Leica DM LS

Instructions

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The information contained in the following documentation represents the latest stage of technology and knowledge. We have composed the texts and illustrations with great care. However, as it is impossible to eliminate the risk of error completely, we cannot accept any kind of liability for the correctness of the contents of this manual. Nevertheless, we are always grateful to be notified of any errors.

The information in this manual may be altered without prior notice.

Contents

Important notes on this manual **7**

Assembly an description of components **8**
Site 8
Mains voltage, fuses 9
Assembly of components 10
Light sources, lamp change 16

Performance parameters **22**
Objectives, eyepieces 22
Tube system 25
Condensers 26

Operation **28**
Basic setting for transmitted light 28
Filters 30
Condensers 30
Phase contrast 34
Transmitted light darkfield 36
Transmitted light polarization 37
Fluorescence 38
Linear measurements 42
Thickness measurements 43
Object marker 44
TV microscopy 44

Care and maintenance **46**

Wearing and spare parts, tools **47**

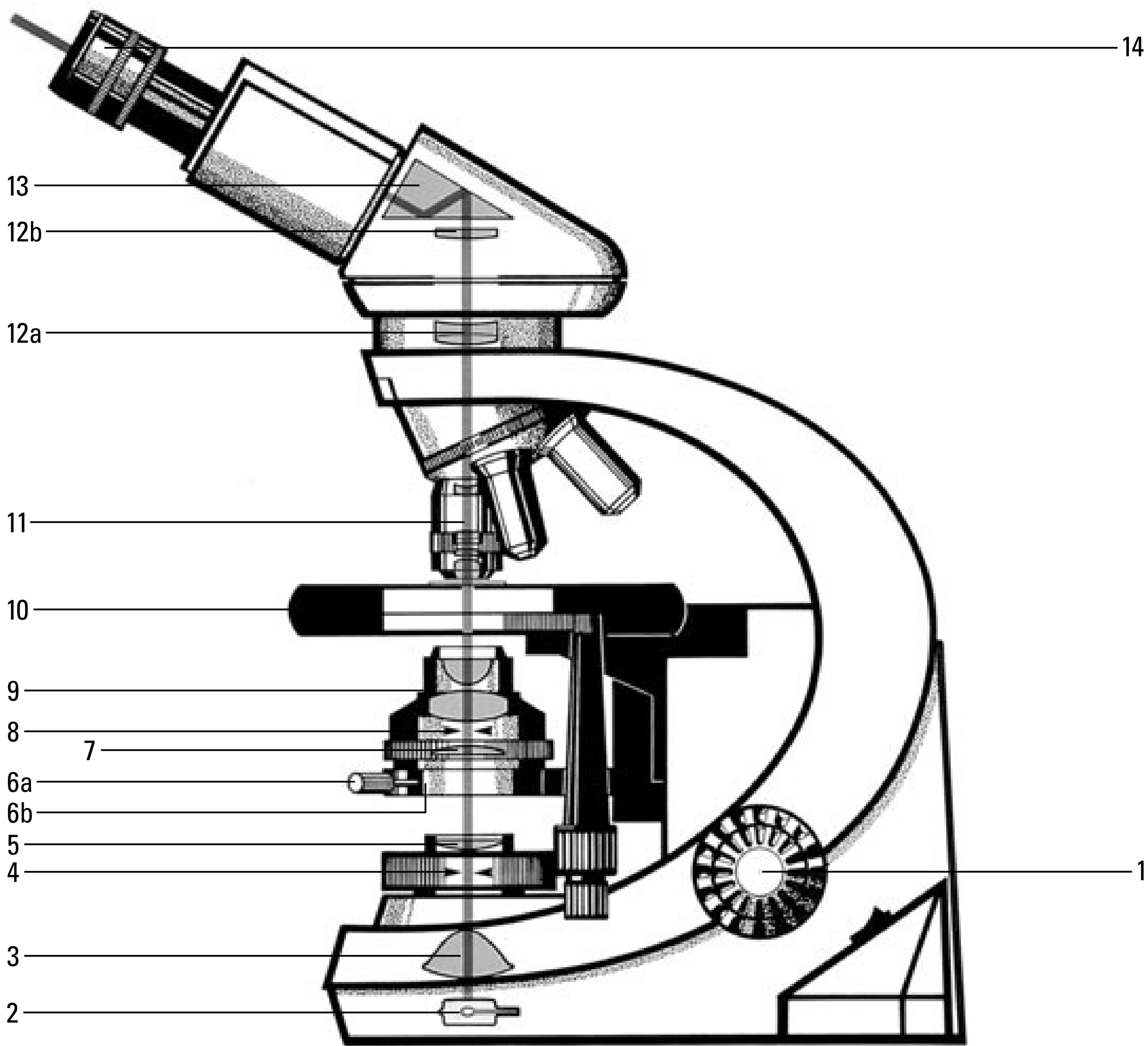
Supplementary information **48**

Index **52**

EU Conformity declaration **53**

General specifications

Main voltage:	230/115/100 V ± 10 %
Frequency:	50 – 60 Hz ~
Power consumption:	max. 40 W
For indoor use only!	
Operating temperature:	10 – 36 °C
Relative humidity:	0 – 80 % to 30 °C
Overvoltage category:	II
Contamination class:	2



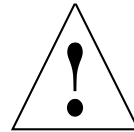
Cross section diagramm of DAS Mikroskop Leica DM LS

1 Coarse/fine focusing
2 Halogen lamp
3 Collector
4 Field diaphragm
5 Exit window in microscope base
6a Condenser lenses
6b Condenser clamp screw
7 Auxiliary lens LS
8 Aperture diaphragm
9 Condenser lenses
10 Microscope stage with specimen
11 Objective
12 Tube lens system
13 Deflecting prisms in tube
14 Eyepiece(s)

Important notes on this manual

The Leica DM L microscope series consists of several basic stands and a range of modular components allowing an almost unlimited variety of individual outfits.
Therefore this manual has been given a modular layout as well to show you other possible configurations besides your own. It applies to the microscope Leica DM **LS** and, together with the supplementary DM LSP manual, to the polarized light microscope Leica DM **LSP**.
This manual is devided into three main chapters:
Assembly, Performance parameters, Operation

The manual is multilingual. Due to the spiral binding you can turn the language you want to the front.
A foldable pocket-sized set of **brief instructions** is also available in various languages for the different basic stands, please consult your supplier.
A list of optics with key data on objectives, eyepieces, graticules and fluorescence filter cubes is also supplied with this microscope. It is constantly being updated.
Special manuals are delivered with some additional equipment such as microscope cameras, heating stages, and also in case of modifications. We also print extensive brochures on microscopy, which can be ordered, as can extra copies of this manual, from our agencies for a cover charge.



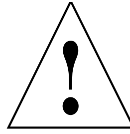
Attention:

This manual is an integral part of the product and must be read carefully before switching on and using the microscope!
It contains important instructions and information for safe operation and maintenance of the product and must therefore be kept in a safe place!

Text symbols and their meanings:

(1.2) Numbers in brackets, e. g. (1.2) refer to illustrations, in this example Fig. 1, pos. 2.

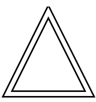
→ **p. 20** Numbers with an arrow, e. g. → p. 20, refer to a specific page in this manual.



Special safety information is marked at the edge by the lefthand symbol and highlighted by a grey background.

! This symbol means that incorrect operation can damage the microscope or its accessories.

Warning of hot surface.



Explanatory note.

* Item is not included in all variants of the microscope.

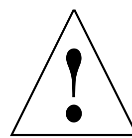
Assembly and description of components

Unpacking Documents

Please compare the delivery carefully with the packing note, delivery note or invoice. We strongly recommend that you keep a copy of these documents with the manual, so that you have information on the time and scope of delivery later when ordering more equipment or when the microscope is serviced. Make sure that no small parts are left in the packing material. Some of our packing material has symbols indicating environmental-friendly recycling.

Attention:

Important note! When taking the microscope out of its packing and putting it onto the desk take care not to damage the sensitive vibration-damping feet on the bottom of the microscope.



Attention:

Do not connect the microscope and peripherals to the mains yet! (→ p. 18 – 21).

Installation site

!

Attention:

Make sure that the workplace is free from oil and chemical fumes. Vibrations, direct sunlight and major temperature deviations have a negative effect on measurements and photomicrography. It is important to have a stable desk of the right height (70 – 80 cm). This and an ergonomically designed chair which can be adjusted in several positions are the basic prerequisites for fatigue-free microscopy.

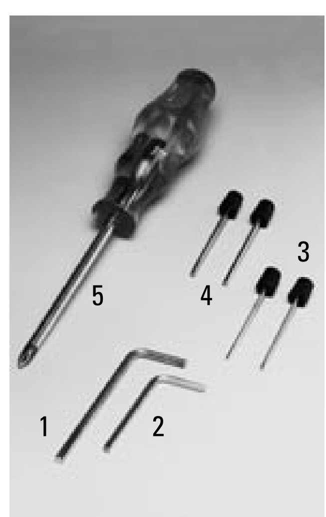


Fig. 1 Assembly tools
1 3 mm Allen key
2 2.5 mm Allen key (short)*
3 1.5 mm centering keys*
4 2 mm centering keys* for UCL/UCLP condenser
5 Crosstip screwdriver*

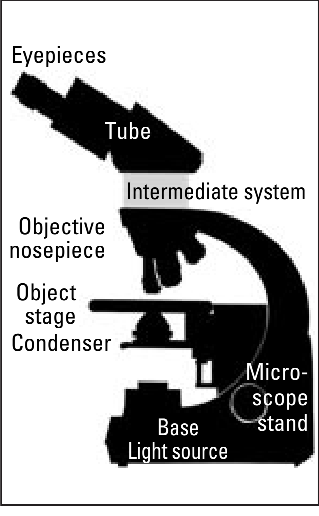


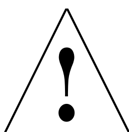
Fig. 2 The main microscope components

* not part of all outfits

Assembly tools

You only need a few ordinary screwdrivers to assemble your microscope. These are supplied with the delivery. Replacements for lost tools can be obtained from us or from a tool shop (Fig. 1, see list of spare parts, → p. 49).

Setting the mains voltage



Attention:

Make sure to check the voltage setting (230 or 115 or 100 V) on the back of the microscope (3.6) and correct if necessary:
Do not forget to disconnect from the mains (3.2)!
n. b.! The 100 V setting must **not** be used for 115 V!

Release the lock button (3.5) by pressure with a biro or pen and remove the fuse holder (3.4). Pull out the square module (3.6) and replace it so that the number of the desired mains voltage appears in the window (upside down).

Push fuse holder (3.4) back in until you hear the **locking button** (3.5) **click into position.**

Fuses

The two mains fuses (see spare parts list on p. 47, identical for all mains voltages) can be accessed after pressing the lock button (see 3.5, mains voltage).

Attention:

Never use other types of fuses!

Attention:

If using external lamp power units, always set the mains voltage as instructed in the special manual or use a series transformer, e. g. 115/230 V.

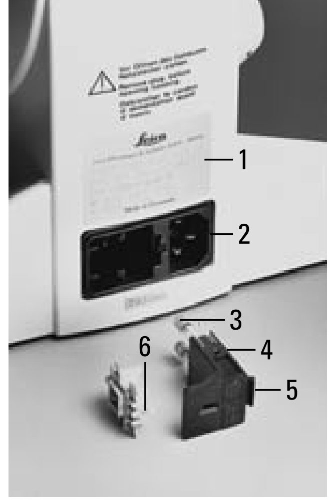
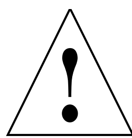


Fig. 3 Fuses and mains adaption
1 Nameplate
2 Mains connection
3 Mains fuses (2)
4 Fuse holder with window showing mains voltage
5 Lock button
6 Module for voltage setting

Fig. 4 Underneath the stand
→ Provision for ground connection

Safety



Attention:

To ensure that the microscope and accessories are in a perfectly safe condition, please note the following advice and warnings: The mains plug must only be inserted into a grounded outlet. If an extension cord is used, it must be grounded as well. Using the connection on the base plate (Fig. 4), any accessories connected to the microscope which have their own and/or a different power supply can be given the same ground conductor potential. Please consult our servicing personnel if you intend to connect units without a ground conductor.

Attention:

The instruments and accessory components described in the manual have been tested for safety or possible hazards. It is essential to consult your Leica agency or the main factory in Wetzlar before carrying out any operations on the instrument, modifications, or combination with non-Leica components not dealt with in this manual.

Transit protection

! **Attention:**

The sensitive focus drive is only automatically protected from damage during transport in its original packing. If the packing is no longer available or greatly damaged, the vertical stage movement must be blocked by putting hard foam rubber padding above and below the stage for longer periods of transport. Objectives, condenser, tube and intermediate systems should be disassembled.

Tubes and intermediate systems

The tube is adapted to the stand direct (Fig. 23) or via mediate systems (Fig. 31). Tubes and intermediate systems are secured with the lateral clamp screw (27.3):
Loosen clamp screw (27.3) slightly if necessary with Allen key (1.1). Insert the tube or intermediate system into the circular mount (dovetail) and align by rotating (viewing port to the front). Pol components may have a clickstop device (pin).

! **Attention:**

Make sure that components do not jam each other. Retighten clamp screw (27.3).

When combined with other intermediate systems, the fluorescence illuminator (Fig. 31) is always assembled underneath (i. e. **directly onto the microscope stand**). The number and type of usable intermediate systems is limited, → p. 25 – 26.
Besides tubes from the DM L range (Fig. 35), it is also possible to adapt tubes from DM R research microscopes (Fig. 36) using the R/L adapter (36.2).
The Ergo module (36.3) is for raising the viewing port by 30 mm (or 60 mm if two are used).

Eyepieces

For direct visual observation. If you are wearing glasses, pull off the glare protection (5.7), as it may prevent you seeing the whole field of view. Only use Leica **HC** PLAN eyepieces.
Exceptions: Widefield 16x/14 B and 25x/9.5 B eyepieces, from the range of Leica AG Heerbrugg/CH, for which a special adapter ring is required, which is pushed onto the eyepiece (6.2).
Always make sure the pair of eyepieces have identical magnifications and field of view numbers, e. g. 10x/20! Further important information → p. 23 – 27.

Assembly of graticules*

Only possible for eyepieces with adjustable eyelens = M type (5.4).

Fig. 5 Eyepieces
1 – 4 Eyepieces ready for use by viewers without eyeglasses (anti-glare protection 10 mounted or pulled up), **5** PHOTO eyepiece, **6** 10x/**25**M eyepiece disassembled, **6** Upper part, **7** Lower part, screwed off (applies also for 10x/22M, 12.5x/16M, but not for 10x/20 and 10x/20M), **8a, b** Retainer ring for eyepiece graticules, can be screwed out, **9** Eyepiece graticule*, **10** Anti-glare protection, removed for viewers wearing eyeglasses (it can be pushed back with eyepieces 10x/20 and 10x/22, insertable and remove pos. 8a or 8b). The **12.5**x/16M model is basically the same as the 10x/25M eyepiece.

