# LEITZ FLUOVERT

## Inverted microscope
## Instructions

WILD LEITZ

## Contents

# 1. Technical Description

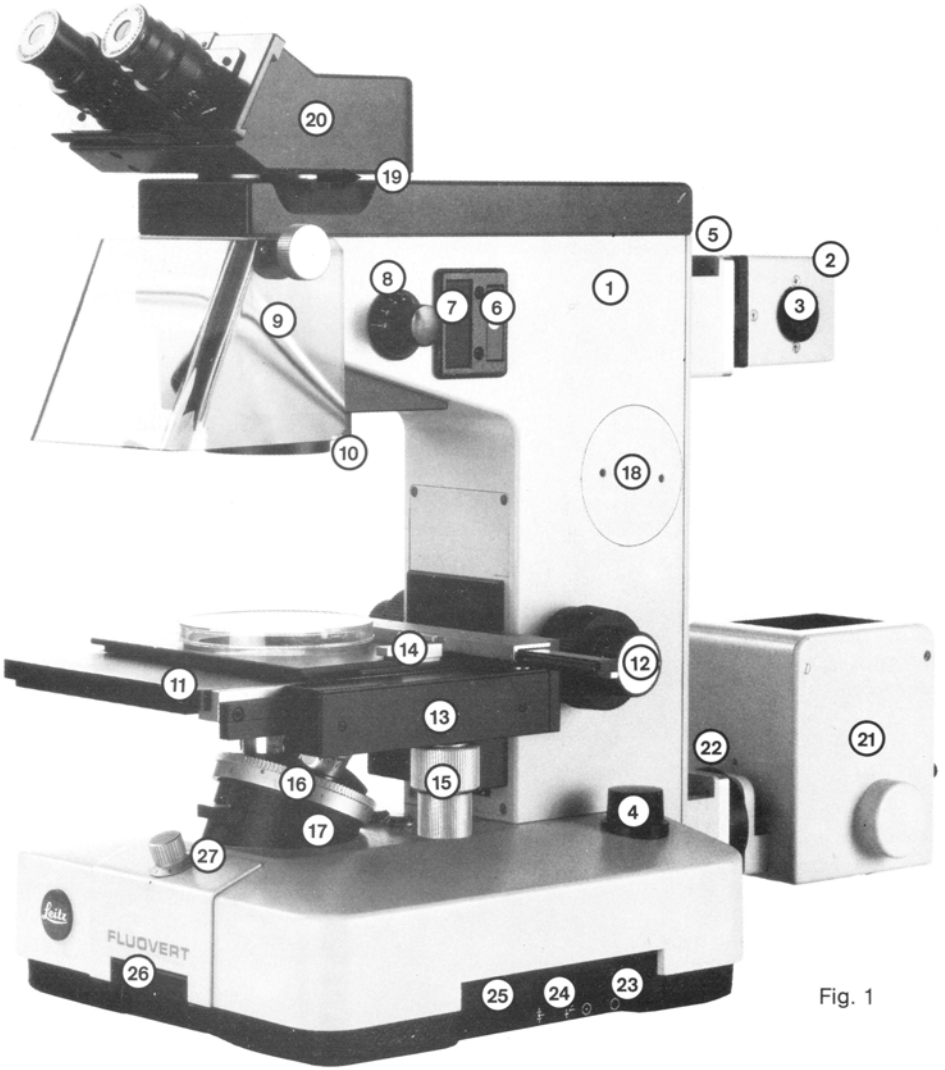


Fig. 1

Fig. 1

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## Unpacking

Two things in particular should be noted when unpacking the microscope:

a) The glass surfaces should not be touched if it can be helped. Finger marks which do appear, however, should be removed immediately with a soft leather or linen cloth. Even small grease marks can attack optical glass in a very short time. Further notes are under "Care and Maintenance" in Chapter 5.

b) Compare the equipment supplied carefully with the packing label and ensure that no small parts especially remain in the packing material.

The microscope should be situated in a dust-, fume- and damp-free room, as these could attack the instrument. Additionally, neither large temperature changes nor vibrations should occur.

# 2. Assembly

## Lamphousings

### Lamphousing 20

Lamphousing 20 is part of the standard FLUOVERT outfit for transmitted-light. It accepts the low-voltage 6V 20W halogen lamp. A reflector is built into the lamphousing in order to provide optimal efficiency, whilst a heat filter reduces the danger of damp or liquid specimens drying out. The attachable diffuser provides homogenous light.

Two contact pins ensure good electrical connection to the transformer built into the microscope base.

If required, lamphousing 20Z, with lamp centring, can be used instead of housing 20.

Before attaching the lamphousing to the stand, insert the 6V 20W halogen lamp into the holder (2.1). Ensure that the protective cap is only removed after the lamp has been properly inserted (**avoid finger contact with the glass**). Insert the lamp holder into the aperture in the side of the lamphousing and turn it to the right to lock.

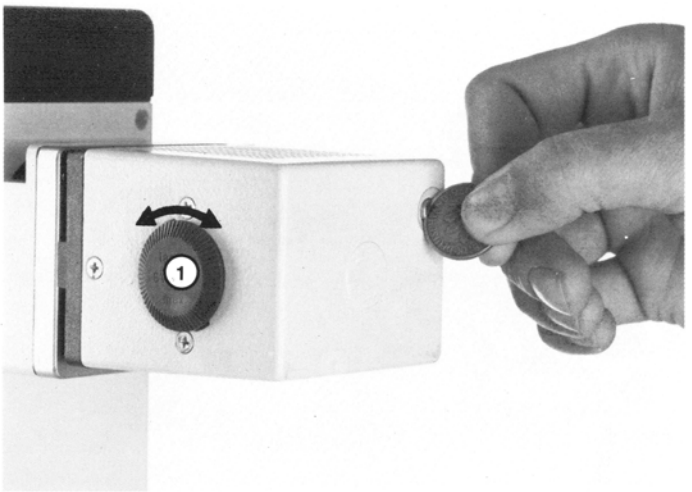
Place the diffuser on the two contact pins of the lamphousing and adjust until it clicks into place. Now insert the two pins into the socket on the stand and tighten with a coin. No centring is required for the lamp.

**Check that the voltage selector in the base plate is set to the correct value, and if necessary correct it. Only now may the microscope be connected to the mains.**

### Lamp replacement

After the lamp has been allowed to cool, press in the holder and turn to the left. The holder may now be removed from the lamphousing. Pull the defective lamp out from the holder and replace with a new one as described above.

Fig. 2 Lamphousing 20



**Lamphousing 102Z with 12V 100W halogen lamp**

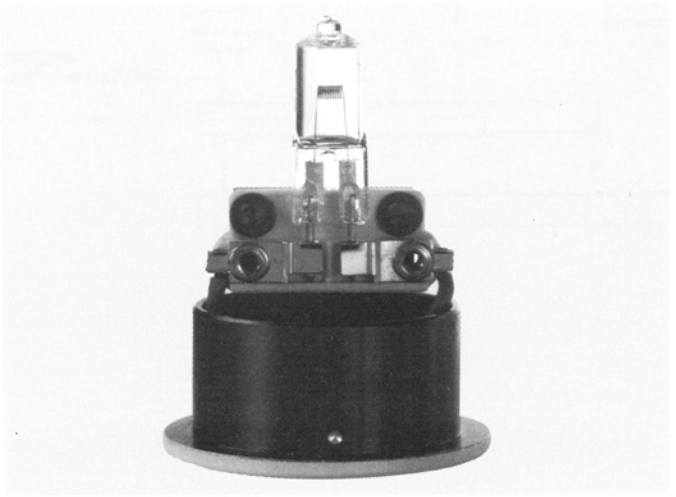
Lamphousing 102Z accepts either the 12V 100W low-voltage or halogen lamps, or the 50W mercury or 75W xenon high-pressure lamps. These all require different holders and different transformers.

Both the lamp holder mount and the reflector are centrable. The built-in collector can be moved along the optical axis, and a heat-absorption filter again protects damp or liquid specimens.

To insert the 12V 100W halogen lamp, push it into the holder, making sure that the protective cap is not removed until the lamp is properly in place (**avoid finger marks!**).

Insert the holder into the aperture in the side of the lamphousing and tighten screw (4.1).

Fig. 3 12V 100W halogen lamp and holder



**Check that the voltage set on the base plate of the transformer corresponds to the mains supply. Correct if necessary.**

Set the bayonet lever on the lamphousing to the upright position, then insert into the upper mount on the FLUOVERT stand, finally clamping by turning the bayonet lever.

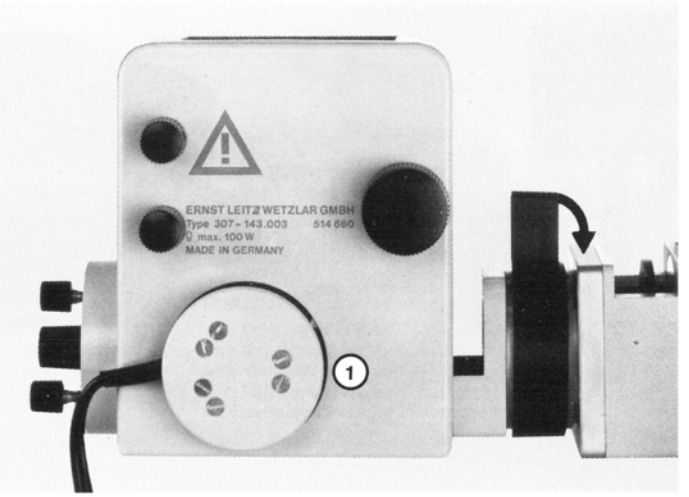
Remove the transport clamping screw for the adjustable collector from the bottom of the lamphousing.

Connect the lamphousing to the transformer, then the transformer to the mains. The lamp is centred as described on p. 15.

**Lamp replacement**

Disconnect the cable to the transformer. Loosen the screw (4.1) and, after the lamp has cooled sufficiently, pull out the holder and the lamp. The new lamp is inserted as described above.

Fig. 4 Lamphousing 102Z



**Lamphousing 102Z with 50W high-pressure mercury lamp**

The lamphousing 102Z with 50W high-pressure mercury lamp is used on the FLUOVERT for incident-light fluorescence.

To insert the lamp, the lamp holder must first be removed from the lamphousing, then the lamp socket without a label should be inserted between the clamping jaws and fixed with screw (5.2). Loosen the screw (5.1) in the mount and insert the other (labelled) socket, then retighten the screw.

