

Nikon

**LV-ECON
E Controller
Instructions**

Thank you for purchasing the Nikon product.

This instruction manual is written for the users of the Nikon LV-ECON E controller.



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

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

WARNING and CAUTION Symbols Used in This Manual

Although this product is designed to provide the utmost safety during use, incorrect usage or failure to follow the safety instructions provided may cause personal injury or property damage. To ensure correct usage, read the instruction manual carefully and thoroughly before using the product. Do not discard the manual; keep it handy for easy reference.

Safety instructions within this manual are accompanied by the following symbols to highlight their importance. For your safety, always follow the instructions accompanying these symbols.

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

Meaning of the Symbol Used on the Product

Symbol



Meaning

Caution for heat

The symbol is indicated on the following places: near the lamp house clamp screw of the LV-UEPI, LV-UEPI2, and LV-UEPI2A illuminator, on the back of the lamp houses, and near the lamp replace cover plate and above the air vent on the back of the C-HGFIE precentered fiber illuminator. They call your attention on the following. For positions of the symbol, refer to the instructions manual of the illuminator.

- The lamp house become extremely hot while the lamp is on and immediately after it is turned off.
- Do not touch the lamp house during and immediately after lighting to prevent the risk of burns.
- Make sure that the lamp house is sufficiently cool before the lamp replacement.
- Do not allow cloths, papers, or highly flammable volatile materials, such as gasoline, benzine, thinner or alcohol, to come near the lamp house, illuminator, or their surrounding areas while the lamp is lit or within 30 minutes after the lamp is turned off.
- Do not allow walls, curtains, or papers to contact the product.
- Keep hands away from the air vent of the C-HGFIE precentered fiber illuminator when the lamp is lit. Do not block the airflow from the air vent.



Caution

The symbol is indicated on the following places: near the lamp replace cover plate on the top and above the air vent on the back of the C-HGFIE precentered fiber illuminator. They call your attention on the following. For positions of the symbol, refer to the instructions manual of the illuminator.

- Before replacing the lamp, turn off the illuminator and unplug the power cord.
- Read the instructions manual carefully for replacing the lamp.



Do not touch when carrying the product.

The symbols on the both sides of the LV-FMA motorized focusing module call your attention on the following. You can see the positions of this symbol on Page 16.

- Do not touch the elevating section and arm when carrying this product.



WARNING

1. Intended product use

This product is used to control the various motorized devices of Nikon LV series products, the specified power supply for the illuminator, and the external light source. Do not use this product for other purpose.

2. Do not disassemble

Disassembling this product may result in electric shock or malfunctions. Never attempt to disassemble any part other than the parts described in this manual. If you experience problems with this product, contact your nearest Nikon representative.

3. Read the instructions carefully

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

Operation for the light source

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

4. Ratings of the power supply

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

5. Power cord

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

6. Object devices of this product

This product can be used with devices described below. But this cannot be used with other devices.

- Motorized nosepiece: LV-NU5A motorized universal quintuple nosepiece ESD, LV-NU5AC motorized universal quintuple centerable nosepiece
- Motorized DIC nosepiece: LV-MDIC motorized DIC module
- Motorized epi illuminator: LV-UEPI2A motorized universal epi illuminator 2A
- Motorized focusing module: LV-FMA FM module A (motorized drive), LV-IMA IM module A (motorized drive)
- Auto focus system: LV-AF auto focus
- Power supply for the lamp: TE2-PS100W power supply
- LED epi illuminator: LV-EPILED epi illuminator LED
- External light source: C-HGFIE Intensilight (precentered fiber illuminator) EXFO X-Cite 120 PC
- PC: Windows PC with an USB interface



WARNING

7. Handling of the motorized devices and the light source

- Each motorized device will move when this product is operated. To prevent injury, do not touch the moving device during operation. Before operating this product, check all moving devices for your safety.
- If you touch the elevating section or its attached devices during operation of the motorized focusing module, it may cause injury to hands or fingers. Do not touch the motorized devices when you operate the product.
- When a power supply for the illuminator or an external light source is connected with this product, you can control the lamp and shutter with operating this product. Before operating this product, check the illuminator and its surroundings for your safety.

8. Heat from the light source

The lamp, the lamp house, and the illuminator become extremely hot. To avoid burns, do not touch the devices 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 benzene, paint thinner, or alcohol) near the devices while the lamp is lit or for about thirty minutes after it is turned off.

9. Cooling fan and air vents

Do not block the opening for the cooling fan on the back and air vents on the side. If the cooling fan or air vents are blocked, the temperature of the product will rise. And it results in a malfunction, damage, or fire.



CAUTION

1. Handle with care

- Handle this product with care to avoid shock on impact.
- Do not forcefully bend, pull or twist the power cord and the cables.
- Do not drop metal pieces such as clips and staples through any clearance into the product inside. It could cause a failure of the product or a fire.

2. Do not wet the product

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

3. Weak electromagnetic waves

The product emits weak electromagnetic waves. There is a possibility that some precision electronic devices are affected by the electromagnetic waves. To prevent bad influences, locate such electronic equipment away from this product. If a TV or radio reception is affected, move the TV or radio set farther from the product.



CAUTION

4. Installation location

If this product is used or stored in an inappropriate environment, malfunctions or poor performance may arise for it. Consider the following factors when selecting an installation location:

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

5. Cautions on assembling this product

- Always turn off the power switch before assembling the product, connecting or disconnecting cords, or lamp replacement.
- Be careful not to pinch your fingers or hands during assembly.
- Scratches or fingerprints on the lenses will adversely affect the image. Be careful not to scratch or touch the lens surfaces.

6. Cable routing

Make sure the cables are routed properly. Do not bring the cables into contact with the lamp house and the illuminator. If a cable comes into contact with the lamp house or the illuminator, the cable sheath may melt and it results in an electrical shock or fire.

7. Cautions when replacing lamps

- For details about replacement method for lamps, refer to the instruction manual for the epi illuminator (LV-UEPI, LV-UEPI2, or LV-UEPI2A) or the precentered fiber illuminator (C-HGFIE). Carefully read the instruction manuals for the illuminator, and then follow the instructions to replace lamps.
- To prevent burn injuries, wait at least 30 minutes after the lamp is turned off to give it sufficient time to cool down when replacing lamps.
- To prevent electrical shock and damage to the product, always turn off the power switch (flip it to the "O" side) and unplug the power cord from the outlet before attaching or detaching the lamp house.
- Never touch the glass surface of the lamp with bare hands. Doing so will cause fingerprints, grease, etc. to burn onto the lamp surface, reducing the illumination. If you do get any fingerprints or dirt on the lamp, wipe them clean.
- Make sure the lamp house cover is securely fitted to the lamp house after replacing lamps. Never turn on the lamp with the lamp house cover removed.
- When you dispose of the replaced lamp, do not break it up. Instead, dispose of the used lamp as special industrial waste or dispose of it according to the local regulations and rules.

8. Software setup works after assembly

When the microscope is assembled or the configuration of the microscope is changed, perform the software setup works for various settings of the microscope via a PC by using the software, "LVSetup," in "LV Series Support Tools" provided with this product.

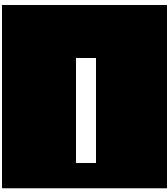
In the setup works, information for the devices and parts (objectives, filter cubes, illuminator, and so on) is registered and interlock controls for such devices are specified.

Make sure to perform the setup works to use the microscope system correctly.

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

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Overview of the Product

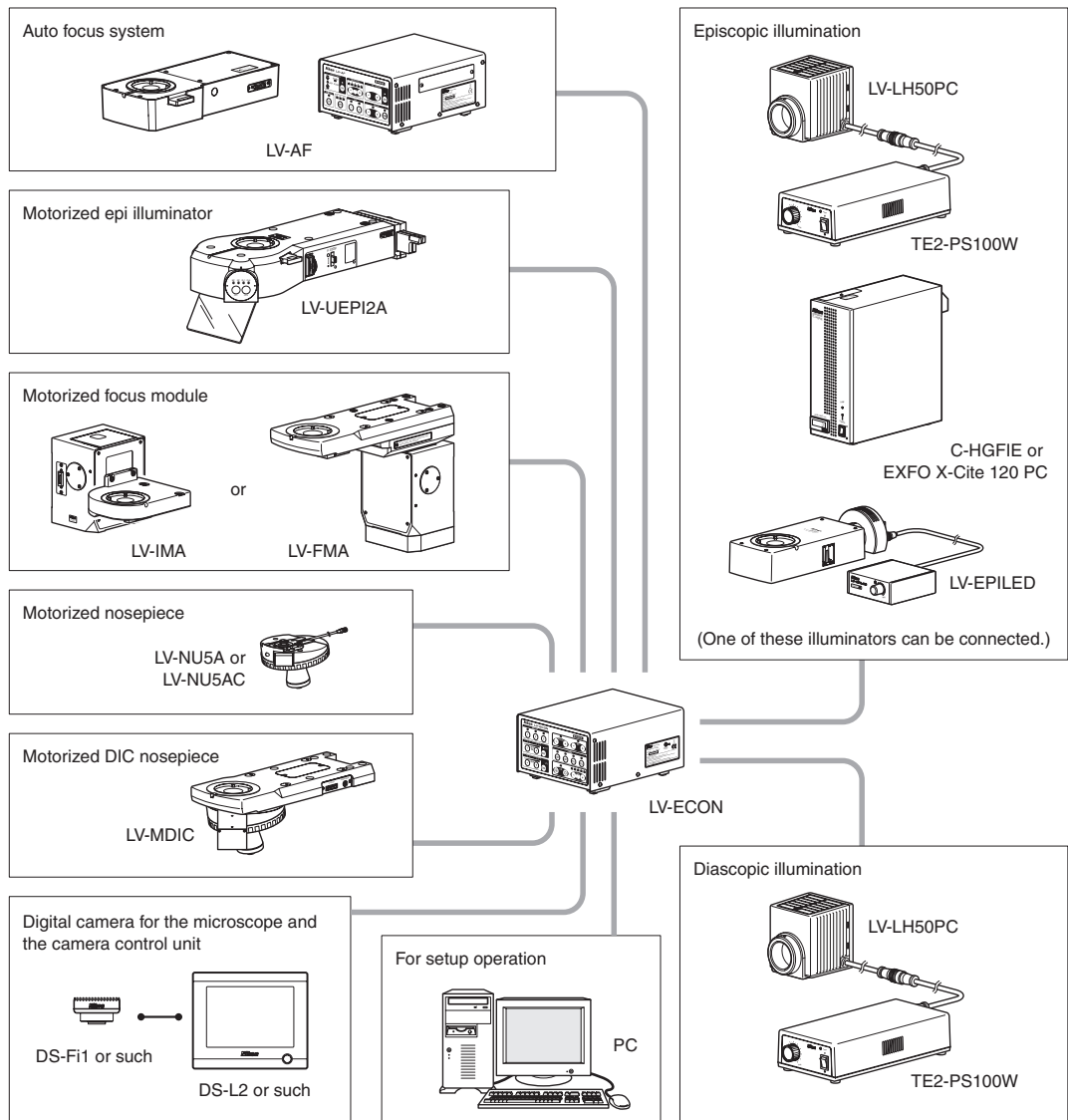
The Nikon LV-ECON E controller is a device to control the microscopy system totally with various motorized devices for the LV series products, the external power supply for the illuminator, and the external light source.

This product can be used with devices described below.

- Motorized nosepiece (LV-NU5A or LV-NU5AC) *1
- Motorized DIC nosepiece (LV-MDIC) *1
- Motorized focusing module (LV-FMA or LV-IMA)
- Motorized epi illuminator (LV-UEPI2A)
- Epi illuminator LED (LV-EPILED) *2
- Halogen lamp power supply for the episcopic illumination (TE2-PS100W) *2
- External light source for the episcopic illumination (C-HGFIE or EXFO X-Cite 120 PC) *2
- Halogen lamp power supply for the diasopic illumination (TE2-PS100W)
- Auto focus system (LV-AF)

*1 The motorized nosepiece and the motorized DIC nosepiece cannot be used together.

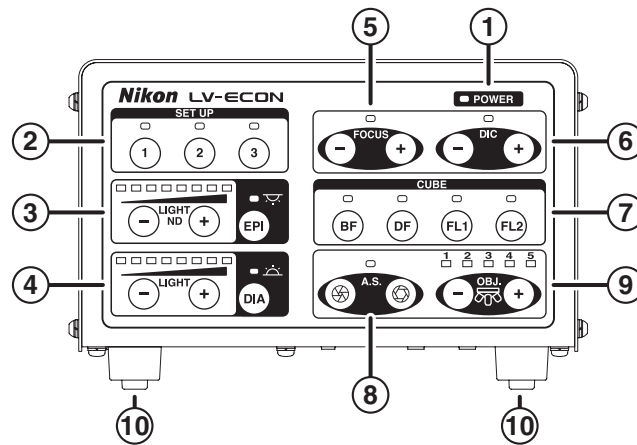
*2 These devices cannot be used at a time.





