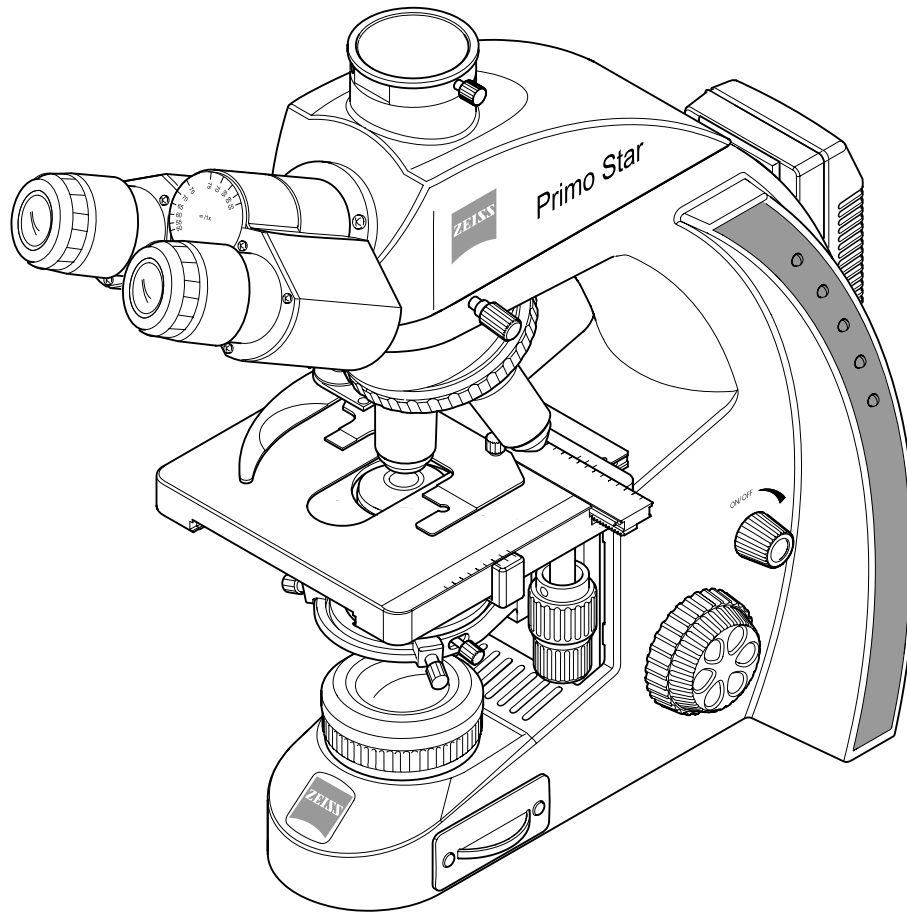


Primo Star



Operating manual
Bedienungsanleitung
Mode d'emploi
Instrucciones de manejo
Инструкция по применению
操作手册



English

Knowledge of this manual is required for the operation of the instrument. Would you therefore please make yourself familiar with the contents of this manual and pay special attention to hints concerning safe operation of the instrument. The specifications are subject to change; the manual is not covered by an update service. Unless expressly authorized, forwarding and duplication of this document, as well as utilization and communication of its contents are not permitted. Violations will entail an obligation to pay compensation. All rights reserved in the event of granting of patents or registration of a utility model.

Deutsch

Die Kenntnis dieser Anleitung ist für die Bedienung des Gerätes erforderlich. Bitte machen Sie sich deshalb mit dem Inhalt vertraut und befolgen Sie besonders Hinweise, die den sicheren Umgang mit dem Gerät betreffen. Änderungen im Interesse der technischen Weiterentwicklung bleiben vorbehalten; das Handbuch unterliegt nicht dem Änderungsdienst. Weitergabe sowie Vervielfältigung dieser Unterlage, Verwertung und Mitteilung ihres Inhalts sind nicht gestattet, soweit nicht ausdrücklich zugestanden. Zuwiderhandlungen verpflichten zu Schadenersatz. Alle Rechte für den Fall der Patenterteilung oder Gebrauchsmuster-Eintragung vorbehalten.

Français

L'utilisation de l'appareil suppose la bonne connaissance du présent mode d'emploi. Nous vous prions par conséquent de lire attentivement les informations contenues dans ce document et de respecter notamment les consignes relatives à la sécurité d'utilisation. Le fabricant se réserve le droit d'apporter des modifications techniques en fonction de l'évolution des technologies. Ces modifications ne sont pas automatiquement prises en compte dans le mode d'emploi qui accompagne chaque appareil. Toute divulgation, reproduction ou publication du présent document, même partielle, est interdite sans notre autorisation écrite. Toute infraction donne droit au versement de dommages et intérêts. Tous les droits sont réservés en cas de délivrance d'un brevet ou de dépôt d'un modèle d'utilité.

Español

El manejo de este equipo presupone el conocimiento de las presentes instrucciones. Por eso le rogamos familiarizarse con su contenido y observar en particular las indicaciones que se refieren al manejo seguro del mismo. Nos reservamos el derecho a modificaciones en interés del desarrollo técnico; el manual no está sujeto al servicio de actualización. Sin nuestro consentimiento expreso no se autoriza ni la entrega y reproducción de este manual, ni el aprovechamiento y la comunicación de su contenido. Cualquier contravención implica el pago de una indemnización. Reservados todos los derechos para el otorgamiento de patentes o el registro de modelos de utilidad.

Русский

Знание данной инструкции необходимо для использования прибора. Поэтому необходимо ознакомиться с ее содержанием и особенно следовать указаниям, касающихся безопасного обращения с прибором. Фирма оставляет за собой право на изменения в интересах технического усовершенствования; руководство не подлежит изменениям. Передача и тиражирование данных документов, использование и сообщение их содержания не допускаются без особого разрешения. В случае нарушений полагается возмещение убытков. Фирма оставляет за собой право на выдачу патента или регистрацию зарегистрированной модели.

版 权

中文

操作本仪器必须先阅读本手册内容。因此请务必熟悉本手册内容，尤其要遵从有关仪器正确操作的注意事项。技术可能会有更新，此手册不含升级服务。未经授权禁止复制，利用和转载本手册内容。如有违背必须承担相应赔偿责任。保留所有申请专利或者样品注册权利。

Issued by: **Carl Zeiss MicroImaging GmbH**

P.O.B. 4041, 37030 Göttingen, Germany
Phone: +49 (0) 551 5060 660
Fax: +49 (0) 551 5060 464
E-Mail: micro@zeiss.de

www.zeiss.de

Number of this manual: B 46-0071 v
Date of issue: Version 7, 03/01/2006

CONTENTS

	Page
1	Notes on Instrument Safety..... 4
1.1	General safety notes..... 4
1.2	Instrument safety and EMC 4
1.3	Unpacking, transportation, storage..... 5
1.4	Disposal..... 5
1.5	Use..... 5
1.6	Notes on warranty..... 7
2	Description 8
2.1	System overview 8
2.2	Total view..... 10
2.3	Intended use 11
2.4	Instrument description and main features 11
2.5	Objectives..... 12
3	Start-Up and Operation 13
3.1	Starting up the microscope..... 13
3.2	Controls 14
3.3	Operating the microscope 16
3.3.1	Setting interpupillary distance and viewing height 16
3.3.2	Compensating for ametropia and inserting the eyepiece pointer..... 16
3.3.3	Adjusting transmitted-light brightfield on the Full Köhler microscope..... 17
3.3.4	Adjusting transmitted-light brightfield on the Fixed Köhler microscope 18
3.3.5	Adjusting transmitted-light phase contrast or transmitted-light darkfield..... 19
3.4	Converting the microscope..... 20
3.4.1	Changing the tube 20
3.4.2	Inserting color filters 20
3.4.3	Replacing the 6V 30W halogen lamp or the LED illumination..... 21
3.4.4	Changing objectives 21
3.4.5	Installing/removing the illuminating mirror 22
3.4.6	Installing a camera..... 23
4	Care and Troubleshooting 25
4.1	Instrument care 25
4.2	Troubleshooting 26
5	Appendix..... 27
5.1	Technical data 27

1 NOTES ON INSTRUMENT SAFETY

1.1 General safety notes

Please read this Operating Manual carefully before starting up the microscope.

If you need supplementary information, contact Carl Zeiss Service or an authorized agency.

To ensure safe operation and troublefree function of the microscope, strictly observe the precautions and warnings given in this manual.

These are set off herein as follows:

**CAUTION**

This symbol indicates a possible hazard to the user of the instrument.

**CAUTION**

This symbol indicates a possible hazard to the instrument or system.

**CAUTION**


Disconnect the plug-in power unit from line power before opening the microscope!

**NOTE**

This symbol refers you to advice that you must observe under all circumstances.

1.2 Instrument safety and EMC

The Primo Star microscope has been designed, produced and tested in compliance with the standards DIN EN 61010-1 (IEC 61010-1) and IEC 61010-2-101 "Safety requirements for electrical equipment for measurement, control and laboratory use".

The Primo Star microscope meets the requirements of the EC Directive 98/79/EC Annex 1 and carries the  mark.

Radio-noise suppression in compliance with EN 55011 Class B

Noise immunity in compliance with DIN EN 61326

The instruments are disposed of in compliance with the WEEE Directive 2002/96/EC.

1.3 Unpacking, transportation, storage

Please observe the following safety notes for unpacking, transportation and storage of the microscope:

- The microscope is supplied packed to commercial standards in a plastic case with cardboard packaging; use the original packaging only for any transportation.
- Retain the original packaging for longer storage or return to the manufacturer.
- When unpacking the equipment, verify that all parts specified on the delivery note are present.



