Nikon

D-CUD UNIVERSAL CONDENSER (DRY)

DIFFERENTIAL INTERFERENCE CONTRAST ATTACHMENT
PHASE CONTRAST ATTACHMENT

Instructions

Thank you for purchasing Nikon products. This instruction manual is written for the users of the Nikon D-CUD (dry) universal universal condenser. 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 any points are unclear or incorrect, contact you nearest Nikon representative.
- Some products introduced 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 unit (the microscope, power supply, etc.).
- In this manual, the differential interference contrast will be abbreviated as “DIC”, and the phase contrast will be abbreviated as “Ph”.

Warning/Caution Symbols Used in This Manual

Though Nikon products are designed to provide you 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

The system should only be used for microscopic observation. Do not use the system for any other purpose.

2. Do not disassemble

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

3. Read the instruction manuals carefully

For your safety, carefully read this manual and the manuals provided with the other products used with the system. Make certain to heed the warnings and cautions at the beginning of each manual in particular.
Furthermore, when using the system in conjunction with the digital imaging head or the Epi-illumination attachment, be certain to carefully read the appropriate manual provided with them. The mercury lamp that is used as the light source in the digital imaging head or the Epi-illumination attachment requires careful handling.

- Cautions regarding the power supply: Read the manuals for the power supply and the microscope.
- Cautions regarding fuses: Read the manuals for the power supply and the microscope.
- Cautions regarding lamp heat: Read the manual for the microscope.
- Cautions regarding the lamp specification: Read the manuals for the microscope and the power supply.

CAUTION

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

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

2. Do not spill liquid on the equipment

If the microscope, the system or the power supply becomes wet, a short circuit may result and the equipment could be damaged or could become extremely hot. If you accidentally spill a 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

The system is a precision optical instrument. Handle the system gently, avoiding any physical shocks.
In particular, the optical system used on DIC method must be kept strain-free; handle the objective and condenser carefully so that they are not deformed.

2. 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 "6. Care and Maintenance."

3. 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 equipment:

- Install the equipment in a location with no vibration.
- Avoid installing the equipment in a location exposed to direct sunlight.
- Avoid installing the equipment in a dusty location.
- Avoid installing the equipment 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.)

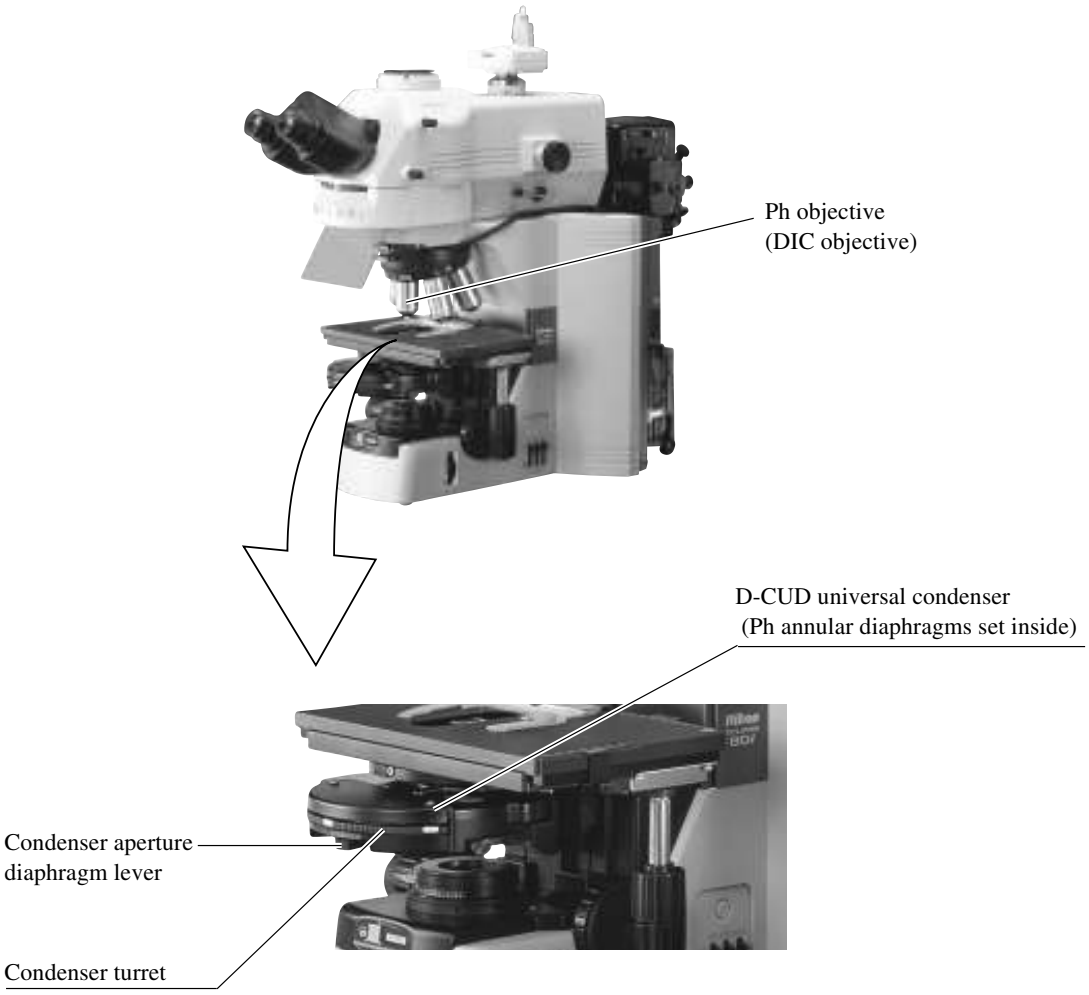
Contents

1 Names of Structural Components and Operational Parts

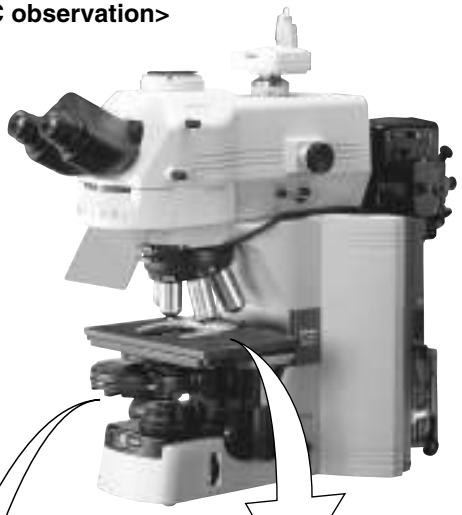
Attaching the D-CUD universal condenser and other necessary components to the microscope makes DIC, dark-field, and Ph observation possible with your microscope.
If the system is not yet assembled, see chapter “4. Assembly,” first.
For details on the assembly and handling of the microscope, power supply, etc., see their respective manuals.

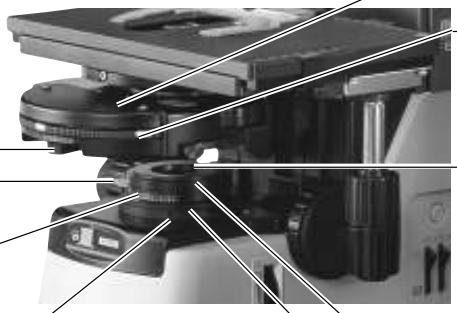
The following pictures show the unit (the Nikon ECLIPSE 80i with the digital imaging head), to which the D-CUD universal condenser, as well as other components for DIC or Ph observation, have been attached. The components included vary according to customized set.

<System components for Ph observation>

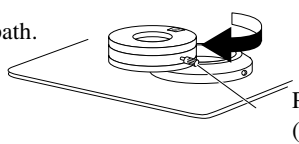


<System components for DIC observation>





Polarizer is swung out of the optical path.



2 Microscopy

The general flow of the microscopy procedure is described below.
For details on each step, see the corresponding section in chapter "3. Operation of Each Part."
If the equipment is not yet assembled, see chapter "4. Assembly," first.
For details on the assembly, handling and operation of the microscope, power supply, etc., see their respective manuals.
The drawings shown in this section are for the microscopy procedure when using the ECLIPSE E800 microscope. The drawings for the microscopy procedure when using the ECLIPSE E600 microscope are shown only when the operations differ.

