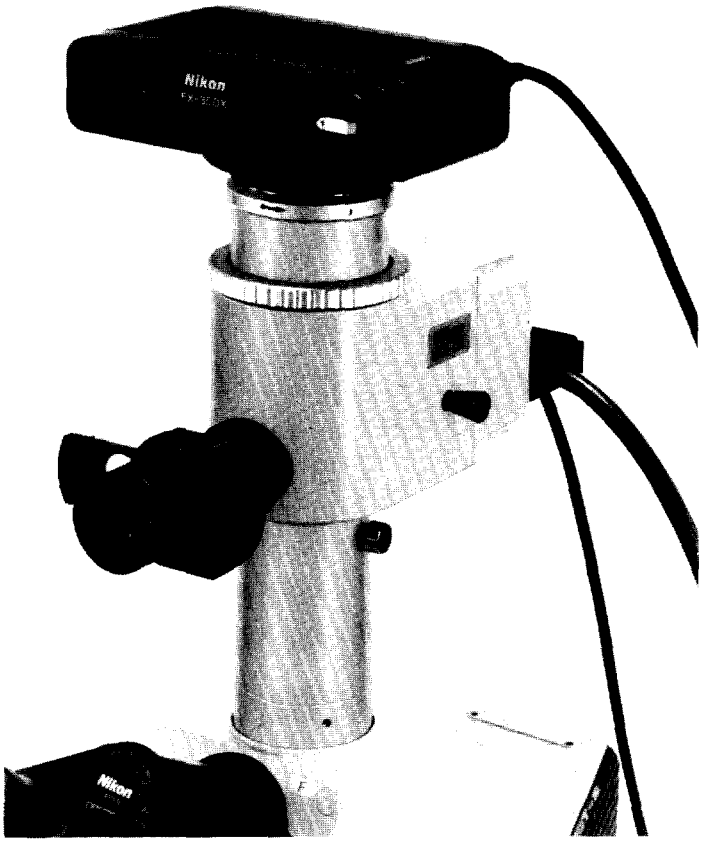
Nikon



›tomicrographic Attachment

MICROFLEX UFX-DX

Instruction Manual

Thank you for your purchasing Nikon Photomicrographic Attachment. Before using the instrument please read this manual carefully to become accustomed to the characteristics and capabilities of this precision instrument.
We hope this instrument will serve you for a long time.

CONTENTS

HANDLING PRECAUTIONS

❶Microscope objectives and projection lenses
In photomicrography, CF PL projection lenses should only be used in combination with CF objectives.

❷Handling
Take care to avoid sharp impacts and shocks when handling the instrument and lenses.

❸Environment
Use the instrument in a location free from dust, vibration, direct sunlight, high temperatures and humidity.

❹High voltage power connector
Never touch or disconnect the high voltage connector while the power switch is ON.

❺Line voltage
Set the line voltage selector switch, located underneath the control box inside the battery chamber, to correspond to the available line voltage. (Refer to Fig. 9)

❻Fuse replacement
Always be sure to turn off the power switch and disconnect the line cord before attempting to replace the fuse.

❼Cable connection/disconnection
Always ensure the control box is turned OFF before performing any cable connections or disconnections.

❽Used Ni-Cd batteries
Never dispose of used Ni-Cd batteries, but return them to your dealer or nearest Nikon representative.

❾Lens care
To ensure precise operation, all lenses and other optical elements must be kept as clean and free from dust, smudges, and fingerprints as possible.

❿Component matching
The serial numbers of the Microflex main unit, its ocular finder, and control box must all be identical, as these components have been adjusted and matched at the factory for optimum combined operating performance.

CARE AND MAINTENANCE

❶Lens cleaning
When cleaning lens surfaces, first lightly brush away dust or dirt with a soft brush or piece of gauze. Only to remove fingerprints or oily smudges, use lens tissue or a soft clean cloth lightly moistened in pure methyl or ethyl alcohol.

❷Cleaning other parts
Avoid using organic solvents, such as thinner, ether, or alcohol, to clean the painted or plastic parts of the instrument or its control box.

❸Battery maintenance
If the instrument is not to be used for a long period of time, the battery should be fully charged and stored separately in a cool, dark place such as a refrigerator.
The battery will require recharging when it is reinstalled.
Recharging will begin when the control box power is switched on.
The battery will be fully charged in 3~4 hours, and can be used for about 1000 hours.
Once exhausted, the battery can be fully recharged again.
Never throw unwanted batteries away, but return them to your dealer or nearest Nikon distributor.

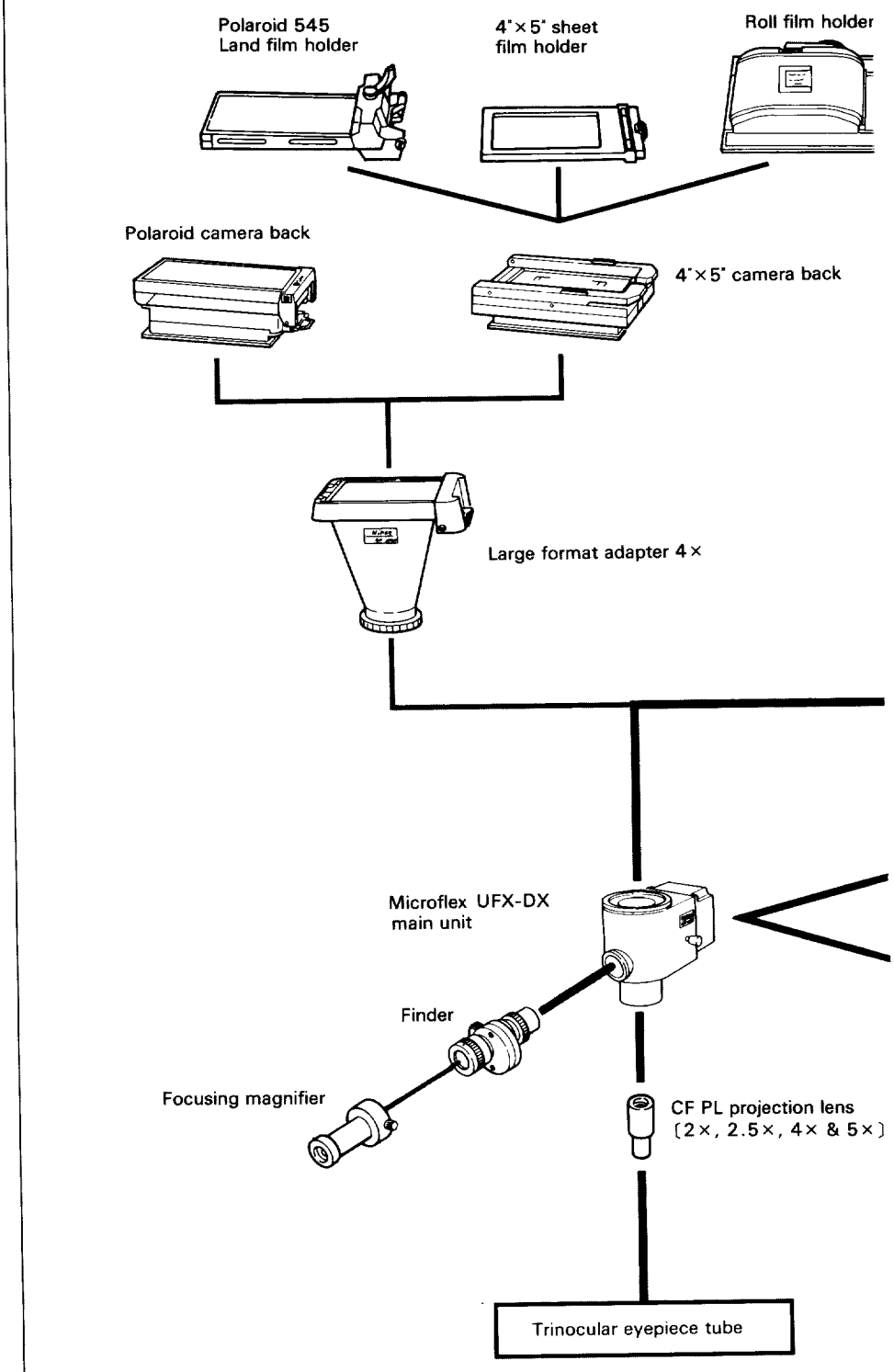
❹Dismantling
To avoid impairing operational efficiency and accuracy, never dismantle the instrument.

❺Storage
When not used for a long period of time, the instrument should be covered and stored in a place free from moisture and fungus.

❻Periodic checks
To maintain the best performance we recommend that the instrument be periodically checked. (For details of this check, contact your authorized Nikon distributor.)

★Please note as per your Nikon warranty, "Any defects or damage directly or indirectly caused by the use of unauthorized replacement parts and/or performed by unauthorized personnel" will void the warranty.

I .MICROFLEX UFX-DX SYSTEM COMPONENTS



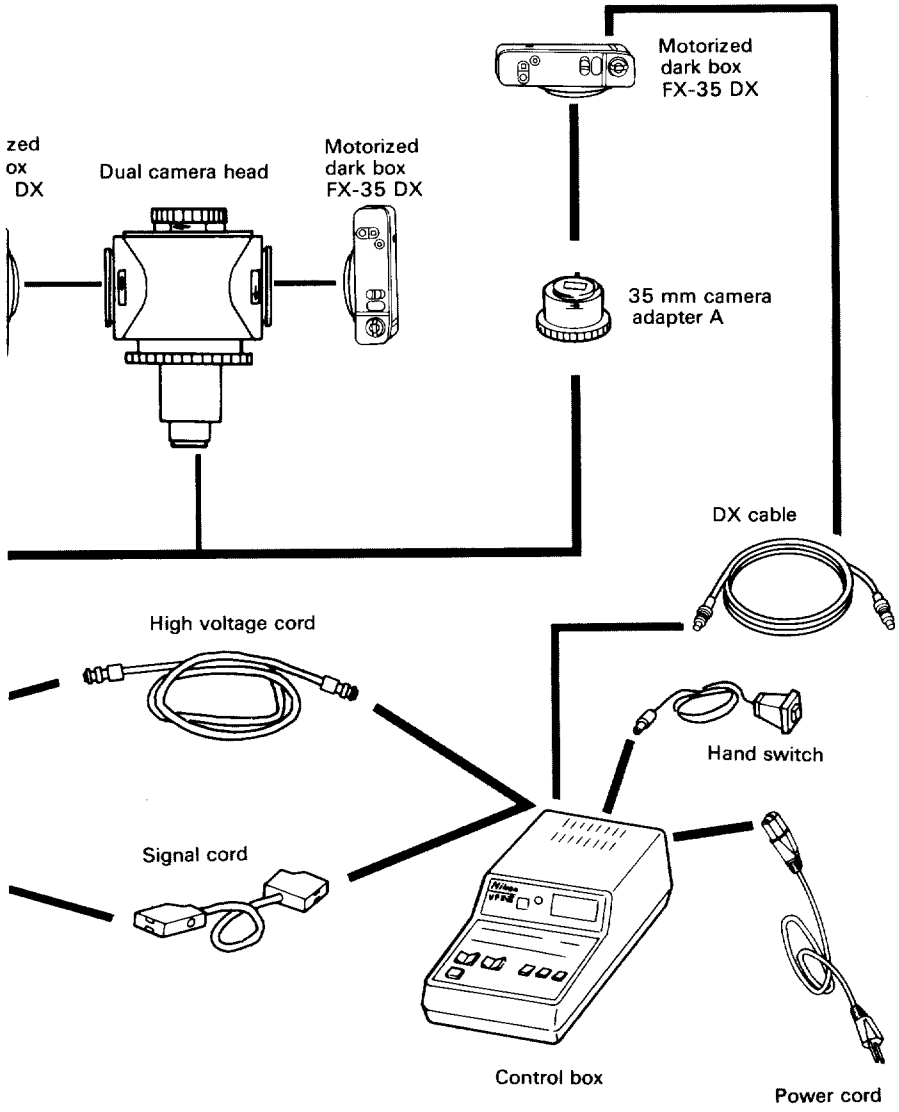
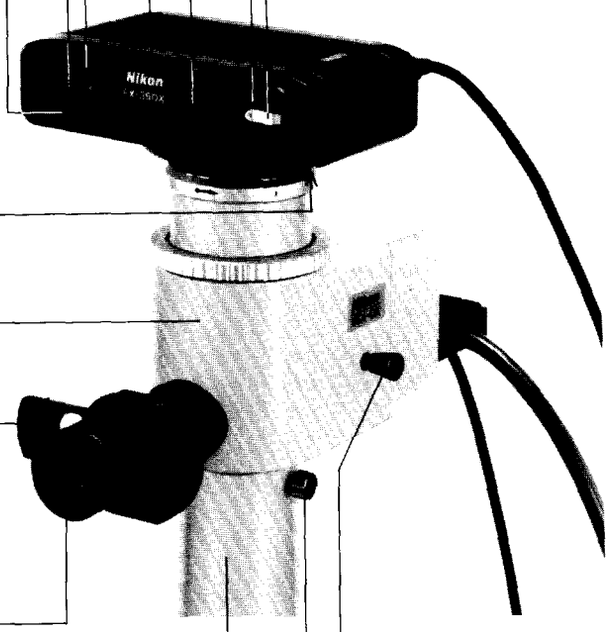

zed
ox
DX
Dual camera head
Motorized
dark box
FX-35 DX
Motorized
dark box
FX-35 DX
35 mm camera
adapter A
DX cable
High voltage cord
Hand switch
Signal cord
Control box
Power cord

Fig. 1

II. 35mm FILM PHOTOMICROGRAPHY

1. Nomenclature and Function



Motorized dark box FX-35DX
35mm film type with F-mount and automatic film advance mechanism. Total magnification calculated as CF objective magnification × CF PL projection lens magnification.

