

Nikon

Y-FL EPI-FLUORESCENCE ATTACHMENT
Instructions

Thank you for purchasing the Nikon products. This instruction manual is for the users of the Nikon Y-FL EPI-FLUORESCENCE ATTACHMENT (abbreviated as “Epi-fl attachment” in this manual).

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

- It is prohibited to alter this manual in part or whole without 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.
- Be sure to read the manuals for any other products that you are using with this attachment (the microscope, super high-pressure mercury lamp power supply, high-intensity light source, etc.).

Warning/Caution Symbols in This Manual

Though Nikon products are designed to provide you with the utmost safety during use, incorrect usage or disregard of the instructions can cause personal injury or property damage. For your safety, read the instruction manual carefully and thoroughly before usage. Do not discard this manual but keep it near the product for easy reference.

Inside this instruction manual, safety instructions are indicated with the symbols shown below. Be sure to follow the instructions marked with these symbols for your safety.

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



WARNING

1. Intended product use

This system should be used only for microscopic observation. Do not use this system for any other purpose.

2. Do not disassemble

Disassembling the system could result in electric shock, exposure to ultraviolet light, or damage to the equipment. Never attempt to disassemble any portion of the microscope or the system unless the procedure is described in this manual. If you have any problems with the system, contact your nearest Nikon representative.

3. Read the instruction manuals carefully

For your safety, carefully read this manual as well as the manual provided with the other equipment you are using with this system. Make certain to heed the warnings and cautions at the beginning of each manual.

- **Cautions regarding the power supply:** Read the manual for the microscope.
- **Cautions regarding lamp heat:** Read the manuals for the microscope and the light source (super high-pressure mercury lamp power supply or high-intensity light source).
- **Cautions regarding ultraviolet light produced by the lamp:** Read the manual for the light source (super high-pressure mercury lamp power supply or high-intensity light source).
- **Cautions regarding lamp bursting and the gas sealed inside the lamp:** Read the manual for the light source (super high-pressure mercury lamp power supply or high-intensity light source).
- **Cautions regarding the lamp specifications:** Read the manual for the microscope and the light source (super high-pressure mercury lamp power supply or high-intensity light source).

4. Mercury lamps and xenon lamps

The mercury (or xenon) lamp used with this system requires special handling. To use this system safely and correctly, carefully read the warnings below and beware of the dangers. Also carefully read the manual for the super high-pressure mercury lamp power supply (or high-intensity light source) and the manual (if provided) by the manufacturer of the lamp and follow their instructions.

Hazards of Mercury Lamps and Xenon Lamps

- 1 Mercury (and Xenon) lamps, when turned on, radiate ultraviolet light that is harmful to the eyes and skin. Direct viewing of the light may result in blindness.
- 2 Gas is sealed under very high pressure inside the lamps. The pressure increases when the lamp is on. If the lamp is scratched, dirty, subjected to high external pressure or physical impact, or used beyond its operational life, the sealed gas may escape or the lamp may burst. This can result in someone inhaling the gas, injuring themselves on the glass, or other accidents.
- 3 When the lamp is on, the lamp and its surroundings become extremely hot. Touching the lamp with bare hands could result in burns. Flammable materials placed near the lamp could ignite.
- 4 Using other than the specified type of lamp could result in an accident, such as burst.

Because safety is a top priority in the design of Nikon products, the hazards described above should not pose any danger as long as you heed all of the warnings and cautions in the manuals and use the system only for its intended purpose.

However, if you fail to heed all of the warnings and cautions in the manuals, if you strike the system, or if you attempt to disassemble the system, the accidents may occur. Be sure to heed all of the warnings and cautions.



WARNING

5. Always turn the lamp off when changing filter blocks

When changing filter blocks, always be sure to turn off the lamp connected to the Epi-fl attachment. If the lamp is left on, you might be exposed to ultraviolet light.



CAUTION

1. Turn off the power when assembling the equipment, connecting or disconnecting cables, or replacing the lamp.

To prevent electric shock and damage to the equipment, always turn off the power switch on the microscope and unplug the power cord before assembling the system, connecting or disconnecting cables, or replacing the lamp.

2. Do not spill liquid on the equipment

Wetting the microscope or this system may cause a short circuit and the equipment could be damaged or could become extremely hot. If you accidentally spill liquid on the equipment, immediately turn the power switch off and unplug the power cord. Then use a dry cloth to wipe away the moisture. If any liquid gets inside of the equipment, do not attempt to use it; instead, contact your nearest Nikon representative.

3. Caution concerning assembly

Be careful not to pinch your hands or fingers when assembling the equipment.

Notes on Handling the System

1. Handle the system gently

This system is a precision optical instrument. Handle the system gently, avoiding any physical shocks.

2. Handling of filters

- Interference filters (especially excitation filters, which are exposed to strong light) deteriorate with time. Replace them according to the number of hours they have been in use.
- Filter characteristics may change if the filter is exposed to high humidity. To prevent changes in or deterioration of filter characteristics, avoid using or storing the filters under conditions of high humidity or high temperature, and avoid subjecting them to rapid temperature changes. When a filter is not in use, store them in a desiccator or a hermetically sealed container with a drying agent.
- The filters in the nine types of filter blocks listed below offer sharp, high-resolution waveform characteristics in comparison with normal filters. However, because they have sophisticated coatings, they must be handled with extra care. Abrasion caused by cleaning is a special concern. (Follow the procedure described in section “1. Filter and lens cleaning” of chapter “7. Care and Maintenance.”)

Single-band filter blocks: DAPI, FITC, TxRed

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

3. Dirty lenses

Do not get dust, fingerprints, etc., on the lenses. Dirt on the lenses, mirrors, etc., will adversely affect the image. If any of the lenses get dirty, clean them as described in chapter “7. Care and Maintenance.”

4. Installation location

To avoid degraded performance and to prevent malfunctions, consider the following requirements when selecting an installation location:

- Install the system in a location with little vibration.
- Avoid installing the system in a location exposed to direct sunlight.
- Avoid installing the system in a dusty location.
- Avoid installing the system in a location subject to high temperatures (40°C or higher) or high humidity (60% or higher). (Such conditions could allow mold or condensation to form on the lenses and filters.)

