

OLYMPUS[®]

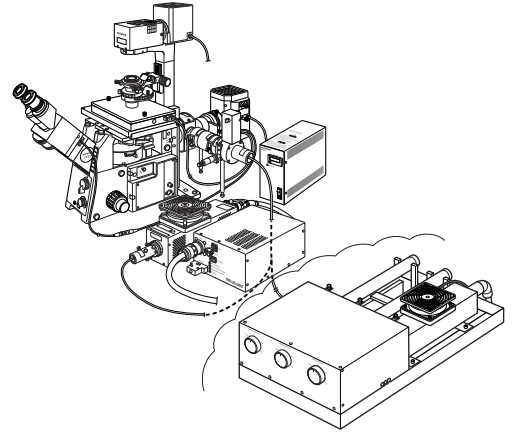
*Modules described
in this manual*

IX2-RFAEVA-2

FV5-LAAR

IX2-COMB

FV5-FUR



INSTRUCTIONS

TOTAL INTERNAL REFLECTION ILLUMINATION SYSTEM

This instruction manual is for the Olympus Total Internal Reflection Illumination 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.

This system employs a laser light source. Take special care for safety and please also read the instruction manual for the laser light source.

Retain this instruction manual in an easily accessible place near the work desk for future reference.



A X 7 3 8 5

This device complies with the requirements of directive 98/79/EC concerning in vitro diagnostic medical devices. CE marking means the conformity to the directive.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CONTENTS

CAUTION

This system employs a laser light source and should be assembled and adjusted by qualified service personnel from Olympus.

Never attempt to assemble or adjust the system for it is extremely hazardous.

IMPORTANT – Be sure to read this section for safe use of the equipment. – 1-7

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IMPORTANT

This system has been designed to be used in combination with an IX2 series (IX81/IX71/IX51) or IX series (IX70/IX50) microscope to provide it with total internal reflection fluorescence illumination* using a laser light source.


* Total internal reflection fluorescence illumination utilizes the “evanescent light”, a very small amount of light at the sub-micrometric order penetrating beyond the total reflection of the cover glass (on the specimen side), to excite only the fluorescent molecules existing near the cover glass surface. By eliminating the background fluorescence, it enables fluorescence observation with very high contrast.




LASER SAFETY PRECAUTIONS

1. The laser used in combination with this system is designated as a laser product of the following class.

**CLASS IIIb (CDRH)
CLASS 3B (IEC60825-1)**







-  A CLASS 3B laser product is permitted to be used exclusively under control of a laser safety manager. Before using this product, read “USER’S SAFETY PROTECTION MEASURES ACCORDING TO IEC60825-1 ‘LASER PRODUCT RADIATION SAFETY STANDARD’” carefully to apply sufficient safety measures before use. If there is any question concerning the laser product, please consult Olympus.

2. The laser beam output from the objective position or objective top lens may injure the skin exposed to it. Avoid exposing your finger or hand to the laser beam. Also, do not output the laser beam externally by engaging a mirror in the light path, for this is extremely hazardous if the output beam enters your eye.
3. Place the specimen horizontally on the stage. If the specimen is tilted, the laser beam may be reflected around the microscope and cause a hazard.
4. Never remove a unit while the laser beam output, for this may cause the laser beam to be output from there. Removal of any unit should be performed by Olympus qualified service personnel. When removal is required, please consult Olympus.
5. Be sure to cap the revolving nosepiece positions where no objective is attached.
6. Do not bend or pull excessively or step on the laser fiber cable, for this may damage the laser fiber cable and cause laser beam leakage that is extremely hazardous. Should laser beam leakage occur, immediately turn off the laser light source and contact Olympus.
7. The laser-cooling fans output warm winds through the air outlets. Do not place an object that is flammable or non-resistant to heat near an air outlet.

-  To prevent electric shock or fire hazard, be sure to consult Olympus if you want to use a remote interlock connector.

Safety Symbols

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

Symbol	Explanation
	Indicates the use of a laser beam. Take special care in handling the part.
	Indicates presence of a high voltage (1 kV or more). Take care against electric shock.
	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.
	Indicates that the main switch is ON.
	Indicates that the main switch is OFF.

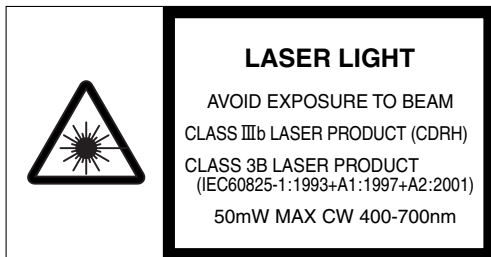
Warning Labels

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

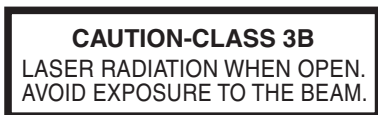
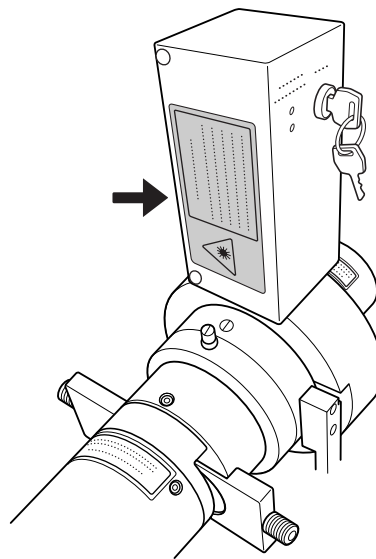
If warning labels become soiled, peel off, etc., contact your local Olympus representative to have them replaced.

Warning Label Positions

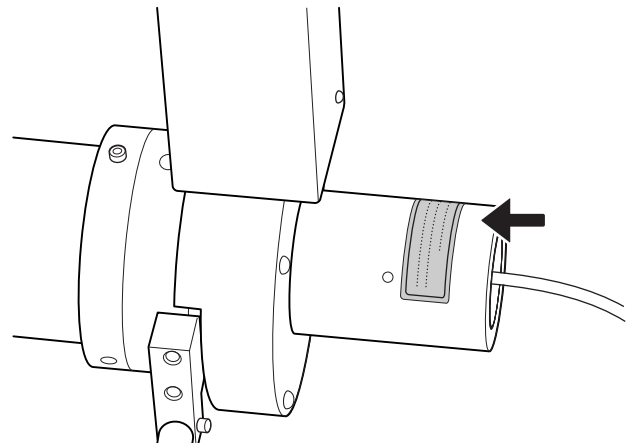
© Warning labels are attached to the positions indicated by the arrows.



