, to the EXTERNAL connector on the power supply and to the LCNT connector on the LV100DA.
3. Turn the EXTERNAL switch on the back of the power supply to the ON side.
   This disables the brightness control knob on the power supply and enables the control functions of the lamp and the brightness on the operation panel of the microscope. When the power supply is used with this microscope, make sure to turn on the EXTERNAL switch.



TE2-PS100W rear



Power supply (TE2-PS100W)

Setup works to use the external power supply
When the external power supply is used with this product, you can independently control the episcopic illumination and diascopic illumination with "LVSetup." You can specify the simultaneous illumination or single illumination. For details about operations and setup works of the "LVSetup," see "LV Series Support Tools software manual."

6 Attaching the Optical Fiber Adapter and an External Light Source

To perform the epi-fl microscopy, the brightness of the specified halogen lamp may be less than the desired brightness. In this case, either of the following external light sources must be connected. When the optional LV-HGFA HG optical fiber adapter is attached to the light source mount part, these external light sources can be connected via the light guide fiber.

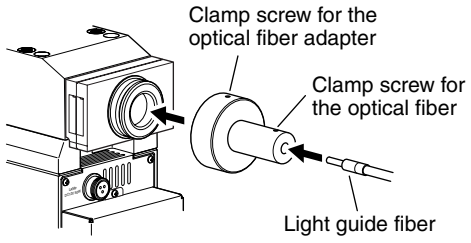
- External light source: Intensilight C-HGFIE
  (HG precentered optical fiber light source, electric operation type)
  EXFO X-Cite 120 PC
  (electric operation type optical fiber light source)

CAUTION

- Please take note that if any external light source is attached, the product will not be treated as a UL-listed product.
- If a manual operation type light source is attached, you cannot control the shutter and the brightness with the microscope. Make sure to use the electric operation type light source specified above.
- 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 microscope are turned off and that the power cable is unplugged from the wall outlet.
- When you use the diascopic 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. 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

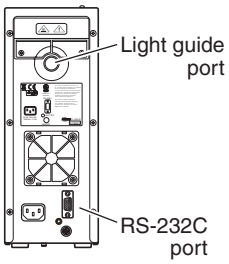
1. Loosen the optical fiber adapter clamp screw sufficiently by using the hexagonal screwdriver.
2. Mount the optical fiber adapter onto the light source mount part of the LV-UEPI2A. Push in the adapter as far as it goes and fix it with the clamp screw.
3. Insert the light guide fiber tip through the 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.



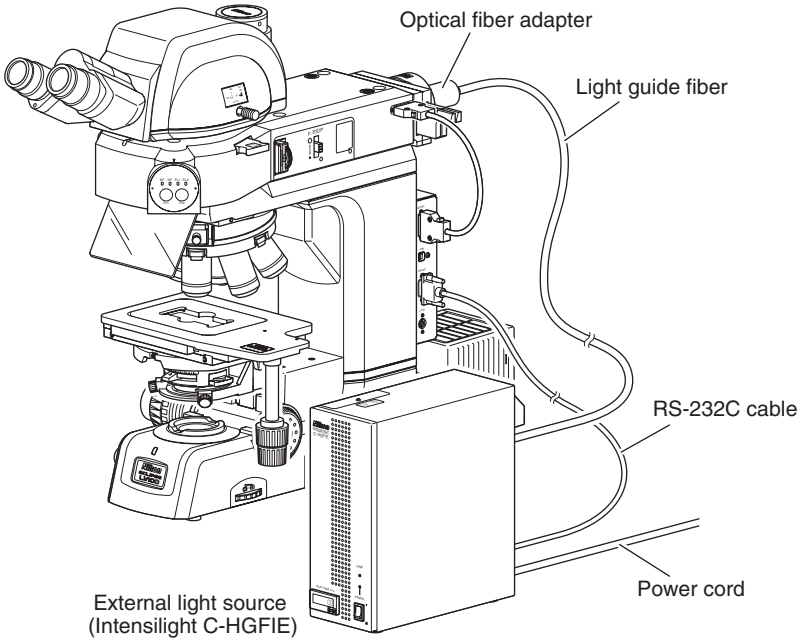
2. Connecting the RS-232C cable

Connect the RS-232C cable to the product and to the external light source (Intensilight C-HGFIE or EXFO X-Cite 120 PC). With this connection, you can control the shutter and the brightness on the light source by operating the switches on the microscope.