- Keep transport and storage temperatures as specified in Technical Data.
- Set up the microscope on a stable worktable with solid and smooth tabletop.
- Do not touch optical surfaces.

1.4 Disposal

Please observe the following safety notes for the disposal of the microscope:



Defective microscopes should not be disposed of with household waste; dispose of them in compliance with the provisions of the law.

1.5 Use

The microscope including its original accessories must not be used for microscopic techniques other than those described in this Operating Manual.

Please observe the following safety notes when using the microscope:



The manufacturer cannot assume any liability for other applications, including those of individual modules or single components. This also applies to any service or repair work that is not carried out by authorized service personnel. In case of non-compliance, all warranty claims shall be forfeited.



The microscope may only be operated by trained personnel who must be aware of the possible dangers involved with microscopy and the particular application concerned. The microscope may only be operated if set up on a stable, solid and smooth surface.



The stereomicroscope is a high-precision instrument that can be impaired in its performance or even be destroyed when handled improperly.



The microscope is equipped with a plug-in power unit allowing line voltages to be used in the range between 100 and 240 V \pm 10%, 50/60 Hz, without the need for changing the voltage setting on the instrument.



The plug-in power unit meets the requirements of Protection Class II (with protective insulation). If its casing is damaged, put the plug-in power unit out of operation. The microscope may be operated only with the supplied plug-in power unit.



If it is determined that protection measures are no longer effective, the instrument must be switched off and safeguarded against inadvertent operation. Please contact a Zeiss service agency or the Carl Zeiss Microscopy Service to repair the instrument.



– Always disconnect the power cable, before opening the instrument and changing the lamp or LED source.



– Wait for the lamp to cool down before replacing it and do not touch the new bulb.

– The instrument may only be opened by qualified specialists or service staff.



– The operation of the instrument in explosion-risk environments is not allowed.



Make sure to read the safety notes provided with Immersol 518 N[®] immersion oil.



Immersion oil irritates the skin. Avoid any contact with skin, eyes and clothing.

After skin contact, wash the oil off with plenty of water and soap.



After eye contact, immediately rinse the eye with plenty of water for at least five minutes.

If the irritation persists, consult a specialist.

Proper disposal of immersion oil: Take care to ensure that immersion oil does not enter surface water or the sewage system.



The microscope is not equipped with special devices for the protection from substances that are corrosive, potentially infectious, toxic, radioactive, or other substances that could be hazardous to health. Make sure to observe all legal regulations, particularly the relevant national accident prevention regulations when handling such substances.



– Before any transport of the instrument, switch it off and let it cool down (hot surface at the bottom of the instrument).



– Operate the device only on a hard, non-combustible support.

– The plug-in power unit must not get in contact with moisture.

1.6 Notes on warranty

The Primo Star Microscope including its original accessories must not be used for microscopic techniques other than those described in this Operating Manual. The manufacturer cannot assume any liability for other applications.

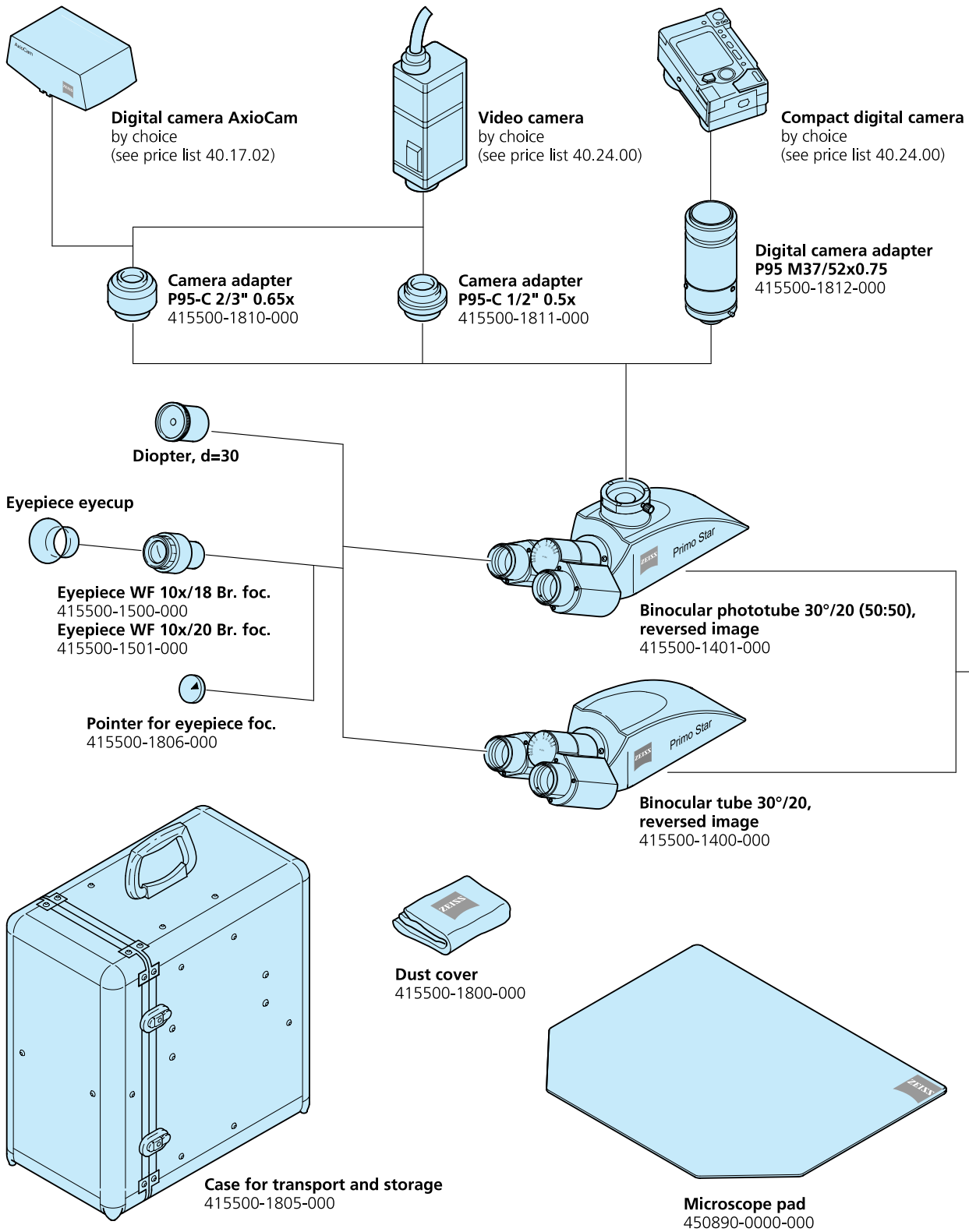
Please note the following information on warranty for the Primo Star Microscope:

- The manufacturer guarantees that the microscope is free of material or manufacturing defects when delivered.
- Possible defects must be notified to us immediately and steps be taken to minimize damage.
- If notified of such a defect, the manufacturer is obligated to rectify it at his discretion, either by repairing the instrument or delivering an intact replacement.
- No guarantee is provided for defects caused by natural wear (wearing parts in particular) and improper use.
- The instrument manufacturer shall not be liable for damage caused by faulty operation, negligence or any other tampering with the microscope, particularly the removal or replacement of microscope components, or the use of accessories from other manufacturers.

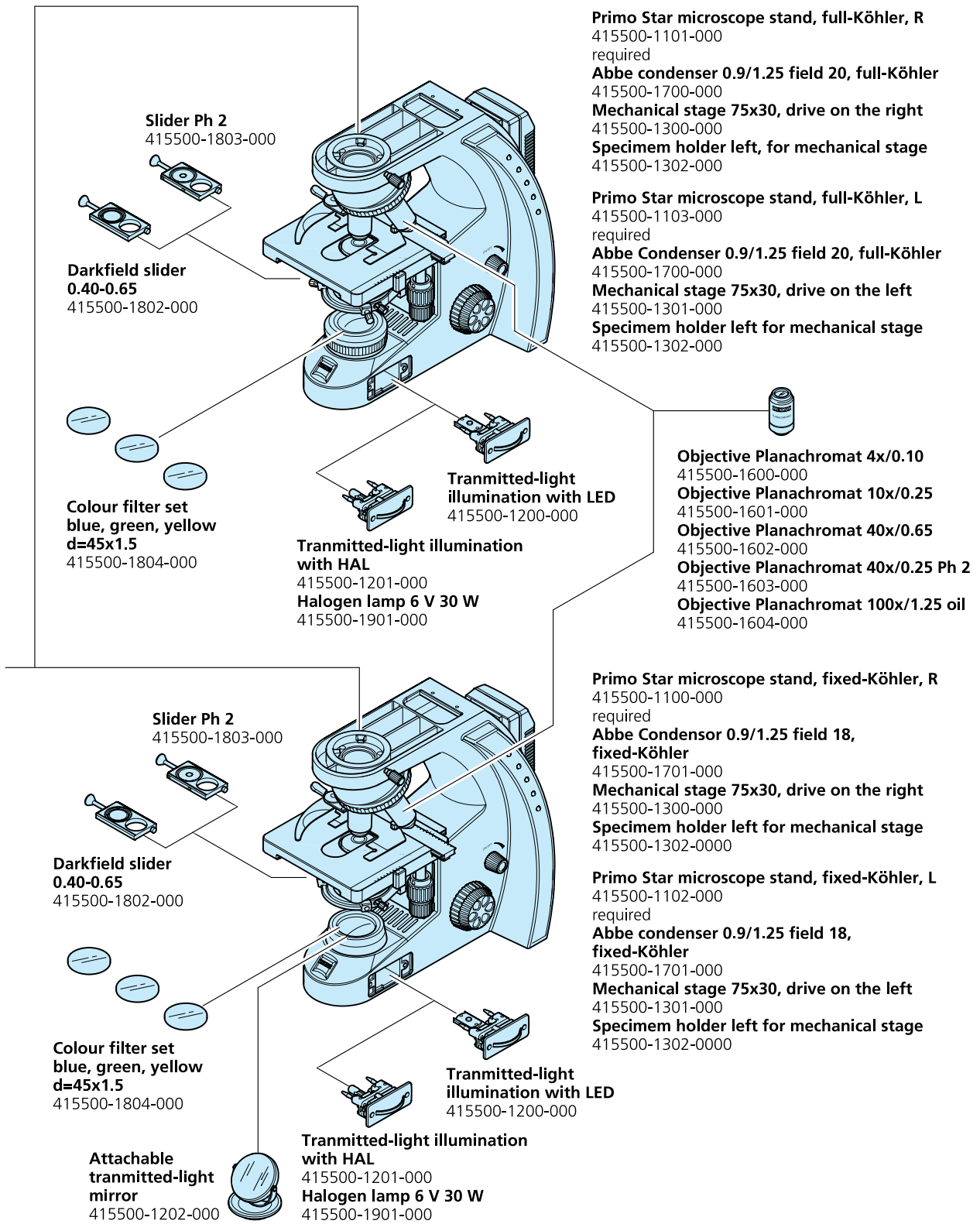
Unauthorized tampering with the instrument shall lead to a forfeit of all warranty claims.

