



Axioskop  
Routine microscope  
for reflected light

Operating manual

## HINTS ON INSTRUMENT SAFETY

The Axioskop routine microscope has been designed and tested in compliance with EN 61010 (IEC 1010-1) regarding the basic requirements of Appendix I of directive 73/23/EEC and in compliance with CSA and UL requirements and left the factory in a perfect state with regard to its safety facilities. To ensure that this remains the case and to guarantee the safe operation of the equipment, the instructions and warnings given in this manual must be observed.

The instrument meets the requirements of the EC directive 89/336/EEC and the EMC legislation of November 9th 1992. It has been allocated the protection degree IP 20 and is categorized as Class 1 Equipment. The power plug must be inserted in an orderly installed socket featuring a grounding (earth) contact. The grounding effect must not be nullified by an extension cable which does not have a protective ground wire.

The following warnings must be observed for your own safety and for the protection of the instrument against damage :

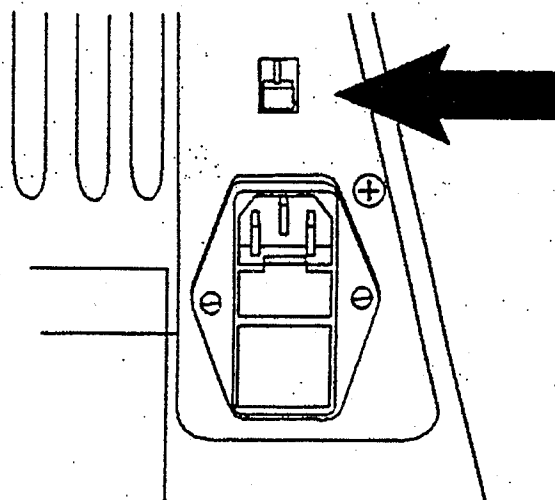
The Axioskop configuration includes special protective devices, e.g. attenuation filters to protect the eyes from intensive radiation or adjustable stops to prevent the specimens from hitting the objectives. These protective devices must be used and must not be removed. Make yourselves familiar with the safety devices of the Axioskop under all circumstances.



### Line voltage

Before switching on the instrument, always check whether it has been set to the line voltage present.

The voltage set is shown on the rear of the microscope stand.



Incorrect voltage settings which do not meet the specifications stipulated in → *Technical Data* may damage the instrument or impair its functions.

The procedure required to change the set voltage is described in chapter 1 → *Lamp Supply*.

Always pull the power plug before changing the fuses or opening the instrument. The instrument may only be opened by specially trained personnel.



**Caution!**

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### Gas discharge lamps

In unfavorable circumstances and with improper use, gas discharge lamps can explode, flinging splinters of glass through the air and causing possible injury. Therefore, it is imperative that the safety and operating instructions of the manufacturer of the gas discharge lamp be followed.

Gas discharge lamps emit ultraviolet radiation which can cause burns on the eyes and skin. Never look directly into the light of these lamps and avoid direct, unprotected incidence of their light on your skin. When using the microscope, always use the protective devices belonging to the instrument, e.g. special attenuation filters.

Gas discharge lamps are contained, for example, in our microscope illuminators HBO 50, HBO 100 and XBO 75. For the relevant safety instructions and warnings please see the operating manuals of these lamps.



**Caution!**

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### Hot surfaces

The lamp housings sometimes become too hot during operation and must therefore not be touched.

Always pull the power plug before changing the lamps and allow the instrument to cool down for approx. 15 mins.



**Caution!**

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### Heat build-up

Placing objects against or covering ventilation slats on the exposure control can lead to a build-up of heat and, in extreme cases, cause a fire.

Therefore, always keep the ventilation slats clear (minimum distance 15 cm).

Always check whether the instrument is switched off before placing the dust cover over it.

**Caution!**

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**Thermally sensitive fluorescence filters**

Fluorescence filters are sensitive to the infrared radiation of microscope lamps and their performance can be permanently impaired by them. Therefore, never remove the heat-reflecting filter on the microscope illuminators when you are working with fluorescence filters.

**Caution!**

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**Dust**

Dust and dirt can impair the performance of the microscope. Therefore, protect the microscope as far as possible against these influences. Always use the dust cover if you do not intend to use the microscope for longer periods of time (more than 6 hours).

All repairs and changes of the instrument components may only be performed by service staff or specially **authorized** personnel.

If service is required, please get in touch with your local agency or with

**Carl Zeiss Jena GmbH**  
Zeiss Gruppe  
Unternehmensbereich Mikroskopie  
D-07740 Jena

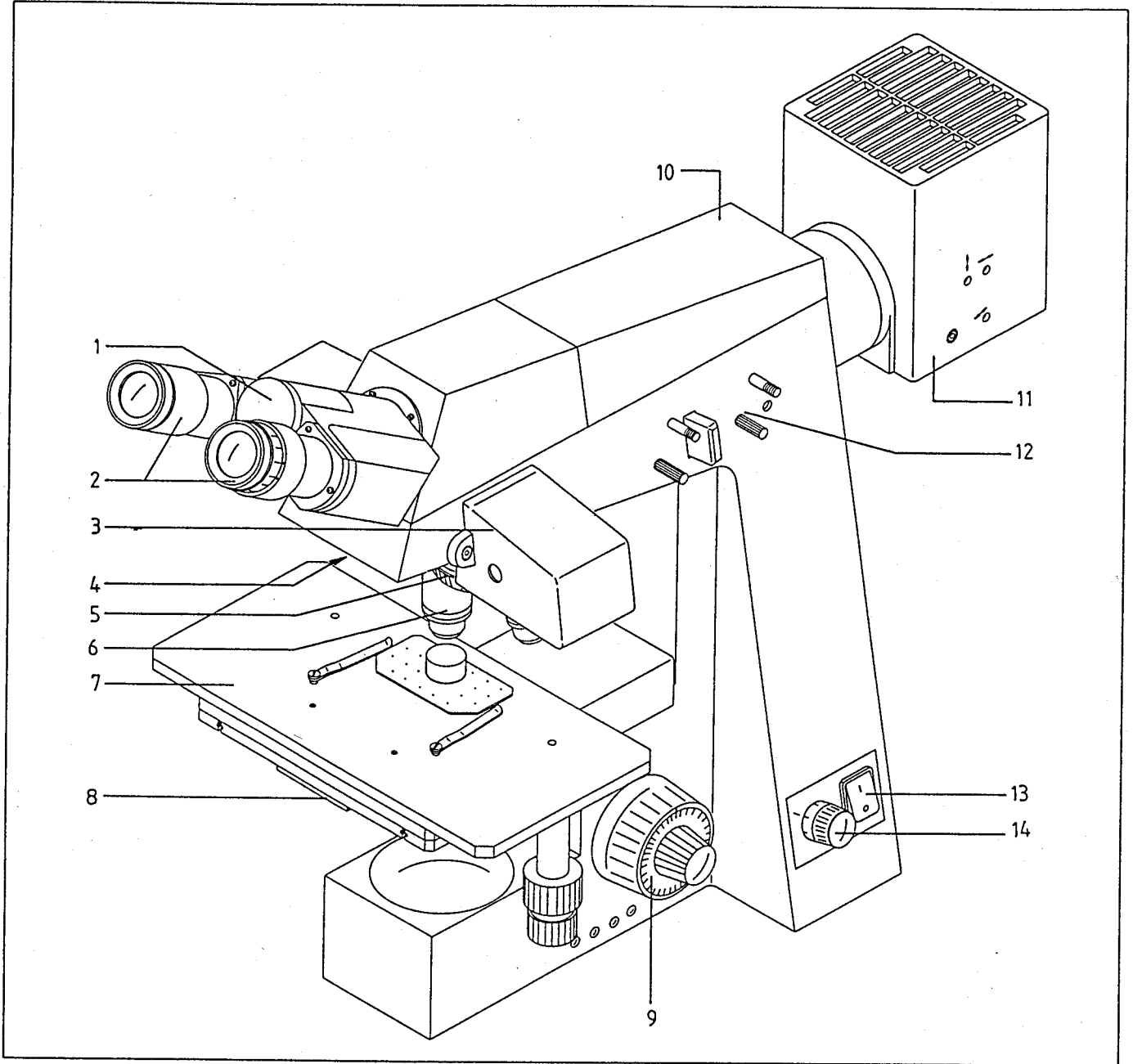
Telephone: (03641) 64-2936  
Telefax : (03641) 64-3144  
Internet : mikro@zeiss.de  
http://www.zeiss.de

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☞ Subject to change.

