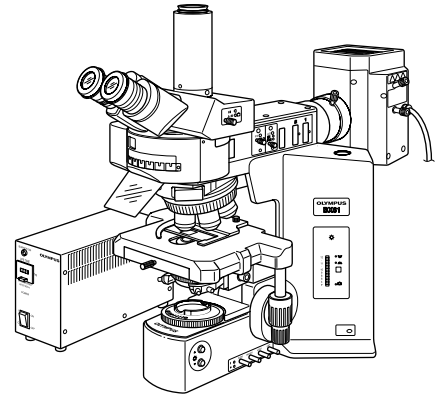


OLYMPUS®

BX-RFAA
U-LH100HGAPO
U-LH100G
Power Supply Unit
U-25ND6
U-25ND25
U-RSL6
U-RSL6EM
BX-RFSS
U-EXBABG
U-EXBAUB
U-EXBAUG



INSTRUCTIONS

MOTORIZED REFLECTED

FLUORESCENCE

SYSTEM

This instruction manual is for the Olympus Motorized Reflected Fluorescence System. To ensure the safety, obtain optimum performance and to familiarize yourself fully with the use of this system, we recommend that you study this manual thoroughly before operating the system. Retain this instruction manual in an easily accessible place near the work desk for future reference.



A X 9 9 4 8

CONTENTS

Correct assembly and adjustments are critical for a reflected fluorescence system to exhibit its full performance. If you are going to assemble the microscope yourself, please read chapter 9, "ASSEMBLY" (pages 29 to 35) carefully.

IMPORTANT – Be sure to read this section for safe use of the equipment. – 1-3

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IMPORTANT

The motorized operations of the BX-RFAA motorized reflected fluorescence illuminator used with this system can be controlled from the BX-UCB control box and U-HSTR2 hand switch (the illuminator can also be interlocked with other motorized equipment using the BX2 software for PC).




- Motorized operations:**
- Turret switching of mirror units
 - Insertion/removal of the shutter
 - Activation of motorized revolving nosepiece connector

SAFETY PRECAUTIONS

1. A microscope with motorized parts is a precision instrument. Handle it with extreme care and avoid subjecting it to impact.
2. For the ultrahigh-pressure mercury burner, use the Olympus-provided USH102D (manufactured by USHIO) or HBO103W/2 (manufactured by OSRAM) DC burner.
3. Make sure that the mercury burner is attached and cords are connected.
4. The internal parts become very hot during and within 10 minutes after completion of operation. Do not attempt to open the light housing in these periods (see page 10).
5. The stoppers provided for some functions may be damaged if excessive force is applied.
6. Do not disassemble the power supply unit because it contains high voltage parts inside.
7. Always use the power cord provided by Olympus. If no power cord is provided, please select the proper power cord by referring to the chapter "PROPER SELECTION OF THE POWER SUPPLY CORD" at the end of this instruction manual. If the proper power cord is not used, product safety and performance cannot be guaranteed.
8. Always ensure that the **grounding terminal** of the power supply unit and that of the wall outlet are properly connected. If they are not grounded, Olympus can no longer warrant the electrical safety and performance of the equipment.
9. Before opening the lamp housing for replacing the burner, etc., be sure to set the main switch to "○" (OFF), unplug the power supply unit's output connector for the power supply to the lamp housing and wait for more than 10 minutes until the burner has cooled down.
10. The top panel of the lamp housing becomes very hot during operation. To prevent fire hazard, do not block the ventilation through the top panel.



Safety Symbols

The following symbols are found on the microscope. Study the meaning of the symbols and always use the equipment in the safest possible manner.

Symbol	Explanation
	High voltage warning indicating presence of high voltage (1 kV or more).
	Indicates that the surface becomes hot, and should not be touched with bare hands.
	Before use, carefully read the instruction manual. Improper use could result in personal injury to the user and/or damage to the equipment.
I	Indicates that the main switch is ON.
○	Indicates that the main switch is OFF.

Warnings

Warning engravings are placed at parts where special precaution is required when handling and using the system. Always heed the warnings.

Warning engraving position	• Lamp housing (U-LH100HG, U-LH100HGAPO)	[Warning against high temperature]	
	• ND filter (U-25ND6, U-25ND25)	[Warning against high voltage]	
	• Power supply unit (for 100 W mercury burner)		

1 Getting Ready

1. This manual pertains only to the operations of the motorized reflected fluorescence system. Also read the instruction manuals of the BX microscope and associated options to obtain general understanding on the system.
2. Do not attempt to operate the motorized parts manually. They may be destroyed by excessive force.
3. The motorized reflected fluorescence system is composed of precision instruments. Handle them with care and avoid subjecting them to sudden or severe impact.
4. Do not use the system where it is subjected to direct sunlight, high temperature and humidity, dust or vibrations.
5. To enable ventilation for the lamp housing and power supply unit, reserve spaces of more than 10 cm around them.
6. The power cord can be used to shut off power supply in case of emergency. To enable this function, install the power supply unit so that its power cord connector (on the rear of the power supply unit) or wall power outlet can easily accessed and unplugged in case of emergency.

2 Maintenance and Storage

1. Clean all glass components by wiping gently with gauze. To remove fingerprints or oil smudges, wipe with gauze slightly moistened with a mixture of ether (70%) and alcohol (30%).
▲ Since solvents such as ether and alcohol are highly flammable, they must be handled carefully. Be sure to keep these chemicals away from open flames or potential sources of electrical sparks — for example, electrical equipment that is being switched on or off. Also remember to always use these chemicals only in a well-ventilated room.
2. Do not attempt to use organic solvents to clean the system components other than the glass components. To clean them, use a clean cloth. If they are extremely dirty, use a soft cloth slightly moistened with a diluted neutral detergent.
3. Never attempt to disassemble any part of the system.
4. When the hour counter on the power supply unit indicates 200 hours (USH102D) or 300 hours (HBO103W/2), set the main switch to “○” (OFF), wait for more than 10 minutes for safety, then replace the mercury burner (see page 33). Unlike fluorescent lamps, the mercury burner incorporates high-pressure gas sealer inside it. If the burner is used far beyond the service life, the distortion will accumulate in the glass tube, which may explode in worst case.

3 Applicable Intermediate Attachment

The BX-RFAA motorized reflected fluorescence illuminator can be used in two-stage stacked configuration by attaching an intermediate attachment on it.

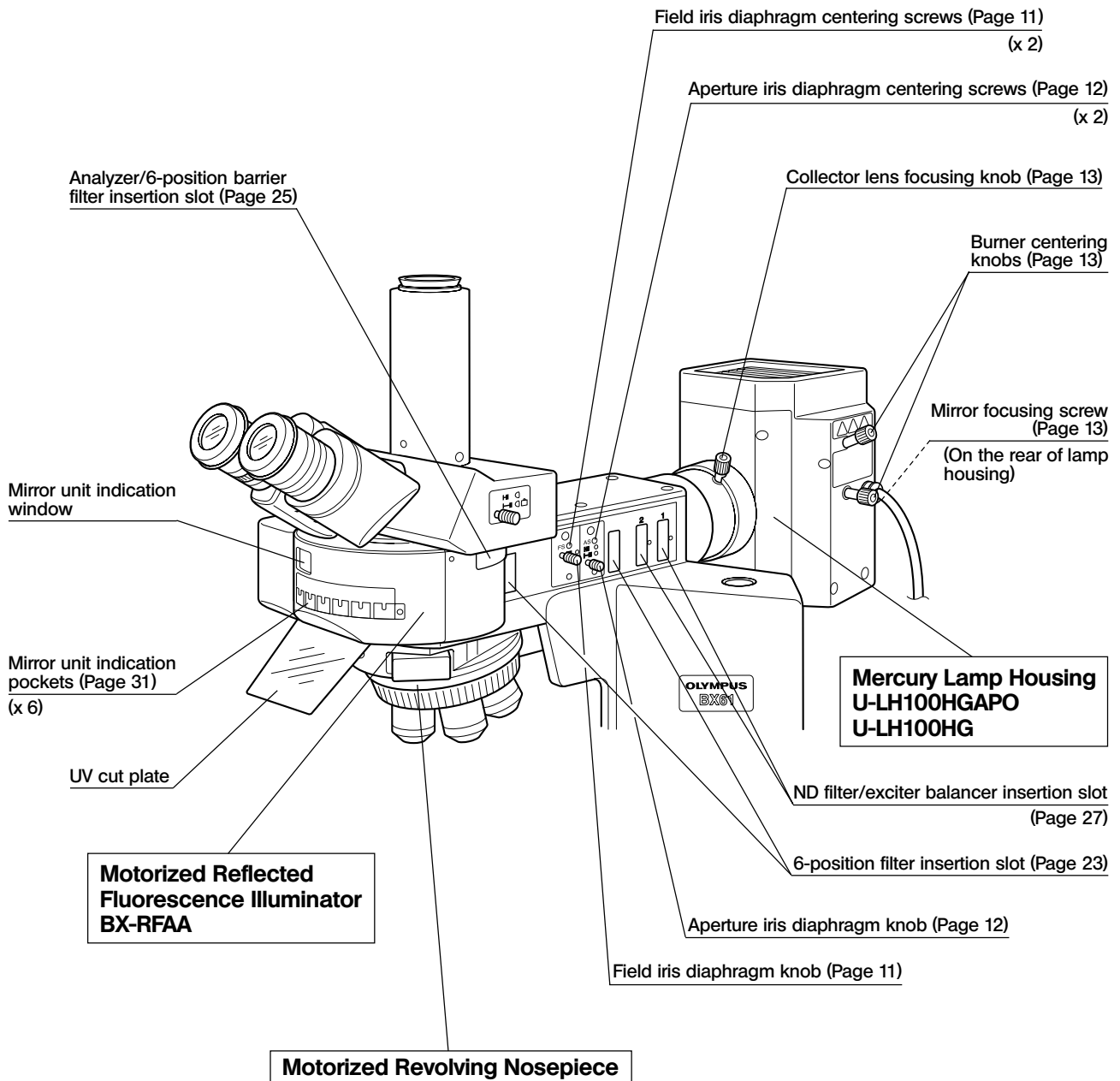
4 Caution

If the system is used in a manner not specified by this manual, the safety of the user may be imperiled. In addition, the equipment may also be damaged. Always use the equipment as outlined in this instruction manual.

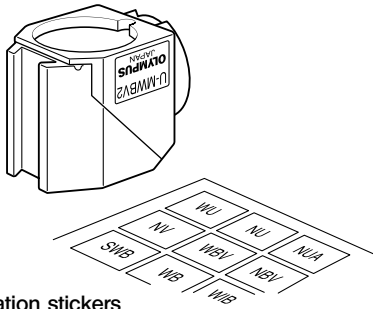
The following symbols are used to set off text in this instruction manual.

- ▲ : Indicates that failure to follow the instructions in the warning could result in bodily harm to the user and/or damage to equipment (including objects in the vicinity of the equipment).
- ★ : Indicates that failure to follow the instructions could result in damage to equipment.
- ◎ : Indicates commentary (for ease of operation and maintenance).

1 NOMENCLATURE



**Fluorescence Mirror Unit
18 models including the U-MWU2**



Indication stickers

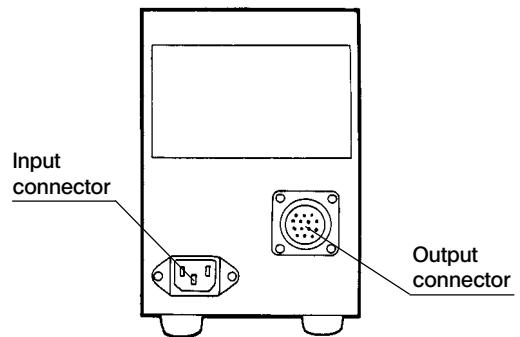
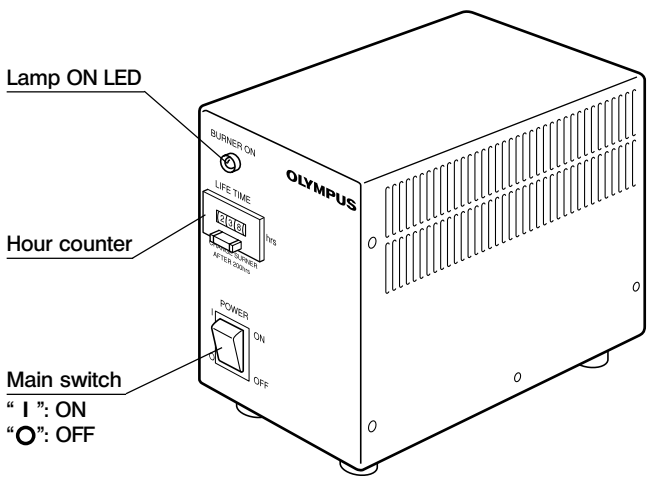
◎ The BX-RFAA can accept up to six fluorescence mirror units.

★ Every mirror unit is composed of a dichroic mirror, barrier filter and excitation filter which are suitable for each excitation method. Basically, do not disassemble the mirror unit.

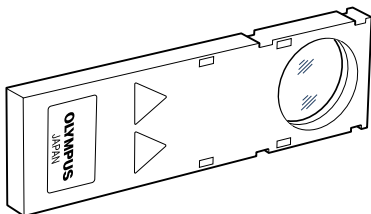
◎ If you want to fabricate an original fluorescence mirror unit, it is recommended to use the U-MF2 empty mirror unit (which does not include filter) (page 32).

A blank indication stickers are provided with the illuminator. Use the stickers for writing the original mirror unit names.