Rewind button
Depress first to rewind film.

Frame counter
Displays frame exposure count, with automatic zero reset.

Advance button
Not used with UFX-DX based systems.

Dark box release button
Depress to detach the dark box from the camera adapter.

Microflex UFX-DX main unit
Equipped with beam splitter prism to divide light between finder and exposure meter. Prism swings out of optical path during exposure for 100% light transmission to camera when shutter opens.

ND filter slider
If the observed image is too bright, push in the slider to position the ND filter in the optical path.

Ocular finder
Used for framing and focusing the desired specimen area for photomicrography. Equipped with diopter adjustment ring.

Trinocular eyepiece vertical photo tube
Insert the CF PL projection lens into this tube.

Microflex unit clamp screw
Tighten to clamp the Microflex body to the vertical photo tube.

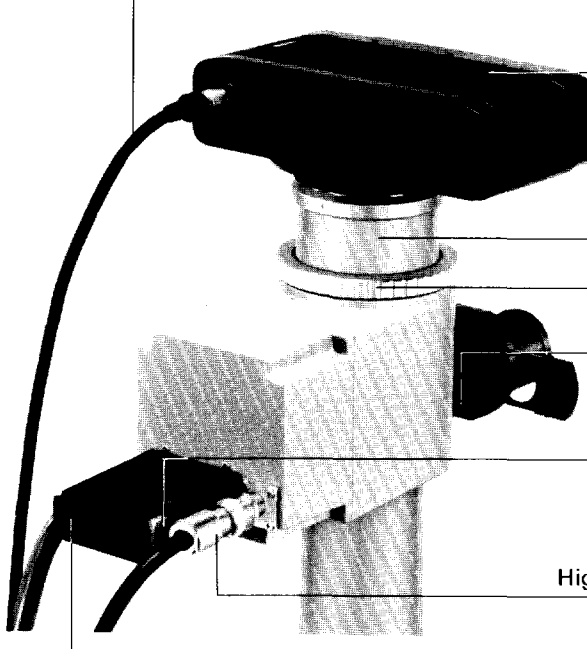
Film advance mode switch
Be sure this switch is set to "A" (Auto mode). Confirm the setting before loading the film.

Dark box back release knob
Pull out this knob to open camera back.

Rewind crank
After pressing the rewind button, turn the rewind crank in the direction indicated by the arrow to rewind the film.

Brightness measurement range selector knob
Pull out to set the brightness measuring range to 30% of picture area.
Push in to set the brightness measuring range to 1% of picture area.

Fig. 2-1



DX cable
Connected to the control box.

Advance indicator

35mm camera adapter A

Camera adapter lock ring
Secures camera adapter to Microflex unit.

Finder lock ring
Secures finder to Microflex unit.

Release button
Ensures secure signal cord plug connection until depressed for release.

High voltage line cord connector

Signal cable connector
Connects the Microflex unit to the control box for signal transmission.

Fig. 2-2

Control Box

Brightness measurement range index

LED indication of selected 30% average or 1% spot measurement range settings.

Exposure compensation indicator

10-segment LED display provides 1/3 EV unit indication of exposure correction setting.

Exposure time display

Displays set exposure time.
Range: 0.01-999.99 sec.

Multiple exposure key

Enables multiple exposure operation, as indicated by lit LED.

Film end LED

Blinks when end of film is reached.

DX mode indicator

Lights when the DX coded film is used.

Check display

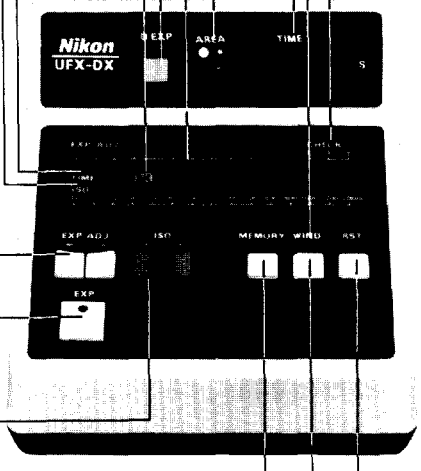
Blinking LED accompanies shutter lock.
"E" LED indicates operation error.
"↑" LED indicates overexposure.
"↓" LED indicates underexposure.

TIME mode indicator

LED lights to indicate TIME mode operation, as selected with a depression of either of the ISO keys.

ISO indicator

15-segment LED display of ISO setting, selected with the keys. Range is ISO 12-3200, and 20000.



Exposure adjustment keys

Dual key adjustment of exposure correction setting, as indicated by LED position. Arrow indicates direction of shift.

Shutter release key

LED lights while shutter is open for exposure; out when shutter is closed.

ISO (& TIME mode) setting keys

Dual key adjustment of ISO setting, as indicated by LED position. Arrow indicates direction of shift. In the DX mode, used as the changeover keys of ISO value of the film being used to TIME mode or vice versa, and doesn't shift the LED lighting to the other ISO value.

Reset key

Resets shutter lock, as well as memory and multiple exposure mode settings.

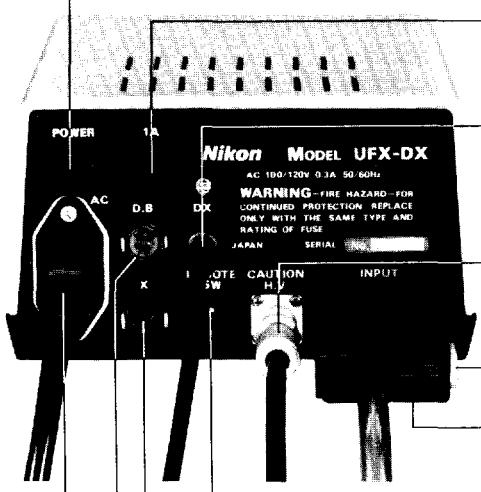
Film advance key

Automatically advances the film to frame number "1" when depressed. Inoperative while shutter is open.

Memory mode key

Used to set the memory mode.

Fig.3-1



Power switch

Fuse
1A 250V (100/120V)
0.5A 250V (220/240V)

DX cable
Connected to the dark box.

High voltage line cord connector

Release button

Signal cable connector

Hand switch receptacle

X contact connector
Accepts the trigger cable S for optional Speedlight SBM-1.

Data back connector
Accepts the trigger cable of optional Photomicrographic data system.

Power cord
Insert into receptacle and connect to line source.
Ensure that the voltage selection switch located in the battery receptacle under the control box is set to the appropriate voltage indication before connection.

Hand switch
Plugs into REMOTE switch receptacle to provide remote shutter control. Shutter release key is rendered inoperative when connected.

Fig.3-2

2. Assembly

1) CF PL projection lens

Insert into the vertical photo tube sleeve of the trinocular eyepiece tube. (Fig.4)

CF PL projection lenses are used exclusively with the Microflex FX series and 4 magnifications (2×, 2.5×, 4×, 5×) are available. The projection lens focuses the image produced by the objective directly onto the film plane. CF PL projection lenses are designed to render superior performance when used in combination with CF objectives.

Note:

- **CF PL projection lenses cannot be used in place of early model HFM, AFM, or PFM photo attachments.**
- **When performing 35mm photomicrography with the 2× CF PL projection lens, there is a chance the viewfield may not be completely exposed owing to differences in the objective or other accessories it is used in combination with.**

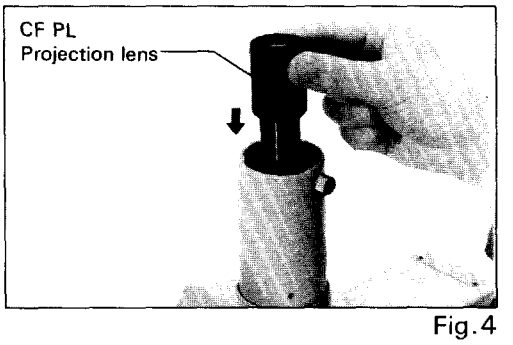


Fig.4

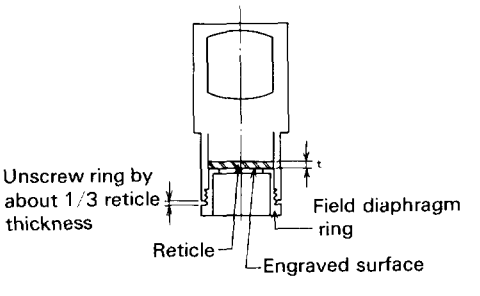
★CF PL projection lens reticle position adjustment

The φ19mm field diaphragm reticle can be used with the 4×and 5×CF PL projection lenses to superimpose its measurement scale on the film. A reticle of up to 3mm in thickness can be used, though the thickness will determine the reticle's position.

① Unscrew the field diaphragm ring to lower the reticle by approximately 1/3 of its thickness. The field diaphragm ring's thread pitch is 0.75mm.

Example: With a 1mm thick reticle, unscrew the diaphragm ring by approximately 1/2 turn.

② Looking into the viewfinder, check to ensure that the double crosshair and viewfield images are in joint focus. If not in focus, readjust the reticle height to correct.



2) Microflex UFX-DX main unit

Slide the unit smoothly and straightly into the trinocular eyepiece vertical photo tube. (Fig.5)

When installing on Stereoscopic Microscope SMZ-10, replace the lower connecting ring with connecting ring "SM" from the trinocular eyepiece tube. Be sure the connecting ring is securely tightened.

3) 35mm camera adapter A

Aligning the adapter's positioning pin with the Microflex unit's alignment slot, mount the adapter and tighten its lock ring. (Fig.6)

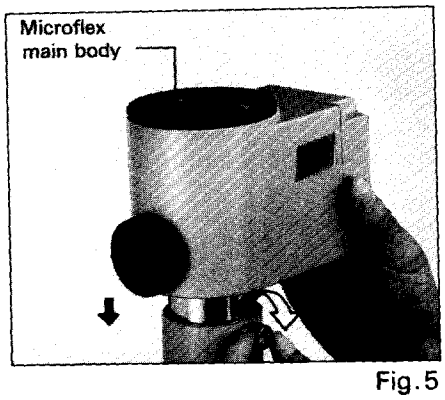


Fig.5

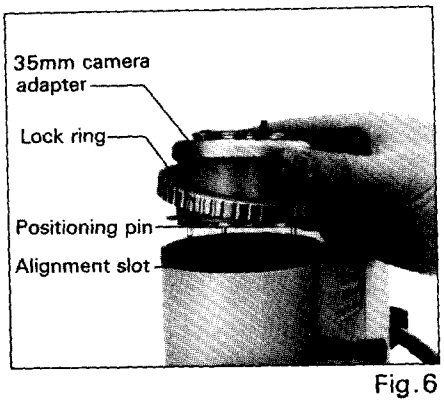


Fig.6

4) Motorized dark box FX-35DX

Aligning its index mark with that on the camera adapter, mount the dark box and rotate it into place in the direction indicated by the arrow. (Fig.7)
To detach, depress the release button and rotate in the opposite direction.

