OLYMPUS®

Your Vision, Our Future

RESEARCH
INVERTED SYSTEM MICROSCOPE

IX71/IX81

IX2 SERIES

UIS2
World-leading optics

Built for live cell imaging

NanoString Exhibit 1053.001

Motorized inverted system microscope

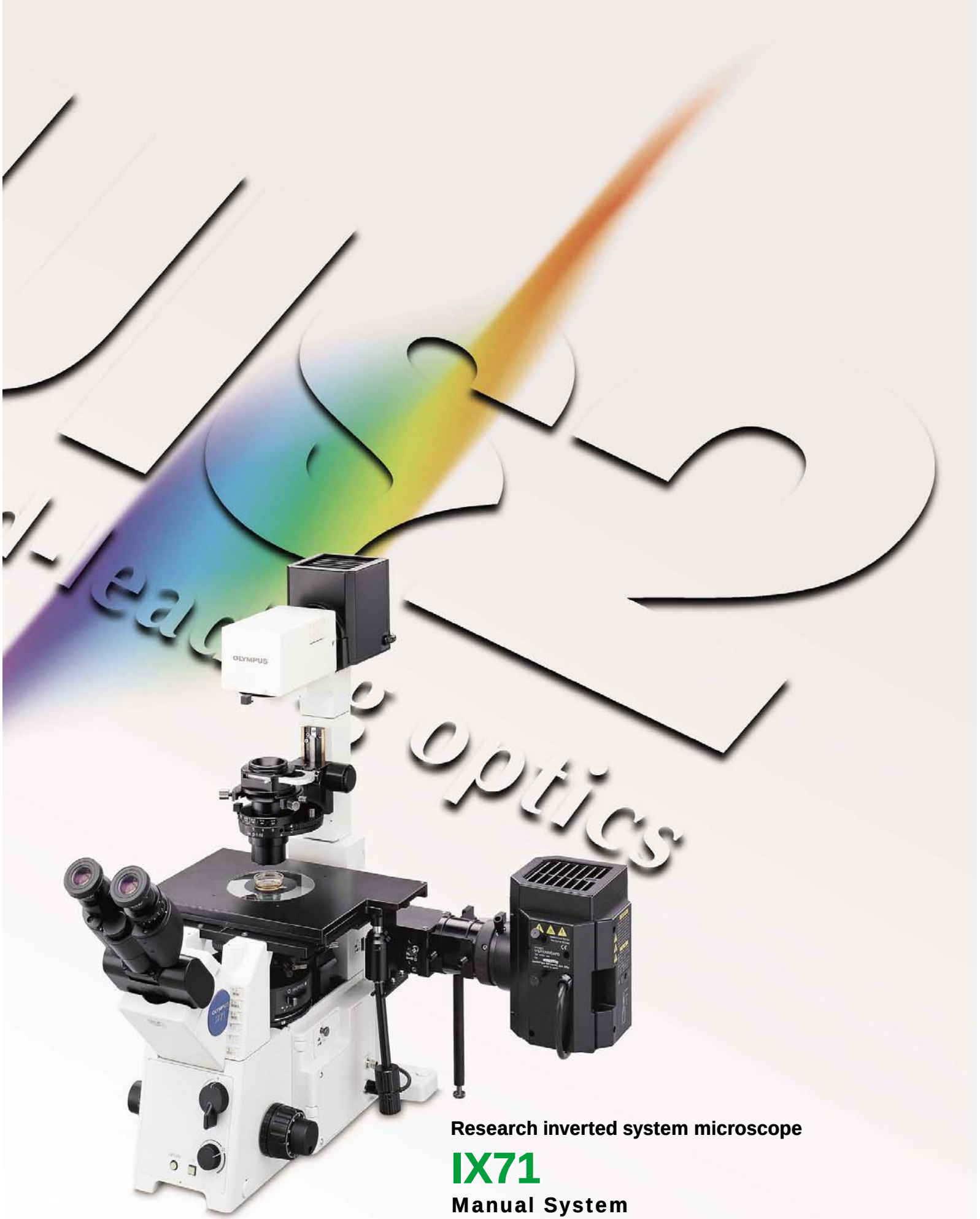
IX81/IX81-ZDC

Motorized System

Olympus IX2 inverted microscopes combined with the new UIS2 optical system open a new world of live cell imaging.

As new fluorochromes are developed and new methods of light excitation and manipulation become more popular for live cell experiments, more and more researchers will require the use of low phototoxicity near-IR wavelengths in addition to the conventional visible spectrum. Olympus has equipped its IX2 series microscopes with the new UIS2 optical system precisely to meet those demands. With its high S/N ratio, its compensation for chromatic aberration over a much wider wavelength range and its flat, high transmittance , this new system sets a new world standard of fluorescence performance — efficiently detecting even faint fluorescence signals without damaging the cell, and optimizing multi-color observation. Delivering unprecedented image quality over a super wide light spectrum, the IX2 inverted system microscope will be your live cell instrument of choice now and in the future.

NanoString Exhibit 1053.002



Research inverted system microscope

IX71

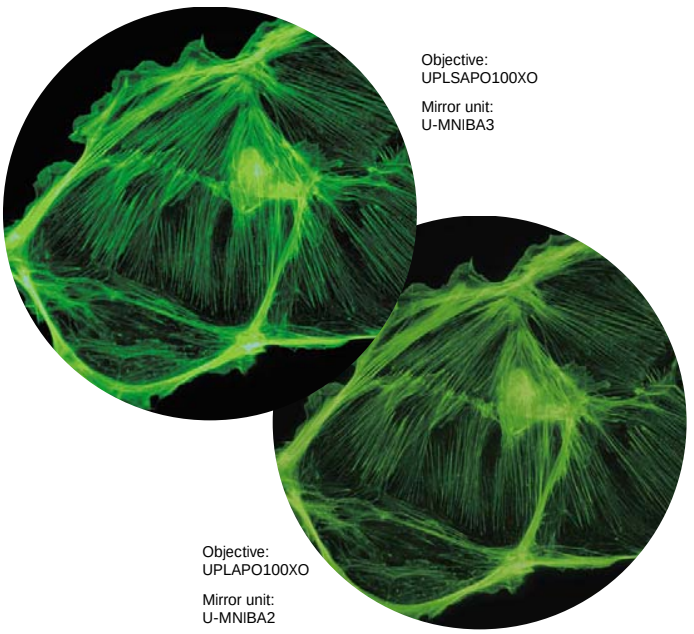
Manual System

NanoString Exhibit 1053.003

UIS2 optics are designed to maximize S/N ratio and optical performance for live cell fluorescence imaging.

Superior S/N ratio delivers imaging excellence

The new UIS2 objective lenses have been designed to maximize signal to noise and outperform existing objectives by as much as 50%. New objective characteristics include carefully selected low autofluorescence glass (with a significant reduction of fluorescence emitted by the antireflection coating and bonding material), combined with increased signal brightness thanks to improved numerical apertures (N.A.). With even faint fluorescence efficiently detected under weak excitation light, the UIS2 system sets new standards for fluorescence imaging of live cells.



Objective:
UPLSAPO100XO

Mirror unit:
U-MNIBA3

Objective:
UPLAPO100XO

Mirror unit:
U-MNIBA2

Objectives providing the best fluorescence S/N ratios.

High performance mirror units optimized for fluorescence proteins.

Stray light reducing function to absorb spurious reflections from dichromatic mirror.

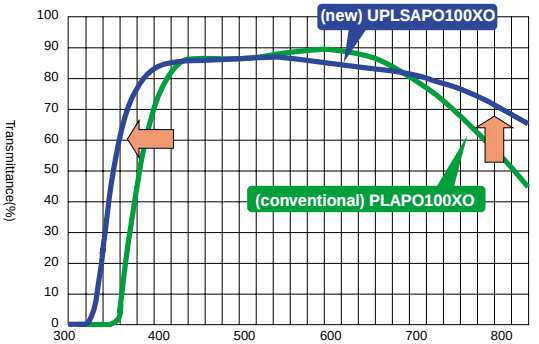
High N.A. objectives for fluorescence imaging

Two new objectives for use with the UIS2 system are the PLAPON60XO, whose N.A. level of 1.42 is the best available for fluorescence imaging, and the UPLSAPO100XO, which is suitable for all applications. In addition to their high fluorescence S/N ratio, both these lenses are able to handle UV excitation light at parfocal 45mm. The UPLSAPO100XO provides a transmittance of up to 340nm.

High transmittances over a wider wavelength range

The IX2 series' built-in UIS2 objective achieves flat, high transmittance from visible to near-infrared light, thanks to its new UW multi-coating which effectively cuts reflection over the super wide band spectrum. In particular, transmission in the near infrared range is significantly enhanced. Overall, its performance all across the wavelength range makes it ideally suited for today's most demanding research applications.

High transmittance UPLSAPO100XO



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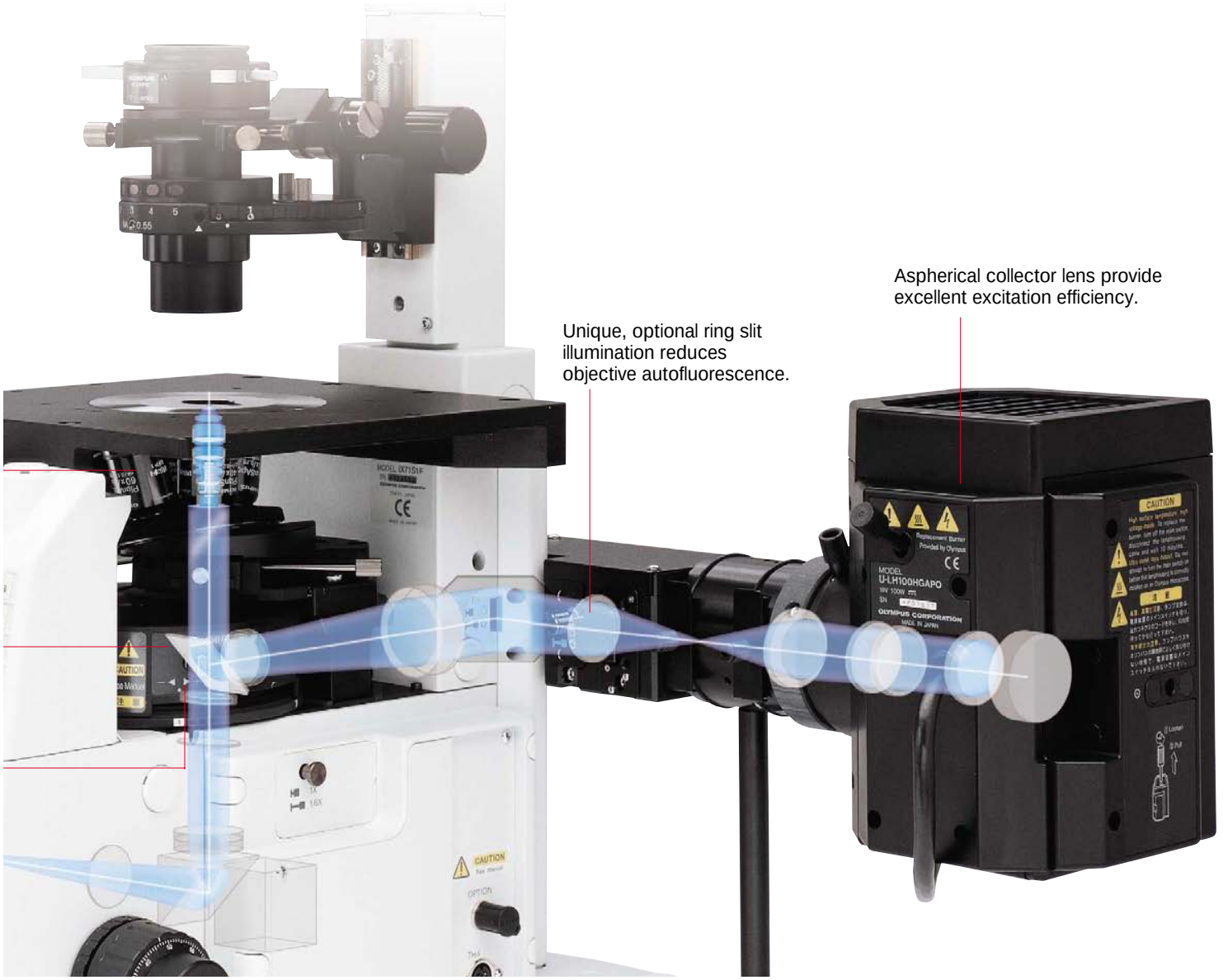
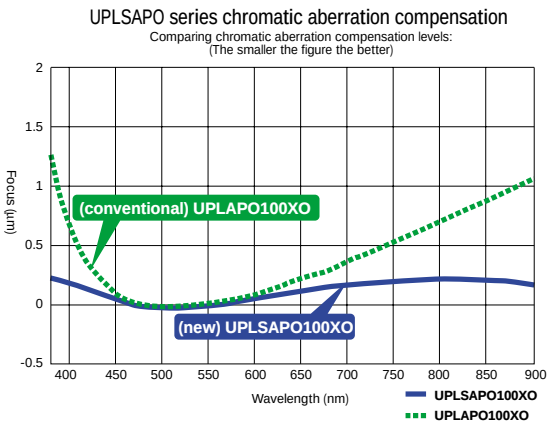
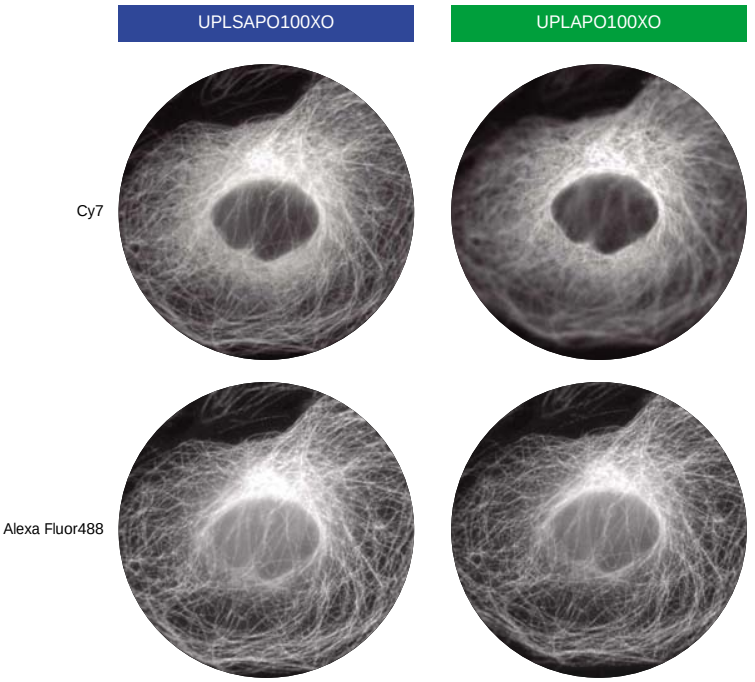


Effective compensation for chromatic aberration up to near-infrared

The highest class UIS2 objectives are the UPLSAPO series, whose super apochromatic features effectively compensate for chromatic aberration from the visible spectrum all the way to 1000nm. This means that imaging from UV to IR is possible with just one objective. The series also offers outstanding image clarity without color shift for multi-color observations using fluorochromes covering a wide wavelength spectrum.