2 DESCRIPTION

2.1 System overview

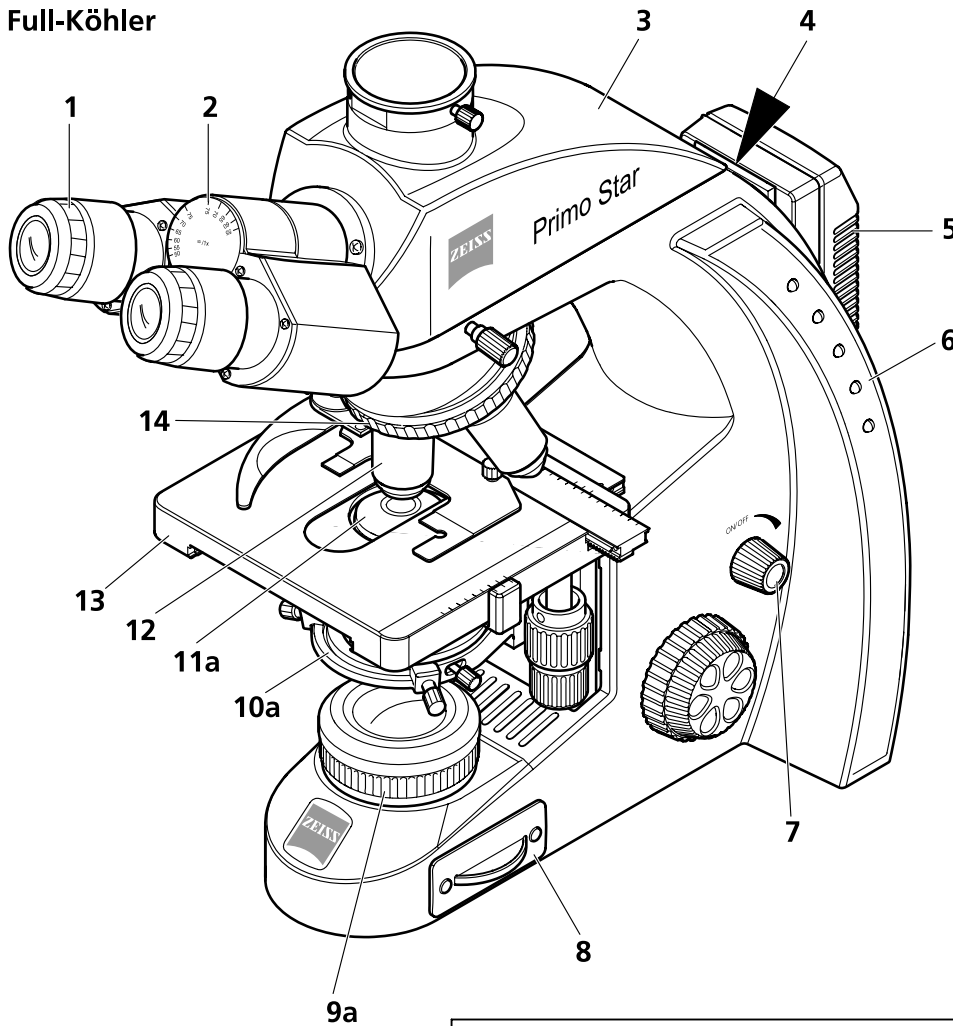


English



2.2 Total view

Full-Köhler



- 1 Eyepiece
- 2 Binocular head
- 3 Tube
- 4 Carrying handle
- 5 Plug-in power unit
- 6 Stand
- 7 ON/OFF switch; illumination intensity
- 8 Illumination module
- 9a Luminous-field diaphragm, adjustable
- 9b Luminous-field diaphragm, fixed
- 10a Condenser carrier, Full Köhler
- 10b Condenser carrier, Fixed Köhler
- 11a Abbe condenser, Full Köhler
- 11b Abbe condenser, Fixed Köhler
- 12 Objective
- 13 Microscope stage
- 14 Objective nosepiece

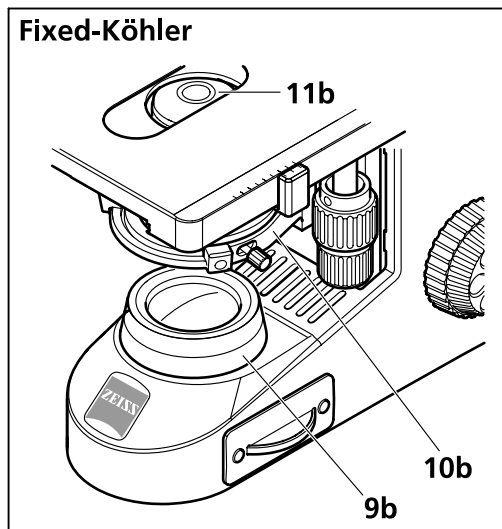


Fig. 1 Total view

English

2.3 Intended use

The Primo Star microscope is a universally applicable light microscope primarily designed for the examination of cell and tissue cultures as well as sediments in culture flasks, Petri dishes and microplates.

Typical applications:

Examination of blood and tissue samples from the human body, observation of intracellular processes on living cell cultures, cell-cell interactions, motility, growth, potential measurement, detection of medical drugs, microinjection and in vitro fertilization.

When handling hazardous substances, observe the instructions on intended operation, correct use and statutory safety precautions.

2.4 Instrument description and main features

The Primo Star is a transmitted-light microscope of compact design with a small footprint.

Beside the high-resolution, infinity-corrected objectives and the important microscopy techniques, such as brightfield, darkfield and phase contrast, the microscope is optionally available with a camera port for photo and video documentation.

The major features of the microscope include:

- Modular illumination through 6V 30W halogen lamp, LED illumination or illuminating mirror.
- Integrated fixture for external power supply and cable (incl. cable with multi-standard plug and country-specific plug adapters)
- Plastic-coated carrying handle integrated in stand for installation, uninstallation and transport
- Blue, light-intensity indicators installed on both sides and well visible from a distance
- Stand in "Full Köhler" or "Fixed Köhler" design
- Convenient coaxial coarse and fine focusing drive, smoothness of coarse focusing drive being adjustable
- Mechanical stage 75×30 left/right with specimen holder, stage controls optionally on the right or left
- Space-saving, continuously adjustable illumination module optionally with halogen or LED source
- "Full Köhler" or "Fixed Köhler" Abbe condensers for brightfield, darkfield and Ph 2 phase contrast
- Backward inclined quadruple objective nosepiece with W 0.8 lens thread running on ball bearing
- Infinity-corrected "Plan-ACHROMAT" objectives with magnifications of 4x, 10x, 40x and 100x/Oil for brightfield, darkfield and Ph 2 phase contrast Ph 2 (40x/Ph2) as well as for oil immersion applications (100x/Oil)
- Binocular tube or binocular phototube (50% vis, 50% doc) with ergonomically favorable tube angle of 30° with adjustable interpupillary distance and viewing height
- 10× focusing eyepieces for field-of-view numbers 18 or 20, suitable for spectacle wearers

2.5 Objectives

The objectives are the optical heart of the microscope. The objectives may be labeled as follows:

Plan-ACHROMAT 10×/0.25 ∞/-.



Fig. 2 Objective

where:

10× Objective magnification,
With a defined color ring on the objective being assigned to each magnification step (Carl Zeiss color code)

0.25 Numerical aperture

∞ Infinite mechanical tube length

– Usable with cover slip thickness $D = 0$ or 0.17 mm

or

0.17 Usable with cover slip thickness $D = 0.17$ mm

Other labels:

Oil Oil immersion objective

Ph 2 Phase contrast objective with green inscription and phase stop Ph 2

Objective magnification multiplied by eyepiece magnification results in overall visual magnification, e.g. $10 \times 10 = 100\times$.

Numerical aperture multiplied by 1000, e.g. $0.25 \times 1000 = 250\times$, presents the maximum useful magnification; there is no resolution for further details above that limit.

When immersion objectives are used, the air between the cover slip and the objective is replaced by a liquid, which in most cases is immersion oil. The plastic oiler containing 5 ml of immersion oil is particularly suitable for this purpose.

