Axiotech and Axiotech^{vario} Materials Microscopes

Operating Manual

ZEISS

Knowledge of this manual is required for the operation of the instrument. Please therefore make yourself familiar with the contents of this manual and pay special attention to hints concerning the safe operation of the instrument.

The specifications are subject to change; the manual is not covered by an update service.

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Notes on instrument safety

The Axiotech and Axiotech[vario] microscopes were designed, produced and tested in compliance with DIN 61010-1 (IEC 1010-1), Safety requirements for electrical measuring, control and laboratory instruments, and meet the requirements of appendix I of directive 73/23/EC and the relevant CSA and UL directives. The microscopes meet the requirements of the EC directive 89/336/EC and the EMC legislation of November 9th 1992. This operation manual includes information and warnings which must be observed by the user.

The following warning and information symbols are used in this manual:

NOTE
This symbol is a warning which you must observe under all circumstances.

CAUTION
This symbol is a warning which indicates a hazard to the instrument or instrument system.

CAUTION
This symbol is a warning which indicates a hazard to the user of the instrument.

CAUTION
Hot surface!

CAUTION
UV radiation is emitted!

CAUTION
Disconnect the instrument from the line before opening it!

The Axiotech and Axiotech^{vario} microscopes, including original accessories, may only be used for the microscope techniques described in this manual.

Particular attention must be paid to the following warning notes:

The manufacturer cannot assume any liability for any other applications, possibly also involving individual modules or single parts. This also applies to all service or repair work which is not carried out by authorized service personnel. If this regulation is not observed, all the claims against warranty will be forfeited.

The power plug must be inserted in a socket featuring a grounding (earth) contact. The grounding effect must not be made ineffective by an extension cable which does not have a protective ground wire.

If it is established that the protection measures are no longer effective, the instrument must be switched off and safeguarded against inadvertent operation. Contact a Carl Zeiss service agency or the Carl Zeiss microscopy service for the repair of the instrument.

The wide-range power unit which is integrated in the stand of the Axiotech 30 microscope permits the use of line voltages in the range between 100 and 240 V ± 10%, 50 - 60 Hz, without the need for the voltage to be changed at the instrument.

The time-tried, stabilized 12V 100 W power unit, which operates in the two switchable line voltage ranges 115 V and 230 V AC ± 10 %, 50-60 Hz, is integrated in the stand of the Axiotech 100 microscope.
Before the start-up of the Axiotech 100, compare the instrument voltage preset at the 230/115 V AC sliding switch on the rear of the stand to the available line voltage and change it, if required!

Depending on the illumination equipment, only external power units are used for the Axiotech^{vario} 100, which must also be compared and adapted - if required - to the existing line voltage.

Always disconnect the instrument from the line before opening the instrument and before changing the fuses.
Make sure to use only fuses of the rated power required. The use of makeshift fuses and the short-circuiting of the fuse holders are not permitted.

The Axiotech and Axiotech[vario] microscopes are not equipped with any special devices for protection from substances which are corrosive, toxic, radioactive or otherwise hazardous to health. All the legal regulations for accident prevention, particularly those in the respective countries, must be observed when handling such substances.

Gas discharge lamps, e.g. HBO 103, emit ultraviolet radiation which can cause burns on the eyes and skin. Therefore, 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). When hot, gas discharge lamps are under high internal pressure and must therefore be changed when cooled down by using protective gloves and goggles (for detailed information please see the operating manual B 40-065 e).

When fluorescence filters are used, the filter protecting from heat emitted by the microscope illuminator must not be removed, since fluorescence filters are sensitive to heat and their function might therefore be impaired.

Avoid touching the hot lamp housing. Always pull the power plug before changing the lamps and allow the instrument to cool down for approx. 15 minutes.

Dust and dirt can impair the performance of the instrument. Therefore, the instrument must be protected against these influences as far as possible, and covered with the dust cover if it is not used for longer periods of time. Before covering the instrument, always check that the microscope has been switched off and the lamp housing has cooled down.

Placing objects against or covering ventilation slats can lead to a build-up of heat which will damage the instrument and, in extreme cases, cause a fire. Always keep the ventilation slats clear and make sure that no objects enter the instrument through the ventilation slats.

The instruments must be operated by trained personnel only who must be aware of the possible danger involved with microscopy and the relevant application. The Axiotech and Axiotech[vario] are precision instruments which can be impaired in their performance or damaged when handled improperly.

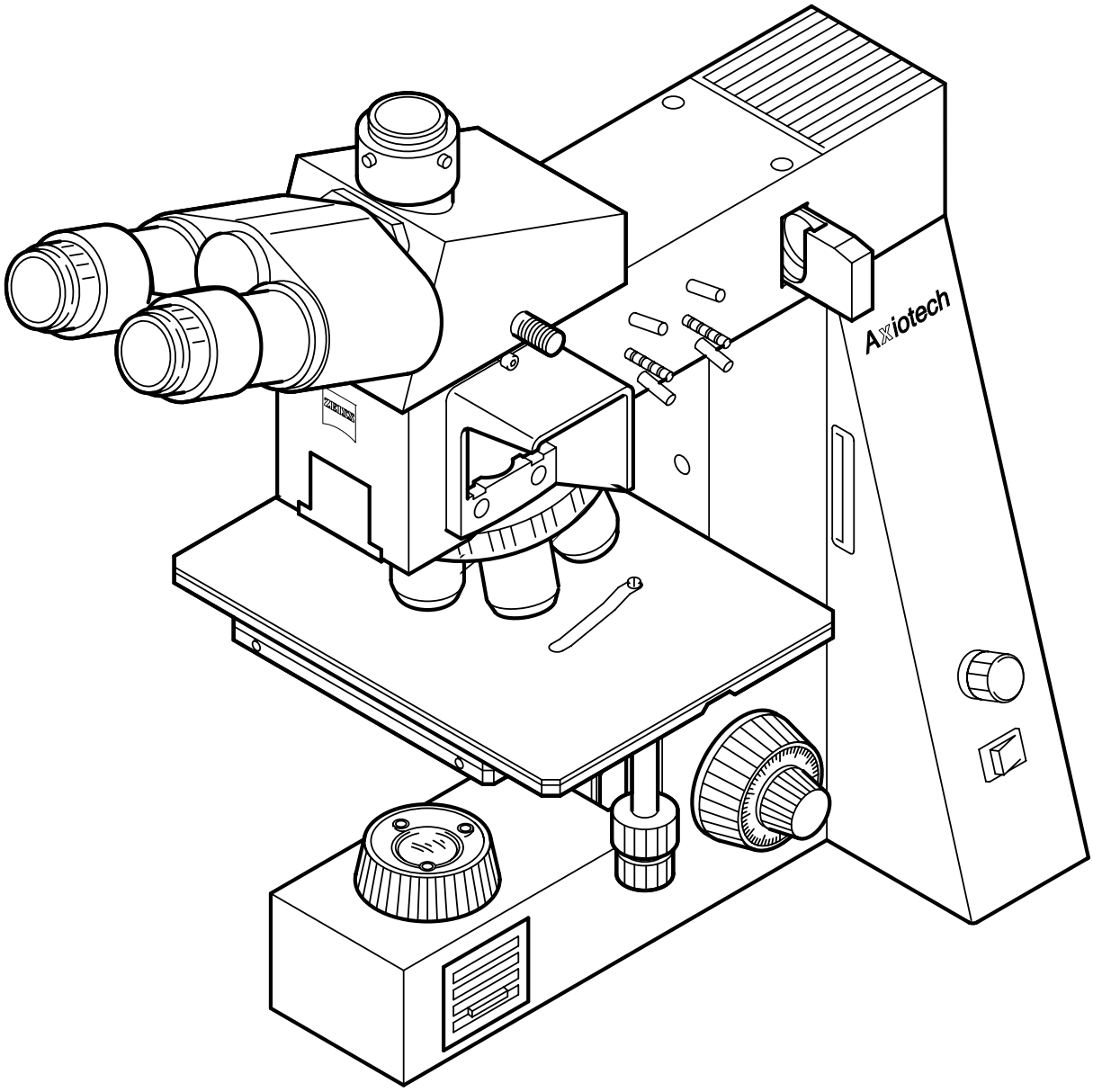
Notes on warranty

The manufacturer guarantees that the instrument has no material and production defects when delivered. You must inform us of any defects immediately and we must do everything to minimize the damage. If the manufacturer is informed of such a defect, he is obliged to remove it; it is his decision whether he does this by repairing the instrument or by delivering an instrument free of any defect. No guarantee is provided for defects caused by natural wear (wearing parts in particular) and improper use.

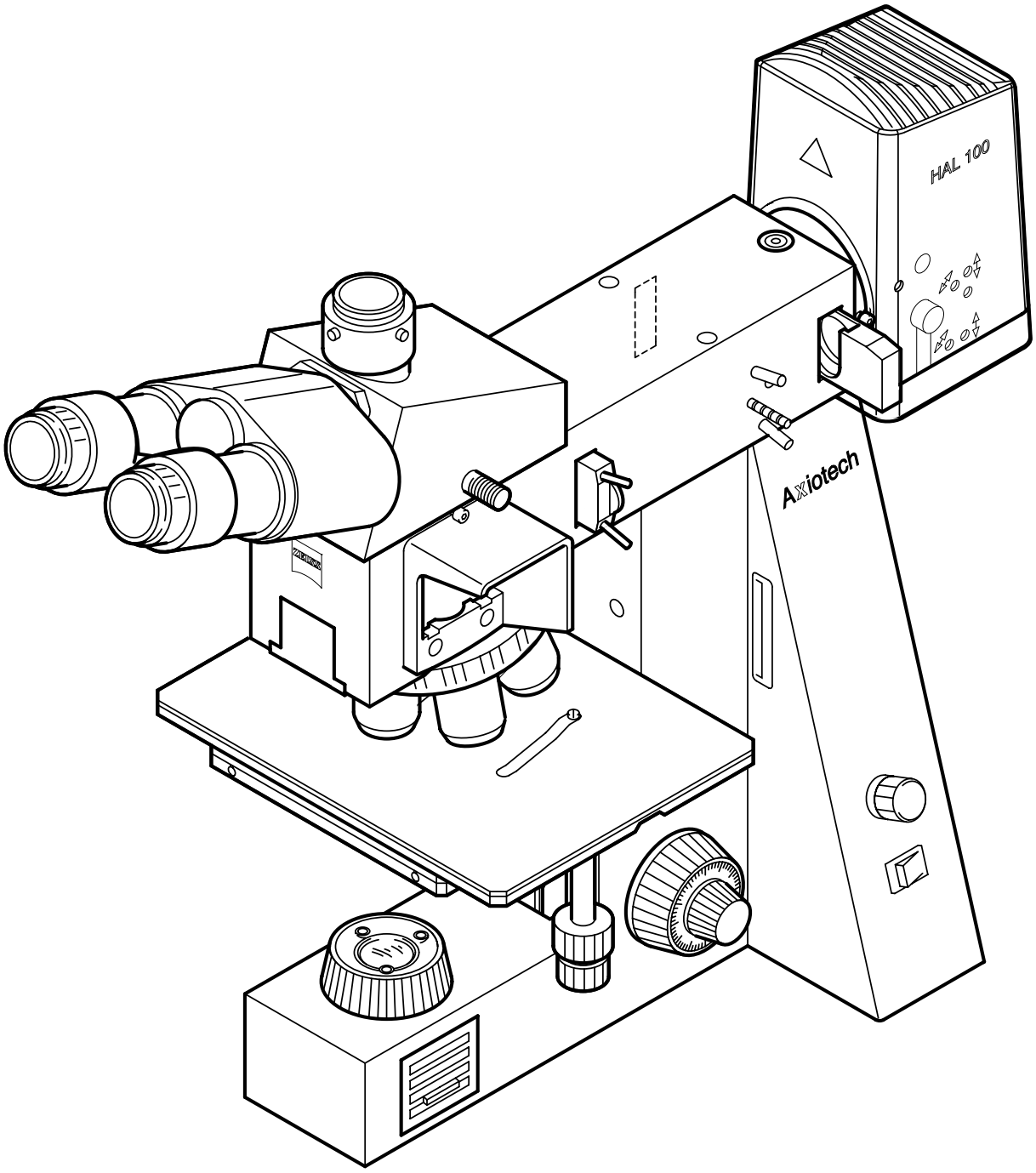
The instrument manufacturer is not liable for damage caused by faulty operation, negligence or any other meddling with the instrument, particularly the removal or replacement of instrument components, or the use of accessories from other manufacturers. This forfeits all the claims against warranty.

With the exception of the work specified in this manual, no maintenance or repair of the Axiotech or Axiotech[vario] may be performed. Repairs may only be performed by Carl Zeiss service staff or specially authorized personnel. Should any defect occur with the instrument, please get in touch with your local Carl Zeiss agency.

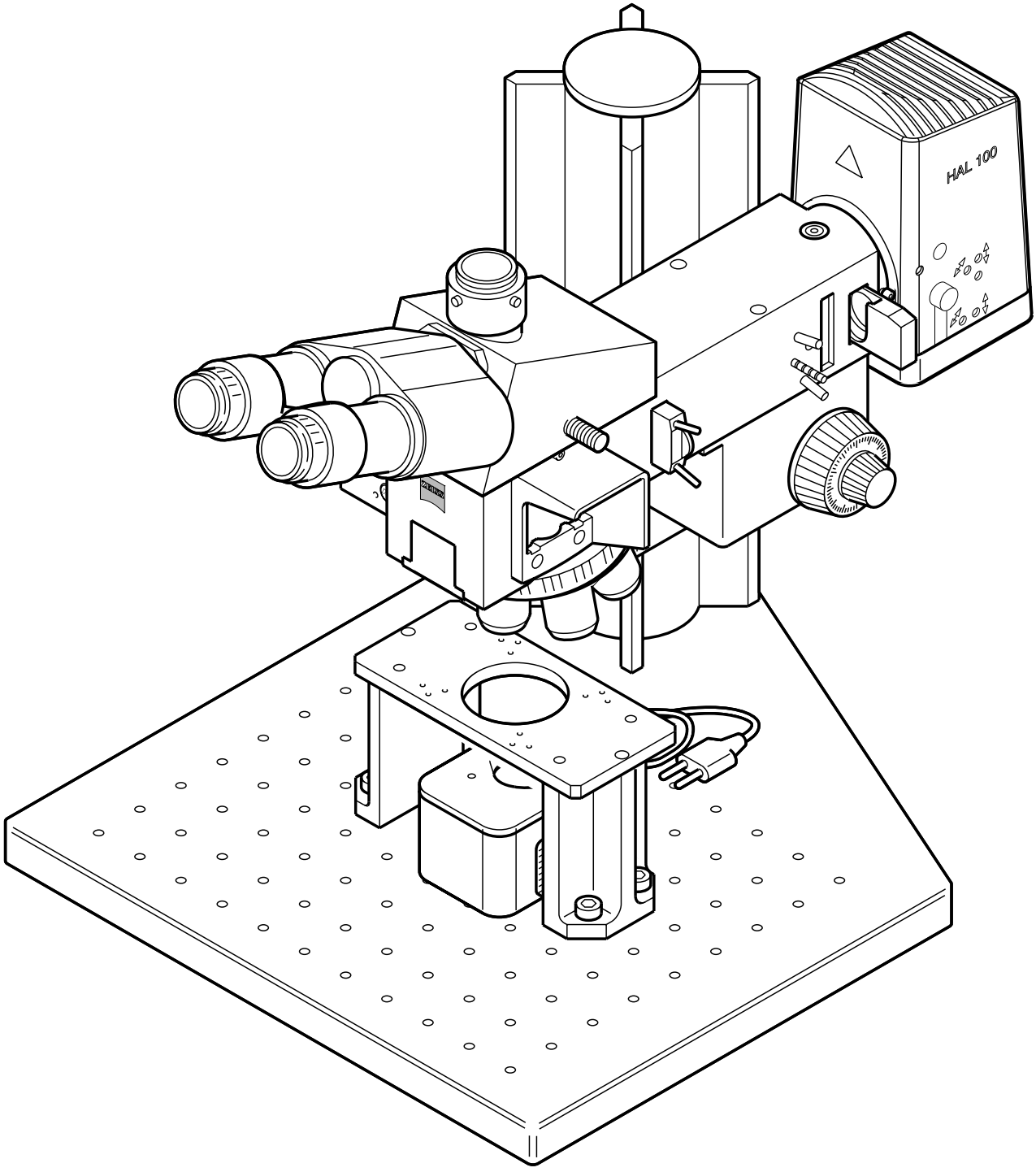
Overall view of the Axiotech 30 reflected-light microscope



Overall view of the Axiotech 100 reflected-light microscope



Overall view of the Axiotech[vario] 100 reflected-light microscope



INSTRUMENT DESCRIPTION

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1 INSTRUMENT DESCRIPTION

1.1 Name and intended application

Manufacturer's description: Upright reflected-light microscope for technical applications
Instrument name: Axiotech and Axiotech[vario]

The Axiotech and Axiotech[vario] instruments fit as follows into the line of upright microscopes from Carl Zeiss:

Axiolab A

Axiotech 30, Axiotech 100 and Axiotech[vario] 100

Axioplan 2

Axiophot 2

The Axiotech and Axiotech[vario] technical microscopes in a modular design feature a sturdy stand and a medium-size stand. The Axiotech and Axiotech[vario] microscopes permit applications in reflected and transmitted light. Simple operation and the flexible use of the various microscope components open up a wide range of applications in technical microscopy and in the OEM area. The following microscopy techniques can be performed:

	Reflected light	**Transmitted light**
Technique	brightfield darkfield polarization interference contrast fluorescence 3D microscopy	brightfield darkfield phase contrast polarization 3D microscopy

1.2 Instrument description and main features

Two models of the Axiotech microscopes are available: **Axiotech** and **Axiotech**^{vario}. Both are upright microscopes with a medium stand size. The Axiotech models are also equipped with transmitted-light illumination which is integrated in the stand. Furthermore, Axiotech microscopes feature the characteristic pyramid design, while the Axiotech^{vario} models are based on a column stand.

Standardized customer interfaces for the Axio line of objectives/eyepieces, illuminators and tubes, and interfaces on the camera/TV port, permit the use of a variety of additional components. The modular design and the user-friendly and clear arrangement of controls guarantee the fast adaptation of the instruments to the required application.

A new reflected-light optical system in the time-tried ICS line (Infinity Color-corrected System) guarantees a high optical performance for all techniques (field number 23, tube factor 1×).
The objectives in the Epiplan line are universal objectives. There are two different groups: "Epiplan" for brightfield and "Epiplan HD" for the additional use of reflected-light darkfield. Of course, all the other objectives in the ICS line can also be used.

Depending on the configuration, Axiotech microscopes are equipped with - or prepared for - a 30 W or 100 W halogen illuminator for reflected-light applications and with a 30 W halogen illuminator for transmitted-light applications. The lamp voltage is adjustable and can be read off a LED line on the Axiotech. The correct color temperature for color photography is reached automatically at the end stop.

The new 6V 30W wide-range power unit for line voltages between 100 and 240 V AC is integrated in the stand of the Axiotech 30 microscope. The Axiotech 100 stand contains the time-tried, stabilized 12 V 100 W power unit which operates in the two switchable line voltage ranges 100 .. 127 or 220 ... 240 V AC. For the Axiotech^{vario} 100, external power units are provided, depending on which illuminator is used. Before start-up, the user of these power units must ensure that the voltage of the power unit and the line voltage are identical.

The Axiotech and Axiotech^{vario} reflected-light microscopes are equipped with a camera port for photo/video documentation as a standard feature.

Photomicrography applications are possible with various adapters and 35 mm SLR (mirror reflex) cameras from various manufacturers, or the two microscope camera systems from Carl Zeiss, **MC 80 DX** and **MC 200 CHIP** (35 mm and large format).

Videomicroscopy and documentation can also be performed using commercially available video cameras..

1.3 Microscope components and modules

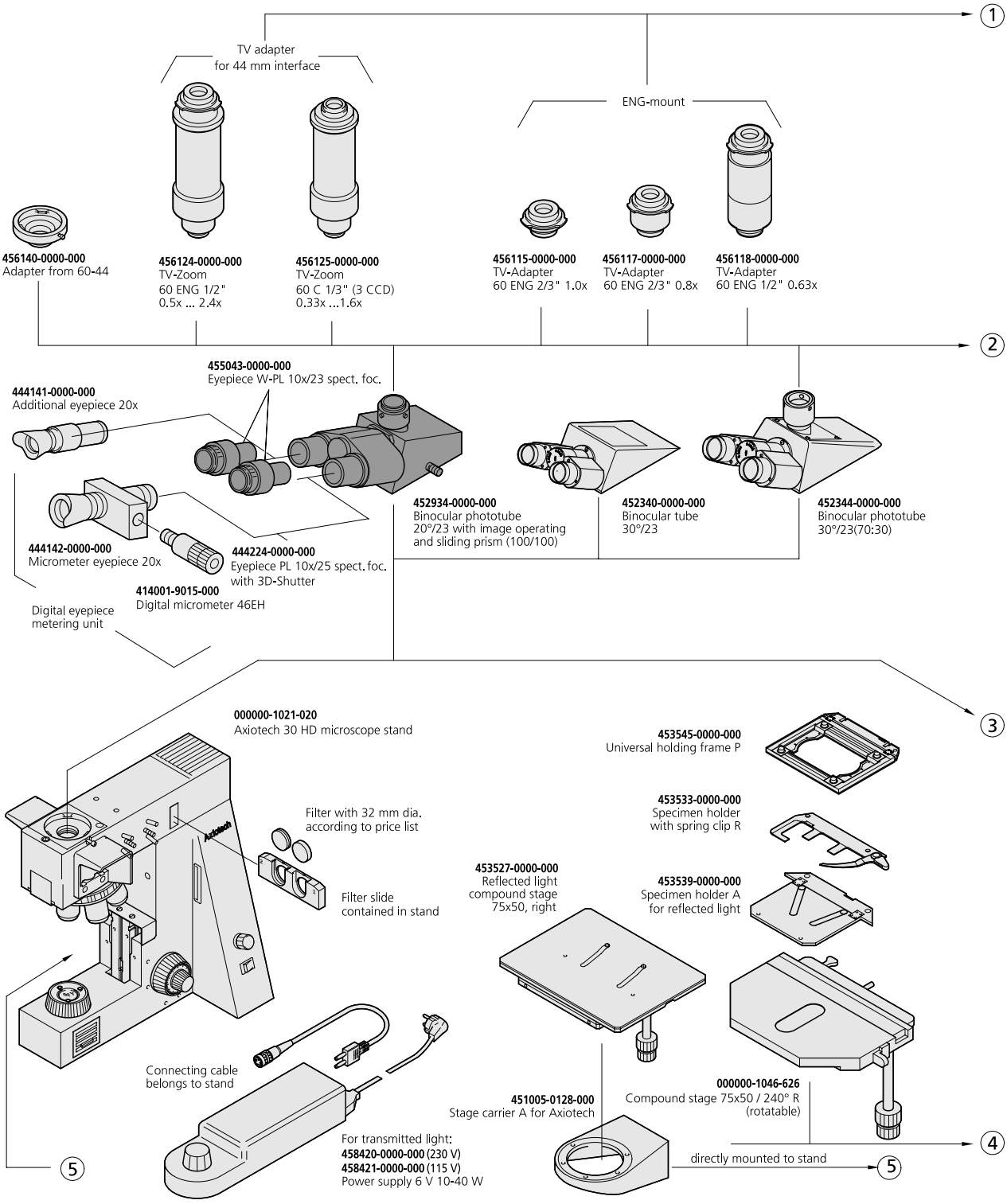


Fig. 1-1 Microscope components and modules (sheet 1)

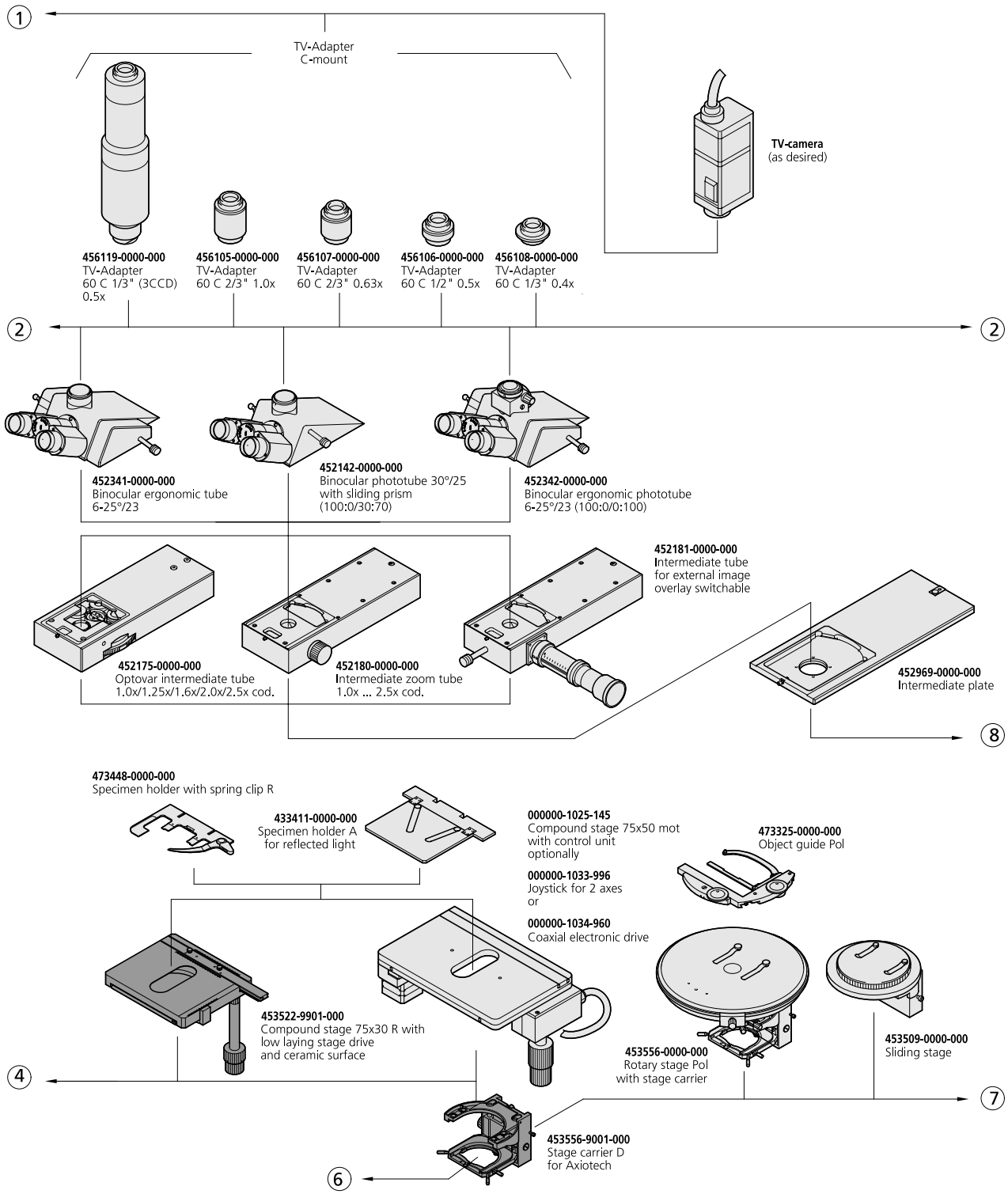


Fig. 1-2 Microscope components and modules (sheet 2)

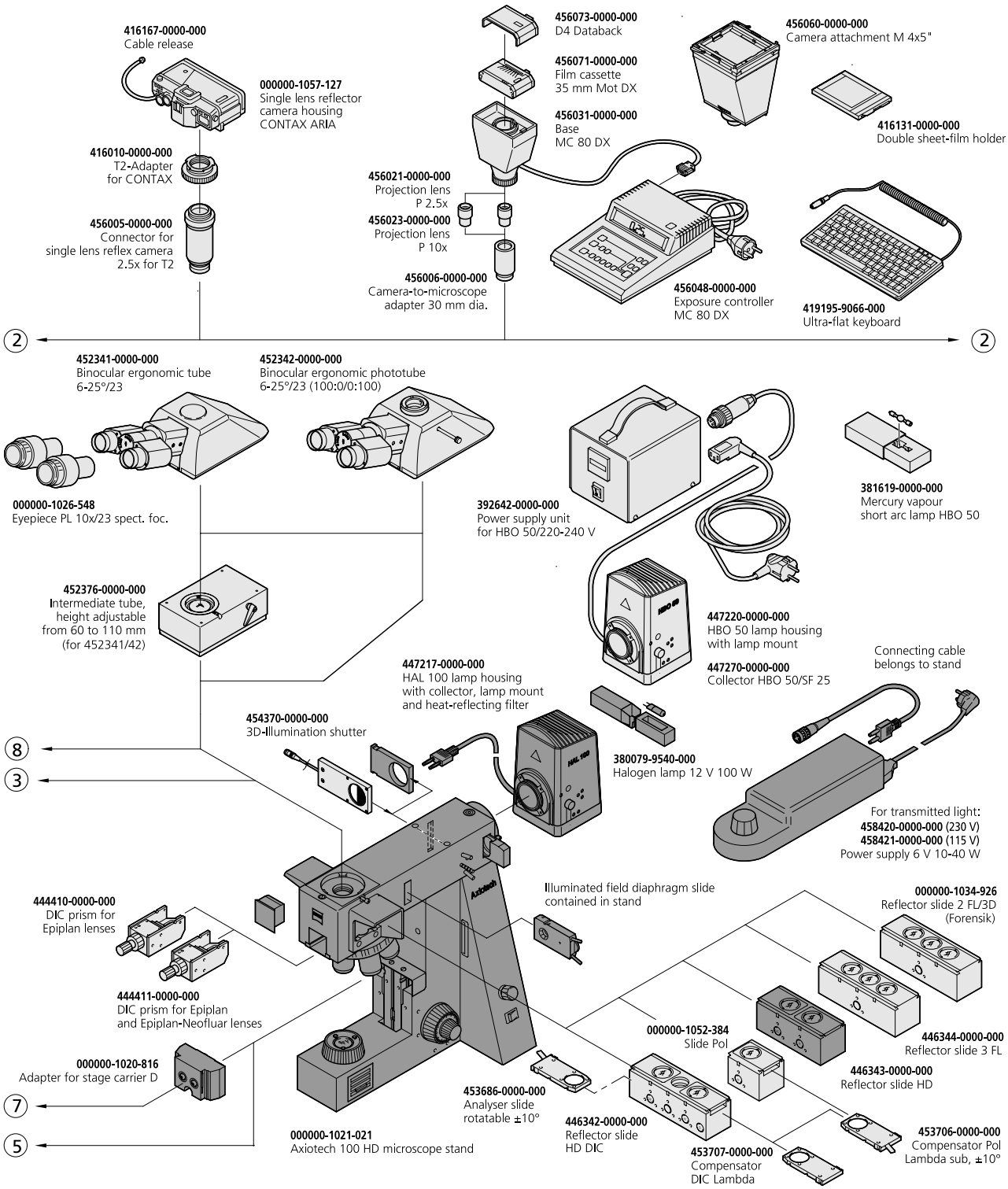


Fig. 1-3 Microscope components and modules (sheet 3)

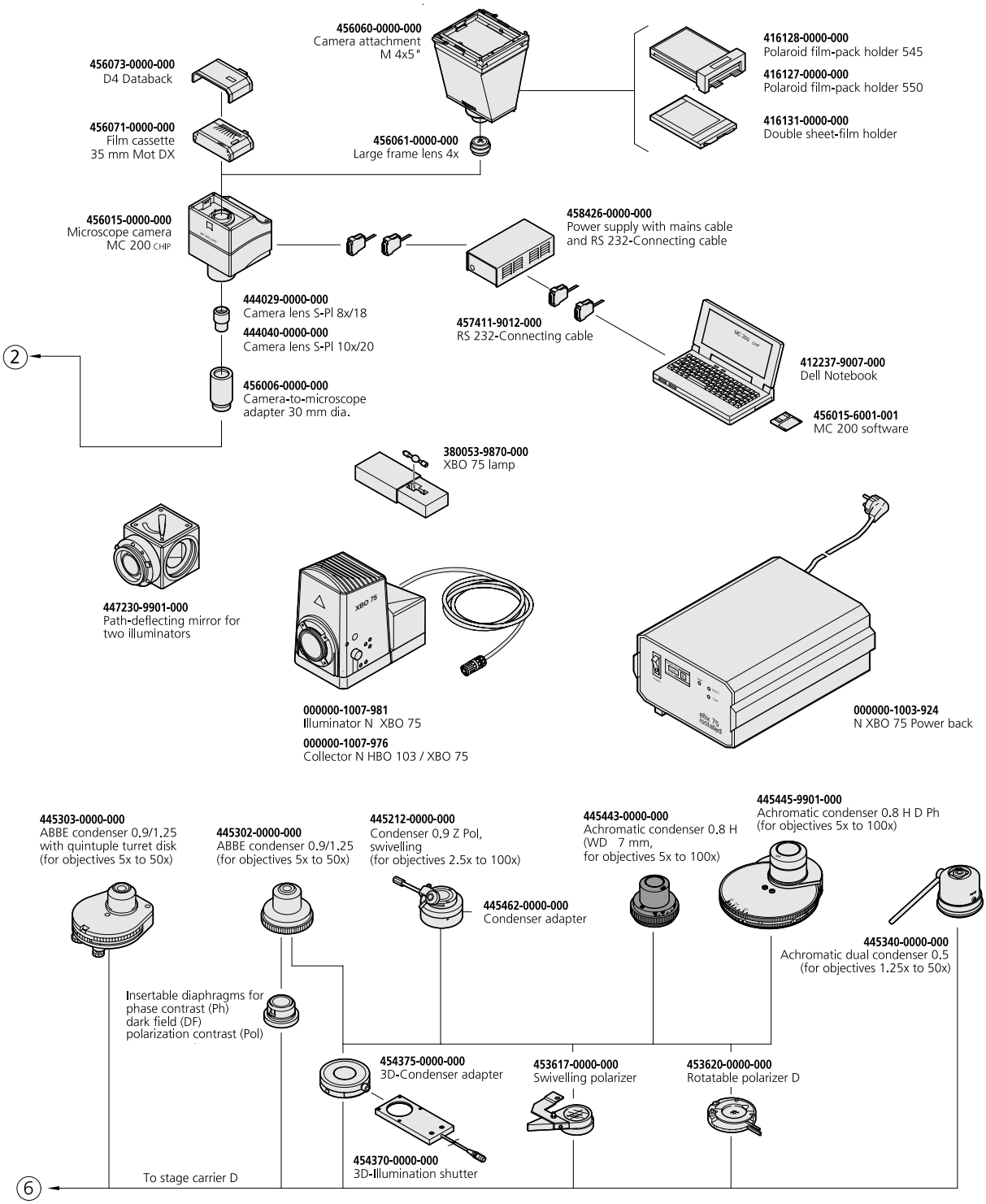


Fig. 1-4 Microscope components and modules (sheet 4)