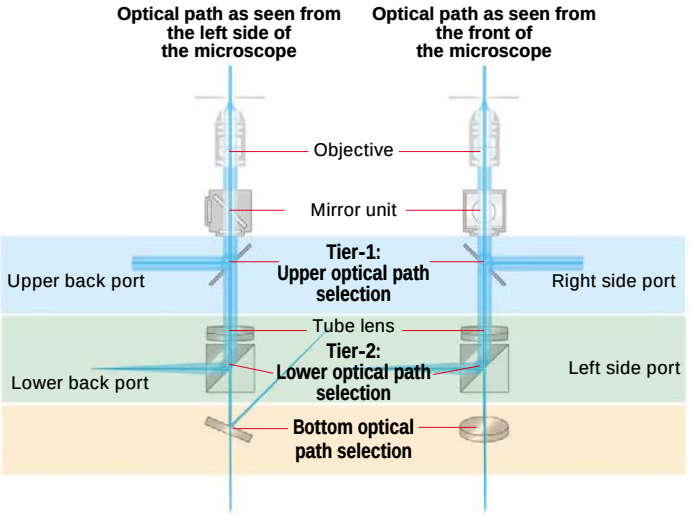
NanoString Exhibit 1053.005

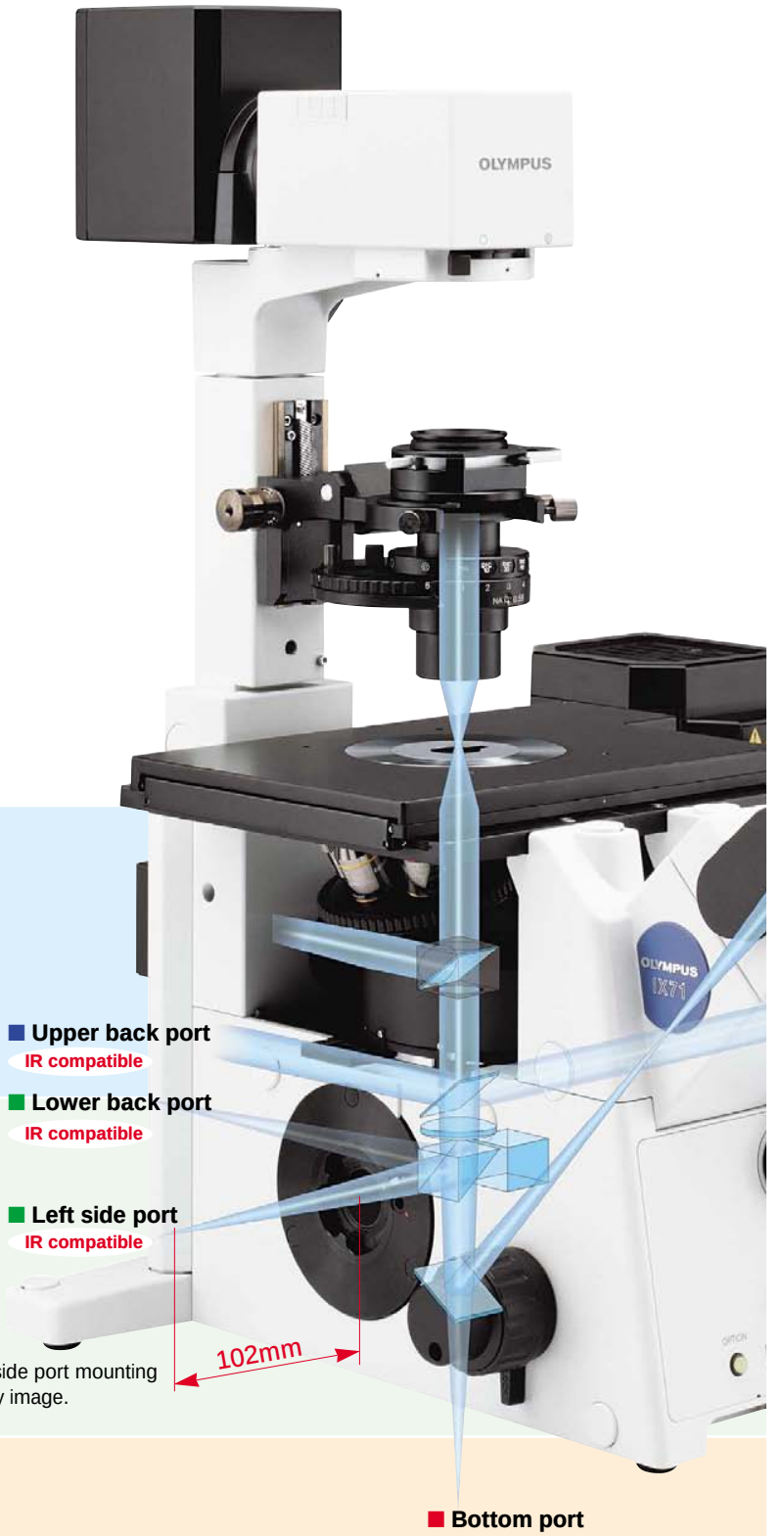
Two-tier multi-port design ensures input/output flexibility.

Two-tier optical design is also near-IR compatible

The input/output of a parallel pencil of rays and the multiple port structure for gaining the primary image are designed internally in the form of tiers. To maximize the possible wavelength width, the optical path branching of each tier is also compatible with the near-infrared spectrum. Even when more than one port is being used simultaneously, there is no change in the stage height; as a result, rigidity and illumination performance remain consistent.

■ IX2 Two-tier optical path





Tier-1

Upper Tier Lightpath Selection (optional)

Located between objective and tube lenses so a parallel pencil of rays can be obtained or introduced. Primary image can be gained by adding a tube lens. Inserting optical components such as a dichromatic mirror does not produce a double image.
(Choose either the right side port or the upper back port)

Tier-2

Lower Tier Lightpath Selection (included)

Located below the frame's tube lens, this tier allows primary image access to either the left side port or lower back port.

Bottom

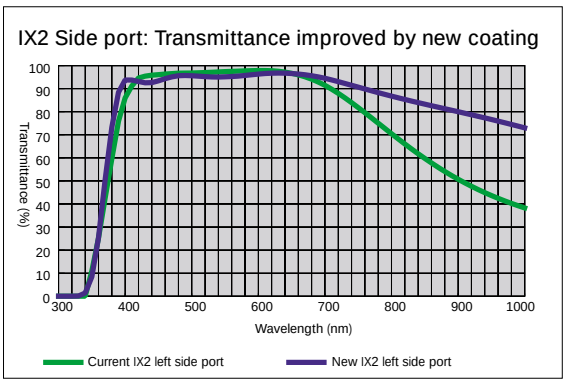
Bottom Lightpath Selection

A direct primary image can be obtained with no reflections. (Bottom port)

NanoString Exhibit 1053.006

Improved near-infrared transmission

With the introduction of the new UIS2 optical system, the IX2 series offers improved IR transmittance for the side port, back port and bottom port, providing a versatile, high-performance response to future research demands.



■ Binocular port

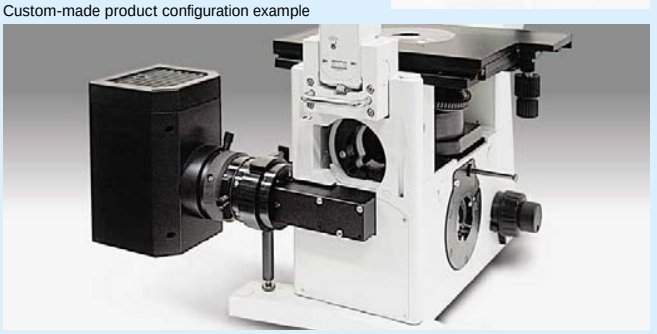
■ Right side port

IR compatible

■ Upper back port

The upper back port does not change the stage height, so there is no reduction in frame rigidity.
The port can be used for optical path input, such as addition of another fluorescence illuminator.

Custom-made product configuration example



■ Right side port

The right side port unit (IX2-RSPC-2: option, F.N.: 16) comes with a tube lens and accepts a C-mount CCD camera.

■ Lower back port

Enables attachment of equipment such as the cooled CCD camera DP30BW.

■ Left side port

Primary image plane on this port is 102mm from the microscope frame for maximum flexibility in mounting filter wheels or the super low 0.25X or 5X camera adapters .

■ Bottom port

Primary image access is also available at the bottom port using IX2-TVR(T-mount).

■ Dual port video adapter / U-DPCAD* (C-mount, left side port)

Two primary images can be obtained.

* optional unit

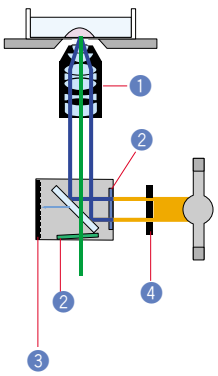
NanoString Exhibit 1053.007

Improved S/N ratio enables efficient detection of even weak fluorescence.

FL Fluorescence Observation Units

Better S/N ratio delivers brighter, higher-contrast images in fluorescence observation.

The ideal microscope allows bright, high contrast fluorescence observation from the minimum amount of excitation light in order to minimize cell damage or fluorescence fading. However, to detect a weak fluorescence signal (S) efficiently, all other light noise (N) must be reduced. The higher this S/N ratio, the brighter and clearer the observation image from weak excitation light.



S Measures to enhance the signal (S)

1. Fluorescence objectives with high N.A.
2. Filters matched to the wavelength characteristics of individual fluorochromes

N Measures to reduce noise (N)

1. Objectives without autofluorescence
2. No crossover from using combined excitation and emission filters
3. Optical system that prevents entry of stray light
4. Ring slit illumination to reduce autofluorescence

High S/N ratio objective with reduced autofluorescence

❶ As well as the PLAPON60XO objective (with its outstanding N.A. 1.42), users can select from a range of other high numerical aperture objectives whose reduced autofluorescence and specially selected glass contribute to improved fluorescence S/N ratios.

	N.A.	W.D(mm)
UPLSAPO 10X	0.40	3.1mm
UPLSAPO 20X	0.75	0.6mm
UPLSAPO 40X	0.90	0.18mm
UPLSAPO 60XO	1.35	0.15mm
UPLSAPO 100XO	1.40	0.13mm
PLAPON60 XO	1.42	0.15mm
UPLFLN40XO	1.30	0.2mm
LUCPLFLN 20X	0.45	6.6 — 7.8mm
LUCPLFLN 40X	0.60	2.7 — 4mm
LUCPLFLN 60X	0.70	1.5 — 2.2mm

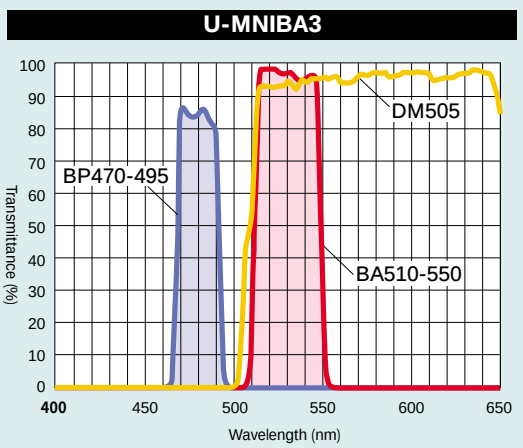
High-performance fluorescence mirror units for fluorescent proteins

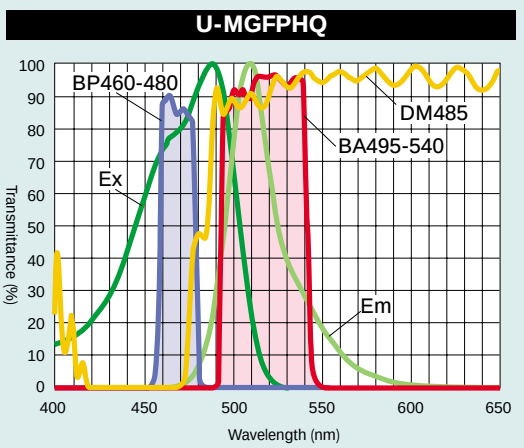
❷ Optimized for ECFP/EGFP/EYFP/DsRed. wavelength properties, this mirror unit provides sharp reaction and a high transmission factor, allowing the user to detect fluorescence from fluorescent protein quickly and efficiently. Bright observation is possible even under weak excitation light, so fluorescence fading is reduced and damage to samples minimized.

Improved performance of interference membrane-type fluorescence mirror unit

❷ The S/N ratio of certain interference membrane-type fluorescence mirror units is now improved, thanks to the application of new coating technology to close the gap between excitation (Ex) and emission (Em) by 6nm. For greater choice, the line-up has been extended including a new IGA-type mirror unit.

High performance mirror units





The sharp reactions of the dichromatic mirror in the new mirror unit minimize crossover with the excitation filter and reduce excitation light leakage to less than a tenth of our conventional models. Combined with the light absorbing mechanism (which absorbs more than 99% of stray light), a high S/N ratio is achieved without the need for any special mechanism to prevent excitation light leakage.