! **Attention:**

Important: Be extremely careful to avoid dust and fingermarks, as these will be visible in the field of view. The graticule diameter is always **26** mm for HC PLAN eyepieces.
10x/25 and 12.5x/16 eyepieces only:
Screw the retainer ring out of the underneath of the eyepiece (5.6).
10x/22 and 10x/25 eyepieces only:
Screw out the bottom part of the eyepiece (5.8) and screw out the retainer ring with a blunt blade. Insert the graticule with the coated side downwards (in the direction of the objective) so that any lettering is seen the right way round when later observed in the viewing direction.
Screw the retainer ring and the bottom part of the eyepiece back in. The eyepiece can be used both with and without spectacles. When wearing spectacles, pull off or push back the anti-glare protection (5.7), as otherwise part of the field of view may not be visible.

Fig. 6 Widefield 16x/14 B eyepiece
1 Clamp screw, **2** Space ring for Leica microscopes (must be pushed upwards as far as the stop)

Photoeyepieces*

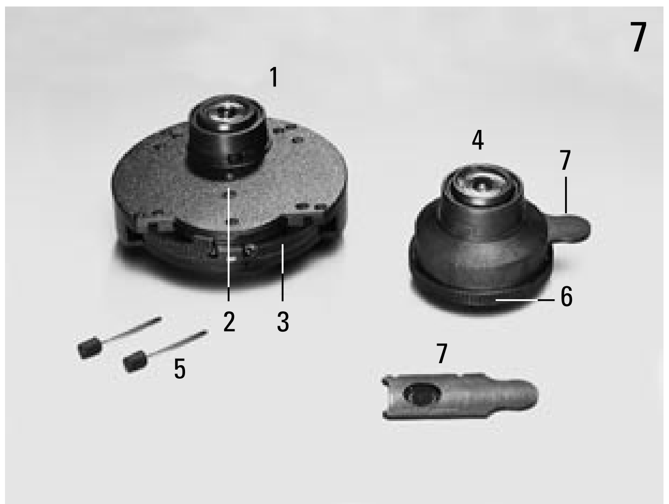
The HC PLAN observation eyepieces (fitting diameter 30 mm) are designed for direct visual observation only. Special eyepieces with fitting diameter of **27 mm** and the engraving **HC...PHOTO** are used for the adaption of photomicrographic equipment with a fixed magnification factor, e. g. MPS systems and for special TV adaption systems (Adapter 36.4).

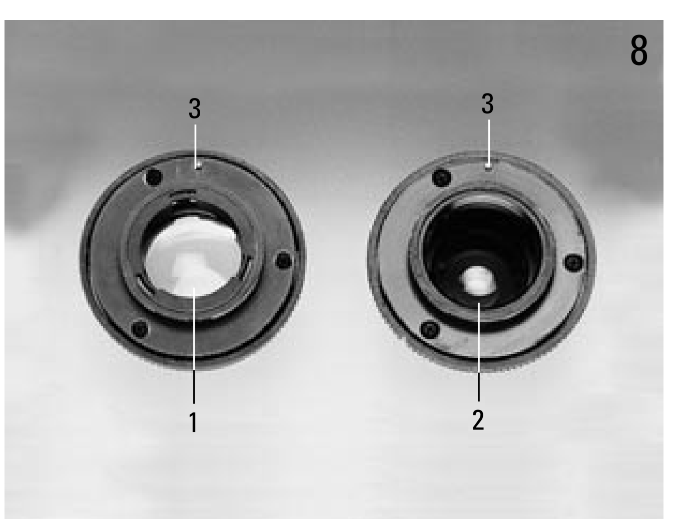
Fig. 7 Condensers UCL 0.90/1.25 OIL (1) and CL/PH 0.90/1.25 OIL (4)
The CLP/PH 0.85 and UCLP 0.85 condensers required for polarisation look very similar to the CL/UCL, but are not intended for oil imersion (Engraving **P** 0.85)
1 UCL 0.90/1.25 OIL, **2** Fixing screw (disc axis), **3** Condenser disc, **4** CL/PH 0.90/1.25 OIL, **5** Centering keys, **6** Auxiliary lens for DM LS/LSP, **7** Slide with light ring DF or PH or diffusion screen for using the 2.5x objective or λ compensator

Fig. 8 Underneath of condenser, with (1) and without (2) auxiliary lens LS (2), **3** Orientation pin

Fig. 9 Fitting the UCL condenser disc
1 Condenser disc, **2** Light ring for darkfield or phase contrast (or λ or λ/4 compensator), **3** Centering screws, **4** Axis, **5** Centering keys, **6** λ or λ/4 compensator, **7** 2.5x . . . 20x auxiliary lens

Fig. 10 Assembly of the condenser (does not apply for versions with fixed condenser). The stage was disassembled to give a clearer picture
1 Condenser height adjustment, **2** Orientation groove and pin (→ 8.3), **3** Clamp screw, **4** Condenser centration





Condensers CL/PH and CLP/PH, UCL/UCLP

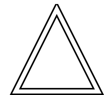
If the condenser is not yet complete, the following components* may have to be fitted before the condenser is adapted to the microscope (Fig. 10). For polarisation the strain-free Pol versions CLP/PH 0.85 or UCLP 0.85 are necessary.
The full name of the condenser has the suffix S 1. This signifies that the condenser is intended for use with specimen slides of ca. 1 mm thickness. To be more precise (as per DIN/ISO) 1.0 to 1.2 mm.

Achromatic condenser A 0.9 (P)

The condenser can be used on both the DM LS and on the DM LB up to fov 22.
Objectives with magnification < 10x should be used with the aperture diaphragm open. This also applies to objective 1.6x, which can also be used up to FOV 22 if the slider with the frosted disc is used.
Objectives with magnifications < 10x are used with the condenser head folded out, magnifications of 10x upwards (up to 100x) with the condenser head folded in.
If the appropriate sliders with light rings are used, the condenser can be used for the following illumination methods:

- Dark field (DF) up to objective aperture 0.7
- Phase contrast (PH 1, PH 2, PH 3)
- Polarisation (P)

Auxiliary condenser lens LS

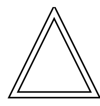


Unlike the microscope series DM L, the DM LS and DM LSP microscopes require the auxiliary lens LS (7.6) to be pushed into the bottom of the condenser. If this lens is not fitted, it may not be possible to obtain exact Koehler illumination, → p. 30.

Condenser disc*

Condenser discs* (7.3; 9.1) can be inserted into condensers UCL 0.90/1.25 OIL (7.1) and UCLP 0.85 for certain illumination techniques (darkfield = DF, phase contrast = PH, polarisation contrast = whole- and quarter-wave compensator, and the lens for the 2.5x objective).
To remove and assemble the disc, screw out the screw (7.2; 9.4) completely. Light rings and Pol components will normally have been already inserted at the factory; if you should need to assemble them yourself: turn back the centering screws (9.3) with the centering keys (7.5) until the **light rings,** whole- and quarter-wave compensator* and lens* 2.5x (Fig. 7 and 9) can be inserted.

Light rings for condenser disc



The somewhat larger hole is for brightfield observation (= BF), the smaller ones for light rings or whole-/quarter-wave compensators. If you use a smaller hole for brightfield, the maximum illumination aperture cannot be used.
The lettering (e. g. DF, PH 1 . . . , λ) must point **upwards,** the whole- and quarter-wave compensators must be inserted with the correct orientation: the notch must point towards the centre of the disc! The lettering of the components should tally with the marking at the opposite position (outer edge of the disc). Tighten the centering screws (9.3; 9.5) until the components are roughly in the center of the holes.

Lens and diffusing screen for 2.5x objective*

For observation with the 2.5x objective, a special adaptation lens (9.7) must be inserted into one of the holes in the condenser disc. This lens is not

available for condensers CL/PH and CLP/PH. A diffusing screen (similar to 7.7) is inserted instead; polarized light is not possible with this screen.

Slide with light ring or λ compensator*

Slides with light rings DF, PH to PH 3 diffusing screen or λ compensator can be slotted into the CL and CLP condensers from the right (7.7).

Fixing the condenser

Raise the specimen stage as far as the stop (11.2). Lower the condenser carrier using the drive knob (11.1, can be operated on both sides). Remove filter holder or polarizer (11.4; 12.3) if present.

Slightly loosen the clamp screw (10.3) so that the condenser can be inserted from the front. The adjustment range of the aperture diaphragm (23.7) should face the front. Make sure the guide pin clicks into the slot! Do not turn the clamp screw (10.3) too tightly!

Object guide*

Assemble using the two clamp screws. The delivery either includes the version for 2 specimen slides (13.1) or the one-hand object holder for 1 specimen slide (26 mm x 76 mm) (13.2).
A rotatable object guide (13.3) is also available. Pol object guide and specimen clips → supplementary manual for DM LSP.

Objectives

Always only use Leica objectives of tube length ∞ (infinity) with M25 thread! It is customary, although not essential, to arrange the objectives so that the magnification increases when the objective nosepiece is rotated counterclockwise. Lower the specimen stage as far as possible before assembling the objectives.

! **Attention:**

Close vacant threads in the nosepiece with dust protection caps (code no. → p. 47)!

Further information → p. 22 – 24.

Fig. 11 Filter magazine
1 Condenser height adjustment, **2** Focusing, **3** Switching lever with adhesive label, **4** Guide catch for clicking into stand

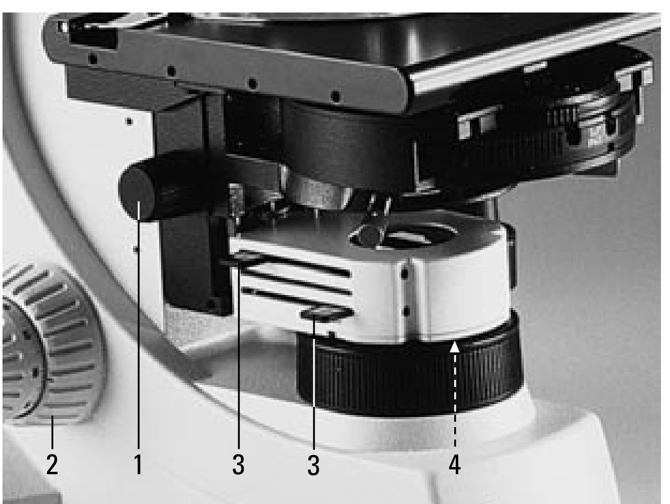


Fig. 12 Filter holder, polarisers
1 Analyser, **2** λ or λ/4 compensator, **3** Polarizer, **4** Filter holder

Filter magazine*/Filter holder*

Set the specimen stage and the condenser at the top position (11.1; 11.2). Push the filter magazine (11.4) or filter holder (12.3) onto the base of the microscope and align by rotation (not for DM LSP!).
Filter magazine only: Lift the back of the magazine slightly and rotate until the catch (11.4) clicks into the stand at the front, then push the magazine towards the back so that its position is fixed. Apply adhesive filter labels to switching levers.

Fluorescence filter cube*, assembly

Pull the filter slide (31.10) out of the illuminator. Lift off lid (14.1). Insert filter systems (max. 2) as follows:

! Attention:

Take care to avoid making finger marks.
The lettering of the filter system, e. g. A 513824 (14.5) must point to the front, so that the dovetail mount (14.5) points downwards.

! Attention:

Put the filter system onto the round steel rod (14.2) so that the curved laminated spring snaps into position. If you try **tilting** the whole slide, the filters must not fall out.

Inserting the filter slide*

Replace the lid (14.1) and rotate the slide until the side **without** a hole faces you. Push the slide in to the illuminator from the left or the right (Fig. 39).
Stick the adhesive labels corresponding to the filter system, e. g. A, outside on the slide or the fluorescence illuminator. Use of adjustment lens (14.4) → p. 39, the enclosed metal plate (25.5 and 31.11) → p. 16.

Fig. 13 Interchangeable object holders*
1 for 2 specimens 26 mm x 76 mm, **2** One-hand object holder for 1 specimen, **3** Mountable rotary stage

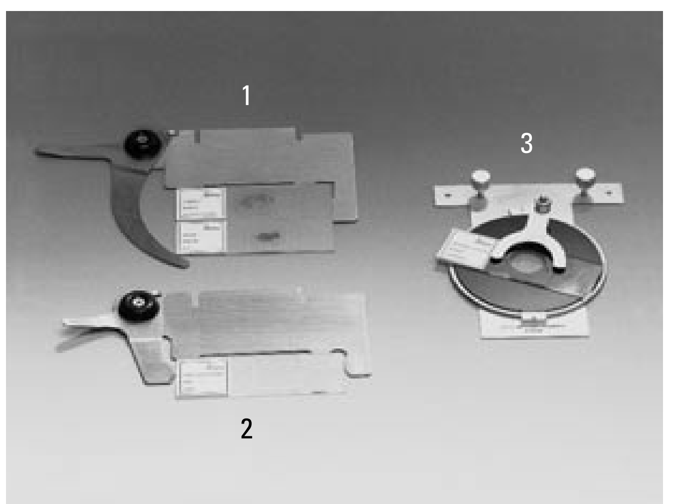
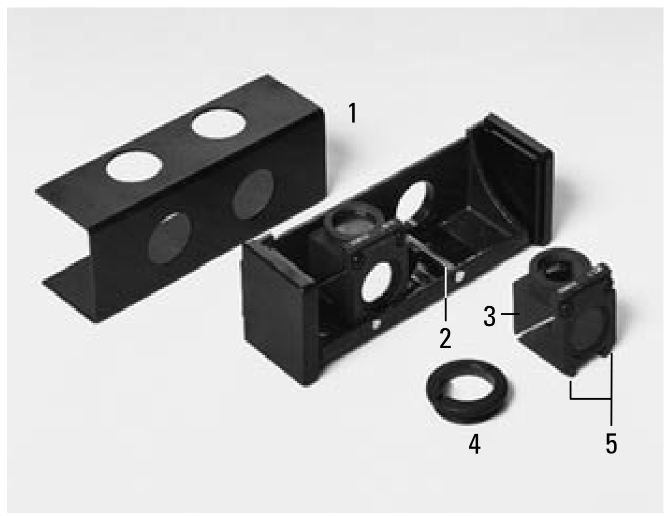


Fig. 14 Assembly of fluorescence illuminator*
1 Lid, **2** Steel rod and spring, **3** Filter system, **4** Adjustment lens F, **5** Dovetail in filter system



Light trap*

Put the metal plate (25.5) between the two stage plates (31.11). For fluorescence only.

Adjustment lens*

Screw the adjustment lens (14.4) for adjustment of the fluorescence lamp → p. 40, into the nosepiece in place of an objective.

