

M616E 12.9.NF.1



M616EN01

Nikon

Industrial Microscope

ECLIPSE LV150N/LV150NA

Instructions

Introduction

Thank you for purchasing a Nikon product.

This instruction manual is written for users of the Nikon ECLIPSE LV150N/LV150NA microscopes.

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

- No part of this manual may be reproduced or transmitted in any form without prior written permission from Nikon.
- The contents of this manual are subject to change without notice.
- The equipment described in this manual may differ from the actual product in its appearance.
- Although every effort has been made to ensure the accuracy of this manual, errors or inconsistencies may remain. If you note any points that are unclear or incorrect, please contact your nearest Nikon representative.
- Some of the equipment described in this manual may not be included in the set you have purchased.
- If you intend to use any other equipment with this product, read the manual for that equipment too.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Symbols Used in This Manual

The following symbols are used in this manual.

◆ Symbols for Safety



WARNING

Highlights important information that should be noted for safety. Read "Safety Precautions" for details.



CAUTION

◆ Other Symbols



Indicates information you should note or comply with to prevent defects or malfunction of this product.



Indicates information you should be aware of in using this product, as well as other useful information.

Contents

Introduction	i
Symbols Used in This Manual	i
Safety Precautions	iv
WARNING and CAUTION Symbols.....	iv
Meaning of Symbols Used on the Product	iv
⚠ WARNING.....	v
⚠ CAUTION.....	vii
Layout Diagrams.....	ix
Operating Posture.....	x

Chapter

1

Names of Each Part..... 1

1 When Configured with the LV-UEPI-N Universal Epi-illumination Attachment	1
2 When Configured with the LV-UEPI2 Universal Epi Illuminator 2.....	3
3 Rear View.....	5

Chapter

2

Microscopy Procedures..... 6

1 Bright-field Microscopy under Epi Illumination	7
2 Dark-field Microscopy under Epi Illumination	17
3 Polarization Microscopy Under Epi Illumination (Simplified/Sensitive Color)	21
4 Differential Interference Contrast Microscopy under Epi Illumination.....	26
5 Epi-fl Microscopy (Only with the LV-UEPI2 Attached)	31

Chapter

3

Operation of Each Part..... 34

1 Turning the Power On/Off.....	34
2 Controlling Illumination	35
3 Switching the Microscopy Type	36
4 Switching the Optical Path	38
5 Adjusting the Binocular Angle (LV-TT2 only)	39
6 Adjusting the Interpupillary Distance	39
7 Adjusting the Diopter	39
8 Focusing on the Sample.....	40
9 Moving the Sample.....	42
10 Switching the Objectives	43
11 Inserting and Removing Filters.....	44
12 Adjusting the Field Diaphragm	45
13 Adjusting the Aperture Diaphragm	46
14 Using the Polarizer Slider.....	47
15 Using the Analyzer Slider	48
16 Performing Sensitive Color Microscopy Using the Lambda Plate Slider (LV-UEPI2 only).....	49
17 Using the DIC Slider.....	50
18 Using Filter Cubes for Fluorescence Observation (LV-UEPI2 Only)	51
19 Using the Excitation Light Balancer (LV-UEPI2 only)	54

Chapter 4	Assembly.....	56
	[1] Checking the Input Voltage.....	58
	[2] Attaching the Stage and the Holder.....	58
	[3] Assembling the Nosepiece.....	59
	[4] Attaching the Epi-illumination Attachment.....	60
	[5] Attaching the Lamphouse and Replacing the Lamp.....	63
	[6] Attaching the Fiber Adapter and Precentered Fiber Illuminator.....	65
	[7] Attaching the Eyepiece Tube.....	66
	[8] Attaching Eyepieces.....	67
	[9] Attaching Objectives.....	67
	[10] Attaching Eye Level Riser.....	67
	[11] Attaching Column Riser.....	68
	[12] Connecting the Power Cord.....	68
	[13] Connecting PC/DS-L3 (LV150NA only).....	69
	[14] Connecting the RS-232C (LV150NA only).....	69
	[15] Installing Separately Sold Accessories.....	69
	[16] Anti-static Treatment.....	69
	[17] Countermeasures to Earthquakes.....	70
Chapter 5	External Communications Control (LV150NA only).....	71
	1 Serial Communication.....	71
	2 USB Communication.....	78
Chapter 6	Troubleshooting.....	79
	1 Optical System and Operation.....	79
	1.1 General.....	79
	1.2 Epi-fluorescence Microscopy.....	83
	1.3 Differential Interference Contrast Microscopy.....	84
	1.4 Simplified Polarization Microscopy.....	84
	2 Electrical Requirements.....	85
	2.1 General.....	85
Chapter 7	Maintenance and Storage.....	86
	1 Cleaning Lenses and Filters.....	87
	2 Cleaning the Painted, Plastic, and Printed Parts.....	87
	3 Storage.....	87
	4 Regular Inspections (Charged).....	87
Chapter 8	Specifications.....	88

Safety Precautions

To ensure correct and safe operation, read this manual before using this product.

WARNING and CAUTION Symbols

Although this product is designed and manufactured to be completely safe during use, incorrect usage or failure to follow the safety instructions provided may cause personal injury or property damage. To ensure correct usage, read this manual carefully before using this 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 indicate their importance. For your safety, always follow the instructions marked with these symbols.

Symbol	Description
 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

When appearing on this product, the symbols below indicate the need for caution at all times during use. Read the relevant instructions in this manual before attempting to use or adjust any part to which the symbol has been affixed.

	<p>Caution for heat.</p> <p>This marking on the rear of the lamphouse, and on the rear-right side of the epi-illumination attachments (LV-UEPI-N and LV-UEPI2), calls your attention on the following. For the symbol position, see pages 1, 3, and 5.</p> <ul style="list-style-type: none"> • The lamphouse is very hot during and immediately after illumination. • Risk of burns. Do not touch the lamphouse during and immediately after illumination. • Make sure that the lamphouse has sufficiently cooled before replacing the lamp.
	<p>Light safety precautions</p> <p>This marking close to the microscopy selection knob of the LV-UEPI2 calls your attention to the following: The position of the marking is shown on page 3 in this manual.</p> <ul style="list-style-type: none"> • Ultraviolet light that is harmful to the eyes and skin is emitted from the objective or the nosepiece opening where objectives are to be attached, via the LV-UEPI2. • Do not look at the emitted light directly and do not look at the reflected light. • To avoid light leakage, cover the openings of the nosepiece to which objectives are not attached using supplied caps. • Referring to WARNING 10 and 11 on page vi, and Chapter 4, step 4, "Attaching the Epi-illumination Attachment", pay attention to the handling of the epi-illumination attachment.



WARNING

1 Intended product use

This microscope should only be used for microscopic observation. Do not use it for any other purpose. Do not observe such a large sample as to stick out of the stage.

2 Do not disassemble.

Disassembly may cause malfunction, electrical shock, and/or injury. Any injury or damage due to such an act will not be warranted. Do not disassemble any part other than those described in this manual. If you experience any problem with the microscope, notify your nearest Nikon representative.

3 Read the instruction manuals carefully.

For your safety, carefully read this manual and the manuals provided with the other products to be used with the system. Be sure to read warnings and cautions at the beginning of each manual in particular.

When the external light source is used:

When you use the external light source using a mercury lamp, handle the lamp with extreme caution. Read the manual for the light source carefully and observe handling precautions.

4 Ratings of power supply

The power circuit in this instrument is rated for AC power supplies of 100 to 240 V, 50/60 Hz. When connecting the instrument to a power line, check that the line conforms to the voltage and frequency ratings mentioned above.

Use of a power line that does not satisfy the ratings may lead to equipment malfunction or damage or a fire.

5 Power cord

Use only the supplied power cord. Using the wrong power cord could result in damage or a fire. Also, connect the microscope to a PE (protective earth) terminal, since the microscope complies with the electric shock protection class I.

And besides, to prevent electrical shock, always turn off the power switch (press it to "O" side) before connecting or disconnecting the power cord.

For details about the specified power cord, see Chapter 8, "Specifications."

6 Specified light source

This microscope must be used with a specified light source. The following light source combinations are specified for this microscope.

- **Epi-illumination attachment:**

Nikon Universal Epi-illumination Attachment (LV-UEPI-N) or
Nikon Universal Epi Illuminator 2 (LV-UEPI2)

- **Lamphouse:**

Nikon precentered lamphouse 12V 50W (LV-LH50PC)

- **Lamp:**

Nikon 12V 50W LONGLIFE halogen lamp (LV-HL50W), or non-Nikon 12V 50W SHORTLIFE halogen lamp (OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027)

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

7 Light source other than the specified ones

To perform epi-fl microscopy with the LV-UEPI2 universal epi illuminator 2, the specified light source brightness may be less than the desired brightness. In this case, an external light source can be attached to the LV-UEPI2.

Use Nikon's manual (C-HGFI) or motorized (C-HGFIE) HG precentered fiber illuminator as external light source. With the microscope model of LV150NA, in particular, be sure to attach the C-HGFIE motorized HG precentered fiber illuminator to prevent a flash of light. The C-HGFIE must be connected with the LV150NA through the RS-232C cable attached to the light source. When the LV150N is used, either external light source will work.



WARNING

8 Heat from the light source

The lamp and the lamphouse become extremely hot. To avoid burns, do not touch the lamphouse 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 lamphouse 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 main body and lamphouse.

If the air vents are blocked, the temperature of the microscope will raise. And it results in damage or fire.

10 Ultraviolet light from an HG precentered fiber illuminator

If you use an HG precentered fiber illuminator, the light source radiates ultraviolet light that is harmful to the eyes and skin from the emission port. Direct viewing of illumination light from objectives or reflection light from the sample may result in snow blindness at a light case or blindness at worst. Do not observe the objective and its surrounding for a long time. To prevent injury, follow the guidelines below.

- 1) In order to avoid light leakage, be sure to attach the caps supplied with the nosepiece to the nosepiece's objective mount if objectives are not attached to it.**
- 2) When performing the epi-fl microscopy using UV excitation light, attach the filter cube provided specially for UV excitation light. And then, if you must see the objective or its surroundings, be sure to observe through the ultraviolet light shield.**

3) Attach the light source to the microscope during use.

Always attach the light source to the microscope when the light source is ready to turn on. Do not turn on the light source unattached to the microscope, or remove the light source from the microscope while the light source is lit. When removing 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 samples reflect illumination. Do not observe the illuminated surface of a sample for a long time because the strong reflection may hurt your eyes. When performing fl microscopy with UV excitation, be sure to observe the sample through the ultraviolet light shield.



<p>1 Handle the system gently</p> <p>Components of this system are precision optical instruments. Handle them carefully, and do not subject them to any shocks.</p> <p>The precision of the objectives in particular can be adversely affected even by weak shocks.</p> <p>2 Do not wet the microscope</p> <p>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 (press it to the "O" side) and unplug the power cord from the wall outlet. Then, wipe away the moisture using a dry cloth or the like. If water gets inside the microscope, do not use it; instead, notify your nearest Nikon representative.</p> <p>3 Weak electromagnetic waves</p> <p>This microscope emits weak electromagnetic waves. The accuracy of any precision electronic equipment may be adversely affected if positioned too close. If the microscope affects TV or radio reception, move the radio or TV farther away from the microscope.</p> <p>4 Installation location</p> <p>Being a precision optical instrument, the microscope may get damaged or loose accuracy if it is used or stored under unsuitable conditions. When selecting the installation location, note the following:</p> <ul style="list-style-type: none"> ● Avoid a brightly lit location, such as exposed to direct sunlight or directly under a room light. The image quality deteriorates if there is excessive ambient light. ● Always install the microscope with a surrounding clear area of 10 cm or more. ● Choose a location that is free from dust or dirt. ● Choose a flat surface with little vibration. ● Choose a sturdy desk or table that is able to bear the weight of the instrument. ● Do not install the microscope in a hot or humid location. ● Select a layout that allows easy removal of the power cord from the microscope's AC inlet in the event of an emergency. 	<ul style="list-style-type: none"> ● For details about the operating environment and storage environment, see Chapter 8, "Specifications." ● Take enough space around the microscope referring to the layout diagrams on page ix. ● The microscope may be moved by earthquakes. We recommend taking anti-earthquake measures. For details about the anti-earthquake measures, see Chapter 4, Step 17, "Countermeasures to Earthquakes." <p>5 Cautions on moving the microscope</p> <ul style="list-style-type: none"> ● The microscope is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may lose accuracy when exposed to even a weak physical shock.) ● When moving the microscope, <u>first remove the stage and the lamphouse</u>. Then, securely hold the microscope by the root of the arm from the back. (Information) The microscope with the stage, eyepiece tube, lamphouse, and other parts attached, weighs approx. 20 kg. ● Do not hold the focusing knobs, eyepiece tube, lamphouse, sub-stage, etc., when carrying the microscope. They may come off and may cause serious injury or malfunction. ● Before carrying the stage, attach the fixing metals to hold the movement of the stage plate. ● Be careful not to pinch your fingers or hands during transportation. <p>6 Cautions on assembling the microscope</p> <ul style="list-style-type: none"> ● Be careful not to pinch your fingers or hands during assembly. ● Scratches or fingerprints on the lens surface will adversely affect the microscope image. Be careful not to scratch or touch the lens surfaces.
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CAUTION

7 Cautions on lamp replacement

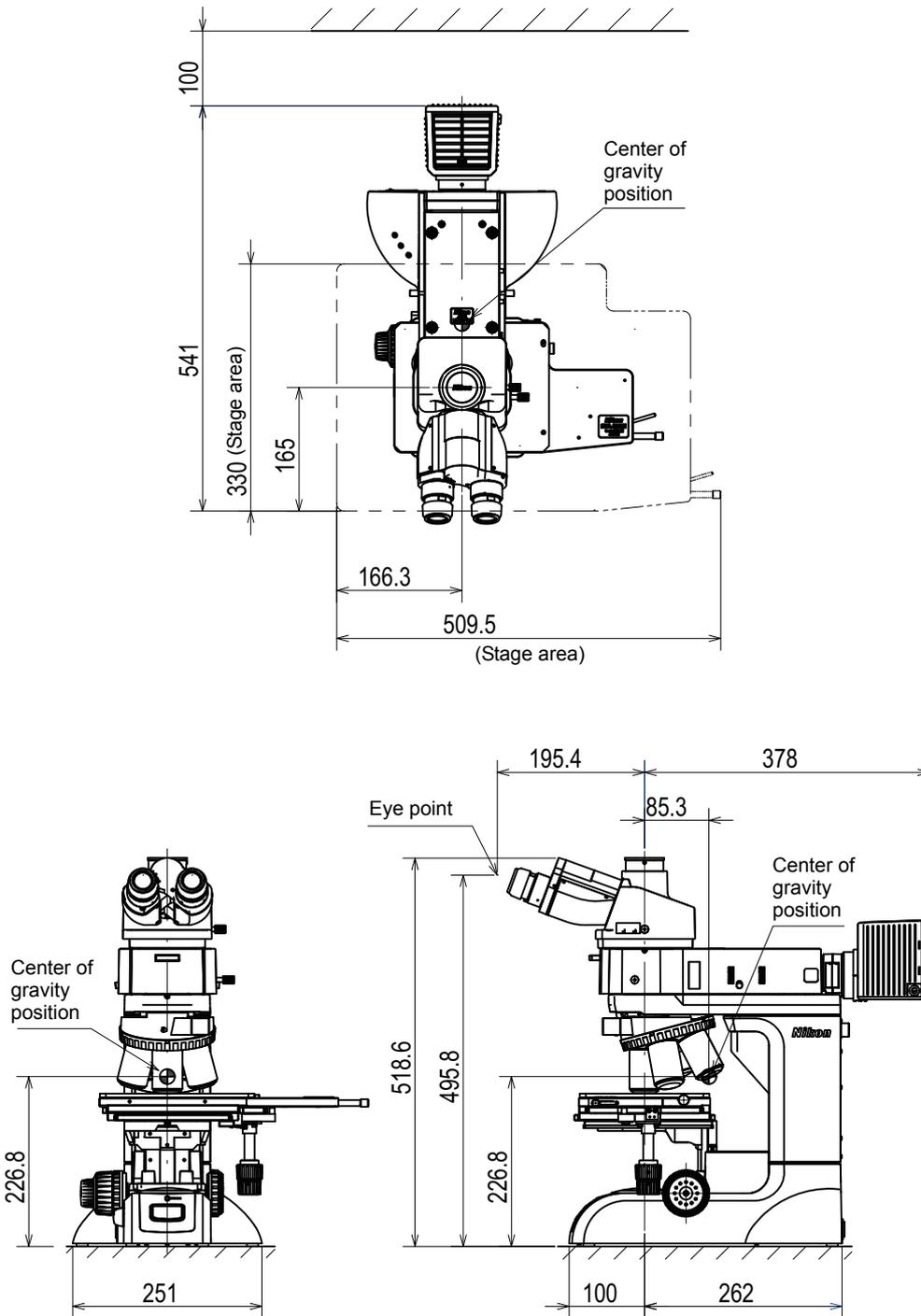
- To prevent burn injury, allow the lamp to cool down sufficiently (for at least 30 minutes after it is turned off) before replacing the lamp.
- To prevent electrical shock and damage to the microscope, always turn off the power switch (press it to the “O” side) and unplug the power cord from the wall outlet before connecting or disconnecting the lamphouse.
- Do not touch the glass surface of the lamp with bare hands. Fingerprints or grease on the bulb surface will reduce the illumination intensity of the lamp. Wipe out any fingerprints or grease attached to the surface.
- Securely attach the lamphouse cover to the lamphouse after replacing the lamp. Never light the lamp while the lamphouse cover is open.
- When you dispose of the replaced lamp, do not break it up. Instead, dispose of the used lamp as special industrial waste or dispose of it according to the local regulations and rules.

8 Handing of filter cubes

When using the microscope configured with the LV-UEPI2 universal epi illuminator 2, a filter cube can be attached to enable epi-fl microscopy. Note the following precautions for handling a filter cube.

- Interference filters (in particular, excitation filters exposed to intense light) are subject to aging. Replace them depending on their total operating hours.
- Filters can change in characteristics under high humidity. To avoid changes in characteristics and quality, do not use or store filters at high temperatures or high humidity, or expose them to rapid temperature changes. When not using filters, they should be stored with a drying agent in desiccators or sealed containers.
- The filters fitted in the nine types of filter cubes listed below have sharper wavelength characteristics than ordinary filters. However, these filters should be handled with care as they are applied with complicate coating. In particular, be cautious against wear during cleaning. (Observe the procedures described in Chapter 7, “1 Cleaning Lenses and Filters.”)
 Single-band filter cubes: DAPI, FITC, TxRed, and GFP
 Multi-band filter cubes: F-R, F-T, D-F, D-F-R, and D-F-T.

Layout Diagrams



Unit: mm

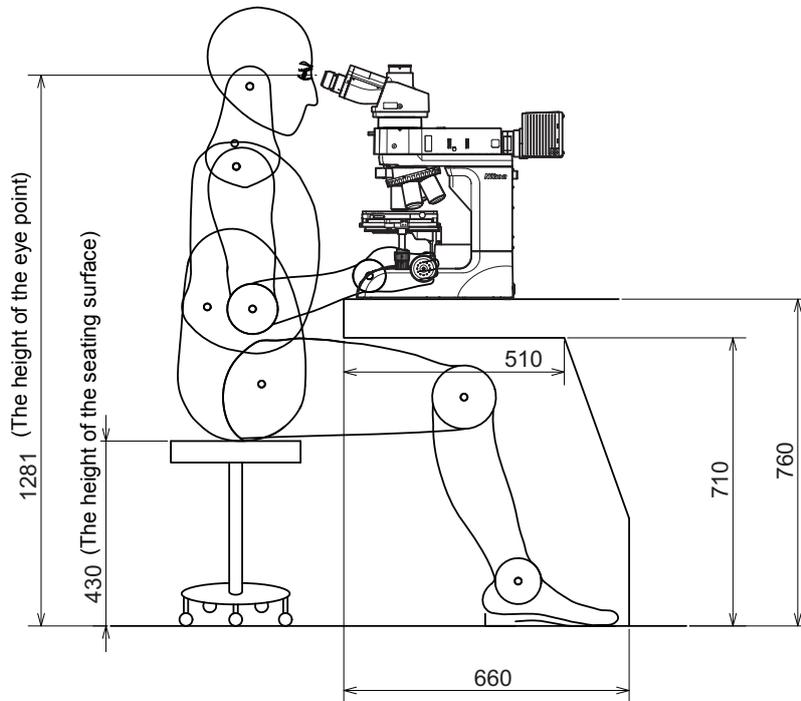
This illustration depicts the LV150NA microscope configured with the LV-UEPI-N universal epi-illumination attachment, LV-T13 eyepiece tube, LV-LH50PC precentered lamphouse, and 6x6 stage.

Operating Posture

The figure below shows the operating posture that prevents strain on your body.

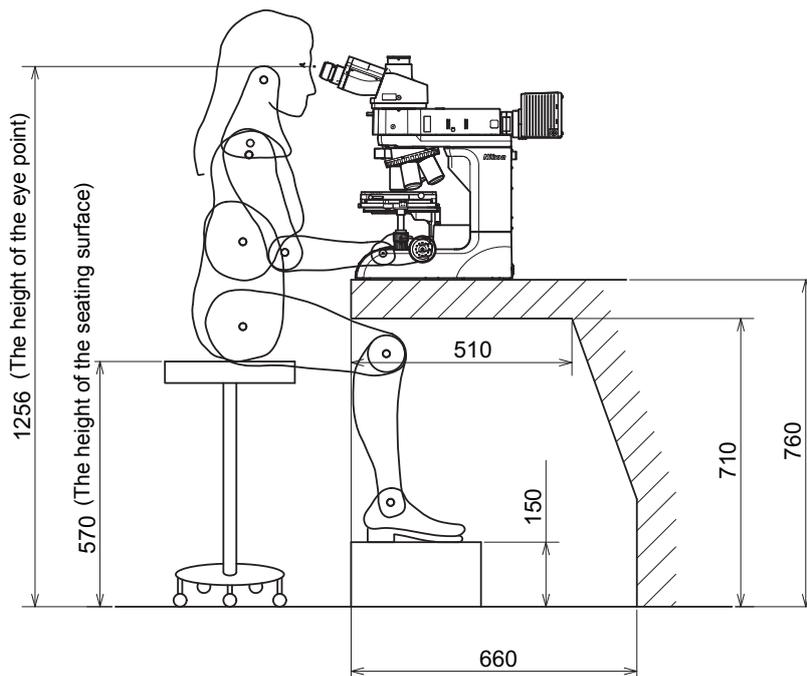
Choose a workbench and a chair having similar dimensions to those shown in the figure.

The 95th percentile male (Height: 189.5 cm)



- * The height of the eye point is that when one eye-level riser is mounted on the microscope.
- * Take at least 610 mm of horizontal clearance for your legs.

The 5th percentile female (Height: 147.5 cm)



- * Take at least 610 mm of horizontal clearance for your legs.

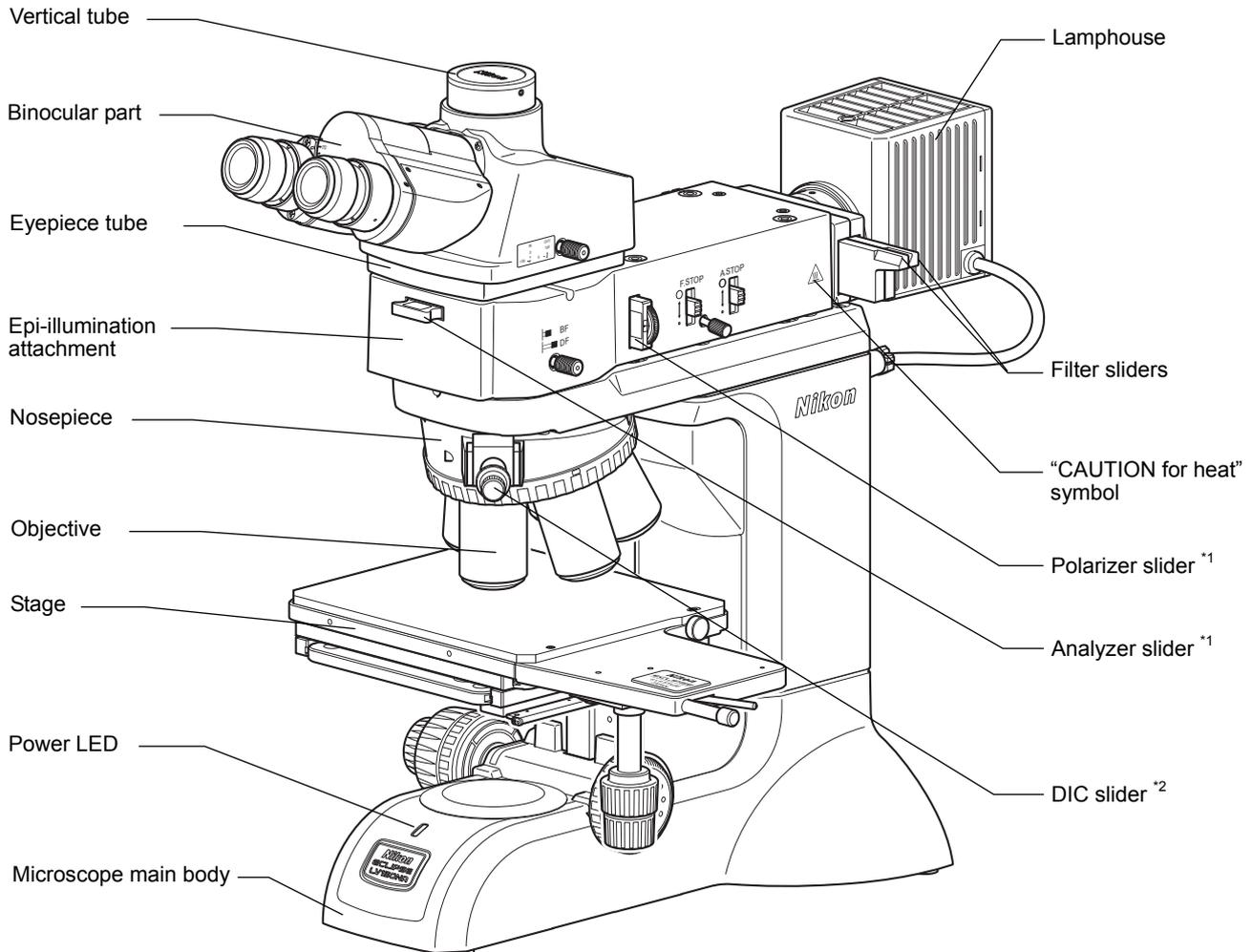
1

Names of Each Part

1

When Configured with the LV-UEPI-N Universal Epi-illumination Attachment

Names of Parts

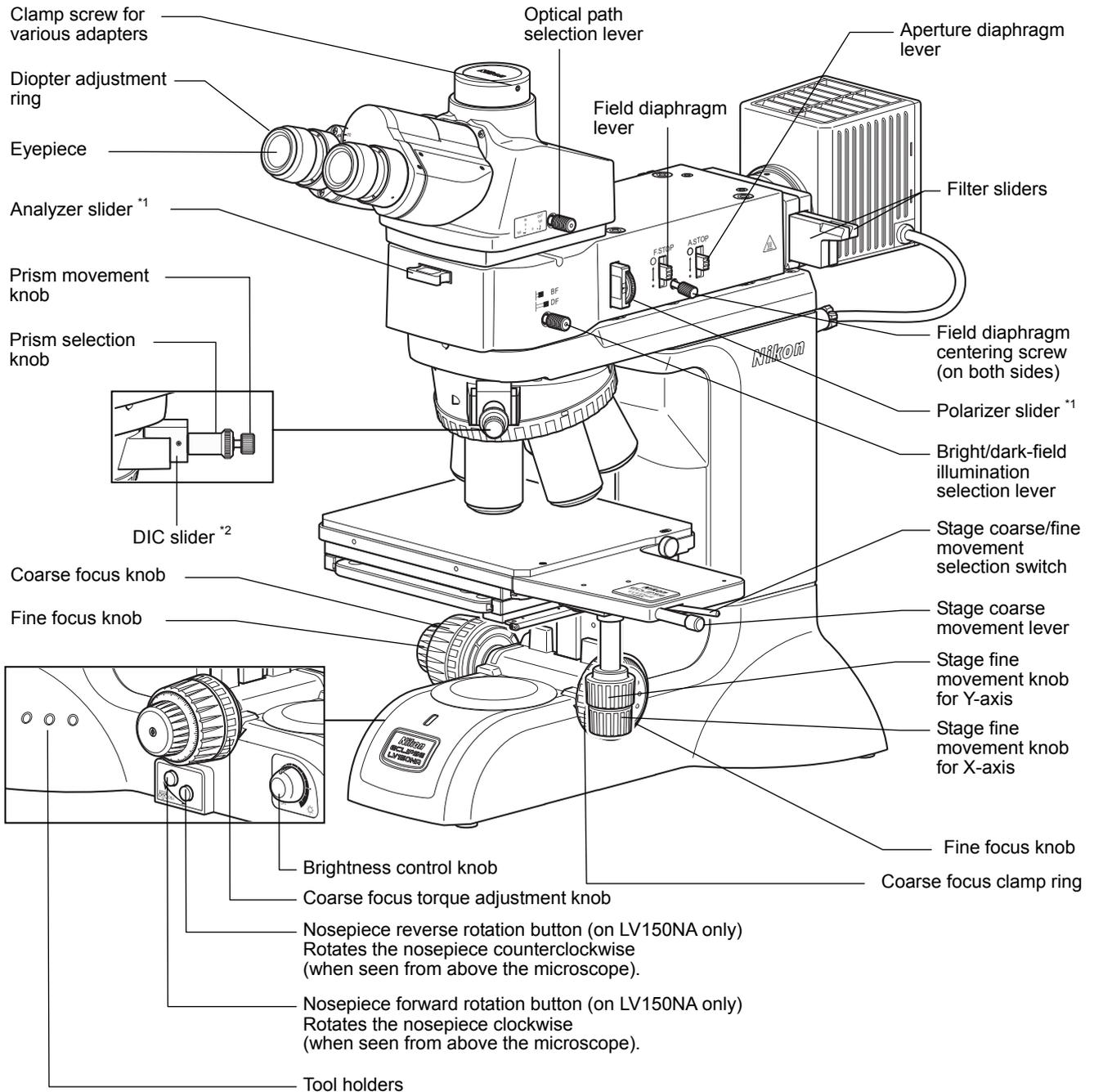


*1: For DIC microscopy or simplified polarization microscopy

*2: For DIC microscopy

This drawing depicts the ECLIPSE LV150NA microscope configured with the LV-UEPI-N universal epi-illumination attachment, LV-T13 trinocular eyepiece tube ESD, LV-LH50PC precentered lamphouse, LV-S6 6x6 stage, and attachments for DIC microscopy.