5) Ocular finder

Aligning the finder's positioning pin with the Microflex unit's corresponding alignment slot, mount the finder and tighten its lock ring. (Fig.8)

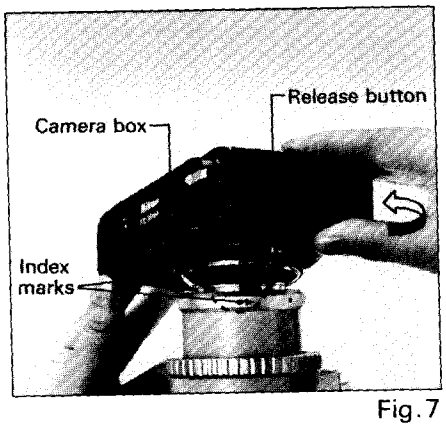


Fig.7

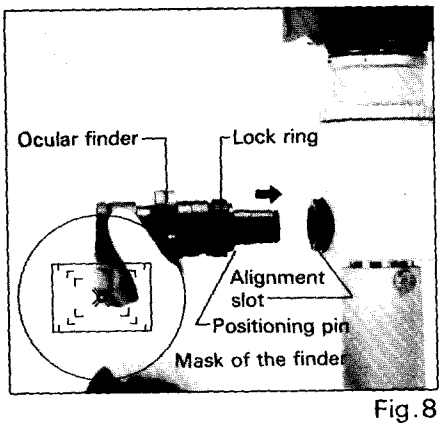


Fig.8

6) Voltage selection switch

Remove the battery chamber cover by sliding it out in the direction indicated by the arrow, then set the internal voltage selection switch to correspond to the available line voltage. (Fig.9)

7) Ni-Cd battery installation

Carefully noting its polarity (+, −), install the supplied 3.6V 50mAH nickel cadmium battery. (Fig.9)

8) Control box

Connect the signal cable and the high voltage line cord to their corresponding outlets on the control box and the Microflex unit. Connect the DX cable to the control box and the FX-35DX dark box. Be sure the lock rings on the high voltage line cord are rotated securely into place.

Note:

- **Always ensure the control box is turned OFF before performing the cable connections.**
- **Never touch or disconnect the high voltage connector while the power is switched ON. Always switch the power OFF first, as indicated by the "CAUTION H.V." label.**

To connect the signal cable, depress the release button and press the connector directly into the receptacle before releasing the button. Next, connect the power cord.

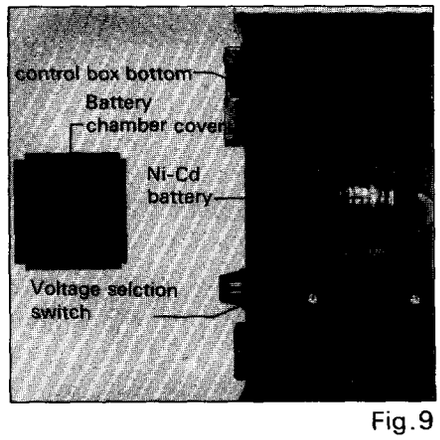


Fig.9

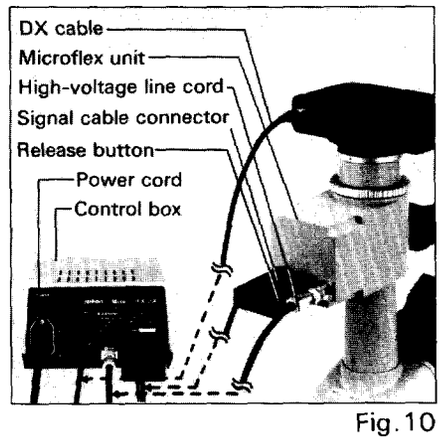


Fig.10

9) Film loading

Precautions

Set the film advance switch to "A" (AUTO mode).

- **Before loading the film, confirm that the film advance switch on the dark box is set to "A" (AUTO mode).**
  If this switch is not correctly set, operation errors, such as no film advance or continuous advance to the end of the roll, will result.

①Open the rear cover by pulling up on the release knob.(Fig.11)

②Insert the film cartridge and press the release knob back down.
(Fig.12-1)

③Pull the tip of the film leader out to the red index mark. (Fig.12-2)

- If the film is pulled too far out of the cartridge, rewind the film a bit and try again.
- Check to assure that the tip of the film leader is not severely bent or otherwise damaged.

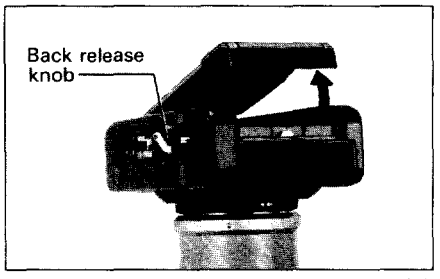


Fig.11

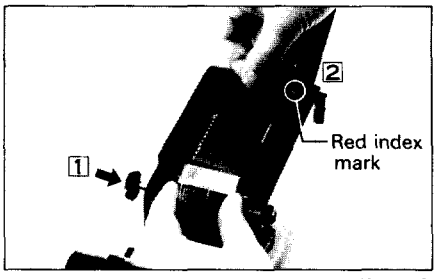


Fig.12

④Confirm the film positioning. (Fig.13)
Check to assure that the edges of the film fit precisely between the two guard rails, and that the perforation holes mate with the sprocket teeth.

- Assure that most of the film slack is taken up, and that the mouth of the film cartridge is level with the film plane.

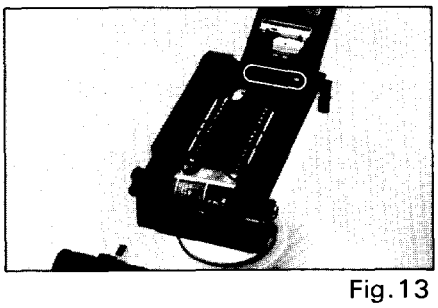
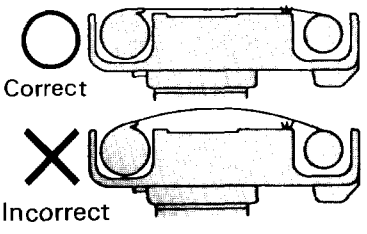


Fig.13



⑤Close the rear cover.
Be sure to press the cover firmly until it clicks securely into place.

- Please refrain from turning the rewind crank to remove film slack, as might be done using a normal single-reflex camera. The film leader tip could shift from its alignment with the index mark, adversely affecting film advancement.

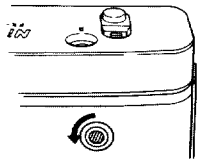
⑥Advance the film.

To automatically load and advance the film to frame number "1", press the film advance key located on the control box.

Please note, however that the auto-load function will not work under the following circumstances, and therefore the film must be manually advanced to frame number "1" by pressing the advance key several times.

▶When any other than the FX-35DX dark box is used.

▶Whenever the DX cable is not connected.



- The advance indicator on the rear cover turns to show that the film is being correctly advanced, therefore it should always be checked for correct operation. If the indicator does not turn correctly, reinstall the film.
- Check to ensure that the film end display LED on the control box is not lit. If lit, depress the film advance (WIND) key again to complete the advance.

For practical photomicrographic operation, refer to p.19.

10) Film rewinding

①The film end indicator LED will start to blink after the final exposure of the film roll. Depress the rewind button on the dark box. (Fig.14-1)

It is not necessary to hold the button down once it has been depressed.

- Do not depress the rewind button until the film has been fully advanced. If depressed between exposures, the film frames will overlap.

②To rewind the film, flip up the rewind crank and turn it in the direction indicated by the arrow. (Fig.14-2)

- The film advance indicator will turn in the opposite direction as the film is being rewound. A little resistance will be felt in the crank as the end of the roll is approached. This occurs as the film is released from the take-up spool. The advance indicator stop soon after to signal rewind completion.

Fig.14

③Pull the back release knob up to open the rear cover, and remove the film cartridge.

- Film replacement should be performed in relatively dark or shaded locations, free from exposure to direct sunlight. Likewise, film cartridges should never be left out where they may be exposed to bright light, and should be sent out for development as soon sa possible.
- Never open the back cover of the dark box until the film has been completely rewound.

④Depress the reset [RST] key on the control box to release the shutter lock, turning off the blinking light.

III.35mm DUAL CAMERA PHOTOMICROGRAPHY

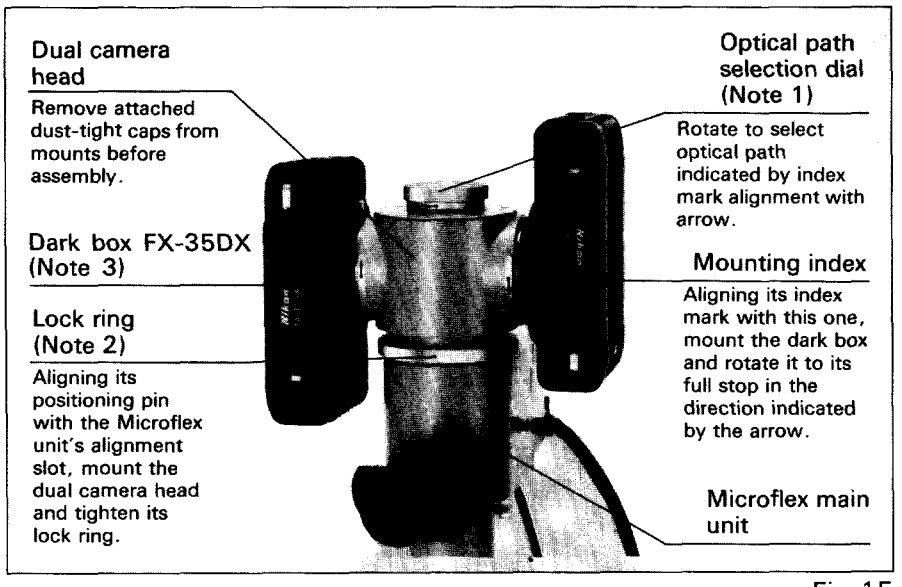


Fig. 15

Note1: Never turn the optical path selection dial while the film is being advanced.

Note2: Always be sure there are no dark boxes attached to the dual camera head before attempting to mount or detach it from the Microflex main unit.

Note3: If only one dark box is mounted on the dual camera head, be sure the free mount is covered with a lens cap (LF-1).
In applications where two dark boxes are installed, set the film speed ISO value manually, without connecting the DX cable to either of the dark boxes. If the DX cable is connected to one of the dark boxes, the film ISO value for the other box cannot be set in the DX mode.

- For the best color exposures, overexpose by 1/3 EV.
- Total photomicrographic magnification:
  CF objective × CF PL projection lens magnification.
- The same image seen through the ocular finder will be photographed. Therefore, compose photos within the finder's 35mm frame mask.
- Nomenclature, function, and assembly procedures for the CF PL projection lens, Microflex main unit, and control box are provided in Section II.
  Standard 35mm photomicrographic procedures are provided in Section VI.

