M350 E 05.4.NF.1

Nikon

Industrial Microscope
ECLIPSE LV150/LV150A

Instructions

Thank you for purchasing the Nikon products.
This instruction manual has been prepared for the users of Nikon's industrial microscope "ECLIPSE LV150/LV150A."
To ensure correct usage, read this manual carefully before operating the instrument.

- It is prohibited to reproduce or transmit this manual in part or whole without Nikon's expressed permission.
- The contents of this manual are subject to change without notice.
- Although every effort has been made to ensure the accuracy of this manual, if you note any points that are unclear or incorrect, contact your nearest Nikon representative.
- Some of the products described in this manual may not be included in the set you have purchased.
- Be sure to read the instruction manual for any other products that may be used in combination with the microscope.

Warning/Caution Symbols Used in This Manual

Although Nikon products are designed to provide you with the utmost safety during use, incorrect usage or disregard of the instructions can cause personal injury or property damage. For your safety, read this instruction manual carefully and thoroughly before using the instrument. Do not discard this manual, but keep it near the product for easy reference.
In this manual, safety instructions are indicated with the symbols shown below. Be sure to follow the instructions indicated with these symbols to ensure correct and safe operation.

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

Meaning of Symbols Used on the Equipment

Symbol	Meaning
	**Caution for heat.** This marking on the rear of the lamphouse, and near the lamphouse clamp screw on the illuminator (LV-UEPI and LV-UEPI2), calls your attention on the following. For the symbol position, see pages 10 and 12. • 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.

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 or so on, 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 (flip it to "○" side) before connecting or disconnecting the power cord.

For details about the specified power cord, see "VIII. 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.

- **Illuminator:**
  Nikon LV-UEPI Universal Epi Illuminator (model LV-UEPI) or Nikon LV-UEPI2 Universal Epi Illuminator (model LV-UEPI2)
- **Lamphouse:**
  Nikon LV-LH50PC precentered lamphouse 12V 50W (model LV-LH50PC)
- **Lamp:**
  Nikon LV-HL50W 12V 50W LONGLIFE halogen lamp (model LV-HL50W), or non-Nikon 12V 50W SHORTLIFE halogen lamp (model OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027)
  If you wish to buy these lamps, contact your nearest Nikon representative.

WARNING

7. Light source other than the specified ones

To perform the epi-fl microscopy wit the LV-UEPI2 illuminator, the specified light source brightness may be less than the desired brightness. In this case, a light source other than the specified ones, an external light source, can be used for the LV-UEPI2.
Use the X-Cite 120 (manual type) or X-Cite 120PC (motorized type) manufactured by EXFO Electro-Optic Engineering Inc. for the external light source. In particular, when the LV150A is used for the microscope main body, be sure to attach the X-Cite 120PC to prevent a flash of light. The X-Cite 120PC must be connected with the LV150A through the RS-232C cable attached to the light source. When the LV150 is used, either external light source will work.
Please take note that if a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI approved product.

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 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 a light source other than the specified ones

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

1) **Insert the UV collector lens into the optical path of the microscope unless the UV excitation light is necessary.**
   On the illuminator LV-UEPI2, the UV filter automatically enters the optical path when turning the microscopy selection knob to BF (bright-field) or DF (dark-field). The UV filter is removed from the optical path when turning the knob to FL1 (epi-fl 1) or FL2 (epi-fl 2).

2) **When performing the epi-fl microscopy by using the UV excitation light, attach the filter cube dedicated to the UV excitation light. And then, if you must see the objective or its surroundings, be sure to see 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 code from the wall outlet.

11. Reflection

Lustrous samples reflect the illumination. Do not observe the illuminated surface of a sample for a long time because the strong reflection may hurt your eyes. When you use the illuminator LV-UEPI2, be sure to view it through the ultraviolet light shield.

CAUTION

1. Handle the system gently

Components of this system are precision optical instruments. Handle them carefully, and do not subject them to any shocks.
The precision of the objectives in particular can be adversely affected even by weak shocks.

2. Do not wet the microscope

If the microscope gets wet, a short circuit may cause malfunction or abnormal heating of the microscope. If you accidentally spill water on the microscope, immediately turn off the power switch (flip it to the "○" side) and unplug the power cord from the wall outlet. Then, wipe 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.

3. Weak electromagnetic waves

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.

4. Installation location

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:

- 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.
- For details about the operating environment and storage environment, see "VIII. Specifications."
- Take enough space around the microscope referring to the layout diagrams on page 6.
- The microscope may be moved by earthquakes. We recommend taking anti-earthquake measures.
  For details about the anti-earthquake measures, see "15. Countermeasures for Earthquakes" in "IV. Assembly."

5. Cautions on moving the microscope

- The microscope is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may loose accuracy when exposed to even a weak physical shock.)
- When moving the microscope, first remove the stage and the lamphouse. 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.

CAUTION

6. Cautions on assembling the microscope

- 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.

7. Cautions on lamp replacement

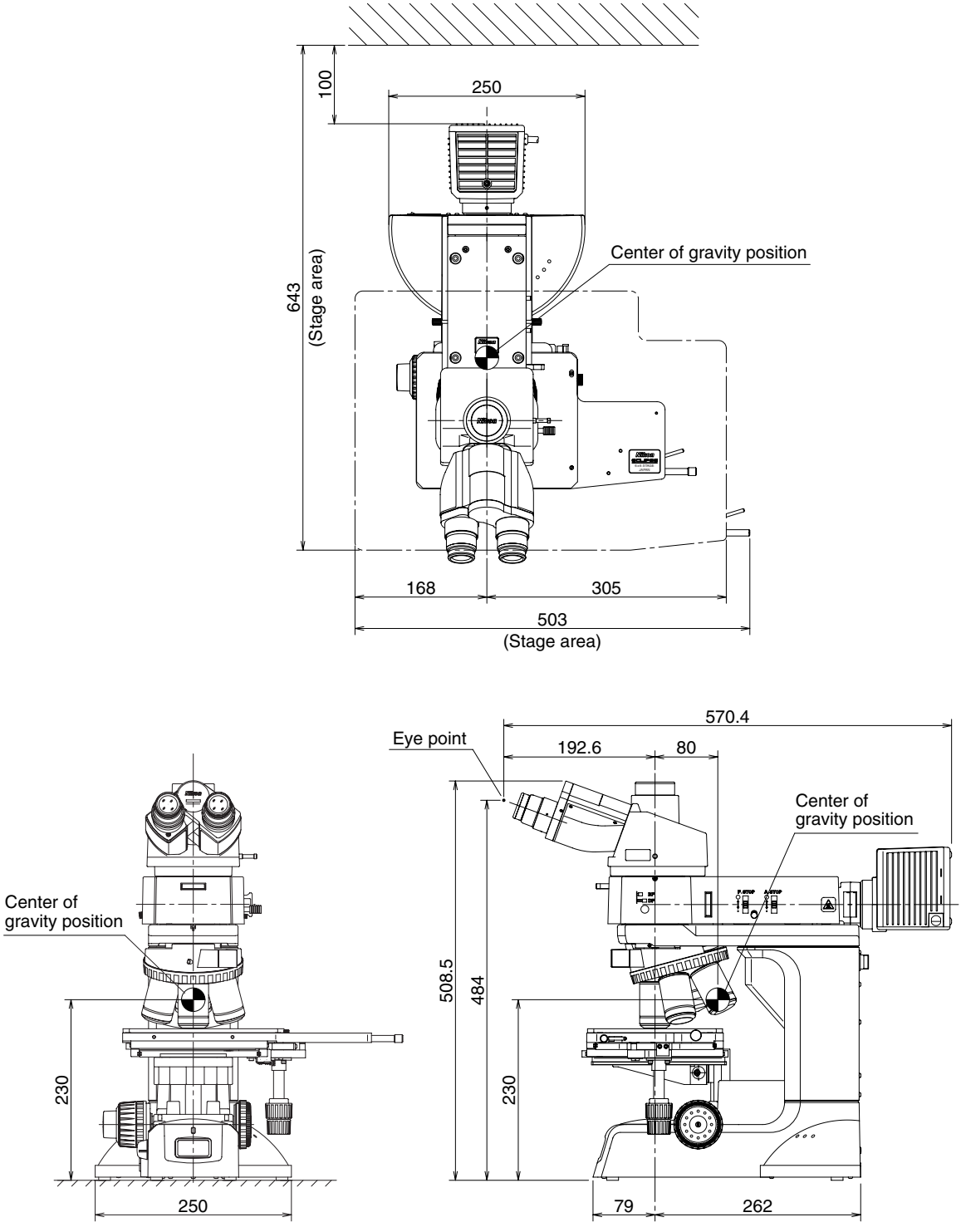
- To prevent burn injury, allow the lamp to cool down sufficiently (for at least 30 minutes after it is turned off) before replacing the lamp.
- To prevent electrical shock and damage to the microscope, always turn off the power switch (flip it to the "○" side) and unplug the power cord from the wall 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 illuminator LV-UEPI2, a filter cube can be attached to enable epi-fl microscopy. Note the following precautions for handling a filter cube.

- Interference filters (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 "Cleaning Filters and Lenses" of "VII. Care and Maintenance.")
  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



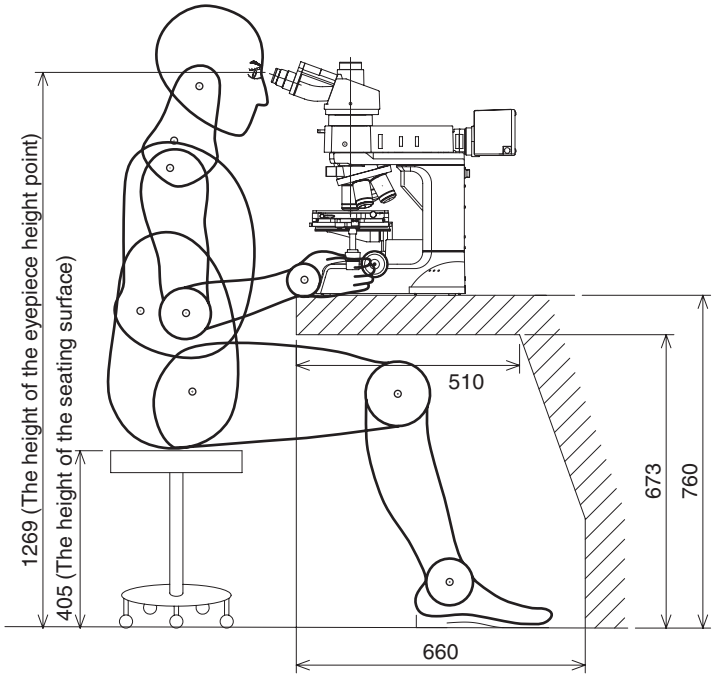
Dimensions are in mm.

This illustration depicts the LV150A microscope configured with the LV-UEPI illuminator, LV-TI3 eyepiece tube, LV-LH50PC 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.

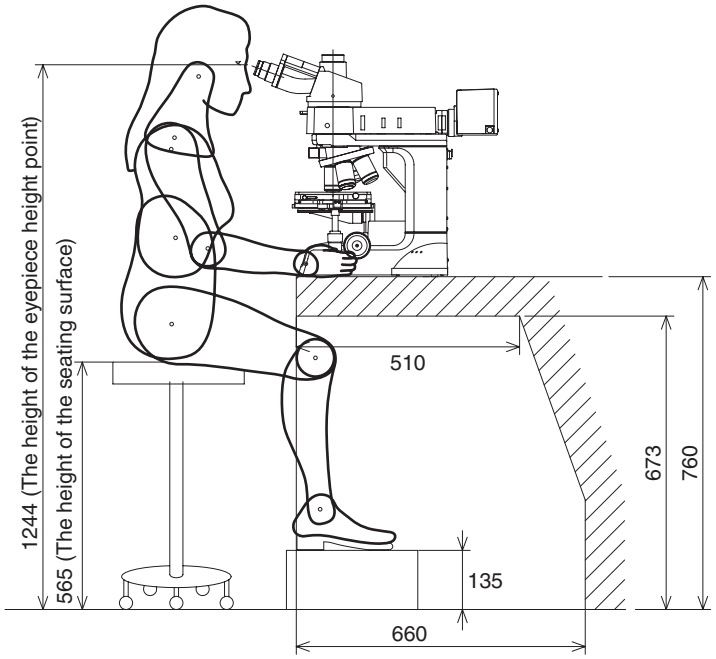
The 95th percentile male (Height: 189.5 cm)



Dimensions are in mm.

* 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)



Dimensions are in mm.

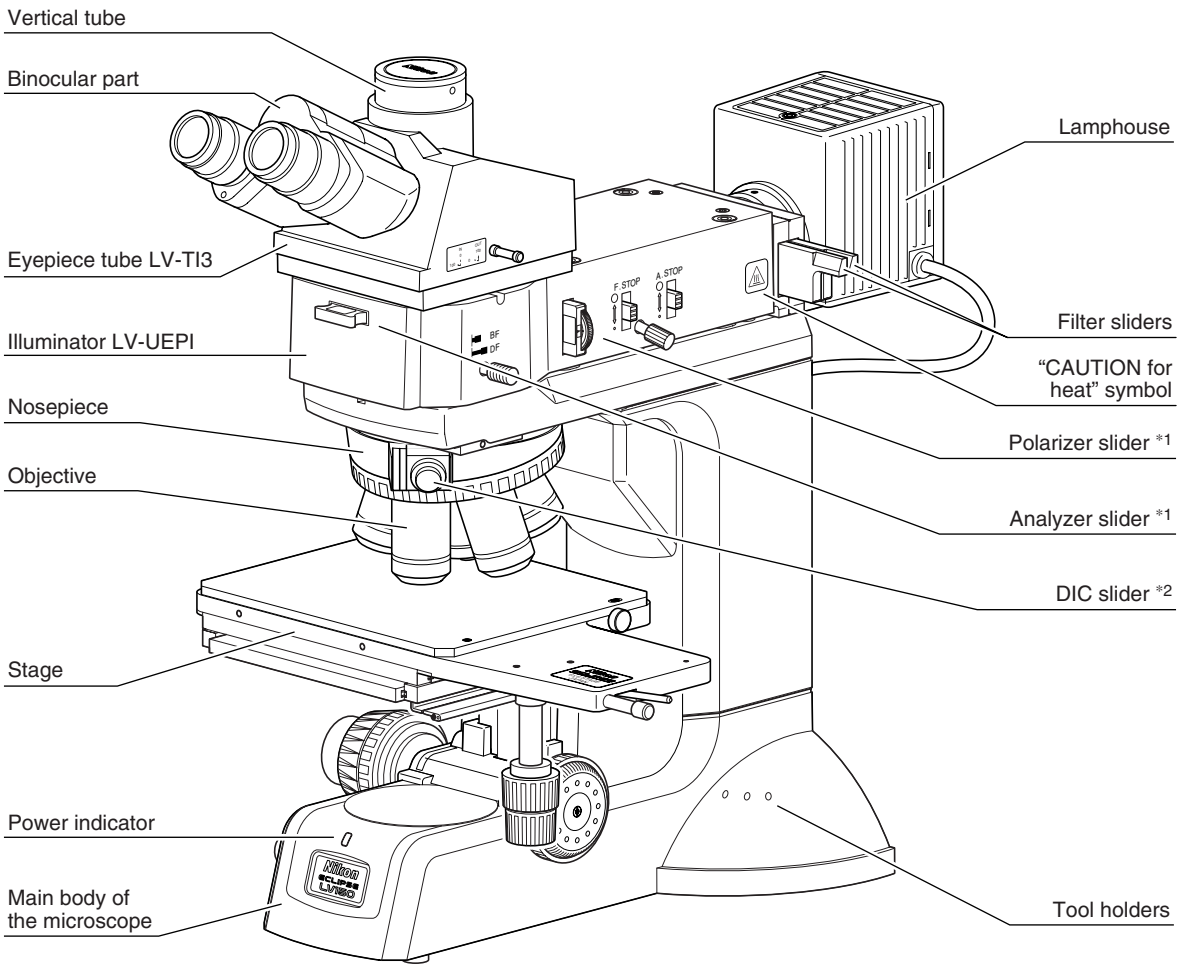
* Take at least 610 mm of horizontal clearance for your legs.

CONTENTS

I Names of Each Part

1 When Configured with the Illuminator LV-UEPI

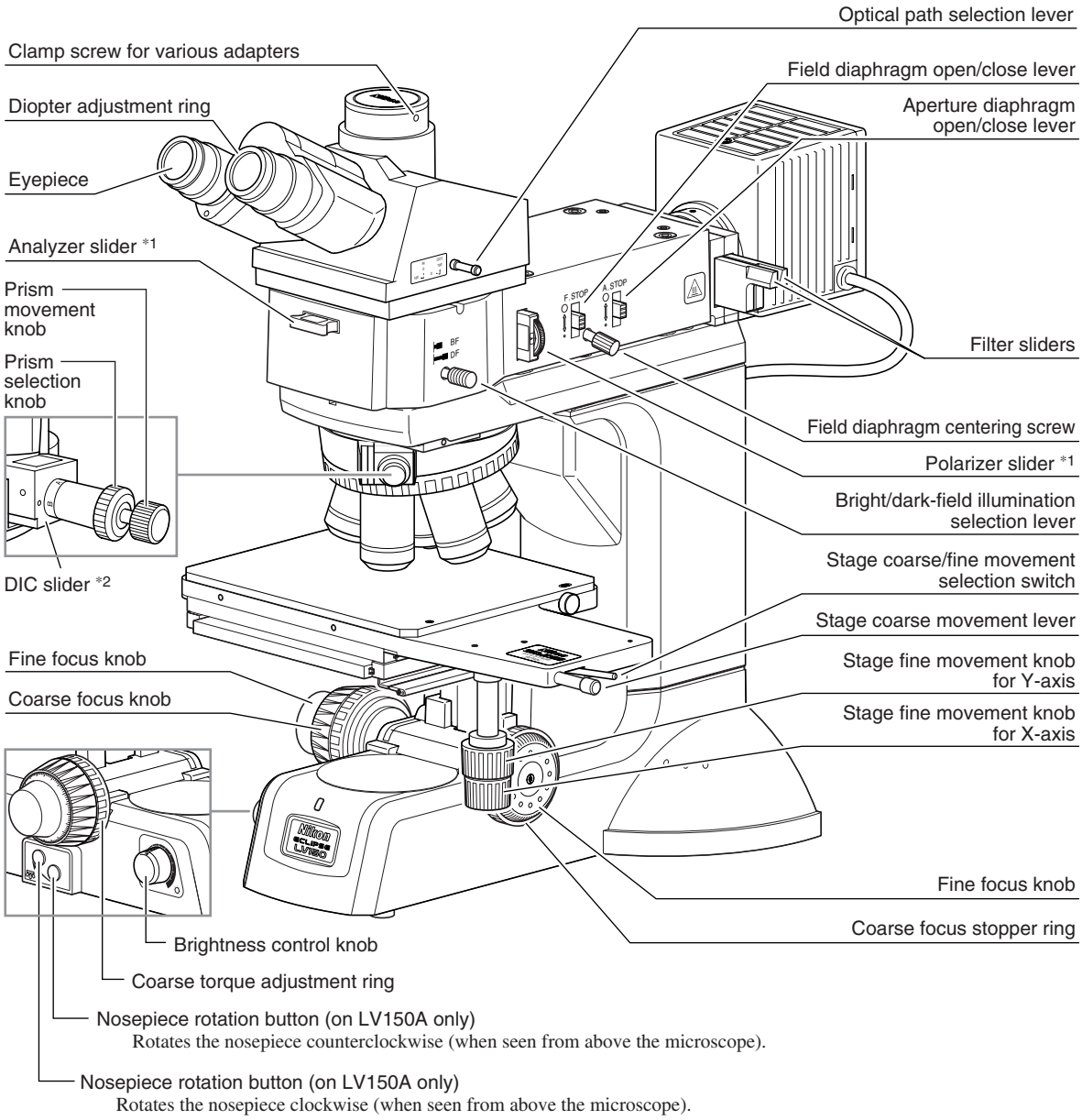
▶ Names of Parts



*1: For DIC microscopy or simplified polarization microscopy.
*2: For DIC microscopy.