WARNING Before using the system, be sure to read the ⚠ **WARNING** and ⚠ **CAUTION** 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 the system (the microscope, power supply, etc.), and heed all of the warnings and cautions in those manuals.

1 Differential interference contrast microscopy

Key points of microscopy

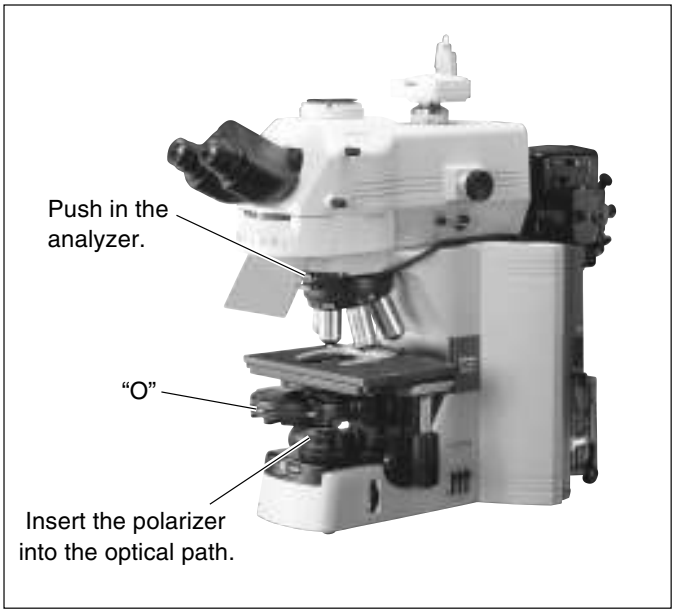
1. Use slide and cover glasses that are not deformed and that are free of dust or dirt.
2. For the DIC method, the adjustments made in steps 6 and 7 below are especially important. If these adjustments are not made properly, viewing will be poor.
3. If the digital imaging head or the DFL Epi-illumination attachment is also mounted on the microscope, see section "3. Microscopy in combination with Epi-fl attachment."

2

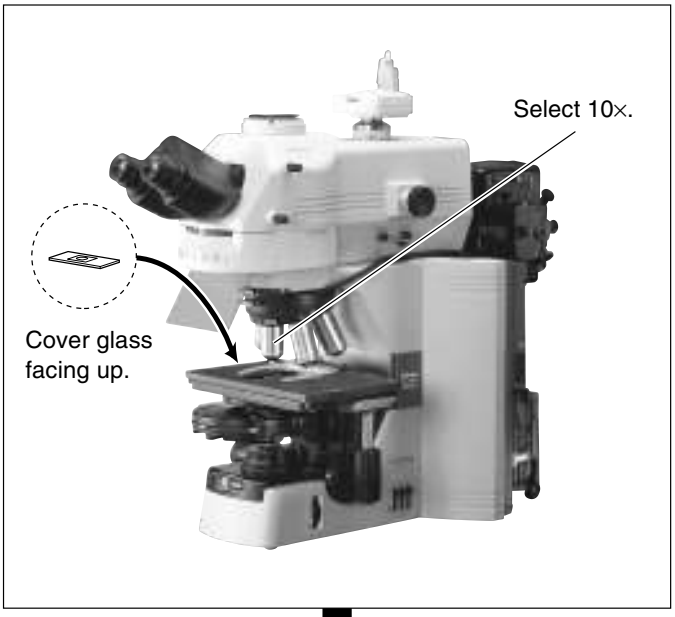
1 Turn on the lamp for the diascopic illumination.

2 Insert the polarizer and the analyzer into the optical path. (p. 21)

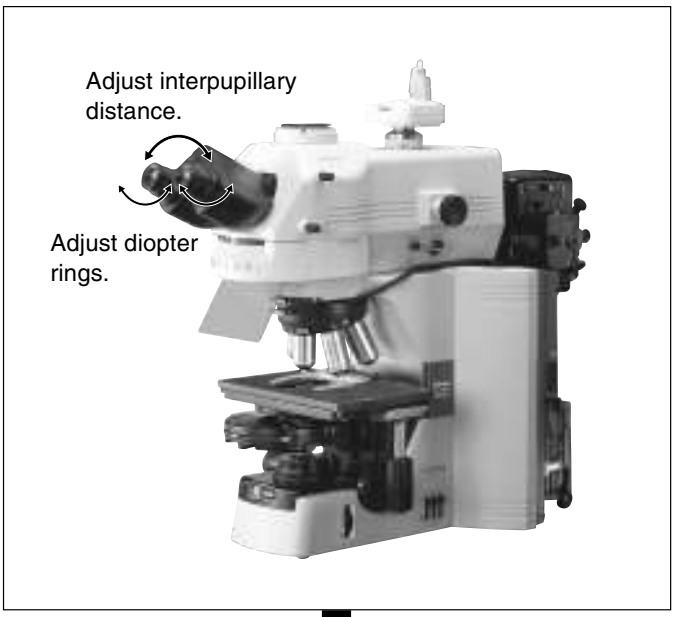
3 Rotate the condenser turret so that the “O” indication is at the front.



4 Place the specimen on the stage, and focus on the specimen with the 10× objective. (See the manual provided with the microscope.)

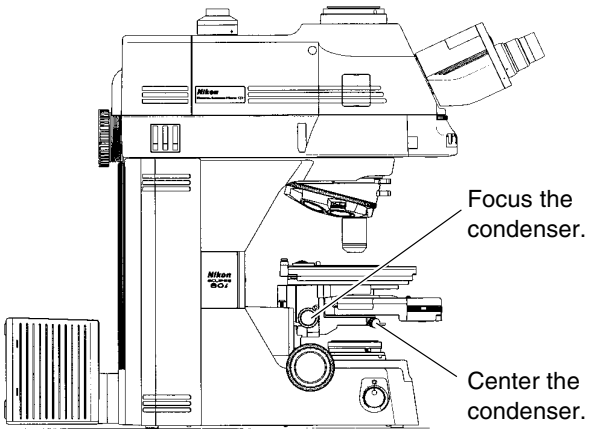


5 Adjust the diopter and the interpupillary distance.
(See the manual provided with the microscope.)



2

6 Center and focus the condenser. These adjustments are very important. Do not skip this step. (p. 20)

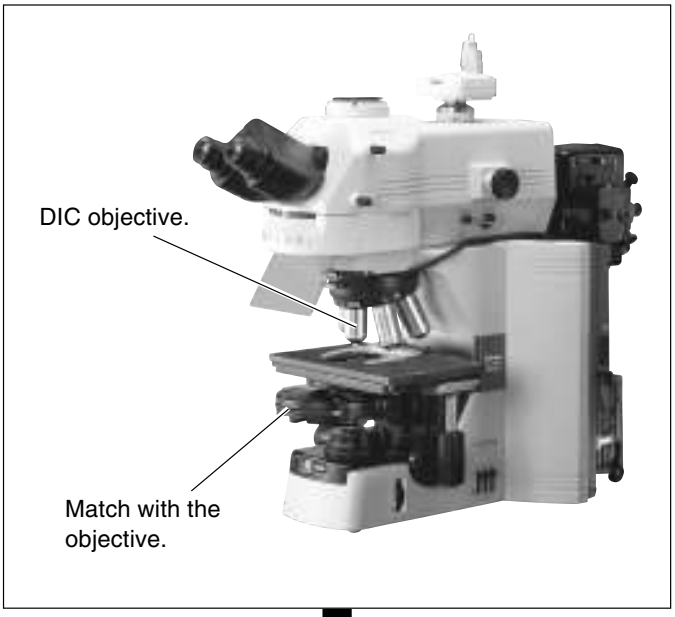


7 Adjust the orientation (direction of vibration) of the optical system.
This adjustment is very important. Do not skip this step.
(p. 21)