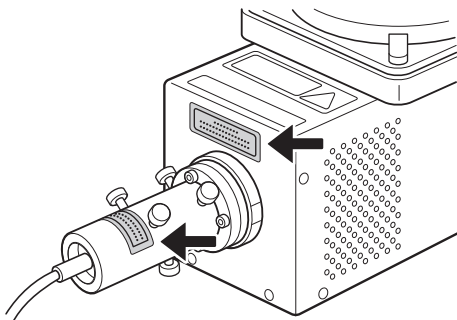
Fiber light illuminator



Fiber light illuminator

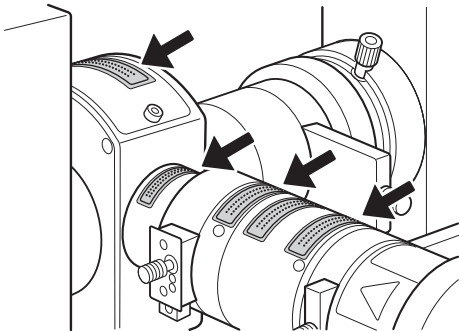


Ar laser unit

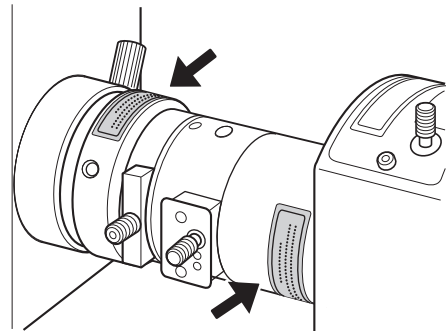


CAUTION-CLASS 3B
LASER RADIATION WHEN OPEN.
AVOID EXPOSURE TO THE BEAM.

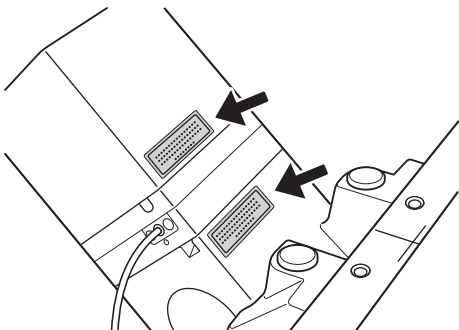
Fiber light illuminator



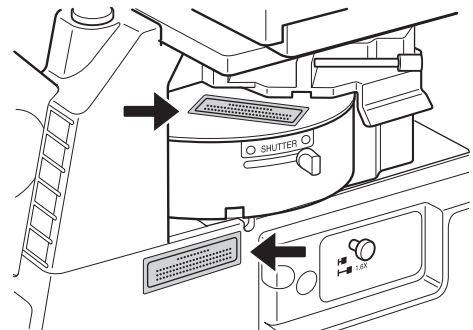
Straight light illuminator



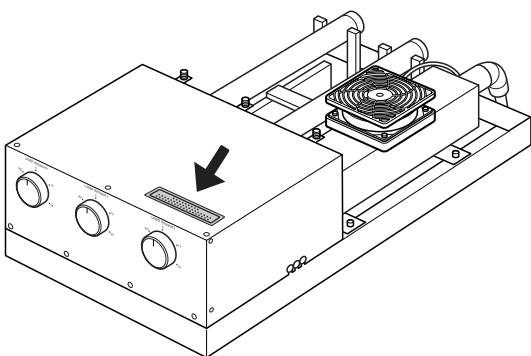
Binocular tube & binocular tube shutter



Microscope frame & revolving nosepiece

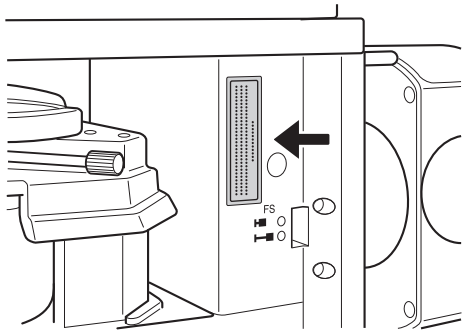


Laser combiner IX2-COMB

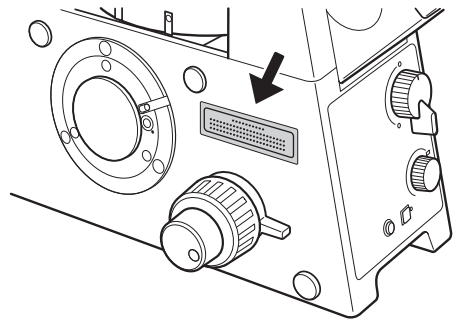


CAUTION-CLASS 3B
LASER RADIATION WHEN OPEN.
AVOID EXPOSURE TO THE BEAM.

Microscope frame (rear right)

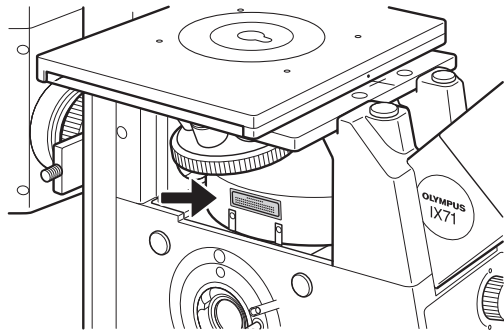


Microscope frame (left side port)



AVOID EXPOSURE
LASER RADIATION IS EMITTED
FROM THIS APERTURE.

Microscope left side (Reflected illumination and observation light path)



SAFETY PRECAUTIONS

Movement of the System

The system is assembled and set up by qualified service personnel. Avoid moving the system for this may deviate the optical adjustments. Consult Olympus when you wish to move the system. If the system is moved by the customer, Olympus will not assume liabilities for the system malfunctions and damage that may result.

Disposal of the System

1. The laser tube used in the system should be disposed of according to your local industrial waste disposal regulations. If disposal by you is forbidden, please contact Olympus.
2. The mercury burner used in the illumination of the system should be disposed of according to your local industrial waste disposal regulations.