Names of Operational Parts



*1: For DIC microscopy or simplified polarization microscopy

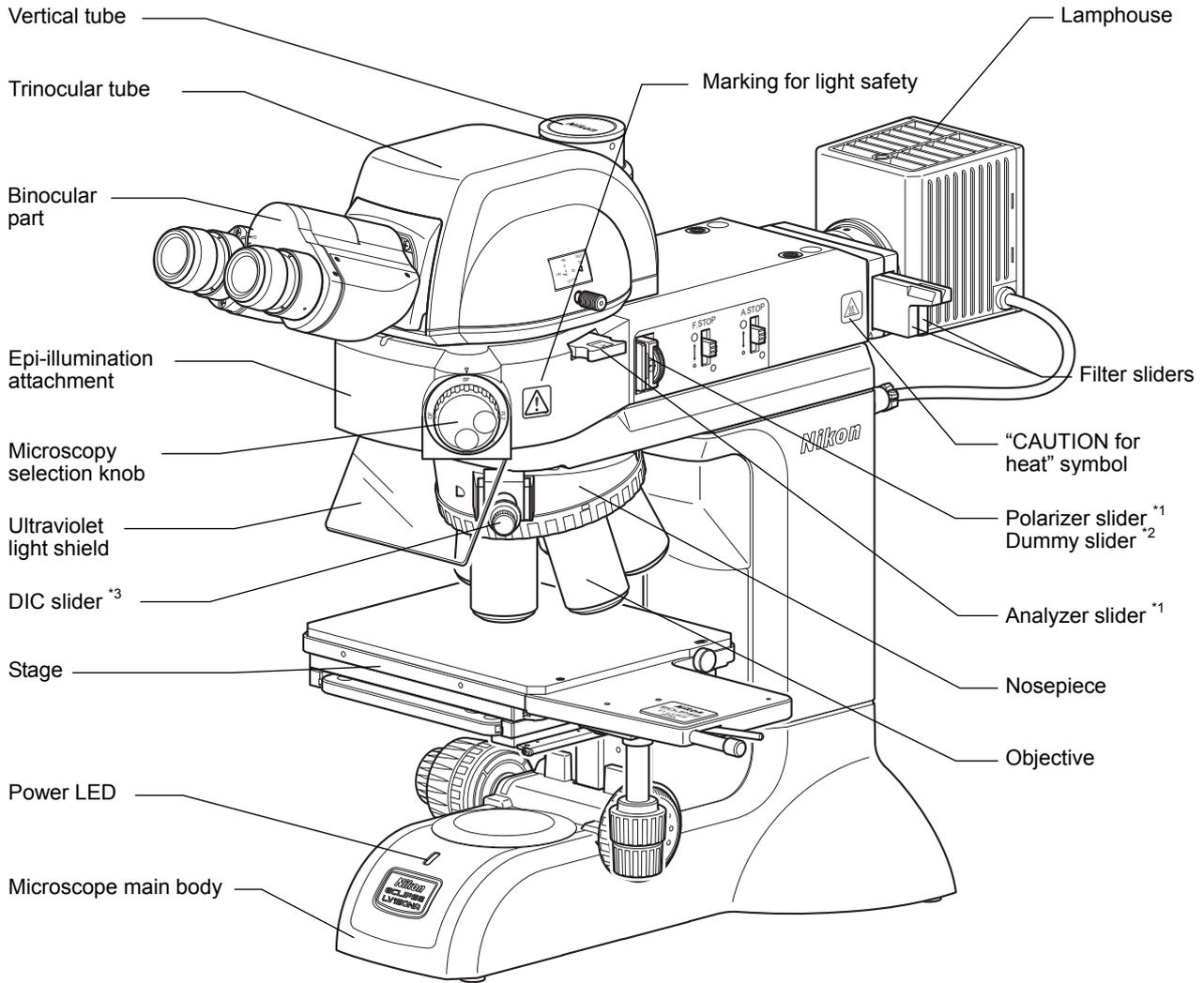
*2: For DIC microscopy

This drawing depicts the ECLIPSE LV150NA microscope configured with the LV-UEPI-N universal epi-illumination attachment, LV-T13 trinocular eyepiece tube ESD, LV-LH50PC precentered lamphouse, LV-S6 6x6 stage, and attachments for DIC microscopy.

2

When Configured with the LV-UEPI2 Universal Epi Illuminator 2

Names of Parts



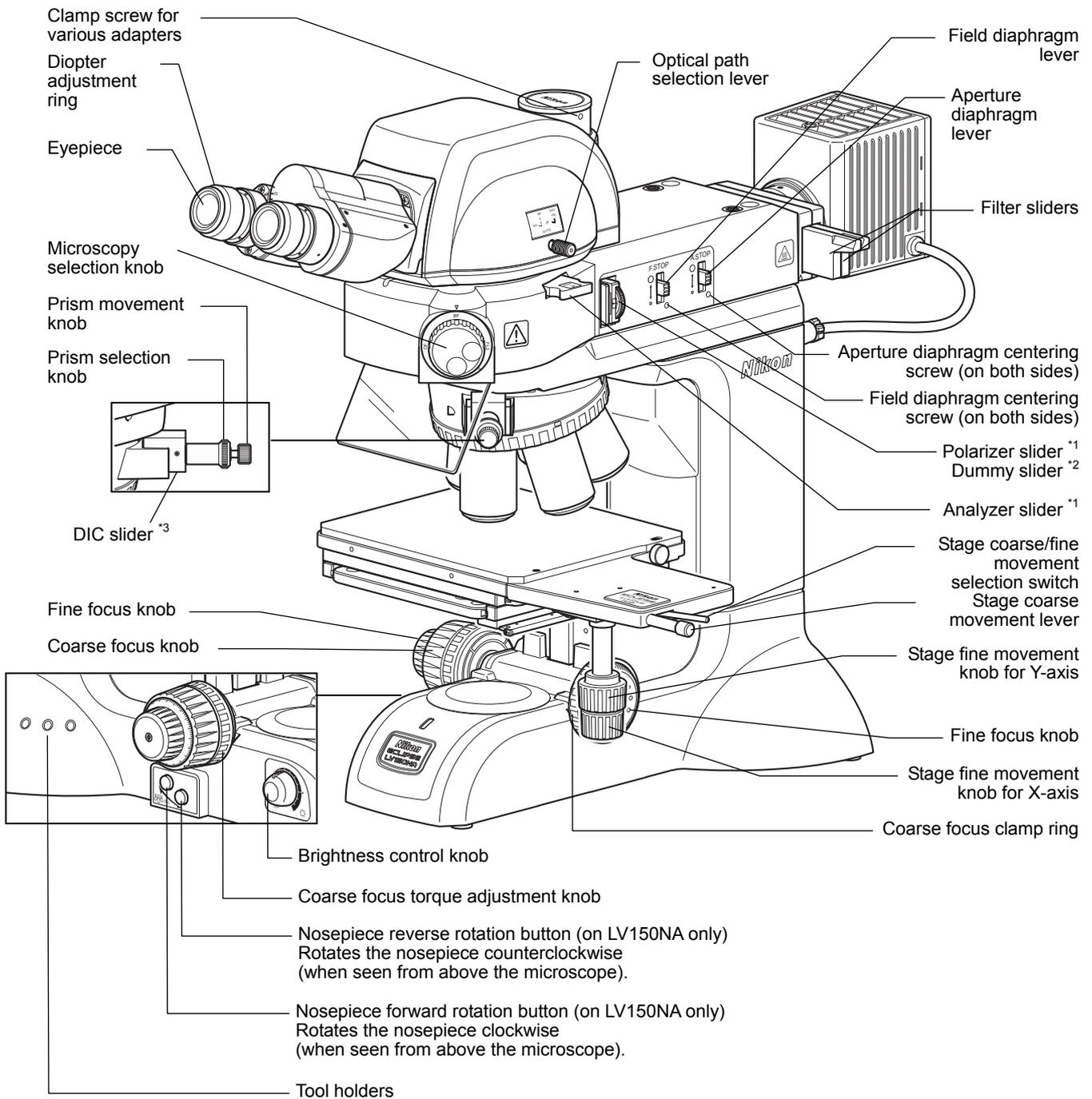
*1: For DIC microscopy, simplified polarization microscopy, or sensitive polarization microscopy

*2: Lambda plate slider in case of sensitive polarization microscopy

*3: For DIC microscopy

This drawing depicts the ECLIPSE LV150NA microscope configured with the LV-UEPI2 universal epi illuminator 2, LV-TT2 trinocular tube, LV-LH50PC precentered lamphouse, LV-S6 6x6 stage, and attachments for DIC microscopy.

Names of Operational Parts

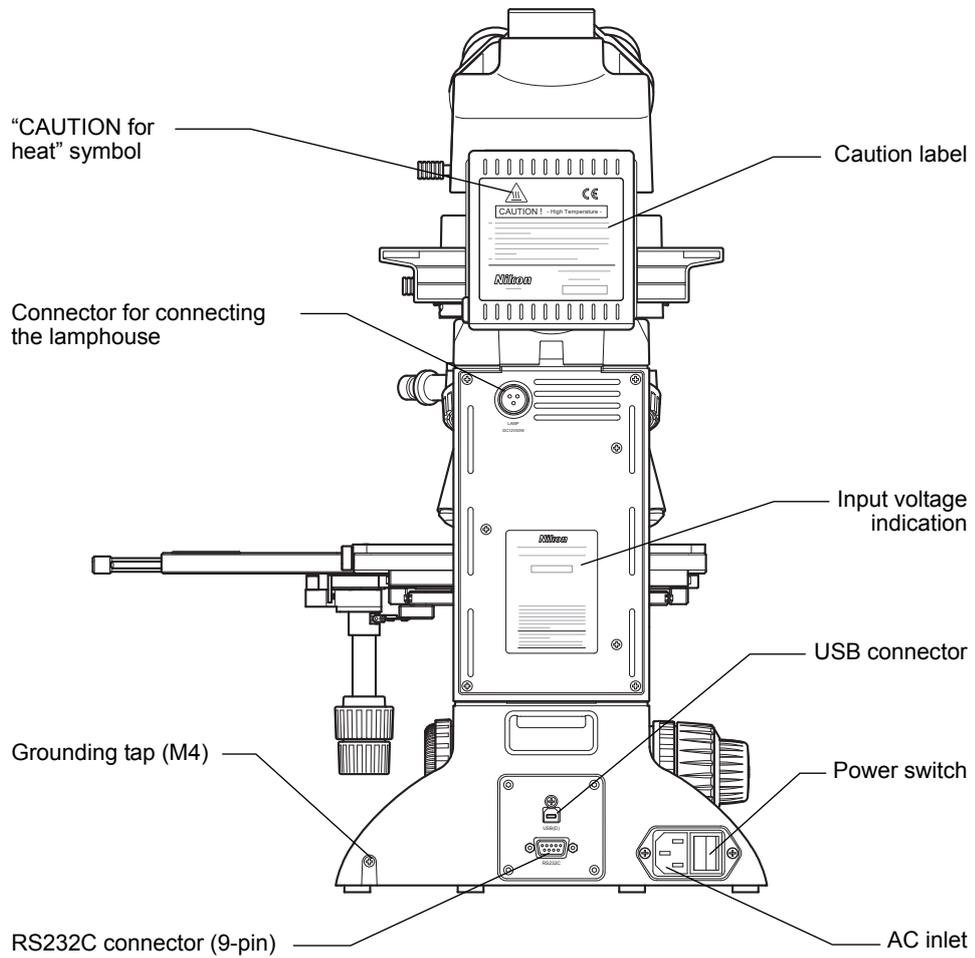


- *1: For DIC microscopy, simplified polarization microscopy, or sensitive polarization microscopy
- *2: Lambda plate slider in case of sensitive polarization microscopy
- *3: For DIC microscopy

This drawing depicts the ECLIPSE LV150NA microscope configured with the LV-UEPI2 universal epi illuminator 2, LV-TT2 trinocular tube, LV-LH50PC precentered lamphouse, LV-S6 6x6 stage, and attachments for DIC microscopy.

3

Rear View



This drawing depicts the ECLIPSE LV150NA microscope configured with the LV-UEPI-N universal epi-illumination attachment, LV-TI3 trinocular eyepiece tube ESD, LV-LH50PC precentered lamphouse and LV-S6 6x6 stage.

2

Microscopy Procedures

This chapter explains the procedure for microscopy.

This microscope can be attached with two types of epi-illumination attachment: LV-UEPI-N or LV-UEPI2. See the table below for the microscopies available with the individual epi-illumination attachments, as well as the optional accessories required for each microscopy.

- See Chapter 4, “Assembly,” when the microscope has not been assembled yet.
- For detailed information about operations of parts of the microscope, see Chapter 3, “Operation of Each Part.”

Microscopy	Microscopy procedure	Epi-illumination attachment	Required accessories (optional)
Bright-field microscopy under epi illumination	P.7	LV-UEPI-N LV-UEPI2	—
Dark-field microscopy under epi illumination	P.17	LV-UEPI-N LV-UEPI2	BD objective Quintuple BD nosepiece (or quintuple universal nosepiece or motorized quintuple universal nosepiece*) (Dark-field microscopy cannot be performed with a sextuple nosepiece.)
Simplified polarization microscopy under epi illumination	P.21	LV-UEPI-N LV-UEPI2	Polarizer slider Analyzer slider
Sensitive color polarization microscopy under epi illumination	P.21	LV-UEPI2	Polarizer slider Analyzer slider Lambda plate slider
Differential interference contrast microscopy under epi illumination	P. 26	LV-UEPI-N LV-UEPI2	DIC objective for industrial microscopes Polarizer slider Analyzer slider DIC slider Quintuple universal nosepiece (or motorized quintuple universal nosepiece*)
Epi-fluorescence Microscopy	P.31	LV-UEPI2	Filter cube (up to two cubes can be attached) HG Precentered Fiber Illuminator Excitation light balancer (optional)

*LV150NA only

1

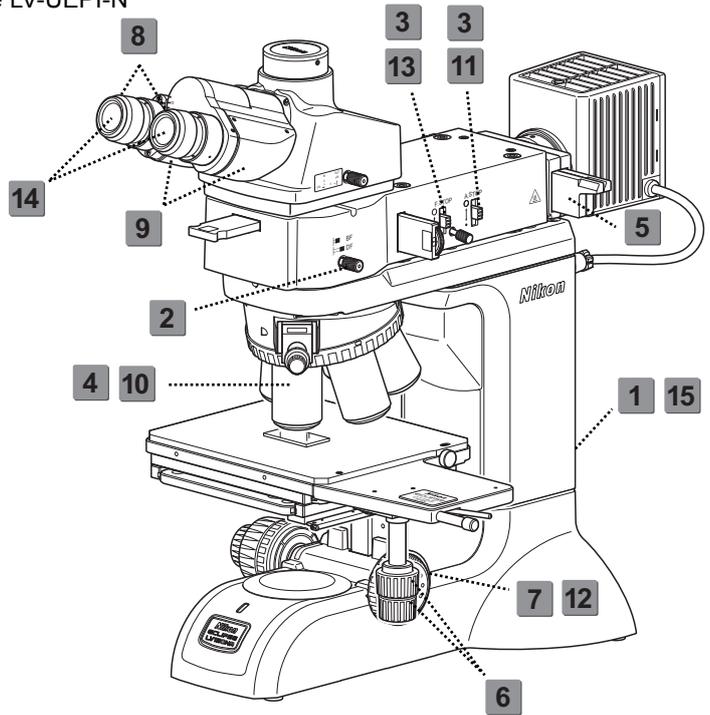
Bright-field Microscopy under Epi Illumination

! WARNING

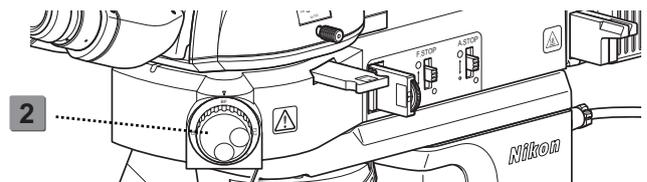
When using an HG precentered fiber illuminator together with an epi-illumination attachment, due to the characteristics of the light source (mercury lamp), special care must be taken when handling it. Make sure you are familiar with and adhere to all warnings and cautions described at the beginning of this instruction manual.

1. Turning on the power
2. Setting the epi-illumination attachment to BF
3. Opening the field and aperture diaphragms completely
4. Bringing the 10x objective into the optical path
5. Putting the NCB11 filter into the optical path
6. Bringing a sample into the optical path
7. Focusing on the sample
8. Adjusting the diopter
9. Adjusting the interpupillary distance
10. Bringing the desired objective into the optical path
11. Adjusting the aperture diaphragm
12. Focusing on the sample
13. Circumscribing the field diaphragm to the field of view
14. Viewing the sample
15. Turning off the power

For the LV-UEPI-N



For the LV-UEPI2

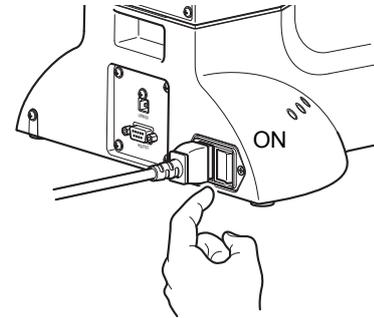


Preparation for microscopy

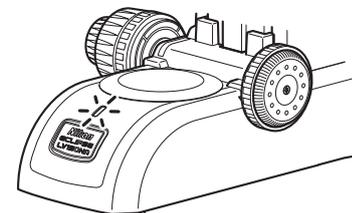
1 Turn on the power.

Turn on the power to the microscope by pressing the power switch to the “I” position. (The power LED on the front of the main body will light up.)

(When using an HG precentered fiber illuminator, for epi illumination, you need not turn on the power switch of the microscope. Go to step 2.)



Power switch ON



LED Illuminated

2 Place the epi-illumination attachment to the BF (bright-field) status.

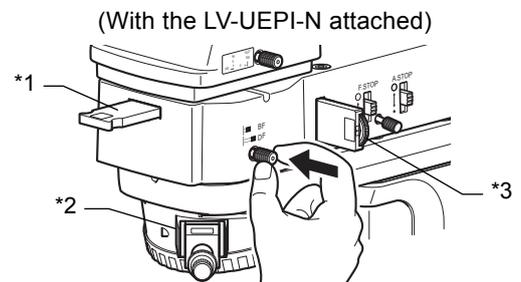
(With the LV-UEPI-N attached)

Push in the illumination selection lever to the “BF (bright-field)” position.

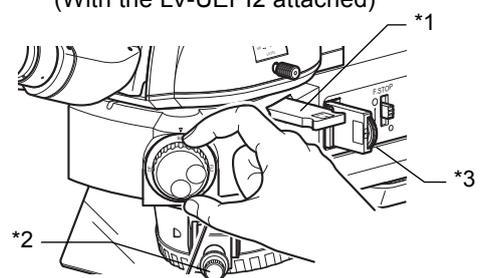
(With the LV-UEPI2 attached)

Turn the microscopy selection knob to the “BF (bright-field)” position.

* If using parts for differential interference contrast (*1 to *3), pull out the parts to remove them from the optical path.



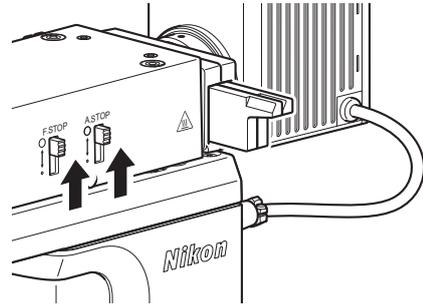
(With the LV-UEPI2 attached)



Positioning to “BF”

3 Open the field diaphragm and aperture diaphragm of the epi illumination completely.

Raise the field diaphragm lever and the aperture diaphragm lever.

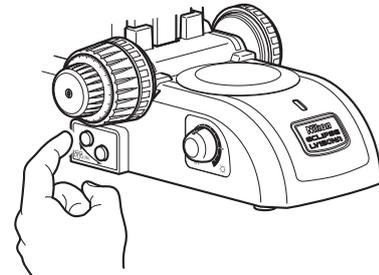


Opening the field and aperture diaphragms completely

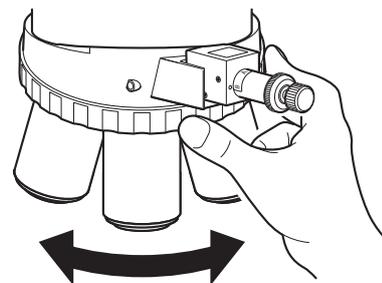
4 Bring the 10x objective into the optical path.

Turn the nosepiece to bring the 10x objective into the optical path.

- ✔ **Rotating the manual nosepiece**
Turn the manual nosepiece until it clicks.



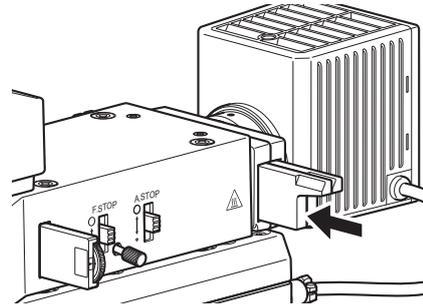
For a motorized nosepiece



For a manual nosepiece

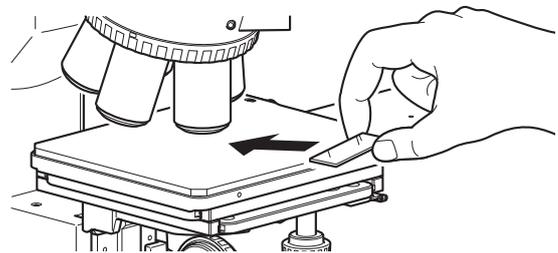
5 Put the NCB11 filter into the optical path and compensate color temperature.

Operate the filter slider to put the NCB11 filter into the optical path.



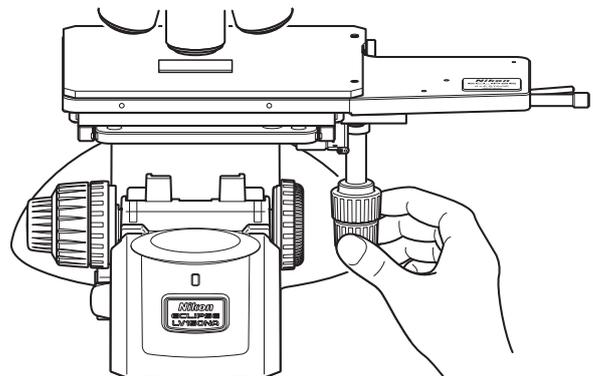
6 Place a sample on the stage, and move the stage to bring the target into view.

- (1) Set the sample onto the stage.



Setting the sample

- (2) Rotate the stage knob to move the stage and bring the target portion of the sample into the optical path.

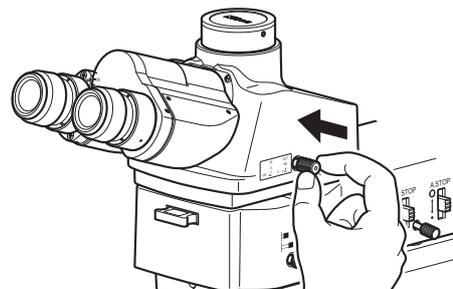


Bringing the target into the optical path

7 Focus on the sample.

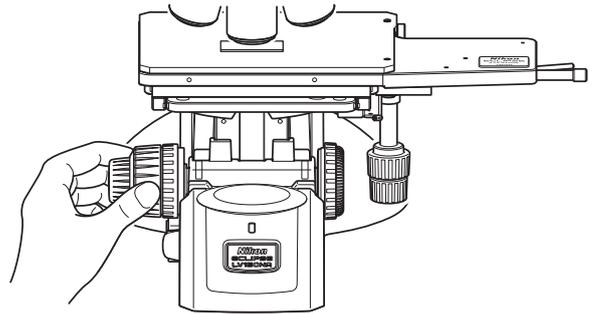
(→Chapter 3, “8 Focusing on the Sample”)

- (1) When using a trinocular tube, push in the optical path switching lever to distribute 100% of light to the binocular section.
- (2) Viewing the microscope from the side, turn the coarse focus knob backward to raise the stage to a level which does not make the objective contact the sample. Then turn the coarse focus knob forward to lower the stage and adjust the focus.



Switching the optical path 100% to the binocular part

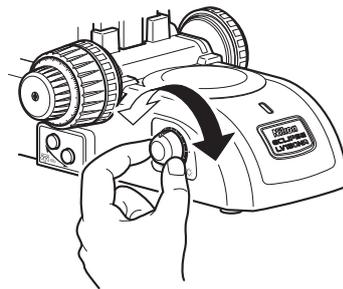
- (3) After the focus is roughly adjusted using the coarse focus knob, turn the fine focus knob to accurately adjust the focus.



Focusing on the sample

- (4) Turn the brightness control knob to adjust the brightness of the field of view.

(When using an HG precentered fiber illuminator, for epi illumination, perform adjustment with the ND of the HG precentered fiber illuminator.)

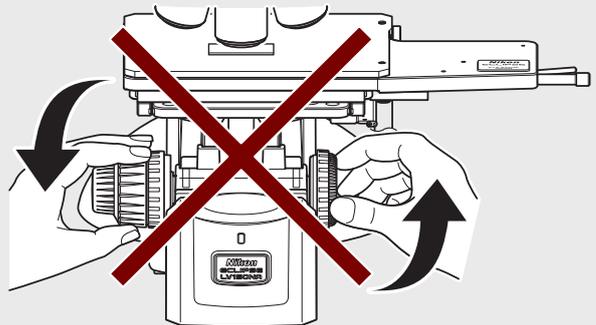


Brightness adjustment

⚠ Notes on controlling the focus knobs

Avoid the following actions, which can cause equipment malfunctions.

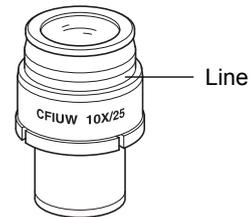
- Rotating the right and left focus knobs in opposite directions.
- Over-rotating the coarse and fine focus knobs.



Do not turn the focus knobs in opposite directions.

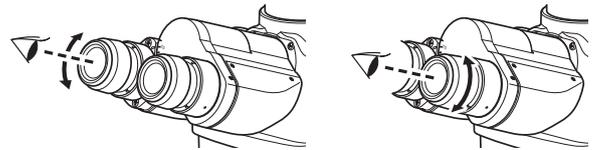
8 Adjust the diopter. (→See Chapter 3, “7 Adjusting the Diopter” for details.)

- (1) Turn the diopter adjustment ring on the right and left eyepieces to align the end face of the diopter adjustment ring with the line. (This is the diopter adjustment reference position.)
- (2) Focus on the sample using the 50x objective.
- (3) Bring the 10x (or 5x) objective into the optical path.



Reference position for diopter adjustment

- (4) Look into the right eyepiece with your right eye and the left eyepiece with your left eye. Turn the diopter adjustment ring of each eyepiece to focus on the sample. Do not use the focus knobs.
- (5) Repeat steps (2) to (4) to make sure the focus has been adjusted properly.



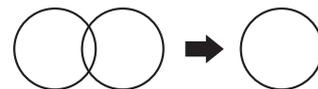
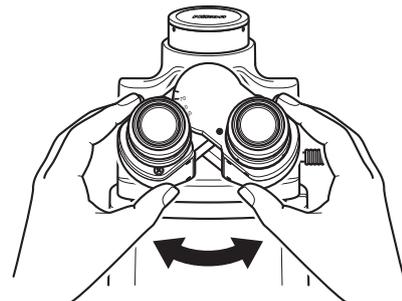
Adjusting the diopter

9 Adjust the interpupillary distance.

Look into both eyepieces and rotate the binocular part to adjust the binocular part's opening until the fields of view for the right and left eyes coincide.