8 Move the stage and center the portion of the specimen to be viewed in the view field.

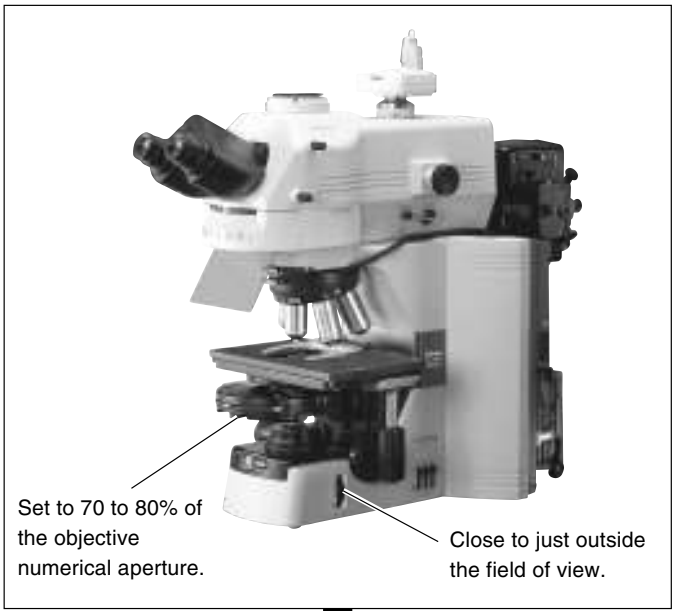
9 Insert a DIC objective into the optical path.

10 Rotate the condenser turret so that the indication that matches the DIC prism indication on the condenser corresponding to the objective in use is at the front. (p. 27)



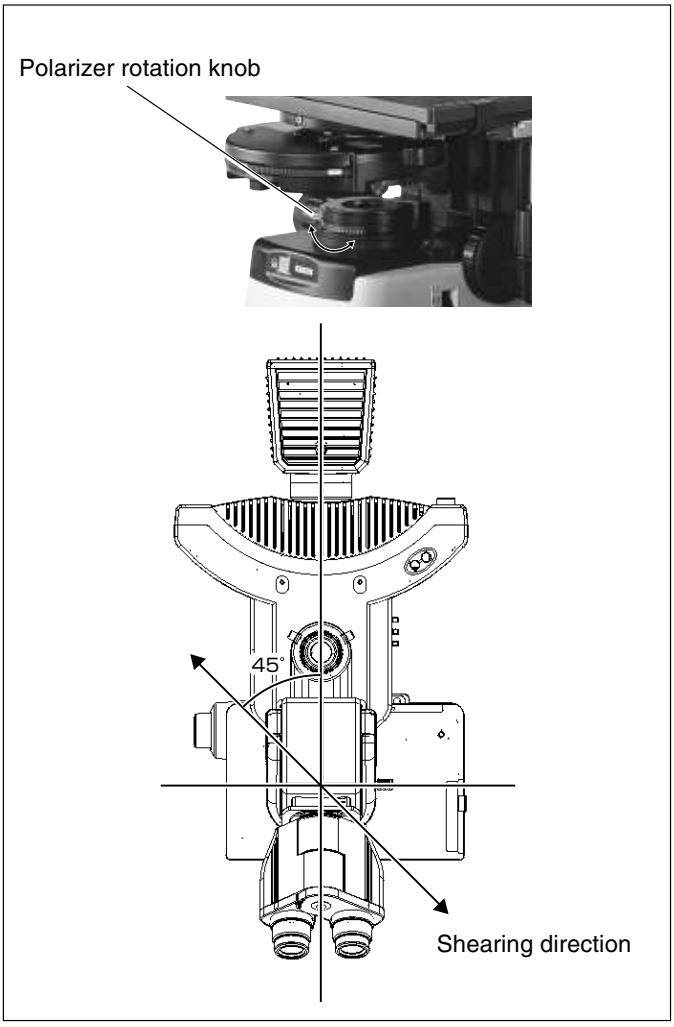
11 When using an oil immersion type objective, apply immersion oil between the specimen and the objective.
(See the manual provided with the microscope.)

12 Adjust the aperture diaphragm and the field diaphragm.
- Generally, stop down the aperture diaphragm to 70 to 80% of the N.A. of the objective.
- Stop down the field diaphragm so that it is just inside or just outside the viewfield.
(See the manual provided with the microscope.)



13 Loosening the polarizer rotation knob and rotating the polarizer changes the image contrast.

- In order to obtain a high contrast, make the background color for the view field a gray sensitive color.
- The highest contrast is obtained in the shearing direction (refer to the diagram); therefore, rotate the stage to adjust the orientation of the specimen, and align the portion of the specimen for which contrast is desired with the shearing direction.



Color contrast microscopy

1. Perform steps **1** to **14** of the DIC microscopy procedure.
2. Insert an NCB filter into the optical path.
3. Insert the lambda-plate (sold separately) in the lambda-plate slot in the DIC nosepiece.
4. The above procedure makes the background color of the view field sensitive, enabling observation with high contrast. (If there are variations in the refractive index or thickness of the specimen, interference colors will appear according to the gradient of those variations.)

2 Phase contrast microscopy

Key points of microscopy

The appearance of a Ph image depends on the phase difference and shape of the specimen, the characteristics of the objective, etc. Keep the following points in mind when preparing a specimen and when selecting the Ph objective.
If the DIC system, the digital imaging head, or the DFL Epi-illumination attachment is also mounted on the microscope, see section "3 Microscopy in combination with Epi-fl attachment."

1 Select a specimen that will not adversely affect the centering of the Ph annular diaphragm.

Specimens that scatter light or produce a prism or lens effect adversely affect the centering of the Ph annular diaphragm. Especially when viewing a thick, live specimen, a large, coarse specimen, or a specimen prepared with a microplate, care must be taken as the centering of the Ph ring diaphragm is shifted by a lens or prism effect, resulting in poor viewing.

2 Select a specimen suited for the latitude and contrast of the objective.

When using a dark contrast Ph objective, make sure that the phase difference of the specimen does not exceed the latitude (phase difference tolerance) of the objective. If the phase difference of the specimen exceeds the latitude, the image will appear brighter than the background, making observation impossible.
When preparing a phase contrast specimen, the phase difference can be adjusted through the thickness of the specimen and the refractive index of the filling agent, the culture solution, etc.
If the contrast of a specimen observed with a DLL objective is low, better results may be obtained with a DM objective.

3 Stained specimens

Specimens with a high contrast or stained too dark are not suitable for Ph microscopy. Ph microscopy is suited for lightly stained specimens, decolored specimens, or ultra-thin specimens for electron microscopes.

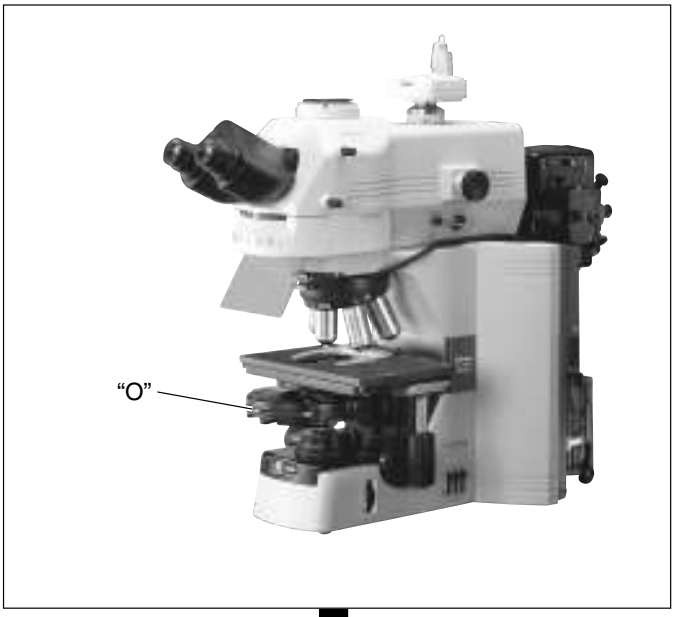
4 Ph annular diaphragm centering

In Ph microscopy, the exact alignment of the objective phase plate and the image of the Ph annular diaphragm in the condenser is extremely important in order to maintain the phase contrast effect. Re-check this alignment before starting microscopy.