1. Check that the power supplies for the microscope and the light source are turned off.
2. Connect the RS-232C cable provided with the light source to the RS-232C connector on the product and to the RS-232S port on the light source.
   Screws are provided for these connectors. Make sure to fix these connectors with screws.



Rear view of the Intensilight C-HGFIE



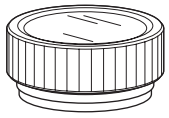
Operation for the light source

For details about the operation for the external light source, refer to the instruction manual for the Intensilight C-HGFIE or the EXFO X-Cite 120 PC.

When the external light source is connected with the product, the shutter and the brightness (iris) on the light source can be controlled only by operating the switches on the operation panel of the microscope. For the EXFO X-Cite 120 PC, if a button on the light source is touched, "LOC"c is displayed on the LCD display for two seconds indicating that the operation on the light source is disabled.

3. 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-UEPI2A when the adapter is used.

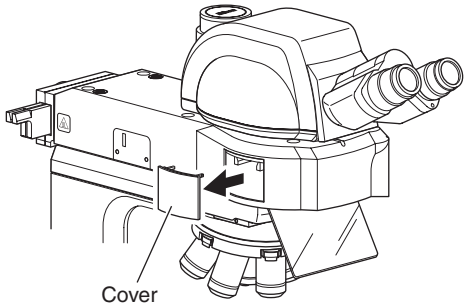


Compensation filter

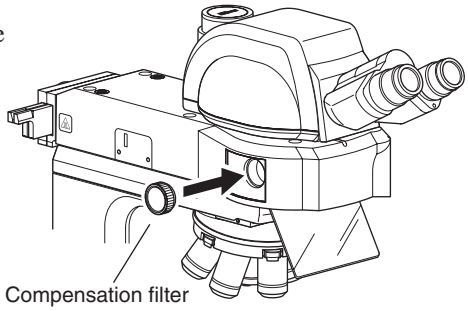
CAUTION

To attach the compensation filter, the product must be turned on with the LV-UEPI2A attached. So, this step must be performed after the assembly of the microscope.

1. When the light source (the lamp house or the optical fiber light source) is attached to the microscope, turn off the light source. And if possible, turn off the power for the light source.
2. Plug the power cord and turn on the product.
3. Remove the cover on the left side of the LV-UEPI2A.
4. Check the position indicator of the filter cube turret in the LV-UEPI2A. Operate the CUBE switch on the operation panel so that the “BF” position is placed at the opening.
5. Screw in the compensation filter provided with the HG fiber adapter into the bright-field block in the LV-UEPI2A.
6. Put the cover back to its original position.



Cover



Compensation filter

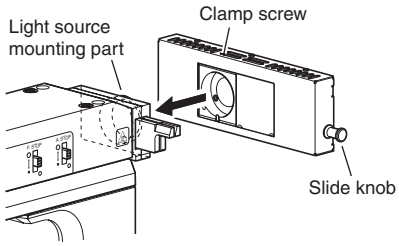
7 Attaching the Double Light Source Adapter

To perform the microscopy under the episcopic illumination, attach the LVUEPI2-DLS double light source adapter. The standard halogen lamp and the external light source can be attached together and switched with the light sources lit.

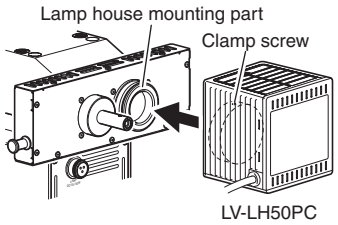
CAUTION Before using the double light source adapter, make sure that the clamp screws on each part are tightened securely.

1 Check that the microscope and the light source are turned off.

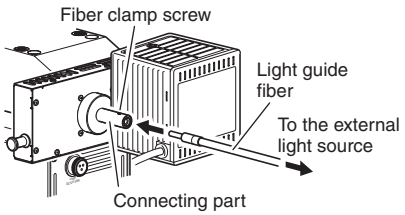
2 Insert the double light source adapter into the mounting part of the LV-UEPI2A as far as it goes and tighten the clamp screw securely with the hexagonal screwdriver provided with the microscope.
Attach the adapter with the clamp screw located on the top and the slide knob on the right.
To tighten the clamp screw, insert the hexagonal screwdriver through the cooling slit into the adapter and tighten the clamp screw inside.



