Leica DM LFS

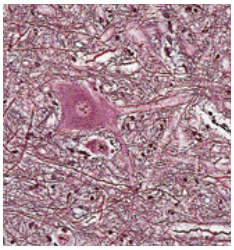
New Dimension in Electrophysiology

Leica

The Leica DM LFS upright microscope for fixed stages

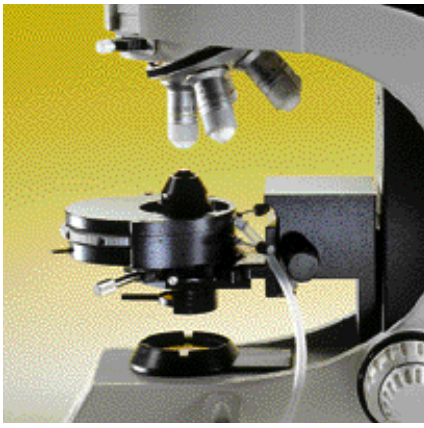
The Leica DM LFS sets new standards of microscopy in patch clamping applications. Specially designed for electrophysiological requirements, this innovative Leica microscope features high precision objective focusing and opens up completely new dimensions with the U-V-I water immersion objectives.

The DM LFS takes the successful Leica DM microscopes of the L and R classes – with the new HC optics – a unique step further into the world of living cell microscopy. The DM LFS microscope for electrophysiology has been developed by users for users.



The Leica DM LFS is a modern application microscope with a modular design for smooth adaptation to all tasks in in vivo/in vitro microscopy. Equally useful for research and routine work, this system is ergonomic and application-specific, while offering the benefits of state-of-the-art top quality optics. Another priority of the designers has been to define the right interfaces and create the necessary work space for present and future applications.
Like the DM LB 100, the top microscope of the L class, the DM LFS excels in solving application problems. First-class, Patented, Revolutionary, Innovative, Indestructible and Safe – this Leica microscope again typifies all the attributes that set DM LFS microscopes apart from previous microscopes in this class.
The DM LFS offers top level technology teamed with a wealth of innovative and practical ideas.

We at Leica specially designed this microscope with submicron precision objective focusing for electrophysiological applications. The objective nosepiece is moved by the high precision Leica focusing control within a range of 26 mm in the robust and stable body of the microscope. Only the small mass of the objectives and their holder has to be moved – the tubes, cameras and microscope modules remain in position. This guarantees extremely accurate and, most importantly, stable focusing over long periods of time.



By applying Finite Element calculations and subsequent thorough testing in all conceivable practical applications we virtually eliminated vibrations of the microscope and its components. By improving the stability of the microscope, we were able to scale down the microscope's footprint to make more room for experiments. All switchable components on the microscope have been optimised to minimise friction and vibrations.

All electronic components have been located away from the microscope to guarantee electric neutrality and stable experiment conditions over the whole time of the measurements. An extra-long insulated cable (3 m) on the standard 12 volt 100 watt lamphousing and the external power supply suppress any electric interference.

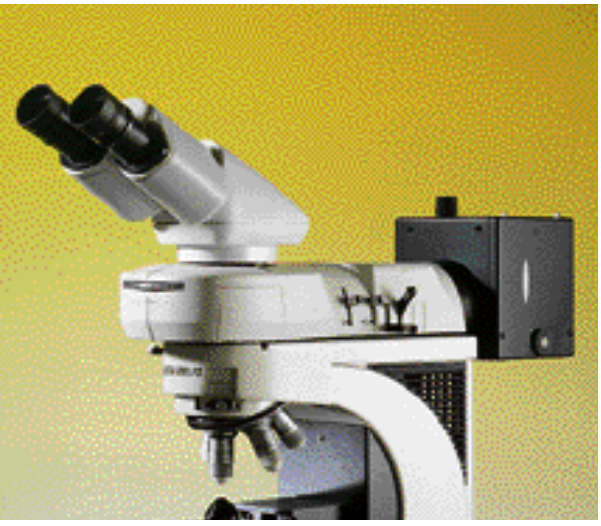
The specimen is completely decoupled, both mechanically and electrically, from the microscope and is surrounded by as much free space as possible for application-specific sample holders, bath chambers and several manipulators at a time.

The upright microscope for fixed stages, the Leica DM LFS, offers wide application potential in animal and plant physiology. The benefits of the new Leica microscope are particularly quickly noticed in electrophysiology and microscopy of thick and non-transparent sections.

The components from the versatile DM LB range can also be used on the DM LFS, for example the fluorescence illuminator. Fitted with a centerable aperture and field diaphragm and a luxury turret for up to four filter cubes, this incident light fluorescence module soon becomes an indispensable piece of equipment for electrophysiological experiments in combination with optimised fluorescence imaging.