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1



1 Binocular tube

2 Eyepieces

3 Dust covers;

behind these slot for reflector sliders H,  
HD, H DIC, HD DIC

4 Spring pin to engage/disengage a reflector

5 Nosepiece

6 Objective

7 Specimen stage

8 Stage carrier

9 Coaxial coarse/fine focusing control

10 Tube panel

11 Reflected-light illuminator

12 Reflected-light system HD

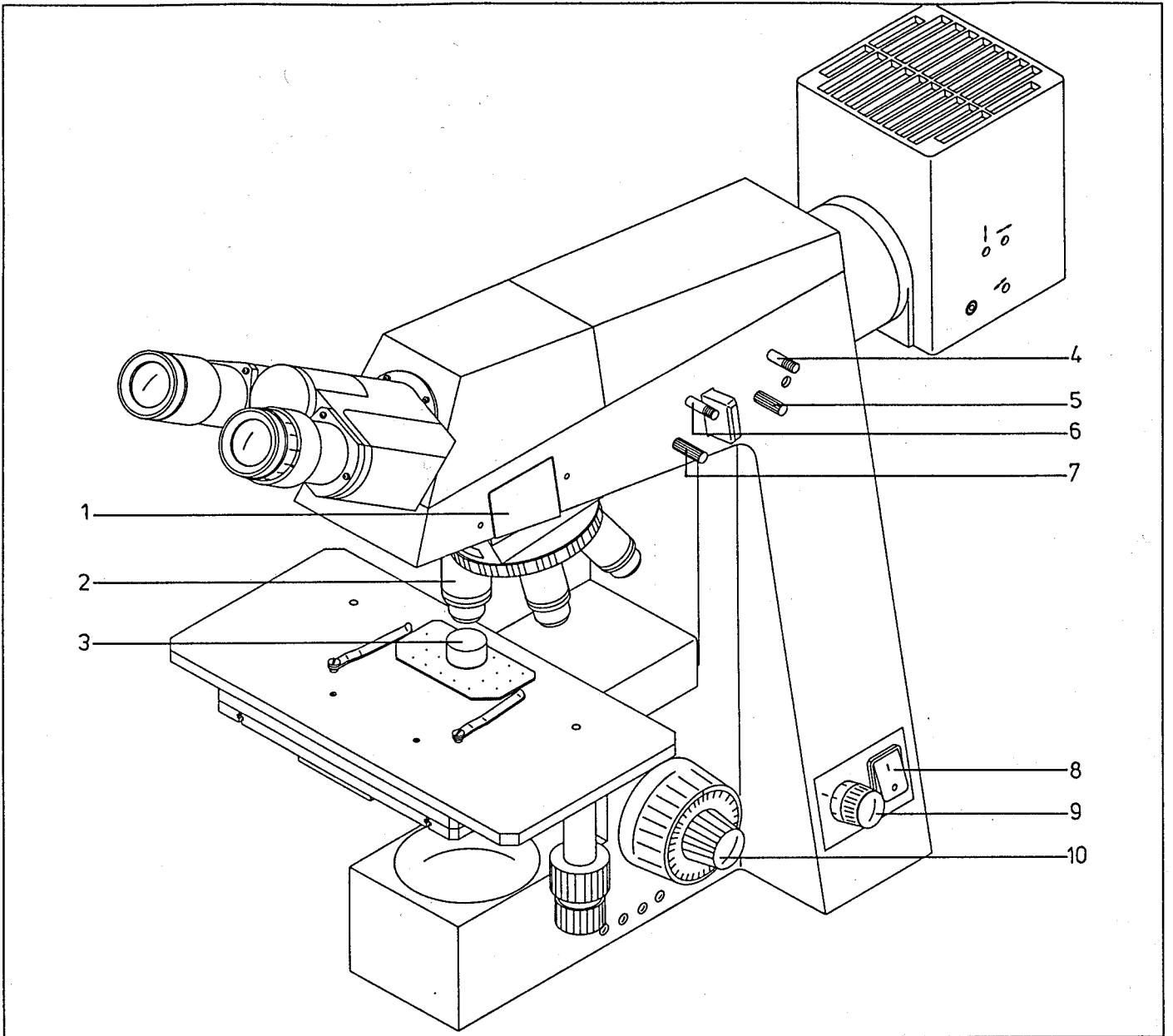
13 Power switch and signal lamp

14 Potentiometer for illumination control

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### Special notes

- The 6- to 10-digit numbers, e.g. 451480, are ordering numbers of instruments or instrument components.
- Caution  
Do not operate the instruments in explosion-risk areas.
- Changes and/or repairs of the instruments should be carried out only by the manufacturer or his authorized representative.
- Specifications subject to change.



Note: Framed numbers like **1.1** refer to the description of the instrument starting on page 6.

- Check data on power rating plate (microscope back) and local power data for coincidence. Plug in microscope power cable, switch on microscope with (8) and set to 3–4 V with (9).
- Load a polished specimen (3) (surface aligned parallel with seating surface e.g. by an alignment press).
- Turn in a 10× objective (yellow ring) on the nosepiece, check the 0-positions on the focusing eyepiece, and slide the (movable) reflector slider (1) to position H (brightfield).

You should now see light spots (the exit pupils) behind the eyepieces. The pushrod of a binocular phototube with sliding prism must be pushed in.

When you look into the tube you will see a bright circle (the eyepiece stop) with each eye. Turning the two eyepiece tubes to your PD will merge the two circles into one.

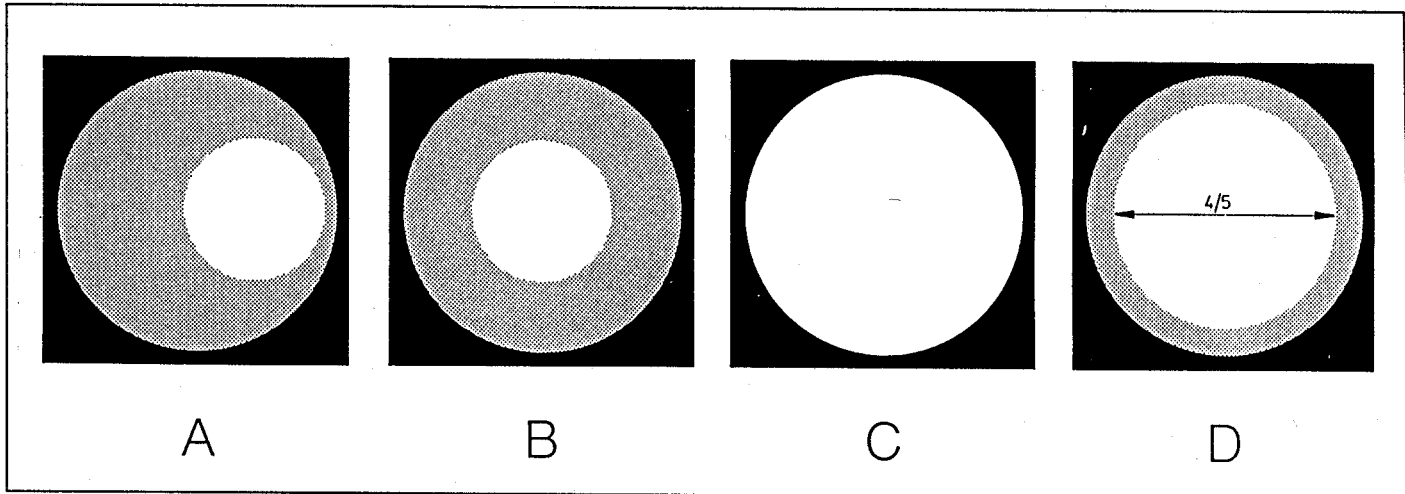
Further steps of Köhler illumination adjustment:

- Move the control (6) of the illumination system to the right, which closes the diaphragm.
- Focus the specimen with (10); the image of the luminous field diaphragm (A), which lies exactly in the specimen plane, will be helpful. (If your eyes have different powers and for work without eyeglasses → **4.5**.)
- Center the diaphragm image in the field of view (B) with centering screws (7), and
- by moving control (6) open this diaphragm so far that the field of view is just free (C).