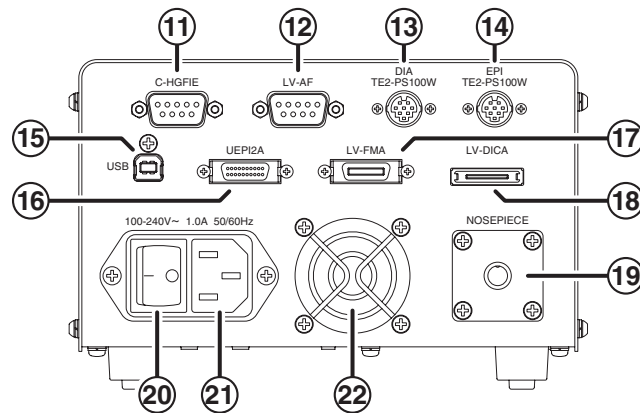
Names and Functions of Component Parts

1 Operation Panel



- ① **POWER indicator (green)**
It turns on green when the product is energized.
- ② **SET UP controls**
They are used to change the microscopy conditions to the user defined conditions specified with "LVSetup."
- ③ **Episcopic illumination controls**
They are used to turn on or turn off the episcopic illumination and to adjust the brightness.
- ④ **Diascopic illumination controls**
They are used to turn on or turn off the diascopic illumination and to adjust the brightness.
- ⑤ **FOCUS controls**
They are used to adjust the vertical position of the motorized focus module.
- ⑥ **DIC controls**
They are used to change the position of the DIC prism (Nomarski prism) of the motorized DIC nosepiece.
- ⑦ **CUBE controls**
They are used to change microscopy methods by rotating the filter cube turret in the motorized epi illuminator.
- ⑧ **A.S. controls**
They are used to adjust the aperture diaphragm in the motorized epi illuminator.
- ⑨ **OBJ. controls**
They are used to change objectives by rotating the motorized nosepiece.
- ⑩ **Tilt adjustment legs**
They are used to adjust the tilt angle of the product.

2 Connector Panel



- ① **C-HGFIE connector**
An external light source (Nikon C-HGFIE or EXFO X-Cite 120 PC) is connected here.
- ② **LV-AF connector**
The auto focus controller (Nikon LV-AF) is connected here.
- ③ **DIA TE2-PS100W connector**
The halogen lamp power supply for the diascope illumination (Nikon TE2-PS100W) is connected here.
- ④ **EPI TE2-PS100W connector**
The halogen lamp power supply for the episcopic illumination (Nikon TE2-PS100W) or LED epi illuminator (Nikon LV-EPILED) is connected here.
- ⑤ **USB connector**
A PC is connected here for set-up works. (It is complies with USB 1.1.)
- ⑥ **LV-UEPI2A connector**
The motorized epi illuminator (Nikon LV-UEPI2A) is connected here.
- ⑦ **LV-FMA connector**
The motorized focusing module (Nikon LV-FMA or LV-IMA) is connected here.
- ⑧ **LV-DICA connector**
The DIC prism control cable of the motorized DIC nosepiece (LV-MDIC) is connected here.
- ⑨ **NOSEPIECE connector**
The nosepiece control cable of the motorized nosepiece (Nikon LV-NU5A or LV-NU5AC) or of the motorized DIC nosepiece (LV-MDIC) is connected here.
- ⑩ **Power switch**
This is the power switch of this product.
- ⑪ **AC inlet**
The AC power supply is connected here. Make sure to use the specified power cord.
- ⑫ **Cooling fan**
This is the cooling fan of this product.



Device Connections

This section describes the procedures to connect this product with motorized devices and light sources. Refer to the instructions below before connecting devices. For detailed information about installing, assembling, and connecting devices, refer to the instruction manuals for such devices.



WARNING

- Before connecting devices, be sure to read the WARNING and CAUTION at the beginning of this instruction manual and follow the instructions written therein.
- To prevent electrical shock and fires, always turn off the power switch (flip it to the “O” side) and unplug the power cord from the outlet before connecting devices.
- For detailed information about installing, assembling, and connecting devices, refer to the instruction manuals for such devices.



CAUTION

- Be careful not to pinch your fingers or hands during assembly.
- Handle the product carefully and do not subject it to a strong physical shock.
- Make sure cables between devices are routed properly. Do not bring the cables into contact with the lamp house or the illuminator. When the diascopic illumination is used and a cable comes into contact with the lamp house, the cable sheath may melt and it results in an electrical shock or fire.



CAUTION

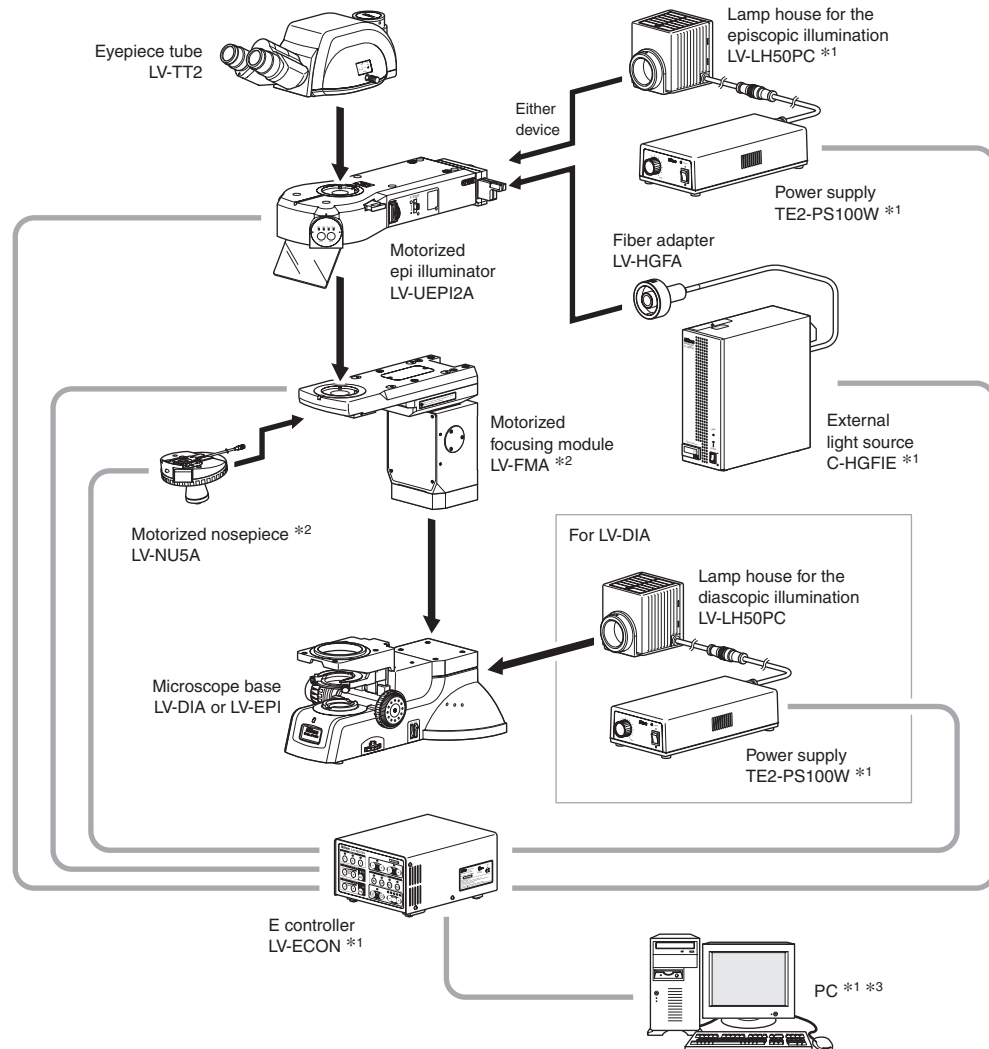
• Software setup work for the microscope system

When the microscope is assembled or the configuration of the microscope is changed, perform the software setup works for various settings of the microscope via a PC by using the software, “LVSetup,” in “LV Series Support Tools” provided with this product.

In the setup works, information for the devices and parts (objectives, filter cubes, illuminator, and so on) is registered and interlock controls for such devices are specified. Make sure to perform the setup works to use the microscope system correctly.

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

▶ Example 1 (configuration with the LV-FMA)

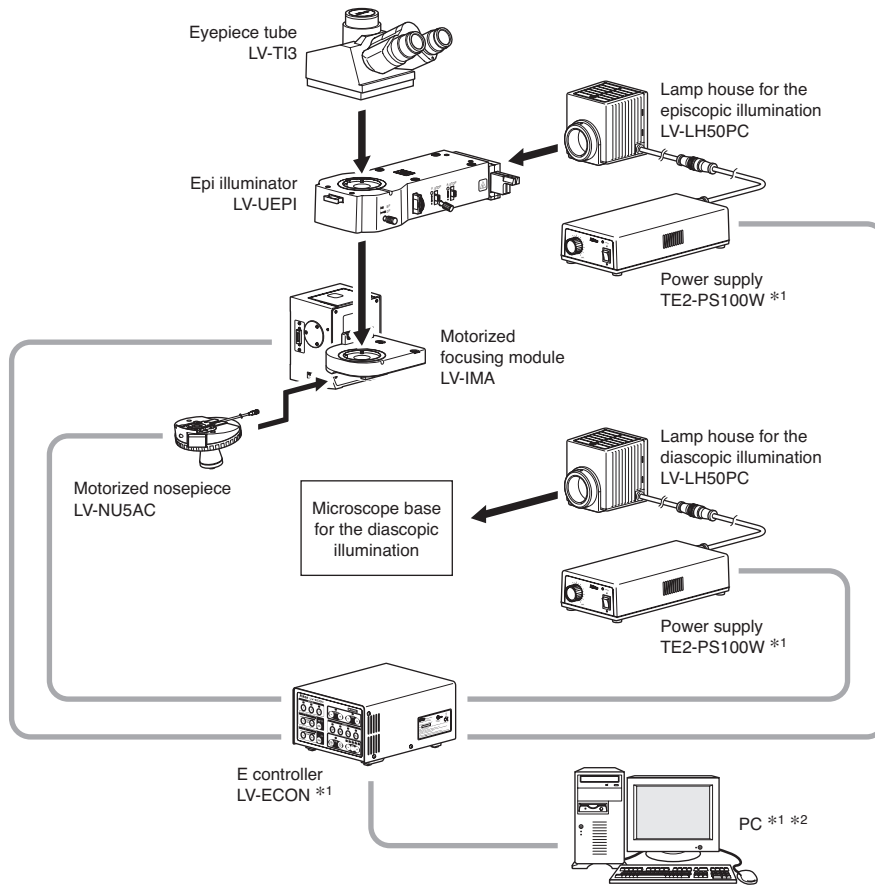


*1 : This device needs a power supply for its own.

*2 : To use the motorized DIC nosepiece, remove the arm of the LV-FMA and attach the LV-MDIC in place.

*3 : A camera control unit such as DS-L2 can be used in place of the PC for control of each unit. (To set up the system configuration, a PC must be used.)

► **Example 2 (configuration with the LV-IMA)**



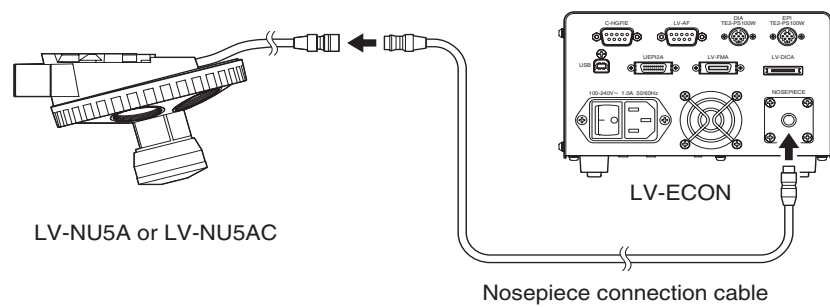
*1 : This device needs a power supply for its own.

*2 : A camera control unit such as DS-L2 can be used in place of the PC for control of each unit. (To set up the system configuration, a PC must be used.)

1 To Connect with the Motorized Nosepiece

To connect the product with the motorized nosepiece (LV-NU5A or LV-NU5AC), perform the following procedure:

- 1 Check that the motorized nosepiece is mounted on the microscope base (the motorized focusing module, or such) correctly.
- 2 Check that the power switch on this product is turned off (the “○” side is pushed).
- 3 Connect the nosepiece cable line to the NOSEPIECE connector on the back of this product using the special nosepiece connection cable, that is 2.8 m in length.
To avoid interference between the cable and the motorized devices, draw the cable carefully.



* An optional nosepiece connection cable of 10 m in length is also available.