All the functional elements are specially matched and harmoniously combine to offer a high standard of performance, top-class quality and engineering and optimal problem solutions. The best conditions for a smooth workflow and reliable results in research and routine.

A new, patented condenser body will be welcomed by all those whose experiments have been held up for hours by cleaning due to liquid from a broken glass sample container seeping into the condenser.

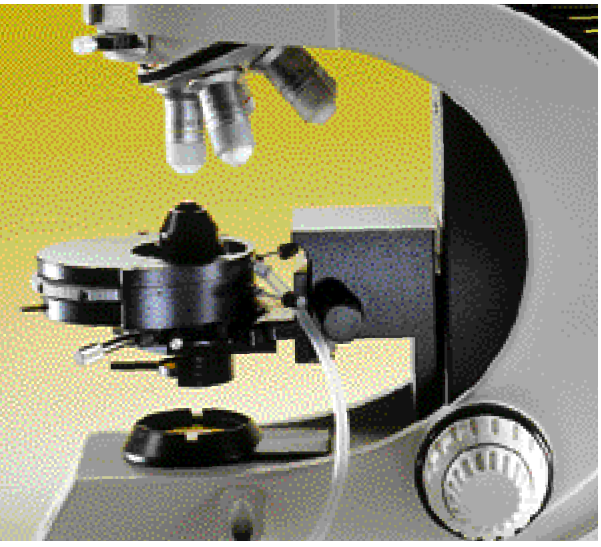


The top of the CL FS condenser can be sealed to the condenser body on request. A channel on the top of the condenser stops any liquid from spilling over the optics and precision mechanical parts of the condenser. An outlet with tubing drains the whole aqueous solution to a collecting vessel.

Not only the condenser, but also the window in the microscope base is sealed against liquids. Even major “water accidents” are no threat to the microscope optics.

Leica has understood what users want. The specifications of the DM LFS address and solve the needs of the present and the future.

The Leica DM LFS upright microscope for fixed stages is optimised for



- the special requirements in electrophysiology
- the special requirements of objective focusing
- greatest possible work space at the microscope
- the minimisation of mechanical, electrical and chemical interference
- maximum stability of the microscope and the sample
- optimal compatibility with Leica’s modular microscopy range.

The new Leica U-V-I water immersion objectives
The application objectives are the most important part of a physiological microscope. With the launch of the HC optics and the new U-V-I standard, Leica has introduced a significant new optical development.

We are offering four new objectives (10 x, 20 x, 40 x and 63 x) for the DM LFS. These new HCX APO L U-V-I water immersion objectives are ideal for microscopy of cells and tissues in petri dishes or bath chambers.

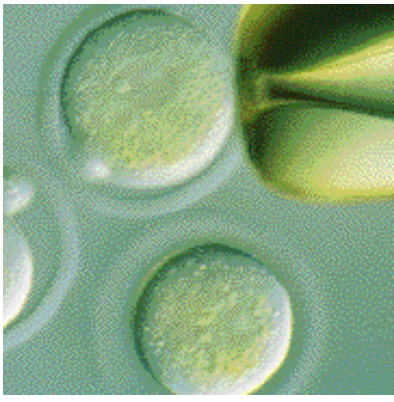
Besides optical parameters, a number of physical, chemical and mechanical advantages have been integrated into the new concept of the application objectives.

Extremely slender shape of objectives,
minimum surface conductivity,
minimum thermal conductivity,
no magnetic fields near the front of the objective,
inert to aqueous solutions,
no diffusion of metal ions,
corrosion-free,
chemically neutral,
outstanding wettability
– these are just the main "non-optical" properties incorporated in the U-V-I series.

This was achieved by using a special, extremely hard ceramic material with the above properties for the whole front lens area. This ceramic material is resistant to mechanical damage and better suited to the requirements of electrophysiology than the customary Teflon® or similar insulation of the metal sleeves of the objectives.

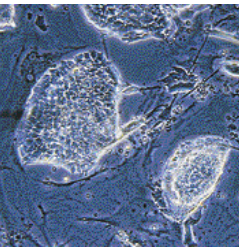
The embedded glass front lens is flat and therefore easy to clean. Above the ceramic part, there is an additional 11 mm long sleeve of high-quality plastic which extends the electromagnetically neutral zone of the objective, including the free working distance, to more than 22 mm.

Another advantage of using the special ceramic material is that the access angle of the objectives, a measure for optimum fitting of the manipulators, has been widened almost to the limits of what is theoretically possible. More than 45° for the 10 x, 20 x and 40 x objectives and more than 42° for the 63 x objective.



When designing the objectives, the applications determined the values of the optical parameters of the U-V-I class. For a field of view of 20 mm the U-V-I objectives are optimised for the longest possible **free working distances.**

The working distances range from 3.7 mm for the 10 x objective, 3.6 mm for 20 x, 3.3 mm for 40 x down to 2.2 mm for 63 x. Here, too, the wettability of the ceramic material is a crucial advantage, preventing the water film from tearing even 4 mm outside the preventing the water film from tearing even 4 mm outside the petri dishes.