3 Attach the lamp house to the lamp house mounting part of the double light source adapter as far as it goes and tighten the clamp screw securely with the hexagonal screwdriver.
For the connection of the lamp cable, see Page 85, “Attaching the Lamp House and Replacing Lamps.”

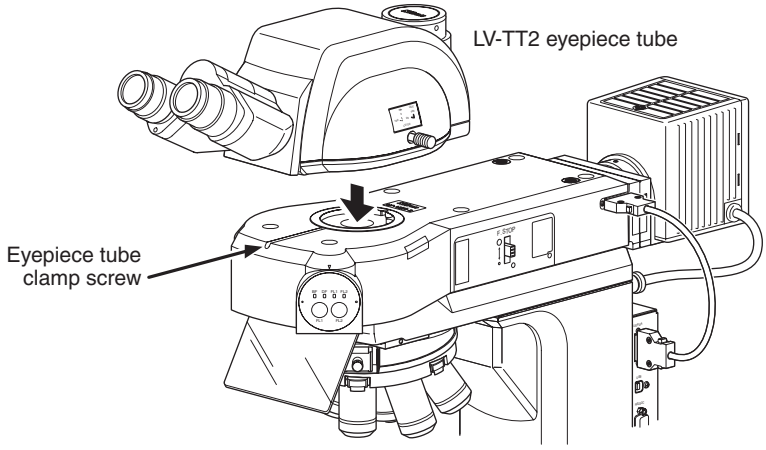


4 Insert the tip of the light guide fiber into the light guide fiber connecting part of the product as far as it goes and tighten the clamp screw securely.
For the procedure of connecting the external light source and the light guide fiber, see the instruction manual for the light source.



8 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 loosing the clamp screw to prevent a sudden disconnection and falling.

9 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.

10 Attaching Objectives

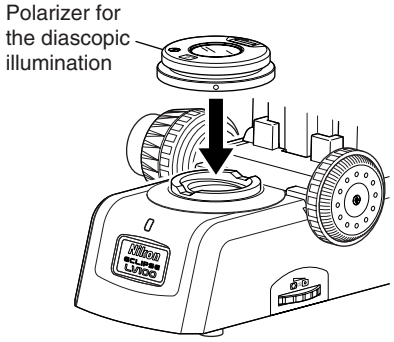
1. Lower the stage as far as it will go.
2. Screw in objectives into the nosepiece so that their magnification increase in the order of the clockwise rotation (as viewed from above the microscope) of the nosepiece.
3. To remove an objective, perform the following: remove the specimen from the stage,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

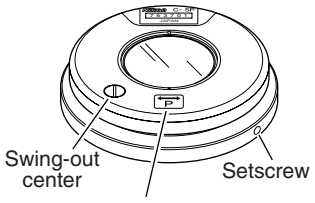
Conversion adapter
For objectives and nosepieces, there are two kinds of screw diameters (25mm and 32 mm). To attach the objective of 25 mm diameter to the nosepiece of 32 mm diameter sockets, use the conversion adapter, LU nosepiece adapter M32-25.

11 Attaching the Polarizer for the Diascopic Illumination

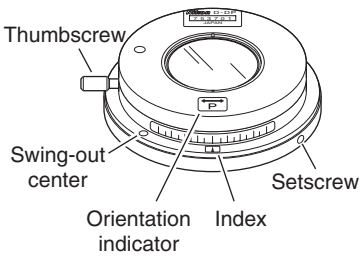
There are two types of polarizers for the diascopic illumination. One is the C-SP polarizer for the diascopic illumination equipped with a polarizer only. And another is the D-DP rotatable polarizer for the diascopic illumination equipped with a polarizer and a 1/4 lambda plate. The C-SP polarizer is used for the polarization microscopy under the diascopic illumination. The D-DP rotatable polarizer is used for the polarization DIC microscopy under the diascopic illumination. Select the polarizer suitable for the microscopy.

1 Check the orientation indicator for the C-SP polarizer. Or check the index for the D-DP rotatable polarizer.
2 Place the polarizer onto the field lens on the base of the microscope. The orientation indicator or the index must face the front of the microscope.
3 Tighten the setscrew to fix the polarizer. The orientation of the polarizer must be adjusted for each observation.