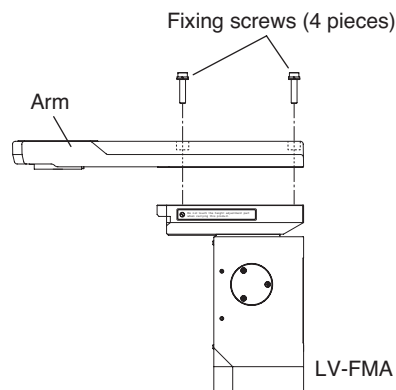
For details about assembly method of the motorized nosepiece, refer to the instruction manual for the LV-FM/LV-FMA or LV-IM/LV-IMA.

2 To Attach and Connect with the Motorized DIC Module (Nosepiece)

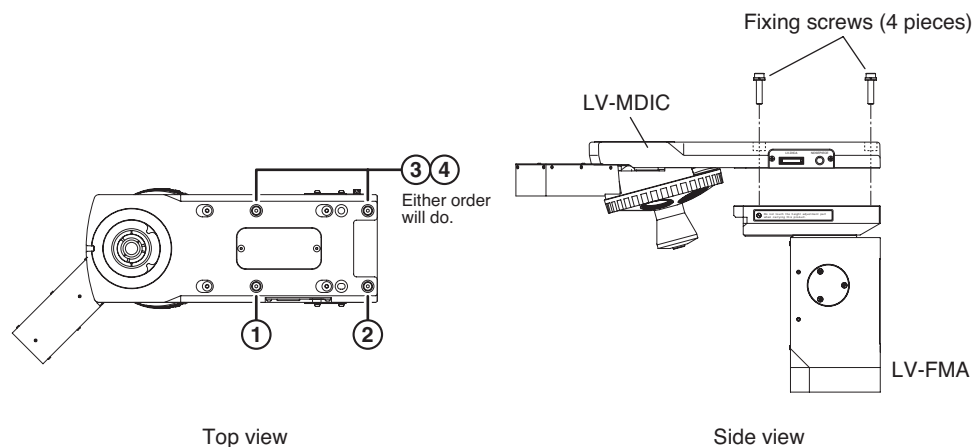
▶ To attach and connect with the motorized DIC module (nosepiece)

The motorized DIC nosepiece (LV-MDIC) can be attached on the LV-FMA motorized focusing module (or a device manufactured by other company). This section shows the installation procedure to the LV-FMA motorized focusing module. To install the product onto other device, refer to the following explanation as a guide and take enough care for the installation.

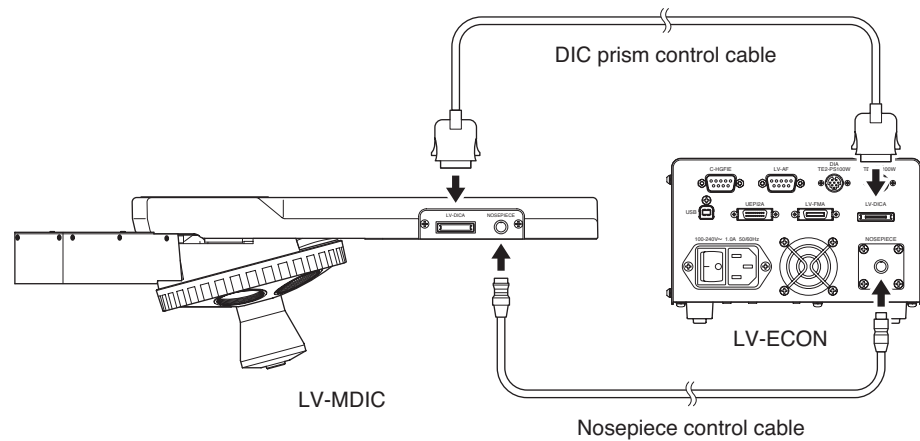
- 1 Check that the LV-FMA is attached on the LV-DIA or the LV-EPI correctly.
- 2 When the LV-FMA and the LV-ECON is connected, press the "0" side of the power switch to turn off the LV-ECON.
- 3 If any device such as a nosepiece or an illuminator is attached to the LV-FMA, detach all devices.
- 4 Unscrew four fixing screws with a hexagonal wrench (size: 3 mm) to detach the arm of the LV-FMA. Be careful not to fall the arm.
* The detached screws can be used for fixing the LV-MDIC. (Same screws come with the LV-MDIC.)



- 5 Mount the LV-MDIC on the LV-FMA in place of the arm and fix it with four screws. The four screws must be tightened with a 3 mm hexagonal wrench in the order presented in the picture below.
* Be sure to keep the order below to insure accuracy.



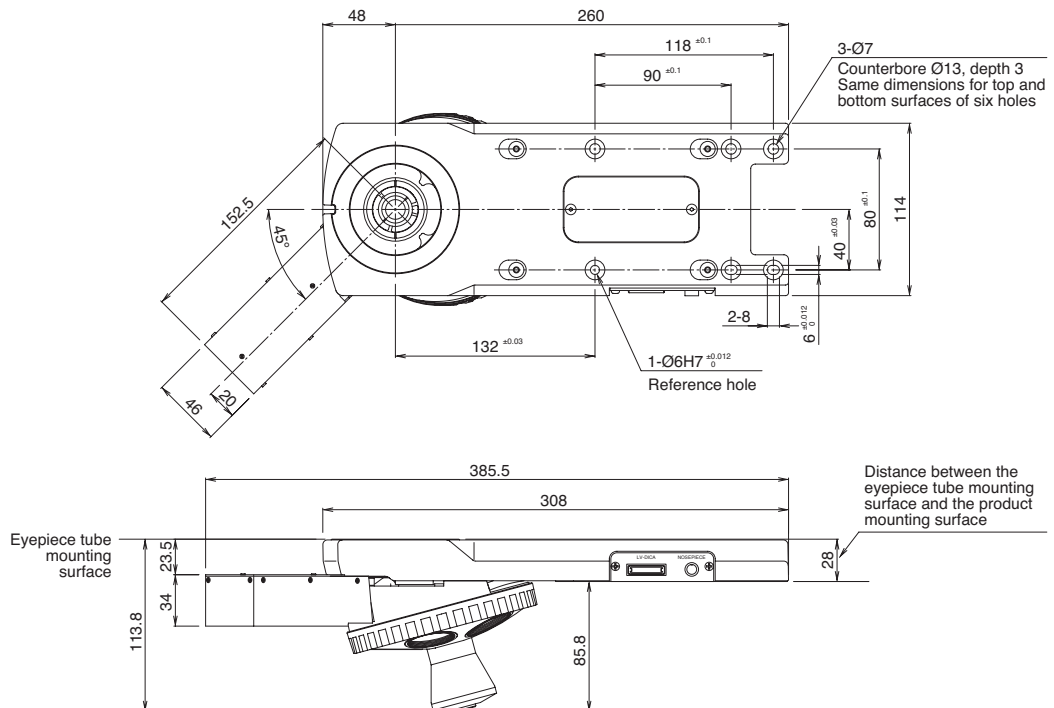
- 6 Connect the NOSEPIECE connectors on the LV-MDIC and the LV-ECON with the special cable (round connectors attached and 2.8 m length).
Be careful that the cable does not interfere with the motorized parts.
- 7 Connect the LV-DICA connectors on the LV-MDIC and the LV-ECON with the special cable (rectangular connectors attached and 2.8 m length).
Be careful that the cable does not interfere with the motorized parts.



* An optional 10 m cable is also available for the nosepiece connection.

Dimension of the mounting parts

Main dimensions of the mounting parts of the LV-MDIC are described in the picture below.

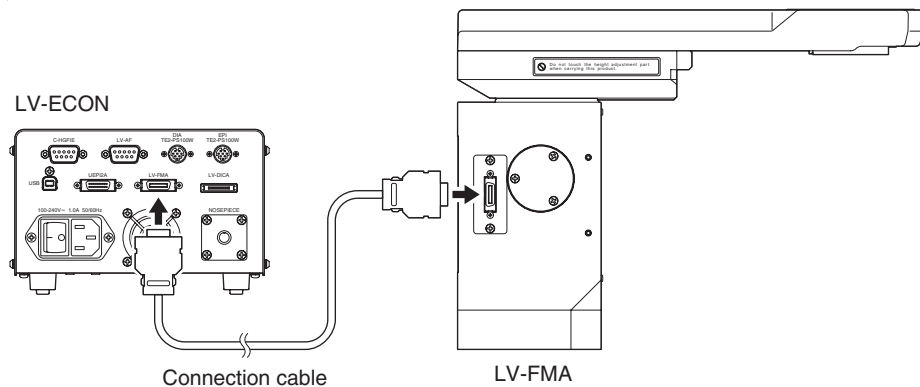


3 To Connect with the Motorized Focusing Module

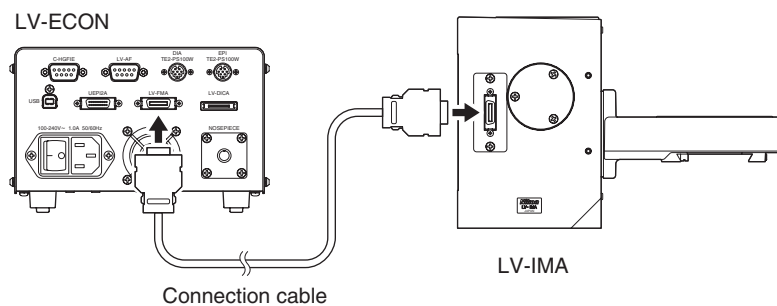
To connect the product with the motorized focusing module (LV-FMA or LV-IMA), perform the following procedure:

- 1 When LV-IMA is used, check that the motorized focusing module is mounted on a pedestal or such sturdy base. When LV-FMA is used, check that the motorized focusing module is mounted on the LV-DIA or LV-EPI.
 - 2 Check that the power switch on this product is turned off (the “○” side is pushed).
 - 3 Connect the connector on the side of the motorized focus module and the LV-FMA connector on the back of this product using the special connection cable, that is 2.8 m in length. To avoid interference between the cable and the motorized devices, draw the cable carefully.
- * To use the auto focus system LV-AF, the motorized focusing module is connected to the LV-AF. For details, refer to p.22 “To Connect with the Auto Focus System” and the instruction manual of the LV-AF.

- For LV-FMA



- For LV-IMA



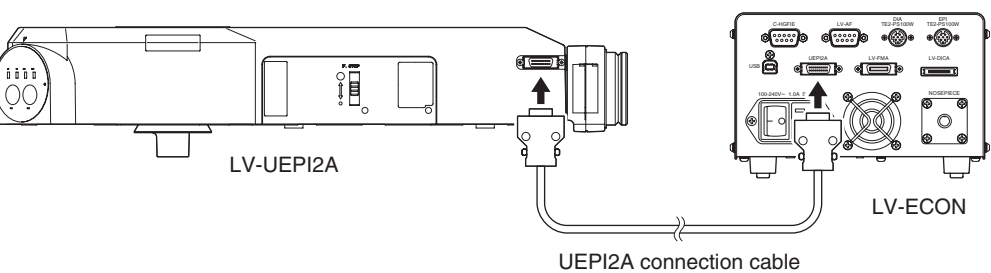
- * An optional connection cable of 10 m in length is also available.

For details about assembly method of the motorized focusing module, refer to the instruction manual for the LV-FM/LV-FMA or LV-IM/LV-IMA.

4 To Connect with the Motorized Epi Illuminator

To connect the product with the motorized epi illuminator (LV-UEPI2A), perform the following procedure:

- 1 Check that the motorized epi illuminator is mounted on the microscope base (the motorized focusing module, or such) correctly.
- 2 Check that the power switch on this product is turned off (the “○” side is pushed).
- 3 Connect the connector on the side of the UEPI2A to the UEPI2A connector on the back of this product using the special UEPI2A connection cable, that is 2.8 m in length.



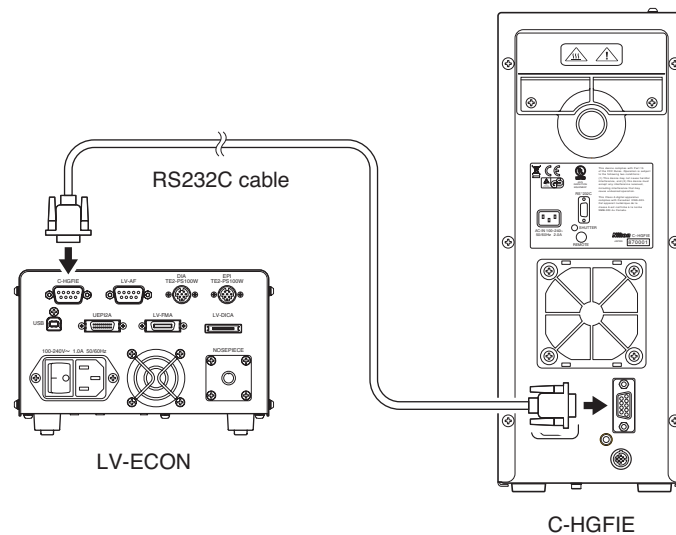
* An optional UEPI2A connection cable of 10 m in length is also available.