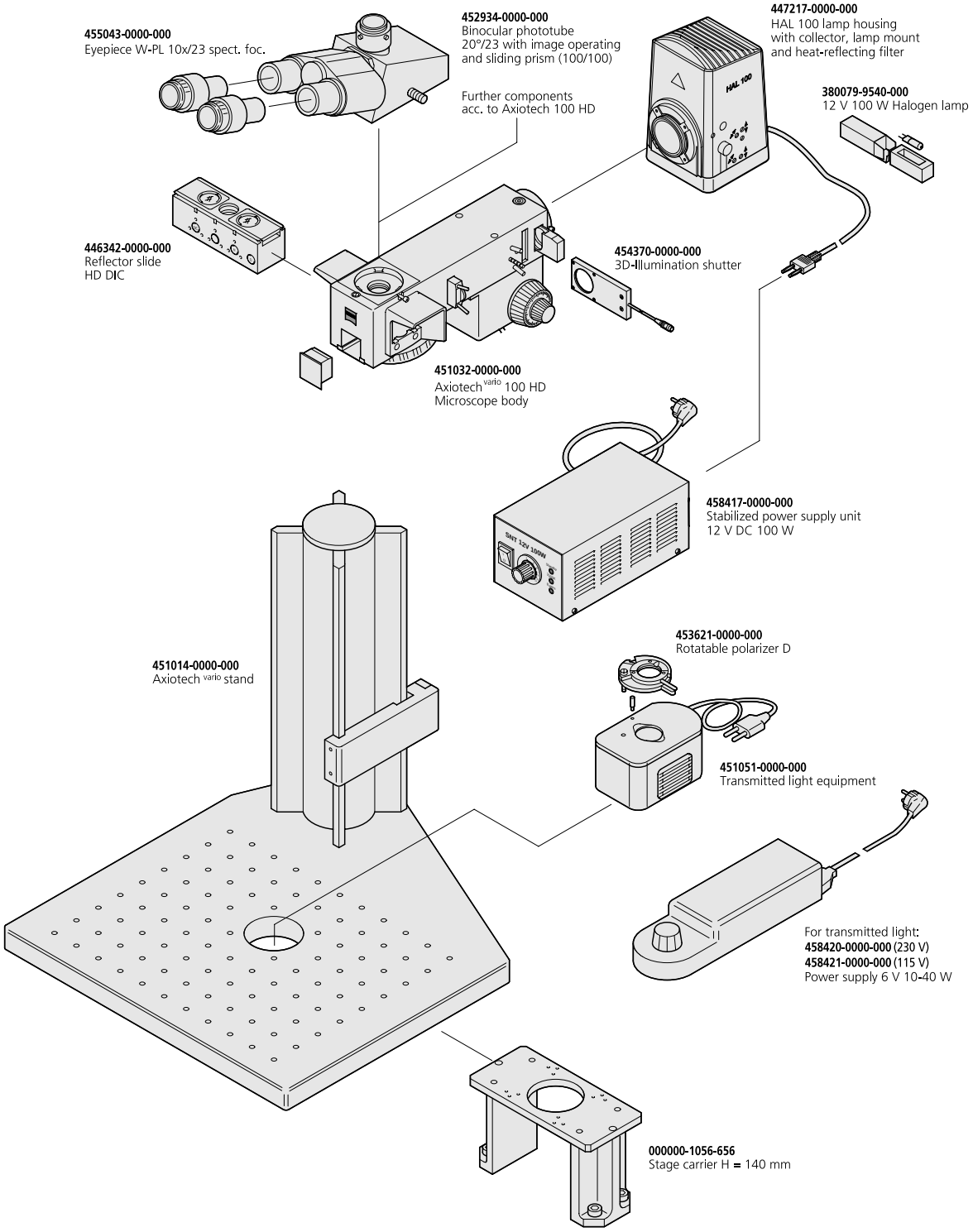


Fig. 1-5 Microscope components and modules (sheet 5)

	Axiotech and Axiotech^{vario} Microscope Configurations		Cat. No.
	Configurations		
1	Axiotech 30 microscope for brightfield and darkfield in reflected light		491003-9804-000
2	Axiotech 30 microscope for brightfield and darkfield in reflected light and brightfield in transmitted light		000000-1061-197
3	Axiotech 30 microscope for brightfield, darkfield and DIC in reflected light		491004-9804-000
4	Axiotech 100 microscope for brightfield and darkfield in reflected light		491005-9804-000
5	Axiotech 100 microscope for brightfield and darkfield in reflected light and brightfield in transmitted light		000000-1061-203
6	Axiotech 100 microscope for brightfield, darkfield and DIC in reflected light		491006-9804-000
7	Axiotech vario 100 microscope for brightfield, darkfield and DIC in reflected light		491009-9804-000
	Configurations 1 to 7 are selected microscope configurations which can be amended individually as required by the customers (also see system overview in section 1.3).		
	Selected modules and components for configuration 1 (example)		
	Axiotech 30 microscope stand with 5-position nosepiece HD M 27, reflected-light equipment 30 with integrated illuminator and 6 V 30 W power supply, stabilized, 100 ... 240 V AC, 50 ... 60 Hz, 80 VA, prepared for transmitted light with integrated 6V 30 W halogen illuminator		000000-1021-020
	Binocular phototube 20°/23 with image erection, sliding prism (100:0/0:100)		452934-0000-000
	Reflected-light mechanical stage 75 × 50, right, with low-mounted stage drive		453527-0000-000
	Stage carrier A for Axiotech		451005-0128-000
	Reflector slider HD		446343-0000-000
	Neutral-density filter 0.06; d = 32 × 2		467848-0000-000
	Neutral-density filter 0.25; d = 32		467849-0000-000
	Conversion filter 3200 ... 5500 K, d = 32 × 2		467847-0000-000
	Dust cover K		459310-0000-000
	Halogen lamp 6 V 30 W	2×	000000-0402-943
	Optical system		
	Epiplan objective 5×/0.13 HD		442924-0000-000
	Epiplan objective 10×/0.20 HD		442934-0000-000
	Epiplan objective 20×/0.40 HD		442944-0000-000
	Epiplan objective 50×/0.70 HD		442954-0000-000
	W-PL eyepiece 10×/23 Br. foc.	2×	455043-0000-000
	Eyecup	2×	444801-0000-000
	On request		
	Epiplan objective 100×/0.75 HD (a = 0.95 mm)		442984-0000-000

1.4 Objectives

The objectives are the optical centerpiece of the microscope. The following is an example of how objectives can be labeled:

Epiplan 10×/0.20 HD ∞/-

where

10× is the objective magnification, with a defined color ring on the objective being allocated to each magnification step (color coding system from Carl Zeiss)

0.20 is the numerical aperture

HD stands for reflected light, brightfield and darkfield objective

∞ means infinite tube length

- means that use without cover slip (D = 0 mm) or with cover slip thickness D = 0.17 mm is possible

or

0 means that use is only possible without cover slip (D = 0 mm)

0.17 means that only the cover slip thickness D = 0.17 mm is possible

and

Oil = oil immersion objective

Ph 2 = phase contrast objective with a green color ring and phase stop Ph 2

Color ring code for objective magnifications:

Color ring on the objective	black	brown	red	orange	yellow	green	light blue	dark blue	white
Magnification factor	1.25×	2.5×	4×; 5×	6.3×	10×	16×;20×;25×; 32×	40×; 50×	63×	100×; 150×

The objective magnification multiplied with the eyepiece magnification (usually 10×) results in the visual overall magnification; example: 10 × 10 = 100×.

The numerical aperture × 1000, e.g. 0.20 × 1000 = 200×, is the highest useful magnification, i.e. no further details are resolved above that limit.

In transmitted-light applications, the exact observance of the cover slip thickness of 0.17 mm is all the more necessary the higher the numerical aperture of the objective. Therefore, so-called "Korr" objectives can be set for different cover slip thicknesses via a correction ring. For this, a specimen area is searched, and the position of the correction ring where optimum focus and image contrast are obtained is determined (refocusing is always required).

Immersion objectives are always insensitive to differences in cover slip thickness.

When immersion objectives are used, the air between the cover slip and the objective is replaced with a liquid, which is immersion oil in most cases. The plastic oiler containing 20 ml of 581 N immersion oil is particularly suitable for this purpose.

The following objectives are available for Axiotech and Axiotech^{vario}:

Objective	Magnification/ Num. aperture	Cover slip thickness D in mm	Free working distance in mm	Contrasting technique	Cat. No.
Epiplan					
Epiplan	5×/0.13	-	19.8	HF, DIC	442920-0000-000
Epiplan	10×/0.20	-	18.4	HF, DIC	442930-0000-000
Epiplan	20×/0.40	0	3.2	HF, DIC	442340-0000-000
Epiplan	50×/0.70	0	0.95	HF, DIC	442950-0000-000
Epiplan	100×/0.75	0	0.95	HF, DIC	442980-0000-000
Epiplan	5×/0.13	-	17.1	HD, DIC	442924-0000-000
Epiplan	10×/0.20	-	17.1	HD, DIC	442934-0000-000
Epiplan	20×/0.40	0	2.8	HD, DIC	442944-0000-000
Epiplan	50×/0.70	0	0.9	HD, DIC	442954-0000-000
Epiplan	100×/0.75	0	0.95	HD, DIC	442984-0000-000
Epiplan-Neofluar					
Epiplan-Neofluar	1.25×/0.035	-	3.9	HF	442300-0000-000
Antiflex cap					444921-0000-000
Epiplan-Neofluar	2.5×/0.075	-	9.4	HF	442310-0000-000
Antiflex cap					444922-0000-000
Epiplan-Neofluar	2.5×/0.075	-	2.5	HD	442314-0000-000
Antiflex cap					444920-0000-000
Epiplan LD					
Epiplan LD	10×/0.25	-	12.6	HF, DIC	442832-0000-000
Epiplan LD	20×/0.40	0 and 1.5	9.8	HF	442840-0000-000
Epiplan LD	50×/0.50	0	6.9	HF	442850-0000-000
Epiplan LD	50×/0.60	0 and 1.5	3.5	HF	442851-0000-000
Epiplan LD	10×/0.25	-	12.5	HD, DIC	442835-0000-000
Epiplan LD	20×/0.40	0	8.0	HD, DIC	442845-0000-000
Epiplan LD	50×/0.50	0	6.5	HD, DIC	442855-0000-000
Objectives for phase contrast					
A-Plan	10×/0.25	-	4.4	HF, Ph 1	441031-0000-000
A-Plan	20×/0.45	0.17	0.53	HF, Ph 2	441041-0000-000
Achroplan	40×/0.65	0.17	0.59	HF, Ph 2	440051-0000-000
Achroplan	100×/1.25 Oil	0.17	0.19	HF, Ph 3	440081-0000-000
Intermediate ring H "0" M 27 / W 0.8					444910-0000-000

All brightfield objectives (HF) are equipped with the Whitworth thread W 0.8 × 1/36“, all brightfield and darkfield objectives (HD) with the metrical thread M 27 × 0.75. HF objectives can also be used in the HD nosepiece via an intermediate ring.

1.5 Eyepieces

The following eyepiece are available for Axiotech and Axiotech[vario]:

Eyepiece	Image angle	Cat. No.
Eyepiece PL 10×/23 Br. foc.	24.7°	000000-1026-548
Eyepiece W-PL 10×/23 Br. foc.	24.7°	455043-0000-000
Eyepiece W-PL 16×/16 Br. foc.	27.1°	455048-0000-000
Eyepiece PL 10×/25 Br. foc. with 3D shutter	26.5°	444224-0000-000
Special eyepiece 20×		444141-0000-000
Micrometer eyepiece 20×		444142-0000-000

If required, eyecups for the eyepieces can be ordered under Cat. No. 444801-0000-000.

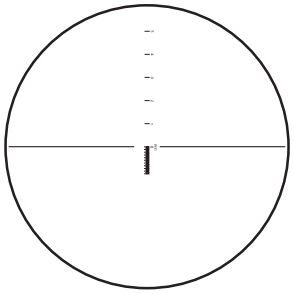
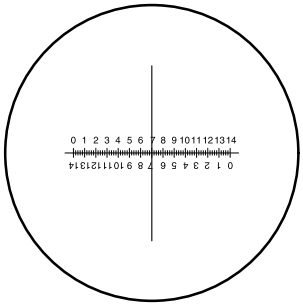
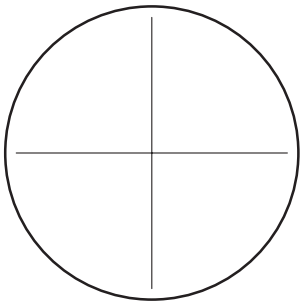
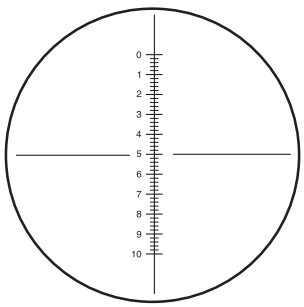
1.6 Condensers

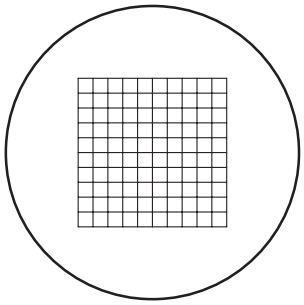
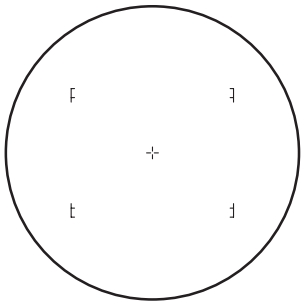
The following condensers are available for Axiotech for combination with stage carrier D and the transmitted-light equipment:

Condenser	Cat. No.	Application range	Notes
ABBE condenser 0.9/1.25 with 5x turret disk	445303-0000-000	for objectives 5×...50×	
ABBE condenser 0.9/1.25	445302-0000-000	for objectives 5×...50×	
Swing-in condenser 0.9 Z Pol	445212-0000-000	for objectives 2.5×...100×	
Achr. condenser 0.8 H	445443-0000-000	for objectives 5×...100×	working distance 7 mm
Achr. condenser 0.8 H D Ph	445445-9901-000	for objectives 5×...100×	
Achr. switching condenser 0.5	445340-9901-000	for objectives 1.25×...50×	

1.7 Stage micrometers and eyepiece reticles

Measuring and counting using the microscope requires stage micrometers and eyepiece reticles, a small selection of which is listed below:

Illustration	Description, Technical Data	Cat. No.
	**Stage micrometer for reflected light, 5 + 100 / 100 y, D = 0 mm** (without cover slip) in case gradation on the +y-axis: 5 mm in 5 intervals gradation on the -y-axis: 1 mm in 100/ 100mm = 10 µm, accuracy ±1 µm	474027-0000-000
	**Crossline micrometer 14 : 140 / d = 26 mm** gradation length = 14 mm increments = 0.1 mm gradation tolerance ≤ 0.001 mm	454060-0000-000
	**Eyepiece reticle / d = 26 mm**	474064-0000-000
	**Crossline micrometer 10 : 100 / d = 26 mm** gradation length = 10 mm increments = 0.1 mm gradation tolerance ≤ 0.001 mm	474066 9901-000

	**Net micrometer 12.5 × 12. 5 / 5; 10 / d = 26 mm** area 12.5 × 12,5 mm, divided in fields of 5 × 5 or 10 × 10	474068-0000-000
	**Photo reticle MC 2.5× / d = 26 mm** for 35 mm photography with an additional magnification of 2.5× or for large-format photography with a 10× additional magnification	454075-0000-000

☞ If an eyepiece reticle is used, the binocular tube or the phototube must be equipped with two foc. eyepieces containing an adjustable eyelens, into one of which the eyepiece reticle is mounted.

1.8 Microscope stages and specimen holders

The microscopes in the Axiotech line can be equipped with the following microscope stages and specimen holders:

Description	Cat. No.	Notes
Reflected-light mechanical stage 75 × 50 R	453527-0000-000	contained in the delivery package of the Axiotech 30 and Axiotech 100 microscopes, stage carrier A also required for Axiotech
Mechanical stage 75 × 50/240° R	000000-1046-626	optional: – specimen holder A for reflected light – specimen holder with spring clip R, – Universal mounting frame P
Mechanical stage 75 × 50 R with low-mounted stage drive and ceramic surface	453522-9901-000	optional: – specimen holder A for reflected light – specimen holder with spring clip R
Mechanical stage 75 × 50 mot with control unit	000000-1025-145	optional with joystick for 2 axes or coaxial electronic drive
Rotary stage Pol with stage carrier	453556-0000-000	optional: Pol specimen holder
Gliding stage	453509-0000-000	only for reflected light
Stage carrier H = 140 mm	000000-1056-656	only for Axiotech[vario]
Universal mounting frame P	453545-0000-000	optional for mechanical stage 75 × 50/240° R
Specimen holder with spring clip R	453533-0000-000	optional for mechanical stage 75 × 50/240° R
Specimen holder A for reflected light	453539-0000-000	optional for mechanical stage 75 × 50/240° R
Specimen holder with spring clip R	473448-0000-000	optional for mechanical stage 75 × 30 R
Specimen holder A for reflected light	433411-0000-000	optional for mechanical stage 75 × 30 R
Specimen holder Pol	473325-0000-000	can be attached to Pol rotary stage

☞ The rotary stage Pol and the gliding stage are both supplied with a factory-attached stage carrier. If these microscope stages are used with the Axiotech[vario] 100, the stage carrier must be removed and the stage screwed onto the stage carrier H = 140 mm. This, however, results in the loss of the factory-set centering of the Pol rotary stage, i.e. the subsequent centering of the microscope stage might be necessary (also see section 2.8.4).

1.9 Binocular tubes

The binocular phototube 20°/23 with image erection and sliding prism is a standard feature of the microscopes in the Axiotech line. The following binocular tubes and intermediate tubes can also be used with the Axiotech and Axiotech[vario]:

Description	**Cat. No.**	**Viewing angle / field number**	**Light splitting vis:doc in %**
Binocular phototube with image erection and sliding prism	452934-0000-000	20°/23	100:0/0:100
Binocular tube	452340-0000-000	30°/23	
Binocular phototube	452344-0000-000	30°/23	70:30
Binocular ergonomic tube	452341-0000-000	6...25°/23	
Binocular ergonomic phototube	452342-0000-000	6...25°/23	100:0/0:100
Binocular phototube with sliding prism	452142-0000-000	30°/25	100:0/30:70
Binocular phototube with sliding prism	452143-0000-000	30°/25	100:0/50:50/0:100
Binocular phototube with 2 ports	452145-0000-000	30°/25	100:0/50:50/0:100
			Notes
Intermediate tube with height adjustment from 60 to 110mm	452376-0000-000		only for tubes 452341/42
Optovar intermediate tube 1.×/1.25×/1.6×/2.0×/2.5×, coded	452175-0000-000		only with adapter 452969 and tubes 452142/43/45
Zoom intermediate tube 1.0× ... 2.5×, coded	452180-0000-000		only with adapter 452969 and tubes 452142/43/45
Intermediate tube for image projection, switchable	452181-0000-000		only with adapter 452969 and tubes 452142/43/45
Adapter	452969-0000-000		

☞ The above binocular phototubes permit photomicrography and videotechnology equipment or adapters with interface 60 mm to be connected to the camera port.

The *italicized* intermediate tubes from the Axioplan 2 line can be screwed onto the Axiotech 100 and Axiotech[vario] 100 stands only via adapter 452969.

1.10 Reflector sliders and microscopy techniques

Description	Cat. No.	Major microscopy techniques
Reflector slider HD	446343-0000-000	reflected-light brightfield, reflected-light darkfield, transmitted-light brightfield, transmitted-light darkfield, transmitted-light phase contrast
Reflector slider HD DIC	446342-0000-000	reflected-light brightfield, reflected-light darkfield, reflected-light polarization, reflected-light differential interference contrast, transmitted-light brightfield, transmitted-light darkfield, transmitted-light phase contrast
Reflector slider Pol	000000-1052-384	transmitted-light polarization
Reflector slider 3 FL	446344-0000-000	reflected-light fluorescence
Reflector slider 2 FL/3D	000000-0134-926	reflected-light fluorescence, 3D technique (forensic)

A detailed description of the reflector positions and the relevant microscopy technique is provided in section 3.4 under the relevant applications.

1.11 Technical Data

Dimensions (width × depth × height)

Axiotech stand ..... approx. 210 × 315 × 435 mm
Axiotech^{vario} stand ..... approx. 412 × 452 × 375 mm
Axiotech footprint ..... approx. 250 × 350 mm
Axiotech^{vario} footprint ..... approx. 420 × 460 mm

Weight

Axiotech ..... approx. 12 kg
Axiotech^{vario} ..... approx. 22 kg

Ambient conditions

Storage and transport (in packaging):

Permissible ambient temperature ..... -40 to +50 °C
Permissible relative humidity (without condensation) ..... max. 80 %
Atmospheric pressure ..... 800 hPa to 1060 hPa

Operation:

Permissible ambient temperature ..... +5 to +35 °C
Permissible relative humidity (without condensation) ..... max. 80 %
Altitude for application ..... max. 2000 m
Atmospheric pressure ..... 800 hPa to 1060 hPa
Pollution degree 2

Operating data

Areas of use ..... closed rooms
Protection class I
Protection type ..... IP 20
Electrical safety ..... according to IEC 1010-1 (DIN EN 61010-1)
taking CSA and UL specifications into account
Excess voltage category II
Radio interference suppression ..... according to EN 55011 Class B
Line voltage ranges:

- wide-range power unit 6 V 30 W, stabilized ..... 100 to 240 V AC ±10 %
- integrated power unit 12 V 100 W, stabilized ..... 100 to 127 V AC or 220 to 240 V AC ±10 %
- external power supply 6 V 10 ... 40 W, 2 ports, switchable ..... 120 V AC ±10 %
  ..... 230 V AC + 6 / - 10 %
- Power unit for HBO 50 ..... 220 to 240 V AC ±10 %
- Transformer N XBO 75 ..... 100 to 240 V AC ±10 %
- Separate transformer SNT 12 V DC 100 W ..... 100 to 127 V AC or 220 to 240 V AC ±10 %

Line frequency ..... 50 to 60 Hz
Power consumption using internal power supplies:
- Axiotech 30 (6 V 30 W) ..... 80 VA
- Axiotech 100 (12 V 100 W) ..... 225 VA

and external power supplies:
- power supply 6 V 10...40 W, 2 ports, switchable ..... 50 VA
- power unit for HBO 50, 220...240 V ..... 350 VA
- transformer N XBO 75, 100...240 V AC ..... 130 VA
- separate transformer SNT 12 V DC 100 W ..... 225 VA

Fuses according to IEC 127

Axiotech 30 stand
- 100...240 V AC ..... T 0.8 A; 250 V; 5 × 20 mm

Axiotech 100 stand
- 220...240 V AC ..... T 2.0 A/H; 250 V; 5 × 20 mm
- 100...127 V AC ..... T 4.0 A/H; 250 V; 5 × 20 mm

Power unit for HBO 50
- 220...240 V AC ..... T 1.6 A; 250 V; 5 × 20 mm

Transformer N XBO 75 ..... T 2 A; 250 V; 5 × 20 mm

Separate transformer SNT 12 V, 100 W
- 220...240 V AC ..... T 4 A; 250 V; 5 × 20 mm
- 100...127 V AC ..... T 4 A; 250 V; 5 × 20 mm

Light sources

Halogen lamp with square flat-core filament ..... HAL 6 V, 30 W
- continuously variable voltage ..... ≤ 1.5 to 6 V DC
- output ..... max. 30 W
- color temperature at 6 V ..... 3200 K
- light flux at 6 V ..... 510 lm
- average life at 4.8 V/6 V ..... 2000 h/100 h
- luminous area ..... 2.0 × 2.0 mm

Halogen lamp 12 V 100 W ..... HAL 12 V, 100 W
- continuously variable voltage ..... ≤ 2.8 to 12 V DC
- output ..... max. 100 W
- color temperature at 11.5 V ..... 3200 K
- light flux at 12 V ..... 3100 lm
- average life at 12 V ..... 50 h
- luminous area ..... 4.6 × 4.6 mm

HBO 50 mercury pressure short-arc lamp
- lamp voltage for lamp types L1 and L2 ..... L1: 39...45 V/L2: 34...39 V
- lamp current for lamp types L1 and L2 ..... L1: 1.30 A/L2: 1.45 A
- output ..... 50 W
- average light current ..... 2000 lm
- average life ..... 100 h
- luminous area ..... 0.3 × 1.0 mm

N XBO 75 Xenon short-arc lamp
- average life of OSRAM XBO 75 W/2 lamp ..... 400 h
- average life of HAMAMATSU Xenon lamp ..... 2000 h

Optical/mechanical data

Stand with stage focusing ..... with coarse drive (2 mm/rot)
..... and fine drive (0.2 mm/rot)
..... fine scaling 2 µm/increment
..... overall lifting range: 25 mm
Objective change ..... manually via 5x HD nosepiece
Objectives ..... ICS-HD objective line with M 27 × 0.75 thread
..... ICS-H objective line with W 0.8″ × 1/36″thread
..... and adapter H "0" M 27 for W 0.8″
Eyepieces with plug-in diameter ..... 30 mm
and field number 23 ..... W-PL 10×/23 Br. foc.
Object stages (selection);
- reflected-light mechanical stage 75 × 50 R;
  - dimensions (width × depth) ..... 160 × 140 mm
  - travel range ..... 75 × 50 mm
- reflected-light mechanical stage 75 × 50/240°R;
  - dimensions (width × depth) ..... 160 × 140 mm
  - travel range ..... 75 × 50 mm

Condensers:
- ABBE condenser 0.9/1.25 with 5-position disk turret ..... for objectives 5...50 ×
- ABBE condenser 0.9/1.25 ..... for objectives 5...50 ×
- swing-in condenser 0.9 Z Pol ..... for objectives 2.5...100 ×
- achr. condenser 0.8 H ..... for objectives 5...100 ×
- achr. condenser 0.8 H D Ph ..... for objectives 5...100 ×
- achr. switching condenser 0.5 ..... for objectives 1.25...50 ×

Binocular tubes (selection):

Binocular tube 30°/23;

maximum field number 23
interpupillary distance..... can be set between 55 and 75 mm
Viewing angle ..... 30°
Viewing port ..... tube factor 1×

Binocular phototube 20°/23 with image erection and sliding prism (100:0/0:100);

maximum field number 23
interpupillary distance..... can be set between 55 and 75 mm
viewing angle..... 20°
viewing height ..... approx. 440 mm
viewing port..... tube factor 1×
camera / video port ..... tube factor 1×
camera / video port ..... interface 60 mm
change via sliding prism..... 100% vis / 100% doc

Binocular phototube 30°/23 (70 : 30);

maximum field number 23
interpupillary distance..... can be set between 55 and 75 mm
viewing angle..... 30°
viewing port..... tube factor 1×
camera / video port ..... tube factor 1×
camera / video port ..... interface 60 mm

START-UP

Contents

List of illustrations

2 START-UP

The Axiotech and Axiotech[vario] reflected-light microscopes including accessories are deliverd in standard packaging. We would recommend you to keep the packaging material so that the instrument can be stored for a longer period of time or returned to the manufacturer.

2.1 Unpacking the microscope

2.1.1 Axiotech 30 and Axiotech 100

- Open the transport case (2-1/**1**) and take out the accessories lying on top.
- Take out the cardboard inserts (2-1/**3**).
- Pull out objective packaging (2-1/**2**), open it over a firm support and take out the objectives.
- Take out the microscope (2-1/**4**) by holding it on the stand and not on the tube!
- Check the packing list for completeness.
- Store the packing material in the transport case or dispose of it as labeled.

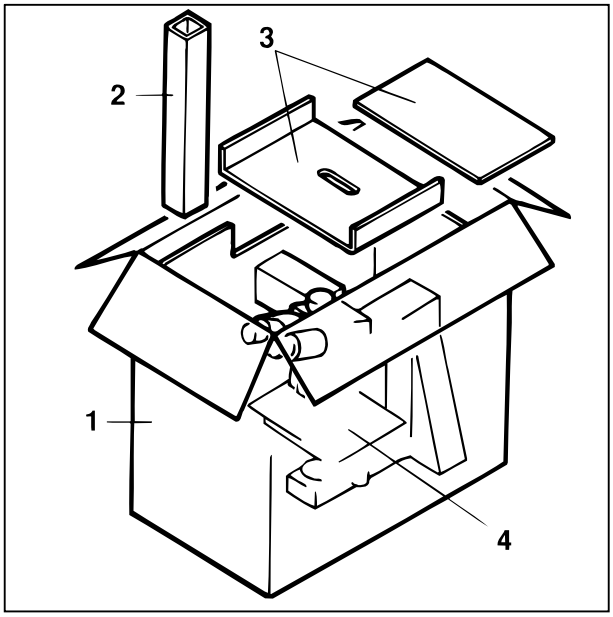


Fig. 2-1 Unpacking the Axiotech

2.1.2 Axiotech[vario] 100

- Open the transport case (2-2/**1**) and remove the top, padded part (2-2/**2**).
- Remove padding (2-2/**4**) from the X95 stand column.
- Remove cardboard wrapping (2-2/**3**) and take out the accessories.
- Take out the microscope (2-2/**5**) by holding it on the stand and not on the tube!
- Raise z-drive approx. 20 mm and remove wooden securing components (2-2/**6**).
- Unscrew stage carrier (2-2/**7**), turn it around and assemble it.
- Check packing list for completeness.
- Store packing material in the transport case or dispose of it as labeled.

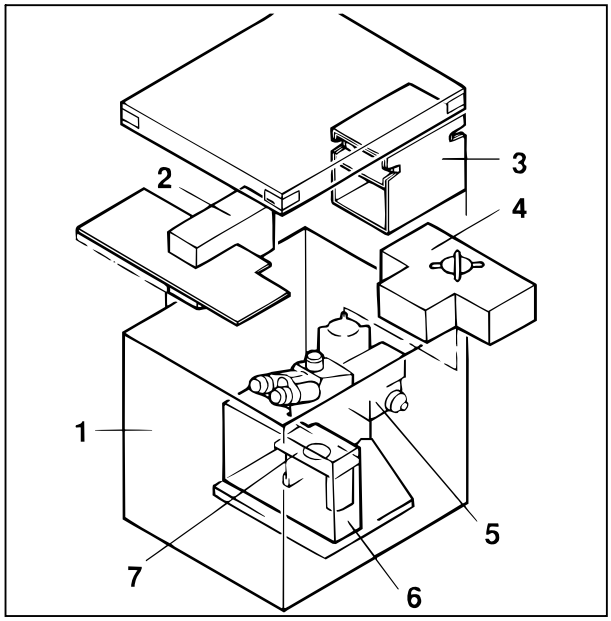


Fig. 2-2 Unpacking the Axiotech[vario]

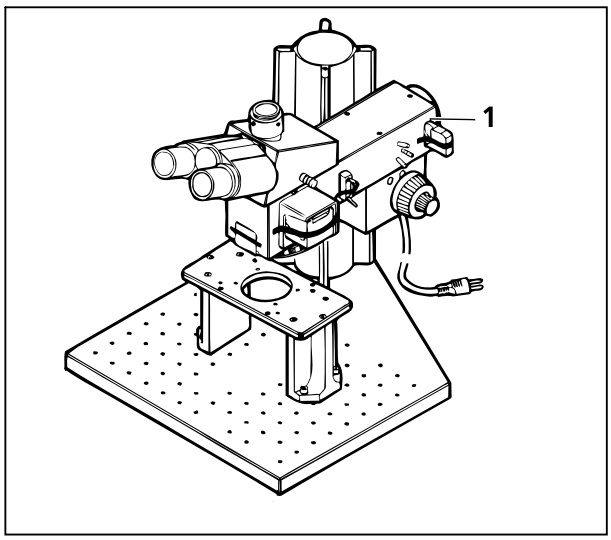


Fig. 2-3 Setting up the microscope

2.2 Setting up the microscope

- Place the microscope on a suitable worktable. This is the required footprint:
  - Axiotech: approx. 250 × 350 mm
  - Axiotech[vario]: approx. 420 × 460 mm.

☞ For the Axiotech[vario], sufficient space should be available for the separate power units.

- Remove the adhesive tapes which secure the various components during transport.
- The dust covers and sliders contained in the reflected-light equipment (2-3/**1**) remain in the instrument.
- Remove the rubber foam padding from below the stage of the Axiotech after moving the stage upwards.

2.2.1 Axiotech[vario] - Attaching the microscope body to column X95

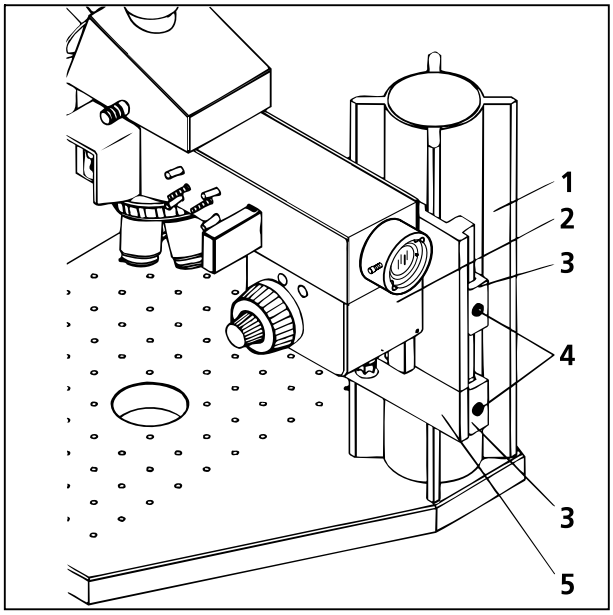


Fig. 2-4 Axiotech[vario] - Attaching the microscope body to column X95

- Depending on specimen and stage, attach and clamp the microscope body (2-4/**2**) to column X95 (2-4/**1**) in such a way that sufficient safety clearance is available between the object plane and the objective.
- Attach securing clamp (2-4/**5**) to column X95, push it against the microscope body from below and clamp it (clamping jaw (2-4/**3**) must point to the rear).
- To lower the microscope body, first move the securing clamp by the relevant distance and clamp it. Then lower the microscope body towards the securing clamp and clamp it in position.
- If the microscope body is moved upwards, the securing clamp must always be moved up with it. The clamping screws (2-4/**4**) are tightened or removed using the angled hexagon key included in the line of accessories.

2.3 Screw in objectives

- Remove dust covers (2-5/**4**) from the objectives inserted in the 5-position nosepiece.
- Screw HD objectives (2-5/**5**) with M 27 × 0.75 thread in the nosepiece (2-5/**3**) starting with the lowest magnification factor.
- Brightfield objectives (2-5/**1**) with W 0.8 × 1/36" thread can only be inserted into the HD nosepiece (2-5/**3**) by using the adapter ring H "0" M 27 × 0.75 on W 0.8 × 1/36" (2-5/**2**).

☞ The dust caps should remain on those nosepiece eyes which are not required. Section 1.4 contains an overview of usable objectives.

