MAGUS METAL D630
METALLURGICAL DIGITAL MICROSCOPE

USER MANUAL

MAGUS

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Before using the microscope, please read this user manual carefully to study the instrument design, operation modes and procedures, operational limitations, and safety precautions.

Due to the continuous improvements in the microscope design, this manual may not reflect minor design changes that do not affect the microscope performance and operation procedures.

SAFETY PRECAUTIONS

Microscope

1. To avoid electric shock or fire, switch off and unplug the microscope before assembling the microscope, replacing the bulb or fuse.
2. Do not disassemble the microscope, except for the removable parts specified in this manual. This can seriously damage its performance. In case of malfunction, please contact a qualified service center.
3. Make sure that the input voltage of the microscope matches that of the local power supply. Using the power supply with the wrong input voltage may cause a short circuit or fire.
4. Using an incorrect bulb, fuse, or power cord may damage the microscope or cause a fire. The power cord must be grounded reliably.
5. In order to avoid a short circuit or any other malfunction, do not expose the microscope to high temperatures or humid or moist environments for a long period of time.
6. If water splashes on the microscope, immediately switch the power off, unplug the power cord, and wipe off the water with a dry cloth.
7. The microscope light bulb generates high temperatures during operation. To avoid burns, do not touch the collector lens or the bulb itself for 10 minutes after the lights have been switched off. To prevent fire, do not place paper or flammable or explosive materials near the air vents on the underside of the base.
8. The microscope employs a coaxial coarse/fine focusing mechanism. Do not turn the left/right coarse/fine focusing knobs in opposite directions. When the limit is reached, you should no longer rotate the coarse focusing knob.
9. Do not expose the microscope to direct sunlight or other light sources. Do not expose the microscope to high temperatures, humidity, or dust; otherwise, it may cause condensation, mold growth, or contamination of the optical parts.
10. Do not touch the lens surfaces with your fingers. Use a brush and special lens-cleaning solution to keep the lenses clean.

11. Bulb installation:

— Do not touch the glass surface of the bulb with your bare hands. When installing the bulb, wear gloves or wrap the bulb with a cotton cloth.

— Use a clean cotton cloth moistened with alcohol-based disinfectant to wipe dirt off the surface of the bulb. Dirt may etch the surface of a bulb, thereby reducing its brightness and shortening its life.

— Check the bulb contact condition. If contact damage occurs, the bulb may stop working or cause a short circuit.

— When replacing the bulb, its base should be inserted as deeply as possible into the socket. If the bulb is not correctly inserted, it may pop out of the socket or cause a short circuit.

Camera

1. Never view the sun, another bright source of light or a laser through a camera – THIS IS DANGEROUS FOR YOUR EYESIGHT!
2. Do not disassemble the camera yourself.
3. Keep the camera away from moisture and do not use it in the rain.
4. Protect the camera from shocks, excessive stress from other objects.
5. Store the camera away from corrosive environments, household and car heaters, switched-on light bulbs and open flames.
6. If there is dirt on the optical surfaces, first blow off dust and small particles or brush them off with a soft brush, then clean the surface with a soft, clean cloth moistened with alcohol or ether.
7. If any instrument part or power component has been swallowed, seek medical attention immediately.

CONTENTS

MAGUS Metal D630 Metallurgical Digital Microscope has been designed and tested in accordance with the international safety standards. If properly used, the microscope is safe for the customer's health, life, property, and the environment. Proper maintenance of the microscope is a prerequisite for its reliable and safe operation.

1 DESCRIPTION

PURPOSE

The microscope is designed to observe the microstructure of metals and alloys, semiconductor materials, control the quality of paint coatings, and study other opaque objects.

The universal microscope does not limit the height and size of the examined samples. It can be employed in confined spaces and its height can be adjusted to meet the specific requirements of the production line.

The reflected light illuminator allows for the brightfield and polarization microscopy techniques.

The microscope is used in the metallurgical, engineering, aerospace, nuclear, and energy industries, as well as in research laboratories and technical universities.