For details about assembly method of the epi illuminator, refer to the instruction manual for the LV-UEPI2A. For details about connection method to the focusing module, refer to the instruction manual for the LV-FM/LV-FMA or LV-IM/LV-IMA.

▶ To connect with an external light source

To observe a specimen under the epi-fl illumination, an optional mercury lamp light source (Nikon C-HGFIE or EXFO X-Cite 120 PC) must be used with this product. In this case, perform the following procedure to connect this product with the light source.

- 1 Check that the optical fiber adapter is attached on the light source mount part on the epi illuminator LV-UEPI2A and that the light source and the epi illuminator are connected with a light guide fiber correctly.
 - 2 Check that the power switches on the light source and on this product are turned off (the “○” side is pushed).
 - 3 Connect the special RS232C cable to the RS232C port on the light source and to the C-HGFIE connector on the back of the LV-ECON.
- Screws are provided for these connectors. Make sure to fix these connectors with screws.

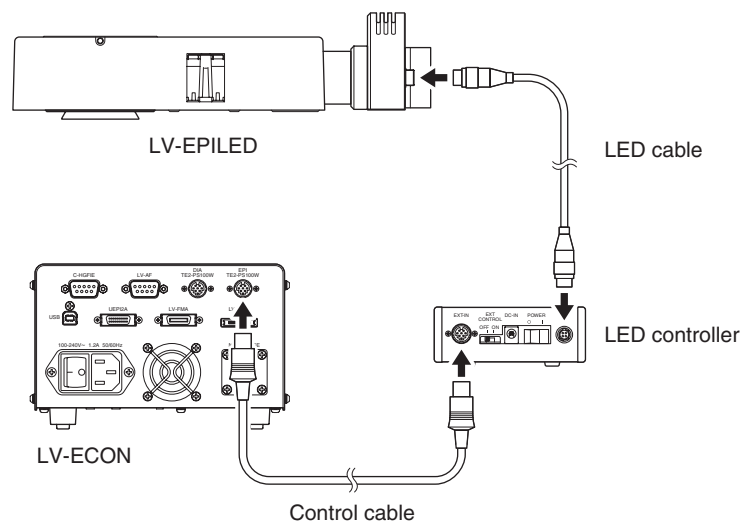


- For details about installation method of the optical fiber adapter and connection method of the light guide fiber, refer to the instruction manuals for the epi illuminator with fluorescent illumination (LV-UEPI2 or LV-UEPI2A) and for the external light source.
- For details about installation, assembly, and operation for an external light source, refer to the instruction manual for the external light source.

▶ To connect with the epi illuminator with LED light source

You can perform the bright-field microscopy under episcopic illumination with ease by using the LED epi illuminator, LV-EPILED. The LV-EPILED has an LED unit as the light source for the episcopic illumination. And the LV-EPILED can be controlled with the E controller. To connect the E controller with the LVEPILED, perform the following procedure:

- 1 Check that the LV-EPILED is mounted on the microscope base (the motorized focusing module, or such) correctly.
- 2 Check that the power switches on the LED controller of the LV-EPILED and on this product are turned off (the “○” side is pushed).
- 3 Connect the special LED cable to the connector on the light source and to the LED connector on the LED controller.
- 4 Connect the special control cable for the LED light source to the EXT-IN connector on the LED controller and to the EPI TE2-PS100W connector on the LV-ECON.
If the control cable is connected to the DIA connector, the LV-EPILED cannot be controlled. Make sure that the control cable is connected to the EPI connector.
- 5 Move the EXT CONTROL switch on the LED controller to the ON position.

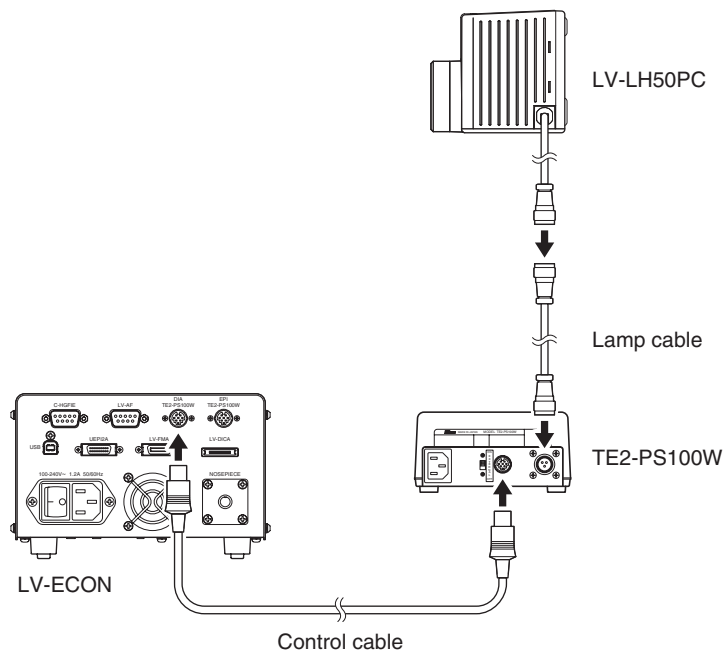


For details about assembly method of the LV-EPILED, refer to the instruction manual for the LV-EPILED.

6 To Connect with the Light Source for the Diascopic Illumination

When a halogen lamp is used as a light source for the diascopic illumination, the lamp house (LV-LH50PC) and the power supply (TE2-PS100W) must be connected. And then, the power supply and this product must be connected with a control cable.

- 1 Check that the lamp house is correctly attached to a microscope base that can be equipped with a diascopic illuminator.
- 2 Check that the power switch on the power supply is turned off (the “○” side is pushed).
- 3 Connect the special lamp cable to the lamp cable of the lamp house and to the OUTPUT connector on the power supply.
- 4 Connect the special control cable, which is 2.8 m in length, to the EXTERNAL connector on the power supply and to the DIA TE2-PS100W connector on this product.
Make sure that the control cable is connected to the connector labeled DIA.
- 5 Move the EXTERNAL switch on the back of the power supply to the ON side.



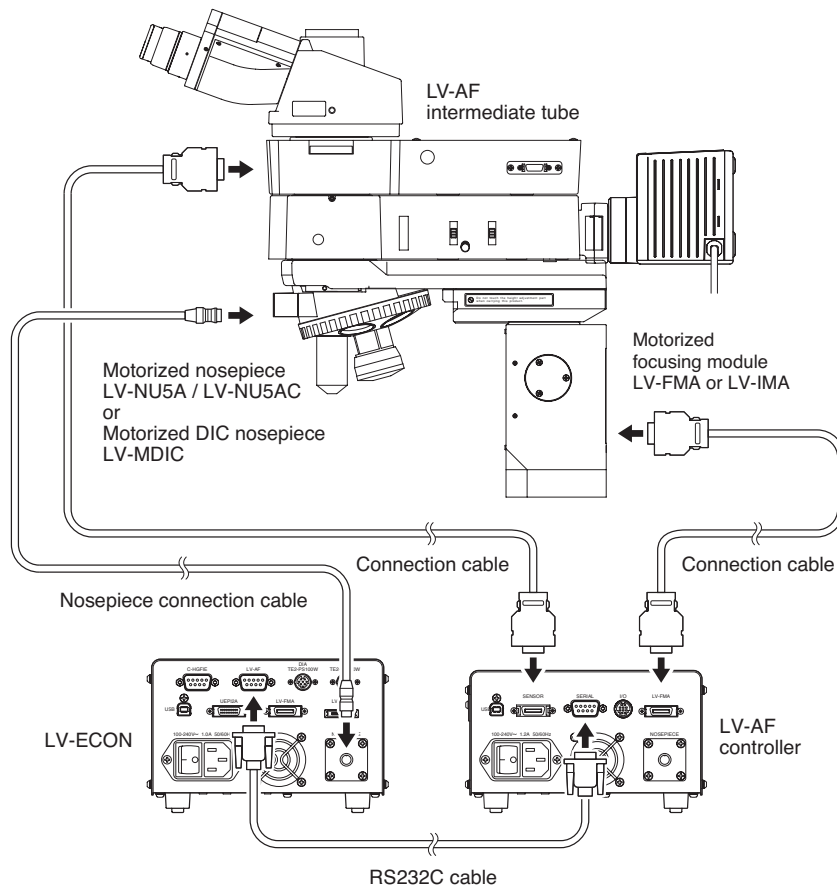
* An optional control cable of 10 m in length is also available.

For details about installation method of the lamp house and replacement method of lamps, refer to the instruction manual for the epi illuminator (LV-UEPI, LV-UEPI2, or LV-UEPI2A).

7 To Connect with the Auto Focus System

To connect the product with the auto focus system, LV-AF, perform the following:

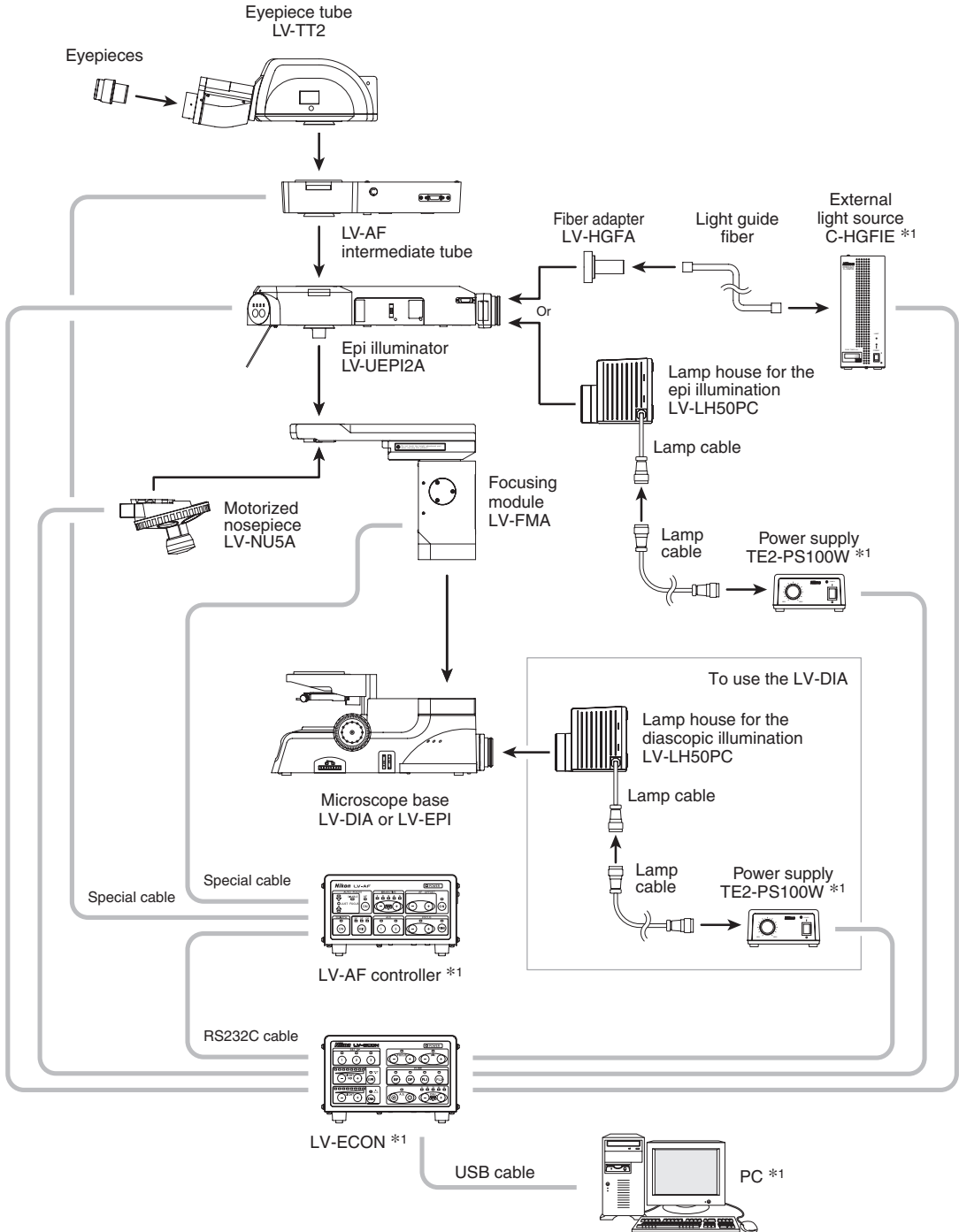
- 1 Refer to the following to check that the devices are correctly installed:
 - The motorized focusing module, LV-FMA or LV-IMA, is fixed on a pedestal or a base such as LV-DIA or LV-EPI.
 - The motorized nosepiece or the motorized DIC nosepiece is attached correctly. (When the motorized nosepiece is attached on the LV-FMA, the cables must be connected before attaching devices such as the illuminator. For details, refer to the instruction manual for the LV-FMA.)
 - The intermediate tube of the LV-AF is attached correctly.
- 2 Check that all power switches are turned off (the “○” sides are pressed.)
- 3 Connect the connector on the side of the LV-AF intermediate tube and the SENSOR connector on the back of the LV-AF controller with the special connection cable.
- 4 Connect the connector on the side of the motorized focusing module and the LV-FMA connector on the back of the LV-AF controller with the special connection cable.
- 5 Connect the cable of the motorized nosepiece with the NOSEPIECE connector on the back of the LV-ECON with the special nosepiece connection cable.
- 6 Connect the SERIAL connector on the back of the LV-AF controller and the LV-AF connector on the back of the LV-ECON with the special RS-232S cable.