Tip on adjusting the interpupillary distance

For easy adjustment, look into the eyepiece as if you were looking at a distant object.

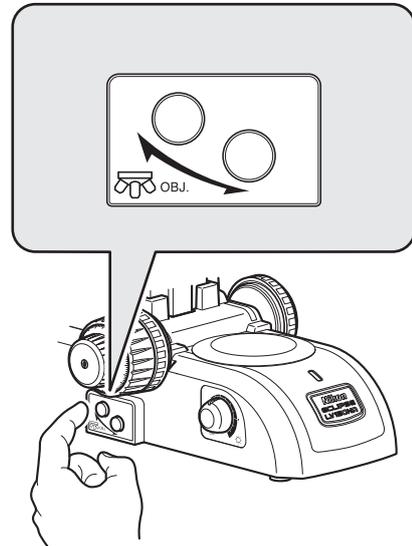


Adjusting interpupillary distance

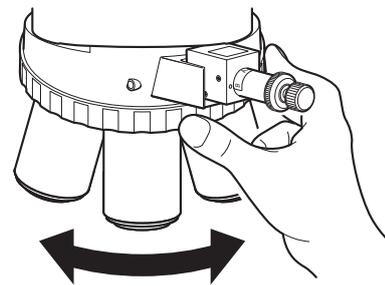
Operations for bright-field microscopy under epi illumination

10 Select the desired objective.

Turn the nosepiece to bring the desired objective into the optical path.



For a motorized nosepiece



For a manual nosepiece

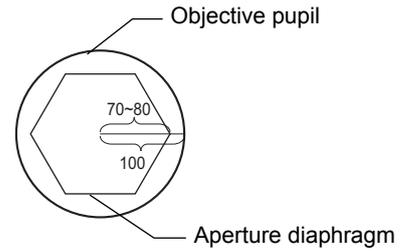
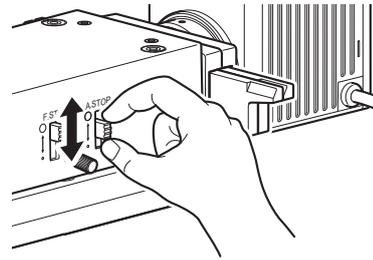
11 Adjust the aperture diaphragm. (→See Chapter 3, “13 Adjusting the Aperture Diaphragm”.)

Move the aperture diaphragm lever to adjust the aperture diaphragm so that it is set to 70 to 80% of the numerical aperture of the objective used.

(You can see the image of the aperture diaphragm by removing the eyepiece and looking into the tube or using a centering telescope.)

✔ **Adjustment timing for the aperture diaphragm**

Be sure to adjust the aperture diaphragm each time you change the objective.



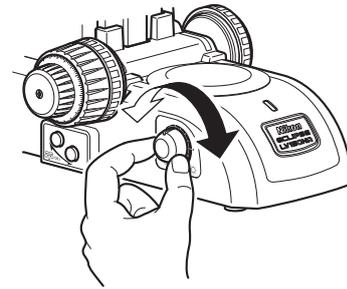
Right size of the aperture diaphragm

12 Focus on the sample. (→See Chapter 3, “8 Focusing on the Sample.”)

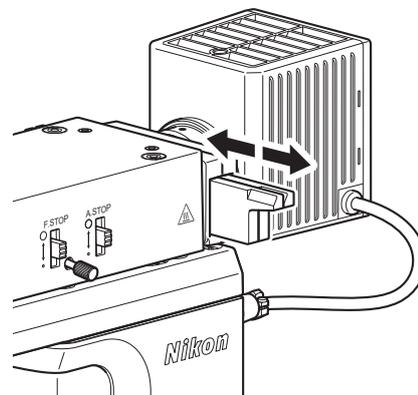
- (1) Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

For details on the procedures for using the HG precentered fiber illuminator, see the operation manual supplied with the illuminator.

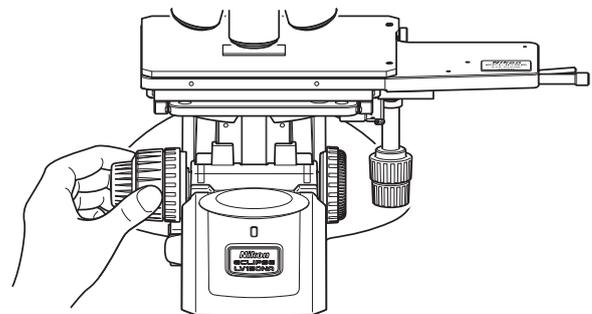
- (2) Rotate the stage knob to move the stage and bring the sample into the optical path.
- (3) If the sample is not in focus, turn the focus knob to focus on it.



Adjusting the brightness with the brightness control knob



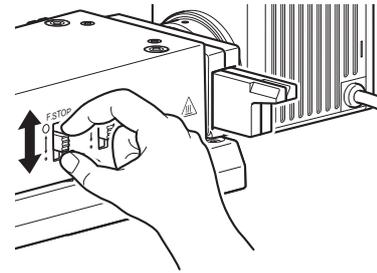
Adjusting the brightness with ND filters



Focusing on the sample

13 Adjust the field diaphragm. (→See Chapter 3, “12 Adjusting the Field Diaphragm.”)

Turn the field diaphragm lever to adjust the field diaphragm so that it almost circumscribes the field of view.

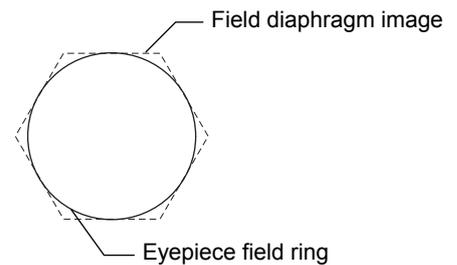


✔ Size of the field diaphragm

Normally, the field diaphragm should be adjusted so that it circumscribes the field of view. Excessively opening the field diaphragm will result in stray light entering the field of view, generating flare and reducing the image contrast.

✔ Adjustment timing for the field diaphragm

Be sure to adjust the field diaphragm each time the objective is changed.



Adjusting the field diaphragm

14 View the sample.

Rotate the stage knob to move the target. If the target is not in focus, use the focus knob to adjust the focus.

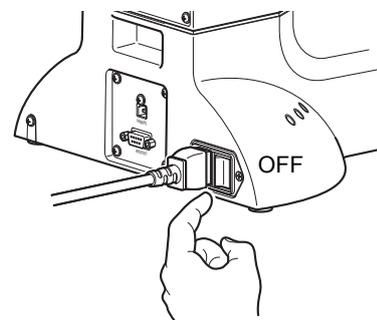
✔ Handling of a hard-to-focus sample

It may be difficult to focus on a sample with small contrast, such as 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 sample is in focus just as well.

15 Turn off the power.

Turn off the power switch (press to the “O” position) for the microscope. (The power LED on the front of the main body will turn off.)

(When using an HG precentered fiber illuminator, turn off its power.)



Power switch OFF

2

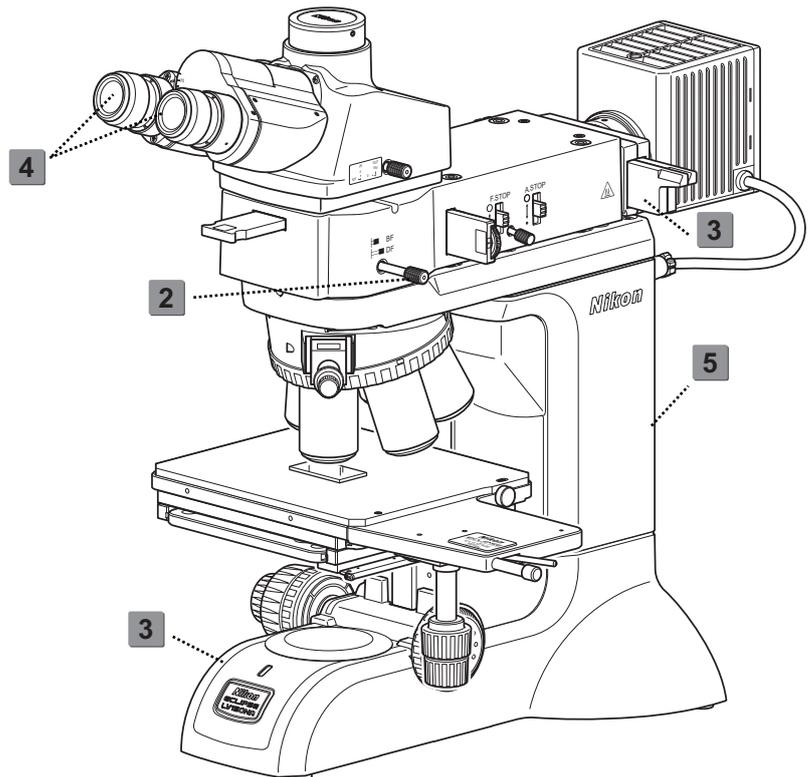
Dark-field Microscopy under Epi Illumination

! WARNING

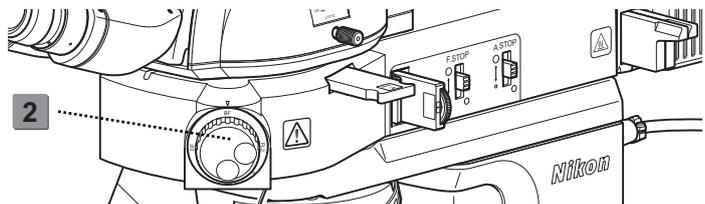
When using an HG precentered fiber illuminator together with an epi-illumination attachment, due to the characteristics of the light source (mercury lamp), special care must be taken when handling it. Make sure you are familiar with and adhere to all warnings and cautions described at the beginning of this instruction manual.

1. Performing bright-field microscopy under epi illumination
2. Setting the epi-illumination attachment to DF
3. Adjusting the brightness
4. Viewing the sample
5. Turning off the power

For the LV-UEPI-N



For the LV-UEPI2



Operations for dark-field microscopy under epi illumination

1 Focus on the sample in bright-field microscopy under epi illumination.

2 Place the epi-illumination attachment to the DF (dark-field) status.

(With the LV-UEPI-N attached)

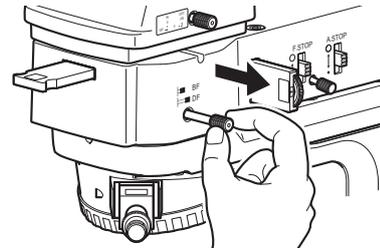
Pull the illumination selection lever to the “DF (dark-field)” position.

(With the LV-UEPI2 attached)

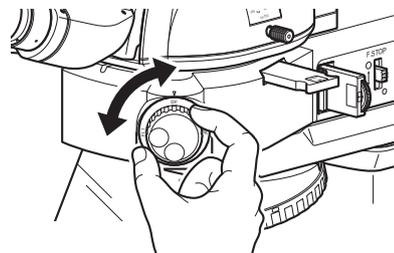
Turn the microscopy selection knob to the “DF (dark-field)” position.

The field diaphragm and the aperture diaphragm are fully opened automatically. (The positions of the diaphragm levers are not changed.)

(With the LV-UEPI-N attached)



(With the LV-UEPI2 attached)

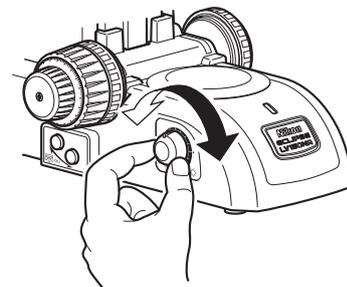


Positioning to “DF”

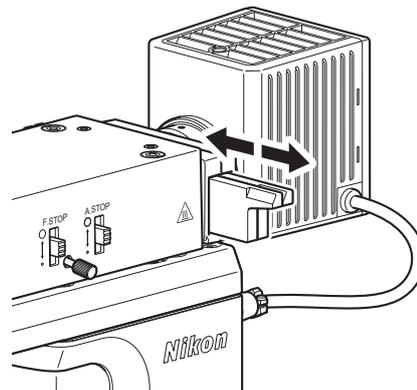
3 Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

For details on the procedures for using the HG precentered fiber illuminator, see the operation manual supplied with the illuminator.



Adjusting the brightness with the brightness control knob



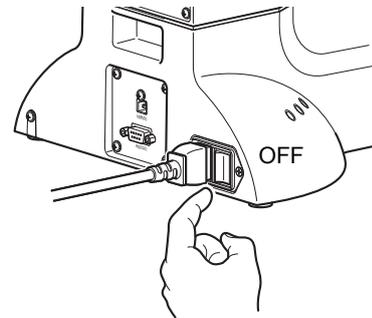
Adjusting the brightness with ND filters

4 View the sample.

5 Turn off the power.

Turn off the power switch (press to the “O” position) for the microscope. (The power LED on the front of the main body will turn off.)

(When using an HG precentered fiber illuminator, turn off its power.)



Power switch OFF

Switching from dark-field microscopy under epi illumination to bright-field microscopy under epi illumination

(1) Darken epi illumination.

Decrease the brightness of the field to an appropriate level using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

⚠ Darkening the field before switching the microscopy type

Before switching the microscopy type, be sure to darken the field. Switching the microscopy type without darkening it can result in too high brightness.

(2) Place the epi-illumination attachment to the BF (bright-field) status.

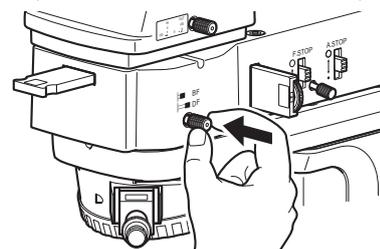
(With the LV-UEPI-N attached)

Push in the illumination selection lever to the “BF (bright-field)” position.

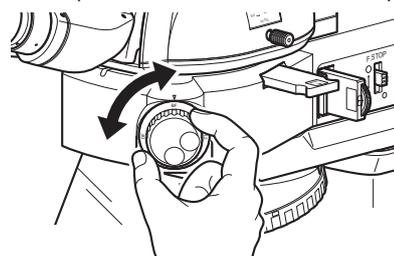
(With the LV-UEPI2 attached)

Turn the microscopy selection knob to the “BF (bright-field)” position.

(With the LV-UEPI-N attached)



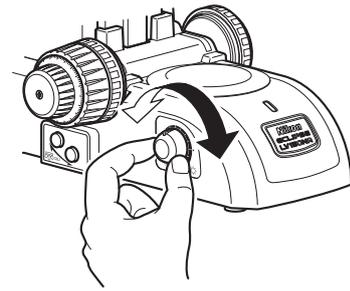
(With the LV-UEPI2 attached)



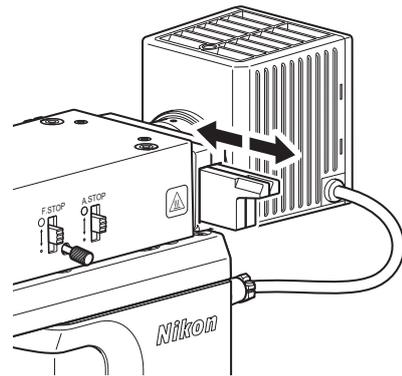
Positioning to “BF”

(3) Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.



Adjusting the brightness with the brightness control knob



Adjusting the brightness with ND filters

3

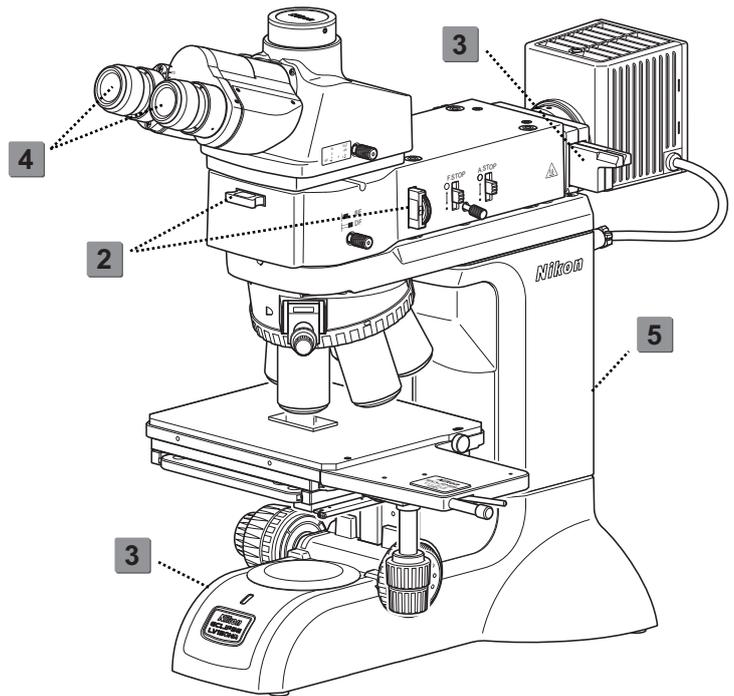
Polarization Microscopy Under Epi Illumination (Simplified/Sensitive Color)

! WARNING

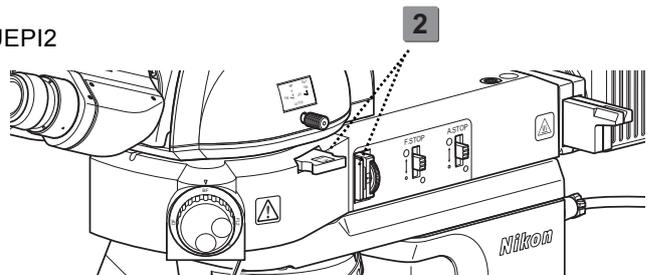
When using an HG precentered fiber illuminator together with an epi-illumination attachment, due to the characteristics of the light source (mercury lamp), special care must be taken when handling it. Make sure you are familiar with and adhere to all warnings and cautions described at the beginning of this instruction manual.

1. **Performing bright-field microscopy under epi illumination**
2. **Putting the analyzer and polarizer into the optical path**
(For sensitive color polarization microscopy with the LV-UEPI2, put also the lambda plate slider into the optical path.)
3. **Adjusting the brightness**
4. **Viewing the sample**
5. **Turning off the power**

For the LV-UEPI-N



For the LV-UEPI2



Operations for polarization microscopy under epi illumination (simplified/sensitive color)

1 Focus on the sample in bright-field microscopy under epi illumination.

2 Put the analyzer and polarizer into the optical path.

(→See Chapter 3, “14 Using the Polarizer Slider” and “15 Using the Analyzer Slider.”)

- (1) Push in the analyzer slider to put the analyzer into the optical path.
- (2) Push in the polarizer slider to put the polarizer into the optical path and to set it to the crossed Nicols position by aligning the index.



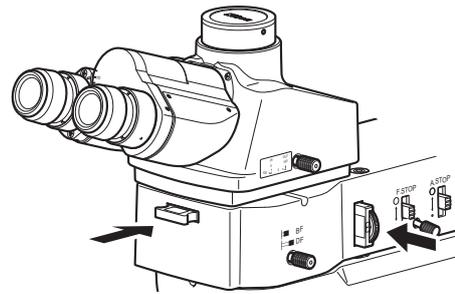
Setting to the crossed Nicols position

✓ If using a PA cube

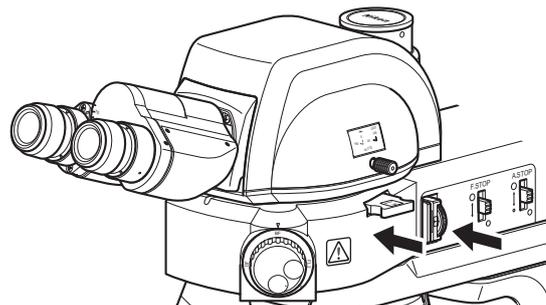
With the LV-UEPI2 attached, you can put the PA cube (LV-PAB) into the optical path instead of the analyzer and polarizer so that the crossed Nicols status is resulted.

With the PA cube, you cannot perform sensitive color polarization microscopy under epi illumination.

(With the LV-UEPI-N attached)



(With the LV-UEPI2 attached)



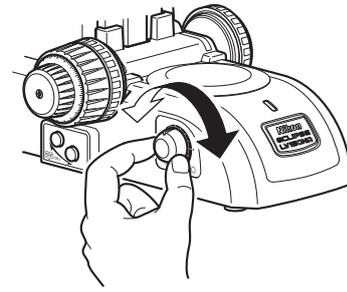
Putting the analyzer and polarizer into the optical path

- (3) When performing sensitive color polarization microscopy with the LV-UEPI2 attached, push in the lambda plate slider to put the lambda plate into the optical path.

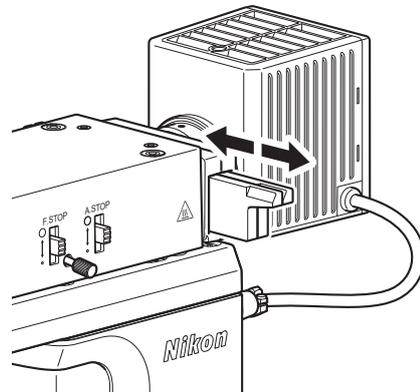
3 Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

For details on the procedures for using the HG precentered fiber illuminator, see the operation manual supplied with the illuminator.



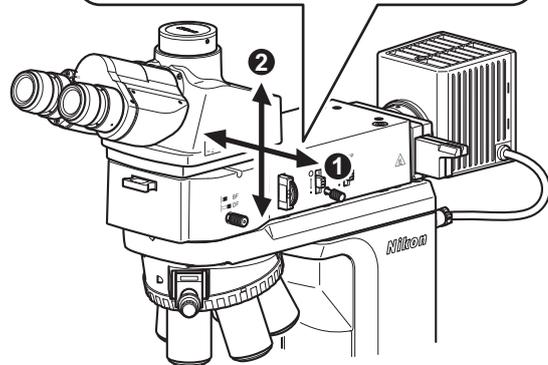
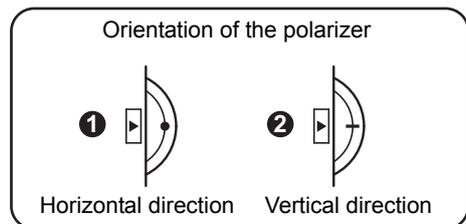
Adjusting the brightness with the brightness control knob



Adjusting the brightness with ND filters

4 View the sample.

Turn the polarizer rotating dial to adjust the polarization while observing the image.

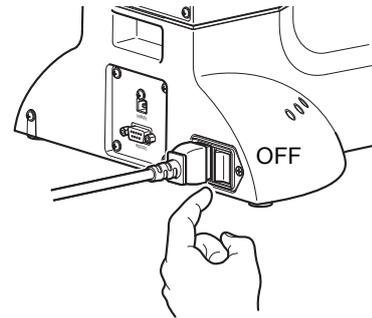


Polarizer slider rotating dial

5 Turn off the power.

Turn off the power switch (press to the “O” position) for the microscope. (The power LED on the front of the main body will turn off.)

(When using an HG precentered fiber illuminator, turn off its power.)



Power switch OFF

Switching from polarization microscopy under epi illumination to bright-field microscopy under epi illumination

- (1) Darken epi illumination.

Decrease the brightness of the field to an appropriate level using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

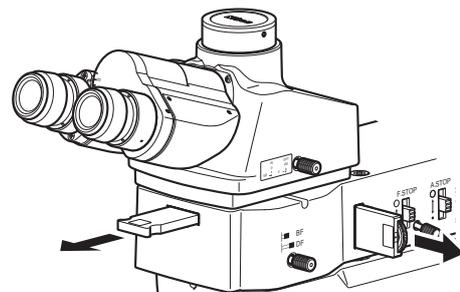
⚠ Darkening the field before switching the microscopy type

Before switching the microscopy type, be sure to darken the field. Switching the microscopy type without darkening it can result in too high brightness.

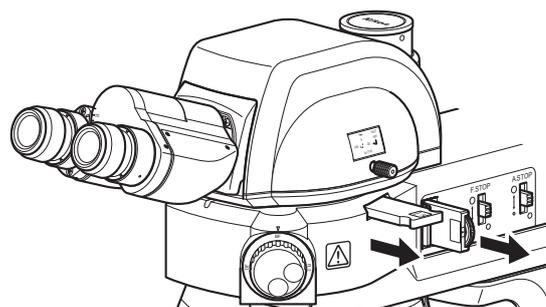
- (2) Remove the analyzer and the polarizer from the optical path.

If using a lambda plate slider with sensitive color microscopy, remove the lambda plate slider from the optical path.

(With the LV-UEPI-N attached)



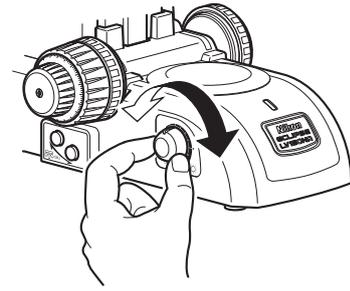
(With the LV-UEPI2 attached)



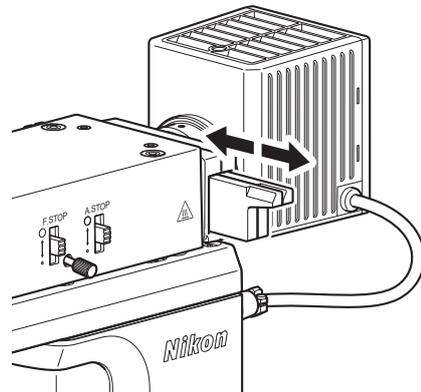
Removing the analyzer and the polarizer from the optical path

- (3) Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.



Adjusting the brightness with the brightness control knob



Adjusting the brightness with ND filters

4

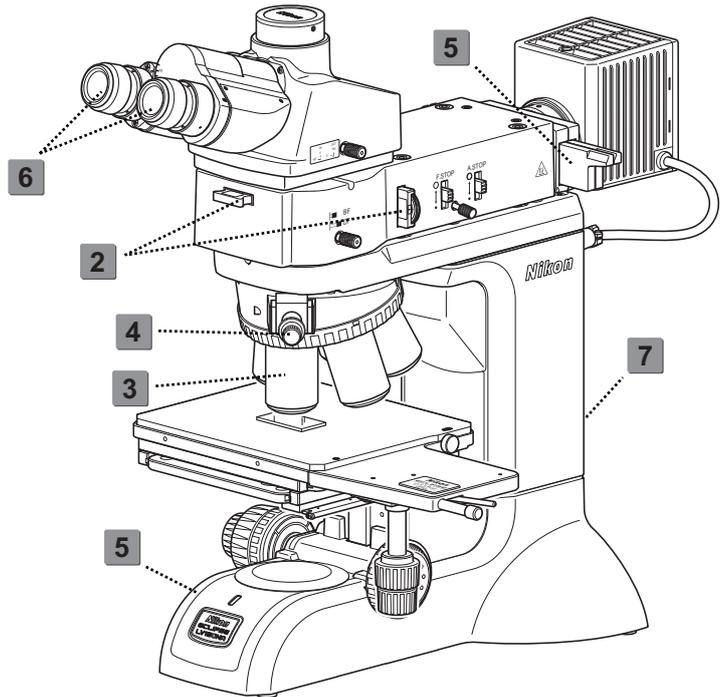
Differential Interference Contrast Microscopy under Epi Illumination

! WARNING

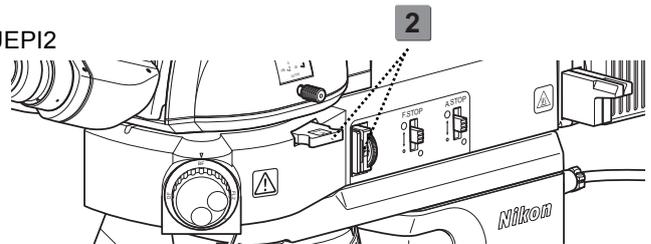
When using an HG precentered fiber illuminator together with an epi-illumination attachment, due to the characteristics of the light source (mercury lamp), special care must be taken when handling it. Make sure you are familiar with and adhere to all warnings and cautions described at the beginning of this instruction manual.

1. Performing bright-field microscopy under epi illumination
2. Putting the analyzer and polarizer into the optical path
3. Bringing the DIC objective into optical path
4. Pushing in the DIC slider
5. Adjusting the brightness
6. Viewing the sample
7. Turning off the power

For the LV-UEPI-N



For the LV-UEPI2



Operations for differential interference contrast microscopy under epi illumination (prism slide method)

1 Focus on the sample in bright-field microscopy under epi illumination.

2 Put the analyzer and polarizer into the optical path.

(→See Chapter 3, “14 Using the Polarizer Slider” and “15 Using the Analyzer Slider.”)

- (1) Push in the analyzer slider to put the analyzer into the optical path.
- (2) Push in the polarizer slider to put the polarizer into the optical path and to set it to the crossed Nicols position by aligning the index.