SPECIFICATIONS (TABLE 1)

Microscope	
Magnification, x	50–500 (1000, 1250, 1500, 2000, 2500)**
Tube length	Infinity (∞)
Microscope head	Eyepiece diameter: 30mm Trinocular (Siedentopf type) 30° inclined Interpupillary distance: 48–75mm Diopter adjustment (left barrel): ±5dp
Eyepieces, x/field, mm	10x/22mm, eye relief: 10mm 12.5x/14mm*, 15x/15mm*, 20x/12mm*, 25x/9mm* 10x/22mm with a scale*, scale division value: 0.1mm
Revolving nosepiece	5 objectives
Objectives, magnification, x/aperture, working distance, mm	PL L 5x/0.12 WD: 26.1mm PL L 10x/0.25 WD: 20.2mm PL L 20x/0.40 WD: 8.8mm PL L 50x/0.70 WD: 3.7mm PL L 40x/0.60 WD: 3.9mm* PL L 60x/0.70 WD: 2.1mm* PL L 80x/0.80 WD 1.2mm* PL L 100x/0.85 (dry) WD: 0.4mm*
Stage	Two-axis mechanical stage Stage size: 185mm×140mm Moving range: 35mm×30mm Base size: 300mm×235mm
Focusing mechanism	Coaxial coarse & fine focusing knobs on both sides Fine focusing scale value: 2μm Coarse focusing tension adjusting knob
Illumination method	Reflected light
Reflected light illumination	Built-in field and aperture diaphragms Built-in analyzer and removable polarizer Color filters: frosted glass, yellow, green, blue
Reflected light source	12V, 30W halogen bulb, brightness-adjustable
Power supply, V/Hz	AC power supply, 220±22/50
Operating temperature range	+5... +35 °C
Operating humidity range	20... 80%

Camera	
Number of megapixels	6.3
Sensor	SONY Exmor CMOS
Color/monochrome	Color
Maximum resolution, pix	3072x2048
Sensor size	1/1.8" (7.37x4.92mm)
Pixel size, μm	2.4x2.4
Signal/noise ratio	0.15mV with 1/30s
Light sensitivity	425mV with 1/30s
Exposure	0.02ms–15s
Video recording	+
Frame rate, fps at resolution, pix	59@3072x2048, 59@1536x1024
Image format	*.jpg, *.bmp, *.png, *.tif
Video format	*.wmv, *.avi, *.h264 (Win 8 or above), *.h265 (Win 10 or above)
Spectral range, nm	380–650 (IR-filtered)
Shutter type	ERS (electronic rolling shutter)
White balance	auto/manual
Exposure control	auto/manual
Software features	image size, brightness, exposure
Port	USB 3.0, 5Gbps
System requirements	Windows 8/10/11 (32bit and 64 bit), Mac OS X, Linux, up to 2.8GHz Intel Core 2 or higher, minimum 2GB RAM, USB 3.0 port, CD-ROM, 17" or larger display
Software	MAGUS View
Mount type	C-mount
Illuminator body	Metal
Power supply	DC 5V from the USB port of the computer
Dimensions without package (WxHxD), mm	345×380×415
Package dimensions (WxHxD), mm	374×730×394
Weight without package	16.3kg
Weight with package	19.8kg