C-SP polarizer for the diascopic illumination



D-DP rotatable polarizer for the diascopic illumination

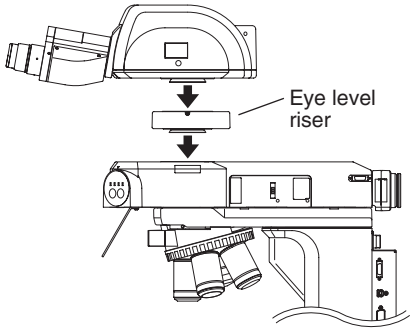
Adjusting the orientation of the polarizer
After attaching the polarizer for the diascopic illumination, adjust the orientation of the polarizer to a right angle to the orientation of the analyzer. For the procedure of adjusting the orientation, see "15. Polarizer for the Diascopic Illumination" in "III. Operation of Each Part."

12 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 dovetail junctions 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.

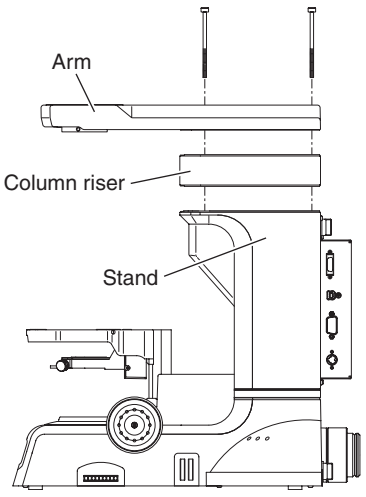


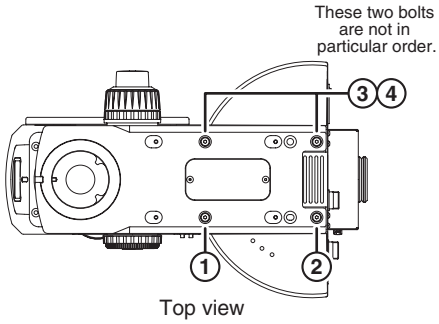
13 Attaching a Column Riser

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 product. 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 arm. 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.
   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.

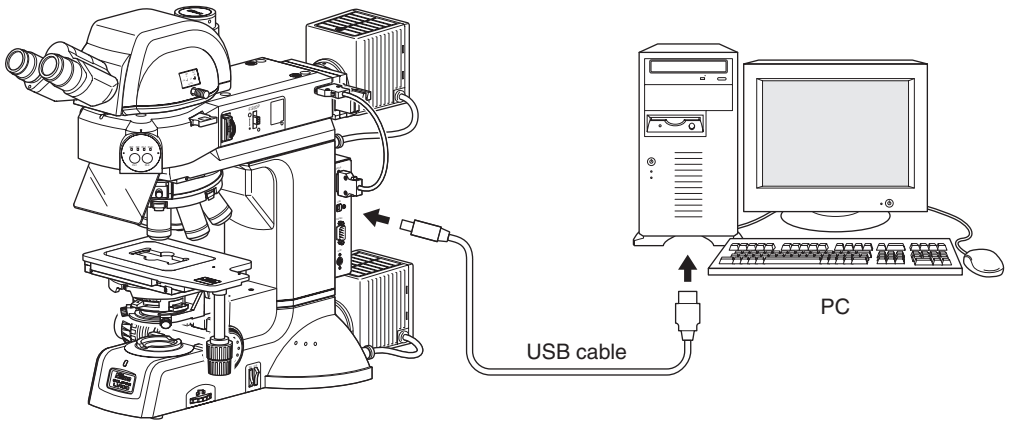




14 Connecting a PC

To use this product, connect a PC after assembling this product and perform the setup works (various settings) for the microscope system with the setup software, “LVSetup.”
Use the universal serial bus (USB) interface to connect with the PC. After assembling and connecting the microscope, connect the USB cable between the PC and the microscope and perform the setup works for the microscope.
The USB connector of this microscope is located in the connector panel on the side.

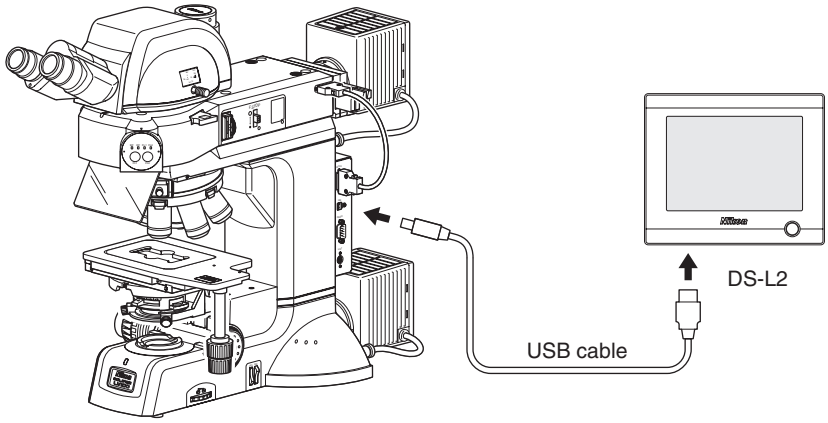
For details about the operation and the setup works of the “LVSetup,” refer to the “LV Series Support Tools software manual.”



