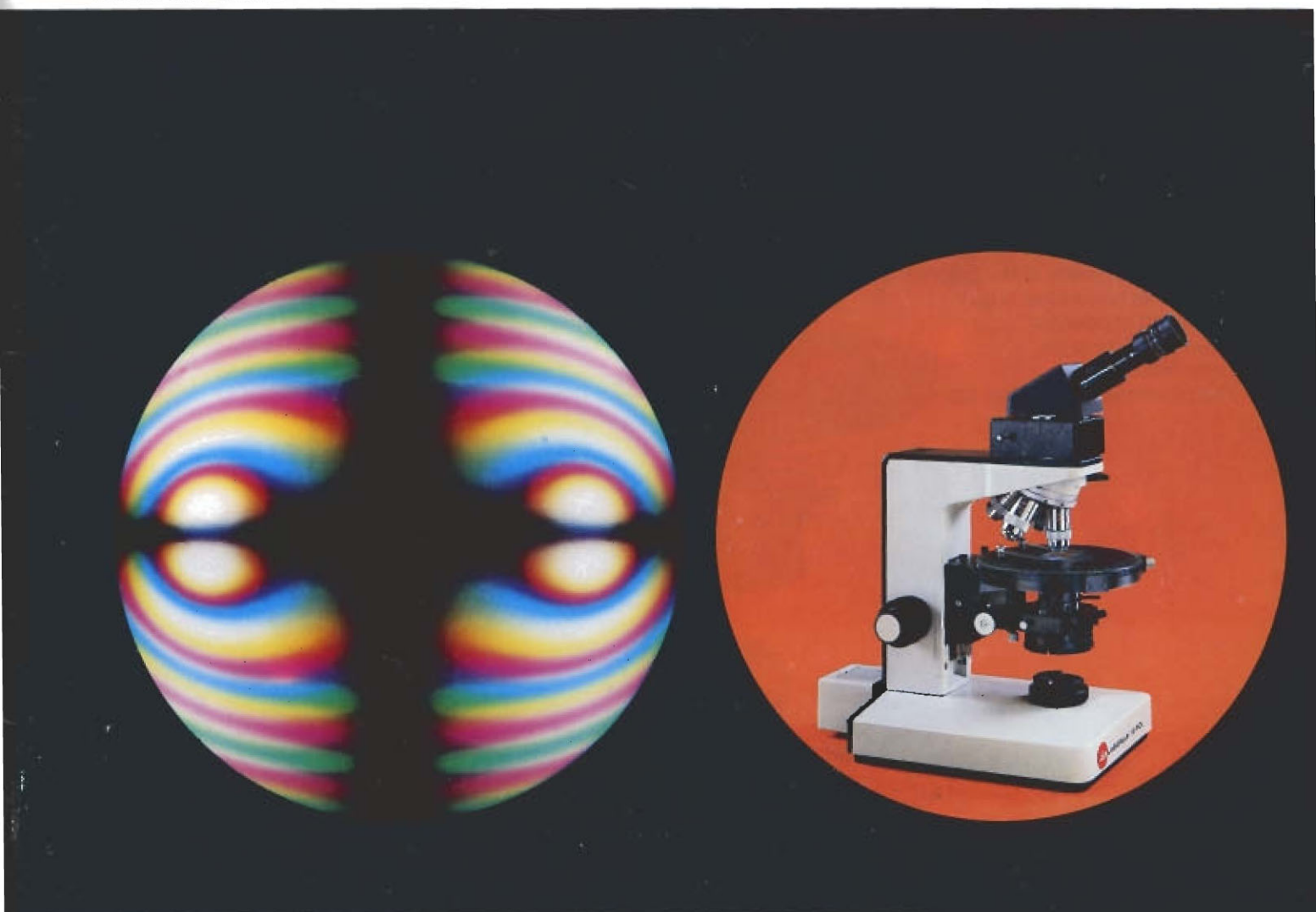
LEITZ LABORLUX 12 POL

Routine and laboratory microscope

Instructions



Code No. 933 407

1. Introduction

The LEITZ LABORLUX® 12 POL is a microscope for investigations in polarised transmitted and incident light.

Because of the modular design principle on which it is based, the following microscopy methods can be used by simply exchanging accessories:

Transmitted light
brightfield
brightfield polarised light
darkground
phase contrast
interference contrast T
television microscopy
universal rotating stage

Incident light
brightfield
brightfield polarised light
interference contrast R
fluorescence
reflection photometry
photomicrography
television microscopy
heating stage microscopy

Contents

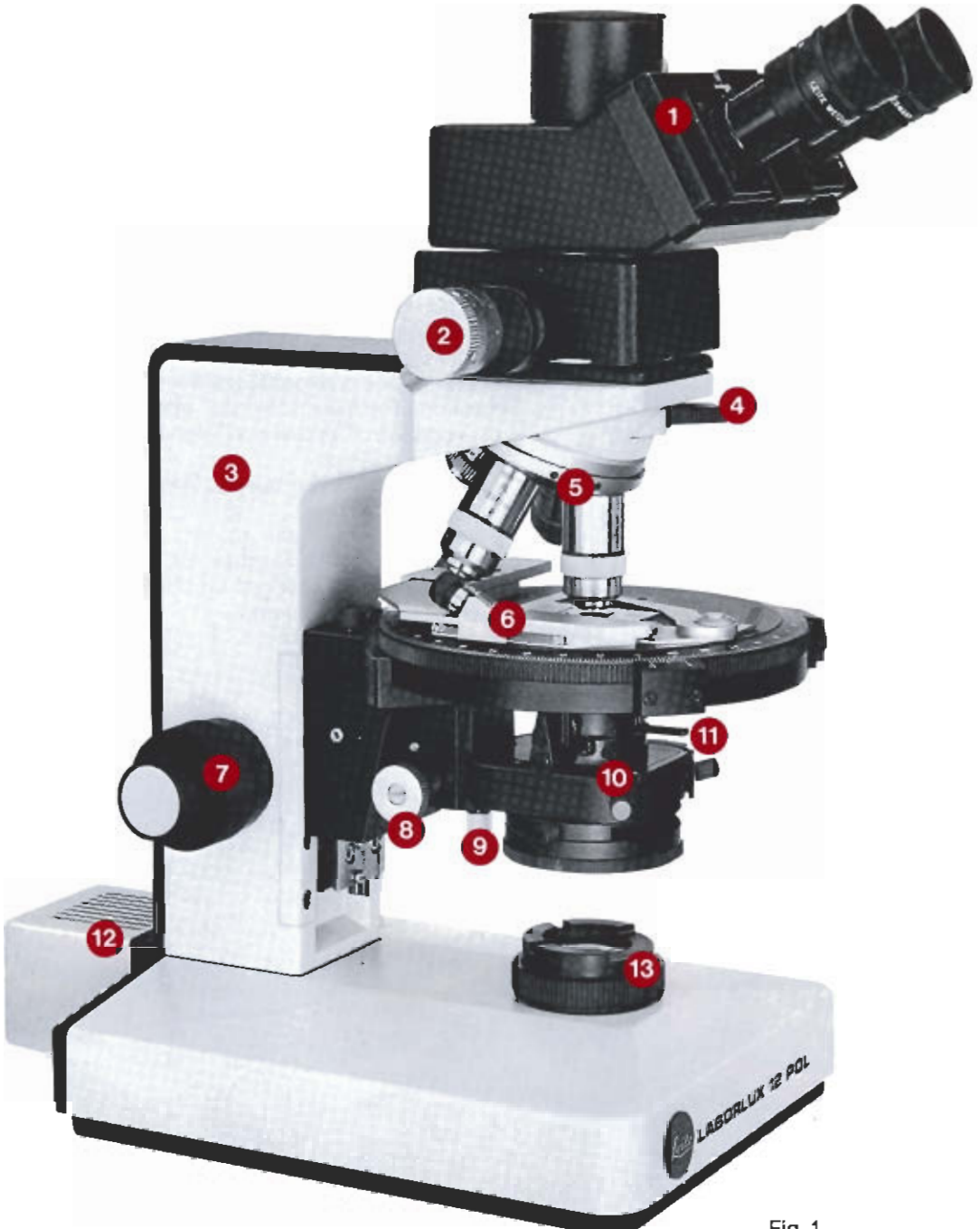


Fig. 1

2. Unpacking and assembly of the microscope

Fig. 1 LABORLUX 12 POL – binocular –

1 Tube (FSA 42/30)
2 Analyser, rotatable (in the intermediate tube 360°)
3 Microscope stand
4 Compensator
5 Centring revolving nosepiece
6 Object stage with object guide
7 Dual knob for the vertical adjustment of the object stage
8 Vertical adjustment of the polarising condenser
9 Adjustable condenser stop
10 Polarising condenser
11 Aperture diaphragm
12 Lamp Housing 20
13 Field diaphragm with filter fitting

2.1 Compare the equipment carefully with the packing note and the delivery note. Components listed individually may already have been fitted together in the factory.

2.2 Location
Ensure that the environment of the chosen site is free from oil or chemical fumes. Vibrations, direct sunlight and considerable temperature fluctuations interfere with measurement and photomicrography. A sturdy instrument table (with drawers for the accessories) from the Leitz range is an ideal support for the microscope. If combined with an ergonomically designed adjustable seat, microscopy will be free from fatigue.

Fig. 2 Voltage selector and fuses (T125 mA) are mounted on the underside of the foot of the microscope.

3. Technical details

Electrical connection
The installation of a multiple socket for the convenient connection of microscope illumination and accessories is recommended. First ensure that the setting of the voltage selector in the foot of the stand (Fig. 2) agrees with the mains supply voltage. Only then connect the instrument to the mains.

If the plug has to be changed, the following colour code of the wires should be observed:
yellow-green = earth
black = live
white = neutral

Tubes for transmitted and incident light
Five different tubes, for polarised light, are available for the various techniques of microscopy.
For transmitted-light investigations the tubes are used only with the transmitted-light intermediate tube, and for incident light only in conjunction with the incident-light devices.
An exception are transmitted-light specimens without a coverglass. They can also be observed through the vertical illuminator with incident-light objectives and transmitted-light illumination.

Monocular Pol tube P 42/30 *
With engageable pinhole stop ① and centring Bertrand lens ②.

* The designation 42/30 means: 42 is the diameter of the tube changer in mm, 30 the viewing angle of the tube in degrees.

Fig. 3

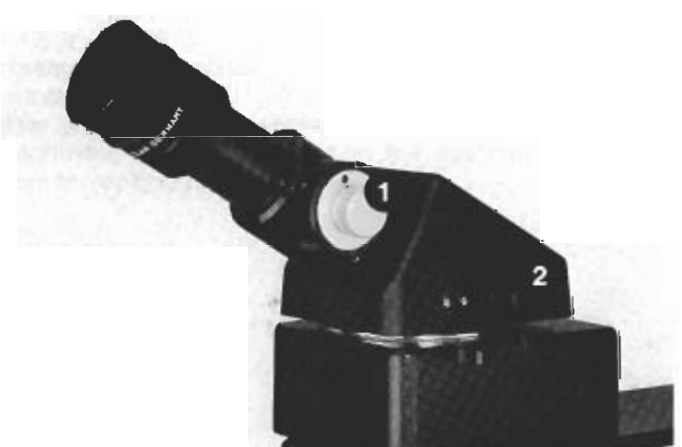


Fig. 4

Binocular Pol tube S 42/30
With the facility to adjust the two eyepieces for the individual interpupillary distance of the user.

Fig. 5

Binocular pol phototubes FSA 42/30 and FSA 42/30 R
For binocular observation and for photomicrography, with alternative beam-splitting arrangements:

- → 100 % of the directed light to the eyepieces;
- ↑ 90 % of the directed light to the phototube, 10 % to the eypieces;
- ↑→ 50 % of the directed light to the phototube and 50 % to the eyepiece.

The binocular pol phototube FSA 42/30 R also offers the possibility of fading-in the format outlines and the measuring field of the automatic LEITZ VARIO-ORTHOMAT camera system and the measuring diaphragm of the MPV-Compact microscope photometer.

Monocular tube O
For photomicrography with camera systems incorporating a focusing telescope (WILD MPS camera system).

Fig. 6

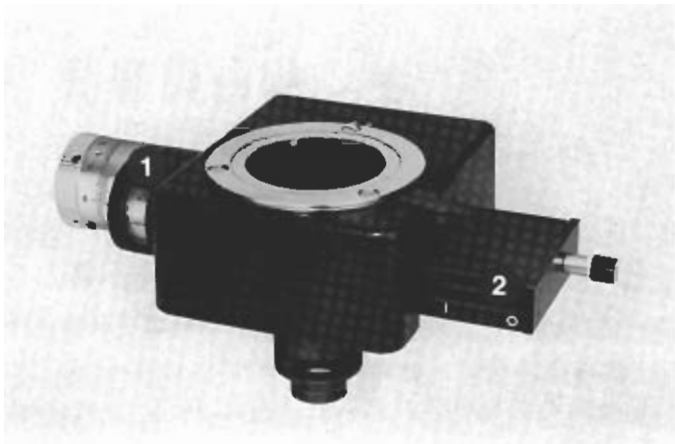


Fig. 7

Intermediate tubes 90, 360 and 360 B for transmitted light
All three intermediate tubes have a disengageable analyser. The tube lens system is 1 x. The intermediate optical system has been computed so that the compensator inserted in the tube slot is in the parallel beam, and therefore does not displace the image.