Ⅳ.3 1/4 " ×4 1/4 " POLAROID PHOTOMICROGRAPHY

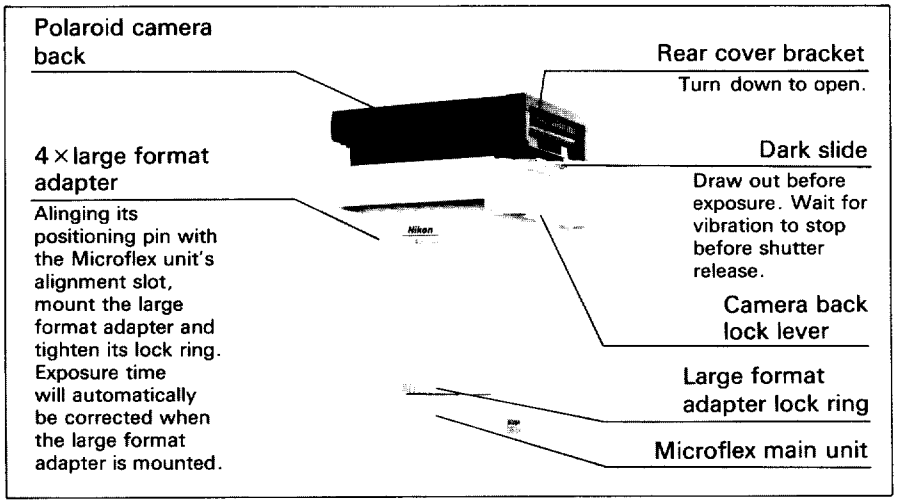


Fig.16

15 Ⅳ.3 1/4"×4 1/4" POLAROID PHOTOMI-CROGRAPHY

- Film size

  3 1/4"×4 1/4" (85mm×108mm) (Effective frame size: 73×95mm)

- Type

  Peel-apart type instant film varieties

(Fuji)	FP-100B	(Polaroid)	Type 107	Type 663	Type 668
	FP-100C		Type 108	Type 664	Type 669ER
	FP-400B		Type 611	Type 665	Type 669 SILK
	FP-3000B		Type 612	Type 667	Type 691

Read film instructions thoroughly before using.

● **Installation of Polaroid camera back:**

①Tilt the Polaroid camera back and press it in towards the left side of the large format adapter as far as possible. (Fig.17-1)

②While turning the camera back lock lever down to its full limit 2, press down on the entire camera back mounting surface to ensure a snug fit 3.

③When the lock lever is released, it will return to its original position with the camera back securely mounted 4.

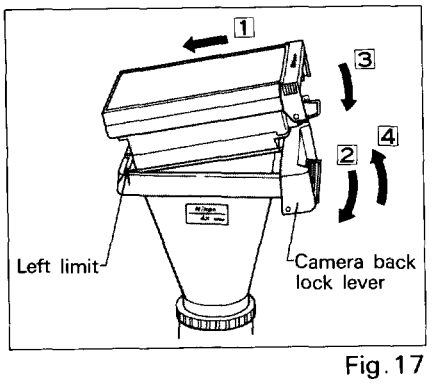


Fig.17

● **Unpacking the film magazine:**

Tear off the edge of the film package and carefully take out the film magazine.

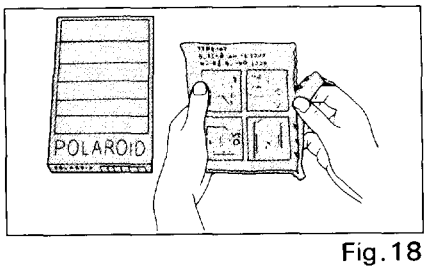


Fig.18

● **Loading the film magazine:**

Tilt the film magazine and slide it all the way in to the left-side.

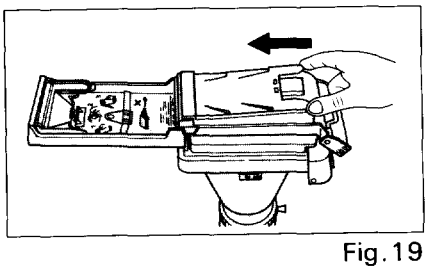


Fig.19

● **Final preparation:**

Close the rear cover, flipping down its cover bracket and locking it into place, then draw out the black tab, thus completing preparation.

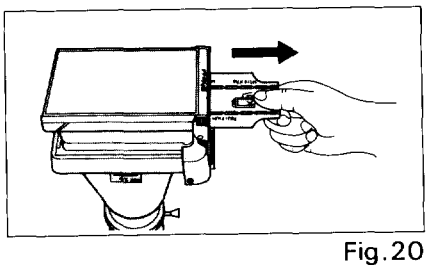


Fig.20

● Total large format magnification:
CF objective × CF PL projection lens × 4 × large format adapter magnification.

● Nomenclature, function, and assembly procedures for the CF PL projection lens, Microflex main unit, and control box are provided in Section II. Standard 35mm photomicrographic procedures are provided in Section VI.

V.4″ ×5″ FILM PHOTOMICROGRAPHY

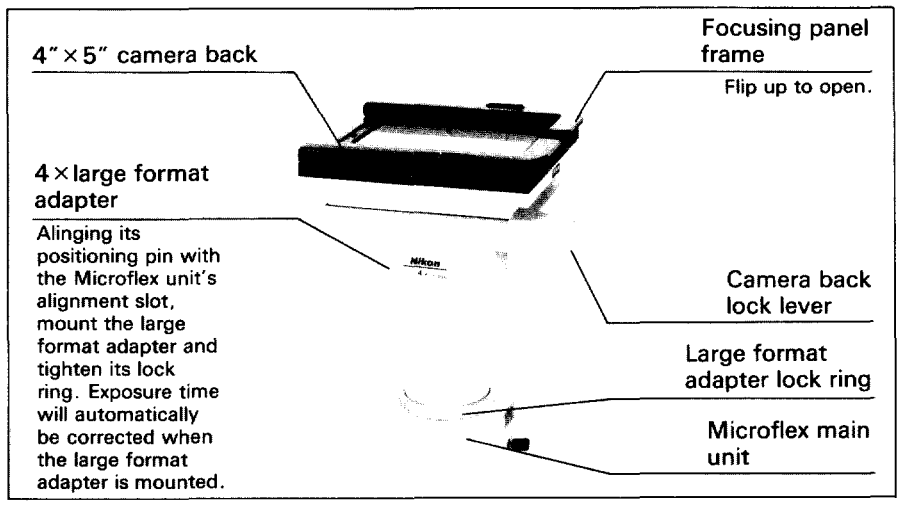


Fig.21

Please purchase the appropriate film holder made by other manufacturers according to the film type and size. Detachable focusing panel frame allows the use of thick holders such as a roll film holder with 4″×5″ adapter (ISO-IS).

●4″×5″ film size and type

(Polaroid)

M405 (Actual size: 73×95mm; Peel-apart type instant pack film)
M545 (Actual size: 89×114mm; Peel-apart type instant sheet film)
M550 (Actual size: 89×118mm; Peel-apart type instant pack film)

(Fuji)

PA-45 (Actual size: 89×118mm; Peel-apart type instant pack film)
MS-45 (Actual size: 89×114mm; Self-developing instant pack film)

★Sheet film holders generally available.
(Actual size: 95×120mm; Negative or positive film types)
★Roll film holders applicable to 4″×5″ International Standard.

Read through the instructions for each film and film holder.

● **Installation of film adapter**

①Tilt the 4"×5" camera back and press it in towards the left side of the large format adapter as far as possible. (Fig.22-1)

Note:Refer to Fig.22 for the camera back's attaching direction.

②While turning the camera back lock lever down to its full limit 2, press down on the entire camera back mounting surface to ensure a snug fit 3.

③When the lock lever is released, it will return to its original position with the camera back securely mounted 4.

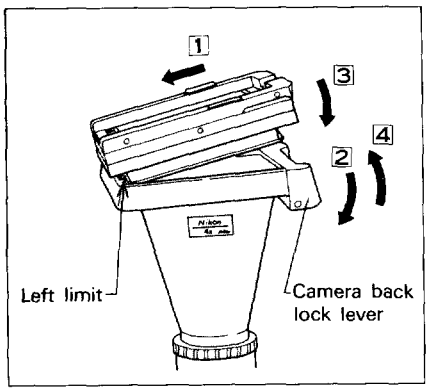


Fig.22

● **Loading the Polaroid 545 Land film holder**

Lifting the focusing panel frame of the camera back, slide the film holder completely into the camere back.

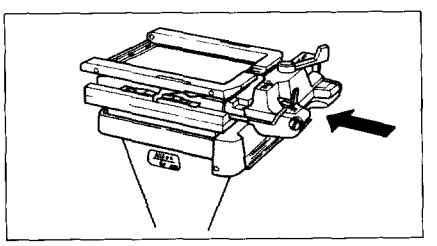


Fig.23

● **Loading the 4"×5" sheet film holder**

Lifting the focusing panel frame of the camera back, slide the film holder completely into the camera back.

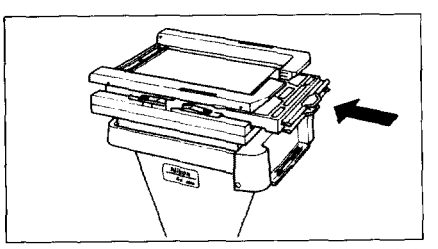


Fig.24

- Total large format magnification:
  CF objective×CF PL projection lens×4×large format adapter magnification.
- Nomenclature, function, and assembly procedures for CF PL projection lens, Microflex main unit, and control box are provided in Section II. Standard 35mm photomicrographic procedures are provided in Section VI.

Ⅵ. PHOTOMICROGRAPHIC OPERATION

1. Exposure Mode Table

The Microflex system offers a variety of photomicrographic possibilities. Referring to the Exposure Mode Table provided below and the Exposure Mode Selection Chart found on p.21 & 22, select the most appropriate method for each particular application. Operating procedures for automatic and memory photomicrographic modes can be found on p.23~26.

Exposure Mode / Procedures	AUTOMATIC EXPOSURE	TIME EXPOSUF
Feature	● Exposure determined automatically. (AUTO EXP.)	● Shutter manually operated. (MANUAL EXP.)
Setting method	● DX mode • Film speed (ISO value) is automatically set when the DX code film is loaded on the dark box FX-35DX. • Reset the MEMORY and MULTIPLE exposure modes.: - - - - - - - - - - - - → RST ● Non-DX mode (Note 1) • Set an arbitrary ISO value: - - - - - → ISO • Reset the MEMORY and MULTIPLE exposure modes.: - - - - - - - - - - - - → RST	● Set shutter interval t TIME.
Determination of exposure time	● Brightness is measured just before shutter release, and exposure time is determined automatically. (Compensation by EXP. ADJ. keys possible.) EXP. ADJ	● No brightness measurement perfo (MANUAL) ● Exposure time is giv the time between pressing and repres the release switch.
Display of shutter time	● Countdown display of exposure time remaining . ● Shutter closes at [000.00] . AREA TIME 4.54s → AREA TIME 000.00s	● When set [999.99 displayed. ● When released (EXF countup display star [000.00] (Note 2) Exposure time dis when shutter closes
Reset method	● Set another exposure mode.	● Set ISO number.

Note 1: The DX mode cannot be used in the following cases:
- ● When the film cartridge is not printed with the DX code.
- ● When no film is loaded in the dark box.
- ● When the DX cable is either not connected or incorrectly connected (as in dual camera applications).
- ● If any other than the NIKON FX-35DX dark box is used.
- ● During large format photomicrography.

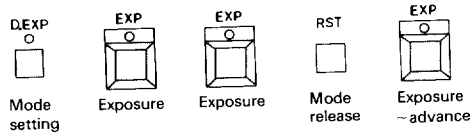
Note 2: If countup display of exposure time exceeds [999.99] , it will be repeated from [000.00] .

Note 3: RST Reset switch resets both memory and multiple modes. Reset during exposure stops the exposure and resets both memory and multiple modes.

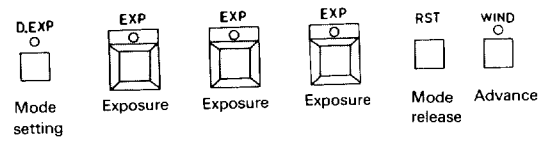
	MEMORY EXPOSURE	MULTIPLE EXPOSURE
	● Exposure time memorized.	● Stops automatic advance of film after exposure.
SO →	● Set memory mode. MEMORY ○	● Set multi-exposure mode. D.EXP ○
EXP ○ / EXP ○	● Displayed shutter time stored in memory as exposure time when memory mode is designated. MEMORY ○	● Same as designated at left.
TIME 9 9.9 9 s / TIME 0 0.0 0 s ↓ TIME 2 3.4 5 s	● Countdown display of remaining exposure time ● shutter closes at [000.00] . AREA ○ TIME 4.5 4 s ↓ AREA ○ TIME 0 0 0.0 0 s	● Same as designated at left.
SO →	● Depress reset key. (Note 3) RST ○	● Depress reset key. (Note 3 & 4) RST ○

Note 4: D.EXP ○ Multi-exposure mode can be released in one of the following ways: Two examples of multiple exposure for 3 picture frames will be given below:

(1) Reset before final exposure.



