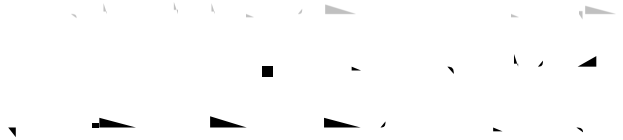

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. 3 1 4 (T) L 3 0 1

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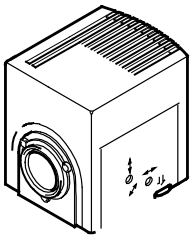
Particular attention should be paid to the warnings, cautions and notes listed below:

Avoid touching the hot lamp housing. Before replacing lamps, be sure to pull the power plug and allow some 15 minutes for the lamp to cool down.

1.2 Nameplate and Warning Labels Attached to the Microscope and to Components



1.3 Notes on Warranty

The manufacturer of the instrument warrants the device to be free from defects in materials and workmanship at the time of its delivery. Any defect must be reported without delay, and every effort is to be made to minimize damage. If such a defect is reported, the manufacturer of the instrument is obligated to correct the defect, at his option, by repairing the instrument or delivering an instrument that is free of defects. No warranty will be provided in the event of defects caused by natural wear and tear (in particular, defective consumables) and improper operation.

The manufacturer of the instrument will not be liable for any damage attributable to operation errors, negligence or tampering with the instrument. This is especially true for damage caused by the removal or replacement of components or the use of accessories made by other manufacturers. Acts of this kind will void all and any warranty.

With the exception of the activities listed in this Operating Manual, no maintenance and repair work may be performed on the microscopes. Repairs may only be carried out by Zeiss Customer Service or by personnel specially authorized by it. Should the instrument malfunction, please contact Carl Zeiss Microscopy Service in Germany first (see Page 99) or get in touch with your Carl Zeiss dealer abroad.

2 INSTRUMENT DESCRIPTION

2.1 Name, Intended Use

Manufacturer's product name: Axio Vert.A1 Inverted Transmitted Light Microscope

Axio Vert.A1 microscopes take the following place within the inverted transmitted light microscope family:

Laboratory Microscopes	Research Microscopes
Primo Vert	Axio Observer.A1 / .D1 / .Z1
Axio Vert.A1	

2.3 System Overview

2.3.1 Stands for Biomed Applications

Axio Vert.A1

2.4 Technical Specifications

Dimensions

Dimensions (Width x Depth x Height)

Axio Vert.A1 ..... 235 mm* x 560 mm x 560 mm
Axio Vert.A1 FL or A1 FL-LED.....235 mm* x 560 mm*** x 560 mm
Axio Vert.A1 MAT.....220 mm** x 560 mm*** x 355 mm

* Equipped with fixed stage without object guide
** Without mechanical stage; with 40 mm x 40 mm mechanical stage: Width: 295 mm
*** Depth: 560 mm, without external (reflected light) illuminators

The above measurements are maximum dimensions, which include space for cable and connector outlets. The depth was measured at an interpupillary distance of 62 mm, with binocular parts lowered.

Transmitted light LED illumination results in the height of transmitted light stands being reduced by 29 mm.

Weight****

Axio Vert.A1 Stand .....10.5 kg
Axio Vert.A1 FL-LED Stand .....12.3 kg
Axio Vert.A1 FL Stand .....11.7 kg
Axio Vert.A1 MAT Stand .....10.3 kg

**** Actual weight of the stand without any attachments, such as stages, tubes, etc.

Ambient Conditions

Shipping (in Packaging):

Permissible ambient temperature.....-40 °C to +70 °C

Storage:

Permissible ambient temperature.....+5 °C to +40 °C
Maximum permissible humidity (without condensation)..... 75 % at 35 °C

Operation:

Light Sources

Halogen illuminator (transmitted light)
- Maximum power consumption ..... 37 W
- Light source adjustability ..... Infinitely adjustable, ” 1.5 V to 12 V

LED illuminator (transmitted light)
- Maximum power consumption ..... 3 W
- Light source adjustability ..... Infinitely adjustable, ” 1.5 V to 12 V

