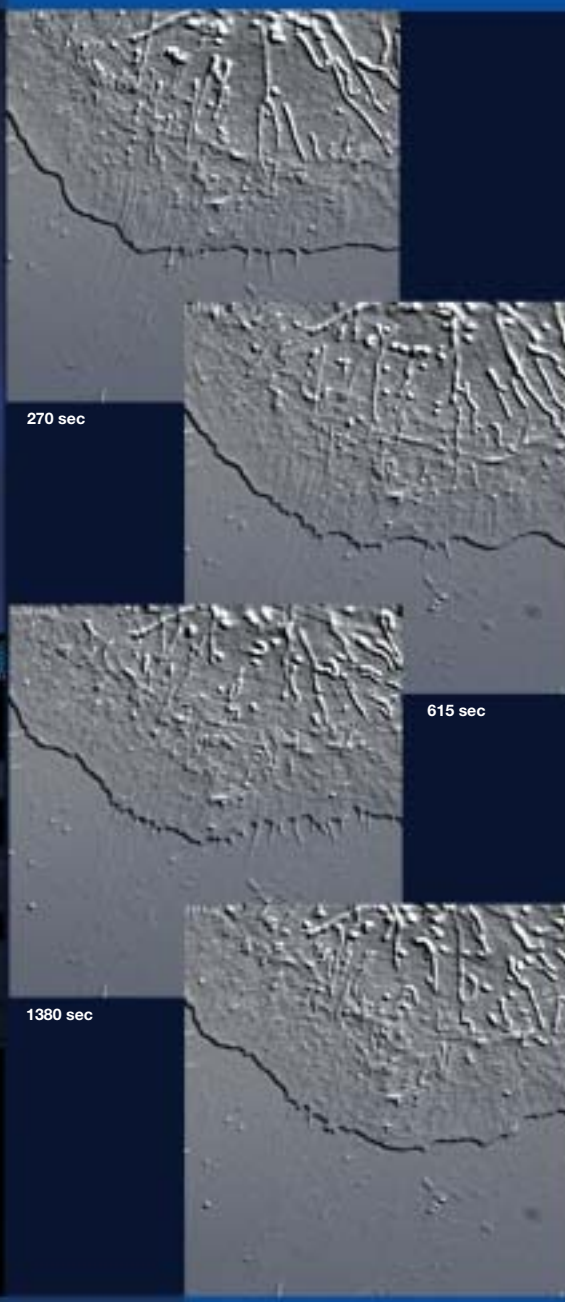
Motorized Inverted Research Microscope with Continuous Focus Correction

Nikon

Inverted Research Microscope

ECLIPSE TE2000-PFS



Farewell to focus drift!

A powerful new model with real-time focus correction strengthens the TE2000 series

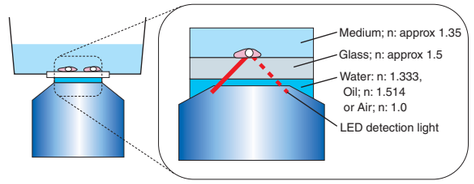
Focus drift is one of the biggest obstacles to acquiring "live cell" time lapse data. Prolonged periods of observation and stage movement as well as a host of other factors can result in focus drift.
The new TE2000-PFS (Perfect Focus System) automatically detects the surface* of the coverslip optically and continually corrects focus to compensate for even the most infinitesimal changes. The benefits of the PFS are obvious:

*Interface of glass and medium in immersion applications or glass and air in dry applications.

- **You no longer have to adjust the focus knob every time stage movement occurs or after adding reagents.**
- **You can continue stable, in-focus observations over an extended period of time—perfect for time-lapse recording.**
- **You can minimize photobleaching, which keeps cells alive longer in fluorescence observation, because focus adjustment is no longer necessary.**
- **You can catch the rapid change of cells because PFS instantaneously corrects focus drift resulting from temperature drop when adding reagents.**
- **While the Perfect Focus system is continually holding focus at the coverslip, you can freely select focus planes throughout the specimen thanks to an Optical Offset feature*.**

*Patent pending

Principle of focus detection



The coverslip surface* is detected by the LED light emitted through the objective.
* Top surface in immersion applications.

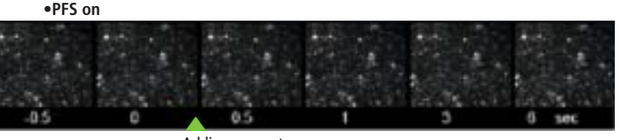
Always in perfect focus Nikon Original!

When PFS is turned on, the position of the coverslip surface is always detected during observation, and the data is continuously fed back to the focusing mechanism thanks to the Nikon's propriety COF (Continuous Optical Feedback) technology*.

*Patent pending

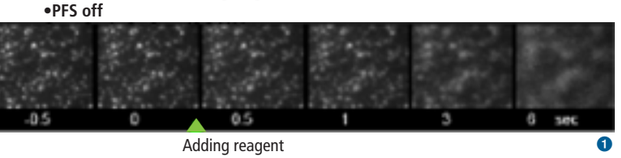
Correction to focus drift caused by expansion/contraction of the plastic dish when reagents are added

•PFS on



Adding reagent

•PFS off



Adding reagent ❶

Observation method: Laser TIRF

Perfect focus to the plane of interest Nikon Original!