(2) After exposure, reset and advance film with WIND key.



2. Exposure Mode Selection Chart

Photographic Conditions \ Exposure Mode	Automatic Ex	EXP
Photography of uniformly distributed specimens.	○	
When correct exposure is especially desired for a part of specimen.	○	
Specimen with extremely bright background.	○	
Specimen with extremely bright background (especially when light measurement is found difficult for 1% picture area).	○	Ac to
Specimen with extremely dark background (e.g. fluorescent specimen).	○	
Specimen with extremely dark background (especially when light measurement is found difficult fo 1% picture area).	○	Ac to
When "over exposure" is desired.	○	Ac to
When "under exposure" is desired.	○	Ac to
For optional exposure settings.		
For exposure times longer than 999.99 sec. (16 min.).		
Correct exposure desired for object other than that at the center of picture field.	○	
When using a substitute to measure exposure for a rapidly moving specimen.	○	
When making two or more of same exposure.	○	
When photographing different objects, or micrometer, in the same picture frame.		
When photographing specimens of different illumination.		

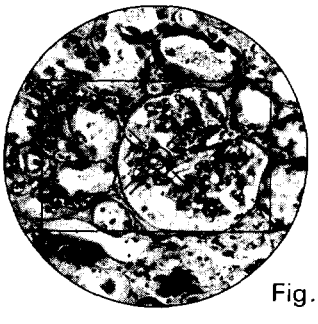


Fig.25

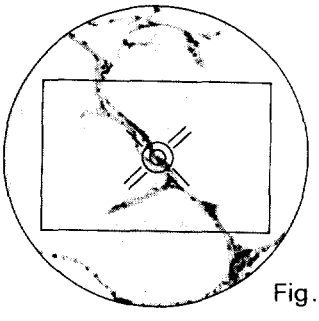
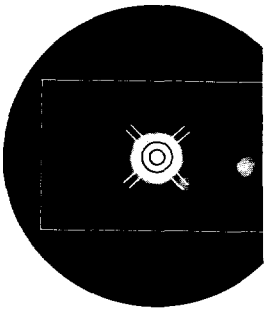


Fig.26



ess rement	TIME Exposure (Manual)	Memory Exposure	Multiple Exposure	Remarks
rage				Fig.25
ot				
ot				
*				Fig.26
ot				Fig.27
*				
*				
*				
	○			
	○			
ot		○		
*		○		
*		○		
	○	○		
* *			○	Fig.28
* *			○	

Note: * ····· Set and select applicable mode in accordance with specimen conditions.

* * ····· Mode combinations such as AUTO/TIME, AUTO/MEMORY, or TIME/MEMORY possible.

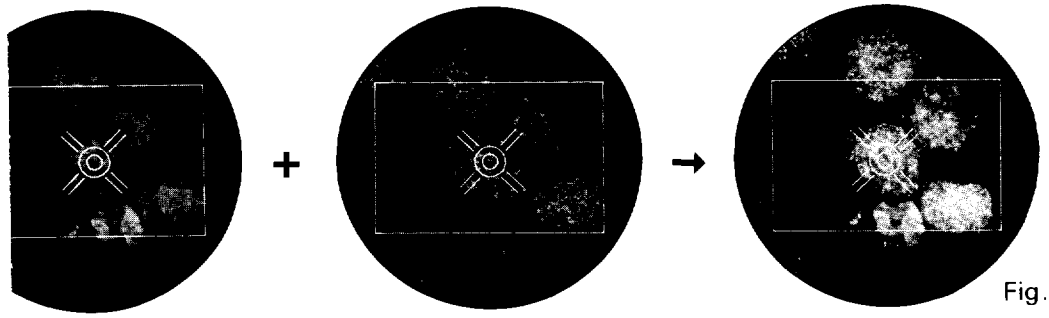
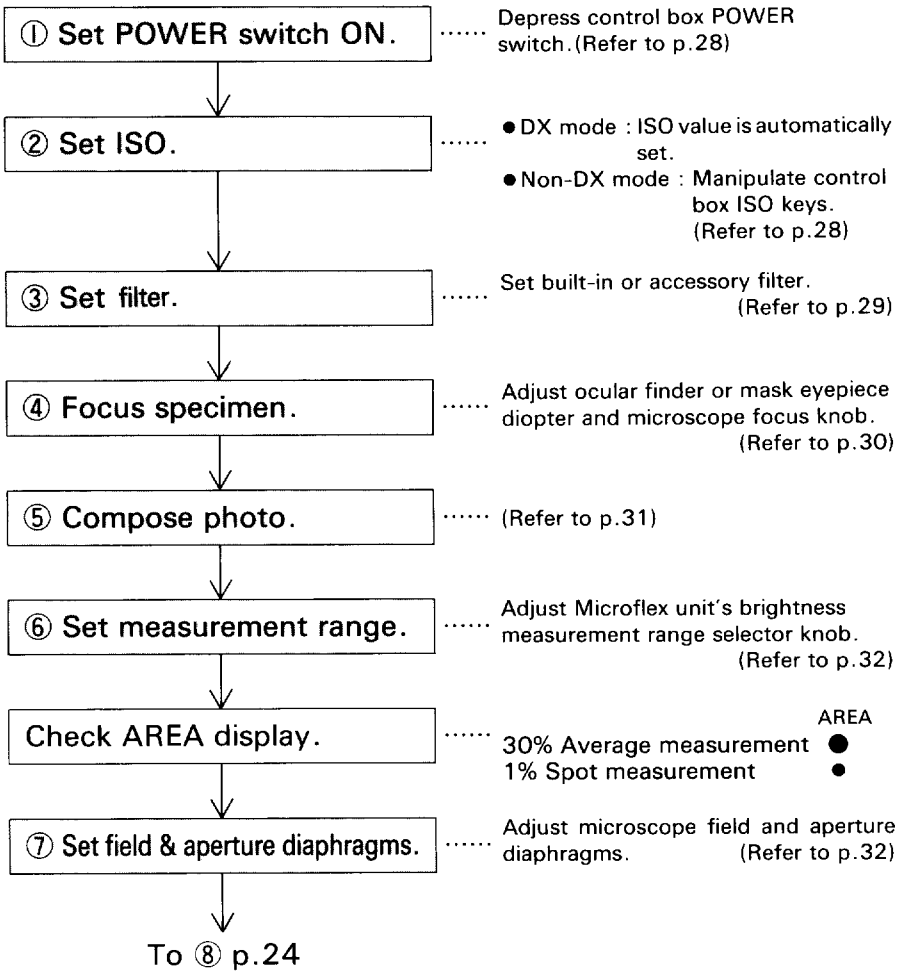
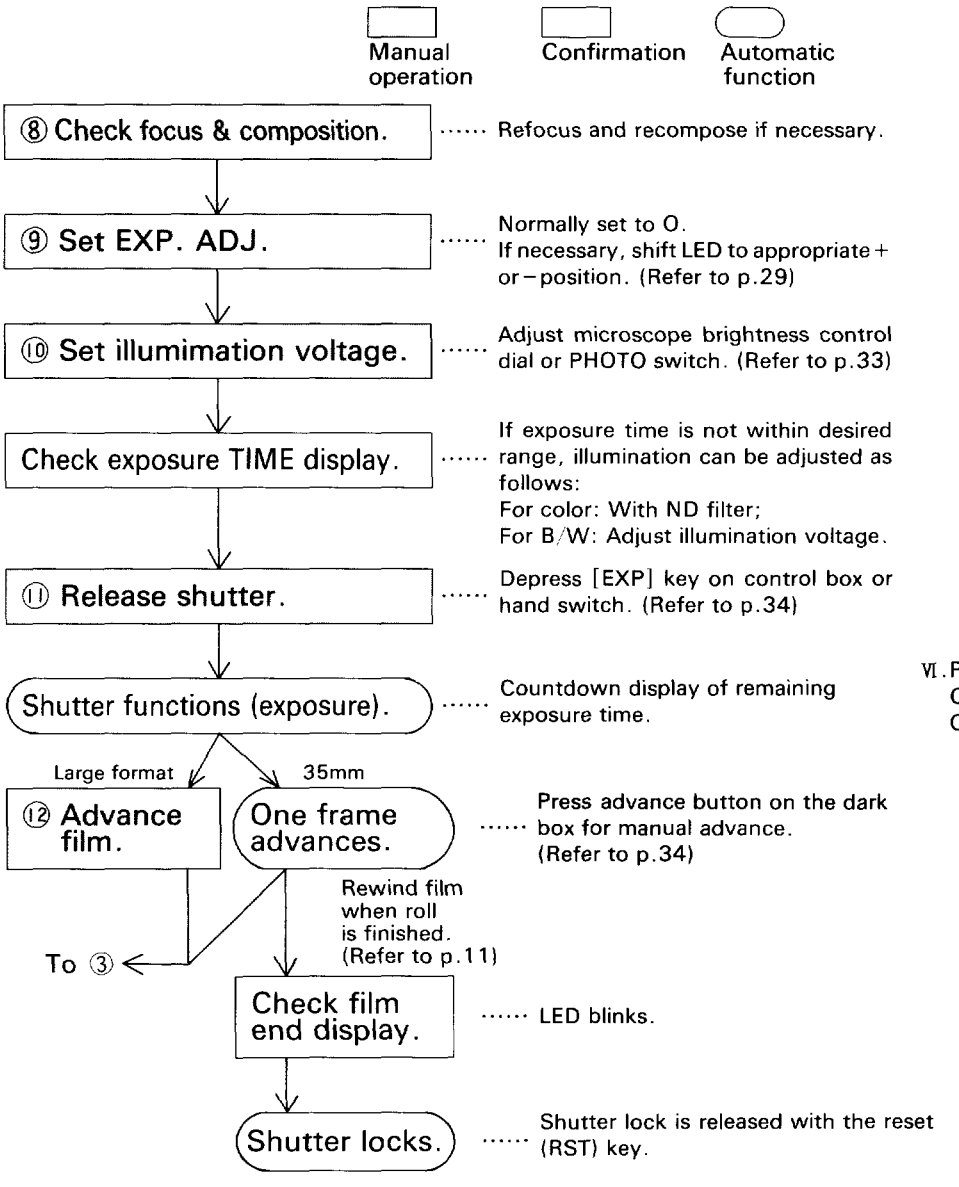


Fig.28

3. Operation Chart

1) Automatic exposure mode




Manual operation
Confirmation
Automatic function
⑧ Check focus & composition.
Refocus and recompose if necessary.
⑨ Set EXP. ADJ.
Normally set to O.
If necessary, shift LED to appropriate + or − position. (Refer to p.29)
⑩ Set illumination voltage.
Adjust microscope brightness control dial or PHOTO switch. (Refer to p.33)
Check exposure TIME display.
If exposure time is not within desired range, illumination can be adjusted as follows:
For color: With ND filter;
For B/W: Adjust illumination voltage.
⑪ Release shutter.
Depress [EXP] key on control box or hand switch. (Refer to p.34)
Shutter functions (exposure).
Countdown display of remaining exposure time.
Large format
35mm
⑫ Advance film.
One frame advances.
Press advance button on the dark box for manual advance. (Refer to p.34)
Rewind film when roll is finished. (Refer to p.11)
To ③
Check film end display.
LED blinks.
Shutter locks.
Shutter lock is released with the reset (RST) key.

2) Memory exposure mode

(In this example, an exposure is to be made of a subject located off the center of the frame.)