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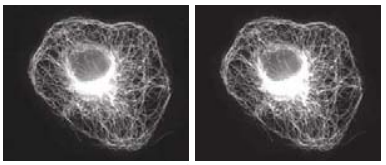
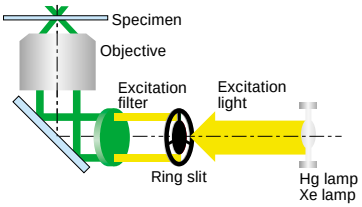
Ring slit illumination unit to reduce noise / IX2-RFRS

❺ Autofluorescence generated at the center of a lens causes noise, but this can be reduced by placing a ring slit at the reflected light illumination aperture diaphragm to allow only excitation light to pass through the objective perimeter (S/N ratio improvement: 1.2 to 3 times). The unit can easily be attached to the IX2-RFAL, and is compatible with 40X, 60X, and 100X oil immersion objectives simply by exchanging the ring slit units (F.N. 11). * Patent pending.

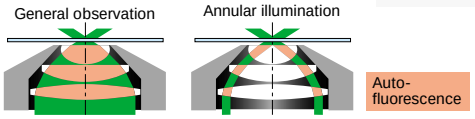


Normal illumination → Ring slit illumination

Illumination	Normal	Annular
SIGNAL	408	479
NOISE	36	18
S/N	11.3	26.6

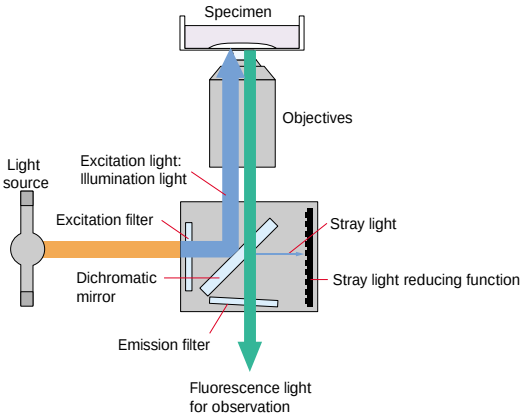


IX2-RFRS and IX2-RS40/60/100



Stray light reducing function equipped on all mirror units

❹ One source of increased noise is very faint excitation light (stray light) transmitted without reflection by the dichromatic mirror. The IX2 series' fluorescent mirror unit incorporates a mechanism that absorbs more than 99% of this stray light.



Glass reflector captures fluorescence of multiple color dyes

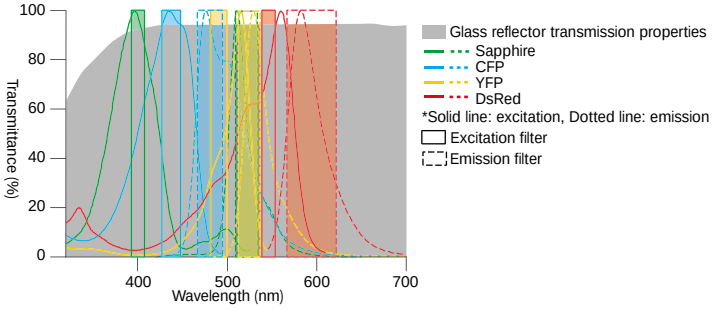
● A multi-band dichromatic mirror is normally used to obtain multi-color images of multiple stained fluorescent samples by using filter wheels on the excitation and absorption sides. However, this kind of mirror encounters the problem that each fluorescence image gets darker as the number of color dyes increase, because the transmission spectrum becomes narrower and the transmittance falls to lower than 90% at best. Olympus has therefore developed the world's first glass reflector that is not wavelength-dependent, offering a high transmittance of 94% across a wide wavelength range from 430nm to 700nm. Used in combination with the filter wheels on the excitation and emission sides, a wider variety of color dyes can be used and fluorescence images are captured more efficiently. *Special order basis product

■ Glass reflector specifications

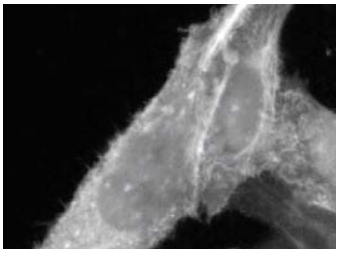
26X38mm (t=1mm) glass substrate
Transmittance 94% (at 430-700nm)
26X38mm

* Observations through eyepieces may have some restrictions

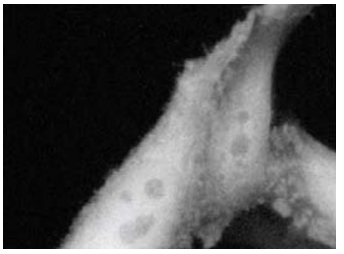
Patent pending



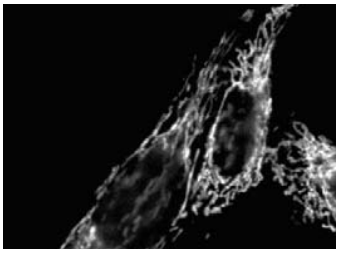
■ Usage examples of the glass reflector



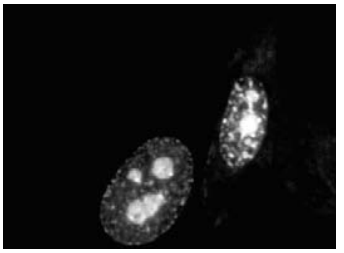
Sapphire-pm.



CFP-CaM



YFP-mt



DsRed-nu

Simultaneous imaging of Sapphire, CFP, YFP, and RFP. HeLa cells were imaged for Sapphire-pm, CFP-CaM, YFP-mt, and DsRed-nu. The images were obtained using either the glass plate in a normal cube.

Optical components used for a 4-fluorophore imaging

Dye	ND Filter*1	Excitation Light Path	Reflector	Emission Light Path
Sapphire-pm		400DF15		535DF2
CFP-CaM	—	440DF20	Glass	480DF30
YFP-mt		490DF20		535DF25
DsRed-nu		546DF10		595RDF60

*1 ND filters in the holder of the illuminator.

NanoString Exhibit 1053.009

A wide range of accessories to enable different kinds of fluorescence imaging.

Fluorescence illumination light source

Bright excitation illumination for cell observation/manipulation

The Olympus lineup for fluorescence illumination equipment meets a wide variety of needs including multi-stained fluorescence, ratio, photobleaching and uncaging observations. Low magnification performance is greatly improved and a metal halide system offers a pre-centered long bulb life option.

Lamp housings

Shape	Model	Aspherical*1 optics	Apochromatic*2 lens	Average lamp life	Lamp centering	IR illumination
	100W mercury apo lamp housing/ U-LH100HGAPO	√	√	300h	Required	Good
	100W mercury lamp housing/ U-LH100HG	√		300h	Required	Good
	75W xenon apo lamp housing/ U-LH75XEAPO*3	√	√	200h	Required	Excellent
	50W metal halide lamp housing/ U-LH50MH	√		2000h	Not required	N/A

*1: Can collect light more efficiently than conventional aspherical optics.
*2: Even illumination and no lamp focusing shift, even when changing excitation light wavelengths
*3: Suitable for multi-color staining or ratio imaging because of flat light source spectrum.

Configuration example

Reflected light fluorescence illuminators

[L-shaped fluorescence illuminator/IX2-RFAL]

Offering twice the brightness of the preceding model, this L-Shaped illuminator offers removable aperture and field stop inserts with excellent access to lamphouse centration mechanism for maximum system flexibility.

[Fluorescence illuminator/IX2-RFA]

2.4 times brighter at low magnifications than our preceding model (comparison made with 10X objective). This illuminator is ideal for applications requiring bright excitation light, or low magnification fluorescence observation. The field stop (FS) is built in.

[Double lamphouse illuminator/IX2-RFAW]

Use two light sources simultaneously. Light stimulation can be performed during observation.

[Dual lamp housing attachment/U-DULHA]

This adapter unit allows users to attach different types of light sources simultaneously, and exchange them according to purpose.
The IX2-RFA is used as a reflected light fluorescence illuminator.
(Optical path: 100/0, 0/100, F.N. 11)

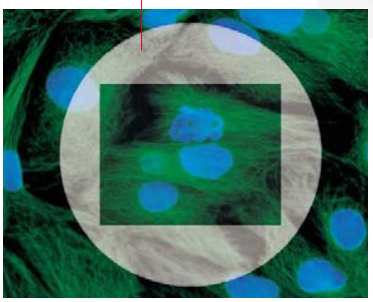
NanoString Exhibit 1053.010

Illumination modular units

[Rectangular field stop/U-RFSS]

This unique field stop allows the user to control the area of fluorescence excitation anywhere inside the visual field. For example, photobleaching and phototoxicity can now be limited to only the area that is being imaged by the CCD improving overall brightness and cell viability over long term observations. The unit is attached at the field stop position of the fluorescence illuminator IX2-RFAL.

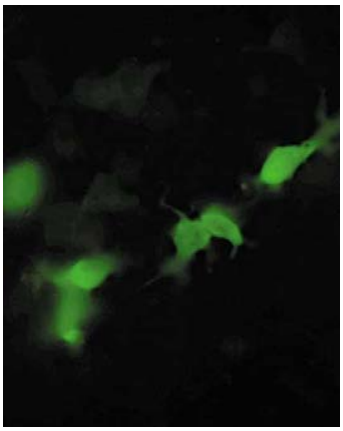
Unnecessary exposure area caused by a round field stop

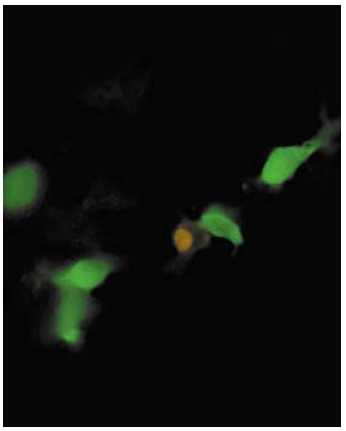


[Pinhole field stop/IX2-RFSPOT]

Providing spotlight illumination on the fluorescence specimen, this unit is useful in a variety of experiments. It is attached to the field stop position of the L-shape fluorescence illuminator IX2-RFAL.

*Use commercially available pinhole plate





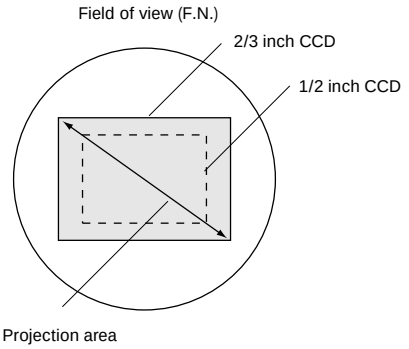
IR camera adapter

[Camera adapters/U-TV0.35XC-2, U-TV0.5XC-3, U-TV1X-2]

These low-magnification camera adapters are attached to the left side port, and covers from visible light to near infrared red wavelength spectrum.

Camera adapter (Projection lens)	Projection magnifications	Projection area (F.N.)		
		2/3 inch CCD	1/2 inch CCD	1/3 inch CCD
U-TV0.35XC-2	0.35X	—	22	17.1
U-TV0.5XC-3	0.5X	22	16	12
U-TV1X-2	1X	11	8	6

$$\text{Practical field of view (mm)} = \frac{\text{Projection area (Field Number)}}{\text{Objective magnifications}}$$



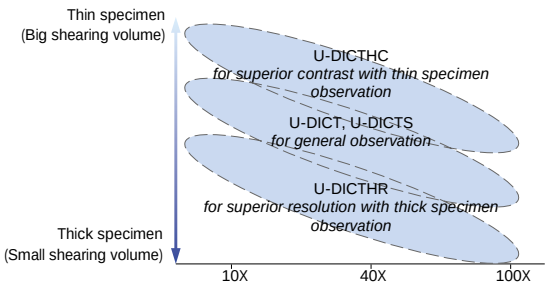
NanoString Exhibit 1053.011

Nomarski DIC system offers the choice of optimal resolution or high contrast in live cell observation.

DIC Differential Interference Contrast

Live cells specimens vary in thickness from a nematode worm such as *C. elegans* to a monolayer of cultured cells. The requirements for DIC are also varied with thicker specimens having a lot of inherent contrast while thin cells are almost invisible. Olympus provides three DIC systems with varying amounts of shear. The greater the amount of shear a DIC prism imparts on the light passing through it, the greater the amount of contrast in the final image. Small shear, high resolution sets are excellent for thicker specimens. High contrast prism with twice the normal shear are excellent for very thin specimens.

■ Selecting the optimum DIC prism optimum for specimen thickness and objective magnification



Long working distance universal condenser/IX2-LWUCD

Suitable for DIC observations from 10X to 100X magnification. Especially in the 20X to 40X observation range, high contrast or high resolution can be selected according to the thickness of the specimen. * Also compatible with 4X to 100X phase contrast observation by combining other optical components.

■ DIC sliders

High resolution DIC slider for transmitted light/U-DICTHR

High contrast DIC slider for transmitted light/U-DICTHC

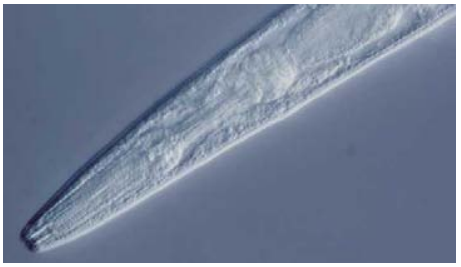
Shift DIC sliders for transmitted light/U-DICTS
DIC sliders for transmitted light/U-DICT

• New DIC system gives a wider choice

More DIC compatible objectives are available. Each condenser prism is compatible with more lenses making setup and configuration easier.