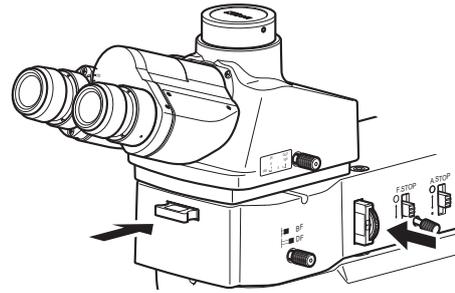


Setting to the crossed Nicols position

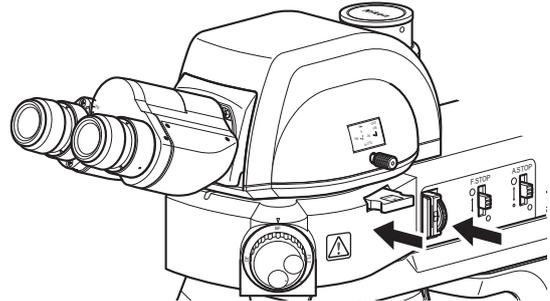
✔ If using a PA cube

With the LV-UEPI2 attached, you can put the PA cube (LV-PAB) into the optical path instead of the analyzer and polarizer so that the crossed Nicols status is resulted.

(With the LV-UEPI-N attached)



(With the LV-UEPI2 attached)



Putting the analyzer and polarizer into the optical path

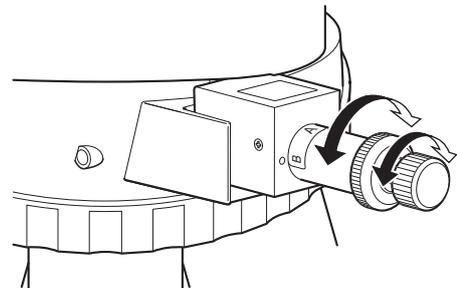
3 Bring an arbitrary DIC objective into the optical path.

Turn the nosepiece to bring the desired objective into the optical path.

4 Put the DIC prism into the optical path and adjust the setting knob.

(→See Chapter 3, “17 Using the DIC Slider.”)

- (1) Push in the DIC slider to put the DIC prism into the optical path.
- (2) Set the prism selection knob of the DIC slider to the position (A or B) indicated on the body of the objective.
- (3) Rotate the prism movement knob at the end of the DIC prism to set an interference color. You can also perform the sensitive color DIC microscopy using the prism movement knob.

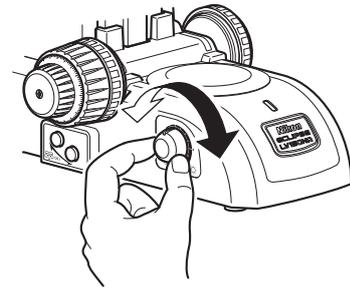


Adjusting the DIC prism

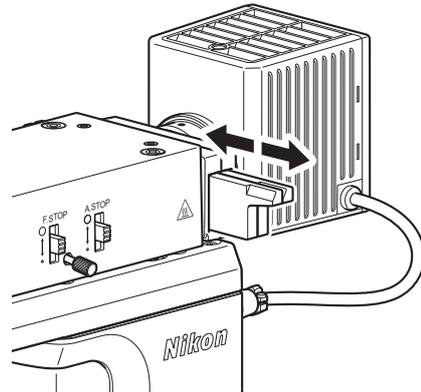
5 Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

For details on the procedures for using the HG precentered fiber illuminator, see the operation manual supplied with the illuminator.



Adjusting the brightness with the brightness control knob



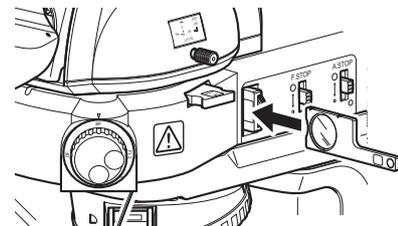
Adjusting the brightness with ND filters

6 View the sample.

- ✔ When performing sensitive color microscopy with a lambda plate slider (only with the LV-UEPI2 attached)

- (1) Put the NCB filter into the optical path.
- (2) Push in the lambda plate slider to put the lambda plate into the optical path.

This will change the background to a sensitive color, enabling observation with high color contrast. An interference color is displayed based on changes in the refraction index and/or thickness of the sample.

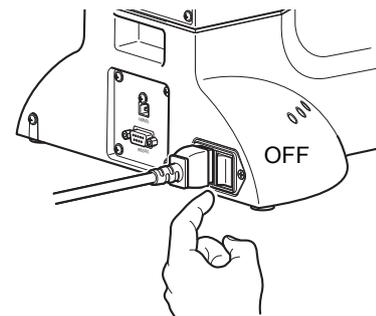


Lambda plate slider

7 Turn off the power.

Turn off the power switch (press to the “O” position) for the microscope. (The power LED on the front of the main body will turn off.)

(When using an HG precentered fiber illuminator, turn off its power.)



Power switch OFF

Switching from differential interference contrast microscopy under epi illumination to bright-field microscopy under epi illumination

- (1) Darken epi illumination.

Decrease the brightness of the field to an appropriate level using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

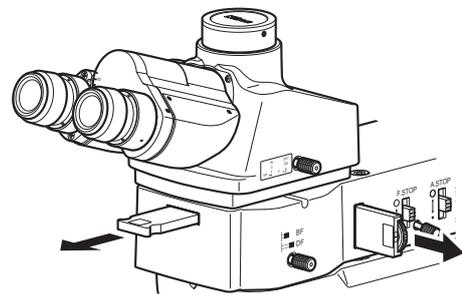
! Darkening the field before switching the microscopy type

Before switching the microscopy type, be sure to darken the field. Switching the microscopy type without darkening it can result in too high brightness.

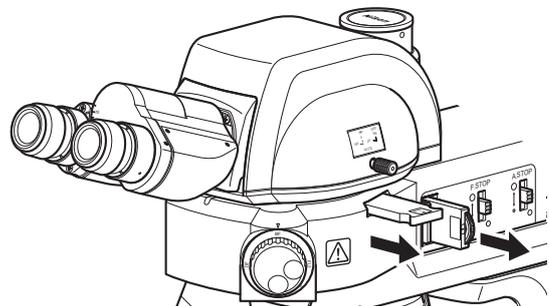
- (2) Remove the analyzer and the polarizer from the optical path.

If using a lambda plate slider with sensitive color microscopy, remove the lambda plate slider from the optical path.

(With the LV-UEPI-N attached)



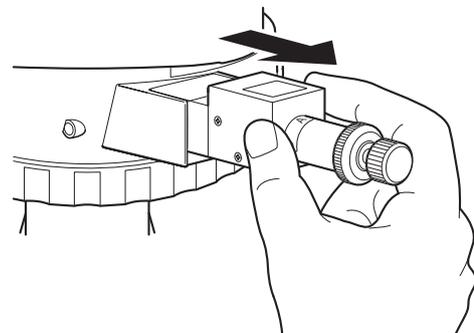
(With the LV-UEPI2 attached)



Remove the analyzer and the polarizer from the optical path.

- (3) Remove the DIC prism from the optical path.

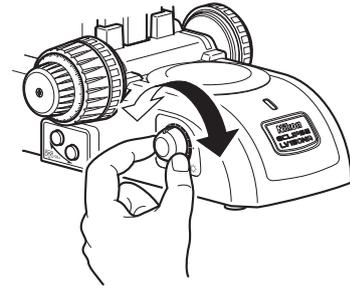
Pull out the DIC slider to remove the DIC prism from the optical path.



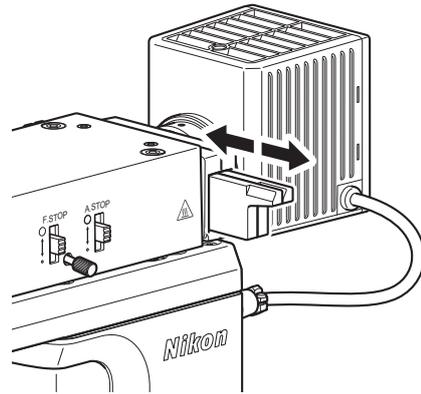
Pulling out the DIC slider

- (4) Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.



Adjusting the brightness with the brightness control knob



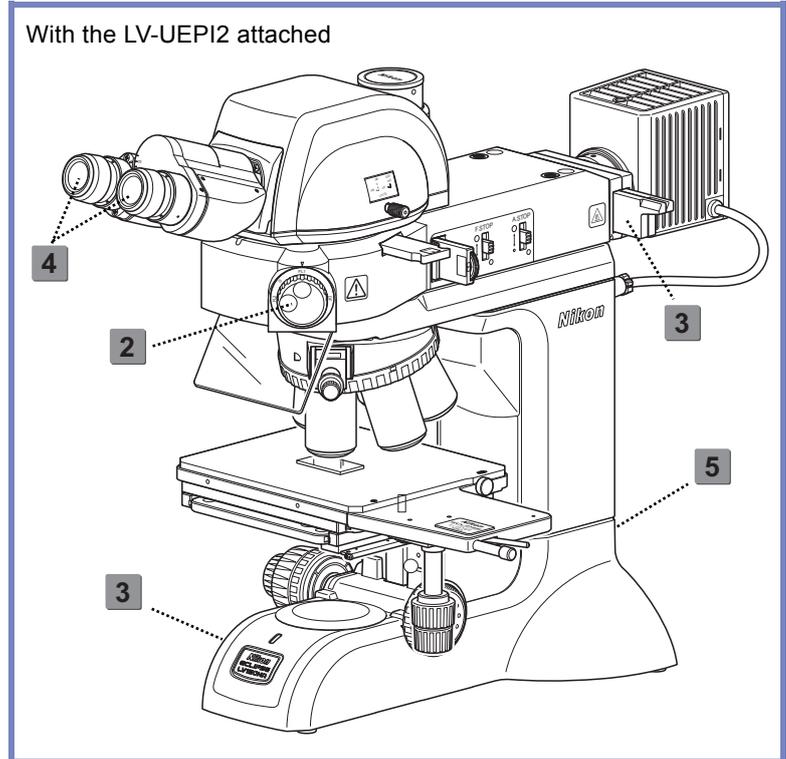
Adjusting the brightness with ND filters

5 Epi-fl Microscopy (Only with the LV-UEPI2 Attached)

! WARNING

When using an HG precentered fiber illuminator together with an epi-illumination attachment, due to the characteristics of the light source (mercury lamp), special care must be taken when handling it. Make sure you are familiar with and adhere to all warnings and cautions described at the beginning of this instruction manual.

1. Performing bright-field microscopy under epi illumination
2. Setting to the FL1 or FL2 status
3. Adjusting the brightness
4. Viewing the sample
5. Turning off the power



Operations for epi-fluorescence microscopy

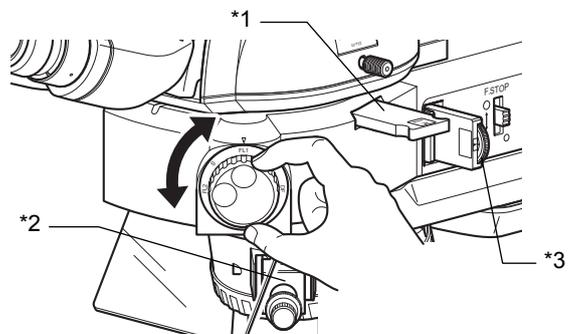
1 Find the target and focus on it by bright-field microscopy under epi illumination.

2 Place the epi-illumination attachment into the FL1 or FL2 status.

(→See Chapter 3, “18 Using Filter Cubes for Fluorescence Observation (LV-UEPI2 Only).”)

Turn the microscopy selection knob to the “FL1” or “FL2” position.

* If using parts for differential interference contrast (*1 to *3), pull out the parts to remove them from the optical path.



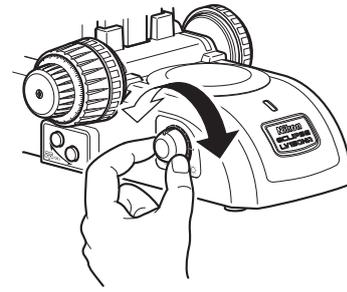
Setting to “FL1” or “FL2”

3 Adjust the epi-illumination brightness.

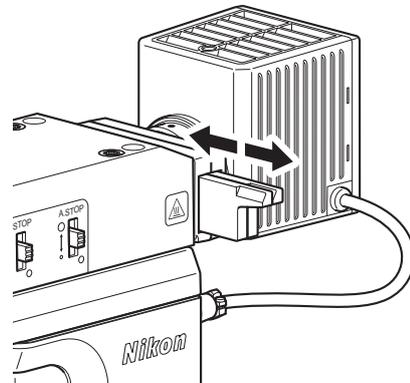
Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

For details on the procedures for using the HG precentered fiber illuminator, see the operation manual supplied with the illuminator.

The aperture diaphragm of the epi-illumination attachment can also be used for brightness adjustment of the image. Be sure to center the aperture diaphragm before use. (See Chapter 3 “13 Adjusting the Aperture Diaphragm.”)



Adjusting the brightness with the brightness control knob



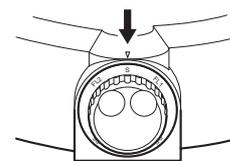
Adjusting the brightness with ND filters

4 View the sample.

✔ About the shutter of the epi-illumination attachment

When the microscopy selection knob of the LV-UPE12 is turned to the “S” position, the shutter closes the optical path of the illumination.

To prevent fading of the sample, make sure to close the shutter when you do not observe the sample.

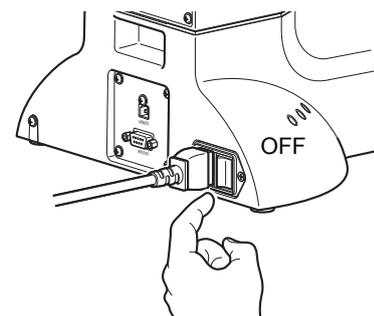


S (shutter) position

5 Turn off the power.

Turn off the power switch (press to the “O” position) for the microscope. (The power LED on the front of the main body will turn off.)

(When using an HG precentered fiber illuminator, turn off its power.)



Switching from epi-fluorescence microscopy to bright-field microscopy under epi illumination or dark-field microscopy under epi illumination

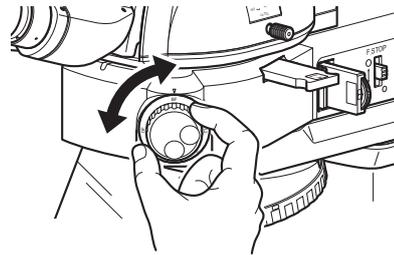
- (1) Darken epi illumination.

Decrease the brightness of the field to an appropriate level using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.

! Darkening the field before switching the microscopy type

Before switching the microscopy type, be sure to darken the field. Switching the microscopy type without darkening it can result in too high brightness.

- (2) Place the epi-illumination attachment to the BF (bright-field) or DF (dark-field) status.
Turn the microscopy selection knob to the “BF (bright-field)” or “DF (dark-field)” position.



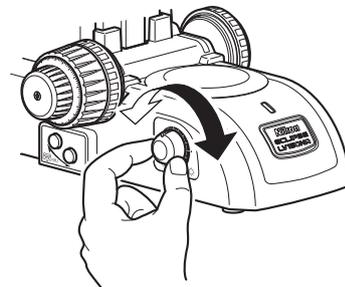
Setting to “BF” or “DF”

✓ About the UV filter mounted in the LV-UEPI2

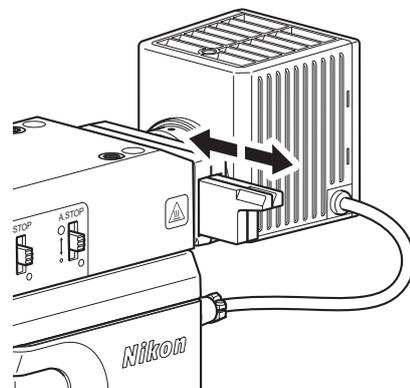
When the filter cube turret of the LV-UEPI2 is set to BF or DF position, the UV filter is also located in the optical path of the microscope. When the turret is set to FL1 or FL2, the UV filter is automatically removed from the optical path.

- (3) Adjust the epi-illumination brightness.

Looking into the eyepiece, adjust the brightness of the field using the brightness control knob or the ND filter slider located at the rear of the epi-illumination attachment; when using an HG precentered fiber illuminator, use its ND instead of the brightness control knob.



Adjusting the brightness with the brightness control knob



Adjusting the brightness with ND filters

3

Operation of Each Part

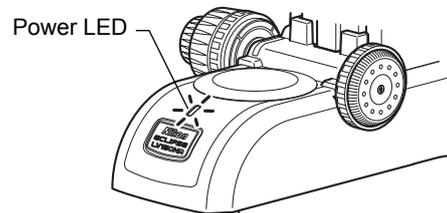
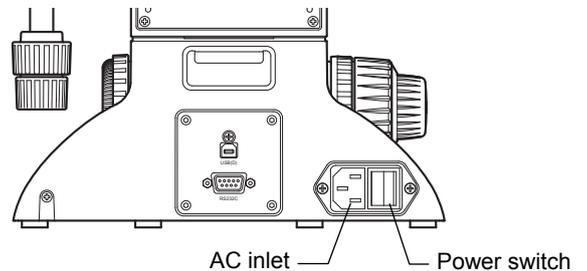
1

Turning the Power On/Off

Power switch for the microscope main body

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

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



Power supply for the lamp

The product has a built-in power supply circuit for the halogen lamp. When the specified lamphouse (LV-LH50PC) is used, the power to the lamp is turned on and off according to the power supply operation of the product.

✔ Power LED

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

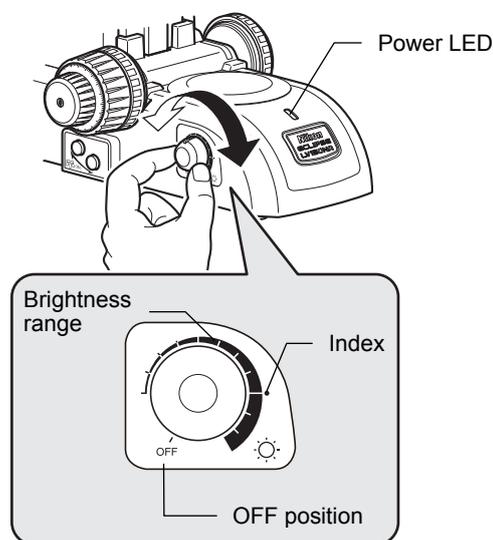
2 Controlling Illumination

Brightness control

When a halogen lamp is used for the light source, the brightness can be controlled by rotating the brightness control knob.

✔ HG precentered fiber illuminator

When an HG precentered fiber illuminator is used, the brightness is controlled by the external light source or the ND filters on the microscope.



✔ Color temperature variation by brightness control

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

When accurate color reproduction is important, set the brightness control knob to the 3 o'clock position so that the index comes to the position as shown in the above figure, and then place the NCB11 filters into the optical path. In this condition, the voltage applied to the lamp is approx. 9V and the color reproduction using the NCB11 filter is improved maximally. To adjust the brightness of the illumination, use ND filters.

Turning on/off the lamp

Illumination can be turned on/off by the switch of brightness control knob. The lamp is turned off when the brightness control knob is rotated to the far side (counter clockwise direction) and set to the OFF position.

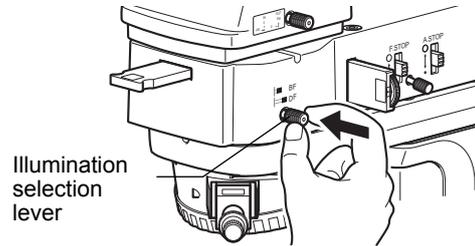
3

Switching the Microscopy Type

■ Illumination selection lever (for the LV-UEPI-N)

When the LV-UEPI-N universal epi-illumination attachment is used, the illumination selection lever on the right side can be used to alternate microscopy illumination between bright-field (BF) and dark-field (DF).

Push the lever in to select bright-field illumination (BF), or pull it out to select dark-field illumination (DF).

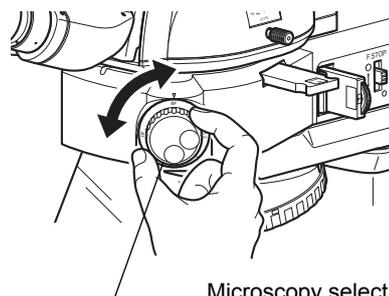


Position	Microscopy
BF	<p>Bright-field microscopy under epi illumination</p> <p>This is used for bright-field microscopy under epi illumination. It is used also for simplified/sensitive polarization microscopy and differential interference contrast (DIC) microscopy under epi illumination.</p>
DF	<p>Dark-field microscopy under epi illumination</p> <p>When the lever is pulled out to be at the DF position, epi illumination has a dark field, and the aperture diaphragm and the field diaphragm are fully opened automatically. The diaphragm lever position does not change.) When the lever is moved back to the BF position, the aperture diaphragm and the field diaphragm are restored to their previous conditions before the lever is set to the DF position.</p>

■ **Microscopy selection knob (for the LV-UEPI2)**

When the LV-UEPI2 universal epi illuminator 2 is used, the microscopy selection knob at the front right of the epi-illumination attachment can be turned to rotate the turret in the epi-illumination attachment to the position of the desired microscopy mode.

The microscopy selection knob has five clickstop positions, BF, DF, FL1, S, and FL2, which correspond to the microscopy modes listed below.



Microscopy selection knob

Position	Microscopy
BF	<p>Bright-field microscopy</p> <p>This is used for the usual bright-field microscopy. It is used also for differential interference contrast (DIC) microscopy and simplified/sensitive polarization microscopies. The UV filter enters into the optical path when the BF position is selected.</p>
DF	<p>Dark-field microscopy</p> <p>Setting the knob to DF selects dark-field illumination, so that the aperture diaphragm and field diaphragm automatically open fully. The positions of the diaphragm levers do not change. When the knob is set to a position away from DF, the aperture diaphragm and field diaphragm are restored to what they were before setting to DF. The UV filter enters into the optical path when the DF position is selected.</p>
FL1	<p>Epi-fluorescence 1</p> <p>The filter cube inserted into the “FL1” position in the epi-illumination attachment enters the optical path. And, the UV filter is removed from the optical path.</p>
S	<p>Shutter</p> <p>The shutter stops the optical path of illumination. This clickstop position is between FL1 and FL2, so that the shutter is readily available to prevent fading of the sample.</p>
FL2	<p>Epi-fluorescence 2</p> <p>The filter cube inserted into the “FL2” position in the epi-illumination attachment enters the optical path. And, the UV filter is removed from the optical path.</p>

If no filter cube is set on the turret in the epi-illumination attachment, nothing is seen when the knob is turned to the FL1 or FL2 position.

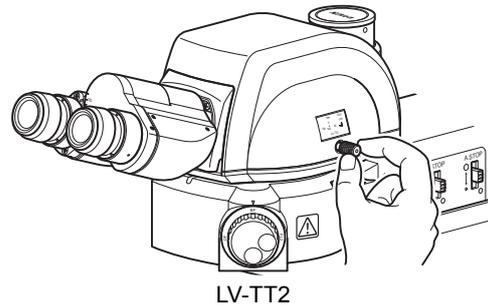
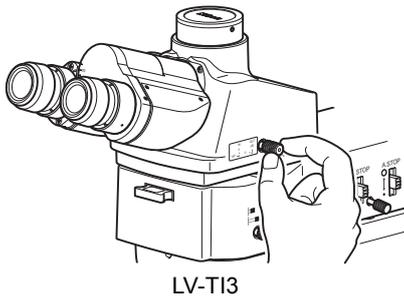
4 Switching the Optical Path

Optical path selection

The optical path selection lever can be used to switch between the proportions of light reaching the binocular part and the vertical tube.

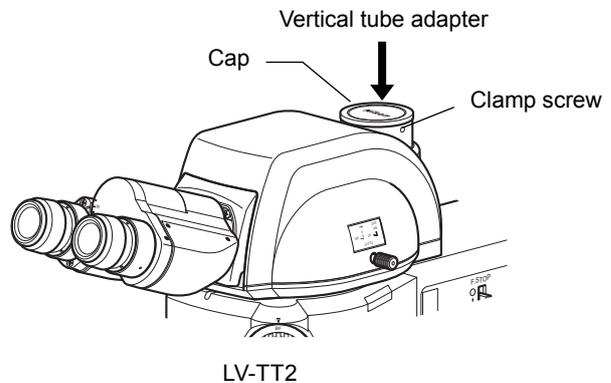
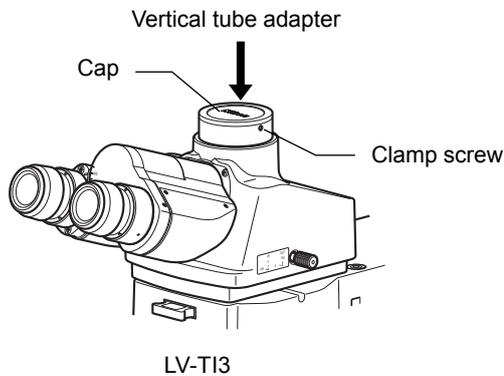
Lever position	Light distribution (%)	
	Binocular part	Vertical tube
IN	100	0
OUT	0	100

Lever position	Light distribution (%)	
	Binocular part	Vertical tube
IN	100	0
OUT	20	80



Vertical tube adapters

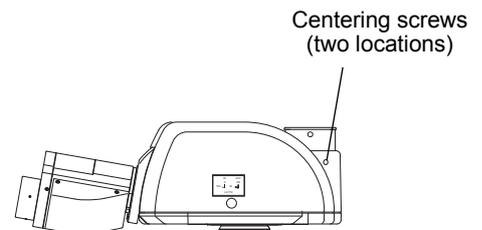
When attaching a camera head to the vertical tube of the trinocular tube, you must first mount the adapter (photomicrographic vertical tube adapter or direct C-mount adapter; both sold separately). Insert the adapter into the vertical tube and secure it with the clamp screw using a hexagonal screwdriver.



Centering the binocular part (LV-TT2 only)

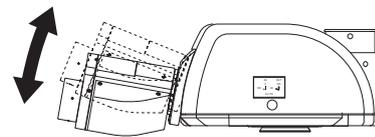
The binocular part and the vertical tube part of the eyepiece tube are centered before the shipping, so usually they can be used with no adjustment.

But some cameras are not aligned their centers of the CCD to the mount. You can center the vertical part by adjusting two centering screws on the back of the vertical tube for such cameras.



5 Adjusting the Binocular Angle (LV-TT2 only)

With the LV-TT2 trinocular tube, the angle of the binocular part can be adjusted. Adjust it to an easily viewable angle.



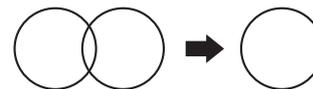
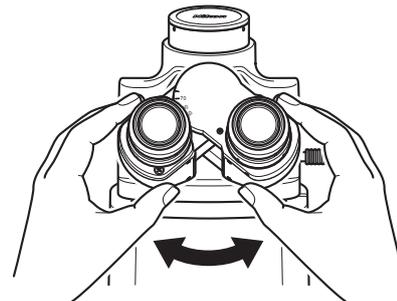
6 Adjusting the Interpupillary Distance

Before adjusting the interpupillary distance, perform the steps of bright-field microscopy (Chapter 2, “1 Bright-field Microscopy under Epi Illumination”) and focus on the image with the 10x objective.

Adjust the interpupillary distance so that the fields of view of the right and the field of view of the left eyes overlap.

Doing so will make observation through the binocular eyepieces with both eyes easier.

The scale on the binocular part is useful in order to memorize your interpupillary distance for the next time.



Overlap the fields of view.

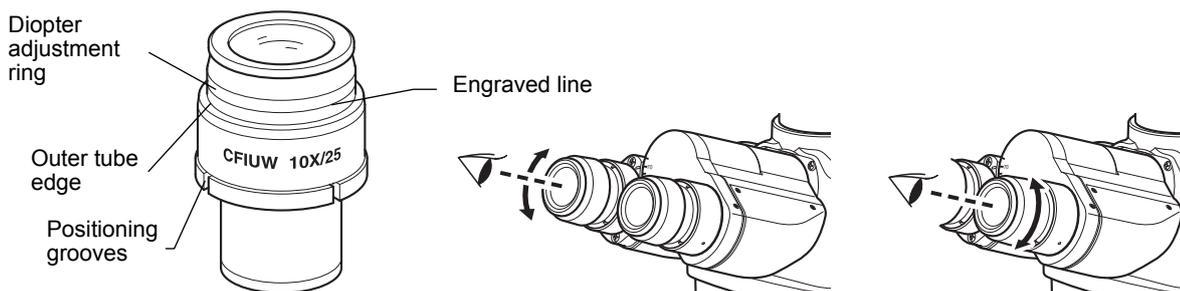
Tip on adjusting the interpupillary distance

For easy adjustment, look into the eyepiece as if you were looking at a distant object.

7 Adjusting the Diopter

Diopter adjustment compensates for differences in eyesight between your left and right eyes. After the correct adjustment, you will find the observation with both eyes easier and the focus shift is reduced when switched to different objectives. Be sure to adjust the diopter adjustment rings on both eyepieces.