HAL 100 halogen illuminator (reflected light) with external power supply unit
- Maximum power consumption of external power supply unit ..... 100 W
- Light source adjustability via external power supply unit ..... Infinitely adjustable from 0 V to 12 V

HXP 120 C illuminator
- Line voltage ..... 100 V to 240 V ±10 %
- Maximum power consumption ..... 210 VA

Mercury vapor lamp for fluorescence
- Maximum power consumption of power supply unit for HBO 50 ..... 90 VA
- Maximum power consumption of power supply unit for HBO 100 ..... 155 VA

VIS-LED (reflected light)
- LED classification ..... LED risk group 1 according to DIN EN 62471:2009
- Wavelength ..... 400 nm to 700 nm, peak at 460 nm
- Power supply ..... Via microscope or external power supply unit
- Voltage ..... 0 VDC to 12 VDC
- Maximum power consumption ..... 20 W

Optomechanical Specifications

Stand with objective focusing
- Coarse focus ..... 4 mm per rotation
- Fine focus ..... 0.4 mm per rotation
- Total focusing range ..... 13 mm

Objectives ..... Set of ICS objectives with M27 thread

Change of objectives ..... Manual, via a five-position nosepiece

Eyepieces ..... Plug-in diameter: 30 mm
Use of eyepieces up to field number 23

P&C reflector turret ..... Capable of holding four freely loadable P&C reflector modules

Change of reflector ..... Manual

LED modules ..... Four positions freely loadable on Axio Vert.A1 FL-LED

2.5.2 Axio Vert.A1 FL Stand for Reflected Light and Transmitted Light Fluorescence

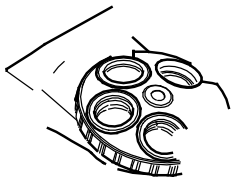
Legend to Fig. 2-7:

1 Eyepieces
2 Binocular part of the tube
3 Transmitted light illumination (either with a halogen or an LED illuminator)
4 Two-position filter slider mounted on the carrier for transmitted light illumination
5

2.5.4 Axio Vert.A1 MAT Stand for Reflected Light (Material)

Legend to Fig. 2-9:

1 Eyepieces
2 Binocular part of the tube
3 40 mm x 40 mm mechanical stage for reflected light
4



2.6 Operation and Functional Elements of Optional Components

2.6.1 Phototube and Intermediate Phototube

Using appropriate adapters, you can attach reflex cameras, microscope cameras and video cameras to the camera port (Fig. 2-10/**1** or Fig. 2-11/**1**) of binocular phototubes.

Binocular Phototube 45°/23 or Binocular Phototube, Left, 45°/23, with Fixed 50:50 Division

Fifty percent of the light is directed to the

2.6.2 Microscope Stages

Mechanical Stage 130x85 R/L with Short Coaxial Drive

Mechanical stage (Fig. 2-14/**1**) designed to hold and position specimens in mounting frame K (Fig. 2-14/**4**)

To insert the mounting frame, put the mounting frame corner marked with a red dot into the recess of the mechanical stage. Press the frame diagonally onto the springs and downward into the recess. In so doing, make sure that the mounting frame is correctly seated.

Drive knobs for X (Fig. 2-14/**2**) and Y adjustment (Fig. 2-14/**3**)

The mechanical stage with coaxial drive can be fitted on the right-hand or left-hand side of the stand.

Specimen Stage 232x230 to Which an M 130x85 mm Object Guide Can Be Attached

Specimen stage (Fig. 2-15/**5**) designed to hold and position specimens for transmitted light and reflected light

With the object guide (Fig. 2-15/**2**) attached, this stage is capable of holding specimens in mounting frame Flex M (Fig. 2-15/**1**1

2.6.3 Condensers

To allow a quick condenser change, all the condensers come with a special connection plate for bayonet mounting.

The condenser can be rotated in its mount in 90-degree steps (after the bayonet mount has been loosened and subsequently tightened). (See Section 3.1.7.)