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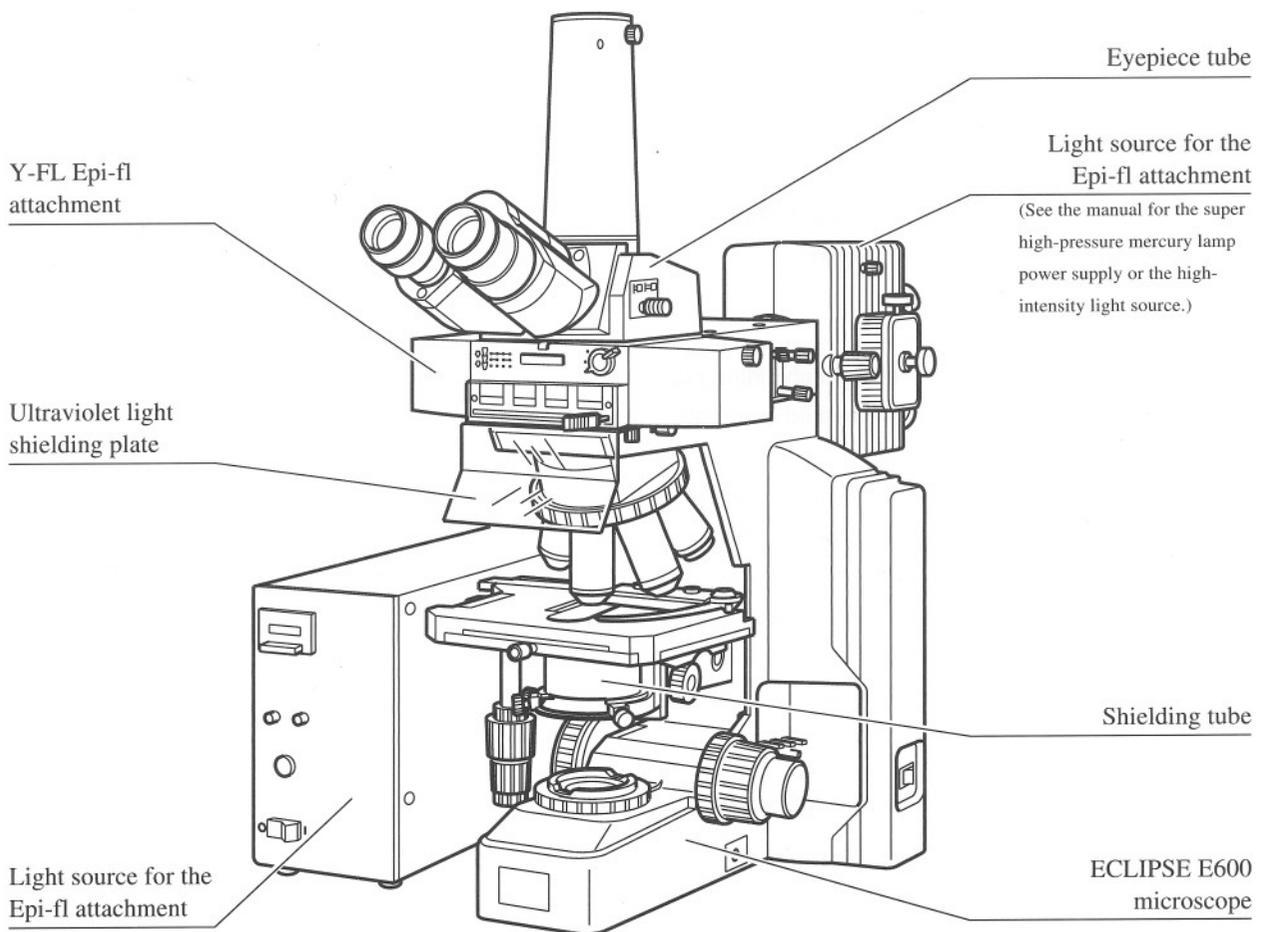
1

Names of Component Parts

See chapter “2. Names of Operational Parts” for the names of the parts that are used to operate the system. If the system is not yet assembled, see chapter “5. Assembly” first.

For details on the assembly and handling of the microscope and light source, see their respective manuals.

(The illustration depicts a Nikon ECLIPSE E600 microscope with a mercury lamp as the light source.)



2

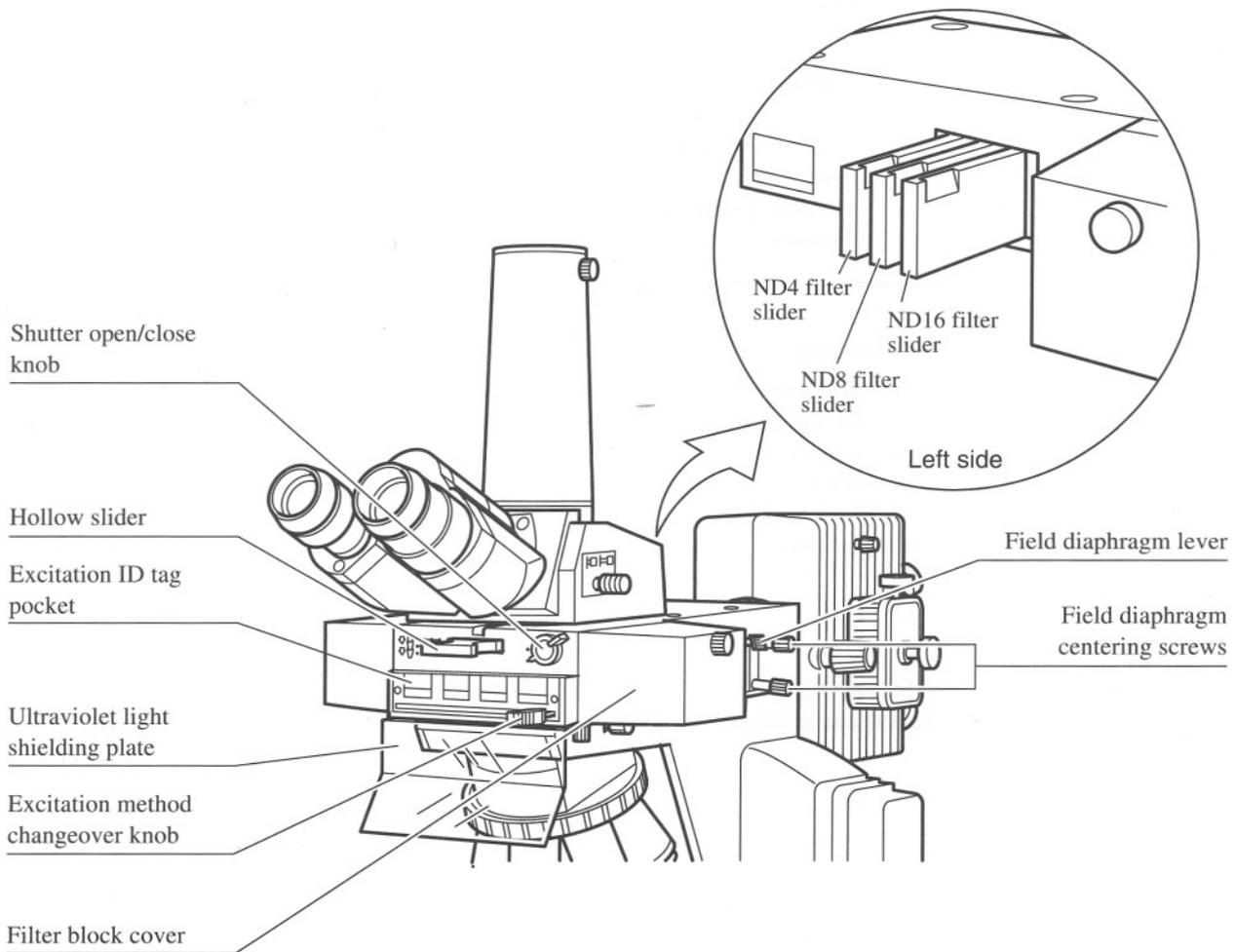
Names of Operational Parts

See chapter "1. Names of Component Parts" for the names of the components of the system.

If the system is not yet assembled, see chapter "5. Assembly," first.

For details on the assembly and handling of the microscope and light source, see their respective manuals.

(Not all components may be included in your set.)



The general procedure for microscopy is described below.

For details on each step, see the corresponding item in chapter “4. Operation of Each Part.”

If the system is not yet assembled, see chapter “5. Assembly” first.

For details on the assembly, handling, and use of the microscope and light source, see their respective manuals.



WARNING Before using the system, be sure to read the “**WARNING**” and “**CAUTION**” sections at the beginning of this manual, and also the section entitled, “Notes on Handling the System.” Be certain to heed all of the warnings and cautions. Also be sure to read the manuals for any other products that you are using with this system (the microscope, super high-pressure mercury lamp power supply, high-intensity light source, etc.), and heed all of the warnings and cautions in those manuals.

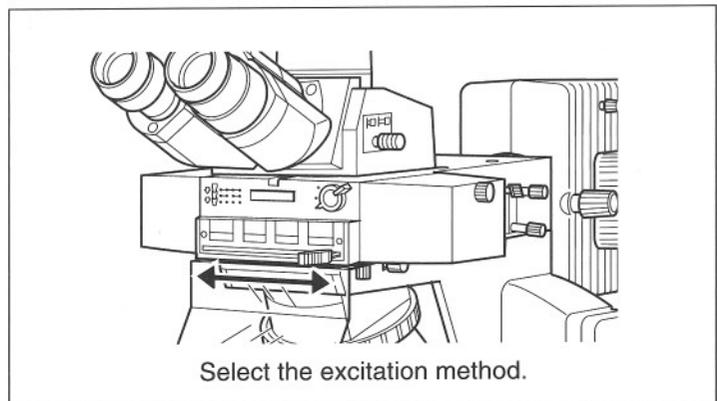
Before starting

- 1 Check the cumulative “lit on” time of the lamp. If the time has exceeded the average operational life for lamps of its kind, replace the lamp.
- 2 Use a non-flourescent slide glass.
- 3 Use a non-flourescent immersion oil.
- 4 To prevent fading of the specimen, always close the shutter whenever you are not actually looking through the binocular eyepiece.