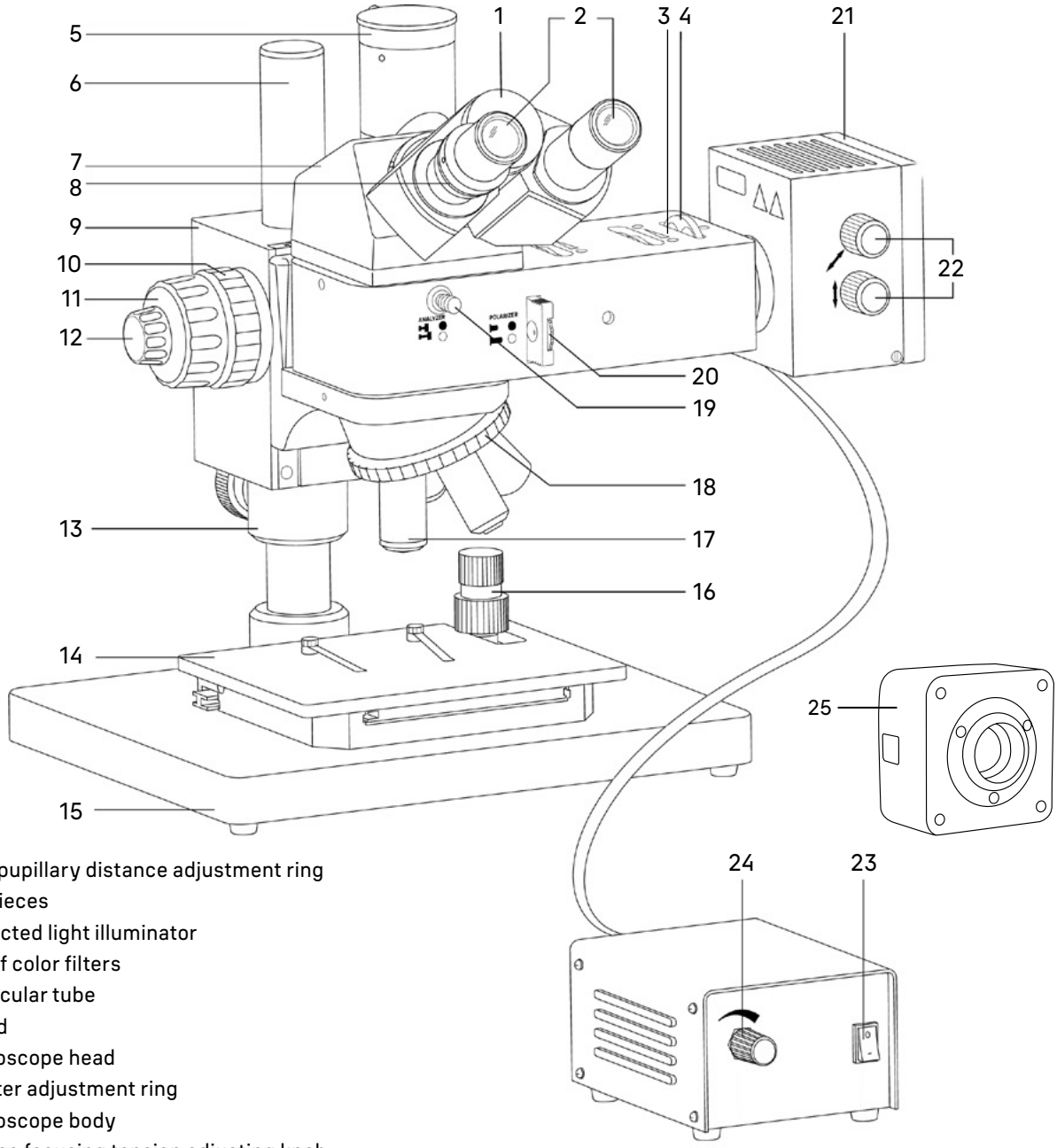
*** Not included in the kit, available on request.**
**** The magnification of the microscope can be increased by using additional (optional) eyepieces and objectives.**
The manufacturer reserves the right to make changes to the product range and specifications without prior notice.

MICROSCOPE KIT

The microscope kit includes the following main components:

— stand with base and stage
— microscope body with focusing mechanism and revolving nosepiece
— reflected light illuminator
— trinocular head
— lamphouse
— set of objectives and eyepieces
— power supply unit
— digital camera
— set of spare parts and accessories
— packaging
— user manual.

See Section 7 of the User manual for a full kit contents.
The general view of the microscope is given in Fig. 1.



1. Interpupillary distance adjustment ring
2. Eyepieces
3. Reflected light illuminator
4. Set of color filters
5. Trinocular tube
6. Stand
7. Microscope head
8. Diopter adjustment ring
9. Microscope body
10. Coarse focusing tension adjusting knob
11. Coarse focusing knob
12. Fine focusing knob
13. Locking support collar
14. Stage
15. Microscope base
16. X/Y stage control knob
17. Objectives
18. Revolving nosepiece
19. Analyzer
20. Polarizer
21. Lamphouse
22. Lamp adjustment knobs
23. ON/OFF switch
24. Brightness adjustment knob
25. Digital camera

Fig. 1. MAGUS Metal D630 Microscope

2 COMPONENTS

MICROSCOPE BODY

The microscope body 9 (Fig. 1) is mounted on the stand 6 (Fig. 1) that is secured on the base 15 (Fig. 1).

There is a focusing mechanism inside the microscope body.

There is a mount on the front of the microscope body to install the revolving nosepiece 17 (Fig. 1) and the reflected light illuminator 3 (Fig. 1).

FOCUSING MECHANISM

The focusing mechanism is located inside the microscope body. The mechanism has coaxial design: Coarse and fine focusing knobs, coarse focusing tension adjusting knob are mounted on the same axis.

Focusing on the specimen is achieved by adjusting the height of the revolving nosepiece. Coarse focusing is performed by rotating the knob 11 (Fig. 1).

Fine focusing is performed by rotating the knob 12 (Fig. 1). Fine focusing allows for more precise focusing on the specimen and re-focusing the microscope to get an accurate image resolution when changing objectives and specimens. Fine focusing scale value: 2μm.

The coarse focusing tension adjusting knob 10 (Fig. 1) is the ring between the microscope body and the coarse focusing knob on the left side. The ring adjusts the coarse focusing tension so that the tension is comfortable for the user, but the revolving nosepiece does not lower spontaneously during operation.

To prevent the focusing mechanism from damage:

— do not turn the left/right coarse/fine focusing knobs in opposite directions

— do not rotate the coarse focusing knob after the knob reaches its limit.