For details about the installation of the LV-AF intermediate tube, refer to the instruction manual for the LV-AF. For other devices, refer to the instruction manuals for them respectively.

► System configuration example

A configuration example of the motorized microscope system with the auto focus system is shown below. Refer to the figure for the installation and the connection of the devices.



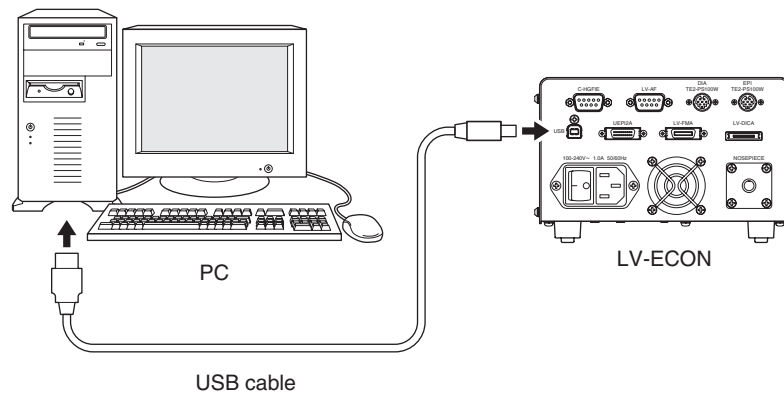
*1 : This device needs a power supply for its own.

8 To connect with a PC

This product has a universal serial bus (USB) interface. Via the USB interface, various settings and operations can be performed from a PC by using the setup software, “LVSetup.”

After assembling and connecting the product to other devices, connect a commercially available USB cable to the PC and to this product. And then, specify various settings for each device.

The USB cable can be connected to the PC or to this product even if the PC or this product is energized.



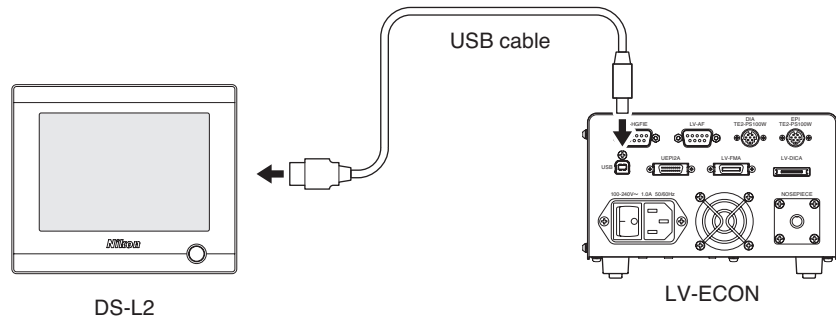
* The USB interface circuit on this product complies with the USB 1.1 specification.

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

9 To Connect with the DS-L2

When a Nikon Digital Sight series digital camera is attached to the microscope, the DS-L2 DS camera control unit can be used for the camera operation and the image display.

Connect the DS-L2 with the LV-ECON by using the USB interface on the back of the LV-ECON. All motorized devices can be controlled on the DS-L2 display.



For operation methods of the DS-L2, refer to the instruction manual for it.

10 Power Cord Connection



WARNING Make sure to use the specified power cord. Using a wrong power cord may result in malfunctions or fire. The product is classified as subject to Class I protection against electrical shock. Make sure it is connected to an appropriate ground terminal (protective earth terminal).

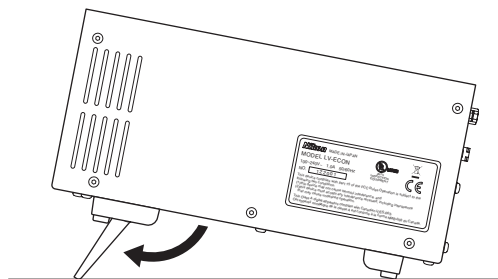
For specifications of the power cord, refer to “VII. Specifications.”

Check that the power switch on this product is turned off (the “○” side is pushed). Insert the socket of the power cord into the AC inlet on the back of the product. Then, securely plug the power cord to the wall outlet.

11 Tilt Adjustment Legs

This product has tilt adjustment legs in the front side legs. You can change the tilt angle of the product with them.

Check the installation condition of the product, and then use the tilt adjustment legs if you wish.



IV

Operation



WARNING

- Each motorized device will move when this product is operated. To prevent injury, do not touch the moving device during operation. Before operating this product, check all moving devices for your safety.
- If you touch the elevating section or its attached devices during operation of the motorized focusing module, it may cause injury to hands or fingers. Do not touch the motorized devices when you operate the product.
- When a power supply for the illuminator or an external light source is connected with this product, you can control the lamp and shutter with operating this product. Before operating this product, check the illuminator and its surroundings for your safety.



CAUTION

• **Software setup work for the microscope system**

When the microscope is assembled or the configuration of the microscope is changed, perform the software setup works for various settings of the microscope via a PC by using the software, “LVSetup,” in “LV Series Support Tools” provided with this product.

In the setup works, information for the devices and parts (objectives, filter cubes, illuminator, and so on) is registered and interlock controls for such devices are specified. Make sure to perform the setup works to use the microscope system correctly.

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

1 Power On/Off



CAUTION

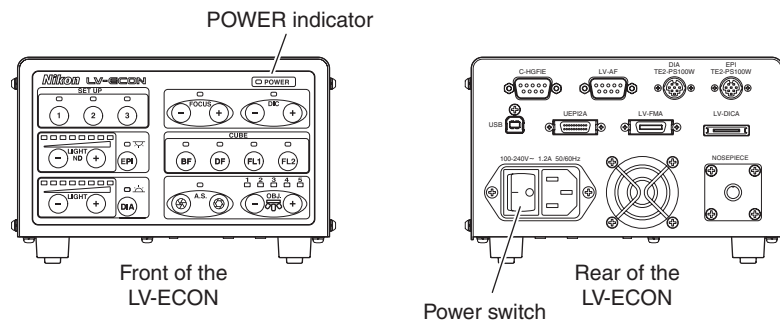
When the power supply for the halogen lamp or the external light source is used with this product, the power-on procedure is the following: Turn on the external device. And then, turn on this product.

Particularly, it takes several minutes to start the external light source. Before turning on the product, check that the external light source startup procedure has completed.

When the C-HGFIE is used for the light source and has completed the startup procedure, the LAMP indicator changes from blinking to lighting. When the EXFO X-Cite120 PC is used for the light source and has completed the startup procedure, the backlight of the LCD changes from blinking to lighting.

▶ Power ON/Off

The power switch of this product is located beside the AC inlet on the rear. To turn on the product, push the power switch to the “I” side. To turn off the product, push the power switch to the “O” side. When the product is turned on, the POWER indicator lights green.



• Initialization of the microscope system

When the product is turned on, a beep sounds, all indicators on the operation panel light up, and this product starts communications with each electrical device. When the communication is established, each electrical device is set to the predetermined conditions and the indicators on the operation panel show the current condition. This procedure is called the “initialization” of the microscope system.

When the initialization ends, a beep sounds again to inform that this product is ready for use. Under the factory default condition, it takes about 15 to 20 seconds to initialize the microscope system. The time for the initialization varies depending on the settings of the setup.

* If communications to a device fails in the initialization, the indicator on the operation panel turns off to inform that the device is disabled.

▶ Microscopy method setting at the initial condition

When the microscopy method at the initial condition has been set with LVSetup and the LV-ECON is turned on, the microscope system starts with the predetermined microscopy method settings.

When the microscopy method at the initial condition has been disabled with LVSetup, the microscope system starts with the same microscopy method settings used at the last time.

2 Setting Up the Microscope System

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



CAUTION

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

▶ Setting procedure

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

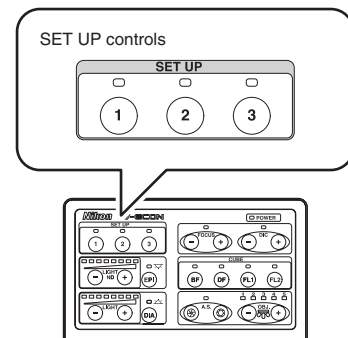
For details about operations and setup works of "LVSetup," see "LV Series Support Tools software manual."

3 Set-up Memory Operation

This product has a memory area names as “set-up memory.” You can register three user-defined settings of the microscope system into the set-up memory by using the special set-up software, “LVSetup.” The registered data can be restored anytime you want. So, it is useful to register the microscopy conditions you wish. When such conditions are registered, you can change microscopies with the push of a button.

The following conditions can be registered in the set-up memory:

- Microscopy method selection
(when the LV-UEPI2A is used)
- Objective to be used
(when the motorized nosepiece or the motorized DIC nosepiece is used)
- Episcopic aperture diaphragm opening size
(when LV-UEPI2A is used)
- Episcopic illumination condition
(on/off and brightness adjustment)
- Diascopic illumination condition
(on/off and brightness adjustment)
- Vertical position of the motorized focusing module
- DIC prism condition
(when the motorized DIC nosepiece is used)



▶ Registering conditions to the set-up memory

To register the user defined conditions to the set-up memory, run “LVSetup” with a PC. Connect a commercially available USB cable to the PC. And then, run “LVSetup” to operate the setup memory.

For details about registering user defined conditions, see “LV Series Support Tools software manual.”

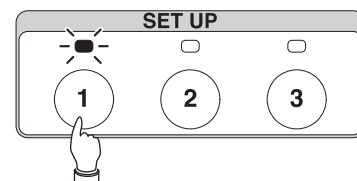
▶ Restoration from the set-up memory

When one of the 1 to 3 button in the SET UP area is pressed, the indicator of the button is lit and each device is set to the registered conditions.

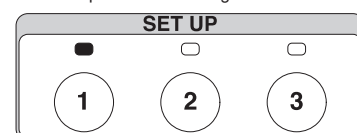
If no data is registered in the set-up memory and a button is pressed, a beep sounds and the indicator remains unlit.

Besides, if some data are registered in the set-up memory but some device cannot be enabled for some reason, a beep sounds and the indicator of the button is turned off.

Restoring settings from the set-up memory



After completion of restoring



The indicator in the CUBE area is lit while the conditions registered in the set-up memory are used. When a button in the CUBE area is pressed, the indicator in the CUBE area is lit and the microscopy method changes. And the indicator in the SET UP area turns off.

► **Modification from the registered condition (User offset)**

When the illumination or the aperture diaphragm for the episcopic illumination is modified from the condition registered in the set-up memory, the indicators on the operation panel blink indicating that it is not in the registered condition any more. This modification is referred to as “User offset” hereafter.

The condition of “User offset” is registered in the memory of this product: therefore, the post-modified condition is restored when the registered combination of the microscopy and the objective is selected, even after another microscopy or objective is selected or the power is turned off.



CAUTION

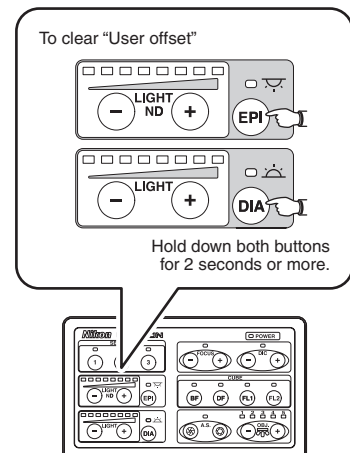
Even if the interlock control mode is changed, the user offset settings are kept. Therefore, if the interlock control mode is changed with “LVSetup” under conditions of user offset, the microscope system condition may differ from user intension. To change the interlock control mode, perform the following if necessary and reset the user offset settings beforehand.

For information about the interlock control mode, see Page 29. For information about changing method of the interlock control mode, refer to the “LV Series Support Tools software manual.”

► **To clear “User offset”**

To clear the user offset condition and return to the registered conditions of the microscope system, hold down the EPI button and the DIA button for two seconds or longer.

When the registered conditions are restored, a short beep sounds and the indicators on the operation panel turn on.