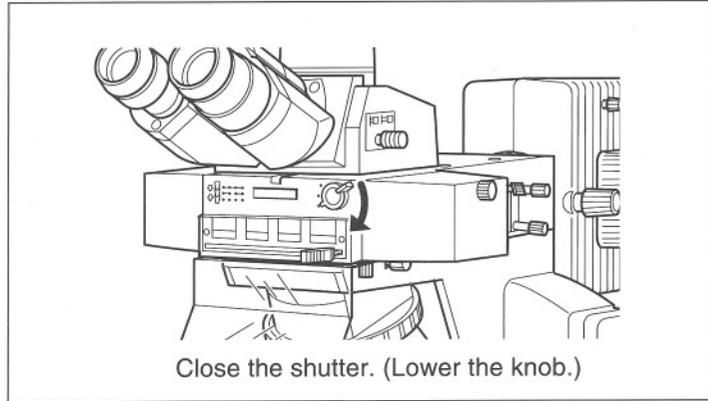
1

Epi-fl microscopy

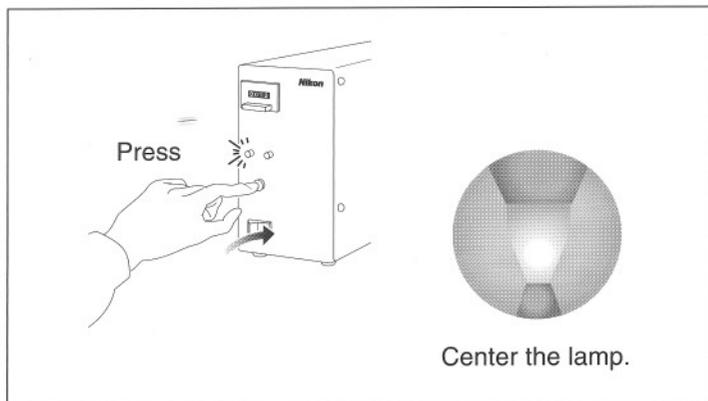
- 1 Slide the excitation method changeover knob to the right or left to insert the filter block of the desired excitation method into the optical path. (p.17)



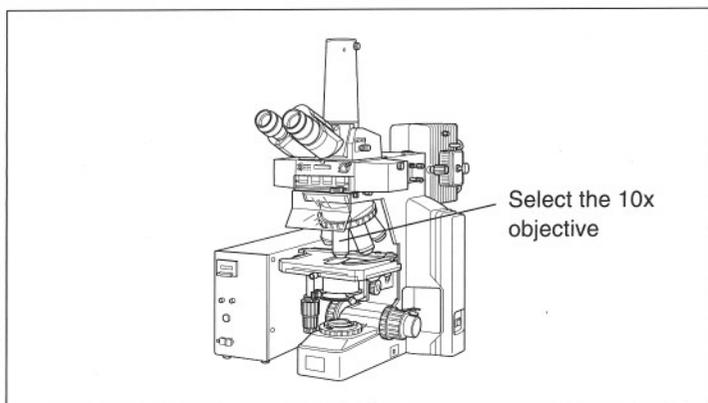
- 2** Close the shutter so that the optical path is blocked.
(p.15)



- 3** Turn the lamp on and center the lamp.
For details, see the manual for the light source (super high-pressure mercury lamp power supply or high-intensity light source).

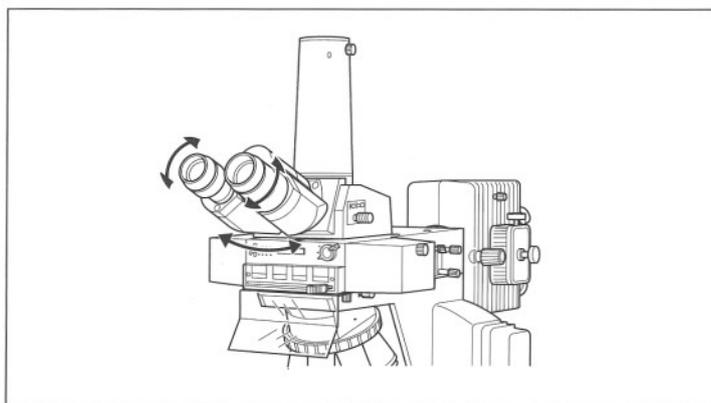


- 4** Place the specimen on the stage and focus on the specimen with the 10x objective.
For details, see the manual for the microscope.

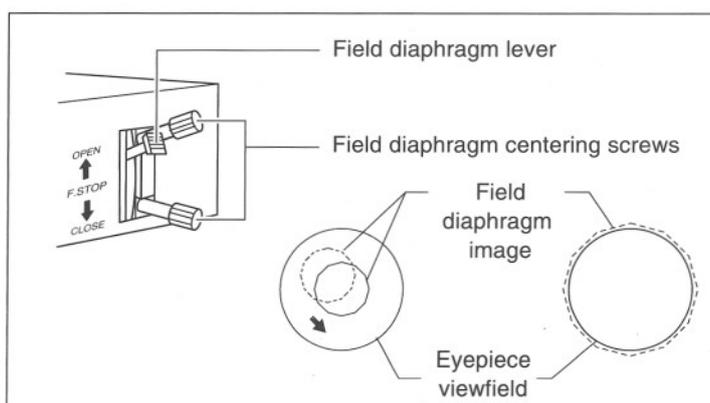




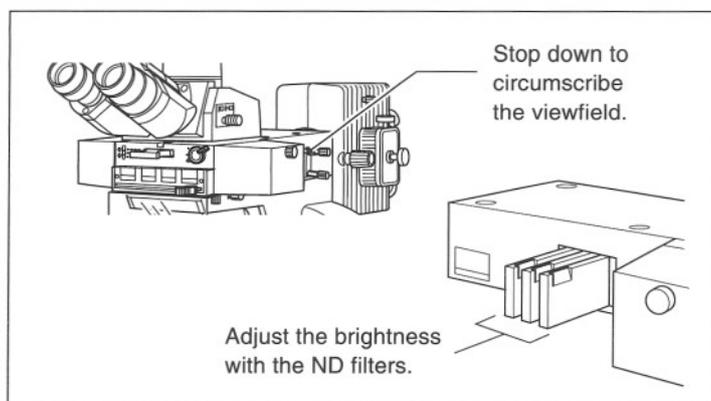
- 5** Adjust the diopter and the interpupillary distance. For details, see the manual for the microscope.



- 6** Center the field diaphragm. (p. 15)



- 7** Switch to any desired objective and view the specimen.
- Readjust the focus.
 - Use ND filters to adjust the brightness. (p. 16)
 - Close the field diaphragm so that it is just outside the view field. (p. 15)
 - When using an oil-immersion type objective, apply immersion oil between the specimen and the objective. (p. 21)



2 General bright-field microscopy

The microscope with the Epi-fl attachment can be used for general bright-field microscopy in the same way as an ordinary bright-field microscope.

- 1 Remove the shielding tube and install a condenser in its place.
- 2 Close the shutter on the Epi-fl attachment so that the episcopic illumination is blocked.
- 3 Slide the excitation method changeover knob to the position where no filter block is set (empty position).
- 4 Turn on the microscope to turn on the diasopic illumination.
- 5 Focus on the specimen.
- 6 Perform the condenser focusing, centering and aperture diaphragm adjustments and then adjust the microscope field diaphragm. Refer to the instruction manual of the microscope for details.