This drawing depicts the ECLIPSE LV150A microscope configured with the LV-UEPI illuminator, LV-TI3 eyepiece tube, LV-LH50PC lamphouse, 6x6 stage, and attachments for DIC microscopy.

▶ Names of Operational Parts

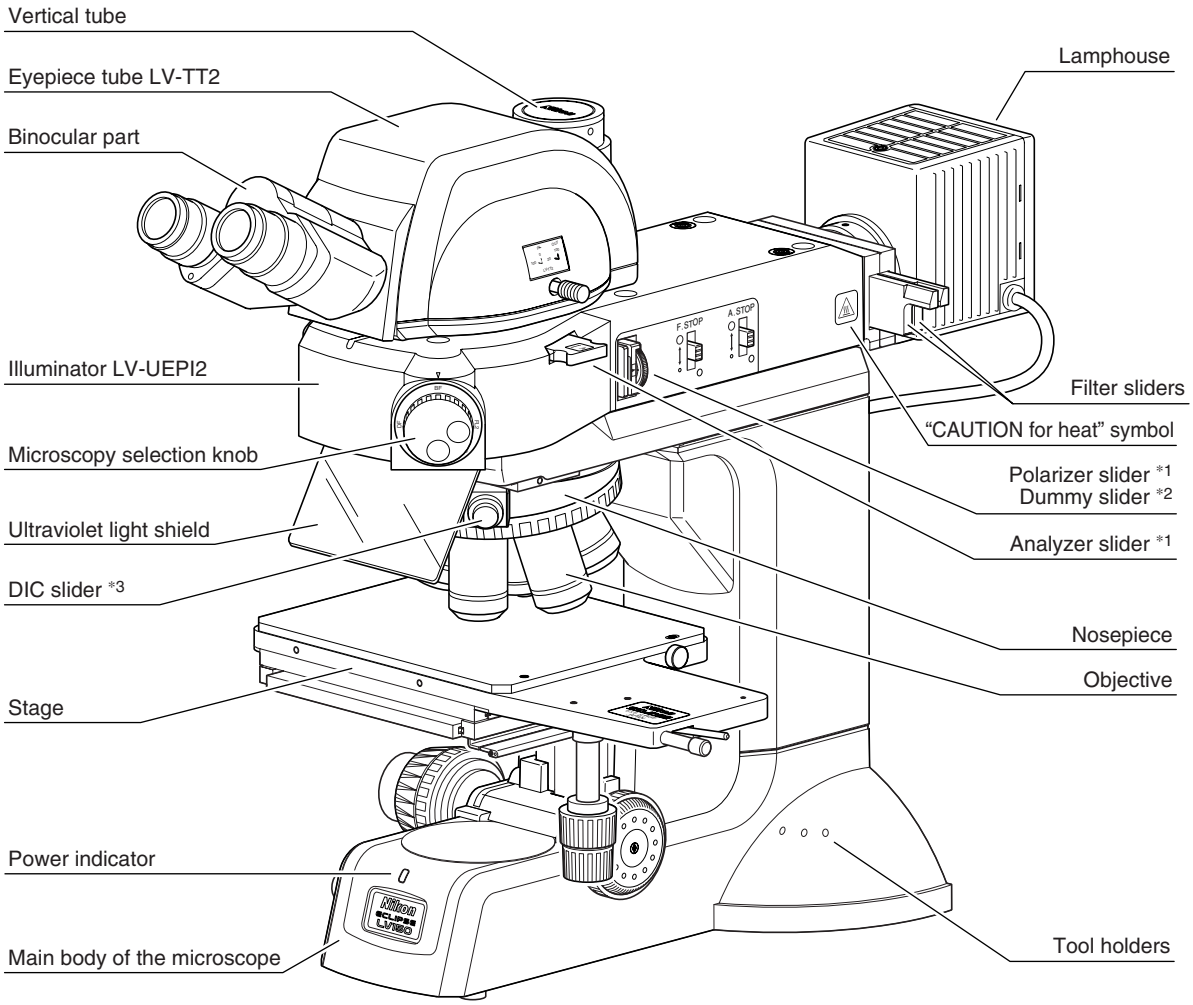


*1: For DIC microscopy or simplified polarization microscopy.
*2: For DIC microscopy.

This drawing depicts the ECLIPSE LV150A microscope configured with the LV-UEPI illuminator, LV-TI3 eyepiece tube, LV-LH50PC lamphouse, 6x6 stage, and attachments for DIC microscopy.

2 When Configured with the Illuminator LV-UEPI2

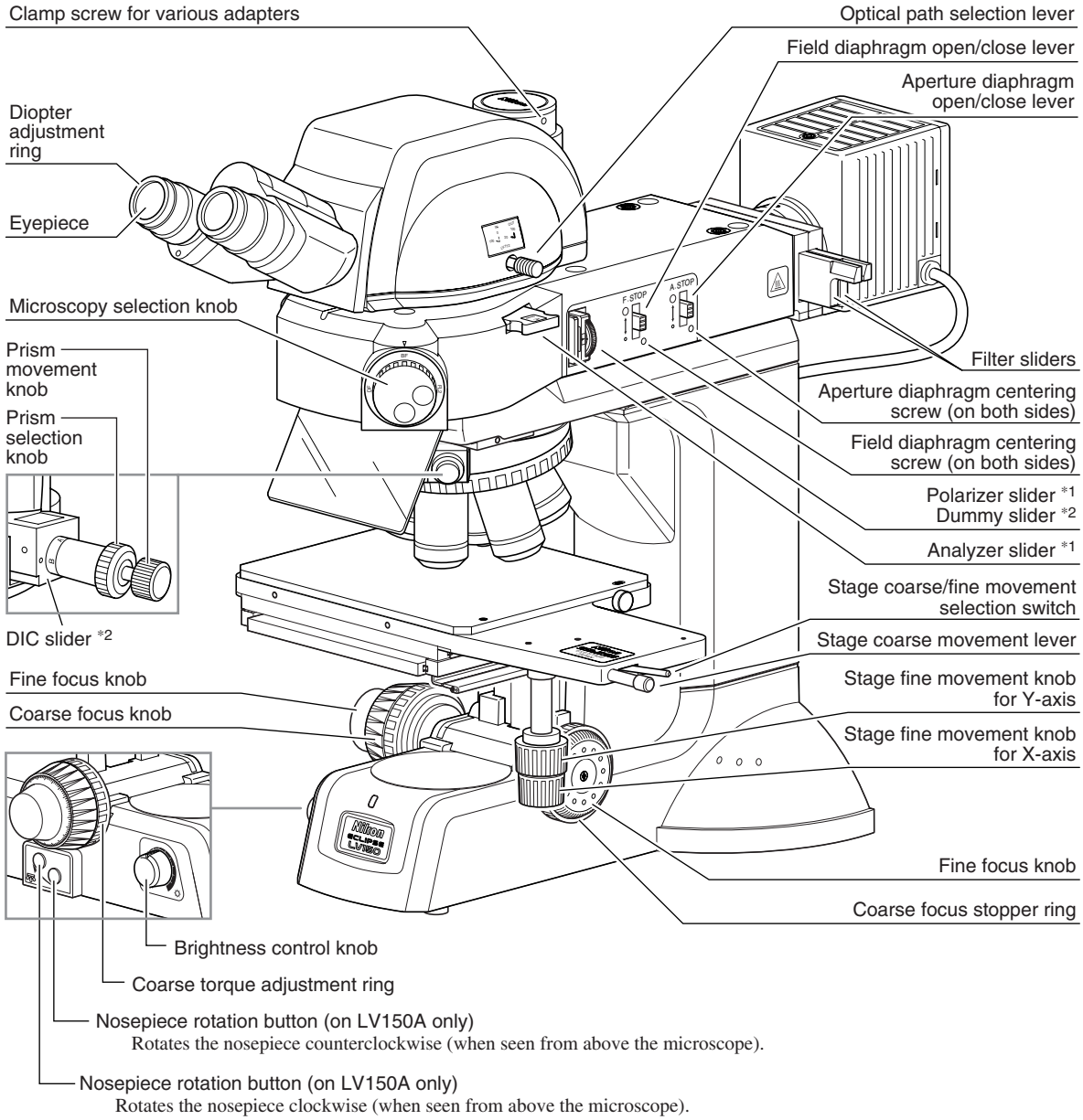
▶ Names of Parts



*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 LV150A microscope configured with the LV-UEPI2 illuminator, LV-TT2 eyepiece tube, LV-LH50PC lamphouse, 6x6 stage, and attachments for DIC microscopy.

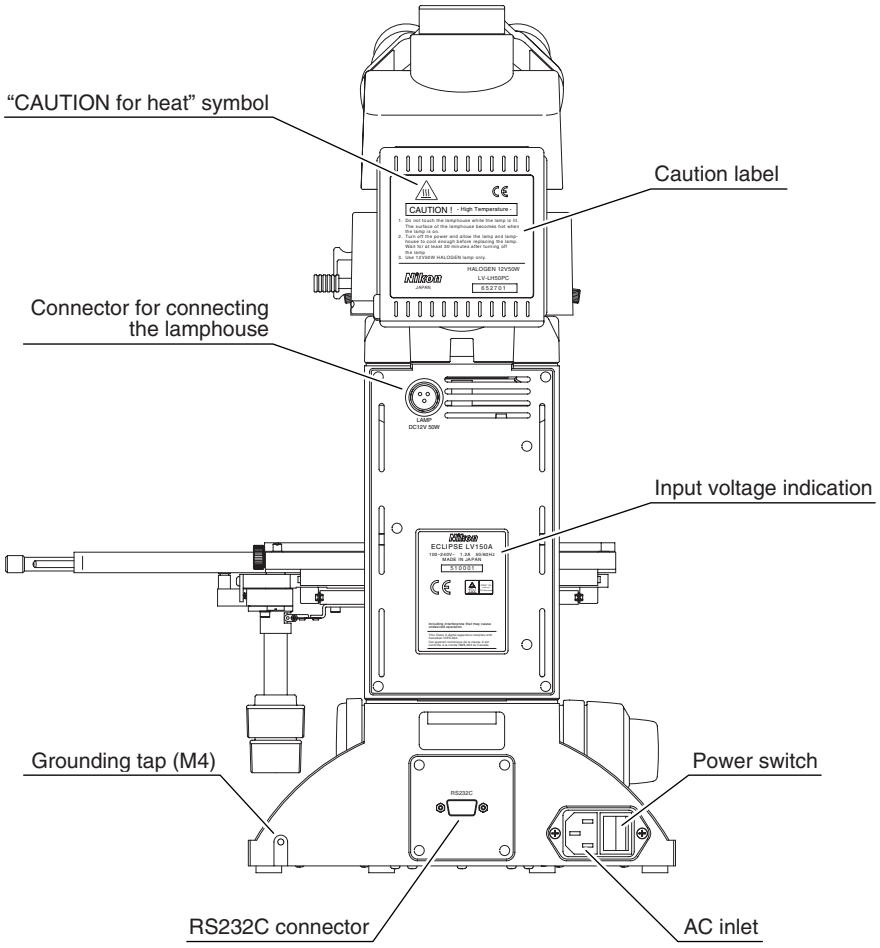
▶ Names of Operational Parts



*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 LV150A microscope configured with the LV-UEPI2 illuminator, LV-TT2 eyepiece tube, LV-LH50PC lamphouse, 6x6 stage, and attachments for DIC microscopy.

3 Rear View



This drawing depicts the ECLIPSE LV150A microscope configured with the LV-UEPI illuminator, LV-TI3 eyepiece tube, LV-LH50PC lamphouse, and 6x6 stage.

II Microscopy

This chapter describes the procedures for each microscopy.
This microscope can be configured with two types of illuminators, LV-UEPI or LV-UEPI2. See the table below for the microscopies available with each illuminator, as well as the optional accessories required for each microscopy.

● If the microscope has not yet been assembled, see “IV. Assembly” on p.45 first.

● See “III. Operation of Each Part” on p.26 for how to operate each part of the microscope.

Microscope	Procedure	Illuminators	Required accessories (optional)
Bright-field microscopy	p.16 to 17	LV-UEPI LV-UEPI2	–
Dark-field microscopy	p.18 to 19	LV-UEPI LV-UEPI2	BD objective BD quintuple nosepiece, universal quintuple nosepiece or motorized universal quintuple nosepiece* (The standard sextuple nosepiece cannot be used for dark-field microscopy.)
Differential interference contrast (DIC) microscopy	p.20 to 21	LV-UEPI LV-UEPI2	Polarizer Analyzer DIC slider Universal quintuple nosepiece or motorized universal quintuple nosepiece* Objectives marked “LU” (Objectives marked “LU” are suitable for DIC microscopy.)
Simplified polarization microscopy	p.22 to 23	LV-UEPI LV-UEPI2	Polarizer Analyzer
Sensitive polarization microscopy	p.24	LV-UEPI2	Polarizer Lambda plate Analyzer
Epi-fluorescence microscopy	p.25	LV-UEPI2	Filter cube (Up to two cubes can be attached.) Fluorescence excitation light balance filter (optional)

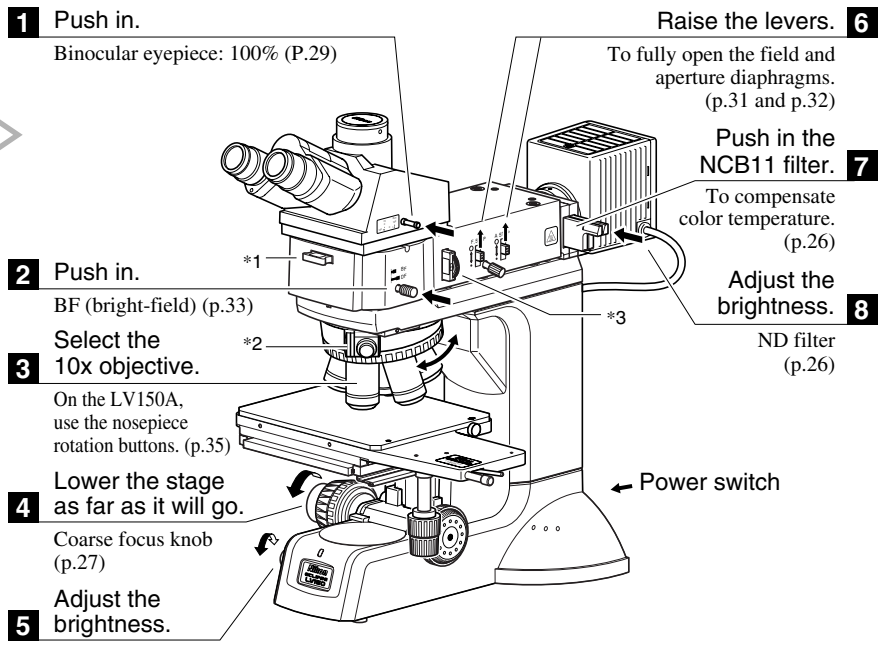
* For the LV150A only.

1 Bright-Field Microscopy

▶ When configured with the LV-UEPI

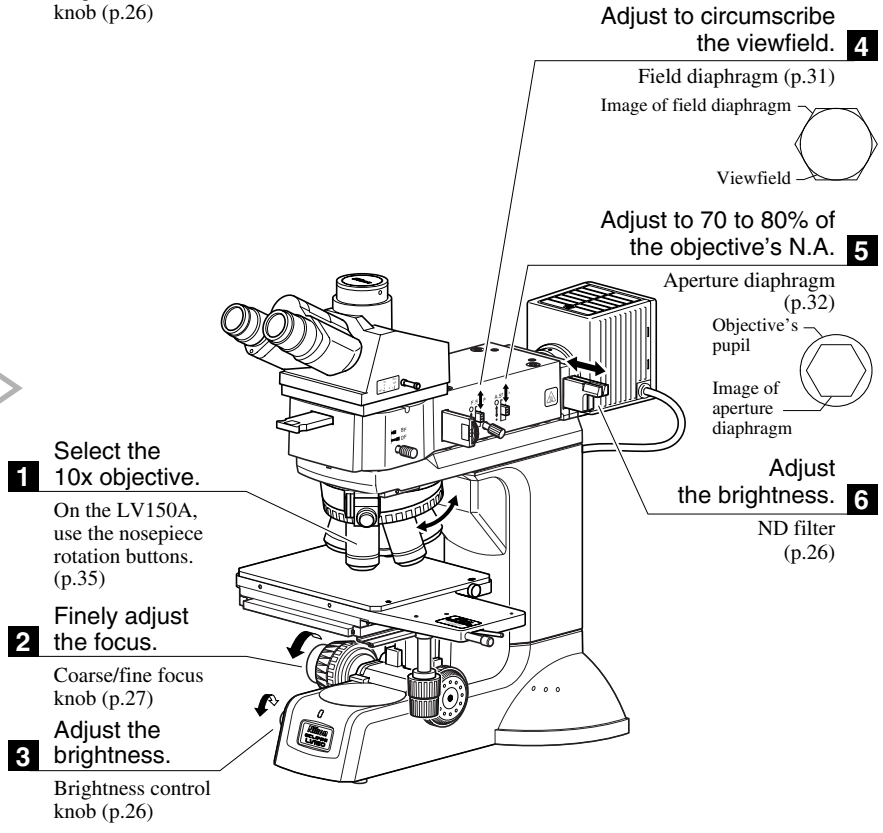
1. Turn on the power.
2. Set the microscope for bright-field microscopy

   If accessories for DIC microscopy (*1 to *3) are in place, pull them out of the optical path.