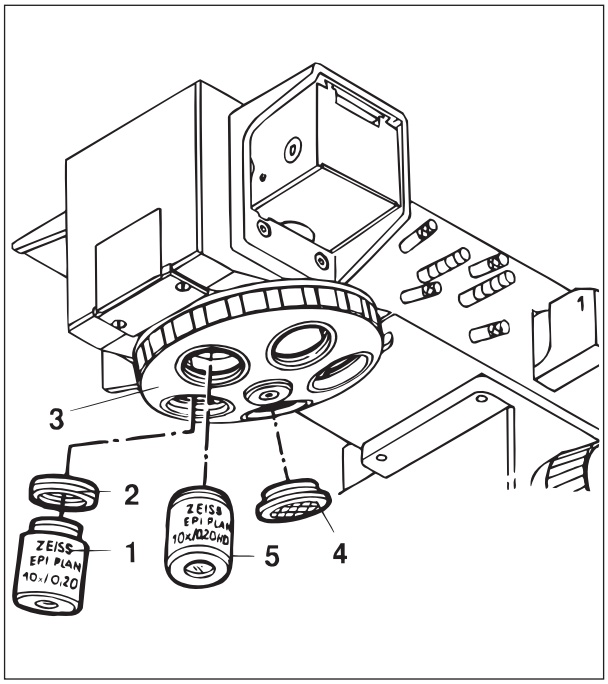


Fig. 2-5 Screw in objectives

2.4 Attachment or change of binocular tubes and intermediate tubes

2.4.1 Attachment of binocular tube

- Use SW 3 ball-headed screwdriver (2-6/**4**) to loosen hexagonal screw (2-6/**3**) and remove binocular tube (2-6/**1**) in upward direction.
- Place dust cap on the dovetail of the binocular tube to protect the tube lens.
- Remove dust cover from the required binocular tube.
- Insert dovetail of binocular tube in the port on the stand (2-6/**2**), align the tube with the reflected-light illuminator and tighten hexagonal screw (2-6/**3**).

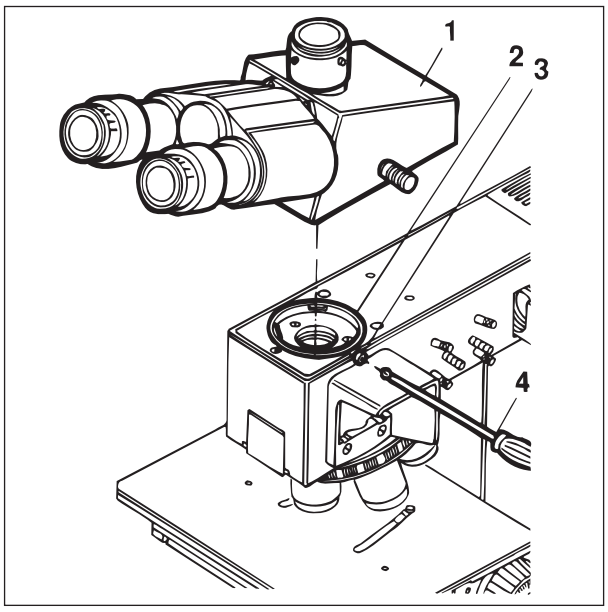


Fig. 2-6 Attachment of binocular tube

☞ An adapter plate is required to attach intermediate tubes and/or binocular phototubes of the Axioplan 2 line (see section 1.9).
An overview of attachable intermediate tubes and binocular tubes is given in section 1.9.

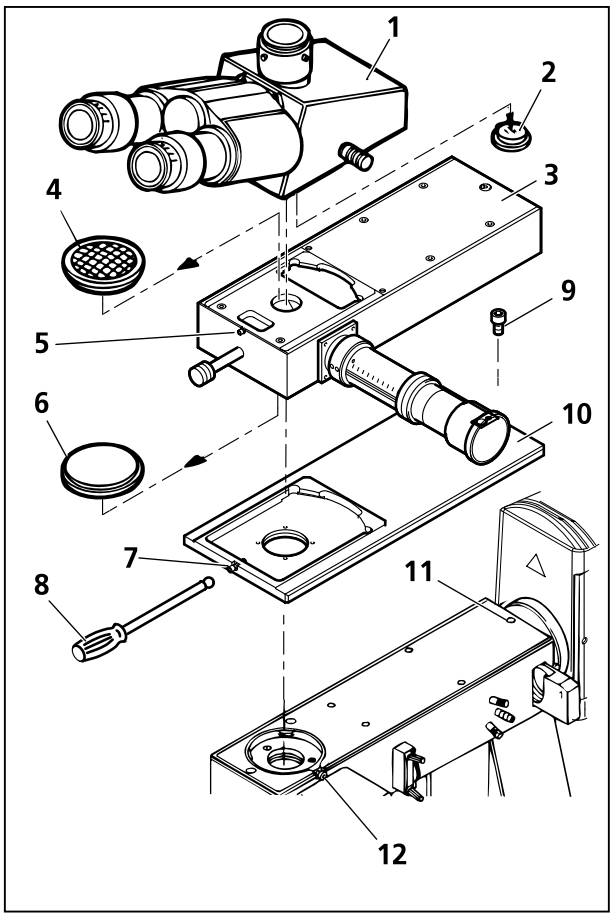


Fig. 2-7 **Attachment of intermediate tube for image projection**

2.4.2 Attachment of intermediate tube for image projection

The intermediate tube for image projection permits the projection of transparencies, crossline micrometers and grain size image series into the microscope image.

- Loosen hexagonal screw (2-7/**12**) using SW 3 ball-headed screwdriver (2-7/**8**) and remove the binocular phototube (2-7/**1**).
- Use the lid of the tube lens case (459511-0000-000) to remove the tube lens (2-7/**2**) from the binocular tube and store the tube lens in the case.
- Insert dovetail (underside) of the adapter plate (2-7/**10**) into the stand port of the Axiotech and slightly tighten clamping screw (2-7/**12**).
- Insert fixation screw (2-7/**9**) into the countersunk hole of the adapter plate and screw it into the drilled hole (2-7/**11**) on the stand.
- Tighten clamping screw (2-7/**12**) and fixation screw (2-7/**9**) using SW 3 ball-headed screwdriver (2-7/**8**).
- Remove dust caps (2-7/**4** and **6**), attach intermediate tube for image projection (2-7/**3**), align it and screw it to the adapter plate with the hexagonal screw (2-7/**7**).
- Attach binocular phototube or other tubes to the intermediate tube and tighten hexagonal screw (2-7/**5**) using the SW 3 ball-headed screwdriver(2-7/**8**).

☞ For further information on the intermediate tube for image projection please see the relevant operating manual B 40-038 from Carl Zeiss.

2.4.3 Attachment of Optovar intermediate tube

The Optovar intermediate tube is used for the continuous additional magnification of the intermediary image by the factors 1×, 1.25×, 1.6×, 2× and 2.5×.

The Optovar intermediate tube can only be used with the Axiotech 100 or the Axiotech[vario] 100.

- Use the SW 3 ball-headed screwdriver (2-8/**6**) to loosen the clamping screw (2-8/**11**) and remove the binocular phototube (2-8/**1**).
- Use the lid of the tube lens case (459511) to remove the tube lens (2-8/**2**) from the binocular phototube (2-8/**1**) and store the tube lens in the case.
- Insert dovetail (underside) of the adapter plate (2-8/**9**) into the stand port of the Axiotech and slightly tighten clamping screw (2-8/**11**).
- Insert fixation screw (2-8/**8**) into the countersunk hole of the adapter plate (2-8/**9**) and screw it into the drilled hole (2-8/**10**) on the stand.
- Tighten clamping screw (2-8/**11**) and fixation screw (2-8/**8**) using SW 3 ball-headed screwdriver (2-8/**6**).
- Remove dust cap (2-8/**4**), attach the Optovar intermediate tube (2-8/**3**), align it parallel to the stand and use SW 3 ball-headed screwdriver (2-8/**6**) to tighten the clamping screw (2-8/**7**) on the adapter plate.
- Attach binocular phototube or other tubes to the Optovar intermediate tube and tighten hexagonal screw (2-8/**5**) using SW 3 ball-headed screwdriver (2-8/**6**).

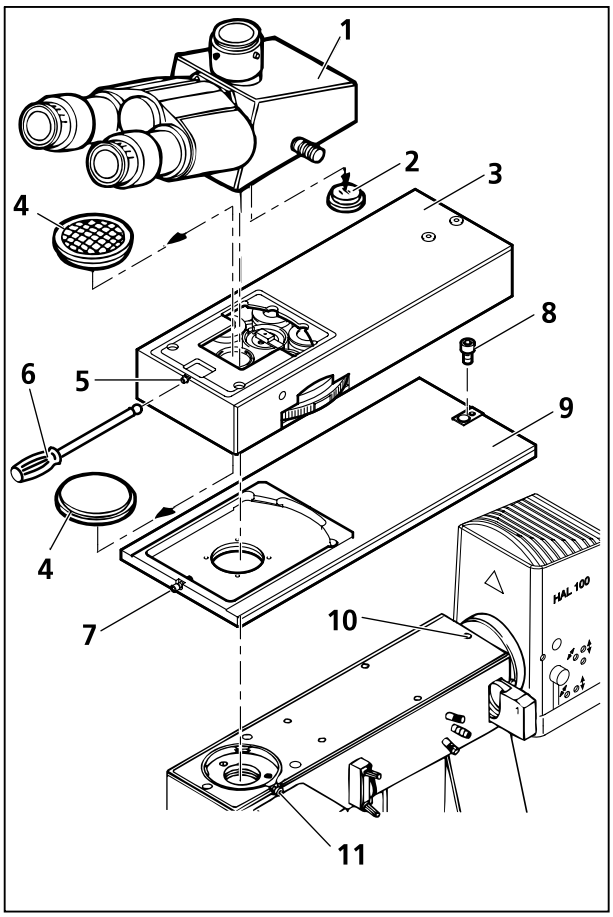


Fig. 2-8 **Attachment of Optovar intermediate tube**

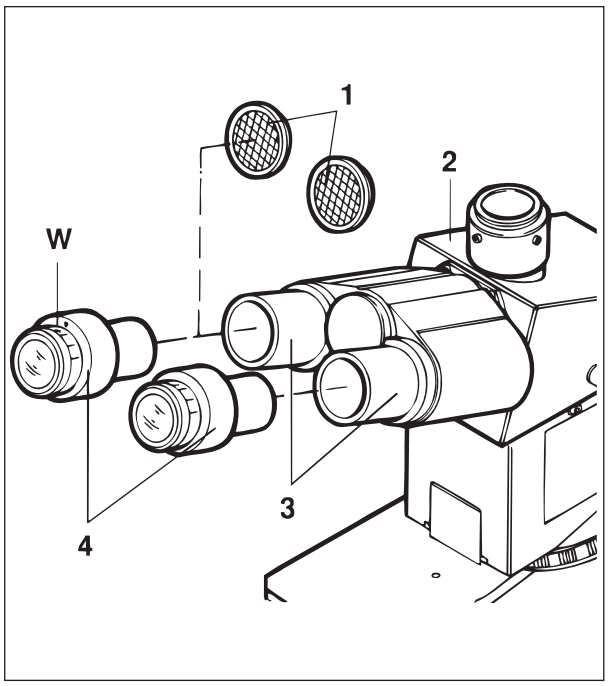


Fig. 2-9 Insertion of eyepieces

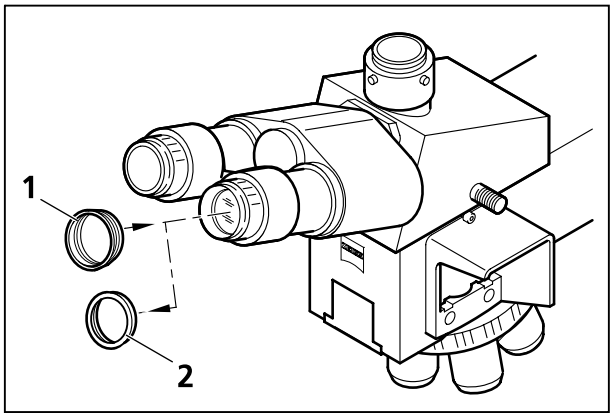


Fig. 2-10 Change of eyecups

2.5 Insertion of eyepieces

☞ All Axiotech microscopes are equipped with two focusing eyepieces. An overview of available eyepieces is given in section 1.5.

- Remove both protection caps (2-9/**1**) from the binocular phototube (2-9/**2**).
- Insert focusing eyepieces (2-9/**4**) into the eyepiece tubes (2-9/**3**).
- If one focusing eyepiece is available, set diopter zero position to the white dot (**W**) of the eyepiece ring and focus on the object with the eye with less ametropia via the coaxial drive.
- Then set the focus for the eye with a higher prescription through the second eyepiece until the object is clearly defined and seen in focus with both eyes.

☞ Particularly in reflected-light polarization contrast or fluorescence techniques of low light intensity, the standard rubber rings (2-10/**2**) can be replaced with fold-down rubber eyecups (2-10/**1**) to protect the eyepieces from stray light.

2.5.1 Insertion of the eyepiece reticle

The eyepieces W-PL 10×/23 Br. foc. and E-PL 10×/20 Br. foc. are intended for use with eyepiece reticles (overview: section 1.7).

The slight image shift caused by the additional path through the glass is taken into account on the diopter scale by the fact that the zero point position is indicated not by the white dot (2-11/**W**), but by the red dot (2-11/**R**).

The eyepiece reticles (2-11/**1**) have been adhered to screw-in mounts (2-11/**2**) by the manufacturer to allow easy replacement.

- To replace an eyepiece reticle, remove screw-in mount with eyepiece reticle and replace it with a new screw-in mount containing the required eyepiece reticle.

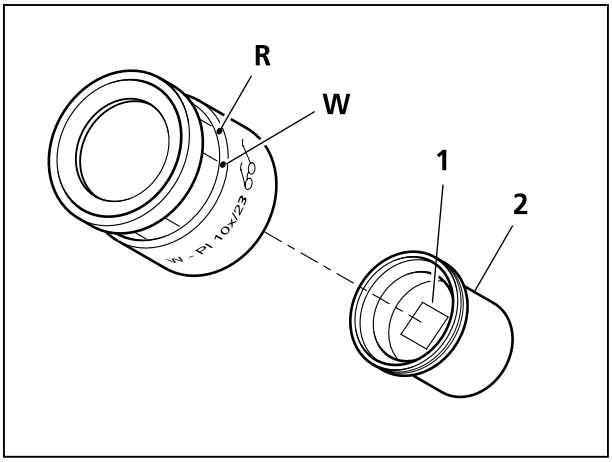


Fig. 2-11 Insertion of the eyepiece reticle

☞ If eyepiece reticles are inserted into the unscrewed mount by the customer, attention must be paid to the labeling being visible the right way up after insertion.
Section 1.7 contains an overview of available eyepiece reticles.

2.5.2 Compensation of ametropia when eyepiece reticles are used

The correct use of an eyepiece reticle requires two focusing eyepieces, e.g. W-PL 10×/23 Br. foc., to enable compensation of ametropia.

- Use the eyelens of the focusing eyepiece to focus on the line figure of the eyepiece reticle; focus on the edge of the field of view if no eyepiece reticle is used.
- Focus on the microscope image of a specimen via the coaxial focusing drive by looking through the eyepiece with reticle.
- When the image and the eyepiece reticle are in focus in the above eyepiece, focus the image for the second eye via the focusing eyelens of the second eyepiece.

☞ The position of the focusing drive on the stand must not be moved.

2.6 Setting of eyepiece (interpupillary) distance and viewing height

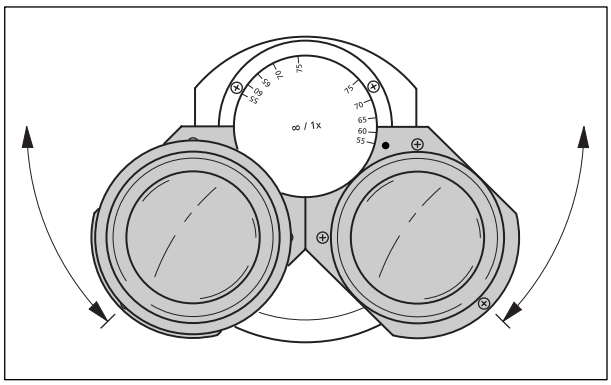


Fig. 2-12 Setting of eyepiece distance and viewing height of the binocular tube

- The eyepiece distance is matched to the user's individual interpupillary distance by swinging the two eyepiece tubes symmetrically towards one another (2-12).

2.7 Attachment of condenser

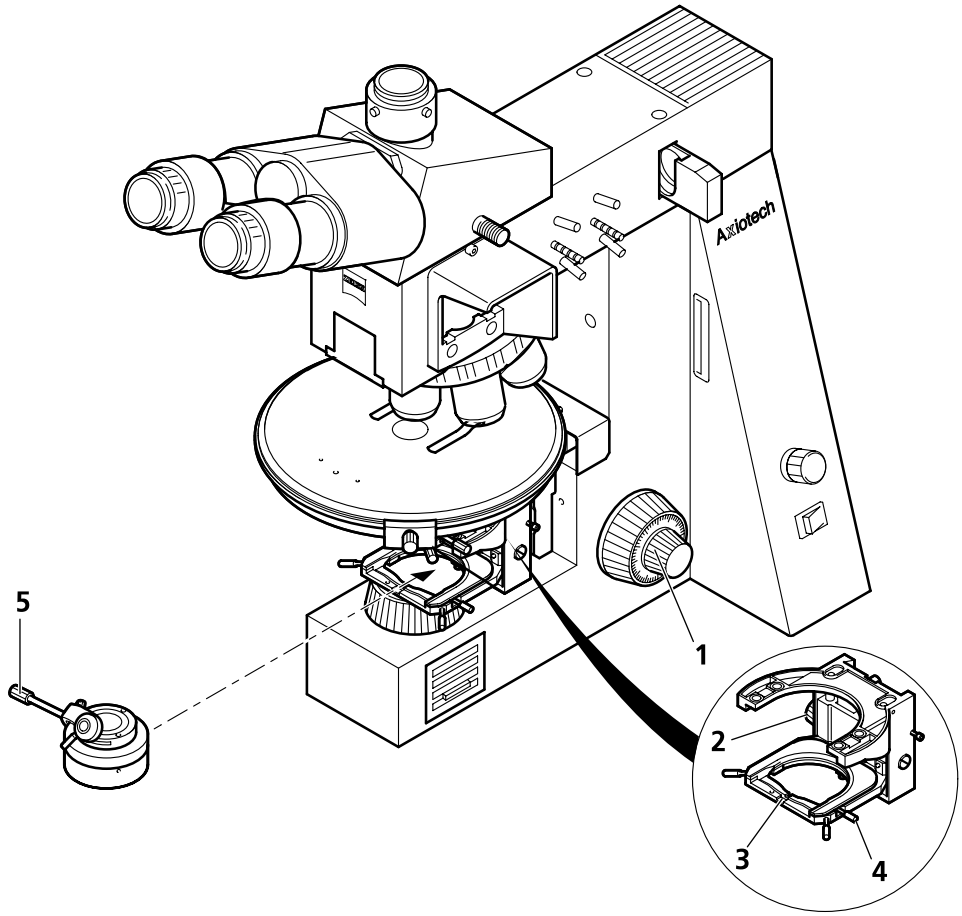


Fig. 2-13 Attachment of condenser

- Remove condenser, e.g. swing-in version 0.9 Z Pol, from the packaging.
- Carefully move microscope stage and stage carrier D to the uppermost stop position via the coarse drive (2-13/**1**). Caution: risk of collision with objectives !
- Lower the condenser holder via the condenser drive (2-13/**2**) and loosen the clamping screw (2-13/**4**). Fold down condenser front lens via the lever (2-13/**5**) and push condenser into the guiding fork from the front.

☞ The notch (2-13/**3**) in the condenser carrier is used for condenser orientation. The swing-in condenser 0.9 Z Pol must be oriented in such a way that the lever (2-13/**5**) points horizontally to the left.

- Fix condenser in position with the clamping screw (2-13/**4**) and move it close to the uppermost stop position via the condenser drive (2-13/**2**).

☞ Section 1.6 contains an overview of condensers available for the Axiotech.

The maximum specimen height for use of stage carrier D is 39 mm.

2.8 Attachment, change and centering of the microscope stage

When delivered, the microscope is factory-aligned in accordance with the order. The possibly required change of the stage between reflected-light and transmitted-light applications is described below.

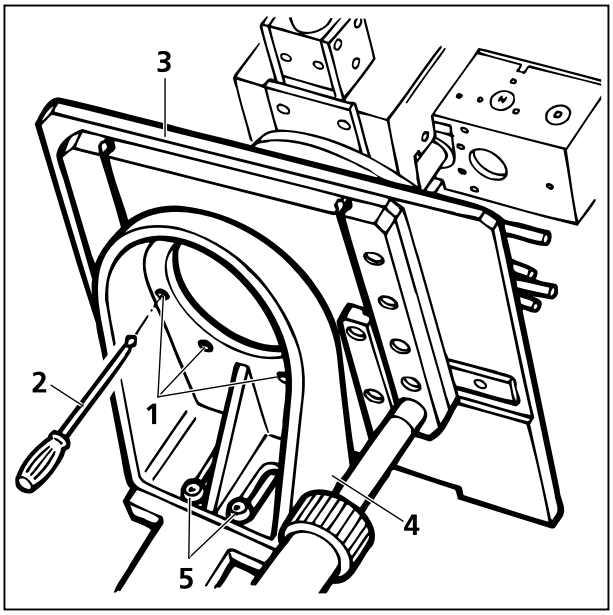


Fig. 2-14 Attachment/change of microscope stage (configuration with stage carrier A)

2.8.1 Axiotech 30 and Axiotech 100 with stage carrier A

- Slightly tilt the microscope stand backwards.
- Loosen four hexagonal screws (2-14/**1**) on the stage carrier A using the SW3 ball-headed screwdriver (2-14/**2**).
- Remove microscope stage (2-14/**3**) and replace it with another stage.
- Screw the suitable specimen holder on the microscope stage.

☞ Stage carrier A (2-14/**4**) remains attached. For specimens which are higher than 25 mm, the stage carrier can be lowered after loosening the two screws (2-14/**5**). The maximum lowering range is 24.5 mm, i.e. the specimen area is increased to the maximum specimen height of 49.5 mm.

2.8.2 Axiotech 30 and Axiotech 100 with stage carrier D and adapter

- Screw adapter for stage carrier D (2-15/**1**) to the Axiotech microscope stand with the semi-round recess showing upwards. For this purpose, tighten both hexagonal screws (2-15/**3**) and washers (2-15/**2**) using the SW3 ball-headed screwdriver (2-15/**4**).
- If not already done, complete transmitted light-compatible microscope stages with stage carrier D: place microscope stage (2-16/**4**) on its underside and screw on stage carrier D (2-16/**1**) with four hexagonal screws (2-16/**3**) using the SW 3 ball-headed screwdriver (2-16/**2**).
- Attach complete unit consisting of transmitted light-compatible microscope stage and stage carrier D to the adapter for stage carrier D in a slightly angled position and tighten fixation screw (2-16/**5**).
- Fix required specimen holder on the microscope stage using two knurled screws.

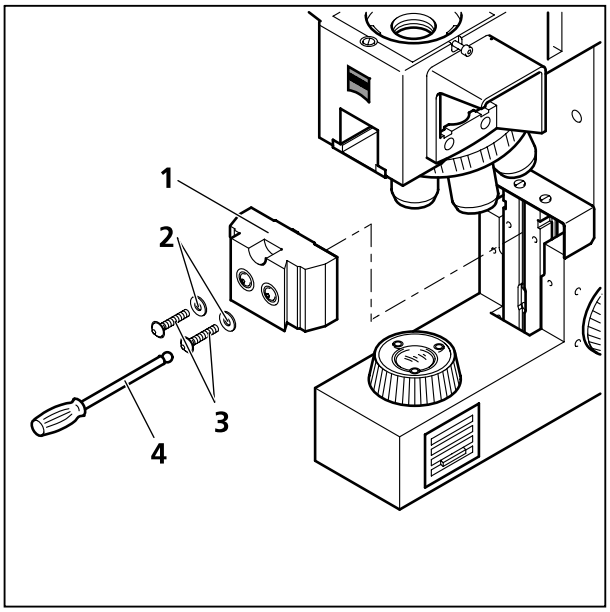


Fig. 2-15 Attachment of adapter for stage carrier D

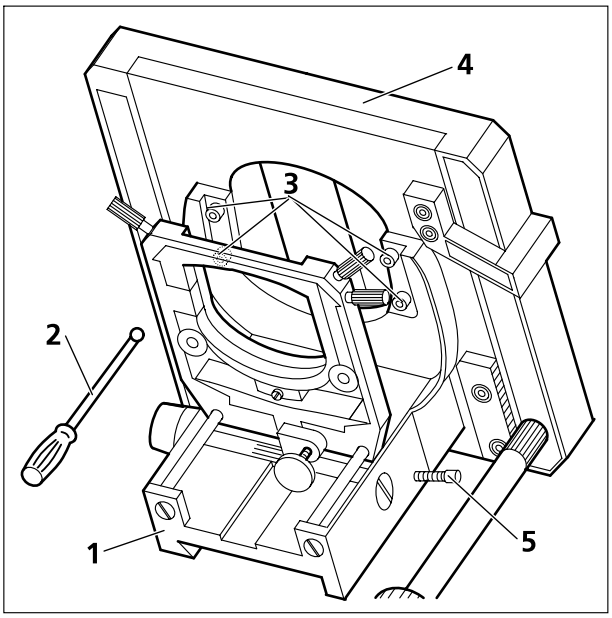


Fig. 2-16 Attachment/change of microscope stage (configuration with stage carrier D)

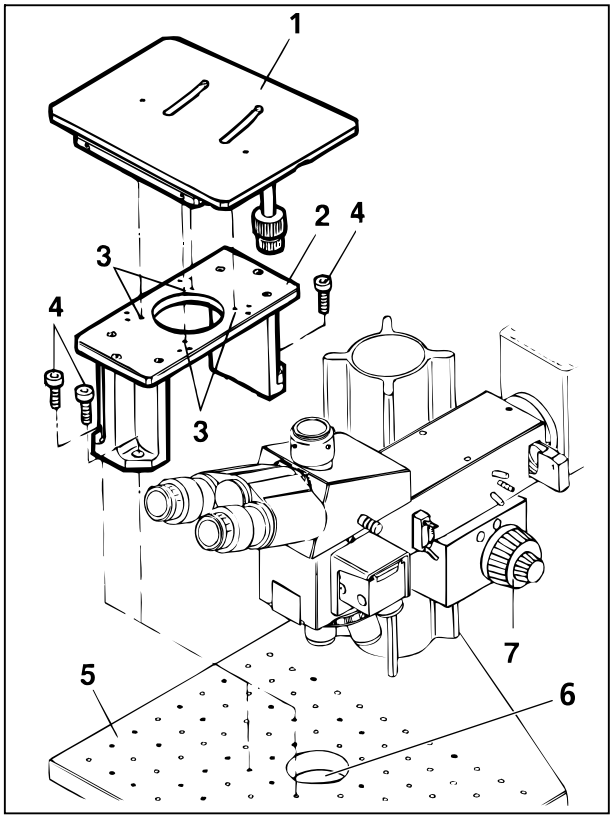


Fig. 2-17 Attachment/change of microscope stage (stage carrier H = 140 mm)

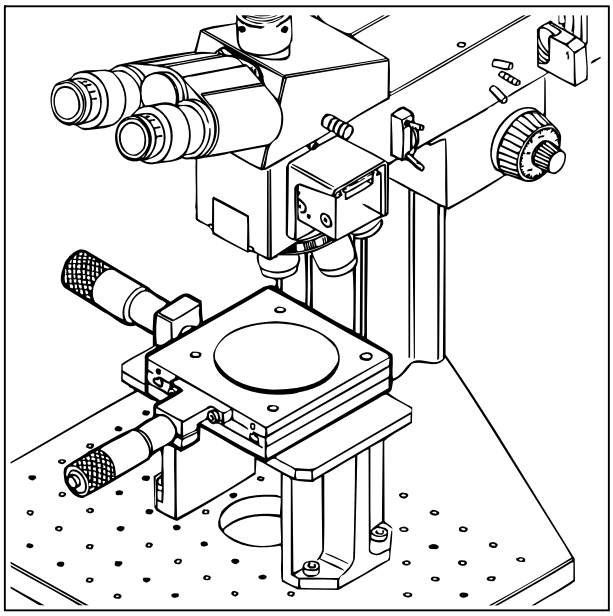


Fig. 2-18 Specimen stage MT 50 x 50

2.8.3 Axiotech^{vario} 100 with stage carrier H = 140 mm

☞ The upper side (2-17/**2**) of the stage plate H = 140 mm has various drilled holes (modular dimensions) which allow not only the use of standard microscope stages (as included in the configurations) with the Axiotech^{vario}, but also stages from Märzhäuser and Mitutoyo.

- Screw microscope stage (2-17/**1**) on the upper part of the stage carrier (2-17/**2**) through the four drilled holes (2-17/**3**) in such a way that the drive controls of the stage are not blocked at the side of the stage carrier.
- Screw stage carrier with premounted microscope stage on the base plate (2-17/**5**) with four hexagonal screws (2-17/**4**). Make sure that the hole in the stage carrier is symmetrical to the mounting hole (2-17/**6**).

☞ For two-handed operation of the Axiotech^{vario}, the microscope stage should be mounted in such a way that the left hand can reach the stage drive controls and the right hand the focusing drive (2-17/**7**).

Fig. 2-18 shows the MT 50 x 50 specimen stage with attached 5 µm (2×) micrometer.

2.8.4 Centering of Pol rotary stage

The Axiotech and Axiotech[vario] microscopes permit use of the Pol rotary stage. This stage has been precentered in the factory, i.e. a centered object detail will remain – within certain tolerances - in the center of the field of view after stage rotation. However, if a centered object detail migrates from the image center when the stage is turned, the Pol rotary stage should be recentered as follows:

- Insert 20× or 50× objective in the beam path.
- Set the object reticle or a selected object point to the center of the eyepiece reticle.
- Turn the stage to determine the maximum deflection (2-19/**1**- **entire arrow length!**) of the object reticle or object point from the eyepiece reticle.
- Carefully adjust or loosen the fixation screws on the stage carrier to move the object reticle or object point in the direction of the center of the eyepiece reticle by **half the arrow length** (2-19/**1**).
- Carefully tighten fixation screws and check whether the object reticle or object point migrates from the eyepiece reticle when the stage is turned again. If required, repeat the centering procedure until the stage is centered within the default tolerances.

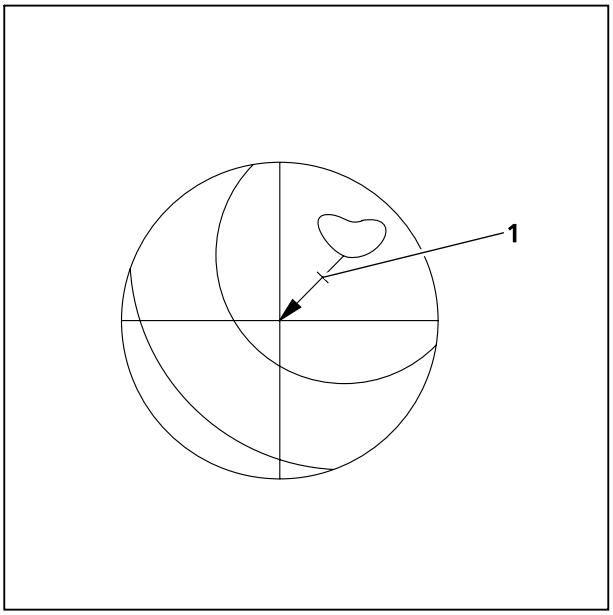


Fig. 2-19 Centering of microscope stage with maximum deflection between object detail and eyepiece reticle

2.9 Change of filters

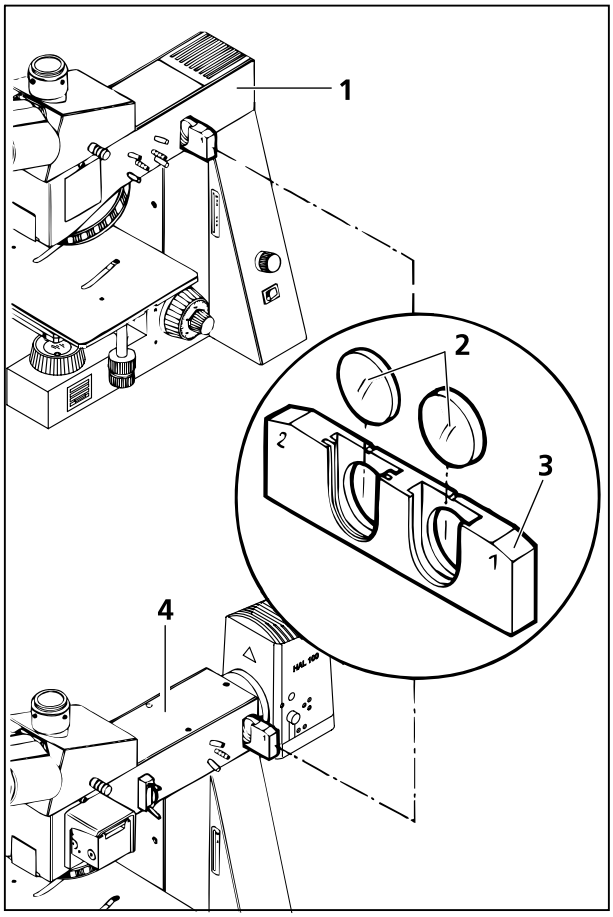


Fig. 2-20 Equip filter slider and push it in beam path

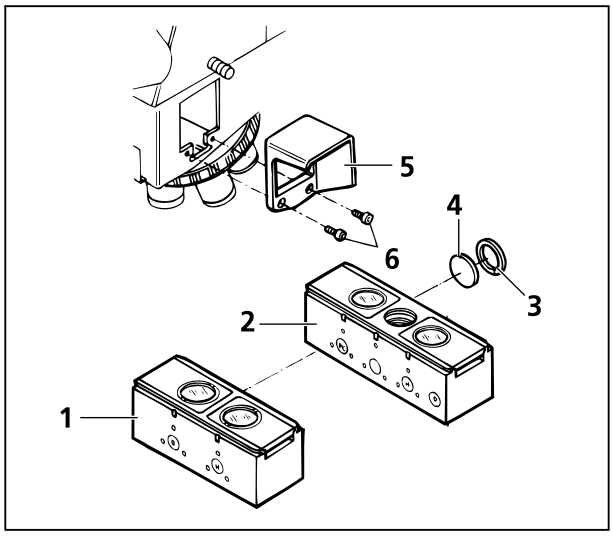


Fig. 2-21 Change of filters in reflector slider

2.9.1 Equip the filter slider with filters and push it in the beam path

- Equip filter slider (2-20/**3**) with the filters (2-20/**2**) required for the relevant microscopy technique, e.g. with
  - attenuation filter D = 0.06 (transmission: 6 %)
  - attenuation filter D = 0.25 (transmission: 25 %)

☞ The combination of the two attenuation filters D = 0.06 × 0.25 = 0.015 results in a transmission of 1.5 %.

- Conversion filter 3200 ... 5500 K if daylight color film is used

- Push equipped filter slider into the relevant reflected-light illuminators (2-20/**1**, **4**).

2.9.2 Change of filters in reflector slider

In its brightfield position, the reflector slider HD DIC (2-21/**2**) has an integrated, dia. 25 mm attenuation filter D = 0.25 (transmission: 25 %).

This filter prevents the user from being dazzled when changing from D to H or from DIC to H.

Unscrew the retaining ring (2-21/**3**) and replace the dia. 25 attenuation filter (2-21/**4**) D = 0.25 with a neutral-density filter, e.g. D = 0.06, dia. 25.

☞ The reflector sliders HD (2-21/**1**) and HD DIC (2-21/**2**) can only be pulled out if one of the dust covers (2-21/**5**) on the left or right stand side has been removed. For this purpose, unscrew the two hexagonal screws (2-21/**6**) on one side using the SW 3 ball-headed screwdriver, remove the dust cover and pull out the reflector slider **very carefully** because a darkfield component projects from the reflector slider!