3 Epi-fl microscopy and DIC (differential interference contrast) microscopy

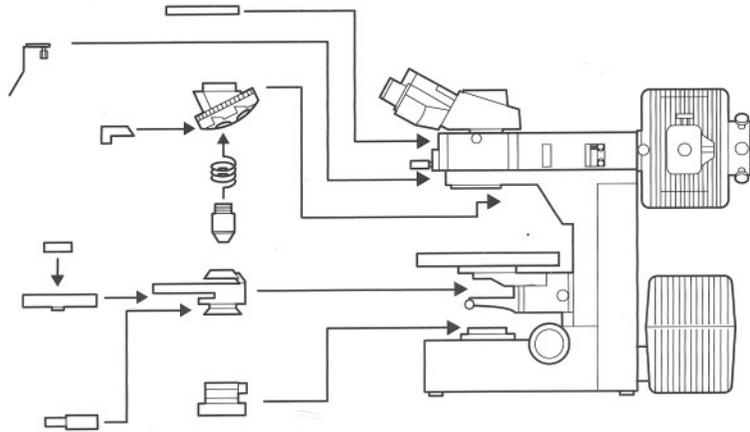
In addition to the Epi-fl microscopy, the differential interference contrast (abbreviated as “DIC” hereunder) microscopy can also be performed by combining certain accessories. The DIC microscopy can be used to search for certain objects instead of Epi-fl microscopy that discolors the specimens. Simultaneously using Epi-fl microscopy with DIC microscopy makes it possible to compensate for the shortcomings of each method. Refer to the instructions for the C-CU universal system condenser for details on the DIC microscopy.

Accessories required for DIC microscopy

- DIC sextuple nosepiece
- Objective DIC prisms
- DIC objectives
- Analyzer slider
- C-CU universal system condenser
 - Top lens
 - Condenser DIC prisms
 - Condenser turret
 - Lambda plate
- Polarizer

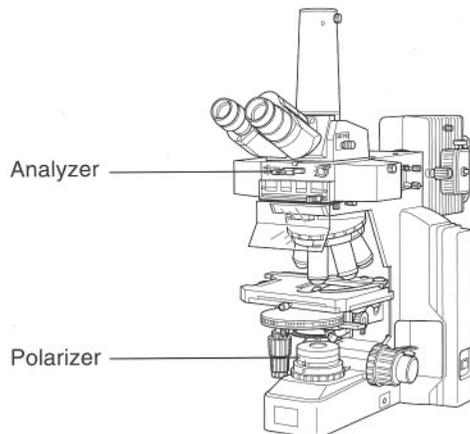


- 1 Install the accessories.



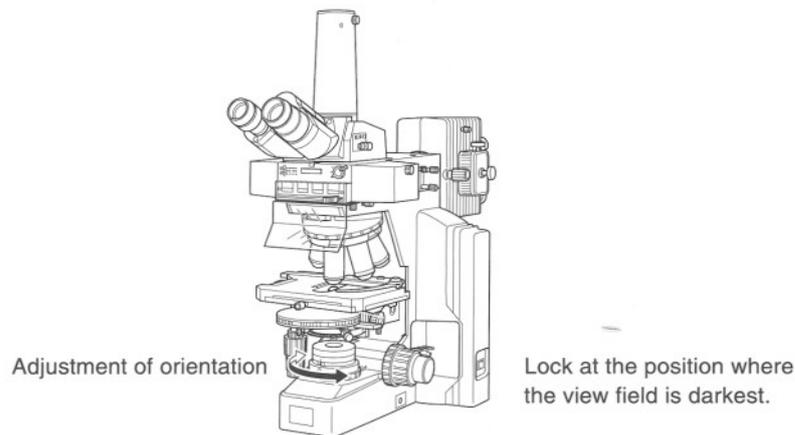
For details, refer to the instructions for the C-CU universal system condenser. The special analyzer slider (Y-FA FL/DIC analyzer) should be used when combining Epi-fl and DIC microscopy. Remove the hollow slider from the Epi-fl attachment and insert the analyzer slider in its place.

- 2 Close the shutter on the Epi-fl attachment to block the optical path of the episcopic illumination.
- 3 Slide the excitation method changeover knob to the position where no filter block is set (empty position).
- 4 Turn on the microscope power to turn on the diascope illumination.
- 5 Insert the polarizer and analyzer into the optical path.



- 6 Turn the condenser turret so that the indication "A (empty position)" comes to the front.
- 7 Bring the DIC objective into the optical path.
- 8 Focus on the specimen.
- 9 Perform centering and focusing of the system condenser.

- 10 Adjust the orientation of the polarizer.



- 11 Turn the condenser turret so that the indication (L, M or H) matches the DIC code of the objective (DIC L, DIC M or DIC H).
- 12 Adjust the aperture diaphragm and field diaphragm.

When performing Epi-fl and DIC microscopy simultaneously, insert the filter block of the desired excitation method into the optical path and open the shutter of the Epi-fl attachment.

Adjust the ND filters of the Epi-fl attachment, ND filters and the brightness adjuster of the microscope so that the brightness levels of the fluorescent image and the DIC image are balanced.

4

Epi-fl microscopy and phase contrast microscopy

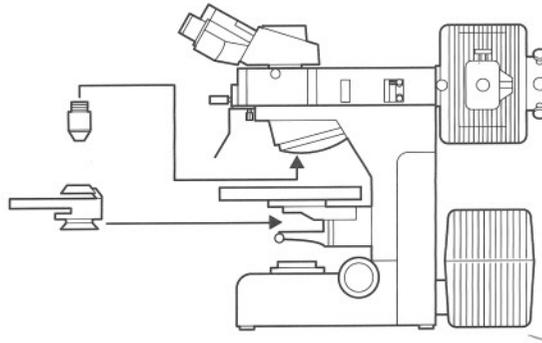
In addition to the Epi-fl microscopy, the phase contrast microscopy can also be performed by combining certain accessories. The phase contrast microscopy can be used to search for certain objects instead of Epi-fl microscopy that discolors the specimens. Simultaneously using Epi-fl microscopy with phase contrast microscopy makes it possible to compensate for the shortcomings of each method.

Refer to the instructions for the C-C Ph condenser (or C-CU universal system condenser) for details on the phase contrast microscopy.

Accessories required for phase contrast microscopy

- Ph objective
- C-C Ph condenser or C-CU universal system condenser
- Centering telescope

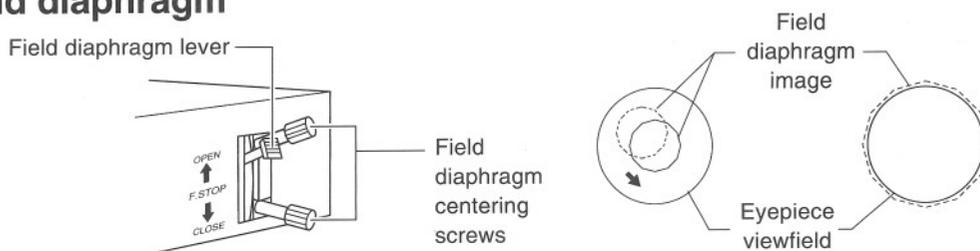
- 1 Install the accessories.



- For details, refer to the instructions for the C-C Ph condenser or C-CU universal system condenser.
- 2 Close the shutter on the Epi-fl attachment to block the optical path of the episcopic illumination.
 - 3 Slide the excitation method changeover knob to the position where no filter block is set (empty position).
 - 4 Turn on the microscope power to turn on the diascope illumination.
 - 5 Bring the Ph objective into the optical path.
 - 6 Turn the condenser turret so that the indication "A (empty position)" comes to the front.
 - 7 Focus on the specimen.
 - 8 Perform centering and focusing of the condenser.
 - 9 Turn the condenser turret so that an indication that matches the Ph code of the objective (Ph1, Ph2 or Ph3) comes to the front.
 - 10 Center the Ph annular diaphragm of the condenser.
The centering procedures for the C-C Ph condenser and the C-CU universal system condenser are different. Refer to the instructions of the condenser being used.
 - 11 Adjust the field diaphragm.