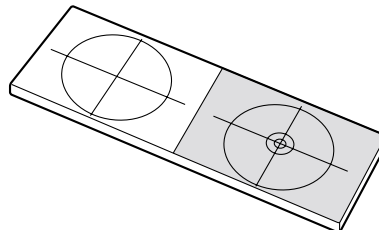
**Power Supply Unit
(for 100 W mercury burner)**



**ND Filter
U-25ND6
U-25ND25**



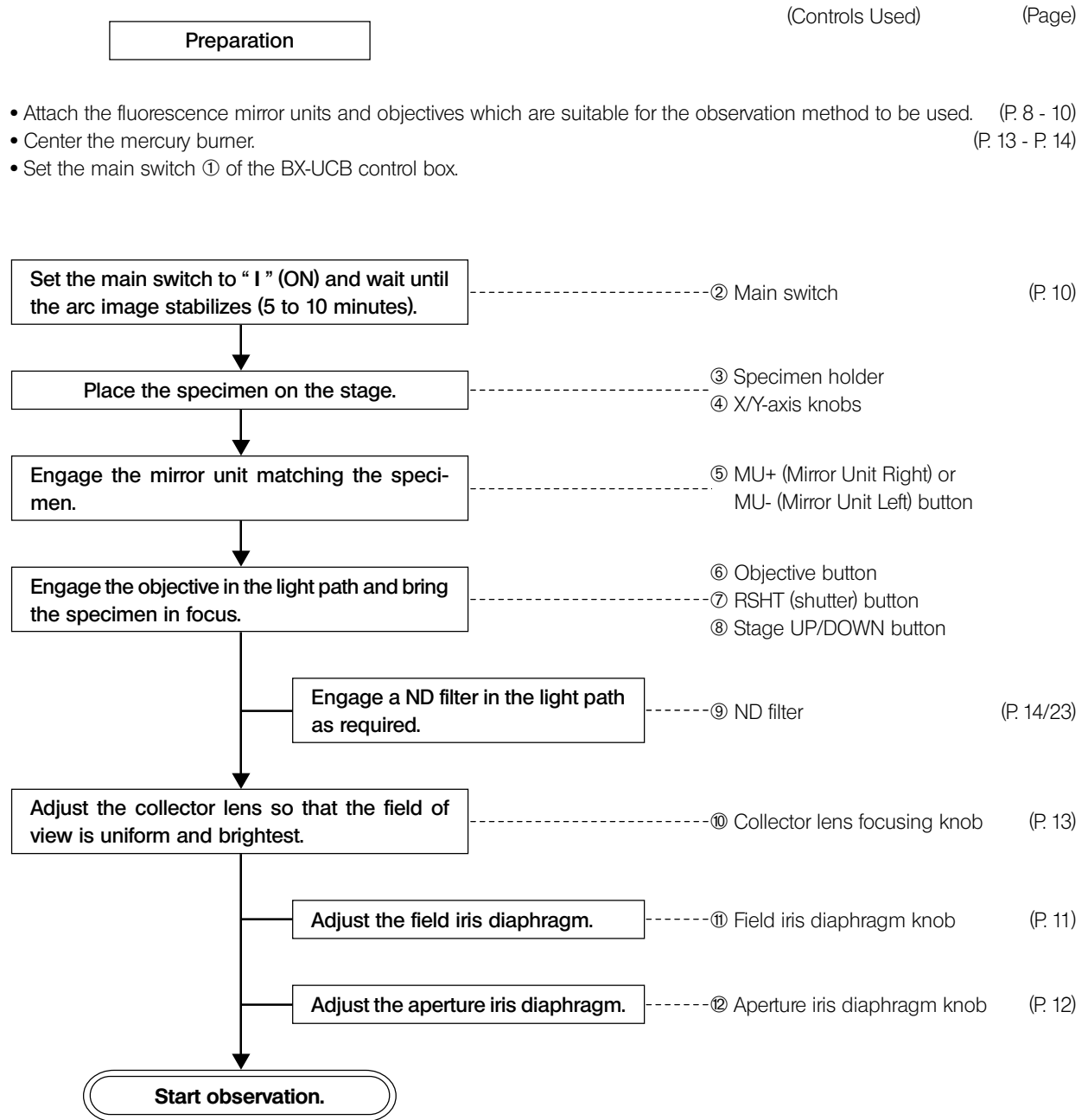
**Centering Target
U-CST**



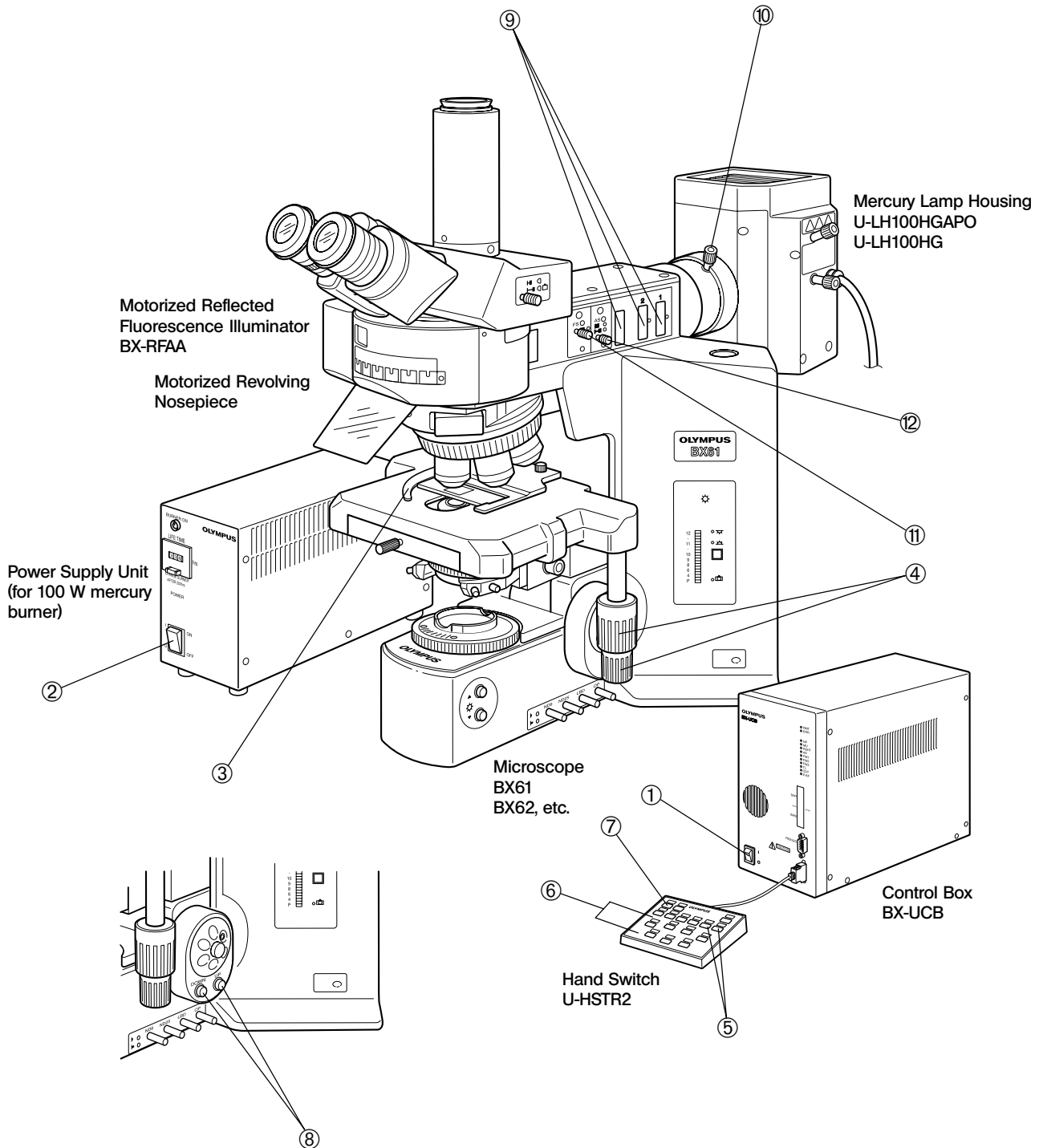
2

REFLECTED FLUORESCENCE OBSERVATION PROCEDURE

©For the operating procedures for simultaneous observations of phase contrast or transmitted Nomarski DIC observation with fluorescence observation, see chapter 4, "SIMULTANEOUS FLUORESCENCE OBSERVATION METHODS" (page 15).



©Engage the shutter if you interrupt observation for a short time. -----⑦ RSHT (shutter) button



© Make a photocopy of the observation procedure pages and post it near your microscope.

3 USING THE CONTROLS

1 General Precautions for Observation

1. Verify that the power supply voltage and frequency match the requirements inscribed on the rating plate.
2. Make sure that the power cord and connecting cables are plugged in securely.
3. If you perform only transmitted light phase contrast or transmitted light DIC observation, leave one fluorescence mirror unit position on the turret empty. This allows for transmission of original color reproduction.
4. Enlarge the field iris diaphragm so it just circumscribes the field of view. If decentered, center it using the Allen screwdriver.
5. Always use immersion oil for immersion objectives.
6. If you use an objective with correction collar such as the UPlanApo40X or PlanApo40X, you can correct variations in cover glass thickness by adjusting the correction collar.

Collection procedure

Turn the correction collar while adjusting the fine adjustment knob to where the image is focused. Cover glass thickness for which correction is possible is from 0.11 to 0.23 mm.

7. Engage the shutter if you interrupt observation for a short time.
(Turning the mercury burner ON and OFF repeatedly will significantly shorten the life span of the burner.)
 8. Color fading of specimens:
This system features high excitation light intensity to ensure bright observation of dark fluorescence specimens. In consequence, after long period of observations using high-power objectives, the colors of specimens will fade quicker than usual, causing the view (contrast of fluorescent images) to deteriorate. In such a case, slightly reduce the excitation light intensity to slow color fading down and improve the fluorescence image.
To reduce the excitation light intensity, use ND filters or aperture iris diaphragm as far as the observation is not affected or use the shutter to limit the exposure of specimen to more than necessary light. Commercially-marketed color fading protection agent (DABCO, etc.) can also delay fading of specimen colors. The use of fading protection agent is recommended especially when you perform high-magnification observations frequently.
- ★ Remember that fading protection agents cannot be used with certain kinds of specimens.

2 Selecting the Fluorescence Mirror Units

Select the fluorescence mirror unit which matches the fluorochrome in use.

★ **Never mount or use the U-MBF3 brightfield mirror unit with a fluorescence mirror unit. The U-MBF3 is excessively bright and injury to the eyes could occur. If this type of mirror unit is to be used together with a fluorescence mirror unit, use the U-MBFL3 mirror unit equipped with a built-in ND filter or add a 3% ND filter to the U-MBF3.**

◎ Use of fluorescence mirror units according to the excitation wavelength

Olympus has prepared some sets of fluorescence mirror unit combined with appropriate filters which are variable depending on wavelengths.

The wide-band (W) set is normally used. There may be cases, however, where superwide-band (SW) or narrow-band (N) sets are recommendable.

① Extremely weak fluorescence brightness
(B- and G-excitation only)

→ Use the superwide-band (SW).

◎ With the SWB2, strong autofluorescence may reduce image contrast.

② Specimens emitting strong autofluorescence

→ Use the narrow band (N).

◎ The fluorescence brightness is somewhat reduced.

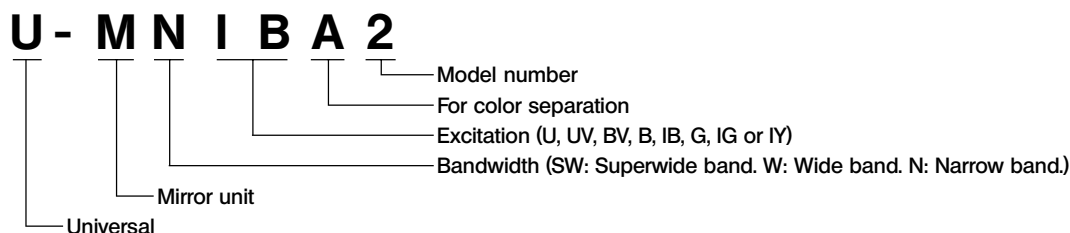
Dichroic Mirrors and Filter Configurations of Fluorescence Mirror Units

Excitation Method	Mirror Unit	Dichroic Mirror	Excitation Filter	Barrier Filter	Fluorochrome
U	U-MWU2	DM400	BP330-385	BA420	<ul style="list-style-type: none"> • Autofluorescence observation • DAPI staining: DNA • Hoechst 33258, 33342 staining: Chromosome
	U-MNU2		BP360-370		
V	U-MNV2	DM455	BP400-410	BA455	<ul style="list-style-type: none"> • Catecholamine observation • Serotonin observation • Tetracycline staining: Bones, teeth
BV	U-MWBV2	DM455	BP400-440	BA475	<ul style="list-style-type: none"> • Quinacine & quinacine mustard staining: DNA • Thioflavine S staining: Lymphocyte • Acriflavine staining: Nucleic acid • CFP
	U-MNBV2		BP420-440		
B	U-MWB2	DM500	BP460-490	BA520IF	<ul style="list-style-type: none"> • FITC staining: Fluorescent antibody • Acridine orange staining: DNA, RNA • Auramine staining: Tubercle bacteria • EGFP, S65T, RSGFP
	U-MNB2		BP470-490		
	U-MSWB2		BP420-480		
IB	U-MWIB2	DM505	BP460-490	BA510IF	<ul style="list-style-type: none"> • Rhodamine & TRITC staining: Fluorescent antibody • Propidium iodide staining: DNA • RFP
	U-MNIB2		BP470-490		
G	U-MWG2	DM570	BP510-550	BA590	
	U-MNG2		BP530-550		
	U-MSWG2		BP480-550		
IG	U-MWIG2	DM565	BP520-550	BA580IF	
IY	U-MWIY2	DM600	BP545-580	BA610IF	Texas Red staining: Fluorescent antibody

Color Separation Filter Combinations

U	U-MNUA2	DM400	BP360-370	BA420-460	For observing only the U-excitation stain, when using U-excitation stain together with FITC.
IB	U-MWIBA2	DM505	BP460-490	BA510-550	For observing only the B-excitation stain, when using B-excitation stain together with FRITC.
	U-MNIBA2		BP470-550		

Meaning of Mirror Unit Name



3 Objectives for Various Observation Modes

Objective	Reflected Light Fluorescence		Phase Contrast Difference	Transmitted Light Nomarski DIC	
	U, V, BV	B, IB, G, IY			
UPlanApo	4X	○	○	-	-
	10X	○	○	○**	○
	10XO	○	○	-	○
	10XW	○	○	-	-
	20X	○	○	○**	○
	20XO	○	○	-	○
	40X	○	○	-	○
	40XOI	○	○	○**	○
	60X	○	○	-	-
	60XW	○	○	-	○
	100XOI	○	○	○**	○
PlanApo	40X	-	○	-	-
	60XO	○	○	○**	○
	100XO	-	○	-	-
UPlanFI	4X	○*	○*	-	-
	10X	○*	○*	○**	○
	20X	○*	○*	○**	○
	40X	○*	○*	○**	○
	60XOI	○	○	○**	○
	100XO, OI	○	○	○**	○
UApo	20X	○	○	-	○
	20XW/340	○	○	-	○
	40X	○	○	-	○
	40XOI	○	○	-	○
	40XW/340	○	○	-	○

○ : Recommended combination.