2.10 Setting of reflected-light luminous-field diaphragm

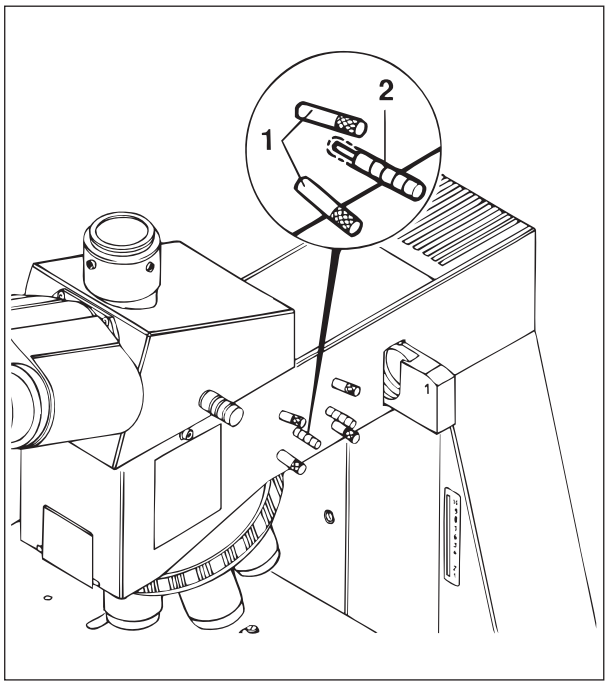


Fig. 2-22 Setting of reflected-light luminous-field diaphragm of the Axiotech 30

2.10.1 Axiotech 30

- The pushrod (2-22/**2**) for the integrated luminous-field diaphragm has two positions:
  - when pushed in, the entire field of view is visible without any restrictions;
  - when pulled out, the visible field has been restricted to approx. 1/3 of the entire field diameter.

  This can be an adjustment aid to find the specimen plane, i.e. focusing is made on the visible diaphragm. Furthermore, this field restriction can reduce the portion of false light in weakly reflecting reflected-light specimens.

☞ The luminous-field diaphragm can be centered using two centering screws (2-22/**1**).

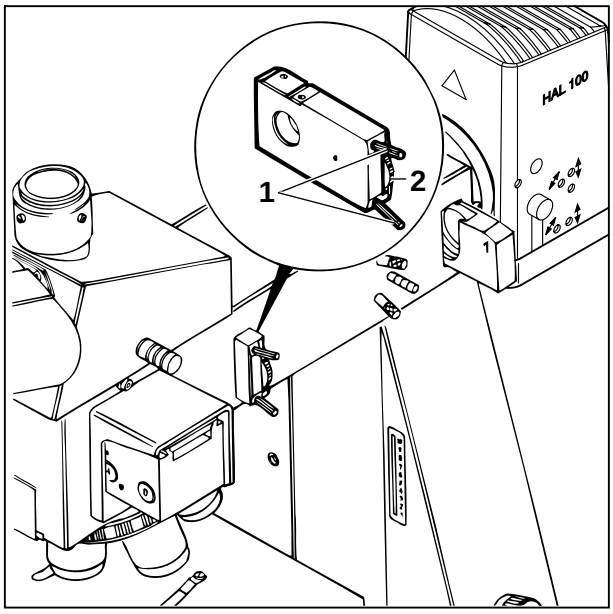


Fig. 2-23 Setting of reflected-light luminous-field diaphragm on Axiotech 100 and Axiotech[vario] 100

2.10.2 Axiotech 100 and Axiotech[vario] 100

- The luminous-field diaphragm is adjusted by turning the knurled wheel (2-23/**2**) which is marked with increments for rough orientation:
  - - position 10: diaphragm open
  - - position 1: diaphragm closed

☞ The luminous-field diaphragm can be centered using two centering screws (2-23/**1**).

2.11 Connection to the line and switching the instruments on and off

2.11.1 Connection of Axiotech 30

The Axiotech microscope features an integrated wide-range power unit, i.e. it can be used with line voltages ranging from 100 to 240 V AC, 50 ... 60 Hz. The wide-range power unit sets itself **automatically** to the relevant line voltage.

- Connect line cable with coupling device (2-24/**1**) to the instrument socket (2-24/**2**) and make connection to the line via line connector (2-24/**3**).

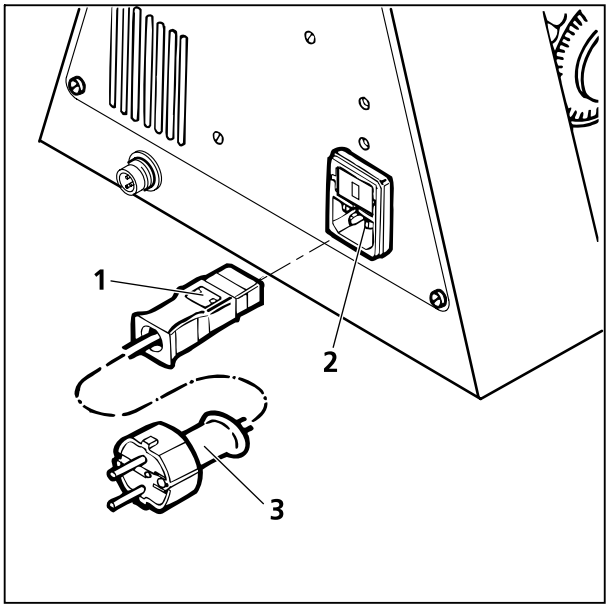


Fig. 2-24 Connecting the Axiotech 30 to the line

- Switch the 6 V 30 W reflected-light halogen lamp on and off again via the on/off switch (2-25/**4**). In the ON position, the green line control lamp in the switch and at least one LED on the lamp voltage display (2-25/**2**) must light up if the 6 V 30 W lamp is switched on.
- Set the required image brightness via the reflected-light illuminance control (2-25/**3**) or use filter slider (2-25/**1**) with attenuation filter

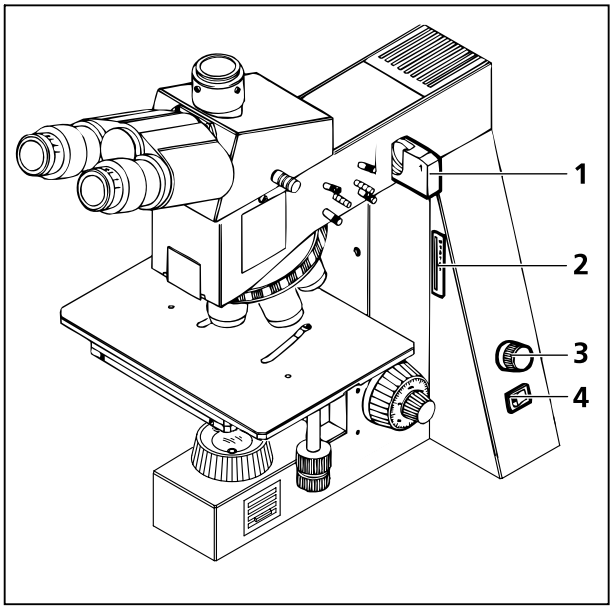


Fig. 2-25 Switching on the Axiotech 30

2.11.2 Connection of Axiotech 100

The Axiotech 100 microscope features an integrated stabilized 12 V 100 W power unit which uses the two switchable voltage ranges 100 ... 127 V AC or 220 ... 240 V AC.

☞ Before the instrument is switched on for the first time, it is therefore absolutely necessary to check whether the voltage set at the sliding switch (2-26/**1**) on the back of the stand complies with the line voltage!

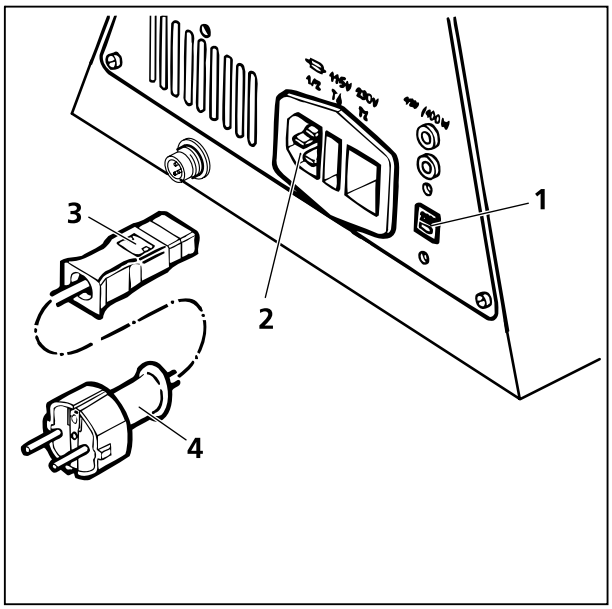


Fig. 2-26 Connecting the Axiotech 100 to the line

- If the preset instrument voltage **does not comply** with the line voltage, **make sure** to set the sliding switch (2-26/**1**) to the correct line voltage using the SW 3 screwdriver!
- Connect line cable with coupling device (2-26/**3**) to the instrument socket (2-26/**2**) and make connection to the line via line connector (2-26/**4**).
- Switch the 12 V 100 W halogen lamp on and off again via the on/off switch (2-25/**4**). In the ON position, the green line control lamp in the switch and at least one LED on the lamp voltage display (2-25/**2**) must light up if the 12 V 100 W halogen lamp is switched on.
- Set the required image brightness via the reflected-light illuminance control (2-25/**3**).

2.11.3 Connection of Axiotech[vario] 100

The Axiotech[vario] 100 microscope has no integrated power unit , i.e. all the usable illuminators are operated via external power units.

☞ Before the instrument is switched on for the first time, it is therefore absolutely necessary to check whether the preset instrument voltage complies with the line voltage!

Separate SNT 12 V DC 100 W power unit for 12 V 100 W reflected-light halogen lamp

- If the instrument voltage set on the separate SNT 12 V DC 100 W power unit **does not comply** with the line voltage, **make absolutely sure** to set the 230/115 V AC sliding switch on the underside of the power unit to the correct line voltage using a SW 3 screwdriver!
- However, the switching of voltages requires the use of the suitable fuse inserts (2-27/**10**).
- To check the fuse inserts, loosen the fuse holder (2-27/**3**) by pressing the two lateral spring tabs and remove it. Check fuse type and function:
  - for 220 ... 240 V: T 2.0 A/H; 250 V;
  - for 100 ... 127 V: T 4.0 A/H; 250 V;

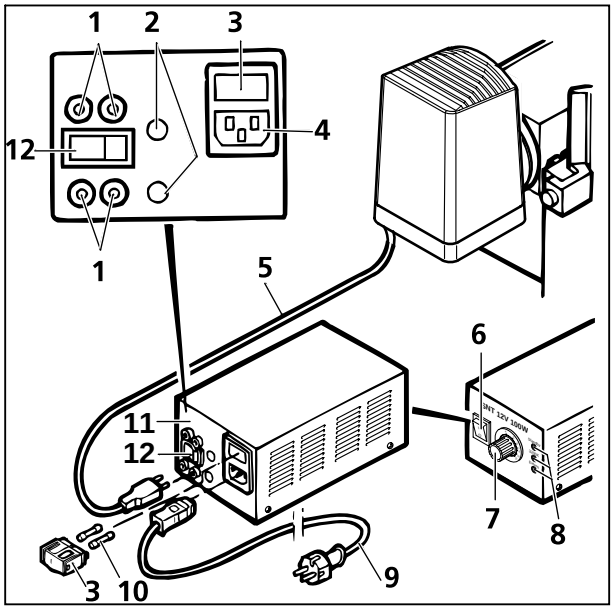


Fig. 2-27 Connecting the Axiotech[vario] 100 to the line via separate power unit

- Connect cable (2-27/**5**) of 12 V 100 W halogen illuminator to one of the sockets (2-27/**1**) of the separate power unit (2-27/**11**).
- Set the changing switch (2-27/**12**) for the upper or lower sockets, according to what has been selected before.
- Insert line cable (2-27/**9**) with coupling device into the instrument socket (2-27/**4**) and make connection to the line via line connector.
- Switch on the separate SNT 12 V 100 W power unit via on/off switch (2-27/**6**).
- The green line control lamp in the switch must light up.
- Set the required brightness level on the potentiometer (2-27/**7**).
  - At approx. 11.5 V, the color temperature of approx. 3200 K for color photography is achieved.

☞ The displays (2-27/**8**) are only active if external control units are connected to the sockets (2-27/**2**).

2.12 Reflected-light illumination equipment

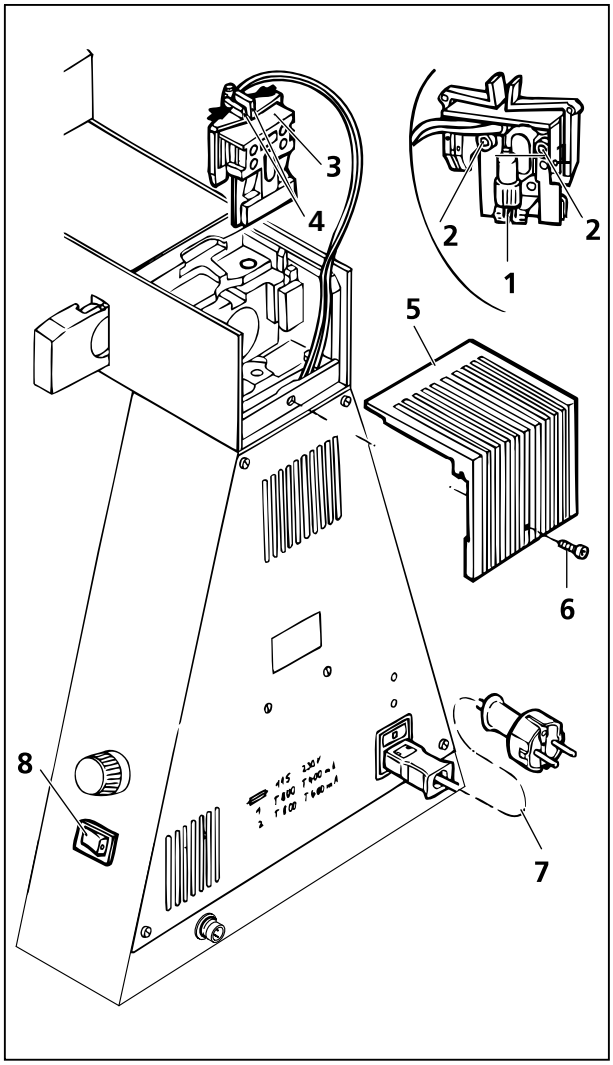


Fig. 2-28 Change of 6 V 30 W halogen lamp

2.12.1 Change of 6 V 30 W halogen lamp
(Axiotech 30)

- Switch off the On/Off switch (2-28/**8**) on the microscope stand and disconnect the instrument cable (2-28/**7**) from the line.
- Allow hot halogen illuminator to cool down for approx. 15 minutes after use.
- Unscrew hexagonal screws (2-28/**6**) using SW 3 ball-headed screwdriver and remove lamp cover (2-28/**5**).
- Press holding components (2-28/**4**) of lamp insert (2-28/**3**) together and pull out lamp insert.
- Remove new 6 V 30 W halogen lamp (2-28/**1**) from the packaging and push it on the guiding rails. Make sure that the lamp carrier plate exactly fits the mounting and fixation pins.
- Attach lamp insert again by pressing the holding components slightly together.
- Attach and screw on lamp cover using the SW 3 ball-headed screwdriver.
- Connect instrument to the line and switch on the On/Off switch on the stand.

☞ Use a protective sleeve (2-31/**3**) to hold the bulb of the 6 V 30 W halogen lamp; if required, clean the lamp bulb before its initial use with pure alcohol to prevent dirt from burning in.

2.12.2 Attachment of 12 V 100 W halogen illuminator, adjustment and change of 12 V 100 W halogen lamp (Axiotech 100 and Axiotech[vario] 100)

a) Attachment of 12 V 100 W halogen illuminator

- Loosen hexagonal screw (2-29/**2**) using ball-headed screwdriver (2-29/**1**) and remove dust protection cap (2-29/**3**).
- Attach 12 V 100 W reflected-light halogen illuminator (2-29/**5**) with dovetail guide (2-29/**4**) and tighten hexagonal screws (2-29/**2**) using the ball-headed screwdriver (2-29/**1**).
- Connect cable (2-29/**6**) with the two sockets (2-29/**7**) on the instrument rear.
- Attach connection cable (2-29/**6**) of halogen illuminator to the cable clamp (2-29/**8**).

☞ Since the power supply is not integrated in the stand of the Axiotech[vario], the 12 V 100 W halogen illuminator must be connected to the external 12 V DC 100 W power unit (also see section 2.11.3).

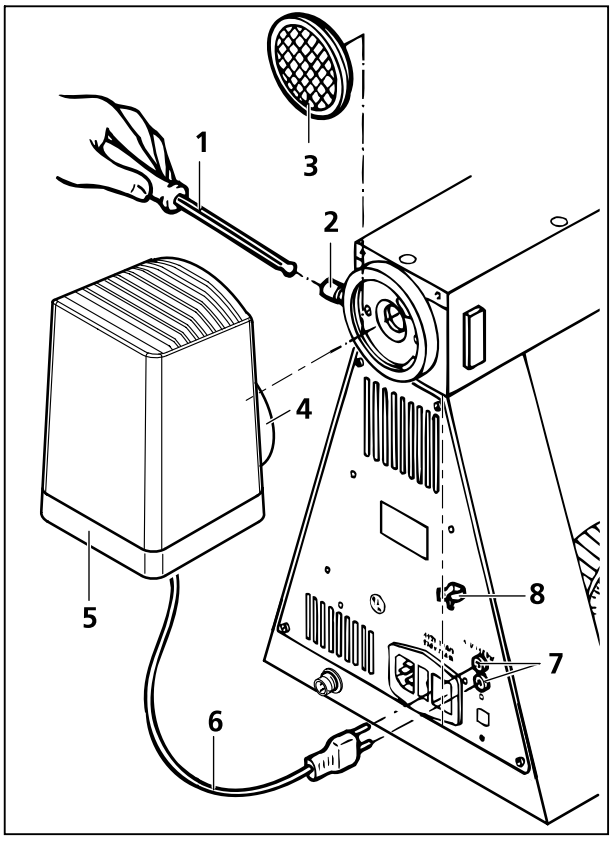


Fig. 2-29 Attachment of 12 V 100 W halogen illuminator

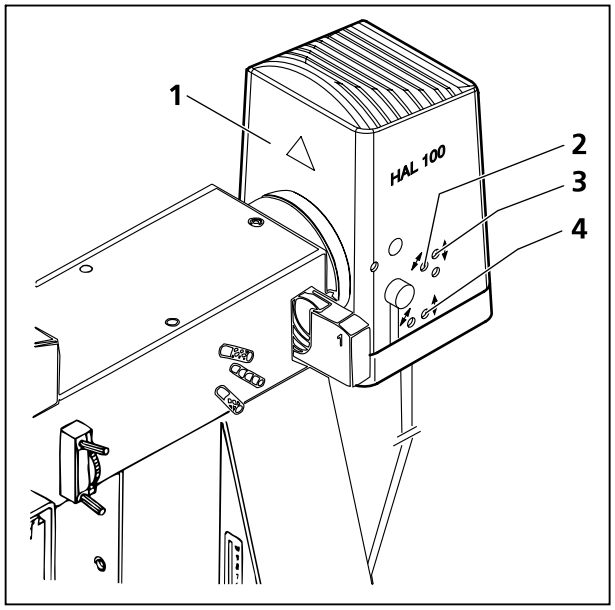


Fig. 2-30 Alignment of 12 V 100 W halogen lamp

b) Alignment of 12 V 100 W halogen lamp

The 12 V 100 W reflected-light halogen illuminator is factory-aligned. If required, it can be realigned as follows:

- Allow the hot 12 V 100 W halogen illuminator to cool down for approx. 15 mins. after use.
- Loosen the hexagonal screw (2-29/**2**) and remove the halogen illuminator from the microscope stand.
- Direct the halogen illuminator and the light beam against a projection area (e.g. a wall) which is at least 3 m away.
- Switch on the microscope and the halogen illuminator as described in section 2.11.

⚠ Make sure **not** to look into the light exit opening of the halogen illuminator and do not point it at other persons!

- Use adjusting screw (2-30/**7**) to set the collector in such a way that the lamp coil is imaged on the projection area as clearly defined as possible.
- The adjusting screws (2-30/**6** and **5**) and a SW 3 ball-headed screwdriver are now used to center the lamp coil, with adjusting screw (2-30/**6**) providing the lateral setting and adjusting screw (2-30/**5**) the horizontal setting of the lamp coil.
- Then use adjusting screw (2-30/**4**) to set the reflection image of the lamp coil with the sharpest possible definition.
- Use adjusting screws (2-30/**3** and **2**) to center the reflection image of the lamp coils in such a way that it exactly fills the gaps of the lamp coil, thus producing a luminous area which is as homogeneous and as much in the center as possible. Adjusting screw (2-30/**3**) provides the horizontal setting, adjusting screw (2-30/**2**) provides the lateral setting of the reflection image of the lamp coil.
- Attach microscope illuminator (2-30/**1**) to the stand again and fix it in position using the hexagonal screw (2-29/**2**).
- Use 10x objective to focus on the specimen, search an empty object spot and check the illumination of the field of view.

☞ Detailed information on the operation and alignment is contained in operating manual G 42-216 from Carl Zeiss, entitled " HAL Microscope Illuminator with Reflector".

c) Change of 12 V 100 W halogen lamp

- Switch off the lamp supply via the On/Off switch of the microscope (see section 2.11).
- Disconnect the line cable from the line.
- Allow the hot 12 V 100 W halogen illuminator to cool down for approx. 15 mins. after use.
- Loosen hexagonal screw (2-31/**1**) and pull off lamp housing (2-31/**2**) in upward direction.
- Press the two spring levers (2-31/**5**) and carefully remove defective 12 V 100 W halogen lamp (2-31/**4**).
- Remove new 12 V 100 W halogen lamp from the packaging by holding it on the protection sleeve (2-31/**3**). Press both spring levers (2-31/**5**) downwards and carefully insert pins of the new halogen lamp into the lamp base. Release spring levers and remove protection cap.

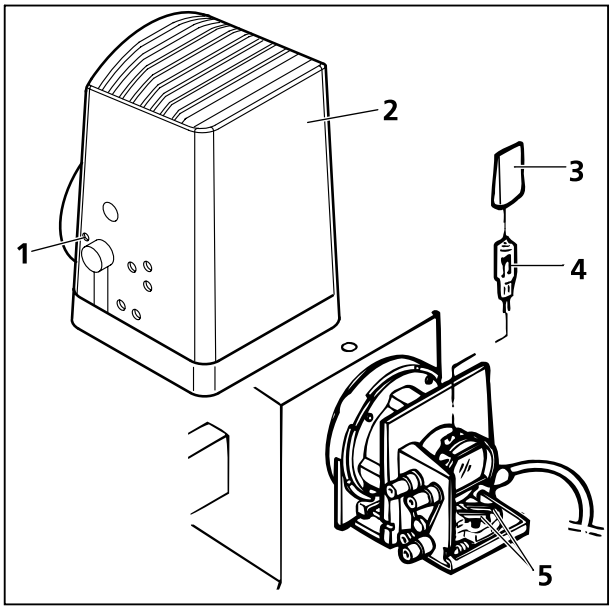


Fig. 2-31 **Change of 12 V 100 W halogen lamp**

☞ Always use the protection sleeve (2-31/**3**) to hold the bulb of the 12 V 100 W halogen lamp and never touch the bulb with your bare hands. If required, clean the bulb with pure alcohol before switching it on for the first time to prevent dirt from burning in.

- Shortly press spring lever downwards again to center the lamp.
- Attach lamp housing (2-31/**2**) again and secure it in position with SW 3 hexagonal screw (2-31/**1**).
- If required, realign 12 V 100 W halogen lamp as described in section 2.12.2 b).

2.12.3 Attachment and connection of N XBO 75 Xenon short-arc illuminator

The N XBO 75 Xenon short-arc illuminator contains the XBO 75 gas discharge lamp with a high radiation intensity and daylight characteristics (5500 K). Electrical power is supplied by the N XBO 75 transformer.

- The N XBO 75 Xenon short-arc illuminator can be connected to the Axiotech or Axiotech^vario microscope stand via the mechanical dovetail mount.
- Connect N XBO 75 illuminator with ozone-free XBO 75 Xenon lamp to the N XBO 75 transformer.
- Connect N XBO 75 transformer to the line via the line cable. The wide-range power unit is suitable for voltages ranging from 100 to 240 V AC, 50 ... 60 Hz.
- Switch the XBO 75 lamp on and off again via the line switch on the front of the transformer. The lamp ignites itself when switched on.

☞ For detailed information on lamp use, change and alignment, please see operating manual B 40-065 from Carl Zeiss, entitled " N HBO 103 and N XBO 75 Microscope Illuminators".

2.12.4 Attachment and connection of HBO 50 mercury-pressure short-arc illuminator

The HBO 50 mercury-pressure short-arc lamp contains the HBO 50 gas discharge lamp with pronounced line-spectrum and continuous background spectrum characteristics. Electrical power is supplied by the power unit for HBO 50.

- The HBO 50 mercury-pressure short-arc lamp can be connected to the Axiotech or Axiotech^vario microscope stand via the mechanical dovetail mount.
- Connect the line cable of the HBO 50 illuminator to the power unit.
- The separate power unit for HBO 50/220 ... 240 V AC must be connected to the line via the line cable.
- Switch the HBO 50 lamp on and off via the line switch on the front of the power unit. The lamp ignites itself when switched on.

☞ For detailed information on lamp use, change and alignment, please see operating manual G 42-160 from Carl Zeiss, entitled " HBO 50 Microscope Illuminator".

2.13 Transmitted-light illumination equipment

2.13.1 Change of 6 V 30 W halogen lamp in the stand base (Axiotech 30 and Axiotech 100)

In the Axiotech 30 instrument configuration for brightfield and darkfield in reflected light, the microscope stand has been prepared for transmitted-light applications in such a way that the 6 V 30 W halogen lamp can be easily attached. The following procedure is required:

- Switch off the microscope via the On/Off switch (2-32/**1**) and disconnect the line cable from the line.
- Allow halogen lamp (2-32/**4**) to cool down for approx. 15 mins. immediately after use.
- Hold ventilation grid (2-32/**2**) on the handle, slightly press it upwards and then pull it off in outward direction.
- Press holding elements (2-32/**3**) of lamp insert together and pull out lamp insert.
- Hold lamp insert on the sides and pull off halogen lamp from the guiding rails.

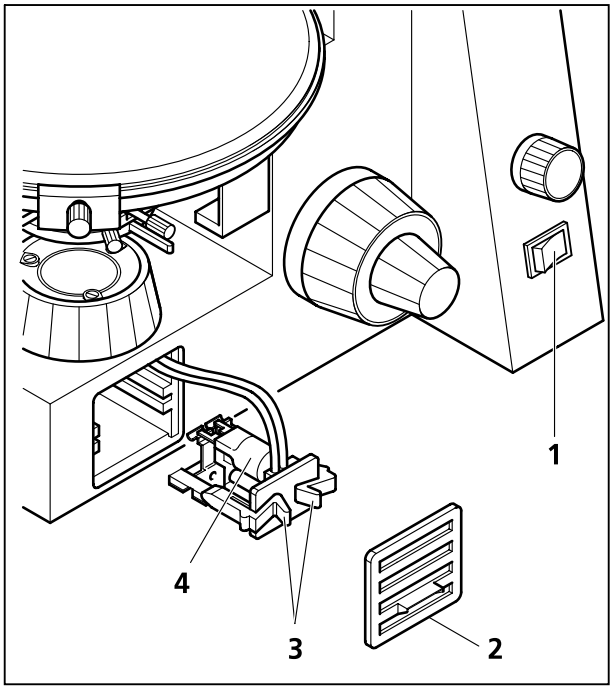


Fig. 2-32 Change of 6 V 30 W halogen lamp (Axiotech 30 and Axiotech 100)

- Remove new 6 V 30 W halogen lamp from packaging by holding it on the protection sleeve and push it on the guiding rails. Make sure that the lamp carrier plate **exactly fits** the mounting and fixation pins!
- Remove protection sleeve from the halogen lamp.
- Attach lamp insert again by slightly pressing the holding elements together.
- Insert ventilation grid from below and press it tight at the base.

☞ Always use the protection sleeve to hold the bulb of the 6 V 30 W halogen lamp and never touch the bulb with your bare hands. If required, clean the bulb with pure alcohol before switching it on for the first time to prevent dirt from burning in.

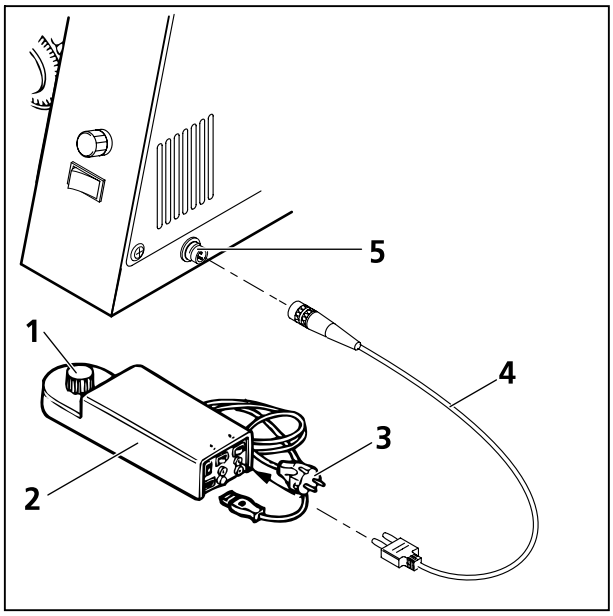


Fig. 2-33 **Connecting the 6 V 30 W halogen illuminator to the line**
(Axiotech 30 and Axiotech 100)

2.13.2 **Connecting the 6 V, 30 W halogen illuminator to the line** (Axiotech 30 and Axiotech 100)

Power supply of the halogen illuminator in transmitted light is always performed via the separate power unit and **not** via the integrated power unit in the stand!

Before connecting and switching on the 6 V 10 ... 40 W power supply, check whether the primary power supply instrument voltage complies with the line voltage! If this is not the case, contact your nearest Carl Zeiss agency immediately.

- Connect cable (2-33/**4**) to the power supply (2-33/**2**) and the microscope stand (2-33/**5**).
- Connect cable (2-33/**3**) to the line and switch the power supply on/off via the assigned On/Off switch on the instrument rear. The red bar on the switch indicates the ON position.
- Set the required illuminance using the control of the power supply (2-33/**1**).

2.13.3 Change of 6 V 30 W halogen lamp (Axiotech[vario] 100)

The transmitted-light equipment of the Axiotech[vario] consists of the following components:

- Transmitted-light equipment (2-34/**1**)
- 6 V 30 W halogen lamp and
- 6 V 10 ... 40 W power supply (2-34/**2**), either for 230 V or 120 V line voltage.

To enable use of the transmitted-light equipment with the Axiotech[vario], it is absolutely necessary to use the stage carrier H = 140 mm.

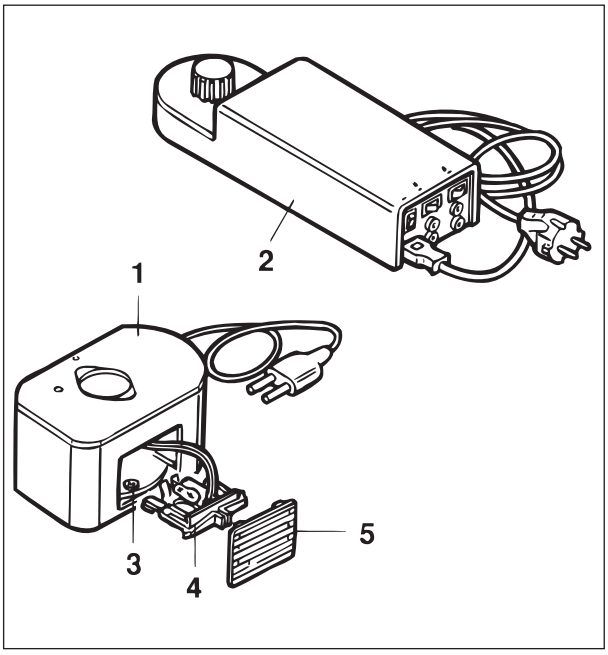


Fig. 2-34 Change of 6 V 30 W halogen lamp (Axiotech[vario] 100)

The 6 V 30 W halogen lamp is changed as follows:

- Allow the halogen lamp to cool down for approx. 15 mins. after use.
- Remove ventilation grid (2-34/**5**) in upward direction.
- Press holding elements of lamp insert (2-34/**4**) together and pull insert out of the transmitted-light illuminator (2-34/**1**).
- Hold mount with halogen lamp on the sides and pull it off the guiding rails of the lamp insert (2-34/**4**).
- Remove new 6 V 30 W halogen lamp from the packaging and push it on the guiding rails. Make sure that the lamp carrier plate exactly fits the mounting and fixation pins.
- Reassemble lamp insert (2-34/**4**) with new 6 V 30 W halogen lamp and ventilation grid (2-34/**5**).
- Insert transmitted-light illuminator (2-31/**1**) in mounting hole of the vario base plate (2-35/**4**) and align it.
- Tighten clamping screw (2-34/**3**) using a SW 3 ball-headed screwdriver.

2.13.4 **Connection of power supply for 6 V 30 W halogen illuminator** (Axiotech[vario] 100)

Before connecting and switching on the 6 V 10 ... 40 W power supply, check whether the primary power supply instrument voltage complies with the line voltage! If this is not the case, contact your nearest Carl Zeiss agency immediately.

- Connect cable (2-35/**5**) of the transmitted-light illuminator (2-35/**4**) to the relevant sockets of the 6 V 10 ... 40 W power supply unit (2-35/**1**).
- Connect the line cable (2-35/**3**) to the line and switch on the power supply unit via its On/Off switch. The red bar on the switch indicates the ON position.
- Set the required illuminance via the control (2-35/**2**) of the power supply unit.

☞ In transmitted-light applications, a reflector slider can be used in the darkfield position to increase the light intensity by approx. factor 2, since no beam splitter is in the beam path in that case.