Handling Precautions

1. After the equipment has been used in an observation of a specimen that is accompanied with a potential of infection, clean the parts coming in contact with the specimen to prevent infection.
 - Moving this product is accompanied with the risk of dropping the specimen. Be sure to remove the specimen before moving this product.
 - In case the specimen is damaged by erroneous operation, promptly take the infection prevention measures.
 - The product becomes unstable if its height is increased by an accessory mounted on it. In this case, take anti-toppling measures to prevent the specimen from being dropped when the product topples down.
2. The system is composed of precision equipment. Handle it with care and avoid subjecting it to sudden or severe impact.
3. Do not bend or pull excessively or step on the fiber cable, for this may degrade the performance considerably.
4. When the reflected light source is turned off, do not turn it again for at least 10 minutes. Otherwise, the service life of the mercury burner may be reduced.
5. Do not apply cool air from an air conditioner, etc., to the laser beam. Otherwise, the operation may become unstable.
6. To avoid destruction of the laser tube, absolutely avoid causing condensation in it. When the laser tube has been left under a cold environment for a long period, condensation is avoided by not starting to warm the operation room until the laser operation has started.
7. When a laser is not used for more than a month, it should be subjected to idle operation (aging) for more than 8 continuous hours at least every month. Otherwise, the laser oscillation may become unstable, causing sudden stopping of oscillation during operation or shortening of service life.
8. The laser-cooling fans output warm winds through the air outlets. Do not place an object that is flammable or non-resistant to heat near an air outlet. Leave a space of 50 cm or more in front of each air outlet to facilitate heat ventilation. (Overheating of laser tube may make the laser oscillation unstable, causing sudden stopping of oscillation during operation. The rise in the equipment internal temperature may also cause malfunction or failure.)
9. As cooling fans are installed at the front and rear of the laser power supply, this should be installed by leaving spaces of 30 cm or more from the surrounding walls so as not to block ventilation from the cooling fans as well as from the splits on the top and side panels. Do not leave an object such as documents or a book on the top of the laser power supply, for this may cause overheating, which leads to sudden stopping of laser oscillation due to activation of the protection circuitry.
10. Install the system so that the power supply to the system can be shut down easily by switching the power switch or unplugging the power cord from the power outlet. Also, the power supply for the system should be positioned in a place allowing easy shutdown of the power supply.

1 Getting Ready

1. This manual pertains only to the handling of the total internal reflection fluorescence illumination system. Please also read the instruction manuals for the IX2 series (IX series) microscope and associated options to understand the comprehensive operating instructions of the microscope system.
2. The total internal reflection fluorescence illumination system is composed of precision instruments. Handle it with care and avoid subjecting it to sudden or severe impact.
3. Do not use the system where it is subjected to direct sunlight, high temperature and humidity, dust or vibrations.
4. Reserves spaces of 10 cm or more around the lamp housing and power supply to facilitate their ventilation.

2 Maintenance and Storage

1. To clean the lenses and other glass components, simply blow dirty away using a commercially available blower and wipe gently using a piece of cleaning paper (or clean gauze).
If a lens is stained with fingerprints or oil smudges, wipe it gauze slightly moistened with commercially available absolute alcohol.
▲ Since the absolute alcohol is highly flammable, it must be handled carefully.
Be sure to keep it 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 it only in a well-ventilated room.
2. Do not attempt to use organic solvents to clean the non-optical components. To clean them, use a lint-free, soft cloth slightly moistened with a diluted neutral detergent.
3. Never attempt to disassemble any part of the system, for this may degrade the performance and the laser beam output.

3 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 the instructions are related to the hazard of laser beam.

▲ : 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 the equipment.

© : Indicates commentary (for ease of operation and maintenance).

1 MODULE NOMENCLATURE

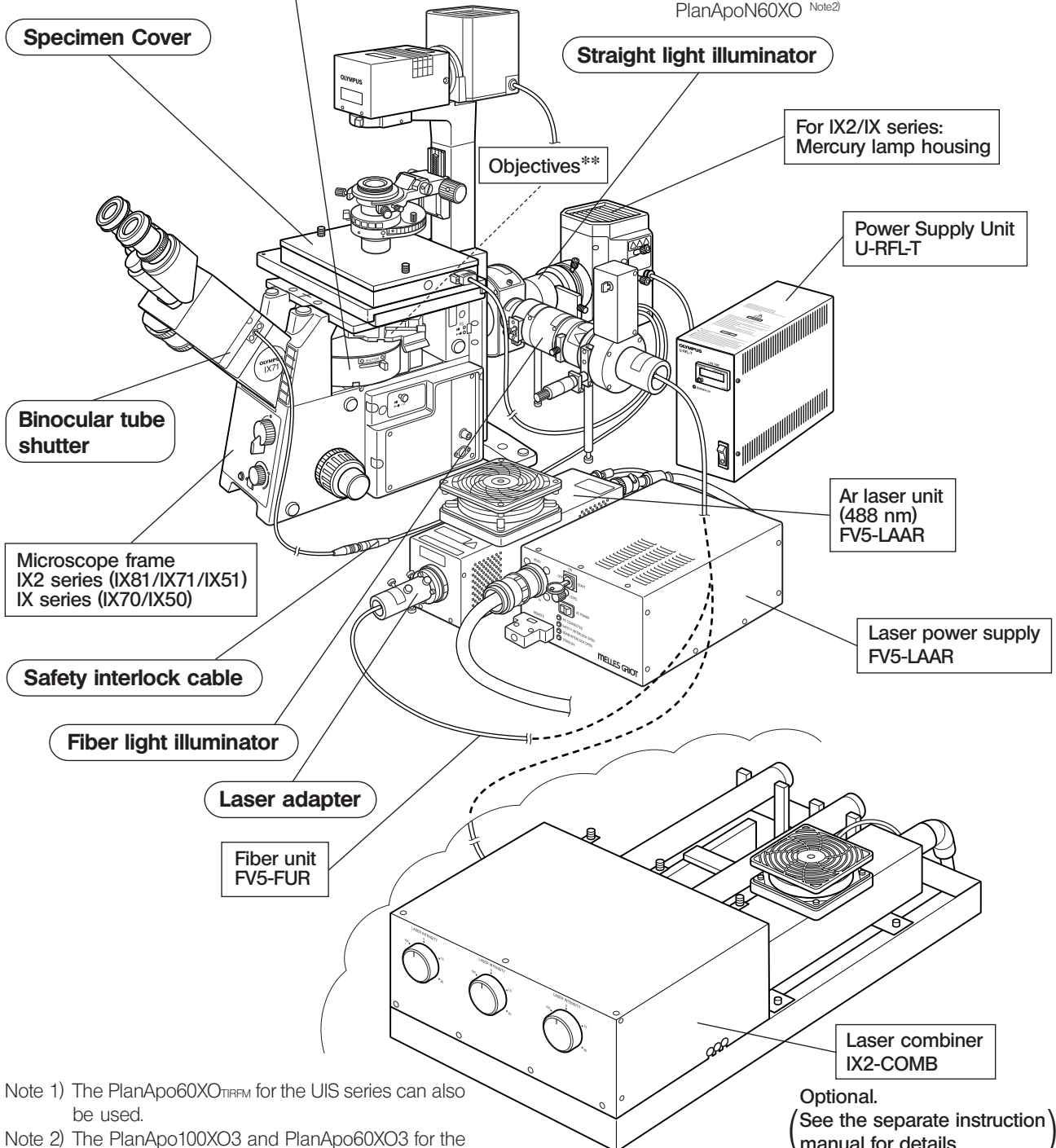
◎ The modules enclosed () belong to the IX2-RFAEVA-2 total internal reflection fluorescence illumination system.