○* : Usable but image be dark depending on NA.

- : Not usable or applicable objective is not available.

○** : A phase contrast objective (Ph) is necessary for phase contrast observation. The Ph objective is not available for the UPlanFI100XOI.

4 Turning the Power Supply Unit On

Set the main switch to "I" (ON). The arc image will stabilize in 5 to 10 minutes after ignition.

⊙ The mercury burner may not be ignited from the beginning due to variance between individual products. In this case, set the main switch to "O" (OFF), wait for 5 to 10 seconds, then set it again to "I" (ON).

★ To extend the mercury burner life, do not turn the mercury burner off for 15 minutes after ignition.

★ The mercury burner cannot be ignited until the mercury vapor has cooled down and liquefied. Before re-igniting a mercury burner, wait for about 10 minutes after the last time it was turned off.

⊙ For the shake of safety, the power supply to the lamp housing is shut down if the lamp housing is opened while the burner is on. If this happens, set the main switch to "O" (OFF), wait for ore than 10 minutes, then set it again to "I" (ON). Do not open the lamp housing until it has cooled down enough.

★ To reset the hour counter, hold its reset button until "000.0" is displayed.

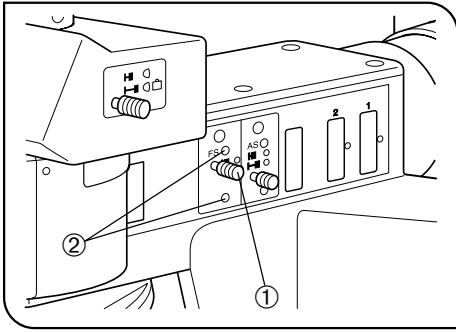
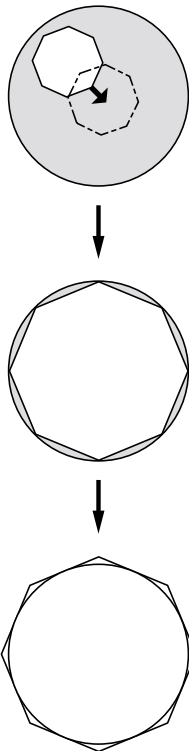


Fig. 1

5 Centering the Field Iris Diaphragm (Fig. 1)

1. Engage the shutter in the light path by pressing the RSHT button on the hand switch.
2. Engage the B or IB mirror unit in the light path by pressing the MU+ or MU- button on the hand switch.
(If these mirror units are not available, engage another fluorescence mirror unit in the light path.)
3. Press the RSHT button to open the shutter.
4. Engage the 10X objective by pressing the objective button, place the specimen on the stage and bring the image into approximate focus.
5. Pull out the field iris diaphragm knob ① to minimize the field iris diaphragm.
6. Fit the Allen wrench provided with the microscope frame in the two field iris diaphragm centering screws ② and adjust them so that the field iris image comes at the center of the field of view.
7. While pushing in the field iris diaphragm knob ①, enlarge the field iris diaphragm until the field iris image inscribes the field of view. If eccentricity is found after this, try centering again.
8. Enlarge the field iris diaphragm until the iris image becomes almost the same size as (i.e. circumscribes) the field of view.



Effects of Field Iris Diaphragm

The field iris diaphragm restricts the diameter of light entering the objective and thus excludes extraneous light, improving image contrast. To exclude extra light, set the field iris diaphragm knob ① on the reflected fluorescence illuminator according to the objective power, so that the image of the field iris diaphragm just circumscribes the field of view.

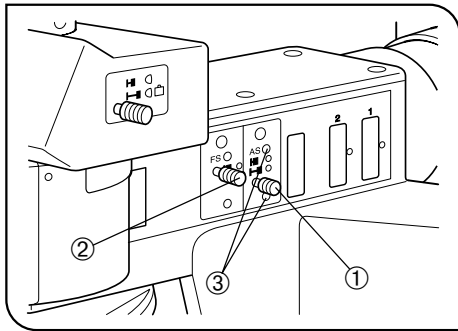


Fig. 2

6 Centering the Aperture Iris Diaphragm (Fig. 2)

1. Engage the shutter in the light path by pressing the RSHT button on the hand switch.
2. Engage the B or IB mirror unit in the light path by pressing the MU+ or MU- button on the hand switch.
(If these mirror units are not available, engage another fluorescence mirror unit in the light path.)
3. Engage the 10X objective in the light path by pressing the objective button, then place the U-CST centering target on the stage.
4. Release the shutter by pressing the RSHT button.
5. Move the white surface with crosslines of the U-CST until the crosslines are overlaid on the center of field.
6. Engage the empty place (the objective cap should be removed) in the light path.
7. Pull out the aperture iris diaphragm knob ① to minimize the aperture iris diameter.
8. Pull out the field iris diaphragm knob ② to minimize the field iris diaphragm. Now the aperture iris image should be visible on the U-CST.
9. Fit the Allen screwdrivers in the two aperture iris centering screws ③ and adjust so that the aperture iris image coincides with the crosslines.

Effects of Aperture Iris Diaphragm

The aperture iris diaphragm helps adjust the brightness of the observed image and improve the contrast.

To perform normal fluorescence observation, enlarge the aperture iris by pushing in the aperture iris diaphragm knob ①.

Ⓞ If specimen colors tend to fade due to too high excitation light, first use ND filters to reduce the brightness, and decrease the aperture iris diaphragm if the ND filters are not enough.

Do not decrease the aperture iris diaphragm too much. Do not use it as a substitute to the shutter.

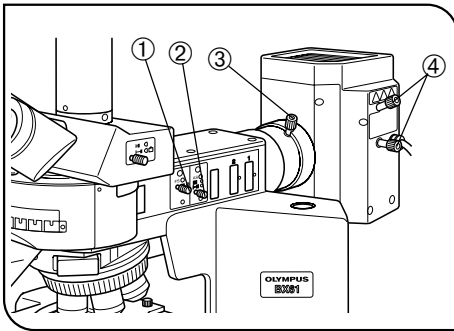


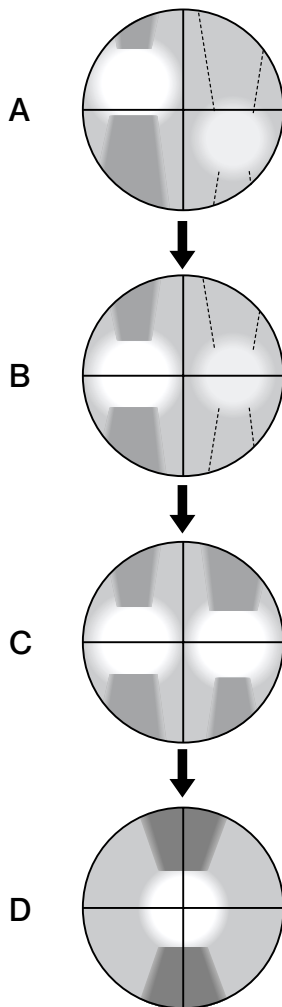
Fig. 3

7 Centering the Mercury Burner

(Fig. 3)

Ⓞ Set the main switch to "I" (ON) and wait for 5 to 10 minutes until the arc image stabilizes before proceeding to the mercury burner centering.

1. Engage the shutter in the light path by pressing the RSHT button on the hand switch.
 2. Engage the B or IB excitation fluorescence mirror unit in the light path (If these mirror units are not available, engage another fluorescence mirror unit in the light path. Also note that, when using an U excitation fluorescence mirror unit, be always sure to observe the specimen image through a UV cut plate.)
 3. Engage the 10X objective in the light path by pressing the objective button, place the U-CST centering target on the stage, and adjust the centering of the center of crosslines on white surface of the U-CST with respect to the center of field of view.
 4. Engage the empty place (the objective cap should be removed) in the light path.
 5. Pull out the aperture iris diaphragm knob ① (to minimize it) and push in the field iris diaphragm knob ② (to maximize it).
 6. Release the shutter by pressing the RSHT button.
 7. Project the arc image on the U-CST by turning the collector lens focusing knob ③. (A)
If the arc image is not projected, adjust the burner centering knobs ④.
 8. Bring the arc image on the center of the left (or right) half of the field by turning the burner centering knobs ④. (B)
 9. Fit the Allen screwdriver in the mirror focusing screw (⑤ in Fig. 4) on the rear of the lamp housing and adjust to bring the mirror arc image in focus. (C)
 10. Overlay the arc image with the mirror arc image by turning the burner centering knobs ④. (D)
- Ⓞ During observation, adjust the collector lens focusing knob ③ so that the observed field is uniform.
- Ⓞ Hereafter, the mercury burner centering need not be adjusted until the next time the mercury burner is replaced.



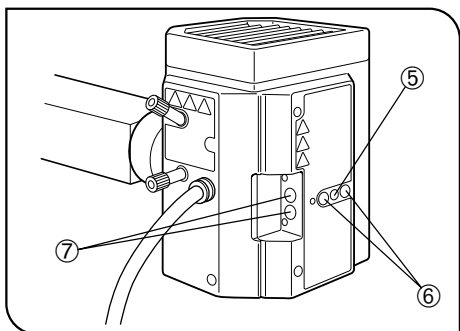


Fig. 4

Precise Centering of Mirror Arc Image

⊙ The mirror arc image position has been adjusted and fixed at the factory. Perform the centering of the mirror arc image after completing the centering of the mercury burner and only when you want to make your adjustments very strict and precise.

Note that, once this adjustment has been executed, the mirror can never be returned to the same status as the factory shipment status.

1. Using a pair of tweezers, etc., peel off the two blink seals ⑥ from the rear of the lamp housing.
2. Loosen the screws below the seals using the Allen screwdriver. The mirror is unclamped when these two screws are loosened.
3. Peel off another couple of blind seals ⑦. This exposes the mirror arc image centering holes.
4. Fit the Allen screwdriver in these holes and adjust the centering of the mirror arc image.

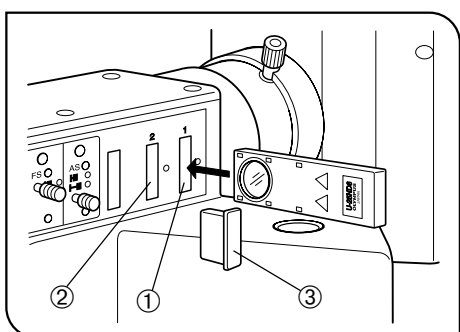


Fig. 5

8 Using the ND Filters

(Fig. 5)

⊙ Specimen color fading can be delayed by reducing the excitation light intensity with ND filters. Use the ND filters as far as they do not hinder observations.

- As necessary, up to two ND filters (U-25ND6, U-25ND25) may be individually inserted into filter insertion slot ① and/or ②. Insert the ND filters with the marked side facing toward the observer.

The ND filters must be inserted in the correct orientation. Otherwise, the ND filters may be damaged.

- When a filter(s) is not used, insert the dummy filter(s) ③ which has been inserted at the factory when the system is delivered.
- The first click position is the empty position and the second click engages the filter in the light path.

⚠ **Note that the metallic filter frame will be very hot if you leave the filter inserted for a long time while the mercury burner is on.**

Do not leave the filter insertion position in other positions than the click positions for a long period of time.

©By properly combining equipment, this system can be used in transmitted light brightfield observation, transmitted phase contrast observation and transmitted light DIC observation in addition to the reflected fluorescence observation. With specimens that fade rapidly, fading can be minimized by initially using transmitted light phase contrast or transmitted DIC observation for positioning. Reflected fluorescence observation can also be executed simultaneously with phase contrast or DIC observation, making it easy to tell which portion of the specimen is fluorescing.