LD Condensers 0.3 and 0.4 for Sliders

Condenser equipped with an adjustable aperture diaphragm (Fig. 2-17/**4**) for sliders with fixed phase stop Ph1/0.3 (Fig. 2-17/**1**) or Ph1/0.4; slider Ph/PlasDIC, H, Ph/PlasDIC (Fig. 2-17/**2**) or slider Ph/PlasDIC, H, Var (Fig. 2-17/**3**)

The sliders can be inserted from the right or left (or from the front or the back).

The center position of the slider is provided with a neutral density or attenuation filter to guard against glare.

Depending on the type of slider employed, the condenser can be utilized for the bright field, phase contrast, PlasDIC or VAREL methods.

2.6.5 Filter Slider and Slider for Aperture and Luminous Light Diaphragms for the Axio Vert.A1 MAT and

x Place the microscope stand (Fig. 3-1/**3**) on a non-

3.1.3 Inserting Eyepieces or an Auxiliary Microscope or a Diopter

- Remove both dust caps (Fig. 3-3/**1** and **4**) from the binocular tube.
- Take the two eyepieces (Fig. 3-3/**2**) out of the container and insert them into the binocular tube as far as they will go.
- The auxiliary microscope (Fig. 3-3/**3**) may be inserted into an eyepiece socket of the binocular tube in place of an eyepiece. It serves to view 1See additional eyepiece reticles are

Compensating for Eyesight Differences (e.g., through the Use of Eyepiece Reticles)

For the correct use of an eyepiece reticle, two focusable eyepieces are required to ensure that differences in the observer's eyesight can be offset.

- Use the eyepiece adjustment features to lock focus on the eyepiece reticle or, if no eyepiece reticle is in place, on the edge of the field of view.
- With the eyepiece adjusted in this way, use the focusing drive to lock focus on the microscopic image of the specimen put on.
- Then use the adjustment features of the second adjustable eyepiece to lock focus on the microscopic image for the second eye. In so doing, be sure to leave the setting of the focusing drive on the microscope stand unchanged.

3.1.5 Screwing Objectives in Place

- Remove as many dust caps (Fig. 3-5/**2**) as there are objectives.
- Take the objectives (Fig. 3-5/**1**) out of the container and screw them into the objective nosepiece by ascending magnification factors. In so doing, make sure the objective is correctly and safely fitted.

3.1.6 Attaching Microscope Stages

3.1.6.1 Mounting the Mechanical Stage

There are three locating points with retaining screw holes which allow the mechanical stage (mechanical stage 130x85 R/L or 40x40 for reflected light) to be mounted directly onto the stand.

After the installation, a mounting frame of your choice can be attached to mechanical stage 130x85 R/L, while mechanical stage 40x40 for reflected light may be equipped with a stage insert. See also Section 2.6.2.

The mechanical stages can be mounted both with the coaxial drive to the right and to the left. For this purpose

3.1.9 Equipping the Reflector Turret

3.1.10.3 Attaching the LED Illuminator

Attach the LED illuminator as a complete assembly and replace it as a complete assembly when its service life has ended.

- Insert the illuminator (Fig. 3-15/**1**) with its contact pins into the slot (Fig. 3-15/**2**) on the carrier, as far as it will go.
- Fasten the illuminator to the carrier with two screws (Fig. 3-15/**4**).

3.1.11.1 Attaching the Fluorescence Illuminator for Reflected Light

For safety reasons, the HBO 50/HBO 100 fluorescence lamps and the HXP 120C mercury vapor short-arc lamps are packaged and delivered to the customer separately.

Before those lamps can be put into operation, they must, therefore, be inserted into the illuminator housings.

The procedure to follow when installing or replacing the lamp is described in the operating instructions enclosed with the devices.