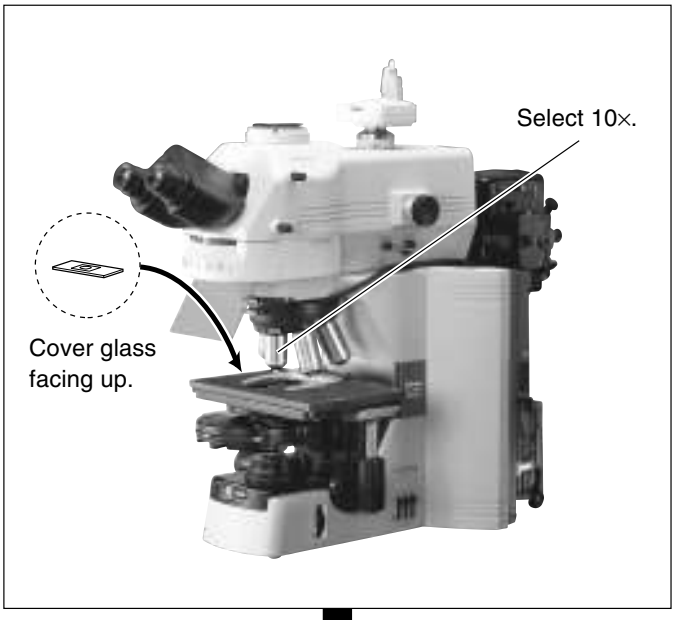
2

1 Turn on the lamp for the diascopic illumination.

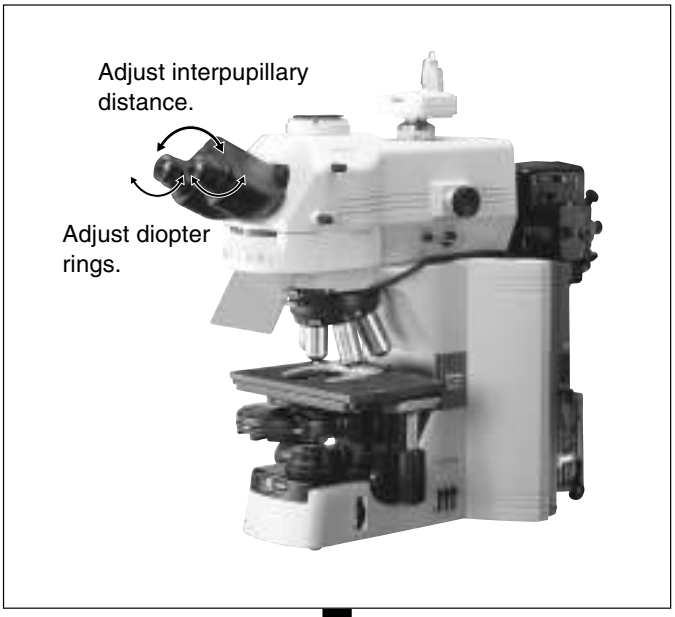
2 Rotate the condenser turret so that the “O” indication is at the front.



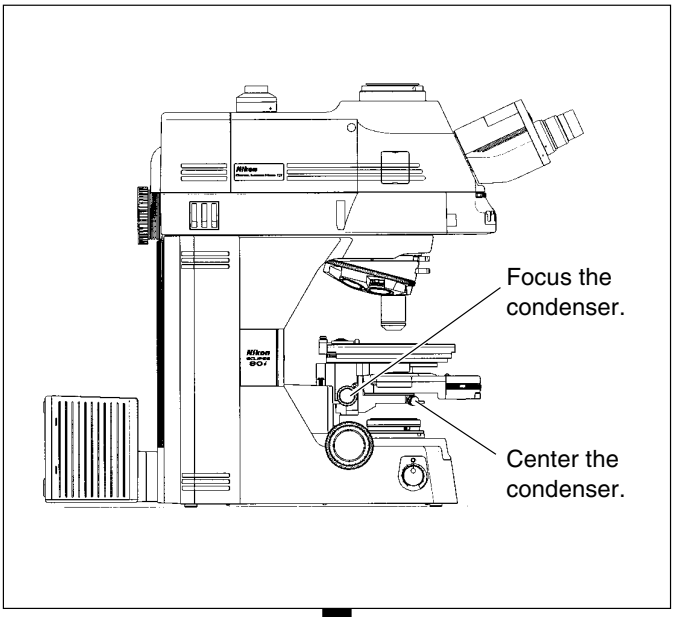
3 Place the specimen on the stage, and focus on the specimen with the 10× Ph objective (Ph1). (See the manual provided with the microscope.)



4 Adjust the diopter and the interpupillary distance.
(See the manual provided with the microscope.)



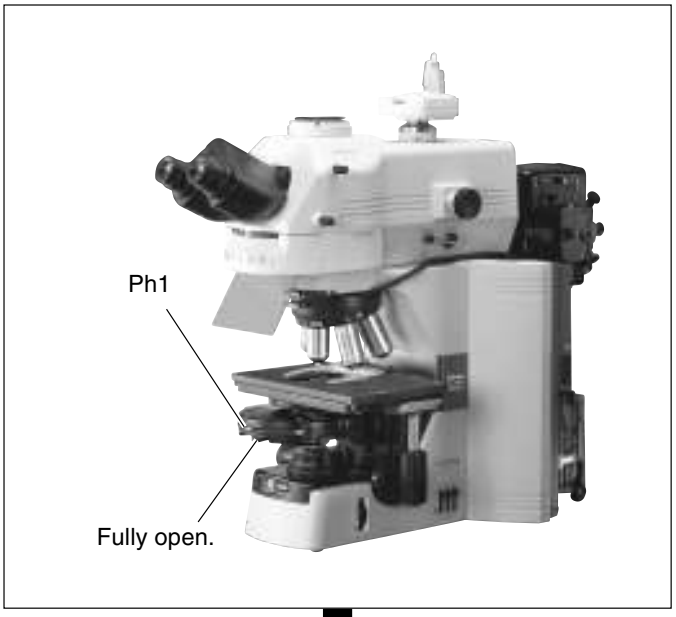
5 Center and focus the condenser. These adjustments are very important. Do not skip this step. (p. 20)



2

6 Rotate the condenser turret so that the “Ph1” indication is at the front. (p. 22)

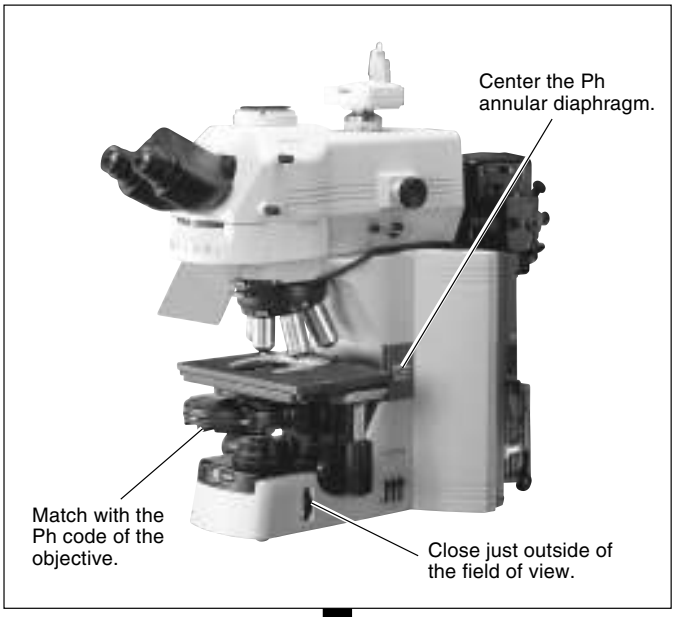
7 Open the condenser aperture diaphragm all of the way.
(Always leave the condenser aperture diaphragm fully open during Ph microscopy.)



8 Center the Ph annular diaphragm. This adjustment is very important. Do not skip this step. (p. 23)

9 Adjust the field diaphragm so that it is just inside or outside of the view field. (See the manual provided with the microscope.)

10 If the objective has been switched, also switch the condenser turret in accordance with the Ph code of the objective. After doing so, always center the Ph annular diaphragm. (p.23) Also readjust the size of the field diaphragm.