1 Simultaneous Reflected Fluorescence and Phase Contrast Observations

The phase contrast observation requires a phase contrast condenser (U-PCD2) or a universal condenser (U-UCD8 or U-UCD8A) and a Ph objective.

1. Engage a dummy mirror unit (an empty position on the turret) in the light path.
 2. Rotate the phase contrast turret to show the same number as the Ph number shown on the objective.
 3. Adjust the optical axis between the ring slit and phase plate by centering them.
 4. Engage the mirror unit corresponding to the desired excitation into the light path and open the shutter.
 5. Adjust the transmitted light for the best balance of fluorescence and phase contrast brightness.
- ©Use ND filters or the intensity control button on the microscope base to adjust the transmitted light intensity.
- ©For details on using phase contrast observation, refer to the instruction manual provided with the phase contrast condenser or universal condenser.

2 Simultaneous Reflected Fluorescence and Transmitted Nomarski DIC Observations

The transmitted light Nomarski DIC (Differential Interference Contrast) observation requires the following accessories:

- 1) Universal condenser (U-UCD8 or U-UCD8A)
- 2) Transmitted DIC slider (U-DICT, U-DICTS, U-DICTHR or U-DICTHC)
- 3) Analyzer (U-AN or U-AN360-3)
- 4) Revolving nosepiece or motorized revolving nosepiece for DIC

©In order for reflected fluorescence to be effective in the simultaneous observation, insert the analyzer (U-AN or U-AN360-3) into the analyzer insertion slot above the dichroic mirror on the illuminator.

Do not insert the U-ANT analyzer in the transmitted light DIC slider, for this will dim the fluorescence observation image and cause the analyzer to be burnt.

1. Engage the dummy mirror unit (or an empty position) in the light path.
2. Adjust the polarizer on the universal condenser to the "crossed Nicol" (complete extinction) status.
3. Insert the transmitted light DIC slider into the position provided on the nosepiece.
4. Rotate the turret on the universal condenser to select the Nomarski prism matching the objective to be used for observation.
5. Engage the objective to be used in the light path.
6. Place the specimen on the stage and focus on the specimen.
7. Adjust the field iris diaphragm of the transmission light illuminator (built in the microscope base) and the aperture iris diaphragm of the universal condenser.
8. Turn the prism movement knob on the transmitted light DIC slider to adjust contrast of the DIC image.
9. Engage the mirror unit corresponding to the desired excitation and open the shutter.
10. Adjust the transmitted light for optimum fluorescence and DIC image brightness.

©For details on the transmitted DIC observation, refer to the instruction manual provided with the U-UCD8 or U-UCD8A universal condenser.

Reference

©We recommend the use of the highly wear-resistant U-ANH analyzer slider instead of the U-AN analyzer when you are frequently switching between reflected fluorescence observation and transmitted light Nomarski DIC observation and need to use both observations simultaneously.

©However, if you are frequently switching between reflected fluorescence observation and transmitted light Nomarski DIC observation but you do not need to use both simultaneously, then it will be more convenient for you to use the M-DICT3 DIC mirror unit instead of an analyzer (U-AN or U-ANH). This facilitates the switching operation because the analyzer simultaneously enters the light path when the fluorescence mirror unit is switched to the DIC mirror unit.

5 TROUBLESHOOTING GUIDE

Under certain conditions, performance of the system may be adversely affected by factors other than defects. If problems occur, please review the following list and take remedial action as needed. If you cannot solve the problem after checking the entire list, please contact your local Olympus representative for assistance.

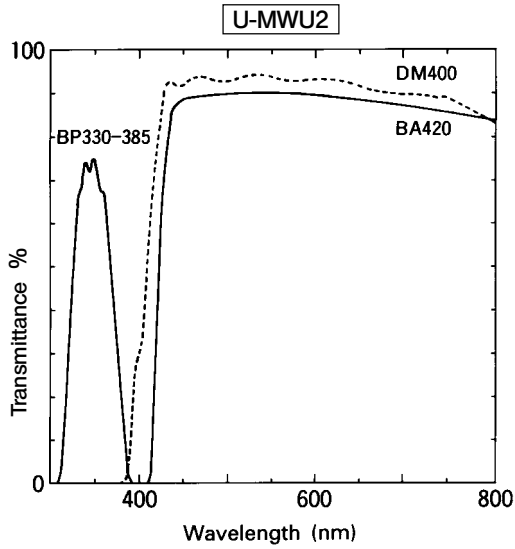
Problem	Cause	Remedy	Page
1. Optical System			
a) Bulb lights but the field of view is dark.	Shutter is closed.	Release shutter.	11
	ND filter is engaged in light path.	Disengage ND filter as required.	14
	Fluorescence mirror unit is not properly engaged in light path.	Engage fluorescence mirror unit correctly.	11
	Aperture and field iris diaphragms are not fully enlarged.	Fully enlarge aperture and iris field diaphragms until they circumscribe field of view.	11/12
	Fluorescence mirror unit in use does not match specimen.	Use fluorescence mirror unit matching specimen.	9
b) Observed image is low quality, not sharp or poor in contrast.	Dirt/dust on objective or filter.	Clean thoroughly.	2
	Aperture and field iris diaphragms are not fully enlarged.	Fully enlarge aperture and iris field diaphragms until they circumscribe field of view.	11/12
	Fluorescence mirror unit in use does not match specimen.	Use fluorescence mirror unit matching specimen.	9
c) Field of view is obscured or not evenly illuminated.	Objective is not correctly engaged in light path	Make sure that revolving nosepiece clicks correctly into place.	11
	Fluorescence mirror unit in use does not match specimen.	Use fluorescence mirror unit matching specimen.	11
	Field iris diaphragm is set too small.	Fully enlarge field iris diaphragm.	11
	ND slider is not stopped at click position.	Make sure that ND slider clicks properly into place.	14
	Mercury burner is not centered or focusing is defective.	Center mercury burner or perform focusing adjustment.	13
d) Field contains dark, spot-like areas.	Dirt or dust on burner or on burner side of collector lens.	Clean them.	2
2. Electrical System			
a) Main switch cannot turn system ON.	Power cord is not connected properly.	Connect firmly.	35
b) Main switch can turn system ON but mercury burner will not light.	Connectors are not connected properly.	Connect firmly.	35
	Mercury burner is not attached.	Attach mercury burner.	33
	Safety device in lamp housing is active.	Set up lamp socket correctly.	33
	Auto ignition is malfunctioning.	Set main switch of power supply unit to "O" (OFF) then "I" (ON) again. (OFF/ON can be repeated.)	10



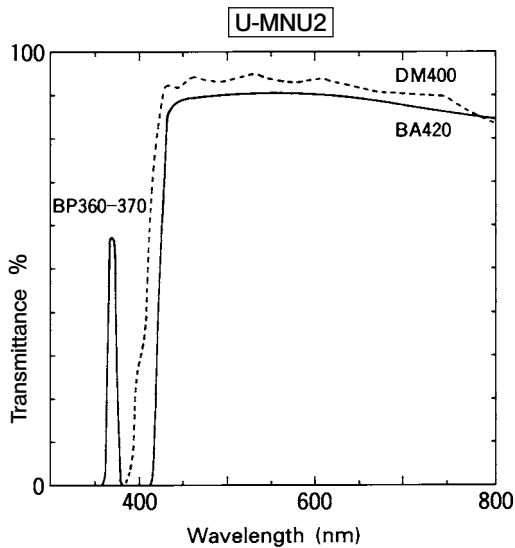
Problem	Cause	Remedy	Page
c) Mercury burner flickers or is dark.	It is soon after ignition.	Leave for 10 minutes or more after ignition.	10
	Burner life has expired.	If hour counter indicates 200 hours (USH102D) or 300 hours (HBO103W/2), replace it.	33
	Burner is deviated from optical axis.	Center mercury burner.	13
d) Motorized controls do not work.	Connector are not correctly connected.	Connect firmly.	-
e) Hand switch or PC indicates that shutter is released, but light is not incident or image is cut off.	Shutter is moved due to external vibrations.	Try perform shutter operation again.	-
f) Turret will not rotate (or stops in the middle of movement).	Fluorescence mirror unit is slipping out of turret.	Remove turret and place fluorescence mirror unit in correct position securely.	31
g) Motorized revolving nosepiece will not rotate.	Motorized revolving nosepiece connector is not correctly connected.	Re-attach motorized nosepiece by inserting it all the way, until stopped.	30

6 SPECTRAL CHARACTERISTICS OF FILTERS

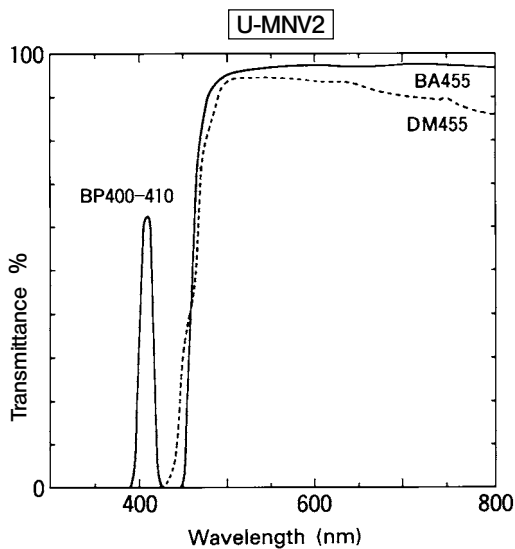
1. U-excitation (Wide band)



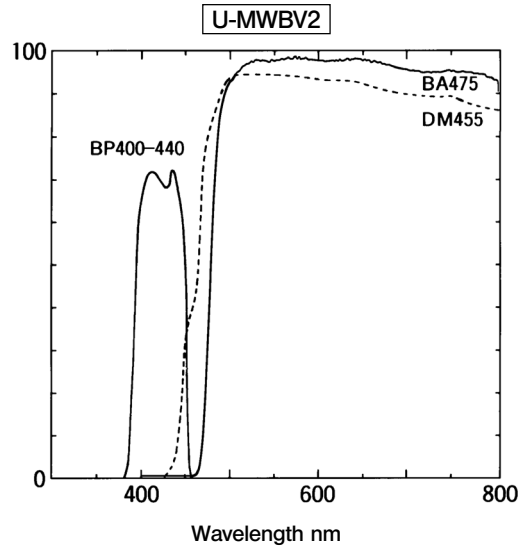
2. U-excitation (Narrow band)



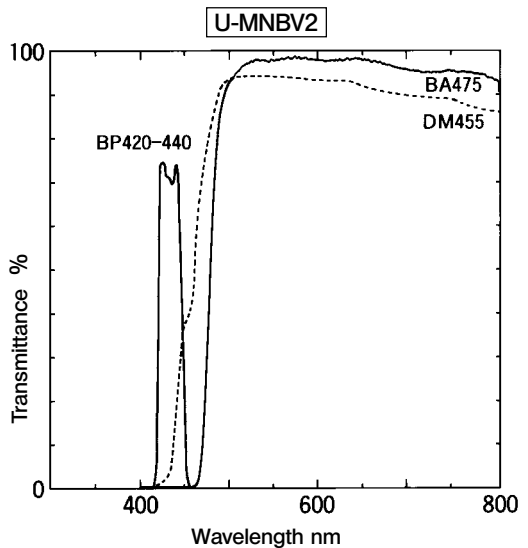
3. V-excitation (Narrow band)



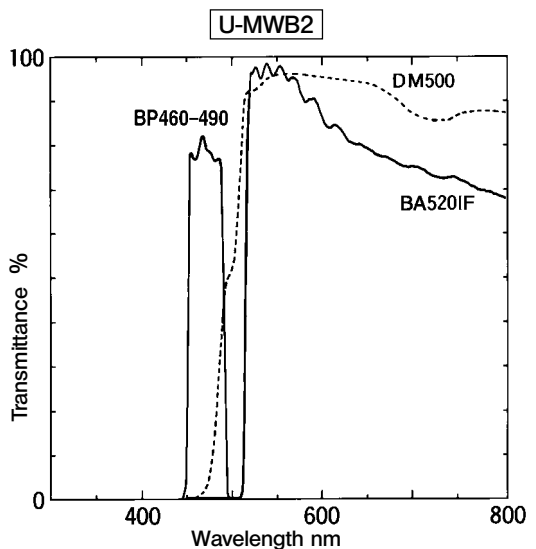
4. BV-excitation (Wide band)



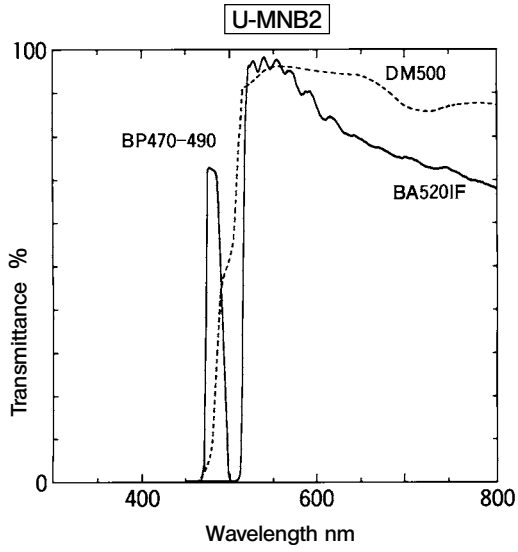
5. BV-excitation (Narrow band)