■ Comparison of thick specimen (*C. elegans*), showing differences in shearing volume

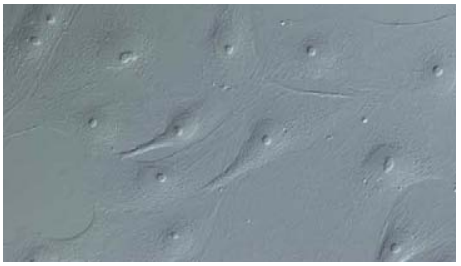
DIC observation using U-DICTHR



DIC observation using general DIC slider

■ Comparison of thin specimen, showing differences in shearing volume

DIC observation using U-DICTHC



DIC observation using general DIC slider

■ HR/HC optical elements for IX2-LWUCD and applicable objectives

DIC elements	Applicable objectives
IX2-DIC20HR IX2-DIC20HC	UPLSAPO20X UPLFLN20X LUCPLFLN20X
IX2-DIC40HR IX2-DIC40HC	UPLSAPO40X UPLFLN40X UPLFLN40XO LUCPLFLN40X

■ General type optical elements for IX2-LWUCD and applicable objectives

DIC elements	Applicable objectives
IX2-DIC10	UPLSAPO10X UPLFLN10X
IX2-DIC20	UPLSAPO20X UPLFLN20X LUCPLFLN20X
IX2-DIC40	UPLSAPO40X UPLFLN40X UPLFLN40XO LUCPLFLN40X
IX2-DIC60	PLAPON60XO UPLFLN60X UPLFLN60XOI LUCPLFLN60X
IX2-DIC100	UPLSAPO100XO UPLFLN100XO UPLFLN100XOI

NanoString Exhibit 1053.012

Water immersion DIC condenser/IX2-DICD

High performance DIC condenser designed for excellent optical performance and specimen access in high magnification observations. Designed for specimen access, all controls are front mounted including prism exchange and aperture control. Three high numerical aperture front lenses are available including the water immersion IX2-TLW that offers 0.9 N.A. with 3.7mm of working distance and a 40° angle of approach for manipulators.

■ **Top lens combination**

	Numerical Aperture (N.A.)	Working Distance (W.D.)	Immersion
IX2-TLW	0.9	3.7mm	Water
U-TLD	0.9	1.5mm	
U-TLO	1.4	0.63mm	Oil

Water immersion DIC condenser IX2-DICD + water immersion top lens IX2-TLW

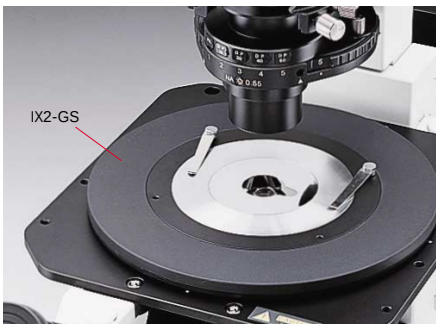
Focusable adapter/IX-ADUCD

This condenser adapter allows the use of upright microscope condensers on the IX2, including the 8-position turret condenser (U-UCD8) for maximum system flexibility. The optical component exchange method for the universal condenser is the turret system, enabling smooth, easy exchange while using illumination with high N.A. The IX2 illumination pillar also offers a 'condenser-only' tilt mechanism to quickly allow access to the specimen without tilting the entire illumination pillar.

* IX2-TLW cannot be used for U-UCD8

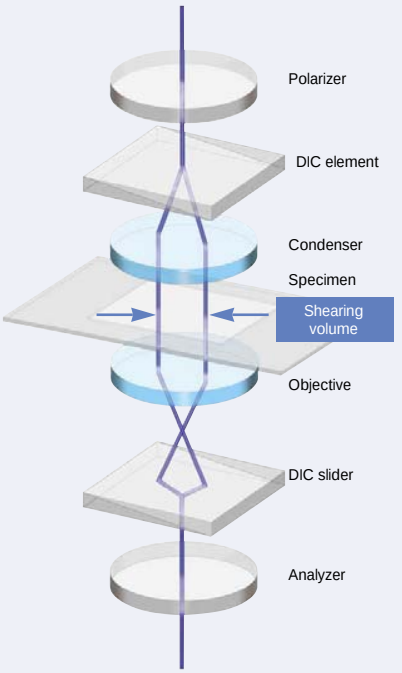
Gliding stage/IX2-GS

The Gliding Stage was designed for quick rotation of the specimen using your fingertips. With 20mm of X-Y travel, 360 degree rotation and completely flat surface, a specimen such as the nematode worm *C. elegans* can be quickly brought into the correct position and alignment for injection or micromanipulations.



■ **Simple principle of Nomarski DIC microscopy**

Nomarski DIC amplifies contrast by using the phase difference which occurs when light passes through material with different refraction values (e.g. a cell) in a particular medium (e.g. water). The wave direction of light from the microscope light source is unified in a polarizer (condenser side); and when it passes through the condenser side DIC prism, it separates into two phases which cross each other at right angles. The distance of separation is called the shearing amount. When two such separated lights pass through a medium with different refraction values (e.g. a cell), one of their phase is delayed; and when the two lights are re-composed by DIC slider (the observation side) and analyzer, the interference effect produces the contrast. This is the principle of Nomarski DIC.



Olympus has developed the most suitable DIC prisms for different types of specimen, based on the shearing amount. When DIC contrast is low, the specimen is hard to observe, while high contrast also hinders observation because of excessive glare. Olympus has therefore developed three different types of DIC prisms to ensure clear observation for every kind of specimen.

NanoString Exhibit 1053.013

Special equipment for relief contrast and phase contrast.

RC Relief contrast equipment

The Olympus Relief Contrast system provides a high contrast, 3-D image similar to DIC for specimens mounted in plastic vessels. Relief contrast is designed for cellular fertilization and making the nuclear envelope easier to see and penetrate.

Relief contrast equipment
* Unifies the shadow directions of each objective, improving operability at all magnifications.
* Maintains a long working distance (45mm) for the condenser (IX2-MLWCD) so as not to hinder operation of the manipulator.

Users can choose from two types of objectives for relief contrast work: cost-efficient Achromat models, or PlanSemiApochromat objectives with high resolution and excellent focusing right up to the image perimeters. Condenser (IX2-MLWCD) also supports DIC and phase contrast observations for maximum flexibility.

The IX2-MLWCD comes equipped with optical component RC1 (for 10X objective), RC2 (for 20X objective), RC3 (for 40X objective) and a polarizer to adjust the contrast.

Mouse embryo

■Objectives for Relief Contrast observation

		N.A.	W.D.
Achromat for Relief Contrast	CPLN 10XRC *1	0.25	9.7mm
	LCACHN 20XRC *1	0.40	2.8mm
	LCACHN 40XRC *1	0.55	1.9mm
Plan Fluorite for Relief Contrast	CPLFLN 10XRC *1	0.30	9mm
	LUCPLFLN 20XRC *2	0.45	6.6 — 7.8mm
	LUCPLFLN 40XRC *2	0.60	3.0 — 4.2mm

*1 Objective with compensation for 1mm plastic dish plus 0.5mm thick thermoplate
*2 Objective with compensation ring for 0~2mm thick cover glass.

■ Phase contrast optical elements for IX2-MLWCD and applicable objectives

Optical elements for IX2-MLWCD	Applicable objectives
IX2-MPHL	UPLFLN4XPH
IX2-MPHC	CPLFLN10XPH, CPLN10XPH, LCACHN20XPH
IX2-MPH1	LUCPLFLN20XPH
IX2-MPH2	LUCPLFLN40XPH, LCACHN40XPH, LUCPLFLN60XPH

■ DIC optical elements for IX2-MLWCD and applicable objectives

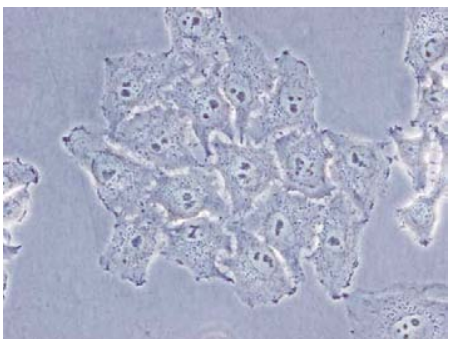
Optical elements	Objectives
IX2-MDIC20	UPLSAPO20X, UPLFLN20X, LUCPLFLN20X
IX2-MDIC40	UPLSAPO40X, UPLFLN40X, UPLFLN40XO* , LUCPLFLN40X

* Use with shift DIC slider (U-DICTS).

PH Phase contrast equipment

Ultra long working distance condenser/IX-ULWCD

This universal condenser for phase contrast and brightfield observations offers excellent workability, due to its long working distance (73mm) and compatibility with large containers: it should be used in combination with 4X -40X phase contrast objectives. Phase contrast observation is also possible with the IX2-LWUCD condenser, whose working distance is 27mm.



NanoString Exhibit 1053.014

A wide lineup of UIS2 objectives.

UIS2 objectives *

	Model	N.A.	W.D. (mm)	F.N	Cover glass thickness (mm)	Immersion	Spring	Correction ring	Iris diaphragm	Water proof & oil proof function
UPLSAPO	UPLSAPO 4X	0.16	13	26.5	—					
	UPLSAPO 10X	0.40	3.1	26.5	0.17					
	UPLSAPO 20X	0.75	0.6	26.5	0.17		○			
	UPLSAPO 40X	0.90	0.18	26.5	0.11-0.23		○	○		
	UPLSAPO 60XW	1.20	0.28	26.5	0.15-0.2	Water	○	○		○
	UPLSAPO 60XO	1.35	0.15	26.5	0.17	Oil	○			○
	UPLSAPO 100XO	1.40	0.13	26.5	0.17	Oil	○			○
PLAPON	PLAPON 60XO	1.42	0.15	26.5	0.17	Oil	○			○
	PLAPON 60XOTIRFM	1.45	0.1	26.5	0.13-0.19	Oil	○	○		○
UPLFLN	UPLFLN 4X	0.13	17	26.5	—					
	UPLFLN 10X	0.30	10	26.5	—					
	UPLFLN 20X	0.50	2.1	26.5	0.17		○			
	UPLFLN 40X	0.75	0.51	26.5	0.17		○			
	UPLFLN 40XO	1.30	0.2	26.5	0.17	Oil	○			○
	UPLFLN 60X	0.90	0.2	26.5	0.11-0.23		○	○		
	UPLFLN 60XOI	1.25-0.65	0.12	26.5	0.17	Oil	○		○	○
	UPLFLN 100XO	1.30	0.2	26.5	0.17	Oil	○			○
	UPLFLN 100XOI	1.3-0.6	0.2	26.5	0.17	Oil	○		○	○
LUCPLFLN	LUCPLFLN 20X	0.45	6.6-7.8	22	0-2			○		
	LUCPLFLN 40X	0.60	2.7-4	22	0-2			○		
	LUCPLFLN 60X	0.70	1.5-2.2	22	0.1-1.3			○		
	LUCPLFLN 20XPH	0.45	6.6-7.8	22	0-2			○		
	LUCPLFLN 20XRC	0.45	6.6-7.8	22	0-2			○		
	LUCPLFLN 40XPH	0.60	3.0-4.2	22	0-2			○		
	LUCPLFLN 40XRC	0.60	3.0-4.2	22	0-2			○		
	LUCPLFLN 60XPH	0.70	1.5-2.2	22	0.1-1.3			○		
UPLFLN-PH	UPLFLN 4XPH	0.13	17	26.5	—					
	UPLFLN 10XPH	0.30	10	26.5	—					
UPLFLN-PHP	UPLFLN 4XPHP	0.13	16.4	22	—					
CPLFLN	CPLFLN 10XPH	0.30	9.5	22	1					
	CPLFLN 10XRC	0.30	9	22	1.5					
LCACHN	LCACHN 20XPH	0.40	3.2	22	1					
	LCACHN 20XPHP	0.40	3.2	22	1					
	LCACHN 20XRC	0.40	2.8	22	1.5					
	LCACHN 40XPH	0.55	2.2	22	1					
	LCACHN 40XPHP	0.55	2.2	22	1					
	LCACHN 40XRC	0.55	1.9	22	1.5					
CACHN & CPLN	CACHN 10XPHP	0.25	8.8	22	1					
	CPLN 10XPH	0.25	10	22	1					
	CPLN 10XRC	0.25	9.7	22	1.5					

* All UIS2 objectives and WHN eyepieces: lead-free eco-glass

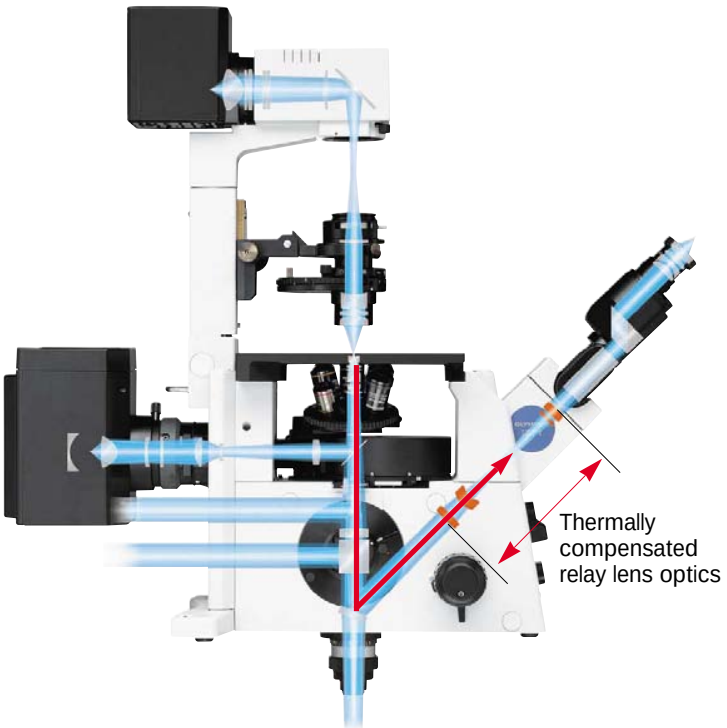
UIS objectives

	Model	N.A.	W.D. (mm)	F.N	Cover glass thickness (mm)	Immersion	Spring	Correction ring	Iris diaphragm	Water proof & oil proof cap
UPLAPO	UPLAPO 10XO3	0.40	0.24	26.5	0.17	Oil	○			○
	UPLAPO 10XW3	0.40	0.43	26.5	0.17	Water	○			○
	UPLAPO 20XO3	0.80	0.19	26.5	—	Oil	○			(○)
	UPLAPO 40XOI3	1.00-0.50	0.12	26.5	—	Oil	○		○	(○)
PLAPO	PLAPO 40X	0.95	0.13	26.5	0.11-0.23		○	○		
UAPO	UAPO 20X3/340	0.75	0.55	22	0.17		○			○
	UAPO 40X3/340	0.90	0.2	22	0.11-0.23		○	○		○
	UAPO 40XOI3/340	1.35-0.65	0.1	22	0.17	Oil	○		○	○
	UAPO 20XW3/340	0.70	0.4	22	0.17	Water	○			○
	UAPO 40XW3/340	1.15	0.25	22	0.13-0.25	Water	○	○		○
APO	APO 100XOHR	1.65	0.1	22	0.15	Oil	○			○

(○): Oil proof cap applicable.