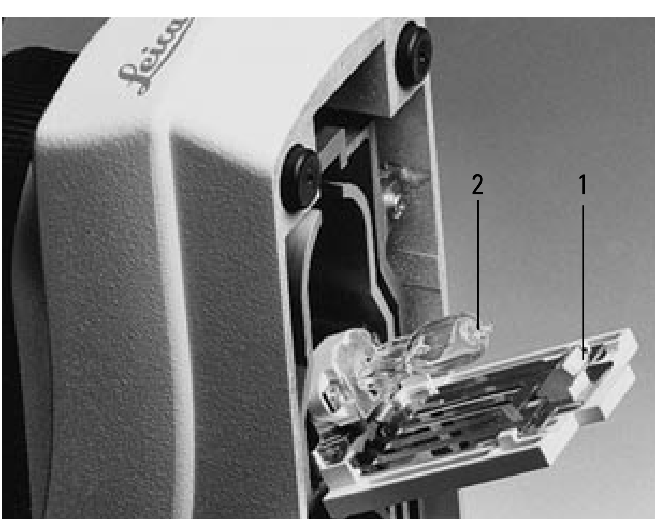
Photomicrography*

In general a trinocular tube (Fig. 35 and 37), a PHOTO eyepieceadapter tube (36.4) and HC PHOTO eyepieces with a fitting diameter of 27 mm are necessary for the adaption of photomicrographic devices. Unless the photomicrographic equipment is fitted with a special viewing port with format outlines, HC PLAN **M** eyepieces, i. e. with focusable eyelens (5.4) and inserted photo graticule have to be used in the binocular port. See the manual supplied with the photographic equipment for further details.

TV adaption*

→ p. 44

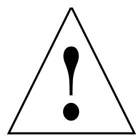
Fig. 15 Transmitted light illumination in microscope base
1 Lock, **2** Halogen lamp



Lamp change transmitted light

The transmitted light illumination with low-voltage halogen lamp is integrated in the microscope base and accessible from the underneath of the microscope (15.2).

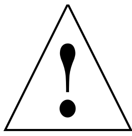
Data of replacement lamp → nameplate on back of instrument (3.1) and p. 47.



Attention:

Unplug the connecting cable from the back of the instrument (3.2).

Tilt the microscope back carefully. Push the base flap (15.1) in the direction of the back of the microscope and flip up.



Caution!

The lamp may still be hot! Pull out lamp.

! **Attention:**

Without removing its protective covering, put the new lamp into its base as far as the stop, make sure it is **not at an angle!** Remove protective covering. If there are any finger marks on the lamp or illumination lens, wipe them off immediately with a clean cloth!

The lamp does not need readjusting.
Inhomogeneous illumination is possible if the lamp has been inserted at an angle or if cheap lamps are used.

Illuminating mirror

→ p. 49 (Fig. 38)

Light sources for incident light fluorescence*

The Leica DM LS microscope can be equipped for incident light fluorescence with a 12 V 100 W halogen lamp, or preferably, due to the considerably brighter image obtained, with mercury and xenon gas discharge lamps (Fig. 16 – 20), each with a separate power unit.

Lamphousing 106, 105/2, 107/2 and 107

Only for 12 V 100 W halogen lamp (centerable in x and y direction), focusable, aspherical collector. Without reflector, with grooved diffusing screen, heat-absorbing filter (Fig. 16 and 29). Lamphousing 105/2 or 107/2: like LH 106, but without lamp and collector adjustment.

Lamphousing 106 z

Like lamphousing 106, but with centerable and focusable reflector and 4- or 6-lens collector (Fig. 18). Quartz collector on request.
The following lamps, each with their own special holder (Fig. 19 and 20) are possible:

- 12 V 100 W halogen lamp, alternating current
- 50 W Hg ultra high pressure lamp, alternating current
- 100 W Hg ultra high pressure lamp, direct current, non-stabilized
- 100 W Hg ultra high pressure lamp, direct current, stabilized
- 75 W high pressure xenon lamp, direct current, stabilized

Assembly

Before assembling to the microscope, check if the lamps have already been inserted (Fig. 16, 18, 20).

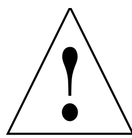
! **Attention:**

When adapting LH 106 and 105/2 or 107/2 and 107, 12 V 100 W halogen and LH 106 z, Xe 75/Hg 100 stabilized it is essential to put the filter holder (Fig. 17.6) in between, as otherwise the lamphousing knocks against the microscope stand; the filter holder is not absolutely necessary for LH 106 z with 12 V 100 W halogen, Hg 50 and Hg 100 non-stabilized.

The lamphousing and filter holder are secured with the lateral clamp screw (17.5 and 17.7) using the Allen key (1.1). Screw tight and check that the lamphousing is firmly in position.

Power units*

Different power units are required for the various types of lamp. Some of these vary from country to country, see separate instructions.



Attention:

Do not connect until the lamps have been assembled → p. 18 – 21. Check the mains voltage setting and correct if necessary or use a series transformer, e. g. 100/230 V.

Spare lamps

Code nos. → p. 47.

Lamphousing 106* and 107, halogen lamp

Disconnect from power supply (external power unit).
Unscrew screw (17.1) and remove cover.
Move the collector to the front (17.4; 16.2, does not apply for LH 105/2 or 107).

Remove the defect lamp and put a new 12 V 100 W halogen lamp into the lamp holder without tilting (16.1).

! **Attention:**

Leave the protective covering on the lamp until it is in its holder. Avoid making fingerprints on the lamp or wipe off immediately.
Close the lamphousing (17.1).

Lamphousing 106 z*, halogen lamp

Disconnect from power supply (plug).
Loosen screws (18.4 and 18.9) with crosstip screwdriver. Pull cut-out plug (18.11) slightly out of socket (18.1) and flip up lid.
Unscrew screws (18.10) on the lamp holder and pull out the lamp holder (Fig. 19). Remove defect lamp and insert new 12 V 100 W halogen lamp.

! **Attention:**

Leave the protective covering on the lamp until it is in its holder! Avoid making fingerprints or wipe off immediately.

Fig. 16 Lamphousing 106*, opened
1 12 V 100 W halogen lamp in holder, **2** Collector, **3** Diffusing screen

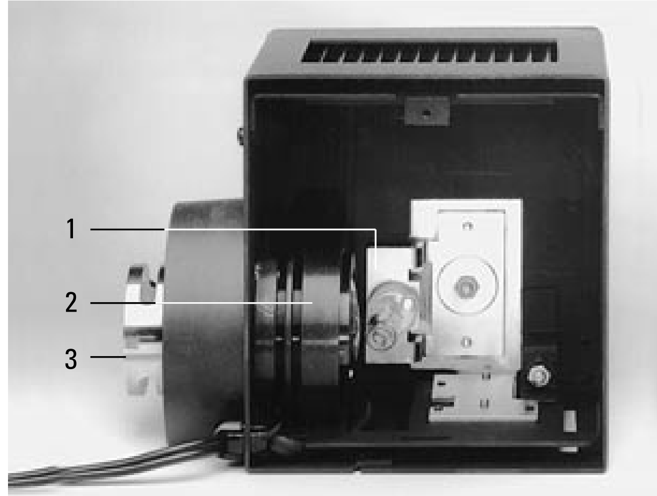
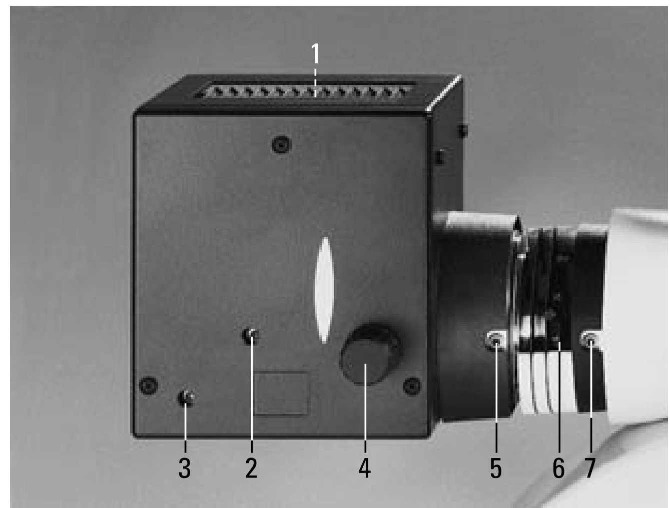
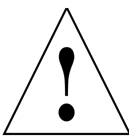


Fig. 17 Lamphousing 106* and filter holder* for filters Ø 50 mm
1 Screw to open the lamphousing, **2, 3** x and y centration of lamp*, **4** Collector focusing, **5, 7** Fixing screws, **6** Filter holder (spacer) for filters Ø 50 mm



Lamphousing 106 z*, Hg and Xe lamps

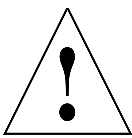


Attention:

Danger: the following information is extremely important and should be adhered to under all circumstances:
Always unplug the power unit from the mains before assembly work is carried out.
Wait for the lamphousing to cool down before opening (at least 15 min.). Danger of explosion!
Never touch glass parts of the burner with your hands. Remove any fingerprints or dust carefully (perhaps using alcohol).
Adjust lamps immediately after ignition (→ p. 39).

! **Attention:**

Avoid switching on and off frequently, as this can impair the stability of the lamp and shorten its life.
Hot Hg lamps cannot be reignited until they have cooled down. We recommend that you let new burners burn in for several hours without interruption if possible.
It is a good idea to keep a record of the hours the lamp is in use and to compare with the manufacturer's specifications. Replace discoloured, spent lamps. Set hour counter on power unit at "0".
We cannot accept any liability for damage resulting from a lamp explosion.



Attention:

Always wear safety clothing (gloves and face mask) when assembling Xe burners (danger of explosion).

Fig. 18 Lamphousing 106 z*
1 Lid, flipped up, **2** Collector, **3** 12 V 100 W halogen lamp with holder or gas discharge lamp (see Fig. 20), **4, 9** Lid screws, **5** Reflector, **6, 8** x/y centering of reflector, **7** Reflector focusing, **10** Screws for lamp socket, **11** Socket for cut-out plug

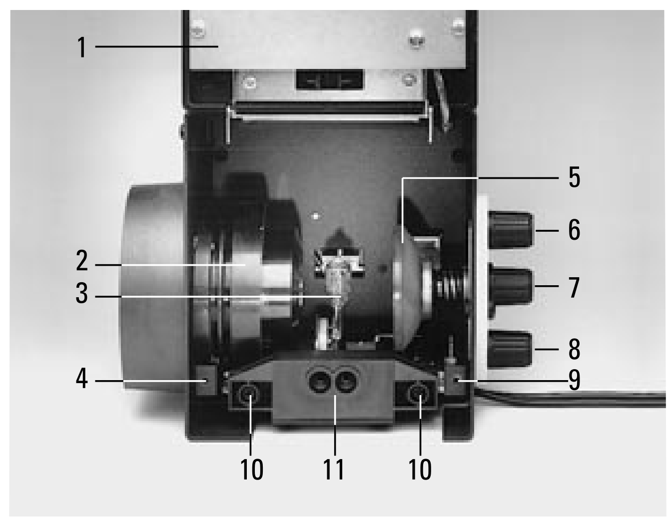
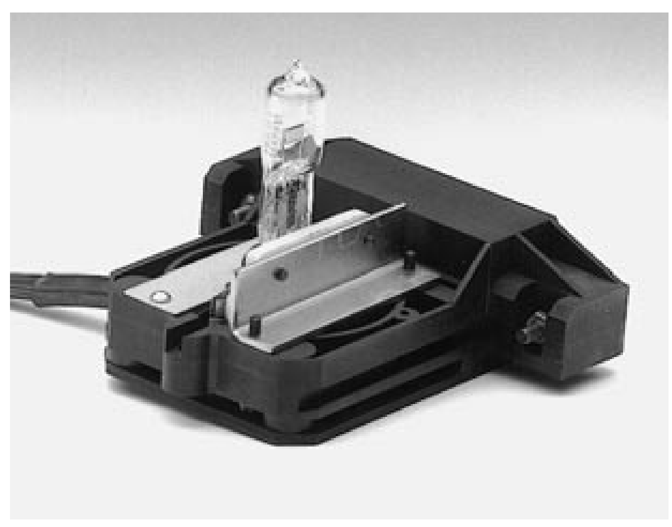
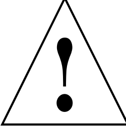


Fig. 19 12 V 100 W lamp holder (LH 106 z only)



! **Attention:**

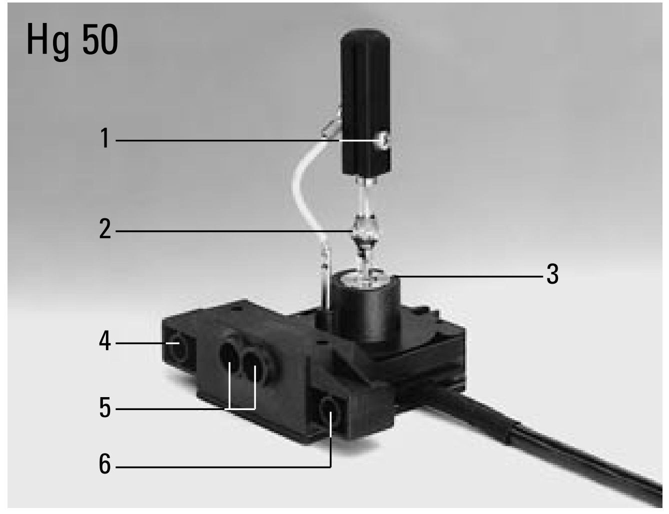
Protect movable interior parts with foam rubber or similar in case of shipment.
To open lamphousing 106 z: undo screws (18.4). Pull the cut-out plug slightly out of the socket (18.11) and flip up the lid of the lamphousing.
Undo the screws (18.10) on the lamp holder and remove the holder (Fig. 20). Remove the spent burner by loosening the clamp screws (20.1 and 20.3).

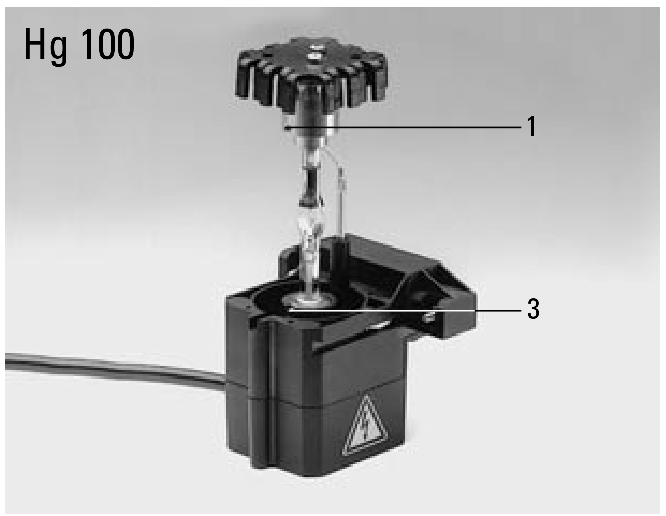


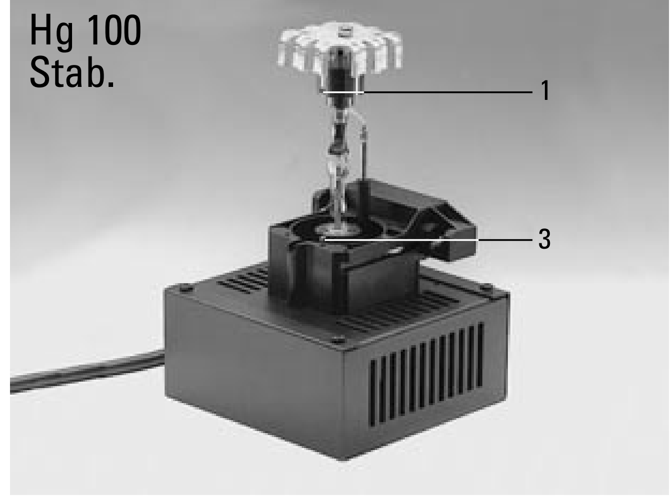
Attention:

Insert burner as follows, adhering strictly to the above safety information:
Do not remove the protective covering yet (20.7).