Set the bayonet lever on the lamphousing to the upright position, then insert into the lower mount on the FLUOVERT stand, finally clamping by turning the bayonet lever.

Connect the lamphousing to the transformer and connect the latter to the mains. Before switching on, it should be ensured that the mains voltage is 220V and that the frequency is correctly set on the transformer (50/60 Hz). The transformer can only be used for 220V ± 10 %. If, for example, the mains voltage is 120V, a corresponding transformer must be used. It should further be ensured that the markings on the lamp socket and the setting on the transformer correspond. For example, if $L_1$ or $L_2$ is marked on the lamp socket, then the transformer must be set to $L_1$ or $L_2$ on the mains connection side in order to use the lamp fully and to extend it's life.

The safety starter (6.1), e.g. No. 192 by Osram, is initially responsible for the lamp start-up. If it does not light properly after several attempts (still warm or faulty), the safety starter switches off. When the lamp has cooled down or been replaced by a new one, the starter can be reset by pressing the red button (6.2). It can be removed by turning to the left and replaced. If it carries the inscription "für HBO 75 W", this means that it was originally developed for this lamp, but may also be used with other similar lamps. Please also note the instructions accompanying the lamp.

Fig. 5 50W high-pressure mercury lamp and holder

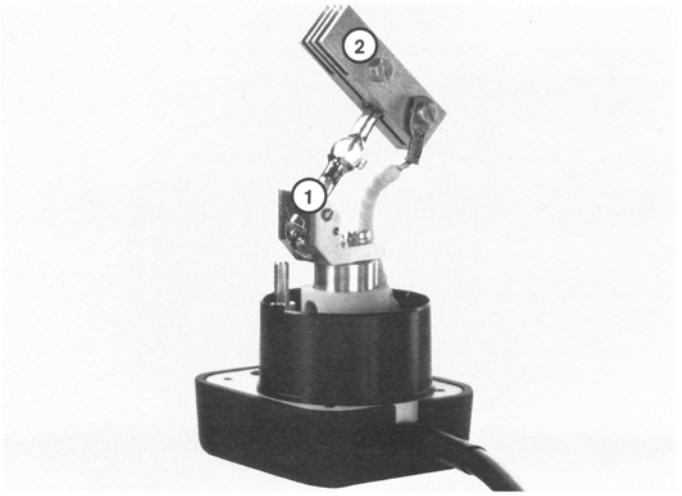
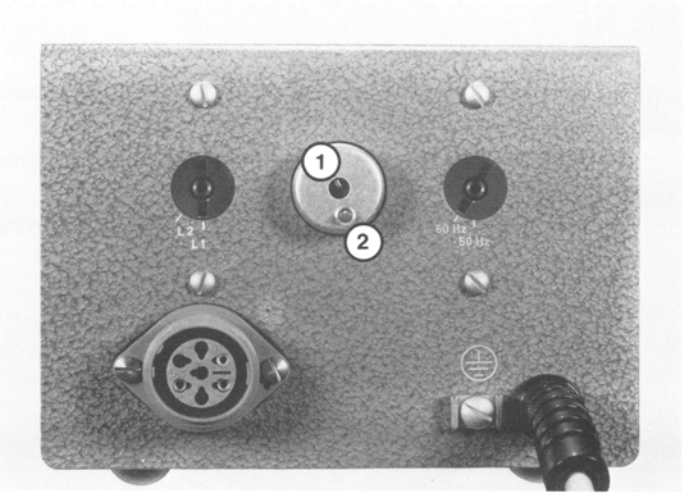



Fig. 6 Transformer for the 50W high-pressure mercury lamp



## Slides and illumination diaphragms

The standard FLUOVERT outfit contains a slide which fits the front slot (1.7) in the stand. This is intended for the:

**diaphragm for oblique illumination**
for use with the S95 or S50 condensers and the 4/0.12 to L 32/0.40 objectives,

or the

**annular diaphragm for darkfield**
for use with the S50 condenser and the PL 2.5/0.08 to EF L 20/0.32 objectives.

As well as this, another slide with an adjustable mount (two knurled screws provide the centring) for the following **phase contrast annular stops** can be inserted into slot (1.7):

**PHACO 0 S95**
for use with the S95 condenser and the NPL-FLUOTAR 6.3/0.20 PHACO 0 objective

**PHACO 0 S50**
for use with the S50 condenser and the NPL FLUOTAR 6.3/0.20 PHACO 0 objective

**PHACO 1 S95**
for use with the S95 condenser and the PHACO 1 objectives

**PHACO 1 S95**
for use with the S50 condenser and the PHACO 1 objectives

**PHACO 2 S50**
for use with the S50 condenser and the PHACO 2 objectives.

This slide allows rapid switching between brightfield and phase contrast.

A slide with a rotatable polarizer can also be inserted into the front slot (1.7).

The rear slot (1.6) is intended for the interference line filter.

There are two slots under the objective nosepiece for the objective Wollaston prisms for interference contrast and for the analyser in polarized light microscopy.

## Condensers

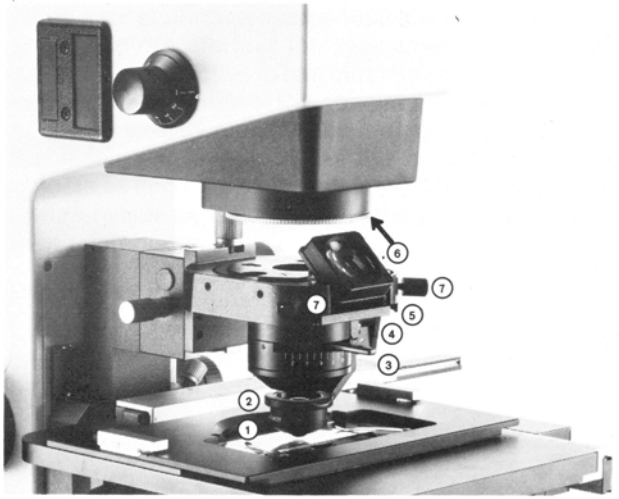
### Special purpose condensers

The S95 or S50 condensers are screwed into the condenser mount (1.10) from below. The condenser height control (23.30) should be set to position "9".

**Special purpose S95 A 0.20 condenser**
For use with tall laboratory containers (free working distance 95 mm) and with objectives of magnification up to 32x (numerical aperture up to max. 0.40) and the PHACO 0 and 1 light rings.

**Special purpose S50 A 0.30 condenser**
For use with medium-sized laboratory containers (free working distance 50 mm), and with objectives with numerical aperture up to 0.60 max. and the PHACO 0, 1 and 2 rings.

Fig. 7 SK system condenser




### System condensers

Firstly, screw the SK/UK illumination lens into the condenser mount (1.10) from below. Set the condenser height control to position "9".

Insert the holder with drive (23.32) and condenser mount (23.33) into the dovetail guide and tighten the clamping screw. Move the drive by means of the rotary control and slide the condenser into the mount, then tighten the clamping screw.

The condenser should not come into contact with the illumination lens when raised with the drive control; screw (23.36) should therefore be set so that it forms a stop with the upper part of the stand, preventing the condenser from being raised too far.

There is a choice of system condensers for the FLUOVERT:

**SK standard condenser,** with sliding mount, fits the holder with drive. Swing in/out mount for the condenser tops, linked to a supplementary lens. Adjustable aperture diaphragm with scale.
Interchangeable condenser tops for brightfield or polarized light with various correction features and free working distance are available, along with tops for darkfield.

**UK universal condenser,** with sliding mount, fits the holder with drive. Swing in/out condenser top mount, linked to a supplementary lens. Adjustable aperture diaphragm. With mount for annular stop turret.
Interchangeable condenser tops for brightfield, phase contrast, polarized light and interference contrast with various correction features and working distances are available, along with tops for darkfield.

The SK and UK condensers can be used with objectives from 2.5x, apart from for darkfield, when the minimum magnification is 16x.

## Condenser tops for the standard SK and universal UK condensers

| Condensor top | Top in/out | Use |
|---|---|---|
| 0.90 S 1.1 | Out (suppl. lens in) | With objective aperture < 0.25 |
| 0.90 S 1.1 | In (suppl. lens out) | With objective aperture > 0.25 |
| OEL 1.32 | In (suppl. lens out) Immersion oil on front element | With 100x oil immersion objectives. |
| 0.70 S 4 | In (suppl. lens out) | Intercept distance 4 mm. With specimen slides of thickness > 1 mm |
| 0.55 S 15 | In (suppl. lens out) | Intercept distance 15 mm. With specimen slides of thickness > 6 mm |
| D 0.80–0.95 | In (suppl. lens out) | Darkfield. With objective apertures < 0.75 and magnifications from 16x |
| D 1.19–1.44 | In (suppl. lens out) Immersion oil on front element | Darkfield. With objective apertures < 1.10 |

For the system condensers, the holder with drive, which is fixed to the dovetail guide, and the SK/UK illumination lens, which is screwed into the condenser mount below the tube, are both necessary.

## Applications for the S50 and S95 condensers

| | S95 | | S50 | |
|---|---|---|---|---|
| Illumination | Objective magnification | Stops/ accessories | Objective magnification | Stops/ accessories |
| Brightfield | 2.5x to 32x | – | 2.5x to 40 x | – |
| Oblique | 4x to 32x | Semi-diaphragm | 4x to 32x | Semi-diaphragm |
| Darkfield | – | – | 2.5x to 20x | Annular stops |
| Phase contrast | 6.3x<br>10x to 32x | PHACO 0<br>PHACO 1 | 6.3x<br>10x to 32x<br>40x | PHACO 0<br>PHACO 1<br>PHACO 2 |
| Polarized light | 2.5x to 32x | Polarizer, analyser | 2.5x to 40x | Polarizer, analyser |

## Attachable mechanical stage

The attachable mechanical stage (1.13), which accepts holders for various laboratory containers, can be mounted on the side of the microscope stage, preferably on the right, using two knurled screws. It is operated by low-lying, coaxial controls and has a range of movement of 83 x 127 mm.