Focus is continuously corrected at any plane of interest throughout the specimen by the Optical Offset feature*. Unlike other systems that have to initially focus on the coverslip interface and then shift the focal point to the plane of interest, PFS can continuously keep focusing on the focus plane. Consequently, you will never again miss rapid events in your specimen because of focus drift.
*Patent pending

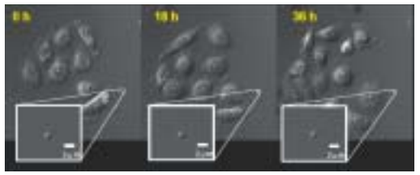
High-precision focusing

By combining the highly sensitive focus detection system and the extremely accurate Z-axis control system of the TE2000-E, focusing precision of less than 1/3 the focal depth of the objective is achieved.

Long-term focal maintenance

All that is required to keep the specimen in focus is to focus on the desired plane, then turn PFS on. This allows consistent focus to be maintained for observations of days or more.

Focus is maintained during time-lapse recording

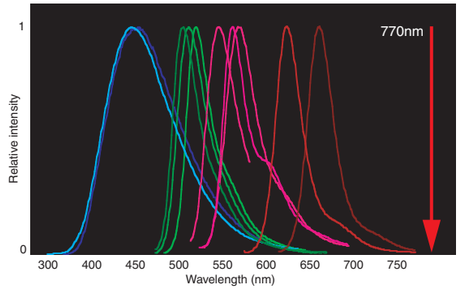


Observation method: DIC

Focus detection with infrared light

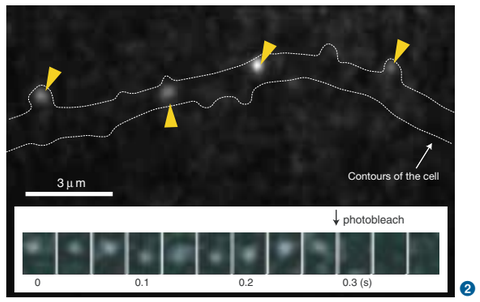
PFS uses an LED in the infrared range and an internal linear CCD detector, to detect the focal point, so it does not intrude on wavelengths used for observation. This means you can carry out observation and focus maintenance at the same time, with no influence at all on captured images.

The 770nm wavelength, which does not affect fluorescence observation, is used for focus detection



Since the wavelength of the LED does not affect the image quality, high-contrast visualization of single fluorescent molecules—normally only possible with high-S/N ratio microscopy—is possible.
The example photo shows that, even immediately after stimulation with a neurotransmitter, the receptor's (YFP fusion protein) dynamic behavior can be continuously tracked at the single molecular level.

Single molecular fluorescence image of YFP label receptor



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Cell: dendrite (part) of a primary dispersion culture cell of a hippocampus
Time-lapse image: being photobleached at after 0.3 s
Observation method: TIRF

Supports all methods

PFS is compatible with a wide array of observation methods, from brightfield, fluorescence to DIC, TIRF, phase contrast, and others.

PFS strongly supports live cell applications

Compatible with various fluorescence imaging platforms
- Laser TIRF system—with laser light source and ultrahigh S/N ratio
- White-light TIRF Multi-fluorescence Imaging System
- Fluorescence system with high S/N capability

Following in the footsteps of the TE2000-E

Just like the TE2000-E, the PFS model comes standard with motorized-focus and motorized 5-way light port changeover—best suited for advanced research.

Streamlined operation from a PC
The microscope can be operated from a PC using third-party application software.

Greater Z-axis precision
The PFS model features a minimum Z-axis linear encoded readout of 0.05µm when operated from the connected PC. Perfect accuracy and focus repeatability is ensured.

Objective anti-collision mechanism
When changing the objective magnification, the nosepiece automatically drops, rotates, and returns to the original height, preventing it from hitting the stage—particularly handy for culture live cell observations.

Auto switching between 5 ports
Five output ports, including a bottom port, are standard and can be easily switched via motorized control.

Acclaimed CFI60 objectives
Nikon's CFI60 infinity objectives series provide high N.A's and long working distances. As tube-lens focal length is as long as 200mm, there will be no aberration even when various optical components are introduced into the optical path.