- (1) Turn the diopter adjustment rings on both eyepieces to align their engraved lines with the edge of the outer tube of the eyepiece. (This is the standard position for diopter adjustment.)
- (2) Focus on the sample with the 10x objective following the steps of bright-field microscopy (Chapter 2, “1 Bright-field Microscopy under Epi Illumination”).
- (3) Bring the 50x objective into the optical path and focus on the sample by turning the coarse/fine focus knobs.
- (4) Bring the 5x or 10x objective into the optical path.
- (5) Focus on the sample by turning the diopter adjustment ring on the right eyepiece (not 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 sample with the diopter adjustment rings.
- (6) Repeat steps (3) to (5) with the 50x and 5x (or 10x) objectives until the image stays in focus even though the objective magnification is changed.



Diopter adjustment standard position

8 Focusing on the Sample

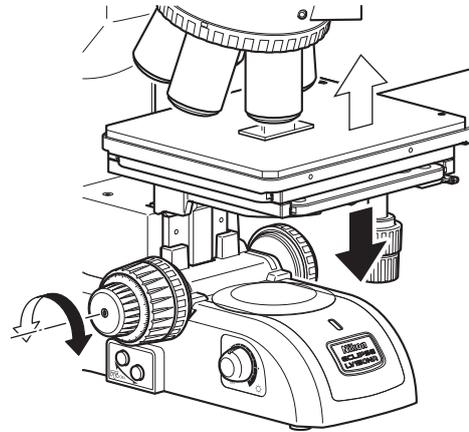
Focus Knob Rotation and Stage Movement

The microscope has a fine focus knob on the right side, and a fine and a coarse focus knobs on the left side of the main body.

The stage movement direction relative to the focus knob rotation is shown in the table below.

Focus Knob Rotation and Stage Movement

Operations	Stage movement
Turn the knob toward the front.	Stage is lowered.
Turn the knob toward the rear.	Stage is raised.



✔ Focusing procedure

Using an objective of high magnification may cause the sample to be pushed against the objective, damaging the objective. Follow the procedure below to focus on the sample to avoid breaking the sample or damaging the objective.

- When raising the stage using the coarse focus knob, take your eyes off the eyepiece and raise the stage while looking at the microscope from the side.
- When working with the coarse focus knob while looking into the eyepiece, you should only turn the knob in the direction for lowering the stage.
- Use an objective of low magnification to adjust the focus, and then switch to an objective of higher magnification.

⚠ Note on controlling the focus knobs

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.

Number of Focus Knob Turns and Distance of Stage Travel

Number of Focus Knob Turns and Distance of Stage Travel

No. of knob turns	Distance of stage travel (vertical direction)
One rotation of the coarse focus knob	Approx. 14.0 mm
One rotation of the fine focus knob	Approx. 0.1 mm
One scale of the fine focus knob	Approx. 1 μ m

The vertical motion range of the stage (coarse/fine focus stroke) is 40 mm.

✔ Reference

When observing with the combination of “6x6 inch stage” and “ESD plate”, the stage vertical movement range is 12.5 mm up and 27.5 mm down.

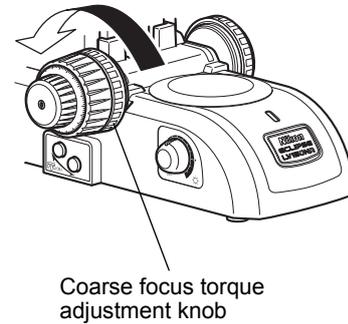
Stiffness adjustment for the coarse focus knob

Adjust the rotation torque of the coarse focus knob (rotation resistance) by turning the torque adjustment knob (TORQUE) located at the base of the coarse focus knob. If the torque is set too low, the stage may descend under its own weight.

Adjusting the Rotating Torque of the Coarse Focus Knob

Operation of torque adjustment knob	Rotation torque
When turned in the direction of the arrow	Rotation torque is increased.
When turned in the direction opposite to the arrow	Rotation torque is decreased.

To increase the torque



Refocusing

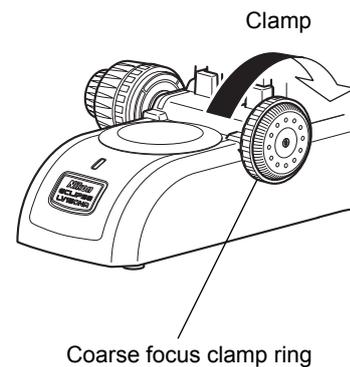
By turning the coarse focus clamp ring after focusing on the sample, you can prevent the stage from being raised further with the coarse focus knob. The movement of the stage with the fine focus knob will not be locked.

Using this function, you can refocus with ease by simply turning the coarse focus knob to the limit. This is helpful when switching between similar samples during the observation.

- (1) With the focus set on the sample, tighten the coarse focus clamp ring by turning it approximately 3/4 of a rotation in the direction of the arrow on the base of the microscope. This will clamp the movement of the coarse focus knob.
- (2) When replacing the sample, lower the stage by using only the coarse focus knob.
- (3) After replacing the sample, use only the coarse focus knob to raise the stage slowly until it reaches the upper limit.

At the upper limit, the focus should be more or less on the sample. Use the fine focus knob for finer adjustment.

If you do not wish to use the refocusing function, be sure to loosen the coarse focus clamp ring to the limit (turn it in the direction opposite to the arrow on the base of the microscope until it hits the limit).



9

Moving the Sample

■ 6x6 stage

The stage can be moved in either the “coarse” mode for swift and long ranged movement, or the “fine” mode for minute movement. To switch between the modes, use the stage coarse/fine movement selection switch on the right side of the stage’s top plate.

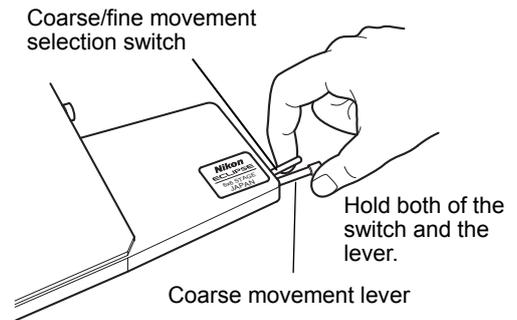
The “coarse” mode

Hold both the stage coarse/fine movement selection switch and the stage coarse movement lever. The stage is now in the “coarse” mode, so that it is freely movable in both X and Y directions. Take hold of the switch and the lever when moving the stage.

Moving the stage only with the stage coarse movement lever without holding the coarse/fine movement selection switch will damage the stage.

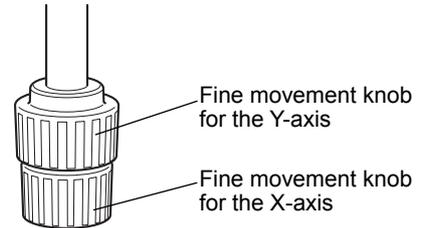
Likewise, pushing or pulling the stage plate without using the switch and the lever will damage the stage.

Make sure that the coarse/fine movement selection switch is held for the coarse mode.



The “fine” mode

Release the stage coarse/fine movement selection switch. The stage is now in the “fine” mode. Turn the stage fine movement knobs to move the stage minutely in both X and Y directions.

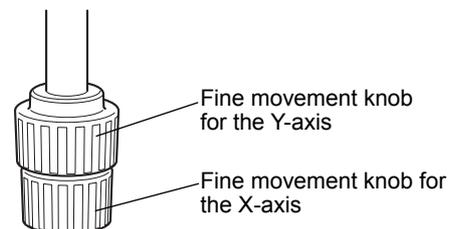


■ 3x2 stage

Stage movement

To move the stage, turn the stage fine movement knobs for the X-axis and Y-axis.

Upper knob is for the Y-axis and lower knob is for the X-axis. Use these knobs to move the sample minutely.



! Do not hold the stage to move it.

If you move the stage plate directly, the stage will be damaged. Use these fine movement knobs to move the stage.

10

Switching the Objectives

Manual nosepiece

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

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

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

Motorized nosepiece

Rotate the nosepiece using the nosepiece forward and reverse rotation buttons on the left side of the microscope to change objectives.

Two buttons are used as the nosepiece rotation buttons. The nosepiece is rotated each time when buttons are pressed.

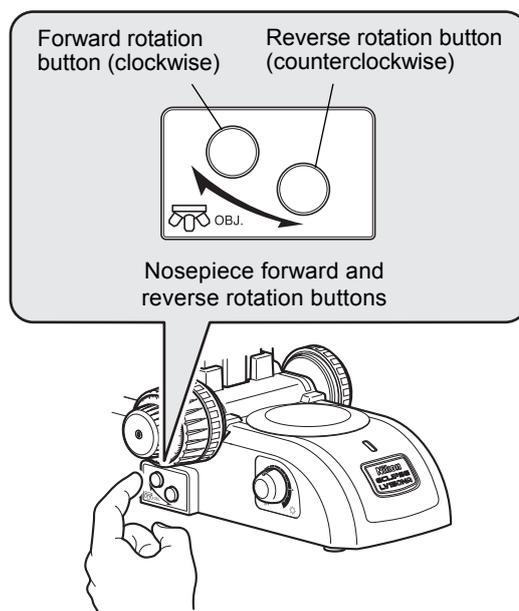
When the far side button is pressed, the nosepiece is rotated in the clockwise direction viewed from the top.

And the near side button is pressed, the nosepiece is rotated in the counterclockwise direction viewed from the top.

✔ **Be careful about the following items to use the motorized nosepiece**

- To mount objectives onto the motorized nosepiece, magnifications of objectives are placed in ascending order from No. 1 position of the nosepiece.
- Reverse rotation from nosepiece hole number 1 to 5 using the nosepiece reverse rotation button is prohibited for sample protection.

Rotate the nosepiece from hole number 1 to 5 by pressing the nosepiece forward rotation button while pressing and holding the nosepiece reverse rotation button.



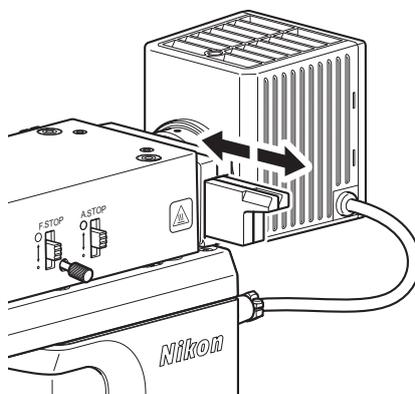
11 Inserting and Removing Filters

There are two filter sliders in the end of the epi-illumination attachment. Two filters can be set on each filter slider.

The desired filters can be brought into the optical path by sliding the filter sliders in and out.

For attaching the filters, refer to “Filter sliders and filters” in Chapter 4, step 4, “Attaching the Epi-illumination Attachment”.

Filters	Usage
NCB11 (neutral color balancing filter)	Color balance adjustment and color image capture
ND4 (ND filter)	Brightness adjustment (transmittance: 25%)
ND16 (ND filter)	Brightness adjustment (transmittance: 6%)
GIF (green interference filter)	Contrast adjustment
IF (interference filter)	For interference



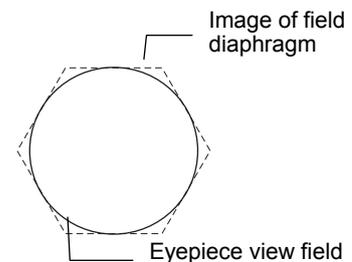
12

Adjusting the Field Diaphragm

The field diaphragm lever changes the size of the field diaphragm. Adjust the size of the diaphragm until it circumscribes or inscribes the viewfield.

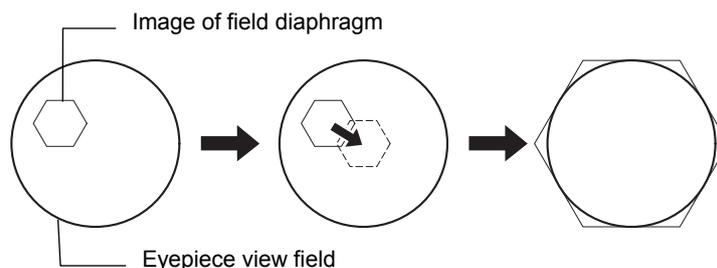
About the field diaphragm

- The field diaphragm restricts illumination on the sample to the area being observed.
- Illuminating an area larger than necessary can let in stray light, creating flaring and reducing the contrast of the optical image.
- Proper operation of the field diaphragm is important for the image capture. Generally, the field diaphragm should be set to the area to be captured.
- Be sure to adjust the field diaphragm after centering it.



Centering the field diaphragm

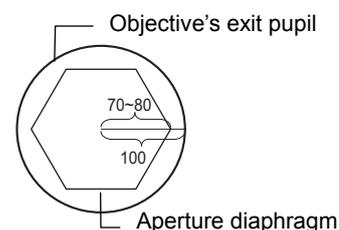
- (1) Focus on the sample with the 10x objective by following the steps of bright-field microscopy (Chapter 2, "1 Bright-field Microscopy under Epi Illumination").
- (2) Lower the field diaphragm lever to reduce the field diaphragm opening.
- (3) Turn the two field diaphragm centering screws on both sides to move the center of the field diaphragm image to the center of the viewfield.
If the LV-UEPI2 universal epi illuminator 2 is used, insert a hexagonal wrench into the field diaphragm centering holes on both sides and turn the internal adjustment screws.
- (4) Use the field diaphragm lever and centering screws so that the field diaphragm image is inscribed in the viewfield.
- (5) When starting observation, raise the field diaphragm lever so that the field diaphragm image is slightly larger the viewfield.



13 Adjusting the Aperture Diaphragm

Remove one of the eyepieces. Operating the aperture diaphragm lever will change the size of the aperture diaphragm as seen within the objective's exit pupil in the eyepiece tube.

Generally, the aperture diaphragm should be adjusted to about 70 to 80% of the numerical aperture of the objective.



About the aperture diaphragm

- Since the aperture diaphragm is for adjusting the numerical aperture of the illumination system, this diaphragm is related to the resolution, contrast, and depth of focus of the optical image.
- The diaphragm image may not appear in the case of samples with low reflectivity. In this case, change to a sample with a near-polished surface.
- For the LV-UEPI-N universal epi-illumination attachment, the aperture diaphragm centering has been adjusted at the factory and does not need to be adjusted.
- A small aperture diaphragm size reduces resolution and brightness but increases contrast and depth of focus. Conversely, a large aperture diaphragm size increases resolution and brightness but reduces contrast and depth of focus. These characteristics involve inherent tradeoffs and cannot be optimized independently.

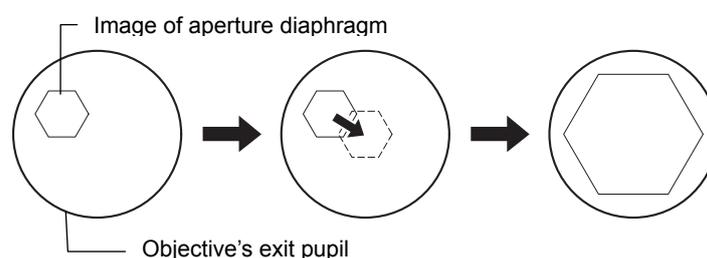
Relationship of the aperture diaphragm size with the optical image's state

Aperture diaphragm	Resolution	Brightness	Contrast	Focal depth
Stop down	Lower	Darker	Larger	Deeper
Open	Higher	Brighter	Lesser	Shallower

Centering the aperture diaphragm (LV-UEPI2 only)

When the LV-UEPI2 universal epi illuminator 2 is used, the aperture diaphragm centering can be adjusted through these steps:

- (1) Focus on the sample with the 10x objective by following the steps of bright-field microscopy (Chapter 2, "1 Bright-field Microscopy under Epi Illumination").
- (2) Remove one of the eyepieces. Check that the aperture diaphragm image is seen within the objective's exit pupil in the eyepiece tube.
- (3) Lower the aperture diaphragm lever to reduce the field diaphragm opening.
- (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 center of the objective's exit pupil.
- (5) Use the diaphragm lever and centering screws so that the aperture diaphragm image is inscribed in the objective's exit pupil.
- (6) When starting observation, adjust the aperture diaphragm lever so that the aperture diaphragm image is 70 to 80% of the numerical aperture of the objective. (Adjust the aperture diaphragm for each objective.)

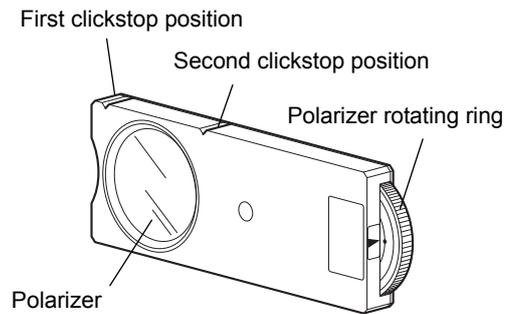


14 Using the Polarizer Slider

The polarizer slider can be used together with the analyzer slider to enable simplified polarization microscopy. Likewise, the polarizer slider can be combined with the analyzer slider and DIC slider to perform DIC microscopy, and with the analyzer slider and lambda plate slider to perform sensitive polarization microscopy (LV-UEPI2 only).

Placing the polarizer in the optical path

- **LV-UEPI-N:** Remove the vertically oriented cover on the right side of the epi-illumination attachment. Insert the polarizer slider into the slot with its orientation indication facing toward the eyepieces.
- **LV-UEPI2:** Remove the vertically oriented cover at the right side of the epi-illumination attachment. Insert the polarizer slider into the rear slot with its orientation indication facing toward the eyepieces. In the front slot, insert a dummy slider or lambda plate slider.
- **Insertion to the optical path:** Pushing the polarizer slider in to the first clickstop position inserts the empty hole into the optical path. Pushing it further in to the second clickstop position inserts the polarizer into the optical path. Set the orientation of the polarizer by turning the polarizer rotating ring.



Removing the polarizer out of the optical path

With the polarizer placed in the optical path, pull it out in the right direction to the first clickstop position. The polarizer has been removed out of the optical path (instead, the empty hole is now in the optical path).

Adjusting the orientation of the polarizer

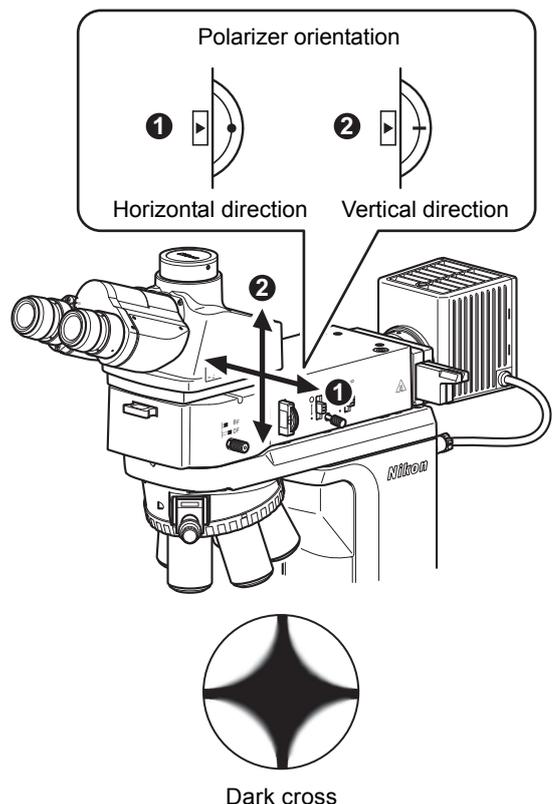
Turning the polarizer rotating ring changes the orientation of the polarizer. Here is how to bring the polarizer and the analyzer into the crossed Nicols position.

Place the polarizer and the analyzer in the optical path. Place a sample with a flat and plain surface on the stage and set the microscope for simplified polarization microscopy.

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

Turn the polarizer rotating ring in either direction until the dark cross appears in the viewfield. This is the crossed Nicols position.

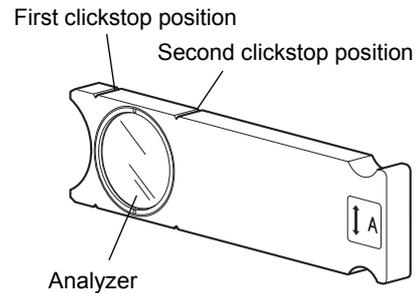
(Matching the marks on the polarizer rotation dial as shown in ❶ on the illustration will bring about the crossed Nicols position as well.)



15 Using the Analyzer Slider

The analyzer slider can be used together with the polarizer slider to enable simplified polarization microscopy.

Likewise, the analyzer slider can be combined with the polarizer slider and DIC slider to perform DIC microscopy, and with the polarizer slider and lambda plate slider to perform sensitive polarization microscopy (LV-UEPI2 only).

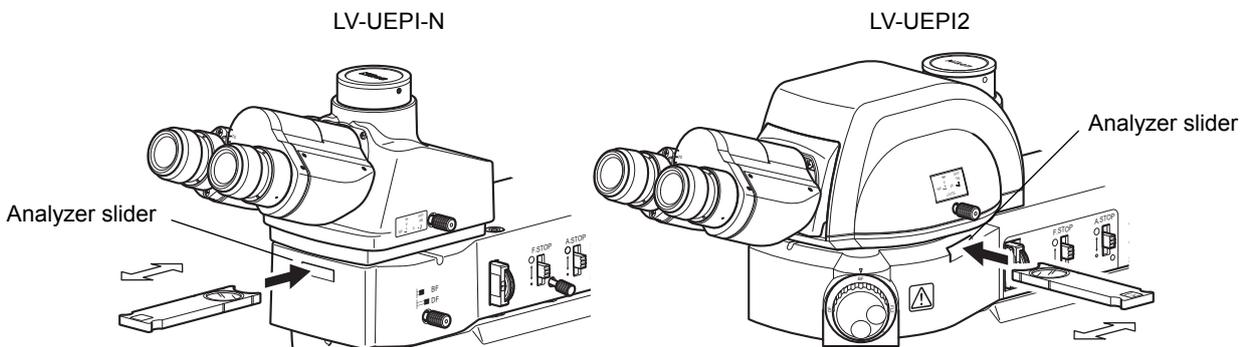


Placing the polarizer in the optical path

- **LV-UEPI-N:** Remove the dummy slider at the front of the epi-illumination attachment, and in its place, insert the analyzer slider (L-AN) with its marking facing up.
- **LV-UEPI2:** Remove the horizontally oriented cover at the right side of the epi-illumination attachment. Insert the analyzer slider (LV-FLAN) into the horizontal slot with its marking facing up.
- **Insertion to the optical path:** Pushing the analyzer slider in to the first clickstop position inserts the empty hole into the optical path. Pushing it further in to the second clickstop position inserts the analyzer into the optical path.

✓ Analyzer orientation

The orientation of the analyzer is as indicated by the arrow on the slider.



Analyzer orientation

Removing the polarizer from the optical path

With the analyzer placed in the optical path, pull it out toward you to the first clickstop position.

The analyzer is removed from the optical path (instead, the empty hole is now in the optical path).

16

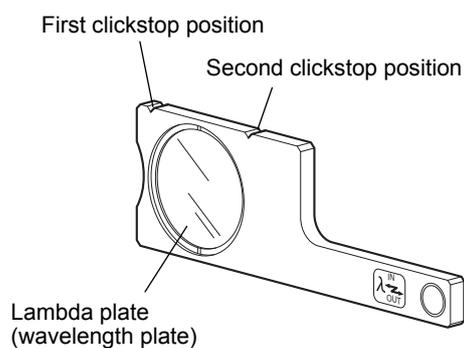
Performing Sensitive Color Microscopy Using the Lambda Plate Slider (LV-UEPI2 only)

If the LV-UEPI2 universal epi illuminator 2 is used, the lambda plate slider can be used together with the polarizer slider and analyzer slider to perform sensitive polarization microscopy.

Placing the lambda plate in the optical path

Remove the dummy slider found in front of the polarizer slider, and in its place, insert the lambda plate slider.

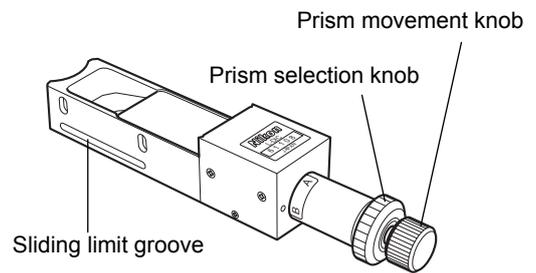
Pushing the lambda plate slider in to the first clickstop position inserts the empty hole into the optical path. Pushing it further in to the second clickstop position inserts the lambda plate into the optical path.

**Removing the lambda plate out of the optical path**

With the lambda plate placed in the optical path, pull it out in the right direction to the first clickstop position. The lambda plate is now out of the optical path.

17 Using the DIC Slider

For DIC microscopy, use the DIC slider together with the polarizer and analyzer sliders.

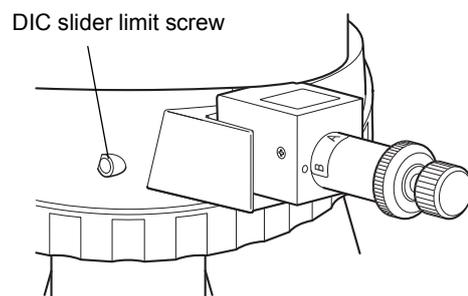


Attaching/removing the DIC slider

Use a hexagonal screwdriver to loosen the DIC slider limit screw on the nosepiece.

Insert the DIC slider into the slot on the nosepiece and screw in the DIC slider limit screw.

When removing the DIC slider from the nosepiece, fully loosen the DIC slider limit screw using a hexagon screwdriver, and then pull out the slider.



Placing the DIC prism in the optical path

Push in the slider to the second clickstop position to place the DIC prism in the optical path.

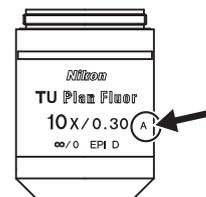
Removing the DIC prism out of the optical path

Pull out the slider to the first clickstop position to remove the DIC prism out of the optical path.

Selecting the DIC prism position

The correct position of the prism selection knob is indicated on the objective barrel after the magnification and the objective NA indications.

In the objective shown in the figure on the right, the letter "A" on the objective indicates that the correct DIC prism position for this objective is "A". Thus, when you use this objective, turn the prism selection knob on the DIC slider to match the letter "A" with the white circle.



Selecting an interference color

Turn the prism movement knob to change the interference colors continuously.

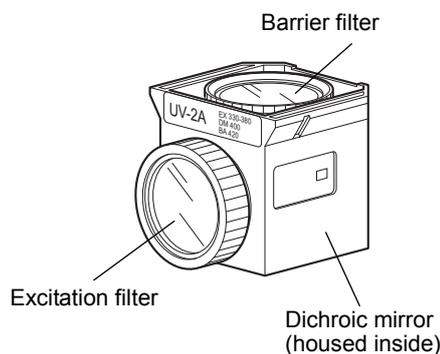
Interference color	Characteristics
Dark	Observation similar to dark-field microscopy can be performed.
Gray	This color enables observation of the phase difference distribution for the whole sample.
Sensitive red-violet	Observation with the highest color contrast can be performed.

18 Using Filter Cubes for Fluorescence Observation (LV-UEPI2 Only)

The LV-UEPI2 universal epi illuminator 2 accommodates two filter cubes for epi-fluorescence observation.

The filter cube consists of an excitation (EX) filter, barrier (BA) filter, and dichroic mirror (DM). Note the following considerations as a guideline and choose the right combination of filters that are most suitable for the characteristics of the sample and fluorescent stain.

- Different combinations of excitation filter and barrier filter are available for the same excitation method.
- Excitation filters, barrier filters, and dichroic mirrors can be purchased separately.
- Excitation filters will deteriorate over time since they are exposed to intense light. Replace them as necessary.



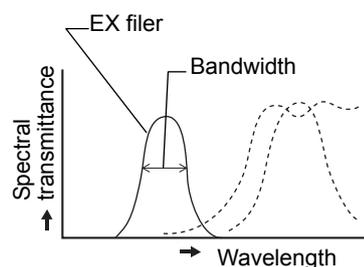
✔ Light source for epi-fl microscopy

To perform epi-fl microscopy with the LV-UEPI2 universal epi illuminator 2, the specified light source brightness may be less than the desired brightness. An HG precentered fiber illuminator can be installed into the LV-UEPI2 for this purpose.

Selecting an excitation (EX) filter

The excitation filter selectively transmits only the light of the wavelength range required for the sample to fluoresce, while blocking the other light. The wavelength range of light that can pass through the filter is called the bandwidth. The bandwidth of an excitation filter determines the brightness of fluorescence image, the occurrence of self-fluorescence (fluorescence generated by materials other than the fluorescent stain), and the degree of fading. A wider bandwidth delivers more excitation light to the sample and makes the image brighter, but it induces more self-fluorescence and therefore more fading. A narrower bandwidth delivers less excitation light to the sample and makes the image darker, but it induces less self-fluorescence and therefore less fading. If self-fluorescence is too intense, use an excitation filter of narrower bandwidth. (The fluorescence image becomes darker, however.)

Excitation filters will deteriorate over time since they are subject to intense light. Replace them as necessary depending on their total operating hours.



	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 a barrier (BA) filter

The barrier filter transmits only the fluorescence emitted by the sample, blocking the excitation light. This enables observation of fluorescence images having less unnecessary light (darker background).

BA filters are available in two types: long-pass (LP) and band-pass (BP). The LP filter blocks all the light of shorter wavelength than a given value. The BP filter transmits light in a given wavelength range. Use the suitable types in accordance with your purposes.