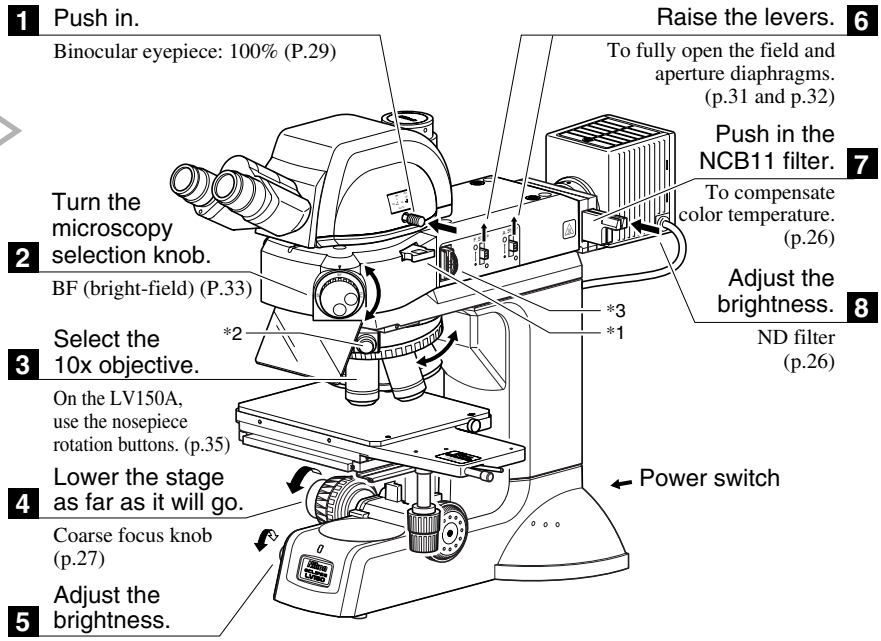
3. Place the sample on the stage and focus on it. (p.27)
4. Adjust the diopter. (p.30)
5. Adjust the interpupillary distance. (p.30)
6. Change the magnification and observe the sample.

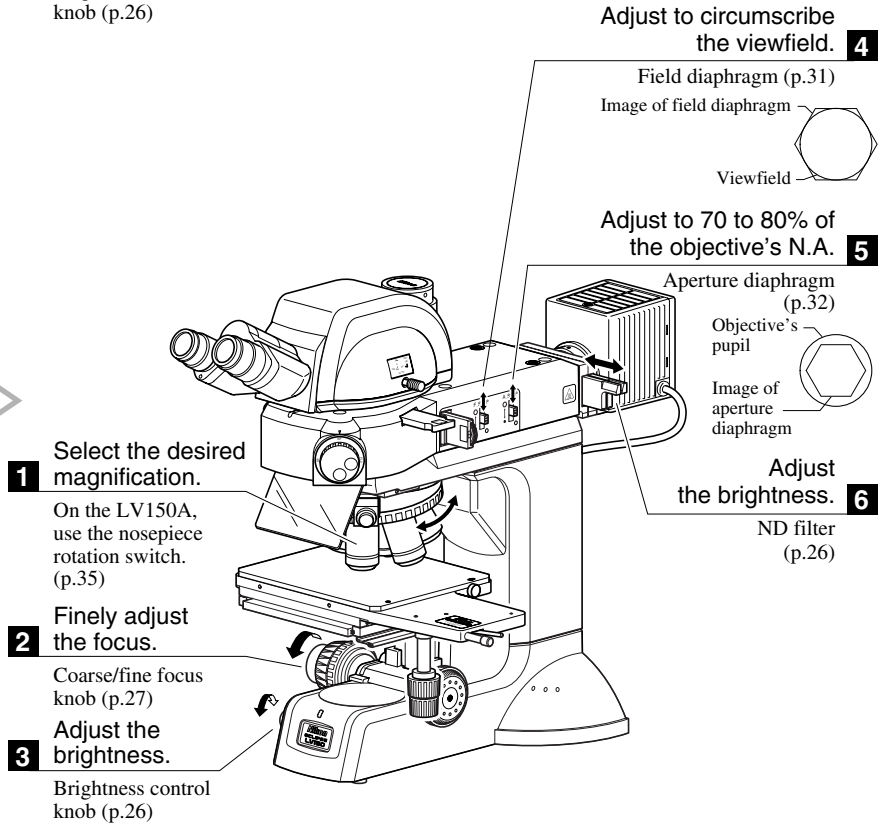
   Hint:
   It may be difficult to focus on a sample with small contrast, such on a polished surface. In a case like this, stop down the field diaphragm so that its image can be seen in the viewfield, and try to focus on the rim of the diaphragm image. When the rim is in focus, the sample is in focus just as well.



▶ When configured with the LV-UEPI2

1. Turn on the power.
2. Set the microscope for bright-field microscopy.
   If accessories for DIC or polarization microscopy (*1 to *3) are in place, pull them out of the optical path.
3. Place the sample on the stage and focus on it. (p.27)
4. Adjust the angle of the binocular part. (p.29)
5. Adjust the diopter. (p.30)
6. Adjust the interpupillary distance. (p.30)
7. Change the magnification and observe the sample.
   Hint:
   It may be difficult to focus on a sample with small contrast, such on a polished surface. In a case like this, stop down the field diaphragm so that its image can be seen in the viewfield, and try to focus on the rim of the diaphragm image. When the rim is in focus, the sample is in focus just as well.





2 Dark-Field Microscopy

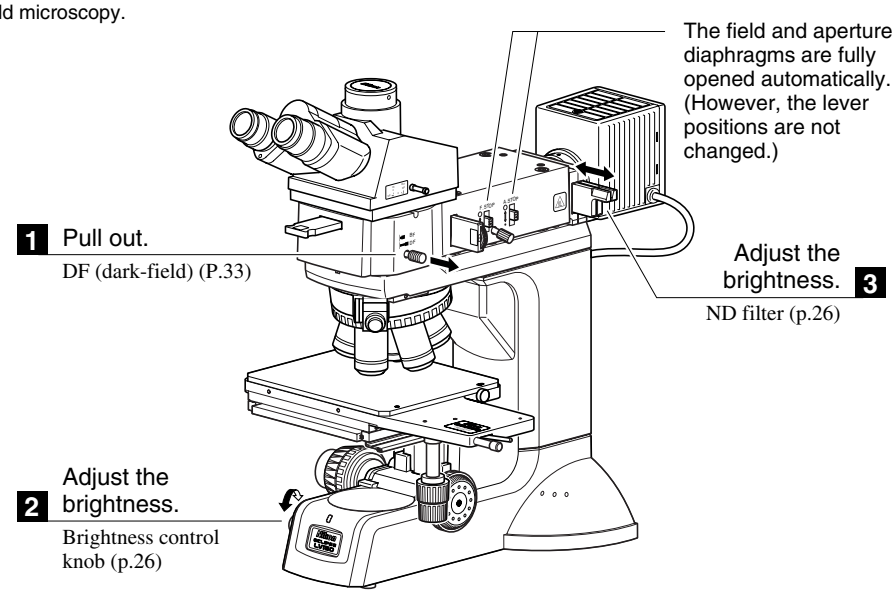
▶ When configured with the LV-UEPI

1. Mount BD objectives and a BD quintuple nosepiece, universal quintuple nosepiece, or motorized universal quintuple nosepiece. (p.56 and 49)

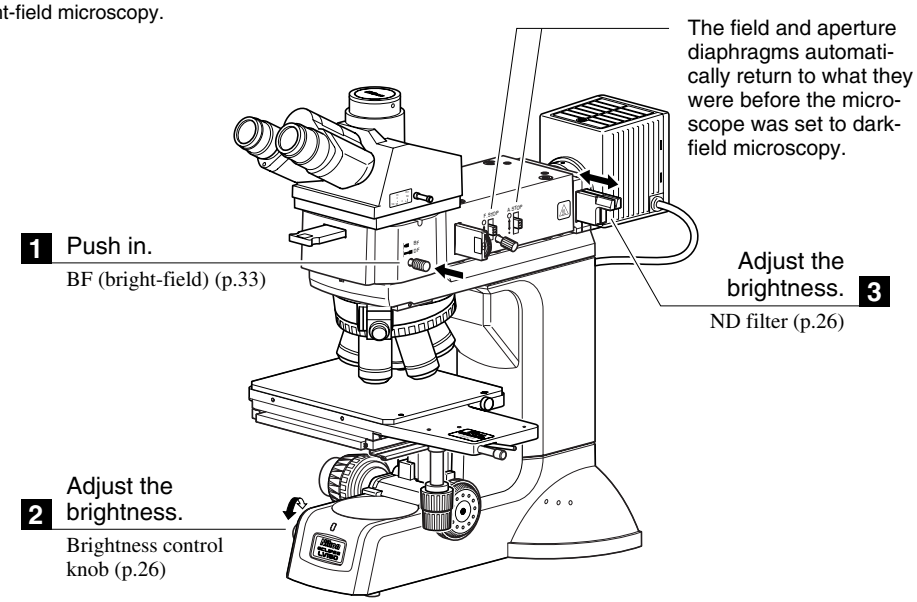
   The standard sextuple nosepiece cannot be used for dark-field microscopy.

2. Focus on the sample with bright-field microscopy. (p.16)

3. Set the microscope for dark-field microscopy.



4. Return the microscope to bright-field microscopy.



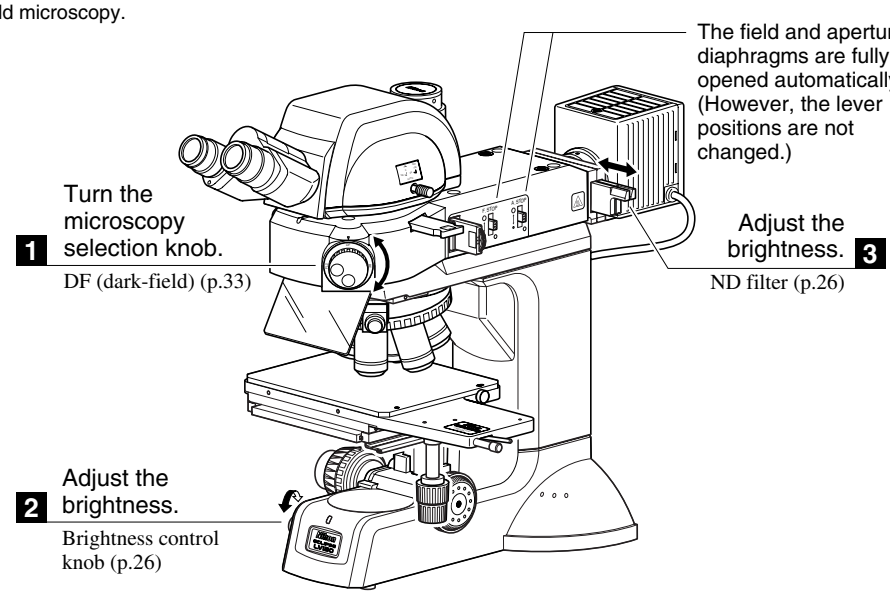
▶ When configured with the LV-UEPI2

1. Mount BD objectives and a BD quintuple nosepiece, universal quintuple nosepiece, or motorized universal quintuple nosepiece. (p.56 and 49)

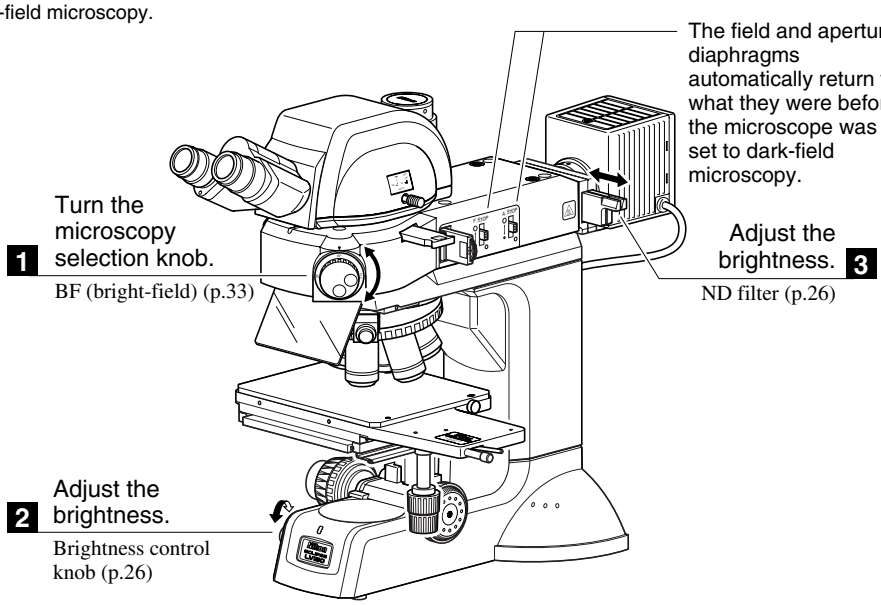
   The standard sextuple nosepiece cannot be used for dark-field microscopy.

2. Focus on the sample with bright-field microscopy. (p.17)

3. Set the microscope for dark-field microscopy.



4. Return the microscope to bright-field microscopy.



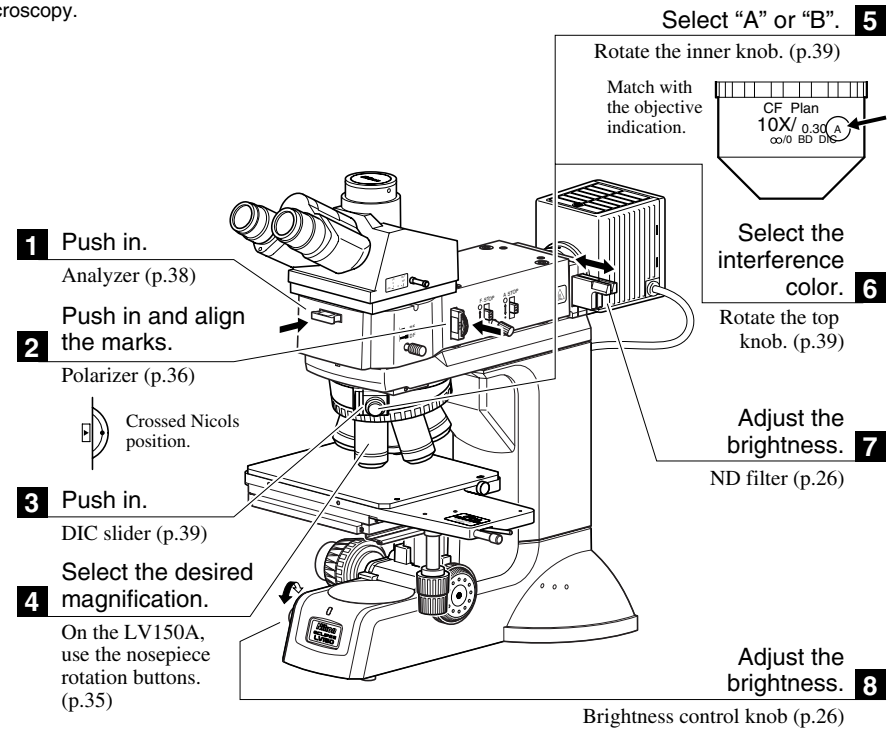
3 Differential Interference Contrast (DIC) Microscopy

▶ When configured with the LV-UEPI

1. Mount objectives marked “LU”, universal quintuple nosepiece or motorized universal quintuple nosepiece, polarizer, analyzer, and DIC slider. (p.36, 38, 39, 49, and 56)

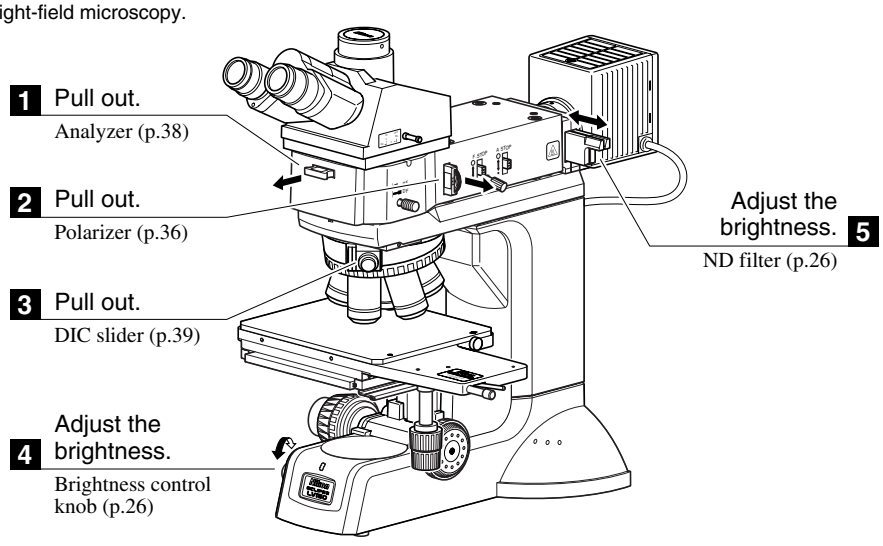
2. Focus on the sample with bright-field microscopy. (p.16)

3. Set the microscope for DIC microscopy.



Information:
The DIC slider can be operated to enable various microscopies, including sensitive DIC.