The following holders are at present available:

| **Holder** for | Order No. |
|---|---|
| Tissue culture plates, 136 x 92 mm with 384 cells | 520 583 |
| Tissue culture plates, 127 x 88 mm with 24 cells | 520 584 |
| TERASAK system | 520 585 |
| Culture flasks, size 1 (125 x 77 mm) | 520 586 |
| Culture flasks, size 2 (adjustable for 82 x 37 mm, 80 x 40.5 mm and 77 x 51.5 mm) | 520 587 |
| Hamax plates, 93 x 67 mm with 60 positions | 520 587 |
| Microtitre plates, 127 x 82 mm with 96 cells | 520 589 |
| Petri dishes, 94 mm diameter | 520 590 |
| Petri dishes, 60 mm diameter | 520 591 |
| Petri dishes, 35 mm diameter | 520 592 |
| Standard size specimen slides, 76 x 26 mm | 520 593 |
| Bellko test tubes | 520 594 |
| Plankton chambers | 520 595 |
| Holder with central hole, for preparation of holders for other containers | 520 596 |

Remove the stage insert. Place the attachable mechanical stage on the right edge of the microscope stage (or if necessary on the left) and fix with the two knurled screws. Insert the holder into the mount (1.14).

Stick the supplied self-adhesive scale for the holder in use onto the mechanical stage.

## Objectives

The five positions on the objective nosepiece (1.16) are numbered to facilitate magnification selction. We recommend that the objective of lowest magnification be screwed into the mount with number 1, the next into mount number 2, and so on, to provide a series of increasing magnification when one turns the nosepiece from engraving 1 to 5. If not all the screw mounts are being used, the empty ones must be protected from dust by means of screw-in caps, Order No. 512 027.

All Leitz objectives which are designated for a tube length of 160 mm can be used on the FLUOVERT. Those designed for a tube length of 170 mm are suitable from 16x magnification.

The objective engravings have the following meanings:
**160/** (170): mechanical tube length, in mm, for which the objective is designed.
For the FLUOVERT, the different tube length is optically corrected using a built-in lens (with magnification factor 1x).

**/0.6–1.6:** necessary specimen slide thickness (or laboratory/culture container base thickness) in mm. Can be corrected for on the NPL FLUOTAR L 40/0.60 Korr. PHACO 2 objective.

**EF:** plan objective with flattened field-of-view to at least 18 mm intermediate image.

**NPL:** plan objective with flattened field-of-view to at least 22.5 mm intermediate image.

**PL:** plan objective with flattened field-of-view to 28 mm intermediate image.

**FLUOTAR:** Leitz type designation for semi-apochromatic objectives.

**L:** objective with long working distance.

**40/** (e. g.): magnification, i. e. size ratio of intermediate image of objective is 40:1.

**/0.60** (e. g.): numerical aperture.

**PHACO:** objective with phase ring for phase contrast studies. Green engraving. An indication of the necessary phase ring insert (e. g. PHACO 1 = 1 S 95 or 1 S 50) or setting on the UK universal condensor PHACO turret (e. g. PHACO 1 = setting 1) is also engraved on the phase contrast objectives.

**Immersion objectives** have an indication of the immersion medium and a black (= oil immersion) or white (= water immersion) ring.

**All objectives** have a coloured ring indicating the magnification, as below:

| Magnification | 2.5 x | 4 x | 6.3 x | 10 x |
|---|---|---|---|---|
| Colour | brown | red | orange | yellow |

| 16 x | 25 x | 40 x | 63 x | 100 x |
|---|---|---|---|---|
| pale green | dark green | pale blue | dark blue | white |

The optical elements in the FLUOVERT stand cause no additional magnification. The FSA-GW-R tube, however, has tube factor 1.25x; this should be taken into account when calculating the microscope magnification.

The overall microscope magnification can be calculated as follows:

Objective magnification x eyepiece magnification (x tube factor).

Example:

| | |
|---|---|
| Objective: | NPL FLUOTAR 25/0.35 PHACO 1 |
| Eyepiece: | PERIPLAN GW 8x M |
| Tube factor: | 1.25x |
| Overall magnification: | 25 x 8 x 1.25 = 250 |

The following objectives with long working distances are available:

| | |
|---|---|
| NPL FLUOTAR 6.3/0.20 (coverglass thickness 0–2 mm) | FWD 7.28 mm |
| NPL FLUOTAR 6.3/0.20 PHACO 0 (0–2 mm) | FWD 7.28 mm |
| EF 10/0.25 (0–1 mm) | FWD 6.78 mm |
| EF 10/0.25 PHACO (0–1 mm) | FWD 6.78 mm |
| EF L 20/0.32 (0.17–0.7 mm) | FWD 6.83 mm |
| EF L 20/0.32 PHACO 1 (0.17–0.7 mm) | FWD 6.83 mm |
| NPL FLUOTAR L 25/0.35 (1.1 ± 0.5 mm) | FWD 13.7–14.3 mm |
| NPL FLUOTAR L 25/0.35 PHACO 1 (1.1 ± 0.5 mm) | FWD 13.7–14.3 mm |
| EF L 32/0.40 (0.17–0.3 mm) | FWD 6.55 mm |
| EF L 32/0.40 PHACO 1 (0.17–0.3 mm) | FWD 6.55 mm |
| NPL FLUOTAR L 40/0.60 Korr. PHACO 2 (0.6–1.6 mm) | FWD 1.65–2.0 mm |

FWD = free working distance
Korr. = objective can be corrected for specimen slide or container base thickness.

## Tubes

Push the lever (1.19) towards the rear of the stand and insert the tube into the mount. Allow the lever to slide back to it's initial position. The tube can be rotated through 360° and clamped in any position by gently pulling on the lever. All Leitz observation and phototubes with mount diameter 42 mm can be used on the FLUOVERT.

**Binocular observation tube S** with 30° or 45° viewing angle and adjustable eyepiece mounts for mechanical tubelength compensation of the interpupillary distance.

**Binocular photo tube FSA** with 30° viewing angle and vertical photo port. Automatic tubelength compensation of interpupillary distance.

Three settings of the beam splitter:

→ 100 % to the light to the eyepieces
0 % to the photo port

↑→ 50 % to the eyepieces
50 % to the photo port

↑ 10 % to the eyepieces
90 % to the photo port

**Binocular photo tube FSA-R** with 30° viewing angle and back reflection for use with the LEITZ VARIO ORTHOMAT automatic camera system and the LEITZ MPV compact microscope photometer. The beam splitting is as for the FSA tube.

**The S, FSA and FSA-R tubes allow a field-of-view index of 18.**

**Binocular photo tube FSA-GW-R** with 30° viewing angle, second photo port and automatic tubelength compensation of the interpupillary distance.

Two switchable beam splitter systems:

A. For eyepieces/photo ports:
as for FSA tube

B. For the photo ports:
The light can be split either 50:50 or 90:10 in favour either port.

PERIPLAN GW eyepieces are used with this tube. The tube factor is 1.25x.

**Note:**

On the FLUOVERT, the magnification changer, which is mounted between the tube and the stand, can only be used for the steps 1.25x, 1.6x and 2x.

## Eyepieces

Eyepieces with fixed eye lenses can be inserted directly into the eyepiece mounts.

Eyepieces with adjustable eye lenses, on the other hand, must first be set, by rotating the latter, so that the edge of the field of view or, if present, the cross wires appear sharp. This is best carried out by looking through the eyepiece at a pale wall or the sky.

Insert the eyepieces into the mounts. Leitz eyepieces suitable for a mechanical tubelength of 160 mm are used. These differ from those intended for a tubelength of 170 mm through the additional engraving of the field-of-view index after the magnification, e.g. 10x/18 (exception: PERIPLAN GW eyepieces).

If Leitz eyepieces are used which have no field-of-view index engraving, a TL 160 spacing ring must be used. The field-of-view index is defined as the diameter of the visible intermediate image in the tube. It appears magnified by the eyepiece factor.

The image diameter of an eyepiece, as it appears to the observer at a distance of 250 mm, is calculated from the eyepiece magnification and the field-of-view index. An example with the PERIPLAN GF 12.5x/18 eyepiece:

| | |
|---|---|
| Eyepiece magnification | 12.5x |
| Field of view index | 18 |
| Image diameter | 12.5 x 18 = 225 mm |

If one divides the field of view diameter by the eyepiece magnification and the stand factor, the diameter of the visible specimen area is obtained. With the above mentioned eyepiece, the NPL FLUOTAR L 25/0.35 PHACO 1 objective and a stand magnification factor of 1x for the FLUOVERT, an area of diameter

$$\frac{18\ \text{mm}}{25 \times 1} = 0.72\ \text{mm}$$

on the specimen can be seen. If the magnification changer is being used, or any other accessory with a tube factor is employed, this is reduced correspondingly, i. e. with magnification 1.25x the diameter becomes

$$\frac{18\ \text{mm}}{25 \times 1.25} = 0.58\ \text{mm}$$

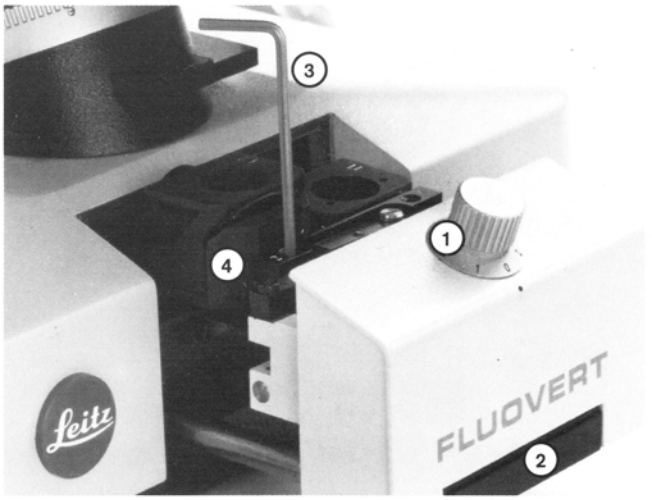
# 3. Operation

## Filter blocks and transmitted-light insert

For transmitted-light illumination on the FLUOVERT, an insert TL is required. This is mounted in the filter block holder in the stand base as follows:

Referring to fig. 8, turn control (1) to position "0". Pull out the drawer using the grip (2), then loosen the Allen screw with the key located inside. Insert the TL insert or filter block (4), with the engraving facing upwards, into the dovetail guide "1" or "2" and retighten the Allen screw. Close the drawer. Either filter block or transmitted-light can be selected by means of control (1).