Intermediate tube 90
In conjunction with the tube P 42/30 for monocular orthoscopy and conoscopy; with the tubes S 42/30 and FSA 42/30 and FSA 42/30 R for binocular orthoscopy. The analyser ① cannot be rotated.

Intermediate tube 360
For binocular orthoscopy, especially for phase difference measurements according to Sénarmont with the tubes P 42/30, S 42/30, FSA 42/30 and FSA 42/30 R. The disengageable analyser ① can be rotated through 360°, vernier reading 1/10°. The disengageable neutral-density filter ② in the empty aperture of the analyser slide serves for brightness compensation when the analyser is removed from the optical path.

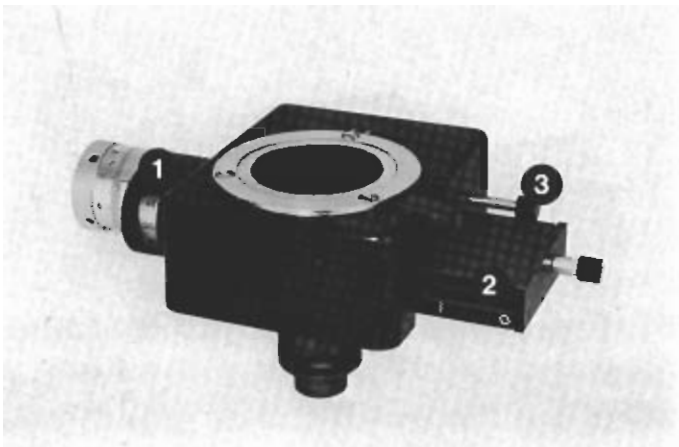


Fig. 8

Intermediate tube 360 B
For binocular orthoscopy and conoscopy with the tubes S 42/30, FSA 42/30 and FSA 42/30 R.
As with the intermediate tube 360, it has an analyser ① rotatable through 360° and a neutral-density filter ② for brightness compensation. In addition a Bertrand lens with integrated pinhole stop ③ for conocscopy of small grains has been fitted.

Fig. 9

Revolving nosepiece
The revolving nosepiece accepts four objectives, which can be individually centred. Precise internal click-stops of the nosepiece guarantee exact and lasting centration (see p. 21) in the axis of rotation of the object stage. Objectives not in the optical path are inclined towards the limb of the microscope.

Fig. 10

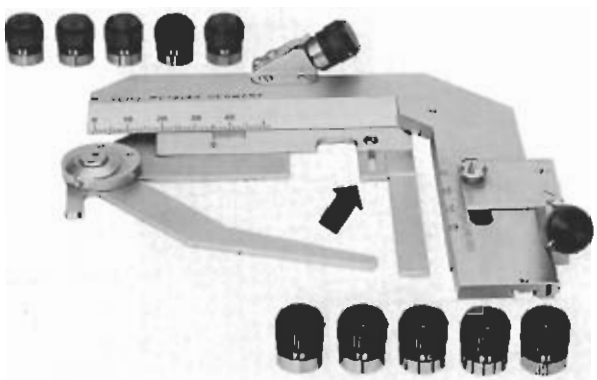


Fig. 11

Object stage

The detachable object stage is mounted on ball bearings, its external diameter is 167mm, the diameter of its useful area 150mm. The rotating stage has a 360° graduation and two 1/10° verniers. The vertical stage travel is 25mm. In addition, it can be lowered in steps of 26mm and 42mm. This lowering is used for mounting the universal rotating stage or for the microscopy of very thick opaque specimens (maximum 67mm).

The centrable condenser fitting and the stage insert can be removed (essential for fitting the universal rotating stage).

When the object guide is used the stage clips must be removed. The centring keys ① can be kept to hand on the top of the stage angle bracket.

Object guide

When a small lever is turned (arrow) the object guide offers the possibility of accepting microscope slides up to 50 x 50mm and 26 x 76mm in size. The movement range is 30 x 40mm. With the aid of the two verniers object coordinates can be determined to an accuracy of 1/10°.

For selective and reproducible step scanning of specimens easily exchangeable pairs of clickstop buttons (0.1 – 0.2 – 0.4 – 1.0 – 2.0mm) are available. A pair of 2mm clickstop buttons is included in the basic outfit.

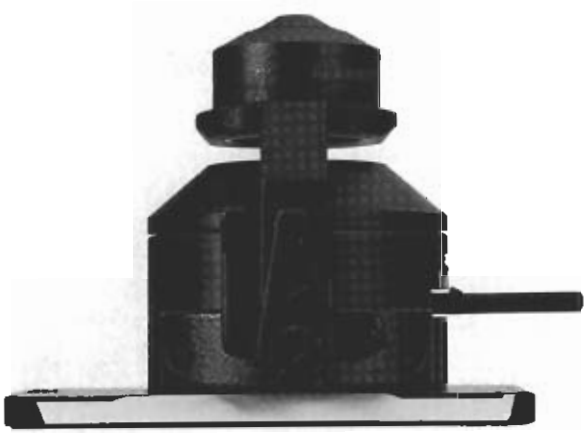


Fig. 12

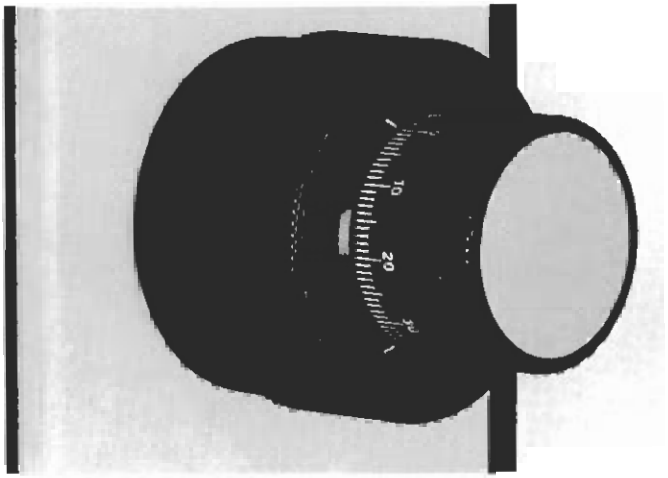


Fig. 13

Condensers for transmitted light
For the basic outfit of the LABORLUX 12 POL the PLK interchangeable pol condenser with built-in aperture diaphragm is available. The lateral polariser attached to the condenser fitting can be rotated through 360°. If a precise extinction position is not achieved in the zero position, the index can be adjusted.
For special purposes * the PLK condenser can be fitted with the following condenser tops:

- ACHR 0.90 S 1.1 P (standard outfit)
- ACHR 0.55 S 15 for heating stages 350 and 1350, of 15mm working distance
- UT 0.34 for universal rotating stage orthoscopy
- UTK 0.62 for universal rotating stage conoscopy
- D 0.80 – D 0.95 for darkground
- D 1.19 – D 1.44 OIL for darkground

In addition, the following condensers can be used:

- UK condenser for brightfield, darkground, phase contrast, and interference contrast T
- UKL condenser for brightfield, darkground, and phase contrast
- Darkground condenser No. 94 D 0.80 – D 0.95
- Darkground condenser No. 92 D 1.19 – D 1.44 OIL

* For special purposes, such as heating-stage microscopy, darkground etc., special instructions are available.

Dual-knob focusing (Fig. 13)
The knurled knobs mounted on both sides of the stand act independently of each other on the object stage. The adjustment range is 25mm. One interval on the fine adjustment scale corresponds to a mechanical plane difference of the object stage of 2µm. The scale of the fine adjustment may be

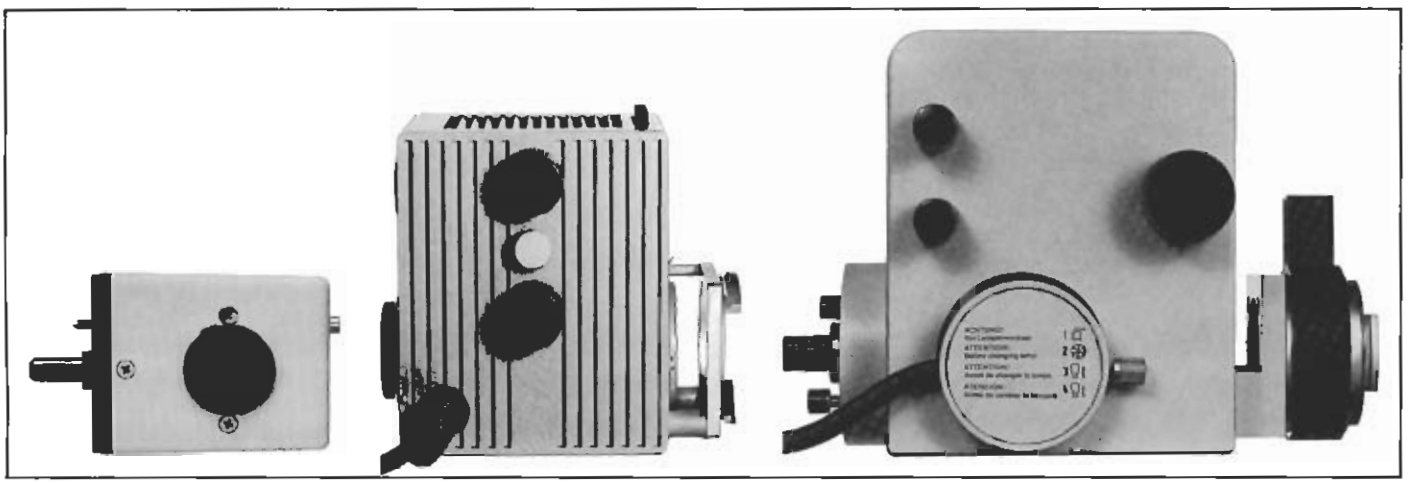


Fig. 14 Lamp Housings 20, 50 and 102 Z

used for thickness and height measurements. If the object is focused on its underside, the measured difference in levels must be multiplied by the refractive index of the object. Further details see p. 41.

Light sources (Fig. 14)
The detachable Lamp Housing 20 with the 6v 20W tungsten halogen lamp can be used alternatively in transmitted or in incident light. In both cases the current is supplied by the built-in transformer.
For higher illuminating intensity the Lamp Housings 50 and 102 Z with separate transformers are available (see p. 42).
The field diaphragm built into the foot of the stand or into the vertical illuminators permits the setting up of Koehler illumination.

Filters
For transmitted-light microscopy the filters are placed on the light exit (1.13) of the foot of the stand; for incident light, they are inserted into the filter slot (44.1) of the vertical illuminator.

The following filters, are examples of those available as accessories:

Diffusion disc
Used for even illumination, especially at low power.

Neutral-density filter N
Used for the adjustment of light intensity while maintaining colour temperature. The engraved value N 4 indicates the transmission in percentage, for example 100:4 = 25 % transmission.

Green filter
For the improvement of picture quality in black-and-white photomicrography.

Blue filter CB 16.5
Filter for the conversion of the spectrum of incandescent light into daylight-like spectrum (transformer set at full power).

Interference filters
For the spectral isolation of a narrow range of wavelengths, for instance the interference line filter IL 546nm. Uses: phase difference measurements with compensator; contrasty reproduction of interference figures in conoscopy. The silvered side of the interference filter must always point towards the light source.

Fig. 17 Transmitted- and incident-light objective

Objectives
The engraved details on the transmitted-light objective (Fig. 17) provide the following information:
160 is the mechanical tube length in millimetres for which the objective is computed. It is the distance between the screw-on flange of the objective and the upper tube rim (eyepiece tube). Objectives of tube length ∞ are used for incident light.
0.17 indicates the thickness of the coverglass. Only specimens under a coverglass (thickness 0.17mm) should be observed through these objectives.
EF objectives produce an outstandingly flat field, and excellent contrast, and are of high resolving power. This also applies to **PL** objectives.
NPL-FLUOTAR[ν] objectives additionally have superior colour correction. They are particularly recommended for photomicrography in colour.

63 is the reproduction ratio, i.e. the length ratio of a line in the intermediate image to the corresponding line in the object (i.e. 63:1).
0.85 is the numerical aperture.
P indicates strain-free objectives.
OIL indicates the immersion medium to be used with this objective.
Colour coding to DIN, see Table below.

∞ mechanical tube length, infinity with incident-light objectives.
/0 thickness of the coverglass = 0, i.e. objects must not be covered with a coverglass.
/30 Parfocal length (30mm).
NPL normal plano objectives giving a flat field of at least 18mm diameter in the intermediate image plane.
20x/ reproduction ratio: the dimensional ratio of the microscopic intermediate image and the object (for instance 20:1).
/0.40 numerical aperture.
P strain-free objectives for polarised light.
LL objectives of very long free working distance.

Oil immersion
Oil immersion objectives are distinguished by the engraving OIL and a black ring round the lower rim of the objective mount. The working distance of an immersion objective is usually very short. Special care is needed therefore when working with oil immersion objectives.