Connecting with a PC when using the “NIS-Elements”
Motorized units can be controlled on a PC with “NIS-Elements,” the software for digital cameras, when a digital camera is used with the product. To use the NIS-Elements, connect the product and the PC with the USB interface in the same manner described above.

15 Connecting the DS-L2

When a camera is attached to the vertical tube and the DS-L2 is connected to the microscope for the camera control, the DS-L2 can be used to control the microscope.
The USB interface is used for the communication between the DS-L2 and the microscope. Connect the USB cable between the USB connectors of the DS-L2 and the microscope.
For the operation procedure of the DS-L2, see the instruction manual for the DS-L2.



16 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 microscope 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 microscope (flip it to the "○" side).
Insert the plug of the power cord into the AC inlet on the back of the microscope. Then, securely plug the power cord to the wall outlet.

17 Installing Options

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

18 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 LV100DA-U, the LV-UEPI2A epi illuminator, the LV-TT2 eyepiece tube, the L-W 10x eyepieces, the 3x2 stage, the ESD plate, the motorized universal quintuple 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.

V Troubleshooting

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. 86 and 87)
		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. 48)
		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 is in an intermediate position.	Move the filter slider to a click-stop position. (p. 44)
		The field diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 50 and 54)
		The nosepiece is not attached correctly.	Install the nosepiece correctly. (p. 79)
		The rotation of the nosepiece is stopped at an incorrect position. (No objective is placed in the optical path.)	Push the OBJ. switch several times to move the objective into the optical path. (p. 43)
		The dummy slider, DIC slider, polarizer slider, lambda plate slider, or analyzer slider is in an intermediate position.	Move the slider to a click-stop position. (p. 56, 60, and 62 to 67)
	Episcopic microscopy	The filter cube turret in the LV-UEPI2A is stopped at an intermediate position.	Push the CUBE switch several times to move the turret to the correct 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. 84)
		The filter cube selection is incorrect.	Select an appropriate filter cube. (p. 38, 68 to 70, and 84)
	Diascopic microscopy	The condenser position is too low.	Adjust the condenser so that the field diaphragm image is focused on the specimen surface. (p. 53)
		The condenser is not centered.	Center the condenser. (p. 53)
		The condenser is not attached correctly.	Install the condenser correctly. (p. 78)
		The condenser turret position of the universal condenser is located in an intermediate position.	Rotate it to the click-stop position. (p. 55)
		The upper part of the polarizer is stopped at an intermediate position.	Move the upper part to a click-stop position. (p. 59)

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 54)
		Dirt or dust exists on the lens, eyepiece, filter, or specimen.	Clean the components. (p. 107)
	Diascopic microscopy	The upper surface of the condenser is not clean.	Clean the components. (p. 107)
		The condenser position is too low.	Adjust the condenser focus knob so that the field diaphragm image is focused on the specimen surface. (p. 53)
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. 107)
		The used objective is not suitable for the microscopy.	Use the designated objective. (p.38, 39, 43, and 93)
		The aperture diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 51 and 54)
	Epi-fl microscopy	The filter cube being used is not suited for the specimen.	Use a filter cube suited for the specimen. (p. 38, 68 to 70, and 84)
		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. 53)
The focus is uneven.		The nosepiece is not attached correctly.	Install the nosepiece correctly. (p. 79)
		The nosepiece is not placed to a click-stop position. (The objective is not placed in the optical path).	Push the OBJ. switch several times to move the objective into the optical path. (p. 43)
		The specimen holder is slanted.	Attach the specimen holder correctly. (p. 77)
The image is elongated. Or, the image shifts during focus.		The nosepiece is not attached correctly.	Install the nosepiece correctly. (p. 79)
		The nosepiece is not placed to a click-stop position.	Push the OBJ. switch several times to move the objective into the optical path. (p. 43)
		The stage is tilting.	Attach the stage correctly. (p. 76)
		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.	Center the condenser. (p. 53)