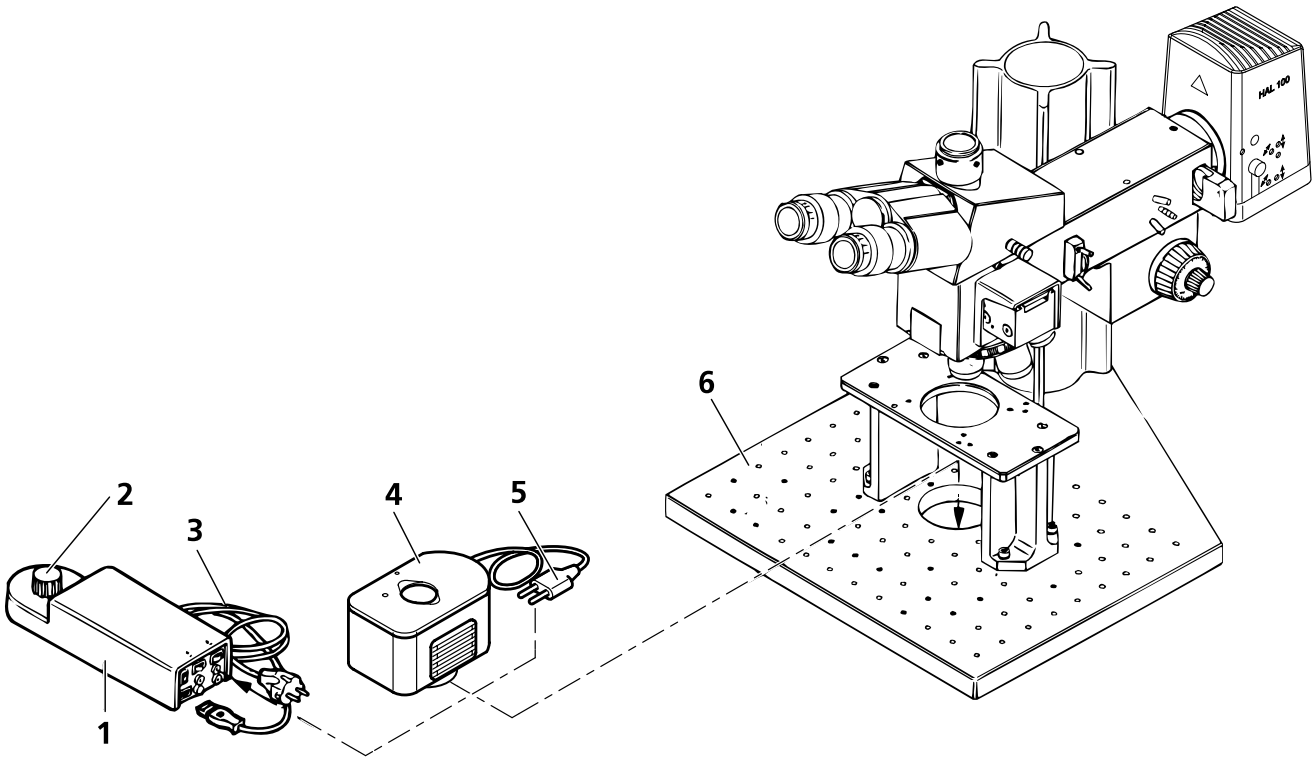


Fig. 2-35 **Connection of power supply for 6 V 30 W halogen illuminator** (Axiotech[vario] 100)

OPERATION

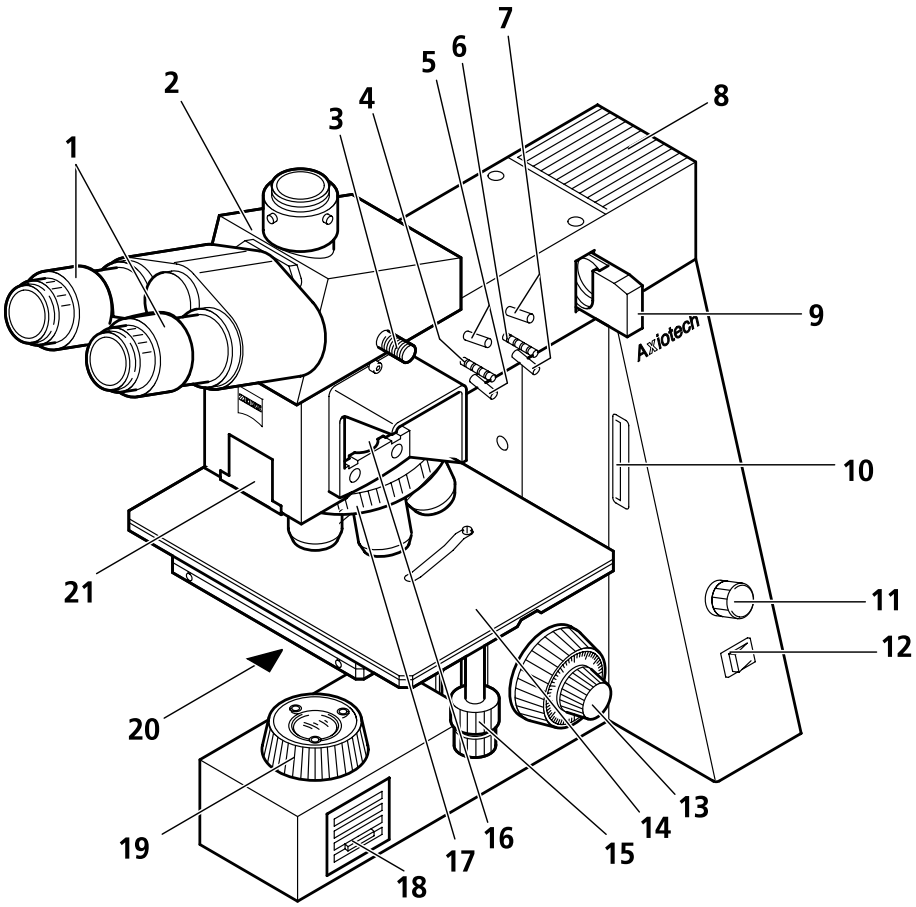
Contents

List of illustrations

3 OPERATION

3.1 Overview of operation and function controls

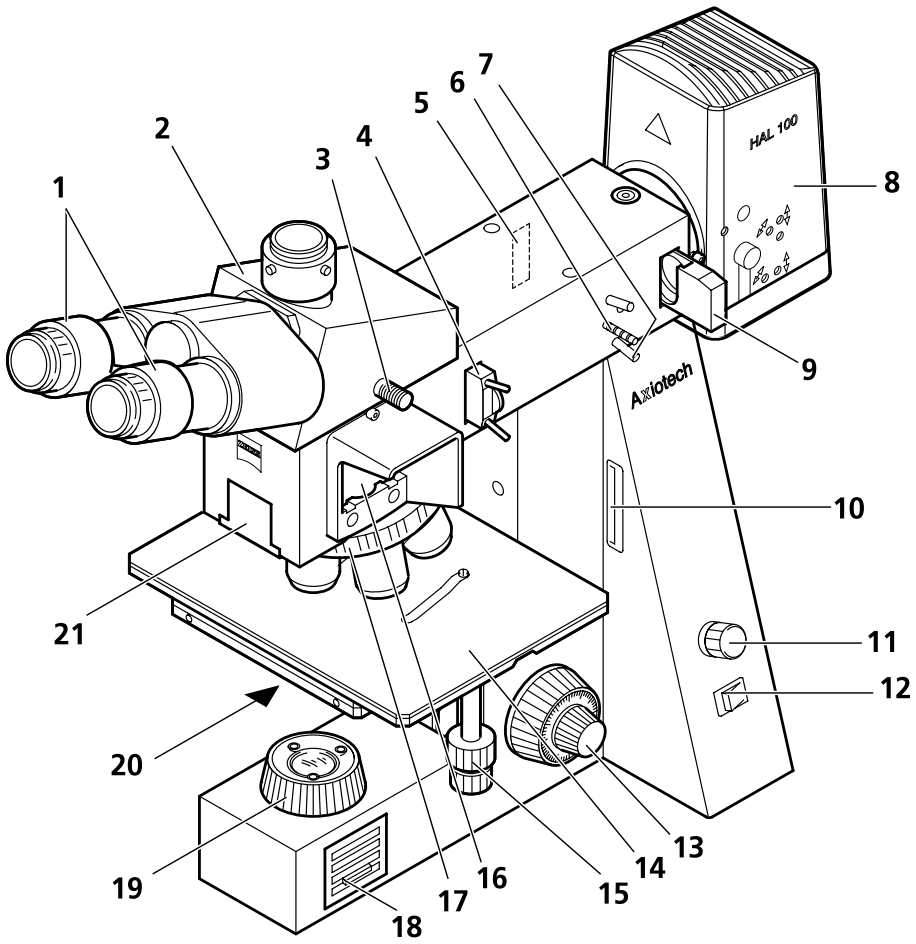
3.1.1 Operation and function controls of the Axiotech 30



1 Eyepieces
2 Binocular phototube 20°
3 Pushrod (to change beam path)
4 Pushrod for luminous-field diaphragm (reflected light)
5 Centering screws for luminous-field diaphragm (reflected light)
6 Pushrod for reflected-light aperture diaphragm
7 Centering screws for reflected-light aperture diaphragm
8 Reflected-light illumination equipment
9 Filter slider
10 Lamp voltage display
11 Reflected-light illuminance control
12 On/Off switch with pilot lamp
13 Coaxial coarse and fine drive
14 Mechanical stage with specimen holder
15 Coaxial stage drive
16 Compartment for reflector slider
17 Objective nosepiece
18 Transmitted-light illumination equipment
19 Transmitted-light luminous-field diaphragm
20 Condenser carrier with condenser
21 Compartment for DIC slider

Fig. 3-1 Operation and function controls of the Axiotech 30

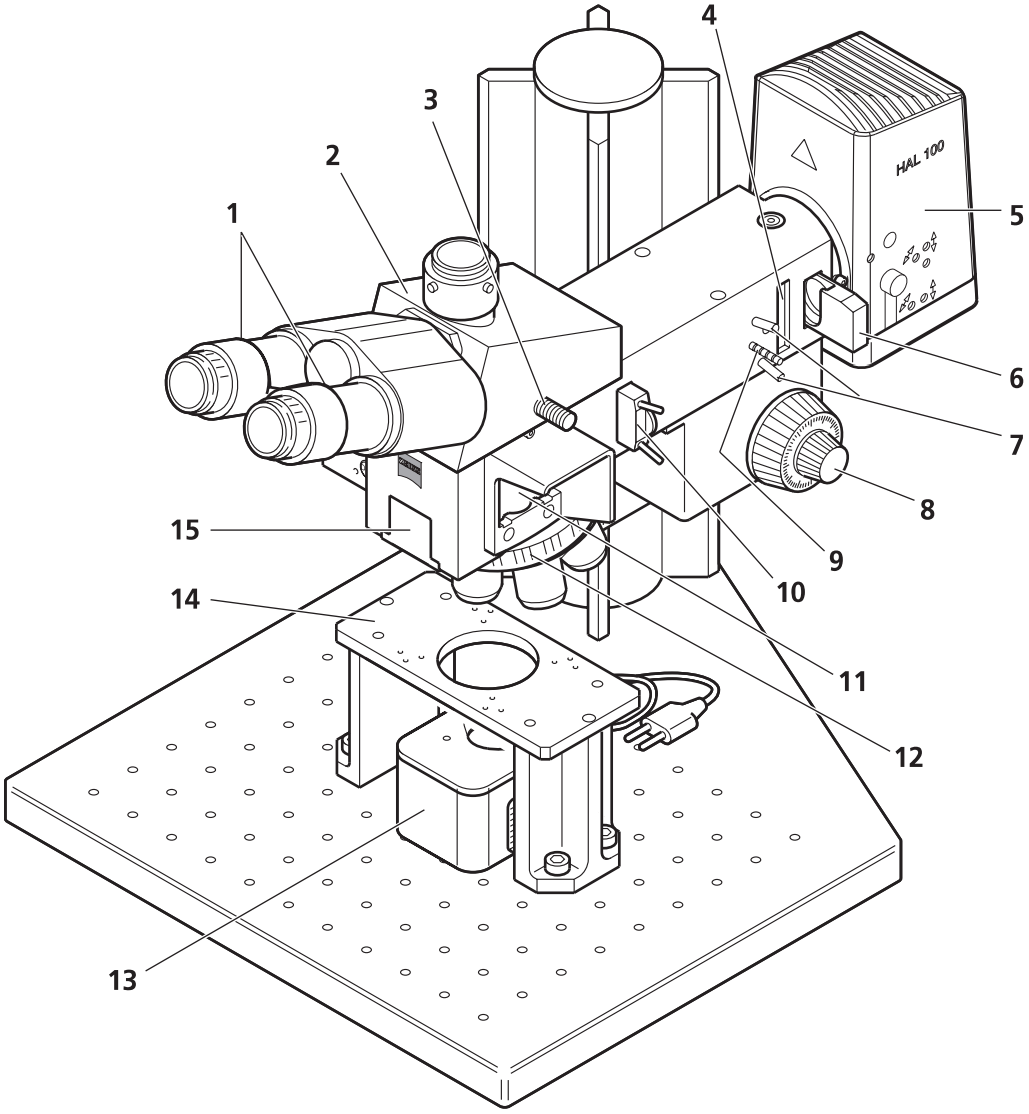
3.1.2 Operation and function controls of the Axiotech 100



1 Eyepieces
2 Binocular phototube 20°
3 Pushrod (to change the beam path)
4 Luminous-field diaphragm slider with centering screws and knurled wheel for reflected light
5 Compartment for 3D illumination shutter
6 Pushrod for reflected-light aperture diaphragm
7 Centering screws for reflected-light aperture diaphragm
8 Reflected-light illumination equipment (HAL 100)
9 Reflected-light filter slider
10 Lamp voltage display
11 Reflected-light illuminance control
12 On/Off switch with pilot lamp
13 Coaxial coarse and fine drive
14 Mechanical stage with specimen holder
15 Coaxial stage drive
16 Compartment for reflector slider
17 Objective nosepiece
18 Transmitted-light illumination equipment
19 Transmitted-light luminous-field diaphragm
20 Condenser carrier with condenser
21 Compartment for DIC slider

Fig. 3-2 Operation and function controls of the Axiotech 100

3.1.3 Operation and function controls of the Axiotech[vario] 100



1 Eyepieces
2 Binocular phototube 20°
3 Pushrod (to change the beam path))
4 Compartment for 3D illumination shutter
5 Reflected-light illumination equipment
6 Reflected-light filter slider
7 Centering screws for reflected-light aperture diaphragm
8 Coaxial coarse and fine drive
9 Pushrod for reflected-light aperture diaphragm
10 Luminous-field diaphragm slider with centering screws and knurled wheel for reflected light
11 Compartment for reflector slider
12 Objective nosepiece
13 Transmitted-light illumination equipment
14 Stage carrier H
15 Compartment for DIC slider

Fig. 3-3 Operation and function controls of the Axiotech[vario] 100

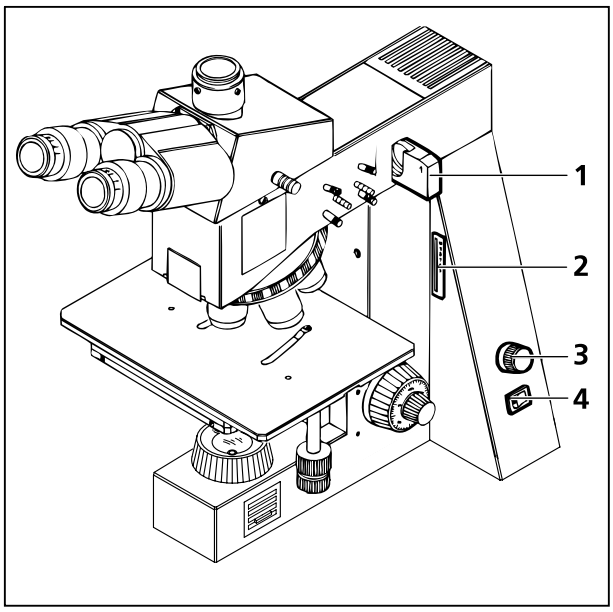


Fig. 3-4 Switch on the Axiotech 30 and Axiotech 100

3.2 Switch on the microscope

3.2.1 Switch on the Axiotech 30 and Axiotech 100

- Switch on the Axiotech 30/100 via the On/Off switch (3-4/**4**):
  – the green pilot lamp in the switch must light up and
  – depending on the position of the illuminance control (3-4/**3**), at least one LED of the lamp voltage display (3-4/**2**) must light up.
- Set required illuminance via the illuminance control (3-4/**3**). If required, insert attenuation filter in the filter slider (3-4/**1**) (also see section 2.9).

☞ When the On/Off switch is switched off, the **0** sign is visible.

The regulation range of the LED lamp voltage display lies between 1.5 and 6 V (in the end stop position, the correct color temperature of 3200 K for color photography is reached).

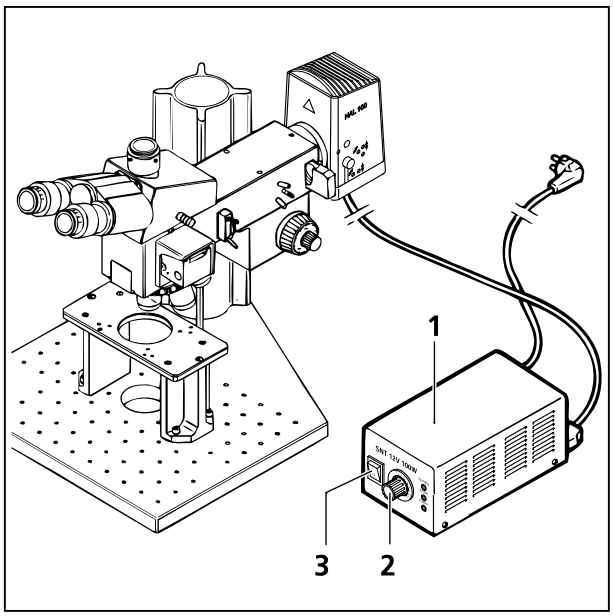


Fig. 3-5 Switch on the Axiotech[vario] 100 HD

3.2.2 Switch on the Axiotech[vario] 100 (separate SNT 12 V DC, 100 W power unit, stabilized)

- Switch on the separate SNT 12V DC 100 W power unit (3-5/**1**) via the On/Off switch (3-5/**3**).
  – The green pilot lamp in the switch must light up.
- Set illuminance to the required level via potentiometer (3-5/**2**).
  – At approx. 11.5 V, the color temperature of approx. 3200 K for color photography is reached.

3.3 Setting the microscope (basic settings)

The description of the steps required for the various illumination and contrasting techniques is based on the following microscope settings:

- As described in chapter 2, the Axiotech or Axiotech[vario] microscope is ready for operation and switched on as described in section 3.2.
- The pushrod (3-1/**3**), (3-2/**3**) or (3-3/**3**) to change the beam path is pushed in (subjective binocular observation). Various reflector sliders now permit the fast change between the various illumination and contrasting techniques.

3.4 Illumination and contrasting techniques

3.4.1 Setting of reflected-light brightfield for KÖHLER illumination

Reflected-light brightfield microscopy is the easiest and most usual optical microscopy technique for the examination of opaque samples or specimens, e.g. polished material sections or wafers.

In addition to so-called direct beam bundles, indirect bundles which are diffracted and scattered at the specimen details, are of major importance for an image as true to the object as possible. The greater the portion of these indirect bundles (aperture), the more the microscope image will be true to the object, according to **ABBE**.

The bundled illumination light coming from a reflected-light illuminator (3-6/**1**) is reflected from a color-neutral beam splitter (3-6/ **2**) and then passes the objective (3-6/**3**) which focuses the beams on the sample surface (3-6/ **4**) (so-called condenser function). The objective gathers the reflected or indirect beam portions and – together with the tube lens (3-6/ **5**) – produces the intermediary image which can then be viewed or documented objectively.

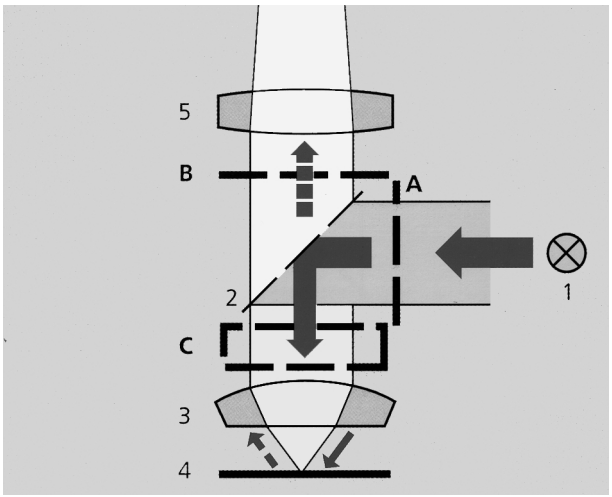


Fig. 3-6 **Reflected-light brightfield illumination**

To make use of the entire optical performance of the microscope and the objective in particular, the luminous-field diaphragm and the aperture diaphragm should be set in accordance with the regulations for **KÖHLER** illumination. These regulations for the setting of the microscope are described below in detail.

In reflected-light brightfield, the **KÖHLER** illumination principle requires the following settings of the luminous-field diaphragm and the aperture diaphragm:

- Perform steps described in sections 3.2 and 3.3.
- Move reflector slider HD DIC (3-7/**5**) or HD (3-7/**6**) in the brightfield position (**H** mark visible on the reflector slider).
- Place a high-contrast reflected-light specimen on the microscope stage.
- Swing 10× objective into beam path via knurled ring of the nosepiece.
- Look through the binocular tube (3-7/**7**) to see the preset and adjusted eyepieces (also see sections 2.5 and 2.5.2).

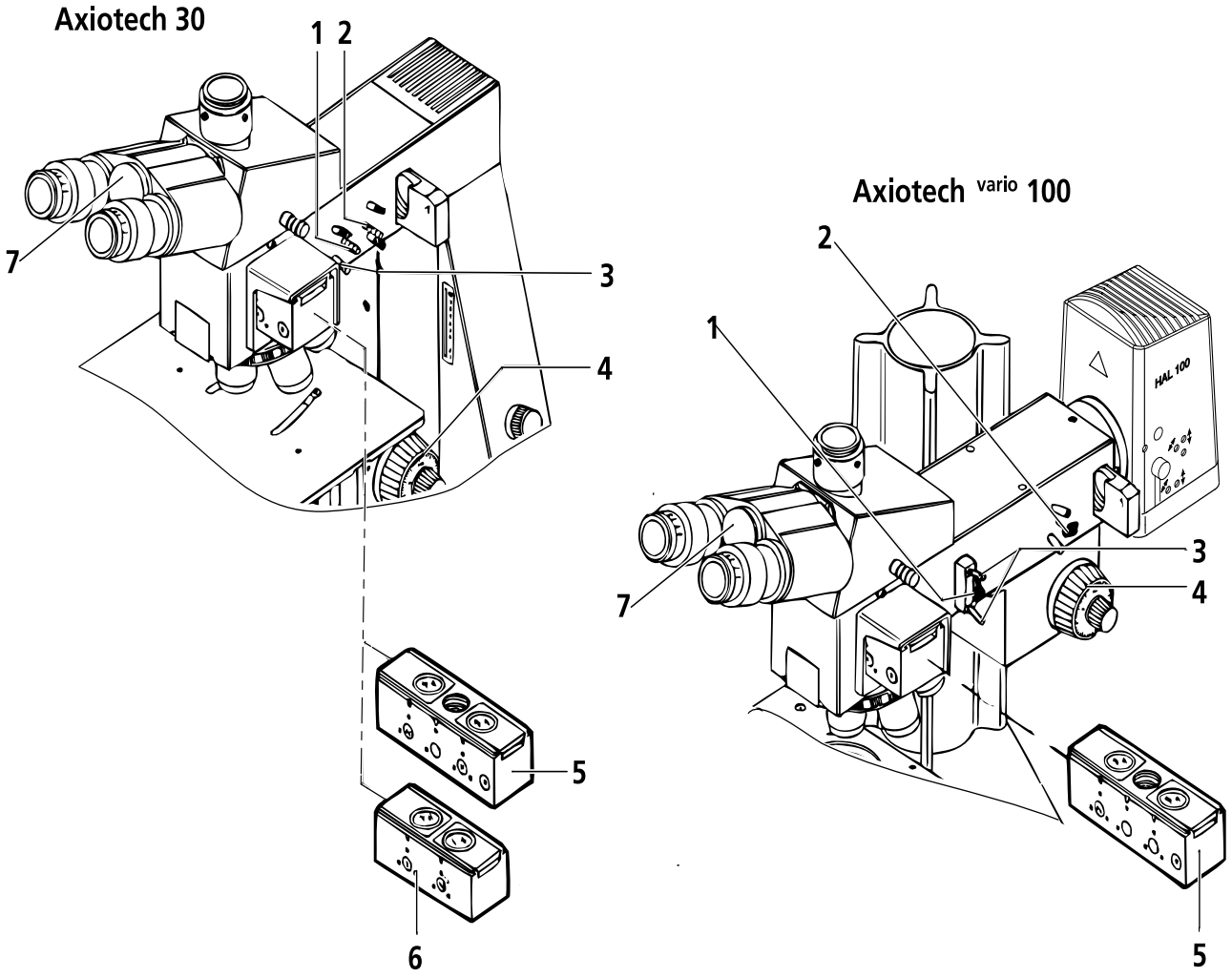


Fig. 3-7 Setting of reflected-light brightfield

- Focus on the specimen via the coaxial drive (3-7/**4**). If possible, always move the specimen away from the objective to avoid a collision between the objective and the specimen.
- Move aperture diaphragm (3-7/**2**) in center position (approx. half opened or half closed) by pulling out the pushrod.
- Pull out the pushrod or adjust the setting wheel to set (reduce) the diameter of the luminous-field diaphragm (3-7/**1**) until it is visible in the field of view (3-8/**A**).
- Use the coaxial focusing drive (3-7/**4**) to refocus on the edge of the luminous-field diaphragm (3-8/**B**) and use screws (3-7/**3**) to center the luminous-field diaphragm in the edge of the field of view (3-8/**C**).
- Then open the luminous-field diaphragm (3-7/**1**) until it just disappears behind the edge of the field of view (3-8/**D**).

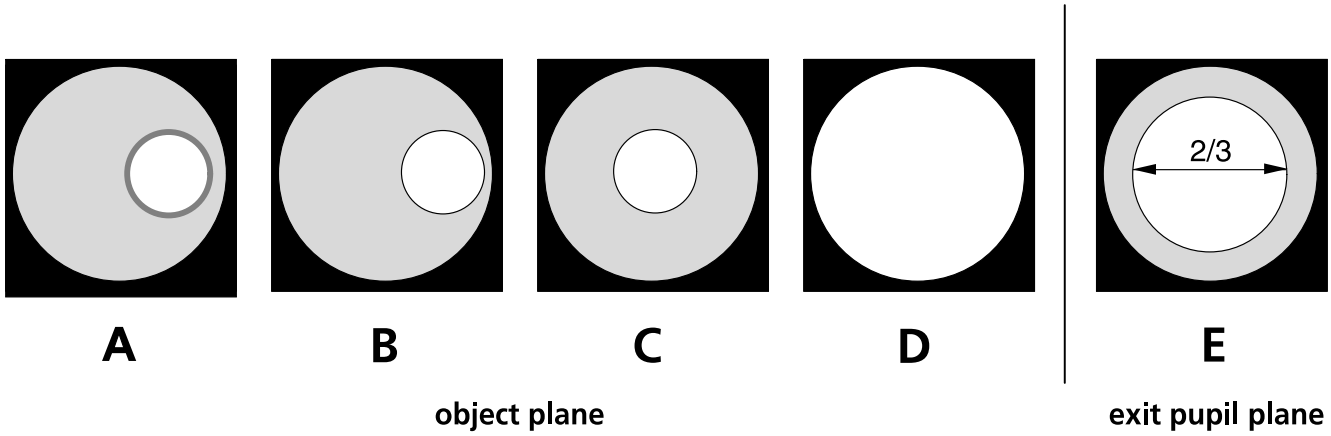


Fig. 3-8 Setting of diaphragm images according to KÖHLER

- To set the aperture diaphragm (image contrast), remove one eyepiece from the tube and look into the tube with your naked eye, or insert the centering telescope instead of the eyepiece.
- Center aperture diaphragm using centering screws (3-1/**7**), (3-2/**7**) or (3-3/**7**) and set pushrod (3-1/**6**), (3-2/**6**), (3-3/**9**) or (3-7/**2**) to approx. 2/3 of the exit pupil diameter of the objective for specimens of medium contrast (3-8/**E**). In most applications, this setting of the aperture diaphragm provides optimum contrast at almost full resolution and is therefore the best compromise for the human eye.
- Finally, refocus on the specimen via the coaxial coarse and fine drive (3-7/**4**) and match the image brightness to the reflected-light specimen.

☞ Since field size and objective aperture change after every objective change, the settings of the luminous-field diaphragm and the aperture diaphragm described above must be repeated. Do not use the aperture diaphragm for adjustment of the image brightness, but use illuminance control (3-4/**3**) or the attenuation filter instead, as described under 2.9.1!

3.4.2 Setting of reflected-light darkfield

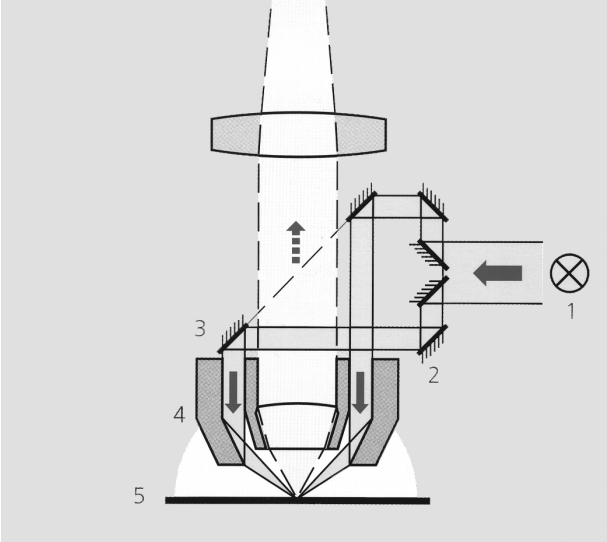


Fig. 3-9 **Reflected-light darkfield illumination**

The reflected-light darkfield technique is ideal for the inspection of surfaces. The illumination light coming from the reflected-light illuminator is directed into the darkfield channel of the HD objective (3-9/**4**) via a component combined of a prism system (3-9/**2**) and a ring mirror (3-9/**3**). After passing a ring-shaped concave mirror, the light rays are directed on the sample surface (3-9/**5**) by glazing incidence. Only the diffracted and scattered light bundles which are so important for image production return to the objective, while the directly reflecting light bundles are guided past the objective. This is one of the reasons why even fine structures can be resolved and appear bright on a dark background although they partially lie below the resolving power of the light microscope.

- Perform steps described in sections 3.2 and 3.3.

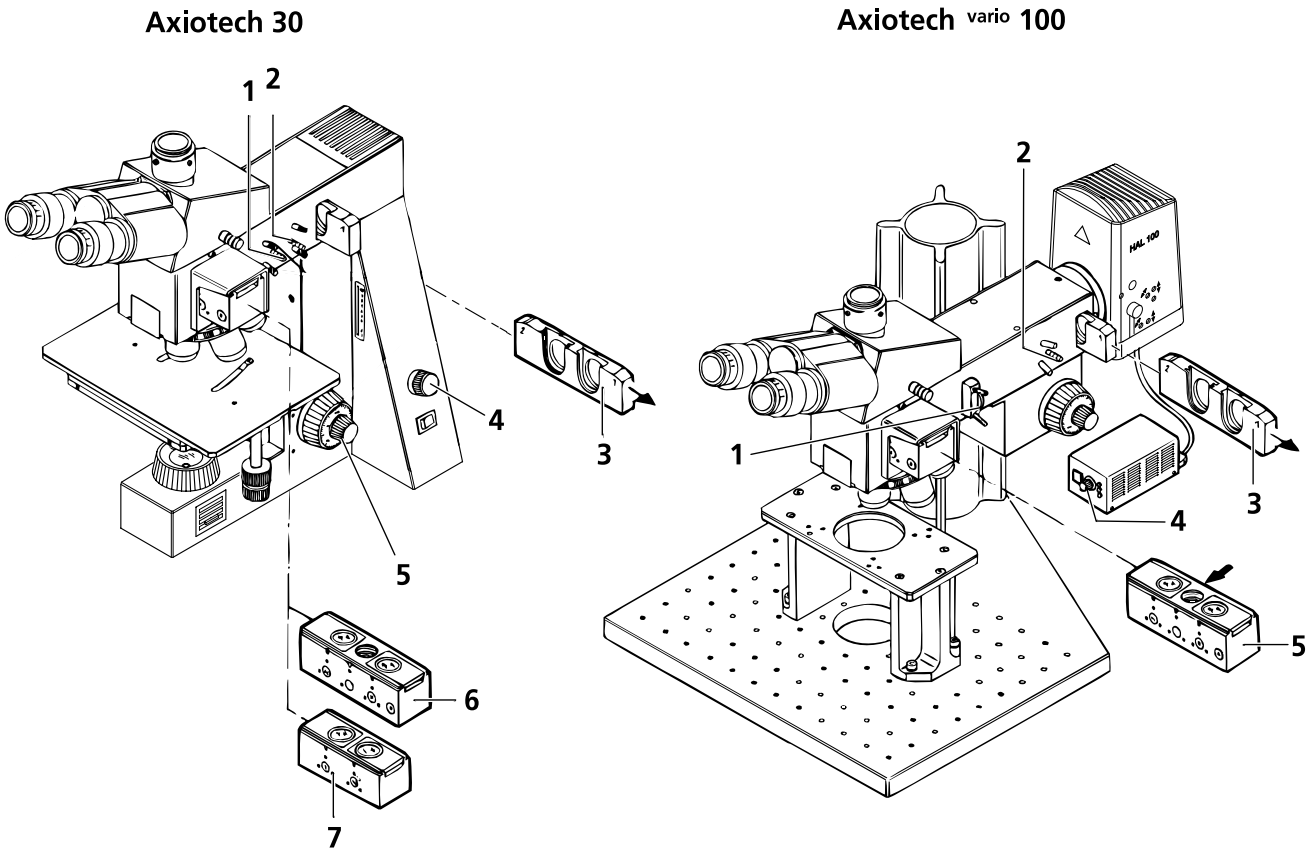


Fig. 3-10 Setting of reflected-light darkfield

- Remove any light and/or attenuation filter which might be in the beam path, i.e. pull out the filter slider (3-10/**3**) completely or switch to the free light path position.
- Push reflector slider HD or HD DIC (3-10/**7** or **6**) into the reflected-light illuminator until the darkfield position is switched on (**D** mark visible on the reflector slider).
- Open the luminous-field diaphragm (3-10/**1**) and the aperture diaphragm (3-10/**2**) completely.
- Turn illuminance control (3-10/**4**) to the right stop position (full lamp voltage); if required, match the brightness to the specimen.
- Focus on the specimen via the coarse/fine drive (3-10/**5**).

☞ Darkfield microscopy requires specimens and optical surfaces to be extremely clean. Finger prints and traces of grease in particular have negative effects, since they brighten the background of the field of view and reduce the image contrast.

3.4.3 Setting of reflected-light interference contrast

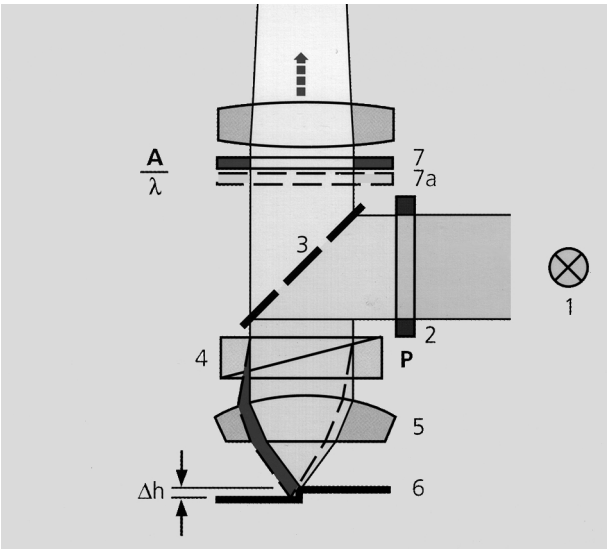


Fig. 3-11 Reflected-light interference contrast

Differential interference contrast (DIC) is based on polarization contrast and is ideal for the visualization of minute elevation differences in surfaces. A birefringent prism (3-11/**4**) is used to split the polarized illumination beams in two partial beams with slight lateral displacement. These two beams hit the sample surface (3-11/**6**) with lateral displacement from each other and pass slightly different optical paths in accordance with the Δh differential elevation differences. The partial beams now assigned with a path difference of 2Δh then pass the objective (3-11/**5**) and the birefringent prism (3-11/**4**) in the opposite direction and can interfere with each other after passing the analyzer (3-11/**7**) because they now feature the same vibration direction again. In the intermediate image, the path difference assigned on the sample surface (3-11/**6**) changes into gray values which can be seen by the eye. Steps become visible as a relief. An additionally inserted lambda plate (3-11/**7a**) changes the gray values into colors again.