- For IX2/IX series:
- Fluorescence mirror unit cassette
 - Fluorescence mirror unit (for mercury burner)
 - Fluorescence mirror unit (for laser)*

* Remove the excitation filter from each laser wavelength compatible excitation mirror unit before use. (See the chart on page 11.)

** For cell specimens and fluorescent molecules: Apo100XOHR/PlanApoN60XO_{TIRFM} (made to order) ^{Note1}

For fluorescent molecules: UPlanSApo100XO/PlanApoN60XO ^{Note2}



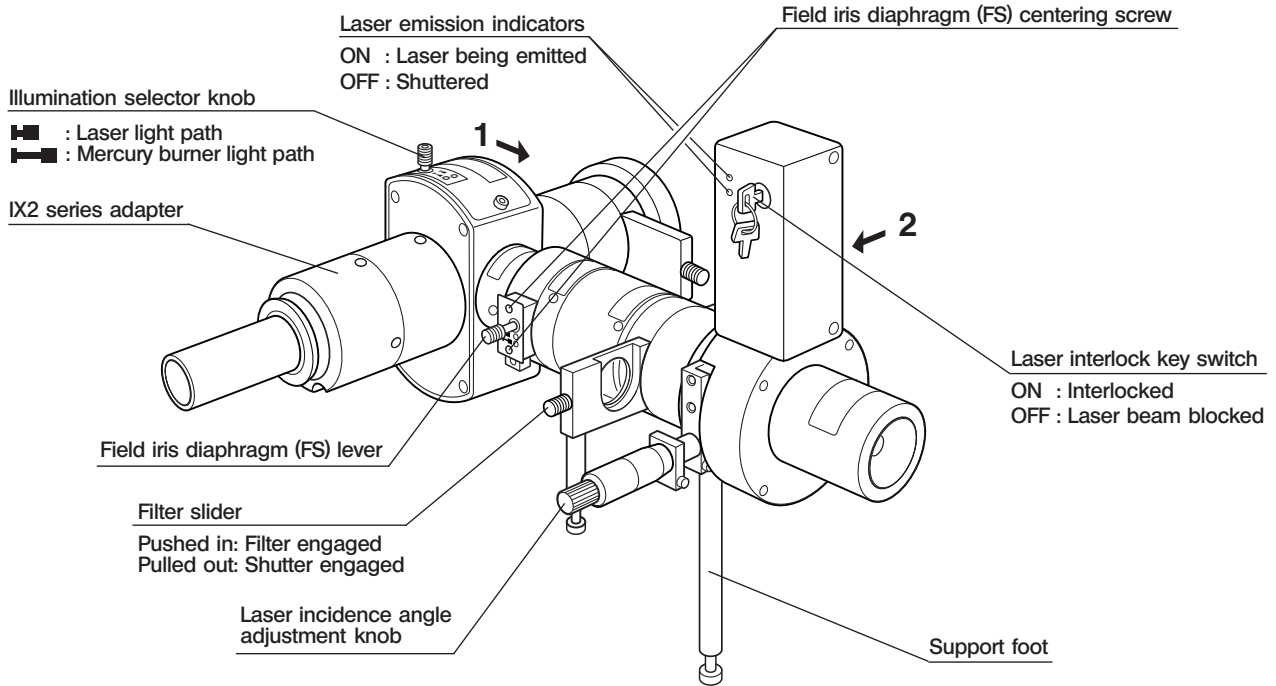
Note 1) The PlanApo60XO_{TIRFM} for the UIS series can also be used.

Note 2) The PlanApo100XO3 and PlanApo60XO3 for the UIS series can also be used (ones with model numbers 3, 2 and none are all usable).

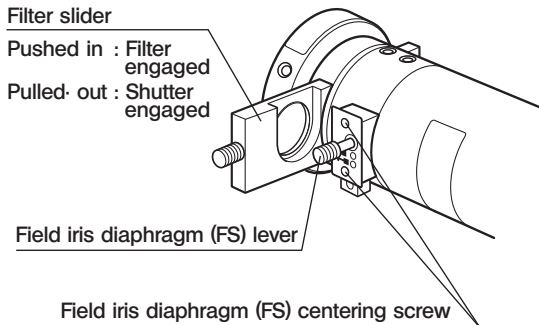
Optional.
(See the separate instruction manual for details.)

2 CONTROLS

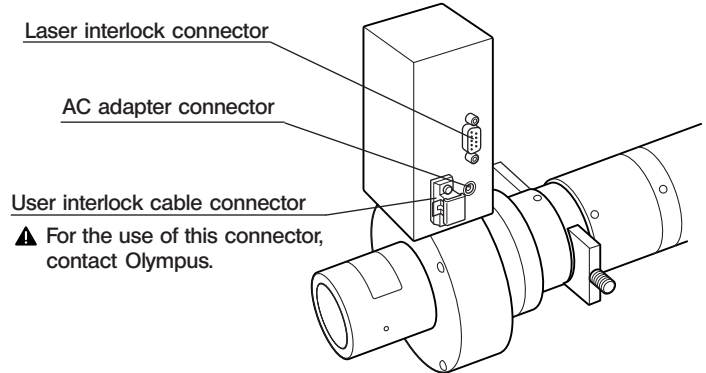
Straight Light Illuminator and Fiber Light Illuminator