① Set POWER switch ON. ..... Depress control box POWER switch. (Refer to p.28)

↓

② Set ISO. ..... ● DX mode: ISO value is automatically set.
● Non-DX mode: Manipulate control box ISO keys. (Refer to p.28)

↓

③ Set filter. ..... Set built-in or accessory filter. (Refer to p.29)

↓

④ Focus specimen. ..... Adjust ocular finder or mask eyepiece diopter and microscope focus knob. (Refer to p.30)

↓

⑤ Compose picture. ..... Main subject not centered in mask, as shown in Fig.29. (Refer to p.31)

↓

⑥ Set measurement range. ..... Adjust Microflex unit's brightness measurement range selector knob. (Refer to p.32)

↓

Check AREA display. ..... AREA
30% average measurement ●
1% spot measurement •

↓

⑦ Set field & aperture diaphragms. ..... Adjust microscope field and aperture diaphragms. (Refer to p.32)

↓

⑧ Set illumination voltage. ..... Manipulate microscope brightness control dial or PHOTO switch. (Refer to p.33)

↓

To ⑨ p.26

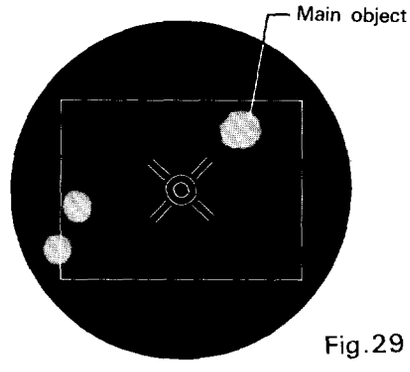


Fig.29

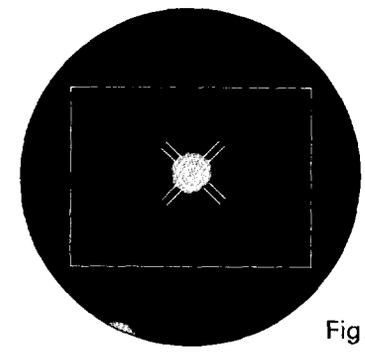
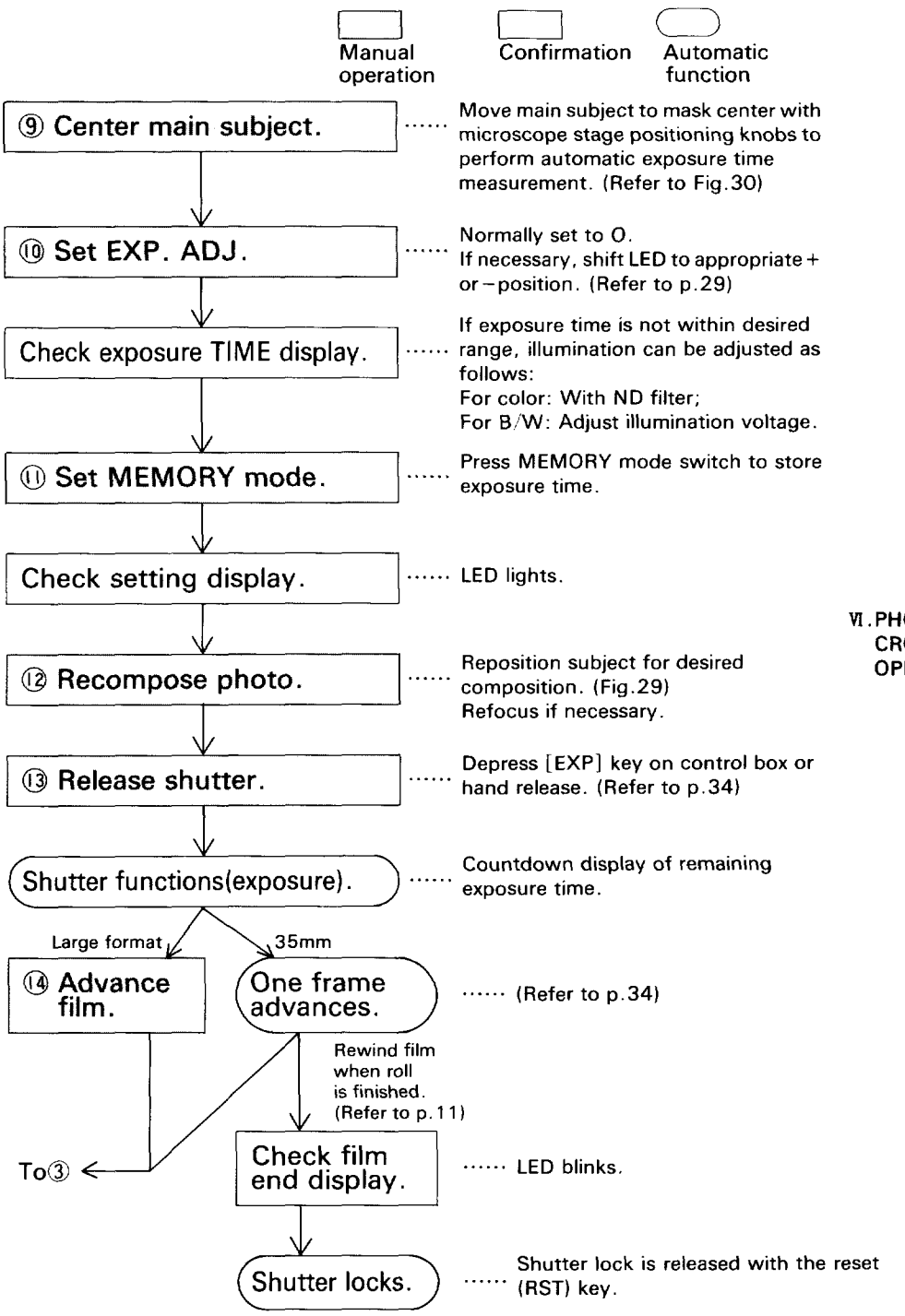


Fig.30


Manual operation
Confirmation
Automatic function
⑨ Center main subject.
Move main subject to mask center with microscope stage positioning knobs to perform automatic exposure time measurement. (Refer to Fig.30)
⑩ Set EXP. ADJ.
Normally set to O.
If necessary, shift LED to appropriate + or − position. (Refer to p.29)
Check exposure TIME display.
If exposure time is not within desired range, illumination can be adjusted as follows:
For color: With ND filter;
For B/W: Adjust illumination voltage.
⑪ Set MEMORY mode.
Press MEMORY mode switch to store exposure time.
Check setting display.
LED lights.
⑫ Recompose photo.
Reposition subject for desired composition. (Fig.29)
Refocus if necessary.
⑬ Release shutter.
Depress [EXP] key on control box or hand release. (Refer to p.34)
Shutter functions(exposure).
Countdown display of remaining exposure time.
Large format
35mm
⑭ Advance film.
One frame advances.
(Refer to p.34)
Rewind film when roll is finished. (Refer to p.11)
To③
Check film end display.
LED blinks.
Shutter locks.
Shutter lock is released with the reset (RST) key.

4. Care of Photomicrography

① **With the power switch ON, if the initial exposure time remains at 000.00, though light intensity is changed:** ⇨ Depress the [RST] key when the film end LED begins to blink. If the "E" (error) LED is also blinking, abnormal shutter or prism operation has caused the shutter to lock. In this case, depress the [RST] key. If the LED does not go out, contact your dealer or nearest Nikon representative.

② **If the CHECK display "⬇" or "⬆" LED blinks for AUTO exposure:** ⇨ **The shutter is locked because the exposure time is outside the measurable range.** Adjust the illumination brightness or (when using color film) use the appropriate ND filter to correct. As incomplete operation of the brightness measurement range selector can also cause the LED to blink, check to ensure the knob is turned completely.

③ **If fhe CHECK display "E" (error) LED blinks:** ⇨ **An operation error has caused the shutter to lock.**
If the LED does not go out when the [RST] key is depressed, contact your dealer or nearest Nikon representative.

④ **When the WIND film end indicator LED blinks:** ⇨ Depress the reset (RST) key.

⑤ **ISO and ADJ values:** ⇨ Film speed (ISO) and exposure adjustment (ADJ) values are stored and initialized as follows depending on the film to be loaded.
- When DX-coded film is loaded:
  ISO = Readout value
  ADJ = Last set value
- When large format film or non-DX-coded film is loaded:
  ISO = Last set value
  (Note: When the last loaded film was the DX-coded one, the set value before.)
  ADJ = Last set value

⑥ **To photograph a dark specimen:** ⇨ **Cap the ocular finder** to prevent stray light from entering and ruining the photograph. A semi-dark room is especially recommended for photomicrography.

⑦ **If a dark box is to be removed before its film has been fully exposed:** ⇨ **Remove the dark box first.** Should the camera adapter or dual camera head be detached beforehand, one picture frame will be exposed.

⑧ **Using the hand switch:** ⇨ **The release key does not function** while the hand switch is in use.

5. Operation Details

1) Power switch

When the control box power switch is switched ON, the ISO and EXP. ADJ LEDs light and the exposure time display gives an initial reading of "000.00". (Fig.31) Simultaneously, the battery begins to charge. It reaches full charge in 3-4 hours, and is effective for approximately 1000 hours of memory storage.

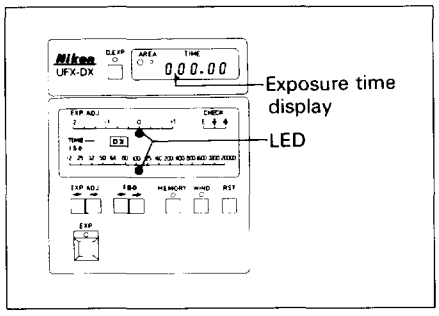


Fig.31

2) ISO setting

In the DX mode (※), film speed (ISO value) is automatically set. If not in the DX mode, depress the keys to move the ISO display LED to the desired value (ISO 12-3200, or 20000). The arrow marks above the keys indicate direction of LED movement. (Fig.32)

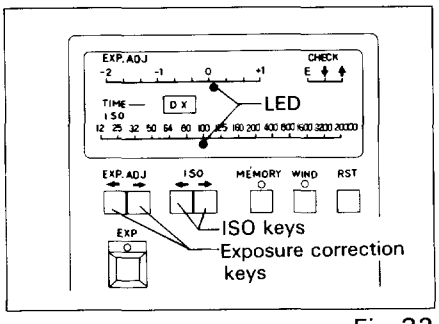


Fig.32

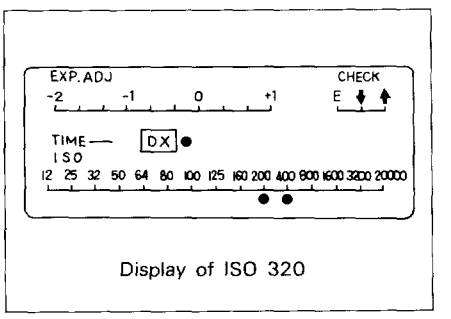
※The DX mode automatically sets and provides a readout indication of the film speed referenced to the DX code printed on the film canister. The DX mode display lamp [DX] on the control box lights when film is installed in the dark box, and the film speed (ISO value) is automatically set and displayed.

[Note]: The DX mode cannot be used in the following cases.

- When the DX code is not printed on the film cartridge.
- When no film is loaded in the dark box.
- When the DX cable is either not connected or incorrectly connected (as in dual camera applications).
- If any other than the NIKON FX-35DX camera body is used.
- During large format photomicrography.

★DX mode film speed display

DX code film speed settings are made in 1/3 step intervals over an ISO range of 25-5000. Should a film speed be registered that does not match any of the ISO values provided on the display (as in the case of an ISO reading of 320), the two ISO display LEDs on either side of the correct value will light. (Fig.33)



Display of ISO 320

Fig.33

★Exposure correction

Although exposure correction is not normally required, it can be introduced by way of the EXP. ADJ keys, providing a −2 ~ +1EV range of exposure correction in 1/3 EV steps. (Fig.33) Positive settings lengthen exposure times for graduated overexposure, and negative settings have the opposite effect.

The arrow marks above the keys indicate the direction of LED movement. Normally, when performing exposure correction outside of the camera's range of −2 ~ +1EV (as would be the case in high sensitivity photography), the ISO value display LED can be moved to compensate. However, during DX mode operation, the ISO value cannot be moved from its lit indication (although it can be moved to the "TIME" setting). Therefore, the DX mode must be overridden using either of the following procedures, and an arbitrary ISO value must be set.