The Axiotech and Axiotech[vario] allow differential interference contrast to be performed with all objectives with magnification ≥ 5×.

- Perform steps described in sections 3.2 and 3.3.

☞ The DIC technique with reflector slider HD DIC (3-12/**3**) can be performed in two different ways:

- Version 1: DIC prism slider (3-12/**5**) with fine adjustment for Epiplan objectives and with DIC compensator (λ), Cat. No. 444410-0000-000
- Version 2: DIC compensation prism slider (3-12/**4**) for Epiplan, Epiplan-Apochromat and Epiplan-Neofluar objectives, Cat. No. 444411-0000-000.

Version 1:

- Remove any light/attenuation filters from the beam path, i.e. pull out the filter slider or switch to the free light path position.
- Push HD DIC reflector slider into the reflected-light illuminator until the DIC position is active (**DIC** mark visible on the reflector slider).

Axiotech 30 **Axiotech 100**

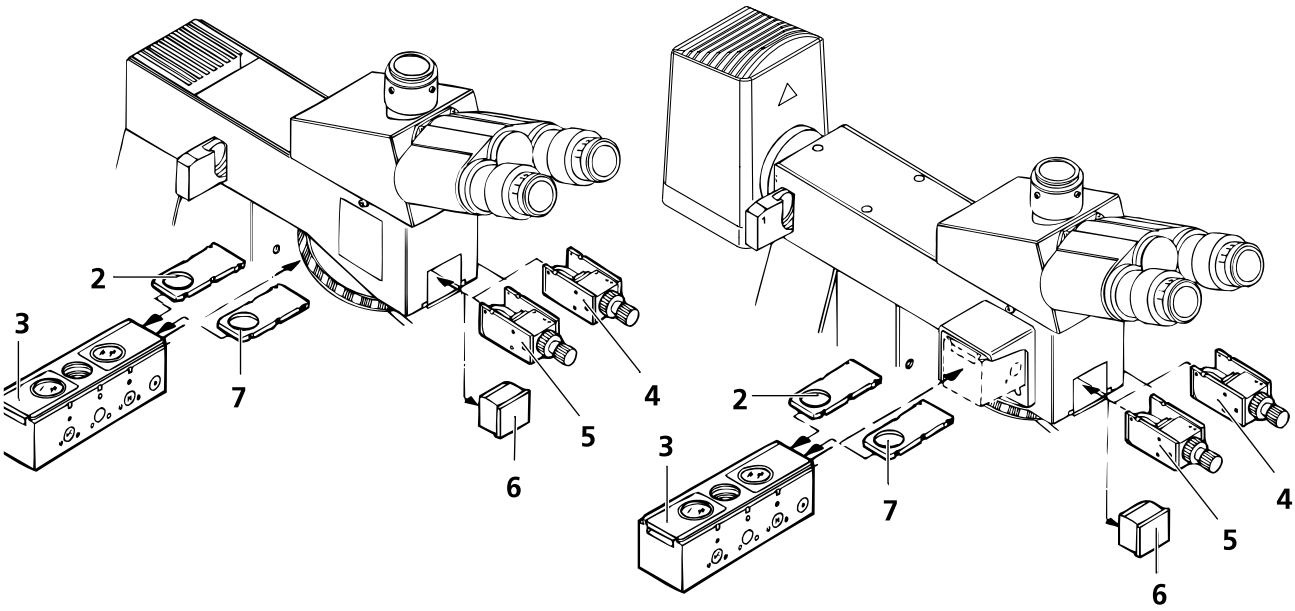


Fig. 3-12 Setting of reflected-light interference contrast

- Place a strongly reflecting specimen on the stage and focus on it.
- Replace protection slider (3-12/**7**) with DIC (λ) compensator (3-12/**2**) and push it into the reflector slider until the first stop (i.e. the DIC (λ) compensator is not yet inserted in the beam path).
- Remove protection cap (3-12/**6**) from the reflected-light illuminator and replace it with the DIC- prism slider with fine adjustment (3-12/**5**).
- Insert DIC prism slider with fine adjustment (3-12/**5**) until stop.

☞ When pushed in half the way, the DIC prism slider can remain in the instrument even if the DIC technique is not applied. When changing from DIC to brightfield H or darkfield D, the DIC prism slider must be pulled out until stop.

- Swing required objective in the beam path .
- Focus on the specimen via the coaxial coarse/fine drive.
- Turn large knurled knob of DIC prism slider until the field center appears as dark as possible.
- Turn small knurled knob of DIC prism slider until the field of view displays homogeneous brightness.

☞ Slightly move the small and the large knurled knob to obtain more homogeneous illumination.

- Set optimum contrast (depending on the application performed and the specimen) via the large knurled knob.

☞ After a change of objectives, the three steps described last must be repeated.

- To change gray contrasts into color contrast, insert the DIC (λ) compensator (3-12/**2**) into the HD DIC reflector slider until stop.

Version 2:

- Perform the same steps as described for version 1.

☞ The DIC (λ) compensator is not required for the DIC compensation prism slider (3-12/**4**). The protection slider can remain in the HD DIC reflector slider.

- Vary the color contrast by turning the large knurled knob of the DIC compensation prism slider (3-12/**4**).

3.4.4 Setting of reflected-light polarization contrast

Reflected-light polarization contrast is the ideal technique for surface structures which change the state of polarization during reflection. The illumination light (3-13/**1**) is linearly polarized by the polarizer (3-13/**2**) and, after passing the objective (3-13/**4**), hits the sample surface (3-13/**5**) where it is reflected. Here, the beam portions experience structure-dependent path differences and polarization-optical rotations which are visualized as different gray values after the analyzer (3-13/**6**) has been passed. A compensator with lambda plate (3-13/**6a**) enables the change from gray contrast to color contrast.

When objectives with a very low magnification are used, a rotary λ/4 plate (Antiflex cap) in front of the objective permits otherwise unavoidable reflection to be also eliminated from "dark" sample surfaces.

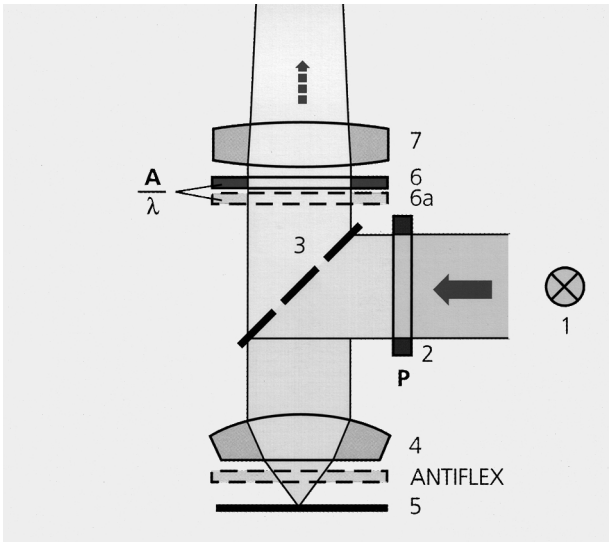


Fig. 3-13 Reflected-light polarization contrast

- Perform steps described in sections 3.2 and 3.3.

☞ No filter should be inserted in the beam path for intensity reasons.

- Do not leave the DIC prism slider (3-14/**5**) in any function position, i.e. either push it in until the first stop or remove it completely and replace it with the protection cap (3-12/**6**).
- If required, remove filter slider (3-14/**1**) with filters or switch to free light path.
- Push HD DIC reflector slider (3-14/**3**) into the reflected-light illuminator until the DIC position is active (**DIC** mark visible on the reflector slider).

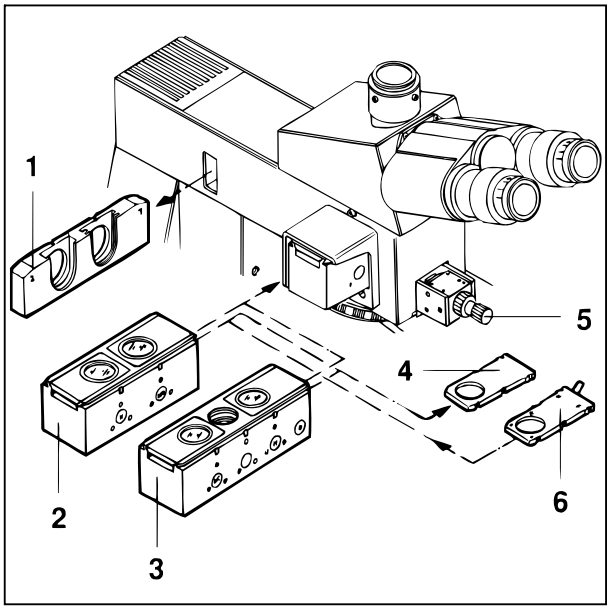


Fig. 3-14 Setting of reflected-light polarization contrast

☞ Polarizer and analyzer are firmly integrated in the reflector slider with the appropriate orientation to each other.

- Place specimen on the stage, set the required magnification, focus and view the specimen in the polarization contrast now present.
- To obtain color contrast of anisotropic specimen details, remove the dust protection insert (3-14/**4**) and replace it with the Pol compensator (λ-sub) (3-14/**6**) which is inserted in the reflector slider from the right. The color intensity can then be varied via the adjusting lever of the compensator.

☞ Adjustment of the lever on the compensator permits anisotropic specimens to be visualized when non-rotary stages are used.

3.4.5 Setting of epi-fluorescence

The epi-fluorescence technique permits high-contrast images of fluorescent substances in typical fluorescence colors. In the epi-fluorescence microscope, the light (3-15/**1**) generated by a high-performance illuminator reaches the excitation filter (3-15/**A**) (bandpass) via a heat-reflecting filter. The filtered, short-wave excitation emission (3-15/**2**) is reflected from a dichroic beam splitter (3-15/**B**) and focused on the specimen via the objective. The specimen absorbs the short-wave emission and then emits long-wave fluorescence (3-15/**3**) (**STOKES**'s law) which is now gathered by the objective and transmitted by the dichroic beam splitter (3-15/**B**). Finally, the beams pass a barrier filter (3-15/**C**) (longpass) which allows only the long-wave emission (3-15/**3**) from the specimen to be transmitted.

The spectrum of excitation and barrier filters, which are positioned in the 3 FL reflector slider together with the appropriate dichroic beam splitter, must be matched very precisely.

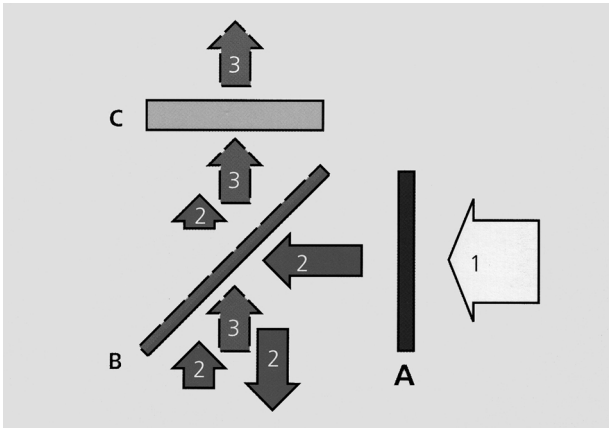


Fig. 3-15 Epi-fluorescence

The epi-fluorescence technique is only described for the Axiotech 100 and the Axiotech[vario] 100, since only these models permit attachment of different illuminators for fluorescence.

The following components are required for epi-fluorescence:

- Filter slider FL with two mounts for dia. 25 mm filters, excitation filter, barrier filter, or
- 3 FL reflector slider, excitation filter, barrier filter.

The HBO 50 illuminator can also be attached, if requested.

The halogen illuminators 6 V 30 W or 12 V 100 W can also be used for strongly fluorescent specimens.

The following measures and settings are required for epi-fluorescence.

3.4.5.1 Setting of epi-fluorescence using the FL filter slider

- Perform steps described in sections 3.2 and 3.3.
- If required, replace HAL 12 V 100 W halogen lamp (3-16/**2**) of the Axiotech 100 or Axiotech[vario] 100 with the HBO 50 illuminator (also see operating manual G 42-160 entitled "Microscope Illuminator with HBO 50").
- Remove attenuation filter (3-16/**5**) of brightness position from the HD DIC reflector slider (3-16/**6**) (see change of filters in reflector slider, Fig. 3-14).
- Move HD or HD DIC reflector slider (3-16/**6**) in position **H**.
- Remove filter slider (3-16/**1**) from the instrument. Press excitation filters into the filter mount in the direction of the arrow (see magnified drawing of FL filter slider 3-16/**3**) and insert the FL filter slider (3-16/**3**) equipped with excitation filters.

☞ In the case of the Axiotech[vario], bolt (3-16/**4**) must be removed from the FL filter slider, since otherwise the slider will hit the stand column and cannot be inserted into the beam path.

- Insert barrier filter (3-16/**7**) into the dust protection slider (3-16/**8**) and push the slider laterally into the reflector slider (3-16/**6**) (brightfield position!).

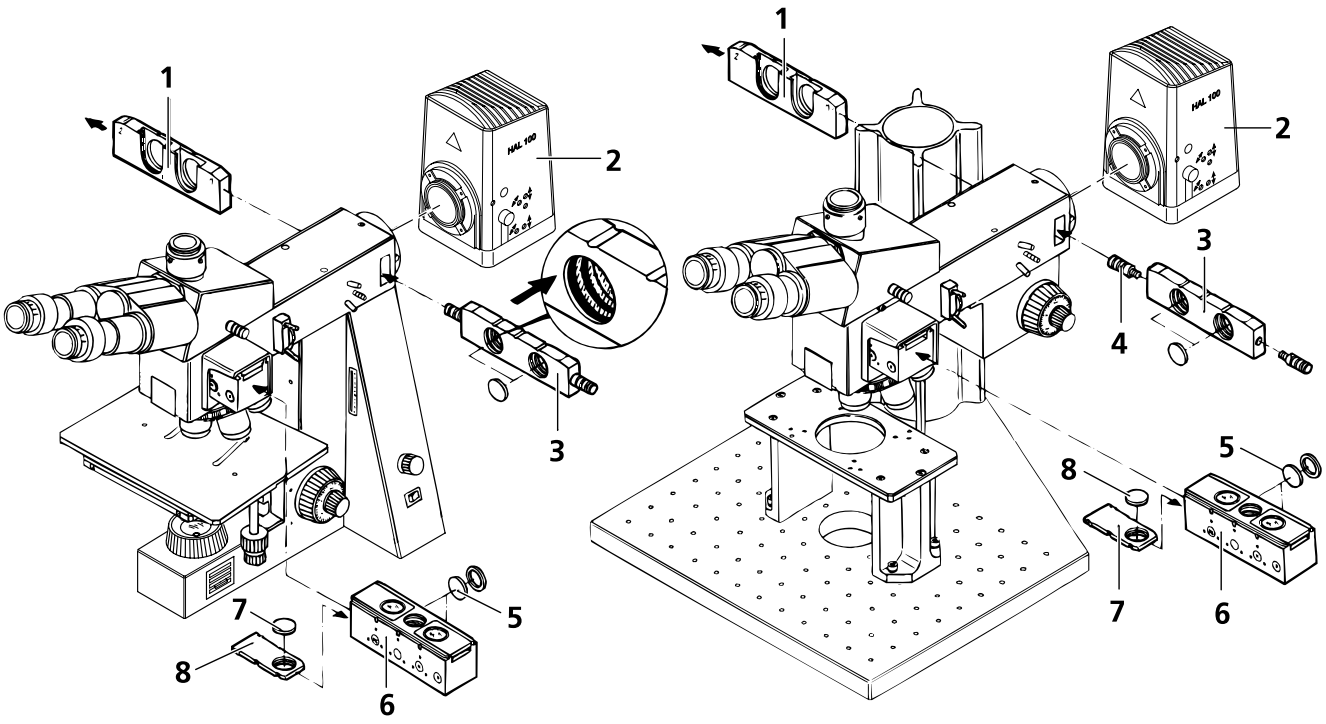


Fig. 3-16 Setting of epi-fluorescence using the FL filter slider

3.4.5.2 Setting of epi-fluorescence using the 3 FL reflector slider

- Perform steps described in sections 3.2 and 3.3.
- The 3 FL reflector slider (3-17/**3**) replaces the reflector slider HD or HD DIC.

☞ The reflector sliders HD and HD DIC can only be pulled out if one of the dust caps (3-19/**5** or 3-17/**2**) has been removed from the left or right side of the stand. To do this, unscrew, the two hexagonal screws (3-19/**6**) from one side using the SW 3 ball-headed screwdriver, remove the dust cap and pull out the reflector slider **very carefully**, since a darkfield component projects from the reflector slider.

- Attach removed lateral dust cap again.
- Move filter slider (3-17/**1**) to free light path position.
- In the center position of the 3 FL reflector slider, select the required specimen spot in reflected-light brightfield and refocus on it via the coarse/fine drive, if required.
- Move the user-specific fluorescence filter combinations in the beam path until the left or right stop position of the 3 FL reflector slider.
- Open the aperture diaphragm completely.

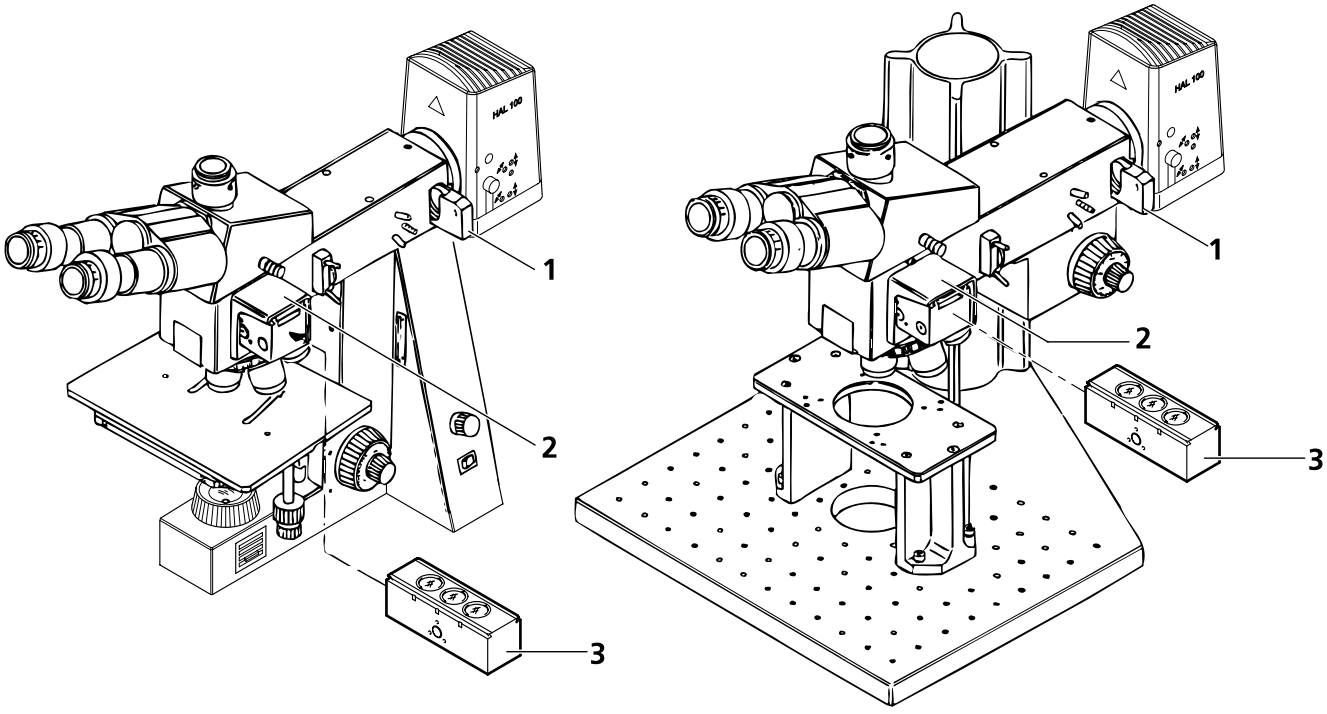


Fig. 3-17 Setting of epi-fluorescence using the 3 FL reflector slider

☞ The 3 FL reflector slider has three stop positions, with the center position being equipped with the FT 395 chromatic beam splitter for reflected-light brightfield. This short-wave chromatic beam splitter permit "quasi" brightfield illumination. If required, this reflector slider position can be upgraded in a filter set for UV excitation by the insertion of filters. The two other stop positions contain complete fluorescence filter combinations specially selected by the user.

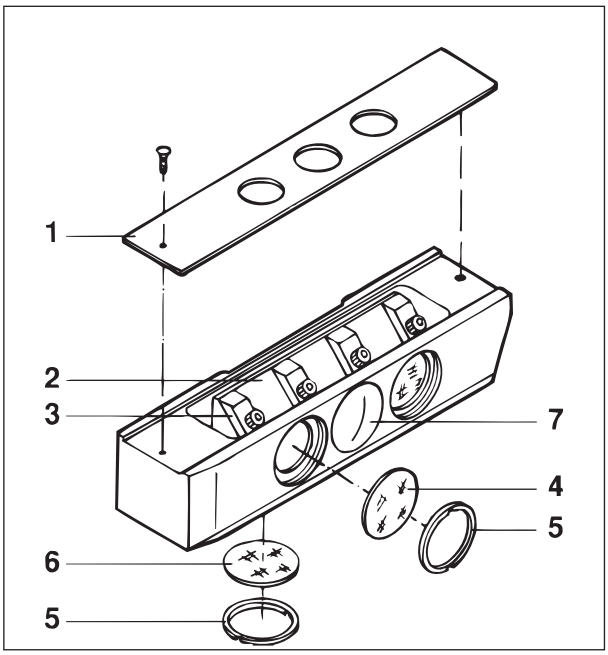


Fig. 3-18 3 FL reflector slider

Excitation filters (3-18/**4**), barrier filters (3-18/**6**) and chromatic beam splitters (3-18/**2**) can be inserted and exchanged; the excitation and barrier filters are accessible and can be exchanged after unscrewing the retainer rings (3-18/**5**), and the chromatic beam splitter after removing the base plate (3-18/**1**) and loosening the mounts (3-18/**3**).

The coating of the chromatic beam splitter must not be touched with your bare hands, and must point to the excitation filter after insertion (i.e. in the direction of the light source).

Depending on the application, various filter sets (see overview) can be ordered and inserted into the reflector slider.

Overview of fluorescence filter sets and chromatic beam splitters (for use in the 3 FL reflector slider)

1.	Filter set 01, UV excitation 365 nm	488001-0000-000	bitumen, petrol products, wood
2.	Filter set 05, blue-violet excitation 395 ... 440 nm	488005-0000-000	cellulose, wood, ceramics
3.	Filter set 09, blue excitation 450 ... 490 nm	488009-0000-000	epodye infiltration of building materials
4.	Filter set 14, green excitation 510 ...560 nm	488014-0000-000	residual paint, contamination
5.	Filter set 18, UV-violet excitation 390 ... 420 nm	488018-0000-000	bitumen, petrol products, wood

For special excitation techniques, please ask for the complete literature on fluorescence filter sets.

3.4.6 Change of filters in the reflector slider

In its brightfield position, the HD (3-19/**1**) or HD DIC (3-19/**2**) reflector slider contains an integrated attenuation fi lter D = 0.25 (25 % transmission), dia. 25 mm.

This filter prevents the user from being dazzled when changing the reflected-light microscopy technique from darkfield (D) to brightfield (H) or from differential interference contrast (DIC) to brightfield (H).

Unscrew the retaining ring (3-19/**3**) and replace the dia. 25 attenuation filter (3-19/**4**) D = 0.25 with a neutral-density filter, e.g. D = 0.06, dia.25.

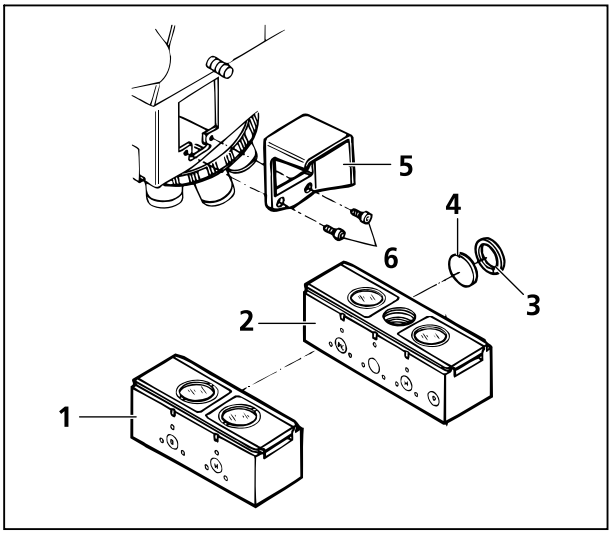


Fig. 3-19 Change of filters in the reflector slider

☞ The reflector sliders HD or HD DIC can only be pulled out if one of the dust caps (3-19/**5**) has been removed from the left or right side of the stand. To do this, unscrew the two hexagonal screws (3-19/**6**) from one side using the SW 3 ball-headed screwdriver, remove the dust cap and pull out the reflector slider **very carefully**, since a darkfield component projects from the reflector slider!

3.4.7 Setting of transmitted-light brightfield for Köhler illumination

Transmitted-light brightfield microscopy is the most usual of all the optical techniques, since it allows the easy and fast viewing of high-contrast or stained specimens.

In transmitted-light brightfield, the KÖHLER illumination principle requires the following settings of the condenser, the luminous-field diaphragm and the aperture diaphragm:

- Perform steps described in sections 2.13.1, 2.13.2 and 3.3.
- Move reflector slider HD DIC or HD to the darkfield position (**D** mark visible on the reflector slider, 100 % of light passing through transmitted light) or, alternatively, to the brightfield position (**H** mark visible, only approx. 50 % of light passing through the beam splitter).
- Place a high-contrast specimen on the microscope stage (3-1/**14**).
- Swing 10× objective into beam path via knurled ring of the nosepiece.
- Look through the binocular tube to see the preset and adjusted eyepieces.
- Focus on the specimen via the coaxial drive (3-1/ **13**). If possible, always move the specimen away from the objective to avoid collision between the objective and the specimen.
- Carefully move condenser, e.g. ABBE condenser 0.9/1.25 (3-21), to the upper stop position via the condenser drive.
- Set (reduce) diameter of the luminous-field diaphragm (3-1/**19**) until it is visible in the field of view (3-20/**A**). Focus the edge of the luminous-field diaphragm by slightly lowering the condenser (color-free edge) (3-20/**B**) and center the image of the luminous-field diaphragm using the two condenser centering screws (3-23/**3**) (3-20/**C**).

  Open the transmitted-light luminous-field diaphragm (3-1/**19**) until it just disappears behind the edge of the field of view (3-20/**D**).

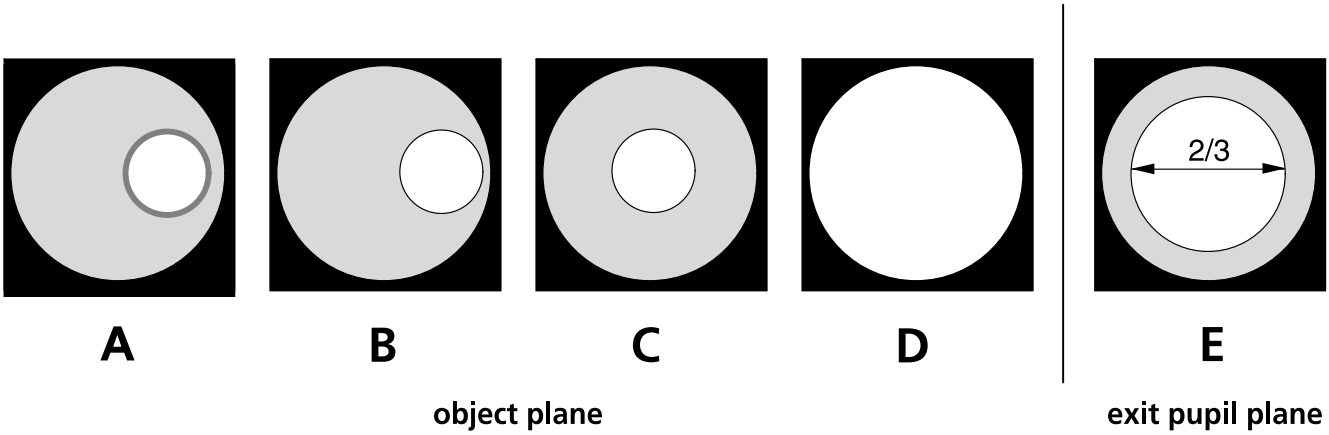


Fig. 3-20 Setting of diaphragm images according to KÖHLER

- Remove the eyepiece, look into the tube and use the centering telescope to center the aperture diaphragm with the exit pupil opening using the two knurled screws (3-21/**2**). Then use the knurled ring (3-21/**1**) to set the aperture diaphragm to approx. 2/3 of the diameter of the objective exit pupil (3-20/**E**). Specimens featuring standard contrast should always be viewed with an aperture diaphragm opening of approx. 2/3 of the diameter of the objective exit pupil. Of course, it is possible to deviate from this rule depending on special specimen features or for other reasons. Tighten fixation screw (3-21/**3**) to retain this setting.
- Finally, refocus on the specimen via the coaxial fine drive.

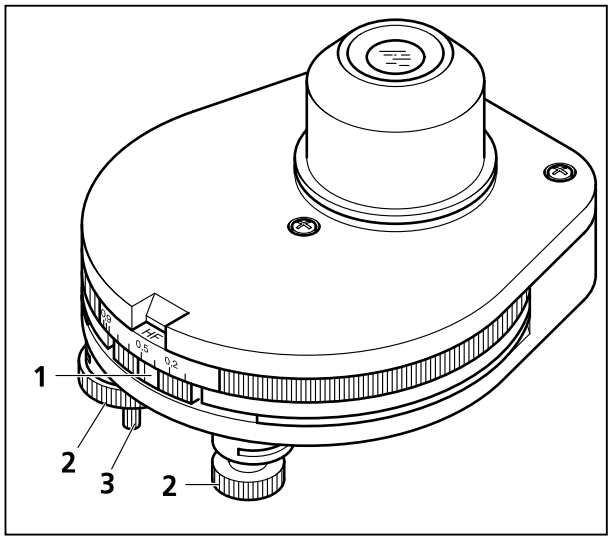


Fig. 3-21 ABBE condenser 0.9/1.25

☞ Since field size and objective aperture change after every objective change, the setting of luminous-field diaphragm and aperture diaphragm must be repeated as described above.
For all objective magnifications V_{Obi} < 10×, the front lens 0.9 of the swing-in condenser 0.9 Z Pol must be removed from the optical beam path.

3.4.8 Setting of transmitted-light polarization contrast

Transmitted-light polarization contrast is used with specimens which change the polarization state of light. Such specimens, e.g. crystals, minerals or polymers, are termed as birefringent. If birefringent substances are viewed between crossed polarizers (polarizer ⊥ analyzer), they appear bright while their surrounding remains dark.

Birefringent substances are recognized by the fact that they display 4 bright and 4 dark positions between crossed polarizers after rotation of the microscope stage around 360°. Depending on the level of birefringence, thickness and orientation of the object, interference colors will occur from gray (usually in biological objects) to white, yellow, red and blue. These interference colors can be of 1 st or higher order.

3.4.8.1 Transmitted-light polarization contrast with the reflector slider HD DIC on the Axiotech 30 and Axiotech 100

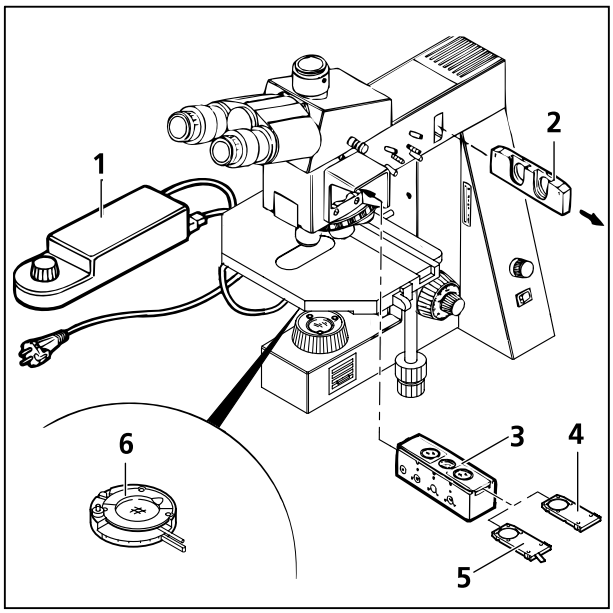


Fig. 3-22 Setting of transmitted-light polarization contrast with reflector slider HD DIC (Axiotech 30/100)

The rotary polarizer D (3-23/**13)** or the swing-in polarizer (3-23/**6**) are available to choose from for the Axiotech 30 and 100.

The rotary polarizer D (3-23/**13**), Cat. No. 453620-0000-000, is oriented in the EAST-WEST vibration direction (zero position). This polarizer is inserted into the beam path until stop, with the lower lever (3-23/**15**) pointing to the right. The upper lever on the rotary bearing of the polarizer (3-23/**14**) must be swung into the zero position (stop) and must point to the front.

The swing-in polarizer, Cat. No. 453617-0000-000, is factory-aligned for orientation in EAST-WEST direction. This polarizer is just swung into the beam path until stop, with the lever pointing to the front.

- Perform steps described in sections 2.13.1, 2.13.2 and 3.3.