NanoString Exhibit 1053.015

High level basic performance makes a vital difference to experiment results.



Capture of high-clarity primary image

The luminous flux can be captured or introduced from the upper back port or the right side port using a parallel pencil of rays. Because the UIS2 optical system is compensation free (i.e. compensation is performed only by the objective lens), a clear primary image* can be captured.

* The "primary image" is the first image created by convergence of the luminous flux after passing through an objective. There is no loss in light quantity and no image deterioration.

V-shaped optical path to reduce light loss

In order to minimize light loss from reflection, a simple V-shaped optical system is employed. This restricts reflection inside the microscope to one-time-only, reducing light loss and allowing observation of even weak fluorescent signals.

■ Thermally compensated relay lens optics

Used for the observation optical path, thermally compensated relay lens optics involve combining lenses with different thermal characteristics to offset blurs caused by temperature change.

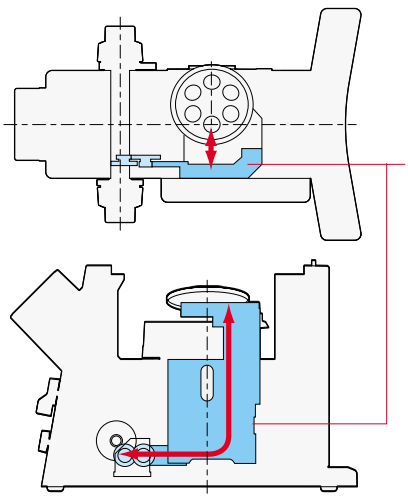
Measures against thermal expansion to prevent blur

■ External power supply

Time-lapse observation over a long period of time will cause some heat strain to the microscope, from temperature changes in the environment and air blown from an air-conditioner. Because such changes can cause blurring, the IX2 series design team addressed the problem with great care. Countermeasures include locating the power supply for transmitted illumination on the outside of the microscope, thereby lessening heat strain on the inside and reducing blur to one-seventh of conventional models. Various accessories are provided to stabilize long-term time-lapses, such as incubator that reduces temperature changes in the environment and the effects of air conditioning.

High body rigidity

In order to maximize rigidity in every area, Olympus simplified or shortened structures from the focusing handle to the revolving nosepiece, thereby minimizing warp in the image traveling section. This in turn prevents blur when operating the objective correction ring or the Nomarski DIC slider.



Revolving nosepiece guide structure

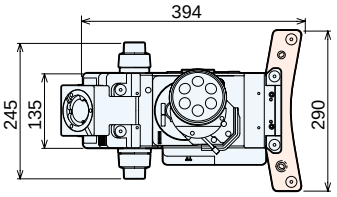
The shorter the section in red, the less influence from heat and force — resulting in improved rigidity.

NanoString Exhibit 1053.016

Ease of use in a compact body

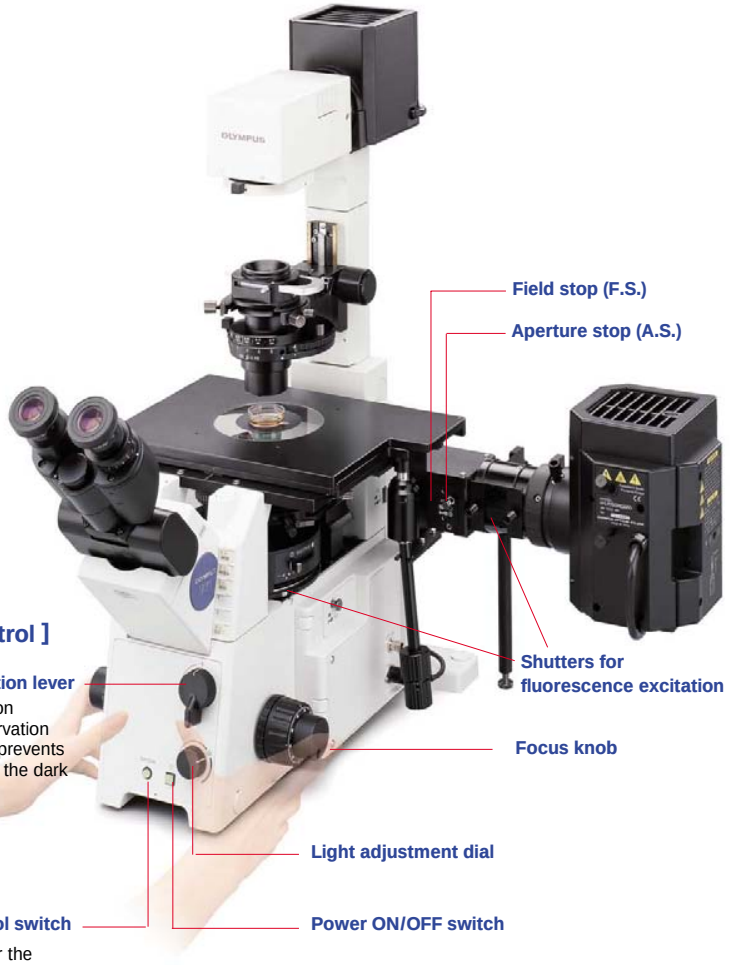
[Compact body]

Despite the compact body design, space has been allowed for a port on both sides and the bottom of the microscope as well as on the back, while the side areas are left open to ensure easy combination with a variety of peripherals. Using specialized tools, the microscope can be fixed to an anti-vibration stand, thereby making it even more compact by removing the support extending out at the back of the unit.



[Tilting binocular tube/U-TBI90]

A tilting observation tube with 35-85° elevation angle. When not in use, the tube can be flipped up and stowed away to keep it from projecting beyond the table edge. A tilting tube allows every user to find the most comfortable observation posture depending on physical build, and also enables observation while standing.



[Frontal control]

Light path selection lever
Two-stage selection between the observation tube and the port prevents operation errors in the dark room.

TTL Pulse control switch
ON/OFF switch for the motorized shutter (e.g. made by UNIBLITZ).

[Focus free collection ring]

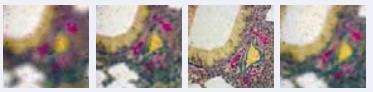
The newly developed LUCPLFLN40X (N.A. 0.6, W.D. 3.4mm*) and LUCPLFLN60X (N.A. 0.70, W.D. 1.5-2.2mm) are compatible with any container thickness. Turning the correction ring does not blur the focus when correcting spherical aberration caused by different container thickness. A simple correction operation optimizes the observation image. * When using 1mm thickness container.

■ **LUCPLFLN 40X**

Operating the correction ring does not blur the focus.

■ **When using a conventional objective with correction ring**

Focus blurs when correction ring is operated.



[Oil immersion protection function]

Prevents immersion oil infiltrating the tip of the objective.

[Magnification changer]

Magnification between 1X and 1.6X can be changed without even touching the objective. 2X (IX2-CA2X) is optional.

[Glass stage insert plate/IX2-GCP]

The type and magnifications of objectives can be confirmed easily from stage surface. Objective magnifications are color-coded for easier confirmation.

* Not available in some areas

[Fluorescence indicator]

Self illuminated labels are used and easily visible in a dark room.

[Fluorescence turret confirmation window]

The fluorescent mirror unit in the optical path can be confirmed from the space between the left and right eyepieces of the observation tube.

NanoString Exhibit 1053.017

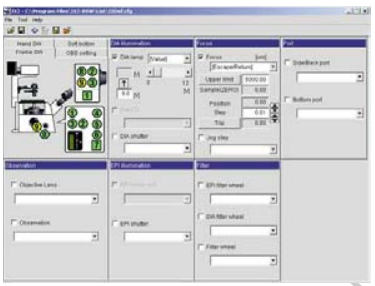
Motorized system for live cell imaging.

Controlling functions via PC, handset or operating buttons on the microscope body

Functions of IX81 control software /IX2-BSW

Nearly every operating function on the IX81 can be allocated to operation buttons on the PC, the hand switch and the microscope in any individual or multiple combinations by using IX2-BSW* control software. Some image analysis software can also be used to control microscope operation, image capturing and analysis; in this case, all operations are done from a single PC.

* Included with the system controller IX2-UCB2



Example : Switching from fluorescence observation to Nomarski DIC.

1. Close shutter for fluorescence illumination
2. Exchange FL mirror unit for DIC mirror unit
3. Open shutter for transmitted illumination

With the IX81, this sequence of functions can be allocated to a single button

■ Parfocal compensation function among objectives
This function allows the focus point to be matched from low to high magnification objectives. Refocusing each time the magnification is changed is no longer necessary.

■ Malfunction prevention
Motorized units ensure that complicated operations are performed without error. Once the usage conditions are set, the setting screen can be hidden to avoid accidental change leading to faulty operation.

■ Setting sensitivity of the fine focus movement for each objective magnification
Users can set the amount of the fine focus movement per rotation of the focus adjustment knob.

■ Save setting conditions for each operator
Customized data can be stored in folders, and each folder labeled for different users or sets of conditions.

Motorized universal condenser/ IX2-LWUCDA2

This condenser has six built-in optical components to enable brightfield, phase contrast and Nomarski DIC observations. Software allows switching optical components to be synchronized with the objective. (Manual AS included.)

Handset/U-HSTR2

A remote handset controls all motorized functions via a convenient and programmable interface.

Focus handle/U-FH

The focus handle allows remote control of the objective position relative to the specimen especially when using an incubator. Allows the user to be away from the microscope and still focus on the specimen. Course/Fine and transmitted light control are also included via buttons.

Microscope front panel

Easy to use buttons allow selection of light path, light intensity and lamp on/off control. Auxiliary buttons can be custom programmed. Includes LED lamp intensity meter.

NanoString Exhibit 1053.018

Motorized shutter/IX2-SHA

Can be mounted in both transmitted and reflected light paths.

Motorized filter wheel/ U-FWR and U-FWO

6 filter positions (32mm or 25mm diameter).

Motorized sextuple revolving nosepiece

Up to 6 objectives are mounted simultaneously, included with microscope frame.

Motorized mirror unit turret/ IX2-RFACA

Six mirror units can be attached to the IX2-RFACA simultaneously, making it easy to switch between them during fluorescence observation of multi-stained specimens. (Manual shutter included)

Internal motorized focus drive

With minimum movement of 0.01µm, the user has precise focus control.

Objective escape and zero-return buttons

Moves objective to lower focus limit. Allows setting of default focus position.

* Equipped on each side of microscope frame.

System controller/IX2-UCB2

All motorized units are powered by this external system controller. Included is an RS232C connection for PC commands and expansion slots for future system upgrades.

Motorized bottom port unit with C-mount/IX2-TVRAC

NanoString Exhibit 1053.019

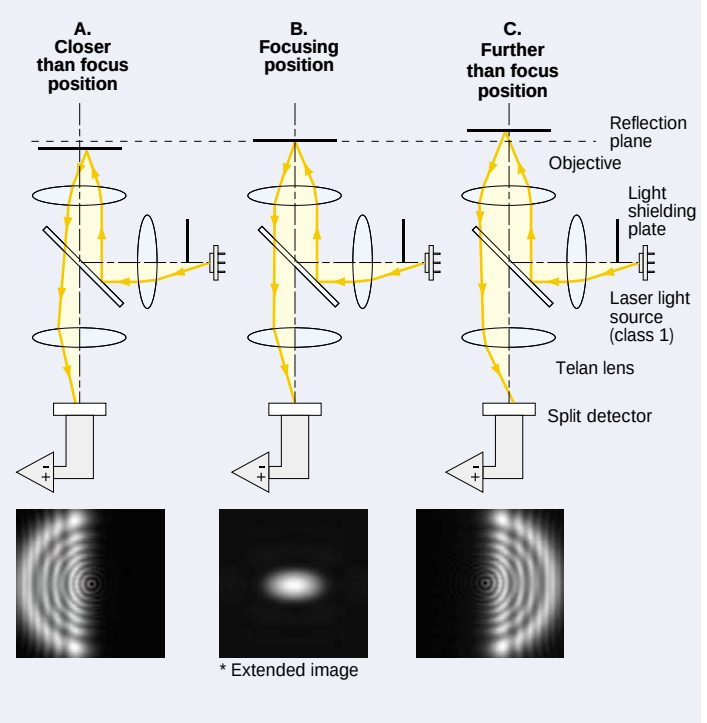
Maintaining long-term stability for live cell observation.

Live cell imaging system

Focus drift compensation function for time-lapse experiments.

Motorized inverted research microscope with focus drift compensation/IX81-ZDC

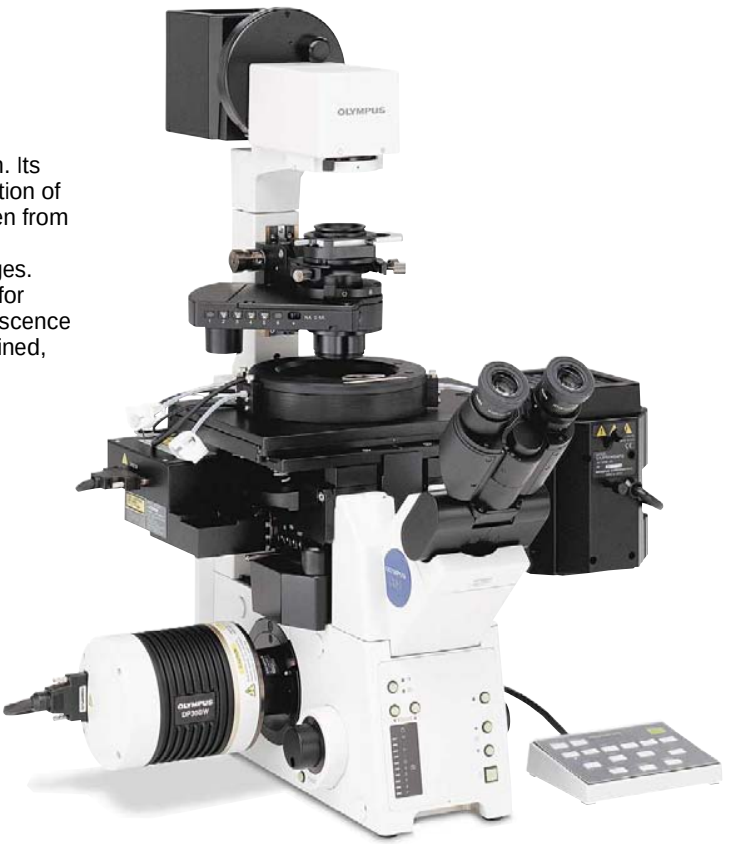
This landmark microscope model makes it easy to reproduce any preset focus position. For time lapse experiments, this capability reduces the need for Z stack images, which take into account the focus blur. Excitation light is not used for reproduction of the focus position, but only 785nm laser light, which is less phototoxic; there is therefore no need for concern about fading. In addition, the laser light is introduced through its own special light path, so all the IX2 light path can be used for imaging.