The contrast is adjusted for each specimen with the aperture diaphragm (4). If you are not certain how far to stop down: approx.  $\frac{4}{5}$  of the rear lens element of the objective (without eyepiece it is visible at the bottom of the tube) should be illuminated (D). With centering screws (5) the image of this diaphragm can be centered in the pupil. The diffusing screen **5.2** should be swung out of the beam path and swung in again for microscopy.

Field of view and objective aperture change, of course, with each objective exchange, so that the last-mentioned steps must be repeated.

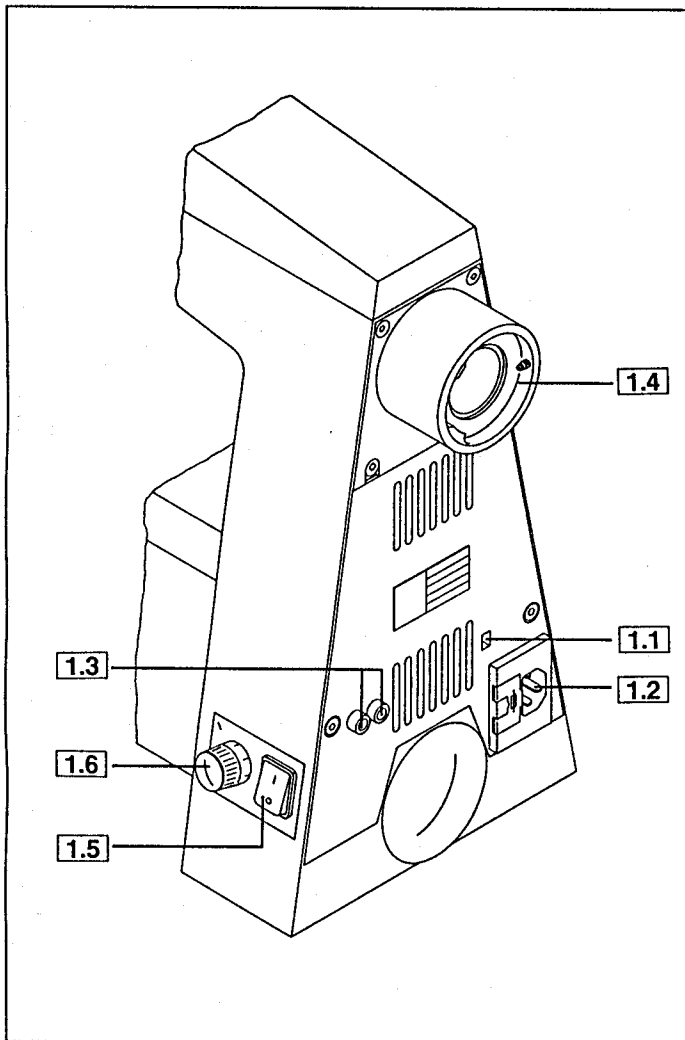
3



Special note

Almost all relevant screws are Allen screws for which a wrench SW 3 with red handle is supplied to mount tubes, illuminators and covers.

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**1.0 Lamp power supply**

The 12V 50W lamp power supply is integrated in the stand.

**1.1** Voltage dial indicating the internally set input voltage (230 V or 115 V); the voltage setting can be changed by a vertical shift with a screwdriver. Additional voltage tolerance in both cases: + 10%, - 15%, frequency 50...60 Hz. The stabilized output voltage is variable from 3...13 V. Power consumption max. 130 VA. The instrument is radio-screened and complies with VDE, IEC, CSA and UL regulations.

**1.2** Power plug with integral fuses for 230 V or 115 V, depending on the voltage set on the dial. The fuses are easily accessible for exchange if the dust cover is swung aside.

Spare fuses:

230 V: 0.8 A SB (3801 27-0190)

115 V: 1.6 A SB (3801 42-2930)

**1.3** Socket for 12V 50W halogen lamp.

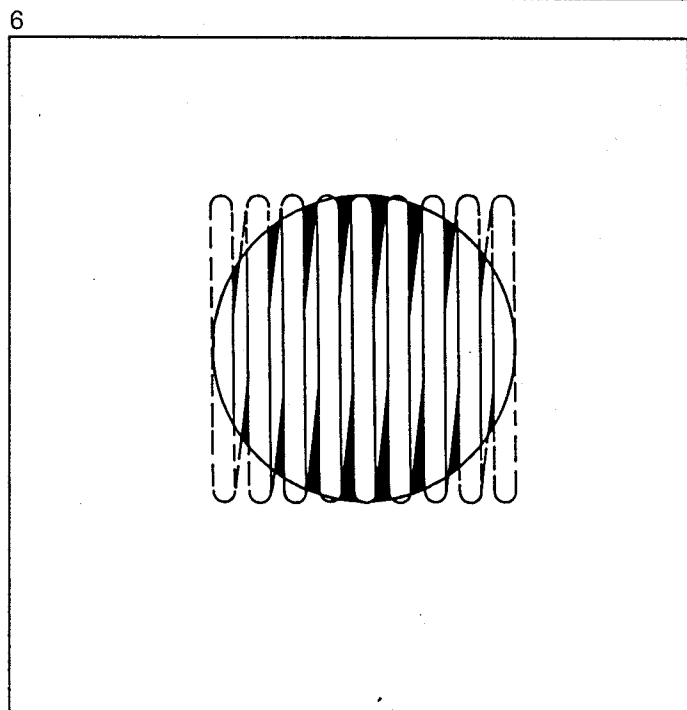
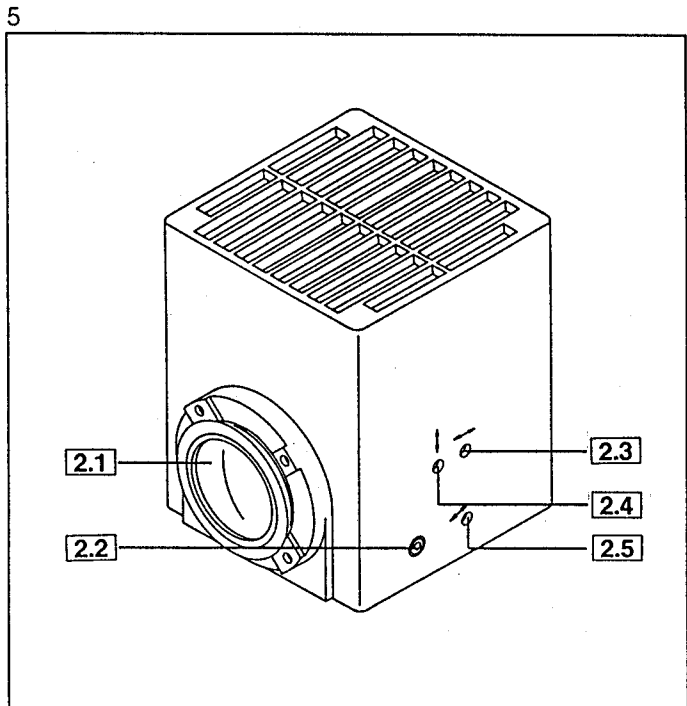
**1.4** Port for reflected-light illuminator. It contains a holder with a 42 mm dia. CB 3 conversion filter.

**1.5** Power switch and power signal lamp.

**1.6** Potentiometer supplies maximum voltage when turned fully clockwise. The adjusted voltage can be read on the index.

**2.0 Illuminator**

Lamp housing Hal with collector and socket and 12V 50W halogen filament lamp is standard outfit. It connects to socket **1.3**.