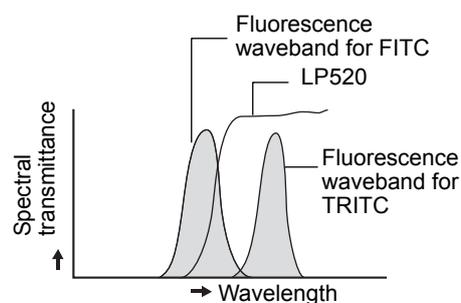
Long-pass (LP) filter

The LP filter blocks all the light of shorter wavelength than a given value, called the cut-on wavelength.

- 1) Some sample may be stained with a fluorescent color for which the fluorescence waveband and the excitation waveband (the light that the sample absorbs to emit fluorescence) are very close to each other. Then, fluorescence microscopy generally will be more efficient by selecting a filter for which the cut-on wavelength is as short as feasible.

A longer cut-on wavelength tends to result in a more complete separation between excitation light and fluorescent light, rendering a darker background of the fluorescence image. With the recent advancement in filter performance, however, shorter cut-on wavelengths are used more often than before.

- 2) LP filters are used for samples stained in multiple colors where fluorescence images for all the colors are desired. However, the usual combination of a dichroic mirror, an excitation mirror, and a barrier filter of LP filter type, may not be sufficient to excite a stain that emits fluorescence of longer wavelength (for example, TRITC when the sample is stained with FITC and TRITC), making the fluorescence image for TRITC very dark. In a case like this, a multi-band filter is recommended.



Both fluorescence images due to FITC and TRITC are seen

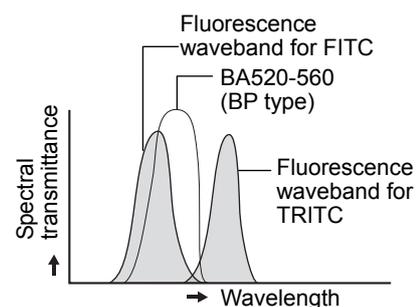
Band-pass (BP) filter

The BP filter transmits light of a certain wavelength range.

This type of filter is used for samples stained in multiple colors where fluorescence images due to a certain stain are desired. (For example, in the case of a dual-stained sample, say FITC and TRITC, and fluorescence images due only to FITC are desired, then BA520-560 should be selected.)

If a BP filter is used, however, any self-fluorescence cannot be discriminate (because the fluorescence image will be green all over for the above combination).

The LP filter is more useful when you wish to discriminate self-fluorescence by a subtle difference in hue.



Only fluorescence image due to FITC is seen

Replacing the excitation filter, barrier filter, and dichroic mirror

The excitation filter, barrier filter, and dichroic mirror can be removed from the filter cube and replaced with different parts. When handling these parts, 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.

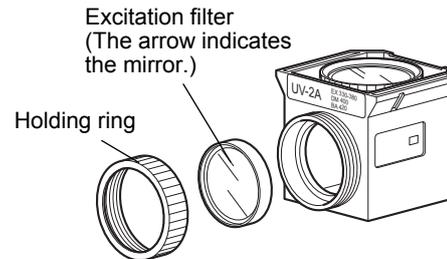
• Replacing the excitation filter

The excitation 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 filter and secure it by the holding ring.

Check and see the arrow mark on the rim of the excitation filter is directed to the dichroic mirror side when attaching the excitation filter.

If a filter made by other manufacturer is used, check and see the indication on the rim of the filter.



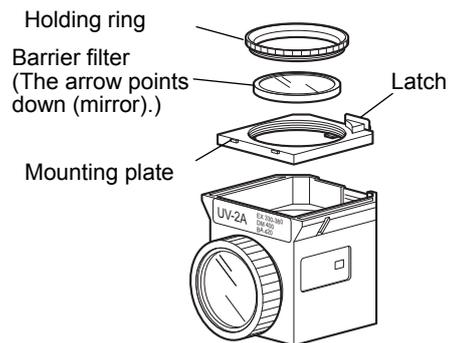
• Replacing the barrier filter

The barrier filter is secured by a screw type holding ring to the mounting plate on the upper side of the filter cube.

- (1) Press the latch to inside and detach the mounting plate and barrier filter together.
- (2) Rotate the holding ring to remove it from the mounting plate.
- (3) Replace the barrier filter and secure it in reverse order.

Check and see the arrow mark on the rim of the barrier filter is directed to downward (dichroic mirror side) when attaching the barrier filter.

If a filter made by other manufacturer is used, check and see the indication on the rim of the filter.



• Replacing the dichroic mirror

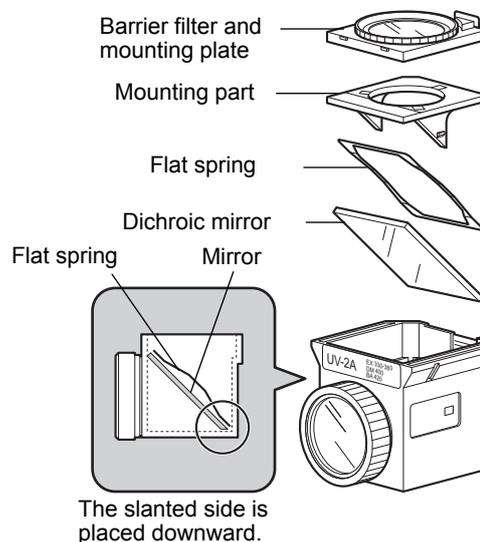
The dichroic mirror is fixed with a flat spring and a mounting part inside the filter cube.

- (1) Detach the mounting plate and barrier filter together.
- (2) Pull the mounting part upward to remove it. (It is clamped with latches on both sides.)
- (3) Remove the flat spring and dichroic mirror.
- (4) Replace the dichroic mirror and put it back to the original position with the flat spring.

One side of the edge of the dichroic mirror is slanted to distinguish the reflection surface. The slanted edge is placed to downward to fit the bottom surface of the dichroic mirror.

And the flat spring is placed to hold the both side of the dichroic mirror.

- (5) Put the mounting part and barrier filter back to their original positions.



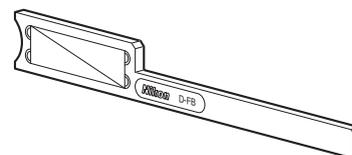
19

Using the Excitation Light Balancer (LV-UEPI2 only)

When the LV-UEPI2 universal epi illuminator 2 is used, the optional D-FB excitation light balancer can be attached for epi-fl microscopy to observe samples stained in multiple colors.

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.

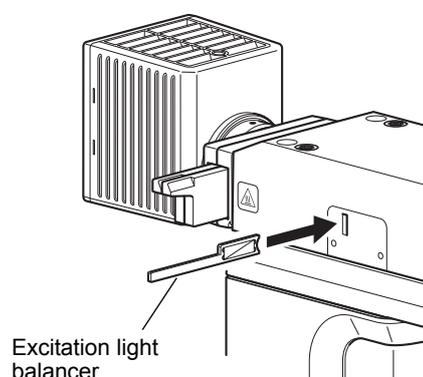


Excitation light balancer

Excitation light balancer usage

Remove the vertically oriented cover on the left side of the epi-illumination attachment, and insert the excitation light balancer with its indication faces 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.

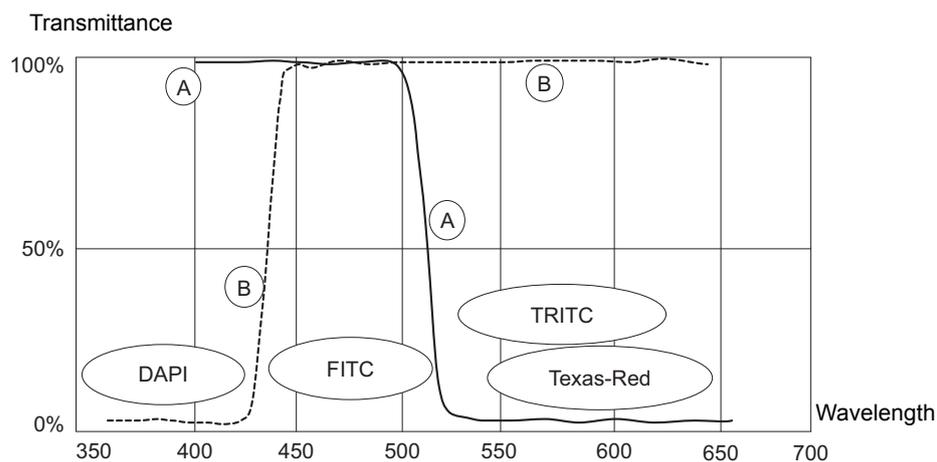
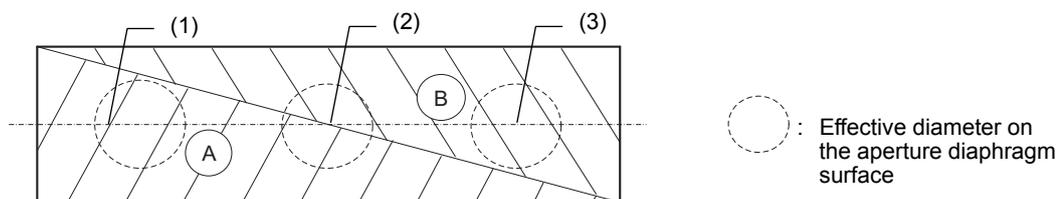


Objectives

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

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

Detailed specification of excitation light balancer



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

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

4

Assembly

Assemble each part of the microscope by referring to the diagram on the next page.

WARNING

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

CAUTION

- Be careful not to pinch your fingers or hands during assembly.
- Scratches or fingerprints on the lens surface will adversely affect the microscope 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 Chapter 7, “Maintenance and Storage.”
- The microscope is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may lose accuracy when exposed to even a weak physical shock.)

Required tools

- Hexagonal screwdriver 2 mm × 2 (supplied with the microscope main body)
- Hexagonal wrench 3 mm × 1 (supplied with the microscope main body)

When not using, place these in the tool holder at the left side of the microscope base.

Installation location

Being a precision optical instrument, this product may get damaged or lose accuracy if it is used or stored under unsuitable conditions. When selecting the installation location, note the following:

- Avoid a brightly lit location, such as exposed to direct sunlight or directly under a room light.
The image quality deteriorates if there is excessive ambient light.
- Choose a location that is free from considerable dust or dirt.
- Choose a flat surface with little vibration.
- Choose a sturdy desk or table that is able to bear the weight of the instrument.
- Do not install the microscope in a hot or humid location.
- Take enough space around the microscope referring to the layout diagrams on page ix.
- The microscope may be moved by earthquakes. We recommend taking anti-earthquake measures.
For details about anti-earthquake measures, see Step 17, “Countermeasures to Earthquakes.”
- For details about the operating environment and storage environment, see Chapter 8, “Specifications.”

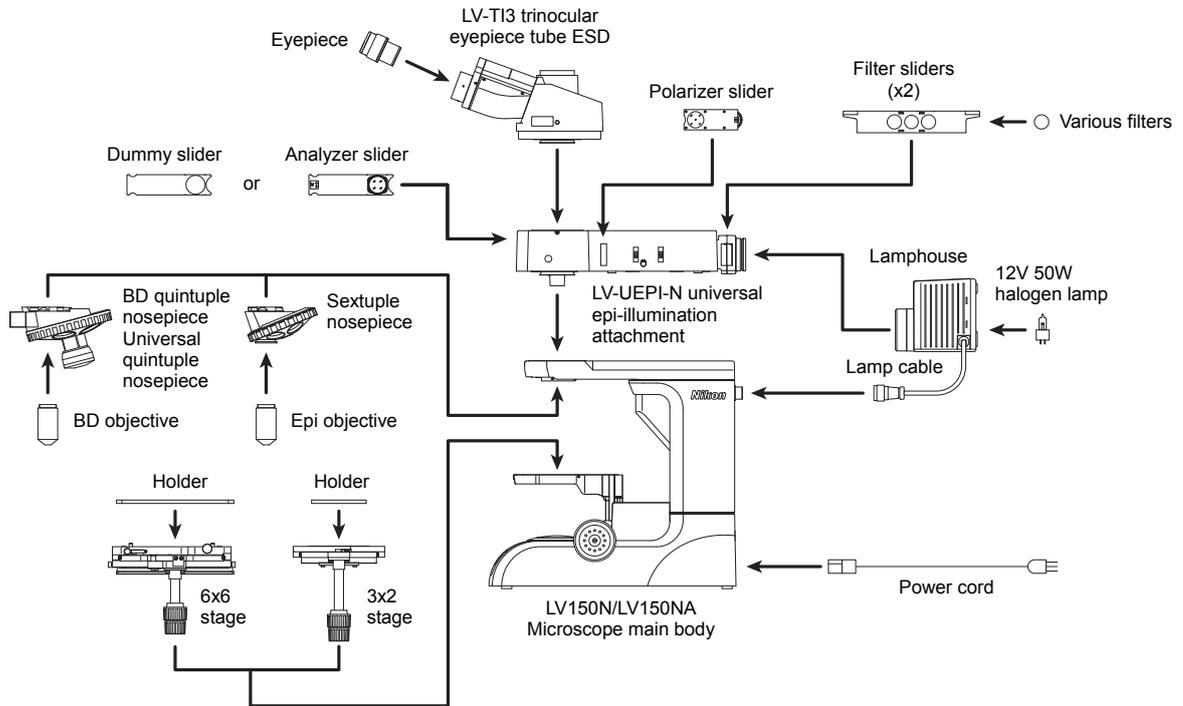
Combination of the epi-illumination attachment and the light source

This microscope system is approved by TUV and SEMI only in the combination of the epi-illumination attachment and the light source describe below. Please take note that if an epi-illumination attachment or a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI approved product.

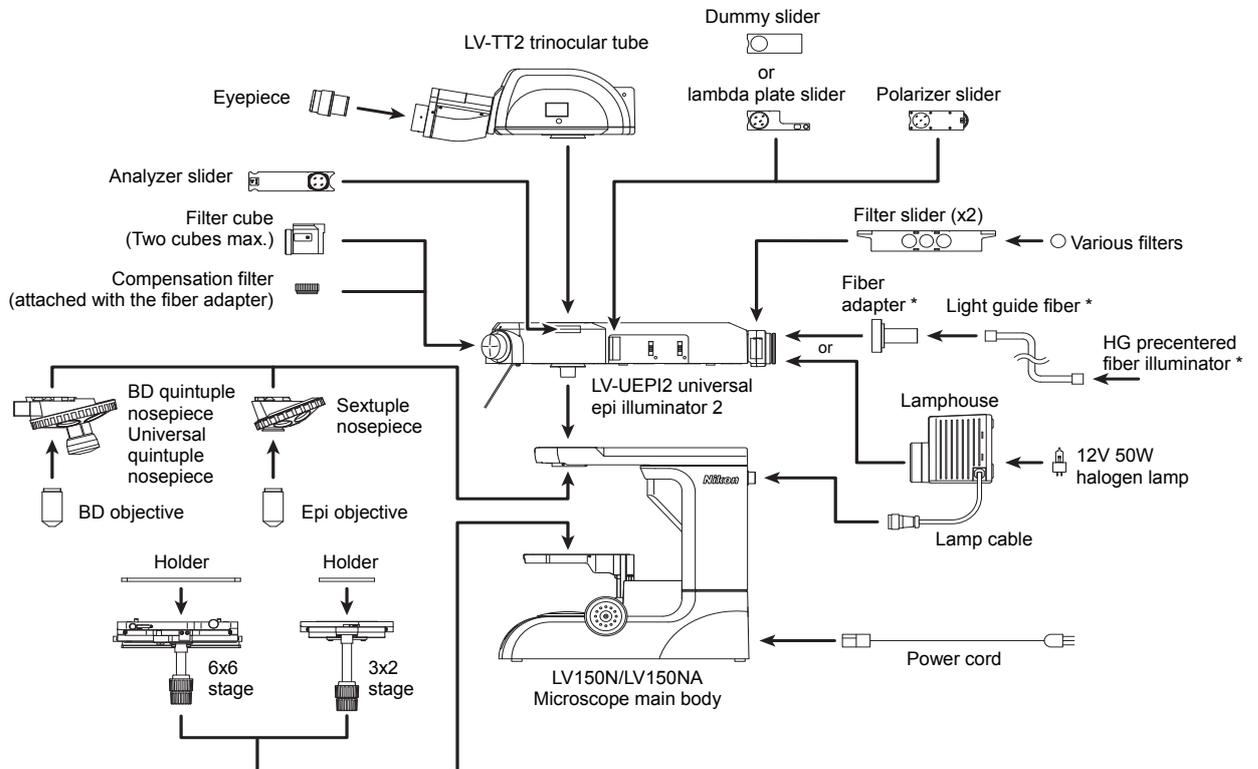
- Epi-illumination attachment
Nikon LV-UEPI-N Universal Epi-illumination Attachment or Nikon LV-UEPI2 Universal Epi Illuminator 2
- Lamphouse Nikon LV-LH50PC precentered lamphouse 12V 50W
- Lamp Nikon LV-HL50W 12V 50W LONGLIFE halogen lamp or non-Nikon 12V 50W SHORTLIFE halogen lamp (model OSRAM HLX 64610, OSRAM HLX64611, or PHILIPS 7027)

Assembling the ECLIPSE LV150N/LV150NA

- When using the LV-UEPI-N universal epi-illumination attachment



- When using the LV-UEPI2 universal epi illuminator 2



* It is installed if the brightness of the specified light source is less than the desired brightness for episcopic microscopy or so on. (Please take note that if an HG precentered fiber illuminator is used, this microscope system will not be treated as a TUV/SEMI approved product.)

1 Checking the Input Voltage

Check the input voltage indicated on the back of the microscope; if using an external power supply, check also the power supply. Use the microscope only if the indicated input voltage matches the power supply voltage for the area in which the microscope will be used.

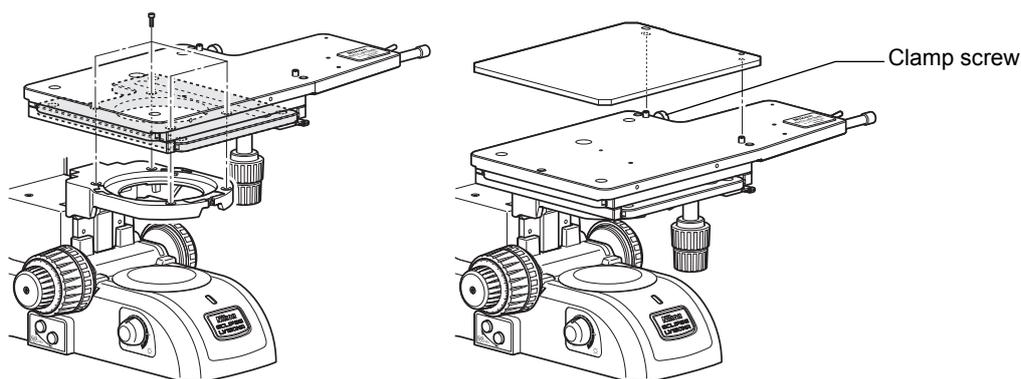
WARNING

If the indicated voltage and the supplied voltage differ, do not attempt to use the microscope. Contact your nearest Nikon representative for advice.

2 Attaching the Stage and the Holder

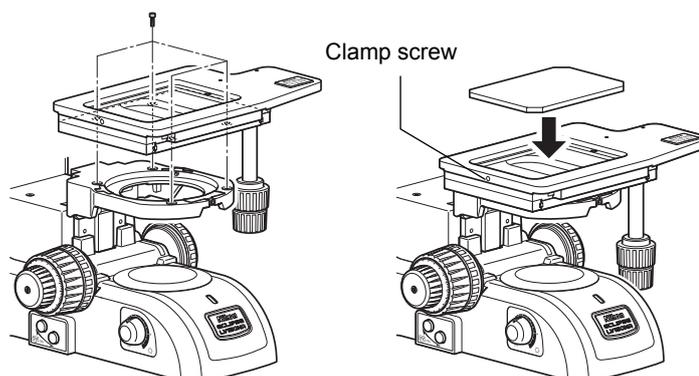
• 6x6 stage

- (1) Lower the sub-stage completely with the coarse focus knob.
- (2) Remove the fixing metals from the stage plate by using the 3-mm hexagonal wrench to the four hex screws.
- (3) Place the stage on the substage and fix it with the four M4 screws that were attached to the sub-stage.
- (4) Place the holder onto the stage by matching its two positioning holes with the two pins on the stage. Secure the holder with the clamp screw at the right side of the stage top plate. Take care not to lift up the holder by tightening the clamp screw too much.



• 3x2 stage

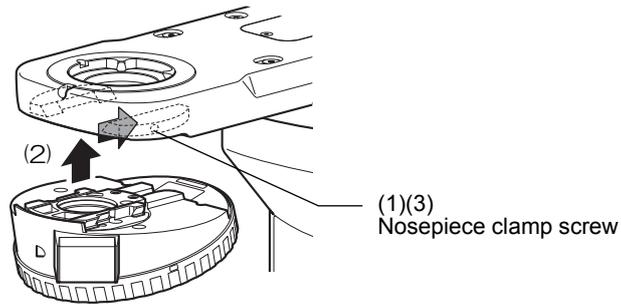
- (1) Lower the sub-stage completely with the coarse focus knob.
- (2) Place the sub-stage and secure it with the four M4 screws provided with the sub-stage, using the 3-mm hexagonal wrench.
- (3) Loosen sufficiently the stage clamp screw. Place the holder on top of the stage and fit it in position so that it is level. Tighten the clamp screws. Take care not to lift up the holder by tightening the clamp screw too much.



3 Assembling the Nosepiece

■ Assembling the manual nosepiece

- (1) Fully loosen the nosepiece clamp screw on the right side of the microscope arm using the hexagonal screwdriver.
- (2) Fit the nosepiece from the front by aligning it to the groove in the bottom of the microscope arm and push it all the way.
- (3) Secure the nosepiece by tightening its clamp screw.

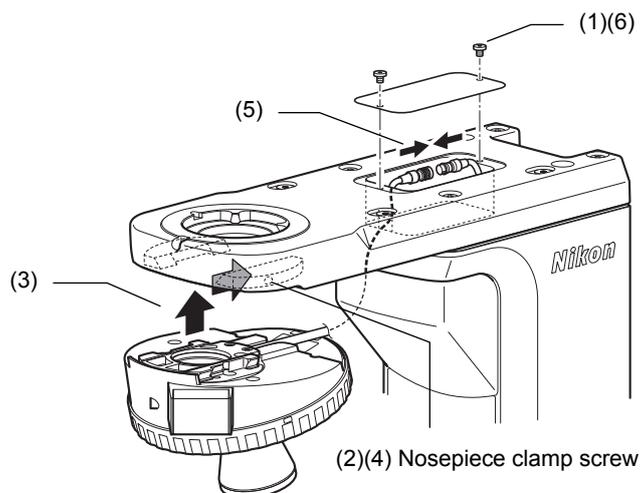


■ Assembling the motorized nosepiece

For the LV150NA, the motorized nosepiece must be attached.

The motorized nosepiece should be assembled before attaching the epi-illumination attachment.

- (1) Remove the cover from the connection block by unscrewing the two M4 screws on the top of the microscope arm.
- (2) Loosen sufficiently the nosepiece clamp screw on the right side of the microscope arm using the hexagonal screwdriver.
- (3) Fit the nosepiece from the front by aligning it to the groove in the bottom of the microscope arm and push it all the way.
Pass the signal cable of the nosepiece through the bottom hole of the arm into the microscope.
- (4) Secure the nosepiece by tightening its clamp screw.
- (5) Connect the signal cable of the nosepiece to the cable in the arm.
- (6) Close the cover over the connection block and secure it with the two M4 screws.



■ Removing the nosepiece

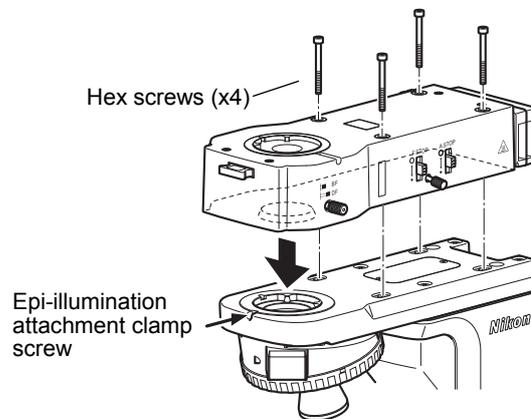
Removing the nosepiece is the reverse order of the above procedure. When removing the nosepiece, lower the stage completely, remove the sample and all objectives, and hold the nosepiece in your hand so that it does not fall when you remove it.

4 Attaching the Epi-illumination Attachment

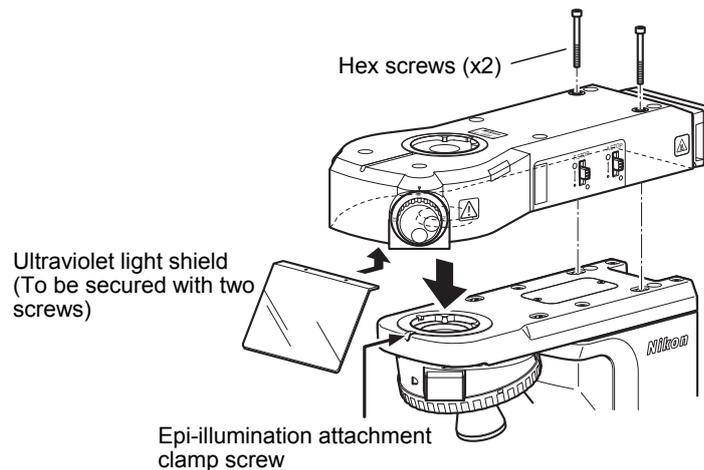
■ Epi-illumination attachment

- (1) Loosen sufficiently the epi-illumination attachment clamp screw on the front of the microscope arm using the hexagonal screwdriver.
- (2) Mount the epi-illumination attachment onto the microscope arm and fix it by tightening the epi-illumination attachment clamp screw.
- (3) Secure the epi-illumination attachment on the microscope arm. Do this by tightening the hex screws supplied with the epi-illumination attachment (four screws for LV-UEPI-N, or two screws for LV-UEPI2) using the hexagonal wrench.
- (4) Cover the bolt holes with the protective stickers supplied with the epi-illumination attachment.
- (5) For the LV-UEPI2, attach the ultraviolet light shield to the front bottom of the epi-illumination attachment using the two screws supplied.

LV-UEPI-N



LV-UEPI2



⚠ Ultraviolet light shield

- Harmful light or strong light may be emitted from objectives with some excitation methods. Be sure to attach the ultraviolet light shield to the LV-UEPI2.
- Be 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.

■ **Sliders (dummy sliders, polarizer slider, lambda plate slider, and analyzer slider)**

• **LV-UEPI-N:**

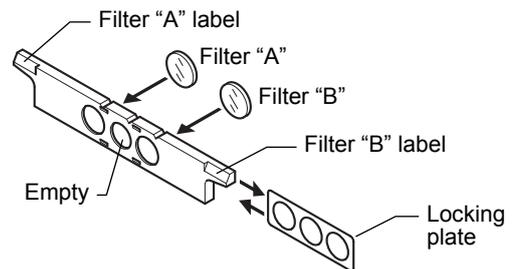
The sliders are to be inserted into the slots on the front and the right side of the epi-illumination attachment. The polarizer slider is to be inserted after removal of the vertically long cover on the right of the epi-illumination attachment. Push in the dummy slider for the analyzer slot until it stops. (Pushing in the dummy slider to the end will place the hole of the dummy into the optical path.)

• **LV-UEPI2:**

The LV-UEPI2 has covers over the slider slots. Remove the covers before inserting sliders. For sliders that are not in use, the covers can be set in place, eliminating the need of inserting dummy sliders. Note that the slots for polarizer slider and lambda plate slider share a single cover. When using only a polarizer, therefore, insert a dummy slider in front of the polarizer slider.

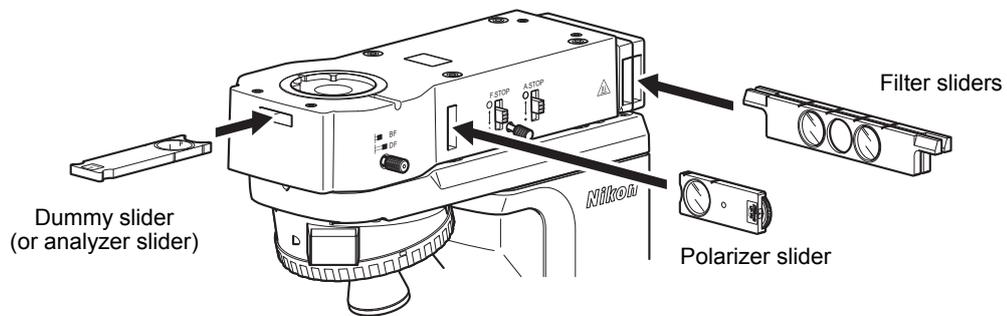
■ **Filter sliders and filters**

- (1) Remove each filter slider from the epi-illumination attachment.
(There are two sliders.)
- (2) Pull out the locking plate from the filter slider.
- (3) Insert the desired filter. (Two filters can be set on the filter sliders.)
- (4) Reinstall the locking plate.
- (5) Affix the label to the appropriate lug of the filter slider.
- (6) Attach the filter sliders to the epi-illumination attachment.