Fig. 20 Lamp holders for gas discharge lamps*
1 Upper clamp, **2** Seal point of the burner, **3** Lower clamp, **4, 6** Drillholes for fixing the holder, **5** Sockets for cut-out plug, **7** Protective cover







Lamphousing 105 z*, Hg and Xe lamps

Always insert the burner so that

Attention:

1. the lettering is upright after insertion (different diameters of the metal base for the Hg 100 and Xe 75 burners ensure that these are always inserted the right way up).

2. If the lamp bulb has a seal point (20.2), turn the burner so that this point will be at the side, not in the light path.

Apart from the halogen lamp the following gas discharge lamps can be used, all requiring different lamp holders (Fig. 20) and power units:

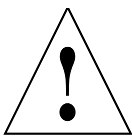
Type		Average life
Hg ultra high pressure lamp	50 W (alternating current)	100 h
Xe high pressure lamp	75 W (direct current, stabilized)	400 h
Hg ultra high pressure lamp	100 W (dir. curr., stabilized, non-stabilized)	200 h
Hg ultra high pressure lamp	100 W (dir. curr., stab., non-stab., type 103 W/2)	300 h

Put the upper pin of the burner between the clamps of the flexible power supply and clamp with screw (20.1).
Unscrew the stud (20.3) in the holder slightly, insert the lower end of the metal base and retighten the stud.

Exchanging the collector on lamphousing 106 z:
Move the collector to the rearmost position with the focusing knob (17.4; 16.2). Pull the focusing knob of the collector outwards. The collector can now be removed.

! **Attention:**

Make sure that the lamp base and the power unit have the same number. If the lamp base is marked L 1, for example, L 1 must also be set on the power unit to make full use of the lamp and not to shorten its life.
Move the collector to the front position with the focusing knob (17.4; 16.2).

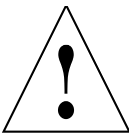


Attention:

Remove the protective covering from the burner (20.7).

! **Attention:**

Put the lamp holder with burner inserted into the lamphousing and secure with the screws (18.10). Try moving the collector (17.4): it must not touch the power lead. When closing the lamphousing make sure that the pins of the cut-out plug engage in the sockets (18.11). Retighten the screws of the lid. Push the cut-out plug in as far as it will go.
Attach the lamphousing to the microscope (17.5) and connect to the power unit (compare mains voltage!).



Attention:

Adjust burner immediately after ignition → p. 39

Performance parameters

Due to basic physical principles and the physiology of the human eye, all imaging techniques, not only the microscope, are subject to limitations in performance. For proper use of the DM LS microscope you should therefore know and observe the following information.

Tube length

The DM LS microscope series is based on tube length ∞ (infinity) and a focal length of the tube lens of f = 200 mm. Therefore, only objectives with the engraving ∞ (Fig. 21) and M25 thread may be used.

Objective lettering

Examples (see also Fig. 21) and meaning of the symbols:

∞/–	**∞/0.17**	**∞/0/D**
C PLAN 10 x/0.22	**C PLAN 40 x/0.65**	**N PLAN 50 x/0.75**

∞

Objective for infinite tube length (∞).

–

The objective can be used **with and without** coverglass.

0.17

The objective may only be used **with** a coverglass of the standard 0.17 mm thickness. Use without coverglass or with a coverglass of a very different thickness will result in a distinct drop in performance, especially for objectives with high apertures.

0

Use **without** a coverglass, e. g. for cell smear specimens.

Fig. 21 Examples of objectives
1 Brightfield objective, **2, 3** POL objectives, **4** Phase contrast immersion objective, **5** Immersion objective with iris diaphragm, **6** CORR objective for inverted microscopes
Some immersion objectives **with** a knurled ring have front part which can be pushed up and "locked" with a small rotational movement. This device must be unlocked for observation! The sleeve of PL FLUOTAR and PL APO objectives can be rotated so that the engraving can be read more easily.

D (or A, B, C)

Pupil position of the objective (not of importance for the user of a DM LS microscope).

Objective type (performance class):

C, C PLAN

Achromat

N PLAN

Planachromat

HC PL FLUOTAR®

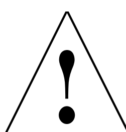
Semiapochromat

HC PL APO

Planapochromat

10 x/0.22

Magnification and aperture. The aperture (pick-up angle) influences resolution, field depth, contrast and brightness. Objectives with a built-in iris diaphragm are engraved with their maximum and minimum aperture, e. g. 0.85-0.55 (Fig. 21).



Attention:

Objectives with built in iris diaphragm! The knurled ring is only for operation of the diaphragm and **not** for screwing this objective in or out! Danger of damage!

OIL, W, IMM

Immersion objectives for: oil, water, universal (oil, water, glycerine, etc.), → p. 33. Safety data sheet on request.

PH

PH = phase contrast objective, the corresponding light ring in the condenser is also indicated, e. g. PH 2.

P, POL

Strain-free objective for quantitative polarized light microscopy.

Eyepieces

Our product range comprises the following eyepieces:

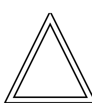
Leica eyepiece type	Magnification/ field of view number	Eyepiece port+)
Eyepieces for observation		
HC PLAN	10 x/20	👓 M
HC PLAN	10 x/22	👓 M
HC PLAN	10 x/25	👓 M
HC PLAN	10 x/20	👓
HC PLAN	10 x/22	👓
HC PLAN	12.5 x/16	👓 M
Widefield++)	16 x/14 B	👓 M
Widefield++)	25 x/9.5 B	👓 M

Necessary for widefield eyepieces 16x and 25x: space ring (6.2).

+) 👓 = with removable or push-back glare protection: for use with or without glasses

M = adjustable eyelens (dioptre compensation) and mount for graticules of 26 mm diametre → p. 11.

Eyepiece tube diameter: 30 mm.



The eyepiece type LEITZ PERIPLAN® may not be used! Eyepieces of the earlier type **L** PLAN may only be used with earlier-type eyepieces (before 1998) which do **not** have the **HC** engraving, → p. 48 (Fig. 35 – 37).

++) Products of LEICA AG Heerbrugg/CH (formerly WILD)

Photo eyepieces and eyepiece adapter tubes

Not for visual observation, only for adaptation of Leica DM LD and MPS photomicro systems, mounting diameter 27 mm, together with special eyepiece adapter tube (36.4).

HC eyepiece 10 x/16 PHOTO
HC eyepiece 12.5 x/13 PHOTO

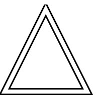
Eyepiece adapter tube HC
for eyepiece HC 10x/16 PHOTO (MPS)
Eyepiece adapter tube HC
for eyepiece HC 12.5x/13 PHOTO (MPS)
Eyepiece adapter tube HC
for DM LD (10x and 12.5x)

Eyepiece field of view number

For certain microscope configuration certain eyepiece field view number must not be exceeded (see below), e. g. 20. If the maximum field of view is exceeded, there may be a disturbing loss of definition or vignetting at the edge of the image, see following pages!

The eyepiece field of view (fov) stands for the diameter of the intermediate image in the eyepiece in mm, i. e. the diameter of the circular diaphragm which defines the image format and which lies roughly in the center of the eyepiece.

This fov is indicated on the eyepiece after the magnification, e. g. 10x/20.



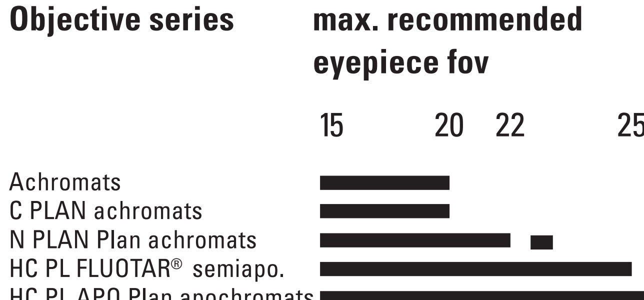
The maximum admissible eyepiece field of view number of certain configuration is derived from the following instrument data:

Field performance of objectives → **p. 24**
Field performance of intermed. module(s) → **p. 25**
Field performance of tube → **p. 25**
Illumination of condenser → **p. 26**

The decisive value is always the smallest. If, for example, the intermediate modules (see below) only allow the field of view number 20, but the objectives and tube 25, the maximum field of view number for the eyepieces is 20. Eyepieces with the field of view number 25 can lead to vignetting. In detail, the following applies:

Field performance of objectives

The engraving on the objectives does not include their field performance. It can vary slightly within a class of objective, e.g. the lower objective magnifications may well have higher values than the approximate values given below:



Field performance of intermediate modules

The maximum admissible field performance of the intermediate modules is derived from the type designation listed in the following table and also on your invoice. Each type designation consists of 2 values separated by a slash, e. g. Ergomodule **2/25**.

The first value (**2** in our example) is a relative measure (height index) of the overall height of the module. If this height index is multiplied by the factor 15, the distance by which the viewing port or the overall height of the microscope is raised is obtained in **mm.** The second value (25 in our example) is the maximum possible field of view number possible with this module.

Example: Ergomodule L **2**/25.
The viewing port is raised by 2 x 5 = 30 mm (approx. value).
Maximum possible fov = 25.

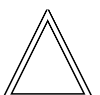
Ergomodule L 2/25
Magnification changer L 3/25
Pol module (intermediate tube) L 4/25
Tracing device L 3/20
Dual-viewing attachment L 3/20 (2 viewers)
Multi-viewing attachment MD L 3/20 (max. 5 viewers)
Illuminator LFS 4/20 for fluorescence
Universal illuminators LU/LUP 4/25 for incident light techniques

Field of view no. of tubes

The type designation contains three-digit combination of numbers which indicate the maximum admissible eyepiece fov number, e.g. Binocular tube HC LB **0/3/4** incl. HC PL + HCX PL models.
The numbers have the following meanings (→ table on p. 26):
the numbers **0/3/2** indicate the maximum permissible height index of the intermediate modules (see section on field performance at the top of this page) for the eyepiece field of view numbers **25, 22 and 20** (→ p. 24).
That is to say, in the above example:

1st number (**0**): Fov 25 is only possible if the tube is directly attached to the microscope, i. e. **without** an intermediate system.
2nd number (**3**): Fov 22 can only be obtained up to height index **3**, e. g. magnification changer L **3**/25 can be used.
3rd number (**4**): Fov 20 is possible up to a maximum height index of **4**, e. g. **2** Ergomodules L **2**/25.

If there is dash instead of number, e. g. –/–/7, it means that the tube cannot be used for the corresponding field of view at all, i. e. in the example not for fov 25 and 22, while fov 20 is possible up to index **7**.



Overstepping the admissible values can cause vignetting (shading at the edges of the image) with some objectives.
HC engraving: Only eyepieces of the type **HC** PLAN and widefield 16x and 25x (→ p. 11 and 24) can be used.

Further examples:

0/4/4

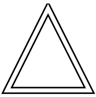
Fov 25 only possible if tube is adapted directly to microscope stand (height index of intermediate modules therefore 0), providing suitable objectives are used.
Fov 22 and 20 can be used up to height index 4, e. g. with the fluorescence device. The addition of further module would not be admissible; a solution to the problem would be a tube with the following parameters:

4/5/7

Fov 25 is possible up to height index 4 (e. g. 2 Ergomodules L 2/25 or magnification changer). Fov 22 is possible up to height index 5, 20 is possible up to height index 7, e. g. illuminator plus magnification changer.

–/–/7

The tube allows fields of view up to **20** mm. Fov 22 and 25 not possible.
If intermediate modules are used, the sum of their height values must not be higher than **7**.



Never exceed the value 7 for the sum of height indices!

Tubes from the DM R range (Fig. 37): Always fov 25, the fov is limited by the tube adapter HC L/R 4/25 here.

Table of tubes

Binocular tube HC LB 0/3/4 and HC LBP 0/3/4
Binocular tube with image erection
Trinocular tube HC L1T 4/5/7 and HC L1TP 4/5/7
Trinocular tube
with 3 switching positions HC L3TP 4/5/7
Ergotube, binocular HC LVB 0/4/4
Ergophototube, trinocular HC L1VT 0/4/4

The abbrevations mean:
L = DM L system
M, B, T = mono-, bino-, trinocular tube
V = variable viewing angle 0 – 35°
P = tube with orientation for Pol eyepieces

DM R tubes incl. adapter HC R/L 4/5/7

further details → p. 48.

Condenser illumination

Any type of condenser can only illuminate a certain maximum object field diameter. If the objective magnification is too low, the edge of the image is insufficiently illuminated. The range of possible objective magnifications is shown in the following table:

Smallest/largest objective magnification with Leica condensers CL/PH/UCL, CLP, PH/UCLP

Eyepiece fov 20 and 22	4x to 100x
Eyepiece fov 25	5x to 100x

with auxiliary 2.5x lens (→ p. 13, 33), UCL/UCLP condensers only:

Eyepiece fov 20, 22 and 25	2.5x to 20x

Total magnification

Total magnification = objective magnification x eyepiece magnification.

If using the magnification changer (→ p. 48), multiply the set magnification factor, e. g. 1.5x, as well.

Useful magnification

The total magnification of a light microscope is subject to physical limits known as the useful magnification. This is roughly **a thousand times** the aperture of the objective.

If the tube factor (TF) is other than 1x, the result must be divided by the tube factor as well.
In the above example, the object field would be 0.5 : 1.5 = 0.33 mm with TF = 1.5.

Simple survey magnification

Use a 4x, 5x or 10x objective. Hold specimen over the light exit in the microscope base instead of putting it on the stage. If the 2.5x lens (condenser disc) is in the light path, disengage it.

! Caution!

Do not cause any scratches!

Examples:

Objective	Eyepiece	Magnification changer	Total magnification	Upper limit of useful magnification	Comment
10x/0.22	**10x/20**	**–**	**100x**	**220x**	**not exceeded**
10x/0.22	**10x/20**	**2x**	**200x**	**220x**	**not exceeded**
40x/0.60	**10x/20**	**–**	**400x**	**600x**	**not exceeded**
40x/0.60	**10x/20**	**1.5x**	**600x**	**600x**	**not exceeded**
40x/0.60	**10x/20**	**2x**	**800x**	**600x**	**exceeded**

In the last example, therefore, the “Useful Magnification” has been exceeded, which may result in blurred images.

Object field diameter

If you divide the eyepiece field of view number by the objective magnification, you obtain the true diameter of the observed object field. The eyepiece magnification is not taken into account in the calculation. With the 10x/25 eyepiece and a 50x objective, for example, an object field of 25 : 50 = 0.5 mm can be surveyed.