11 When using an oil immersion type objective, apply immersion oil between the specimen and the objective.
(See the manual provided with the microscope.)

3 Microscopy in combination with Epi-fl attachment (digital imaging head or DFL Epi-illumination attachment)

It is possible to combine DIC microscopy (or Ph microscopy) with Epi-fl microscopy by mounting both the components for the DIC microscopy (or the Ph microscopy) and the digital imaging head or DFL Epi-illumination attachment on the microscope. For example, use the DIC method (or the Ph method) instead of the Epi-fl method (which causes colors to fade) to search for the target portion of the specimen. It is also possible to use both methods simultaneously in order to compensate for their individual shortcomings.
For details on the microscopy procedure when using the Epi-fl method, see the manual provided with each Epi-fl attachment for details on the microscopy procedure, and for the DIC method or the Ph method, see pages 7 and 13, respectively.

1. Switching the methods

Perform the following steps when switching between the different microscopy methods.

When switching to DIC microscopy

- Move the shutter on the digital imaging head or DFL Epi-illumination attachment into the optical path to block off the excitation light.
- Rotate the excitation method switchover turret until the empty slot (i.e., no filter cube attached) is in the position for insertion into the optical path.
- Insert the analyzer into the optical path.
- Swing the polarizer into the optical path.
- Bring a DIC objective into the optical path.
- Insert the objective DIC prism into the optical path.
- Rotate the condenser turret so that the indication, which is the same as the DIC prism indication in the condenser for the objective to be used, is at the front (P.29).
- Adjust the size of the aperture diaphragm (normally, to about 70 to 80% of the N.A. of the objective).

When switching to Ph microscopy

- Move the shutter on the digital imaging head or DFL Epi-illumination attachment into the optical path to block off the excitation light.
- Rotate the excitation method switchover turret until the empty slot (i.e., no filter cube attached) is in the position for insertion into the optical path.
- Remove the analyzer from the optical path.
- Swing the polarizer out of the optical path.
- Bring a Ph objective into the optical path.
- Rotate the condenser turret so that the indication that is the same as the Ph code of the objective is at the front.
- Open the aperture diaphragm completely.

When switching to Epi-fl microscopy

- Turn off the microscope's diascopic illumination lamp. (Viewing is difficult if the lamp is left on.)
- Remove the shutter on the digital imaging head or DFL Epi-illumination attachment from the optical path.
- Bring the desired filter cube into the optical path.
- Remove the analyzer from the optical path.
- Remove the objective DIC prism from the optical path. (Only when using a DIC objective.)
- Adjust the size of the aperture diaphragm (normally, to about 70 to 80% of the N.A. of the objective).

2. Simultaneous microscopy

When using both the DIC method (or the Ph method) and the Epi-fl method simultaneously, follow the procedure described below.

1. Use the DIC method (or the Ph method) to find the portion of the specimen to be observed.
2. Bring the desired excitation filter cube into the optical path.
3. Open the shutter on the digital imaging head or DFL Epi-illumination attachment and recheck the focus.
4. Use the ND filters of the Epi-fl attachment to adjust the brightness of the fluorescent image.
5. Use the microscope's ND filters to adjust the brightness of the DIC image (or the Ph image).

4 Bright field microscopy

For bright field microscopy, perform the steps described below. For details on the microscopy procedure, see the manual provided with the microscope.

- Rotate the condenser turret so that the “O” indication is at the front.
- If the polarizer, analyzer, or objective DIC prism is in the optical path, remove it. Since removing any of these will increase the illumination, adjust the brightness by inserting ND filters into the optical path.
- When using a 2× or 4× objective, rotate the condenser turret until the “2-4×” indication comes to the front and fully open the field and aperture diaphragm during observation.

3 Operation of Each Part

1 Universal condenser

1. When using a 2× or 4× objective

When using a 2× or 4× objective, insert a 2-4× auxiliary lens (optional) moccnted in the condenser turret into the optical path by rotating the turret until the "2-4×" indication comes to the front. (Fully open the field and aperture diaphragm when the top lens is out of the optical path.) Doing so expands the illuminated area so that observation using a 2× or 4× objective is possible.

2. Focusing and centering the universal condenser

Focus and center the universal condenser, referring to the section on focusing and centering the condenser in the manual provided with the microscope. When doing so, keep the following points in mind.

- Rotate the condenser turret so that the "O" indication is at the front.
- If the polarizer, analyzer, or objective DIC prism is in the optical path, remove it. Since removing any of these will increase the illumination, adjust the brightness by inserting ND filters into the optical path.

3. Universal condenser aperture diaphragm adjustment

Adjust the size of the aperture diaphragm, referring to the section on the aperture diaphragm in the manual provided with the microscope. Normally, the diaphragm should be closed to 70 to 80% of the N.A. of the objective. When doing so, keep the following points in mind.

- For Ph microscopy, open the aperture diaphragm all of the way. If the aperture diaphragm is even partially closed, the Ph annular diaphragm may be blocked, making Ph microscopy impossible.

2 Components for DIC microscopy

1. Polarizer

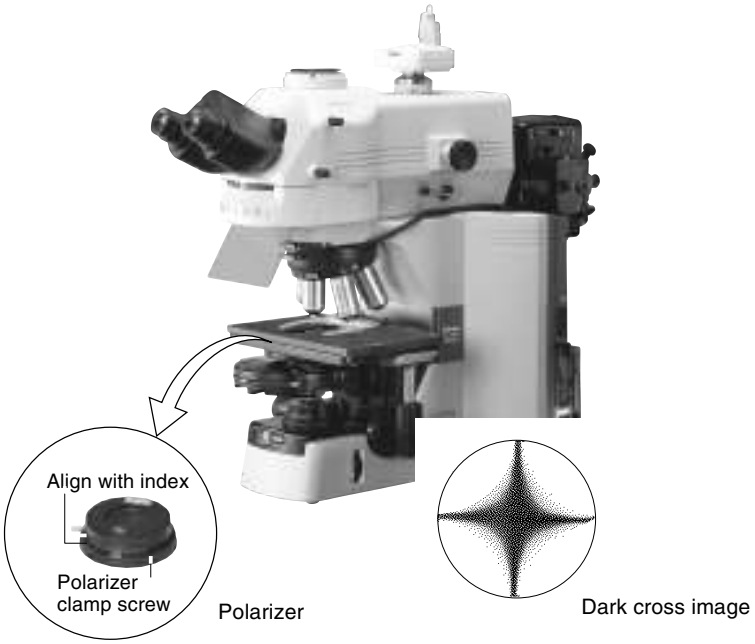
- To remove the polarizer from the optical path, swing the upper part of the polarizer out of the optical path.
- The polarizer can be rotated by loosening the polarizer rotation knob; the background color can be changed by rotating the polarizer. The polarizer rotation knob can be used in either of the two tap holes on the front of the polarizer.

2. Analyzer

- Insert the analyzer into the optical path by pushing it into the second click position. To remove the analyzer from the optical path, pull it out.

3. Optical system orientation adjustment (adjustment of direction of vibration)

Adjust the orientation of the polarizer and the analyzer so that they are perpendicular. Perform this adjustment carefully, since it determines the basic performance of the DIC method.



1 Focus and center the condenser. (P. 20)
2 Focus on the specimen. (See the manual provided with the microscope.)
3 Insert a 40× objective into the optical path, and rotate the condenser turret so that the "O" (empty position) indication is at the front.
4 Remove the objective DIC prism from the optical path if it is located above the 40× objective.
5 Insert the analyzer into the optical path.
6 Swing the polarizer into the optical path.
7 Loosen the polarizer rotation knob, align the line marked with • to the arrow by rotating the upper part of the polarizer, and clamp it in place.
8 Remove the specimen from the view field.
9 Adjust the angle at which the polarizer is mounted on the microscope.
Method 1: Use a hexagonal screwdriver to loosen the polarizer clamp screw. Next, while looking through the eyepieces, rotate the entire polarizer and then fix it in place at the position where the view field is darkest.
Method 2: Remove an eyepiece, and then use an adapter (sold separately) to mount a centering telescope (sold separately). Close the aperture diaphragm to a minimal opening, and then turn the eyepiece of the centering telescope so that the aperture diaphragm is brought into focus.
Open the aperture diaphragm as far as it will go.
Loosen the polarizer clamp screw with a hexagonal screwdriver. Next, rotate the entire polarizer and then fix it in place at the position at which the dark cross image become visible.
10 Install an objective DIC prism (one for a 40× objective) in the revolving nosepiece.