Fig. 8 Filter block drawer




## Lamphousings

### Lamphousing 20 with 6V 20W halogen lamp

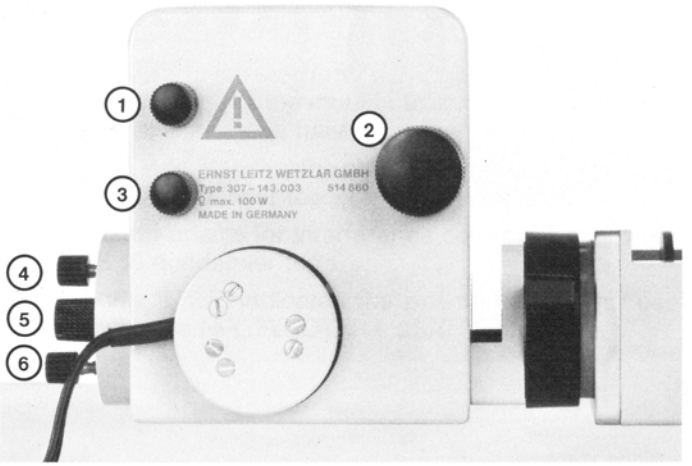
Turn on the mains switch (23.28) and adjust the illumination intensity via control (1.4).

### Lamphousing 102Z with 12V 100W halogen lamp

**When using lamphousing 102Z with the 12V 100W halogen lamp, a diffuser must be inserted into filter mount (1.5).**

Fig. 9

Lamphousing 102Z
1 and 3 Lamp centring screws
2 Collector adjustment
4 and 6 Reflected image centring screws
5 Mirror horizontal adjustment



Switch on the lamp with the transformer switch and adjust the brightness. Put a sheet of white paper on the object stage, then close the iris diaphragm (1.8). Using the collector knob (9.2), focus the image of the lamp filament. When using the SK/UK system condensers, these must be removed from the holder during the centralization process.

Move the filament image to the top half of the illuminated field using the centring control (9.1) and, with control (9.3), adjust it so that the upper area is completely filled.

Now adjust the reflected filament image so that it moves into the lower half of the illuminated area (9.4 and 9.6).

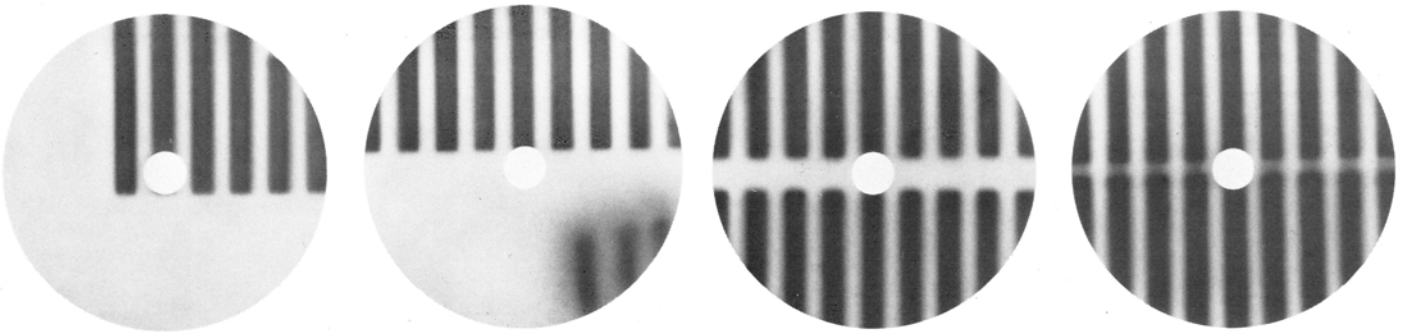
Adjust the axial mirror control (9.5) so that the reflected lamp image is in focus, then move it using knobs (9.4) and (9.6) until it fills the lower part of the illuminated area.

Finely adjust knobs (9.1) and (9.4) until the two filament images just touch in the centre.

Open the aperture diaphragm (1.8)

Fig. 10

Schematic representation of the lamp filament and reflected images



**Lamphousing 102Z with 50W mercury lamp**

Switch on the lamp at the transformer. Open the light barrier (1.24).

Select a filter block (position 1 or 2 on control 1.27). Unscrew the objective in the light path from the nosepiece, then, after placing a sheet of white paper on the microscope stage, close the field diaphragm (1.25)

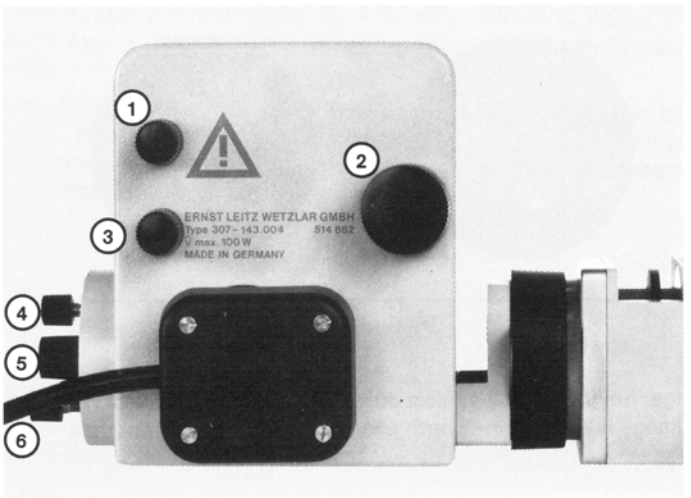



Fig. 11

Lamphousing 102Z
1 and 3 Lamp centring screws
2 Collector adjustment
4 and 6 Reflected image centring screws
5 Mirror horizontal adjustment

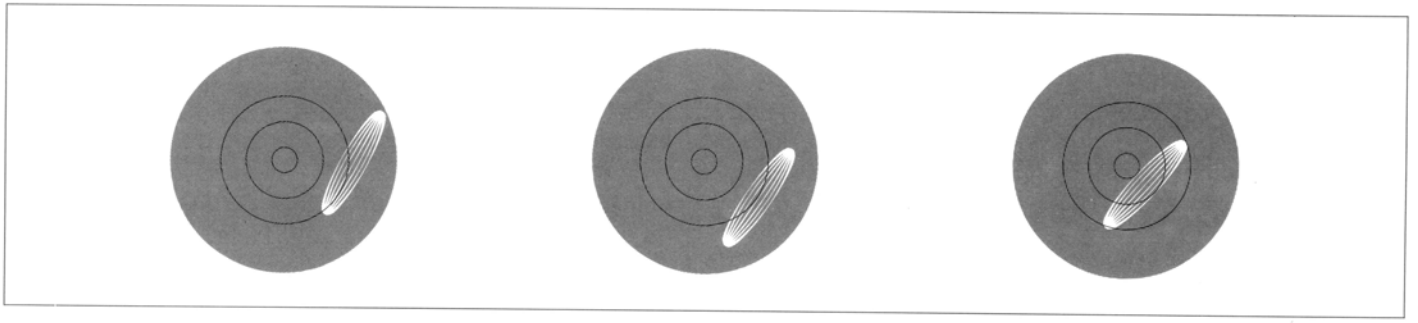
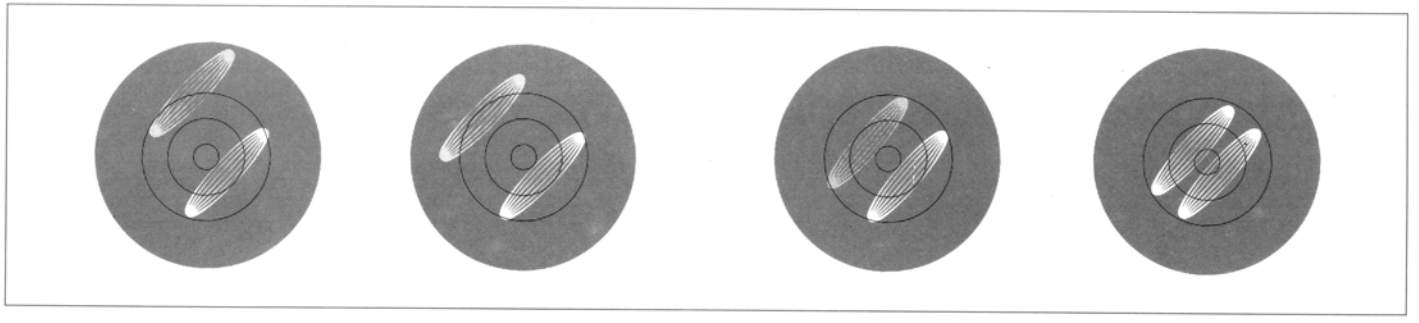


Fig. 12
Lamp image

Adjust the collector adjustment knob (11.2) until the discharge arc image on the paper is in focus.

Turn the lamp height adjuster (11.3) until the discharge arc image is at the correct height according to the illustration.

Turn the lamp horizontal adjuster (11.1) until the discharge arc image is positioned in the centre according to the illustration.



Lamp and reflected image

Adjust the mirror adjustment knob (11.5) until the reflected discharge arc image is focus.

Turn the reflected image height adjuster (11.4) until the reflected image is at the same height as the direct image.

Now adjust the horizontal control (11.6) until both images are next to one another.

## Tube adjustments

On the **binocular observation tube S,** set the interpupillary distance by pulling or pushing the grips until the images from both eyes completely cover each other and appear as a single circular image.

Read off the distance from the scale on the tube front plate and transfer this to both eyepiece mounts, e. g. for an interpupillary distance of 65 mm, set this on both eyepiece mounts.

**Defective eyesight** is corrected as follows: look through the left eyepiece with the left eye and focus the specimen with the fine control. Then, with the right eye, look through the right eyepiece and turn the eyepiece mount until the same specimen detail as before is sharp; do not touch the focus controls during this. If an adjustable eyepiece is being used, this correction is carried out by adjusting the front element without turning the eyepiece mount.

For the **FSA, FSA-R and FSA-GW-R photo tubes,** the interpupillary distance is set as fot the tube S, but the mechanical tube length compensation is automatic. Differing vision in each eye is corrected by adjusting the eyepiece front element.

The FSA-GW-R phototube has a magnification factor of 1.25x, which must be taken into account when calculating the overall microscope magnification; all other Leitz tubes have factor 1x.

## Focusing

Place the specimen on the object stage or in the corresponding holder in the object guide. Focus with coarse and fine controls (1.12).

Turn the focus stop knob (23.29) to the right; the stop now acts on the coarse/fine drive.

## Condenser adjustments

**S 95 and S 50 condensers**

**Brightfield:**
Move the condenser mount to its highest position (control 23.30). Then close the aperture diaphragm (1.8) until the desired image contrast is obtained.