Main Specifications

Compatible specimen		Specimens in aqueous solutions (cultured specimens, in-vitro assays, etc.)
Compatible dish		Glass-bottom dishes (glass thickness: 150-180mm, No. 1S recommended)
Detect boundary		Immersion lens: between glass and medium; between dry lens: glass and air
Offset distance		Adjustable with the controller dial
Memory function		Offset distance, Store/recall of nosepiece up/down distance (up to 6 points per nosepiece)
Main body	Focusing	Via motorized/manual nosepiece up/down movement
		Stroke—manual: up 7mm, down 3mm; motorized: up 6mm, down 2.5mm Coarse stroke: 4.9mm/rotation (motorized); Fine stroke: 0.1mm/rotation (motorized) Minimum fine reading: 0.05µm by optical linear encoder External fine focusing unit
	Intermediate magnification	1.5x
Eyepiece tube		(1) T-TD Binocular Tube D (2) T-TS Binocular Tube S (3) T-TERG Binocular Ergonomic Tube D (4) T-TI Intermediate Tube
Eyepiece lens (F.O.V.)		CFI 10x (22mm), CFI 12.5x (16mm), CFI 15x (14.5mm)
Illumination		T-DH 100W Illumination Pillar
Condenser		ELWD condenser for phase contrast, System condenser LWD, Hoffman Modulation condenser® (HMC), High N.A. condensers, Motorized system condenser LWD
Nosepiece		T-ND6-E Motorized Sextuple DIC Nosepiece
PFS-compatible objectives		Plan Fluor 40x/40xH, Plan Fluor ELWD 20xC/40xC, Plan Fluor ELWD DM 20xC, Plan Fluor ELWD ADL 20xC/40xC, Plan Apo VC 60xH/100xH/60xWI, Plan Apo 60xHA/100xH/60xWI/20x, Plan Apo DM 60xH/100xH, Plan Apo TIRF 60x
Stage		T-SR Rectangular Stage, T-SSR Short Rectangular Stage, T-SP Plain Stage, T-SAM Attachable Mechanical Stage (must be used with T-SP Plain Stage)
Motorized functions		Fine focusing (minimum reading: 0.05µm), Motorized 5-port switching (eyepiece, front, right, left, bottom ports), Motorized coarse focusing (option) DIC nosepiece, Analyzer, Epi-fl filter rotating turret, Epi-fl shutter, Excitation filter wheel, Barrier filter wheel, System condenser turret
Operating environment		Temperature: +20-30°C Humidity: 60% or less (no condensation)
Weight (approx.)		Phase contrast set: 45kg; Epi-fl set: 50kg
Power consumption (max.)		100-240V, 1.2A max. 50-60 Hz

Images courtesy of:

1. Profs. Akihiro Kusumi and Dr. Chieko Nakada, Kusumi Office, Institute for Frontier Medical Sciences, Kyoto University
2. Dr. Chieko Nakada, Kusumi Office, Institute for Frontier Medical Sciences, Kyoto University
   Co-researcher: Professor Shigeo Okabe, Tokyo Medical and Dental University

Images on the front cover courtesy of Dr. Alexey Khodjakov, Laboratory of Cell Regulation, Wadsworth Center

Molecular Probes invitrogen detection technologies The spectral data of the fluorescence labels included in this brochure was created by Molecular Probes Corporation and provided courtesy of Invitrogen Corporation.

Specifications and equipment are subject to change without any notice or obligation on the part of the manufacturer. July 2005

WARNING TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.

* Monitor images are simulated.

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NIKON INSTECH CO., LTD.
Parale Mitsui Bldg., 8, Higashida-cho, Kawasaki-ku,
Kawasaki, Kanagawa 210-0005, Japan
phone: +81-44-223-2168 fax: +81-44-223-2182
www.nikon-instruments.jp/eng/

NIKON INSTRUMENTS (SHANGHAI) CO., LTD.
CHINA phone: +86-21-5836-0050 fax: +86-21-5836-0030
(Beijing office)
CHINA phone: +86-10-5869-2255 fax: +86-10-5869-2277

NIKON SINGAPORE PTE LTD
SINGAPORE phone: +65-6559-3618 fax: +65-6559-3668

NIKON MALAYSIA SDN. BHD.
MALAYSIA phone: +60-3-78763887 fax: +60-3-78763387

NIKON INSTRUMENTS KOREA CO., LTD.
KOREA phone: +82-2-2186-8410 fax: +82-2-555-4415

NIKON INSTRUMENTS EUROPE B.V.
P.O. Box 222, 1170 AE Badhoevedorp, The Netherlands
phone: +31-20-44-96-222 fax: +31-20-44-96-298
www.nikon-instruments.com/

NIKON FRANCE S.A.S.
FRANCE phone: +33-1-45-16-45-16 fax: +33-1-45-16-00-33

NIKON GMBH
GERMANY phone: +49-211-9414-0 fax: +49-211-9414-322

NIKON INSTRUMENTS S.p.A.
ITALY phone: + 39-55-3009601 fax: + 39-55-300993

NIKON AG
SWITZERLAND phone: +41-43-277-2860 fax: +41-43-277-2861

NIKON UK LTD.
UNITED KINGDOM phone: +44-20-8541-4440 fax: +44-20-8541-4584

NIKON INSTRUMENTS INC.
1300 Walt Whitman Road, Melville, N.Y. 11747-3064, U.S.A.
phone: +1-631-547-8500; +1-800-52-NIKON (within the U.S.A.only) fax: +1-631-547-0306
www.nikonusa.com/

NIKON CANADA INC.
CANADA phone: +1-905-625-9910 fax: +1-905-625-0103

NIKON CORPORATION
Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku,
Tokyo 100-8331, Japan
www.nikon.com/

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