Vibration-free, high-sensitivity cooled CCD camera developed for live cell imaging.

High sensitivity cooled CCD camera/DP30BW

This camera is cooled (to 5°C) by the Peltier cooling system. Its built-in shutter and background subtraction function (reduction of dark current) enable high quality images to be captured even from weak fluorescence. Used with DP-BSW software, it is also compatible with still image and movie recording of live images. In addition, it can be used with imaging software designed for motorized units, making it possible to motorize many fluorescence imaging procedures from 2D to 6D, such as multi-color stained, deconvolution and time-lapse experiments.

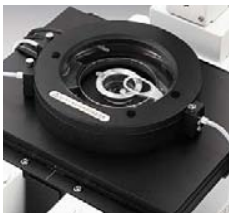


NanoString Exhibit 1053.020

Accessories to improve stability in long-duration observations

[CO_2 incubators/MIU-IBC-I, MIU-IBC-IF]

Highly precise incubator control keeps the environment inside a laboratory dish completely stable, at just below 37°C temperature, 90% moisture and 5% CO_2 concentration (when using a CO2 5% concentration bomb); in this way, live cell activity can be maintained for around 2 days. In addition, a special structure device is employed to minimize drift on the stage caused by thermal expansion. As a result, this incubator is ideal for time-lapse experiments under a confocal laser scanning microscope. It is also possible to inject the cell in the laboratory dish by using the injection hole located on the top heater.



* Built-in stage warming plate
* Objective heater
* 5% CO2 supply tube with ø4 outer diameter, ø2 inner diameter and 400mm length.
* Not available in some areas

MIU-IBC-I

Basic configuration which allows control of heaters for top, bath, stage and objective.

MIU-IBC-IF

This configuration includes a built-in flowmeter for 5% CO_2 and 95% air. Use the 5% CO_2 and 95% air bombs.

[Incubators]

Incubators keep the microscope temperature stable, thus preventing blur caused by changes in the environmental temperature.

[Thermoplate/MATS series]

This thermoplate maintains the cell specimen container temperature at 37°C.

* Tokai Hit Company products

[Frame plate adapter/ IX2-FP]

This is used to fix the microscope body to the anti-vibration stand.

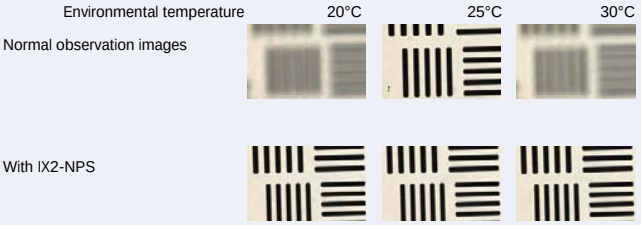
*M6 screws (available separately) are required for fixing.

[Nosepiece stage/IX2-NPS (patent pending)]

This newly-developed stage-and-pole configuration is fixed to the revolving nosepiece for long time observations. Its effect is to minimize the distance between the specimen and the objectives, which in turn minimizes the effect of temperature change and prevents blur during long observations. To use, attach one objective to the pole.

[Comparison of normal observation images]

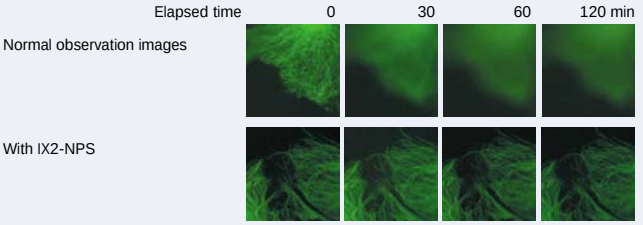
Change of focus when environmental temperature (25°C) changes by ±5°C. *When the microscope is used without an incubator.



[Comparison of fluorescence images]

Time-lapse observation images.

*When the microscope is used without an incubator.

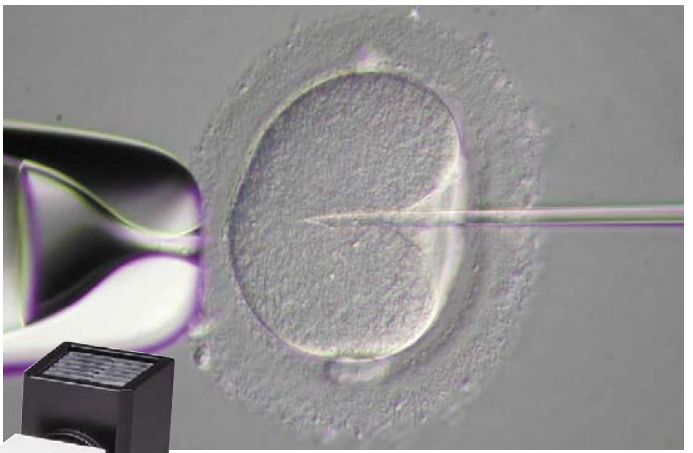


NanoString Exhibit 1053.021

Manipulating cells.

Micromanipulation system/ON3

Low stage design combined with a lowered center of gravity offers superior stability for micromanipulation applications. A variety of screw holes are available to securely mount manipulators onto the microscope, allowing optimal choice of angles and positioning. Manipulator joysticks can be placed in the most comfortable, accessible position due to the compact frame design.



Human embryo

ON3-99D

ON3-99D with return mechanism (UT-R)

Manual combination
(ONM-2D+ONO-301D+UT-D)

Manual combination with return mechanism
(ONM-2D+ONO-301D+UT-D+UT-R)

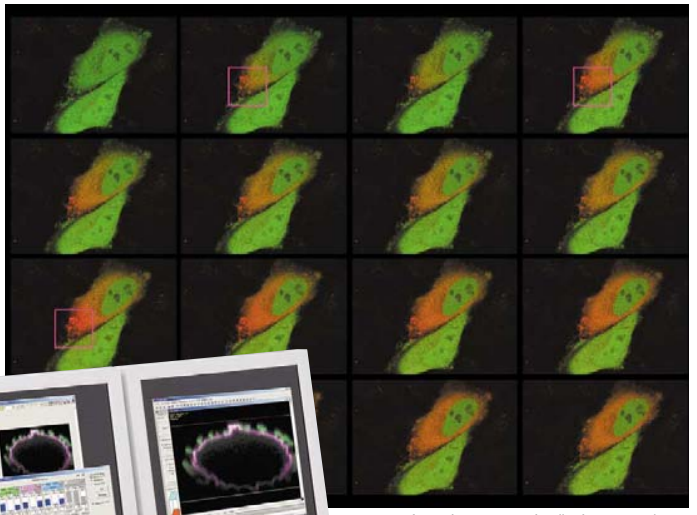
NanoString Exhibit 1053.022

Laser Scanning Confocal

Simultaneous laser light stimulation and imaging.

Confocal laser scanning microscope/ FV1000 FLUOVIEW system

The basic performance of this laser scanning microscope delivers significantly brighter, quicker and more precise imaging, obtaining accurate living organism information while minimizing the chance of damage to the specimen.
Used with the (optional) SIM scanner, the FV1000 can synchronize the observation and light stimulation lasers so as to perform laser light stimulation and imaging simultaneously.



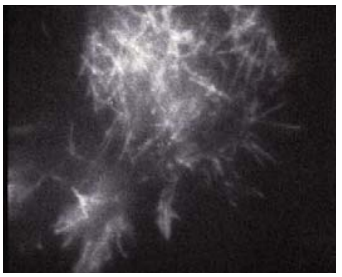
Images of Kaede-expressed cells demonstrating the photoactivation acquired every 300msec and observed via 405 blue diode laser illumination with twin scanners.

TIRFM

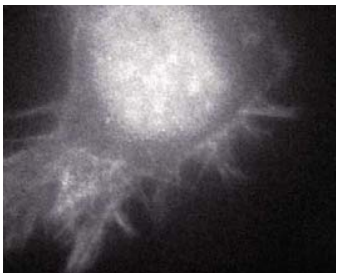
Ultra-sensitive fluorescence microscopy.

TIRFM (Total Internal Reflection Fluorescence Microscopy System)

Since 1997, Olympus has been a market leader in objective based Total Internal Reflection systems that allows evansecent wave illumination approximately 200nm into the specimen beyond the coverglass interface. Olympus extends that leadership role by offering three objectives for TIRFM including the world's highest NA objective, the 100X N.A. 1.65 objective.
The incredibly thin optical section created be TIRFM allows an extremely high signal to noise image to be collected. Popular applications include vesicle tracking, cellular adhesions and single molecule events.



Total Internal Reflection Fluorescence observation with evanescent wave excitation



Widefield fluorescence observation with mercury arc lamp excitation

• Olympus' original high N.A. objectives make it easy to produce an evanescent wave field. So little light is leaked that a high-contrast image can be obtained against a dark background.

* N.A. 1.65, 100X objective (APO100XOHR).
  Incompatible resolution and brightness (use special cover glass and immersion oil)

* N.A. 1.45 objectives (PLAPON60XOTIRFM, PLAPO100XOTIRFM)
  UPLSAPO100XO (N.A. 1.4)
  (Use normal cover glass and immersion oil)

• After initial alignment of the single mode fiber to the laser head and TIRFM illuminator, a simple micrometer adjustment is all that is required to move the laser position between TIRFM and widefield illumination.

NanoString Exhibit 1053.023

Obtaining confocal images easily by use of an arc light source.

Disk Scanning Confocal Microscope System

The Olympus Disk Scanning Unit (DSU) offers confocal images using a white light, arc excitation source and CCD camera. The heart of the system is a unique, Olympus designed slit pattern disk that offers excellent light throughput and thinness of optical sectioning or "confocality'.

• Compliance with various fluorochromes with different spectral characteristics.

Since an arc light source is used, the unit can meet different fluorochrome requirements across a wide wavelength spectrum by simply exchanging a standard mirror unit.

• Minimize excitation light damage to the specimen.

The excitation light volume is reduced to around 5% as a result of passing through the disk. Even so, there is almost no fading of fluorescence emission from the surface of the focused sample.

• Quick construction of 3D images.

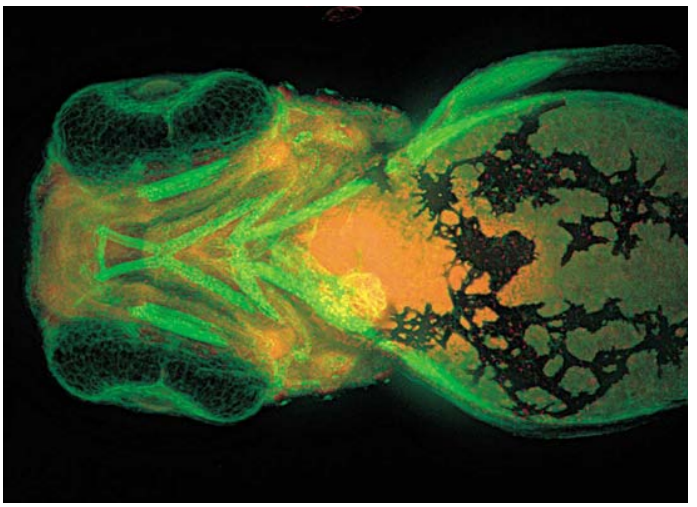
A single DSU image can be obtained very quickly, in 0.1~0.4 seconds (exposure time with recommended camera). Overlapping successively photographed cross images enables speedy construction of a 3D image.

• Low and high magnification objective support.

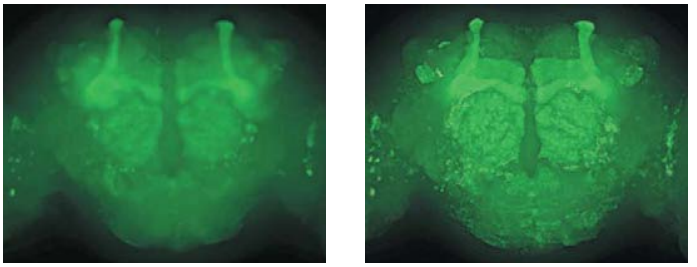
Five DSU disks are available of varying slit spacing and width. Disks can be thus be matched to the magnification and N.A. of the preferred objective. The DSU supports 10X to 100X confocal imaging.

• Easy exchange between confocal and reflected light fluorescence observation .

IN/OUT of the confocal disk to the light path can be done by a hand switch or via software, so it is easy to exchange observation methods between DSU and reflected light fluorescence.



Zebrafish 3-day embryo, ventral view, projection of 62 serial optical sections



Adult brain of *Drosophila*, reflected light fluorescence image (left) and DSU image (right)

* Not available in some areas

NanoString Exhibit 1053.024

World's first evanescent illumination system from an arc lamp source.

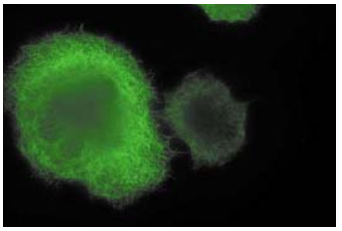
TIRFM (Total Internal Reflection Fluorescence Microscopy) system with arc lamp source

Featuring the Olympus-developed total internal reflection illumination system and slit mechanism to provide evanescent wave illumination from an arc lamp source. High signal to noise fluorescence observations with extremely thin optical sectioning can now be easily performed at the specimen-coverslip interface.

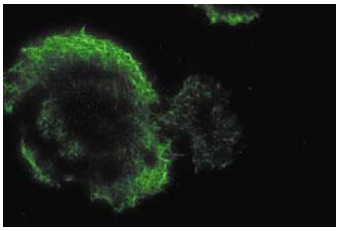
The arc lamp is focused on an off-center slit using a wedge prism. The light is then focused on the outer edge of the back focal plane of the objective thus causing the excitation light to exit the objective beyond the critical angle resulting in Total Internal Reflection. For normal fluorescence observation, the wedge prism and slit can be easily removed from the light path via a slider. Through the use of filters, this system enables a wider choice of excitation colors than is currently possible with wavelength-limited laser light sources.