Focus by adjusting the height of the stage (23.5) or the condenser (23.3).
Although this method does not claim to produce a good image, it offers the advantage of great field depth, e. g. for fast scanning of series of specimens in a similar way to a magnifying glass. If the photomicrographic equipment does not comprise a data reflection facility, a labelled piece of foil or paper can be copied onto the beginning of the film, for example, to enable identification in the photo lab.

Operation

Switching on

Mains connection and fuses → p. 9.
Operate mains switch (on the right side of the microscope base) so that the integrated coloured pilot lamp lights up.

Brightness

Adjust the brightness with the dial (23.6). The numbers on the dial are not absolute values, but are intended to enable reproducible settings. The maximum value is about 12 V, the marking point of a colour temperature of approx. 3200 K.

Brightfield, basic setting

Switch the condenser disc* (23.8), if present, to the **BF** (= brightfield) position or pull out light ring slide (7.7).
Move condenser as far as the upper stop (23.3).
Open the field diaphragm (23.10).
If present: Pull out the light trap* (25.5; 31.11).
Set magnification changer* (36.1) at pos. 1.

Fig. 22 Tube adjustment
↔ Individual interpupillary distance setting
1 Scale (mm), **2** Intermediate module*, in illustration: Ergo-module (→ 35.2)

If you want to use transmitted light, switch fluorescence illuminator* into empty position or filter system A (31.10).

Adjustment specimen

For the initial adjustment of the microscope it is advisable to have a specimen that contains areas of high and low contrast.

For incident light fluorescence of transparent specimens, adjust in transmitted light first.

Secure the specimen with object holder (Fig. 13) or specimen clips. The coverglass must point **upwards.**

! **Attention:**

Before shipping, the specimen stage is covered with a protective film, this should be removed.

Focusing

The smaller dial (23.5) is for fine focusing only, with each scale interval corresponding to a vertical movement of about 3 µm → p. 43, the larger dial is for coarse focusing.

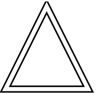
Setting the tube and eyepieces

For trinocular tube* with switchable beamsplitter only: Set beamsplitter at visual observation by adjusting the rod (37.4). A key to the switching positions is given in symbols on the side of the tube.

If wearing glasses you should remove or push back (Fig. 5) the glare protection on the microscope, but make sure to use it if you are not wearing glasses.

For eyepieces **with inserted graticule*** only: Bring the object greatly out of focus or remove from the light path and sharply focus the graticule with a relaxed eye by adjusting the eyelens (Fig. 5.4). (The easiest way to relax your eye is to look at a distant object outside the room for a moment). Focus the object through the eyepiece **with** graticule only. Then close your eye and focus the object only by adjusting the second eyepiece.

Only when **no** graticule is inserted in either eyepiece:
When adjusting the eyelens you will see a light-coloured line (5.5) encompassing the basic part of the eyepiece. This shows the correct position of the eyelens for people with normal eyesight and for spectacle wearers looking through the microscope with corrective glasses.



Glasses with bifocal or progressive lenses should be removed before looking through the microscope.

Only when **one** eyepiece is **without** an adjustable eyelens: Focus the object exactly though this eyepiece first (close your other eye), then focus the image again by adjusting the eyelens of the second eyepiece.

Set your interpupillary distance by pulling the eyepiece tubes apart or pushing them closer together until you see one superimposed image, not a double image, when you look with both eyes. Make a note of your personal interpupillary distance, e. g. 65 (22.1).
Close any tube exits you will not be using (35.4; 37.5) as stray light may otherwise disturb viewing.

Analyser*

If the microscope has an integrated analyser (27.1; 28.1) → p. 37, fit or remove as necessary (after removing the tube or intermediate system); (only necessary for polarized light!).
A special Pol module* with switchable analyser and centrable Bertrand lens is available for the DM LSP polarizing microscope.

Filters

The light filters have the following functions:

Transmitted light

Filter	Application
Grey filter	Grey filters (neutral density filters) are used to attenuate light without influencing the colour temperature. The engraved value, e. g. N 16, indicates the attenuation value. N 16, therefore, means reduction to 100/16 = 6.3 % transmission, integrated in filter magazine (11.3) N 16:
Green filter, panchromatic	Contrast enhancement for black-and-white photography, integrated filter magazine (GR).
DLF	**D**ay**l**ight **f**ilter = conversion filter (blue, identical with CB 12) for colour photography with daylight film, integrated in filter magazine.
BG 20	Highlights in red in Polaroid exposures.
VG 9 (green filter)	Contrast enhancement for chromosome photography.
BG 38 (blue filter)	Suppression of red in fluorescence (is integrated in fluorescence illuminator (31.8)).

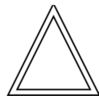
Apart from the non-interchangeable N 16, DLF (= **D**ay**l**ight **f**ilter, formerly CB 12) and green filters integrated in the filter magazine (Fig. 11), filters (with mount diameter 32 mm) can be inserted into the filter holder (12.3), see also DM L/DM R data sheet.

Brightfield, Koehler illumination*

Turn a low-power objective (4x to 10x) into the light path and focus the object (23.5).

Condensers field diaphragm*

Close the field diaphragm (23.10).
Narrow the aperture diaphragm (23.7) if necessary.
Rotate the condenser stop screw (23.4) in a clockwise direction and move the condenser to the highest position with the height adjustment (23.3, bilateral). Click the condenser disc (23.8) into the BF = brightfield position or pull out the light ring slide (7.7) as appropriate.

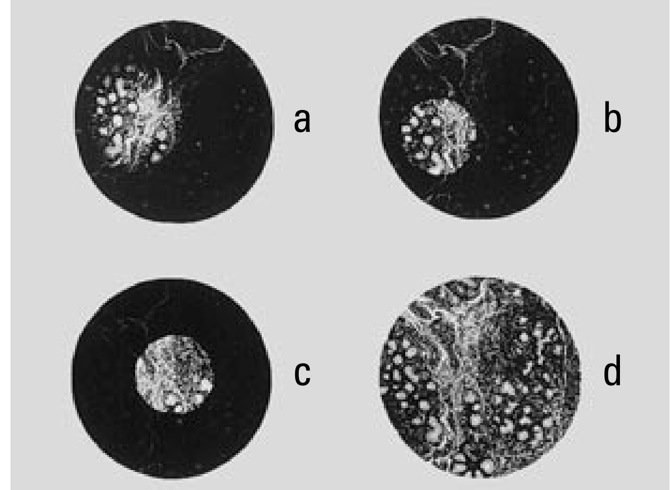


The condenser must be properly fitted in its mount (not tilted). Check that the fixing screw (10.3) is firmly in position.

By rotating the condenser stop screw (23.4) or the condenser height adjustment (23.3), lower the condenser until the edge of the field diaphragm appears sharply focused (24b). Centre the image of the field diaphragm with both centering screws (23.9), i. e. until it is in the centre of the field of view (24c).

Fig. 23
1 Object holder (clamp screw), **2** Centering keys* for condenser disc*, cf Fig. 9, **3** Condenser height adjustment, bilateral control, **4** Adjustable condenser height stop, **5** Coarse and fine focusing, **6** Lamp brightness control (transmitted light); the mains switch with pilot lamp is on the right side of the microscope base, **7** Aperture diaphragm, cf Fig. 7, **8** Condenser disc* for UCL condenser, **9** Condenser centering, **10** Field diaphragm

Fig. 24 Koehler illumination
a Field diaphragm not focused, not centered, **b** Field diaphragm focused, but not centered, **c** Field diaphragm focused and centered, but diameter too small, **d** Field diameter = field of view diameter (Koehler illumination)



Open the field diaphragm (23.10) until it just disappears from the field of view (24d). When changing an objective the condenser centration may have to be slightly adjusted.

The field diaphragm (23.10) protects the specimen from unnecessary warming and keeps all light not required for image formation away from the object to enable greater contrast. It is therefore only opened just wide enough to illuminate the viewed or photographed object field. A change in magnification therefore always necessitates matching of the field diaphragm → light path p. 6.

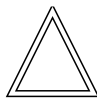
Aperture diaphragm

The aperture diaphragm (23.7) determines the resolution, depth of field and contrast of the microscope image. The best resolution is obtained when the apertures of the objective and the condenser are roughly the same.

When the aperture diaphragm is stopped down to be smaller than the objective aperture, resolving power is reduced, but the contrast is enhanced. A noticeable reduction in the resolving power is observed when the aperture diaphragm is stopped down to less than 0.6x of the objective aperture and should be avoided where possible.

The aperture diaphragm is set according to the viewer's subjective impression of the image, the scale on the dial is just to allow reproducible settings and does not represent absolute aperture values. In principle you can do a calibration yourself by comparison with the apertures of various objectives. Visual comparison of the apertures of the objective and the condenser can be made as follows: Remove the eyepiece from the eyepiece tube or engage an auxiliary telescope (Fig. 25.1) (→ p. 35) and focus. Close or open the aperture diaphragm until its image is just visible in the objective pupil (brighter circle). This is considered the standard setting, i. e. condenser aperture = objective aperture.

For objectives with low contrast the aperture diaphragm can be stopped down further to highlight faint specimen details. In polarized light microscopy narrowing the aperture diaphragm usually results in brighter colours.



n.b.:
The aperture diaphragm in the **illumination light** path is **not** for setting the image brightness. Only the rotary brightness adjustment knob or the neutral density filters should be used for this.

An aperture diaphragm in the **objective** (Fig. 21) is normally opened. The reduction in image brightness caused by stopping down results in:

Greater depth of field
Less coverglass sensitivity (p. 22)
Suitability for darkfield (p. 36)
Change in contrast

2.5x objective*

Condensers CL/PH and CLP/PH: Insert diffusing screen (like 7.7).
Condensers UCL/UCLP:
first **disengage** the lens for the 2.5x objective (9.7) (switch PH or BF position), set Koehler illumination → p. 30 with 4x or 10x objective.
Engage lens for 2.5x objective with condenser disc (23.8).
Open the aperture diaphragm (23.7) as far as the stop.
Narrow the field diaphragm (23.10). In case of arc-shaped vignetting, center the lens: insert both centering keys (23.2) into the UCL or UCLP condenser (9.3) at an angle from the back and adjust until the **asymetrical** vignetting disappears. Remove the centering keys and open the field diaphragm.
The lens can only be used up to an objective magnification of max. 20x. Exact Koehler illumination (→ p. 30) can no longer be obtained! 1.6x objectives can be used if the condenser is removed.

Immersion objectives*

OIL: only use optical immersion oil of DIN/ISO standard. Cleaning → p. 46.
W: Water immersion, use distilled water if possible.
IMM: Universal objective for water, glycerine or oil. A push-on immersion cap is available for the 10x N PLAN objective.

Locking of objectives

Some immersion objectives (FLUOTAR and PL APO types) with a knurled grip (Fig. 21) can be shortened by about 2 mm by pushing in the front part and rotating slightly. This stops any remaining drops of immersion liquid from wetting objects and other objectives when the nosepiece is turned.

! Attention:

This locking device must be released before the immersion objective is used again, as otherwise the spring mechanism protecting the specimen and the objective is inactive and the other objectives are not parfocal with the immersion objective.

Colour code rings on objectives

In accordance with DIN/ISO standards the magnification of each objective is indicated by a colour ring:

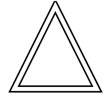
100x 125x 150x 160x	63x	40x 50x	25x 32x	16x 20x	10x	6.3x	4x 5x	2.5x	1.6x
white	dark blue	light blue	dark green	light green	yellow green	orange	red	brown	grey

Immersion objectives have a second coloured ring (Fig. 21) further down:

black	Oil or Imm (= universal objective oil, water, glycerine)
white	water
orange	glycerine

Immersion condenser

The condensers CL/PH 0.90/1.25 **OIL** and UCL 0.90/1.25 **OIL** (Fig. 7) are usually used **dry.** The maximum illumination aperture is then 0.90. Both condensers can also be used with immersion oil (25.4). 1 – 3 drops of immersion oil are applied to the front lens, the specimen is put on the stage, avoiding air bubbles, and Koehler illumination is set as usual, → p. 30. The optical coupling medium then allows apertures of up to max. 1.25, i. e. an improvement of the resolving power of high-aperture oil objectives (e. g. 100x/1.25 **OIL**), but only for brightfield. See p. 46 on how to remove the oil.

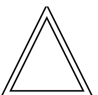


You can also use glycerine instead of oil. The Pol condensers CL P/PH 0.85 and UCL P 0.85 can only be used dry.

Brightfield

Illumination techniques which display the empty areas of the specimen as the brightest parts of the image are called brightfield. Light-absorbing object structures are required for this type of imaging, i. e. it usually makes sense to stain the specimen first. Optical contrasting techniques offer an alternative (PH, DF, POL, etc.).

Possible errors



Wrong coverglass thickness (→ p. 22) or wrong objective. Specimen has been placed on stage with coverglass downwards instead of upwards. Aperture diaphragm (23.7) opened too wide or closed.
Condenser at wrong height or wrongly centered. Lamp not inserted straight (→ p. 16). Dirty optics.

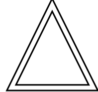
Phase contrast

Similar to transmitted light darkfield (→ p. 36), phase contrast is used to form high contrast images of unstained specimens.
Turn the phase contrast objective (engraving PH, Fig. 21) with the lowest magnification (usually 10x) into the light path and focus the specimen. If you have difficulty in finding the object plane: Temporarily narrow the aperture diaphragm (23.7) or use a stained specimen. Set the condenser disc in the BF position (23.8) or pull out light ring slide (8.7).

Set Koehler illumination (→ p. 30): Focus the field diaphragm together with the object by x, y and z adjustment of the condenser.

Set the light ring (e. g. 1) corresponding to the objective engraving (e. g. PH 1) on the condenser disc (23.8) or use the light ring slide (8.7).

The double engraving λ and λ/4 on the condenser disc is without significance here (the disc can be optionally equipped with light rings, whole- and quarter-wave compensators for polarization (9.6) or with the 2.5x lens (9.7).



Make sure to open the aperture diaphragm (23.7) (= pos. **PH**).

Auxiliary telescope

Insert an auxiliary telescope* (25.1) into the observation tube in place of an eyepiece. Slightly loosen the clamp ring (25.3) and focus the annular structures by adjusting the eyelens. Retighten the clamp ring. Does not apply for configuration with light ring slides (8.7).

Centering the light rings

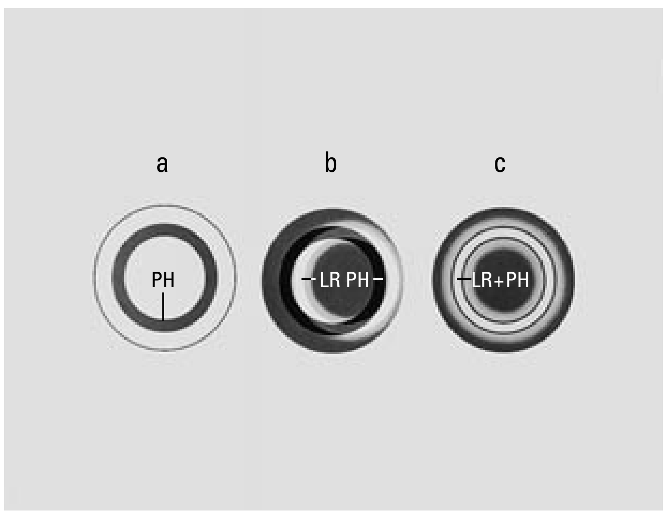
Condenser UCL/UCLP (7.1):
Push in the two centering keys (7.5; 8.3) at the back of the condenser (23.2; 9.3) and rotate until the dark ring (PH = phase ring in the objective) coincides with the slightly narrower bright ring (LR = light ring in condenser), → Fig. 26a – c.