To install the illuminators, proceed as follows:

h 0 C 2 [illegible] T9(c .25)-w0.02 Tc 0.029 Tw 1.826 0 Td[(l)-6c 0 Tw 4.065 0 T26.6

3.1.11.2 Adjusting the HBO 50 Illuminator WARNINGTo

3.1.11.3 Adjusting the HBO 100 Illuminator

e eye damage, never look directly into the such as sunglasses, to protect your eyes when observing the bright

3.1.11.4 Installing the VIS-LED Attachment Lamp

3.1.11.5 Attaching the HAL 100 Illuminator

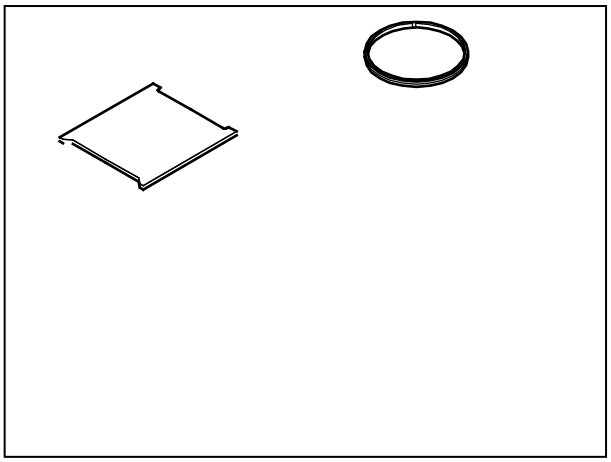
3.1.12 Adjusting the HAL 100 Illuminator

Coarse Adjustment

- Loosen the clamping screw (Fig. 3-21/**2**) and then detach the operational halogen illuminator (Fig. 3-22/**4**) from the microscope stand.
- Switch on the microscope. (See Section 1.1.)
- Aim the light beam at a projection surface (wall) that is at least 3 m away.

3.1.13 Changing the HAL 100 Halogen Lamp

- Lock the cams (Fig. 3-25/**1**) on the underside of the mounting tool into the recesses (Fig. 3-25/**4**) of the contrast module.
- Insert the contrast module into the desired modulator disk position, using the gripping component (Fig. 3-25/**6**) of the mounting tool.
- The two centering screws (Fig. 3-25/**11**) may first have to be turned back slightly, as appropriate. These Td[)4)Tj0.283te0 1 Tf-7498.11.53T7498.1n-2.1n-2e[jn-2.007 Tw 11.543 0 Td[M)-4(0.002 Tc3 ho-)1(7498.s-6(a



3.3.3 Changing the Filter Set in the FL P&C Reflector Module

The customer can put together and install the filter sets for the FL P&C reflector module individually. Appropriate filter sets or even completely assembled FL P&C reflector modules can be ordered from Carl Zeiss.

- Take the FL P&C (Fig. 3-28/**3**) reflector module out of the reflector turret and set it down. (See also Section 3.1.9.)
- Use the mounting plate (Fig. 3-28/**6**) from the tool kit to screw out the retaining ring (Fig. 3-28/**1**).
- Turn over the reflector module to let the filter (Fig. 3-28/**2** or **5**) fall out onto a soft surface.
- Insert the barrier filter (emission filter) as shown in (Fig. 3-28/**2**) and the excitation filter as shown in (Fig. 3-28/**5**), and then secure them with the retaining rings (Fig. 3-28/**1**).

Both the barrier filter and the excitation filter may carry their designation and an arrow on the circumference. The arrow, which must always point inwards, indicates the direction in which the filter in question is to be installed into the reflector module. (See arrows in Fig. 3-28.)

With a view to minimizing the image shift in multifluorescence images, the barrier filter may be provided with another marking, i.e., a marking that indicates the position of the wedge angle.

When installing the barrier filter into the reflector modules used, be sure to align that marking to the orientation groove (Fig. 3-28/**4**). This ensures that the wedge angle of the barrier filter will be in the same defined position in the reflector module in use, thus compensating, among modules, for and/or minimizing what is actually a very small image shift anyway in the Zeiss filter sets utilized.

If the installation of filters not provided with direction markings (arrows) proves necessary, we recommend that the procedure below be followed:

Be sure to install filters with reflecting, dielectric layers in such a way that the reflecting layer (Fig. 3-29/**6**) in the excitation filter (Fig. 3-29/**5**) points outward (in relation to the reflector module). In the barrier filter (Fig. 3-29/**1**), the reflecting layer(Fig. 3-29/**2**) must point inward (Fig. 3-29).