4. Return the microscope to the bright-field microscopy.

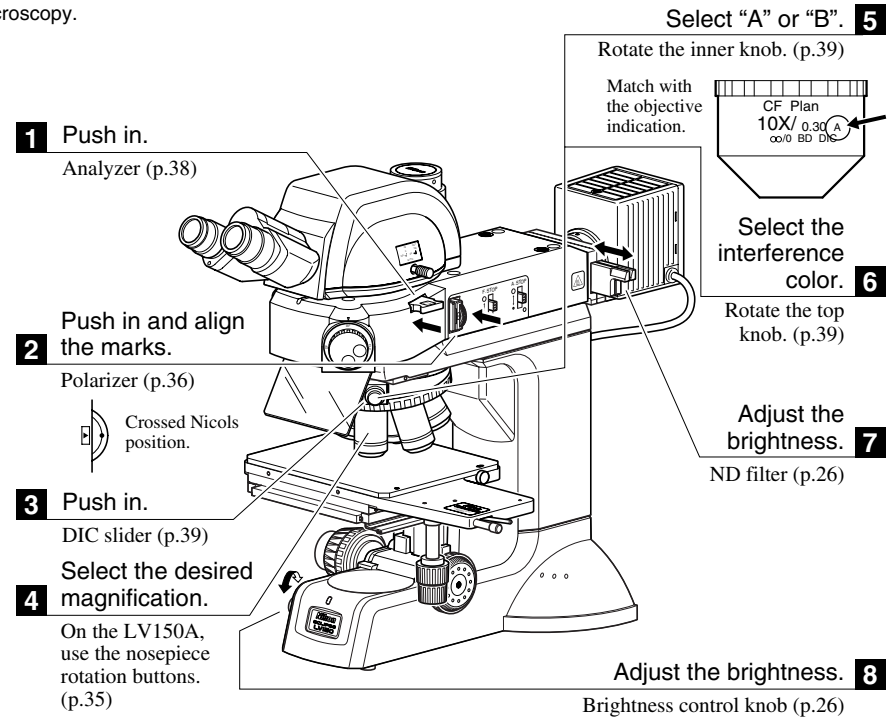


▶ When configured with the LV-UEPI2

1. Mount objectives marked “LU”, universal quintuple nosepiece, polarizer or motorized quintuple nosepiece, polarizer, analyzer, and DIC slider. (p.36, 38, 39, 49, and 56)

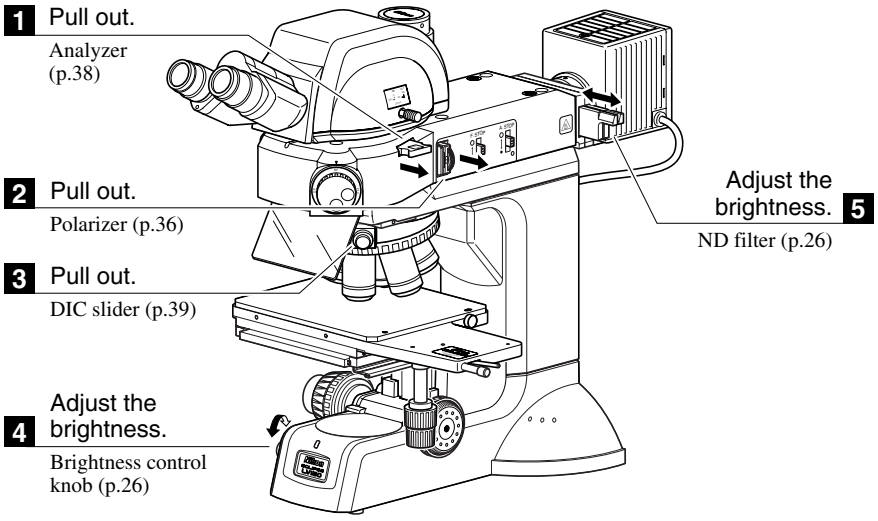
2. Focus on the sample with bright-field microscopy. (p.17)

3. Set the microscope for DIC microscopy.



Information:
The DIC slider can be operated to enable various microscopies, including sensitive DIC.

4. Return the microscope to bright-field microscopy.



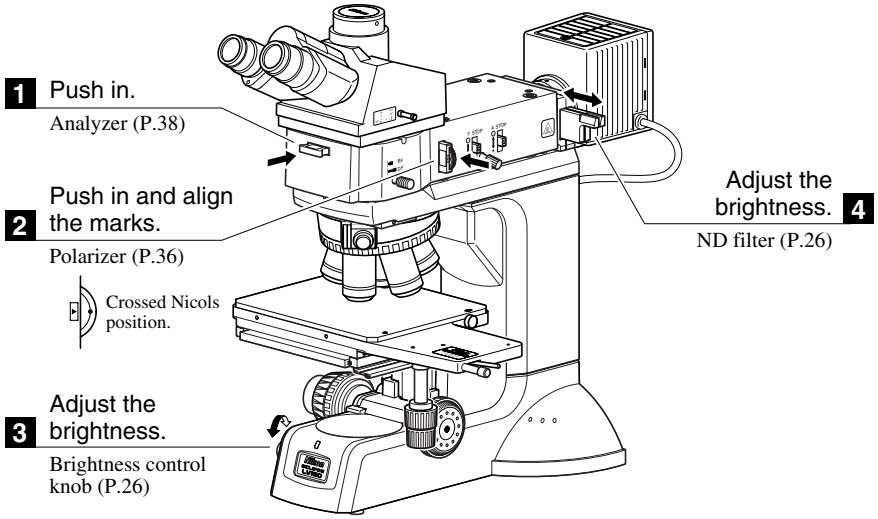
4 Simplified Polarization Microscopy

▶ When configured with the LV-UEPI

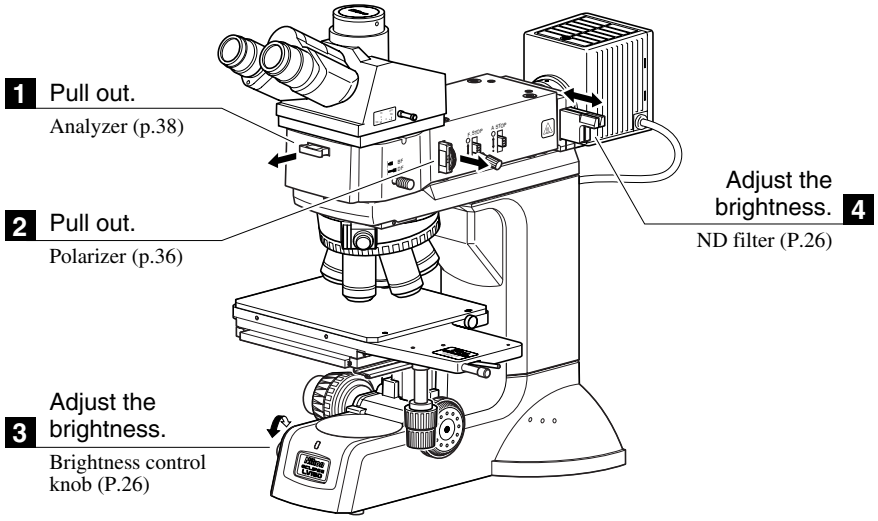
1. Mount a polarizer and an analyzer. (p.36, 38)

2. Focus on the sample with bright-field microscopy. (p.16)

3. Set the microscope for simplified polarization microscopy.



4. Return the microscope to bright-field microscopy.

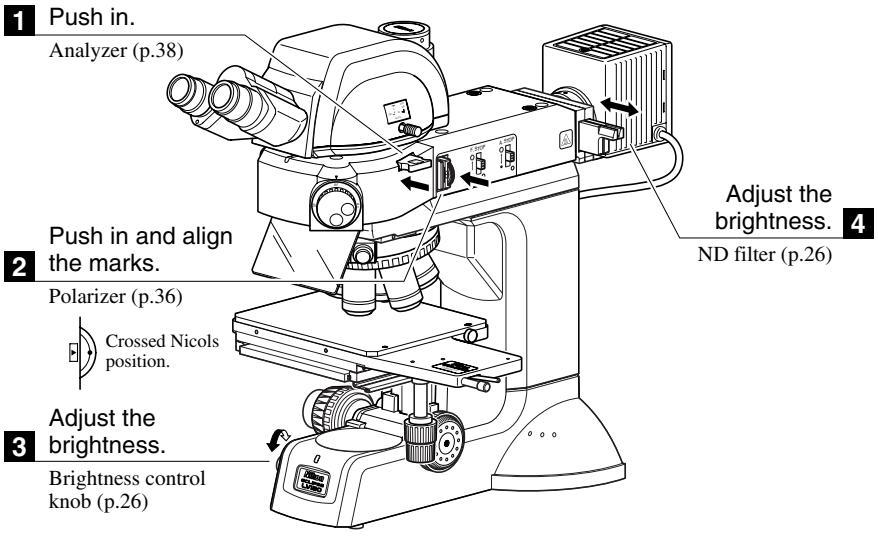


▶ When configured with the LV-UEPI2

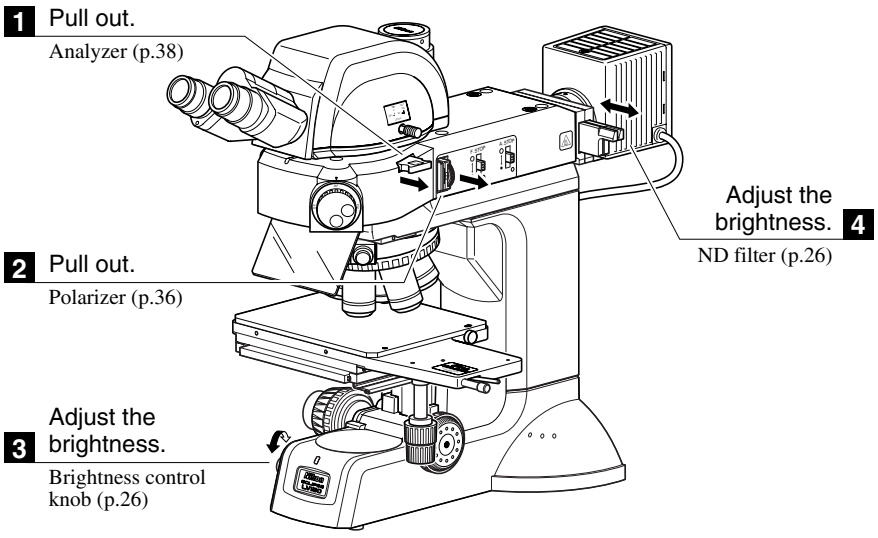
1. Mount a polarizer and an analyzer. (p.36, 38)

2. Focus on the sample with bright-field microscopy. (p.17)

3. Set the microscope for simplified polarization microscopy.



4. Return the microscope to bright-field microscopy.



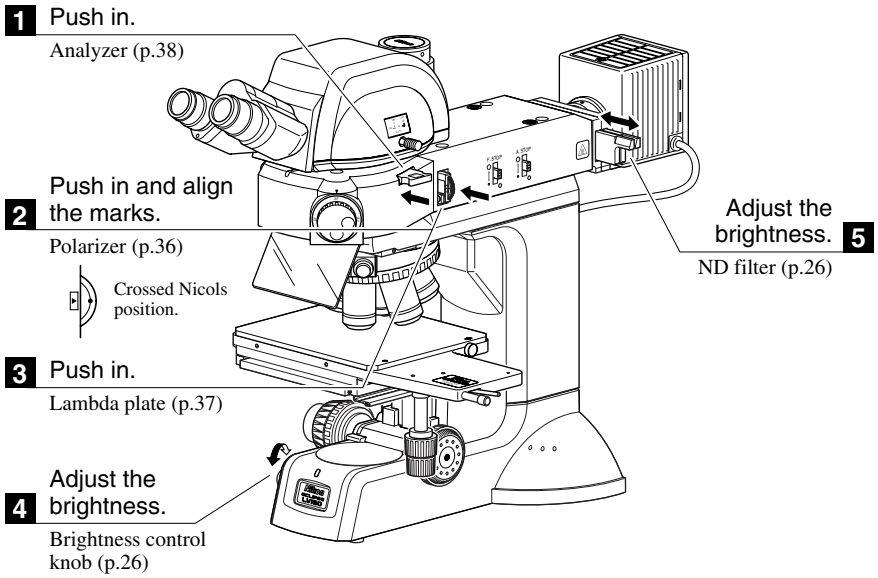
5 Sensitive Polarization Microscopy

▶ Only when configured with the LV-UEPI2

1. Mount a polarizer, lambda plate, and analyzer. (p.36 to 38)

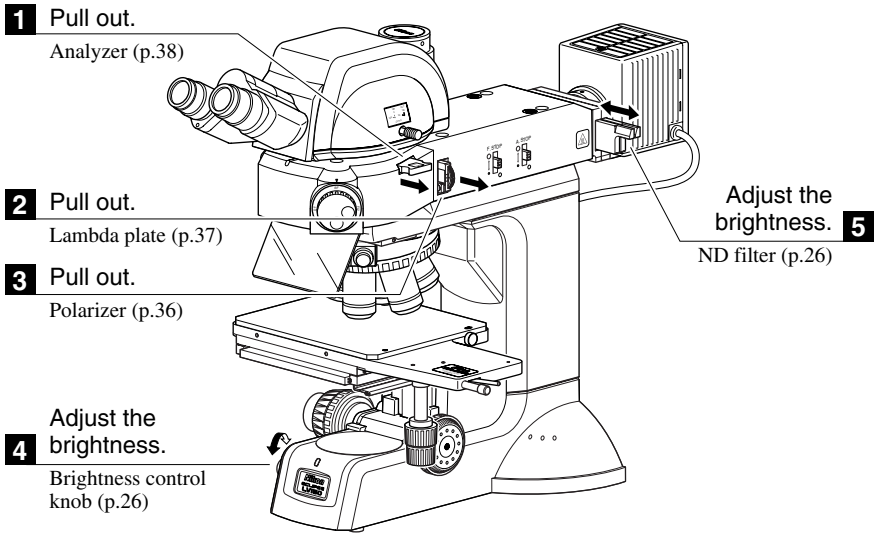
2. Focus on the sample with bright-field microscopy. (p.17)

3. Set the microscope for sensitivity polarization microscopy.



Information:
Turn the polarizer knob to adjust the polarization while observing the image.

4. Return the microscope to bright-field microscopy.



6 Epi-Fluorescence Microscopy

▶ Only when configured with the LV-UEPI2

1. Attach the filter cube to the turret in the illuminator. (p.52)

   Up to two filter cubes can be attached.

2. Install the suitable illuminator for the excitation method as necessary. (p.54)

   To perform the epi-fl microscopy, the brightness of the specified light source (halogen lamp) may be less than the desired brightness. An external light source other than the specified ones can be installed for this purpose.

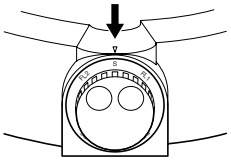
   * Please take note that if a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI approved product.

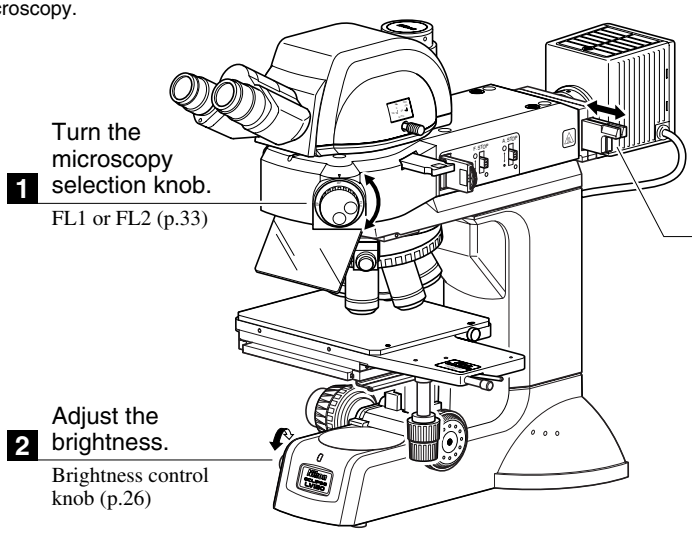
3. Find the object using bright-field or dark-field microscopy, and then focus on the sample. (p.17, 19)

4. Set the microscope for epi-fl microscopy.

   Information:
   When the microscopy selection knob is turned to the "S" position, the shutter closes the optical path of illumination.
   To prevent fading of the sample, be sure to close the shutter when moving your eyes away from the binocular part.

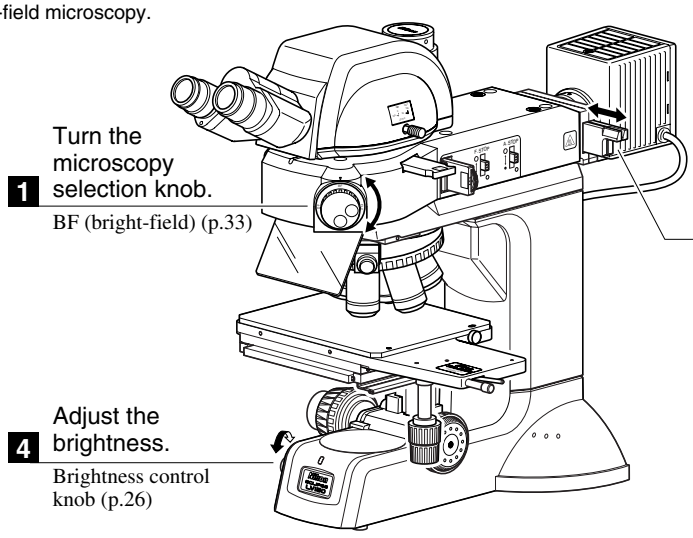
   S (for shutter) position

5. Return the microscope to bright-field microscopy.

   Information:
   During the epi-fluorescence microscopy, the UV filter is removed from the optical path. But the UV filter is inserted into the optical path during the bright-field or dark-field microscopy. The inserting/removing of the UV filter is performed together with the rotation of the microscopy selection knob.

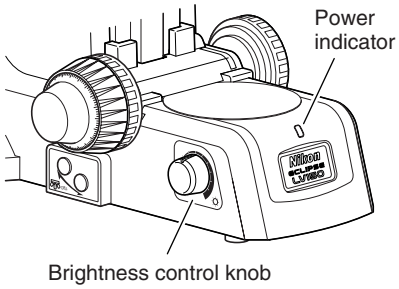
III Operation of Each Part

1 Operation of the Illumination

▶ Brightness control

When the specified lamphouse LV-LH50PC is used for the halogen lamp to illuminate, the brightness can be controlled by rotating the brightness control knob.

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



▶ Turning on/off the lamp

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

▶ Power indicator

The power indicator color changes according to the halogen lamp status. When the halogen lamp is lit, it is green. When the brightness control knob is positioned at OFF, it is orange.

2 Filters

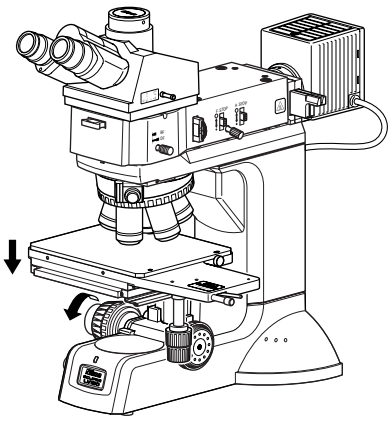
There are two filter sliders in the end of the illuminator. Two filters can be set on each filter slider. The desired filters can be brought into the optical path by sliding the filter sliders in and out.
For attaching the filters, refer to p.51.

Filters	Usage
NCB11 (neutral color balancing filter)	Color balance adjustment and color photomicrography.
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.

3 Coarse/Fine Focus Knobs

▶ Relationship between focus knob rotation and stage vertical movement

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



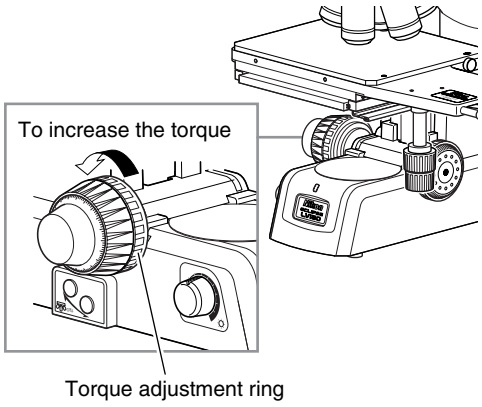
- The stage moves approximately 14.0 mm per one full rotation of the coarse focus knob.
- The stage moves 0.1 mm per one full rotation of the fine focus knob.
- The stage moves 1 μm per one step of the fine focus knob graduations.
- The stroke (range) of stage vertical movement is 30 mm.

Reference) When observing with the combination of "6x6 inch stage" and "ESD plate", the stage vertical movement range is 11.5 mm up and 28.5 mm down.