IX2-ARCEVA

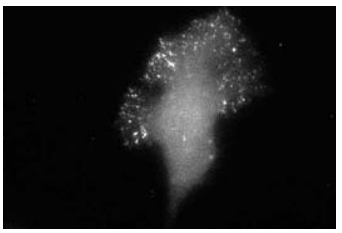
Conventional fluorescence observation

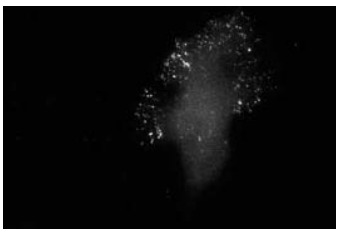


TIRFM observation



Microtubule of an NG108-15 cell labeled with Alexa488 through indirect fluorescence antibody test

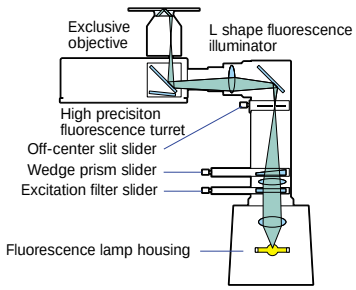




Kaede-Crk II protein expressed in a HeLa cell

High-precision fluorescence turret /IX2-RFACEVA

Turret includes three, highly precise, empty fluorescence filter cubes that permit dichromatic mirror switching while maintaining excitation light position on the back focal plane of the objective. This system makes multi-color observations easy and alleviates the usual adjustment of the excitation source when changing mirror units. Up to six mirror units can be installed.



Main specifications

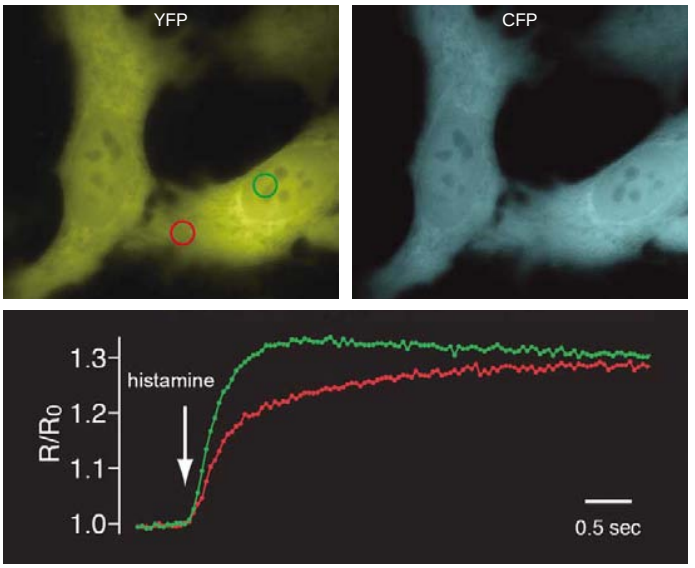
Microscope	Research inverted system microscope IX71
Fluorescence illuminator	Arc illumination total internal reflection fluorescence unit IX2-ARCEVA (Slit slider, wedge prism slider and excitation filter slider) L-shape fluorescence illuminator IX2-RFAL
Mirror unit cassettes (choose from either fluorescence turret)	High-precision fluorescence turret IX2-RFACEVA (with centering mechanism and 3 vacant mirror units)
	Fluorescence turret IX2-RFAC
Lamp light source	100W mercury lamp, 75W Xenon lamp
Objectives	PLAPON60XOTIRFM N.A. 1.45, W.D. 0.1mm Used with normal cover glass and immersion oil
Stage	Left short handle stage IX-SVL2
Total internal reflection illumination F.N.	11
Observation	Recommend high sensitive camera

NanoString Exhibit 1053.025

Bright, simultaneous two-wavelength imaging using the primary image.

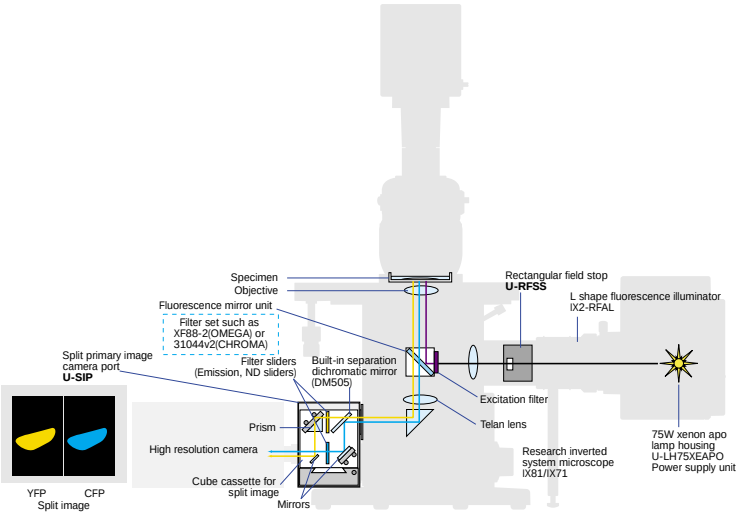
FRET Split imaging system

- Simultaneous two-color split imaging with one CCD camera.
- Unique design splits the primary image for the highest efficiency and light transmission necessary for weak fluorescence signals such as CFP/YFP FRET experiments.
- Compact and space-saving design takes advantage of the 70mm of free space between the microscope frame and the primary image plane found on all Olympus Research Upright and Inverted Microscopes.
- Simple cassette mechanism makes it easy to switch between split and full frame imaging.
- Unit is up to 10% brighter than similar relay lens based, image splitting systems.
- When used with the rectangular field stop U-RFSS, excitation energy is limited to the camera's field of view, minimizing specimen photo-bleaching



HeLa cell, in which YC3.1 (cytoplasm) and YC3.1nu (with nuclear localization signal) are coexpressed.

FRET changes are observed through histamine stimulation, and images are acquired at intervals of 50msec.



U-SIP main specifications

Microscope	IX71/81
Image separation	Right and left 2-separation (can be adjusted independently)
Built-in separation dichromatic mirror	DM505 (special size)
Filter slider	Emission, ND filters' size ø25mm, total thickness:8mm Used together with commercially available filter set (XF88-2 OMEGA) or 31044v2(CHROMA)
Field Number	Split image: 8 Full image: 11
Magnifications	1X (primary image)
Objectives	40X and higher
Camera mounting	C-mount
Recommended camera	Chip size 2/3 inch

* Not available in some areas

NanoString Exhibit 1053.026

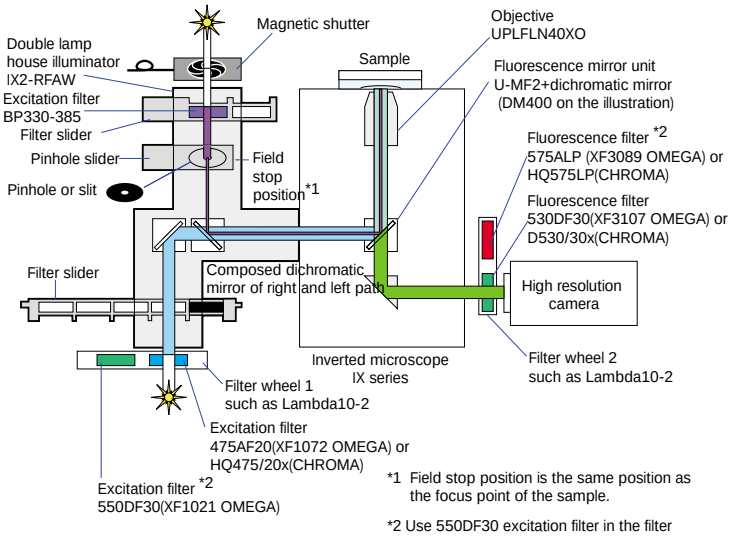
Photoactivation illuminator for inverted microscopy.

Photoactivation Fluorescence Microscope system

The photoactivation illuminator allows the exposure of UV light to specific regions of a cell for photoconversion, the uncaging of compounds and the photoactivation of specific fluorochromes.

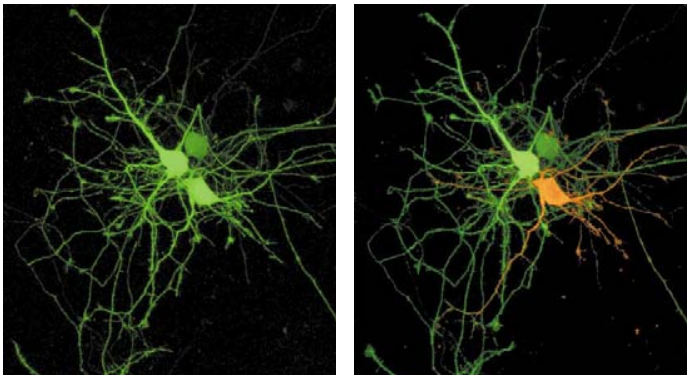
- A specified area of the cell can be exposed to UV light while observing the targeted cell by fluorescence or transmitted (DIC) method.
- Compliance with FRAP or FLIP experiments (by special order).
- Easy system upgrade by attaching double lamphouse illuminator IX2-RFAW to IX2 series inverted microscope.

Double lamphouse illuminator IX2-RFAW



*1 Field stop position is the same position as the focus point of the sample.

*2 Use 550DF30 excitation filter in the filter wheel 1 and 575ALP fluorescence filter in the filter wheel 2 when observing red Kaede protein. Exchange of the fluorescence mirror unit is not required.

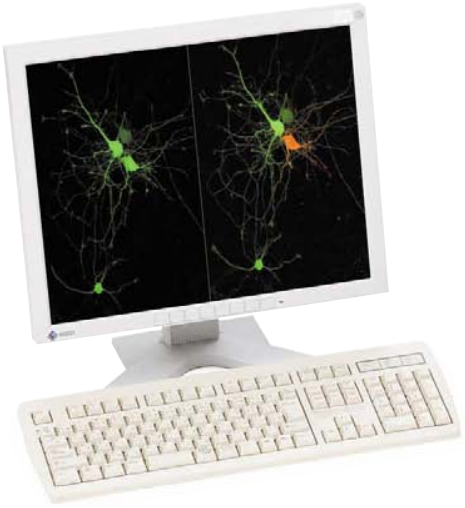


The novel Kaede gene is useful in biology because it exhibits photoconversion. Normally, the Kaede gene shows green fluorescence but after exposure to UV light will exhibit red fluorescence. By exposing UV light to only a specific region within a labeled cell and then noting the movement of red beyond that region, observations of internal cellular dynamics can easily be made. The photo on the left shows a nerve cell (from a rat hippocampus) pre-labeled with green Kaede gene.

The photo on the right side was taken after the right-most cell body was exposed to a 10µm diameter spot of UV light for 60 seconds, thus changing the Kaede gene from green to red. Note the translocation of the red shifted gene outside of the 10µm spot thus indicating intracellular transport mechanisms.

IX2-RFAW Specifications

Microscope	IX81/71/51, IX70/50
Pinhole slider	2-step exchange (pinhole or slit/vacant hole) Pinhole and slit are available on the market (ø16mm Melles Griot Inc. products)
Exposed area on the specimen	$\frac{\text{Pinhole diameter}}{\text{objective magnification}}$
Filter slider	3-step exchange (shutter/filter pocket/vacant hole) BP330-385 excitation filter equipped
Excitation filter slider	5-step exchange (4-step filter pocket/vacant hole)
Filter size	Excitation filter: ø25mm, thickness: 6mm and below ND filter: ø32mm, thickness: 1mm and below
Composed dichromatic mirror of right and left light path	DM400 (standard) Slide IN/OUT type
Power consumption	7.4A
Dimensions	Width: 710mm Depth: 740mm (from the front of tilting tube to the end of the illuminator)



* Not available in some areas

NanoString Exhibit 1053.027

IX71 specifications

Microscope body	Revolving nosepiece		Sextuple, simple waterproof mechanism incorporated
	Focus		9mm stroke (from stage surface, 7mm upward and 2mm downward), coaxial coarse and fine focusing knobs (minimum fine focus graduation: 1µm, full rotation of fine focusing knobs: 100µm), upper limit stopper, torque adjustment for coarse focusing
	Primary image port		Lower port (standard left side port: S1F 100% or S8F 80%, or optional lower Back port selectable, 2-step light path selection), Upper port when built-in magnification changer 1X/1.6X is replaced (optional right side port or upper back port selectable, 2-step light path selection), Bottom port (option)
	Frontal operation		Light path selector, Transmitted light intensity control and light ON/OFF switch, TTL Pulse control switch
Transmitted light illuminator	100W transmitted light illumination pillar	IX2-ILL100	Pillar tilt mechanism (30° inclination angle, with vibration reducing mechanism), Condenser holder (with 50mm stroke, swing-in/out mechanism), Field iris diaphragm adjustable, 4 filter holders (ø45mm, t=6mm or less)
	External power supply unit	TH4-100/200	Two versions available (100V and 200V), Optional TH4-HS hand switch can be used, 2.2kg weight
Observation tube	Tilting binocular tube	U-TBI90	35-85° continuous angle adjustable (eyepoint height range: 406mm-471mm), interpupillary distance adjustable between 50-76mm, diopter adjustment function, erect image, F.N. 22
	Binocular tube	U-BI90CT	Built-in focusing telescope, interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
		U-BI90	Interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
	Trinocular tube	U-TR30H-2	3 step optical path selectable (observation : straight port = 100:0, 20:80, 0:100), interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
Stage	Cross stage with flexible right handle	IX2-SFR	50mm(X) X 50mm(Y) stroke, stage insert plate exchangeable (ø110mm)
	Cross stage with short left handle	IX-SVL-2	50mm(X) X 43mm(Y) stroke, stage insert plate exchangeable (ø110mm)
	Plain stage	IX2-SP	232mm(X) X 240mm(Y) stage size, stage insert plate exchangeable (ø110mm)
		IX-MVR	Mechanical stage to be used with IX2-SP, 130mm(X) X 85mm(Y) stroke
	Narrow plain stage	IX2-KSP	160mm(X) X 240mm(Y) stage size, stage insert plate exchangeable (ø110mm)
		CK40-MVR	Mechanical stage to be used with IX2-KSP, 120mm(X) X 78mm(Y) stroke
	Gliding stage	IX2-GS	Upper circular stage 360° rotatable, 20mm(X/Y) travel
Condenser	Long working distance universal	IX2-LWUCD	5 positions for optical devices (3 positions for ø30mm and 2 position for ø38mm), aperture iris diaphragm adjustable, N.A. 0.55 / W.D. 27mm
	Long working distance Relief Contrast	IX2-MLWCD	4 positions for optical devices (for ø50mm, Relief Contrast optical devices rotatable), aperture iris diaphragm adjustable, N.A. 0.5 / W.D. 45mm
	Ultra long working distance	IX-ULWCD	4 positions for optical devices (for ø29mm), aperture iris diaphragm adjustable, N.A. 0.3 / W.D. 73mm
	Water immersion DIC	IX2-DICD + IX2-TLW	Single position for optical device (include two optical device holders), 40° injection pipette or electrode insertion angle, aperture iris diaphragm adjustable, N.A. 0.9 / W.D. 3.7mm
Eyepiece		WHN10X	High eyepoint, F.N. 22
		WHN10X-H	High eyepoint, diopter adjustment function, F.N. 22
Reflected light fluorescence unit	Fluorescence illuminator	IX2-RFAL	L-shaped design with exchangeable F.S. and A.S. modules, two filter holder sliders (2 positions, ø32mm, t=6mm or less)
		IX2-RFA	Straight design with field iris diaphragm, filter holder slider (2 positions, ø32mm, t=6mm or less)
	Fluorescence cube turret	IX2-RFAC	6 positions in a rotating turret, built-in shutter
	Light source		100W Hg lamp housing and transformer, or 75W Xe lamp housing and transformer