In mounting position, the reflecting layer (Fig. 3-29/**4**) of the beam splitter (Fig. 3-29/**3**c002 Tc 0.898 Tw -4.598 -1.

3.3.6 Mounting the Aqua Stop

The aqua stop should be inserted to protect the objectives and the nosepiece whenever you work with liquid specimens.

- Detach the microscope stage and screw out the objectives.
-

3.3.7 Changing LED Modules in the Axio Vert.A1 FL-LED Stand

4 OPERATION

4.1 Use of LD Objectives

In tests performed with inverted microscopes, vessels are usually employed whose bottom thickness differs considerably from the common cover slip thickness of 0.17 mm.

Normally, the working distances (a) of low-magnification objectives easily bridge such distances.

A-Plan 5x / 0.12 a = 10.9 mm (in air)
or
A-Plan 5x / 0.25 a = 5.3 mm (in air)

When it comes to the medium magnification range, however, those working distances shrink to values around or below 1 mm in most cases. Those objectives can than no longer be utilized for greater bottom thicknesses.

This deficiency can be overcome with special LD (long-distance) objectives. They feature a relatively long working distance as well as the usual 45-mm p9(= 10)10A-6(o)11(c-4(a)-2(l)3(u v3)3(e)d( )Tjfo)4(sy)4 as t long

4.5 Use of Objectives

Objectives for Bright Field and PlasDIC

EC Plan-Neofluar 1.25x
EC Plan-Neofluar 2.5x
A-Plan 2.5x
A-Plan 5x
LD A-Plan 10x to 63x (also suitable for phase contrast if available as Ph objective)
LD Plan-Neofluar Korr 20x, 40x, 63x (also suitable for phase contrast if available as Ph objective)

4.7 Height Stop for the Focusing Drive

The purpose of the height stop for the focusing drive is to limit the uppermost position of the focusing drive, so as to protect the specimen against damage or from being lifted out during the focusing process.

x Turn the clamping lever of the stop (Fig. 4

4.9 Light Manager Function on the Axio Vert.A1 MAT Stand

The light manager function can be employed both in reflected light (using the VIS-LED attachment lamp) and transmitted light (using the HAL illuminator or the LED illuminator for transmitted light, provided the optional carrier for transmitted light illumination is installed).

4.11 Illumination and Contrast Techniques in Transmitted Light

Every Axio Vert.A1 stand version allows the user to apply the transmitted light

4.11.3 Transmitted Light VAREL Contrast

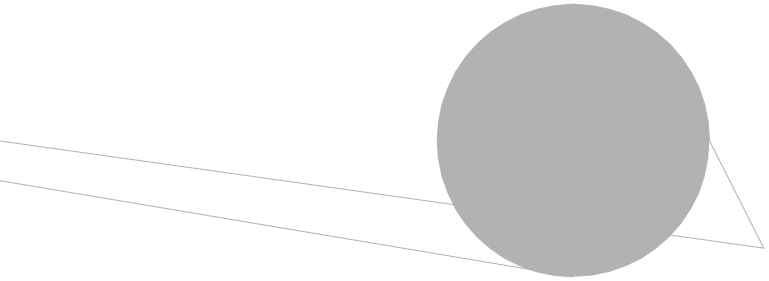
VAREL (variable relief contrast) delivers relief-like images of specimens and can be used as an alternative to phase contrast. VAREL may also be employed for curved surfaces, e.g., 96-microtiter plates, which cannot be contrasted with phase contrast, as it is impossible to set a ring overlap.