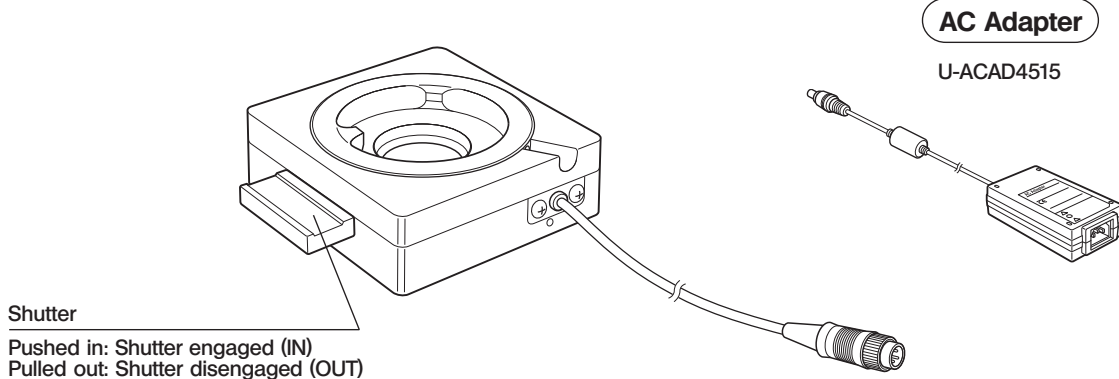
View in the direction of arrow 1



View in the direction of arrow 2

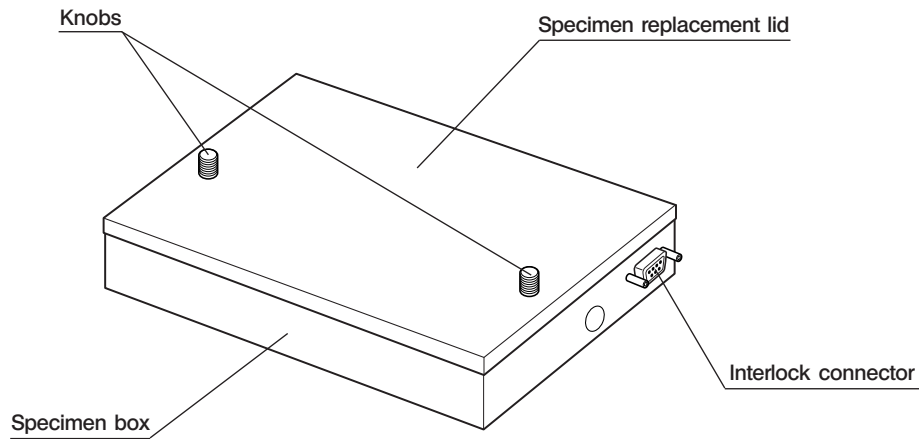


Binocular Tube Shutter

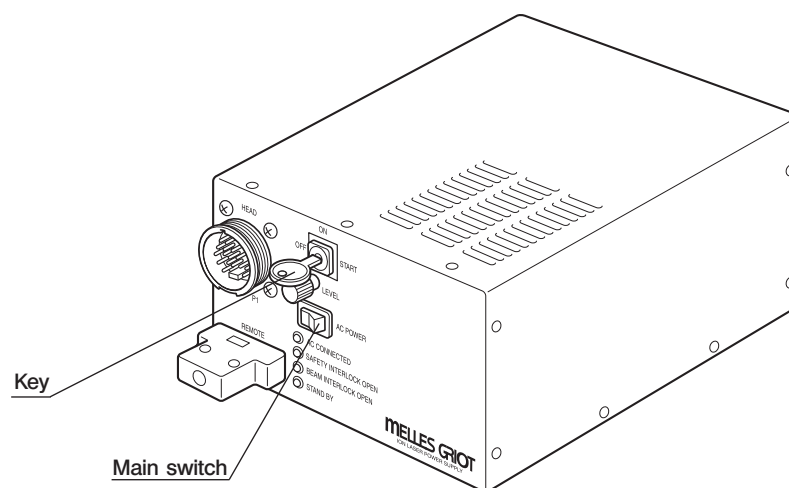


Specimen Cover

© Lighting the specimen replacement lid activates the interlock key switch and the motorized shutters (x2) of the fiber light illuminator blocks the laser beam.



Ar Laser Power Supply (488 nm) FV5-LAAR



3 TOTAL INTERNAL REFLECTION FLUORESCENCE OBSERVATION



Because this observation method employs laser beam, be sure to observe the following precautions.

- Never remove a part on which a warning panel is attached.
- Be sure to set the interlock key switch to OFF and make sure that the laser emission indicator is OFF before proceeding to the objective switching or fluorescence turret switching.

3-1 Conditions of Observation



Be sure to observe the following laser operating environment conditions.

- Temperature: 18 to 28°C (performance guaranteed), 10 to 35°C (laser oscillation guaranteed).
- Humidity: 30% to 80% (without condensation)
- Excitation wavelengths: 400 to 750 nm with both laser and mercury burner.



Observe the following precautions in the total internal reflection fluorescence observation.

- Applicable objectives for total internal reflection fluorescence observation
Cell specimens and fluorescent molecules: Apo100XOHR (NA 1.65), PlanApoN60XO_{TIRFM} (made to order, NA 1.45).
Fluorescent molecules: UPlanSApo100XO (NA 1.40), PlanApoN60XO (NA 1.42).
- A special cover glass and immersion oil are required when using the Apo100XOHR.
- The total internal reflection fluorescence mirror unit can be used by removing the excitation filter of the excitation mirror unit.

Excitation Mirror Unit		Laser (Wavelength)	
IB excitation	U-M●IB3 U-M●IBA3	Ar laser	(488 nm)
G excitation	U-M●G2 U-MWIG3 U-M●IGA3	HeNe-G laser Nd-YAG laser	(543 nm) (532 nm)
R excitation	(Commercially available product)	HeNe-R laser	(633 nm)
IY excitation	U-MWIY2	Kr laser	(568 nm)
BV excitation	U-M●BV2	He-Cd laser	(442 nm)

- The character(s) in ● can be SW, W or N. Type 2 excitation mirror units can also be used.
- For the multi-excitation mirror units, consult Olympus.
- For IB excitation fluorescence observation using the mercury burner, it is required to prepare a separate IB excitation mirror unit incorporating an excitation filter, apart from the total internal reflection fluorescence mirror unit.
- Total internal reflection observation is not available with the binocular tube light path (because the laser will not be emitted unless the binocular tube shutter is engaged in the light path).
- The observation field number is 11.7 with both laser and mercury burner.

3-2 Preparation for Observation

! Never peel off warning label from a position it is attached. Otherwise, the laser beam may enter your eyes.

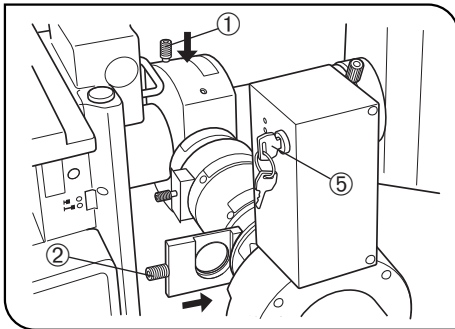


Fig. 1

1 Preparing for Laser Beam Introduction (Fig. 1)

1. Set the light path selector knob of the microscope for the camera light path.
2. Push in the illumination selector knob ① for the laser light path.
3. Rotate the fluorescence mirror unit turret to engage an excitation mirror unit that is compatible with total internal reflection fluorescence observation.
4. Engage the objective for total internal reflection observation in the light path.
5. Push in the shutter of the binocular tube shutter to engage it in the light path.
6. Push in the filter slider ② of the fiber light illuminator to engage the released shutter.
7. Release the shutter of the fluorescence mirror unit turret (by setting the shutter to position marked "O").
8. Put the specimen replacement lid on the specimen box.