3 Components for Ph microscopy

1. Ph annular diaphragm

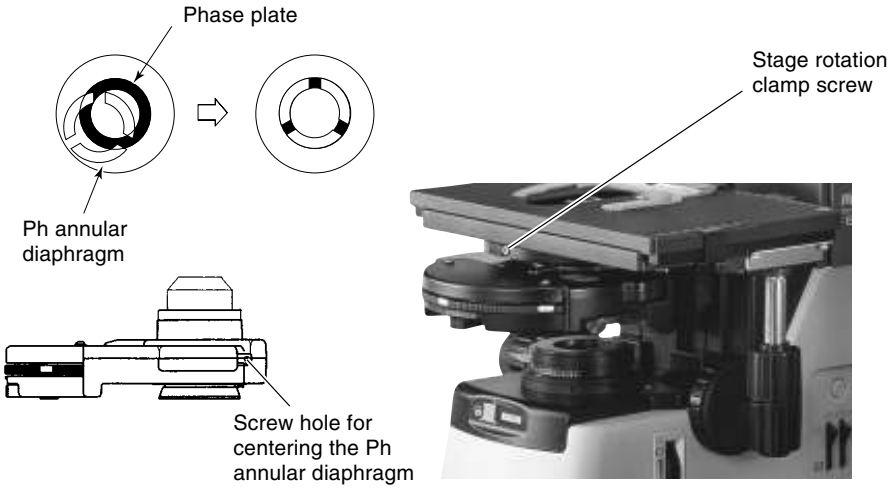
Ph microscopy is performed by matching the universal condenser Ph annular diaphragm with the objective phase plate.

Ph code

One of the phase codes (Ph1, Ph2, or Ph3) is displayed on a Ph objective, depending on the size of the phase plate. (The Ph code has no bearing on the magnifying power of the objective.) Rotate the universal condenser so that the Ph annular diaphragm with the same code is in the optical path. Ph microscopy is not possible if different codes are used in combination.

Centering the Ph annular diaphragm

1 If the aperture diaphragm is closed even partially, open it fully.
2 Remove an eyepiece, and then use an adapter (sold separately) to mount a centering telescope (sold separately).
3 Turn the eyepiece of the centering telescope so that the images of the objective phase plate and the universal condenser Ph annular diaphragm image are brought into focus.
4 If the images of the phase plate and the Ph annular diaphragm are not in alignment, use the two hexagonal screwdrivers provided with the microscope to adjust the Ph ring diaphragm centering screws on the condenser turret so that the centers of the two images are aligned. (Insert the screwdrivers in the screw holes at the rear side of the universal condenser.)
Note that if the image of the Ph annular diaphragm extends beyond the phase plate, the phase image contrast deteriorates.
If the stage handle is in the way, loosen the stage clamp screw and rotate the stage slightly.



2. Ph objective

The Plan Fluor Ph objective can be used for bright field microscopy, DIC microscopy, and Epi-fl microscopy. The Plan Apochromat Ph objective can be used for bright field microscopy, DIC microscopy, and Epi-fl microscopy, excluding UV excitation. However, because both have a phase plate inside, the "view" may differ from an objective intended specifically for the microscopy method in question.
For the absolute best results, use an objective intended specifically for the microscopy method in question.

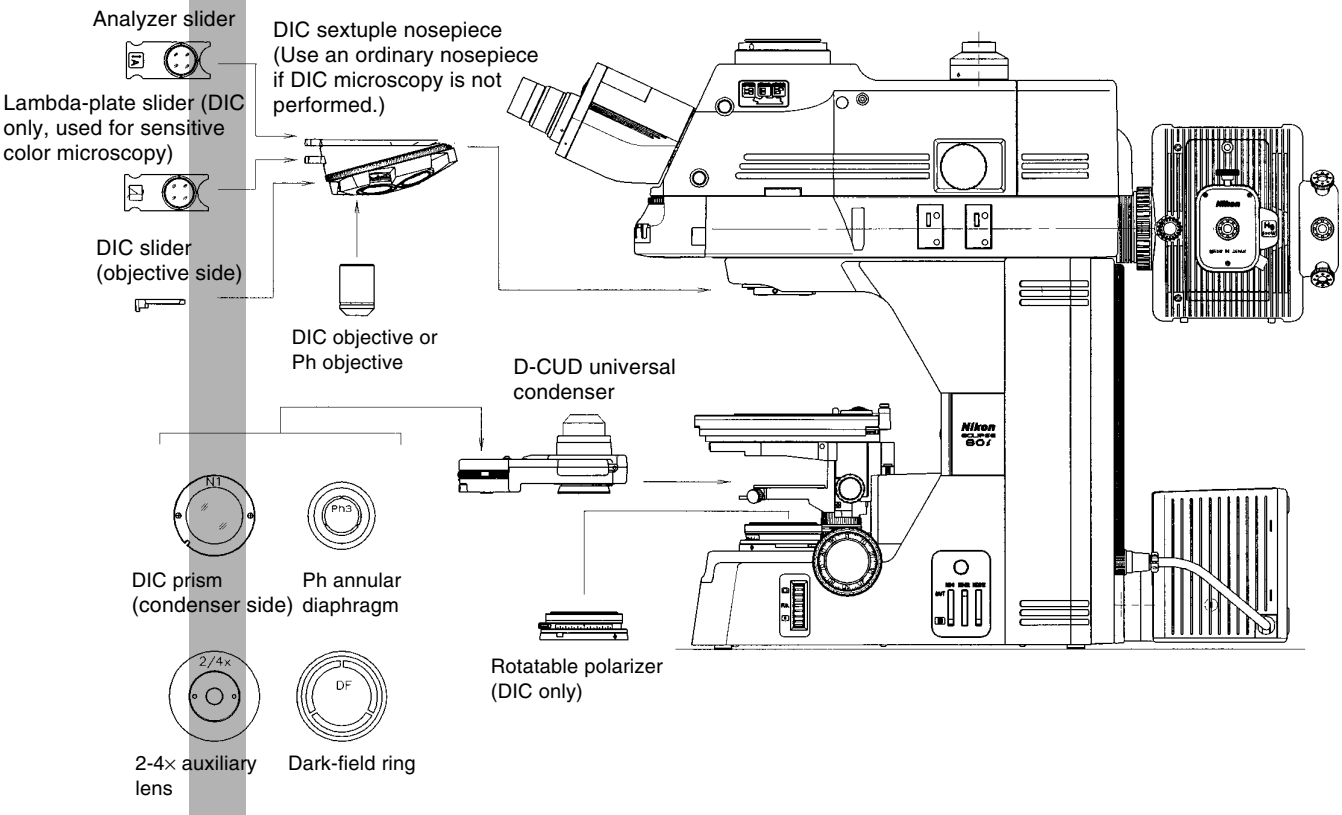
4 Assembly

WARNING Before assembling the system, be sure to read the ⚠**WARNING** and ⚠**CAUTION** 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 the system (the microscope, power supply, digital imaging head, etc.), and heed all of the warnings and cautions in those manuals.
In order to prevent accidents, burns, and injuries caused by electric shock, fire, or ultraviolet light, turn off the power switches for the microscope and power supply during assembly.

Refer to the illustrations while assembling the equipment.
For details on the assembly, handling, and operation of the microscope, power supply, digital imaging head, etc., see their respective instruction manuals.
Scratches or fingerprints on the lenses and prisms will adversely affect the image. Handle these components carefully during assembly in order to keep them free from scratches and fingerprints.

Required tools

- Hexagonal screwdriver: 1
  (Use the tool provided with the microscope.)