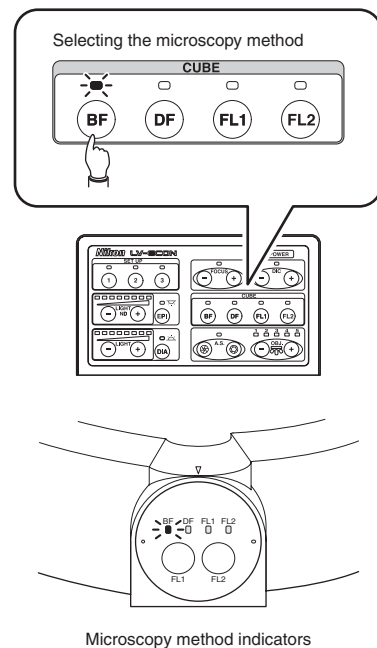
4 Selecting the Microscopy Method

When the LV-UEPI2A epi illuminator is connected with this product, one of the CUBE indicators lights up to show the address of the filter cube turret in the optical path. When you wish to change the microscopy method, push the desired button from the BF / DF / FL1 / FL2 buttons in the CUBE area to rotate the filter cube turret.

▶ Selecting the microscopy method

When one of the BF / DF / FL1 / FL2 buttons in the CUBE area is pushed, the filter cube turret in the LV-UEPI2A rotates to the position for the specified microscopy method. The current microscopy method is indicated on the indicator of the CUBE control and on the microscopy method indicator of the LV-UEPI2A.

Control	Filter cube selection
BF	Bright-field block
DF	Dark-field block
FL1	Epi-fl filter cube (or PA cube) at the FL1 block
FL2	Epi-fl filter cube at the FL2 block



Microscopy method indicators

▶ Interlock function for the microscopy method change

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



CAUTION

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

When the interlock control is enabled with LVSetup, the following devices are changed to the predetermined conditions in connection with the objective and the microscopy method.

- Aperture diaphragm size for the episcopic illumination
- Episcopic illumination (on/off control and brightness control)
- Diascopic illumination (on/off control and brightness control)
- Vertical position of the motorized focusing module (parfocal correction)
- Motorized DIC nosepiece (DIC prism insertion/removal, position A/B, fine adjustment position)

▶ Interlock control

The light quantity and the aperture diaphragm opening changes differently depending on the interlock control setting, Default mode or Optional mode, as described below:

- **Default mode**

The light quantity is set to the predetermined value. The aperture diaphragm for the epi-illumination is automatically adjusted to 75% of the numerical aperture of the objective.

- **Optional mode**

The light quantity and the aperture diaphragm for the epi-illumination are set to form a diameter and a value that has been set with “LVSetup.”

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

▶ Modification from the registered condition (User offset)

When the light quantity or the aperture diaphragm for the episcopic illumination is modified from the registered condition, the indicator on the operation panel starts blinking, indicating that it is not in the registered condition. This modification is referred to as “User offset” hereafter.

The condition of “User offset” is registered in the memory of this product: therefore, the post-modified condition is restored when the registered combination of the microscopy and the objective is selected, even after another microscopy or objective is selected or the power is turned off.



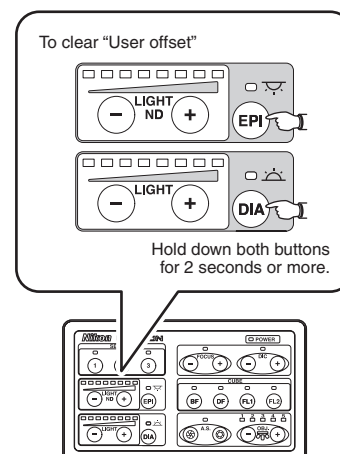
CAUTION

Even if the interlock control mode is changed, the user offset settings are kept. Therefore, if the interlock control mode is changed with “LVSetup” under conditions of user offset, the microscope system condition may differ from user intension. To change the interlock control mode, perform the following if necessary and reset the user offset settings beforehand.

For information to change the interlock control mode, refer to the “LV Series Support Tools software manual.”

▶ To clear “User offset”

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





5 Operation for the Aperture Diaphragm for the Episcopic Illumination

When the LV-UEPI2A epi illuminator is connected with this product, the A.S. indicator lights up. The aperture diaphragm in the LV-UEPI2A can be adjusted by operating the A.S. control buttons.

Since the aperture diaphragm is used 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.

▶ Operation for the aperture diaphragm for the episcopic illumination

To adjust the aperture diaphragm, operate the open/close button of the A.S. controls.

Control	Aperture diaphragm for the episcopic illumination
Open button (right, )	Open (The opening increases.)
Close button (left, )	Close (The opening decreases.)

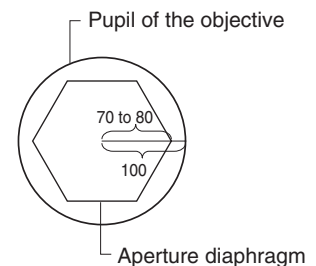
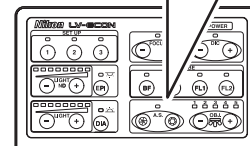
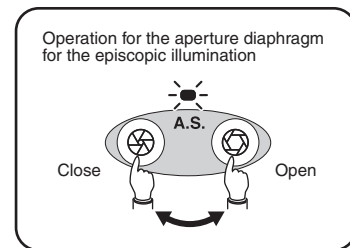
When the aperture diaphragm is set to the maximum or minimum size and its size is attempted to be changed farther, a beep sounds.

To adjust the aperture diaphragm, remove one of the eyepieces, and then adjust the aperture diaphragm opening to 70 to 80% of the pupil of the objective while observing the pupil of the objective (the bright area when the aperture diaphragm is fully opened) in the eyepiece tube.

▶ Interlock function

When the interlock function is enabled with “LVSetup”, the aperture diaphragm opening for the episcopic illumination is controlled to the predetermined condition in conjunction with the microscopy method or with the objective.

If the aperture diaphragm for the episcopic illumination is changed after the interlock function, the A.S. indicator blinks to notify it.



6 Changing Objectives

Objectives can be changed by operating the + / - buttons in the OBJ. area to rotate the motorized nosepiece. When the motorized nosepiece (LV-NU5A or LV-NU5AC) or the motorized DIC nosepiece (LV-MDIC) is connected with this product, one of the 1 to 5 indicator in the OBJ. area lights up to notify the current nosepiece address set in the optical path.

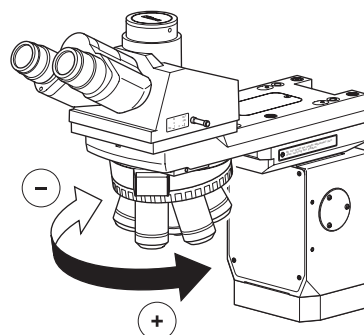
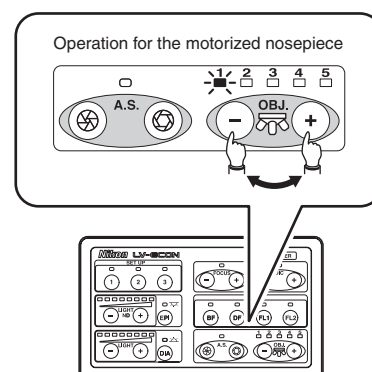
Switching Objectives

The motorized nosepiece moves as described below by operating the + / - buttons in the OBJ. area.

Control	Motorized nosepiece	Objective magnification *
+ button	Counterclockwise rotation viewed from the above (forward rotation)	The magnification increases.
- button	Clockwise rotation viewed from the above (reverse rotation)	The magnification decreases.

During the rotation of the motorized nosepiece, all indicators turn off temporarily.

Mount the objectives to the nosepiece in ascending order. (The nosepiece address 1 is the lowest magnification and the nosepiece address 5 is the highest magnification.)



Interlock function for objectives

When the interlock function is enabled, the following devices are changed to the preset condition in conjunction with the objective.

- Aperture diaphragm opening for the episcopic illumination
- Episcopic illumination (on/off control and brightness control)
- Diascopic illumination (on/off control and brightness control)
- Vertical position of the motorized focusing module (parfocal correction)
- Motorized DIC nosepiece (DIC prism insertion/removal, position A/B, fine adjustment position)

Limitation on switching objectives

The following limitations can be applied to the operation for the motorized nosepiece with “LVSetup.”

- You can disable the rotation of the nosepiece not to change objectives from a low magnification objective of 5x or lower to a high magnification objective of short working distance less than 1 mm.

7 Operation for the Motorized Focusing Module

When the motorized focusing module (LV-FMA or LV-IMA) is connected with this product, the FOCUS indicator lights up. The vertical movement of the motorized focusing module can be controlled by operating the + / - buttons in the FOCUS area.

▶ Operation for the motorized focusing module

The elevating section of the motorized focusing module moves as described below by operating the + / - buttons in the FOCUS area.

Control	Elevating Section	Objective
+ button	Up	It moves farther from the specimen.
- button	Down	It moves closer to the specimen.

When the arm is located at the upper or lower limit position and it is attempted to be moved farther, a beep sounds.

* The vertical movable range of the elevating section of the LV-FMA and LV-IMA is approximately 20 mm. And the limit positions for vertical movement can be set with "LVSetup."

▶ Interlock control for the motorized focusing module

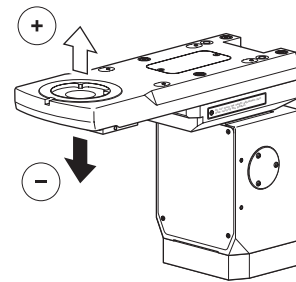
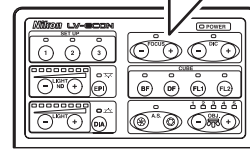
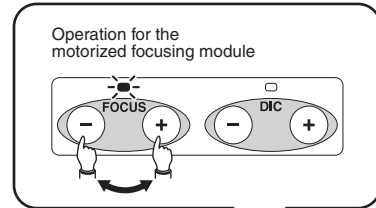
When the interlock control function is enabled with "LVSetup," the elevating section can be moved to the predetermined position in accordance with the objective.

This function can be used the parfocal correction for objectives and the automatic retraction for changing objectives of high magnification.

▶ Operation with the auto focus system

When the auto focus system (LV-AF) is used with the LV-ECON, the FOCUS indicator on the LV-ECON turns off and the operation for the motorized focusing module with the LV-ECON is disabled.

Operate the LV-AF for all motorized focusing module operation such as auto focus function on/off, offset setting for auto focus, and manual focus operation.



8 Operation for the DIC Prism

When the motorized DIC nosepiece (LV-MDIC) is installed, the DIC indicator lights up. In this setting, the DIC prism (Nomarski prism) position in the motorized DIC nosepiece can be adjusted by operating the +/- buttons in the DIC area.

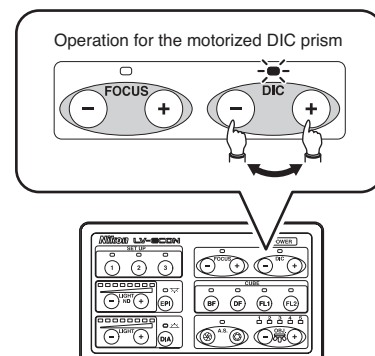
▶ Operation for the DIC prism

The DIC prism moves as described below by operating the +/- buttons in the DIC area.

Control	DIC prism
+ button	The prism moves into the optical path.
- button	The prism moves away from the optical path.

If the DIC prism is located at the limit and an attempt is made to move the prism farther, a beep sounds.

To perform differential interference contrast (DIC) microscopy with the DIC prism, a polarizer and an analyzer must be located in the optical path. When the LV-UEPI2A is used with the product, a polarizer and an analyzer can be set in the optical path easily with the PA block.



▶ Interlock control of the DIC prism

When the interlock control function is enabled with LVSetup, the DIC prism condition changes in accordance with the microscopy method and the selected objective.

- DIC prism insertion/removal (interlocked with the microscopy method)
- Position A/B selection (interlocked with the objective)
- DIC prism fine adjustment position (interlocked with the objective)

If the DIC prism is operated manually after the interlock control, the DIC indicator blinks to show that the prism condition is modified from the registered condition.

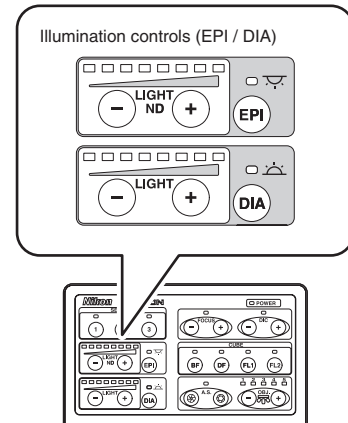
▶ Selection between position A/B

To perform DIC microscopy, the DIC prism position must be selected between position A or position B in accordance with the pupil position of the selected objective. "A" or "B" symbol is indicated on the side of the objectives to show the pupil position.

When the motorized DIC nosepiece is used and the information of the objectives are registered with LVSetup, the DIC prism position is moved to position A or position B automatically in accordance with the selected objective.