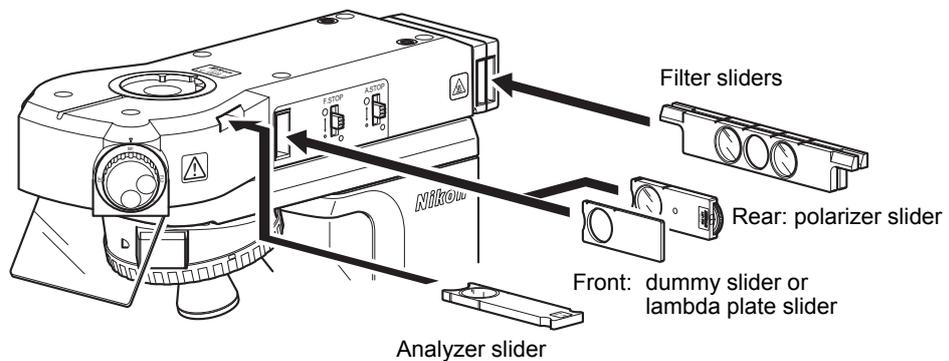


ND4, ND16, and NCB filters are already set on the filter sliders at the factory. You can set an additional filter in the empty position.

For the LV-UEPI-N



For the LV-UEPI2



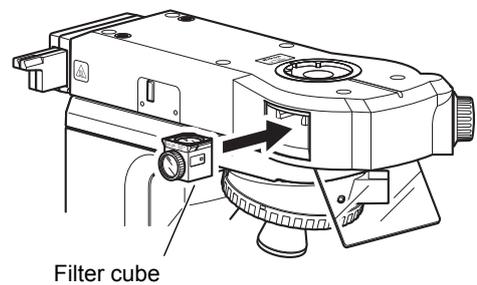
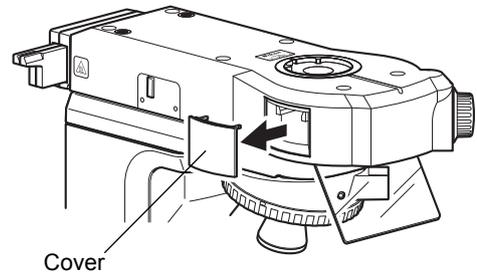
■ Filter cubes for fluorescence observation (LV-UEPI2 only)

The LV-UEPI2 accommodates two filter cubes for epi-fluorescence microscopy.

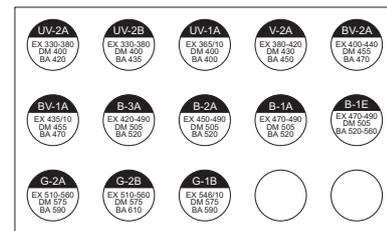
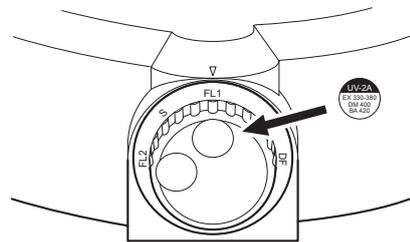
✓ PA cube

Attach the PA cube to the FL1 position.

- (1) Check that the illumination shutter is closed and the power supplies to the microscope and light source are off.
- (2) Remove the cover from the left side of the epi-illumination attachment.
- (3) Turn the microscopy selection knob so that the position indication “FL1” or “FL2” on the turret in the epi-illumination attachment faces the opening.
- (4) Insert the desired filter cube into the dovetail of the turret and push it in to the clickstop position. Make sure that the filter cube has its excitation filter facing out.
- (5) Now that the filter cube is installed in the position FL1 or FL2, refit the cover.



- (6) Check the stickers of excitation method supplied with the epi-illumination attachment and find the one that corresponds to the filter cube just installed. Affix it to the position FL1 or FL2 on the microscopy selection knob. If there is no sticker corresponding to the excitation method of the filter cube, write the excitation method in a blank sticker and affix it.



Stickers of excitation method

5 Attaching the Lamphouse and Replacing the Lamp

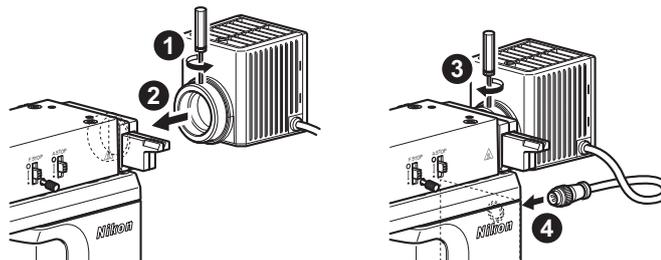
CAUTION

- To prevent electrical shock and damage to the microscope, always turn off the power switch (press it to the “O” side) and unplug the power cord from the outlet before connecting or disconnecting the lamphouse.
- To prevent burn injury, allow the lamp and the lamphouse to cool down sufficiently (for at least 30 minutes after the lamp is turned off), before replacing the lamp.
- Use the Nikon LV-LH50PC precentered lamphouse for the lamphouse.
- 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.
- Do not touch the glass surface of the lamp with bare hands. Fingerprints or grease on the bulb surface will reduce the illumination intensity of the lamp. Wipe clean any fingerprints or grease attached to the surface.
- Securely attach the lamphouse cover to the lamphouse after replacing the lamp. Never light the lamp with the lamphouse 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.

■ Attaching the lamphouse

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

- (1) Loosen the clamp screw on the upper side of the lamphouse connection port by using the hexagonal screwdriver supplied with the microscope.
- (2) Mount the lamphouse to the connection port on the rear of the epi-illumination attachment and press the lamphouse as far as it goes.
- (3) Using the hexagonal screwdriver, tighten the clamp screw on the top of the connection port of the lamphouse to secure the lamphouse.
- (4) Plug the cable coming from the lamphouse into the lamp connector on the rear of the microscope and tighten the ring of the connector to secure the connection.



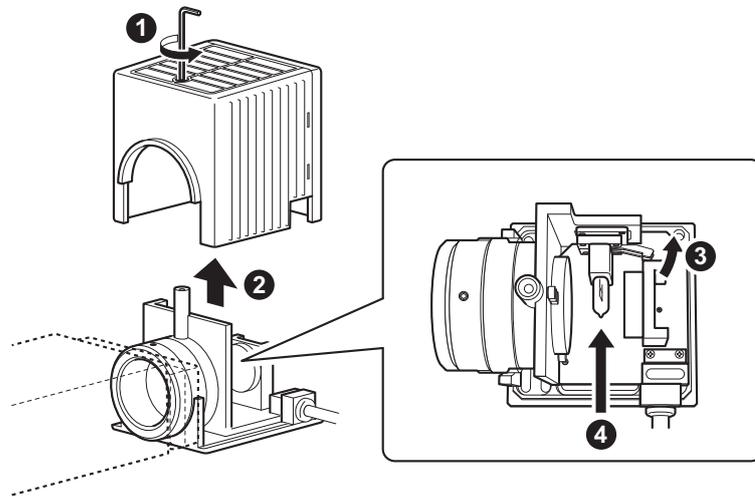
To remove the lamphouse, reverse the above procedure.

■ Replacing the lamp

The lamp can be removed without having to detach the lamphouse from the microscope.

Before performing the following procedures, turn off the power supply for the microscope (press the "O" side) and unplug the power cable from the wall outlet. And check that the lamp and lamphouse have cooled down sufficiently.

- (1) Loosen the lamphouse cover clamp screw using the hexagonal wrench.
- (2) Remove the lamphouse 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 pin holes of the socket. Press 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 with bare hands. When releasing the lamp clamp lever, use care so that the lamp does not tilt.
- (5) Close the lamphouse cover and secure it by tightening the clamp screw.



6 Attaching the Fiber Adapter and Precentered Fiber Illuminator

If the brightness of the specified light source is less than the desired brightness, an external light source can be used with the LV-UEPI2 to perform epi-fl microscopy.

The following light sources can be attached through the light guide fiber when the optional LV-HGFA HG fiber adapter is mounted on the light source mount part.

- **External light source:** C-HGFI HG Precentered Fiber Illuminator (manual type)
C-HGFIE HG Precentered Fiber Illuminator (motorized type)

CAUTION

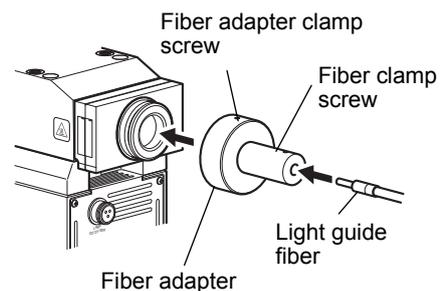
- If a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI approved product.
- Carefully read the instruction manual for an external light source to use it, and follow their instructions.
- A light source emits very strong 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.

■ Attaching the fiber adapter

Loosen the clamp screw on the fiber adapter by using the hexagonal screw driver. And then, attach the HG fiber adapter onto the mount part of the epi-illumination attachment. Push in the adapter to the limit position, and then tighten the clamp screw to fix it.

Next, insert the light guide fiber tip through the hole of the fiber adapter, and then tighten the clamp screw to fix it by using the hexagonal screw driver.

At last, connect the light guide fiber to the light source.



■ Attaching the compensation filter (LV-UEPI2 only)

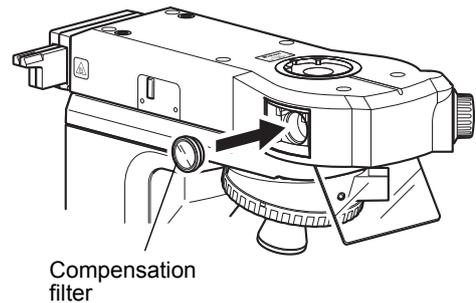
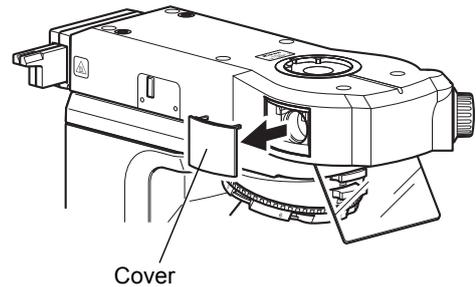
A designated compensation filter comes with the HG fiber adapter. Attach it into the bright-field cube in the LV-UEPI2.

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 for bright-field microscopy. Be sure to attach the filter.



Compensation filter

- (1) Check that the shutter for illumination is closed and power supplies to the microscope and the light source are turned off.
- (2) Remove the cover on the left of the epi-illumination attachment.
- (3) Check the position indicator of the turret in the microscope, and rotate the microscopy selection knob to locate the "BF" label into the opening.
- (4) Screw in the compensation filter attached with the fiber adapter to the cube in the epi-illumination attachment.
- (5) Put the cover back to its original position.



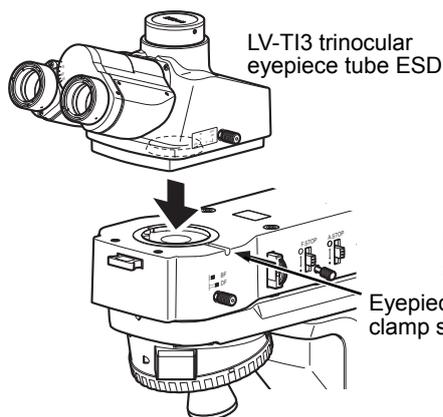
■ **Connecting the LV150NA and an external light source**

When the LV150NA is used with an external light source, be sure to attach the C-HGFIE HG precentered fiber illuminator. The shutter must be controlled in synchronization with the nosepiece. So, the C-HGFIE must be connected with the microscope through the RS-232C cable attached to the light source. If this communication is not established, a flash of light may be fired at the rotation of the motorized nosepiece. Be sure to connect them.

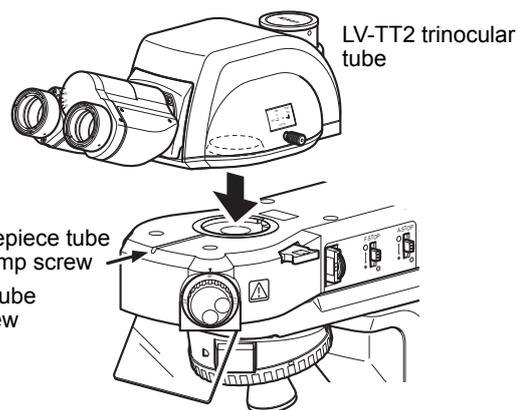
7 Attaching the Eyepiece Tube

Fully loosen the eyepiece tube clamp screw with the hexagonal screwdriver. Fit the eyepiece tube onto the mount on the top of the epi-illumination attachment and tighten the eyepiece tube clamp screw with the hexagonal screwdriver.

When using the LV-UEPI-N



When using the LV-UEPI2



✔ **Note on removing the eyepiece tube**

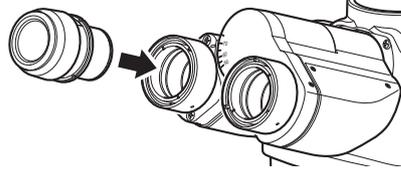
Take hold of the eyepiece tube when loosening the eyepiece tube clamp screw since the eyepiece tube may come off suddenly.

8 Attaching Eyepieces

Attach eyepieces of the same magnification and of the same viewfield number to the left and the right eyes.

✔ Notch on eyepiece

Eyepiece has a notch to prevent rotation. When attaching, match the notch with the protrusion on the eyepiece sleeve. Otherwise, eyepiece is not attached to the correct position.



9 Attaching Objectives

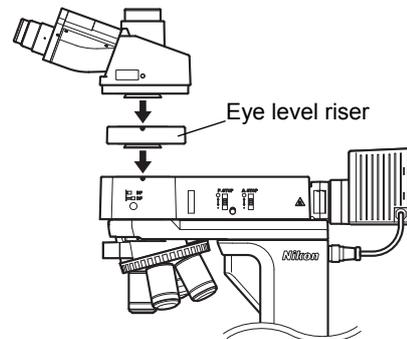
- (1) Lower the stage completely.
- (2) Screw objectives from number 1 into the nosepiece so that the magnification increases with the clockwise rotation (as viewed from above the microscope) of the nosepiece.
- (3) When removing the objectives, remove the sample, lower the stage completely, and hold each objective using both hands so that it does not fall during the removal.

10 Attaching Eye Level Riser

The optional eye level riser is 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 eye level riser

- (1) Loosen the tube clamp screw of the epi-illumination attachment sufficiently, and then fit the circular dovetail joint of the eye level riser into the circular dovetail receptacle of the epi-illumination attachment.
- (2) Tighten the clamp screw for the eyepiece to fix the eye level riser.
- (3) Attach the eyepiece tube on the eye level riser.

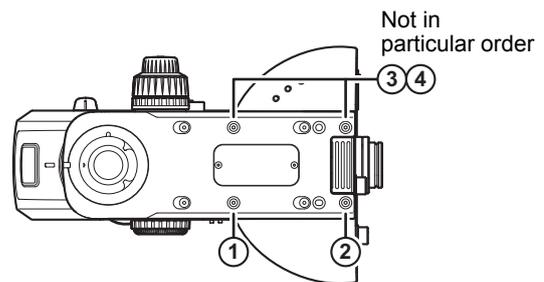
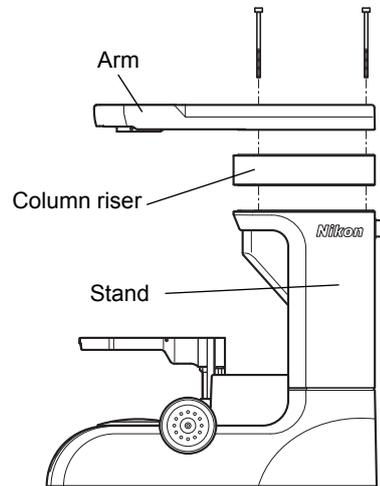


11 Attaching Column Riser

The optional column riser is used for the adjustment of the distance between the objective and the stage when observing a thick sample. It is attached between the arm and the stage of the microscope main body. When one column riser is attached, the objective height rises 35 mm.

■ Attaching column riser

- (1) Remove the epi-illumination attachment eyepiece, and nosepiece if they are attached onto the microscope. Be careful not to drop them.
- (2) Remove four hex screws, which fix the arm of the microscope main body to the stand. And then, remove the arm.
- (3) Mount the column riser and arm on the stand and fix them by four hex screws attached with the column riser.
To maintain accuracy, be sure to insert the hex screws in the order shown in the figure on the right, and then evenly tighten the four screws little by little. Do not use four hex screws that were used to fix the arm.
- (4) Put the removed parts back to their original positions.



12 Connecting the Power Cord

⚠ WARNING

Use only the supplied power cord. Using the wrong power cord could cause hazards or fire. Also, connect the microscope to a PE (protective earth) terminal, since the microscope complies with the electric shock to protection class I.

For details about the power cord, see Chapter 8, "Specifications."

To prevent electric shock, always turn off the power switch (press to the "O" position) for the microscope before connecting the power cord.

Turn off the power switch of the microscope (press it to the "O" side).

Insert the socket into the AC inlet at the rear of the microscope, and then firmly insert the plug into the wall outlet.

13 Connecting PC/DS-L3 (LV150NA only)

The LV150NA microscope is equipped with the USB (Universal Serial Bus) interface. You can connect a PC or the DS-L3 digital camera control unit to the microscope via the USB interface to configure the microscope settings or control the operation. The LVSetup application needs to be installed in the PC to use it for such purposes.

See Chapter 5, “2 USB Communication” for details on connecting USB interface.

14 Connecting the RS-232C (LV150NA only)

The LV150NA has an RS-232C interface for serial communications, enabling external equipment such as a PC to control the motorized nosepiece, etc. When making an RS-232C interface connection, see Chapter 5, “1 Serial Communication.”

When the LV150NA is used with the HG precentered fiber illuminator, connect the light source with the microscope through the RS-232C cable attached to the lightsource.

15 Installing Separately Sold Accessories

Install a camera head and other separately sold accessories by referring to the system diagram or the instruction manual for each accessory.

16 Anti-static Treatment

Many parts of the microscope have anti-static finishes, which should be very useful when observing electrostatically sensitive samples. The anti-static parts include: LV150N/LV150NA microscope main body, LV-UEPI-N universal epi-illumination attachment/LV-UEPI2 universal epi illuminator 2, LV-TI3 trinocular eyepiece tube ESD/LV-TT2 trinocular tube, LV-10X eyepieces, 3x2 stage, 6x6 stage, ESD plate, BD quintuple nosepiece, universal quintuple nosepieces, motorized universal quintuple nosepiece and objectives. The ground is taken through the 3-conductor power cord of the microscope. If the power to the microscope main body is not used at all, as when using an external light source, the ground can be taken by connecting the grounding line to the grounding tap at the rear of the main body.

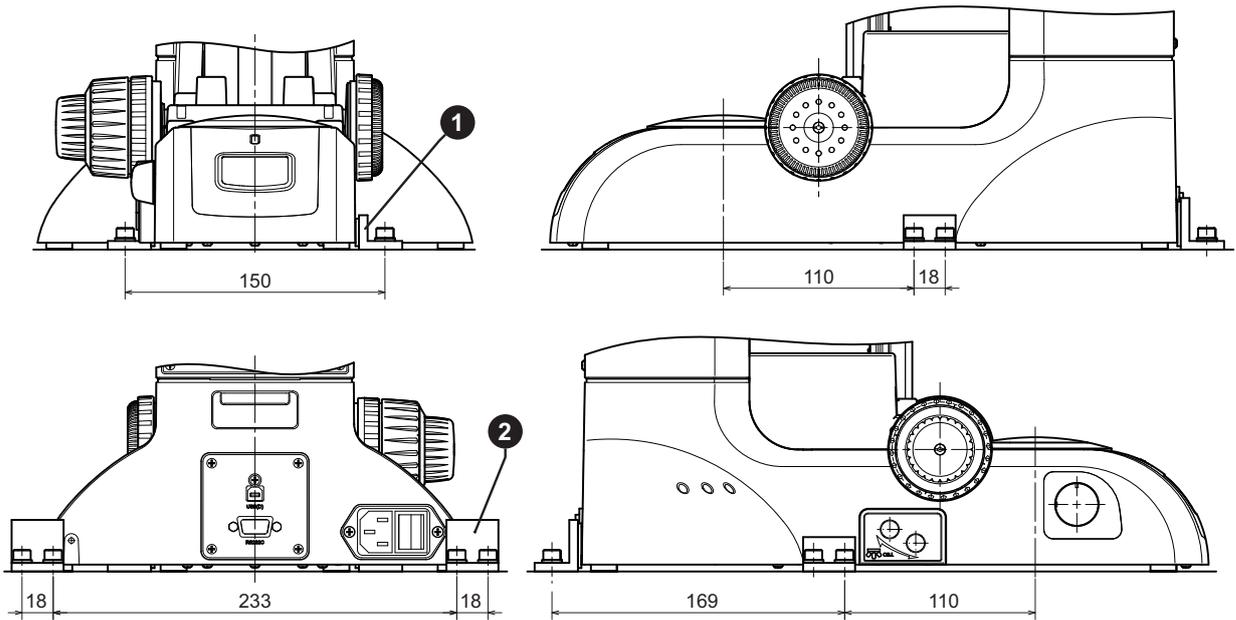
17 Countermeasures to Earthquakes

To prevent the microscope from being slipped and shaken by the strong shake of an earthquake, we recommend taking the following countermeasures:

Prepare four angle-shaped brackets as shown in the figure, and screw them onto the table so that the microscope is held tight by the brackets. See the figure for the sizes of the brackets. The brackets should be made of aluminum alloy, with a thickness of 5 mm or more.

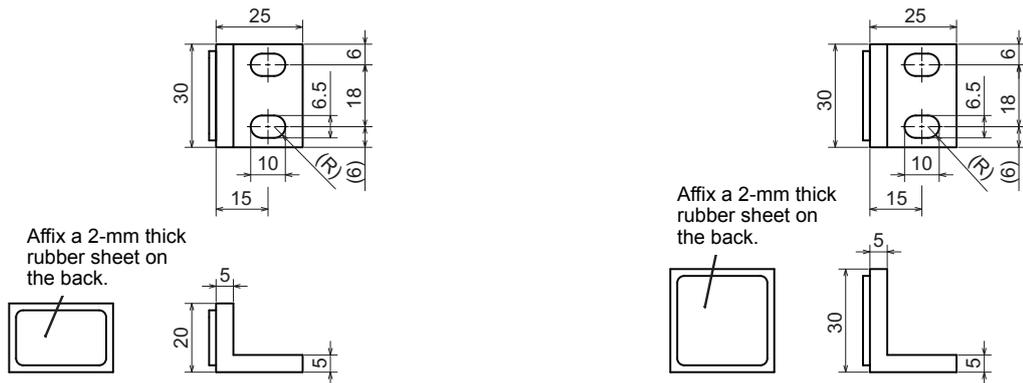
We recommend the use of an anti-vibration table to eliminate the influences of the vibration of the table.

The dimensions in the figure below are for brackets 5 mm thick. Figure out the layout and dimensions of brackets on the table in a way that best fit your condition.



Bracket 1

Bracket 2



5

External Communications Control (LV150NA only)

The LV150NA has RS-232C and USB interfaces. It can be controlled by an external device such as a PC.

1

Serial Communication

Serial communication enables you to rotate a nosepiece, read its position and set/read its status from an external device such as a PC.

■ Communication Method

Asynchronous (start-stop synchronized) serial communication

RS-232C (EIA standard compliant)

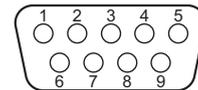
■ Connector Specifications

(1) Connector Type Name

D-sub 9-Pin Male

(2) Pin Assignment

Pin number	Signal name	In/out
1	-	-
2	RxD	Input
3	TxD	Output
4	DTR	-
5	SG	GND
6	DSR	-
7	RTS	-
8	CTS	-
9	-	-



--: Not used

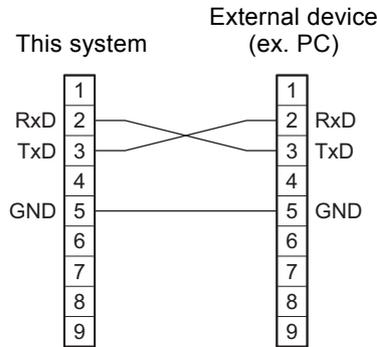
✔ NOTE

The control lines DTR, DSR, RTS, and CTS are not used in communication with this unit.

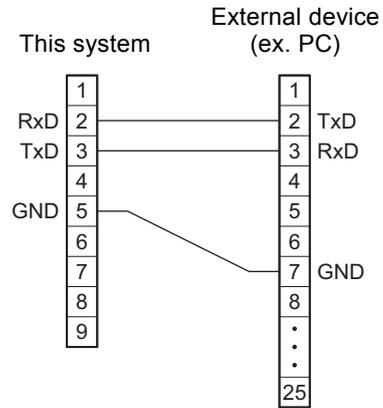
■ **Cable Specifications**

The following diagram shows signal connections necessary for a cable to work with the factory default.

For 9-pin connector type external device



For 25-pin connector type external device



■ **Communication Parameters**

- Baud Rate 9600 bps
- Data Length 8 bits
- Start Bit 1 bit
- Stop Bit 1 bit
- Parity Bit None

■ **Communication Formats**

The format of data received by this unit from an external device shall be defined as the “receiving format”, and the format of data sent by this unit to an external device as the “sending format”. Note that in the following text “[”, “]”, “<”, and “>” are used as delimiters only for the purpose of description and that they are not part of the characters to be included in data sent or received.

(1) **Receiving Format: [Identification Code] [Command] [Data] [<CR>]**

[Identification Code]: 1 lower-case alphabetic character (ASCII code, 1 byte)

Identification code	Specifications
c	Operation command, control command, or data set command
r	Settings condition read, or data read

[Command]: 3 upper-case alphabetic characters (ASCII code, 3 bytes)

[Data]: ASCII code, 4 bytes maximum

[<CR>]: Transmission control character (Carriage Return: 0x0D)

(2) Sending Format: [Identification Code] [Command] [Data] [<CR>]

[Identification Code]: 1 lower-case alphabetic character (ASCII code, 1 byte)

Identification code	Specifications
o	Acknowledging response against a "c" code
n	Negative acknowledging response against a "c" or "r" code
a	Acknowledging response against an "r" code
s	Status transmission

[Command]: 3 upper-case alphabetic characters (ASCII code, 3 bytes), [?] (ASCII code, 0x3F)
 [?] is added when the [command] portion of a message received by this unit is short of 3 bytes.

[Data]: ASCII code, 4 bytes maximum

In case the identification code is an [n], the lower-case alphabetic character (ASCII code, 1 byte) set to [data] will be an error code whose meanings are defined in the table below.

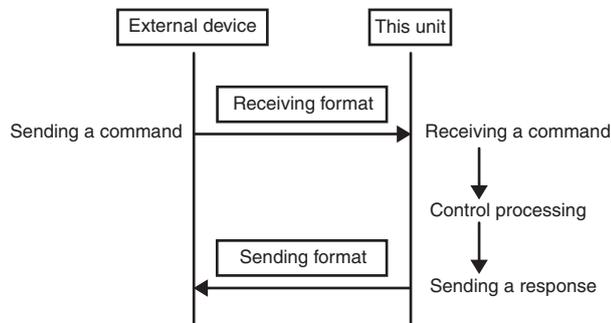
Error code	Name	Specifications
a	Command error	Indicates an unregistered command is received
b	Data Error	Indicates that data is invalid
d	Control Timeout Error	Indicates a timeout error occurred during control
f	Control Forbidden Error	Indicates a control command is received while control is forbidden
4	Receive buffer overflow	The received data exceeded the limit.
5	Hardware error	Hardware breakdown

[<CR>]: Transmission control character (Carriage Return: 0x0D)

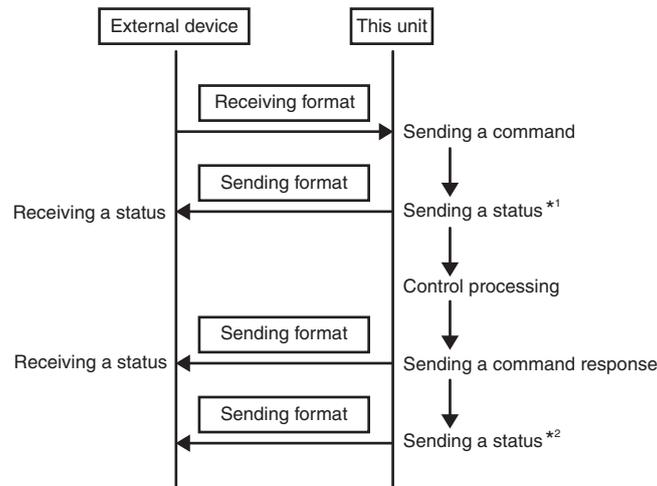
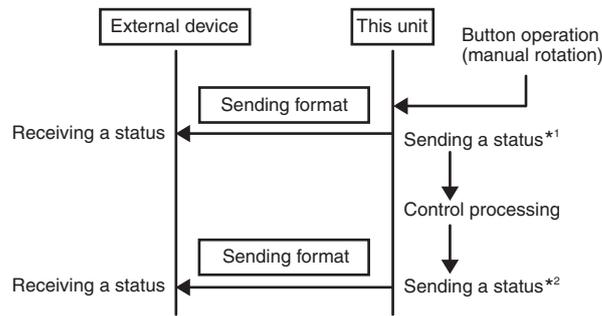
■ Communication Sequence

The factory default is the state of (3). If you don't need to connect the external light source and to send the shutter close command, disable the status output by using the communication command.