**Darkfield** with S 50 condenser:
Insert the central darkfield stop DF S 50 into the corresponding slide and push this into the slot (1.7). Darkfield is possible with all objectives from 2,5 :1 to 10 :1.

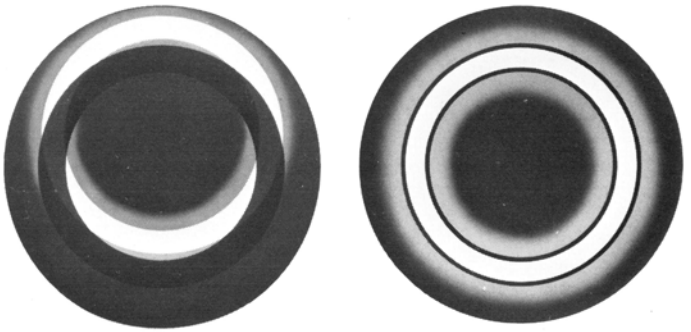
**Oblique illumination:**
Insert the oblique illumination diaphragm into the slide and push this into the slot (1.7). The contrast can be altered by moving the slide in the slot. All objectives from 4/0.12 to EF L 32/0.40 are suitable for oblique illumination.

**Phase contrast:**
Move the condenser mount to its highest position (control 23.30). Insert the phase contrast ring corresponding to the objective to be used (e. g. PHACO 1 for the NPL FLUOTAR L 25/0.35 PHACO 1 objective) into the slide with centralizable holder.

Push the slide into the slot (1.7) until the second position clicks into place. Select the correct objective. Remove an eyepiece from the tube and insert the adjustment telescope (15.5) in its place. Loosen the clamping ring (15.7) on the telescope and adjust the front element until the light and phase rings are in focus. If the light ring is somewhat to the side of the phase ring, use the knurled adjustment screws on the slide until the two are completely superimposed on one another. If the sizes of the two rings are not the same, then alter the condenser height. This is necessary for specimen in a liquid (up to 45 mm deep).

Fig. 13
Phase and light rings as seen through the adjustment telescope.

1. Light ring displaced: **no phase contrast!**
2. Rings superimposed: **phase contrast**



**SK condenser**

Close the iris diaphragm in the upper part of the stand (1.8). This acts as a field diaphragm when the SK or UK system condensers are being used (if the condenser top is in position). Adjust the height of the condenser (with top in position) until the diaphragm appears sharp in the focused specimen image. If the diaphragm image is not in the centre of the field-of-view, use the two screws (7.7) to centre the condenser. After all the adjustments are complete, open the diaphragm until its image just disappears from view. When the objective is changed, the condenser centring must, if necessary, be slightly adjusted.

Close the aperture diaphragm (7.3) until the desired image contrast is obtained.

**Note:**
The aperture diaphragm should not be used to adjust the image brightness. The transformer control or illumination brightness control (1.4) should be used for this. The brightness can also be reduced by means of neutral density filters (32 mm), which fit the filter slot on the lamphousing, or the LEITZ VARIOLUM illumination adapter (can only be used with lamphousing 102Z). For objectives with numerical aperture $< 0.25$, only the condenser top need be swung out of position. The aperture diaphragm should be left open. The iris diaphragm in the upper part of the stand no longer acts as a field diaphragm and should therefore be opened fully.

**UK universal condenser**

If the condenser is already fitted with an annulus turret, this should be set to position H (for brightfield). The condenser must then be adjusted as for the SK condenser described above; the centring screws and aperture diaphragm are shown in fig. 23 (components 37 and 39 resp.).

Please also read the footnote under SK condenser.

The UK condenser additionally allows phase contrast, darkfield and interference contrast T.
A turret accommodates the various diaphragms and Wollaston prisms required.

**Insertion or exchange of the annular stops or Wollaston prisms**

Corresponding annular stops are available for the various condenser tops with different working distances. They are marked as follows:

"1" (e. g.) indicates that the stop is for use with the PHACO 1 objective. It should be inserted into the mount opposite the engraving "1".

"DF" indicates that the stop is for darkfield use only. It should be inserted into one of the mounts which remain free when the phase contrast stops have been inserted.

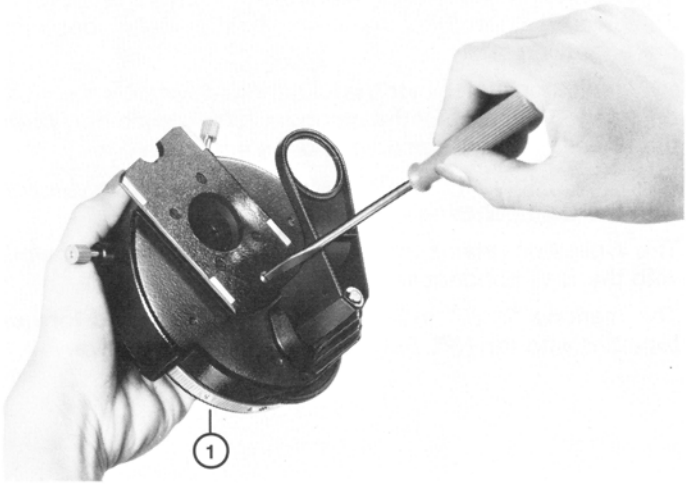
"S 1.1" (e. g.) indicates that the stop is for use in combination with the S 1.1 condenser top.

The Wollaston prisms for interference contrast T only work with the S 15 condenser top.

The marking "L 25" indicates the prism intended for use together with the NPL FLUOTAR L 25/0.35 objective.

The annular stops and Wollaston prisms must always be inserted so that the engraving on the turret next to the **opposite** mount agrees with the stop marking (e. g. in fig. 15, stop 3 (2) is inserted opposite its marked posifion).
The mount opposite the engraving "H" should be left empty for brightfield work; for this reason, it has no centring screws. To mount the annular stops, first loosen the Allen screws (15.4) for the mount concerned until their heads are level with the knurled turret grip ring. Press the stop against the spring pin in the mount and insert or remove as appropriate. Screw in both the centring screws until the stop is in the centre of it's mount.

Fig. 14 Insertion or removal of the turret (1).




**inserting the turret**
Slide the condenser head into position (supplementary lens out of position) to gain access to the clamping screw in the underside of the condenser (see Fig. 14). Loosen this screw. Remove the dust cover from the condenser, insert the turret and retighten the clamping screw.

Fig. 15 Turret and adjustment telescope

1. Turret
2. Annular stop
3. Free for brightfield
4. Annulus centring screws
5. Adjustment telescope
6. Eye lens
7. Clamping ring

**Phase contrast**

Select a phase contrast objective (e. g. PHACO 1), then turn the turret to position "H" and focus the specimen. Check the centring of the condenser as described on p.21, correcting if necessary. Open the aperture diaphragm (setting "PH" = phase contrast). Select the correct phase contrast annular stop on the turret, here position "1".Now remove an eyepiece from the tube and insert the adjustment telescope (fig. 15) in its place. Loosen the clamping ring (15.7) on the telescope and adjust the eye lens (15.6) until the light ring (bright) and the phase ring (dark grey) are in focus. Using the stop centring keys (23.41, push in and turn), adjust the stop so that the light and phase rings are exactly aligned (see fig. 13). This should be repeated for each PHACO annular stop being used; the settings then remain correct for all subsequent work.

**Darkfield**

Insert the darkfield stop into the turret as described above and centre approximately with the Allen screws (15.4). Mount the turret in the UK condenser and clamp with the screw (fig. 14).

Select an objective, the 25x for instance. Turn the turret to position "H", focus the specimen and open the aperture diaphragm ("PH"). Turn the turret until the darkfield stop is in position and check that the specimen appears with a dark background; if not, centre the stop with the keys (23.41). When correctly centred, a homogenously dark specimen background should be visible.

Optimal contrast in darkfield is obtained at medium magnifications.

**UK condenser for brightfield, darkfield, phase contrast and interference contrast**

| Condenser top | Annular stop | Wollaston prisms | Turret setting | Objective with engraving | Application |
|---|---|---|---|---|---|
| 0.90 S 1.1 | – | | H | (all objectives) | brightfield |
| | 1 S 1.1 | | 1 | PHACO 1 | phase contrast |
| | 2 S 1.1 | | 2 | PHACO 2 | phase contrast |
| | 3 S 1.1 | | 3 | PHACO 3 | phase contrast |
| | 4 S 1.1 | | 4 | PHACO 4 | phase contrast |
| | DF S 1.1 | | 5 | (all objectives aperture < 0.75) | darkfield |
| 0.70 S 4 | – | | H | (all objectives) | brightfield |
| | 1 S 4 | | 1 | PHACO 1 | phase contrast |
| | 2 S 4 | | 2 | PHACO 2 | phase contrast |
| | 3 S 4 | | 3 | PHACO 3 | phase contrast |
| | 4 S 4 | | 4 | PHACO 4 | phase contrast |
| 0.55 S 15 | – | | H | (all objectives with aperture <0.90) | brightfield |
| | 1 S 15 | | 1 | PHACO 1 | phase contrast |
| | 2 S 15 | | 2 | PHACO 2 | phase contrast |
| | 4 S 15 | | 4 | PHACO 4 | phase contrast |
| | | L 25 | 1 | L 25/0.35 | Interference contrast T |
| | | L 40 | 2 | L 40/0.60 | Interference contrast T |

**Interference contrast T**

Insert the slide with rotatable polarizer into the slot provided (1.7). Screw the holder with Lambda plate (16.1) onto the condenser mount (left).

Slide the UK condenser (16.2) with Wollaston prisms into the condenser mount and clamp. Slide condenser top S 15 (16.3) into position.

Select an interference contrast objective (e. g. NPL FLUOTAR L 25/0.35), place a specimen on the stage and focus. Rotate the turret (16.4) until the corresponding Wollaston prisms (here L 25) are in position.

Insert the slide with the objective-side Wollaston prisms into the slot (16.5) under the objective nosepiece.