- Cover the DX code printed on the film cartridge with plastic tape (any color will do, as the code must be insulated from the camera's code sensors.
- Disconnect the DX cable. **Be sure to turn OFF the control box before disconnecting.**

3) Filter selection

ND filters, such as the built-in NCB filter, are generally used for color photomicrography. Color correction (CC) filters are used to correct for color rendition differences between varying film types.

Filter selection for B/W films is dictated by desired contrast. For example, green or monochromatic interference filters are selected for better contrast in metallurgic, interference, polarization and phase contrast photomicrographies.

4) Focusing

Focusing can be performed with either the ocular finder or the mask-equipped binocular eyepiece of the microscope's trinocular eyepiece tube. Note that some eyepiece tube types do not permit binocular eyepiece focusing. (Table 1)

Table 1

	Eyepiece Tube	Focusing Through Binocular Eyepiece
OPTIPHOT-2 & LABOPHOT-2A systems	Trinocular eyepiece tube "T2"	○
	Ultra widefield trinocular eyepiece tube "UW2"	○
	Tiltable eyepiece tube	○
	Quadruple eyepiece tube "Q2"	○
	Trinocular eyepiece tube "F2"	×
LABOPHOT-2 systems	Trinocular eyepiece tube "FJ"	×
OPTIPHOT & LABOPHOT systems	Trinocular eyepiece tube "T"	○
	Ultra widefield trinocular eyepice tube "UW"	○
	Tiltable eyepiece tube	○
	Quadruple eyepiece tube "Q"	○
	Trinocular eyepiece tube "F"	×
Stereoscopic Microscope	SMZ-U	○
	Trinocular eyepiece tube for SMZ-10	×

Note: When a reticle is installed in the 4× or 5× CF PL projection lens, the ocular finder must be used for focusing.

① **Adjust diopter.**

● **Ocular finder:**

Ajust the diopter ring so the double cross hairs can be seen cleary. (Fig.34)
If the viewfield is too bright to look into the finder, insert the ND filter slider.

● **Binocular eyepiece tube:**

Use 4× or 10× objective.
Insert the mask eyepiece into either the left or right eyepiece sleeve.
Adjust the diopter ring to bring the double cross hairs at the center of the viewfield into focus. (Fig.35)
Next focus the specimen image on the central area of the mask using the microscope focus knob.
The diopter of the other eyepiece can be adjusted by focusing on the specimen with the diopter ring, without using the microscope focus knob.

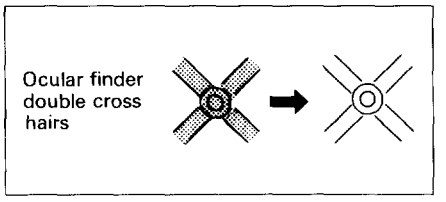


Fig.34

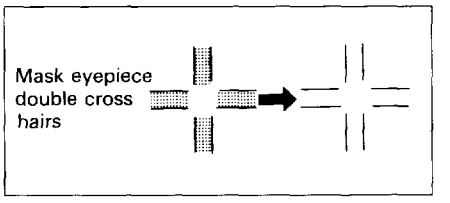


Fig.35

②Focus according to the magnification of the objective being used.

- **Using 40× or higher power objectives:**
  Adjust the microscope's fine focus knob until both the double crosshairs of the photo mask and the specimen are in sharp focus.
- **Using medium magnification objectives (10×, 20×, etc.):**
  After focusing following the above procedure, cotinue to adjust the fine focus knob while moving your eyes from side to side until the relative position of the double crosshairs and specimen images appears unchanged.
- **Using 4× or lower power objectives:**
  Mount the focusing magnifier on the ocular finder. (Fig.36)
  Looking through it, slide the focusing magnifier forward and back to bring the double crosshairs image into sharp focus.
  Finally, adjust the fine focus knob until both the double crosshairs and the specimen are in sharp focus.

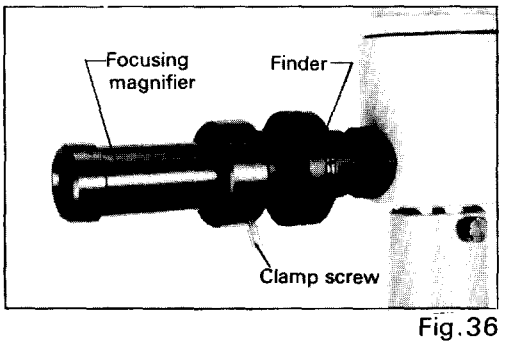


Fig.36

5) Picture composition

Adjust the microscope's stage motion control knobs to compose the picture within the ocular finder's picture composition frame which corresponds to the film size in use. (Fig.37)
Eyepiece masks are applicable to 35mm film picture composition. Select a mask suitable to the CF PL projection lens in use.(Fig.38)
Keep in mind, however, that the picture composition frames are more accurate than those for the eyepiece mask.

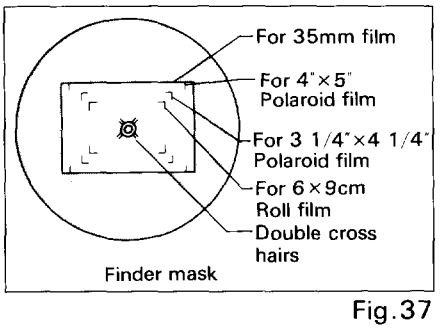


Fig.37

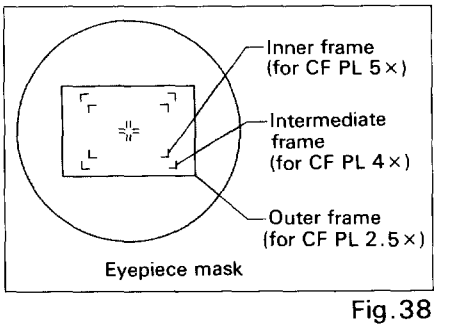


Fig.38

6) Exposure measurement area

Either the 1% spot or 30% average measurement area can be selected for exposure measurement, depending on the specimen. (Fig.39) Spot measurement is particularly effective in ensuring correct exposure of small objects scattered across the viewfield, specific portions of a larger specimen, or fluorescent photomicrography. To perform spot measurement, the subject must be positioned at the center of the viewfield crosshairs. Average measurement is more suitable to photographs of specimens evenly spread across the viewfield or evenly illuminated subjects such as integrated circuits. Press in the measurement range selector knob to its full limit for 10% spot measurement, or pull it out to its limit for 30% average measurement. The "AREA" display on the control box panel indicates the selected measurement range. (Fig.40)

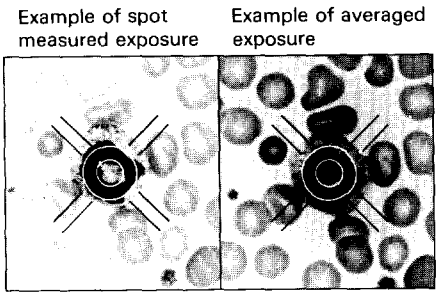


Fig.39

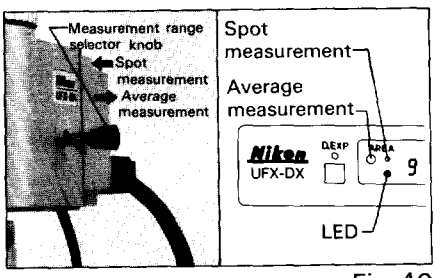


Fig.40

7) Field and aperture diaphragms

(Stereoscopic microscopes are not equipped with these diaphragms)

For optimum photomicrographic specimen illumination, the microscope's field and aperture diaphragms must be adjusted as follows:
Stop down the field diaphragms to the outer perimeter of the mask area to restrict stray light entry. The aperture diaphragm is usually stopped down to approximately 70-80% of the objective's N.A. (numerical aperture) (Fig.41), although it may be adjusted to provide the optimum contrast, depth of field, and resolution of the specimen being photographed.

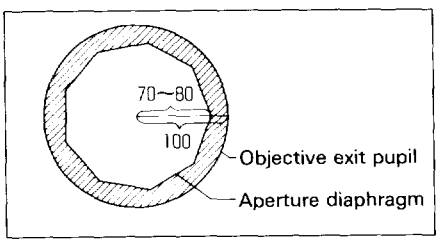


Fig. 41

8) Illumination lamp voltage

The microscope lamp voltage must be set to suit the type of photomicrography being performed. Referring to Table 2, set the microscope system's brightness control dial or depress the PHOTO switch to the corresponding brightness indication for the type of microscope and film being used.

Table 2

Film type / Microscope type	Color (Daylight)	B/W
OPTIPHOT-2 (Diascopic illumination)	With PHOTO switch (9V)	Min. 6V
OPTIPHOT-2/ OPTIPHOT (Episcopic illumination)	12V	Min. 6V
LABOPHOT-2A	With PHOTO switch (4.7V)	Suitable
LABOPHOT-2	4.7V	Suitable
LABOPHOT	5.5V	Suitable

Table 2 shows standard reference figures only, and may be adjusted to achieve better color reproduction.

★Exposure time setting

The exposure time is automatically displayed within the range of 0.01~999.99 sec (1/100"~approx. 16').

The exposure time changes in response to changes in specimen illumination, ISO setting, measurement range, aperture, etc.

However, if exposure time ever exceeds the measurement range, the "⬆" (overexposure) or "⬇" (underexposure) LED on the CHECK display will light, locking the shutter. (Fig.42)

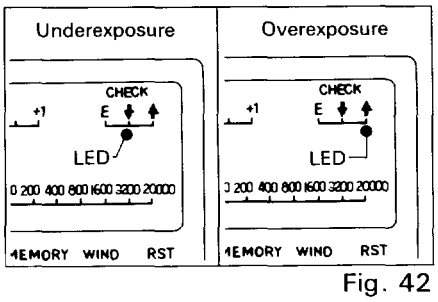


Fig. 42

Note:

- **Color photomicrography**
  If exposure time is not correctly set, reciprocity failure will cause faulty color reproduction.
  Therefore, it is especially important for color film to be exposed at the correct shutter speed. Exposure time can be adjusted with the ND filter(s).
- **B/W photomicrography**
  As exposure time is not as critical to B/W photography, the main consideration for photograph quality should be limiting the effects of vibration during the exposure by adjusting the illumination voltage.

9) Shutter release (EXP) key

The shutter is released by either depressing the shutter release key on the control box or the connected hand switch. (Fig.43)

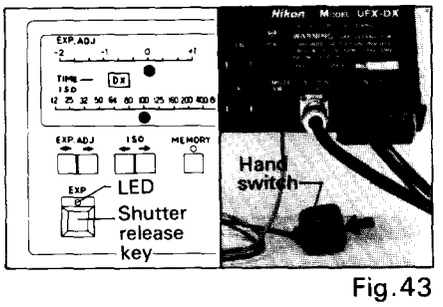


Fig.43

In normal operation, when the film is exposed the shutter function LED display remains lit until the shutter closes, whereupon the film is advanced by one frame and the shutter automatically resets.
The shutter release key is rendered inoperative while the hand switch is connected.

10) Reset (RST) key

Depress this key to stop exposure in case of emergency or to release Memory mode and Multiple exposure mode settings.
If the exposure time display fails to instantly indicate "000.00" when the power is switched ON, or the CHECK display indicates "E", depress the reset key to check the circuit. If "000.00" still fails to appear or the "E" LED fails to go out, contact your dealer or nearest Nikon Representative.

11) Film advance

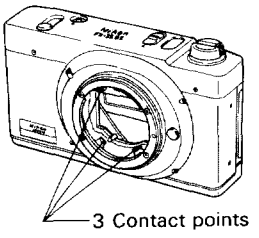
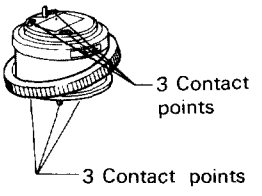
Dark box FX35-DX is equipped with an automatic film advance device. Setting the film advance mode switch to A (Auto Mode) automatically advances the film one frame after each exposure.
However, as the large format film holders cannot be advanced automatically , they must be advanced manually.