Analyzer slider
DIC sextuple nosepiece
(Use an ordinary nosepiece
if DIC microscopy is not
performed.)
Lambda-plate slider (DIC
only, used for sensitive
color microscopy)
DIC slider
(objective side)
DIC objective or
Ph objective
D-CUD universal
condenser
N1
Ph3
DIC prism
(condenser side)
Ph annular
diaphragm
2/4×
DF
2-4× auxiliary
lens
Dark-field ring
Rotatable polarizer
(DIC only)

4

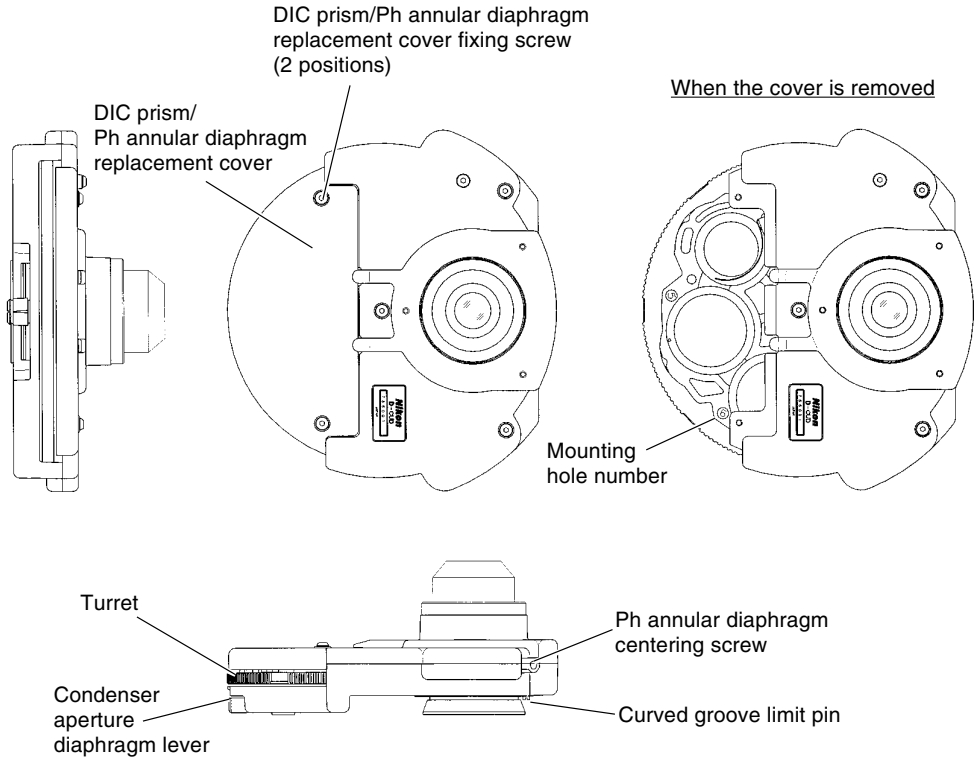
1. Microscope assembly

Assemble the microscope as described in the microscope manual.
However, do not mount the revolving nosepiece, the objectives or the condenser.
(If not performing DIC microscopy, mount the revolving nosepiece.)

2. Mounting the digital imaging head or DFL Epi-illumination attachment

If the digital imaging head or DFL Epi-illumination attachment is mounted to the microscope, refer to the monual provided with each attachment.
However, do not mount the shielding plate until after mounting the components for DIC microscopy (or the Ph microscopy). In addition, do not mount the shielding tube, since it is not used.

3. Universal condenser assembly



This system and the various available turret modules support a wide range of different microscopy procedures. (These modules include condenser DIC prisms and Ph annular diaphragms.)

Condenser DIC prisms	Used for DIC microscopy
Ph annular diaphragms	Used for Ph microscopy
Dark field annular diaphragms	Used for dark field microscopy
2-4× auxiliary lenses	Used for dark field microscopy with 2× or 4× objectives

Follow the steps given below to install the various modules to the turret:

1 Select condenser DIC prisms and Ph annular diaphragms that suit the objective to be used.

Selecting a condenser DIC prism

Refer to the table of DIC prism/objective combinations on p.?? to select a DIC prism suitable for the objective to be used.

Selecting a Ph annular diaphragm

Select a Ph annular diaphragm with the same Ph code indicated on the Ph objective.

(Note 1) Dark field annular diaphragms support all objectives with numerical apertures (N.A.) of 0.7 or smaller, except for 2× and 4× objectives.

(Note 2) 2× and 4× objectives are used exclusively for bright field microscopy.

2 Use the hex wrench provided with the microscope to remove the screws (at two points) holding the cover when replacing DIC prisms or Ph annular diaphragms. Remove the cover.

3 Mount a module to one of the 7 holes on the turret. The numbers next to each hole indicate their mounting position and determine the types of prisms and annular diaphragms that may be mounted at each position. Note that modules cannot be attached to the #1 hole, which is left open for bright field observation.

Name	Mounting	Hole Number
Ph annular diaphragm	Ph 1	2
	Ph 2	3
	Ph 3	4
DIC prism	N1	7
	N2	5 or 6
Dark field ring		5 or 6
2-4× auxiliary lenses		5 or 6

Turn the turret before mounting a module until the desired mounting hole is visible.

Mounting condenser DIC prisms, dark field rings, or 2-4× auxiliary lenses

Holes for condenser DIC prisms, dark field rings, or 2-4× auxiliary lenses to be mounted have a pin.

Before mounting, use the hex wrench to loosen the screws holding the DIC prisms. Next, position the module so that the pin in the hole is set into the notch on the side opposite the module's model identification. The notch on dark field rings and 2-4× auxiliary lenses is relatively broad relative to the pin, so meticulous alignment is not required. Last, tighten the screws holding the DIC prisms.

Setting a Ph annular diaphragm

When performing Ph microscopy, set a Ph annular diaphragm (with the model identification facing up) in the hole with the springs. Using the hex wrench, loosen both Ph annular diaphragm centering screws. Push aside the spring, then set the Ph annular diaphragm into the center of the hole.

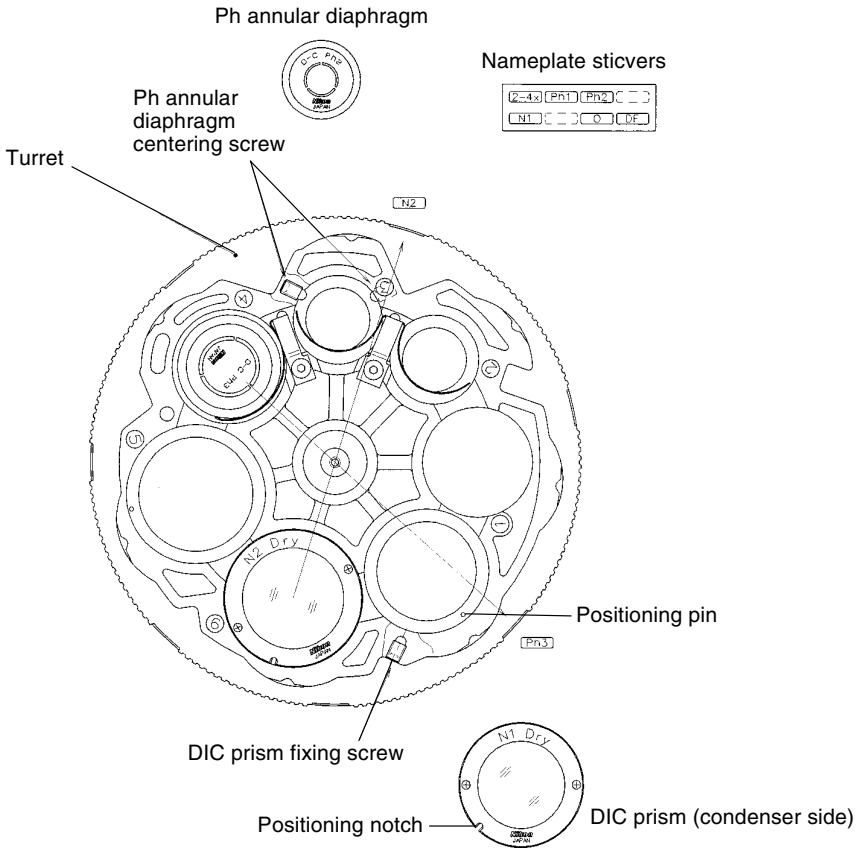

Ph annular diaphragm
Nameplate sticvers
Ph annular diaphragm centering screw
Turret
N2
Positioning pin
Pn3
DIC prism fixing screw
N1 Dry
Positioning notch
DIC prism (condenser side)