Because of their short working distances, the 40×, 40x/Ph 2 and 100x/Oil objectives are equipped with resilient mounts for specimen protection.

3 START-UP AND OPERATION

3.1 Starting up the microscope



Before installing and starting up the microscope, be sure to carefully read and observe the notes on instrument safety (see Section 1).



Do not touch optical surfaces when unpacking the microscope to avoid fingerprints!

The microscope is supplied completely assembled and inclusive of accessories packed to commercial standards. Additionally ordered components, such as sliders or transmitted-light equipment with illuminating mirror, are packed separately.

- Remove the microscope from the transport case and place it onto the worktable.



Retain the original packaging for storage of the instrument in longer periods of non-use or for return to the manufacturer.

- Remove the plug-in power unit (Fig. 3/2) from its storage fixture on the back wall of the microscope.
- Replace the installed power outlet adapter by one of the supplied country-specific adapters (Fig. 3/4), if necessary. To this end, pull off the attached adapter and plug on the desired adapter.
- Connect the plug-in power unit to a power outlet.
- If the plug-in power unit cannot be plugged into the chosen power outlet because of limited space, replace the power outlet adapter by the supplied IEC adapter (Fig. 3/3). This allows the plug-in power unit to be put flat onto the tabletop and connected to the power outlet through a country-specific appliance cable.

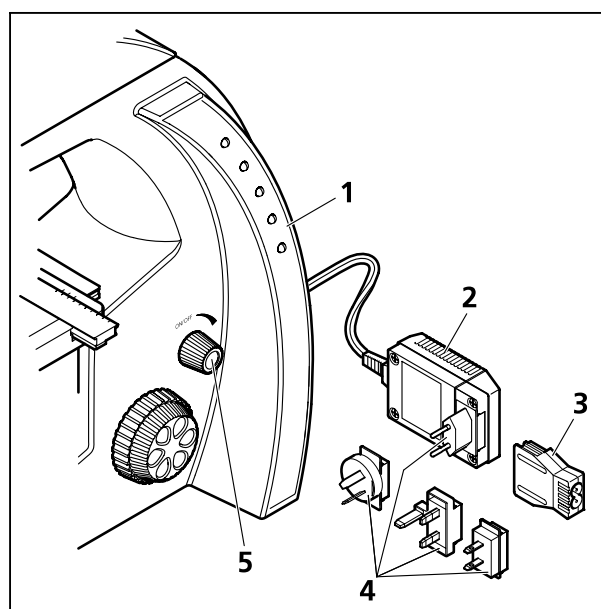


Fig. 3 Starting up the microscope



When using the IEC adapter, the plug-in power unit can be fixed to the back wall of the microscope stand by means of the supplied two self-adhesive hooks and the Velcro® strip.

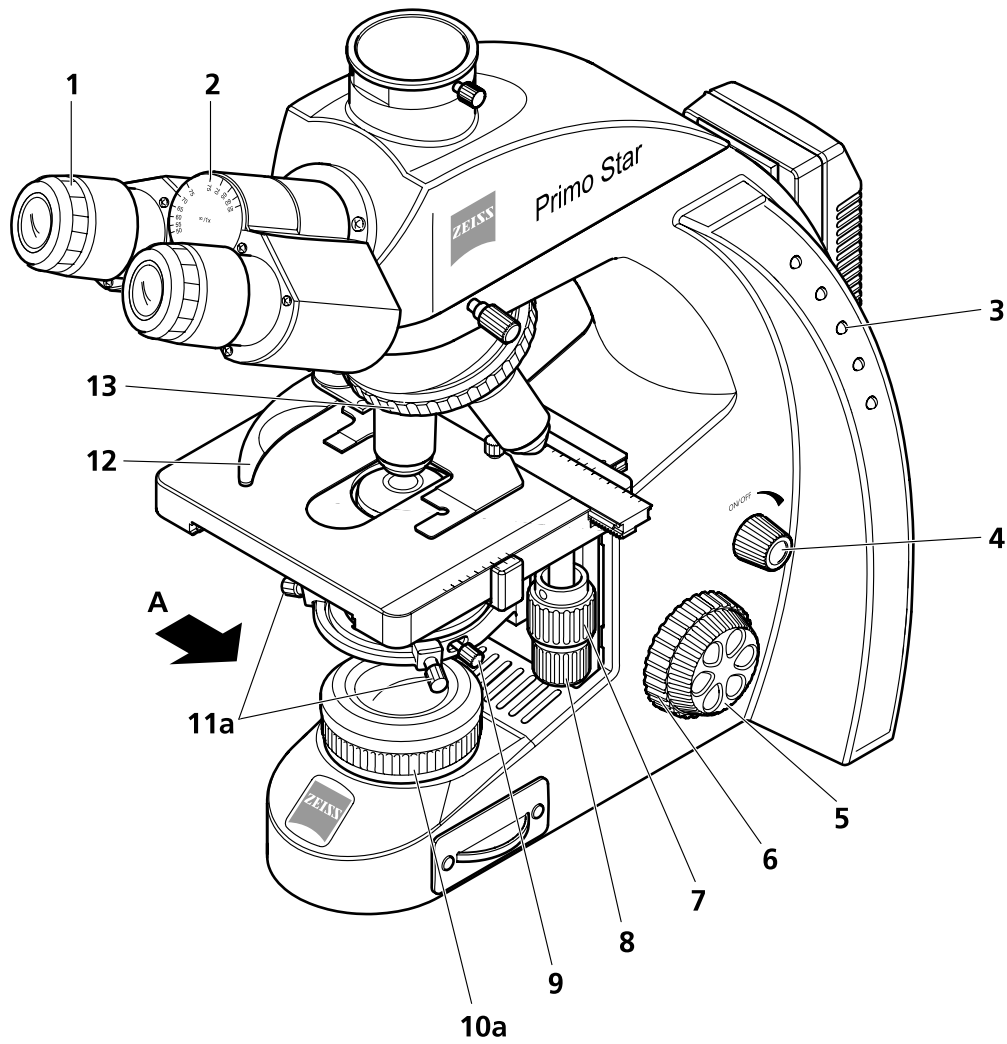
- Turn on the microscope with rotary switch (Fig. 3/5) and adjust the illumination to the desired intensity.

The selected intensity is indicated in five steps by the blue light-emitting diodes (Fig. 3/1) arranged on both sides of the stand.

- At the end of the microscopic examinations, turn the microscope off with the rotary switch and cover it with the dust cover.
- The smoothness of the coarse focusing drive (Fig. 4/18) is factory-adjusted. However, you can readjust it when required.

3.2 Controls

English



View A

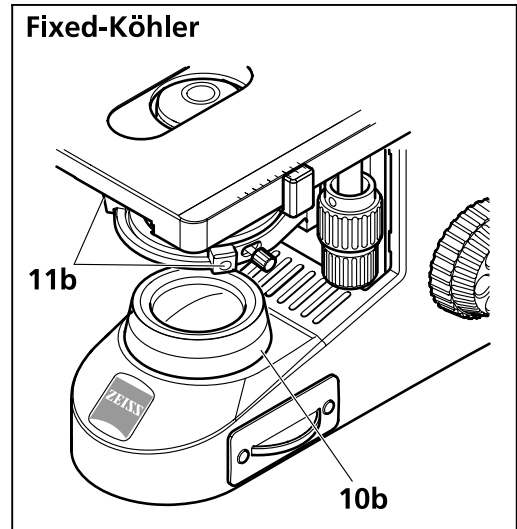
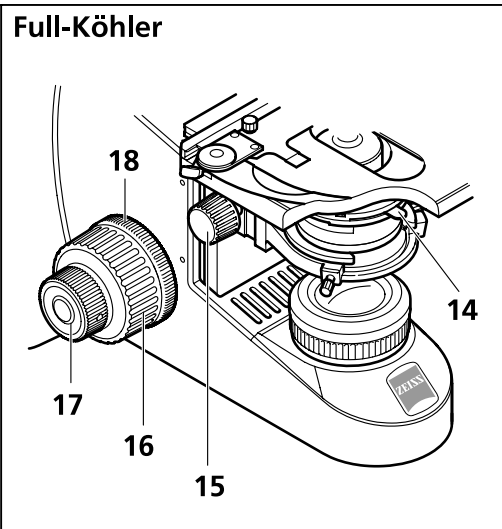


Fig. 4 Controls

Legend to Fig. 4:

- 1 Eyepieces
- 2 Binocular body of the tube
- 3 Illumination-intensity indicators
- 4 Rotary knob for switch ON/OFF and adjustment of illumination intensity
- 5 Fine focusing drive (right side)
- 6 Coarse focusing drive (right side)
- 7 Control knob for X travel of mechanical stage
- 8 Control knob for Y travel of mechanical stage
- 9 Condenser clamp screw
- 10a Knurled ring for adjustment of luminous-field diaphragm (with Full Köhler equipment only)
- 10b Luminous-field diaphragm (fixed in Fixed Köhler equipment)
- 11a Condenser entering screws (in Full Köhler equipment: knurled screws)
- 11b Condenser centering screws (in Fixed Köhler equipment: Allen screws)
- 12 Spring lever of specimen holder
- 13 Knurled ring of objective nosepiece
- 14 Lever for the adjustment of the aperture diaphragm of the condenser
- 15 Knurled knob for vertical adjustment of condenser
- 16 Coarse focusing drive (left side)
- 17 Fine focusing drive (left side)
- 18 Knurled ring for adjusting the smoothness of the coarse focusing drive