Immersing the specimen
Use only Leitz immersion oil. Ensure that the immersion oil is free from air bubbles (do not shake the bottle).
Lower the object stage or turn the objective out of the optical path and apply one to two drops of immersion oil to the specimen. Raise the object stage or turn the objective into the optical path and focus the specimen. After the examination remove the oil as soon as possible to avoid transfering it to the other objectives (see p. 46).

Annular colour code of the reproduction ratio of the objectives

Magnification range	1.6:1	2.5:1	4:1 5:1	6.3:1	10:1	16:1 20:1	25:1 32:1	40:1 50:1	63:1	100:1 125:1
Colour code	grey	brown	red	orange	yellow	bright green	dark green	bright blue	dark blue	white

Immersion objectives have an additional code ring, which with oil immersion is black.

Strain-free objectives for transmitted-light microscopy
160/0.17/45mm (Parfocal length = 45mm)

Type of objective	Reproduction ratio	Aperture	Free working distance in mm	Coverglass correction
Strain-free PL PLANO objectives	PL 1.6 *	0.05 with iris diaphr.	7.2	–
	PL 2.5	0.08 P	11.8	–
Strain-free EF P flat-field objectives	EF 4	0.12 P	25.00	–
	EF 10	0.25 P	6.80	–
	EF 25	0.50 P	0.50	0.17
	EF 40	0.65 P	0.45	0.17
	EF 63	0.85 P	0.15	0.17
Strain-free NPL FLUOTAR® P Planachromats	NPL FLUOTAR 16	0.45 P	0.58	0.17
	NPL FLUOTAR 25	0.55 P	0.36	0.17
	NPL FLUOTAR 40	0.70 P	0.24	0.17
	NPL FLUOTAR 100	1.32 P OIL	0.17	0.17

* Strain-free within limits (only for orientating low-power observation).
[1]) – can be used with and without coverglass, 0.17 with 0.17mm coverglass; O microscopy without coverglass.

Strain-free objectives for incident-light microscopy

∞/0/30mm (Parfocal length 30mm; NPL 5 x = 39mm*)

Type of objective	Reproduction ratio	Aperture	Free working distance in mm	Coverglass correction
Achromats	20 x	0.30 P	4.80	O
	50 x	0.65 P	0.45	O
	LL 20 x	0.40 (P) **	10.10	O
NPL P Planachromats	*** NPL 5 x	0.09 P	12.00	O
	*** NPL 10 x	0.20 P	14.00	O
	*** NPL 20 x	0.40 P	0.90	O
	*** NPL FLUOTAR 50 x	0.85 P	0.24	O
	*** NPL 100 x	0.90 P	0.10	O
Immersion systems (Achromats)	20 x	0.40 OIL P	0.46	O
	32 x	0.65 OIL P	0.30	O
	50 x	0.85 OIL P	0.35	O
	*** 125 x	1.30 OIL P	0.28	O

* 30mm in preparation ** (P) = strain-free within limits *** can also be used for interference contrast R

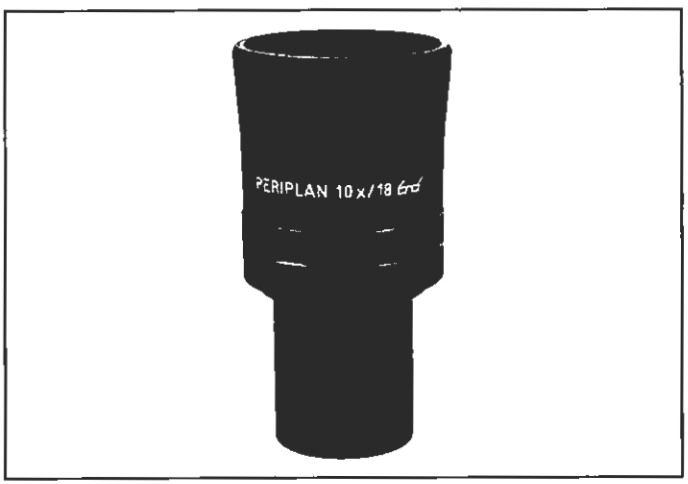


Fig. 18 PERIPLAN 10x/18 6o eyepiece

Eyepieces
In the monocular or binocular tube Leitz eyepieces which are computed for the mechanical tube length of 160mm are used both for transmitted-light objectives (tube length 160mm) and for incident-light objectives (tube length ∞). They can be recognised by the additional engraving of the field-of-view index **18** after the magnification, for instance 10x/18.
The field of view is the area of the intermediate image that can be seen through the eyepiece. It will appear magnified by the eyepiece factor. The microscopic image in a 10x/18 eyepiece, for instance, appears as large as an area of 180mm dia. viewed from a distance of 250mm. For investigations in polarised light an eyepiece with orientated crosslines and horizontal graduation (length measurements see p. 41) is used. The axes of the crosslines indicate the vibration directions of the polarisers and of the object respectively.

Object field diameter
Division of the diameter of the field of view (18) by the objective magnification results in the true diameter of the object field observed.
With the 10x/18 eyepiece and a 4:1 objective, for instance, an object area of
$\frac{18}{4}$ = 4.5mm dia.
is observed.

Final magnification of the microscope
The final magnification is the product of the reproduction ratio of the objective and the eyepiece magnification
e.g.: objective 25/0.50
eyepiece 10x/18
25 x 10 = 250 x final magnification.

Eyepieces engraved **M** will accept graticules (dia. 19.0mm).

Those engraved 6o indicate that the eyepiece can also be used by spectacle wearers. When spectacles are worn the eyecup must be reversed. For use without spectacles the eyecup should be used, when it will also act as a protection against glare.

4. Assembly of the microscope for transmitted light

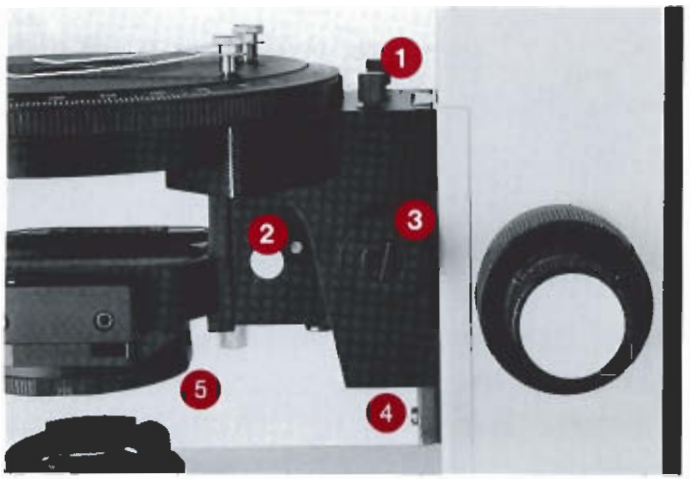


Fig. 19

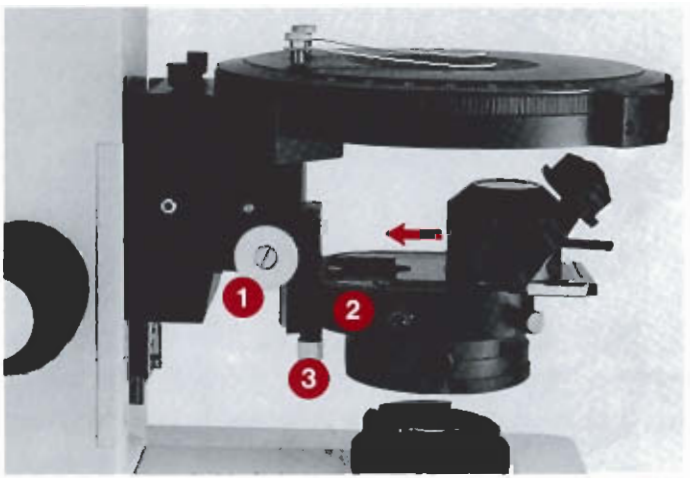


Fig. 20

Object stage, polariser, condenser
Loosen the clamping screw ③ as far as it will go and pull it out (towards the right) in the axial direction so that it can be loosened a little further (anticlockwise).
Attach the object stage roughly in the centre of the dovetail guide ④ and slightly tighten with the clamping screw ③.

Attention
For the fitting of the universal rotating stage or for extremely thick opaque specimens the stage is attached to the dovetail guide rail so that the bore engages in the screw ④ on the underside of the guide.

Attach the polariser ⑤ with rack-and-pinion drive to the dovetail guide rail, push it up as far as it will go and lock it with screw ②. Keep the centring key ① in the stage angle bracket.

Srew the condenser top in, insert the condenser in the dovetail guide and clamp it with the knurled screw ②. Now raise the condenser as far as possible with the knurled wheel ①. The knurled screw ③ serves for the reproducible setting of the field diaphragm (Koehler's illumination).

Stage clips and object guide
Alternatively insert stage clips in the two bores or screw the object guide Pol on to the stage with a coin.

Lamp Housing 20
Remove the dust cap from the back of the stand, attach the lamp housing in its place and secure it with the aid of a coin.
Lamp change see p. 45.

Fig. 21

Fig. 22

Mounting objectives on the nosepiece
Lower the object stage and screw the objectives onto the revolving nosepiece in the order of ascending magnification. For transmitted light use only objectives of tube length 160mm.
Exception: when thin polished sections without coverglass are to be examined incident-light objectives of tube length ∞ can be used, but only in conjunction with a vertical illuminator instead of an intermediate tube.
Turn the objective sleeve ① so that the engraving points towards you.

Inserting an intermediate tube for transmitted-light observation
Remove the protective cap of the tube lens system.
Push the lever in the direction of the arrow and place the tube straight into the changer. Ensure that the locating pin engages in the recess of the changer. Allow the lever to slide forward. Additionally clamp the intermediate tube by slightly tightening the lever.
Mounting the vertical illuminators see p. 38.

Preparing the microscope for operation with transmitted light

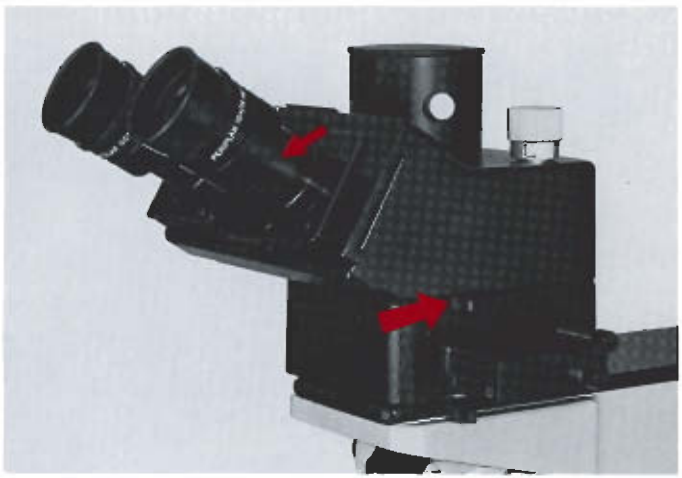


Fig. 23

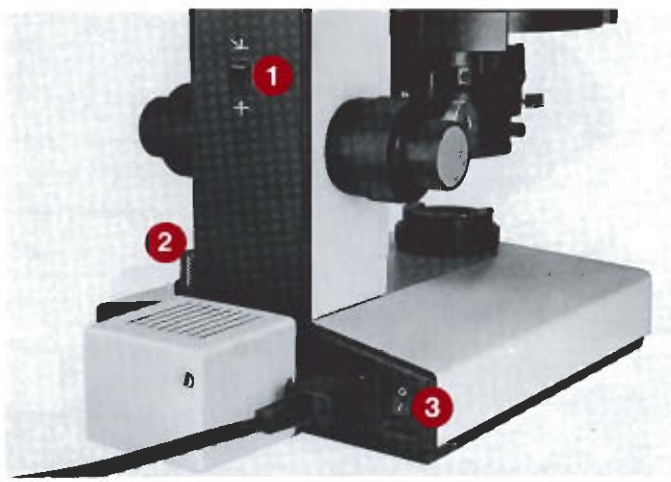


Fig. 24

Inserting the Pol tube and the eyepieces
Push the lever on the intermediate tube back and place the tube straight into the changer. Ensure correct engagement of the pin.
Additionally clamp the observation tube by slightly tightening the lever (Fig. large arrow).
Insert the eyepiece(s).
The eyepiece with crosslines and graduation is inserted in to the right-hand eyetube of the binocular. Ensure that the eyepiece engages in one of the two slots in the right-hand tube (small arrow). The eyepiece without crosslines is inserted in the left-hand eyetube.

Connect the instrument to the mains.
Move the mains switch ③ in the back of the foot of the stand downwards. Move the selector ① in the back of the stand down for transmitted-light illumination.
Set the brightness to a low level by means of the knurled knob ②.
Place the specimen on the object stage. Ensure that the coverglass faces the objective.