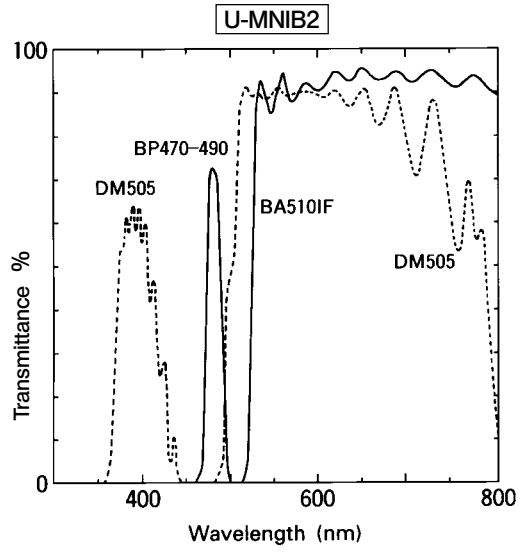
6. B-excitation (Wide band)



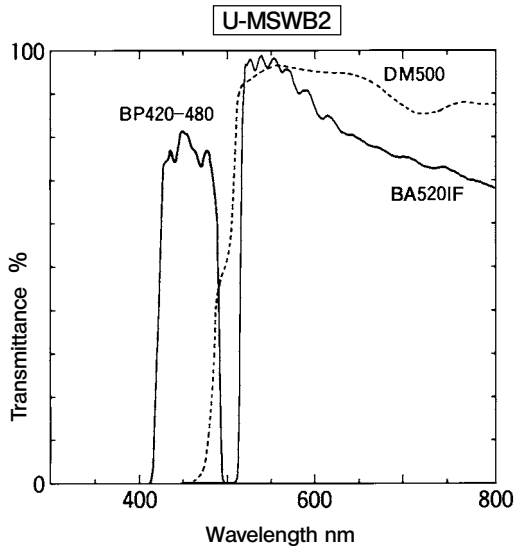
7. B-excitation (Narrow band)



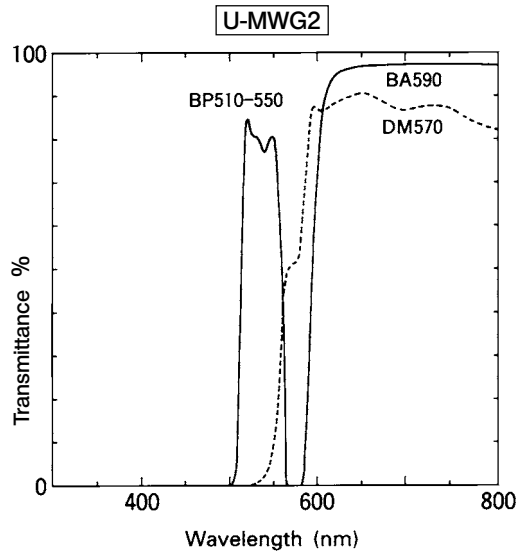
10. IB-excitation (Narrow band)



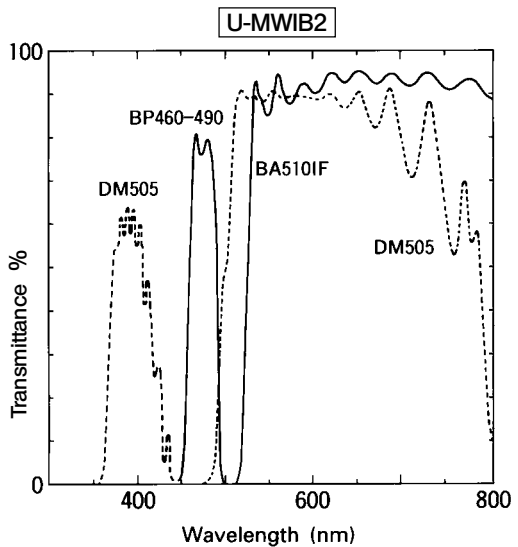
8. B-excitation (Superwide band)



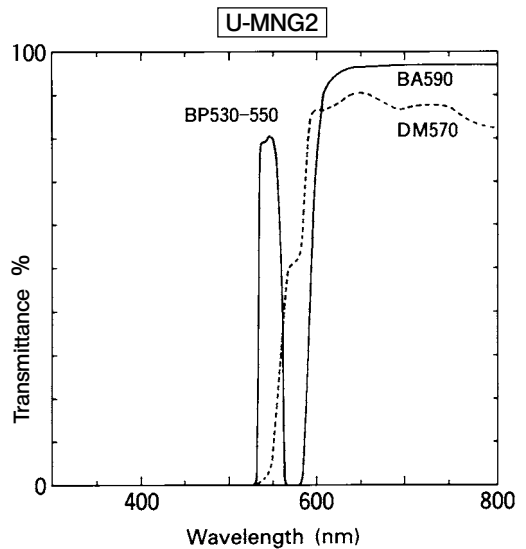
11. G-excitation (Wide band)



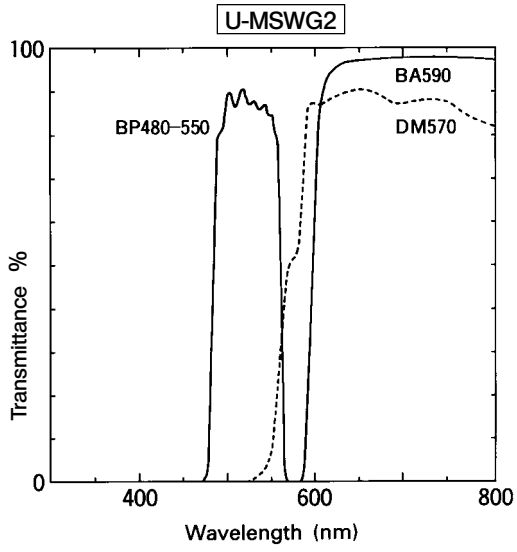
9. IB-excitation (Wide band)



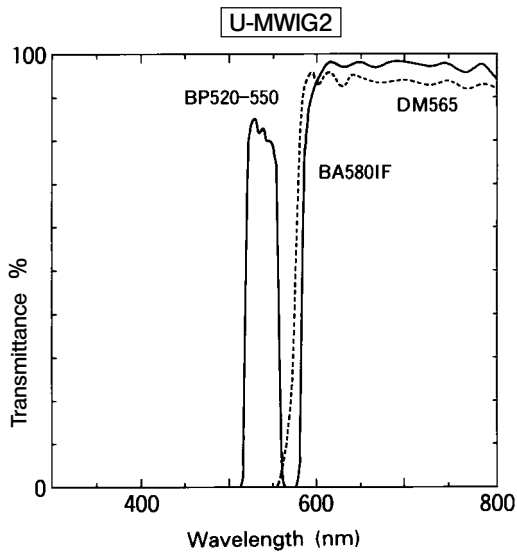
12. G-excitation (Narrow band)



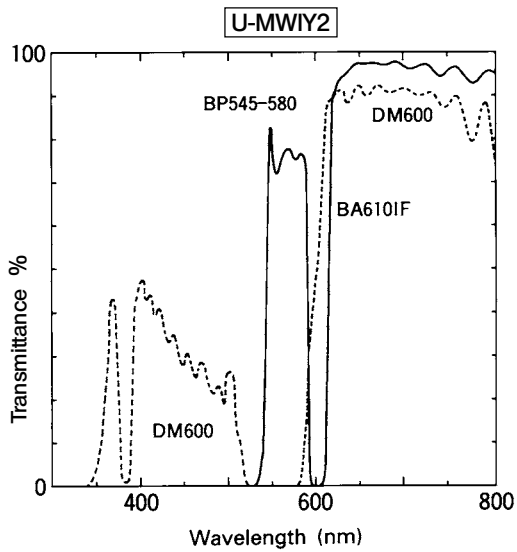
13. G-excitation (Superwide band)



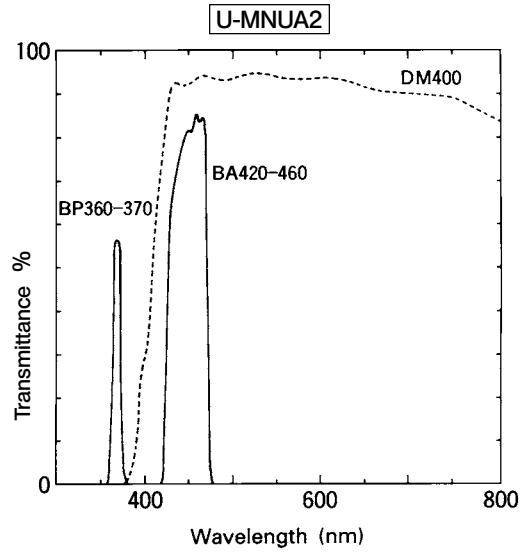
14. IG-excitation (Wide band)



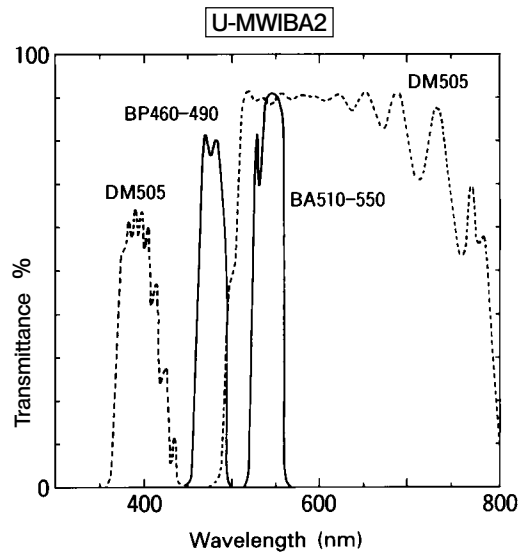
15. IV-excitation (Wide band)



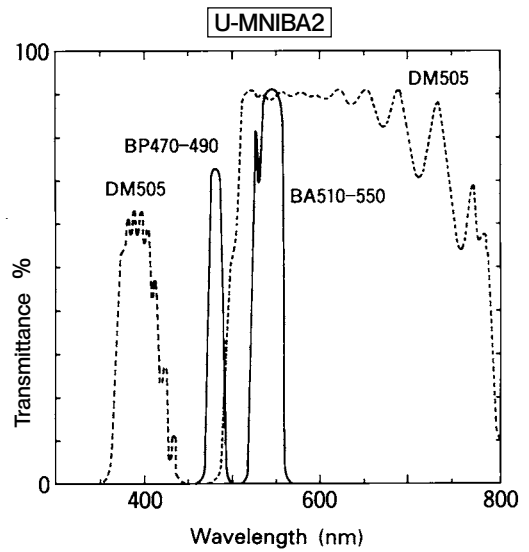
16. U-excitation for color separation (Narrow band)



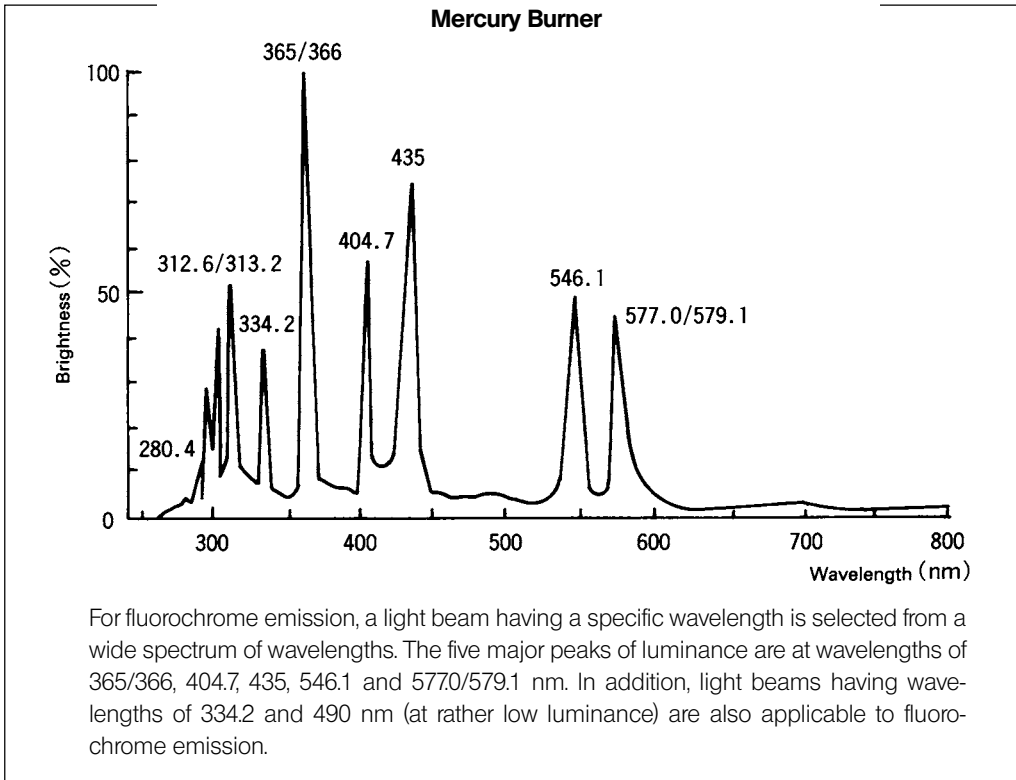
17. IB-excitation for color separation (Wide band)