## Technical features

- 2.1** Light exit. Dovetails for mounting on the microscope:
1. Loosen screw **1.4** sufficiently.
  2. Insert dovetails of inclined illuminator in recess opposite the clamping screw, lower illuminator on to the seating surface and secure it by tightening the screw.
- In front of the collector the light exit contains a holder for a 42 mm dia. heat-reflecting filter.
- 2.2** Clamping screw for lamp socket and collector
- 2.3** Lamp coil focusing
- 2.4** Vertical adjustment of lamp coil
- 2.5** Lateral adjustment of lamp coil

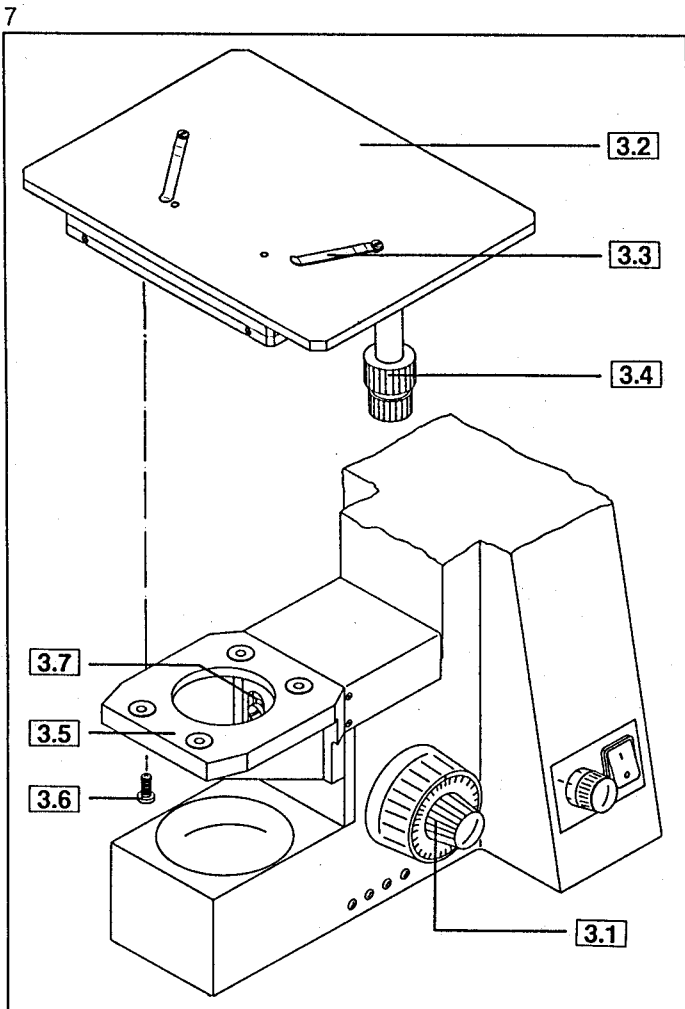
The lamp is factory-adjusted. Should re-centering be necessary, proceed as follows:

1. Switch on lamp, swing out diffusing screen **5.2** by pushing pushrod from the right, turn in a 50X or 20X objective, use a specularly reflecting surface as specimen and brightfield illumination.
2. Without eyepiece the pupil and the coil image will be visible at the bottom of the tube. The coil image should uniformly cover the pupil surface. If the image is other than in Fig. 6, correct with **2.4** and **2.5**.
3. Swing in diffusing screen **5.2** by pushing pushrod from the left, check the pupil image again, and optimize the adjustment with **2.3**.

## Technical data of halogen lamp (380079-9550)

Voltage	12 V
Power	50 W
Color temperature at 6 V	2800 K*
Luminous flux	950 lm
Mean life	2000 hrs
Luminous area	3.1X3.1 mm

\* The built-in conversion filter CB 3, see **1.4**, provides for the right color temperature in the beam path for photography with artificial-light color reversal film which is sensitized for 3200 K.



### 3.0 Stand base and specimen stage

**3.1** Coaxial coarse/fine focusing control acting on a slide in two guideways, which carries the stage carrier. Turning the outer part of the control towards the user lowers the stage. Overall travel (including fine focusing control) 25 mm. One turn of the coarse focusing control corresponds to 2 mm travel; gear ratio of fine focusing control reduced 1:10. The index line on the coarse focusing control can be used for rough measurement of the specimen thickness: 1 interval corresponds to approx. 2  $\mu$ m.

**3.2** Mechanical stage with control to the left (453526) or right (453527) **3.4** is standard equipment.

**3.3** Two stage clips to secure the specimen.

**3.4** Coaxial controls (x and y) for a 75x50 mm travelling range of the stage.

**3.5** Stage carrier A; it allows the examination of max. 40 mm high specimens.

The microscope stage is mounted on the stage carrier by means of 4 screws **3.6**.

For adjustment to varying specimen heights the stage carrier can be lowered max. 15 mm after loosening the 2 screws **3.7**.

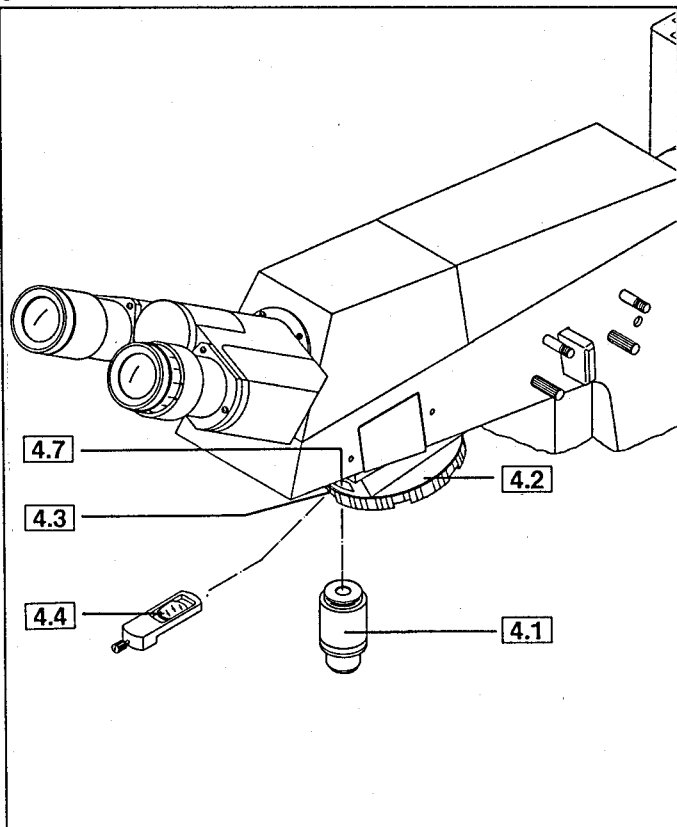
#### 4.0 Image-forming components

**4.1** The objectives, the most important elements of a microscope must be kept meticulously clean, especially their front lens surfaces. (Breathing on the surface and wiping over it with a Q-tip suffice for general cleaning; for thorough cleaning see the brochure G 41-100 "Microscopy from the very beginning".)

The numbers and symbols engraved on the objectives, e.g. Epiplan-Neofluar 20X/0.50, ∞ /0 signify: 20X = (individual) magnification, 0.50 = numerical aperture, ∞ = infinite image distance, 0 = cover glass thickness 0 (uncovered specimens). (Individual magnification multiplied by the eyepiece magnification (generally 10X) results in the microscope magnification.

Numerical aperture × 1000 (500 in the above example) is the highest useful magnification; no more details will be revealed above this value.

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The symbol ∞ is to remind the user that these objectives cannot be used on microscopes with objectives bearing the number 160.

Brightfield/darkfield objectives whose image-forming elements are surrounded by a concentric illumination system are engraved HD.

Objectives designated DIC (or Pol) are virtually strain-free and therefore equally well suited for polarizing microscopy. Because of their short working distances 20X and higher-power objectives have spring mounts to protect the specimen. To prevent specimens from being contaminated by oil if the nosepiece is turned, immersion objectives can be locked in the upper position of the spring mount by a clockwise turn (don't forget to disengage them from this "lock-in" position!).