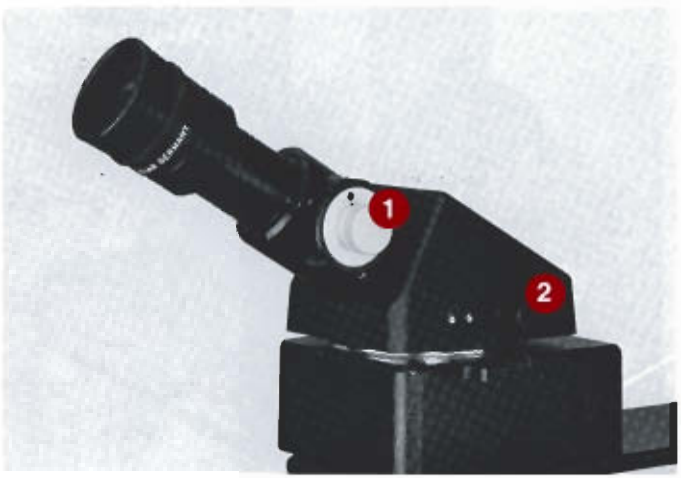


Fig. 25

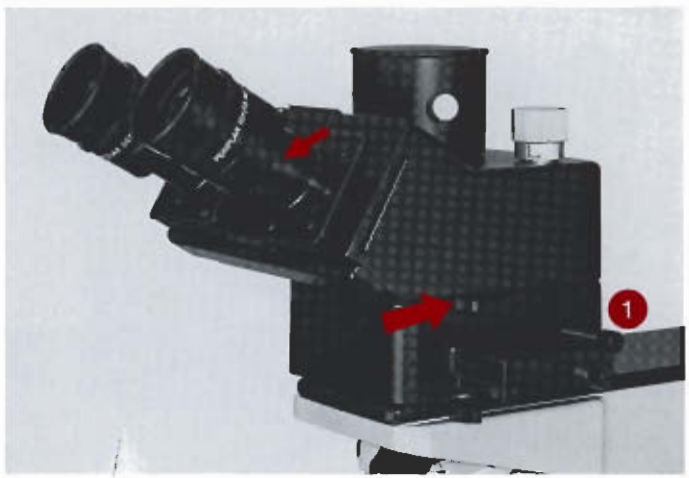


Fig. 26

Tube setting – monocular
Turn out pinhole stop ① and Bertrand lens ②. Remove the eyepiece and focus the eyelens on the crosslines with the eye relaxed.
(The eye relaxes best if you briefly look at a distant object outside the room.)
Replace the eyepiece with correct orientation. The soft rubber eyecup offers the microscopist without spectacles a lateral protection against glare, spectacle wearers should reverse the eyecup.

Tube setting – binocular
Set the crosslines as described and insert the eyepiece in the **right-hand** eyepiece tube. Using the right eye only focus the specimen with the coarse and fine adjustment (Fig. 13). Observe the image with your left eye only and adjust the focusing eyelens to bring the specimen to focus. Do not adjust the coarse and fine focus.

Fig. 27

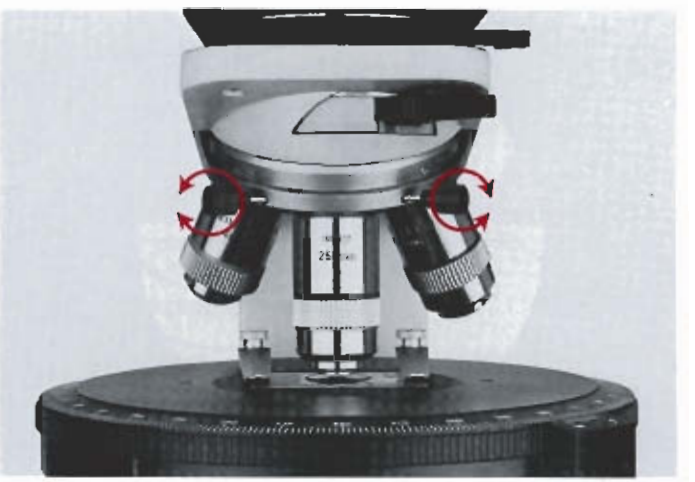


Fig. 28

Adjust the **interpupillary distance** of the tube by pushing the eyepiece tubes together or pulling them apart, until only one image can be seen with both eyes.
If necessary, re-adjust the left-hand eyelens.
With the FSA and FSA R tubes the optical path can be adjusted via a triple beam splitting prism, so that sufficient light reaches the eyepieces and phototube according to requirements. The alternatives are as follows:

- → 100 % of the light is directed to the eyepieces
- ↑ 90 % of the light is directed to the phototube, 10 % to the eyepieces
- ↑↳ 50 % of the light is directed to the phototube, and 50 % to the eyepieces.

The knurled screw on the left of the tube FSA 42/30 R serves to engage and disengage the fade-in device; (the electrical contact on the top permits closing the observation tubes during measurement or exposure).

Centring the objectives
For centring, the objectives are adjusted with the aid of two Allen keys, until the optical axis of the objective (and therefore the centre of the image) coincides with the axis of rotation of the object stage. With correct centration, an aligned area of the specimen does not drift from the field of view as the stage is being rotated. An object point in the centre of the crosslines does not change its position during a full rotation of the stage.
It is best to use a detail enriched, contrasty specimen for centring objectives. Close the aperture diaphragm (1.11). Remove the analyser (1.2), pinhole stop (25.1), and Bertrand lens (25.2 or 26.1).

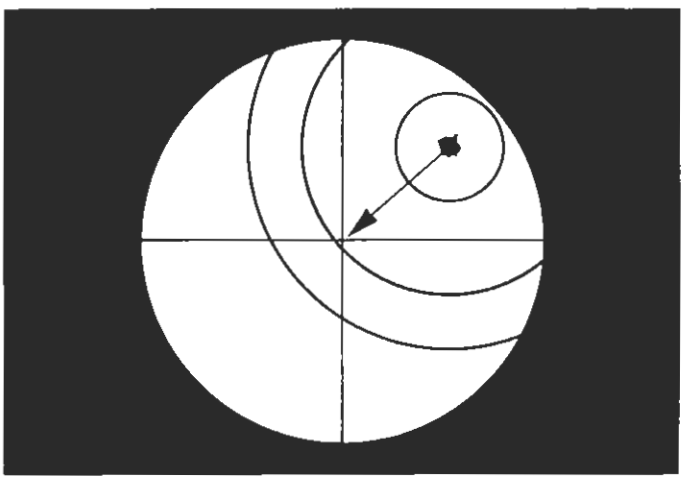


Fig. 29a

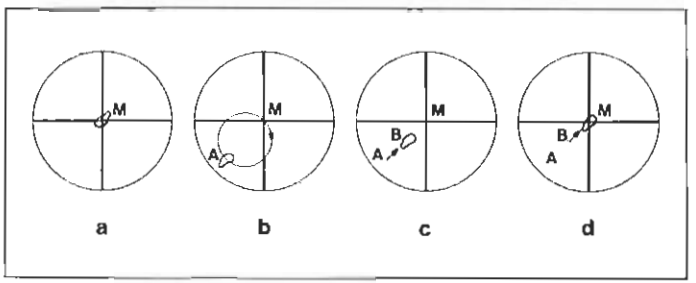


Fig. 29b

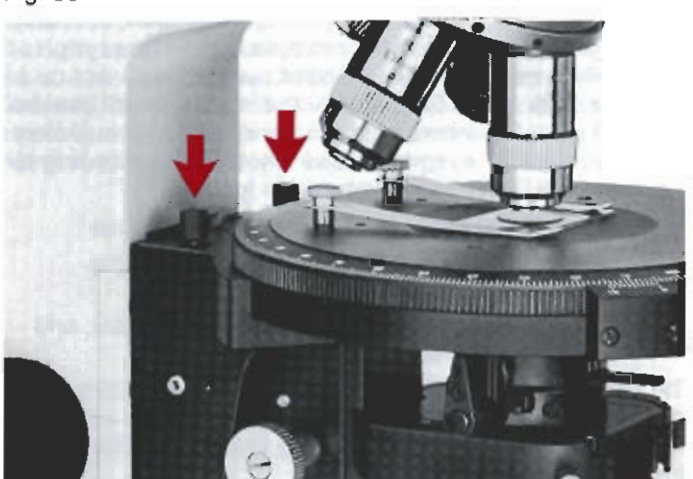
point A (maximum deflection of the object area) may be outside the field of view.

Two similar methods exist for objective centration.

Method I (Fig. 29a)
Insert the objective centring key in the apertures above the objective which is to be centred. Rotate the object stage and note the area of the object which does not move on a circular orbit. This object point corresponds to the mechanical axis of rotation of the object stage.
The previously determined object point can now be moved into the centre of the crosslines by adjusting the two centring keys. If necessary repeat the procedure to improve centration.

Method II (Fig. 29b)
Move a prominent area of the object A into the centre of the crosslines M. Rotate the object stage until the area of the object is at its maximum distance from the centre of the crosslines M (position A, Fig. 29). In an extreme case the

Fig. 30



Insert both centring keys into the apertures above the objective used. Move the microscopic image by turning the centring keys so that the object area A is in the centre (position B) of the line between the farthest position A and crosslines M. Adjust the object manually or with the aid of the attachable object guide until the prominent area is in the centre of the crosslines M. Rotate the object stage and check whether the axis of rotation of the stage coincides with the centre of the crosslines in the eyepiece. Repeat centration if necessary. If the objective is not moved from this position on the nosepiece centration will be preserved.

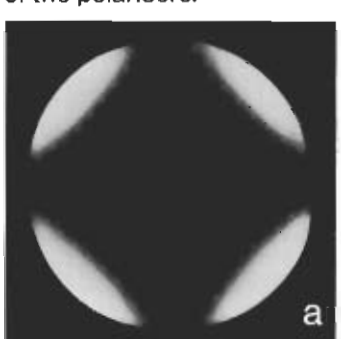
Centring the Bertrand lens
Insert the centring keys in the centring apertures (45.2). Turn in Bertrand lens (3.2), disengage the analyser. Centre the bright circular patch to the crosslines.
Store the centring keys in the two bores of the stage angle bracket (Fig. 30).

Crossing the polariser and analyser
Look for an empty area in the specimen or remove the specimen from the optical path. Turn in a dry objective of high magnification, for instance 40:1 or 63:1. Set lamp at maximum observable brightness. Turn in the polariser (19.5). Open the aperture diaphragm (1.11). Insert the analyser (1.2).
With the rotatable analyser temporarily slacken the clamping screw on the back and set the position exactly at 90°.
Turn in the Bertrand lens (8.3 or 3.2).
Disengage the pinhole stop (3.1) of the monocular tube P.
If necessary slightly pull the compensator out of the tube slot. If the compensator is not in use, it need not be fully pulled out of the tube slot. It is sufficient if it unblocks the optical path for normal observation. The compensator thus protects the tube lens against dust.

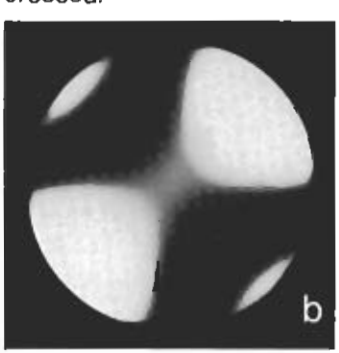
Fig. 31 Dust protection slide

If the compensator is fully pulled out, the slot should be sealed with the dust protection slide (Fig. 31). If necessary, remove the $\lambda/4$-plate (p. 43) for circular polarisation from the condenser.
Rotate the polariser through the zero position until a symmetrical, blurred cross seen in the eyepiece indicates the exact crossed position of the polarisers (see Fig. 32).
Turn out the Bertrand lens.

Fig. 32
Exact crossed position of the polarisers.



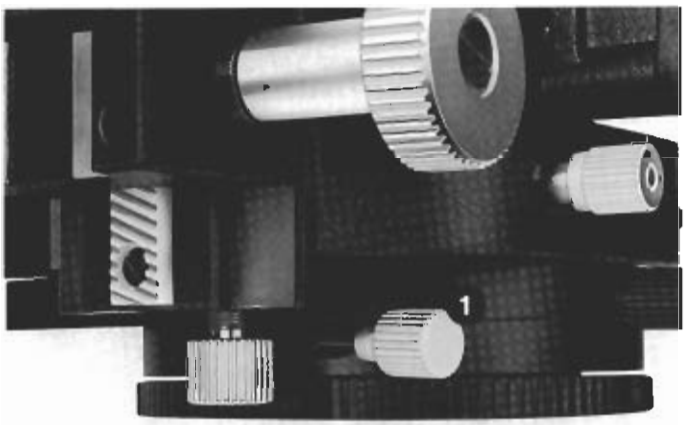
Polarisers not exactly crossed.



In microscopes without a Bertrand lens, it is best to remove one eyepiece for this adjustment. The blurred cross will then become visible inside the tube (observe from about 10 to 25cm distance above the tube).
If the zero point does not coincide with the index, the index must be adjusted with the centring key in the back of the polariser ① (Fig. 33).

Setting the condenser – Koehler illumination
The condenser top S 1.1 can be used only for microscope slides of up to 1.2mm thickness. For thick microscope slides condenser tops of a longer working distance must be used.