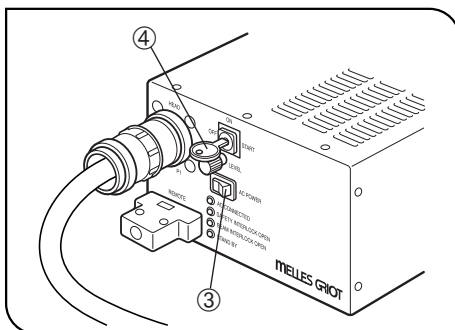


Fig. 2

2 Introducing the Laser Beam (Fig. 2)

- Ⓞ To ensure stable laser beam output, warm up the system (for about 10 minutes) after turning the laser power supply on.
1. Set the main switch ③ to "I" (ON).
 2. Turn the key ④ till the ON position. This also starts the laser-cooling fans. The laser will start oscillation in about 10 seconds to 1 minute.
 3. Set the laser interlock key switch (⑤ in Fig. 1) to ON.

3-3 Observation Procedure

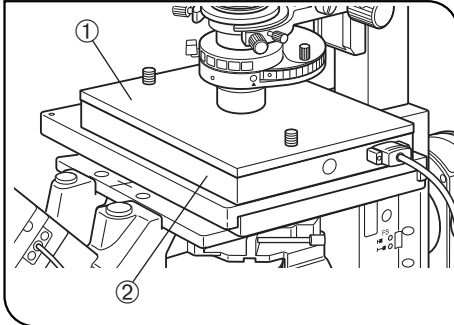


Fig. 3

1 Adjusting the Focus (Fig. 3)

(Fig. 3)

1. Remove the specimen replacement lid ① from the stage.
2. Apply immersion oil on the objective top lens and place the specimen on the stage.
3. Place the specimen replacement lid ① on the specimen box ②; the laser beam will be output. When the image is displayed on the monitor for the TV camera, bring the displayed specimen image into focus.

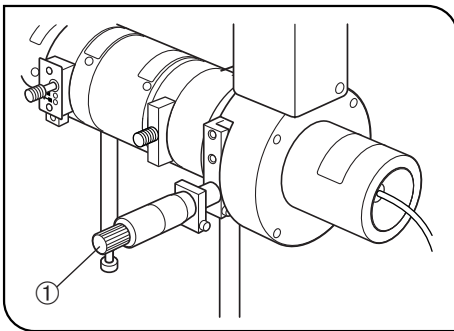


Fig. 4

2 Adjusting the Laser Beam Incidence Angle (Fig. 4)

⊙ Perform the laser beam incidence angle adjustment by referring to the “Explanation Diagrams” on the next page.

⊙ When the laser beam incidence angle adjustment knob ① of the fiber light illuminator is set to the fully clockwise position, the angle of the laser beam output from the objective is smaller than the critical angle and total internal reflection is not obtained (see Explanation 1).

★ **Do not turn the adjustment knob further clockwise from the above condition by force.**

1. While observing the monitored image, turn the adjustment knob ① slowly counterclockwise until total internal reflection fluorescence is obtained (Explanation 3).

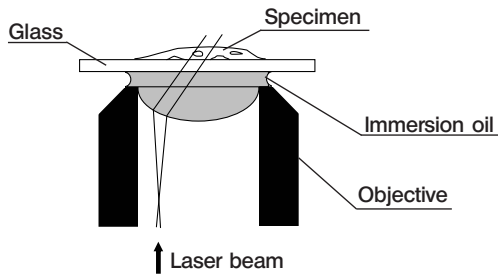
When the laser incidence angle approaches the critical angle (Explanation 2), the bright part of the fluorescence image flows in the vertical or horizontal direction of the field of view. When the angle is increased further, the background fluorescence darkens suddenly and the total internal reflection fluorescence is obtained (Explanation 3).

2. Turning the adjustment knob ① further counterclockwise decreases the range where total internal reflection fluorescence is observed (depth from the cover glass surface). Turning the adjustment knob clockwise increase the above range.

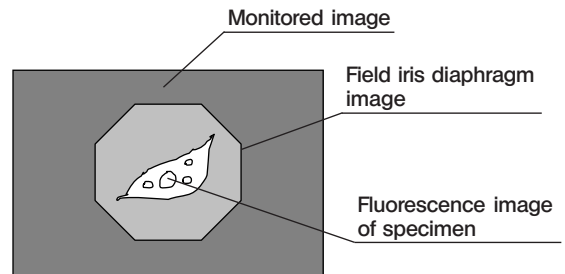
⊙ If the adjustment knob is turned too much counterclockwise, nothing will be visible eventually (Explanation 4).

Explanation Diagrams (Laser Beam Incidence Angle Adjustment)

Explanation 1 : Condition before laser incidence angle adjustment

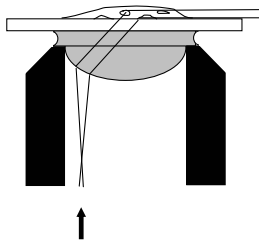


- The laser beam is transmitting through the glass and specimen.

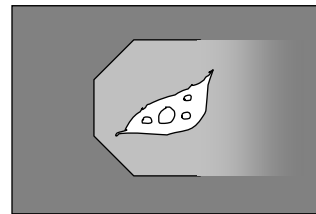


- The fluorescence image of specimen is observed even when it is defocused by moving the objective upward.

Explanation 2 : Critical angle condition

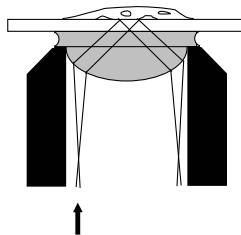


- The laser beam travels on the upper surface of the glass.

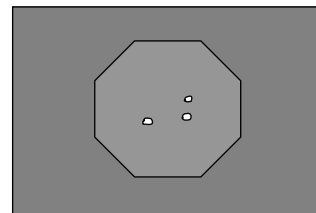


- The image flows in the horizontal direction (also in the vertical direction depending on the camera installation orientation).

Explanation 3 : Total internal reflection condition

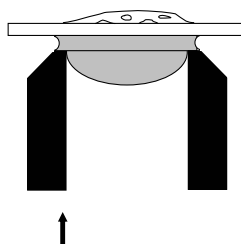


- When total internal reflection is achieved, the reflected laser beam returns to the objective and forms an evanescent field on the glass.

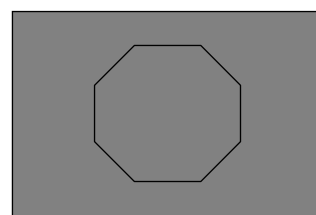


- The image darkens suddenly.
- The focused plane is thin.
- The fluorescence image of specimen becomes invisible when it is defocused by moving the objective upward.

Explanation 4 : Condition before laser incidence



- The laser beam hits the inner frame of objective and does not reach the specimen.



- The image is completely dark.
- When the camera gain is increased, vague light may be visible due to the stray light.

4

REFLECTED LIGHT FLUORESCENCE OBSERVATION (Observation Using the Mercury Burner)

© Follow the instructions given by the instruction manual for the reflected light fluorescence system in use.
For this observation, be sure to attach the original fluorescence mirror unit, which incorporates the excitation filter, to the turret.