Problem		Cause	Countermeasure
The image is tinged yellow.		The NCB11 filter is not used.	Locate the NCB 11 filter into the optical path. (p. 44)
		The lamp voltage is too low.	Increase the brightness with the brightness control switch, and then adjust the brightness with ND filters. (p. 42 and 44)
The image is too bright.		The lamp voltage is too high.	Adjust the brightness with the brightness control switch. Or, locate a ND filter into the optical path. (p. 42 and 44)
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 switch. (p. 42)
		A ND filter is placed in the optical path.	Remove the ND filter from the optical path. (p. 44)
		The aperture diaphragm is stopped down too far.	Open the diaphragm to a suitable size. (p. 51 and 54)
		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 61)
		A halogen lamp is used for a dark specimen.	Replace the light source to brighter one. (p. 89)
		The used objective is not suitable for the microscopy.	Use the designated objective. (p. 38, 39, 43, and 93)
		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. 53)
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. 49)
		The eyepieces are not attached correctly.	Mount the eyepieces correctly by aligning the positioning grooves. (p. 93)
The specimen does not move smoothly.		The specimen holder is not secured correctly on the stage.	Secure the specimen holder correctly. (p. 77)
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. 49)
		The eyepiece diopters are not adjusted.	Adjust the diopters. (p. 49)
Eye strain develops while viewing.		The interpupillary distance is not adjusted.	Adjust the distance. (p. 49)
		The eyepiece diopters are not adjusted.	Adjust the diopters. (p. 49)
		The brightness is not appropriate.	Adjust the brightness with the brightness control switch or ND filters. (p. 42 and 44)
		Eyepieces with different viewfield numbers are used for the left and right eyes.	Use eyepieces having the same viewfield number.

Problem		Cause	Countermeasure
The coarse focus knob is heavy in rotation.		The coarse torque adjustment ring is tightened too much.	Loosen the torque adjustment ring adequately. (p. 46)
		The coarse focus stopper ring is locked to restrict the upper limit.	Turn the coarse focus stopper ring to release the stopper function. (p. 47)
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. 46)
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. 47)
No interference color is seen in the DIC microscopy.		No polarizer is placed in the optical path.	Place it into the optical path. (p.57 to 59, and 61)
		No analyzer is placed in the optical path.	Place it into the optical path. (p.60 and 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.
		No objective DIC prism is placed in the optical path.	Place it into the optical path. (p. 64 to 66)
		The combination of the objective and the objective DIC prism is wrong.	Place the DIC prism suitable for the objective into the optical path. (p. 64 and 66)
	Diascopic microscopy	The condenser DIC prism is not placed in the optical path.	Place the condenser DIC prism into the optical path. (p. 66)
		The combination of the objective and the condenser DIC prism is wrong.	Place the DIC prism suitable for the objective into the optical path. (p. 66 and 67)
Uneven colors are seen or low contrast image is seen in the DIC microscopy.		A wrong type of objective is used.	Use an objective suitable for the DIC microscopy. (p. 64 to 66, and 93)
		The orientation of the polarizer is wrong.	Adjust the orientation of the polarizer correctly. (p.57 and 59)
		Dust exists on the objective, the condenser, or the specimen.	Clean it. (Pay great attention to dust for the differential interference contrast microscopy.) (p.107)
		The combination of the objective and the objective DIC prism is wrong.	Place the DIC prism suitable for the objective into the optical path. (p.64 to 66)
	Diascopic microscopy	A wrong condenser DIC prism is selected.	Place the DIC prism suitable for the objective into the optical path. (p. 66 and 67)
		The field diaphragm image is not focused on the specimen surface.	Focus the condenser. (p. 53)
No sensitive color is seen in the polarization microscopy.		No lambda plate is placed in the optical path.	Plase it into the optical path (p. 62 and 63)
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. 55)
		The field diaphragm image is not focused on the specimen surface.	Focus the condenser. (p. 53)

2 Electrical Problems

▶ At turn-on

Problem	Cause	Countermeasure
There is no power 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. 98)