Fig. 33



Condenser adjustment for objectives from 10:1 upwards (Fig. 34)
Koehler illumination
Focus the specimen, turn in the condenser top.

1. Close the field diaphragm by turning the knurled wheel.
2.a Turn the knurled screw for the vertical stop of the condenser back into the holder.
2.b Move the condenser into its top position. Form a sharp image of the field diaphragm by turning the knurled screw b clockwise.
3. Centre the field diaphragm with the two knurled screws.
4. Turn the knurled wheel and open the field diaphragm up to just beyond the edge of the field of view.

When another objective is being used check the adjustment and focus of the diaphragm.

Condenser adjustment for objectives below 10:1
Turn out the condenser top. Lower the condenser with the knurled knob until a sharp image of the closed field diaphragm is in focus together with the object. Centre the image of the diaphragm with the two knurled screws. Now open the field diaphragm just beyond the edge of the field of view.

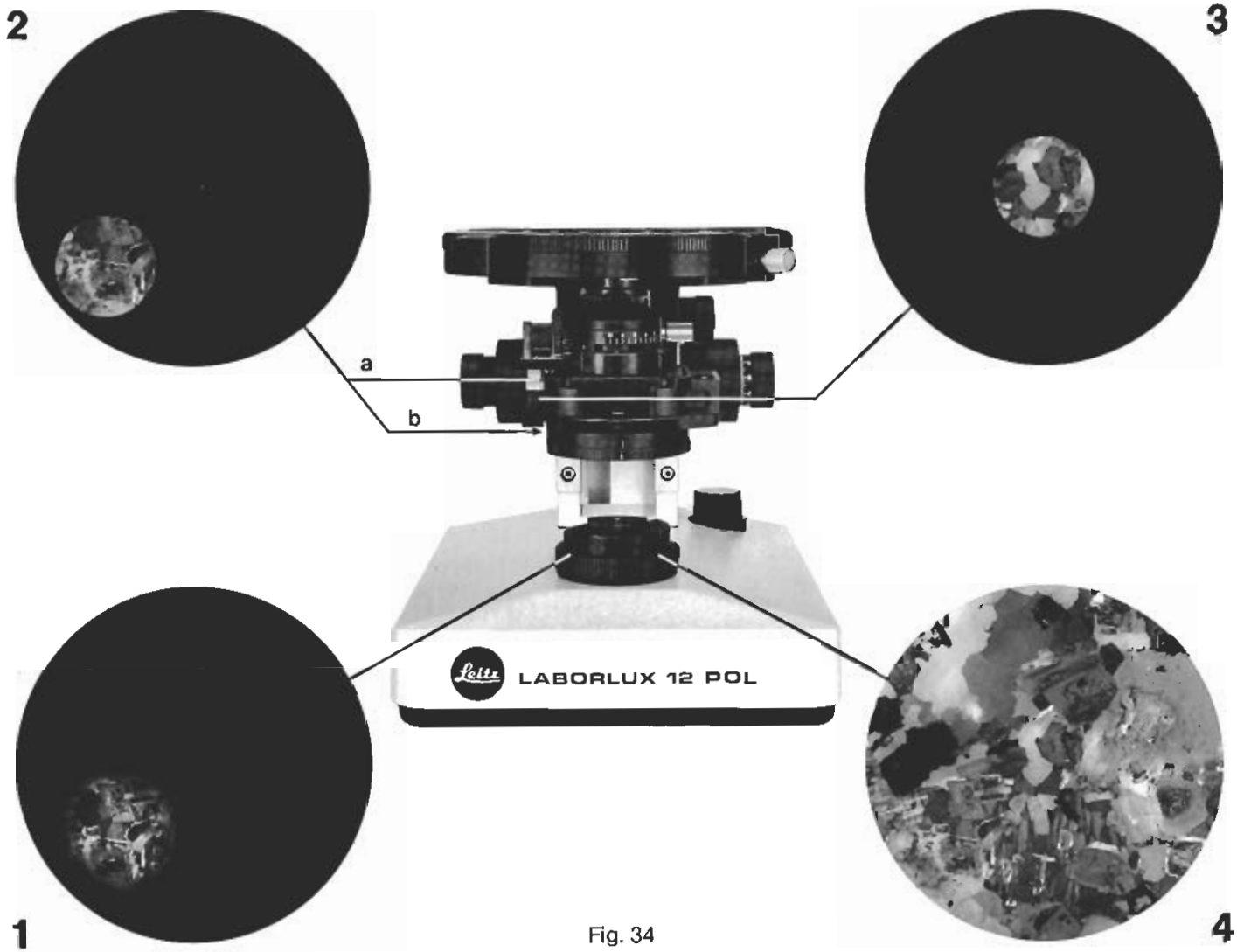


Fig. 34

The aperture diaphragm

The aperture diaphragm influences resolution, contrast, and depth of field of the microscope image. Optimum resolution is achieved when the apertures of the objective and of the condenser are the same. When the aperture diaphragm is closed resolution decreases, but depth of field and contrast increase. When it is closed beyond about 1/3 of the aperture of the objective the resolving power is noticeably reduced.

(When the analyser is turned out and the Bertrand lens turned in, the objective aperture will appear as a slightly brighter circular area).

In polarising microscopes the aperture diaphragm is set for orthoscopic observation so that the contrast is as high as possible. When **conoscopic observations** are being made, the **aperture diaphragm must always be fully opened.**

Important

The aperture diaphragm does not serve for the adjustment of image brightness. For this purpose, only the transformer adjustment or neutral-density filters must be used.

Mounting the universal rotating stages UT4 / UT5

Loosen the stage clamp (19.3) as far as it will go, pull the clamping screw (axial) outwards (to the right) so that it can be slightly loosened further.

Remove the object stage (swivelling movement to the left) and lower it on the dovetail guide until the stop screw (19.4) engages in the locating bore on the back of the stage changer. Retighten the stage clamping screw (19.3).

Take the stage plate out of the object stage.

Lower and pull out the normal Pol condenser.

Loosen the clamping screw (19.2) and remove the rack-and-pinion drive with polariser. Remove the polariser with the Allen key.

Screw the special UT condenser (35.4 or 5) into the holder and attach the polariser (35.2) with the two screws (35.3).

For orthoscopic investigations the UT0.34 condenser, for conoscopic investigations the UTK0.62 condenser is used.

Loosen the stop screw (20.3) as far as it will go and with the vertical adjustment (20.1) raise the condenser as far as it will go. Adjust the built-in aperture diaphragm in the condenser 0.34 (35.4).

Screw the universal rotating stage onto the object stage (if necessary with the aid of a coin).

Insert the segment support (35.6) in the U stage so that the bores for the attachment screws are above the corresponding threaded bores of the U stage.

Insert the lower segment ($n_e = 1.554$) in the object support (35.6).

Apply Leitz immersion oil (1 to 2 drops) free from air bubbles to the top of the segment.

Place the specimen in position and apply Leitz immersion oil also to the coverglass.

Place the upper segment (35.7) in position and attach it with the aid of the two spring screws. The larger segments are used for orthoscopy; the smaller for conoscopy.

For the vertical adjustment of the specimen an Allen ob-

jective centring key (Fig. 30) is inserted in one of the bores of the segment support.
Screw the special UT objectives into the objective centring revolving nosepiece.
For conoscopy only UT objectives with an aperture of > 0.60 must be used.
Centre the objectives to the rotation of the stage. Further adjustment see special instructions for the universal rotating stage.

Fig. 35

Fig. 36

Investigation of birefringent objects in the orthoscopic beam

Thin polished section of rock (granite, crossed polarisers).

Orthoscopy is the normal observation of the magnified image of the object in a polarising microscope. Conoscopy or observation in a divergent or a convergent beam is the investigation of the interference image produced in the rear focal plane of the objective. This interference image is as a rule viewed through the Bertrand lens turned into the optical path and through the ordinary eyepiece. Here, the Bertrand lens takes over the function of an objective and together with the eyepiece forms a microscope, which permits the observation of the magnified interference image (Fig. 42).

Birefringent objects (except when cut vertical to an optical axis) appear dark (normal positions) when the object stage is rotated through 90°, and bright or coloured in the intermediate regions (diagonal positions).

Isotropic objects (as well as empty areas and birefringent objects cut vertical to an optical axis) on the other hand do not exhibit intensity differences when the object stage is rotated.

Causes of the alternate extinction and reappearance of the interference colours are:

Birefringent objects (except in the direction to a crystal optical axis in which the object exhibits isotropy) divide the light into two beams vibrating vertically to each other. In one fibre, for instance, one beam vibrates parallel, the other transversely to the longitudinal axis.

Extinction position will occur when both beams vibrate parallel to the transmission directions of the polarisers.

Brightness (interference colour) will occur when both rays vibrate diagonally to the transmission direction of the polarisers. Both rays have different velocities of propagation, i.e. two different refractive indices. The higher refractive index is always called n_γ', the lower one with n_α'. The magnitude of these refractive indices changes with the transmission direction in the specimen. In the direction of an optical axis both refractive indices are identical; the object therefore appears isotropic. The maximum values of the two refractive indices are called n_γ and n_α, the corresponding birefringence will be:

$\Delta n = n_\gamma - n_\alpha$.

The spatial distribution of the refractive indices and of the vibration directions is demonstrated in a threedimensional model, the so-called indicatrix. For details, special textbooks on polarised light microscopy should be consulted.
The differential velocity of propagation of both rays causes a phase difference Γ, which depends both on the magnitude of the effective birefringence Δn, and on the thickness d of the object:
$\Gamma = d \cdot \Delta n$.
After passing through the analyser both rays will interfere. Depending on the degree of the phase difference Γ produced in the specimen, a specific interference or polarising colour will appear, which can be obtained from the table on the right.
Interference colours are divided into orders. The unit chosen for this is the wave length 551nm, which corresponds roughly to the brightest point in the solar spectrum. First-order colours correspond to a phase difference of 0 – 551nm, second-order colours from 552 – 1102nm etc.
With some practice, the magnitude of the phase difference can already be estimated from the interference colours.
With ascending orders the interference colours become increasingly paler and merge into the so-called "higher-order white". Adjustable compensators – see p. 32 – serve for the precision measurement of the phase differences.
The sequences of the interference colours up to fourth order can be observed by the adjustment of the quartz wedge (Fig. 39) or of the tilting compensator (Fig. 41). For this purpose the quartz wedge or the tilting compensator is inserted in the tube slot (1.4). For observation the Bertrand lens (8.3) can be additionally inserted in the optical path.

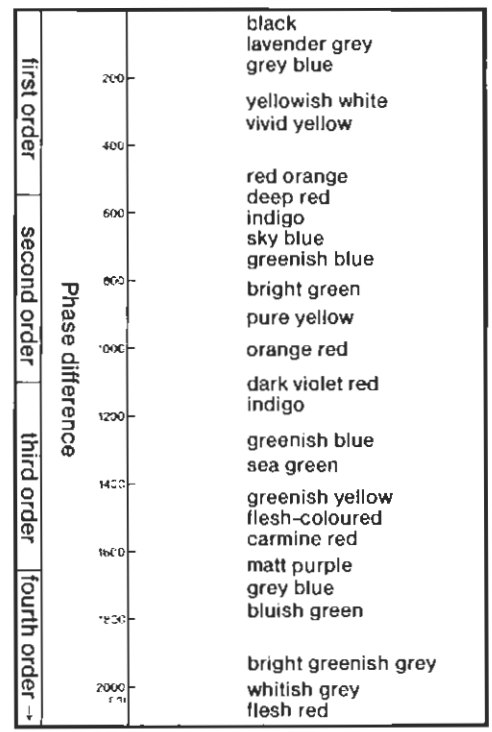


Fig. 37
Table of the first- to fourth-order interference colours.

The use of λ/4- and λ-plates

The vibration directions γ' and α', which correspond to the rays of refractive indices n_{γ}' and n_{α}' as well as the angle which they include with cleavages, crystal faces etc., are frequently of interest. The vibration directions can be determined by the insertion of an auxiliary object (compensator) in one of the tube slots of the microscope. If the vibration directions of the object n_{γ}' and compensator n_{γ} corresponding to the higher refractive index are parallel to each other, the total phase difference in the microscope will increase, and a "higher" interference colour is seen. But if the two vibration directions corresponding to the rays of the higher refractive indices are vertical to each other (Fig. 38) the phase difference will decrease. The vibration direction of the compensator is marked on the mount with a line or arrow (Fig. 39).