5

USING THE CONTROLS

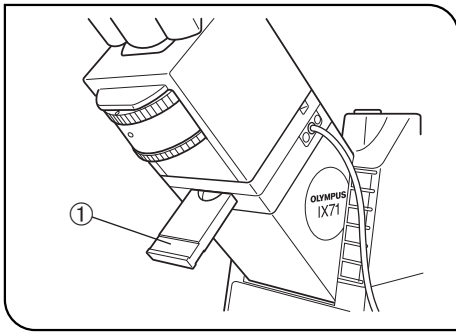


Fig. 5

1 Using the Binocular Tube Shutter

(Fig. 5)

© When the shutter ① of the binocular shutter is pulled out, the laser interlock key switch is activated, blocking the laser beam output and, for safety, making the total internal reflection observation unavailable for the binocular tube.

1. To observe the specimen through the binocular tube, pull out the shutter ① to open the light path.
In this case, the laser beam is not output because it is blocked by the motorized shutter.
2. To perform total internal reflection observation, push in the shutter ① all the way until it is stopped.
This activates the laser interlock key switch, causing the laser beam to be output.

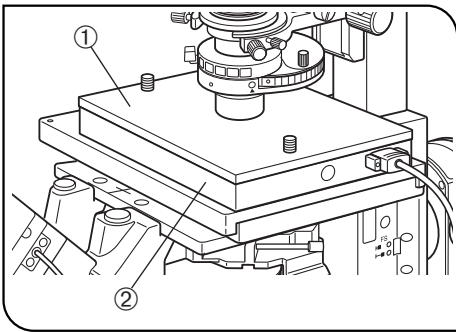


Fig. 6

2 Using the Specimen Cover

(Fig. 6)

© Removal of the specimen replacement lid ① activates the laser interlock key switch and blocks the laser beam output.

1. For transmitted light observation or for changing the specimen, remove the specimen replacement lid ①.
In this case, the laser beam is not output because it is blocked by the motorized shutter.
2. To perform total internal reflection observation, place the specimen replacement lid ① on the specimen box ②.
This activates the laser interlock key switch, causing the laser beam to be output.

★ When a condenser with short working distance (IX2-LWUCD, IX2-LWUCDA2, IX2-DICD or U-UCD8) is used, push down the transmitted light illumination column toward the rear or swing the condenser holder upward in advance.

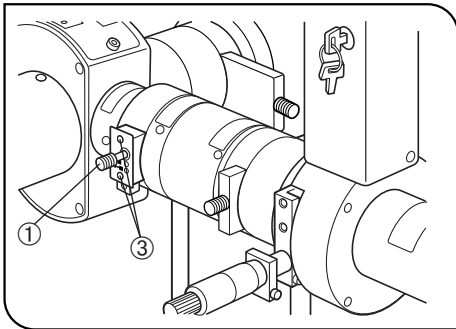


Fig. 7

3 Field Iris Aperture Diaphragm (Fig. 7)

- ⊙ To prevent progress of specimen fading, stop down the field iris aperture diaphragm to cover only the observed area.
- The field iris diaphragm can be stopped down by pulling out the field iris diaphragm lever ①.

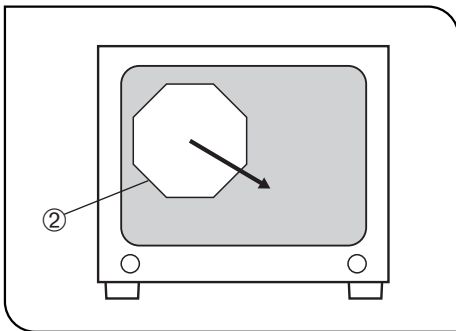


Fig. 8

Centering the Field Iris Diaphragm (Figs. 7 & 8)

1. Place a specimen on the stage and bring the specimen image displayed on the monitor into focus.
 2. Pull out the field iris diaphragm lever ① so that the field iris diaphragm image ② is displayed on the monitor screen.
 3. Insert the Allen screwdriver, provided with the microscope frame, alternately into the two centering screws ③ to bring the field iris diaphragm image ② at the center of the monitor screen.
 4. After completing centering, push in the field iris diaphragm lever ① until the field iris diaphragm image ② circumscribes the monitor screen.
- ⊙ If the TV camera uses image pickup devices that are larger than 2/3 inch, the field iris diaphragm image will not circumscribe the monitor screen even when the field iris diaphragm is opened at maximum.

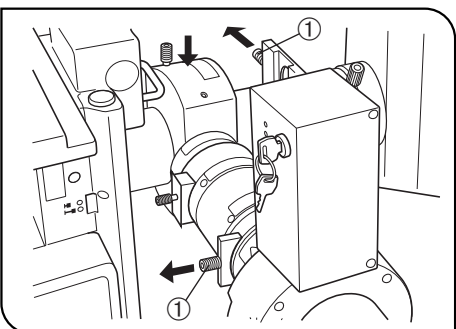





Fig. 9

4 Filter Slider (Fig. 9)

- ⊙ The filter slider has the same structure with both the straight light illuminator and fiber light illuminator, allowing either the shutter or filter pocket to be engaged in the light path according to the left and right sliding of the slider.
 - ⊙ When observation is not performed, engage the shutter in the light path to prevent the specimen from fading.
1. Pull out the filter slider ① in the direction of the arrow to engage the shutter in the light path.
 2. The filter pocket accepts brightness adjustment ND filters, which can be dropped into the pocket for insertion.
 - Up to five ND filters, including the 32ND6, 32ND12, 32ND25 and 32ND50 can be inserted.
- ⚠ If the ND filters in the fiber light illuminator are tilted, irregularities due to interference of laser beam may be observed in the field of view. To prevent this, keep the ND filters vertical by means of the ring spring inside the filter pocket.
- ⚠ The filter slider becomes very hot when the system has been on for a long period. Be careful not touch the filter slider parts other than the knob.