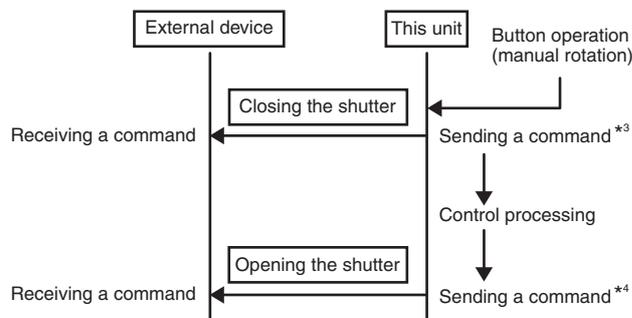
(1) When the status output of this unit is disabled;



(2) When the status output of this unit is enabled;



(3) When an external light source (HG precentered fiber illuminator) is attached and the control for the external light source shutter is enabled;



- *1: The unit status will be sent when the nosepiece is rotated by using the forward/reverse rotation button, when the nosepiece is rotated by using the communication command, or when the objective goes out of the optical path.
- *2: The unit status will be sent when the motorized/manual nosepiece rotation ends or when the objective comes into the optical path.
- *3: The shutter close command will be sent when the nosepiece is rotated by using the forward/reverse rotation button, when the nosepiece is rotated by using the communication command, or when the objective goes out of the optical path.
- *4: The shutter close command will be sent when the motorized/manual nosepiece rotation ends or when the objective comes into the optical path.

■ List of Control Commands

Identification code	Command	Data	Specifications
c	RCW	-	Rotates the nosepiece in forward direction to the next address.
c	RCR	-	Rotates the nosepiece in reverse direction to the next address. (However, rotation from nosepiece address 1 to 5 is prohibited.)
c	RCC	-	Rotates the nosepiece in reverse direction to the next address.
c	RDC	p	Rotates the nosepiece to the specified address (p: 1 to 5).
r	RAR	-	Reads the nosepiece address.
r	VER	-	Reads the program version.
r	PNM	-	Reads the program name.
c	SAS	-	Sets the status output setting.
r	SAR	-	Reads the status output setting.
s	SAE	-	Outputs the status.
c	DEF	-	Initializes the control data (factory default).

■ **Response to Control Commands**

[c] [RCW] [<CR>]

Rotates nosepiece in forward direction to the next address.

→ When properly finished [o] [RCW] [<CR>]

→ When control error occurred [n] [RCW] [error code] [<CR>]

[c] [RCR] [<CR>]

Rotates nosepiece in reverse direction to the next address. (Rotation from address 1 to address 5 is prohibited.)

→ When properly finished [o] [RCR] [<CR>]

→ When control error occurred [n] [RCR] [error code] [<CR>]

[c] [RCC] [<CR>]

Rotates nosepiece in reverse direction to the next address.

→ When properly finished [o] [RCC] [<CR>]

→ When control error occurred [n] [RCC] [error code] [<CR>]

[c] [RDC] [p] [<CR>]

Rotates nosepiece to the specified address (p: 1 to 5).

→ When properly finished [o] [RDC] [<CR>]

→ When control error occurred [n] [RDC] [error code] [<CR>]

[r] [RAR] [<CR>]

Reads nosepiece address.

→ When properly finished [a] [RAR] [p] [<CR>]

→ When control error occurred [n] [RAR] [error code] [<CR>]

[p]: Nosepiece address 0, 1, 2, 3, 4, or 5 ("0" when address unidentified.)

[r] [VER] [<CR>]

Reads the program version number.

→ When properly finished [a][VER][data][<CR>]

→ When control error occurred [n][VER][error code][<CR>]

[data]: V*.** (* denotes numeral. Example: V1.00)

[r] [PNM] [<CR>]

Reads the program name. You can identify devices connected on the communication line from an external device.

→ When properly finished [a][PNM][data][<CR>]

→ When control error occurred [n][PNM][error code][<CR>]

[data]: LV150NA

[c] [SAS] [data] [<CR>]

Sets the status output setting for rotation of the nosepiece.

→ When properly finished [o][SAS][<CR>]

→ When control error occurred [n][SAS][error code][<CR>]

[data]: 0 (status output disabled), 1 (status output enabled), or 2 (external light source shutter control enabled)

[r] [SAR] [<CR>]

Reads the status output setting (the value set with cSAS command).

→ When properly finished [a][SAR][data][<CR>]

→ When control error occurred [n][SAR][error code][<CR>]

[data]: 0 (status output disabled), 1 (status output enabled), or 2 (external light source shutter control enabled)

[s] [SAE] [data] [<CR>]

Outputs the status with the rotation of the nosepiece when the status output is enabled. No response is required from the external device to this unit.

→ Status output is [s][SAE][data][<CR>]

[data]: 0 (at the start of nosepiece rotation), or 1 to 5 (address) (at the end of the nosepiece rotation)

[c] [DEF] [<CR>]

Initializes the control data to the factory default.

→ When properly finished [o][DEF][<CR>]

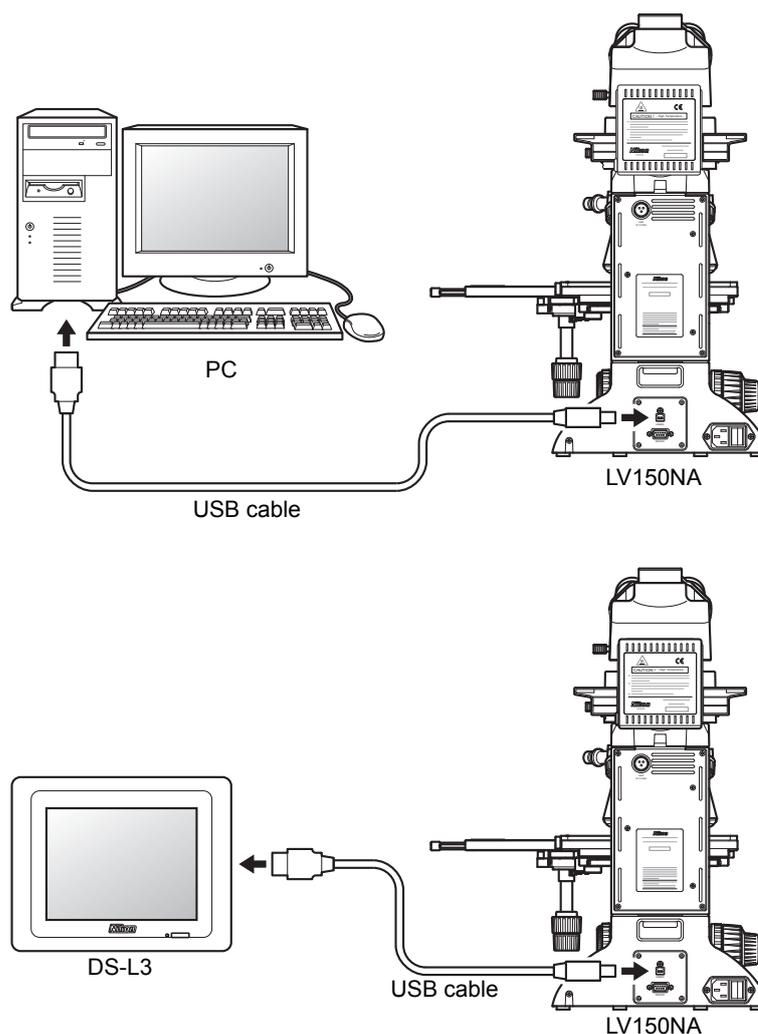
→ When an error occurred [n][DEF][error code][<CR>]

NOTE: Please refer to “■ Communication Formats” for description of [error code].

2 USB Communication

The LV150NA microscope is equipped with the USB (Universal Serial Bus) interface. Configure and control the microscope by a PC or the DS-L3 digital camera control unit connected to the microscope. (Dedicated setup software “LVSetup” is required for controlling a microscope from a connected PC.)

First assemble your microscope, then setup the connection between the microscope and PC or DS-L3 with a commercially-available USB cable. A USB cable can be connected to the microscope, PC, or DS-L3 while their power is on.



Note: USB interface of the LV150NA complies with USB 2.0 specification.

✔ LVSetup software

See the instruction manual of LV Series Support Tools software for setup and operation procedures of LVSetup application.

For details on controlling the microscope using the DS-L3, see the instruction manual for the DS-L3.

6

Troubleshooting

Misuse of the microscope may adversely affect performance, even if the microscope is properly functional. If any of the problems listed in the table below arise, take the countermeasures indicated.

If you detect problems that are not listed below or the problem still persists after measures are taken, turn off the device and contact your nearest Nikon representative.

1

Optical System and Operation

1.1

General

Problem	Cause	Measure
A dirty or dusty field of view when looking into the eyepiece	Dirt or dust rotates when the eyepiece is turned. ➡ The eyepiece is dirty.	Clean the eyepiece. (→Chapter 7 "1 Cleaning Lenses and Filters")
	Dirt or dust does not rotate when the eyepiece is turned. ➡ (1) to (3) (1) The sample is dirty if dirt or dust moves when the sample is moved on stage. (2) The objective is dirty if dirt or dust disappears when the objective is switched. (3) The aperture diaphragm is stopped down too far.	(1) Clean the sample. (2) Clean the objective. (→Chapter 7 "1 Cleaning Lenses and Filters") (3) Open it to the appropriate size. (→Chapter 3 "13 Adjusting the Aperture Diaphragm.")
Dirt or dust is displayed on the monitor.	Dirt or dust on the monitor moves when the camera is turned ➡ The lenses or sample is dirty.	Check and clean them in accordance with "Dirt or dust does not rotate when the eyepiece is turned." of "A dirty or dusty field of view when looking into the eyepiece."
	Dirt or dust on the monitor does not move when the camera is turned ➡ The camera is dirty.	Detach the camera and clean it by following the instruction manual for the camera.
The image quality is poor. The contrast or the resolution is poor.	Dirt or dust is present on the lens, filter, or sample.	Check and clean them in accordance with "Dirt or dust does not rotate when the eyepiece is turned" of "A dirty or dusty field of view when looking into the eyepiece."
	The aperture diaphragm is stopped down too far or it is opened too much.	Open it to the appropriate size. (→Chapter 3 "13 Adjusting the Aperture Diaphragm.")
	An objective suitable for microscopy is not used.	Use an appropriate objective.
Illumination is too bright.	The ND filters are out of the optical path.	Place ND filters in the optical path. (→Chapter 3, "11 Inserting and Removing Filters")
	The brightness of the lamp is not adjusted appropriately.	Adjust the brightness using the brightness control knob. (→See Chapter 3, "2 Controlling Illumination.")

Chapter 6 Troubleshooting

Problem	Cause	Measure
The field of view is too dark.	The brightness of the lamp is not adjusted appropriately.	Adjust the brightness using the brightness control knob. (→See Chapter 3, “2 Controlling Illumination.”)
	The aperture diaphragm is stopped down too far.	This should normally be adjusted to 70 to 80% of numerical aperture of the objective. (→Chapter 3 “13 Adjusting the Aperture Diaphragm.”)
	The optical path is not switched to binocular 100%.	Set to binocular 100%. (Chapter 3, “4 Switching the Optical Path”)
	The lamp comes to the end of its life.	Replace the lamp. (→Chapter 4, Step 5 “Attaching the Lamphouse and Replacing the Lamp”)
	An ND filter is located in the optical path.	Remove the ND filter from the optical path. (→Chapter 3, “11 Inserting and Removing Filters”)
	During bright-field microscopy, an accessory such as a polarizer or analyzer is located in the optical path.	Remove an accessory such as a polarizer or analyzer from the optical path.
	A halogen light source is used for a dark sample.	Change the light source to a brighter one. (→Chapter 4, Step 6 “Attaching the Fiber Adapter and Precentered Fiber Illuminator”)
	An objective suitable for microscopy is not used.	Use an appropriate objective.
	The room is bright (during dark-field, epi-fluorescence microscopy)	Make it darker.
The image is yellowish or very bluish.	The lamp voltage is too low or too high.	Turn the brightness control knob to the mark position (three o'clock position) and adjust the brightness with the ND filters. (→Chapter 3, “2 Controlling Illumination” and “11 Inserting and Removing Filters”)
	The NCB11 filter is not used.	Put an NCB11 filter. (→Chapter 3, “11 Inserting and Removing Filters”)
Color of the image visible to the naked eye is different from that of the image displayed on the monitor.	White balance of the camera is not set correctly.	Set the white balance in accordance with the camera's instruction manual.
The entire field of view is bluish or yellowish.	An epi -fluorescence filter cube is in the optical path even though epi-fluorescence observation is not being performed (when using the LV-UEPI2).	Remove the filter cube from the optical path.
Lack of visibility around periphery of field of view. Illumination is uneven across the field of view. The field of view is not visible.	Parts are attached incorrectly.	Confirm that parts (nosepiece, polarizer, etc.) are correctly attached. (→Chapter 4 “Assembly”)
	Movable parts are not seated correctly.	Properly switch the tube's optical path switching lever, epi-illumination attachment's illumination switching lever (microscopy selection knob), nosepiece, filters, and sliders. (Move the part until it clicks or to the limit position.)
	The field diaphragm is stopped down too far.	Open the field diaphragm slightly wider than the field of view. (→Chapter 3 “12 Adjusting the Field Diaphragm”)
	The lamp is attached incorrectly.	Attach it correctly. (→Chapter 4, Step 5 “Attaching the Lamphouse and Replacing the Lamp”)
	Dirt or dust is present on a lens or sample.	Clean them as appropriate. (→Chapter 7 “1 Cleaning Lenses and Filters”)
	The microscopy selection knob is set to the “S” position. (When using LV-UEPI2)	Set the microscopy selection knob to an observation position. (→Chapter 3, “3 Switching the Microscopy Type”)

Chapter 6 Troubleshooting

Problem	Cause	Measure
Out of focus with an objective of high magnification.	A sample damage protection device of the objective is pushed in.	Some objective has a stopper to keep the pushed in state. Turn the tip of the objective to release the stopper. Tip of the objectives without stopper cannot be rotated. Do not attempt to forcibly pull it out. Contact your nearest Nikon representative.
A focal deviation is high when switching over objectives.	The objective is attached incorrectly.	Screw the objective all the way in. (→Chapter 4, Step 9 "Attaching Objectives")
	The eyepiece is attached incorrectly.	Mate the positioning groove and attach securely.
	Dioptr adjustment has not been performed.	Perform diopter adjustment. (→Chapter 3, "7 Adjusting the Diopter")
The image is not in focus although the stage is raised to the highest position.	The stage is attached incorrectly.	Attach it correctly. (→Chapter 4, Step 2 "Attaching the Stage and the Holder")
	The refocusing position is set lower than the focusing position.	Check and reset the setting. (→Chapter 3, "8 Focusing on the Sample")
The torque of the coarse focus knob is heavy.	The coarse handle torque adjustment knob is tightened excessively.	Loosen it as appropriate. (→Chapter 3, "8 Focusing on the Sample")
	The upper end is locked with the coarse focus clamp ring.	Unlock it. (→Chapter 3, "8 Focusing on the Sample")
The stage falls by itself and the focus is shifted during microscopy.	The coarse handle torque adjustment knob is loosened excessively.	Tighten it as appropriate. (→Chapter 3, "8 Focusing on the Sample")
One side of the field of view (up, down, right, or left) is not in focus. The image flows. (i.e. becomes asymmetrically defocused when moving the focal point.)	The nosepiece is attached incorrectly or not rotated to the click stop position.	Attach it correctly and rotate it to the click stop position. (→Chapter 4, Step 3 "Assembling the Nosepiece")
	The sample is tilted relative to the stage surface.	Correctly reposition the sample on the stage.
	The stage or the sample holder is slanted.	Attach the stage and sample holder correctly. (→Chapter 4, Step 2 "Attaching the Stage and the Holder" and Chapter 3, "9 Moving the Sample")
	The microscope is not installed on a level surface.	Install the microscope on a level surface.
Images in right and left eyepieces are not coincident.	Interpupillary adjustment has not been performed.	Perform interpupillary adjustment. (→Chapter 3, "6 Adjusting the Interpupillary Distance")
	Dioptr adjustment has not been performed.	Perform diopter adjustment. (→Chapter 3, "7 Adjusting the Diopter")

Chapter 6 Troubleshooting

Problem	Cause	Measure
Eyes become fatigued.	Diopter adjustment has not been performed.	Perform diopter adjustment. (→Chapter 3, “7 Adjusting the Diopter”)
	Interpupillary adjustment has not been performed.	Perform interpupillary adjustment. (→Chapter 3, “6 Adjusting the Interpupillary Distance”)
	Eyepieces having different field numbers at the right and left sides are used.	Use eyepieces having the same field number at the right and left sides.
	Brightness is inadequate.	Adjust the brightness using the brightness control knob or ND filters to attain a suitable brightness. (→Chapter 3, “2 Controlling Illumination” and “11 Inserting and Removing Filters”)
The sample does not move smoothly.	The sample holder is not securely-fixed to the stage.	Fix the holder securely. (→Chapter 4, Step 2 “Attaching the Stage and the Holder” and Chapter 3, “9 Moving the Sample”)

1.2 Epi-fluorescence Microscopy

Problem	Cause	Measure
Lack of visibility around periphery of field of view Illumination is uneven across the field of view. The field of view is not visible.	The filter cube is not set or is not at the appropriate position.	Attach the filter cube to the correct position. (→Chapter 4, Step 4 “Attaching the Epi-illumination Attachment”)
A fluorescent image is not visible (when the lamp is on).	The shutter is closed.	Open the shutter. (Chapter 3, “3 Switching the Microscopy Type”)
	The selection of the filter cube is incorrect.	Use a correct filter cube. (→Chapter 3, “18 Using Filter Cubes for Fluorescence Observation (LV-UEPI2 Only)”)
The fluorescent image is very dark (when the lamp is on).	The ND filters of the epi-fluorescence attachment are in the optical path.	Remove the ND filters from the optical path as necessary. (→Chapter 3, “11 Inserting and Removing Filters”)
	ND filters in the HG precentered fiber illuminator are used to suppress the brightness too much.	Adjust the brightness. (→Instruction manual for the light source in use)
	A halogen light source is used for a dark sample.	Change the light source to the HG precentered fiber illuminator.
	A mercury lamp in the HG precentered fiber illuminator has reached the end of its product life.	Replace the lamp. (→Instruction manual for the light source in use)
	A designated objective is not used at UV or V excitation.	Use a designated objective.
	The room is bright.	Make it darker.
	The optical path switching lever is not set to 100% of light distribution for the binocular section.	Switch the lever position to 100% of light distribution for the binocular section. (Chapter 3, “4 Switching the Optical Path”)
The fluorescent image quality is poor. The contrast of the fluorescent image is poor.	The filter cube being used is not suitable for the sample.	Use a filter cube suitable for the sample. (→Chapter 3, “18 Using Filter Cubes for Fluorescence Observation (LV-UEPI2 Only)”)
	The objective is dirty.	Clean it as appropriate. (→Chapter 7 “1 Cleaning Lenses and Filters”)

1.3 Differential Interference Contrast Microscopy

Problem	Cause	Measure
No contrast	The polarizer is out of the optical path.	Bring the polarizer into the optical path. (→Chapter 3, “14 Using the Polarizer Slider”)
	The analyzer is out of the optical path.	Bring the analyzer into the optical path. (→Chapter 3, “15 Using the Analyzer Slider”)
	The DIC slider is out of the optical path.	Place the DIC slider into the optical path. (→Chapter 3, “17 Using the DIC Slider”)
	The objective in use is not the specified one.	Use an industrial DIC objective.
	The setting of the DIC slider (A or B) is not correct.	Turn the knob of the DIC slider to make the appropriate setting for the objective to be used. (→Chapter 3, “17 Using the DIC Slider”)
Poor contrast	The orientation of the polarizer is incorrect.	Adjust the orientation of the optical system correctly. (→Chapter 3, “14 Using the Polarizer Slider”)
	The objective in use is not the specified one.	Use an industrial DIC objective.
	The setting of the DIC slider (A or B) is not correct.	Turn the knob of the DIC slider to make the appropriate setting for the objective to be used. (→Chapter 3, “17 Using the DIC Slider”)
	An objective or a sample is dusty.	Gently wipe dust off. (Special attention should be paid to dust.) (→Chapter 7 “1 Cleaning Lenses and Filters”)

1.4 Simplified Polarization Microscopy

Problem	Cause	Measure
Sensitive color is not generated.	The lambda plate is out of the optical path.	Place the lambda plate into the optical path.

2 Electrical Requirements

2.1 General

■ Power supply

Problem	Cause	Measure
There is no power even though the power switch is on.	The power cord is not connected, or is connected improperly.	Connect the power cord properly. (→Chapter 4, Step 12 "Connecting the Power Cord")

■ Illumination

Problem	Cause	Measure
Lamp does not light. The lamp flickers. The brightness is unstable. There is no power even though the power switch is on.	There is no power supplied. The cord is not connected securely.	Plug in the power cord securely. Securely connect the lamphouse cable to the microscope's connector or the external power source unit. (→Chapter 4, Step 12 "Connecting the Power Cord," Step 5 "Attaching the Lamphouse and Replacing the Lamp," and Instructions for the light source in use)
	The lamp has been burned out. The lamp is burning out.	Replace the lamp with a designated lamp. (→Chapter 4, Step 5 "Attaching the Lamphouse and Replacing the Lamp" and Instructions for the light source in use)
	The lamp is attached incorrectly.	Attach a designated lamp securely. (→Chapter 4, Step 5 "Attaching the Lamphouse and Replacing the Lamp" and Instructions for the light source in use)
	The designated lamp is not used.	Attach a designated lamp. (→Chapter 4, Step 5 "Attaching the Lamphouse and Replacing the Lamp" and Instructions for the light source in use)
The mercury lamp of the HG precentered fiber illuminator burns out immediately after it lights.	The lamp type is incorrect. The lamp is at the end of its life.	Replace the lamp with a designated lamp. (→Instruction manual for the light source in use) Contact your nearest Nikon representative for advice if a new lamp will burn out soon after replacement.

■ Motorized Nosepiece

Problem	Cause	Measure
Pressing the nosepiece rotation button does not switch the objective (LV150NA only).	The signal cable is not connected.	Connect it securely. (→Chapter 4, Step 3 "Assembling the Nosepiece")
	An attempt was made to directly turn nosepiece from address 1 to 5.	The nosepiece cannot be directly turned from address 1 to 5. Turn the nosepiece in the direction by which the enlargement ratio increases in the order.
When the HG precentered fiber illuminator (C-HGFIE) is connected, turning the nosepiece does not close the shutter of the light source unit (LV150NA only).	An RS232C cable is not connected.	Firmly connect the RS232C cable supplied with the HG precentered fiber illuminator.

7

Maintenance and Storage

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

Do not let dust, fingerprints, and the like, 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 Lenses and Filters.” When cleaning, be sure to turn off the power switch (press the switch to “O” 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 bottom ends of 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 tip) (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, fingerprints, etc., get on lenses and filters. Dirt on lenses, filters, etc., will adversely affect the view of the image. If any lens gets dirty, clean it as described below.

- Either brush away dust with a soft brush, or wipe it away gently with gauze.
- Only in cases of fingerprints or grease, dampen a piece of soft, clean cotton cloth, lens tissue, or gauze with absolute alcohol (ethyl or methyl alcohol) and wipe. (Use a piece of cleanroom wiper in the cleanroom instead of cotton cloth, lens tissue, and gauze.)
- Absolute alcohol requires care in handling as it is highly flammable. Be careful when using fire or turning on/off the power switch nearby.
- Follow the instructions provided by the manufacturer when using absolute alcohol.

✔ Tips on wiping dirt

Do not reuse cotton cloth, lens tissue, or gauze that have already been used.

2 Cleaning the Painted, Plastic, and Printed Parts

Do not use organic solvents (alcohol, ether, and paint thinner, etc.) on painted, plastic, or printed parts. Doing so could result in discoloration or in the peeling of printed characters. If the dirt is hard to remove, wipe it gently using a piece of gauze dampened with a neutral detergent solvent. (Use a piece of cleanroom wiper in the cleanroom instead of gauze.)

3 Storage

- Store the microscope in a dry place where mold is not likely to form. Storage conditions are as follows: temperature (-20°C to +60°C), humidity (90% RH max., no condensation)
- Store the objectives and eyepieces with a drying agent in a desiccator or similar container.
- Put a plastic cover over the microscope main body to protect it from dust.
- Before putting on the plastic cover, turn off the power switch of the microscope (press it to the “O” side) and wait until the lamphouse is cool (approx. 30 min).

4 Regular Inspections (Charged)

Regular inspections (chargeable service) of this product are recommended in order to maintain peak performance. Contact your nearest Nikon representative.

8

Specifications

Model name	ECLIPSE LV150N, ECLIPSE LV150NA
Optical system	CFI60 optical system (infinity-corrected CF optical system)
Illumination	<p>Epi-illumination system: The power source for the lamp, NCB11, ND4, and ND16 are built-in. (exchangeable)</p> <p>Specified illuminator: LV-UEPI-N universal epi-illumination attachment or LV-UEPI2 universal epi illuminator 2</p> <p>Lamp ratings: 12 V, 50 W halogen lamp</p> <p>Specified lamp: LV-HL50W 12V 50W longlife halogen lamp</p> <p>Specified lamphouse: LV-LH50PC 12V 50W precentered lamphouse</p>
Focusing mechanism	<p>Manual operation type single axis coarse/fine focus knob mechanism (left side with coarse/fine focus, right side with fine focus, calibration marking for fine focus: 1 μm/ marking)</p> <p>Stroke: 40 mm, with coarse focus stopper mechanism</p> <p>Coarse focus knob: 14 mm/revolution</p> <p>Fine focus knob: 0.1 mm/revolution</p>
Eyepiece	10x, field number: 22, 25
Input ratings	<p>Input voltage: 100 to 240 VAC \pm10% 50/60 Hz</p> <p>Rated current: 1.2 A max.</p>
Operating environment	<p>Temperature: 0°C to +40°C</p> <p>Relative humidity: 60% RH max. (no condensation)</p> <p>Altitude: 2000 m max.</p> <p>Pollution degree: Degree 2</p> <p>Installation category: Category II</p> <p>Electric shock protection class: Class I</p> <p>Indoor use only</p>
Storage environment	<p>Temperature: -20°C to +60°C</p> <p>Relative humidity: 90% RH max. (no condensation)</p>
Safety standards compliance	<ul style="list-style-type: none"> • This product got the TUV SEMI mark. (SEMI guideline S2-0310C, S8-0308) • This is a C-UL-US listed product. • This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de classe A est conforme à la norme NMB-003 du Canada. • This product meets Australian AS/NZS CISPR11 Class A. <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements.



■ Power cord

Use this product with a power cord set of the following specifications, having the shape as shown in Figure 1.



Figure 1
Connector shape

<p>For use in Japan</p>	<p>PSE certified detachable three-conductor power cord set with a ground connection plug</p> <p>Power cord type: VCTF Rated current: 7 A or more Rated voltage: 125 VAC Cord rated temperature: 60°C or higher Length: Within 3 m Power plug shape: JIS C8303 Class I (Figure 2)</p>	
<p>For use in the USA</p>	<p>UL-listed detachable three-conductor power cord set with a ground connection plug</p> <p>Power cord type: SVT Rated current: 10 A or more Rated voltage: 125 VAC Cord rated temperature: 60°C or higher Length: Within 3 m Power plug shape: NEMA5-15P (Figure 2)</p>	
<p>For use in Europe</p>	<p>Detachable three-conductor power cord set with a ground connection plug, certified by the corresponding certification agency, such as VDE, SEMKO, etc. listed in Table 1.</p> <p>Power cord type: H05VV-F Rated current: 10 A or more Rated voltage: 250 VAC Cord rated temperature: 70°C or higher Length: Within 3 m Power plug shape: CEE 7/VII (Figure 3), or similar</p>	
<p>For use in other countries</p>	<p>Detachable three-conductor power cord set with a ground connection plug, which is certified by the corresponding certification agency listed in Table 1, and satisfies the power voltage and rated input voltage (100 to 240 VAC) of this product</p> <p>Rated current: 6 A or more Cord rated temperature: 60°C or higher Length: Within 3 m</p>	

Table 1 Example of the certification agency for each country

Country	Cert. Agency	Country	Cert. Agency	Country	Cert. Agency
Argentina	IRAM	Denmark	DEMKO	Netherlands	KEMA
Australia	SAA	Finland	FEI	Norway	NEMKO
Austria	OVE	France	UTE	Spain	AEE
Belgium	CEBEC	Germany	VDE	Sweden	SEMKO
Canada	CSA	Ireland	NSAI	Switzerland	SEV
China	CCC	Italy	IMQ	United Kingdom	ASTA,BSI