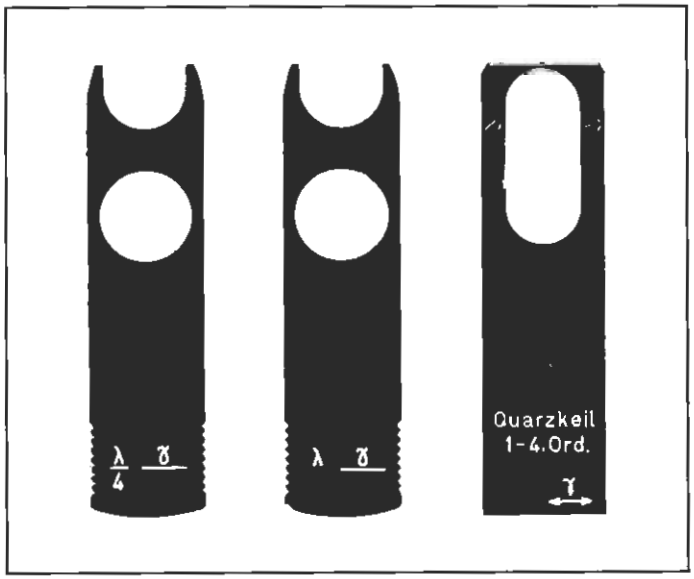


Fig. 39 λ/4- and λ-compensator and quartz wedge first to fourth order

Fig. 38 a and b addition position
c and d subtraction position

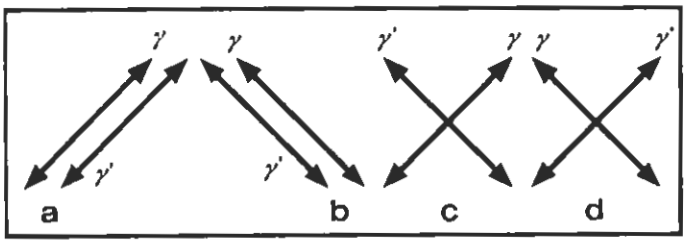
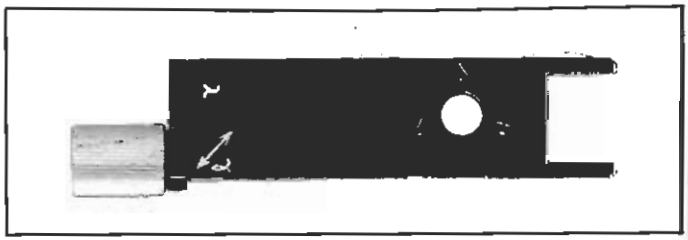


Fig. 40 λ-plate in subparallel position



Example 1:
An object exhibits the interference colour vivid yellow of first order (see table). After insertion of the $\lambda/4$-plate (phase difference about 137nm) in the tube slot of the microscope the object will appear red-orange. The phase difference, therefore, has increased as the table shows:
The vibration direction γ' (specimen) is parallel to the vibration direction γ: Figs. 38a, b.

Example 2:
Interference colour of the object: grey-blue, with λ-plate sky blue.
The phase difference has therefore increased: γ' (specimen) is parallel to γ (compensator) Figs. 38a, b.

Example 3:
Interference colour of the object: vivid yellow; with $\lambda/4$-plate: yellowish-white.
The phase difference has decreased: γ' (specimen) is vertical to γ (compensator), Figs. 38c, d.
Instead of the two fixed compensators the quartz wedge (Fig. 39) and tilting compensator (Fig. 41) can be used for these determinations. The choice of the compensator depends on which of them produces the more clear-cut results.

Use of the λ-plate in subparallel position
This compensator serves for the detection of very weak birefringence ($\Gamma < 20$nm) and for the determination of the vibration directions γ' and α' in weakly birefringent objects (Fig. 40).
The vibration direction γ of the rotatable λ-plate is parallel to the transmission direction of the polariser (east-west) when the two red dots coincide. After slight clockwise or anticlockwise rotation of this plate from its normal position object areas of very small phase difference will become prominent by a colour shift towards blue (addition) or yellow (subtraction). Because the orientation of the λ-plate is known according to the subsequent rotation (WSW-ENE or NWN-ESE) the vibration direction γ in weakly birefringent objects can be determined as with the use of the λ- and $\lambda/4$-plate (Fig. 39).

References: LAVES F. und Th. ERNST: Die Sichtbarmachung des Charakters äußerst schwacher Doppelbrechungseffekte. – Naturwiss. **31**. 68–69. 1943.
SCHMIDT, W. J.: Diagonale und Subparallele Gipsplatte Rot I und verwandte Hilfsmittel in der histologischen Polarisationsmikroskopie. – Leitz-Mitteilungen Wiss. Tech. **III** (8). 234–243. 1967.
PATZELT, W.: Polarisationsmikroskopie; Leitz Broschüre 550–51.

Quantitative determination of phase differences through the use of compensators

Adjustable compensators serve for the exact measurement of phase differences. When the thickness of the object d is known, birefringence $\Delta n'$ can be calculated according to the following formula:

$\Gamma = d \cdot \Delta n'$ [nm]

For the measurement the compensator is inserted in the tube slot and adjusted until the object area to be measured is in its maximum extinction position. For this purpose the object has to be moved into a certain diagonal position. Further details are contained in the instructions for the use of the compensators.

The following compensators are available:

Elliptical compensator according to Brace-Koehler

The compensator is supplied with a compensator plate of about $\lambda/10$ phase difference. Measurement is carried out in white or in monochromatic light.

Main use:

Objects of very small phase differences (biology, strained glasses).

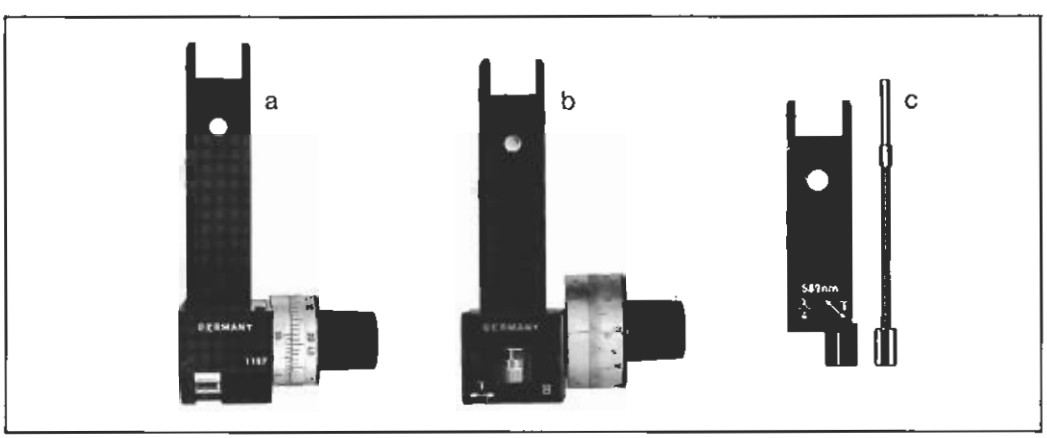


Fig. 41
Compensator according to Brace-Koehler (a).
Tilting compensator (b).
Compensator with $\lambda/4$-plate in subparallel position (c) (with adjustment).

Elliptical compensator
according to Sénarmont
($\lambda/4$-plate in subparallel position)
Measurement is executed in monochromatic light (546nm), and the use of a rotary analyser (intermediate tube 360 or 360 B) is necessary. Normally this compensator serves for the measurement of phase differences of up to first order. But higher phase differences, too, can be measured. The compensation, however, does not produce the entire phase difference but only the amount that is in excess of a whole wave length or of a multiple thereof. Whole wave lengths must be determined with a tilting compensator, quartz wedge, or estimation of the interference colour. Accuracy is higher than with the tilting compensator.

Tilting compensator B according to BEREK,
measuring range up to 5 orders
Compensator with MgF_2 plate for measurements in monochromatic or in white light of up to 5 orders phase difference. The phase difference can be read directly from the sum of the two angles of compensation produced when the compensator plate is tilted in both directions, from a calibration chart supplied.

Tilting compensator E according to EHRINGHAUS
of up to 10 orders' measuring range
Evaluation as with the tilting compensator B.

Tilting compensator K,
measuring range up to 10 and 30 orders
For the measurement of phase differences in white or in monochromatic light up to the maximum phase difference mentioned above. The compensator plate consists of calcite; evaluation is based on simple calculation by means of enclosed tables and the stated calibration constants.

Investigation of birefringent objects in the conoscopic beam

The optical axes of crystals are reproduced and the optical character (positive or negative birefringence) is determined in the conoscopic beam. Here the object is transilluminated in as many different directions as possible, i.e. at large condenser aperture, and the interference image formed in the rear focal plane of the objective is observed with the Bertrand lens in the optical path. With the appropriate cutting angle of the object, the shape of the interference figure reveals whether the crystal is uniaxial or biaxial (Fig. 42). The additional use of fixed and variable compensators also allows the determination of the optical character on the basis of the shift of the interference fringes in the various quadrants and sectors of the interference figure. Details of the determination will be found in textbooks on polarised-light microscopy.

Setting the microscope for conoscopic observation
The most suitable object areas for conoscopy are those that show the lowest possible phase differences (Table p. 29).
It is essential to perfect conoscopical observation that the objectives should be precisely centred and the polarisers precisely crossed.
Turn an objective of the highest possible aperture, for instance 40:1 or 63:1, and the condenser top into the optical path. Open the aperture diaphragm (59.6) and turn the Bertrand lens (59.2) into the optical path. In microscopes without Bertrand lens the interference figures will become visible after removal of the eyepiece. Interference figures can also be observed when the focusing telescope (Code No. 513468) is used instead of the eyepiece.

Isolation of small grains
Narrow the field diaphragm (59.9). Turn in the pinhole stop (25.1) when using the P tube.
In the intermediate tube 360 B the Bertrand lens is already coupled with a pinhole stop, which, after removal of the tube, can be unscrewed, for instance to permit cleaning of the Bertrand lens.

Determination of the optical character (Fig. 42)

Uniaxial crystals
For the determination of the optical character cutting angles are particularly suitable in which the optical axis of the crystal and that of the microscope are parallel to each other. In the orthoscopic beam, objects that are orientated accordingly show no or very slight phase differences when the object stage is rotated. Uniaxial crystals observed in the conoscopic (divergent) beam show a dark cross, whose centre indicates the position of the optical axis. The cross is surrounded by coloured interference fringes*. When a variable compensator (quartz wedge or tilting compensator) is operated the rings drift towards the centre and outwards respectively in two opposite quadrants of the cross. The optical character is determined from the movement direction of the rings according to the following rule (Fig. 42):

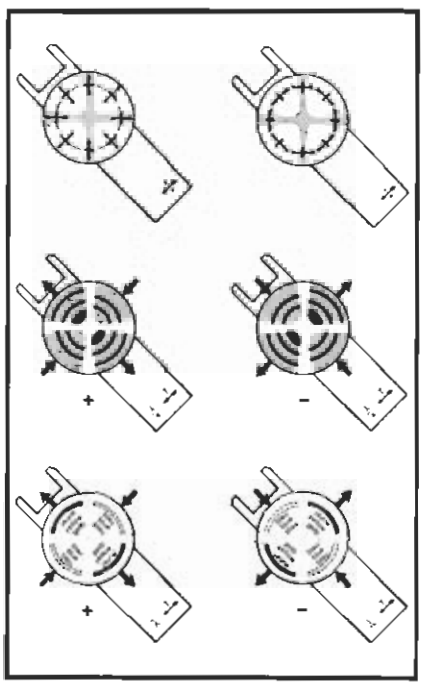
* With thin objects or with objects of low birefringence only the cross will be visible.

Uniaxially positive crystals:
The movement direction of the fringes from the centre of the cross outward is vertical to the engraved γ-direction of the compensator.

Uniaxially negative crystals:
The movement direction of the fringes from the centre of the cross outward is parallel to the γ-direction of the compensator.

Cutting directions in which the optical axis of the crystal is inclined to the direction of observation are also suitable for the determination of the optical character, which can mostly be determined even when the centre of the cross is outside the field of view. Fig. 42 shows that fixed instead of variable compensators can also be used for the determination of the optical character.

Fig. 42
Tables for the determination of the optical character.



Orientation of the compensator plate	Uniaxial		Biaxial	
	+	−	+	−
*				

* With the 1/4-λ mica plate black dots will occur instead of the black arcs.

Conoscopy of biaxial crystals
For the determination of the optical character cutting directions are particularly suitable in which the bisectrix of the two optical axes is parallel to the viewing direction (section vertical to the acute bisectrix).
In the divergent beam a dark cross will be seen which opens up into the two branches of a hyperbola, the so-called isogyres, when the object stage is being rotated. The cross and the branches of the hyperbola are surrounded by interference fringes. According to Fig. 42 or the rule mentioned below the optical character can be determined from the displacement direction of these fringes after operation of the compensator. The symmetry plane of the isogyres (axial plane) must be vertical to the γ-direction of the compensator:

Biaxially positive crystals.
The interference fringes move from the convex to the concave side of the isogyres when the compensator is operated.

Biaxially negative crystals.
The interference fringes move from the concave to the convex side.

The optical character can be usually identified even when only one of the optical axes is in the viewing direction of the observer. In the parallel beam the brightness of specimens orientated in this way changes little if at all during rotation. In the divergent beam, only one of the two isogyres will then be visible.