IX81 specifications

Microscope body	Revolving nosepiece		Sextuple motorized with objective lens retraction in PC mode, simple waterproof mechanism incorporated
	Focus		9mm stroke (from stage surface, 7mm upward and 2mm downward), fine/coarse switchable focusing knobs (minimum graduation: 0.01µm), objective lens escape/return buttons and return to memory position buttons (each side of microscope frame)
	Primary image port		Lower port (standard left side port: S1F 100% or S8F 80%, or optional lower Back port selectable, 2-step light path selection), Upper port when built-in magnification changer 1X/1.6X is replaced (optional right side port or upper back port selectable, 2-step light path selection), Bottom port (option)
	Frontal operation		Light path selector button, Transmitted light intensity control buttons and light ON/OFF switch button, Fine/Coarse focus selector button, TTL Pulse control switch (auxiliary) buttons
Transmitted light illuminator	100W transmitted light illumination pillar	IX2-ILL100	Pillar tilt mechanism (30° inclination angle, with vibration reducing mechanism), Condenser holder (with 50mm stroke, swing-in/out mechanism), Field iris diaphragm adjustable, 4 filter holders (ø45mm, t=6mm or less)
	External power supply unit	IX2-UCB2	Auto voltage selector (100V / 200V), RS232C interface for PC operation, IX2-BSW driver software
Observation tube	Tilting binocular tube	U-TBI90	35-85° continuous angle adjustable (eyepoint height range: 406mm-471mm), interpupillary distance adjustable between 50-76mm, diopter adjustment function, erect image, F.N. 22
	Binocular tube	U-BI90CT	Built-in focusing telescope, interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
		U-BI90	Interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
	Trinocular tube	U-TR30H-2+IX-ATU	3 step optical path selectable (observation: straight port = 100:0, 20:80, 0:100), interpupillary distance adjustable 50-76mm, diopter adjustment function, F.N. 22
Stage	Cross stage with flexible right handle	IX2-SFR	50mm(X) X 50mm(Y) stroke, stage insert plate exchangeable (ø110mm)
	Cross stage with short left handle	IX-SVL-2	50mm(X) X 43mm(Y) stroke, stage insert plate exchangeable (ø110mm)
	Plain stage	IX2-SP	232mm(X) X 240mm(Y) stage size, stage insert plate exchangeable (ø110mm)
		IX-MVR	Mechanical stage to be used with IX2-SP, 130mm(X) X 85mm(Y) stroke
	Narrow plain stage	IX2-KSP	160mm(X) X 240mm(Y) stage size, stage insert plate exchangeable (ø110mm)
		CK40-MVR	Mechanical stage to be used with IX2-KSP, 120mm(X) X 78mm(Y) stroke
	Gliding stage	IX2-GS	Upper circular stage 360° rotatable, 20mm(X/Y) travel
Condenser	Motorized long working distance universal	IX2-LWUCDA2	Motorized turret with 6 position slots for optical devices (3 positions each for ø30mm and ø38mm), aperture iris diaphragm adjustable, N.A. 0.55 / W.D. 27mm
	Long working distance Relief Contrast	IX2-MLWCD	4 positions for optical devices (for ø50mm, Relief Contrast optical devices rotatable), aperture iris diaphragm adjustable, N.A. 0.5 / W.D. 45mm
	Ultra long working distance	IX-ULWCD	4 positions for optical devices (for ø29mm), aperture iris diaphragm adjustable, N.A. 0.3 / W.D. 73mm
	Water immersion DIC	IX2-DICD+IX2-TLW	Single position for optical device (include two optical device holders), 40 injection pipette or electrode insertion angle, aperture iris diaphragm adjustable, N.A. 0.9 / W.D. 3.7mm
Eyepiece		WHN10X	High eyepoint, F.N. 22
		WHN10X-H	High eyepoint, diopter adjustment function, F.N. 22
Reflected light fluorescence unit	Fluorescence illuminator	IX2-RFAL	L-shaped design with exchangeable F.S. and A.S. modules, two filter holder sliders (2 positions, ø32mm, t=6mm or less)
		IX2-RFA	Straight design with field iris diaphragm, filter holder slider (2 positions, ø32mm, t=6mm or less)
	Fluorescence cube turret	IX2-RFACA	Motorized turret with 6 positions, built-in shutter
	Light source		100W Hg lamp housing and transformer, or 75W Xe lamp housing and transformer

IX81-ZDC specifications

Focusing position	Dry objective	Interface between air and cover glass	
	Oil immersion objective	Interface between sample (cultured liquid) and cover glass	
Offset method	Controlled by software	Compensation for shift of observation position toward the focusing plane is by Z-axis control (built into the IX81-ZDC)	
Observation methods		Fluorescence /DIC: DIC cannot be used beside gray-sensitive colors.	
Dichromatic mirror IN/OUT method for AF laser introduction		Manual exchange	
F.N. limitation		Light volume is low at the image perimeter for F.N. 22 when using 2X, 4X, 10X objectives	
Focusing speed		Within approx. 0.8 seconds (average) from near focusing position (not including offset time through software)	Speed also varies according to the start position of auto focusing, and individual PC performance
Focusing accuracy		±0.3µm (when environmental temperature change is within 5°C)	
Laser safety standard		Class 1 (JISC6802, IEC825, CDRH)	
Laser safety function		Front monitor method (Laser light volume by special PD)	IEC60825
Camera port	Left side port	Can only be combined with U-TV1X-2+U-CMAD3, U-DPCAD, U-SIP (primary image , 1X)	
	Observation tube	IX-ATU+U-TR30H-2+IX-TVAD+U-CMT IX-ATU+U-TR30-2+U-TV1X-2+U-CMAD3	

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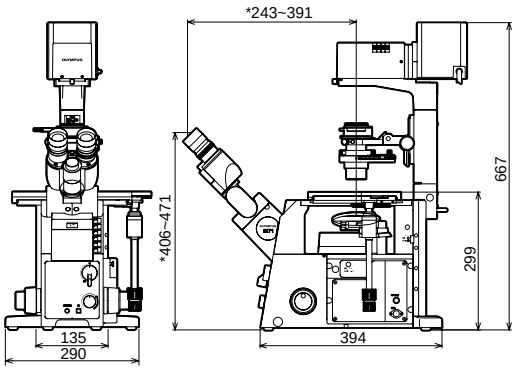
IX71 dimensions

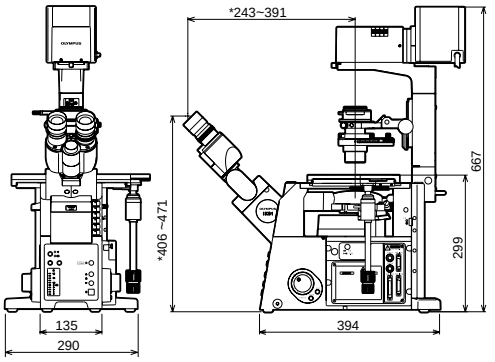
(unit: mm)



Weight: 16kg Power consumption: 350VA
* Lengths with an asterisk (*) vary according to interpupilllary distance.

IX81 dimensions

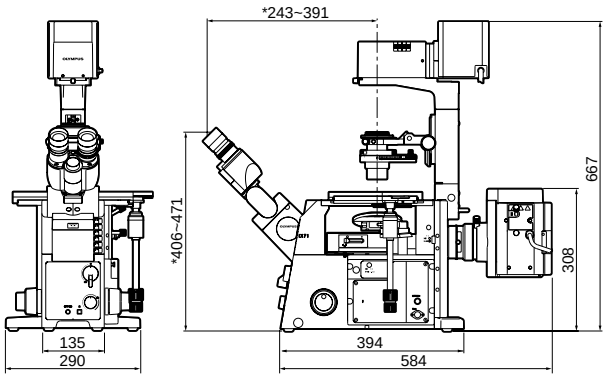
(unit: mm)



Weight: 16.9kg Power consumption: 350VA
* Lengths with an asterisk (*) vary according to interpupilllary distance.

IX71+fluorescence illuminator combination dimensions

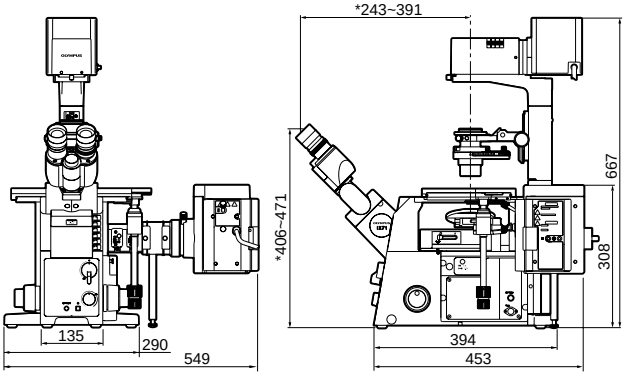
(unit: mm)



Weight: 20.2kg Power consumption: 480VA
* Lengths with an asterisk (*) vary according to interpupilllary distance.

IX71+L shape fluorescence illuminator dimensions

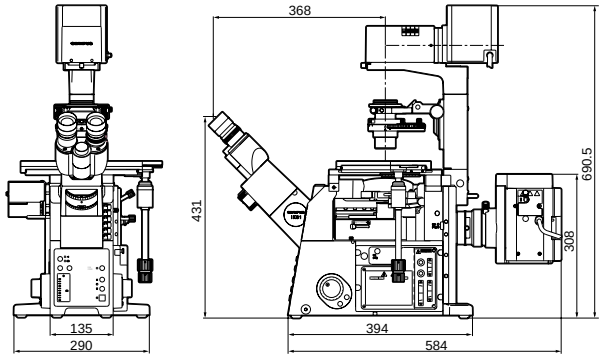
(unit: mm)



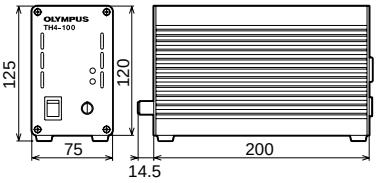
Weight: 21.2kg Power consumption: 480VA
* Lengths with an asterisk (*) vary according to interpupilllary distance.

IX81-ZDC dimensions

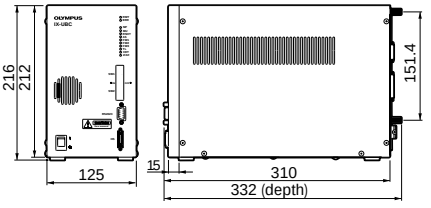
(unit: mm)



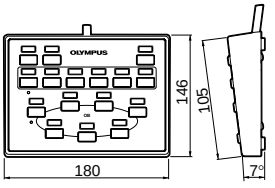
TH4 dimensions



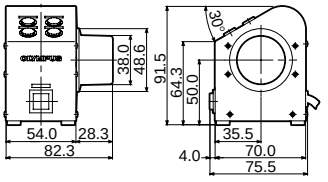
IX2-UCB2 dimensions



U-HSTR2 dimensions



U-FH dimensions



(unit: mm)

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Photos courtesy of:
Teruhiko Wakayama, Ph.D., Laboratory for genomic Reprogramming, Head of Laboratory, Riken Kobe Institute, Center for Developmental Biology (CDB) (P15)
Yuji Abe M.D.Ph.D., The 1st Department of Obstetrics & Gynecology School of Medicine, Toho University (P21)
Ms. Ryoko Ando, Dr. Atsushi Miyawaki RIKEN Brain Science Institute Laboratory for Cell Function Dynamics (P8, P22 above, 25 and 26)
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Dr. Kazuo Kurokawa, Department of tumor virology, Research institute for microbial diseases, Osaka university (P24 below, Kaede-Crk II protein expressed in a HeLa cell)

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OLYMPUS CORPORATION
Shinjuku Monolith, 3-1, Nishi Shinjuku 2-chome, Shinjuku-ku, Tokyo, Japan
OLYMPUS EUROPA GMBH
Postfach 10 49 08, 20034, Hamburg, Germany
OLYMPUS AMERICA INC.
Two Corporate Center Drive, Melville, NY 11747-3157, U.S.A.
OLYMPUS SINGAPORE PTE LTD.
491B River Valley Road, #12-01/04 Valley Point Office Tower, Singapore 248373
OLYMPUS UK LTD.
2-8 Honduras Street, London EC1Y OTX, United Kingdom.
OLYMPUS AUSTRALIA PTY. LTD.
31 Gilby Road, Mt. Waverley, VIC 3149, Melbourne, Australia.
OLYMPUS LATIN AMERICA, INC.
6100 Blue Lagoon Drive, Suite 390 Miami, FL 33126-2087, U.S.A.

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