Requirements

The microscope must have properly been put into operation, as described in Section 3.
The microscope must be switched on.
Condenser with slider for VAREL contrast
Objective for VAREL contrast

Setting VAREL Contrast

- Rotate the objective for VAREL contrast into the light path.
- Open the aperture diaphragm (Fig. 4-5/**4**) on the condenser (Fig. 4-5/**5**) completely.
- Using a fitting mounting frame, insert the specimen into the retaining clips (Fig. 4-5/**3**) of the object guide.
- Move the VAREL position of the Ph/PlasDIC, H, VAR slider (Fig. 4-5/**2**) into the light path until the notch for the currently selected specimen magnification has been found. There are three different notches for VAREL.
- The contrast desired can be adjusted via the setscrew (Fig. 4-5/**1**).



Setting DIC

- Open the aperture diaphragm on the condenser completely. Put on the specimen.
- On the nosepiece, rotate in the objective suitable for DIC.
- Put the corresponding DIC slider (Fig. 4-8/**3**) into the slot on the nosepiece. Make sure the DIC slider snaps safely into position.
- On the condenser, (Fig. 4-8/**1**) rotate the proper DIC I, II or III condenser module (as identified by the stickers on the front of the condenser) into the light path.
- Put the three-position contrast slider (Fig. 4-8/**2**) with the analyzer position into the stand or rotate in the D P&C analyzer module on the reflector turret. Watch for the correct locking position.
- Adjust optimum contrast, using the knurled thumb screw on the DIC slider (Fig. 4-8/**4**). By adjusting the DIC slider sym6(u)17(l)9(e)4(o)6(n)6(th)17(e)4( )11(r33W5)4(r)1.

4.11.5 Transmitted Light PlasDIC

PlasDIC, an innovative interference contrast,

- If necessary, use the two centering keys to precenter the iHMC module in the mount, based on your visual judgment. The two holes for accessing the centering screws (Fig. 4-10/**1**) are l.Tc 0.r-4(c)d[ar)43.261 0(-2(s)]TJ5ou)11(r587)Tj470 TcTj TT

Aligning the iHMC Module

- Rotate the iHMC objective into the light path.
- Put on the microscope a typical specimen, such as an egg cell or adherent cells, placed in a cultivation dish.
- View and focus the specimen via the eyepieces.
- Replace an eyepiece by inserting the auxiliary microscope into an eyepiece tube.

The rear focal plane of the objective will now be visible through the auxiliary microscope.

- Adjust the eye lens of the auxiliary microscope to bring the zone plate of the objective (Fig. 4-11/**1a**) and the iHMC diaphragm (Fig. 4-11/**1b**) in focus.
- Turn the ring of the iHMC objective until the zone plate is aligned parallel to iHMC diaphragm. (See Fig. 4-11/**2**.)
- Using the two centering keys, move the iHMC diaphragm until area **a** of the zone plate and area **b** of the iHMC diaphragm line up completely in middle position if possible (Fig. 4-11/**3**). In the example shown, the position of the contrast elements may appear rotated in relation to Fig. 4-11, depending on the relief impression orientation chosen.
- Remove the auxiliary microscope and insert the eyepiece.
- Stick onto the relevant space for the condenser position used the condenser label for the iHMC magnification just set. (The numbers of the space at the front and of the condenser position set must be identical.)

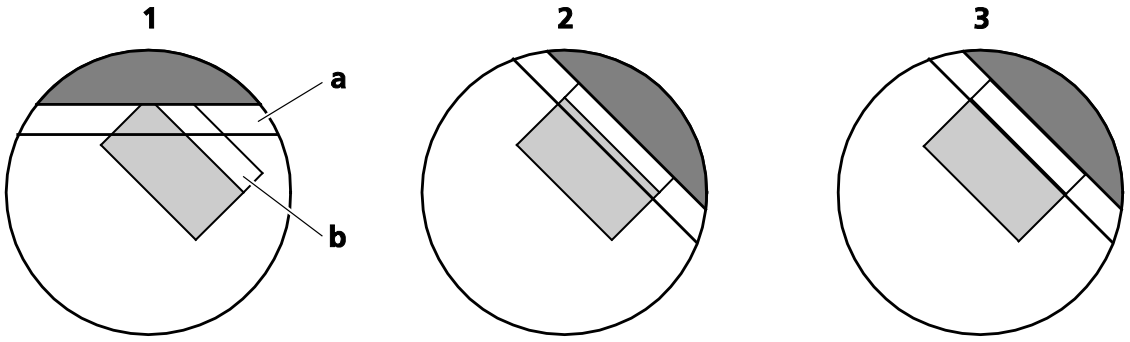


Fig.