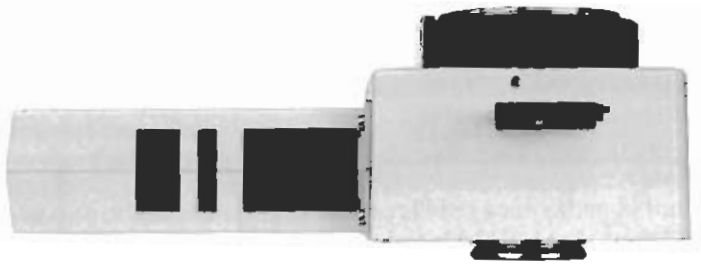


Fig. 43 Pol vertical illuminator SR (with semi-reflecting optical-flat reflector)

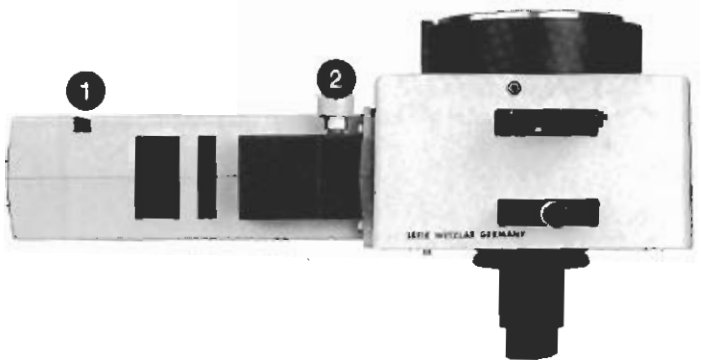


Fig. 44 Pol vertical illuminator TR (① filter slot, ② vertical adjustment of the aperture diaphragm)

Fig. 45 LABORLUX 12 POL with SR Pol vertical illuminator
1 Pinhole stop
2 Apertures for the adjustment of the Bertrand lens
3 Bertrand lens
4 Analyser
5 Polariser
6 Aperture diaphragm
7 Field diaphragm
8 Dust slide

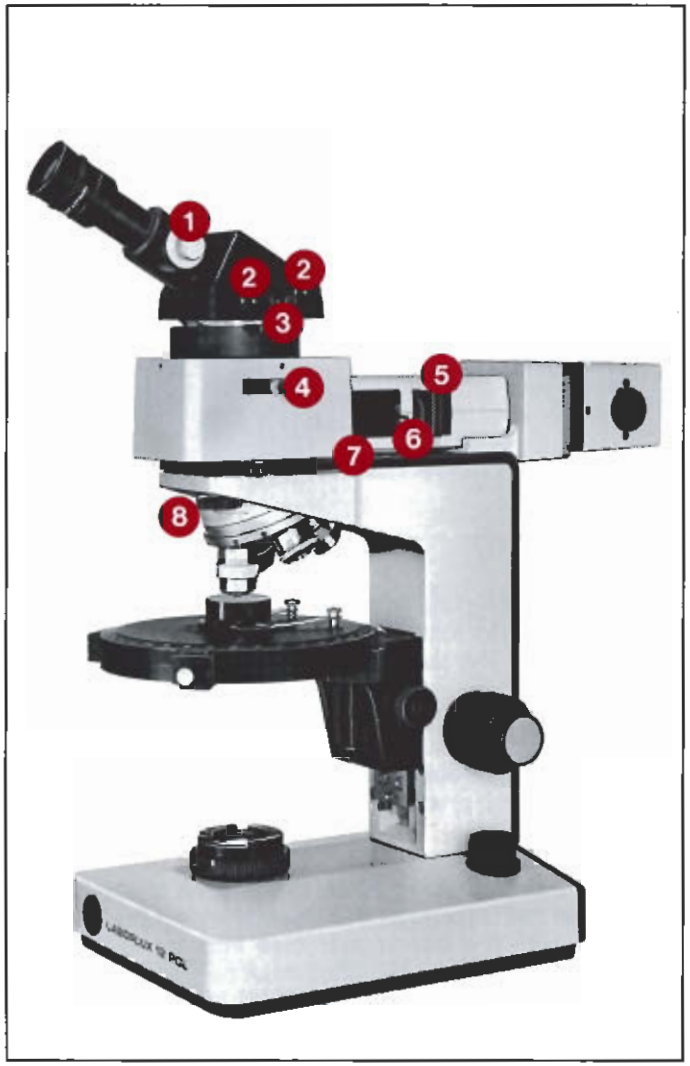


Fig. 46 LABORLUX 12 POL with TR Pol vertical illuminator
1 Analyser
2 Polariser

Assembly of the Pol vertical illuminators

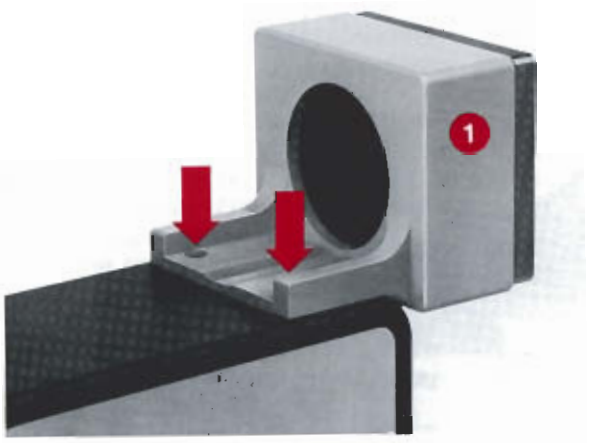
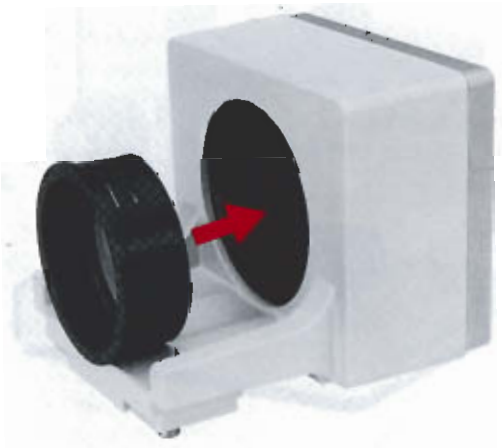


Fig. 47

Fig. 48



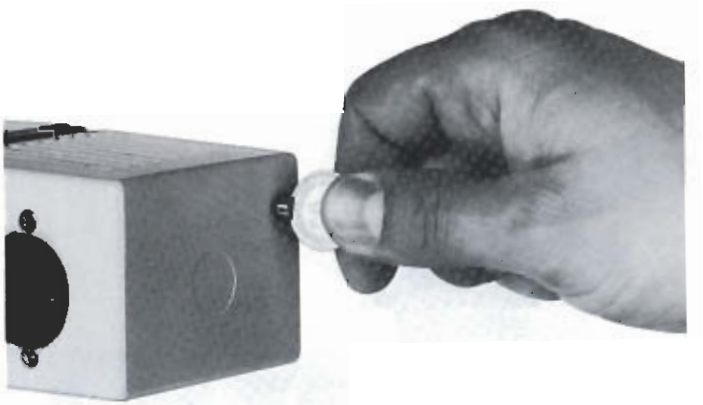


Fig. 49

Fig. 47
Remove the cover plate from the top of the stand (with the aid of a paperclip for instance), wipe the contacts with a clean dry cloth, insert the lamp holder ① into the aperture and screw it home.

Fig. 48
Only with the **TR** vertical illuminator with Lamp Housing 20: insert the diffusion disc.

Fig. 49
Screw the Lamp Housing 20 on to the back of the holder with a small coin. Through the internal wiring the lamp is connected with the transformer built into the foot of the microscope. Other lamp housings must be connected to an external power supply unit (see p. 11).

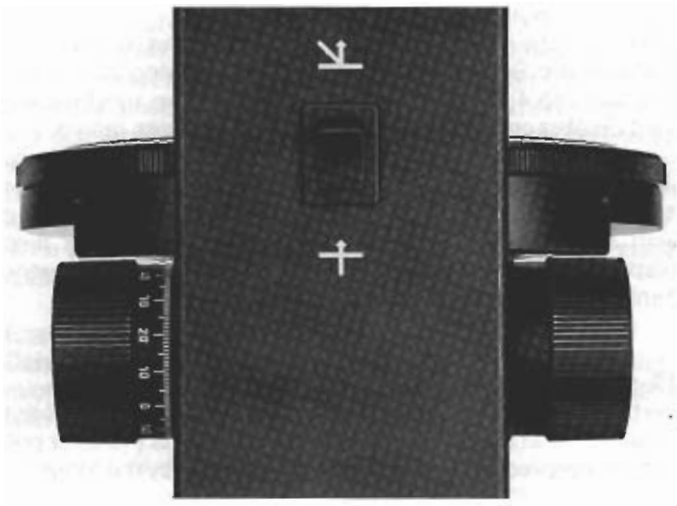


Fig. 50

Fig. 50
Press the rocker switch for incident light upwards. Operate the mains switch (24.3) on the back of the stand.

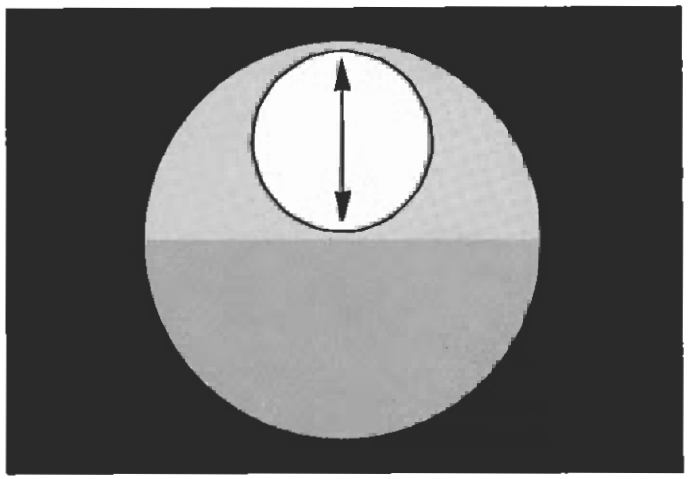
Fig. 51

Fig. 51
Pull off the protective caps, mount the vertical illuminator and the tube on the stand and secure them. Insert the eyepiece(s). Screw the incident-light objectives into the centrable revolving nosepiece.

Preparing the incident-light devices for operation

Fig. 53

Inserting the neutral-density filter (accessory)
Remove the right-hand securing screws and pull out analyser to the left.
Insert the neutral-density filter in the empty hole and secure it with the clamping ring (arrow). Replace the analyser slide.
When the analyser is disengaged, the neutral-density filter protects the eye against glare by preventing an excessive increase in lighting intensity.
SR vertical illuminator: insert the dust slide (31) into the tube slot (45.8).



SR and TR pol-vertical illuminator
Switch on the illumination. Set up the tube and eyepiece(s). Remove the Bertrand lens (45.3), pinhole stop (45.1) and analyser (45.4) from the optical path. Open the aperture and field diaphragms (45.6, 7). Centre the objectives (see p. 21). Cross the polarisers: push polariser and analyser in towards the right. Swivel the analyser until the object area is at maximum extinction. This adjustment cannot be carried out with specimens that exhibit bireflection. Close the field diaphragm to the edge of the field of view and, if necessary, centre it with the centring keys (45.7).

TR-pol-vertical illuminator (Figs. 44, 46)
Vertical adjustment of the aperture diaphragm: turn out the polariser or analyser. Turn in the Bertrand lens (45.3) or pull out the eyepiece and, if necessary, replace it by the focusing telescope. Adjust the diameter of the aperture diaphragm which now becomes visible as a polygon to obtain the required contrast (Fig. 54).
Vertically adjust the aperture diaphragm with the setting knob (44.2) so that its rim touches neither the lower horizontal edge nor the upper semicircular boundary (objective pupil).

Fluorescence excitation with the 3λ-PLOEMOPAK see special instructions.

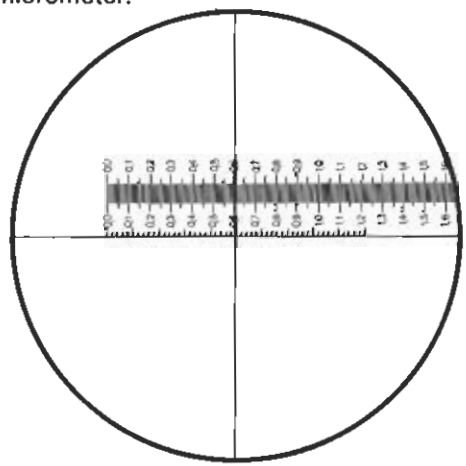
Fig. 54 Centred aperture diaphragm (TR-pol-vertical illuminator)

6. Microscope measurement

Linear measurements of microscope objects are carried out with the graduation of the eyepiece crosslines (Fig. 55). Before measurement is begun the micrometer value of the objective used must be known. The micrometer value is the distance in the object plane which corresponds to an interval of the crosslines scale in the micrometer eyepiece. Because the optical constants of the objectives are subject to minor fluctuations, the microscopist is advised to determine the micrometer values himself with the aid of a stage micrometer.

Example:
Determination of the micrometer value with the aid of a stage micrometer 2mm = 200 intervals and a micrometer eyepiece with graticule 10mm = 50 intervals.

Fig. 55
Graduation of the graticule in the eyepiece and image of the stage micrometer.