Never attempt either of the following actions, as these will damage the microscope.
- *Rotating the left and right knobs in opposite directions at the same time.*
- *Continuing to rotate the coarse focus knob after the stage has reached the limit of its motion.*

▶ Adjusting the torque of the coarse focus knob

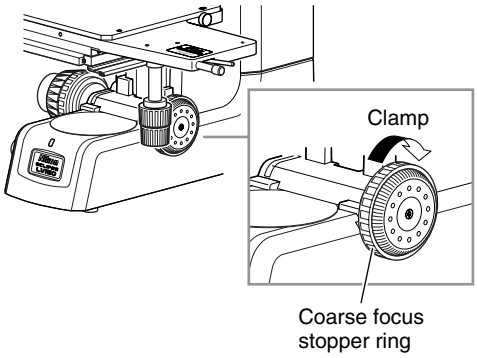
The torque of the coarse focus knob can be adjusted.
To increase the torque, turn the coarse torque adjustment ring (labeled "TORQUE→", located at the root of the coarse focus knob) in the direction shown by the arrow on the microscope base.
To decrease the torque, turn it opposite to the arrow.



Coarse focus stopper

The coarse focus stopper restricts the movement of the coarse focus knob so that the stage cannot be raised higher than the position the operator specifies.
When the coarse focus stopper ring is rotated in the direction of the arrow (labeled “CLAMP→”) on the microscope base, the coarse focus knob cannot be used to move the stage any higher. (Movement of the stage by the fine focus knob is not restricted.)
For example, once the coarse focus knob is clamped in place at the focus position, a rough focus can be attained the next time simply by raising the stage until the coarse focus knob cannot be turned any further.
If the coarse focus stopper is not being used, be sure to turn the ring in the direction opposite to the arrow on the microscope base as far as it goes.

[Example usage]
With the sample in focus, turn the coarse focus stopper ring as far as it goes in the direction of the arrow (labeled “CLAMP→”) on the microscope base (about 3/4 revolution). The coarse focus stopper is now clamped in position.
When changing the sample, lower the stage by turning only the coarse focus knob.
After changing the sample, gently raise the stage by turning only the coarse focus knob as far as it goes. The sample should be roughly in focus when the stage has been raised as far as it goes. Use the fine focus knob to bring the sample into perfect focus.



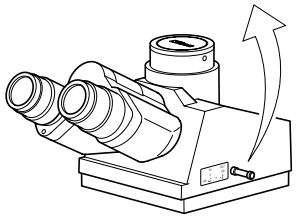
4 Eyepiece Tube

▶ Optical path selection

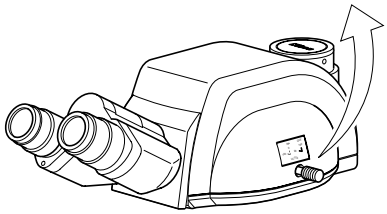
The optical path selection lever can be used to switch between the proportions of light reaching the binocular part and the vertical tube.

Lever position	Light proportion	
	Binocular part	Vertical tube
IN	100	0
OUT	0	100

Lever position	Light proportion	
	Binocular part	Vertical tube
IN	100	0
OUT	20	80



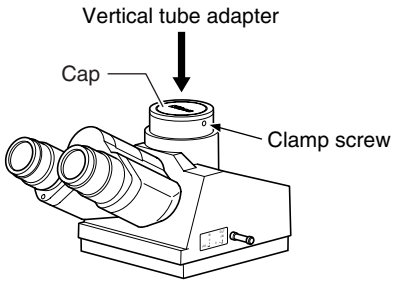
Eyepiece tube LV-TI3



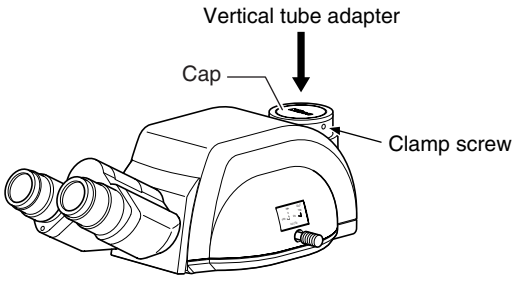
Eyepiece tube LV-TT2

▶ Vertical tube adapters

When attaching photomicrographic equipment or TV camera to the vertical tube of the trinocular eyepiece 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.



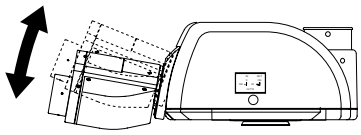
Eyepiece tube LV-TI3



Eyepiece tube LV-TT2

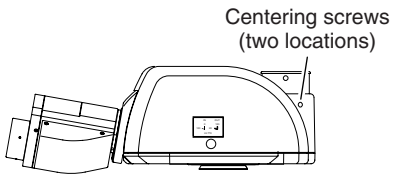
▶ Angular adjustment of binocular part (for the LV-TT2 only)

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



▶ Centering the binocular part (for the LV-TT2 only)

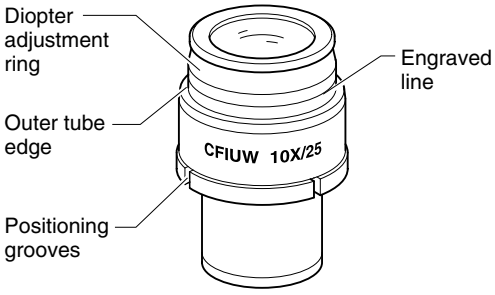
The binocular part and the vertical tube part of the eyepiece tube are centered before the shipping, so usually they can be used with no adjustment.
But some cameras are not aligned their centers of the CCD to the mount. You can center the vertical part by adjusting two centering screws on the back of the vertical tube for such cameras.



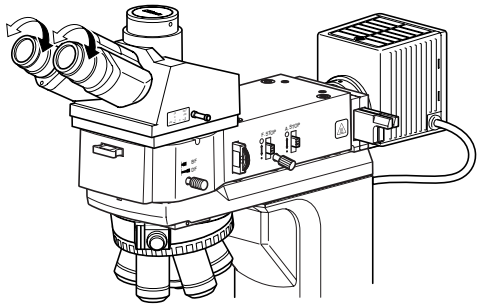
5 Diopter Adjustment

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 (p.16, 17).
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.

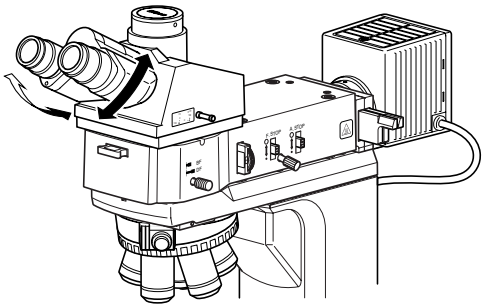


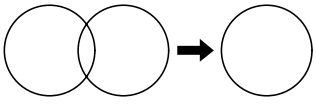
Diopter adjustment standard position



6 Interpupillary Distance Adjustment

Before adjusting the interpupillary distance, perform the steps of bright-field microscopy (p.16, 17) and focus on the image with the 10x objective. Adjust the interpupillary distance so that the viewfields for both eyes are at the same position on the sample.
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.

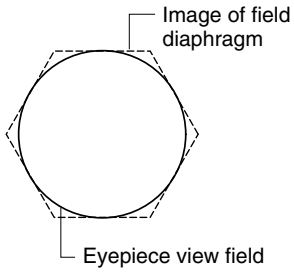




Merge the view fields into one.

7 Field Diaphragm

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

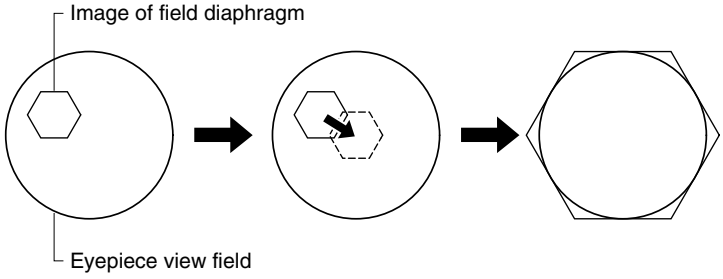


▶ About the field diaphragm

- 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 during photomicrography. Generally, the field diaphragm should be set to the area to be exposed on film, that is, to an area slightly larger than the photographed area.
- Be sure to adjust the field diaphragm after centering it.

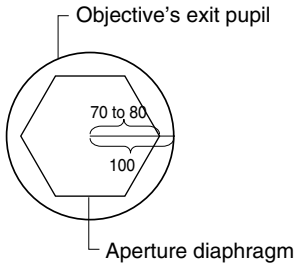
▶ Centering the field diaphragm

1. Focus on the sample with the 10x objective by following the steps of bright-field microscopy (p.16, 17).
2. Lower the field diaphragm open/close 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 illuminator LV-UEPI2 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 open/close lever and centering screws so that the field diaphragm image is inscribed in the viewfield.
5. When starting observation, raise the field diaphragm open/close lever so that the field diaphragm image is slightly larger the viewfield.



8 Aperture Diaphragm

Remove one of the eyepieces. Operating the aperture diaphragm open/close 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.



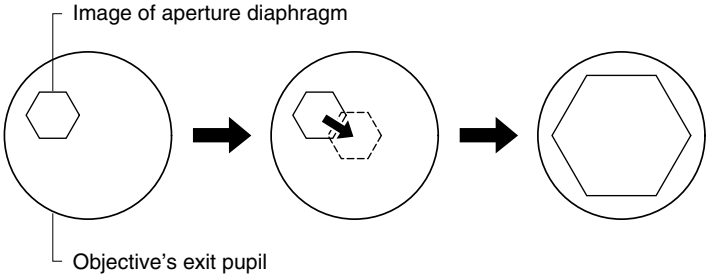
About the aperture diaphragm

- 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 illuminator LV-UEPI, the aperture diaphragm centering has been adjusted at the factory and does not need to be adjusted.

Centering the aperture diaphragm (for the LV-UEPI2 only)

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

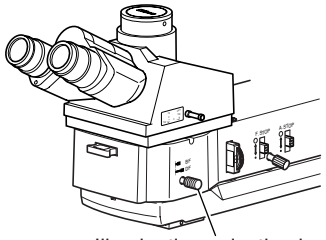
1. Focus on the sample with the 10x objective by following the steps of bright-field microscopy (p.16, 17).
2. Remove one of the eyepieces. Check that the aperture diaphragm image is seen within the objective's exit pupil in the eyepiece tube.
3. Lower the aperture diaphragm open/close lever to reduce 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 open/close 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 open/close 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.)



9 Illumination Selection Lever and Microcopy Selection Knob

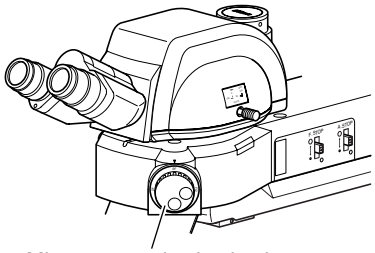
1. Illumination selection lever (for the LV-UEPI)

When the illuminator LV-UEPI is used, the illumination selection lever on the right side can be used to alternate the 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).


Illumination selection lever

2. Microscopy selection knob (for the LV-UEPI2)

When the illuminator LV-UEPI2 is used, the microscopy selection knob at the front right of the illuminator can be turned to rotate the turret in the illuminator 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	**Bright-field microscopy** 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.
DF	**Dark-field microscopy** Setting the knob to DF selects the 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.
FL1	**Epi-fluorescence 1** The filter cube inserted into the “FL1” position in the illuminator enters the optical path. And, the UV filter is removed from the optical path.
S	**Shutter** 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.
FL2	**Epi-fluorescence 2** The filter cube inserted into the “FL2” position in the illuminator enters the optical path. And, the UV filter is removed from the optical path.

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

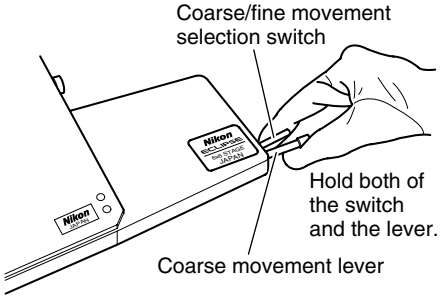
10 Stage

1. 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.

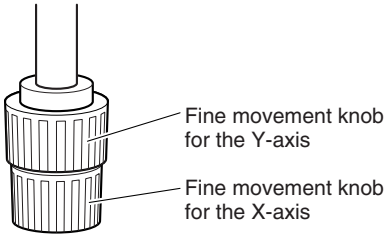
▶ The “coarse” mode

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.

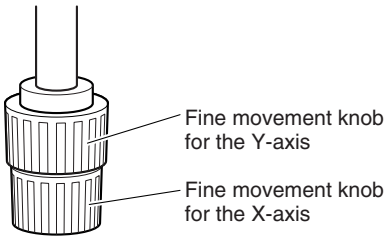


2. 3x2 stage

▶ 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 specimen minutely.

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

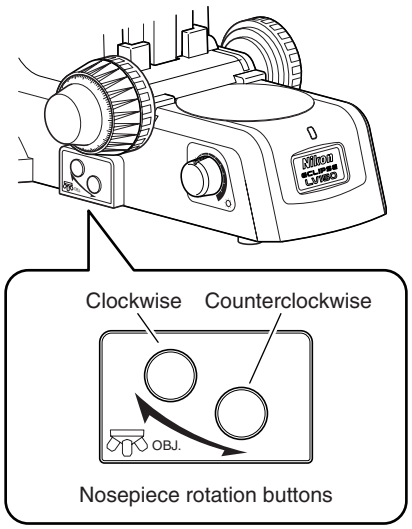


▶ Slide glass usage

To observe a specimen by using a slide glass, replace the stage glass to the optional slide glass holder.
Loosen the clamp screw on the left side of the stage to remove the standard stage glass. Then, mount the slide glass holder and secure it by the clamp screw.

11 Motorized Nosepiece Operation

The LV150A is equipped with a motorized nosepiece, and you can rotate the nosepiece by operating the nosepiece rotation buttons on the left side of the microscope to change objectives.
Two buttons, far side and near side, are used as the nosepiece rotation buttons. The nosepiece is rotated each time when either button is 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.

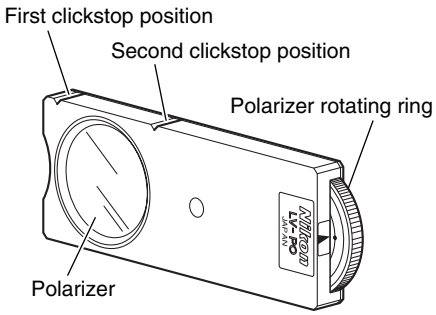


Be careful about the following items to use the motorized nosepiece:

- *To mount objectives onto the motorized nosepiece, magnifications of objectives are placed in ascending order from No. 1 position of the nosepiece.*
- *The nosepiece rotation from No. 1 position to No. 5 position and from No. 5 position to No. 1 position is prohibited in normal operation.*
  This limit is applied because a collision may occur when a rotation from the lowest magnification objective to the highest magnification objective is attempted under an inadequate adjustment.
  If you wish to rotate the nosepiece between No. 1 position and No. 5 position on purpose, press the button for the opposite direction while holding down the desired direction button. Before this operation, be sure to adjust each part of the microscope and check that no collision occurs for objectives.

12 Polarizer Slider

The polarizer slider can be used together with the analyzer slider to enable the 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 (with the LV-UEPI2 only).



▶ Placing the polarizer in the optical path

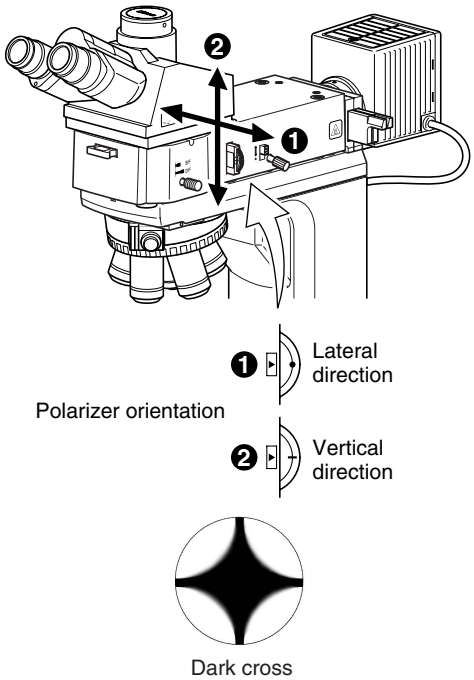
- **For the LV-UEPI:**
  Remove the dummy slider at the right side of the illuminator, and in its place, insert the polarizer slider with its orientation indication facing toward the eyepieces. (p.51)
- **For the LV-UEPI2:**
  Remove the vertically oriented cover at the right side of the illuminator. 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. (p.51)
- **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 specimen 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.)

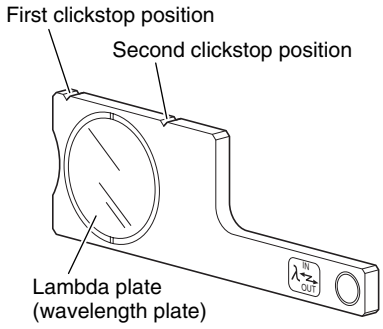


UV polarizer slider

The UV polarizer slider is used for the epi-microscopy under the UV excitation light to make the excitation light to the linear polarization. The UV polarizer will deteriorate over time, so change it as necessary.

13 Lambda Plate Slider (for the LV-UEPI2 only)

If the LV-UEPI2 is used for the illumination, 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

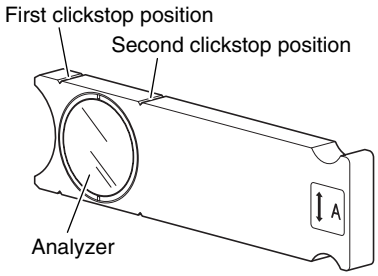
Remove the dummy slider found in front of the polarizer slider, and in its place, insert the lambda plate slider. (p.51)
Pushing the lambda plate slider in to the first clickstop position inserts the empty hole into the optical path. Pushing it further in to the second clickstop position inserts the 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.