When performing Epi-fl and phase contrast microscopy simultaneously, insert the filter block of the desired excitation method into the optical path and open the shutter of the Epi-fl attachment. Insert and remove the ND filters of the Epi-fl attachment and the microscope so that the brightness levels of the fluorescent image and the phase contrast image are balanced.

1 Field diaphragm



The field diaphragm restricts illumination to the area being viewed. Turning the field diaphragm lever changes the size of the field diaphragm. For normal observation, the size of the diaphragm should be such that it is just outside (or inside) the edge of the view field. If a broader area than necessary is illuminated, stray light from outside sources will enter the optical system, creating flaring, reducing the contrast of the optical image, and expanding the area of fading of the specimen.

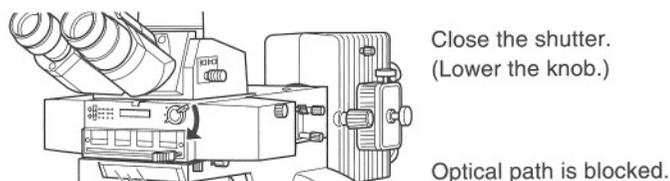
The operation of the field diaphragm is especially important in photomicrography; generally, the best results are obtained by stopping down the field diaphragm to just slightly larger than the area that will be reproduced on the film, i.e., the size of the picture composition frame.

The field diaphragm of this Epi-fl attachment needs to be centered before usage.

Centering the field diaphragm

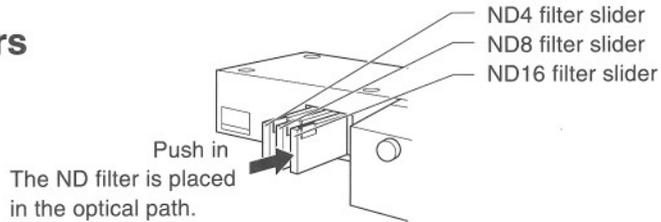
- 1 Perform steps **1** to **5** in "1. Epi-fl microscopy" of chapter "3. Microscopy".
- 2 Stop down the field diaphragm. (Lower the field diaphragm lever.)
- 3 Move the center of the field diaphragm image to the center of the view field. (Turn the field diaphragm centering screws.)
- 4 Adjust the field diaphragm to roughly the size of the view field. (Raise the field diaphragm lever.)
- 5 Once again, move the center of the field diaphragm image to the center of the view field. (Turn the field diaphragm centering screws.)

2 Shutter



The shutter blocks the light from the light source. To prevent fading of the specimen, always close the shutter when not observing a specimen. (Turning the shutter open/close knob clockwise closes the shutter to block the optical path.) Make closing the shutter a habit to protect important specimens. In addition, when temporarily halting Epi-fl microscopy in favor of microscopy using diascopic light, do not forget to close the shutter and block the episcopic fluorescent light.

3 ND filters



An ND filter reduces illumination without changing the color balance of the light. When using strong fluorescent light, or when a specimen is badly faded, adjust brightness by pushing the ND filter sliders to the right to place the ND filters in the optical path. (If the fluorescent light is too strong, the contrast may worsen.)

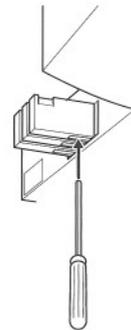
The chart on the right shows how brightness is affected by different combinations of ND filters.

ND4	ND8	ND16	Brightness
—	—	—	1
○	—	—	1/4
—	○	—	1/8
—	—	○	1/16
○	○	—	1/32
○	—	○	1/64
—	○	○	1/128
○	○	○	1/512

○ : In optical path — : Not in optical path

Removal of ND filter sliders

Pull out the ND filter slider while pushing on the portion shown in the figure with a hexagonal screwdriver or the like.



CAUTION Be sure to turn off the light source of the Epi-fl attachment when removing an ND filter slider.

4 Ultraviolet light shielding plate

The ultraviolet light shielding plate prevents the ultraviolet light (irradiated from the objective to the specimen) from bouncing back and entering the observer's eye. To remove this plate, loosen the clamp screws and then pull the plate forward.

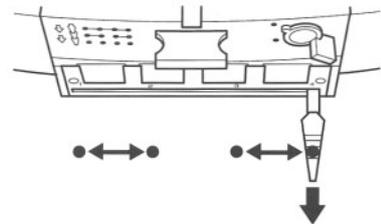
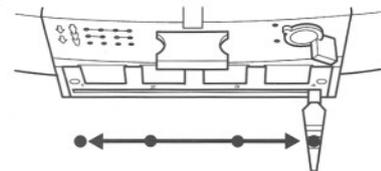
5 Excitation method changeover knob

This attachment can hold a maximum of four filter blocks.

Slide the excitation method changeover knob to the right or left to bring the filter block of the desired excitation method into the optical path. The changeover mechanism has the functions described below.

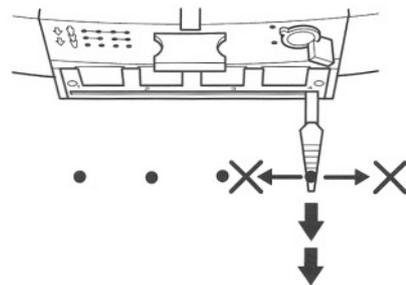
Changeover limiting

When the excitation method changeover knob is pulled out one notch, the knob's movement is limited to two positions on the right (positions 1 and 2) or two positions on the left (positions 3 and 4). This is useful when distinguishing frequently used excitation methods from those which are not.

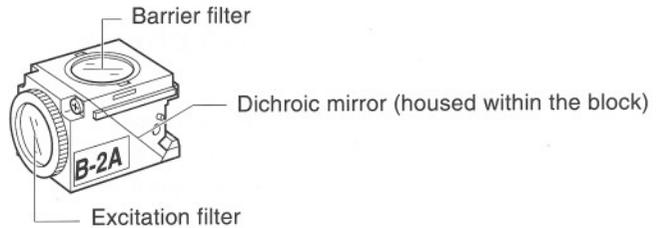


Changeover locking

Pulling out the excitation method changeover knob two notches causes the slide mechanism to be locked. This prevents the excitation method from being changed inadvertently. This is also useful when installing filter blocks.



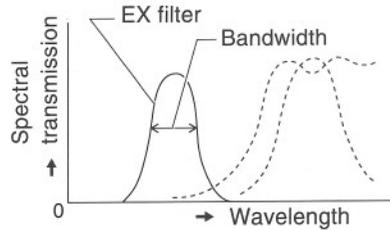
6 Filter blocks



Filter blocks consist of three types of optical components: an excitation filter (EX filter), a barrier filter (BA filter), and a dichroic mirror (DM). Using the items below as a guide, select a combination that best suits your purposes and the characteristics of the specimen and the fluorescent stain.

- You can select different combinations of excitation and barrier filters within the same excitation method.
- Excitation filters, barrier filters, and dichroic mirrors can all be purchased individually.
- Excitation filters will deteriorate over time since they are exposed to intense light. Replace them as necessary.
- See page 27 for the installation procedure of filter blocks.

1. Selecting excitation filters (EX filters)



Excitation filters selectively pass the light within a certain range of wavelengths needed to cause the specimen to fluoresce (excitation light) and filter out all other light. The range of wavelengths that a given filter passes is called the “bandwidth” of the filter. An excitation filter’s bandwidth determines the brightness of the fluorescent image, the occurrence of self-fluorescence (fluorescence originating from materials other than the fluorescent stain), and the extent of fading. A wide bandwidth allows a high level of excitation light to illuminate the specimen, producing a brighter image. However, a wide bandwidth also leads to a high level of self-fluorescence and severe fading. Conversely, while a narrow bandwidth yields a dark image, since little excitation light reaches the specimen, self-fluorescence and fading are minimal. When self-fluorescence is pronounced, use an excitation filter with a narrow bandwidth. (The resulting fluorescent image will be darker, however.)