Classification	Problem	Cause	Remedy	Caution
Laser beam output	No laser beam is output.	The laser oscillator is not ON.	Set the main switch and key of the laser oscillator to ON.	 <p>Never look into an objective to check if the laser beam is output.</p>
		The illumination selector knob is set for the mercury burner illuminator.	Push in the illumination selector knob to select the laser illuminator light path.	
Laser beam observation	Total internal reflection fluorescence cannot be obtained.	The filter slider of the fiber light illuminator is pulled out.	Push in the filter slider to open the light path.	 <p>Be sure to pulled out the shutter to block the laser beam before proceeding to treatment.</p>
		The manual shutter of the fluorescence mirror unit cassette is closed.	Release the manual shutter.	
		Other fluorescence mirror unit than a total internal reflection fluorescence mirror unit is engaged in the light path.	Engage a total internal reflection fluorescence mirror unit in the light path.	
		The laser beam incidence angle adjustment knob is turned too much counterclockwise.	Turn the laser beam incidence angle adjustment knob all the way clockwise.	
		The binocular tube shutter is pulled out.	Push in the binocular tube shutter.	
		The specimen replacement lid is removed.	Place the specimen replacement lid on the specimen box.	
		The interlock key switch is set to OFF.	Set the interlock key switch to ON.	
		The AC adapter connector is connected improperly.	Connect it properly.	
		The equipment is normal if the laser beam is output within about 1 minute.	Wait until the laser beam is output.	
		The laser incidence angle is not the critical angle.	Turn the laser incidence angle adjustment knob counter clockwise.	
		The laser beam incidence angle adjustment knob is turned too much counterclockwise.	Turn the laser beam incidence angle adjustment knob clockwise.	
		An objective other than the total internal reflection fluorescence objective is engaged in the light path.	Engage a total internal reflection fluorescence objective in the light path.	
		The specimen is tilted.	Place the cover glass so that it is parallel with the stage center plate.	
		The specimen being observed has a refractive index of 1.38 or more (glycerin sealed specimen, etc.)	Use the Apo100XOHR objective (NA 1.65) to observe a specimen with a refractive index of 1.38 (index of cytoplasm) or more.	
The immersion oil or cover glass is not suitable.	Special immersion oil and cover glass are required when using the Apo100XOHR (NA 1.65).			
Linear or elliptical interference stripes are observed in the field.	Random interference stripe is observed in the field, and the stripe moves when the stage is moved.	The ND filter in the filter slider is tilted.	Stand the ND filter vertically using the ring spring provided in the filter slider. If the interference stripe still does not disappear, rotate the ND filter to minimize the interference stripe.	 <p>Be sure to pulled out the shutter to block the laser beam before proceeding to treatment. If the interference stripe does not disappear after treatment, please consult Olympus.</p>
		A fluorescence mirror unit incorporating an excitation filter is engaged in the light path.	Engage a total reflection fluorescence mirror unit without excitation filter in the light path.	
Random interference stripe is observed in the field, and the stripe does not move even when the stage is moved.	An interference stripe with a concentric pattern is observed.	The specimen (cell) is not in close contact with the cover glass but is separated from it at some positions.	Put the specimen (cell) in close and perfect contact with the cover glass.	
		The immersion oil contains bubbles.	Wipe off the immersion oil and attach new oil by avoiding bubble penetration.	
Random interference stripe is observed in the field, and the stripe does not move even when the stage is moved.	An interference stripe with a concentric pattern is observed.	The objective is dirty.	Clean the objective top lens with the cleaning mixture fluid.	
		Dust is attached to the dichroic mirror or barrier filter.	Blow dust away using a blower, etc.	

7 SPECIFICATIONS

Item	Specification
Applicable microscope frames	<ul style="list-style-type: none"> IX2 series (IX81/IX71/IX51) IX series (IX70/IX50)
Applicable reflected fluorescence systems	<ul style="list-style-type: none"> IX2 and IX series systems (Reflected light illuminator unnecessary)
Total internal reflection illumination system IX2-RFAEVA	<p><u>Straight (mercury burner)/Fiber light (laser) double illuminator</u></p> <ul style="list-style-type: none"> Either illuminator can be selected using the illumination selector knob. Interlock mechanism (Laser interlock/User interlock). Field iris diaphragm (Diameter adjustable between 1.7 and 13 mm) Filter slider Maximum FN 11.7 Interlock key switch Laser emission indicators <p><u>Binocular tube shutter</u></p> <ul style="list-style-type: none"> Laser interlock mechanism with the binocular tube shutter. (Releasing the shutter engages the shutter in the laser light path.) <p><u>Specimen cover</u></p> <ul style="list-style-type: none"> Laser interlock mechanism with the specimen replacement lid. (Removing the specimen replacement lid engages the shutter in the laser light path.)
Ar laser unit/power supply FV5-LAAR	<ul style="list-style-type: none"> 10 mW power, linear polarization Forced air-cooled Ar ion laser (488 nm) Connection with the fiber light illuminator: Polarization plane saving fiber cable FV5-FUR (3 m) Power consumption: 115 V, 10 A (max) 230 V, 10 A (max)
Operating environment	<ul style="list-style-type: none"> Indoor use Altitude: Max. 2000 m Temperature: 18 to 28°C (performance guaranteed), 10 to 35°C (laser oscillation guaranteed) Relative humidity: 30% 80% (without condensation) Supply voltage fluctuations: ±10% Pollution degree: 2 (in accordance with IEC60664) Installation (overvoltage) category: II (in accordance with IEC60664)
Storage environment	<ul style="list-style-type: none"> Temperature: -25 to 65°C Relative humidity: 10% to 90%

Safety

EN61010-1(1993 +A2 1995): Safety requirements for electrical equipment for measurement, control and laboratory use.

EN60825-1(1994 +A2 2001): Safety of laser products.

Electromagnetic Compatibility

EN61326(1997 +A1 1998): Electrical equipment for measurement, control and laboratory use EMC requirements.

EN61326 defines two categories according to the location for use.

Class A: Equipment suitable for use in establishments other than domestic, and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Class B: Equipment for use in domestic establishments, and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

This system is applied Class A. Some interference may occur if this system is used in domestic location.

■ 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 plug 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	JET, JQA, TÜV, UL-APEX / 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		USA	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
Comité Électrotechnique Belge (CEBEC)	CEBEC	⟨HAR⟩	10	30	10
VDE Verband der Elektrotechnik Elektronik Informationstechnik e.V.	⟨VDE⟩	⟨HAR⟩	30	10	10
Union Technique de l'Électricité (UTE)	USE	⟨HAR⟩	30	10	30
Istituto Italiano del Marchio di Qualità (IMQ)	IEMMEQU	⟨HAR⟩	10	30	50
British Approvals Service for Cables (BASEC)	BASEC	⟨HAR⟩	10	10	30
N.V. KEMA	KEMA-KEUR	⟨HAR⟩	10	30	30
SEMKO AB Svenska Elektriska Materielkontrollanstalten	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
Asociación Electrotécnica Española (AEE)	⟨UNED⟩	⟨HAR⟩	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	⟨HAR⟩	30	30	70
Instituto Português da Qualidade (IPQ)	np	⟨HAR⟩	10	10	90
Schweizerischer Elektrotechnischer Verein (SEV)	SEV	⟨HAR⟩	10	30	90
Elektriska Inspektoratet	SETI	⟨HAR⟩	10	30	90

Underwriters Laboratories Inc. (UL)
Canadian Standards Association (CSA)

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

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