14 Analyzer Slider

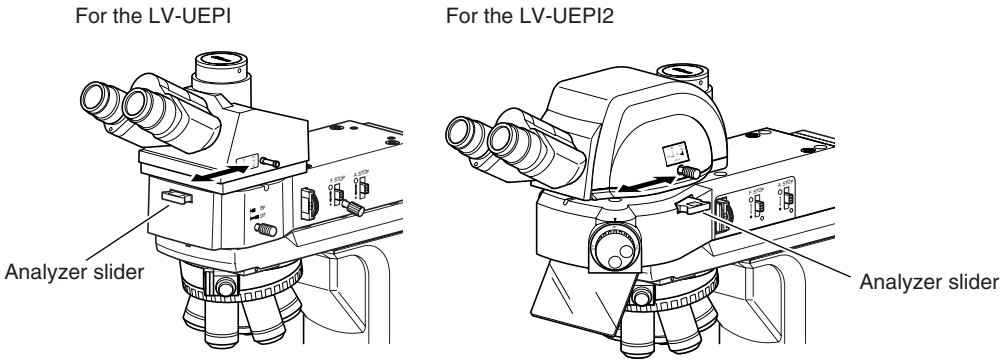
The analyzer slider can be used together with the polarizer slider to enable simplified polarization microscopy. Likewise, the analyzer slider can be combined with the polarizer slider and DIC slider to perform DIC microscopy, and with the polarizer slider and lambda plate slider to perform sensitive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



▶ Placing the polarizer in the optical path

- **For the LV-UEPI:**
  Remove the dummy slider at the front of the illuminator, and in its place, insert the analyzer slider with its marking facing up. (p.51)
- **For the LV-UEPI2:**
  Remove the horizontally oriented cover at the right side of the illuminator. Insert the analyzer slider into the horizontal slot with its marking facing up. (p.51)
- **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.

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



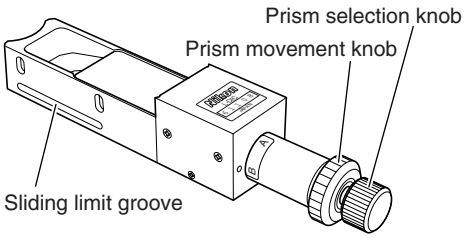
Analyzer orientation

▶ Removing the polarizer out of the optical path

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

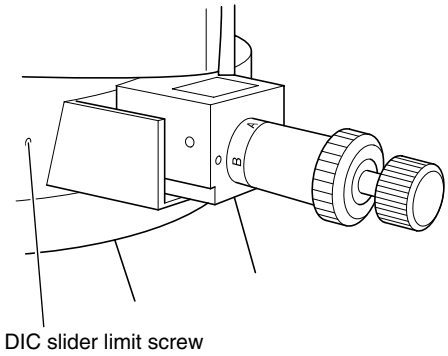
15 DIC Slider

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

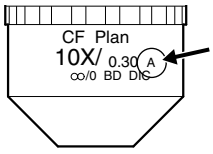
Push in the slider to the second clickstop position to place the DIC prism in the optical path.

▶ 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 N.A. 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.



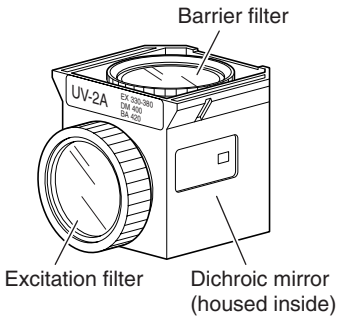
▶ Selecting an interference color

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.

16 Filter Cubes for Fluorescence Observation (for the LV-UEPI2 only)

The illuminator LV-UEPI2 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.



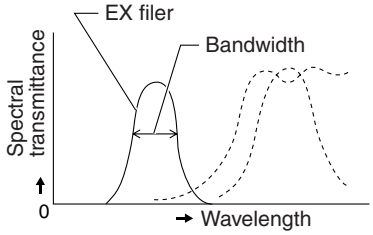
- Different combinations of excitation filter and barrier filter are available for the same excitation method.
- Excitation filters, barrier filters, and dichroic mirrors can be purchased separately.
- Excitation filters will deteriorate over time since they are exposed to intense light. Replace them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

Light source for the epi-fl microscopy

To perform the epi-fl microscopy with the LV-UEPI2 illuminator, the specified light source brightness may be less than the desired brightness. An external light source suitable for the excitation method can be installed into the LV-UEPI2 for this purpose.

* *Please take note that if a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI approved product. Nikon recommends that the light source to be installed onto this microscope should have been tested by a safety certification organization.*

▶ 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.

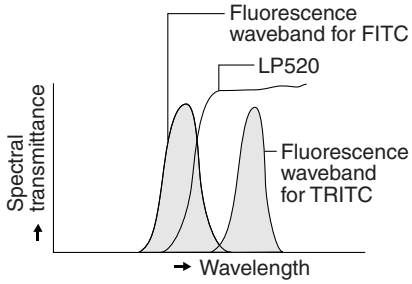
	Narrow	Bandwidth of excitation filter	Wide
Brightness of fluorescence image	Dark		Bright
Occurrence of self-fluorescence	Less frequent		Frequent
Degree of fading	Small		Large

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.

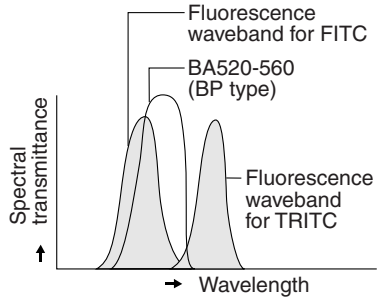


Both fluorescence images due to FITC and TRITC are seen

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, TRIC 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.

- **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

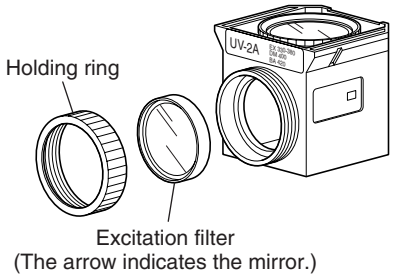
Replacing the excitation filter, barrier filter, and dichroic mirror

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.

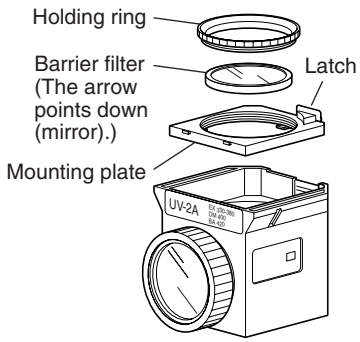
1. Rotate the holding ring in counterclockwise direction to remove it.
2. Replace the excitation filter and secure it by the holding ring.
   Check and see the arrow mark on the rim of the excitation filter is directed to the dichroic mirror side when attaching the excitation filter.
   If a filter made 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.

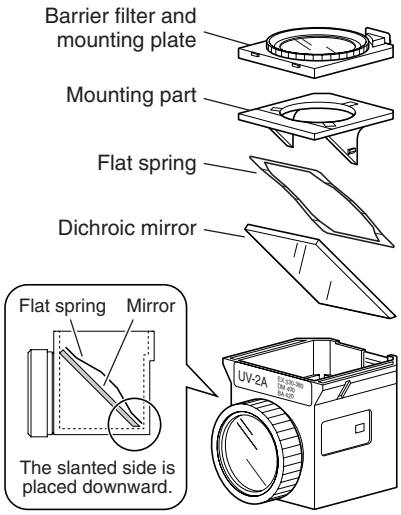
1. Press the latch to inside and detach the mounting plate and barrier filter together.
2. Rotate the holding ring to remove it from the mounting plate.
3. Replace the barrier filter and secure it in reverse order.
   Check and see the arrow mark on the rim of the barrier filter is directed to downward (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**

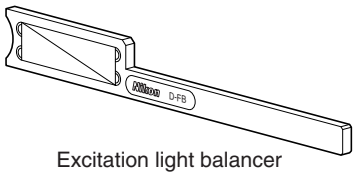
The dichroic mirror is fixed with a flat spring and a mounting part inside the filter cube.

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.



17 Excitation Light Balancer (for the LV-UEPI2 Only)

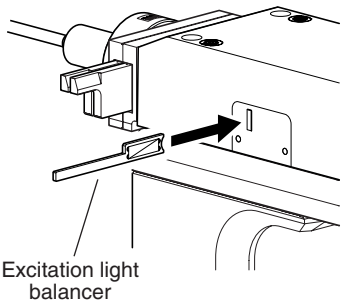
When the illuminator LV-UEPI2 is used, the optional D-FB excitation light balancer can be attached for the epi-fl microscopy to observe specimens stained in multiple colors.
The excitation light balancer enables the continuous change of the wavelength characteristics for the excitation light without 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 illuminator, 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.

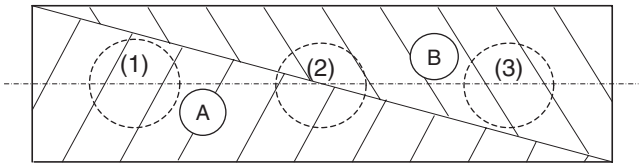


▶ Objectives

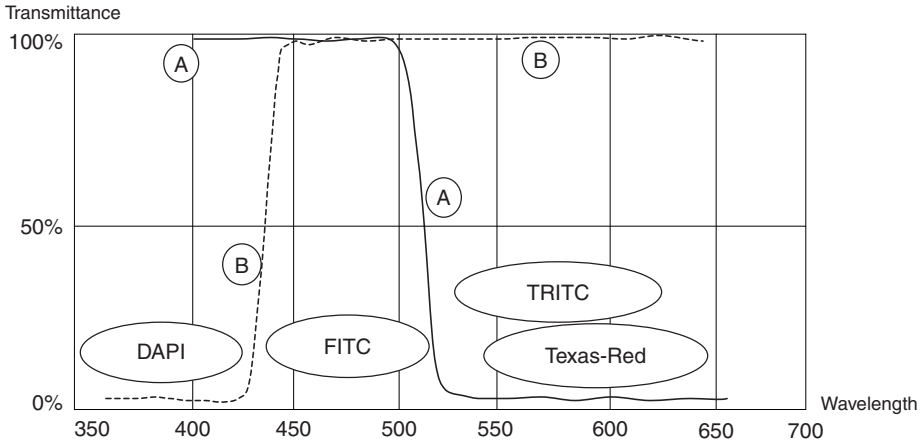
To use the excitation light balancer, use the following objectives in combination. If other objective is used, uneven image may be observed in the view field.

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



: Effective diameter on the aperture diaphragm surface



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

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

IV Assembly

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 (flip it to the "○" side) when assembling the microscope.

CAUTION

- Be careful not to pinch your fingers or hands during assembly.
- Scratches or fingerprints on the 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 "VII. Care and Maintenance."
- The microscope is a precision optical instrument. Handle it carefully and do not subject it to a strong physical shock. (In particular, objectives may loose accuracy when exposed to even a weak physical shock.)

▶ Required tools

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

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

▶ Installation location

Being a precision optical instrument, this product may get damaged or loose 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 6.
- The microscope may be moved by earthquakes. We recommend taking anti-earthquake measures.
  For details about anti-earthquake measures, see "15. Countermeasures for Earthquakes."
- For details about the operating environment and storage environment, see "VIII. Specifications."

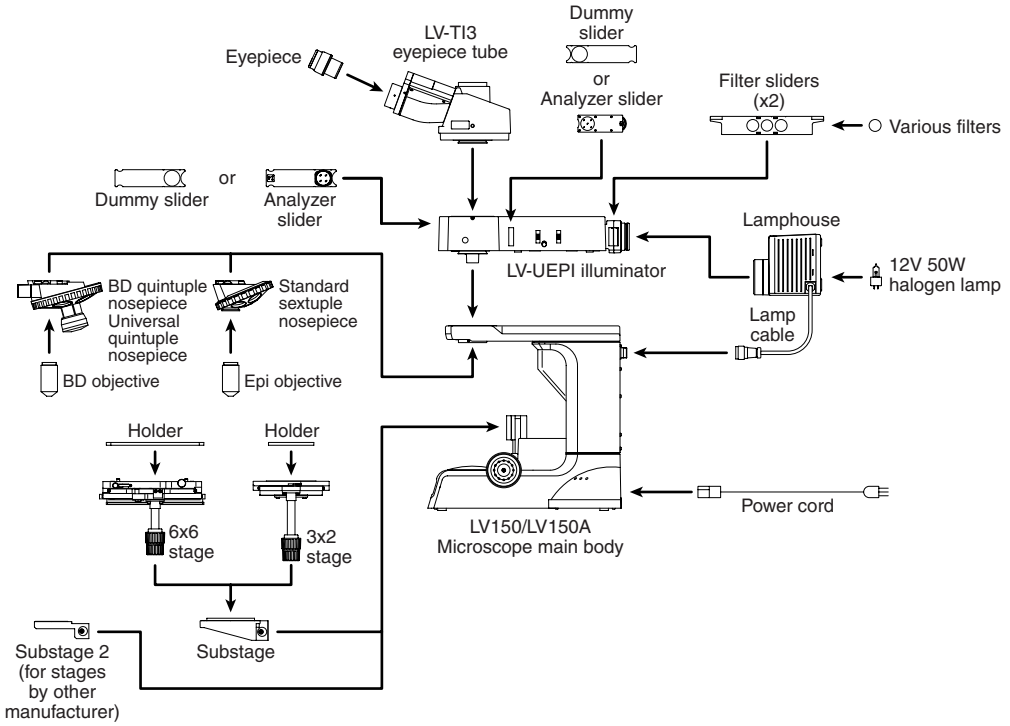
▶ Combination of the illuminator and the light source

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

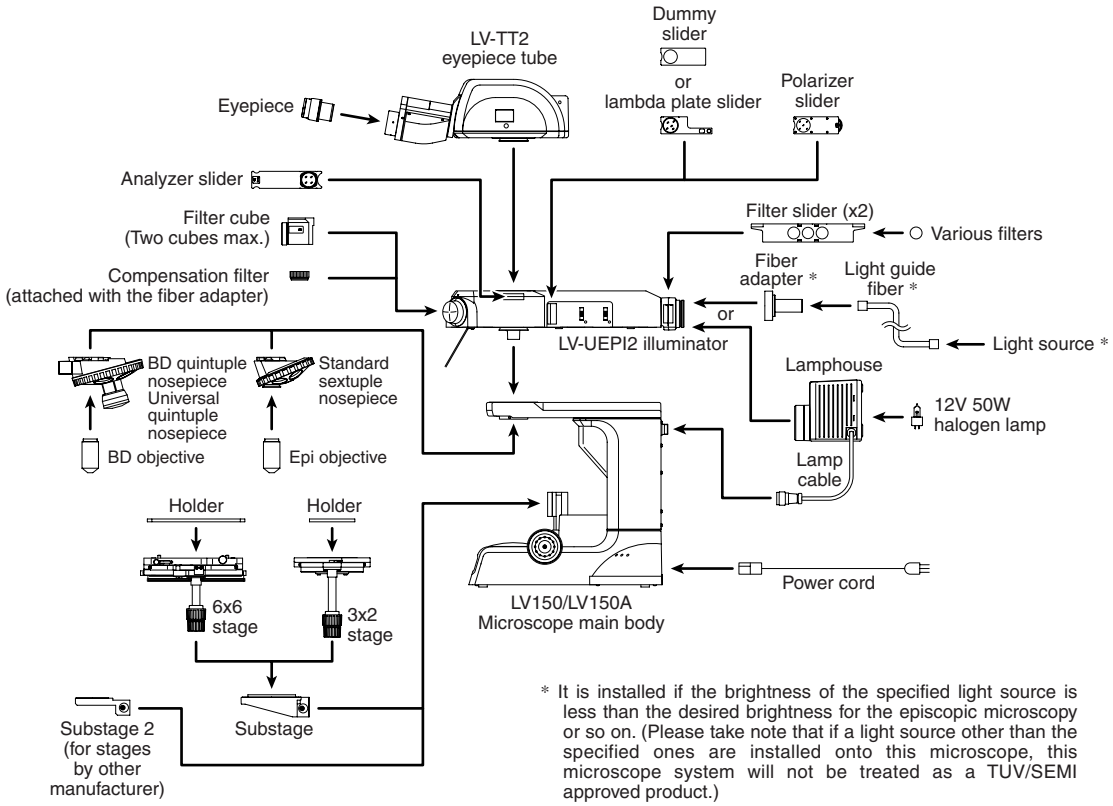
- Illuminator Nikon LV-LH50PC precentered lamphouse 12V 50W
- Lamphouse Nikon LV-LH50PC precentered lamphouse 12V 50W
- Lamp Nikon LV-HL50W 12V 50W LONGLIFE halogen lamp or non-Nikon 12V 50W SHORTLIFE halogen lamp (model OSRAM HLX 64610, OSRAM HLX 64611, or PHILIPS 7027)

Assembling the ECLIPSE LV150/LV150A

- **When using the illuminator LV-UEPI**



- **When using the illuminator LV-UEPI2**



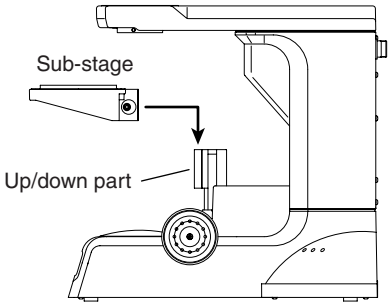
* It is installed if the brightness of the specified light source is less than the desired brightness for the episcopic microscopy or so on. (Please take note that if a light source other than the specified ones are installed onto this microscope, this microscope system will not be treated as a TUV/SEMI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

1 Attaching the Stage and the Holder

1. Attaching the sub-stage

The sub-stage must be attached onto the microscope before installing the stage.

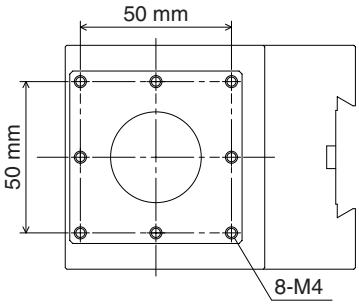
1. Lower the sub-stage completely with the coarse focus knob.
2. Loosen the clamp screw for the sub-stage. And then attach the sub-stage with fitting the dovetail joints on the up/down part. Secure the sub-stage by the clamp screw so that the upper surfaces of the up/down part and sub-stage are the same height.
3. If you wish, the sub-stage can be attached at the 8 mm below from the standard position described above. Adjust it according to the specimen.



2. Attaching the Sub-stage 2

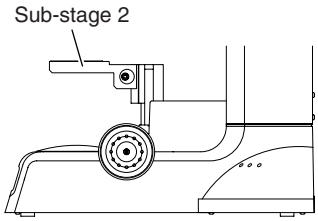
A 60 mm square stage made by other manufacturer can be attached by using the sub-stage 2.

The tap dimensions for the sub-stage 2 are described in the figure on the right.

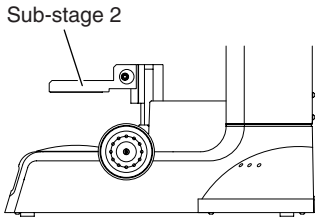


Tap dimensions for the sub-stage 2

1. Lower the sub-stage completely with the coarse focus knob.
2. Loosen the clamp screw for the sub-stage 2. And then attach the sub-stage 2 with fitting the dovetail joints on the up/down part. Secure the sub-stage 2 by the clamp screw so that the upper surfaces of the up/down part and sub-stage 2 are the same height.
3. If you wish, the sub-stage can be attached at the 16 mm below from the standard position described above. And more, when the sub-stage is attached upside down, the stage surface can be lowered 26.5 mm below from the standard height.



After attaching the sub-stage



Upside down condition

3. 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.