▶ Lamp

Problem	Cause	Countermeasure
The lamp flickers, or its brightness is unstable.	The lamp is about to blow.	Replace the lamp with a new one. (p. 87)
	The power cord or the cable of the lamp house is not connected securely.	Connect them correctly. (p. 86, 88, and 98)
	The lamp is not securely inserted into the socket.	Insert the lamp securely. (p. 87)
	The lamp house is not connected securely.	Connect the lamp house securely. (p. 86 and 88)
The lamp does not light even though the illumination switch is pressed.	The cable of the lamp house is not connected at all, or is not connected securely.	Connect the lamp cable correctly. (p. 86 and 88)
	No lamp is attached.	Attach a lamp. (p. 86 and 87)
	The lamp is blown.	Replace the lamp with a new one. (p. 87)
	A wrong lamp is used.	Use the specified lamp. (See “VII. Specifications.”)
	The lamp information is not registered correctly.	Perform the setup works for the microscope. (p. 36)
The lamp does not light even though the illumination switch is pressed. (When the external power supply is used.)	The power for the external power supply is turned off.	Turn on the power supply. (p. 35)
	The lamp cable or the control cable is not connected correctly.	Connect the cable correctly. (p. 88)
	The EXTERNAL switch on the power supply is set to the “OFF” position.	Change the “EXTERNAL” switch position to “ON”. (p. 88)
	The information of the external power supply is not registered correctly.	Perform the setup works for the microscope. (p. 36)
The lamp does not light even though the illumination switch is pressed. (When the external light source is used.)	The power for the light source is turned off.	Turn on the light source. (p. 35)
	The light guide fiber is not connected correctly.	Connect it properly. (p. 89)
	The RS-232C cable is not connected correctly.	Connect it properly. (p. 90)
	The information of the light source is not registered correctly.	Perform the setup works for the microscope. (p. 36)

▶ Lamp (continued)

Problem	Cause	Countermeasure
The brightness of the lamp does not change even though the brightness control switch is pressed.	The lamp information is not registered correctly.	Perform the setup works for the microscope. (p. 36)
The brightness of the lamp does not change even though the brightness control switch is pressed. (For the simultaneous illumination)	The information of the external power supply is not registered correctly.	Perform the setup works for the microscope. (p. 36)
	The power supply is operated manually.	Connect the control cable correctly and turn the EXTERNAL switch to the ON position. (p. 88)
The brightness of the lamp does not change even though the brightness control switch is pressed. (For the external light source)	The information of the light source is not registered correctly.	Perform the setup works for the microscope. (p. 36)
	The light source is operated manually.	Connect the RS-232C cable. (p. 90)
The brightness of the illumination changes when objectives or filter cubes are changed.	Interlock controls are enabled.	Disable the interlock controls. (Refer to "LV Series Support Tools software manual.")
	The information of the microscope configuration is not registered correctly.	Perform the setup works for the microscope. (p. 36)
The brightness of the illumination does not become a suitable level even though objectives or filter cubes are changed.	Interlock controls are disabled.	Enable the interlock controls. (Refer to "LV Series Support Tools software manual.")
	The information of the microscope configuration is not registered correctly.	Perform the setup works for the microscope. (p. 36)

▶ LV-UEPI2A

Problem	Cause	Countermeasure
The aperture diaphragm for the episcopic illumination does not change even though the aperture diaphragm open/close switch is pressed.	The cable for the LV-UEPI2A is not connected correctly.	Connect it properly. (p. 82)
The filter cube turret does not move even though the CUBE switch is pressed.	The cable for the LV-UEPI2A is not connected correctly.	Connect it properly. (p. 82)
The aperture diaphragm for the episcopic illumination does not move in conjunction with changing objectives.	Interlock controls are disabled.	Enable the interlock controls. (Refer to "LV Series Support Tools software manual.")
The aperture diaphragm for the episcopic illumination does not move in conjunction with changing filter cube turret.	Interlock controls are disabled.	Enable the interlock controls. (Refer to "LV Series Support Tools software manual.")
The aperture diaphragm does not change to a suitable size even though the information of the objectives is registered correctly and the objectives are changed correctly.	The correction value for the aperture diaphragm size is not suitable for the objective change.	Restore the correction value to the initial condition. Or, change the value to a suitable one. (Refer to "LV Series Support Tools software manual.")