Make the zero lines of the micrometer eyepiece and of the stage micrometer coincide in the microscope. The micrometer value is read with unchanged setting of the scale of the micrometer eyepiece (Fig. 55).
If 1.220mm of the stage micrometer coincides with 50 intervals of the micrometer eyepiece, the micrometer value = 1.220 : 50 = 0.0244mm = 22.4µm. Only 10 intervals on the micrometer eyepiece are compared with low power objectives which do not form an image of the stage micrometer across the entire scale of the micrometer eyepiece. If, for instance, 0.36mm of the stage micrometer coincides with 10 intervals of the micrometer eyepiece, the micrometer value = 0.36 : 10 = 0.036mm = 36µm. For very precise measurements under the microscope a screw micrometer eyepiece is used. Our list 513–17 supplies detailed information.

Thickness measurements
The thickness of objects can be measured with the scale (Fig. 13) on the fine-adjustment knob. The distance between two division lines corresponds to a mechanical plane difference of 2µm. When layer thicknesses of transmitted-light objects are measured, it is essential to remember that the result is initially falsified with focusing on the bottom boundary of the layer through the object. For correction, the division line distance must be multiplied by the approximate refractive index of the object. To increase accuracy, the drive knob should be turned only in one direction during focusing on the top and bottom boundary.

Example:
It was possible to focus the top and bottom boundary of a thin polished section at division line 10.5 and 17.0. The refractive index n of the object area is 1.5.
Thickness b = 2 (17.0 – 10.5) 1.5 = 19.5µm.

7. Possibilities of extended use

Transmitted-light darkground

1. Replace the pol top of the PLK condenser by the darkground condenser top D 0.80 – 0.95 for objectives of apertures < 0.75 or with the immersion condenser top D 1.19 – D 1.44 OIL for objectives of aperture < 1.10.
2. Darkground condenser No. 94 D 0.80 – D 0.95 or No. 92 D 1.19 – D 1.44 OIL.
3. Darkground with the UKL condenser
   Turn the revolving turret into position 5 (only for objectives of aperture < 0.75).

Darkground setting
Focus the specimen with a low-power objective. Open the aperture diaphragm. Close the field diaphragm. Remove the polariser and analyser from the optical path. Centre the condenser (see p. 24/25) and adjust it vertically.

Transmitted-light phase contrast

Special PHACO objectives and a special method of illumination are required for phase contrast microscopy.
1. Phase contrast with push-in diaphragms: screw in phase contrast objectives. Turn out the condenser top. Open the aperture diaphragm. Turn out the polariser. Insert the push-in diaphragm corresponding to the objective in the condenser from below. Centre the condenser.

2. Phase contrast with the UKL condenser.
Screw in the phase contrast objectives and insert the UKL condenser. Turn out the analyser. Place the specimen on the object stage. Open the aperture diaphragm. Turn the light ring turret into the position corresponding to the objective (for instance position 1). Close the field diaphragm. Focus the specimen with the coarse and fine adjustment. Set the condenser with the knurled knob and the stop screw so that a sharp image is formed of the edge of the field diaphragm. Now centre the field diaphragm with the two knurled screws, and open it so that it just disappears beyond the edge of the field of view. Replace the eyepiece by the focusing telescope. Release the knurled clamping wheels of the focusing telescope and turn the eyelens until a sharp image is formed of the light- and of the phase-ring. Centre both rings to each other by means of the built in centring keys.

Circular polarisation

Fig. 56

When the object stage is fully rotated birefringent objects show four extinctions. Especially with low-power observation, some of a large number of birefringent objects always happen to be in the extinction position. Circular polarisation is used for the simultaneous observation of interference colours of all objects.
For this purpose, a λ/4-plate is inserted in the tube slot and another one in the condenser.
With exactly crossed polarisers, remove the specimen, and turn the lower λ/4-plate until maximum extinction is reached. The specimen can now be observed.

Stronger light sources for incident-light illumination

1. Lamp Housing 50 with 12v 50W tungsten halogen lamp.
2. Lamp Housing 102 Z with 12v 100W tungsten halogen lamp or gas discharge lamps up to 100W.

Warning!
To protect the polariser, always use monochromatic interference filters with high-pressure gas discharge lamps. An additional heat filter should be inserted to protect the polariser when 50W or 100W tungsten halogen lamps are used.

8. Fault finding

Microscope illumination does not function
Possible causes:
Mains fuse blown.
Connecting cable defective or incompletely inserted in the instrument or socket.
Rocker switch on the back left of the foot of the stand not switched on.
Rocker switch on the back of the limb not switched over.
Built-in fuse in the foot of the stand (2) blown.
Lamp defective (55).
Dirty contacts in the incident-light lamp holder (48).
The protective cap in the back of the stand was not removed before the lamp housing was attached.

Poor extinction
Possible causes:
Polarisers not exactly crossed.
Polariser damaged by intense light sources (yellow discolouration).
Aperture diaphragm opened too far.
Strain in the condenser top or objective (to detect this, rotate the condenser top or objective in the mount and observe it through the Bertrand lens).
Compensator in the condenser (p. 43) or tube slot.
Optical system very dirty (check with Bertrand lens).

Unsatisfactory image quality
Possible causes:
Front of the objective or interior of the objective contaminated with oil.
Coverglass absent or too thick.
Specimen too thick or too thin.
Birefringent material (plastics) has been used for the microscope slide, the coverglass, or the embedding medium.
Aperture diaphragm closed or too far open or wrongly adjusted in incident light.
Condenser top not turned in.
Koehler illumination not set up (p. 24).

9. Accessories

WILD MPS microphoto system
The WILD MPS microphoto system offers the choice between various outfits for three different camera formats. Details are contained in the special Wild literature.

Tracing device
The tracing device is inserted between stand and observation tube. The microscope image is traced in the coincident-image mode: the tracing area and pen are observed simultaneously with the microscopic image in the tube. The reproduction ratio of the tracing can be continuously varied up to a factor of 2.
Recommended eyepiece: LEITZ PERIPLAN 12.5x/18

Television microscopy
Compact television cameras of up to 5 kg weight and with C-mount lens change can be directly mounted through an adapter on the monocular tube O or the phototubes FSA 42/30 (R).

10. Care and maintenance

To protect it against dust the microscope should be covered with the flexible dust cover when not in use. The stand should be occasionally cleaned with a linen rag or chamois leather. No methylated spirit must be used, because this attacks the enamel. Benzine, however, is eminently suitable for the cleaning of enamel surfaces. Bright patches on the object stage can be rubbed off with liquid paraffin or acid-free vaseline.
Special care is indicated during investigations for which acids or other corrosive chemicals are used. Direct contact of the optical system and stand with these chemicals should be avoided in all circumstances and all components should be carefully cleaned after use.
The optical components of the microscope should be kept meticulously clean.
Dust on glass surfaces is best removed with a fine, dry sable brush, and light blowing across the surface as the brush is being used. If the dirt is firmly lodged, a clean cloth moistened with some distilled water should be used. If even this is ineffective, use pure methylated spirit. Immersion oil is removed with alcohol (ethanol) only.
Objectives must not be dismantled for cleaning.

All Leitz instruments have been manufactured and tested with the greatest of care according to the latest technical developments. Should you still have difficulties, it is not advisable to interfere with these instruments and their accessories. Contact your national Agency or our central servicing department, address:

ERNST LEITZ WETZLAR GMBH
Technical Service
Department Technical Service Instruments (TSI)
P.O.B. 20 27
D–6330 Wetzlar, Germany

Telephone: 0 64 41 / 29-0 (Switchboard)
Telex: 4 83 727 ELTSC

Exchanging the 6v 20W tungsten halogen lamp

Apply slight pressure to the knurled wheel of the lamp mount and turn the wheel to the left. Pull out the lamp mount (Fig. 57).

Turn off the mains supply and remove the plug from the instrument socket. Insert the new lamp between the two clamps in the socket. To avoid fingermarks, it is essential to grip the new lamp in its wrapper. Insertion in the lamp mount centres the lamp (Fig. 57).

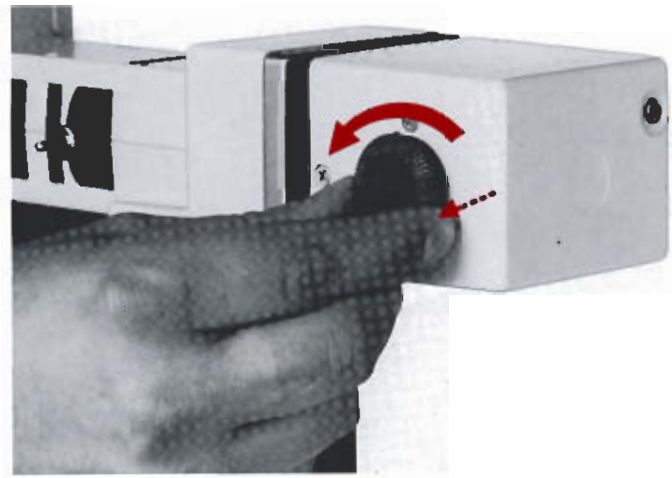
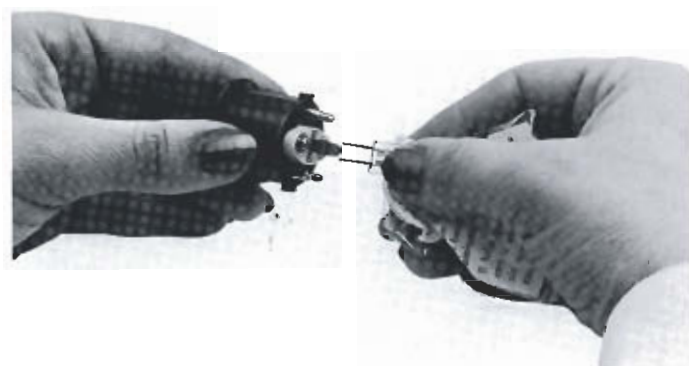
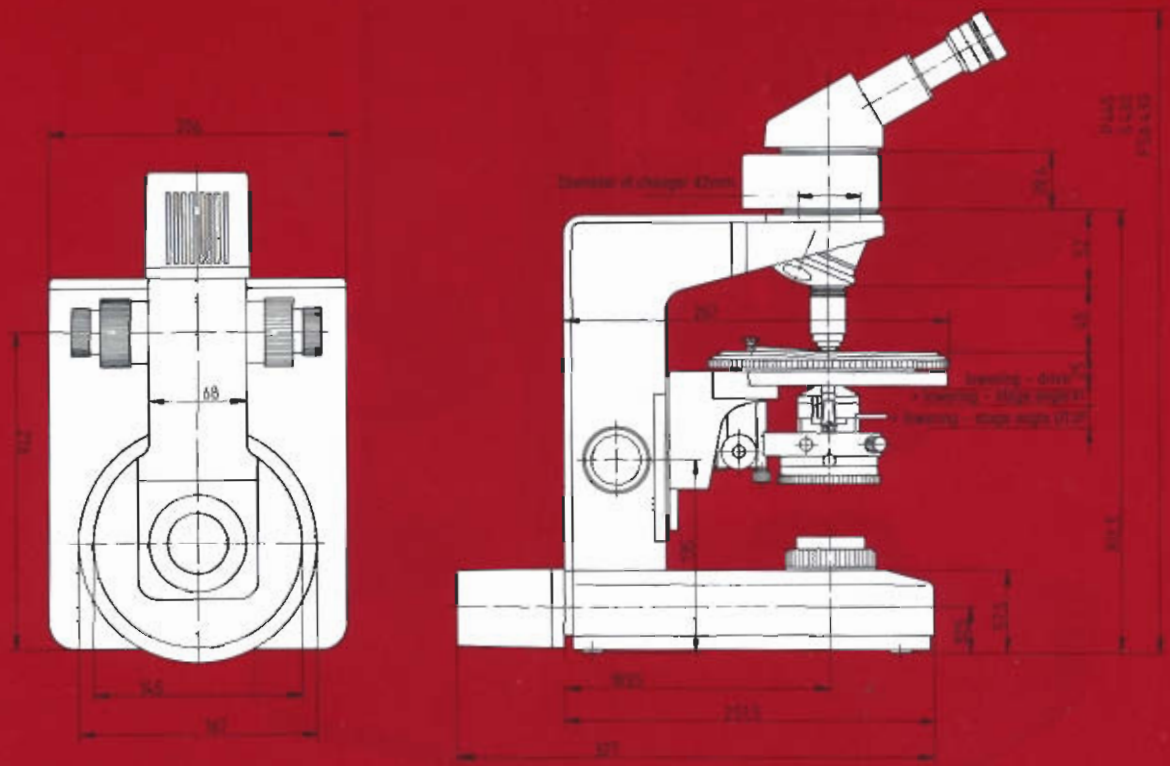


Fig. 57

Fig. 58



Dimensions of the microscope in mm



Weight of the microscope about 8.0 kg

Fig. 59 LABORLUX 12 POL – monocular –

1 Pinhole stop
2 Bertrand lens, fittings for centring keys next to it
3 Intermediate tube
4 Compensator
5 Object stage
6 Aperture diaphragm
7 Dual knob for the vertical adjustment of the object stage
8 Polariser with rack-and-pinion drive
9 Field diaphragm with filter support

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LABORLUX 12 POL

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