2 Assembling the Nosepiece

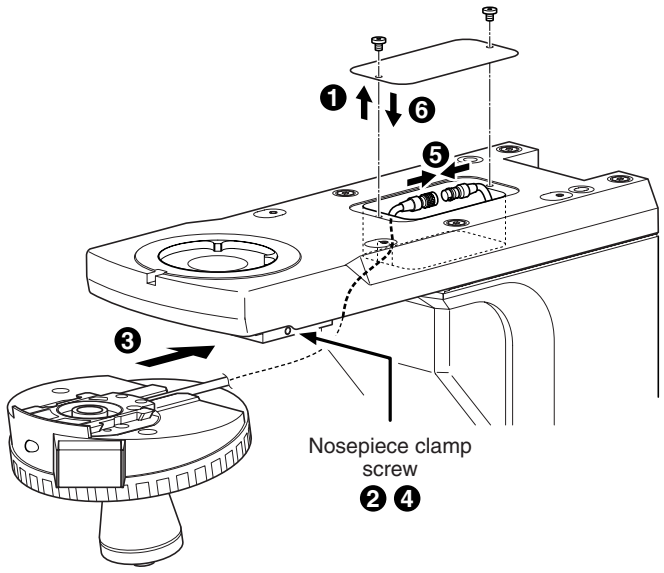
1. Assembling the manual nosepiece

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.

2. Assembling the motorized nosepiece

For the LV150A, the motorized nosepiece must be attached.
The motorized nosepiece should be assembled before attaching the illuminator.

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.



3. Removing the nosepiece

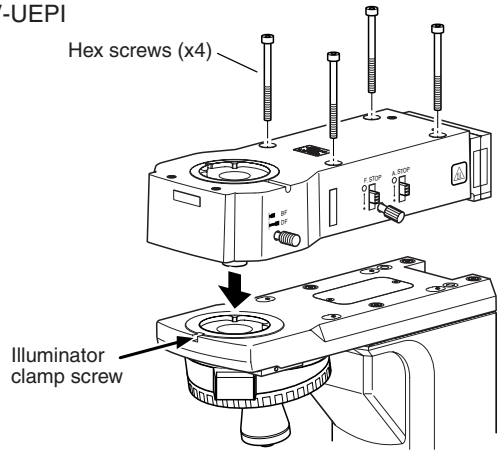
Removing the nosepiece is the reverse order of the above procedure. When removing the nosepiece, lower the stage completely, remove the sample and all objectives, and hold the nosepiece in your hand so that it does not fall when you remove it.

3 Attaching the Illuminator

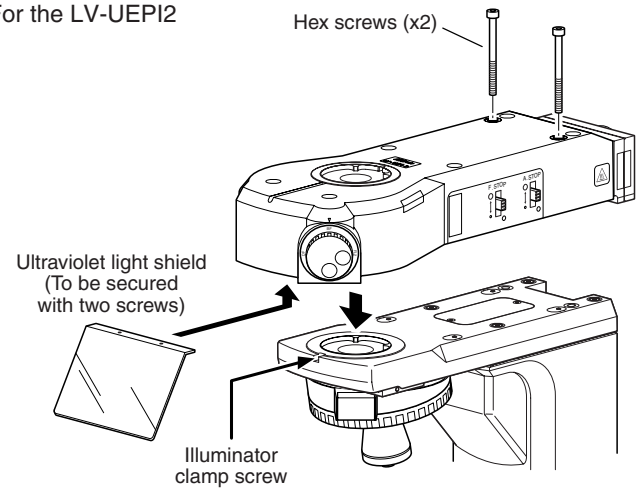
1. Illuminator main unit

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

For the LV-UEPI



For the 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.*

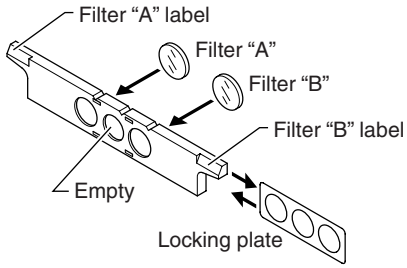
* *Be sure to use the attached screws to fix the ultraviolet light shield. If other screws are used or only screws are attached without the light shield, malfunctions occur at the inner mechanism.*

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

- **For the LV-UEPI:**
  The sliders are to be inserted into the slots on the front and the right side of the illuminator. In case of dummy sliders, slide them in till the limit (so that the empty hole will be set in the optical path).
- **For the 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.

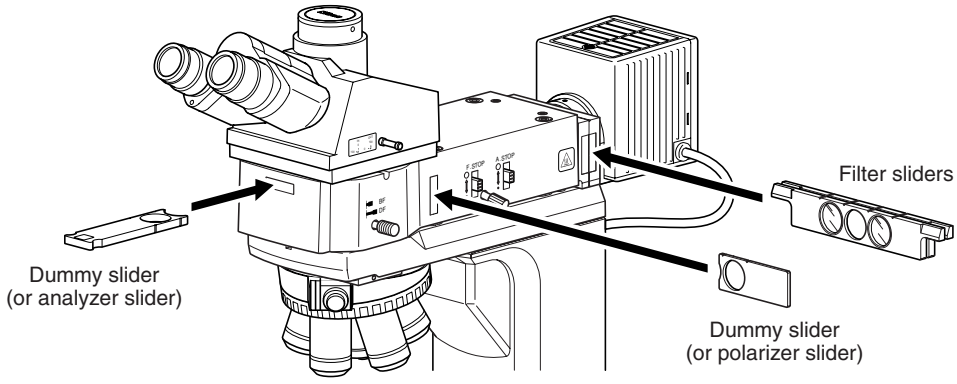
3. Filter sliders and filters

1. Remove each filter slider from the illuminator. (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 illuminator.

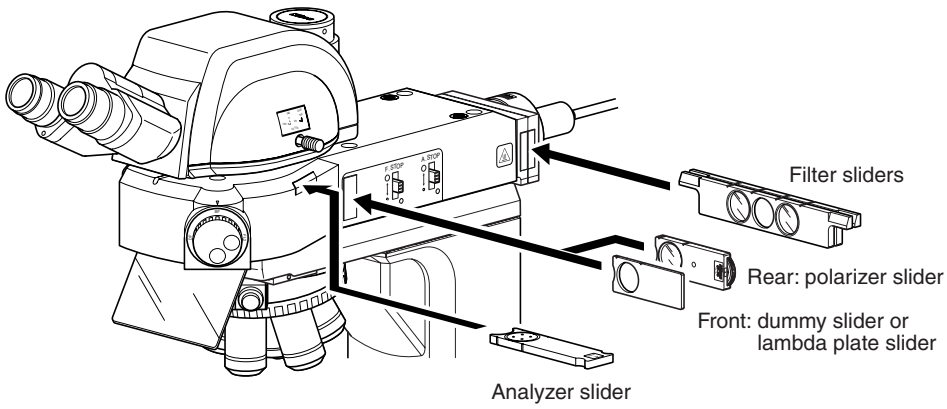


ND4, ND16, and NCB filters are already set on the filter sliders at the factory. You can set an additional filter in the empty position.

For the LV-UEPI



For the LV-UEPI2

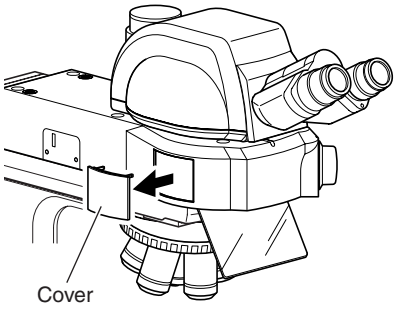


4. Filter cubes for fluorescence observation (for the LV-UEPI2 only)

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

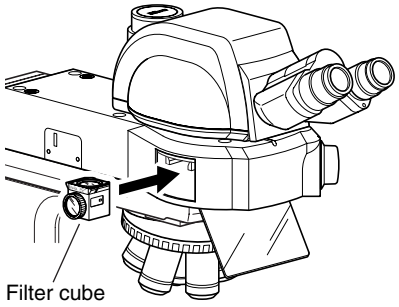
1 Verify that the illumination shutter is closed and the power supplies to the microscope and light source are off.

2 Remove the cover from the left side of the illuminator.



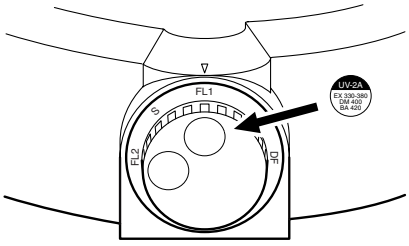
3 Turn the microscopy selection knob so that the position indication “FL1” or “FL2” on the turret in the illuminator faces the opening.

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.

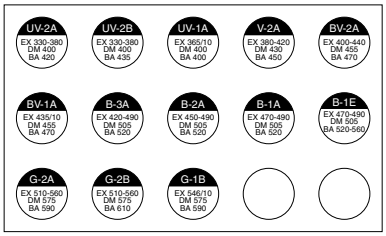


5 Now that the filter cube is installed in the position FL1 or FL2, refit the cover.

6 Check the stickers of excitation method supplied with the illuminator 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.



Sticker to be affixed to the microscopy selection knob



Stickers of excitation method

4 Attaching the Lamphouse and Replacing the Lamp

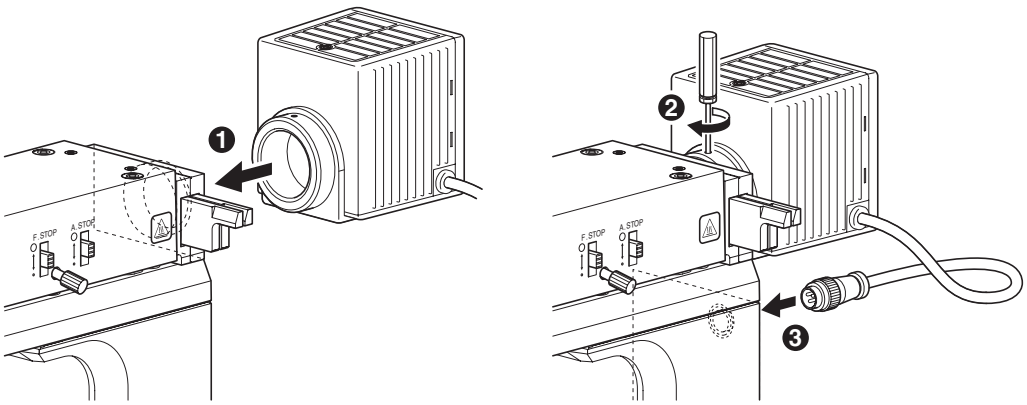
CAUTION

- To prevent electrical shock and damage to the microscope, always turn off the power switch (flip it to the "○" side) and unplug the power cord from the outlet before 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 halogen 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.

1. Attaching the lamphouse

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



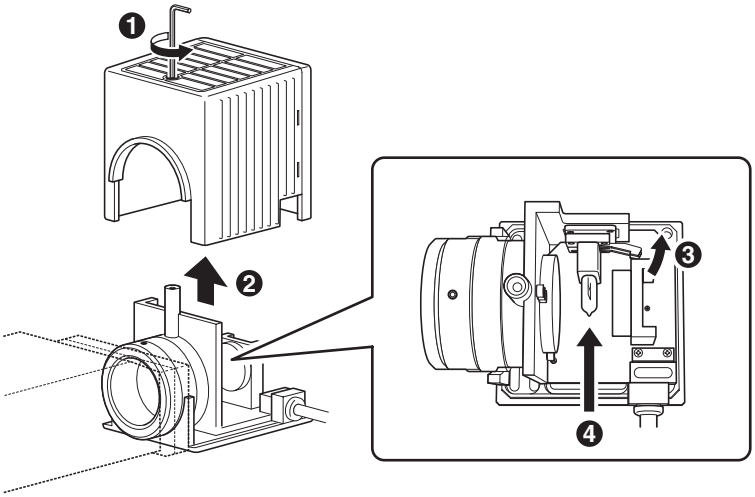
To remove the lamphouse, reverse the above procedure.

2. 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 "○" 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.



5 Attaching the Fiver Adapter and External Light Source

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 the 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.

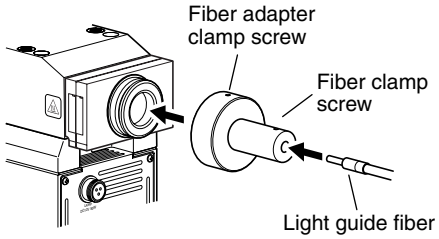
- External light source: EXFO X-Cite 120 (manual type) or EXFO X-Cite 120PC (motorized type)

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

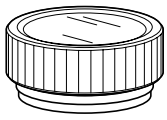
Loosen the clamp screw on the fiber adapter by using the hexagonal screw driver. And then, attach the HG fiber adapter onto the mount part of the illuminator. Push in the adapter to the limit position, and then tighten the clamp screw to fix it.
Next, insert the light guide fiber tip through the hole 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.

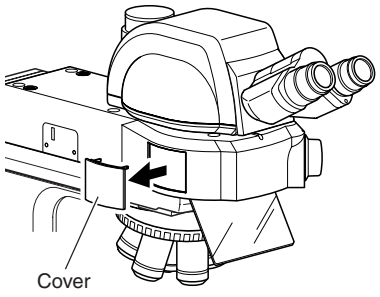


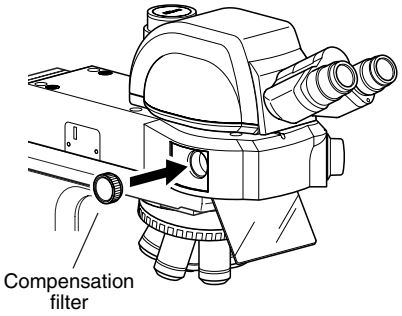
Attaching the compensation filter (only for LV-UEPI2)

A designated compensation filter comes with the HG fiber adapter. Attach it into the bright field block 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 the bright-field microscopy. Be sure to attach the filter.

1. Check that the shutter of the 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 illuminator.
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 block in the illuminator.
5. Put the cover back to its original position.


Compensation filter





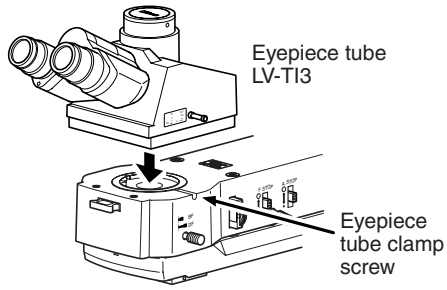
Connecting the LV150A and an external light source

When the LV150A is used with an external light source, be sure to attach the X-Cite 120PC (motorized type) manufactured by EXFO. The shutter must be controlled in synchronization with the nosepiece. So, the X-Cite 120PC 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.

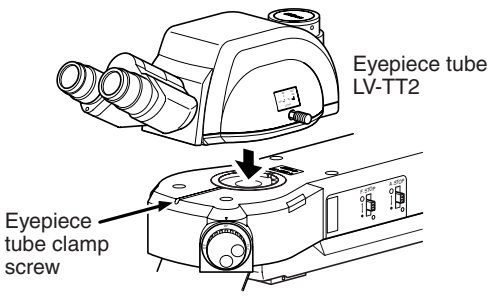
6 Attaching the Eyepiece Tube

Fully loosen the eyepiece tube clamp screw with the hexagonal screwdriver. Fit the eyepiece tube onto the mount on the top of the illuminator and tighten the eyepiece tube clamp screw with the hexagonal screwdriver.

When using the LV-UEPI



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.

7 Attaching Eyepieces

Attach eyepieces of the same magnification and of the same viewfield number to the left and the right eyes.
There are positioning pins on the eyepiece sleeve. Insert the eyepiece so that its positioning grooves match the pins.

8 Attaching Objectives

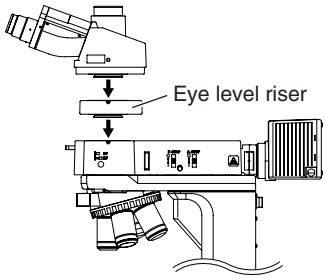
1. Lower the stage completely.
2. Screw objectives into the nosepiece so that the magnification increases with the clockwise rotation (as viewed from above the microscope) of the nosepiece.
   To use the motorized nosepiece, attach objectives so that the magnification increases in order of No. 1 to No. 5 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.

9 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 clamp screw for the eyepiece sufficiently. And then, insert the eye level riser with fitting the dovetail junctions of the eye level riser and illuminator.
2. Tighten the clamp screw for the eyepiece to fix the eye level riser.
3. Attach the eyepiece tube on the eye level riser.

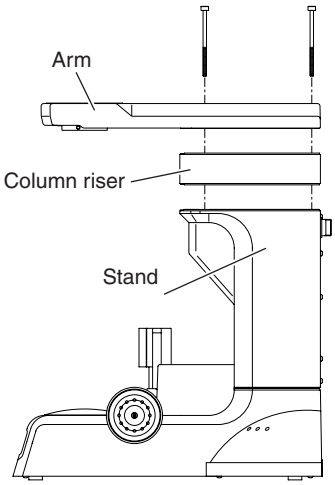


10 Attaching Column Riser

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

▶ Attaching column riser

1. Remove the illuminator, 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 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.
   Do not use four hex screws that were used to fix the arm.
4. Put the removed parts back to their original positions.



11 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 "VIII. Specifications."

Turn off the power switch of the microscope (flip it to the "○" side).
Insert the socket into the AC inlet at the rear of the microscope, and then firmly insert the plug into the wall outlet.

12 Connecting the RS-232C

The LV150A has an RS-232C interface for serial communications, enabling external equipment such a PC to control the motorized nosepiece, etc. When making an RS-232C interface connection, see "V. External Communication Control."
When the LV150A is used with the external light source, X-Cite 120PC manufactured by EXFO, connect the light source with the microscope through the RS-232C cable attached to the light source.

13 Installing Separately Sold Accessories

Install photomicrographic equipment and other separately sold accessories by referring to the system diagram or the instruction manual for each accessory.

14 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: LV150/LV150A microscope main body, LV-UEPI/LV-UEPI2 illuminator, LV-TI3/LV-TT2 trinocular tube, L-W10X 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 of the microscope 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 microscope.