Watch the quality of the phase contrast image. If using the auxiliary telescope, watch the image with one eye through the eyepiece. Then repeat the centration process for the other objective light ring combinations.

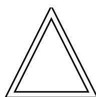
CL/PH condenser (7.4; 7.7): with light ring slides (8.7). Centration is not necessary.

Fig. 25
1 Auxiliary telescope, **2** Adjustable eyelens, **3** Clamp ring for fixing the focus position, **4** Immersion oil, **5** Light trap for fluorescence (intrruption of transmitted light, → 31.11)

Fig. 26 Centration process for phase contrast, observed with an auxiliary telescope
a Condenser in brightfield position (BF), PH = Light ring in objective, **b** Condenser in PH position, light ring LR not centered, **c** Light ring and phase ring centered



Possible errors



Specimen: too thick, too thin, too brightly stained; refractive index of mounting medium and specimen identical so that there is no phase jump.
Specimen slide too thick, so Koehler illumination not possible.
Wedge-shaped coverglass position, so centration of light and phase ring is no longer effective.
Wrong light ring, or light ring has been inserted upside down (see assembly → p. 13). Aperture diaphragm not open. Light ring not centered.

Transmitted light darkfield with CL/CLP and UCL/UCLP condensers

! Attention:

Darkfield is possible with most objectives from 10x magnification; the image background may be inhomogeneously illuminated at lower magnifications. The highest possible objective aperture is **0.75,** although objectives with higher apertures can be used if it is possible to reduce the aperture with a built-in iris diaphragm. These objectives can be identified by the fact that the maximum and minimum apertures are given in the objective engraving and in our lists, e. g. 1.30 – 0.60 (Fig. 21).

Rotate the condenser disc to position **BF** or pull out **DF** light ring slide out as far as the stop. Focus the specimen (10x objective). If you have trouble finding the specimen plane, temporarily close the aperture diaphragm (23.7).

Set Koehler illumination (p. 30) (sharply focus the centered field diaphragm together with the specimen, Fig. 24), does not apply for simple configuration.
Open the aperture diaphragm as far as the stop (= pos. **PH**) and turn the disc to pos. **D** (= darkfield ring) or insert slide with DF light ring into condenser CL/PH or CLP/PH (Fig. 7). If the DF image is inhomogeneous with a homogeneous specimen, center the DF light ring as follows (does not apply for CL/PH and CLP/PH condensers, Fig. 7.4): Use an objective with a higher magnification (40x – 100x), observe without an eyepiece or insert auxiliary telescope → p. 35 and focus. Put the two centering keys into the condenser (23.2) from the back at an angle and adjust until the brighter circle (objective pupil) is no longer asymetrically illuminated. Optimize image homogeneity by slightly adjusting the height of the condenser.

Possible errors

Darkfield illumination is very sensitive to the slightest inhomogeneities in the specimen. As dust particles and fingermarks on the upper or lower surface of the specimen and the front lens of the condenser also cause scattering and diffraction of light, it is essential to keep specimen surfaces and neighbouring lenses absolutely clean.

If the objective aperture is larger than the threshold value listed above of 0.75, you will get an image similar to brightfield. This will also happen if the condenser is greatly decentered.

Oblique illumination

To obtain a relief-like contrast: push DF slide (CL/PH condenser; 7.7) in part way or rotate condenser disc (7.3) slightly out of the DF position (open aperture diaphragm).

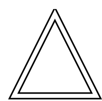
Assembly of polarizers*

Analyser: Disassemble the tube or intermediate module (27.3) and put the analyser (28.1) in the microscope (via the objective nosepiece) (27.1), the **orientation groove** must latch into the orientation pin (27.2).
An intermediate tube Pol* with engageable and disengageable analyser and Bertrand lens is also available as an option.

Polarizer: Mount the filter holder (28.4) instead of the filter magazine (Fig. 11). Push the polarizer (28.3) into the lower opening.

! **Attention:**

Always use the polarizer with the labelled side **upwards,** as otherwise the integrated heat protection filter is ineffective and the special polarizer will become useless (discolouring!).
As an alternative, a polarizer is available which is secured underneath the condenser.*



Condenser: The standard condensers CL/PH and UCL 0.90/1.25 OIL S1 are **not** suitable for polarization, as there may be major lens strain. The Pol condenser CLP/PH 0.85 S1 or UCLP 0.85 S1 is required. Apart from the lettering, it looks just like the standard condensers from the outside.

Fig. 27 Assembly of analyser
1 Analyser (cf Fig. 28.1), **2** Orientation pin and groove, **3** Champ screw for tube or intermediate system

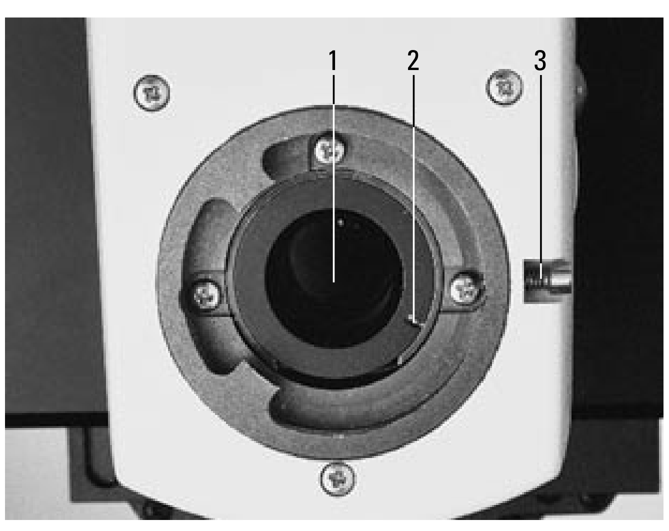


Fig. 28
1 Analyser, **2** λ or λ/4 compensator, **3** Polarizer, **4** Filter holder

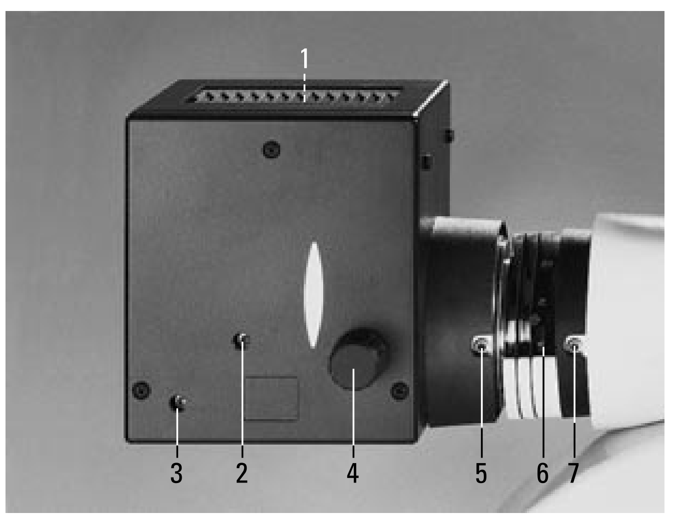
Adjustment crossed position λ and λ/4 compensator

Cross polarizers: Remove the object or find an empty area of the specimen. Rotate the polarizer until you reach the maximum extinction position in the eyepiece. Insert the whole- or quarter-wave compensators above the polarizer (28.2) and rotate to the left, roughly as far as the stop. The disc (9.6) can also be equipped with a whole- and quarter-wave compensator.

Possible errors

Polarizers damaged (discoloured) by powerful light sources or dirty. Objectives or condenser strained through mechanical damage or wrong condenser.
Beamsplitter or filter between the polarizers.
Mounting medium or specimen slide or coverglass birefringent. Further sources of error → p. 33.

Fig. 29 Lamphousing 106 (with 12 V 100 W halogen lamp)
1 Screw for opening Lamphousing 106, 105/2 and 107, **2, 3** X/Y lamp centration (holes for Allen centering keys or 3 mm screwdriver), **4** Collector focusing, **5, 7** Clamp screw, **6** Filter holder (spacer)* (Pos. 2–4 do not apply for Lamphousing 105/2 and 107)



Fluorescence

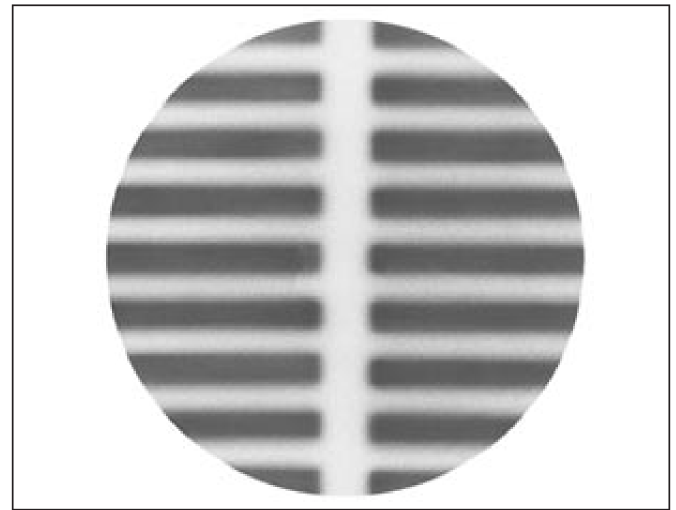
! **Achtung:**

Switch on the lamp by the external power unit. Hg lamps take a few minutes to achieve their full intensity, and do not ignite when hot!
Move filter cube into the light path with the slide (31.10; 14.3). Open the light trap (31.9).

Attention:

Make sure to adjust the light sources immediately, then form an image by one of the following methods (30; 32), does not apply for Lamphousing 105/2 and 107 (without centering facility): **Danger of glare!** Never look into the direct light path or switch on incident light brightfield reflectors when using Hg or Xe lamps!
Fire hazard! Keep lamphousings (hot surfaces!) at least 10 cm (4″) away from inflammable objects such as curtains, wallpaper or books!

Fig. 30 Lamphousing 106
Reflection of the lamp filament, greatly schematized: in reality the reflection is extremely low in contrast, the bright overlap area is wider and less defined.



Imaging the light sources to check adjustment

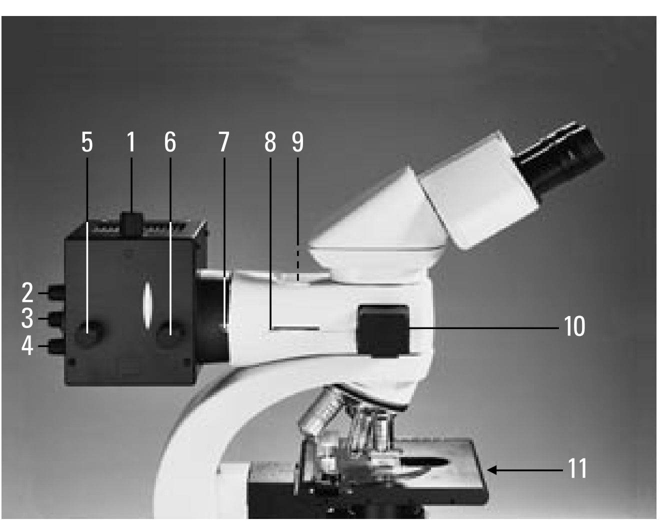
Using the adjustment lens R/F (method 1)
Screw the adjustment lens R/F (14.4) into the objective nosepiece instead of an objective. Put a piece of dark paper or similar on the specimen stage and roughly focus the surface with a dry objective of low to medium magnification. With a felt or ballpoint pen, make a dot or cross at any position on the paper and slide it into the small illuminated field. Turn the adjustment lens into the light path: the fluorescence light source (29; 31) will then be imaged on the paper via the beamsplitter/filter cube.

Projection on the microscope base (method 2)
Center the condenser at least roughly → p. 30. Remove the specimen. Turn a 4x, 5x or 10x objective into the light path. Switch the condenser disc* to the BF position (23.8) or pull out the light ring slide (7.7). Open the aperture diaphragm. Put piece of paper on the microscope base. Adjust the height of the stage (23.5) or condenser (23.3) until the bright circle (= image of the objective pupil) is quite sharply defined. Mark the centre of the circle.

Centering the fluorescence lamps

Lamphousing 105/2 or 107
No adjustment necessary.
Lamphousing 105/2 or 107 (Fig. 29)
with 12 V 100 W halogen lamp
Adjust the collector (29.4) until you see the lamp filament (Fig. 30).

Fig. 31 Lamphousing 106 z and controls for fluorescence with LF illuminator
1 Vertical adjustment of lamp, **2, 4** Vertical and horizontal adjustment of reflection, **3** Mirror focusing, **5** Horizontal adjustment of lamp, **6** Collector (focusing of lamp image), **7** Fixing screw, **8** BG 38 filter, **9** Interruption of the incident light path, **10** Slide for 2 filter systems (filter cubes), **11** Interruption of the transmitted light path (light trap 25.5)



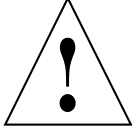
Using an Allen key (1.1) adjust the horizontal position (29.3) of the lamp holder until the slightly brighter stripe in the reflection of the lamp filament is in the centre of the brighter area (Fig. 30), as marked by the dot you made. Then move the reflection of the lamp filament with the vertical adjustment (29.2) to the centre of the range of movement.

Lamphousing 106 z with halogen lamp and gas discharge lamps (Fig. 31 and 32).
The image of the light source is focused with the collector (31.6).

The adjustment principle is similar for all light sources:
Move the **reflection** of the lamp filament or discharge arc to the side (32a) by turning the adjustment screws on the back of the lamphousing (31.2 and 31.4). Focus the **direct image** of the filament or discharge arc (31.6) and adjust as follows (32b, 31.5 and 34.6):

Halogen lamp: just above or below the center marking you made (Fig. 32b).
First focus the reflection (31.3) and then move it symmetrical to the direct image (31.2 and 31.4) inside the brighter circle (32c).

Mercury (Hg) and xenon (Xe) lamps
Move the direct image (32a, b) to the centre of the brighter circle with the horizontal and vertical (31.2 and 31.4) adjustment of the holder. Focus the reflection (3.3) and adjust the mirror (3.2 and 3.4) until the reflection coincides with the direct image (32c).



Attention:

<u>Caution with Hg and Xe lamps:</u>
Be careful not to project the reflection on the electrodes for long, as there is a risk of explosion if they overheat. The two electrodes can just be seen in the extension of the symmetry plane of the discharge arc. Replace spent burners in good time and dispose of in an environment-friendly way.