The air between the cover glass and an immersion objective is replaced by immersion oil from oiler (462958). Some training is necessary to achieve a bubble-free layer. Some microscopists prefer to turn the objective from the side into the oil drop on the coverglass, others recommend to lower the objective from "lock-in" position of the spring mount. The exit pupil should always be controlled (see page 5) which will instantly reveal any bubbles. If the bubbles have not disappeared even if the objective has been turned in several times, clean the specimen and repeat the procedure.

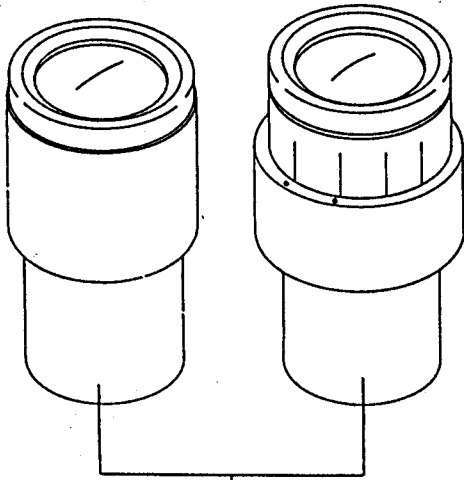
**4.2** Nosepiece, firmly mounted on the microscope stand. If the microscope is suited for differential-interference-contrast microscopy, the knurled ring of the nosepiece 5X HD DIC (for DIC with objectives with W "0.8" thread mounts you need adapter ring H "0" M 27/W 0.8 (44 4910)) features

**4.3** slots for

**4.4** DIC sliders which must snap in when inserted (designation face up) (see also DIC adjustment on p. 15). The DIC sliders can be left in their slots as dust covers even if no DIC is made.

Nosepieces 5X HD and HD DIC for Epiplan-Neofluar objectives HD and HD DIC have wider screw mounts (M 27). Via adapter rings (44 4910) these nosepieces also accept objectives such as Epiplan-Neofluar or Epiplan-Neofluar DIC.

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4.5

**4.5** The eyepieces with 10× magnification and field-of-view number 20 produce angular fields of 43°, are equally well suited for eyeglass wearers (Br), and carry exchangeable, soft rubber rings to protect eyeglasses (folding eyecups are available under ordering number 44 48 01).

One eyepiece is a focusing eyepiece (foc). If your eyes have different powers or for microscopy without eyeglasses, make the adjustment as follows:

- Look through the fixed eyepiece with the less emmetropic eye and focus on the specimen.
- Leave the microscope adjustment unchanged, but for the more emmetropic eye adjust the focus with the eyelens of the focusing eyepiece until the specimen is in focus for both eyes. This eyepiece adjustment is facilitated by a screw which engages a notch in the eyepiece tube and thus secures the eyepiece position, which is important especially for the use of reticles.

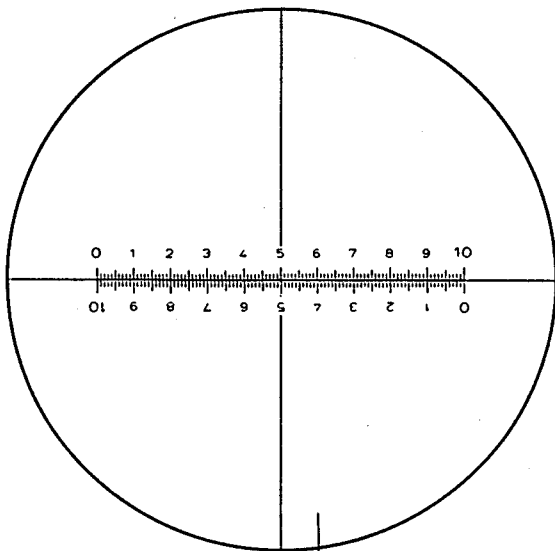
Eyeglass wearers who take their glasses off for microscopy may experience unsatisfactory objective parfocalization.

Eyeglasses with a "cylinder" must be kept on for microscopy.

**4.6** Reticles in the eyepiece diaphragm plane used for measurement and to outline the photographic format of an attached photomicrographic camera fit only in focusing eyepieces. The slight image displacement they cause is considered by the zero position on the diopter scale indicated by the red dot.

The exchange of reticles should be left to specialists because of the high demands on cleanliness and exact alignment.

(The lower part of the eyepiece can be unscrewed; the scale-bearing surface of the reticle must face down.)



4.6

**4.7** Slot for auxiliary objects and compensators (irrelevant for reflected light). A quartz depolarizer should be mounted in the microscope for photomicrography in DIC. The depolarizer is screwed properly oriented on the stand below the tube port.

Any of the following tubes fits on an Axioskop microscope:

**4.8** Binocular tube

**4.9** Binocular phototube with a fixed beam-splitting ratio of 50% of the light relayed upwards to a camera and 50% for observation.

**4.10** Binocular phototube with sliding prism and light shutter. Two positions can be adjusted by sliding the pushrod in or out with the knob on the right:

100% of the light for observation (pushrod slid in),

or

30% of the light for observation and 70% to the camera (right and left pushrods pulled out). If the left pushrod is slid in in this position, the light shutter on the eyepiece side is activated. No observation through the tube – straylight cannot enter – 70% of the light reaches the camera.

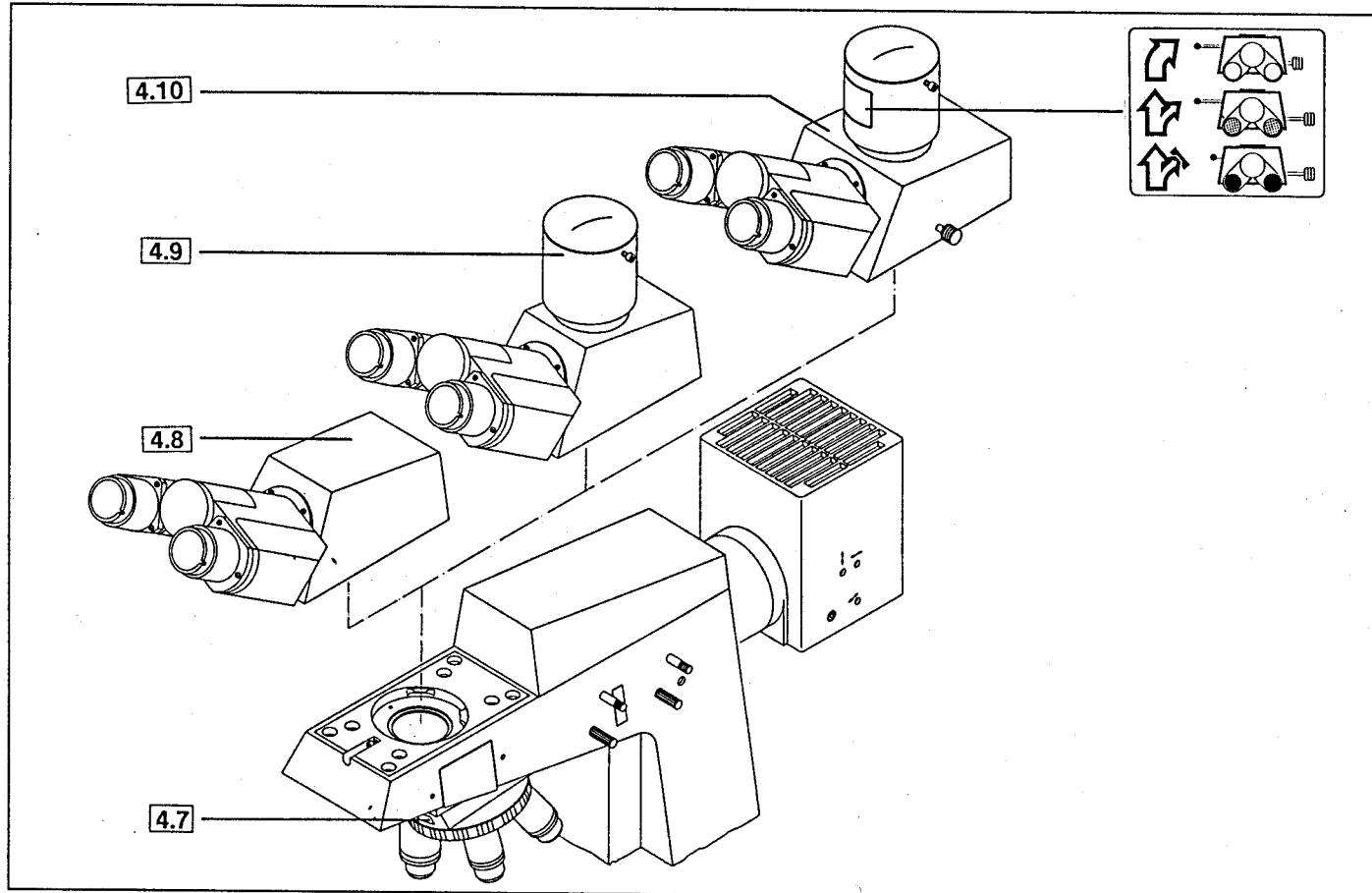
Binocular phototubes with eyepiece shutter are provided with a label on the photo port with symbols referring to the various switch positions.