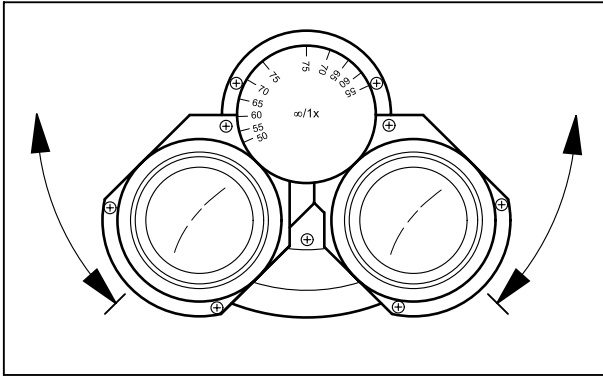


Fig. 5 Setting the interpupillary distance

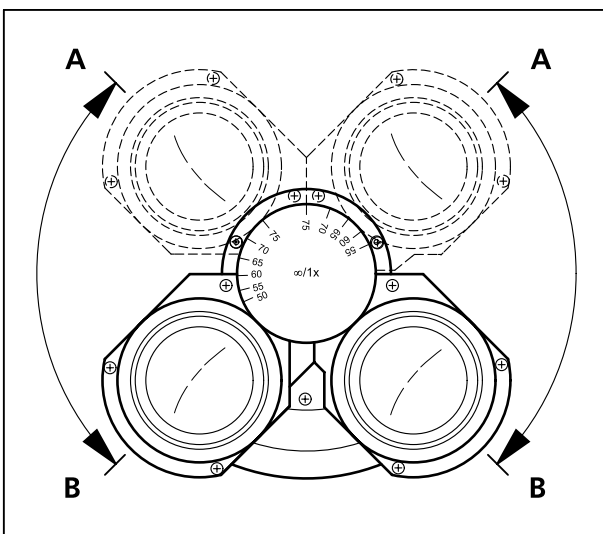


Fig. 6 Adjusting the viewing height

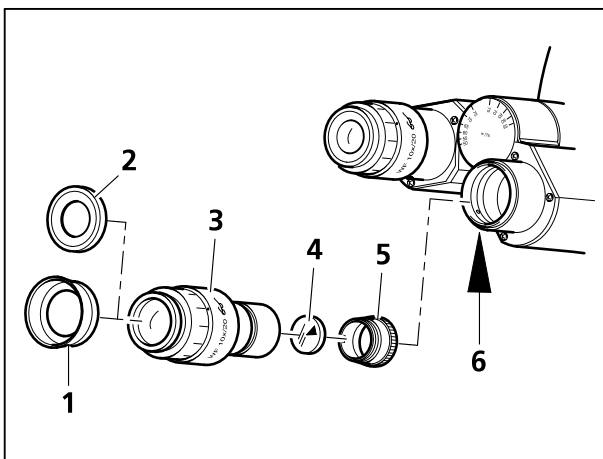


Fig. 7 Inserting the eyepiece pointer

3.3 Operating the microscope

3.3.1 Setting interpupillary distance and viewing height

- Swing the eyepiece tubes symmetrically slightly toward or away from one another to adjust the distance between the tubes to your individual interpupillary distance (Fig. 5).

The adjustment of the interpupillary distance is correct when you see only **one** round image while looking through the two eyepieces!

- Swivel the eyepiece tubes fully up (Fig. 6/A) or down (Fig. 6/B) to adjust the viewing height to your individual requirements.

3.3.2 Compensating for ametropia and inserting the eyepiece pointer

The eyepieces (Fig. 7/3) are equipped with fold-over rubber eyecups (Fig. 7/1: pulled out; Fig. 7/2: folded over).

Both eyepieces are suitable for spectacle wearers. Additionally, they contain a focusing ring for the compensation of defective vision. The provided diopter scale serves to facilitate finding the correct setting.

The eyepiece pointer can be inserted in one eyepiece, when required.

To this end, follow this procedure:

- Use Allen key SW 1 mm to loosen grub screw (Fig. 7/6) on the binocular body from the bottom; remove the eyepiece.
- Unscrew the stop (Fig. 7/5) by hand from the eyepiece.
- Insert the eyepiece pointer (Fig. 7/4) into the eyepiece (with the coated side facing your eyes). Screw in the eyepiece stop again.
- Put the eyepiece into the tube and fix it with the grub screw.

- Turn the focusing ring of the eyepiece (Fig. 7/3) to focus on the triangular figure of the eyepiece pointer.
- Put the specimen onto the mechanical stage. Look at the specimen through the eyepiece with the eyepiece pointer and focus on the microscopic image by turning on the focusing drive.
- When in the above-mentioned eyepiece both microscopic image and eyepiece pointer appear sharply, focus the image for the second eye by turning the focusing ring of the second eyepiece.

Having done so, both microscopic images inclusive of the eyepiece pointer are focused.

Afterwards, you should focus on the specimen only by adjusting the focusing drive.

3.3.3 Adjusting transmitted-light brightfield on the Full Köhler microscope

- First, place a contrasty specimen slide with the 0.17 mm cover slip being on top in the specimen holder of the mechanical stage. Fix the slide by means of the spring lever (Fig. 4/12).
- If the microscope stand is equipped with a phase or dark-field slider, pull this slider out to the left as far as it will go.
- Turn rotary knob (Fig. 8/1) on microscope stand to adjust the illumination intensity.
- Move the Abbe condenser up to the top mechanical stop by turning knurled knob (Fig. 4/15); set the control lever of the aperture diaphragm (Fig. 4/14) to mid-position.



The knurled knob for vertical adjustment of the condenser is at the left of the microscope, if you use the mechanical stage 75x30 with drive on the right, it is at the right, if the stage controls are on the left.

- Turning at the knurled ring (Fig. 8/6) of the nosepiece, swing the 10x objective into the light path.
- On the binocular tube (Fig. 8/7), first look through one eyepiece and turn the focusing drive (Fig. 8/2) to focus on the specimen.
- Then, readjust the focus for the other eye, if necessary, by turning the eye lens of the focusing eyepiece.
- Close the luminous-field diaphragm (Fig. 8/3) until it becomes visible (even if not in focus) in the field of view (Fig. 8/A).

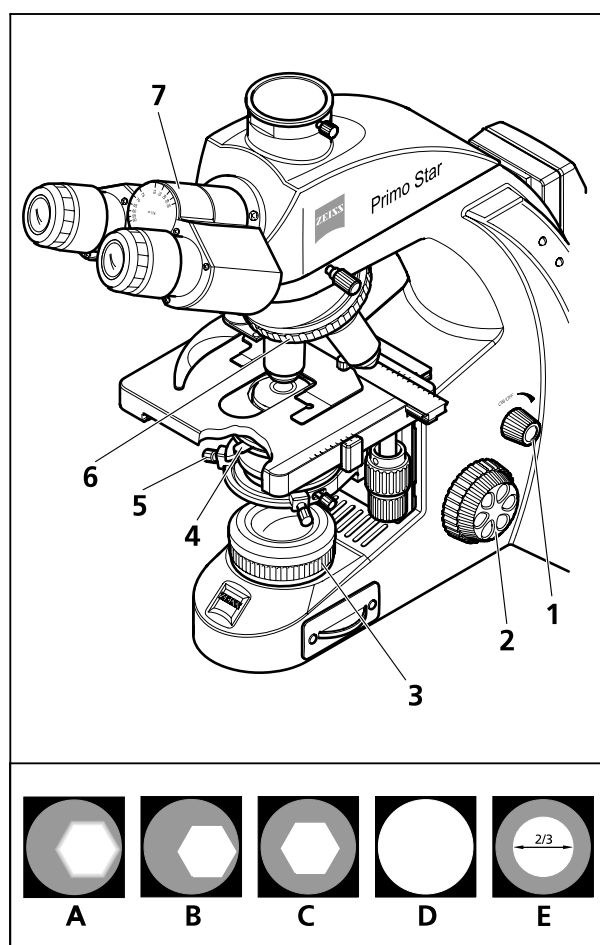



Fig. 8 Adjusting transmitted-light brightfield


- Turn the knurled knob for vertical adjustment of the condenser (Fig. 4/15) until the edge of the luminous-field diaphragm appears sufficiently sharp (Fig. 8/B).
- Center the image of the luminous-field diaphragm using both centering screws (Fig. 8/5) of the condenser (Fig. 8/C). Then, open the diaphragm until it just disappears from the field of view (Fig. 8/D).
- To adjust the aperture diaphragm (contrast), remove one eyepiece from the tube and look through the tube with your naked eye. Swing lever (Fig. 8/4) to adjust the aperture diaphragm to approximately 2/3 ... 4/5 of the diameter of the exit pupil of the objective (Fig. 8/E). In most applications, this aperture diaphragm setting provides optimum contrast at almost ideal resolution, and is therefore the best compromise for the human eye.
- Insert the eyepiece back in the tube.

 Specimen field size and objective aperture change after every objective change. Therefore, repeat the adjustment of luminous-field diaphragm and aperture diaphragm to obtain optimum results.

3.3.4 Adjusting transmitted-light brightfield on the Fixed Köhler microscope

The Primo Star Fixed Köhler Microscope is supplied factory-adjusted. Operation is restricted to a few manipulations.

- Place the specimen in the specimen holder of the mechanical stage.
- If the microscope stand is equipped with a phase or dark-field slider, pull this slider out to the left as far as it will go.
- Adjust the desired magnification by swinging in the corresponding objective.
- Set the control lever of the aperture diaphragm of the condenser to the value of the selected magnification (**10x**, **40x** or **100x**).
- Turn the rotary knob on the microscope stand to adjust the illumination intensity to a level pleasant for observation.