Excitation filters are likely to deteriorate the more they are used, since they are exposed to intense light. Replace excitation filters as necessary.

	Excitation filter bandwidth	
	Narrow	Wide
Brightness of fluorescent image	Dark	Bright
Occurrence of self-fluorescence	Minimal	Pronounced
Extent of fading	Minimal	Pronounced

2. Selecting barrier filters (BA filters)

A barrier filter allows only fluorescent light generated by the specimen to pass and blocks all other excitation light reflected from the specimen. This filter makes it possible to observe the fluorescent image without unnecessary light (i.e., on a dark background).

There are two types of barrier filters: LP filters (long-pass filters), which block all wavelengths that are shorter than a certain boundary wavelength and allow to pass all wavelengths longer than the boundary wavelength, and BP filters (band-pass filters), which allow only light in a certain range of wavelengths to pass. Use whichever type best suits your purposes.

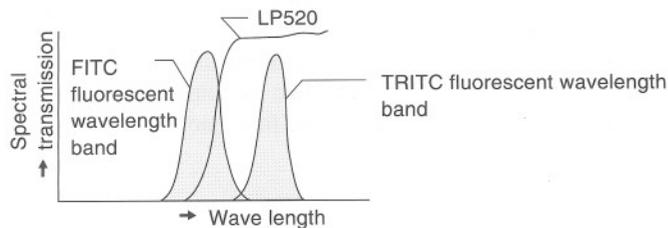
LP filters (long-pass filters)

LP filters block all wavelengths that are shorter than a certain boundary wavelength and allow to pass all wavelengths longer than the boundary wavelength. The boundary wavelength is called the cut-on wavelength.

- ① When the specimen is stained with a fluorescent color for which the fluorescent light wavelength band and the excitation wavelength band (the light that is absorbed by the specimen in order to fluoresce) are extremely close together, the fluorescent light can generally be seen most effectively if a barrier filter with a "cut-on" wavelength that is comparatively short, within the range permitted by performance considerations, is selected.

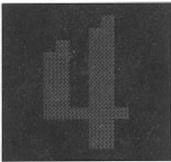
As a general rule, the longer the cut-on wavelength is, the completer the separation is between the excitation light and the fluorescent image becomes. Recently, however, because of improved filter performance, it is becoming increasingly common to use barrier filters with shorter cut-on wavelengths.

- ② To view the fluorescent images of all of the colors in a specimen stained in multiple colors, use an LP filter.



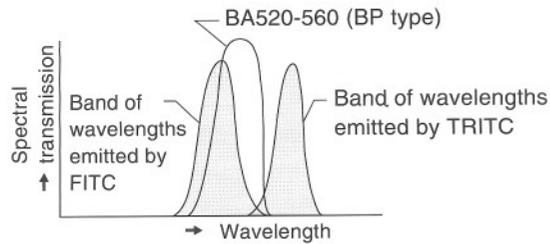
Both the FITC fluorescent image and the TRITC fluorescent image are visible.

However, when using a normal dichroic mirror, an excitation filter, and an LP filter-type barrier filter in combination, the stain that fluoresces at the longer wavelength (for example, TRITC when the specimen is stained with FITC and TRITC) may not be excited sufficiently, with the result that the fluorescent image created by that stain may appear extremely dark. In this type of situation, the use of a multi-band filter is recommended.



BP filters (band-pass filters)

A BP filter allows only light in a certain range of wavelengths to pass. This type of filter is used to view the fluorescent image created by a specific stain when a given specimen has multiple stains. (For example, in a specimen with two stains, FITC and TRITC, select BA520-560 to observe the fluorescent image created by FITC.)



Only the fluorescent image created by FITC is visible

However, you may not be able to distinguish the self-fluorescence from the other fluorescence in the image created by the BP filter since the image will be of only one color (green, in the above example).

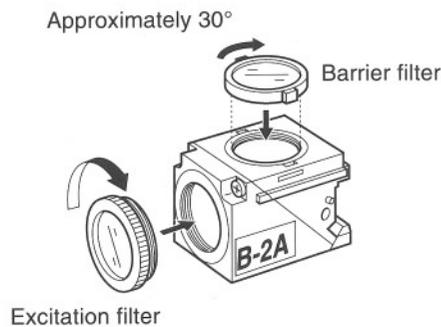
It is best to use LP filter if you wish to distinguish the self-fluorescence from the subtle hue.

3. Excitation filter and barrier filter replacement

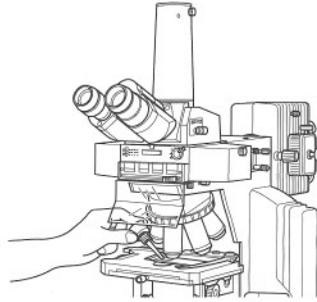
Excitation and barrier filters can be removed from the filter block and replaced with other filters. (The dichroic mirror cannot be removed from the filter block.)

The excitation filter screws into the filter block.

The barrier filter plugs into the filter block. Align the notches on the filter block with the protrusions on the barrier filter, fit the filter into place, and then rotate the filter about 30° in a clockwise direction to secure.



7 Oil-immersion type objectives



Objectives marked “oil” are oil-immersion type objectives. These objectives are used with immersion oil applied between the specimen and the tip of the objective. Always use non-fluorescent oil. (For example, Nikon Immersion Oil DF.) If other kinds of oil is used, fluorescent light from the oil may adversely affect the image.

Bubbles in the oil will adversely affect the viewing of the image. Be careful to prevent the formation of air bubbles. To check for air bubbles, remove the eyepiece, open the field diaphragm and the aperture diaphragm as far as possible, and look at the exit pupil of the objective within the eyepiece tube. (The exit pupil will appear as a bright circle.) If it is difficult to see if there are any bubbles, mount a centering telescope (sold separately) to the eyepiece tube using an adapter (sold separately) (refer to the manual supplied with the microscope) and rotate the eyepiece part of the telescope. If there are bubbles in the oil, remove them by one of the following methods:

- Turn the revolving nosepiece slightly, moving the objective in question back and forth one or two times.
- Add more oil.
- Remove the oil and replace it with new oil.

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

Any oil remaining on oil-immersion type objectives or on the tip of dry-type objectives has a discernible, negative effect on the image. After using oil, wipe all of it away and also make sure that there is no oil on the tips of the other objectives. Oil on the condenser lens should also be wiped away carefully after use.

Use petroleum benzene to wipe away immersion oil. Then, after the oil has been removed, wipe the lens surfaces, etc., with absolute alcohol (ethyl alcohol or methyl alcohol).

If you cannot obtain petroleum benzene, use methyl alcohol. However, because methyl alcohol does not clean as well as petroleum benzene, it will be necessary to wipe the surfaces repeatedly. (Usually, three or four times is sufficient to clean the lenses.)

Use petroleum benzene only to remove immersion oil from the tips of objectives; do not use it for cleaning the fluorescent filters, etc. Use absolute alcohol and petroleum benzene according to the instructions provided by their manufacturers.

8 Fluorescent photomicrography

For the basic procedures and key points of photomicrography, see the manual provided with the photomicrographic equipment. Please note, however, that when using a fluorescent specimen, the fluorescence may fade during exposure. Take the following countermeasures in order to avoid this problem.

1. Use high-sensitivity film

Use “Tri-X (ISO400)” for monochrome photomicrograph. For color shots, use daylight-type high-sensitivity film, such as “Kodak Ektachrome 400 (ISO400)” or “Fujichrome 400 (ISO400).”

2. Creating a bright optical system combination

Even if the total magnification on the film is the same, the exposure time can vary greatly for different combinations of objectives and projection lenses. Rather than increasing the magnification of the projection lens, increasing the magnification of the objective is recommended. (This is because, in general, the numerical aperture of the objective increases as the magnification increases, and the higher the numerical aperture, the brighter the image.)