18. IB-excitation for color separation (Narrow band)



Typical Example of Emission Spectrum of Ultrahigh-Vacuum Mercury Burner



7 SPECIFICATIONS

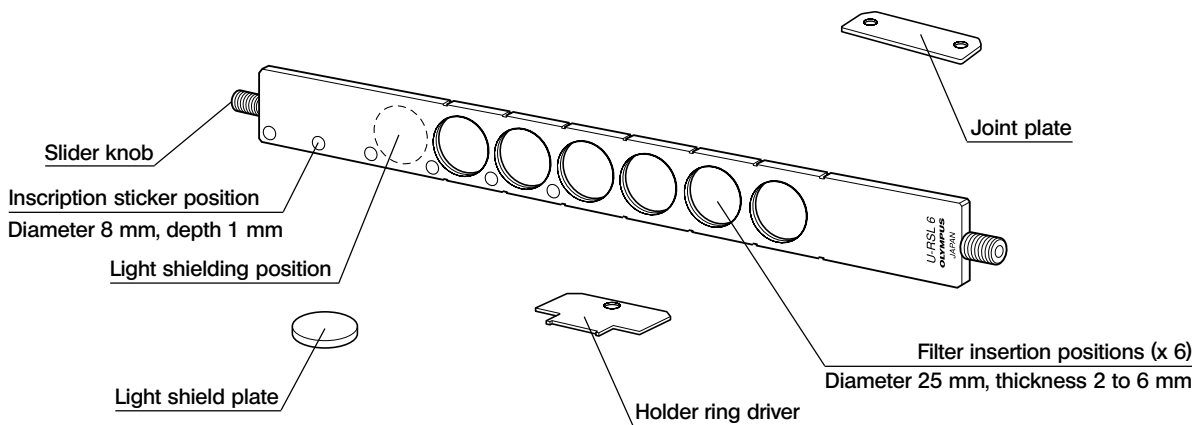
Item	Specification
Motorized Reflected Fluorescence Illuminator BX-RFAA	<ul style="list-style-type: none"> • UIS (Universal Infinity System) optics • Magnification: 1X (Superwide field compatible: FN 26.5) • Observation switching: Motorized mirror unit turret (Switching rate approx. 0.8 sec.) Mirror unit turret carrying max. 6 mirror units. • Aperture and field iris diaphragms: both centrable and detachable • Shutter provided: Motorized opening/closing, release speed 0.1 sec. • Motorized revolving nosepiece connector: Connector position fixed at the factory. <hr/> <ul style="list-style-type: none"> • Slider insertion slots: <ul style="list-style-type: none"> ① Analyzer/6-position barrier filter slider ② 6-position filter slider ③ ND filter slider ④ 6-position filter slider <hr/> <ul style="list-style-type: none"> • Available observations: <ul style="list-style-type: none"> ① Reflected fluorescence ② Reflected fluorescence + Transmitted light DIC ③ Reflected fluorescence + Phase contrast ④ Transmitted light • Applicable microscope frames: BX41, BX51, BX52, BX61, BX62, BX51WI, BX62WI <hr/> <ul style="list-style-type: none"> • Options <ul style="list-style-type: none"> ① Exciter balancer U-EXBABG, U-EXBAUB, U-EXBAUG ② Rectangular field stop BX-RFSS
Mercury lamp housing	<ul style="list-style-type: none"> • 100 W mercury lamp housing U-LH100HG • 100 W mercury apo lamp housing U-LH100HGAP0 • Mercury burner USH102D (USHIO) or HBO103W/2 (OSRAM)
Operating environment	<ul style="list-style-type: none"> • Indoor use. • Altitude: Max. 2000 meters • Ambient temperature: 5° to 40°C (41° to 104° F) • Maximum relative humidity: 80% for temperatures up to 31°C (88°F), decreasing linearly through 70% at 34°C (93°F), 60% at 37°C (99°F), to 50% relative humidity at 40°C (104°F). • Supply voltage fluctuations: ±10% • Pollution degree: 2 (in accordance with IEC664) • Installation (overvoltage) category: II (in accordance with IEC664)

8 OPTIONAL MODULES

★ The sliding performance of the U-RSL6 or U-RSL6EM filter slider may drop when it has been used for 2000 or more times of reciprocation. In this case, remove the dirt and contamination on the sliding surface. If it is expected to use the slider for more than 2000 times of reciprocation, apply a thin layer of lubricant such as grease on the sliding surface.

1 6-Position Filter Slider U-RSL6

◎ This filter slider is for common use with the BX-URA2 or BX-RFA illuminator and accommodates a total of six excitation and ND filters. It is designed to prevent centering deviation between the optical axes of the excitation filters when multiple excitation mirror units are used and switched.

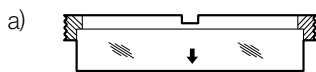


Filter Mounting Procedure

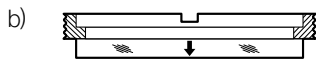
1. Remove the slider knob on the opposite end to the extremity where the slider inscription is engraved, and place the filter slider so that the surface with the slider inscription faces down.
2. Remove the filter holder rings from the filter insertion positions by turning it counterclockwise using the provided holder ring driver.

★ **The insertion orientation of the holder rings should be changed according to the thickness of the mounted filters.**

3. If the mounted filters include an exciter filter, insert it so that the arrow inscription on the side faces down.



- a) Filter with thickness of 4 mm or more:
Place each filter so that it fits inside the holder ring.



- b) Filter with thickness of 4 mm or less:
Place each filter so that it does not fit inside the holder ring.

▲ **If you perform transmitted light observation or you do not want to use a filter, mount the provided light shield plates (having the same size as the filter) in place.**

If nothing is mounted, the scattered light of reflected lighting may enter your eyes or the view in transmitted light observations will be deteriorated.

4. If it is required to attach a filter type inscription, write the filter type on a commercially-available round seal with diameter of no more than 8 mm and attach the seal to the specified position.

★ **Be careful not to attach the seal outside the specified circular area. Otherwise, the slider may be stuck during use.**

5. Insert the U-RSL6 filter slider from the right of the 6-position filter slider insertion slot on the illuminator so that inscription "U-RSL6" comes at the deep, then attach the slider knob which has been removed in step 1 above.

Using the Joint Plates

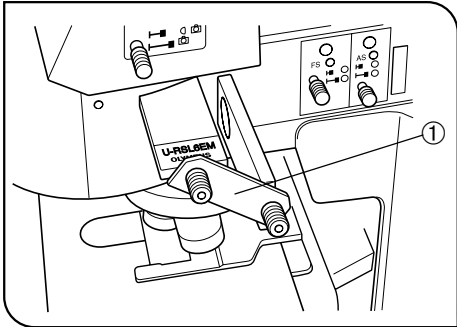


Fig. 6

The joint plate ① can be attached and locked between the slider knob and slider as shown in Fig. 6. The joint plates should be attached on both ends of the filter slider.

By locking with the joint plates, you can switch the barrier and excitation filters together as a set.

NOTES

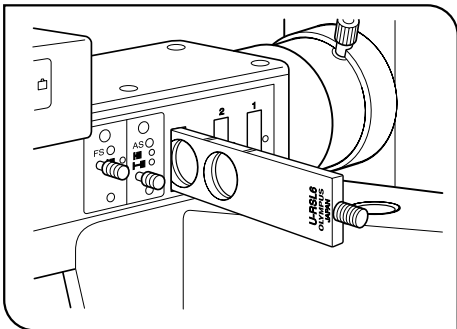


Fig. 7

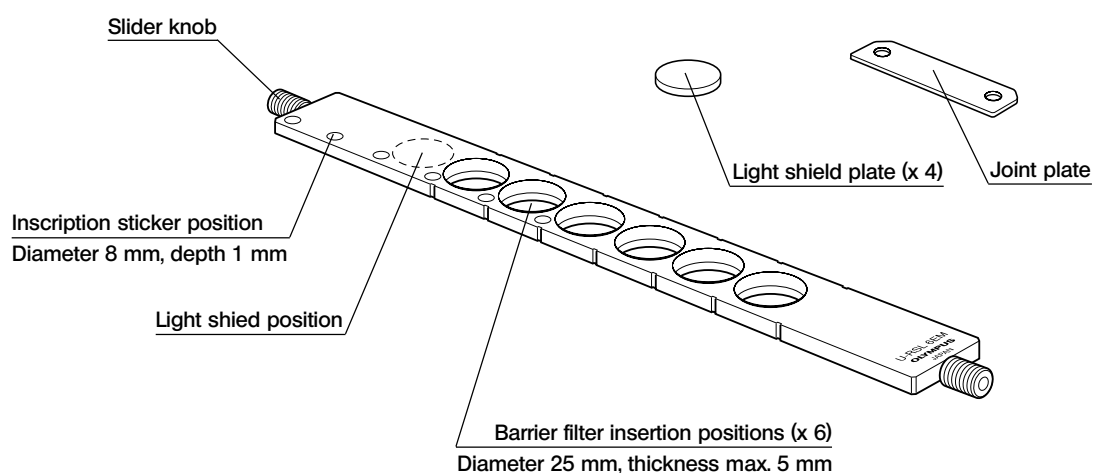
- When the 6-position filter slider near the rear panel is used, avoid using the interference type or color glass type filters.

(This is because the 6-position filter slider near the rear panel is one of the positions where the energy from the light source is concentrated. When an interference type or color glass type filter is mounted in it, the filter interference film may peel off or the color glass may be damaged.)

- Make sure that the 6-position filter slider is set to a click position.
- For safety, insert the provided light shield plates in the unused filter positions.

2 6-Position Barrier Filter Slider U-RSL6EM

© This filter slider is for common use with the BX-URA2 or BX-RFA illuminator and accommodates a total of six barrier filters.



Filter Mounting Procedure

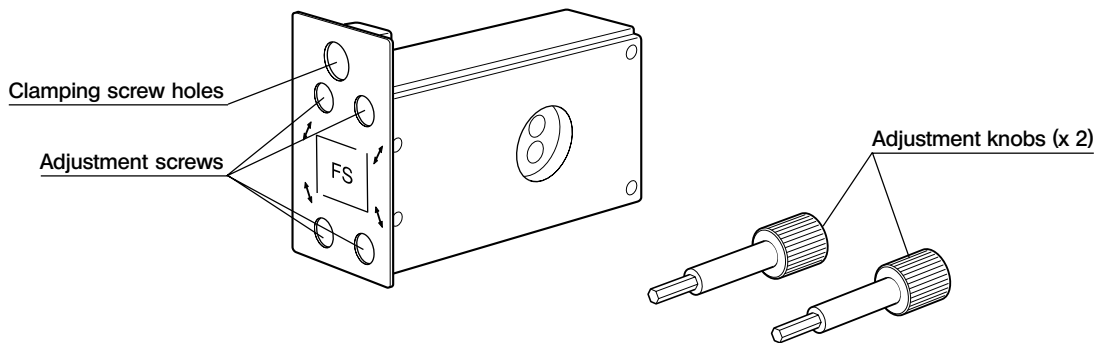
1. Remove the slider knob on the opposite end to the extremity where the slider inscription is engraved.
2. Gently place the barrier filters in their insertion positions.
★ Insert the filters so that their arrow inscriptions on the side face downward.
3. If it is required to inscribe the types of the inserted filters, write them on commercially available round stickers in the same way as with the U-RSL6 filter slider.
4. Gently insert the filter slider from the right of the analyzer insertion slot on the illuminator, and attach the slider knob which has been removed in step 1 above.
5. Use the joint plates if you want to interlock this filter slider with the U-RSL6 filter slider. (For the attaching method, see the description on the U-RSL6.)

NOTES

- © Be sure to insert the filter slider in the specified orientation. Otherwise, the filters cannot be set in the correct positioning.
- © For safety, insert the provided light shield plates in the unused filter positions.

3 Rectangular Field Stop Unit BX-RFSS (for exclusive use with the BX-RFA/RFAA)

Ⓞ When fluorescence images are recorded with the TV camera for observation or image processing, this unit projects a rectangular iris diaphragm image with size variable according to the captured image size. This helps prevent color fading of specimen due to other reasons than image capturing.



Ⓞ The adjustment knobs can be stored by inserting them in the adjustment holes of the upper adjustment screws.

Installation Procedure (Fig. 8)

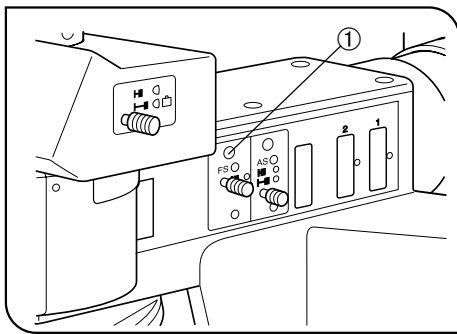


Fig. 8

1. Using the Allen screwdriver, loosen and take out the field iris diaphragm clamping screw ① of the BX-RFAA.
2. Remove the field iris diaphragm by pulling it toward you.
3. Insert the BX-RFSS rectangular field stop into the position of the field iris diaphragm then tighten the clamping screw ①.

Operation Procedure

1. Insert the provided adjustment knobs into the two adjustment screw holes near the front panel, and move the two sides of the rectangle to the desired position by turning the knobs.
 2. Insert the adjustment knobs into the two adjustment screw holes near the rear panel, and move the other two sides of the rectangle by turning the knobs.
 3. After the desired shape has been obtained by moving the sides, remove the adjustment knobs.
- Ⓞ Rectangle area: A rectangle which circumscribes the field with a number of 22 (the center of the rectangle should be located at the center of field). The rectangle iris diaphragm cannot be rotated.