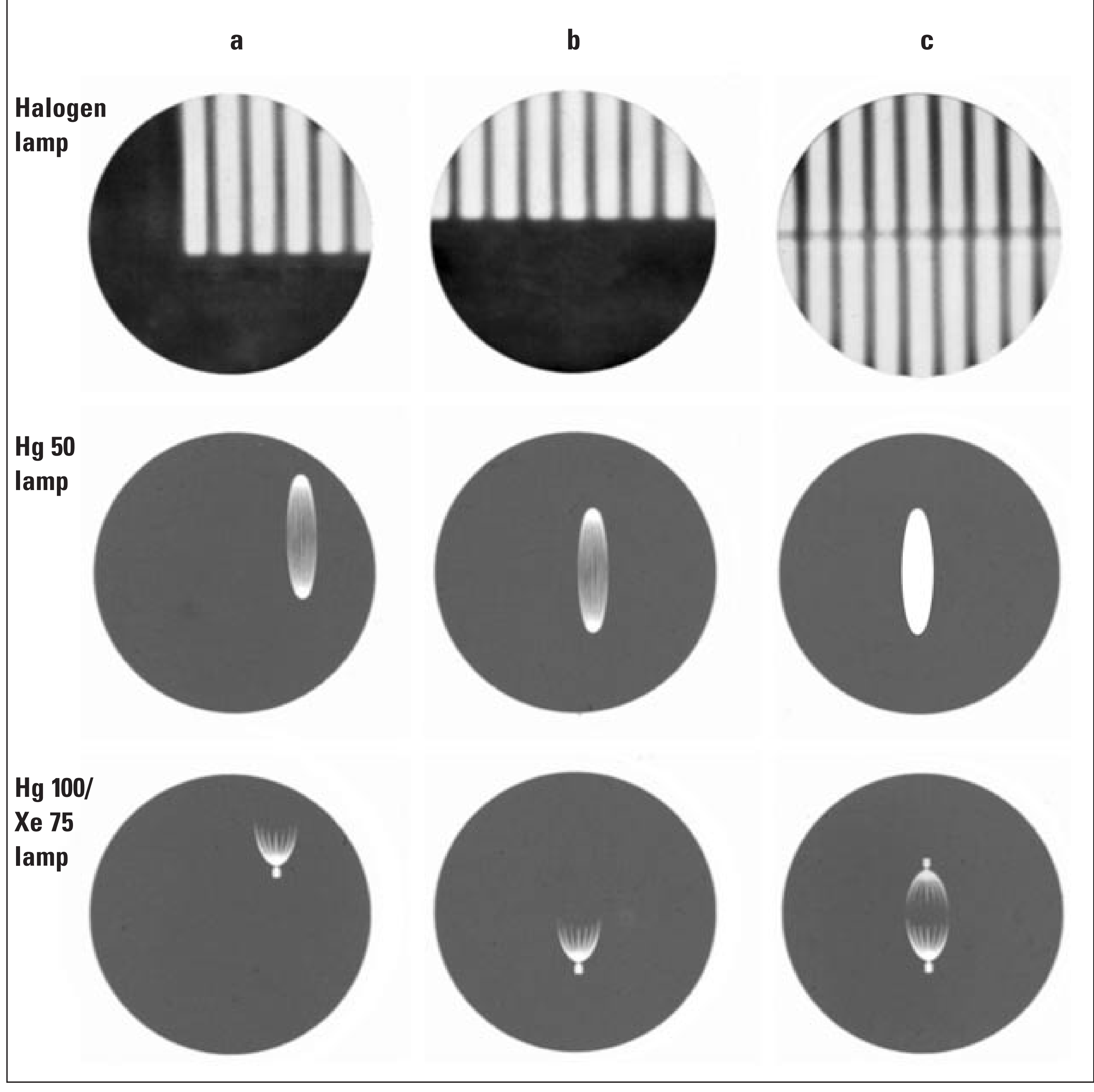
Do not open the lamphousing until the lamp has cooled down and you have disconnected it from the mains. Wear protective clothing (gloves and mask) when using Xe lamps. Hg lamps take a few minutes to reach their full intensity; they do not ignite when hot.

Filter cube, objective, tube factor

Disengage the adjustment lens. Focus the specimen in transmitted light first if possible. Select a filter cube to suit the excitation and emission spectrum of the specimen and switch it into the light path (31.10), → p. 15 for assembly. Use high-aperture objectives (immersion) to obtain optimum image intensity; open the iris diaphragm in the objective if applicable (Fig. 21).

Trinocular tube* with switchable beamsplitter: switch to highest possible intensity for visual observation (37.4). Switch magnification changer* (36.1), if present, to factor 1x. Protect the immersion oil from impurities to avoid disturbing fluorescence. Use low-fluorescence mounting media, coverglasses and specimen slides!

Fig. 32 Schematic diagram of lamp adjustment for lamphousing 106 z (in reality the lamp images are less well defined)
a direct filament image, focused but decentered
b direct filament image in the right position
c reflected and direct filament image in the right position

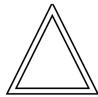


Unblock the incident light path (31.9), switch off transmitted light or cover with slide (25.5) (push into the stage from the front: 31.11), focus the specimen.
Disengage the BG 38 filter (31.8) if there is no disturbing red background. Always engage the filter for photography, however.

Collector setting

Halogen, Hg and Xe lamps:
Adjust the collector (31.6) until the object is homogeneously illuminated, optimize adjustment if possible.

Possible errors



Weak fluorescence, weak image intensity due to:
Incorrectly stored, too old or faded specimens; fast specimen fading (e. g. with FITC); inspecific filter combination, numerical aperture of objectives too low; eyepiece magnification too high; spent lamp; room too bright. Trinocular tube: wrong beamsplitter setting (37.4), secondary light due to reflection at the condenser.

Low contrast image due to:
Excitation bandwidth too great; inspecific staining; fluorescing inclusion medium; autofluorescence of the objective or immersion oil.

Linear measurements

The following are required for linear measurements:
- Graticule with scale division in eyepiece (Fig. 33) HC FSA 25 PE tube with diapositive overlay device or a digital linear measuring eyepiece.
- Stage micrometer for calibration.

Micrometer value

The micrometer value of the objective-eyepiece combination used must be known before the measurement, i. e. the distance in the specimen that corresponds to the length of a division on the graticule used.

Calibration:
Align the stage micrometer and the graticule parallel to each other by rotating the eyepiece and adjust the zero marks of both scales to exactly the same height (Fig. 33).

Read how many scale divisions of the stage micrometer correspond to how many on the microscope scale (graticule) and divide the two values. This gives the micrometer value for the total magnification that has just been used.

Example:
If 1.220 mm of the stage micrometer corresponds to 50 divisions of the measurement scale, the micrometer value is 1.220 : 50 = 0.0244 mm = 24.4 µm. For extremely low objective magnifications it may be that only part of the measurement scale can be used for calibration.

Important: If using the magnification changer (36.1): Remember to take the additional magnification value into consideration! We strongly recommend you calibrate each objective separately instead of extrapolating the micrometer values of the other objectives from the calibration of one objective. Measurement errors may occur if the eyepiece is not pushed into the tube as far as the stop.

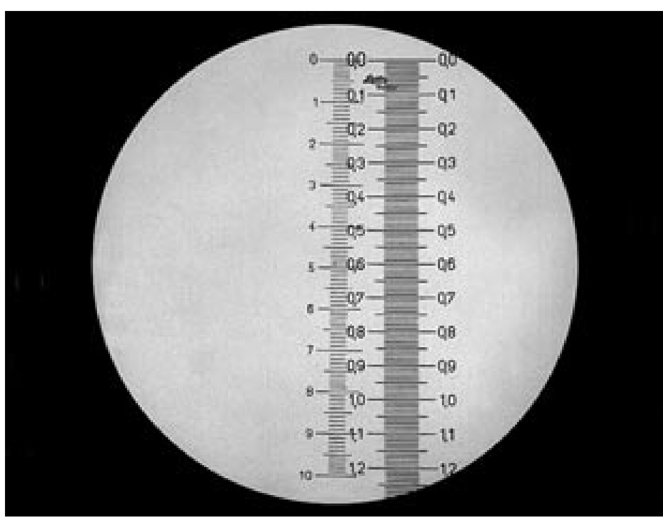
Particularly large object structures can also be measured on the stage with the verniers (0.1 mm); the distance to be measured could be calculated from a combined x and y measurement.

Thickness measurements

In principle, thickness measurements can be carried out if both the upper and the lower surface of the object can be clearly focused. The difference in stage height setting (mechanical dual knob focusing: distance between two divisions = ca. 3 µm) gives a value for transmitted light objects that is falsified by the refractive index of the object (which has been "transfocused") and perhaps immersion oil. The true thickness of the object detail measured in transmitted light is given by the vertical stage movement (focusing difference) d' and the refractive indices n_o of the object and n_i of the medium between the coverglass and the objective (air = 1).

$$d = d' \frac{n_o}{n_i}$$

Fig. 33 Scale of the graticule in the eyepiece (left) and image of stage micrometer (right)



Example:
The upper and lower surfaces of a thin polished specimen have been focused with a dry objective (n_i = 1.0), scale readings of the mechanical fine drive (division spacing = ca. 3 µm):
18.5 and 12.5.
Therefore d' = 6 x 3 = 18 µm.
The refractive index of the object detail was taken to be n_o = 1.5.
Thickness d = 6 x 3 x 1.5 = 27 µm.

Object marker

The object marker is screwed in place of an objective (not illustrated). When rotated, a diamond is lowered onto the coverglass or object surface, where circles of variable radii can be scribed to mark objects.

TV microscopy

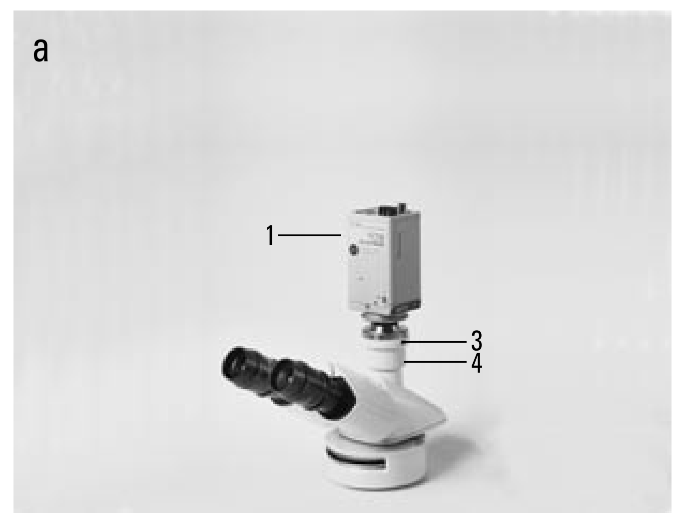
Various adapters are available for the connection of TV cameras (Fig. 34).

Cameras with c-mount and B-mount objective thread
The c-mount adapters listed in the following table can be used on all trinocular phototubes. The picture area on the monitor depends on the adapter used and on the chip size of the camera. The photo adapter tube (34.4) is necessary for HC FSA and HC 1TP tubes.

	Recorded picture diagonal (mm) with			
	1 inch camera	2/3 inch camera	1/2 inch camera	1/3 inch camera
Without zoom magnification:				
c-mount-adapter 1x HC	16	11	8	6
c-mount-adapter 0.63x HC	–	17.5	12.7	9.5
c-mount-adapter 0.5x HC	–	–	16	12
c-mount-adapter 0.35x HC	–	–	–	17.1
c-mount-adapter 4x HC	4	2.8	2	1.5
With zoom magnification (Vario TV adapter):				
c-mount, 0.32 – 1.6x HC	–	–	19+) – 5	18 – 3.8
B-mount, 0.5 – 2.4x HC	–	–	16 – 3.3	–
B-mount, 0.5 – 2.4x HC	–	–	–	12 – 2.5

+) from zoom factor 0.42x only!

Fig. 34 C-mount adapter on trinocular tube
1 TV camera, **2** Adapter with c-mount thread, **3** Clamp screw, **4** Photo adapter tube



Calculation of the magnification on the monitor
The magnification on the monitor can be calculated with the following formula or measured with a stage micrometer and a cm scale.

$$V_{TV} = \text{objective magnification} \times \text{factor of magnification changer}^{*} \times \text{TV adapter magnification} \times \frac{\text{monitor diameter}}{\text{chip diameter of camera}}$$

Possible errors

Picture too dim (noisy TV picture, poor contrast)
Remedy: Increase lamp intensity, swing filter out of light path, switch over beamsplitter in tube system, switch TV camera to higher sensitivity.

Picture too bright (TV picture glare)
Remedy: Switch neutral density filter, switch over beamsplitter in tube system, reduce camera sensitivity.

Picture area too small
Remedy: Use a TV adapter with a smaller factor.

Incorrect colour rendering
Remedy: Vary illumination intensity, carry out white balance for TV camera according to manufacturer's instructions, use a conversion filter, e. g. DLF or CB 12.

Disturbed picture frame
Remedy: Ground the microscope, Variotube and camera. Avoid parallel laying of mains and signal cables; connect camera and microscope to the same mains phase (socket).

Picture spoilt by inhomogeneous glare and/or spots. Lamps or windows are reflected in through the eyepieces.
Remedy: Switch over the beamsplitter or cover eyepieces or remove the disturbing light source. Dirt particles in the light path, lamphousing not centered (TV systems are generally more sensitive to inhomogeneous illumination).

Care and maintenance

Dust protection

Attention:

Disconnect from the mains before cleaning and servicing!

Protect the microscope and peripherals from dust by putting on the flexible dust cover after each work session. Dust and loose particles of dirt can be removed with a soft brush or lint-free cotton cloth.

Solvents

Obstinate dirt can be removed with a clean cotton cloth moistened with any ordinary hydrous solution, benzine or alcohol. Do not use acetone, xylol or nitro dilutions. Cleaning agents of unknown composition should be tested on an inconspicuous part of the microscope. Painted or plastic surfaces must not be tarnished or etched.

Acids, alkaline solutions

Particular care should be taken when working with acids or other aggressive chemicals. Always avoid direct contact between such chemicals and the optics or stands. Thorough cleaning after use is strongly recommended. Keep the microscope optics absolutely clean.

Dust/optics

Remove any dust from glass surfaces with a fine, dry, grease-free artists' hair brush, or by blowing with a bellows ball or by vacuum suction. Any remaining dirt can be removed with a clean cloth moistened with distilled water. Failing this, use pure alcohol, chloroform or benzine.

Oil

First wipe off immersion oil with a clean cotton cloth, then wipe over several times with ethyl alcohol.

n.b.: Fibre and dust residue can cause disturbing background fluorescence in fluorescence microscopy.
Objectives must not be opened for cleaning. Only the front lens can be cleaned in the ways described above and the upper lens by blowing dust off with a bellows ball.

All Leica instruments are manufactured and tested with extreme care. If you do have cause for complaint, however, please do not try to repair the instruments and their accessories yourself. Contact your national agency or our central servicing department, the Technical Service in Wetzlar direct.

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Please direct any questions on application to our agency or Produktmanagement Mikroskopie → p. 2.