Another outstanding feature of the U-V-I objectives is their **high numerical aperture** (0.3, 0.5, 0.8, 0.9), while their apochromatic correction results in parfocality in a range from 350 – 1000 nm, i.e. from **U**ltravilolet through the **V**isual range to **I**nfrared.

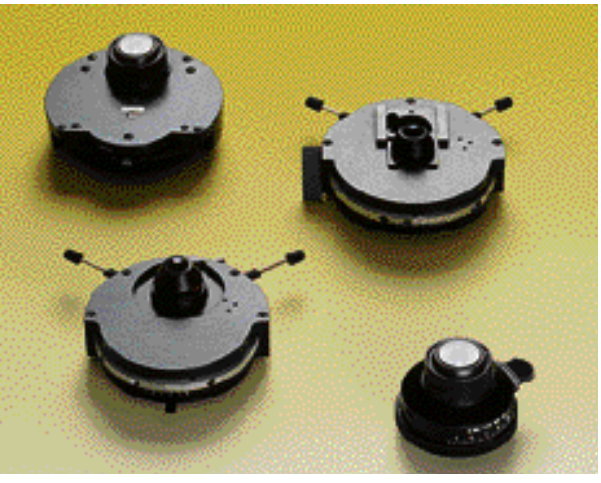
Excellent results are also obtained in **polarised light** and for **differential interference contrast (DIC).** Leica has also designed a new Wollaston prism to go with the U-V-I objectives. All 4 water immersion objectives have the advantage of the same pupil position and can therefore use the same objective prism. This prism (D1) is optimised for extremely high resolution in line with physiological requirements.

The superb **transmission qualities** of the objectives in ultraviolet, visual and infrared round off the performance of the new class of Leica objectives.

The water immersion objectives for the DM LFS are optimised in terms of:

Optical parameters such as

- maximum free working distances
- high numerical apertures
- high transmission from UV to IR
- parfocality from UV through visual to IR
- best possible DIC with optimisation in the IR range
- extremely good suitability for fluorescence
- universal application potential in the whole Leica DM range



Design parameters and material properties such as

- extremely slender design
- largest possible access angle
- special ceramic material
- no interaction with the sample
- extremely good wettability

The DM LFS electrophysiological microscope for top level infrared microscopy

All the optical components of the DM LFS are optimised for infrared microscopy.

Tissue or brain sections to a thickness of several hundred microns can be optimally imaged with infrared illumination. That's why all the optical components of the DM LFS have been optimally adjusted to the near IR range of 700 – 1000 nm.

Because of the illumination type there are no IR-absorbing heat filters in the light path. Specially designed infrared filters provide excellent illumination, e.g. for a selected spectral range of 720 nm – 850 nm. The rest of the illumination and imaging light path of the DM LFS via the condenser, objectives and tube to the photoadapters has been completely optimised for infrared.

A special IR polariser and IR analyser and the infrared DIC prisms with finer beamsplitting allow extremely good resolution and ultra high contrast. Even in the thickest specimens the new Leica DIC prisms for IR applications deliver crisp and bright images.

Simultaneous viewing in fluorescence and UV transmission brings out the advantages of the new U-V-I objectives to the full. This applies to all the objectives in the entire series (10 x, 20 x, 40 x and 63 x).

Fluorescence and DIC together or separately in the whole range from 350 – 1000 nm are the best techniques to use for patch clamping. Dodt's gradient contrast technique can be applied and special illuminators can be individually adapted.

The documentation of the results via special IR video adapters shows that Leica has thought of everything here, too. A tube adapter with 2 ports (dichromatic beamsplitter) for Visual and Infrared directs the full light intensity to both cameras. The images are the same way round, i.e. not mirror-inverted – an advantage which is unique to Leica.

A parfocal magnification changer allows a further secondary magnification by a factor of 4 x in the infrared range without changing the objective.

To sum up, the name DM LFS stands for the first upright microscope for fixed stages which is specifically tailored to the infrared patch clamp user. Here, too, we were guided by our Leica mission:

Our mission is to be the world's first-choice provider of innovative solutions to our customers' needs for vision, measurement and analysis.

Leica Microsystems – the brand for outstanding products

Leica Microsystems Mission is to be the world's first-choice provider of innovative solutions to our customer's needs for vision, measurement, lithography and analysis of microstructures.

Leica, the leading brand for microscopes and scientific instruments, has grown from five brand names with a long tradition: Wild, Leitz, Reichert, Jung and Cambridge Instruments. Leica symbolizes both tradition and innovation.

Leica Microsystems – an international company with a strong network of customer services

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