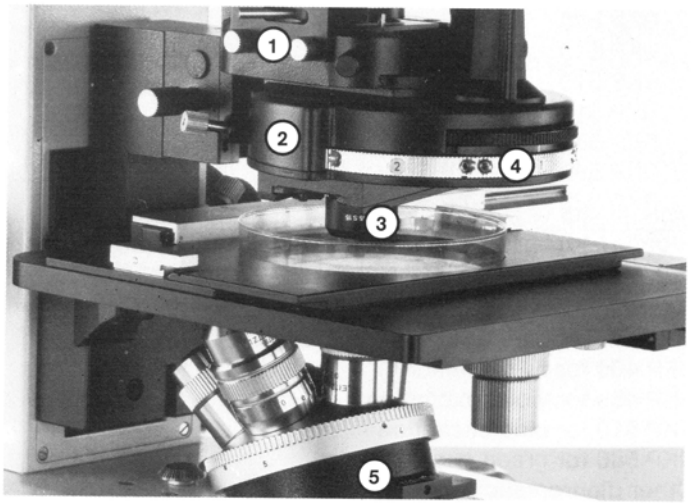
Check that the condenser is centred as described on p. 21. The image contrast can be varied by rotating the polarizer; the contrast can be increased by matching the degree to which the field diaphragm is opened to the field of view, as well as by slightly closing the aperture diaphragm.

The lambda plate can be used to provide interferential colour contrast.

If the interference contrast device is not supplied together with the FLUOVERT microscope, but is ordered separately, a slight adjustment of the objective Wollaston prisms is necessary. We recommend the following procedure:

1. Remove the specimen and the objective which is positioned in the light path.
2. Turn the Universal Condenser turret (16.4) to the "H" setting.
3. With the slot (16.5) empty, insert the polarizer into its slot (1.7), and rotate it until the field of view in the observation tube appears completely dark.
4. Rotate the condenser turret (16.4) until the correct Wollaston prism (e. g. L25 for the NPL FLUOTAR L25/0.35 objective) is in position.
5. Select the objective corresponding to the Wollaston prism.
6. Push the objective-side Wollaston prism slide (in the above example L25/0.35) into the slot (16.5) below the objective nosepiece.
7. Whilst viewing through the microscope, use the Allen key supplied to adjust the screws in the slide until the darkest setting is reached.
8. Place the specimen in position, focus and set the image contrast by adjusting the polarizer and closing the aperture diaphragm simultaneaously.

Fig. 16 Interference contrast components



## Incident-light fluorescence

Open the light barrier (1.24).
Select a filter block by means of control (1.27).
Place the specimen on the stage and focus.
Whilst viewing the image, adjust the lamp collector (11.2) until the specimen is homogenously illuminated.

Close the field diaphragm (1.25) and check that it is correctly centred, adjusting if necessary, then open the diaphragm until it matches the field of view.

If a red specimen background is visible in UV excitation, this can be eliminated by using the red-absorbing filter BG 38 (1.23).

**Filter blocks for incident-light fluorescence**

| Filter block | Excitation range | Excitation filters | Dichromatic mirror | Suppression filter | Type of filter Excitation | Suppression |
|---|---|---|---|---|---|---|
| A 2 | ultra-violet | BP 270–380 | RKP 380 | BP 410–580 | G | F |
| A | ultra-violet | BP 340–380 | RKP 400 | LP 430 | G | F |
| B 2 | uv + violet | BP 350–410 | RKP 455 | LP 470 | G | F |
| D | uv + violet | BP 355–425 | RKP 455 | LP 460 | IKP | F |
| E 3 | blue | BP 436/7 | RKP 475 | LP 490 | IBP | F |
| G | uv + violet + blue | BP 350–460 | RKP 510 | LP 520 | G | F |
| H 3 | violet + blue | BP 420–490 | RKP 510 | LP 520 | IKP | F |
| I 2/3 | blue | BP 450–490 | RKP 510 | LP 520 | IKP | F |
| K 3 | blue | BP 470–490 | RKP 510 | LP 520 | IKP | F |
| L 3 | blue | BP 450–490 | RKP 510 | BP 525/20 | IKP | IBP |
| M 2 | green | BP 546/14 | RKP 580 | LP 580 | IBP | F |
| N 2 | green | BP 530–560 | RKP 580 | LP 580 | IKP | F |
| N 2.1 | green | BP 515–560 | RKP 580 | LP 580 | IKP | F |

Transmitted light insert also available, replaces a filterblock

BP = band pass filter
F = gelatine filter (combination)
G = colored glass filter (combination)
IBP = high-performance interference band filter
IKP = high-performance interference short-pass filter
LP = long-pass filter
RKP = reflection short-pass filter

Filter blocks with dichromatic mirror, but without excitation or suppression filters (fitted by user).
RKP 400 for uv excitation
RKP 455 for violet excitation
RKP 510 for blue excitation
RKP 580 for green excitation
Other dichromatic mirrors on request.

## Polarized light

Insert slide with rotatable polarizer into the slot (1.7) in the upper stand until the polarizer clicks into position. Push the analyser slide into the slot (1.17) below the objective nosepiece until it clicks into place.

Focus on the specimen and then remove it from the light path. Turn the polarizer until the field-of-view appears at its darkest (approx. at 90° setting), then replace the specimen on the stage.

If the S 95 or S 50 condensers are being used, the lambda or lambda/4 plate must be inserted into the holder, which is clipped to the condenser mount. The compensators can then be rotated about the optical axis by 90°.

For the SK or UK condensers, the compensators should be inserted into the condenser mount from above.

## Microscopic measuring

The measurement of micrsocopic objects is carried out using a measuring eyepiece (usual scale; 10 mm = 100 divisions). Before starting the measurement, the micrometer value of the objective in use must be known. The micrometer value is the distance in the specimen plane which produces an image exactly one division long on the graticule scale in the measuring eyepiece. As the optical constants of the objectives fluctuate slightly, it is recommended that the micrometer value be determined initially with the aid of a specimen micrometer.

Examples:

Evaluation of the micrometer value with a specimen micrometer (2 mm = 200 divisions) and a measuring eyepiece with graticule (10 mm = 100 divisions).

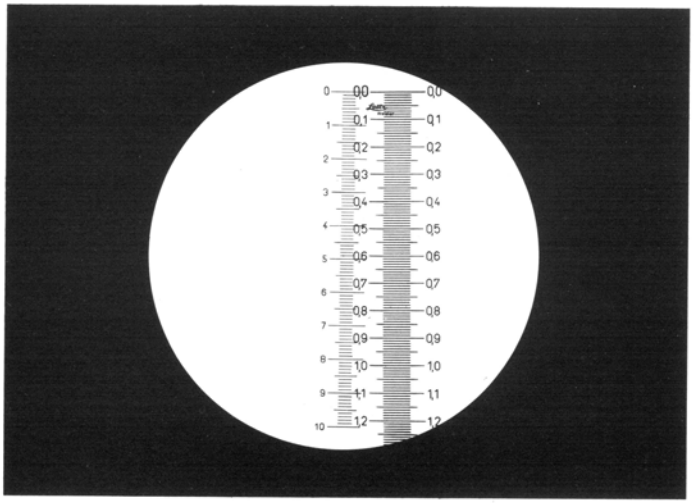
Move the micrometer until the zero lines on both it and the measuring eyepiece coincide; the micrometer value can be read off from the end of the measuring eyepiece scale.

In this example (fig. 17), the end of the eyepiece scale (100 divisions) coincides with 1.220 mm on the micrometer scale. 100 divisions are therefore equivalent to 1.220 mm, and 1 division = 0.01220 mm = 12.20 µm.

For low-power objectives where the micrometer scale does not cover the entire eyepiece scale, only 10 eyepiece scale divisions are measured. For example, if the tenth division corresponds to 0.36 mm on the micrometer scale, then 1 division = 0.036 mm = 36 µm.

For very precise measurements, the screw micrometer eyepiece is available; further details from brochure 513–017.

Fig. 17 Graticule scale in the eyepiece and specimen micrometer image.



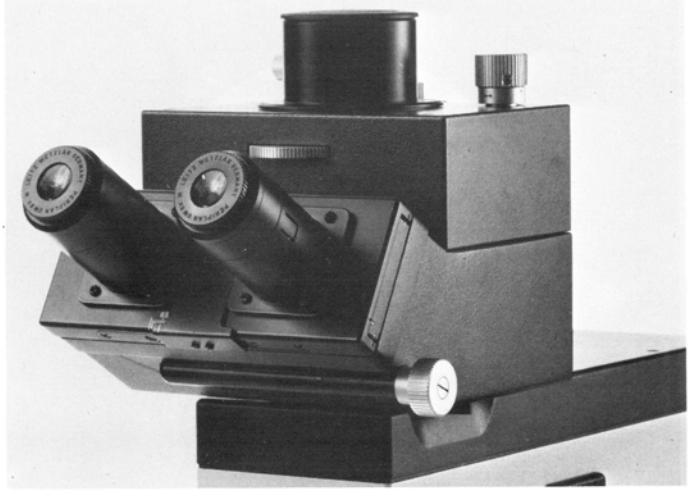
## Image recording systems

### Mounting on phototubes

All the phototubes in the Leitz range allow one image recording system (e. g. a microscope camera or video) to be attached, apart from the FSA-GW-R tube, which can accomodate two systems.

Vertically-mounted cameras can be additionally supported by rails which are available in two different lengths, 312 or 456 mm. The rails are attached to the top of the stand via the two mounting holes provided (the screws must be first removed).

Fig. 18 FSA-GW-R phototube.



In addition to the holder, for which various adapters are available for different cameras, the 4 x 5" bellows camera with reflex attachment can also be attached for classical large format photography.

### Mounting on the side-reflection module

In order to insert the module for side-reflection of the image-forming light, the FLUOVERT stand must first be opened above the focus controls. The special key for this is supplied with the module and is used to unscrew the cover plate on the right-hand side of the stand (fig. 19). The glass element for optical compensation should be pushed out to the left.

Unscrew the cap ring on the module, then insert the latter into the left aperture in the stand and slide loosely to the right.

**Note: Do not use force, as the module can easily tilt over.**

Make sure that the orientation pin on the module engages correctly in the left-hand aperture, as only then is proper orientation of the module in the light path guaranteed.

Screw the cap ring over the module from the right and tighten.