Wearing and spare parts, tools

Code no. Part no.	Component		Used for
Spare lamps			
500 317	Halogen lamp	12 V 30 W	Integrated illumination, transmitted light
500 974	Halogen lamp	12 V 100 W	Lamphousing series 105/106/107 simple configuration only
500 318	Halogen lamp	6 V 5 W	Multi-viewing attachment
500 137	Ultra high pressure Hg lamp	50 W	Lamphousing 106 z
500 138	Ultra high pressure Hg lamp	100 W	Lamphousing 106 z
in preparation	Ultra high pressure Hg lamp	100 W (103 W/2)	Lamphousing 106 z
500 139	High pressure xenon lamp	75 W	Lamphousing 106 z
Tools/adjustment keys			
703-100.605-500	3 mm Allen key		Assembly and adjustment of
023-123.030-027	2 mm Allen key		light rings, UCL condenser
020-434.045	2.5 mm Allen key, angled, shortened		Assembly of heating stage and illumination mirror
Spare axis (screw) for condenser UCL/UCLP condenser			
023-123.030-015			
Screw covers for vacant nosepiece positions			
020-422.570-000(4)	Screw cover M25		Objective nosepiece
090-938.001-057	Adjustment lens F		Fluorescence
090-938.001-017	Light trap		Fluorescence
Spare eyecups (anti-glare protection) for HC PLAN eyepieces			
021-500.017-005	Eyecup HC PLAN		10x/25 eyepiece
021-264.520-018	Eyecup HC PLAN		10x/22 eyepiece
021-264.520-018	Eyecup HC PLAN		10x/20 eyepiece
Immersion oil DIN/ISO standard, fluorescence-free			
513 787	10 ml		OIL and IMM objectives,
513 522	100 ml		Oil condenser tops
513 788	500 ml		
Spare fuses according to IEC 127-2 and/or UL 198 G and/or company typ			
824-767.000-000	T 630 mA	IEC 127-2 or: Wickmann 19 195/ Schurter FST/UL 198 G	DM LB microscope power supply (for 12 V 30 W halogen) unstabilized
823-493.000-000	T 2.5 A for 90 – 140 V	IEC 127-2	Power unit Xe 75 Hg 100 stabilized (500 311)
827-902.000-000	T 1.25 A for 90 – 140 V/ 187 – 264 V	IEC 127-2	Power unit Xe 75 Hg 100 stabilized (500 311)
824-716.000-000	T 160 mA for 90 – 140 V	IEC 127-2	Power unit Xe 75 Hg 100 stabilized (500 311)
826-095.000-000	T 80 mA for 187 – 264 V	IEC 127-2	Power unit Xe 75 Hg 100 stabilized (500 311)
825-347.000-000	T 2 A	IEC 127-2	Power unit Hg 100 non-stabilized (500 299)

Without fuses: Power unit Hg 50 (500 277)
302-053.023-001 Ignition capacitor for power unit Hg 50

Supplementary information

Tube series

2 tube series are available for DM LS microscopes. Note that the field of view number might be limited → p. 25 – 26:

Tubes from the DM L range (Fig. 35).

Tubes for polarized light microscopy are identified by the extra letter P, e. g. Binocular tube LBP 25-0/4. The Pol tube is exactly aligned for polarized light microscopes by an orientation pin and special Pol eyepieces with ready aligned cross line (right-hand eyepiece only); it can also be used without restriction on ordinary DM L microscopes.

Tubes from the DM R research microscope range (Fig. 37).

In combination with the tube adapter R/L 25-4/7 (36.2), these can also be used on all microscopes in the DM LS range. Special tubes enable, for example, graticule or slide overlay, etc.

Intermediate modules*

! **Attention:**

When using intermediate modules, remember that the eyepiece field of view number may be affected → p. 25 – 26.

Ergomodule*

By integrating one or several Ergomodules L 2/25 (36.3), the viewing port of the microscope can be raised by 30 mm for each one.

Magnification changer*

For stepwise additional increase of the total magnification by the factors 1.25x, 1.5x and 2x. → p. 25, Fig. 36.1.

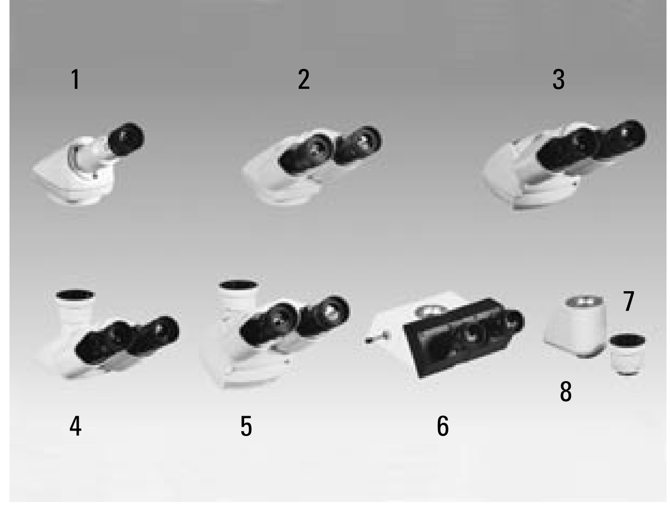


Fig. 35 Tube range L
1 Monocular tube LMP* –/–/7, **2** Binocular observation tube HC LB 0/3/4, **3** Ergonomy tube, binocular, viewing angle 0 – 35° HC LVB 0/4/4, **4** Trinocular tube H L1T 4/5/7, with fixed beamsplitter (50 % to the vertical exit, 50 % to the binocular port), **5** like 4, but with adjustable viewing angle 0 – 35° (HC L1VT 0/4/4), **6** Trinocular with 3 switching positions HC L3TP 4/5/7, **7** Photo adapter tube for tube (6), **8** Photo adapter tube for tube (6) with 2 exits (50 %/50 %)

* no longer produced

Illuminating mirror

Normal daylight, for example, is used as illumination for the microscope, Fig. 37.
Disassemble the illumination tube (38.2) with the short 2.5 mm (1.2) Allen key. (The 3 fixing screws are in a concealed position in the illumination tube).
Put the illumination mirror into the microscope base.

Fig. 36 Additions to the tube range
1 Magnification changer (1x, 1.25x, 1.5x, 2x), **2** Adapter R/L for DM R tubes (Fig. 37), **3** Ergomodule L2/25 for raising the viewing port by 30 mm, **4** Adapter for connecting photo-eyepieces to trinocular tubes L

Fig. 37 Microscope tubes from the DM R range (only with adapter 36.2)
1 HC BSA 25: Binocular tube with focus compensation, **2** HC FSA 25 PR and HC FSA 25 P: Binocular phototubes with (PR) or without (P) back reflection, **3** HC FSA 25 PE: Binocular phototube with lateral reflection, **4** Switch rod for beam-splitter, **5** Mount for photo adapter tube, **6** Clamp ring for photo adapter tube, **7** Clickstop device for Pol eyepieces, **8** Socket for dark flap control cable (PR tube only), **9** Connection for lateral reflection, **10** FSA photo adapter tube, **11** FSA photo adapter tube with 2 exits (3 switching positions)

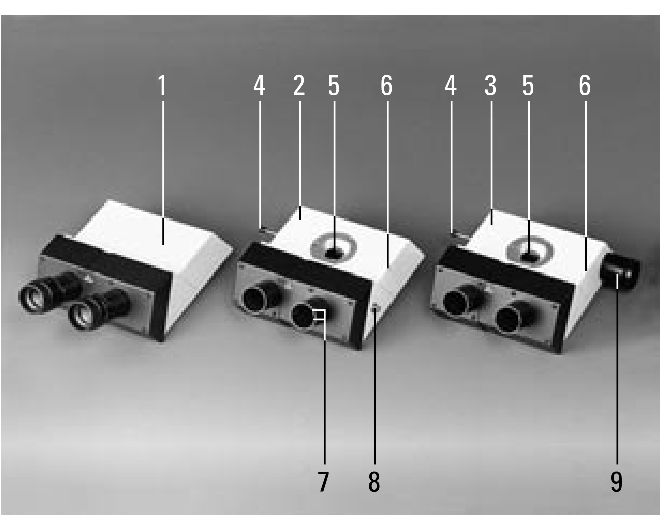


Fig. 38 Illuminating mirror
1 Mirror, alignable in x and y direction
2 Illumination tube with drill holes for loosening the 3 fixing screws, disassembled

You may have to rotate the tube on the microscope by about 180° to allow light to impinge unobstructed on the mirror. Align the microscope and the mirror so that light from a large area, e. g. sky or a pane of opal glass, is reflected into the condenser.

Attention:

Never use direct sunlight (danger of damaging eyes due to glare, poor illumination).

Battery connection

If there is no way of connecting the microscope to the mains, you can connect a 12 V or 24 V car battery or another low-voltage power source yourself instead of using the illuminating mirror (Fig. 38). To do this, the normal power lead to the lamp holder in the microscope base has to be interrupted.

!

Attention:

However, **on no account** may the new power lead connect the lamp holder **directly** to the power source. For adjustment of the lamp intensity, interpose a suitable single-turn potentiometer or slide resistor, also a fuse and a suitable fixed resistor, as in reality, for example, the "12 V" network of vehicles sometimes has higher voltages, which could destroy the lamp.

Heating stage

Temperature range up to approx 40 °C.
Assembly: Detach the ordinary specimen stage (only rectangular stages are suitable) from the stage bracket by undoing the 4 Allen screws underneath the stage and replace with the heating stage, using the two screws at the back only! No special objectives or condensers are required. The heating stage has its own instruction manual. Heating stage 350 (up to 350 °C) should not be used, as it requires condensers with long intercept distances for exact illumination conditions (see **DM LB** and **DM R** microscope series).

Multi-viewing attachments

Dual viewing attachment L 3/20 for 2 viewers (Fig. 40). The two viewers may either sit next to each other (images rotated by 180° in relation to each other) or opposite (image positions identical). The telescopic support (40.3) should always be set exactly, making sure that the tracing device is not at a tilt to the microscope and that the microscope stand is not deformed. The fade-in arrow (40.2) can be moved in x and y direction: Move the lever (40.1) vertically or pull out/push in. If this lever is rotated, the colour of the arrow can be changed (red – yellow).

Multi viewing attachment L MD 3/20 (Fig. 41)
→ separate manual.
There may be limitations for specimen images in dim light (darkfield, polarization, fluorescence).

Tracing device

The tracing device L3/20 (Fig. 42, see separate manual) allows an optical overlay of large objects (next to the microscope) on the microscope image. This makes it easy to draw specimens by tracing their outlines or superimpose scales.
By interrupting the microscope light path it is also possible, particularly for TV microscopy, to display larger objects or whole pages of books. An additional lamp, e. g. reading lamp, is necessary for this.

Fig. 39 Heating stage
1 Fixing screw(s), **2** Screws, of no significance for DM LS microscope

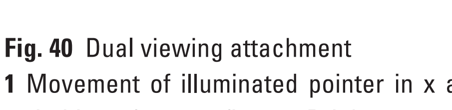
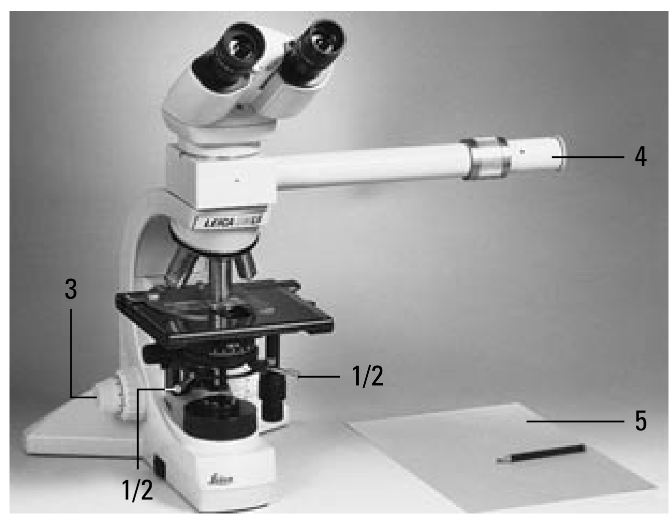


Fig. 40 Dual viewing attachment
1 Movement of illuminated pointer in x and y direction and switching of colour filter, **2** Brightness adjustment, **3** Adjustment of support
The external power supply (illuminated arrow) is not illustrated.

Fig. 41 Tracing device
1, 2 Clamp screws, **3** Focusing, **4** Shutter, **5** Drawing plane



Index

Achromat 24
Addresses 2, 48
Adjustment lens 16
Adjustment telescope 35
Analyser 37
Aperture 23
Aperture diaphragm 30, 32
Apochromat 24
Auxiliary lens 13, 26

Brightfield 30, 33

Care of microscope 45
Centration 35, 38
Cleaning 47
Collector 18, 19
Colour temperature 28
Condenser 12
Contrast 32, 34 – 37 , 40
Coverglass 29, 33
Cross section 6

Darkfield 13, 36
Data 35, 22
Diaphragms 23, 30, 32

Ergomodule 10, 25
Eyepieces 11, 23, 29

Field diaphragm 30 – 32
Field of view number 23 – 26
Filters 15, 28
Filter cube 15
Fluorescence 10
FLUOTAR 23, 24
Focusing 10, 29
Fuses 9

Gas discharge lamps 17
Graticules 11

Halogen lamp 16
Hg lamp 17, 19, 39

Immersion 23, 33
Incandescent lamps 16
Intermediate systems 10, 25
Iris diaphragm 23

Koehler illumination 30

Lamps 16 – 21
Lamp change 16 – 21
Lens (2.5x) 13, 33
Light path 6
Light ring 13, 35
Light source 16 – 21
Light trap 16
Linear measurement 42

Magnification 27
Mains voltage 9
Mercury lamp 16, 18
Microscope stand 8
Mirror 48
Multi-viewing attachment 48

Object field 27
Object guide 14
Object marker 44
Objectives 14, 22, 24
Oblique illumination 36
Oil 23, 33

Phase contrast 13, 34
Photo 12, 14
Photo eyepieces 12
Planachromat 24
Planapochromat 24
Polarizer 37
Power unit 18, 49
Pupil 23

Red I 37

Spare parts 47
Specimen 29
Specimen clip 14
Specimen stage 10, 29
Spectacle wearers 11

Thickness measurement 43
Tools 9
Tracing device 48
Transmitted light 28
Transport protection 10
Trinocular tube 49
Tube 10, 25, 29
Tube length 22
Tube lens 22
TV 44

Useful magnification 27

Water immersion 23
Whole-/quarter wave compensator 13

Xenon lamp 19, 39

EU Conformity declaration

We hereby declare that the product specified below conforms in its design and construction as well as the model we have put on the market to the relevant safety and health regulations laid down by the European Union.
This declaration will cease to be valid if the instrument is modified without our consent.

Product name:	**DM LS and DM LSP**
Instrument type:	Light microscope
Instrument no.:	020-518.500 and 020-522.101
EU directives:	Low voltage: 73/23/EWG Electromagnetic compatibility: 89/336/EWG
Harmonised standards applied:	EN 50081-1 EN 50082-1 EN 61010-1

Wetzlar, 17. 1. 1996

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