 If the condenser had been removed (e.g. for installing the illuminating mirror), make sure to reinstall and center it by means of the two centering screws (for this, refer to Section 3.4.5).

3.3.5 Adjusting transmitted-light phase contrast or transmitted-light darkfield

- First, adjust the microscope as you do for brightfield.
- Turn the nosepiece to swing the phase-contrast objective (40x/Ph 2) into the light path.
- Open the luminous-field diaphragm (Fig. 9/3, if adjustable) on the stand and open the aperture diaphragm by means of control lever (Fig. 9/1) on Abbe condenser (Fig. 9/2).
- If the phase-contrast slider (Fig. 9/6) was not factory-installed yet, first unscrew its screw (Fig. 9/7). Then, push the slider from the left into the Abbe condenser and screw the screw (Fig. 9/7) back in again.
- Push the slider to the right as far as it will go to move the phase stop into the light path.
- Move the control lever of the aperture diaphragm to fully open it on the Full Köhler model or set it to the **PH** mark on the Fixed Köhler model.
- Adjust the illumination intensity as needed.
- Check the centering of the phase stop according to the drawing in Fig. 10. To this end, remove one eyepiece and replace it by the eyepiece telescope.
- Center the phase stop, if necessary, (Fig. 10/A) by turning the two adjusting screws of the slider (Fig. 9/5) by means of the two Allen keys SW 1.5 (Fig. 9/4) until the phase stop image corresponds to that shown in Fig. 10/B.
- Afterwards, replace the eyepiece telescope by the eyepiece again.

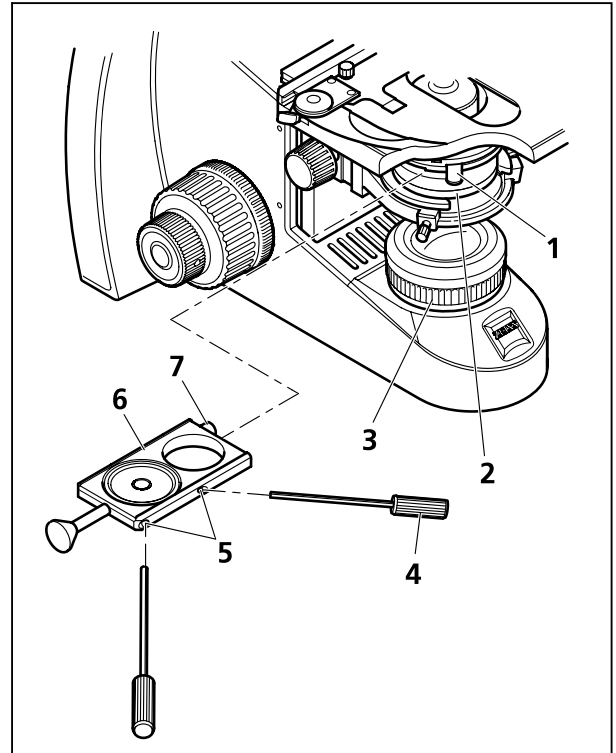


Fig. 9 Inserting the slider

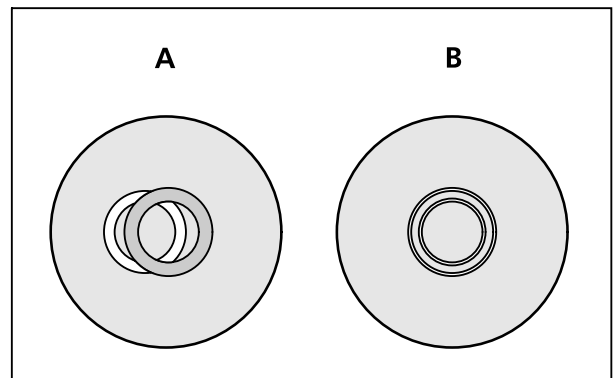


Fig. 10 Centering the phase stop



For darkfield applications, use the darkfield slider in place of the phase-contrast slider.

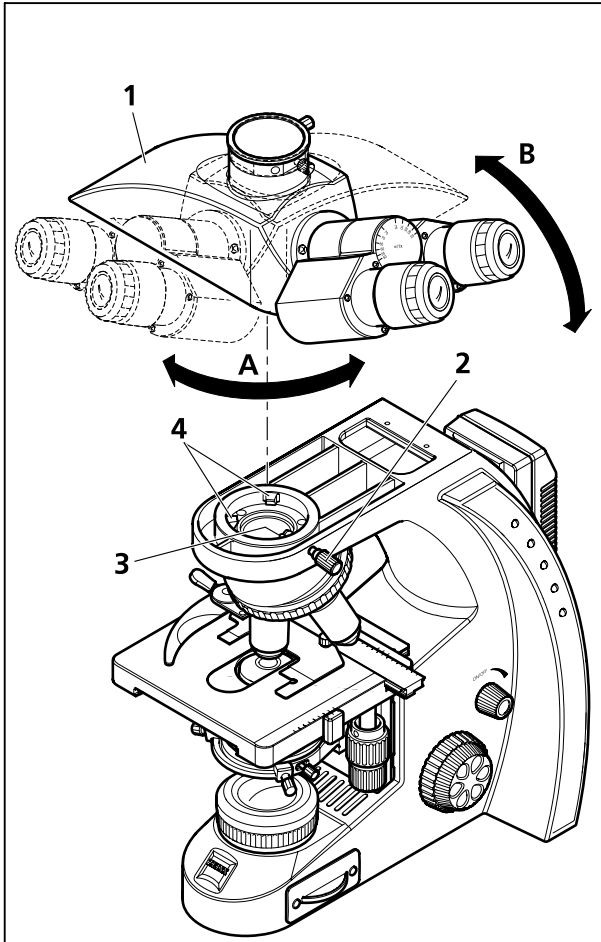


Fig. 11 Changing the tube

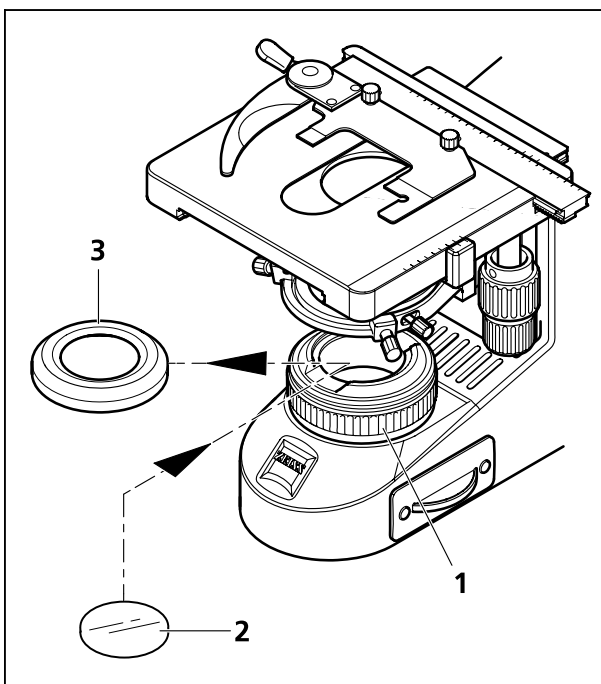


Fig. 12 Inserting a color filter

3.4 Converting the microscope



Unplug the plug-in power unit from line power before converting the microscope.

3.4.1 Changing the tube

- Loosen clamp screw (Fig. 11/2), turn the installed tube (Fig. 11/1) clockwise by approximately 90° (Fig. 11/A) and on the right side take it off upward (Fig. 11/B).



For reasons of space, the tube may also be clamped by the grub screw with hexagonal socket head supplied with the tube.

- Insert the tube to be installed, with the eyepieces pointing to the right and its dovetail mount slightly inclined, under the two holding elements (Fig. 11/4) in the stand.
- Then, place the tube horizontally onto the stand. In doing so, the groove on the underside of the tube must be located above the third holding element (Fig. 11/3) of the stand.
- Turn the tube counterclockwise by 45° (eyepieces pointing forward), align it to the stand and tighten clamp screw (Fig. 11/2).



For space-saving storage of the microscope (e.g. in a cabinet) the tube may also be rotated by 180° to the back.

3.4.2 Inserting color filters

- Move the condenser carrier fully up by turning the knurled screw for vertical adjustment (Fig. 4/15).
- Unscrew the cover cap (Fig. 12/3) from the luminous-field diaphragm (Fig. 12/1).
- Put the desired filter – yellow, green or blue – (Fig. 12/2) onto the mounting surface of the luminous-field diaphragm and screw the cover cap back into place.

3.4.3 Replacing the 6V 30W halogen lamp or the LED illumination



Unplug the plug-in power unit from the power outlet and allow for a sufficient cool-down time of the 6V 30W halogen lamp before you replace it.

- Loosen both fastening screws (Fig. 13/3) of the illumination module (Fig. 13/1 or 2). In doing so, slightly press the screws against the spring and turn them by 90°: Turn left screw clockwise and right screw counterclockwise.
- Pull the illumination module (Fig. 13/1 or 2) out of the stand.
- If the stand is equipped with a 6V 30W halogen lamp (Fig. 13/2), remove the halogen lamp (Fig. 13/4) from the lamp carrier and insert the new halogen lamp. Do not touch the new lamp with naked fingers as this will reduce lamp life.
- If the stand is equipped with an LED source, replace the complete illumination module including the LED (Fig. 13/1).
- Push the illumination module (Fig. 13/1 or 2) back into the stand and lock it by means of the two screws (Fig. 13/3). In doing so, slightly press the screws against the spring and turn them by 90°: Turn left screw counterclockwise and right screw clockwise.