Ⅶ.TROUBLESHOOTING TABLE

Table 3

Symptom	Causes	Countermeasures
1.Photo not sharp.	Incorrect focus.	●Viewing through ocular finder (or mask eyepiece), turn diopter correction ring to bring double crosshairs into focus . Moving the eye laterally, rotate fine focus knob, until no parallax separation appears between the image and double crosshairs.
		●Use additional focusing magnifier at lower magnifications.
	Focusing position shift.(Especially during long exposure at higher magnifications)	●To eliminate external vibration, use vibration isolation table or rigid desk.
		●Select a location free of vibration (caused by traffic, passers-by, motors, etc.)
	Momentary vibration.	●Using ND filter to lengthen exposure time. (for color film : 1/4~1/15 sec.)
		●Lower the voltage to lengthen exposure time (for black-and-white film). Note, however, for color film, that lowering of color temperature and change of spectral characteristics will be unavoidable.
	Incorrect cover glass thickness. (especially with large N.A. and high power objectives).	●Use a standard 0.17mm cover glass. (No.1 1/2)
		●Use objective with cover glass thickness correction ring.
	Dry objectives used for smear preparations.	●Use NCG objectives.
		●Use cover glass with slide whenever standard-type objectives are used.
2.Image foggy.	Grease, dust or dirt on optical surface(s).	●Check and clean objective lens, eyepiece lens, slide glass, projection lens, condenser lens, field lens, etc. Take care to avoid contamination. Cover instrument when not in use.
3.Photo show uneven brightness.	Inadequate adjustment of illumination. (More conspicuous in photography than in observation.)	●Adjust illumination, following microscope instructions.
		●If lamp bulb is cause, replace immediately.
4.Insufficient image contrast.	Aperture diaphragm opened too large.	●Microscope illumination should be based on the Koehler principle for bright and uniform illumination. Contrast adjustable with condenser aperture. Generally, best results achieved with aperture stopped down to 70-80% of objective N.A.

Symptom	Causes	Countermeasures
4. Insufficient image contrast.	Incorrect filter selection.	● In metallurgical, interference, polarization or phase-contrast microscopy, use GIF (green) filter or monochromatic interference filter (e.g. peak wavelength = 546nm, half-value range = 30nm) to increase contrast. ● To increase contrast of a particular stain, use a complimentary filter color.
	Incorrect field diaphragm setting.	● To limit extraneous light causing flare, ghosts, etc., stop down field diaphragm to a diameter slightly larger than the picture frame. ● Ensure correct diaphragm setting with low power objectives or reflective metallurgical specimens.
	Low specimen contrast.	● To increase contrast, perform phase contrast, darkfield, or differential interference microscopy. ● Deeply stain specimens whenever possible. ● In color photography, depending upon the specimen, red-blue separation staining (Mallory or Azan methods) provides better contrast than red-violet (H-E) stain. ● Fine grain, high contrast film (minicopy film) is better suited for B/W photomicrography. ● For general use, a film of wider latitude and finer grain is preferable.
5. Poor microscope resolution.	Incorrect objective N.A.	● Image resolution is proportional to sum of the objective and condenser N.A. (Refer p.40 Table 4.) ● To attain higher resolution and sharpness for the same magnification, increase objective power rather than that of eyepiece even though depth of field is reduced.
	Excessive Magnification	● 500X-1000X N.A. is magnification range for optimum resolution.
6. Ghosts or flare on photos.	Extraneous light entering the ocular finder.	● Especially for long exposure times, darken surroundings or place cap on ocular finder.
	Stray light entry.	● Take care not to expose microscope and specimen to direct sunlight or other intense lights.

Symptom	Causes	Countermeasures
7. Poor photo-graphic quality.	Incorrect filter selection.	● Select best filter combination for microscope being used.
	Film of another make or emulsion No.	● Use CC filters. (For details, refer to film's data sheet or contact film manufacturer.)
		● When using daylight films widely different spectral sensitivities may result depending upon the type, make, etc.
		● Although the same film type is used, color reproduction may differ with emulsion number.
	Wrong lamp voltage setting.	● Color temperatures change depending upon lamp voltage and brightness. Always perform photomicrography at the lamp voltage specified in the microscope's instruction manual.
	Incorrect exposure time setting.	● Due to reciprocity failure, incorrect exposure time setting can result in untrue color renditions. Referring to the exposure TIME display, use the ND filter(s) to adjust the exposure time to match film characteristics, or adjust the failure with the CC filter(s).
	Influenced by film development.	● Consult the development laboratory, especially for color print film.
8. Film won't advance.	Contacts dirty.	● Clean contact points of dark box and camera adapter A (or dual camera head) using soft cotton cloth or tissue paper lightly moistened with alcohol.  
9. Overlapped frames.	Contacts dirty.	

Ⅷ. SPECIFICATIONS

Type: Reflex type with swing prism
Automatic exposure meter built-in
Brightness measuring method: Memory type
Light detector: photo multiplier

1. Brightness measurement range
   1% or 30% of picture area (selectable) for 35mm film format
2. Exposure time range
   Automatic: 0.01~999.99sec.
   (ISO 100, 35mm film format)
   Manual: Time exposure and flash synchronization for X~1/60 sec. setting.
3. ISO range
   - Automatic ISO set: 1/3 step intervals over an ISO range of 25~5000
   - Arbitrary ISO set: ISO 12~3200 (12, 25, 32, 50, 64, 80, 100, 200, 400, 800, 1600, 3200) and 20000 (35mm and large format films)
4. Exposure compensation
   −2EV~+1EV, in 1/3 steps
5. Exposure time display
   Digital display of 0.01~999.99 sec.
6. Shutter lock
   - Automatic exposure time setting out of operational range
   - Film advanced to end of roll
   - Film end LED is blinking or lit
   - Shutter or prism functions abnormal
7. Film advance
   - Automatic: One frame advanced automatically at each exposure.
   - Manual: Single frame advance at depression of WIND key.
   - Automatic film lead-in function
8. Other exposure controls
   - Memory exposure control
   - Multiple exposure control
9. Optical path
   Transmitted light divided into 50% for finder and 50% for measurement.
   Prism swings out of path for exposure with 100% of transmitted light.
10. Ocular finder
    With ND filter slider
    Focusing magnifier may also be used for lower magnifications.
11. Motorized dark box FX-35DX
    35mm film type;
    Automatic film advance;
    Automatic light shield control;
    F mount, frame counter;
    Manual rewind crank;
    DX signal output connector.
12. Photomicrographic attachments for large format films
    - Polaroid camera back (for 3 1/4"×4 1/4" Polaroid pack film)
    - 4"×5" camera back (for 4"×5" Polaroid film and sheet film)
13. Projection lens
    2×, 2.5×, 4× & 5× CF PL projection lenses available
14. Photographic magnification
    35 mm: CF objective×CF PL projection lens magnification
    Large format: CF objective×CF PL projection lens× 4× large format adapter magnification
15. Power source
    Voltage: 100V/110V or 220V/240V 50/60Hz
    Fuse: 1A/250V for 100/120V
    0.5A/250V for 220/240V
    Battery: 3.6V 50mAH Ni-Cd
16. Operating conditions
    Temperature: 0~40℃
    Humidity: 80% or less
17. Weight
    Microflex main unit: 1080g (with finder)
    900g (without finder)
    Control box: 2360g

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.

★35mm Photomicrography Optical Data

Table 4

(For Biological Microscope)

Objective		Numerical aperture N.A.	Resolving power ε (μm)	CF PL Projection lens magnification (×)	Total magnification β (×)	Depth of focus t (μm)	Real field of view φ (mm)
CF Plan achromat	4×	0.13	2.1	2	8	64	5.4
				2.5	10	54	4.3
				4	16	40	2.7
				5	20	35	2.2
	10×	0.3	0.92	2	20	11	2.2
				2.5	25	10	1.7
				4	40	7.3	1.1
				5	50	6.4	0.9
	20×	0.5	0.55	2	40	3.6	1.08
				2.5	50	3.1	0.87
				4	80	2.3	0.54
				5	100	2.1	0.43
	40×	0.7	0.39	2	80	1.5	0.54
				2.5	100	1.3	0.43
				4	160	1.0	0.27
				5	200	0.92	0.22
	60×	0.85	0.32	2	120	0.87	0.36
				2.5	150	0.77	0.29
				4	240	0.63	0.18
				5	300	0.58	0.14
	100× (Oil)	1.25	0.22	2	200	0.57	0.22
				2.5	250	0.51	0.17
				4	400	0.42	0.11
				5	500	0.39	0.09
CF Plan apochromat	4×	0.2	1.4	2	8	38	5.4
				2.5	10	32	4.3
				4	16	23	2.7
				5	20	20	2.2
	10×	0.45	0.61	2	20	7.6	2.2
				2.5	25	5.8	1.7
				4	40	4.2	1.1
				5	50	3.6	0.9
	20×	0.75	0.37	2	40	2.2	1.08
				2.5	50	1.8	0.87
				4	80	1.3	0.54
				5	100	1.2	0.43
	40×	0.95	0.29	2	80	0.96	0.54
				2.5	100	0.83	0.43
				4	160	0.63	0.27
				5	200	0.56	0.22
	60×	0.95	0.29	2	120	0.74	0.36
				2.5	150	0.65	0.29
				4	240	0.52	0.18
				5	300	0.48	0.14
	100× (Oil)	1.4	0.20	2	200	0.48	0.22
				2.5	250	0.43	0.17
				4	400	0.35	0.11
				5	500	0.32	0.09

(For Metallurgical Microscope)

Objective		Numerical aperture N.A.	Resolving power ε (μm)	CF PL Projection lens magnification (×)	Total magnification β (×)	Depth of focus t (μm)	Real field of view φ (mm)
CF M Plan achromat	2.5×	0.075	3.7	2	5	182	8.7
				2.5	6.25	156	6.9
				4	10	116	4.3
				5	12.5	102	3.5
	* 5×	0.10	2.8	2	10	78	4.3
				2.5	12.5	68	3.5
				4	20	53	2.2
				5	25	48	1.7
	* 10×	0.25	1.1	2	20	14	2.2
				2.5	25	12	1.7
				4	40	9.4	1.1
				5	50	8.4	0.9
	* 20×	0.40	0.69	2	40	4.8	1.08
				2.5	50	4.2	0.87
				4	80	3.3	0.54
				5	100	3.0	0.43
	* 40×	0.65	0.42	2	80	1.6	0.54
				2.5	100	1.4	0.43
				4	160	1.1	0.27
				5	200	1.0	0.22
	* 60×	0.80	0.34	2	120	0.95	0.36
				2.5	150	0.85	0.29
				4	240	0.69	0.18
				5	300	0.64	0.14
	* 100× (Dry)	0.90	0.31	2	200	0.62	0.22
				2.5	250	0.56	0.17
				4	400	0.48	0.11
				5	500	0.45	0.09
	100× (Oil)	1.25	0.22	2	200	0.57	0.22
				2.5	250	0.51	0.17
				4	400	0.42	0.11
				5	500	0.39	0.09
CF M Plan apochromat	* 40×	0.80	0.34	2	80	1.2	0.54
				2.5	100	1.1	0.43
				4	160	0.82	0.27
				5	200	0.74	0.22
	50×	0.90	0.31	2	100	0.90	0.43
				2.5	125	0.78	0.35
				4	200	0.62	0.22
				5	250	0.56	0.19
	100×	0.95	0.29	2	200	0.56	0.22
				2.5	250	0.51	0.17
				4	400	0.43	0.11
				5	500	0.41	0.09
CF BD Plan apochromat	100×	0.9	0.31	2	200	0.62	0.22
				2.5	250	0.56	0.17
				4	400	0.48	0.11
				5	500	0.45	0.09

(Note): BD type objectives are also available for the objective magnifications marked with *. Their specification data are the same with those of corresponding M type objective.

Resolving power: $\varepsilon = \frac{\lambda}{2 \times N.A.}$

Depth of focus: $t = \frac{n \times \lambda}{2 \times N.A.^2} + \frac{n \times \delta}{\beta \times N.A.}$

Real field of view: $\phi = \frac{\sqrt{24^2 + 36^2}}{\beta}$

$\lambda = 0.55 \mu m$
$\delta = 0.55$ Resolution on film 20/mm
n: Refractive index of objective side medium
n = 1.0 Dry objective
n = 1.52 Immersion objective

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