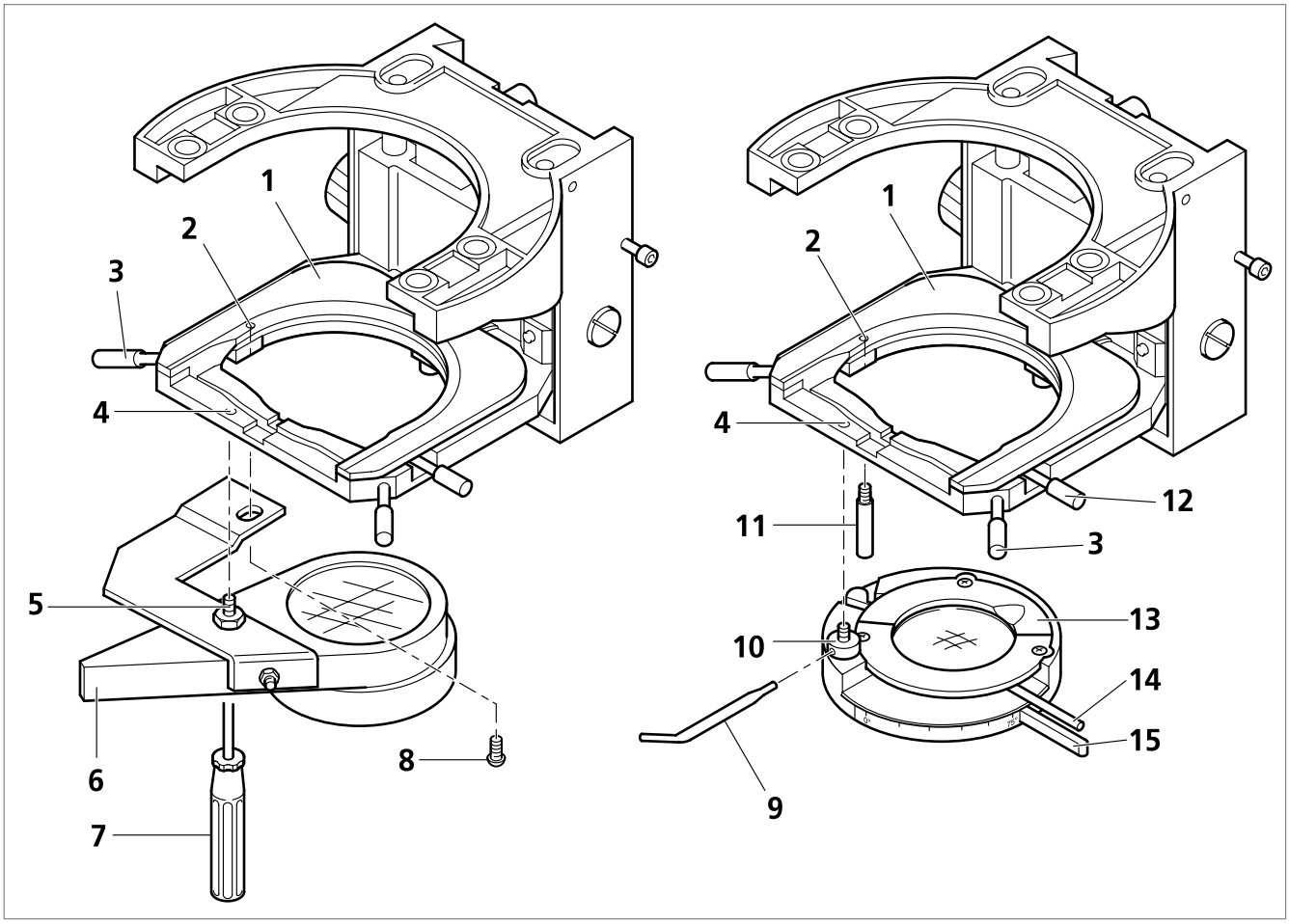


Fig. 3-23 Attach polarizer to stage carrier D

- Attach selected polarizer to the underside of the stage carrier D with screws (3-23/**5** and **8** or **10**) and stop screw (3-23/**11**).
- Place specimen to be examined on the microscope stage and fix it.
- Push reflector slider HD DIC (3-22/**3**) into the reflected-light illuminator until the DIC position is active (**DIC** mark visible on the reflector slider). The analyzer is integrated in the reflector slider and must be switched in orientation position.
- Swing polarizer D (3-23/**13**) into the beam path using the lower lever (3-23/**15**) and move the upper lever (3-23/**14**) into the zero stop position. The upper lever (3-23/**14**) will then point to the front.

☞ No filter should be inserted in the beam path for intensity reasons (remove filter slider (3-22/**2**)).

- Set maximum darkness position in the field of view (crossed polars) by slightly turning polarizer D via lever (3-23/**14**).

- Set optimum polarization image by turning the specimen (turn the specimen itself when the fixed mechanical stage is used, or the stage when using the rotary mechanical stage!).
- If required, the compensator DIC lambda or Pol lambda sub, ± 10° (3-22/**5**) can also be inserted in the reflector slider HD DIC from the right, and the adjusting lever of the latter can be used to optimize the image contrast.

3.4.8.2 Transmitted-light polarization contrast with reflector slider HD DIC on the Axiotech[vario] 100

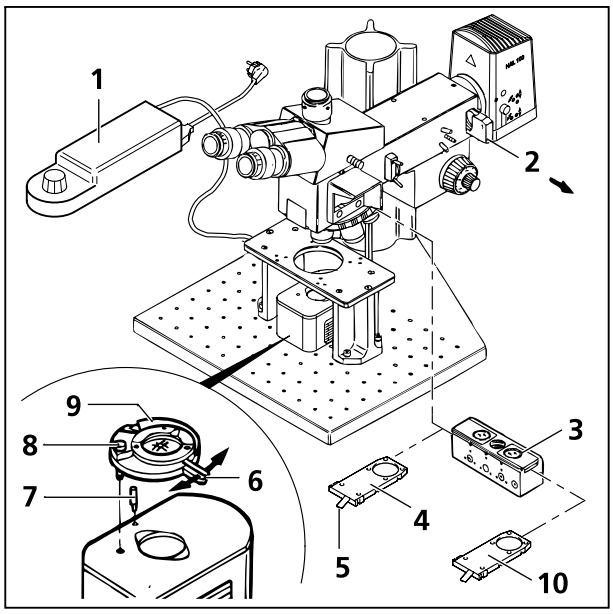


Fig. 3-24 Setting of transmitted-light polarization contrast with reflector slider HD DIC (Axiotech[vario] 100)

The rotary polarizer D (3-24/**9**) is used with the Axiotech[vario] 100.

- Perform steps described in sections 2.13.3, 2.13.4 and 3.3.
- Use screw (3-24/**8**) and bolt (3-24/**7**) to screw polarizer D in the marked, threaded holes of the transmitted-light equipment. Use the supplied pin spanner to tighten the screw.
- Place specimen to be examined on the microscope stage and fix it.
- Push reflector slider HD DIC (3-24/**3**) into the reflected-light illuminator until the DIC position is active (**DIC** mark visible on the reflector slider). The analyzer is integrated in the reflector slider and is switched in orientation position.
- Unlike DIC, the brightfield position (**H** mark visible on the reflector slider) requires the rotary analyzer slider (3-24/**4**) to be inserted in the reflector slider HD DIC until stop on the left side. The adjusting lever (3-24/**5**) of the ± 10°rotary analyzer slider permits the image contrast to be further optimized with crossed polars.
- Use the lower lever (3-23/**15**) to swing polarizer D (3-23/**13**) into the beam path and move the upper lever (3-23/**14**) into the zero stop position (the upper lever will then point to the front).

☞ No filter should be inserted in the beam path for intensity reasons (remove filter slider (3-24/**2**)).

- Set maximum darkness position in the field of view (crossed polars) by slightly turning the upper lever (3-24/**6**) of polarizer D.

- Set optimum polarization image by turning the specimen (turn the specimen itself when the fixed mechanical stage is used, or the stage when using the rotary mechanical stage!).
- If required, the compensator DIC lambda or Pol lambda sub, ± 10° (3-24/**10**) can also be inserted into the reflector slider HD DIC from the right, and the adjusting lever of the latter can be used to optimize the contrast.

3.4.8.3 Transmitted light polarization contrast using reflector slider without DIC position on the Axiotech 30 and Axiotech 100

☞ Polarization contrast using the reflector slider without DIC position in combination with the transmitted-light equipment is possible with the ± 10° rotary analyzer slider, Cat. No. 453686-0000-000.

- Perform steps described in sections 2.13.1, 2.13.2 and 3.3.
- Place the specimen to be examined on the microscope stage and fix it.
- Use the lower lever (3-23/**15**) to swing polarizer D (3-23/**13**) into the beam path of the condenser module, and move the upper lever (3-23/**14**) into the zero position until stop (the upper lever will then point to the front).
- Push HD reflector slider (3-25/**4**) into the reflected-light illuminator until the H position is active (**H** mark visible on the reflector slider). Insert the ± 10° rotary analyzer slider (3-25/**5**) into the left mount of the HD reflector slider until stop. The adjusting lever (3-25/**6**) of the ± 10° rotary analyzer slider permits the image contrast to be further optimized with crossed polars.
- The Pol reflector slider (3-25/**2**), which can be used as an alternative, features an integrated analyzer in the function position and can therefore also be equipped with the compensator DIC lambda or Pol lambda sub ± 10° (3-25/**3**). Since no beam splitter is required, the Pol reflector slider has the additional benefit of an intensity gain of about 50%.

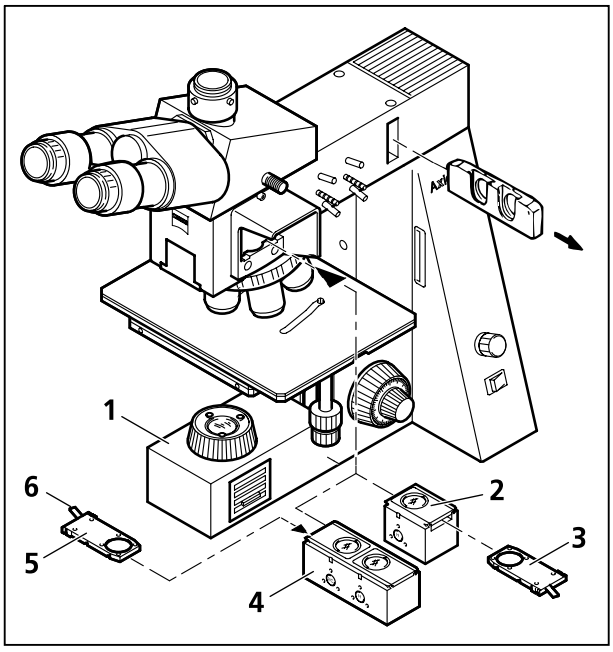


Fig. 3-25 Setting of transmitted-light polarization contrast using reflector slider without DIC position (Axiotech 30/100)

3.4.8.4 Transmitted-light polarization contrast using reflector slider without DIC position on the Axiotech[vario] 100

☞ Polarization contrast using the reflector slider without DIC position in combination with the transmitted-light equipment is possible with the ± 10° rotary analyzer slider, Cat. No. 453686-0000-000.

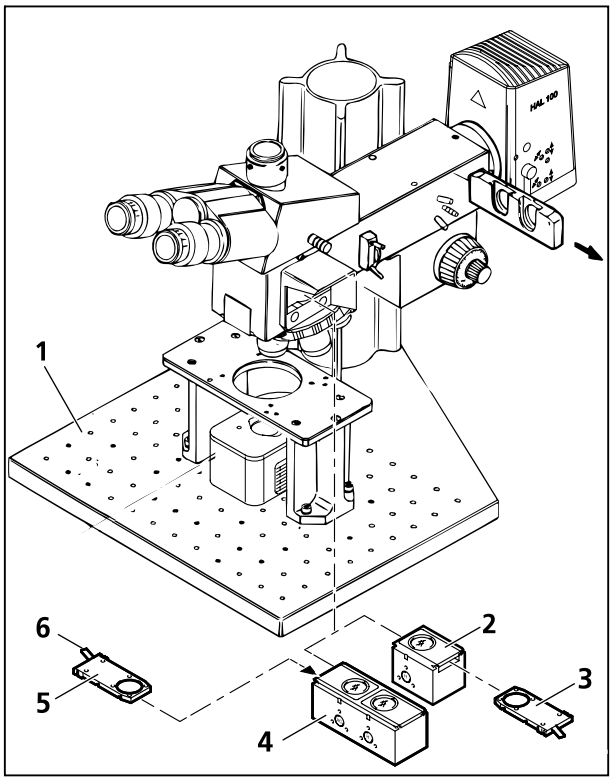


Fig. 3-26 Setting of transmitted-light polarization contrast using reflector slider without DIC position (Axiotech[vario] 100)

- Perform steps described in sections 2.13.3, 2.13.4 and 3.3.
- Place specimen to be examined on the microscope stage and fix it.
- Use lower lever (3-24/**6**) to swing rotary polarizer D (3-24/**9**) into the beam path of the transmitted-light equipment, and move the upper lever (3-24/**6**) into the zero position until stop (the upper lever will then point to the front).
- Push HD reflector slider (3-26/**4**) into the reflected-light illuminator until the H position is active (**H** mark visible on the reflector slider). Insert the ± 10° rotary analyzer slider (3-26/**5**) into the left mount of the HD reflector slider until stop. The adjusting lever (3-26/**6**) of the ± 10° rotary analyzer slider permits the image contrast to be further optimized with crossed polars.
- The Pol reflector slider (3-26/**2**), which can be used as an alternative, features an integrated analyzer in the function position and can therefore also be equipped with the compensator DIC lambda or Pol lambda sub ± 10° (3-26/**3**). Since no beam splitter is required, the Pol reflector slider has the additional benefit of an intensity gain of about 50%.

3.4.9 Setting of transmitted-light phase contrast

The phase contrast technique is ideal for the examination of thin, transparent and unstained specimens, e.g. etching and epitaxy. The human eye is unable to recognize phase differences (differences in refractive index and thickness) between the various specimen components.

The phase contrast technique uses the optical modulators "phase stop and phase ring" and the interference procedures during the formation of the intermediate image to change the small phase differences into intensity and color differences which are visible to the human eye.

Configurations

Depending on which condenser is used, the phase contrast technique requires the following modules and can therefore only be performed with the Axiotech 30 and the Axiotech 100.

- For the ABBE condenser 0.9/1.25 with 5-position turret disk, Cat. No. 445303-0000-000:
  phase contrast objectives marked Ph 1, Ph 2 and/or Ph 3,
  phase stops Ph 1, Ph 2 and/or Ph 3,
  centering telescope.
- For the ABBE condenser 0.9/1.25, Cat. No. 445302-0000-000:
  phase contrast objectives marked Ph 1, Ph 2 and/or Ph 3,
  plug-in phase rings Ph 1, Ph 2 and/or Ph 3,
  centering telescope.
- For the achromatic condenser 0.8 H D PH, Cat. No. 445445-9901-000:
  phase contrast objectives marked Ph 1, Ph 2 and/or Ph 3,
  phase stops Ph 1, Ph 2 and/or Ph 3,
  centering telescope.

Centering of phase stops

- The basic settings for transmitted-light brightfield described in section 3.4.6 must be performed before the phase stops can be centered as follows:
- Focus on the specimen in transmitted-light brightfield, then open the luminous-field diaphragm until the edge of the field of view. In the case of low-contrast transmitted-light specimens, it might be useful to reduce the opening of the aperture diaphragm (move knurled ring (3-27/**1**) towards 0.2 or 0.3 on the aperture scale).
- Swing phase-contrast objective, e.g. 10× Ph 1, into the beam path and switch on the appropriate phase stop Ph 1 or plug it into the turret disk.

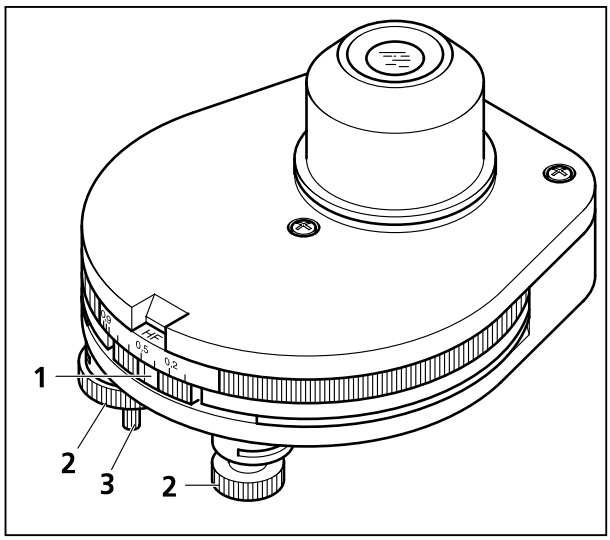


Fig. 3-27 ABBE condenser 0.9/1.25

- To check the centering and congruence of the bright phase stop (in the condenser) with the dark phase ring (in the objective), remove one eyepiece from the tube and replace it with the centering telescope. Use the correction facility of the centering telescope to focus on the phase stop and phase ring in the objective exit pupil. Open the aperture diaphragm completely.

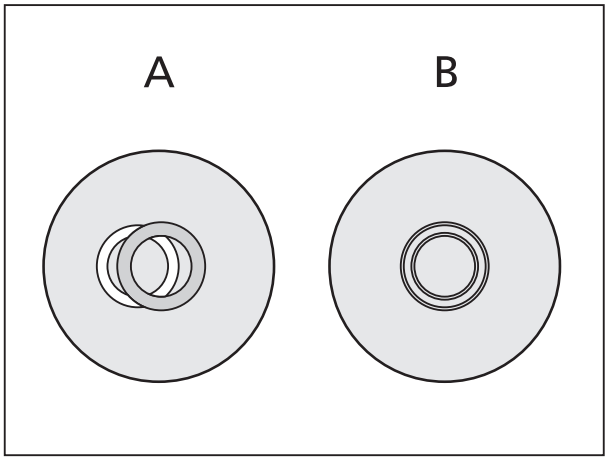


Fig. 3-28 Centering of phase stop (bright in condenser) with phase ring (dark in objective)

- If congruence is not perfect (3-28/**A**), the two knurled screws (3-27/**2**) on the **ABBE** condenser must be used to recenter the bright phase stop until complete congruence with the dark phase ring has been achieved (3-28/**B**). Tighten fixation screw (3-27/**3**) to retain this setting.
- Finally, remove the centering telescope from the tube and replace it with the eyepiece.

☞ To enhance the image contrast, an interference wide-band filter, green 32 × 4, can be placed on the luminous-field diaphragm.

Complete phase contrast is only achieved if the bright phase stop (in the condenser) and the dark phase ring (in the objective) are exactly congruent in the illumination beam path (3-28/**B**).

Even more than brightfield, phase contrast requires particularly clean glass-to-air surfaces on the specimen and the optics. Make sure to avoid finger prints in particular.

3.4.10 3D Microscopy

Detailed information on 3D microscopy using the Axiotech 100 and Axiotech[vario] 100 is contained in the following operating manuals (B) and brief instructions (K) from Carl Zeiss;

Axiotech 100: B 40-022-2, K 40-022-2

Axiotech[vario] 100: B 40-022-3, K 40-022-3

In its center position, the reflector slider 2 FL/3D (forensic) contains a 1:1 beam splitter for the visual range, and a depolarizer for 3D microscopy in the eyepiece version. The two outer positions can be equipped as required with filters and beam splitters for fluorescence applications.

3.5 Attachment of photomicrography equipment

The Axiotech and Axiotech^vario microscopes can be switched from observation to photomicrography via a pushrod (3-29/**7**) on the phototube (photomicrography function: pushrod pulled out). Special adapters allow commercially available 35-mm SLR cameras and special microscope cameras (e.g. MC 80 DX, MC 200 CHIP) to be attached to the camera port. For the use of photomicrography equipment, please observe the relevant, separate manuals in addition to the information provided in this manual, e.g.:

B 40-046 Photomicrography using 35 mm SLR cameras
B 40-036 MC 80 DX Microscope Camera
B 40-008 MC 200 CHIP Microscope Camera

3.5.1 Attachment of SLR camera, e.g. CONTAX Aria

- Screw T2 adapter for the CONTAX bayonet (3-29/**3**) on the 2.5× connector for T2 (3-29/**4**) (456005-0000-000).
- Attach camera housing (3-29/**2**) and cable release (3-29/**1**), if required.
- Loosen three hexagonal screws (3-29/**6**), remove the dust cover (3-29/**8**) from the phototube (3-29/**5**) and insert the premounted unit (3-29/**A**) into the phototube.
- Align the camera unit in the required position and tighten three hexagonal screws (3-29/**6**).
- Pull out pushrod (3-29/**7**) completely for photomicrography.
- If artificial light color reversal film is used, the conversion filter CB 3 will provide the correct color temperature of 3200 K.
- For daylight color reversal film, the CB 12 conversion filter must be used in addition to the CB 3 conversion filter.

☞ If focusing is not to be performed via the viewfinder of the camera, the component with the eyepiece reticle must be screwed into the eyepieces.

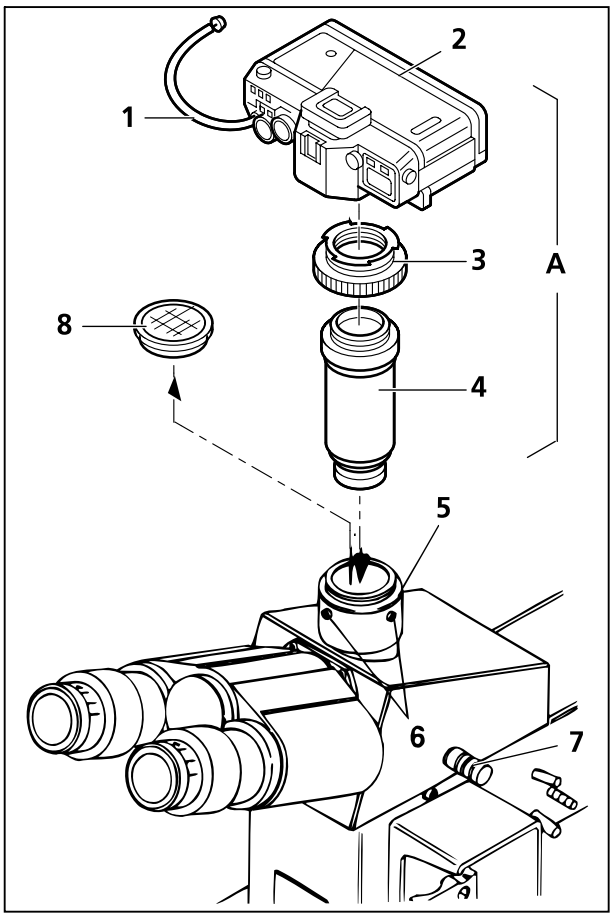


Fig. 3-29 Attachment of SLR camera, e.g. CONTAX Aria

The following T2 adapters are available for SLR cameras:

T2 adapters for SLR cameras	**Cat. No.**
T2 adapter for CONTAX (CONTAX bayonet)	416010-0000-000
T2 adapter for OLYMPUS OM (OM bayonet)	416002-0000-000
T2 adapter for MINOLTA (SR bayonet)	416003-0000-000
T2 adapter for CANON (FD bayonet)	416004-0000-000
T2 adapter for NIKON (F bayonet)	416009-0000-000
T2 adapter for PENTAX (KA bayonet)	416011-0000-000

☞ For detailed information on SLR cameras, please see the new operating manual B 40-046 entitled "Photomicrography using 35 mm SLR Cameras" from Carl Zeiss.

3.5.2 Attachment of MC 80 DX microscope camera (35 mm format with film cassette 35 mm)

- Loosen three hexagonal screws (3-30/**10**) and remove dust cap (3-30/**8**).
- Insert adapter 60 for microscope cameras (3-30/**7**) (456006) into phototube (3-30/**9**) and tighten three hexagonal screws (3-30/**10**).
- Insert P 2.5× projection lens (3-30/**5**) or P 10 (3-30/**6**) into adapter 60 for microscope cameras (3-30/**7**).
- Attach MC 80 DX basic body (3-30/**3**) to adapter 60 for microscope cameras until stop, align it and fix it by turning the clamping ring (3-30/**4**) anticlockwise.
- Attach film cassette 35 mm Mot DX (3-30/**2**) to the basic body in such a way that the contact pins firmly engage in the relevant sockets. If required, attach data back (3-30/**1**) to the film cassette.
- Pull out pushrod (3-30/**11**) completely for photomicrography.
- If artificial light color reversal film is used, the conversion filter CB 3 will provide the correct color temperature of 3200 K.
- For daylight color reversal film, the CB 12 conversion filter must also be used.
- Connect plug (3-30/**14**) of the microscope camera to the control panel (3-30/**12**).
- Connect line cable of control panel (3-30/**13**) to the line.

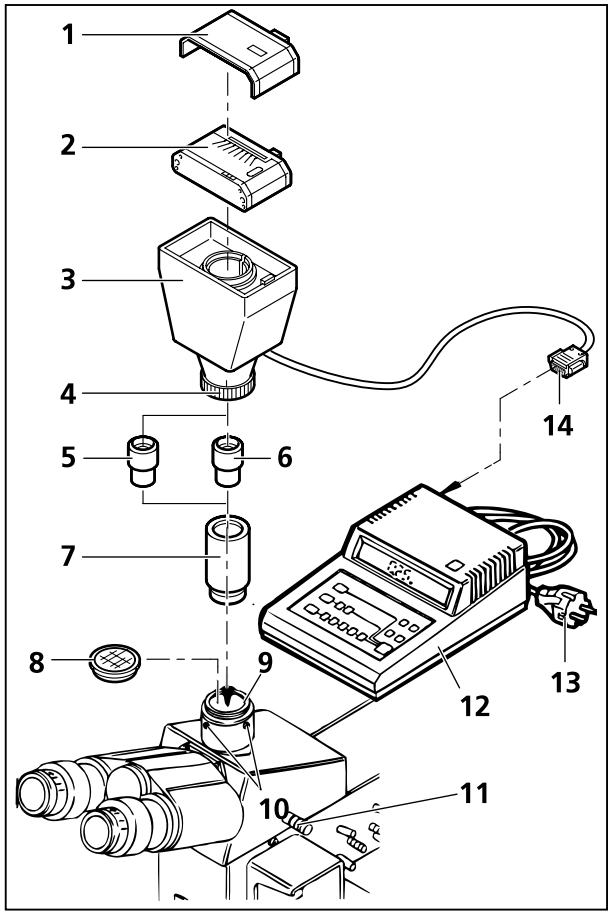


Fig. 3-30 Attachment of MC 80 DX microscope camera (35 mm format)

☞ For detailed information on the MC 80 DX, please see operating manual B 40-036, MC 80 DX Microscope Camera, from Carl Zeiss.

3.5.3 Attachment of MC 80 DX microscope camera (large format with 4" × 5" large-frame attachment)

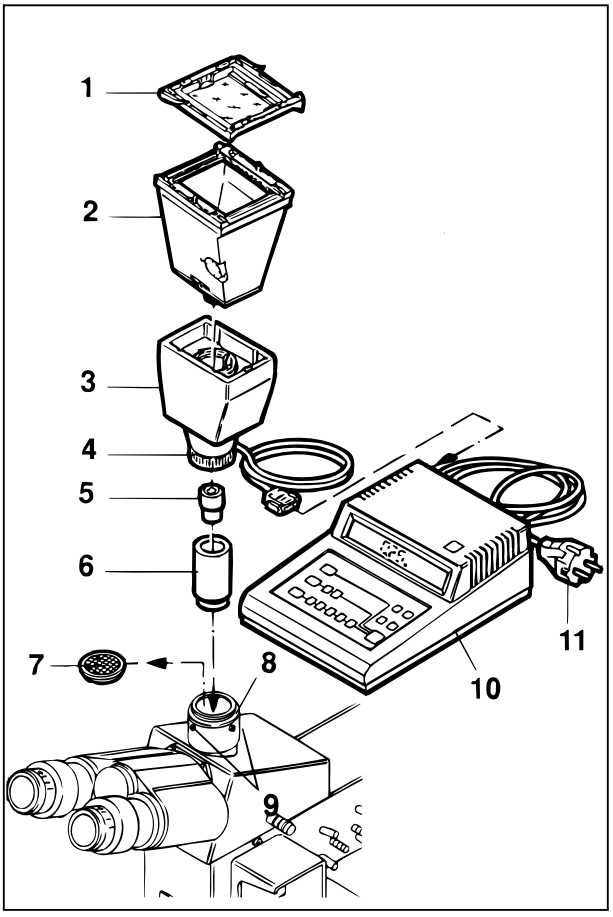


Fig. 3-31 Attachment of MC 80 DX microscope camera (large format)

- Loosen three hexagonal screws (3-31/**9**) and remove dust cap (3-31/**7**).
- Insert adapter for MC 80 DX microscope camera (3-31/**6**) into the phototube (3-31/**8**) and tighten three hexagonal screws (3-31/**9**).
- Insert P 10× projection lens (3-31/**5**).
- Attach basic body (3-31/**3**) until stop and tighten knurled ring (3-31/**4**).
- Attach 4" × 5" large-frame attachment (3-31/**2**) including the matte screen (3-31/**1**).
- Connect cable of basic body (3-31/**3**) to the exposure control (3-31/**10**).
- Insert a film.
- Connect cable (3-31/**11**) to the line.

☞ For detailed information on the MC 80 DX, please see operating manual B 40-036, MC 80 DX Microscope Camera, from Carl Zeiss.

3.6 Attachment of videomicroscopy equipment

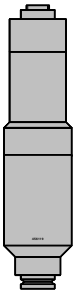
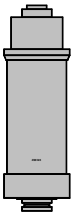
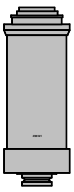
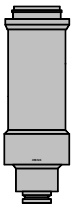
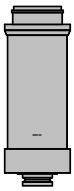
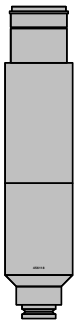
Videomicroscopy with the Axiotech and Axiotech^{vario} microscopes can be performed using TV adapters and video zoom adapters. Video zoom adapters with continuously variable factors between 0.4 and 2.0× permit the standard magnification to be transferred to video prints.

When 2/3" and 1"-chip video cameras are used on the v ideo zoom adapters, the video image will display circular vignetting in the low-factor range.

Video zoom adapter	Size of camera chip	Vignetting for factor
2/3" ENG	2/3" (∅ 11 mm)	< 0.5 x
C-mount	2/3" (∅ 11 mm)	< 0.5 x
C-mount	1" (∅ 16 mm)	< 0.7 x

3.6.1 Selection and assembly of adapters for video cameras

The following video adapters and video zoom adapters with 60 mm interface permit the connection of 1-chip b/w and color CCD cameras and 3-chip color CCD cameras to the phototube of the Axiotech and Axiotech[vario].

Tube	Adapter			Cameras
	 **456105** 60 C 2/3" 1.0×	 **456107** 60 C 2/3" 0.63×	 **456106** 60 C 1/2" 0.5×	**CAMERAS WITH C-MOUNT**
	 **456119** 60 C 1/3" (3CCD) 0.5×	 **456108** 60 C 1/3" 0.4×	 **456123** Zoom 60 C 2/3" 0.4× ... 2×	
AXIOTECH PHOTOTUBE WITH 60 MM INTERFACE	 **456115** 60 ENG 2/3" 1.0×	 **456117** 60 ENG 2/3" 0.8×	 **456121** Zoom 60 ENG 2/3" 0.4× ... 2×	**3-CHIP CAMERAS WITH 2/3" BAYONET**
	 **456124** Zoom 60 ENG 1/2" 0.5× ... 2.4×	 **456122** Zoom 60 ENG 1/2" 0.4× ... 2×	 **456118** 60 ENG 1/2" 0.63×	**3-CHIP CAMERAS WITH 1/2" BAYONET**

The connecting piece 60 - 44 also allows video adapters with 44 mm interface to be used with the phototube of the Axiotech and Axiotech[vario] with 60 mm interface.

Video adapter (Cat. No.)	Suitable for:	Comments
 **456140** Adapter 60 - 44	microscopes with 60 mm interface and all video adapters for 44 mm interface.	connects video adapters for 44 mm interface to microscopes with 60 mm interface.

3.6.2 Attachment of video camera

- Loosen three hexagonal screws (3-32/**6**) and remove the dust cap (3-32/**4**) from the phototube (3-32/**5**).
- Screw video adapter (3-32/**3**) or video zoom adapter (3-32/**2**) with C-mount thread into the video camera (3-32/**1**).

  Insert video adapter or video zoom adapter in ENG 2/3" or ENG ½" bayonet of the video camera and clamp it tight.
- Insert premounted unit (video camera (3-32/**1**) with video adapter (3-32/**3**) or video zoom adapter (3-32/**2**)) into the phototube (3-32/**5**) of the Axiotech or Axiotech[vario], align it and fix it using the three hexagonal screws (3-32/**6**).
- Insert eyepiece with photo reticle in the binocular tube and align photo reticle parallel to camera.
- Pull out pushrod on the binocular phototube to direct 100% of the light to the camera port.
- Set the required zoom magnification factor via the wheel of the video zoom adapter (3-32/**2**).

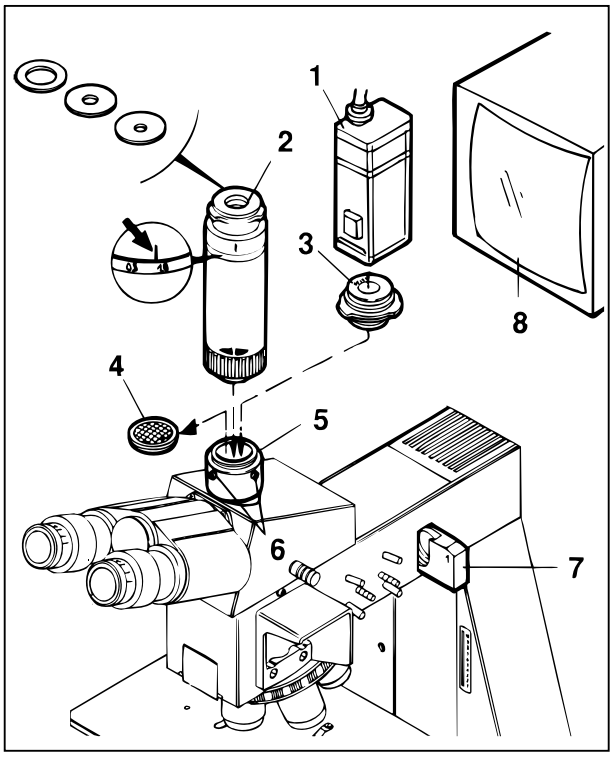


Fig. 3-32 Attachment of video camera

- If required, adjust image brightness on the monitor (3-32/**8**) by changing the lamp brightness via the illuminance control (3-4/**3**) or the potentiometer (3-5/**2**), or by inserting the attenuation filter into the filter slider (3-32/**7**).

☞ The instructions of the camera manufacturer must also be observed for the operation of the video camera.

3.7 Measuring, counting and comparing techniques using the microscope

3.7.1 Length measurements using stage micrometer and crossline micrometer

The measurements of lengths using the Axiotech/Axiotech[vario] requires the following, for example:

- stage micrometer for reflected light, 5 + 100/100 y, and
- eyepiece crossline micrometer 10: 100, d = 26 mm

An overview of stage micrometers and eyepiece reticles available from Carl Zeiss is given in chapter 1.6.

Before the length measurement using the microscope can be performed, the micrometer or scale value of the used objective / eyepiece combination must be determined. This scale value is exactly that distance in the specimen which complies to one interval of the used eyepiece crossline micrometer.

☞ The distance to be measured should be ≥ 5 mm in the intermediate eyepiece image in order to keep the influence of random measuring deviations as low as possible. Other measuring errors can occur if the eyepiece has not been inserted into the tube until stop.