All tubes have viewing angles of 30°; PDs between 55...75 mm can be adjusted by moving the tube halves in and out. The phototubes feature reticle erection (accurate to 1°).

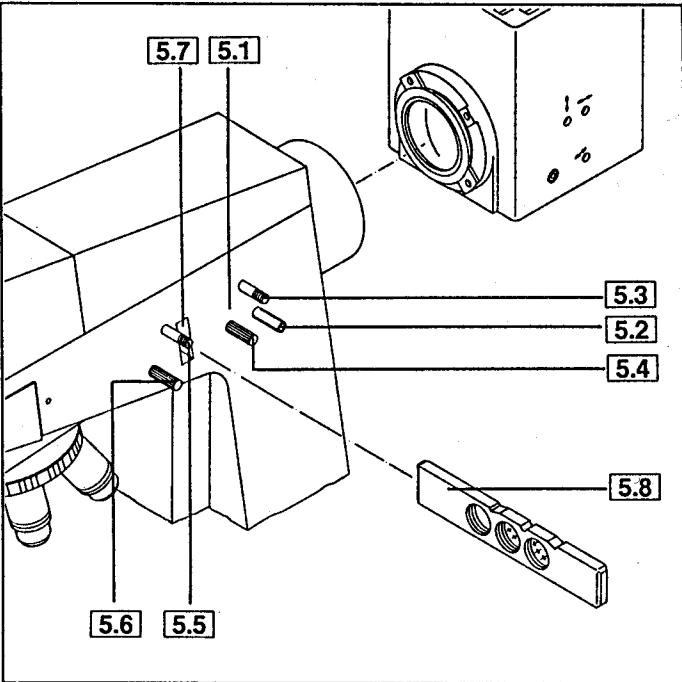
A photomicrographic, TV or special camera can be mounted on the upper tube port. The adapter for microscope camera (452996) and a photo eyepiece S-PI 10× or S-PI 12.5× are required for the microscope camera MC 63 S. Cine and TV cameras with standard C-mounts are fitted via standard C adapter (452995), without eyepiece.

Both adapters are parfocalized with the reticle in one of the eyepieces.

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**5.0 Illumination system**

The illumination system for reflected-light examinations comprises besides the illuminator:

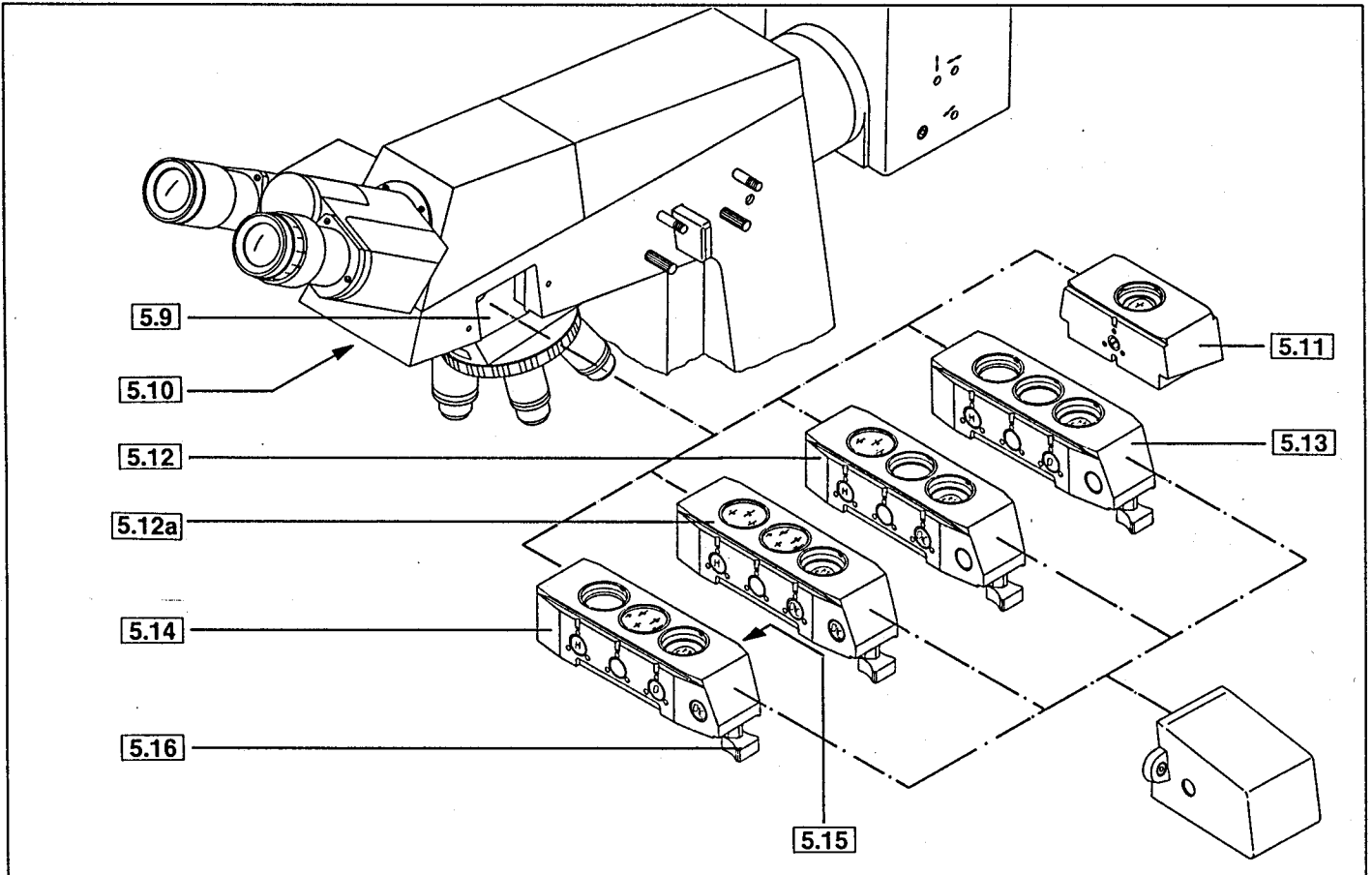
**5.1** Reflected-light system HD

**5.2** Diffusing screen operated by a pushrod. Pushed from the left the pushrod swings the diffusing screen in the beam path, pushed from the right, out of it. The diffusing screen is used to center or homogenize the light-source image.

**5.3** Pushrod for aperture diaphragm: to the left – diaphragm open to the right – diaphragm closed.

**5.4** Centering screws for aperture diaphragm.

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**5.5** Pushrod for luminous field diaphragm acts like **5.3**.

**5.6** Centering screws for luminous field diaphragm correspond to **5.4**.

**5.7** Slot (between the two aforementioned diaphragms) for

**5.8** Filter slider A which accepts any of the following 18 mm dia. filters of different thickness:

- Neutral density filter 0.25 (25% transmittance)
- Neutral density filter 0.06 ( 6% transmittance)
- Conversion filter 3200/5500 K
- Green interference wide-band pass filter

The filters can be fitted by the user; they are secured by a sealing ring. Two (e.g. neutral density) filters can be used in a set in one position.