▶ Motorized nosepiece

Problem	Cause	Countermeasure
Objectives do not change even though the OBJ. switch is pressed.	The cable for the motorized nosepiece is not connected correctly.	Connect it properly. (p. 79)
The nosepiece does not rotate smoothly, or it stops in an intermediate position and returns to the previous objective position.	Attached objectives are few in number and they are located in an eccentric way.	Push the OBJ. switch several times and repeat the rotation of the nosepiece. (p. 43)
Sometimes the high magnification objective does not come to the optical path position.	It is disabled to switch the objective to the high magnification objective.	Rotate the nosepiece in the opposite direction or enable the switching.(p. 43) (Refer to "LV Series Support Tools software manual.")
When objectives are switched, the aperture diaphragm size for the episcopic illumination or the brightness of the lamp changes.	Interlock controls are enabled.	Disable the interlock controls. (Refer to "LV Series Support Tools software manual.")
	The information of the microscope configuration is not registered correctly.	Perform the setup works for the microscope. (p. 36)
The aperture diaphragm size for the episcopic illumination or the brightness of the lamp does not change in conjunction with switching objectives.	Interlock controls are disabled.	Enable the interlock controls. (Refer to "LV Series Support Tools software manual.")
	The information of the microscope configuration is not registered correctly.	Perform the setup works for the microscope. (p. 36)

VI Care and Maintenance

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, etc. 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, etc.
- 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 microscope (flip it to the "○" 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.

VII Specifications

▶ LV100DA-U

Model name	ECLIPSE LV100DA-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-UEPI2A Motorized Universal Epi Illuminator 2A
	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, simultaneous illumination is available when used with an external power supply)
	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/marking)	
	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	
Interface	UEPI2A connector:	for LV-UEPI2A epi illuminator
	USB connector:	for PC to perform setup work, for the DS-L2 (USB 1.1 compatible)
	RS-232C connector:	for external light source
	LCNT connector:	for external power supply for lamp (for simultaneous illumination)
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	• 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 appreil 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) CE marking • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. (EN61326)

▶ LV-UEPI2A

Model name	LV-UEPI2A Motorized Universal Epi Illuminator 2A
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: motor 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: motorized Variable range: 1.2 to 8.0 mm in diameter (bright-field microscopy) Projected magnification: 1.55x (on the objective pupil plane) Full open diameter (for dark-field microscopy): 8.5 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
Interface	Special interface (for LV100DA or LV-ECON)
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)

▶ LV-NU5AI

Model name	LV-NU5AI U5AI Motorized Nosepiece
Mountable objective number	5
Objective switching method	Rotating the motorized nosepiece Nosepiece drive device: center motor Switching time: approximately 0.5 seconds
Dimensions	Overall height: 88.9 mm Outer diameter: 127 mm Inclination angle: 15° Dimension of objective thread: M32 x 0.75 mm Distance between the attachment position of the objective barrel and the attachment reference position of the nosepiece: 53 mm
Joint part to the microscope	Sliding dovetail (reference dimension: 50 mm)
Slot for the DIC slider	Dovetail, five locations (Each objective address has a slot for it.)
Slot for the lambda plate slider	Slot size: 16.5 mm x 24 mm Built-in swing-out mechanism for the bright-field/dark-field optical path separation ring (interlocked with the lambda plate slider insertion)
Interface	Connector of 12-pin
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)

▶ LV-NU5A, LV-NU5AC

Model name	LV-NU5A Motorized Universal Quintuple Nosepiece LV-NU5AC Motorized Universal Quintuple Centerable Nosepiece
Mountable objective number	5
Objective switching method	Rotating the motorized nosepiece Nosepiece drive device: center motor Switching time: approximately 0.5 seconds
Dimensions	Overall height: 88.9 mm Outer diameter: 127 mm Inclination angle angle: 15° Dimension of objective thread: M32 x 0.75 mm Distance between the attachment position of the objective barrel and the attachment reference position of the nosepiece: 48 mm
Joint part to the microscope	Sliding dovetail (reference dimension: 50 mm)
Slot size for the Nomarski slider	16.5 mm x 24 mm
Objective centering mechanism (only for the LV-NU5AC)	One fixed objective and four centerable objectives Centering screw: two M3 setscrews (two screws for each objective) Centering range: 0.3 mm in diameter
Interface	Connector of 12-pin
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-PS100W power supply
Input ratings	100 to 240 VAC, 2.4 A, 50/60 Hz
Power cord	When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type (3 conductor grounding Type SVT, NO.18 AWG, 3m 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 (3 conductor grounding Type H05VV-F, 3m 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.)
Output ratings	12 VDC, 100 W, 8.4 A
Built-in fuse ratings	250 V T4A
Operating conditions	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 conditions	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)
Safety standards compliance	UL listed, GS approved, CE certified