For calibration, align the scales of the stage micrometer and the crossline micrometer parallel to each other by turning the eyepiece, and make the zero lines of both scales exactly congruent. If, for example, 99 increments (of 10 µm each) of the stage micrometer correspond to exactly 100 increments of the crossline micrometer, as shown in Fig. 3-33, the resulting scale value k' for the used objective / eyepiece reticle combination (A-Plan 10×/0.25 and crossline micrometer 10 : 100) is:

$$k' = \frac{99}{100} \times 10\ \mu m = 9.9\ \mu m.$$

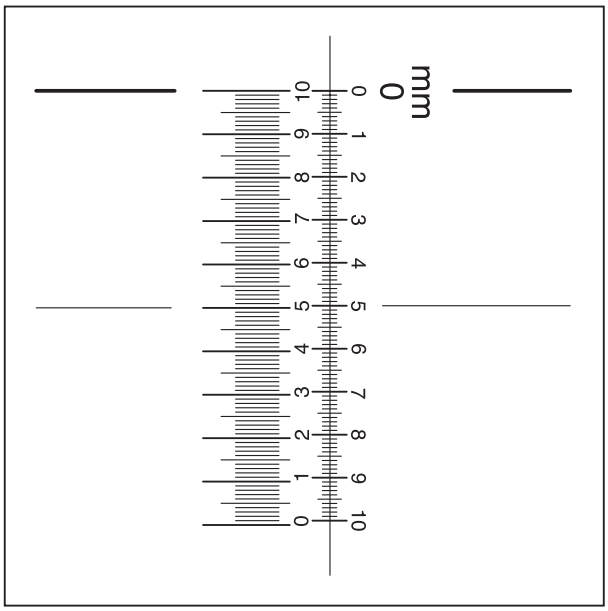


Fig. 3-33 Measurement of lengths

After exchange of the stage micrometer for the specimen to be measured, the measuring distance of interest results from the number of increments of the eyepiece crossline micrometer (estimated: one tenth) multiplied with the scale value k':

$L = 35.5 \times 9.9\ \mu m = 351.5\ \mu m.$

Particularly large object structures can also be determined by using the vernier scale gradations (0.1 mm) on the mechanical stage. Here, it might be necessary to determine the distance to be measured through a calculation from a combined x- and y-measurement (Pythagoras).

3.7.2 Length measurement using the digital eyepiece measurement device

The **digital eyepiece measuring device** is particularly suitable for measuring tasks requiring a higher accuracy than that obtained in comparison measurements using stage micrometers and crossline micrometers.

The digital eyepiece measuring device is a combination of:

- additional eyepiece PL 20 ×/18 Br. foc. (3-34/**1**) for binocular observation,
- micrometer eyepiece PL 20 ×/18 Br. foc. (3-34/**2**), and
- digital micrometer screw 46 EH (3-34/**3**).

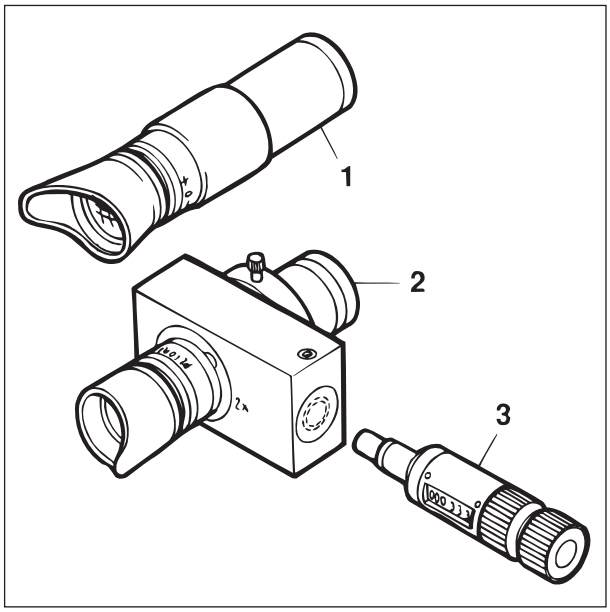


Fig. 3-34 Digital eyepiece measuring device

3.7.2.1 Attachment of digital eyepiece measuring device

- Remove microscope eyepieces W-PL 10 ×/23 from the binocular tube of the appropriate Axiotech model.
- Insert additional eyepiece (3-35/**1**) into the left tube.
- Pull red protection label from the micrometer eyepiece (3-35/**2**).
- Insert digital micrometer screw (3-35/**8**) into the opening of the micrometer eyepiece (3-35/**2**) until stop using the mounting shaft (3-35/**6**) and clamp it using the hexagonal screw (3-35/**3**); use the special key (3-35/**4**) for this purpose.

☞ When the micrometer screw is attached, the measuring spindle (3-35/**5**) should project approx. 10 to 12 mm from the mounting shaft. The digital LCD display (3-35/**7**) should be legible from the front. Micrometer screws from other manufacturers can always be attached, provided they feature a measuring range of 25...35 mm and a mounting shaft diameter of 12 mm with fit tolerance h6/h7.

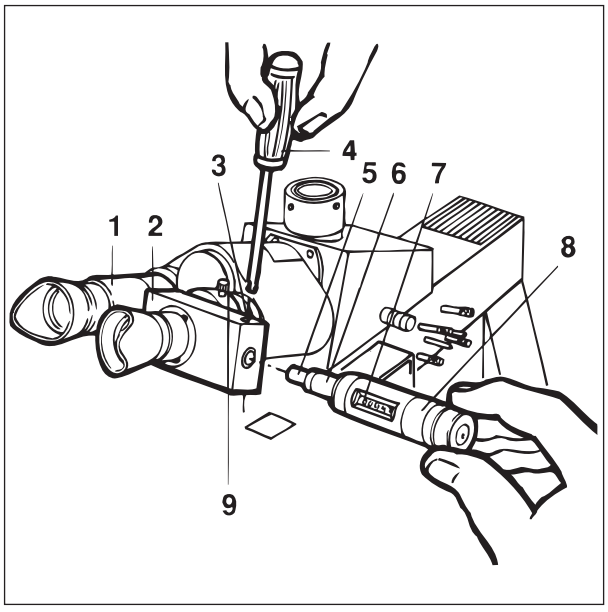


Fig. 3-35 Attachment of digital eyepiece measuring device

- Insert micrometer eyepiece with clamped integrated micrometer screw into the right tube and clamp it onto the tube using the clamping screw (3-35/**9**).
- Focus the reticle figure by turning the eyelens on the micrometer eyepiece, then focus on the object. The reticle figure and the object must be in focus.
- Focus by turning the eyelens on the additional eyepiece. The object is now in focus in the binocular.
- Set the interpupillary distance for binocular observation and adjust the measuring axis (shifting direction of the measuring marks) of the object structure to be measured by turning the micrometer eyepiece, with the clamping screw (3-35/**9**) being loosened.

☞ The clamping of the micrometer eyepiece in any position between horizontal to the right and vertical downwards (with little overflow) enables adjustment of the measuring axis positions required for measuring.

Use of this accessory ensures conjugation of the intermediate eyepiece image (reticle figures) and the images on the camera/TV port.

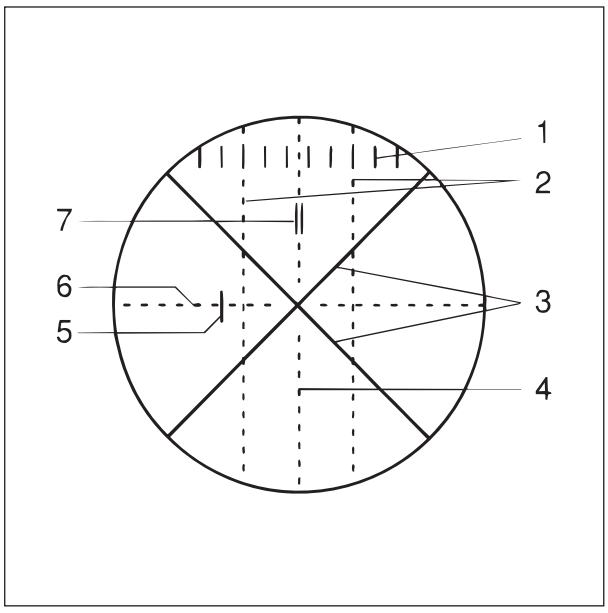


Fig. 3-36 Crossline figure in the eyepiece intermediate image of the digital eyepiece measuring device

3.7.2.2 Using crossline figures

Appearance of the dia. 18 mm intermediate eyepiece image:

- fixed positions:
  - the unnumbered millimeter gradation l = 10 mm (3-36/**1**), and
  - two dashed lines perpendicular to the millimeter gradation, each 3 mm to the left and right of the field center (3-36/**2**);
- the following markings can be shifted within a range of ± 5 mm from the image center using the integrated micrometer:
- a reticle (3-36/**3**) slanted at 45° to the shifting direction for scanning points on contours with a bent line,
  - a dashed line (3-36/**4**) perpendicular to the shifting direction (to touch convex contours or to enable congruence with straight-line edges),
  - a double line (3-36/**7**) to trap narrow straight lines or to touch tips, fiber ends, etc., and
  - one short line (3-36/**5**) perpendicular to the shifting direction and 4 mm to the left of the dashed line (3-36/**4**) to enable measurement of object details positioned in front of the millimeter gradation.

The flush line (3-36/**6**) marks the shifting direction of the adjustment marks.

3.7.2.3 Measuring with the digital eyepiece measuring device

Identical to measurements using eyepiece reticles (see section 3.7.1), the scale constant must also be calculated for the measurement of object sizes using the eyepiece measuring device. Only in the case of the eyepiece measuring device is the scale constant the distance in the object plane which corresponds to one increment of digits on the digital display of the integrated micrometer (in the case of the integrated micrometer with drum gradation: the gradation interval of the measurement drum).

Example:

Number of measured scale parts of the object micrometer ..... n = 30

Number of scale parts determined with the integrated digital micrometer
for 30 scale parts of the object micrometer ..... n' = 6024

(calculated from the value measured for 30 scale parts of the object micrometer
the micrometer amounting to 6.054 mm and the smallest digital increment of 1 mm as scale part

$\Rightarrow$ 6.054 mm / 1 µm per scale part = 6.024 mm / 0.001 mm per scale part = 6024 scale parts)

object micrometer gradation distance 5 + 100 / 100y ..... k = 10 µm

Therefore:

$\Rightarrow$ scale constant on digital eyepiece micrometer k' = (30 / 6024) × 10 µm = 0.0498 µm

For an object detail measured using the digital micrometer (measured value 2.748 mm = 2748 scale parts), this scale constant results in the following object size:

$\Rightarrow$ L = 2748 x 0.0498 µm = 136.85 µm = 0.13685 mm

◆ **measuring procedure:**

- Move the selected measuring mark until it is flush with the starting point of the specimen structure/distance to be measured $\Rightarrow$ 1st read-off value.
- Use the drive of the integrated measuring spindle to move the measuring mark to the end point of the object structure/distance to be measured until it is flush with the end point $\Rightarrow$ 2nd read-off value.
- The difference between the two read-off values converted to scale parts is the result of the measurement.

☞ To minimize random deviation, the object must be measured several times and the average of these single measurements must be taken as the result.

◆ **digital micrometer 46 EH:**

The **digital micrometer 46 EH** features a function selection ring and a function key. This makes it possible to choose from different measuring functions:

- value adjustment to "+" or "-" (PRESET),
- normal use "N",

- zero reset of the digital display at any point of the "0" measuring range, e.g. at the starting or end point of the measured distance,
- measuring unit of the display in inch or mm "IN/M" with 1 inch = 25.4 mm.

Furthermore, the **RS 232 C data output** is available, which allows a printer and a computer to be connected for measurement logs and measured value processing via the 16 Eiv interface.

For further information, please see the enclosed manual "Digital Micrometer 46 EH".

3.7.3 Determination of microhardness using the MHT-4 microhardness tester

The MHT-4 microhardness tester is used to determine the microhardness applying loads ranging from 0.0005 to 2 N (i.e. 0.05 to 200 p):

The microhardness tester consists of:

- MHT-4 sensor and
- MHT-4 control unit

The sensor is screwed into the objective nosepiece via its W 0.8 × 1/36“ thread. In nosepieces with M 27 × 0.75 thread, it can be attached via an intermediate ring. The sensors can be equipped with either **VICKERS** or **KNOOP** diamonds.

All the parameters and functions for microhardness determination are entered via the keyboard of the control unit and are shown alphanumerically on a LC display.

The measurement itself is shown on the video monitor. A digitizing instrument (mouse) is used to move lines visible on the monitor to the ends of the diagonal of indentation, like a micrometer, and the length of these lines can then be read.

The RS-232-C serial interface allows the connection of a printer for the recording of all parameters which have been entered, measured and calculated.

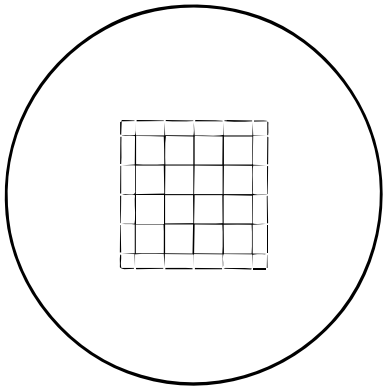
For further information on the use of the MHT-4 microhardness tester, please see brochure GK 42-170.

3.7.4 Determination of grain sizes in material structures

3.7.4.1 Measuring and counting technique

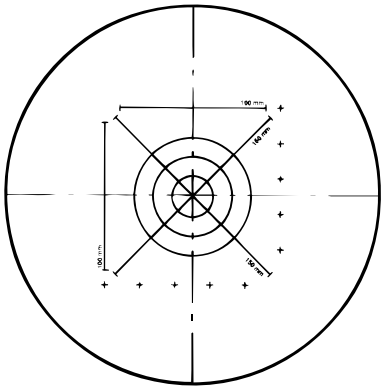
The following reticles can be used to determine the grain parameters of standard and textured structures according to the line intersection technique:

Eyepiece reticle 25/2 × 2 w



25 test points,
test line length: 25 × 2 × 2 mm,
test area: 25 × 2 × 2 mm

Counting reticle according to ISO



- reticle figure corresponds to ISO 643-1983 and ASTM E 112-88 with straight lines and circles
- in addition to the line intersection technique, the grain size can also be determined using the area counting technique

Fig. 3-37 Eyepiece reticle 25/2 × 2 w and counting reticle according to ISO

3.7.4.2 Structure comparison reticles

Three different structure comparison reticles according to ISO 643 -1983 and ASTM E 112 -88 can be used:

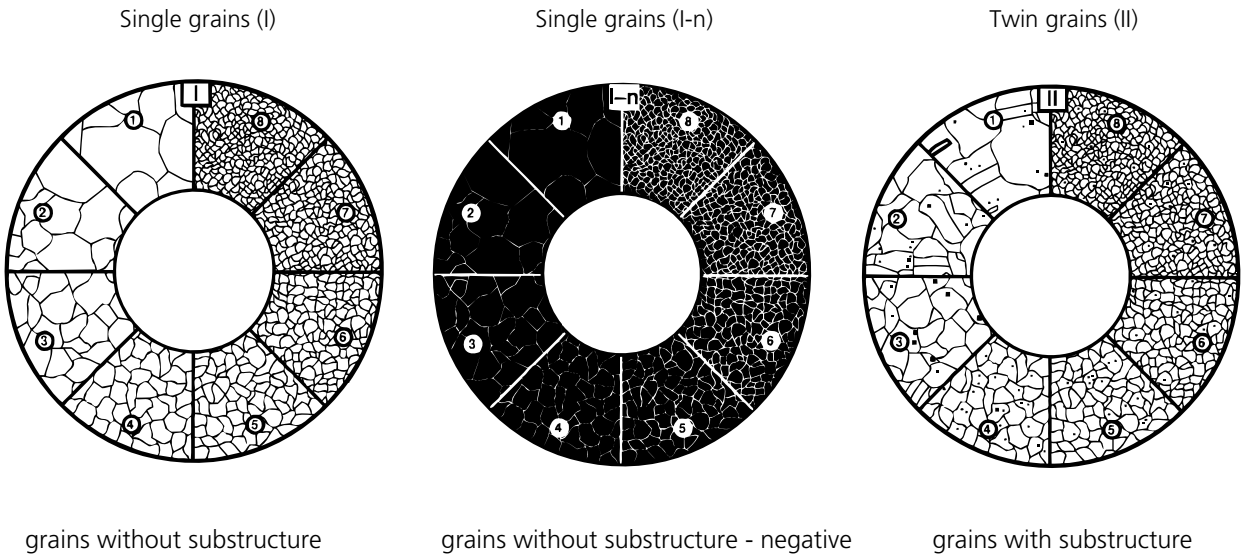
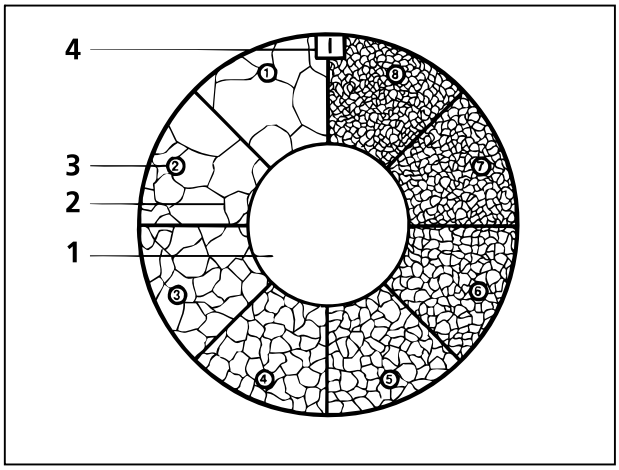


Fig. 3-38 Structure comparison reticles

Design of comparison reticles



1 empty image field, dia. 10 mm
2 circle ring sector with structure pattern of the image series table according to ISO 643-1983 and ASTM E 112-88 (altogether 8), size of structure patterns is graded from one sector to another
3 number of the sector
4 description of the comparison reticle (I, I-n or II)

Fig. 3-39 Design of the comparison reticles

3.7.4.3 Determination of grain parameters or materials structures:

- The grain size of the object imaged in the empty field must be compared to the grain sizes of the segments.
- Determine the number of the sector, the grain size of which is nearly identical to that of the object image.
- Determine the appropriate grain size number for this sector number:
  With the microscope magnification 100:1, the sector number corresponds to the grain size number, with magnifications > and < 100:1 the grain size number must be determined using the table "Grain size numbers as a function of magnification and sector number".
- On the basis of the appropriate grain size number, the grain parameters of the structure must be determined from the table "Allocation of grain size number – grain parameter".

☞ The tables "Grain size number as a function of magnification and sector number" and "Allocation grain size number – grain parameter" are included in the aforesaid sta ndards, e.g. ISO 643-1983, pages 5 and 7.

CARE, MAINTENANCE, TROUBLESHOOTING AND SERVICE

Contents

Illustrations

4 CARE; MAINTENANCE; TROUBLESHOOTING AND SERVICE

4.1 Instrument care

Maintenance of the Axiotech or Axiotech^{vario} is limited to the following operations:

- Switch off the instrument after every use, allow the illuminator(s) to cool down for approx. 15 min., and place instrument cover on the instrument to protect it from dust and humidity.
- Never expose the instrument to inadmissible climatic conditions (high humidity and temperature).

The best way to remove stubborn dirt on glass surfaces, e.g. finger prints or traces of grease and immersion oil, is the use of a piece of cotton wrapped around a wooden stick and a small amount of distilled water or a non-aggressive solution.

- Distilled water: clean glass surface using a slightly moistened wad of cotton by moving in circles starting in the middle.
- Optics cleaning solution, consisting of 85 % isopropanol and 15 % medical alcohol (gasoline): clean glass surface using a slightly moistened wad of cotton by moving in circles starting in the middle.
- Remove dust from optical surfaces using a natural hair brush or an air blower.

When using the microscope in humid climatic zones, proceed as follows:

- Store instrument in bright, dry and well ventilated rooms with a humidity of less than 65 %: optical components and accessories which are particularly susceptible to the growth of fungus, e.g. objectives and eyepieces, should be stored in a dry cabinet.
- When the equipment is stored in closed cases for a longer period of time, the growth of fungus can be avoided by including cloths soaked in fungicide in the cases.

The risk of growth of fungus on opto-mechanical instruments always exists in the following conditions:

– Relative humidity of more than 75 % and temperatures between +15 °C and +35 °C for more than three days.

– Installation in dark rooms without air ventilation.

– Dust deposits and finger prints on optical surfaces.

4.2 Instrument maintenance

4.2.1 Performing checks

- Make sure that the required line voltage is available, e.g. on the Axiotech 100 stand or the separate power unit SNT 12 V DC, 100 W.
- Check the line cable and the plug for defects.
- If any damage is visible, switch off the instrument. Have instrument repaired only by an expert.
- Make sure that the maximum operation time of the halogen, xenon and mercury vapor short-arc lamps is not exceeded.

4.2.2 Changing the fuses

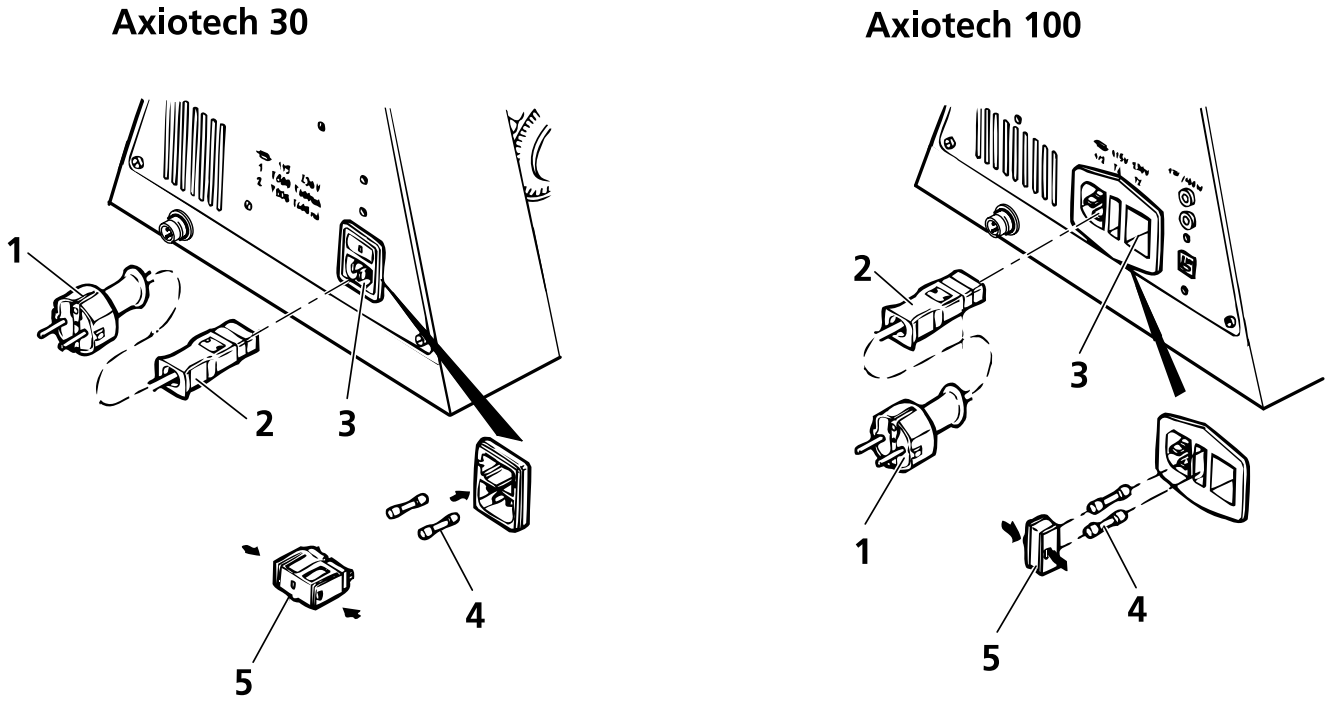


Fig. 4-1 Changing the fuses

- Switch off the Axiotech via the On/Off switch, disconnect the power plug (4-1/**1**) from the line and remove line coupler (4-1/**2**) from the instrument socket (4-1/**3**).
- Check line cable and instrument plugs and exchange them, if required.
- Use 2.0 mm watchmaker's screwdriver to press the two spring mounts of the fuse holder (4-1/**5**) to the inside over the groove and remove the fuse holder.
- Remove defective fuse inserts (4-1/**4**) from the fuse holder and replace them with new ones.

- The following fuse inserts must be used:

on the Axiotech 30	100 ... 240 V AC	T 0.8 A; 250 V; 5 × 20 mm
on the Axiotech 100	220 ... 240 V AC	T 2.0 A/H; 250 V; 5 × 20 mm
	100 ... 127 V AC	T 4.0 A/H; 250 V; 5 × 20 mm

☞ For the catalogue numbers of the fuse inserts, please see chapter 4.4, page 4-9.

- Insert fuse holder with new fuse inserts until lick-stop of the lateral spring mounts.

4.2.3 Check instrument voltage and change it, if required

(1) Axiotech 30 microscope stand

The Axiotech microscope has an integrated wide-range power unit and can be connected to line voltages ranging from 100 to 240 V AC, 50 to 60 Hz. The wide-range power unit sets itself **automatically** to the appropriate line voltage.

(2) Axiotech 100 microscope stand

The stabilized 12 V, 100 W power unit is integrated in the Axiotech 100 microscope stand and operates in the two switchable line voltage ranges 100 V – 127 V AC or 220 ... 240 V AC. Before start-up, it is therefore absolutely necessary to check whether the reset instrument voltage on the instrument rear and to change it, if required!

(3) Axiotech[vario] 100 microscope stand

The Axiotech[vario] 100 has no integrated power supply, i.e. all the usable illuminators are operated via external power units. Before start-up of the power units, it is therefore absolutely necessary to compare the preset instrument voltage with the line voltage and to change it, if required.

(4) Separate power unit SNT 12 V DC, 100 W

Check whether the voltage set on the voltage selector on the underside of the separate power unit SNT 12 V DC, 100 W for halogen illumination in reflected light complies with the line voltage.

(5) Power supply for HBO 50

Compare instrument voltage and frequency set on the window on the rear of the HBO 100 transformer with the line voltage and frequency. If the voltage and frequency values are not identical, the instrument voltage and frequency must be changed to the appropriate line voltage and line frequency only by Carl Zeiss Service staff or specially **authorized** personnel. Further information see on page 4-10.

4.3 Troubleshooting

Problem	Cause	Remedy
Vignetting or inhomogeneous image brightness in the field of view; the field is not entirely visible	The vis/phot pushrod on the camera tube is not in the correct (intermediate) position	Move the vis/phot pushrod in the correct (end) position, see pp. 3-3, 3-4, 3-5 or 3-33
	Nosepiece with objective not switched to stop position	Switch nosepiece with objective in stop position
	Condenser not set correctly	Set condenser correctly (adjustment, centering), see p 3-23 ff.
	Aperture diaphragm not set correctly	Set aperture diaphragm correctly (centering, opening), see p. 3-9 ff.
	Luminous-field diaphragm not set correctly	Set luminous-field diaphragm correctly (centering, opening,), see p. 3-9 ff.
	Filter not correctly inserted in filter mount	Insert filter correctly in filter mount
Low resolving power and poor image contrast	Aperture diaphragm opening not set correctly	Set aperture diaphragm opening in accordance with the 2/3 rule or depending on the specimen features, see p. 3-9 and 3-22 ff.
	Condenser not correctly focused	Focus condenser correctly, see p. 3-22 ff.
	Use of no or unspecified immersion oil with CZ immersion objectives	Use CZ immersion oil 518 N
	Air bubbles in the immersion oil	Apply new oil to remove the bubbles
	Immersion oil at the front lens of a dry objective	Clean the front lens of the dry objective, see p. 4-3
	Dirt or dust on the optical surfaces of objectives, eyepieces, condensers or filters	Clean the appropriate optical components, see p. 4-3

Problem	Cause	Remedy
Image aberration	Condenser not set correctly	Set condenser correctly, see pp. 2-11 ff. and 3-22 ff.
	Nosepiece not correctly switched to click-stop position	Correctly click-stop the nosepiece
	Specimen is not clamped on the mechanical stage	Correctly insert specimen in holder and clamp it
Great focus differences after objective change	Focusing eyepieces are not set correctly	Set focusing eyepieces to the appropriate ametropia, see pp. 2-8 and 2-10
Left and right fields of view cannot be combined into an image	Interpupillary distance of the binocular tube is not set correctly	Set interpupillary distance correctly, see p. 2-10
	Focusing eyepieces are not set correctly	Set focusing eyepieces to the appropriate ametropia, see pp. 2-8 and 2-10
Eye-fatiguing microscopy	Interpupillary distance of the binocular tube is not set correctly	Set interpupillary distance correctly, see p. 2-10
	Focusing eyepieces are not set correctly	Set focusing eyepieces to the appropriate ametropia, see pp. 2-8 and 2-10
	Image brightness is not acceptable	Reduce lamp voltage or insert conversion filter
Dirt or dust in the field of view	Condenser not focused correctly	Focus condenser, see pp. 3-22 ff.
	Aperture diaphragm opening too small	Set aperture diaphragm opening in accordance with the 2/3 rule or depending on the specimen features, see pp. 3-9 and 3-22
	Dirt or dust on the optical surfaces of objectives, eyepieces, condensers, filters or specimens	Clean the optical surfaces of the appropriate components, see p. 4-3

Problem	Reason	Remedy
The 12 V, 100 W halogen lamp does not function, although the On / Off switch is in "On" position	Line cable not connected to the line	Connect line cable to the line and make sure to check the instrument and line voltage, see pp. 2-19 ff.
	6 V, 30 W halogen lamp not installed	Attach 6 V, 30 W halogen lamp, see pp. 2-22, 2-27 and 2-30
	6 V, 30 W halogen lamp is defective	Replace 6 V, 30 W halogen lamp, see pp. 2-22, 2-27 and 2-30
	The required 6 V, 30 W halogen lamp is not used	Use the required 6 V, 30 W halogen lamp, see p. 4-9
	12 V, 100 W halogen lamp is not installed	Insert 12 V 100 W halogen lamp, see p. 2-25 ff.
	12 V, 100 W halogen lamp is defective	Replace 12 V, 100 W halogen lamp, see p. 2-25 ff.
	The required 6 V, 100 W halogen lamp is not used	Use the required 6 V, 100 W halogen lamp, see p. 4-9
	Fuses are defective	Replace the fuses, see pp. 4-4, 4-5 and 4-9
	Integrated electronics unit might be defective	Have the electronics unit checked by the microscopy service and replaced, if required, see p. 4-10
The 12 V, 100 W halogen lamp flickers, unstable brightness	End of average life of 12 V / 100 W halogen lamp	Replace 12 V 100 W halogen lamp, see p. 2-25 ff.
	Incorrectly installed or broken line cable	Connect line cable correctly or replace it, see p. 2-19 ff.
	The pin of the 12 V, 100 W halogen lamp are not correctly inserted into the base	Carefully insert pins of 12 V, 100 W halogen lamp into the base until stop, hold lamp only with protection sleeve, see p. 2-25

4.4 Table of spares, consumables and tools

Description	Cat. No..	Purpose
Halogen lamp 6 V, 30 W	000000-0402-943	for microscope illuminator HAL 30
Halogen lamp 12 V, 100 W	380079-9540-000	for microscope illuminator HAL 100
Xenon lamp XBO 75 (ozone-free)	380053-9870-000	for microscope illuminator XBO 75
Mercury vapor short-arc lamp HBO 50	381619-0000-000	for microscope illuminator HBO 50
SW 3 ball-headed screwdriver	000000-0069-551	to change tubes and illuminators
2 eyepiece eyecups	444801-0000-000	recommended for low-brightness techniques, e.g. reflected-light darkfield or polarization, to suppress reflection
Dust cap for nosepiece Dust cover for eyepiece tube	462981-0000-000 000000-0168-373	to close instrument openings which are not used
G- fuse inserts (5 × 20 mm): Axiotech 30: T 0.8 A; 250 V; Axiotech 100: T 2.0 A/H; 250 V; T 4.0 A/H; 250 V;	 000000-0127-019 000000-0127-024 000000-0127-027	protects power supply units from excessive load
Light filters: Interference wide-band filter green, d=32×4 Interference band filter green 546, d=32×3 Conversion filter CB 12, d = 32 × 2 Conversion filter CB 6, d = 32 × 2 Conversion filter CB 3, d = 32 × 2 Conversion filter 3200...5500 K, d= 32×2 Neutral density filter N 0.25; d = 32 × 2 Neutral density filter N 0.06; d = 32 × 2 Gray filter 0.50, d = 32 × 4 Gray filter 0.12, d = 32 × 4 Gray filter 0.03, d = 32 × 4 Heat-reflecting filter KG 1, d = 32 × 2 Reflection protection filter, d = 32 × 2	 467803-0000-000 467807-0000-000 467850-9901-000 467851-0000-000 467852-0000-000 467847-0000-000 467849-0000-000 467848-0000-000 467840-0000-000 467841-0000-000 467842-0000-000 467830-0000-000 467832-0000-000	for contrast enhancement in b/w photography and phase contrast for color photography using daylight color and artificial light color reversal films for observation and b/w photography with transmission indicated in % for photography without color distortion, transmission indicated in % to protect specimens from excess heat
Dust cover K	459310-0000-000	to cover the instrument after use

4.5 Requesting service

All repairs of mechanical, optical and electronic components inside the instrument and of the Axiotech and Axiotech^{vario} electronics system may only be performed by Carl Zeiss service staff or specially **authorized** personnel.

To ensure the optimum setting and trouble-free function of your microscope even for a longer period of time, we would recommend you to conclude a service / maintenance contract with Carl Zeiss.

In the case of subsequent orders or when service is required, please get in touch with your local Carl Zeiss agency.

Further information is also available at the following Internet address:

Micro@zeiss.de

www.zeiss.de/micro

ANNEX

List of Abbreviations

A	reflected light
AC	Alternating Current
AS	aspheric
ASTM	American Society of Testing Materials
A-Plan	achromatic objectives featuring improved image flatness (ICS line)
Br.	suitable for eyeglass wearers
CB	Correction Blue (conversion filter)
CCD	Charge Coupled Device
CP-Achromat	achromatic objective (ICS line)
CSA	Canadian Standards Association
d	diameter
D	darkfield and transmission of filters
DC	Direct Current
DIC	differential interference contrast
DIN	Deutsches Institut für Normung (German standards association)
doc	documentation
DX	coding system for the storage of electronically legible information, e.g film speed
EG	European Community
EMV	electromagnetic compatibility
EN	European standards
ENG	Electronic News Gathering
E-PL	description of an eyepiece type with an aspheric lens and a flat field
EWG	European Economic Community
FAA	free working distance
foc.	focusing
HAL	halogen lamp
H	brightfield
HD	brightfield and darkfield
ICS	Infinity Color corrected System
IEC	International Electrotechnical Commission
IP	International Protection
ISO	International Standard Organization
L	left (drive control on the left side of the mechanical stage)
LED	Light Emitting Diode
LD	Long Distance
MC	Microscope Camera
N	neutral-density filter
OEM	Original Equipment Manufacturing
PL	flatfield

R	right (drive control on the right side of the mechanical stage)
SLR	Single Lens Reflex
SK	Protection class
SW	wrench opening
s/w	black-and-white
T	slow-blow fuse type
TV	television
T2-Adapter	standardized adapter for 35 mm cameras
UL	Underwriters Laboratories
V_{Obj}	magnification of the objective
VDE	Verband Deutscher Elektrotechniker (association of German electrotechnicians)
vis	visual
W 0,8"	Whitworth-type thread 0.8"
Z	centerable

Physical and Technical Units

A	ampere
°	angular degree
°C	Centigrade
h	hour
Hz	Hertz
K	Kelvin
kg	kilogram
lm	Lumen (light flux)
in	inch (1 in = 25.4 mm)
mm	millimeter
N	Newton
P	Pond
U	rotations
V	Volt
W	Watt