9 Operation for the Illumination

To light up/down the illumination and to adjust the brightness, operate the episcopic illumination controls (EPI) or the diascope illumination controls (DIA).

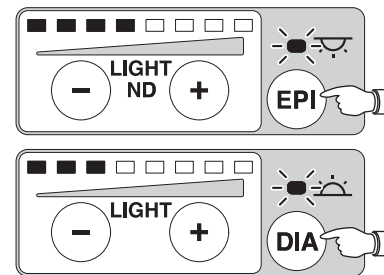


▶ To light up/down the illumination

To light up/down the illumination, operate the EPI button or the DIA button. Each time the button pressed, the illumination turns on or off. When the illumination turns on, the corresponding indicator turns on (or blinks).

Indicator	Illuminator selection
EPI + DIA	Both (simultaneous illumination of episcopic and diascope)
EPI	Episcopic illumination only
DIA	Diascope illumination only

To light up/down the illumination



Episcopic and diascope illuminations are controllable individually.

▶ Interlock function

The illumination is turned on/off automatically and the brightness is controlled automatically when one of the following operations is performed: a set-up memory button is pushed, the microscopy method is changed with the interlock function enabled, or objectives are changed with the interlock function enabled.

The registration to the set-up memory and the interlock function settings are specified with “LVSetup.” For detailed information, refer to “LV Series Support Tools software manual.”

▶ Simultaneous illumination settings

When you don't need the simultaneous illumination of episcopic and diascope illumination, you can disable the simultaneous illumination by using “LVSetup.” In this setting, the episcopic illumination or the diascope illumination will be selected exclusively.

For details about the settings, refer to “LV Series Support Tools software manual.”

To operate the episcopic illumination

To light up/down the episcopic illumination and to adjust its brightness, operate the episcopic illumination controls.

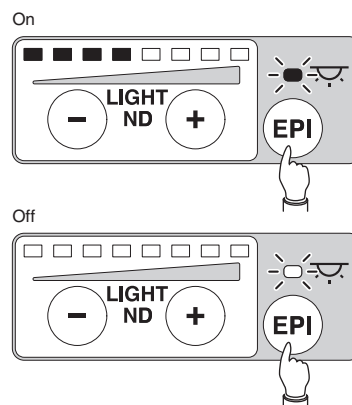
This product can control one of the following devices: the power supply for the halogen lamp (TE2-PS100W), the external light source (C-HGFIE or EXFO X-Cite 120 PC), or the LED epi illuminator (LV-EPILED).

- To light up/down the episcopic illumination**

To light up the illumination, push the EPI button. Each time the button pressed, the illumination turns on or off. When the illumination turns on, the corresponding indicator turns on (or blinks).

For the halogen lamp or LED epi illuminator: The lamp turns on/off each time the EPI button pressed.

For the external light source: The lamp in the external light source is always lit when it is energized. The shutter in the external light source opens/closes every time the EPI button pressed.

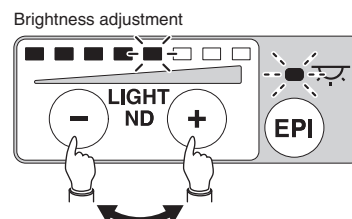


- Brightness adjustment for the episcopic illumination**

To adjust the brightness for the illumination, operate the +/- buttons. The current brightness is displayed on the brightness level indicator in steps of eight (1 to 7: green, 8: orange). When the brightness becomes the upper or lower limit, a beep sounds.

For the halogen lamp or LED epi illuminator: The brightness can be adjusted by pressing the + / - button.

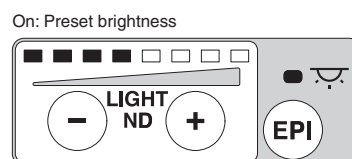
For the external light source: The brightness can be adjusted in steps of five by pushing the + / - button to change the iris (ND filter) in the light source.



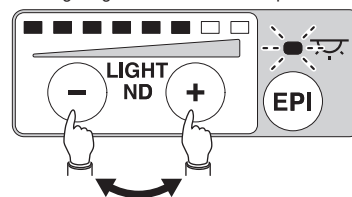
- EPI indicator**

The lamp status for the illuminator is displayed with the EPI indicator as described below.

Indicator	Episcopic illumination
On	The illumination lights up with the brightness of the preset setting. (It is the adjusted condition in accordance with the set-up memory or the interlock function.)
Blinking	The illumination lights up with the brightness other than the preset condition. (It is the adjusted condition with the + / - buttons.)
Off	The illumination is not lit.



Blinking: Brightness other than the preset condition

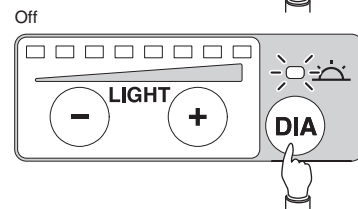
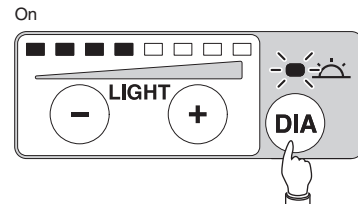


Diascopic illumination

To light up/down the diascopic illumination and to adjust its brightness, operate the diascopic illumination controls. This product can control the power supply for the halogen lamp (TE2-PS100W).

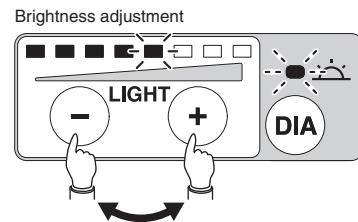
• **To light up/down the diascopic illumination**

To light up the illumination, push the DIA button. Each time the button pressed, the illumination turns on or off. When the illumination turns on, the corresponding indicator turns on (or blinks).



• **Brightness adjustment for the diascopic illumination**

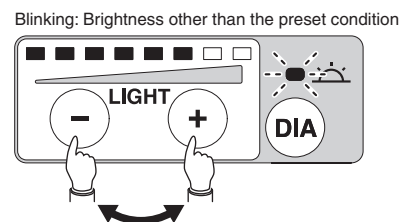
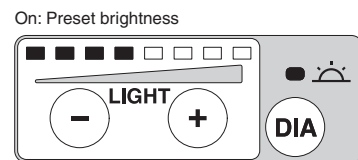
To adjust the brightness for the illumination, operate the +/- buttons. The current brightness is displayed on the brightness level indicator in steps of eight (1 to 7: green, 8: orange). When the brightness becomes the upper or lower limit, a beep sounds.



• **DIA indicator**

The lamp status for the illuminator is displayed with the DIA indicator as described below.

Indicator	Diascopic illumination
On	The illumination lights up with the brightness of the preset setting. (It is the adjusted condition in accordance with the set-up memory or the interlock function.)
Blinking	The illumination lights up with the brightness other than the preset condition. (It is the adjusted condition with the +/- buttons.)
Off	The illumination is not lit.



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

Problem	Cause	Countermeasure
There is no power even though the power switch is on.	The power cord is not plugged in.	Connect it properly. (p.26)
A motorized device does not work.	The motorized device is not connected correctly.	Connect it properly. (p.10 to 25)
	The setting on the motorized device for the external control is disabled.	Enable the external control setting.
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)
Sometimes the nosepiece does not rotate.	A limitation is specified to the rotation of the nosepiece.	Release the restriction. (Refer to “LV Series Support Tools software manual.”)
The halogen lamp cannot be controlled.	The power for the power supply is turned off.	Turn on the power.
	The control cable is not connected correctly.	Connect it properly. (p.18, 21)
	The EXTERNAL switch on the power supply is set to the “OFF” position.	Change it to the ON setting. (p.18, 21)
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)
The external light source cannot be controlled.	The power for the light source is turned off.	Turn on the power.
	The power of this product was turned on before the light source could start up.	Turn on the product after the startup procedure of the light source. (p.28)
	The RS-232C cable is not connected correctly.	Connect it properly. (p.19)
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)
The LED epi illuminator cannot be controlled.	The power for the LED controller is turned off.	Turn on the power.
	The control cable is not connected correctly.	Connect it properly. (p.20)
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)

Problem	Cause	Countermeasure
No interference color is seen in the DIC microscopy.	No analyzer or no polarizer is placed in the optical path.	Place the component into the optical path. (p.37)
	No DIC prism is placed in the optical path.	Place the component into the optical path. (p.37)
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)
Uneven colors are seen or low contrast image is seen in the DIC microscopy.	A wrong objective is used.	Use an objective that has the “LU Plan” or “LU Plan Apo” mark.
	The used objective and the DIC prism do not match for the microscopy.	Change the objective or the DIC prism to a correct component.
	The setup work has not performed. Or, the setting is wrong.	Perform the setup work to specify the settings properly. (Refer to “LV Series Support Tools software manual.”)

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

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

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

▶ Daily care and maintenance

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

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

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

▶ Cleaning tool and supplies (consumables)

- **Cleaning tool**

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

- **Cleaning supplies (consumables)**

Ethyl or methyl alcohol

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

1 Cleaning Lenses and Filters

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

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

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

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

3 Storage


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

4 Regular Inspections

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

► LV-ECON E controller

Model name	LV-ECON E controller
Controllable devices	<p>Motorized nosepiece: LV-NU5A motorized universal quintuple nosepiece ESD, LV-NU5AC motorized universal quintuple centerable nosepiece</p> <p>Motorized DIC nosepiece: LV-MDIC motorized DIC module</p> <p>Motorized epi illuminator: LV-UEPI2A motorized universal epi illuminator 2A</p> <p>Motorized focusing module: LV-FMA FM module A (motorized drive), LV-IMA IM module A (motorized drive)</p> <p>Auto focus system: LV-AF auto focus</p> <p>Power supply for the lamp: TE2-PS100W power supply</p> <p>LED epi illuminator: LV-EPILED epi illuminator LED</p> <p>External light source: C-HGFIE Intensilight (precentered fiber illuminator) X-Cite 120 PC manufactured by EXFO</p> <p>PC: Windows PC with an USB interface</p>
Interface connectors	<p>External light source interface connector: RS232C interface</p> <p>AF controller interface connector: RS232C interface</p> <p>Power supply interface connector for the diascopic illumination: Special interface</p> <p>Interface connector for the power supply for the episcopic illumination or for the LED epi illuminator: Special interface</p> <p>Interface connector for a PC: USB 1.1 interface</p> <p>Interface connector for the motorized epi illuminator: Special interface</p> <p>Interface connector for the motorized focusing module: Special interface</p> <p>Interface connector for the motorized DIC: Special interface</p> <p>Interface connector for the motorized nosepiece: Special interface</p>
Input ratings	100-240 VAC, 1.0A, 50/60Hz
Power cord	<p>When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type (3 conductor grounding Type SVT, NO.18 AWG, 3m long maximum, rated at 125 VAC minimum)</p> <p>When the supply voltage is 220 V to 240 V: Cord set approved according to EU/EN standards, 3 conductor grounding Type (3 conductor grounding Type H05VV-F, 3m long maximum, rated at 250 VAC minimum)</p> <p>When used in Japan: Cord set satisfying the Electrical Appliance And Material Safety Law (PSE mark attached) (3 conductor grounding VCTF 3x0.75mm², 3m long maximum, rated at 125 VAC minimum)</p>
Operating conditions	<p>Temperature: 0°C to +40°C</p> <p>Humidity: 85% relative humidity maximum (no condensation)</p> <p>Altitude: 2000m maximum</p> <p>Pollution degree: Degree 2</p> <p>Installation category: Category II</p> <p>Electric shock protection class: Class I</p> <p>Indoor use only</p>
Storage conditions	<p>Temperature: -20°C to +60°C</p> <p>Humidity: 90% relative humidity maximum (no condensation)</p>
External dimensions	165 mm (width) x 109 mm (height) x 210 mm (depth) (excluding protrusions)
Weight	Approx. 2.2 kg

<p>Safety standards compliance</p>	<ul style="list-style-type: none"> • This is UL-listed product (UL61010A-1). • This product meets FCC Part 15B Class A requirements: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. <div style="text-align: right;">  </div>
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► LV-FMA

Model name	LV-FMA FM module A (motorized drive)
Focusing mechanism	Motorized drive type (controlled from optional LV-ECON) Stroke: 20 mm (19 mm up and 1 mm down from the reference position) Resolution of movement: 0.05 µm Speed: 2.5 mm/sec maximum Useful load: 3 to 6 kg (standard condition) 6 to 9 kg (with optional counter spring)
Mounting part for the optical parts	Eyepiece tube mounting part: Round dovetail joint (reference dimension for the dovetail diameter: 46 mm) Nosepiece mounting part: Dovetail joint (reference width: 50 mm, sliding dovetail joint with trapezoid shape)
Mounting hole	Bottom: Four M6 screw holes (distance between holes: 80 x 62 mm, four fixing bolts are attached with the product)
Designated controller	LV-ECON E controller
Interface	LV-ECON special interface
Operating conditions	Temperature: 0°C to -40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage conditions	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)
External dimensions	W : 123.8 mm x H : 225 (224 to 244) mm x D : 308 mm
Weight	Approx. 6.0 kg
Safety standards compliance (Tested with the LV-ECON)	<ul style="list-style-type: none"> • This is UL-listed product (UL61010A-1). • This product meets FCC Part 15B Class A requirements: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements.