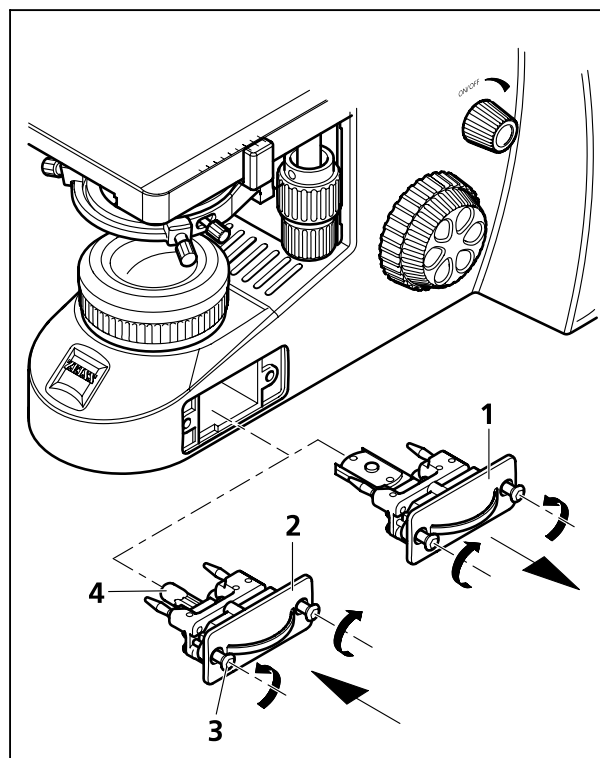


Fig. 13 Replacing the 6V 30W halogen lamp or the LED illumination module

3.4.4 Changing objectives

- Turn the focusing drive to move the mechanical stage fully down.
- Turn the nosepiece (Fig. 14/3) to move the objective to be changed (Fig. 14/1) into a lateral position.
- Unscrew the objective and remove it downward.
- Screw the desired objective (Fig. 14/2) into the nosepiece as far as it will go.
- If you intend to insert the objective in a lens mount not used so far, remove the dust cover from the corresponding mount of the nosepiece.

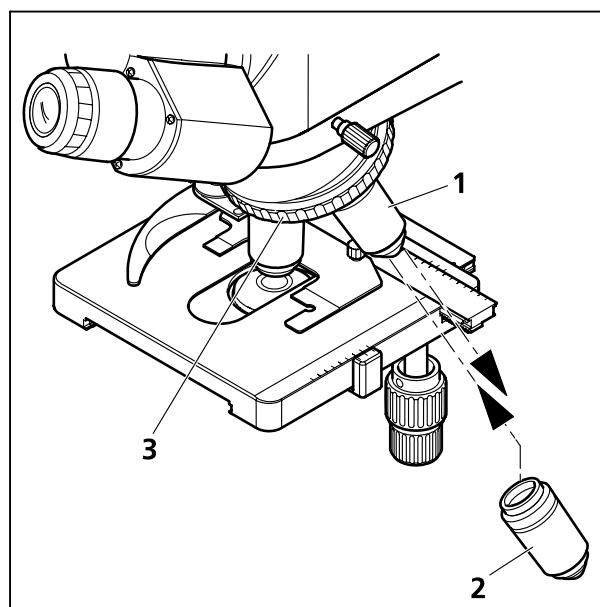


Fig. 14 Changing an objective

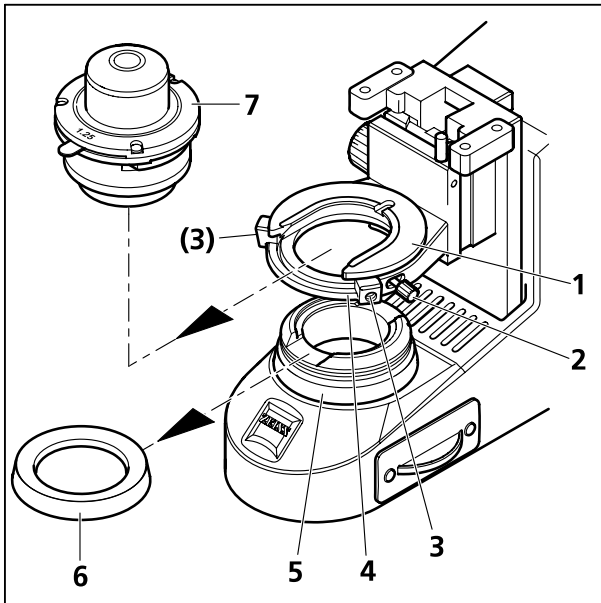


Fig. 15 Removing/installing the condenser

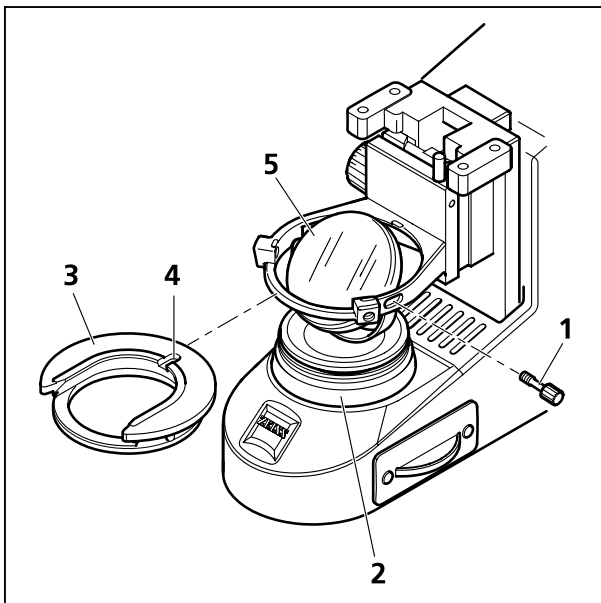


Fig. 16 Installing/removing the illuminating mirror

3.4.5 Installing/removing the illuminating mirror

The mirror serves to illuminate the specimen if no power outlet is available.

It can be used only in combination with the Primo Star Fixed Köhler Microscope. For this purpose, it is necessary to remove the condenser and the condenser carrier insert.

Installing the illuminating mirror:

- Remove cover cap (Fig. 15/6) from luminous-field diaphragm (Fig. 15/5).
- Using an Allen key, loosen the clamp screw (Fig. 15/2) of the condenser and the centering screws (Fig. 15/3) of the condenser carrier (Fig. 15/4) so that the condenser (Fig. 15/7) can be removed frontward. Remove the condenser (Fig. 15/7).
- Unscrew clamp screw (Fig. 15/2 or Fig. 16/1) from condenser carrier insert (Fig. 15/1 or Fig. 16/3).
- Push the condenser carrier backward against the spring and inclining it remove it upward from the condenser carrier (Fig. 15/4).
- Insert the mirror (Fig. 16/5) from top through the aperture of the condenser carrier and place it onto the mount of the luminous-field diaphragm (Fig. 16/2). Take care that the mirror rests level on the mount.
- Rotate and incline the mirror until the daylight is reflected homogeneously into the light path.

Removing the illuminating mirror:

- Remove the mirror (Fig. 16/5) upwards through the aperture of the condenser carrier.
- Slightly incline the condenser carrier insert (Fig. 15/1 or Fig. 16/3) to insert it in the aperture of the condenser carrier. In doing so, press the unit backward against the spring and place it horizontally onto the condenser carrier.
- Screw the condenser clamp screw (Fig. 16/1) into the condenser carrier insert.

- Taking care that the locating screw on the rear side of the condenser fits in groove (Fig. 16/4) of the condenser carrier insert, put the condenser into this insert.
- Screw the cover cap back onto the luminous-field diaphragm.
- To center the condenser, connect the microscope to the power outlet and switch it on.
- Turn the nosepiece to swing the 4x objective into the light path.
- Turn the two centering screws (Fig. 15/3) to adjust the illuminated image symmetrically to the edge of the field of view.

3.4.6 Installing a camera

You can install a digital camera, a video camera or a compact digital camera to your choice on the microscope via the available camera adapters (see Section 2.1).

- First, install the photo tube (Fig. 17/7), if necessary (refer to Section 3.4.1).
- Loosen clamp screw (Fig. 17/8) and remove the dust cap from the photo tube.

Installing a compact digital camera

- Sliding mount (Fig. 17/4), thread adapter ring M37/52 (Fig. 17/3) and lens mount (Fig. 17/6) are supplied premounted as **Digital Camera Adapter P95 M37/52x0.75**. The opposite drawing shows this unit dismantled.
- Furthermore, you may unscrew the M37/52 thread adapter (Fig. 17/3) (not shown) from the sliding mount (Fig. 17/4) so that you can also mount cameras with M37 thread.
- Mount the adapter ring (Fig. 17/2) (supplied with the camera) to the camera (Fig. 17/1) (see the operating instructions of the camera).
- Screw the unit consisting of sliding mount (Fig. 17/4), thread adapter ring M37/52 (Fig. 17/3) and lens mount (Fig. 17/6) into the adapter ring (Fig. 17/2).
- Insert the camera with adapter into the photo tube as far as it will go. Align it and fasten it with clamp screw (Fig. 17/8).