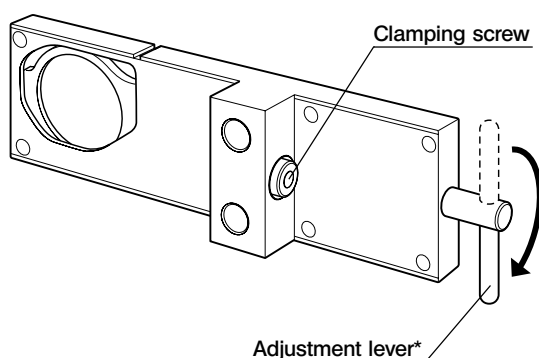
NOTES

The BX-RFAA illuminator cannot be attached or removed while the BX-RFSS is installed. If you want to install the BX-RFAA illuminator, remove the BX-RFSS temporarily.

4 Exciter Balancer U-EXBABG/EXBAUB/EXBAUG (for exclusive use with the BX-RFA/RFAA)

©When a fluorescence image obtained by multiple excitation of U/B/G is observed with dual- or triple-band fluorescence mirror units, use the exciter balancer to select the balance between the excitation light intensities of the fluorochromes.

* To use an exciter balancer with the BX-RFAA, remove the adjustment lever and attach it to the opposite end.



Installation Procedure (Fig. 9)

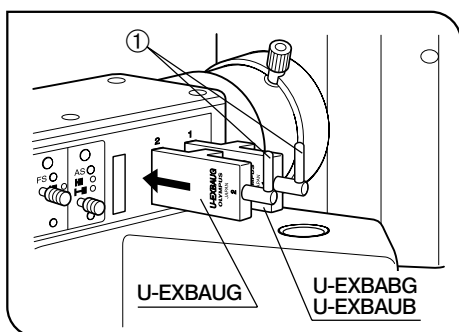


Fig. 9

1. Stand the adjustment lever ① of the exciter balancer vertically and insert it the ND filter insertion slot with the same number as the slider on the rear part of the right side of the illuminator.

- The insertion position is variable depending on the type of the exciter balancer.
- Always insert the exciter balancer so that the clamping screw faces toward the rear.

2. Tighten the clamping screw using the Allen screwdriver.

Operation Procedure

Observing a Double Stained Specimen

1. Set up normal reflected fluorescence observation.
2. Mount the fluorescence mirror units for double staining and engage them in the light path.

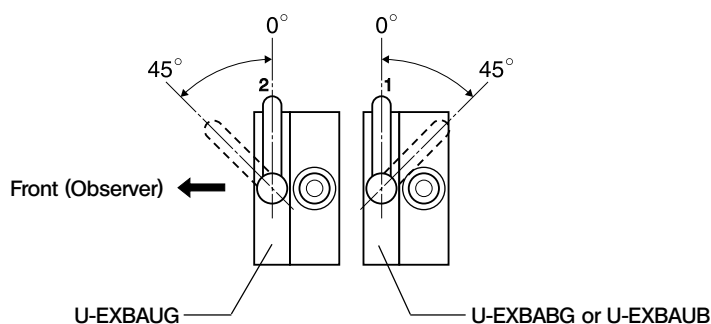
©Olympus standard products

Exciter Balancer	Fluorescence Mirror Units	
	Fluorescence Mirror Units for Double Staining	Fluorescence Mirror Units for Triple Mounting
U-EXBABG	<ul style="list-style-type: none"> • U-DM-FI/TR2 • U-DM-FI/PI2 • U-DM-FI/TX2 	<ul style="list-style-type: none"> • U-DM-DA/FI/TR2 • U-DM-DA/FI/PI2 • U-DM-DA/FI/TX2
U-EXBAUB	<ul style="list-style-type: none"> • U-DM-DA/FI2 	
U-EXBAUG	<ul style="list-style-type: none"> • U-DM-DA/TR2 • U-DM-DA/PI2 • U-DM-DA/TX2 	

★ Due to its characteristics, the G-excitation has a narrower intensity control range than the U- and B-excitation. The intensity control range is also variable depending on the status of specimen and variance in mirror units' characteristics.

★ Lighting irregularities may be observed on the upper and lower edges of the field dye to the rotation angles of filters and the variance in mirror units' characteristics. However, these lighting irregularities do not affect the photographed area.

3. Push in the adjustment lever of the balancer slider to be used to engage the filter in the light path.
 ☉ The angle of each adjustment lever can be adjusted in the range shown below, only when the lever is pushed in.



4. While conducting fluorescence observation, adjust by tilting the adjustment lever of the exciter balancer which is currently in the light path.
- With the U-EXBABG, setting the lever to 0° enhances the fluorescence of longer wavelengths (near red) and to 45° enhances the fluorescence of shorter wavelengths (near green).
 - With the U-EXBAUB, setting the lever to 0° enhances the fluorescence of shorter wavelengths (near blue) and to 45° enhances the fluorescence of longer wavelengths (near green).
 - With the U-EXBAUG, setting the lever to 0° enhances the fluorescence of longer wavelengths (near red) and to 45° enhances the fluorescence of shorter wavelengths (near blue).

Observing a Triple Stained Specimen

- ☉ The operation is basically similar to the double stained specimens, but fluorescence mirror units for triple staining should be used. The exciter balancers to be used are the U-EXBAUG (insertion slot 2) and U-EXBAUB (insertion slot 1).
- While conducting fluorescence observation, adjust the intensities of the three fluorescence lights by tilting the two adjustment levers.

NOTES

1. When the adjustment lever of an exciter balancer is stood vertically, flare tends to occur easily due to the repeated reflections on the filter surface. Be sure to disengage the exciter balancer from the light path when it is not used.
2. Be sure to stand the adjustment lever vertically when disengaging the filter from the light path or removing the exciter balancer. (Otherwise, damage may result.)
3. To use the ND filters while the exciter balancer is already used, insert the ND filters in the 6-position filter insertion slot which is on the further left.



9-1 Assembly Diagram

The diagram below shows the sequence of assembly of the various modules. The numbers indicate the order of assembly.

The module numbers shown in the following diagram are merely the typical examples. For the modules with which the module numbers are not given, please consult your Olympus representative or the catalogues.

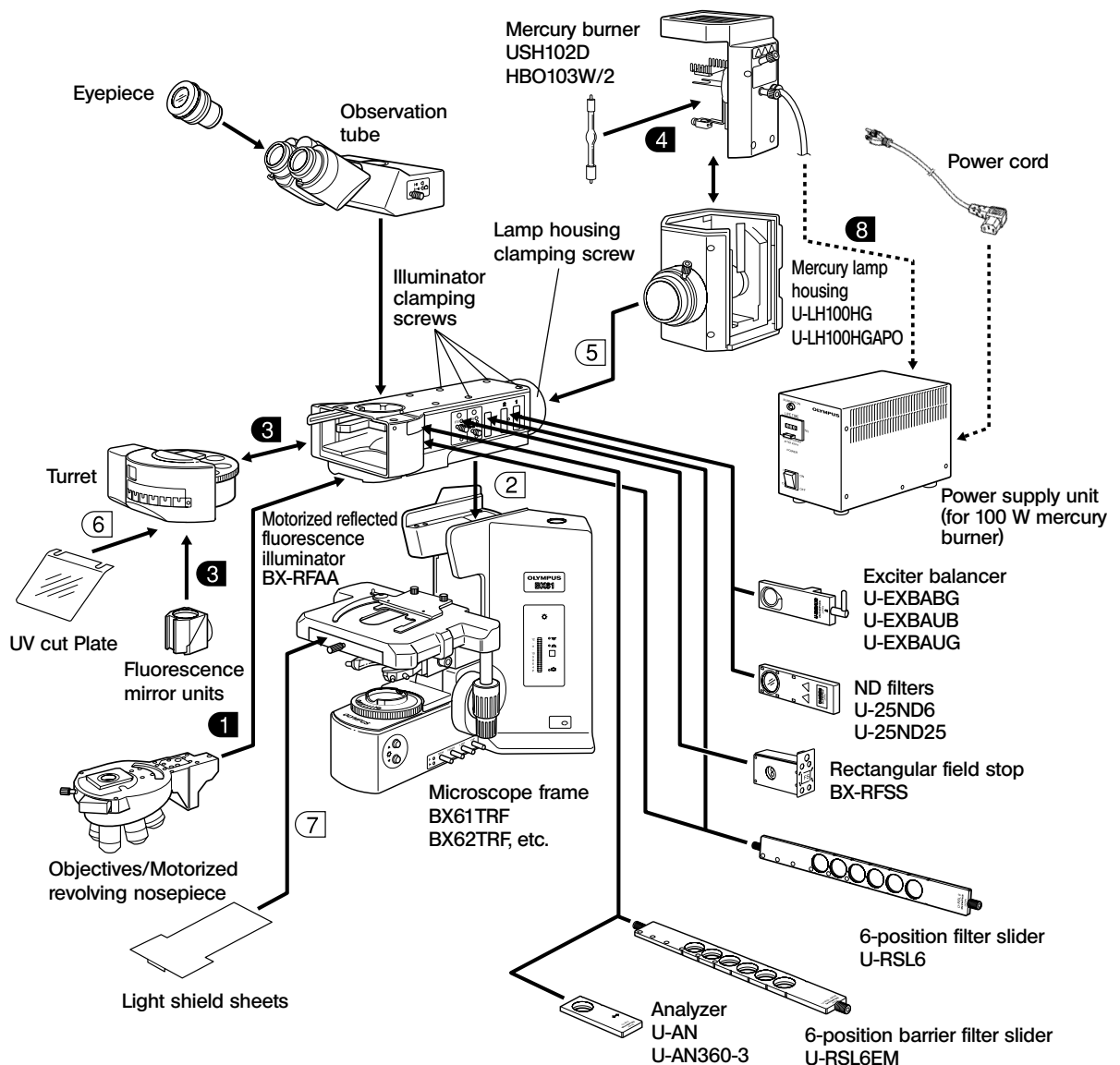
★ When assembling the microscope, make sure that all parts are free of dust and dirt, and avoid scratching any parts or touching glass surfaces.

Assembly steps enclosed in **■** will be detailed on the subsequent pages.

© All assembly operations are possible by using the Allen screwdriver () provided with the microscope. The Allen wrench () provided with the motorized reflected light illuminator is used only for clamping the screws inside the illuminator. (To retain the performance, have your local Olympus representative conduct this work.)

NOTES

- Be sure to insert the sliders in the orientations shown in the diagram. Otherwise, they cannot be fitted in click positions and engaged correctly in the light path.



9-2 Detailed Assembly Procedures

1 Attaching the Revolving Nosepiece (Motorized Revolving Nosepiece)

©With certain series of motorized revolving nosepiece products, the connector of the BX-RFAA illuminator should be unlocked before proceeding to the attaching operation as described below.

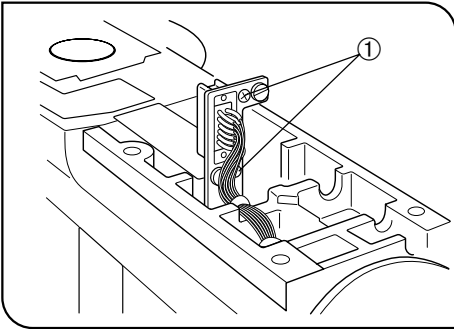


Fig. 10

U-D6REM/5BDREM

These revolving nosepieces can be installed in the same way as manual revolving nosepieces. For installation, push the revolving nosepiece as far as it will go to connect it to the motorized revolving nosepiece connector.

U-D6REO/P5REMC

Remove the screw ① which has been clamped at the factory using a Phillips screwdriver. This unlocks the connector so the revolving nosepiece can be installed in the same way as the above.

To re-lock the connector:

After installing the motorized revolving nosepiece, clamp the screw ①. Note that, in this case, other motorized revolving nosepieces than the combined motorized revolving nosepiece may sometimes be unable to be connected due to the lack of compatibility with other motorized revolving nosepieces.

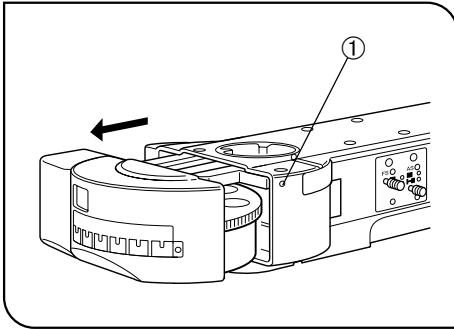


Fig. 11

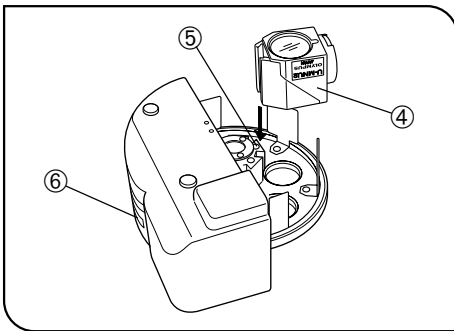
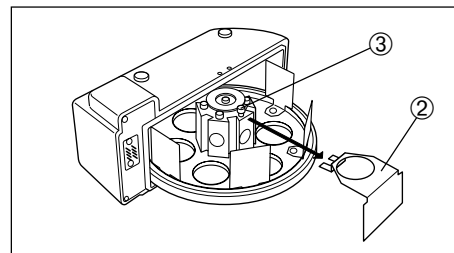


Fig. 12

3 Attaching the Fluorescence Mirror Units (Figs. 11 & 12)

1. Using the Allen screwdriver, loosen the clamping screw ① at the right side of the illuminator.
2. Pull out the turret and place it upside down.
- Ⓞ Dummy mirror units ② are mounted in the mirror unit positions. Remove the dummy mirror units from the positions you want to mount mirror units by loosening the clamping screw ③ of each mirror unit position using the Allen screwdriver.