Table of possible combinations of object adn DIC prism

Name of objective		Standard combination		Combination when contrast is crutial	
		Name of objective DIC prism	Name of condenser DIC prism	Name of objective DIC prism	Name of condenser DIC prism
10X	Plan Fluor 10X S Fluor 10X Fluor 10X W	10X	N1		
20X	Plan Fluor 20X Plan Apo 20X Fluor 20X W	20X	N2	20X-C	N1
40X	Plan Fluor 40X Plan Apo 40X S Fluor 40X	40X I		40X I-C	N1
	Plan Fluor 40X Oil S Fluor 40X Oil	40X II			
	Fluor 40X W Plan Apo 40X Oil	40X III			
60X	Plan Apo 60XA Oil Plan Apo 60X Fluor 60X W Plan Apo VC 60X Oil	60X I			
	Plan Fluor 60X Oil Ins Plan Apo TIRF 60X Oil Plan Apo 60X WI Plan Apo VC 60X WI	60X II			
100X	Plan Apo VC 100X Oil	100X I			
	Plan Fluor 100X Oil Plan Apo 100X Oil	100X II			

4 Apply labels to the side of the turret in accordance with the DIC prisms and Ph annular diaphragms that were installed. Apply each label in the position that appears in the front when the system condenser is mounted on the microscope and the DIC prism or Ph annular diaphragm in question is inserted into the optical path. (The label will be on the diagonal from the DIC prism or Ph annular diaphragm in question.) Place the label "A" on spaces for vacant holes.

4. Mounting the universal condenser

Using the condenser focus knob, lower the condenser carrier (the bottom portion of the substage) as far as it will go. (If mounting another condenser, loosen the condenser clamp screw and remove the condenser.)
Slide the universal condenser in horizontally so that the limit pin on the circular dovetail of the universal condenser fits in the notch on the condenser carrier. Tighten the condenser clamp screw to lock the condenser in place. (Tighten it so that it does not loosen even when the turret is rotated.)

5. Mounting the DIC sextuple nosepiece (only when performing DIC microscopy)

Use a hexagonal screwdriver to adequately loosen the microscope's revolving nosepiece clamp screw. Align the revolving nosepiece with the notch on the revolving nosepiece mount on the microscope and slide the revolving nosepiece in from beneath, pushing it toward the rear as far as it will go. Tighten the revolving nosepiece clamp screw to fix the revolving nosepiece in place.

Note when removing the revolving nosepiece

Lower the stage and remove any objectives in the nosepiece.
Be sure to hold the revolving nosepiece while removing it so that it does not fall.

6. Mounting the objectives

Lower the stage. Screw the objectives into the revolving nosepiece so that the objectives are in order of increasing power when the revolving nosepiece is rotated clockwise (when viewed from above).

Note when removing the objectives

Lower the stage, and if there is a specimen on the stage, remove it.
Use both hands when removing the objectives so that they do not fall.

7. Mounting the objective DIC prism (only when performing DIC microscopy)

Remove the dummy slider located directly above the DIC objective. Replace the dummy slider with a DIC prism slider that corresponds with the DIC objective.

8. Mounting the analyzer slider (only when performing DIC microscopy)

Remove the dummy slider from the analyzer slot of the DIC sextuple nosepiece. (Note that there are two slots and the analyzer slot is the one marked with "A.") Then, insert the analyzer slider into the slot. (The analyzer enters the optical path at the second click position. Pulling the slider out removes it from the optical path.)

9. Installing the polarizer (only when performing DIC microscopy)

Loosen the polarizer clamp screw, rotate the polarizer so that the index lines match, and then lock it in place.
Place the polarizer over the field lens in the microscope base, and then tighten the clamp screw to lock the polarizer in position where the index line is in front. (Be sure to make adjustments of the direction of vibration before performing microscopy.)

10. Mounting the lambda-plate (only when performing DIC microscopy)

Remove the dummy slider from the lambda-plate slot of the DIC sextuple nosepiece. (Note that there are two slots and the lambda-plate slot is the one marked with "λ.") Then, insert the lambda-plate with the λ mark facing up into the slot.

Assembly is now complete.

5 Troubleshooting Tables

Improper use of the microscope may adversely affect performance even if the microscope does not suffer damage. If any of the problems listed in the table below arise, take the countermeasures indicated. If a problem not covered in the tables below arises, or if the countermeasures indicated in the tables below do not resolve the problem, see the manual provided with the microscope.

1 DIC microscopy

Problem	Cause	Countermeasure
The view field is vignetting	The condenser turret is in an intermediate position.	Turn the turret until it clicks into place.
	The objective DIC prism is in an intermediate position.	Mount the prism correctly.
	The revolving nosepiece is not mounted properly.	Mount the revolving nosepiece correctly.
	The polarizer/analyzer is in an intermediate position.	Insert in, or move out from the optical path correctly.
	The lambda-plate is in an intermediate position.	Insert the plate as far as it will go.
Contrast not obtained when using the DIC method	The polarizer is not in the optical path.	Insert the polarizer into the optical path.
	Analyzer is not in the optical path.	Insert the analyzer into the optical path.
	The condenser DIC prism is not selected correctly.	Insert the DIC prism corresponding to the objective to be used into the optical path.
	The objective DIC prism is not in the optical path.	Mount the prism correctly.
	The combination of the objective and the objective DIC prism is not correct.	Use the DIC prism that corresponds to the objective.
Poor contrast obtained when using the DIC method	The polarizer orientation is incorrect.	Correctly adjust the orientation of the optical system.
	The condenser DIC prism is not selected correctly.	Insert the DIC prism corresponding to the objective to be used into the optical path.
	The combination of the objective and the objective DIC prism is not correct.	Use the DIC prism that corresponds to the objective.
	There is dirt on the objective, condenser, or specimen.	Gently wipe away the dirt. (Because this is a polarized interference microscope, dirt poses more of a problem than usual.)
	The field diaphragm image is not focused on the specimen surface.	Move the condenser up or down to focus the image on the specimen surface.

2 Ph microscopy

Problem	Cause	Countermeasure
Poor phase contrast is obtained.	The condenser Ph annular diaphragm and the objective phase plate do not match.	Adjust the Ph annular diaphragm so that it matches with the objective phase plate.
	The condenser Ph annular diaphragm and the objective Ph code do not match.	Insert the Ph annular diaphragm with the same Ph code as the objective into the optical path.
	The field diaphragm image is not focused on the specimen surface.	Focus the image on the specimen surface using the condenser focus knob.

6 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 else 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. However, do not use the same area of the cloth, etc., to wipe more than once.
- Use petroleum benzine only to remove immersion oil from the objective. For optimum results, we recommend following up petroleum benzine with absolute alcohol (ethyl or methyl alcohol). If petroleum benzine is unavailable, use methyl alcohol alone. When using just methyl alcohol, note that surfaces will need to be wiped repeatedly to ensure complete removal of immersion oil. Usually, three or four times should be sufficient to clean the lens.
- 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.
- Because absolute alcohol and petroleum benzine are both highly flammable, be careful when handling, when near naked flames, when turning the power switches on and off, etc.
- Use absolute alcohol and petroleum benzine according to the manufacturers' instructions.

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. Use of a silicon cloth is recommended.

3 Storage

Store the equipment under conditions of low humidity where mold is not likely to form.
Store the objectives, eyepieces, filter cubes, etc., in a desiccator or similar container with a drying agent.
Put the dust-proof cover over the equipment to protect it from dust.
Before putting on the dust-proof cover, turn off the power switches for the microscope and the fluorescent illumination attachment light source for the digital imaging head, etc., and wait until the lamphouse is cool.

4 Regular inspections

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