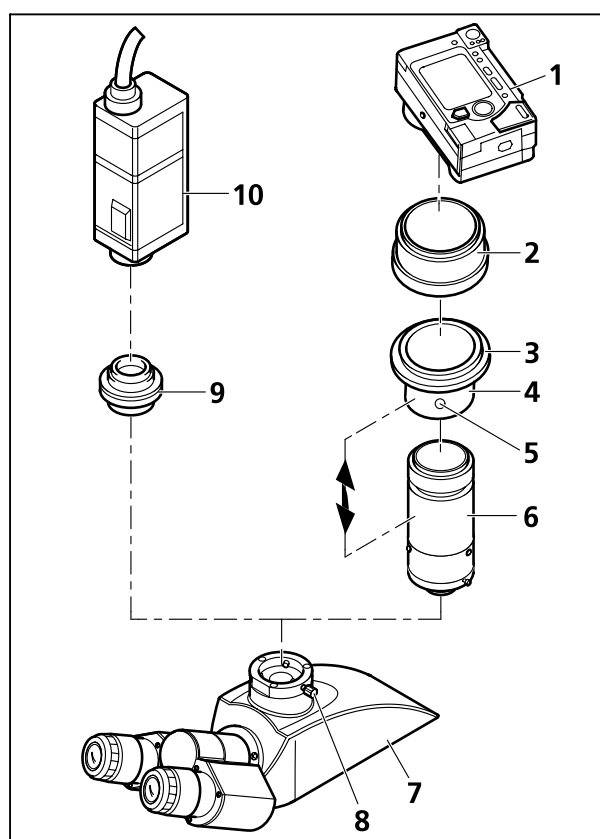


Fig. 17 Installing a camera

- Depending on the microscope equipment or the camera used, it may be necessary to optimize the distance between camera lens and lens mount (Fig. 17/6) (see double-headed arrow). This will be necessary in particular, if it is impossible to obtain an unvignetted image in any of the zoom positions of the camera lens. To this end, adjust the camera as follows:
 - Switch off the autofocus.
 - Set the object distance to ∞ .
 - Set aperture-priority auto exposure mode.
 - Choose an aperture as large as possible (i.e. small aperture value!).

Not all the cameras provide these options. Please consult the Operating Manual of the used camera.

- Loosen grub screw (Fig. 17/5).
- Vary the camera lens/lens mount distance gradually, i.e. displace the sliding mount with camera on lens mount in defined steps.
- Zoom the camera lens through from wide angle (W) to tele position (T).
- Carry out this test until the image is format filling without masking or vignetting.
- Retighten the grub screw (Fig. 17/5).



With camera/adapter combinations that have not been recommended expressly by Zeiss, it may be quite impossible to obtain an unvignetted image.

Installing a digital camera or video camera with C-mount thread

Cameras with C-mount thread are to be connected to the phototube of the microscope by means of the camera adapter P95-C 2/3" 0.65x or P95-C 1/2" 0.5x (Fig. 17/9).

- Put the camera (Fig. 17/10) together with the corresponding camera adapter (Fig. 17/9) into the phototube as far as it will go, align it and fasten it by means of the clamp screw (Fig. 17/8).

4 CARE AND TROUBLESHOOTING

4.1 Instrument care

Care of the microscope is restricted to the following operations:

- Cover the instrument with the dust cover after every use.
- Do not install the microscope in a humid room; maximum humidity < 75%.
- Cover open tubes with the dust caps.
- Remove dust and loose dirt from visible optical surfaces with a brush, blower brush, cotton bud, optics cleaning tissue, or a cotton cloth.
- Remove water-soluble dirt (coffee, cola, etc.) by blowing on it and subsequent wiping it off with a cloth moistened with water to which you may also add a mild detergent.
- Wipe off stubborn oily or fatty dirt (immersion oil, fingerprints) with a cotton bud or a lint-free cotton cloth and the optics cleaning solution L.

The cleaning solution consists of 90 vol% gasoline and 10 vol% isopropanol (IPA). Its individual constituents are also known as:

Gasoline:	Medical alcohol, petrolether
Isopropanol:	2-Propanol, Dimethylcarbinol, 2-Hydroxypropane

Clean optical surfaces by polishing in circles starting in the middle and moving to the edges using slight pressure only.

For the use in humid climatic zones, all optical components of the microscope are provided with protection against fungus attack.

4.2 Troubleshooting

Problem	Cause	Remedy
The field of view is not completely visible.	Nosepiece with objective has not been switched into click-stop position.	Switch nosepiece with objective into click-stop position.
	Condenser has not been set correctly.	Set condenser correctly.
	The aperture diaphragm has not been adjusted correctly.	Adjust aperture diaphragm correctly.
	The luminous-field diaphragm has not been adjusted correctly.	Adjust luminous-field diaphragm correctly.
	The filter has not been inserted correctly in the filter mount.	Insert filter correctly into filter mount.
Low resolving power, poor image contrast	The aperture diaphragm has not been opened to the correct size.	Set opening of aperture diaphragm to correct size.
	Condenser not focused correctly.	Focus the condenser.
	Wrong cover slip thickness selected for use of transmitted-light objectives corrected for 0.17mm cover slips.	Use standard 0.17 mm cover slips.
	Use of no or non-specified immersion oil with immersion objective	Use the supplied immersion oil.
	Air bubbles in immersion oil	Remove the bubbles by applying new oil or moving the objective to and fro.
	Immersion oil on the front lens of a dry objective.	Clean the front lens of the dry objective.
Greater focus differences after changing the objective	Dirt or dust on the optical surfaces of objectives, eyepieces, condenser, or filters	Clean the respective optical components.
	The focusing eyepieces have not been set correctly.	Set the focusing eyepieces to the corresponding defective vision.
The 6V 30W halogen lamp or the LED source does not light up although the microscope has been switched on.	Power plug has not been plugged into power outlet.	Connect power plug to power outlet.
	6V 30W halogen lamp or LED source is defective.	Replace the defective 6V 30W halogen lamp or the LED module
The 6V 30W halogen lamp is flickering, its light intensity unstable, the illumination inhomogeneous	End of average service life of 6V 30W halogen lamp has been reached.	Replace the 6V 30W halogen lamp.
	Power cable Incorrectly installed or broken power cable	Connect the power cable correctly or replace it.
	The pins of the 6V 30W halogen lamp have not been inserted correctly in the lamp holder.	Insert the pins of the 6V 30W halogen lamp correctly in the lamp holder.
	The pins of the 6V 30W halogen lamp have not been inserted symmetrically in the lamp holder.	Insert the pins of the 6V 30W halogen lamp symmetrically in the lamp holder.
Stage comes down by itself, image focus is unstable	Adjusted torque of coarse focusing drive is too low.	Increase the torque of the coarse focusing drive to make motion stiffer.

5 APPENDIX

5.1 Technical data

Dimensions (width x depth x height)

Stand with binocular tube	approx. 190 x 425 x 395 mm
Stand with phototube	approx. 190 x 425 x 395 mm
With tube / phototube turned by 180°	approx. 190 x 375 x 395 mm

Weight

Primo Star with phototube	8.2 kg
---------------------------	--------

Ambient conditions

Transport (in packaging): Permissible ambient temperature	-40 to +70 °C
Storage: Permissible ambient temperature	+10 to +40 °C
Permissible humidity (no condensation)	max. 75% at 35 °C
Operation: Permissible ambient temperature	+5 to +40 °C
Permissible humidity (no condensation)	max. 75% at 35 °C
Atmospheric pressure	800 hPa to 1060 hPa

Operating data

Protection Class	II
Protection Type	IP20
Electrical safety	in compliance with DIN EN 61010-1 (IEC 61010-1) including CSA and UL directives
Pollution degree	2
Overtoltage category	II
Radio interference suppression	in accordance with EN 61326
Line voltage	100 to 240 V (±10 %) wide-range input power supply, i.e. the voltage setting of the instrument need not be changed!
Line frequency	50 / 60 Hz
Power consumption	70 VA; secondary voltage of external power supply 12V
Output of plug-in power unit	12 V DC; max. 2.5A
Microscope 12V/6V DC	1.5V – 6V adjustable

Light sources

Halogen lamp	HAL 6V 30W
Adjustability of light source	continuous, from 1.5 to 6V DC
Color temperature at 6V	2800 K
Luminous flux	280 lm
Average service life	1000 h
Luminous area	1.5 x 3 mm

LED illumination	
Constant, brightness-independent color temperature of	7480 K
Homogeneous field illumination	20 mm diameter
Suitable for objectives with magnifications of	4x to 100x
Analogous brightness adjustment from	approx. 15 to 100%

Optical/mechanical data

Stand with stage focusing	
With coarse focusing drive	4 mm/revolution
With fine focusing drive	0.5 mm/revolution
Total stage lift	15 mm
Objective change	Manual via quadruple objective nosepiece
Objectives	Infinity-corrected objective range with W 0.8 mounting thread
Eyepieces	30 mm tube size
With field-of-view number 18	PL 10x/18 Br. foc.
With field-of-view number 20	PL 10x/20 Br. foc.
Specimen stage	Mechanical stage 75x30 right/left
Dimensions (width x depth)	140 x 135 mm
Stage travel (X x Y)	75 x 30 mm
Coaxial drive	Optionally right or left
Vernier scales	Readable from the right
Specimen holder	With spring lever, left
Abbe condenser 0.9/1.25, fixed collector	For V_{obj} : 4x to 100x
Abbe condenser 0.9/1.25	For V_{obj} : 4x to 100x
Binocular tube 30°/20	
Maximum field-of-view number	20
Interpupillary distance	Adjustable from 48 to 75 mm
Tube angle	30°
Viewing height	380 to 415 mm
Viewing port	Tube factor 1x
Binocular phototube 30°/20	
Maximum field-of-view number	20
Interpupillary distance	Adjustable from 48 to 75 mm
Tube angle	30°
Viewing height	380 to 415 mm
Viewing port	Tube factor 1x
Photo/video port	Tube factor 1x, 60 mm mount
Light path selection with swing-in prism	50% vis / 100% doc
Illuminating mirror	With plane surface and spherical surface with $f' = 75$ mm