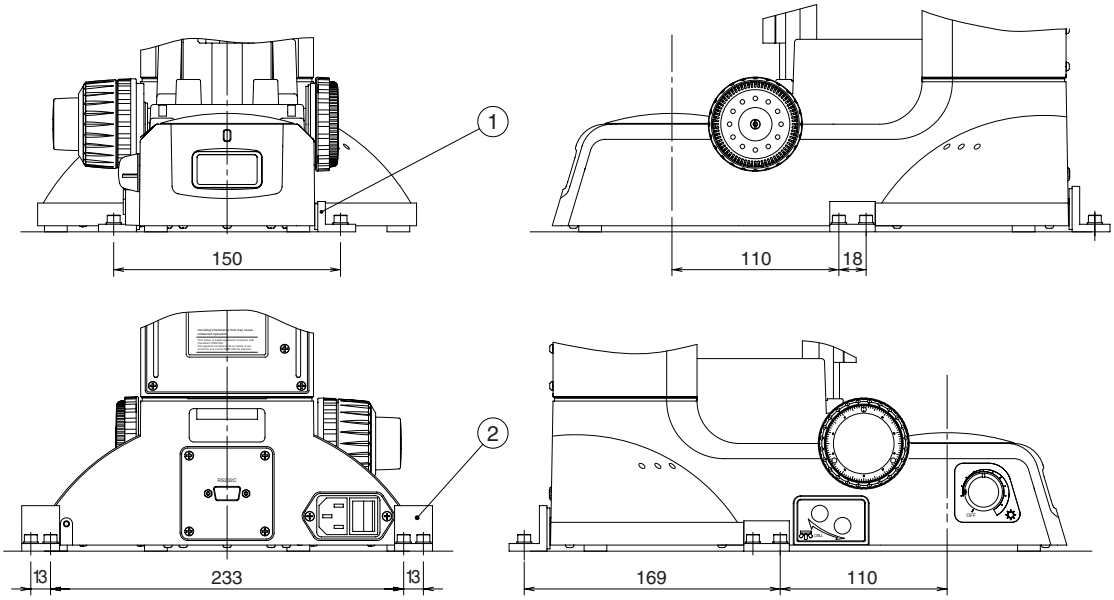
15 Countermeasures for Earthquakes

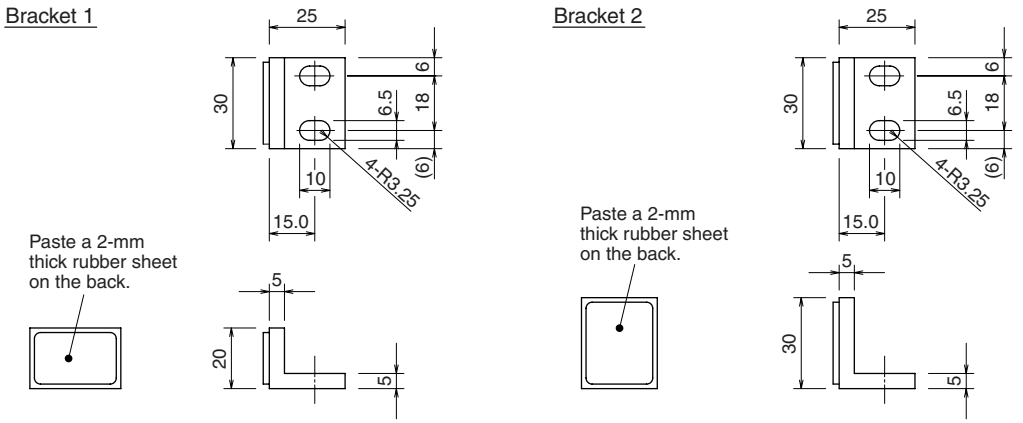
To prevent the microscope from being slipped and shaken by the strong shake of an earthquake, we recommend taking the following countermeasures:

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.





V External Communications Control

The LV150A has an RS-232C interface. The serial communication can be used to rotate the nosepiece and read its position or to set and read status by external device, such as PC.

1. Communication Method

Asynchronous (start-stop synchronized) serial communication
RS-232C (EIA standard compliant)

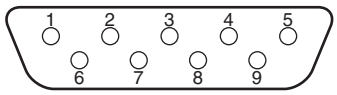
2. Connector Specifications

(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	–	–

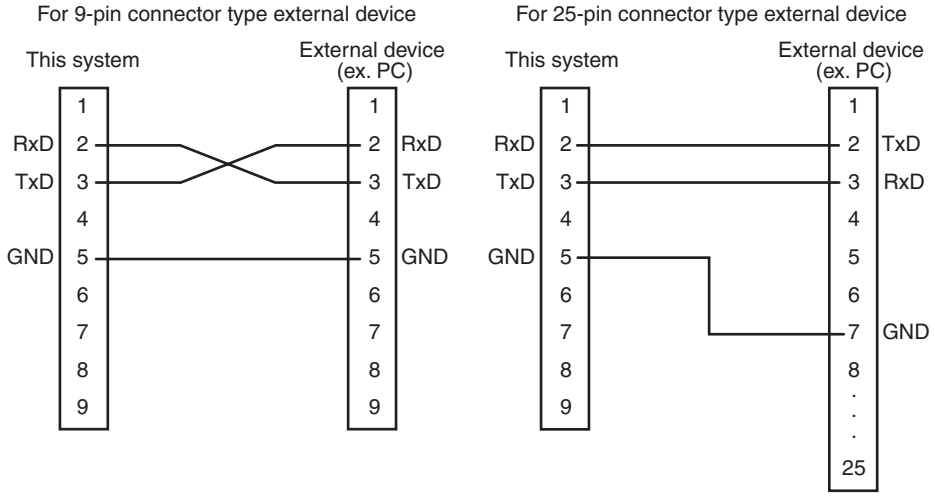


–: Not used

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

3. Cable Specifications

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



4. Communication Parameters

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

5. 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)

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.

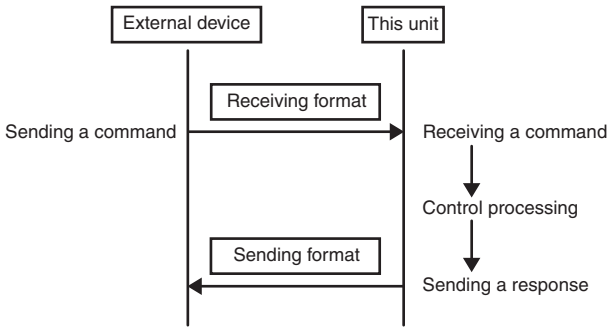
Error code	Name	Specifications
a	Command error	Indicates an unregistered command is received
b	Data Error	Indicates that data is invalid
d	Control Timeout Error	Indicates a timeout error occurred during control
f	Control Forbidden Error	Indicates a control command is received while control is forbidden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

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

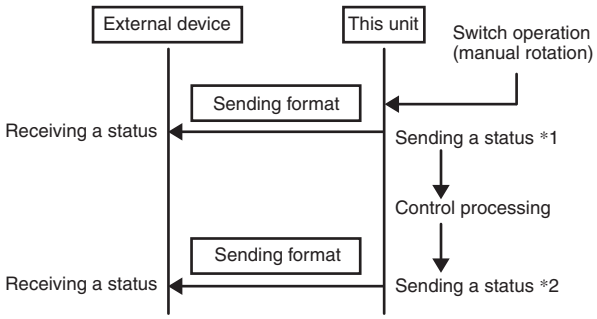
6. Communication Sequence

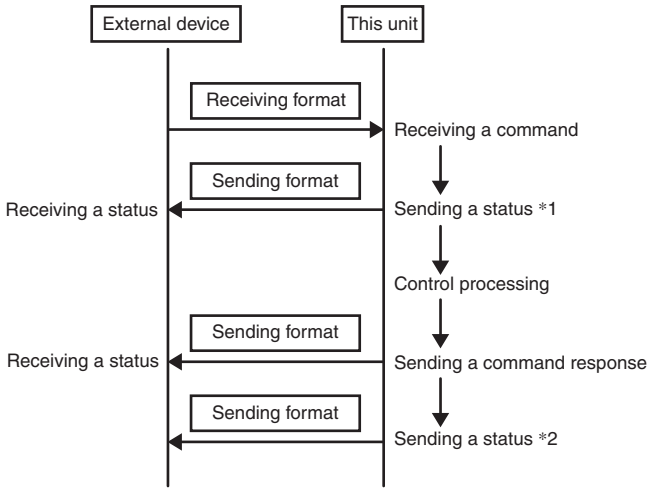
The factory default is the state of (3). If you don't need to connect the external light source and to send the shutter close command, disable the status output by using the communication command.

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

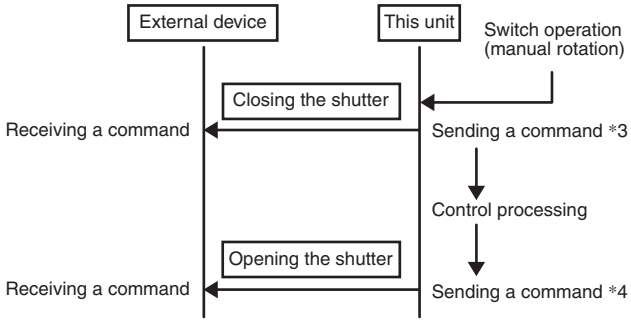


(2) When the status output of this unit is enabled;





(3) When an external light source 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 switch, 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 the rotation driven by the motor 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 switch, 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 the rotation driven by the motor ends or when the objective comes into the optical path.

7. 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).

8. 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]: LV150A

[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 “5. Communication Formats” for description of [error code].

VI Troubleshooting

Improper use of the microscope may adversely affect its performance even though there is no damage on itself. If any of the problems listed below arises, take the countermeasures indicated.

1 Viewing and control systems

Problems	Cause	Countermeasures
The viewfield is invisible, vignetted, or uneven in brightness	Lamp not properly installed.	Install it securely. (p.53 to 55)
	Optical path selection lever on the eyepiece tube is in an intermediate position.	Set the optical path selection lever to 100% (or 20%) binocular eyepiece. (p.29)
	Optical path selection lever on the eyepiece tube is not set to 100% (or 20%) binocular eyepiece.	
	Filter slider is in an intermediate position.	Move it to a clickstop position. (p.26)
	Field diaphragm is stopped down too far.	Open to a suitable size. (p.31)
	Nosepiece is not properly installed.	Install it securely. (p.49)
	Nosepiece is not rotated to a clickstop position. (Objective is not in the optical path.)	Rotate to a clickstop position. (Place the objective in the optical path.)
	Dummy, DIC, polarizer, lambda plate, or analyzer slider is in an intermediate position.	Move it to a clickstop position. (p.36 to 39)
	Bright/dark-field illumination selection lever (for LV-UEPI), or microscopy selection knob (for LV-UEPI22), is in an intermediate position.	Push in, or pull out, the lever to the limit. Set the knob to a clickstop position. (P.33)
	Microscopy selection knob is at “S” position (when LV-UEPI2 is used).	Change to a microscopy position. (p.33)
	Filter cube is not set in place or is attached to a wrong position (when LV-UEPI2 is used for epi-fl microscopy).	Attach it to the correct position. (p.52)
	A wrong filter cube is selected (when LV-UEPI2 is used for epi-fl microscopy).	Select the appropriate filter cube. (p.40 to 42)
Dirt or dust in the viewfield	Aperture diaphragm is stopped down too far.	Open to a suitable size. (p.32)
	Dirt or dust on the lens, eyepiece, filter, or sample.	Clean it. (p.70)
Uneven focus	Nosepiece is not properly installed.	Install it securely. (p.49)
	Nosepiece is not rotated to a clickstop position.	Rotate to a clickstop position.
	Sample holder is slanted.	Mount it securely. (p.48)

Problems	Cause	Countermeasures
Elongated image	Nosepiece is not properly installed.	Install it securely. (p.49)
	Nosepiece is not rotated to a clickstop position.	Rotate to a clickstop position.
	Stage is slanted.	Mount it securely. (p.48)
	Microscope is not installed on a flat surface.	Install it on a flat surface.
Image tinged yellow.	NCB11 filter is not used.	Place the NCB11 filter in the optical path. (p.26)
	Lamp voltage is too low.	Raise the voltage with the brightness control knob and adjust the brightness with the ND filters. (p.26)
Too bright image	Lamp voltage is too high.	Adjust the brightness with the brightness control knob. Or place ND filters in the optical path. (p.26)
Dark image (See also the troubles and countermeasures in Section 2, "Electrical.")	Lamp voltage is too low.	Adjust the brightness with the brightness control knob. (p.26)
	ND filter is in the optical path.	Remove the ND filter from the optical path. (p.26)
	Aperture diaphragm is stopped down too far.	Open to a suitable size. (p.32)
	Polarizer or analyzer in the optical path exists during bright-field microscopy.	Remove them out of the optical path. (p.16, 17)
	Halogen illumination is used on dark sample.	Replace the light source to more bright one. (p.53 to 55)
	Objective is not suitable for microscopy.	Use the specified objective. (p.56)
	Ambient light is too bright (for dark-field or epi-fl microscopy).	Darken the light.
Viewing is poor (too much or too little contrast, or poor resolution).	Dirt or dust exists on the lens, eyepiece, filter, or sample.	Clean it. (p.70)
	Objective is not suitable for the microscopy.	Use the specified objective. (p.56)
	Aperture diaphragm is stopped down too far.	Open to a suitable size. (p.32)
	Filter cube is not suitable for the specimen (for epi-fl microscopy).	Use a filter cube suitable for the specimen. (p.40 to 42)
	Cover glass is not attached (for epi-fl microscopy).	Attach cover glass. (It is not required for NCG objective, however.)
	Fluorescence is emitted by slide glass (during epi-fl microscopy).	Use a nonfluorescent slide glass.

Problems	Cause	Countermeasures
Objective hits the sample when switched from low to high magnification. Sample is out-focused by objective switching.	Eyepiece diopter is not adjusted.	Adjust the diopter. (p.30)
	Eyepieces are not mounted correctly.	Mount them by aligning the positioning grooves. (p.56)
Sample does not move smooth.	Sample holder is not secured correctly on stage.	Secure it correctly. (p.48)
Viewfields do not merge into one when observed with both eyes.	Interpupillary distance is not adjusted.	Adjust the interpupillary distance. (p.30)
	Eyepiece diopter is not adjusted.	Adjust the diopter. (p.30)
Eye fatigue	Interpupillary distance is not adjusted.	Adjust the interpupillary distance. (p.30)
	Eyepiece diopter is not adjusted.	Adjust the diopter. (p.30)
	The brightness is not suitable.	Adjust the brightness with the brightness control dial or the combination of ND filters. (p.26)
	Eyepieces with different viewfield numbers are used for left and right eyes.	Use eyepieces having the same viewfield number.
Coarse focus knob is heavy in rotation	Coarse torque adjustment ring is tightened too much.	Loosen the torque adequately. (p.27)
	Coarse focus stopper ring is locked at the top limit.	Release the coarse focus stopper ring. (p.28)
Stage falls on its own weight and the image is out-focused.	Coarse torque adjustment ring is loosened too much.	Tighten the torque adequately. (p.27)
Stage cannot be raised by coarse focus knob.	Coarse focus stopper ring is locked at the bottom limit.	Release the coarse focus stopper ring. (p.28)
No interference color is seen on DIC microscopy.	Analyzer or polarizer is not placed in the optical path.	Put it in the optical path. (p.36 and 38)
	DIC prism is not placed in the optical path.	Put it in the optical path. (p.39)
Interference colors uneven or low-contrasted on DIC microscopy	Wrong objective is used.	Use objectives marked “LU Plan” or “LU Plan Apo.”
	DIC prism selection does not match the objective in use.	Match the prism selection according to the objective. (p.39)
No sensitive color is seen on polarization microscopy	Lambda plate slider is not placed in the optical path.	Put it in the optical path. (p.37)

2 Electrical

Problems	Cause	Countermeasures
Lamp does not light when switched on.	Power is not supplied.	Plug the power cord into an outlet. (p.58)
	Power cord is not connected to microscope.	Connect the power cord. (p.58)
	Cable of lamphouse is not connected to the connector on microscope.	Connect the cable. (p.53)
	No lamp is installed.	Install the lamp. (p.54)
	Lamp is blown.	Replace the lamp. (p.54)
	Specified lamp is not used.	Use the specified lamp (see “VIII. Specifications.”)
Lamp flickers. Unstable brightness.	Lamp is about to blow.	Replace the lamp. (p.54)
	Power cord, or cable of lamphouse, is not connected securely.	Connect it securely. (p.53, 58)
	Lamp is not securely inserted in the socket.	Insert it securely. (p.54)
	Lamphouse is not connected securely.	Connect it securely. (P.53)
Nosepiece does not turn when nosepiece rotation button is pressed. (On LV150A only.)	Signal cable is not connected.	Connect it securely. (p.49)
	You attempted to turn nosepiece directly from address #1 to #5.	Nosepiece cannot be rotated directly from address #1 to #5. Turn the nosepiece in the progressively ascending order of magnification.
The nosepiece does not rotate correctly. The objective stops in an intermediate position and it returns to its original position. (On LV150A only)	Attached objectives are small in number and attached in an eccentric way.	Retry the rotation some times. It can stop in the correct position after some retries. (p. 35)

VII Care and Maintenance

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 the lenses and Filters.” When cleaning, be sure to turn off the power switch (flip the switch to “○” side) to avoid malfunction.

▶ Daily care and maintenance

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

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.
- Store the objectives and eyepieces with a drying agent in a desiccator or similar container.
- Put a plastic cover over the microscope to protect it from dust.
- Before putting on the plastic cover, turn off the power switch of the microscope (flip it to the "○" side) and wait until the lamphouse is cool.

4 Regular Inspections

Regular inspections of this microscope are recommended in order to maintain peak performance. Contact your nearest Nikon representative for details about regular inspections.

VIII Specifications

Model name	ECLIPSE LV150, ECLIPSE LV150A
Optical system	CFI60 optical system (infinity-corrected CF optical system)
Illumination	Epi-illumination system: The power source for the lamp, NCB11, ND4, and ND16 are built-in. (exchangeable) Specified illuminator: LV-UEPI illuminator or LV-UEPI2 illuminator Lamp ratings: 12 V, 50 W halogen lamp Specified lamp: LV-HL50W 12V 50W longlife halogen lamp Specified lamphouse: LV-LH50PC precentered lamphouse
Focusing mechanism	Manual operation type single axis coarse/fine focus knob mechanism (left side with coarse/fine focus, right side with coarse focus, calibration marking for fine focus: 1 µm/marking) Stroke: 30 mm, with coarse focus stopper mechanism Coarse focus knob: 14 mm/revolution Fine focus knob: 0.1 mm/revolution
Eyepiece	10x, field number: 22, 25
Input ratings	Input voltage: 100 to 240 VAC ±10% 50/60 Hz Rated current: 1.2 A max.
Power cable	When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type SVT, No.18 AWG, 3 m long maximum, rated at 125 V AC minimum. When the supply voltage is 220 V to 240 V: Approved according to EU/EN standards, 3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 V AC minimum.
Operating environment	Temperature: 0°C to +40°C Relative humidity: 85% RH max. (no condensation) Altitude: 2000 m max. Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class 1 Indoor use only
Storage environment	Temperature: -20°C to +60°C Relative humidity: 90% RH max. (no condensation)

Safety standards compliance	• This product got the TUV SEMI mark. (SEMI guideline S2-0703, S8-1108) • This is UL-listed product. (UL61010A-1) • 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 appreil numérique de classe A est conforme à la norme NMB-003 du Canada. • This product meets Australian EMI. (AS/NZS CISPR11 Group 1 Class B) CE marking • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. (EN61326)