Brightness control by neutral density filters (graded by a factor of 4):

Filters 0.25 and 0.06 used in combination yield  $0.015 = 1.5\%$ . The conversion filter converts artificial light into daylight for observation and color photomicrography on daylight film. A green filter may improve the image quality of uncolored specimens and increase the contrast of colored objects, especially in B/W photography.

**5.9** Slot for reflectors which combine illumination and observation beam paths, after pulling out spring pin

**5.10**. The spring pin provides for the stops at either end. Which reflector is used depends on the observation method for which the microscope is equipped.

1: **5.11** Reflector slider H for brightfield illumination alone.

2: **5.12** Reflector slider H DIC for brightfield and DIC.

It has three click-stop positions for:

brightfield

free light path

DIC (crossed polarizing filters)

or reflector slider H DIC DIC with three click-stop positions:

H – brightfield with plane glass plate and neutral density filter 0.06

DIC – with plane glass plate, polarizer and analyzer

Color DIC – with plane glass plate, polarizer and analyzer with lambda plate.

3: **5.13** Reflector slider HD for brightfield and darkfield with the click-stop positions:

brightfield

free light path

darkfield.

4: **5.14** Reflector slider HD DIC for brightfield, DIC and darkfield with the click-stop positions:

brightfield

DIC (crossed polarizing filters)

darkfield.

In the multi-position reflector sliders which allow change between different illumination methods (darkfield or DIC to brightfield) an automatically provided neutral density filter prevents the user from being blinded by the intensive light. The 25 mm dia. neutral density filter **5.15** is secured by a retaining ring. It can be removed if much light is needed for dark specimens. Never remove the retaining rings of the polarizing filters (in DIC positions), because this impairs their orientation.

Dust covers to the left and right on the stand protect the multi-position reflector sliders. Adjust the illumination method with **5.16**; it can be read in the right or left window. For retrofitting of the sliders see p. 16.

It is applied to examine specular surfaces of different reflectance (ideal brightfield specimens) as well as scratches, fissures, pores, which project from a flat surface. Such light-scattering features light up in darkfield, while the specular flat surfaces remain dark.

The necessary equipment

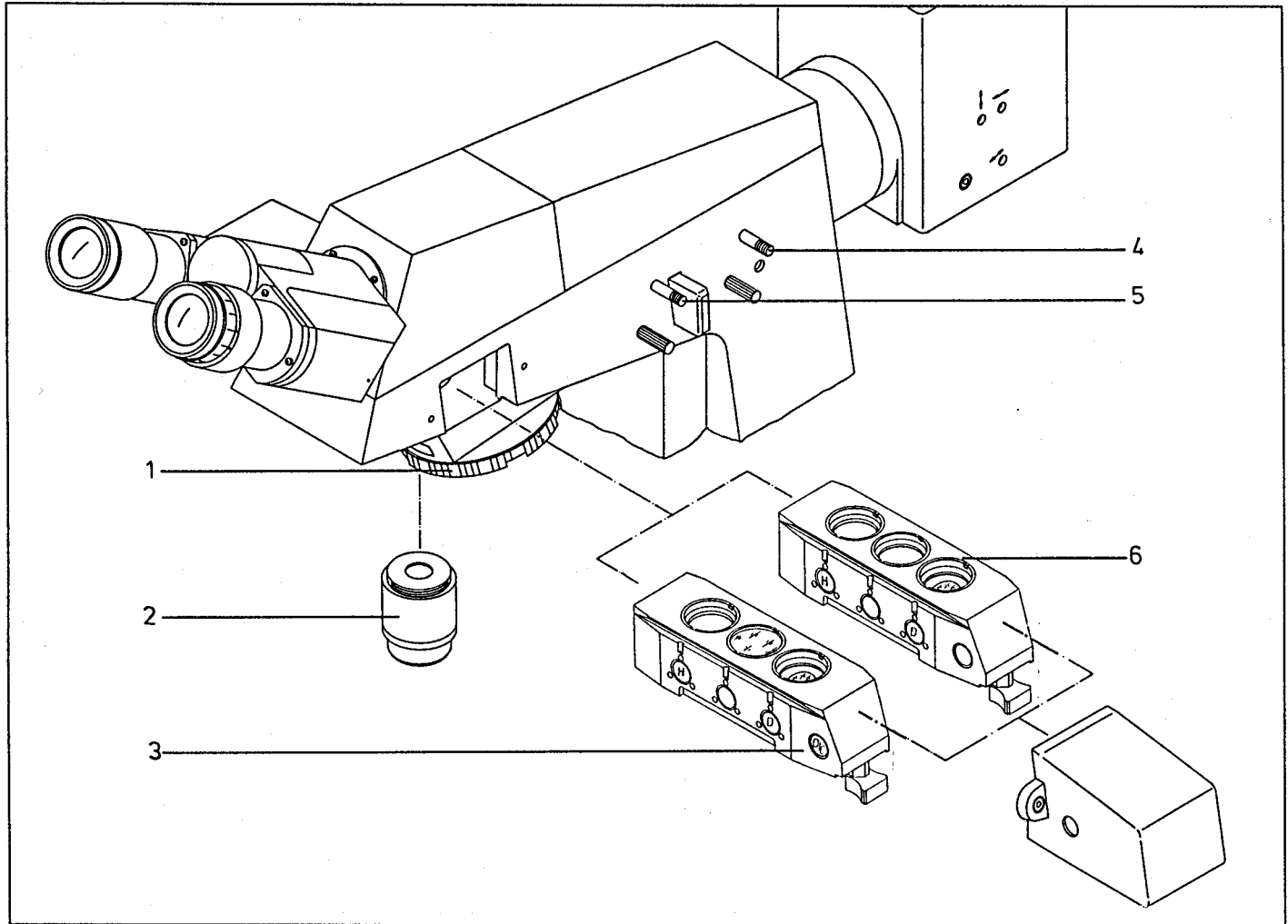
- Reflector slider HD (6) or HD DIC (3)
- Nosepiece HD (1) with wide screw mounts for
- Epiplan HD objectives (2)

The necessary adjustment after brightfield adjustment

Change the reflector sliders from H (brightfield) to D (dark-field). The automatically provided neutral density filter prevents the user from being blinded.

Aperture (4) and luminous field (5) diaphragms must be open to avoid light losses; the neutral density filter(s) in filter slider A must be swung out.

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It is applied mainly to display with high contrast the relief of a specimen surface (height differences ranging from several wavelengths to  $\frac{1}{20}$  of a wavelength).

The DIC sliders can be left in the beam path for brightfield and darkfield adjustments.