The prism contained in the module can be set to allow the following:

a) 100 % of the light to the observation port
b) 25 % of the light to the observation port
75 % to the image-recording system

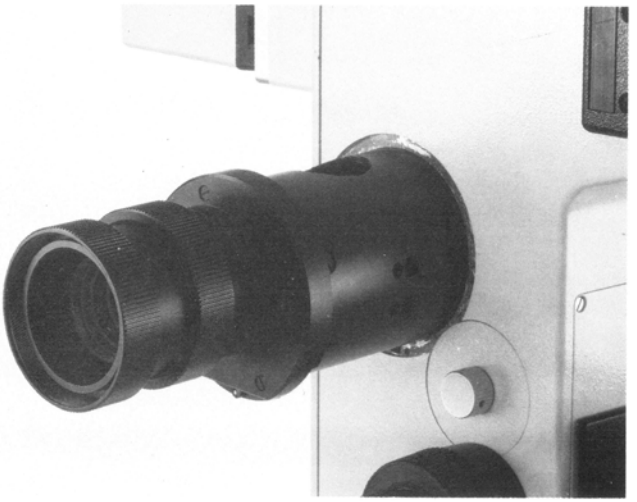
The TV 1 oder TV 2 adapters can be attached to the module, providing image erection when, for example, video cameras are attached. The TV 1 adapter is for video cameras with C-mounts, the TV 2 for use in combination with photo eyepieces (fixed or pancratic).

The TV 1 oder TV 2 adapters (fig. 21) are screwed to the module using the cap ring. The rotary movement for the adapter height adjustment cap be clamped using the knurled ring.

For support of smaller TV cameras, the telescopic camera support (543 516) is available. The height can be adjusted by turning the knurled ring under the tripod screw; this is clamped using the ring in the centre of the support.

Fig. 19 Opening the stand.

Fig. 20 Inserting the module.



For attachment of large TV cameras, e.g. for colour, the mounting base plate of the FLUOVERT is provided with a horizontal camera rail. The height can be adjusted to allow various types of camera to be attached.

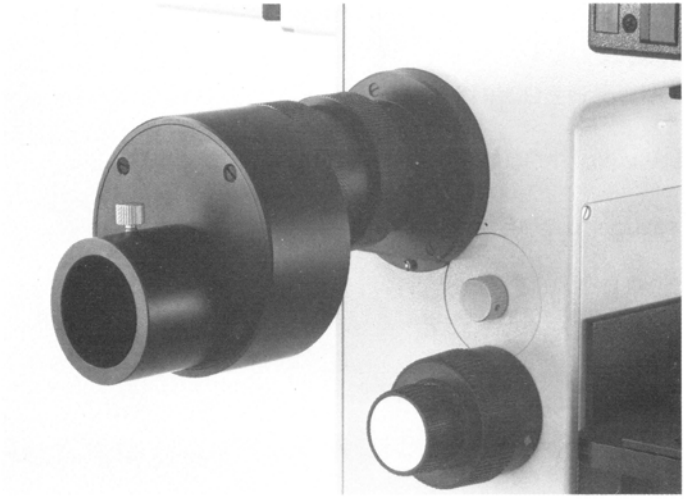
The diagrams on pages 31 to 33 show the various components available for side-attachment of image-recording systems.

The prismatic guide rail on the mounting plate can be moved in order to align the TV camera horizontally. To do this, the two M6 Allen screws, accessible from the rear of the support, should be loosened using the supplied Allen key. The vertical adjustment is carried out on the camera holder, which slides along the prismatic guide rail.

The TV camera should be aligned as follows:

1. Set up an image of a specimen via the eyepieces at medium magnification and move a distinct detail to the centre of the field of view.

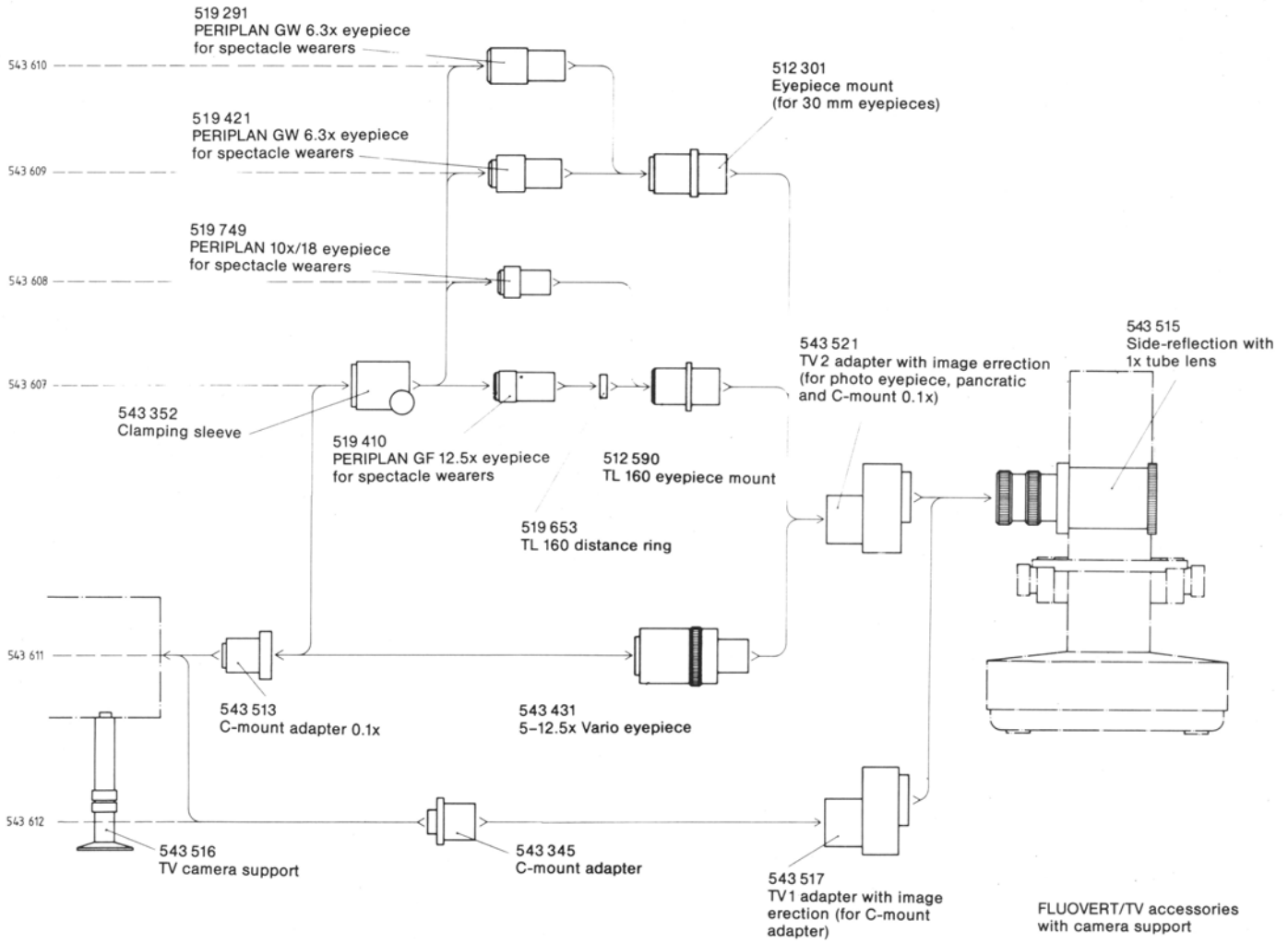
Fig. 21 Attachment of the image-erection adapter.

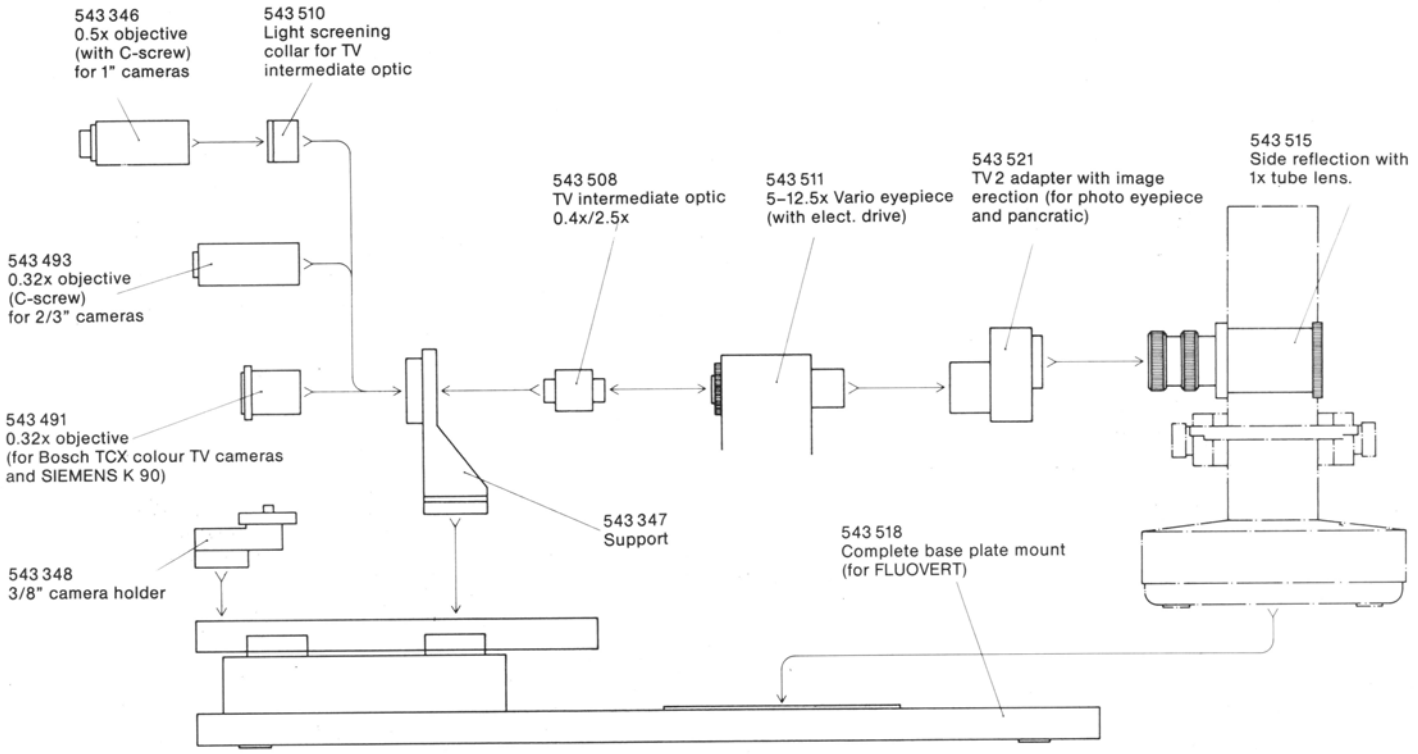


2. Image the specimen on the monitor.
3. Find the mid-point of the monitor screen (intersection of the diagonals).
4. If the detail at the centre of the field of view is not in the centre of the monitor screen, then the horizontal alignment of the prismatic guide rail and/or the vertical alignment of the camera holder must be corrected.
5. When using the zoom eyepiece, the centred detail should not move when the eyepiece magnification is adjusted.
6. When all alignments are complete, retighten the screws.