3. Adjusting the excitation light

If the excitation light is too bright, the specimen will fade quickly, making it impossible to get a good shot of the fluorescent image. Therefore, adjust the brightness by inserting ND filters into the optical path.

4. Specimen

If a faded portion of a specimen is shot, the exposure time increases, the color reproduction is poor, and the resulting photomicrograph will not be satisfactory. Move the specimen and shoot a more vivid portion of the specimen that has not been previously exposed to the excitation light. We recommend using the differential interference contrast method or the phase contrast method to select the portion to be shot, and then switching to the Epi-fl method for shooting the actual photomicrograph.

9 TV monitoring

When monitoring a specimen using a high-sensitivity TV camera, it is sometimes best to insert an infrared (IR) cut filter in front of the camera receptor. Experiment, and use the IR cut filter when needed.

The procedures for assembling the system are described below.

For details on the assembly, handling, and usage of the microscope, super high-pressure mercury lamp, etc., see their respective manuals.



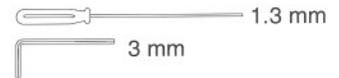
WARNING Before using the system, be sure to read the **WARNING** and **CAUTION** sections at the beginning of this manual, and also the section entitled, “Notes on Handling the System.” Be certain to heed all of the warnings and cautions.

Also be sure to read the manuals for any other products that you are using with this system (the microscope, super high-pressure mercury lamp power supply, high-intensity light source, etc.), and heed all of the warnings and cautions in those manuals. In particular, mishandling a mercury (or xenon) lamp used with this system can lead to a serious accident. Exercise caution.

In order to prevent electric shock, fire, accidents involving ultraviolet light, burns, and other injuries, make sure that the power switches for the microscope and super high-pressure mercury lamp (or high-intensity light source) power supply are turned off before beginning assembly work.

Required tools

- Hexagonal screwdriver: 1 (Provided with the microscope)
- Hexagonal wrench: 1 (Provided with the Epi-fl attachment)



See the illustrations while assembling the system.

Scratches or fingerprints on the lenses and filters will adversely affect the image. Handle these components carefully in order to keep them free from scratches and fingerprints.

1. Installation location

In order to avoid degraded performance and to prevent malfunctions, take the following requirements into consideration when selecting a location to install the system:

- Install the system in a location with little vibration.
- Avoid installing the system in a location exposed to direct sunlight.
- Avoid installing the system in a dusty location.
- Avoid installing the system in a location subject to high temperatures (40°C or higher) or high humidity (60% or higher).

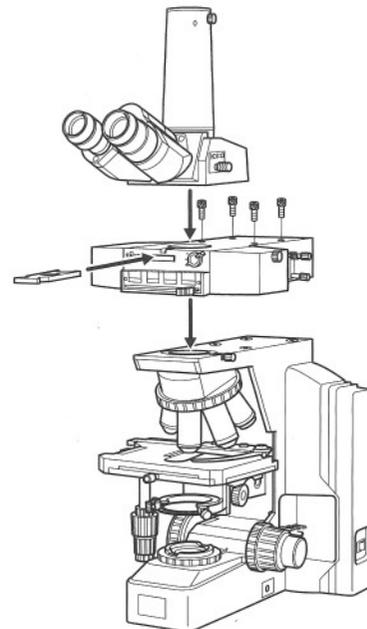
(Such conditions could allow mold or condensation to form on the lenses and filters.)

2. Microscope assembly

Follow the instructions in the microscope manual.

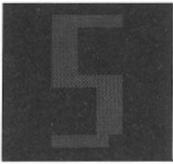
3. Installing the Epi-Fl Attachment

- 1 Place the Epi-fl attachment on the arm of the microscope.
- 2 Secure by tightening the clamp screw on the right side of the arm.
- 3 Fasten the Epi-fl attachment to the microscope by tightening the four bolts (provided) with a hexagonal wrench.
- 4 Cover the bolt-holes with the supplied stickers.
- 5 Insert the hollow slider into the slot in the front of the Epi-fl attachment.



4. Installing the Eyepiece Tube

Install the eyepiece tube on the upper mount of the Epi-fl attachment and secure by tightening the clamp screw on the front of the Epi-fl attachment with a hexagonal screwdriver.



5. Mounting the shielding tube

Mount the shielding tube on the microscope's substage (where the condenser is normally mounted) and secure it in place with the condenser clamp screw.



CAUTION Failure to mount the shielding tube could allow ultraviolet light that passes through the specimen to leak out. (Ultraviolet light is not visible to the human eye.) Be certain to mount the shielding tube.

6. Mounting the ultraviolet light shielding plate

Mount the ultraviolet light shielding plate under the Epi-fl attachment and secure it in place with the locking screws.



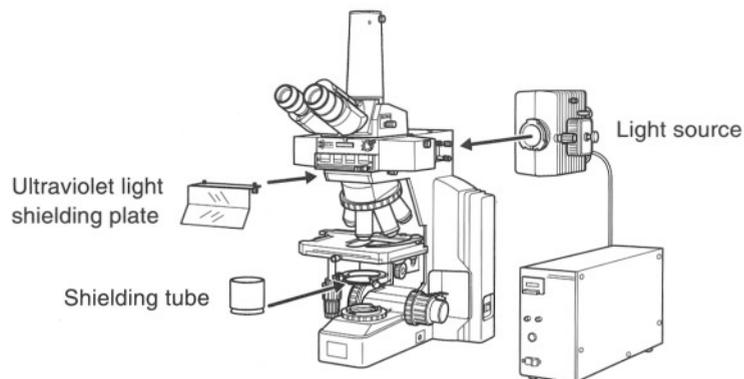
CAUTION Failure to mount the ultraviolet light shielding plates could allow ultraviolet light to reflect off of the specimen and back into the observer's eye. (Ultraviolet light is not visible to the human eye.) Be certain to mount the ultraviolet light shield.

7. Installing the light source

Install the light source to the Epi-fl attachment. (For details, see the manual provided for either the super high pressure mercury lamp power supply or the high-intensity light source.)



WARNING A mercury lamp (or xenon lamp) requires careful handling. Be sure to heed all of the warnings and cautions in the manual for the light source.

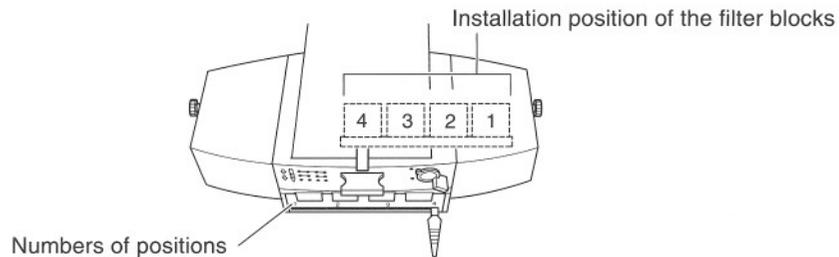


8. Installing the filter blocks

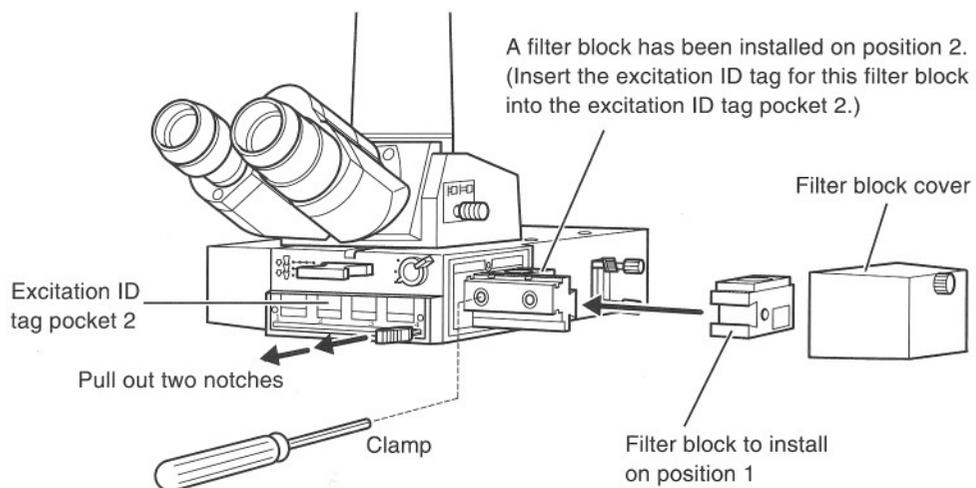
Do not touch the surfaces of the filters.