3. Hold the fluorescence mirror unit ④ to be mounted so that the model name inscription on the side is upside down, align it with the mount dovetail and insert all the way into the insertion position. Tighten the clamping screw ③ firmly.

★ If the clamping screw ③ is loose, the turret will be unable to be rotated due to interference with the turret cover.

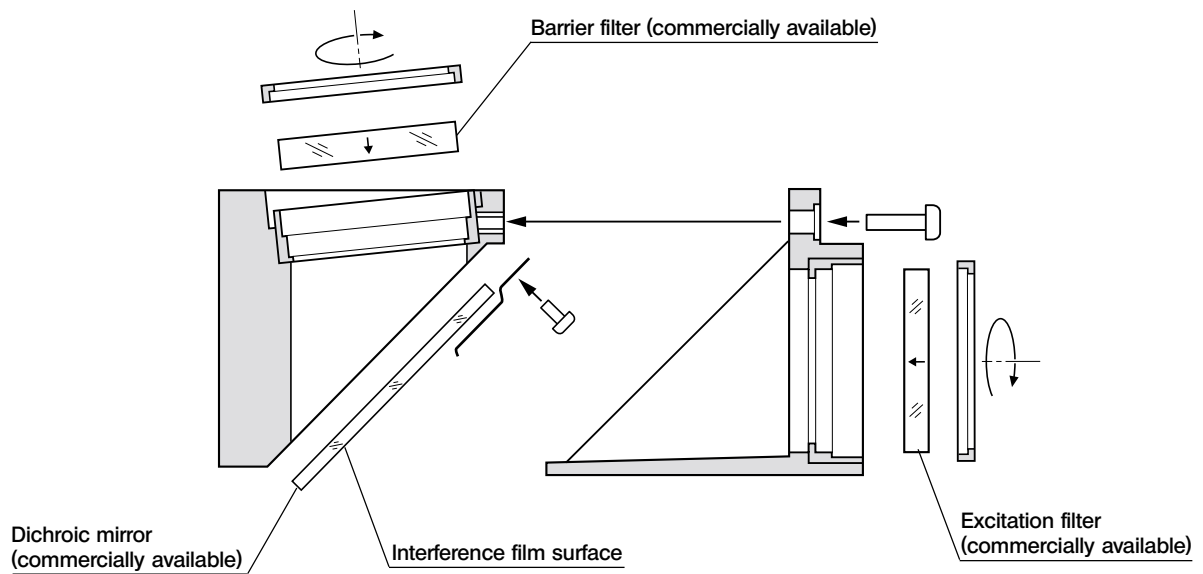
4. Check the mount dovetail number ⑤ and place upside down the indication sheet of the mounted fluorescence mirror unit into the indication pocket ⑥ with the same number on the front of the turret.
5. Mount other required fluorescence mirror units in the visible mount dovetails by repeating the above steps for each of them.
- Ⓞ If you want to mount more fluorescence mirror units in the mount dovetails located under the turret cover, first complete the present procedure then rotate the turret by motorized operation then mount the mirror units in the mount dovetails.
6. Place the turret in the original position and tighten the clamping screw ① while pushing the turret in.

Making an Optional Fluorescence Mirror Unit

© You can also fabricate optional fluorescence mirror units by fitting a commercially available barrier filter, excitation filter or dichroic mirror in the U-MF2 mirror unit frame.

Dimensions of Optical Parts

- Barrier filter
 - Excitation filter
 - Dichroic mirror
- } Diameter $\phi 25$ -0.1/-0.2 mm, max. thickness 6 mm
26 -0.1/-0.3 x 38 -0.1/0.3 mm, thickness 1 ± 0.05 mm



★ When replacing the dichroic mirror, take special care not to stain it with fingerprints, etc.

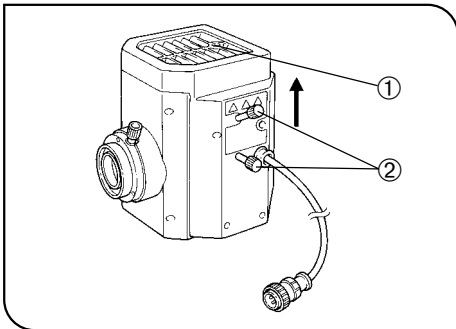


Fig. 13

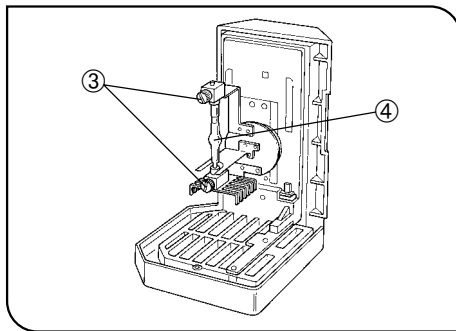


Fig. 14

4 Attaching the Mercury Burner (Figs. 13 - 16)

1. Loosen the socket clamping screw ① using the provided Allen screwdriver.
2. Hold the upper section of lamp housing and pull it upward to remove the socket section.

★ To prevent malfunctions, do not hold the lamp housing by the centering knobs ②.

3. Place the socket section upside down as shown in Fig. 14.

Ⓞ The lamp housing is equipped with the holder for transportation in the factory shipment condition or with an old burner when the burner is replaced. Remove the holder or old burner by loosening the two burner holding screws ③.

4. Attach the + (positive) pole of a specified mercury burner ④ to the fixed mount on the upper side, then the - (negative) pole to the mount on the lower side.

★ Be sure to use the USH102D (mfd. by USHIO Inc.) or HBO103W/2 (mfd. by OSRAM) burner.

▲ To prevent burner cracking due to glass distortion cause by stain, be careful not to stain the burner with fingerprints or dirt. If it is contaminated, clean by wiping gently with a piece of gauze moistened with a mixture of alcohol (70%) and ether (30%).

5. Attach the socket section with burner to the original position and tighten the clamping screw ①.

★ Align the external edges of the lamp housing with those on the socket section, and push the lamp housing straight downward.

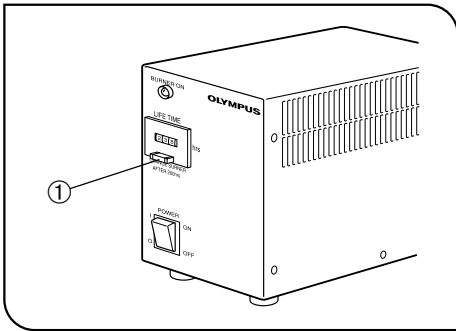


Fig. 15

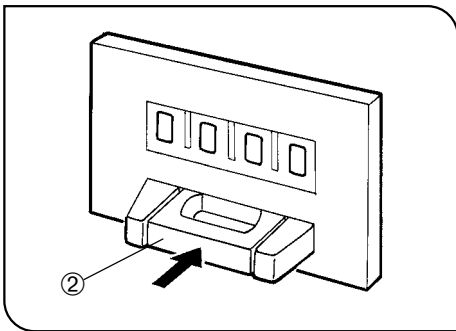


Fig. 16

Resetting the Burner Hour Counter

1. Press the center section ① of the reset button ② on the power supply unit's front panel to reset the hour counter to "000.0".
- Ⓞ The hour counter shows elapsed time in hours. The service life of a burner is 200 (USH102D) or 300 (HBO103W/2) hours. For safety's sake, replace the burner when the hour counter indicates 200.0 (USH102D) or 300 (HBO103W/2) hours.

▲ Mercury Burner Replacement

1. In order not to impair the safety of the equipment, replace the burner when it has been used for 200 (USH102D) or 300 (HBO103W/2) hours. The burner may crack if used beyond the specified life time.
2. Before replacing the burner, wait at least 10 minutes or until the lamp and lamp housing have cooled down after turning the burner off. Before removing the burner, confirm that the main switch on the power supply unit is "○" (OFF) and unplug the connecting cord from the output connector on the power supply unit. Refer to page 33 for details on replacement procedure.
3. After replacing the burner, reset the hour counter to 000.0 as outlined above.

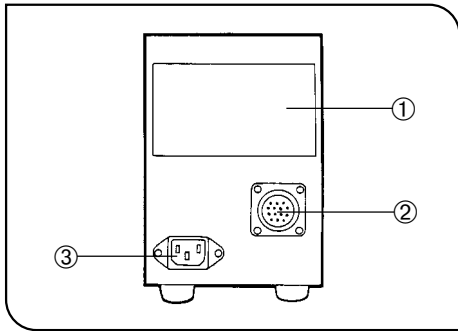


Fig. 17

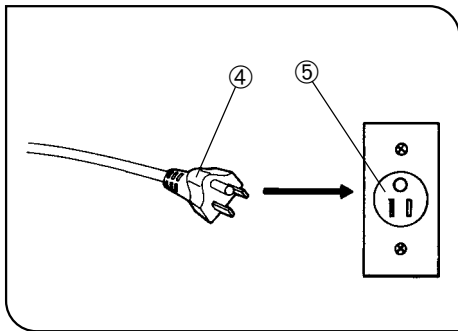


Fig. 18

8 Setting Up the Power Supply Unit (Figs. 17 & 18)

▲ Cables and cords are vulnerable when bent or twisted. Never subject them to excessive force.

▲ Make sure that the main switch is set to “O” (OFF) before connecting the power cord.

▲ Always use the power cord provided by Olympus. If no power cord is provided with the microscope, please select the proper power cord by referring to chapter “PROPER SELECTION OF THE POWER SUPPLY CORD” at the end of this instruction manual.

1. Verify that the voltage and frequency of the input power supply match the requirements inscribed on the rating plate ①.

(The 100 V system can be used with voltages in the 100 to 120 V range and 200 V system can be used with voltages in the 220 to 240 V range, both with frequencies of 50 or 60 Hz.)

2. Securely plug the burner socket connection cord into the power supply unit's connector ②.

3. Plug the power supply unit's power cord into its power input connector ③, then plug the power plug ④ into the wall power outlet ⑤.

▲ Be sure to supply power from a grounded, 3-conductor power outlet using the proper power cord. If the power outlet is not grounded properly, Olympus can no longer warrant the electrical safety performance of the equipment.

■ PROPER SELECTION OF THE POWER SUPPLY CORD

If no power supply cord is provided, please select the proper power supply cord for the equipment by referring to “Specifications” and “Certified Cord” below:

CAUTION: In case you use a non-approved power supply cord for Olympus products, Olympus can no longer warrant the electrical safety of the equipment.

Specifications

Voltage Rating	125V AC (for 100-120V AC area) or, 250V AC (for 220-240V AC area)
Current Rating	6A minimum
Temperature Rating	60°C minimum
Length	3.05 m maximum
Fittings Configuration	Grounding type attachment pulg cap. Opposite terminates in molded-on IEC configuration appliance coupling.

Table 1 Certified Cord

A power supply cord should be certified by one of the agencies listed in Table 1 , or comprised of cordage marked with an agency marking per Table 1 or marked per Table 2. The fittings are to be marked with at least one of agencies listed in Table 1. In case you are unable to buy locally in your country the power supply cord which is approved by one of the agencies mentioned in Table 1, please use replacements approved by any other equivalent and authorized agencies in your country.

Country	Agency	Certification Mark	Country	Agency	Certification Mark
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	MITI	
Austria	ÖVE		Netherlands	KEMA	
Belgium	CEBEC		Norway	NEMKO	
Canada	CSA		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA BSI	
Germany	VDE		U.S.A.	UL	
Ireland	NSAI				

Table 2 HAR Flexible Cord

APPROVAL ORGANIZATIONS AND CORDAGE HARMONIZATION MARKING METHODS

Approval Organization	Printed or embossed Harmonization Marking (May be located on jacket or insulation of internal wiring)		Alternative Marking Utilizing Black-Red-Yellow Thread (Length of color section in mm)		
			Black	Red	Yellow
Comite Electrotechnique Belge (CEBEC)	CEVEC	⟨HAR⟩	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prüfstelle	⟨VDE⟩	⟨HAR⟩	30	10	10
Union Technique de d'Electricite' (UTE)	USE	⟨HAR⟩	30	30	10
Instituto Italiano del Marchio di Qualita' (IMQ)	IEMMEQU	⟨HAR⟩	10	30	50
British Approvals Service for Electric Cables (BASEC)	BASEC	⟨HAR⟩	10	10	30
N.V. KEMA	KEMA-KEUR	⟨HAR⟩	10	30	30
SEMKO AB Svenska Elektriska Materielkontrollanstalter	SEMKO	⟨HAR⟩	10	10	50
Österreichischer Verband für Elektrotechnik (ÖVE)	⟨ÖVE⟩	⟨HAR⟩	30	10	50
Danmarks Elektriske Materielkontrol (DEMKO)	⟨DEMKO⟩	⟨HAR⟩	30	10	30
National Standards Authority of Ireland (NSAI)	⟨NSAI⟩	⟨HAR⟩	30	30	50
Norges Elektriske Materielkontroll (NEMKO)	NEMKO	⟨HAR⟩	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	⟨UNDE⟩	⟨HAR⟩	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	⟨HAR⟩	30	30	70
Instituto Portugues da Qualidade (IPQ)	I np I	⟨HAR⟩	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	⟨HAR⟩	10	30	90
Elektriska Inspektoratet	SETI	⟨HAR⟩	10	30	90

Underwriters Laboratories Inc. (UL)

SV, SVT, SJ or SJT, 3 X 18AWG

Canadian Standards Association (CSA)

SV, SVT, SJ or SJT, 3 X 18AWG

This device complies with the requirements of both directive 89/336/EEC concerning electromagnetic compatibility and directive 73/23/EEC concerning low voltage. The CE marking indicates compliance with the above directives.

MEMO

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