► LV-IMA

Model name	LV-IMA IM module A (motorized drive)
Focusing mechanism	Motorized drive type (controlled from optional LV-ECON) Stroke: 20 mm (19 mm up and 1 mm down from the reference position) Resolution of movement: 0.05 µm Speed: 2.5 mm/sec maximum Useful load: 4 to 7 kg (standard condition) 7 to 10 kg (with optional counter spring)
Mounting part for the optical parts	Eyepiece tube mounting part: Round dovetail joint (reference dimension for the dovetail diameter: 46 mm) Nosepiece mounting part: Dovetail joint (reference width: 50 mm, sliding dovetail joint with trapezoid shape)
Mounting hole	Rear: Four M6 screw holes (distance between holes: 95 x 120 mm, depth: 10 mm) Bottom: Four M6 screw holes (distance between holes: 80 x 62 mm, maximum length of screw: 11mm)
Designated controller	LV-ECON E controller
Interface	LV-ECON special interface
Operating conditions	Temperature: 0°C to + 40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage conditions	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)
External dimensions	114 (W) x 138.8 (H) x 217 (D) mm (excluding protrusions)
Weight	Approx. 3.7 kg
Safety standards compliance (Tested with the LV-ECON)	<ul style="list-style-type: none"> • This is UL-listed product (UL61010A-1). • This product meets FCC Part 15B Class A requirements: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements.



► LV-UEPI2A

Model name	LV-UEPI2A Motorized Universal Epi Illuminator 2A
Optical system	CFI60 system (chromatic aberration free infinity optics system)
Light source connection	1 (rear)
Illumination	Köhler illumination
Field number	25
Illumination method	Bright-field, dark-field, DIC*, simplified polarization*, sensitive color polarization*, epi-fl* (* needs options)
Illumination selection method	Four port turret rotation in conjunction with a shutter to provide dazzling light (noise terminator attached) Turret drive method: motor Filter cube: up to two filter cubes can be installed (filter cubes for the bright-field and dark-field microscopy are fixed)
Field diaphragm	Adjustment: manual Variable range: 1.0 to 8.9 mm in diameter (bright-field microscopy) Projected magnification: 3.0x (on the eyepiece image plane) Full open diameter (for dark-field microscopy): 9.8 mm Centering range: 2.4 mm in diameter
Aperture diaphragm	Adjustment: motorized Variable range: 1.2 to 8.0 mm in diameter (bright-field microscopy) Projected magnification: 1.55x (on the objective pupil plane) Full open diameter (for dark-field microscopy): 8.5 mm Centering range: 2.4 mm in diameter
Filters	Built-in filter: lemon skin filter, UV filter (only for bright-field and dark-field microscopy) ND filter: two manual type sliders Analyzer slot: right side Polarizer slot: two slots on right side, lambda plate attachable Excitation light balancer slot: left side
Interface	Special interface (for LV100DA or LV-ECON)
Operating condition	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage condition	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)

► LV-EPILED

Model name	LV-EPILED epi illuminator LED
Illumination type	Köhler illumination
Source connection	1 (rear)
Optical system	CFI60 system (chromatic aberration free infinity optics system)
Illumination method	Bright field
Field number	25
Light source unit	Light source: White LED Electric power consumption: 3W Color temperature: 5,500K
Filter	Integrated lemon skin filter ø 25 filter sliders (ND4 and ND16, for the slots on the right side)
LED controller unit	LED lamp input voltage and maximum current: 12 VDC $\pm 5\%$, 1 A maximum (supplied from the AC adapter)
Power source	AC adapter
AC adapter	Manufacturer: Electricity Power Source (E.P.S.) Inc. Model name: F1650K Rated input: 100 to 240 VAC $\pm 10\%$, 1.2 A maximum, 50-60 Hz Rated output: 12VDC, 3.5 A maximum Certifications: UL listed, GS approved, and CE marking approved.
Power cord for AC adapter	When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding type (3 conductor grounding Type SVT, NO.18 AWG, 3 m long maximum, rated at 125 VAC minimum) When the supply voltage is 220 V to 240 V: Cord set approved according to EU/EN standards, 3 conductor grounding type (3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 VAC minimum) When used in Japan: Cord set satisfying the Electrical Appliance And Material Safety Law (PSE mark attached) (3 conductor grounding VCTF 3x0.75mm ² , 3 m long maximum, rated at 125 VAC minimum)
External connection	LED connector External control connector (special interface, for LV-ECON) 12 VDC input connector (for connecting to the AC adapter)
Operating conditions	Temperature: 0 °C to + 40 °C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class I (AC adapter) Indoor use only.
Storage conditions	Temperature: -20 °C to + 60 °C Humidity: 90% relative humidity maximum (no condensation)

<p>Safety standards compliance</p>	<ul style="list-style-type: none"> • This is UL-listed product (UL61010A-1). • This product meets FCC Part 15B Class A requirements: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. <p>Laser safety</p> <ul style="list-style-type: none"> • This product complies with IEC/EN 60825-1, Class 1 standards. (Class 1 LED Product)
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► **LV-NU5A, LV-NU5AC**

Model name	LV-NU5A motorized universal quintuple nosepiece LV-NU5AC motorized universal quintuple centerable nosepiece
Mountable objective number	5
Objective switching method	Rotating the motorized nosepiece Nosepiece drive device: center motor Switching time: approximately 0.5 seconds
Dimensions	Overall height: 88.8 mm Revolver outer diameter: 127 mm Knurling angle: 15° Dimension of objective thread: M32 x 0.75 mm Distance between the attachment position of the objective barrel and the attachment reference position of the nosepiece: 48 mm
Joint part to the microscope	Sliding dove tail (reference dimension: 50 mm)
Slot size for the Nomarski prism slider	16.5 mm x 24 mm
Objective centering mechanism (only for LV-NU5AC)	One fixed objective and four centerable objectives Centering screws: two M3 set screws (two screws for each objective) Centering range: ø0.3mm
Interface	Connector of 12-pin
Operating condition	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage condition	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)

► LV-MDIC

Model name	LV-MDIC motorized DIC module
Mountable objective number	5
Objective switching method	Rotating the motorized nosepiece Nosepiece drive device: center motor Switching time: approximately 0.5 seconds
Dimensions of the nosepiece	Revolver outer diameter: 127 mm Revolver tilt angle: 15 ° Dimension of objective thread: M32 x 0.75 mm
Mounting part	Arm mounting part: 6-mm-diameter hole x 6 locations Four fixing holes including the reference hole (X: 80 and Y: 90, or X: 80 and Y: 118) and shoulder bolts are used for fixing. Eyepiece tube mounting part: Circular dovetail joint (reference dimension for the circular dovetail diameter: 46 mm) Epi illuminator mounting part: Circular dovetail joint and M4 tap Distance between the arm mounting surface and the eyepiece tube mounting surface: 28 mm Distance between the objective body mounting position and the eyepiece tube mounting surface: 73 mm
Nomarski prism part	Insertion/removal travel distance: 32 mm Insertion/removal time: Approximately 4 seconds or less Contrast adjustable range: 7.8 mm Contrast conversion range: $-1/2 \lambda$ to $+3/2 \lambda$ Vertical travel distance (position A/B selection): 5.4 mm (interlocked with the objective selection) Position A/B changeover time: Approximately 1.5 seconds or less
Interface	12-pin circular connector: For nosepiece control (LV-ECON) 16-pin rectangular connector: For DIC prism control (LV-ECON)
External dimensions	External dimensions: 185 mm (width) x 114 mm (height) x 385 mm (depth)
Operating condition	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class III Indoor use only
Storage condition	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)

<p>Safety standards compliance (Tested with the LV-ECON)</p>	<ul style="list-style-type: none"> • This is UL-listed product (UL61010-1 2nd Edition). • This product meets FCC Part 15B Class A requirements: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI (AS/NZS CISPR11 Group 1 Class A) <p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product meets EU EMC Directive requirements. <div style="text-align: right;">  </div>
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► TE2-PS100W

Model name	TE2-PS100W power supply
Input ratings	100 to 240VAC, 2.4A, 50/60 Hz
Power cord	<p>When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type (3 conductor grounding Type SVT, NO.18 AWG, 3m long maximum, rated at 125 VAC minimum)</p> <p>When the supply voltage is 220 V to 240 V: Approved according to EU/EN standards, 3 conductor grounding Type (3 conductor grounding Type H05VV-F, 3m long maximum, rated at 250 VAC minimum)</p> <p>When used in Japan: Cord set satisfying the Electrical Appliance And Material Safety Law (PSE mark attached) (3 conductor grounding VCTF 3x0.75mm², 3m long maximum, rated at 125 VAC minimum)</p>
Output ratings	12VDC, 100W, 8.4A
Built-in fuse ratings	250V T4A
Operating conditions	Temperature: 0°C to +40°C Humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class I Indoor use only
Storage conditions	Temperature: -20°C to +60°C Humidity: 90% relative humidity maximum (no condensation)
Safety standards compliance	UL listed, GS approved, CE certified

► C-HGFIE

Model name	C-HGFIE Intensilight (precentered fiber illuminator)
Shutter	Shutter system: light shield plate insertion/removal type Drive system: motorized type
Light control function	Light control system: punching metal rotation Light control range: ND1, ND2, ND3, ND4, ND8, ND16, and ND32 (6 steps) Wavelength range: 380 to 600 nm Drive system: motorized type
Available mercury lamp	Model name: Nikon C-LHGFI HG lamp Ratings: 130 W DC Lighting system: DC lighting Average service life *: 2,000 hrs. * The average service life is defined as the hours at which 50% or more normally working lamps still light up with the brightness of 50% or more of the initial optical characteristics after the usage of lifetime lighting (lighting cycle: repetition of 3.5 hours on, and then 0.5 hour off).
Available light guide fiber	Model name: Nikon HG fiber 15 C-HGFIF15 (cable length 1.5 m) Nikon HG fiber 30 C-HGFIF30 (cable length 3.0 m) Core diameter: 3 mm
Input ratings	100 to 240 VAC (±10%), 50/60 Hz, 2.0 A
Power cord	When the supply voltage is 100 V to 120 V: UL Listed detachable cord set, 3 conductor grounding Type (3 conductor grounding Type SVT, No.18 AWG, 3 m long maximum, rated at 125 VAC minimum) When the supply voltage is 220 V to 240 V: Cord set approved according to EU/EN standards, 3 conductor grounding Type (3 conductor grounding Type H05VV-F, 3 m long maximum, rated at 250 VAC minimum) When used in Japan: Cord set satisfying the Electrical Appliance And Material Safety Law (PSE mark attached) (3 conductor grounding VCTF 3x0.75mm ² , 3 m long maximum, rated at 125 VAC minimum)
Dimensions and weight	Dimensions: 110 (W) x 283 (H) x 258 (D) mm (C-HGFIE main body excluding protruding portion) Weight: approximately 6.0 kg
Remote controller (only for C-HGFIE)	Model name: C-HGFIE-C HG controller Connector: mini DIN 8 pin Cable length: 2.8 m Dimensions: 67 (W) x 122 (H) x 20 (D) mm (excluding protruding portion)

Communication function	Communication type: RS-232C compliance serial interface Connector: D-sub 9 pin
Shutter control signal	Connector: 3.5 mm diameter type stereo mini jack
Operating environment	Temperature: 0 to +35°C Relative humidity: 85% relative humidity maximum (no condensation) Altitude: 2000 m maximum Pollution degree: Degree 2 Installation category: Category II Electric shock protection class: Class I Indoor use only
Storage environment	Temperature: -20 to +60°C Relative humidity: 90% relative humidity maximum (no condensation)
Safety standard compliance	<p>CE marking</p> <ul style="list-style-type: none"> • This product meets EU Low Voltage Directive requirements. • This product has obtained GS mark. (EN61010-1:2001) • This product meets EU EMC Directive requirements. (EN61326) • This is the UL-listed product.(UL61010-1 (Second Edition)) • This product meets FCC Part 15B Class A requirements. <p>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.</p> <p>These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.</p> <p>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.</p> <p>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.</p> <ul style="list-style-type: none"> • This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada. • This product complies with Australian EMI. (AS/NZS C1SPR11 Group1 Class B)
Acoustic Noise	Less than 70 dB
	Maschinenlärminformations-Verordnung - 3. GPSGV, 06.01.2004: Der höchste Schalldruckpegel beträgt 70 dB(A) oder weniger gemäß EN ISO 7779