A maximum of four filter blocks can be installed. When performing diascopic microscopy in addition to Epi-fl microscopy, only install up to three filter blocks and leave one space empty.

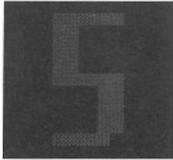
Install filter blocks at positions 1 and 2 from the right side and at positions 3 and 4 from the left side. Installation starts from the right side in the following installation procedure.



- 1 Remove the filter block cover.
- 2 Slide the excitation method changeover knob to position 4.
- 3 Pull out the excitation method changeover knob two notches. When in this position, the knob is locked and prevented from sliding. This makes the following procedures easier.
- 4 Insert a filter block (to be mounted on position 2) into the installation dovetail and push in until you can feel it click into the second click position.
- 5 Clamp in position with a hexagonal screwdriver.



- 6 Insert the filter block to be mounted on position 1 and clamp in position.



- 7** Push in the excitation method changeover knob as far as it will go to unlock it.
- 8** Install the filter block cover.
- 9** Install filter blocks on the left side in the same way.
- 10** Insert the excitation ID tags for each filter block installed into the excitation ID tag pocket.

This completes the assembly procedure.



Troubleshooting Tables

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
Lamp does not light.	The power is not supplied.	Plug the power cord into an outlet.
	The lamp connector is not connected to the power supply.	Connect the lamp connector to the power supply.
	The lamp has reached the end of its operational life.	Replace the lamp.
	The fuse is blown.	If the fuse can be replaced, replace it. Otherwise, contact your nearest Nikon representative.
Even though the lamp is on, the image is not visible.	The shutter is closed.	Open the shutter.
	The filter block selection is incorrect.	Select the correct filter block.
Even though the lamp is on, the image is extremely dark.	The light source is not centered properly.	Center the lamp. Especially when using a 100x objective, recenter the lamp while observing the fluorescent image.
	ND filters are in the optical path.	If necessary, remove the ND filters from the optical path.
	A halogen lamp is being used with a dark specimen.	Change the light source to a mercury lamp.
	A designated objective is not being used with UV or V excitation.	Use the designated objective.
	The room is too bright.	Darken the room.
Contrast is poor.	The objective or cover glass is dirty.	Clean the objective or cover glass.
	The immersion oil is fluorescing.	Use non-fluorescent immersion oil (Nikon Immersion Oil DF).
	The slide glass is fluorescing.	Use a non-fluorescent slide glass.



6. Troubleshooting Table

Problem	Cause	Countermeasure
Viewing is poor.	There is no cover glass in place.	Use a cover glass. (However, no cover glass is required when using an NCG objective.)
	No immersion oil has been applied to the tip of an immersion-oil type objective.	Apply Nikon Immersion Oil DF.
	The specified immersion oil is not being used.	Apply Nikon Immersion Oil DF.
	The filter block being used is not suited for the specimen.	Use a filter block suited for the specimen.
The view field is vignetting.	The field diaphragm has been stopped down too far.	Open the field diaphragm so that it is just outside of the view field.
	The ND filter slider has stopped at an intermediate position.	Pull out or push in the slider all of the way.
	The installed position of a filter block has deviated from the prescribed position.	Clamp at the prescribed position.
Excitation method changeover knob does not move.	The knob is pulled out to the LIMIT or LOCK position.	Push in the excitation method changeover knob as far as it will go.



Care and Maintenance

1 Filter and lens cleaning

Do not get dust, fingerprints, etc., on the lenses or filters. Dirt on the lenses, filters, etc., will adversely affect the image. If any of the lenses or filters get dirty, clean them as described below.

- Use an air blower to blow away dust. If that does not suffice, brush away the dust with a soft brush, or wipe it away gently with gauze.
- Only if there are fingerprints or grease on a lens or filter, dampen a piece of soft, clean cotton cloth, lens tissue, or gauze with absolute alcohol (ethyl alcohol or methyl alcohol) and wipe away the dirt. However, do not use the same area of the cloth, etc., to wipe more than once.
- Use petroleum benzine to clean off immersion oil. Wiping with absolute alcohol (ethyl alcohol or methyl alcohol) after the oil has been removed finishes the clean up process. If you cannot obtain petroleum benzine, use methyl alcohol. However, because methyl alcohol does not clean as well as petroleum benzine, it will be necessary to wipe the surfaces repeatedly. (Usually, three or four times is sufficient to clean lenses or filters.)
- Use petroleum benzine only to remove immersion oil from objectives; do not use petroleum benzine for cleaning the entrance lens on the eyepiece tube, filters, etc.
- Absolute alcohol and petroleum benzine are both highly flammable. Be careful when handling them, when around open flames, when turning the power switch on or off, etc.
- Use absolute alcohol and petroleum benzine according to the instructions provided by their manufacturers.

2 Cleaning of painted components

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 the peeling of printed characters. For persistent dirt, dampen a piece of gauze with diluted detergent and wipe lightly.

3 Storage

Store the system under conditions of low humidity where mold is not likely to form.

Store the objectives, eyepieces, filter blocks, etc., in a desiccator or similar container with a drying agent.

Put the vinyl cover over the system to protect it from dust.

Before putting on the vinyl cover, turn off the power switches for the microscope and the Epi-fl attachment light source, and wait until the lamphouse is cool.

4 Regular Inspections

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



Nikon reserves the right to make such alterations in design as may be considered necessary in the light of experience. For this reason, particulars and illustrations in this handbook may not conform in every detail to models in current production.



NIKON CORPORATION

9-16, Ohi 3-chome, Shinagawa-ku, Tokyo 140, Japan
Tel: +81-3-3773-8121/8122 Fax: +81-3-3773-8115

NIKON INC.

Instrument Group

1300 Walt Whitman Road, Melville, NY 11747-3064, U.S.A.
Tel: +1-516-547-8500 Fax: +1-516-547-0306

NIKON EUROPE B.V.

Schipholweg 321, P.O. Box 222, 1170 AE Badhoevedorp, The Netherlands
Tel: +31-20-44-96-222 Fax: +31-20-44-96-298

NIKON AG

Kaspar-Fennerstrasse 6, 8700 Küsnacht, Zürich, Schweiz
Tel: +41-1-913-62-00 Fax: +41-1-910-37-44

NIKON GMBH

Tiefenbroicher Weg 25 40472 Düsseldorf 30, Fed. Rep. of Germany
Tel: +49-0211-94-14-0 Fax: +49-0211-94-14-322

NIKON FRANCE S.A.

191, rue du Marché Rollay, 94504 Champigny-sur-Marne Cedex France
Tel: +33-1-45 16 45 16 Fax: +33-1-45 16 00 33

NIKON INSTRUMENTS S.P.A.

Via Tevere, 54 50019 Sesto Fiorentino (FI), Italia
Tel: +39-55-3009601 Fax: +39-55-300993

NIKON U.K. LTD.

380 Richmond Road, Kingston, Surrey KT2 5PR, United Kingdom
Tel: +44-181-541-4440 Fax: +44-181-541-4584

NIKON SINGAPORE PTE LTD.

150 Beach Road #30-01/04, The Gateway West, Singapore 189720
Tel: +65-297-8123 Fax: +65-297-8131