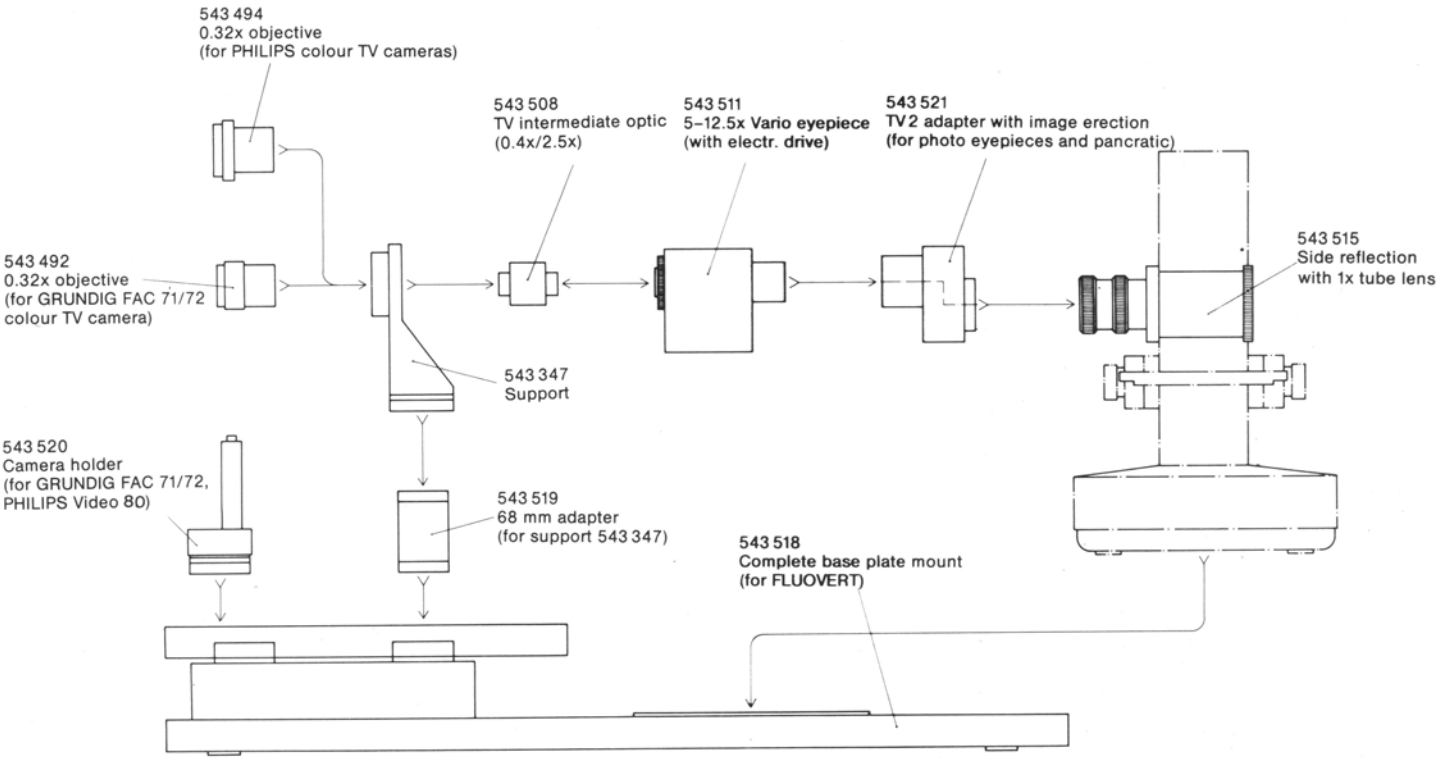
The attachment of cine cameras via the FLUOVERT camera rail cannot be recommended due to possible vibrations caused by the camera which could be transmitted to the microscope. Cine cameras can, however, be mounted on a special stand or on a wall bracket. Adaption parts for connecting the microscope to the camera, and a universal holder for firm mounting of the camera on a stand or wall bracket are available from Leitz for the most common 8 and 16 mm cameras.

Fig. 22 Attachment of image recording systems.






| FLUOVERT/TV attachment, horizontal | |
|---|---|
| with Vario eyepiece for TCX and K 90 | 543 617 |
| with Vario eyepiece for LDK 44 | 543 616 |
| with Vario eyepiece for FAC 71/72 | 543 615 |
| with Vario eyepiece for 1" cameras | 543 614 |
| with Vario eyepiece for 2/3" cameras | 543 613 |




FLUOVERT/TV attachment,
horizontal
with Vario eyepiece for PHILIPS video 80
and GRUNDIG FAC 71/72

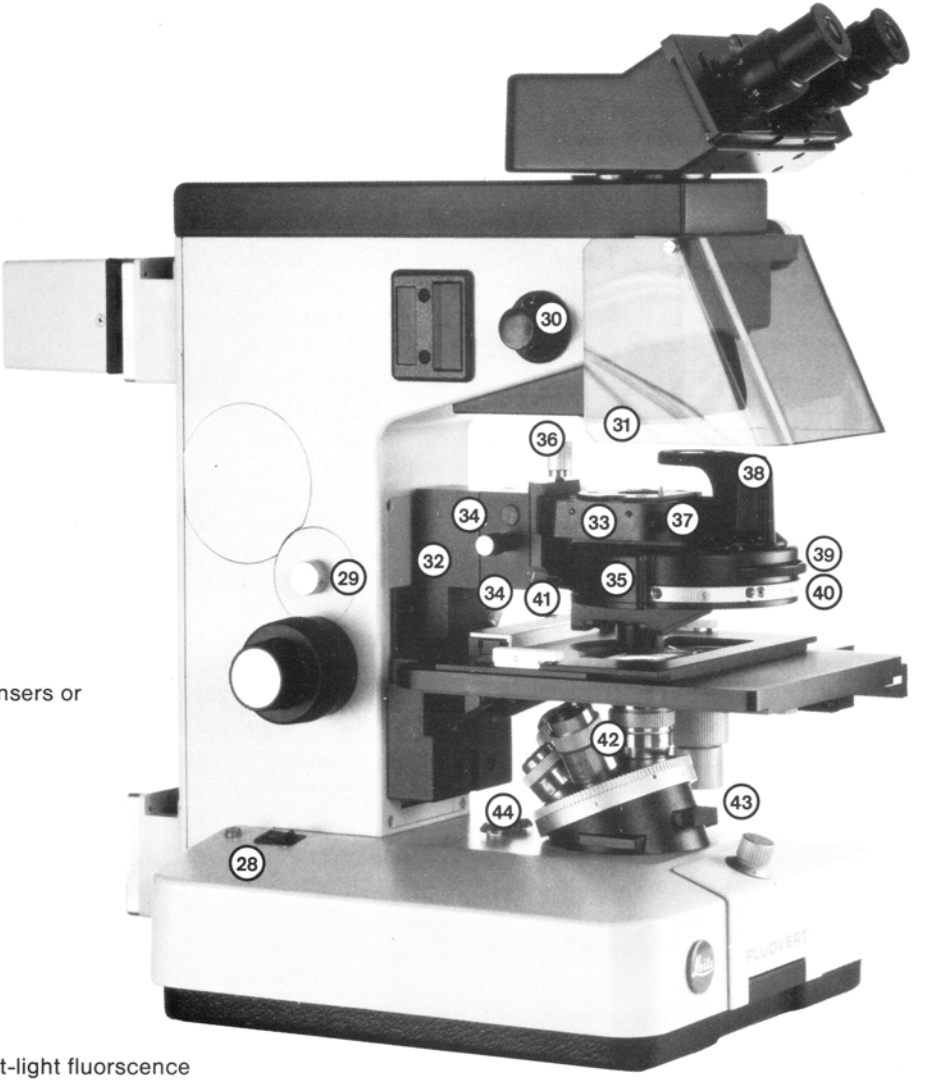



Fig. 23

28 6V 20W lamp switch/regulator
29 Focus stop
30 Height adjustment for the S 95/S 50 condensers or SK/UK illumination lens
31 SK/UK illumination lens
32 Holder for drive and condenser mount
33 Drive with condenser mount
34 Clamping screw
35 UK condenser
36 Adjustable condenser height stop
37 Condenser mount centring screws
38 Supplementary lens
39 Aperture diaphragm control
40 Annular diaphragm/Wollaston prism turret
41 Phaco annular diaphragm centring keys
42 Objectives
43 Wollaston prism slide
44 Centring for the field diaphragm for incident-light fluorscence

# 4. Care and Maintenance

Dust protection is provided by a flexible dust cover which should always be used when the instrument is not in use. The stand should be cleaned from time to time with a linen or leather cloth; alcohol must not be used as it attacks the paint, but petroleum is well suited for cleaning the painted surfaces. Pale spots on the object stage can be removed by rubbing with paraffin oil or vaseline.

Particular care should be taken when undertaking studies using acids or other aggressive chemicals. Direct contact of these substances with the stand or optics must be avoided under all circumstances, and all parts should be carefully cleaned after use.

The optics must be kept scrupulously clean. Dust can be removed from glass surfaces by means of a dry, fine haired brush, blowing gently across the surface whilst brushing. If the dirt is difficult to remove, a clean cloth, moistened with distilled water, can be used or, if this also has no effect, pure alcohol may be applied. Particular care should be taken when cleaning anti-reflection coatings. The outer eyepiece surfaces and the front elements of the objectives have coatings of approximately the same hardness as glass and must be correspondingly carefully cleaned.

Objectives should not be screwed apart during cleaning. If damage or dirt is noticed inside them, they should be returned to us for repair. Clenaning of the inner surfaces of the eyepieces is also advised against.

Proper handling of the microscope will ensure decades of service. If, however, a check over or repair becomes necessary, please contact your Leitz agency or our Technical Service direct.

**Technical Service**
**ERNST LEITZ WETZLAR GMBH**
**Postfach 2007**
**D-6330 Wetzlar**
**West Germany**
**Telephone: 06441/29–0 (Switchboard)**
**Telex: 483727 eltsc**

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