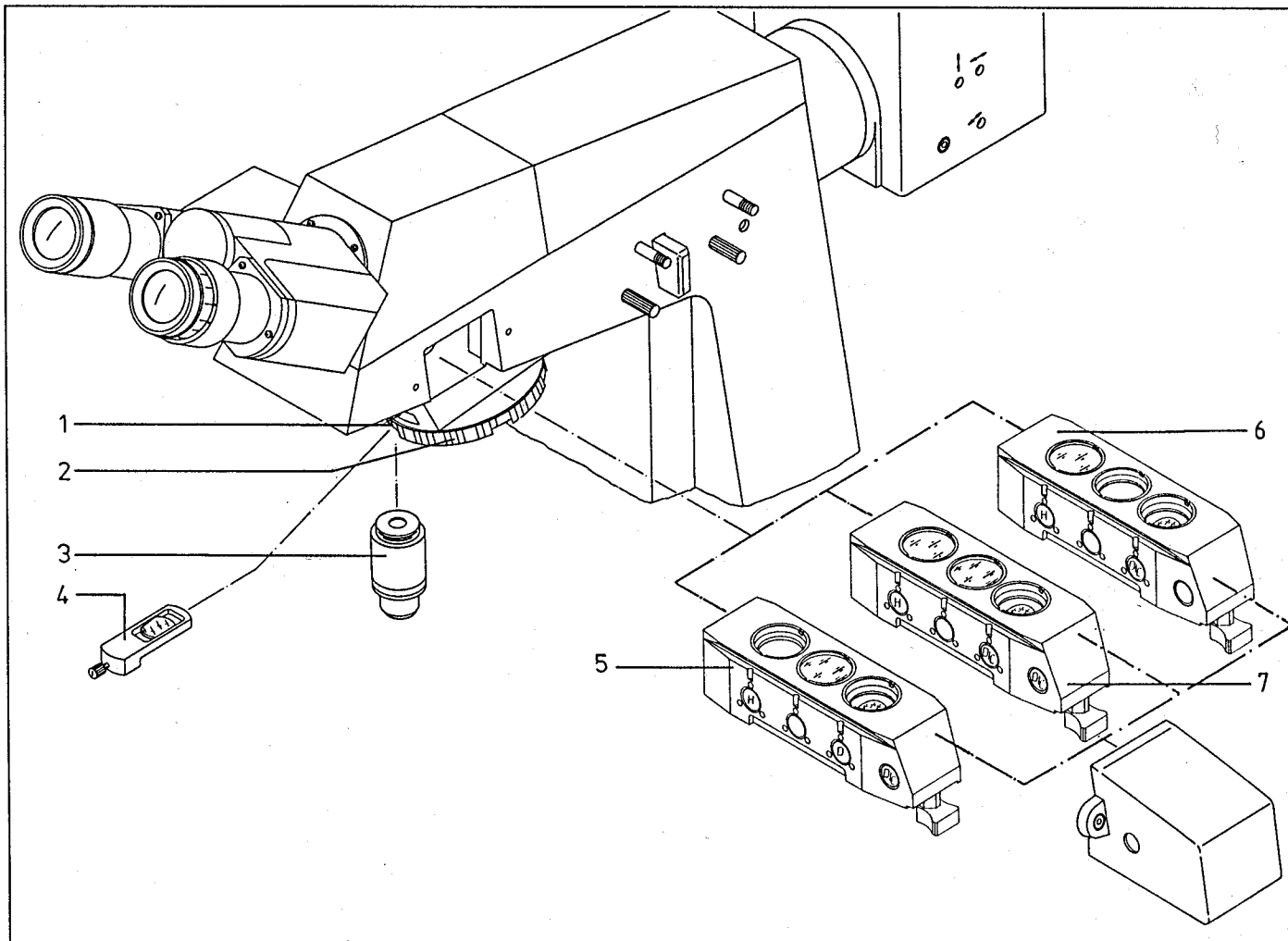
The necessary equipment

- Epiplan-Neofluar objectives (3) designated DIC or Pol
- Special nosepiece (2) with slots (1) for the DIC sliders (4).
- DIC slider "Epi" for each objective whose magnification and aperture are indicated on top of the slider.
- Reflector slider H DIC (6), HD DIC (5) or H DIC DIC.

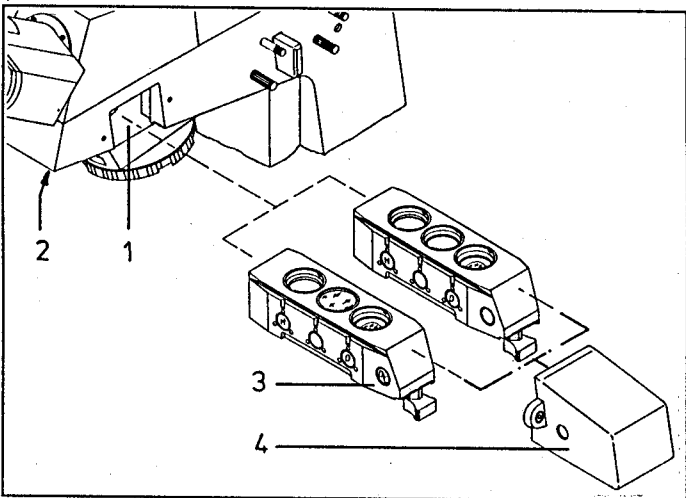
The necessary adjustment after brightfield adjustment

See p. 13 under [5.0]. The contrast is continuously variable with the knurled screws of the DIC sliders.

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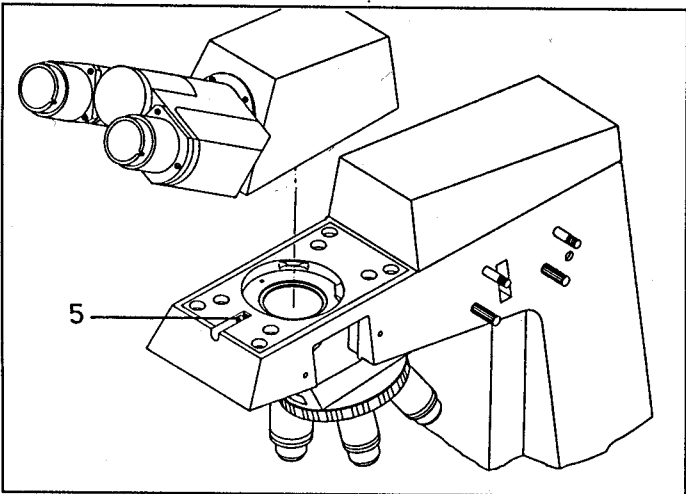
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#### Insertion of a multi-position reflector slider

Pull the spring pin (2) and take the reflector slider H or the blind slider out of the slot (1). Mount the dust cover with 2 screws on the left slot. Pull the spring pin (2) and slide the reflector slider H DIC, H DIC DIC, HD, or HD DIC (3) in from the right as far as it will go. The handle of the slider must be at the lower right. Screw the right dust cover (4) on the stand by alternately tightening the right and left Allen screw.

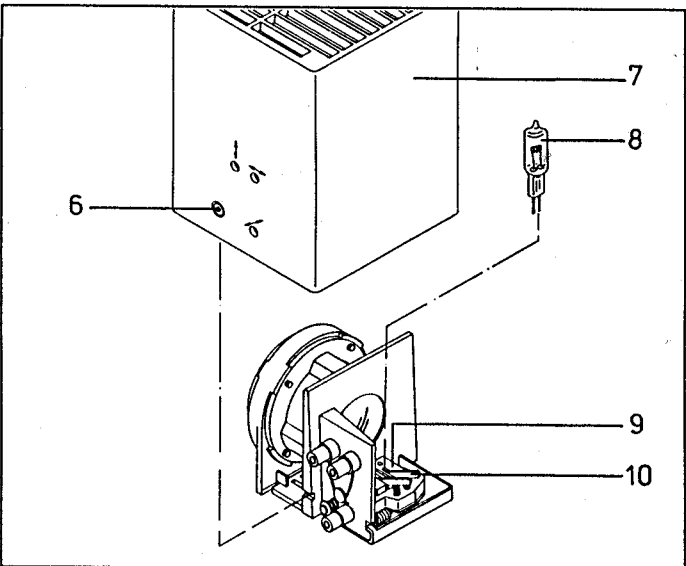
17



#### Tube

- Loosen screw (5) so far that it is no longer visible inside and take off the tube.
- Mount the other tube and secure it.

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#### Exchange of 12V 50W halogen lamp

Pull the plug on the microscope back, loosen the screw (6) and take off the lamp housing Hal (7). The defective lamp can be removed from its socket (9) by pressing the two spring clips (10) together; mount the new lamp (8). Remove fingerprints on the bulb with tissue paper soaked in alcohol, mount the lamp housing (7) and secure it with screw (6).

The spares are listed below as they appear in the instrument description starting on page 6.

**1.2** Fuses for integral power supply  
230 V: 0.8 A SB (3801 27-0190)  
115 V: 1.5 A SB (3801 42-2930)

**2.1** 42 mm dia. heat-reflecting filter (467828)

**4.0** Plastic oiler containing 50 cc PCB-free immersion oil (462958)

**5.8** 18 mm dia. filters for filter slider A:  
neutral density filter 0.06 (467855)  
neutral density filter 0.25 (467856)  
conversion filter 3200/5500 K (467854)  
green interference wide-band pass filter (467859)

(Fig. 18.8) 12V 50W halogen lamp (380079-9550)