4.11.7 Transmitted Light Polarization Contrast

The technique of viewing transparent objects between crossed polarization filters is employed in geology and mineralogy, in particular. Increasingly, it is also used for plastic, glass, technical films, etc.

With this technique, optical anisotropies (e.g., tensions) are rendered visible, which would otherwise go undetected with reflected or transmitted light methods.

Setting the Polarization on the Axio Vert.A1 MAT, Using Polarizer DL and Analyzer Slider A 12x35 mm, Rotatable 90 Degrees

- Set up the microscope for bright field in transmitted light.
- Slide polarizer DL (Fig. 4-12/**1**) on the condenser (Fig. 4-12/**2**) in the light path.
- Insert the analyzer slider (Fig. 4-13/**2**) (a P&C analyzer module in the reflector turret may be used as an alternative) into the slot (Fig. 4-13/**1**) under the nosepiece. The analyzer can be rotated 90 degrees.
- Use the analyzer turning lever (Fig. 4-13/**4**) to cross the vibration direction of the analyzer and polarizer (dark position).
- The analyzer slider may be inserted both from the left-hand and right-hand sides.

4.12

x If required, adjust the illumination intensity on the **On/off**

4.12.3 Reflected Light DIC

The reflected light DIC or reflected light C-DIC technique (DIC = differential interference contrast; C-DIC = differential interference contrast in circularly polarized light) allows a high-contrast imaging of phase objects, i.e., objects which, unlike amplitude objects, only change the phase of the light.

Requirements

The microscope must have properly been put into operation, as described in Section 3.

The microscope must be switched on.

VIS-LED or HAL 100 reflected light illumination

Objectives for DIC or polarization (designation: DIC or Pol)

Setting C-DIC

- Set the microscope up for reflected light bright field.
- Rotate the C-DIC P&C reflector module into the light path.
- Insert C-DIC slider 6x20 (Fig. 4-15/**1**) into the slot.
- Put on the specimen, focus and turn the adjustment wheel on C-DIC slider 6x20, so that the structure of interest is visible with maximum contrast.
- You can create additional contrast effects by turning the adjustment wheel on the C-DIC slider.

Additional Comment

4.12.4 Reflected Light Polarization

Reflected light polarization is another contrasting option for polished faces of ore minerals, coal, ceramic products, certain metals and metal alloys, as those often exhibit a different reflection behavior in linearly p

Setting Polarization with the Pol P&C Reflector Module and Analyzer Slider A 12x35 mm, Rotatable 90 Degrees

- Set up the microscope for bright field in reflected light.
- Rotate in the Pol P&C reflector module on the reflector turret.
- Insert the analyzer slider (Fig. 4-16/**2**) into the slot (Fig. 4-16/**1**) under the reflector turret. The analyzer can be rotated 90 degrees.
- Use the analy(F)eB8f115eheanalyzinto the

- Insert the FL attenuator into slot A for aperture sliders. Set the correct brightness with the adjustment wheel.
-

5.2 Maintenance

5.2.1 Performing Checks

The following checks should be performed at six-month intervals:

General

- Check the power cable and power plug for possible damage.
-

5.3 Service

Be sure to have all the repairs of optical parts or motion elements located inside the instrument, as well as work on the power supply performed by customer service or specially **authorized** personnel only.

6 ANNEX

6.1 List of Abbreviations

A / AL	Auflicht = reflected light
AC	Alternating current
BioMed.	Biological-medical
Br.	Brillenträger-Eignung = Suitable for spectacle wearers
CSA	Canadian Standards Association (Canadian standards and testing agency)
D	Deckglasdicke = cover slip thickness
D / DF	Dark field
d	Diameter (of a filter, for example)
DIC	Differential interference contrast
DIN	Deutsches Institut für No

Axio

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