MICROSCOPE HEAD

The trinocular head 7 (Fig. 1) provides the visual observation of the specimen image. The microscope head is mounted on the reflected light illuminator 3 (Fig. 1) and secured with a screw.

The interpupillary distance is adjusted by rotating the eyepiece tubes in the range of 48–75mm. The distance between the eyepieces matching the observer's interpupillary distance is marked on the adjustment scale.

For convenience, the microscope head is inclined at 30°.

Eyepiece diameter: 30mm.

There is a diopter adjustment 8 (Fig. 1) on one of the eyepiece tubes to compensate for the observer's ametropia.

An imaging system with a monitor is installed in the trinocular tube 5 (Fig. 1) using a C-mount adapter. You can switch the light path to the trinocular tube using the lever located on the right side of the microscope body (not shown in Fig. 1). The lever has two positions: 100/0 and 0/100.

EYEPIECES

The microscope kit includes eyepieces 2 (Fig. 1). The eyepieces have long eye relief and are designed to work with or without glasses.

Eyepiece diameter: 30mm.

Eyepiece magnification: 10x. Field of view: 22mm. Eye relief: 10mm.

The 10x eyepiece with a scale and 0.1mm scale value, 12.5x/14mm, 15x/15mm, 20x/12mm, 25/9mm eyepieces are not included in the kit and are optional.

REVOLVING NOSEPIECE

The revolving nosepiece 18 (Fig. 1) allows for the installation of five objectives 17 (Fig. 1). Objectives are changed by rotating the knurled ring of the revolving nosepiece until the objective fits into place.

Do not rotate the revolving nosepiece by holding the objectives.

The revolving nosepiece rotates clockwise and counter-clockwise.

The revolving nosepiece is mounted on the front panel of the microscope body. The objectives are screwed clockwise into the revolving nosepiece in order of increasing magnification. For convenience, the objectives are turned "away from the observer".

OBJECTIVES

The objectives are designed for the infinity-corrected tube length. Parfocal distance: 45mm, linear field of view: 22mm. The objectives have long focal length.

Each objective has the following inscriptions: "PL L" correction type, linear magnification, numerical aperture, "∞" tube length, magnification color code according to the international standard.

The specifications of the objectives (Table 2):

Objective identification	Microscopy technique	Magnification	Numerical aperture	Working distance, mm	Color marking
PL L 5x/0.12	Brightfield	5x	0.12	26.1	Red
PL L 10x/0.25	Brightfield	10x	0.25	20.2	Yellow
PL L 20x/0.40	Brightfield	20x	0.40	8.8	Green
PL L 50x/0.70	Brightfield	50x	0.70	3.7	Light blue

If objectives are damaged, we recommend repairing them in the service center.

The objectives are intended to image the specimens through air. Do not use immersion oil.

REFLECTED LIGHT ILLUMINATION

The microscope illumination system allows for setting up Köhler illumination. The light source – 30W halogen bulb – is centered on three axes.

The reflected light illuminator 3 (Fig. 1) with the built-in field and aperture diaphragms is mounted on the microscope body. The field diaphragm is also centered using the centering screws. The diaphragms are opened/closed by rotating the rings on the top of the reflected light illuminator (not shown in Fig. 1).

STAGE

The XY mechanical stage 14 (Fig. 1) is fixed on the microscope base. It is moved using the knobs 16 (Fig. 1).

Stage size: 185mm×140mm. Moving range: 35mm×30mm.

LAMPHOUSE

There is a connection adapter on the side of the illuminator. It is intended for mounting the halogen lamphouse 21 (Fig. 1).

The lamp is centered using the knobs 22 (Fig. 1).

While removing the lamphouse from the stand, make sure that the microscope power supply is off!

The lamphouse warms up during operation. To avoid fire, it is forbidden to cover the lamphouse, to place laboratory glassware, examined samples and other objects on its surface.

POLARIZER/ANALYZER SET

To allow the polarized light observations, the microscope is equipped with a polarizer/analyzer set, which includes a built-in analyzer 20 (Fig. 1) and removable polarizer 20 (Fig. 1). The polarizer rotates 0–360°.

COLOR FILTERS

The microscope kit includes a round slider with color filters 4 (Fig. 1). The slider has 5 positions: yellow, green, blue, frosted glass filters, and a free slot. Color filters help to properly adjust color reproduction depending on the specimen, improve color balance, and enhance image contrast and brightness.

CAMERA

The digital camera equipped with the SONY CMOS Exmor sensor delivers high light sensitivity and low noise performance. The camera is powered through the USB port of a computer.

3 UNPACKING AND ASSEMBLING

The assembly procedure is given in Fig. 2.

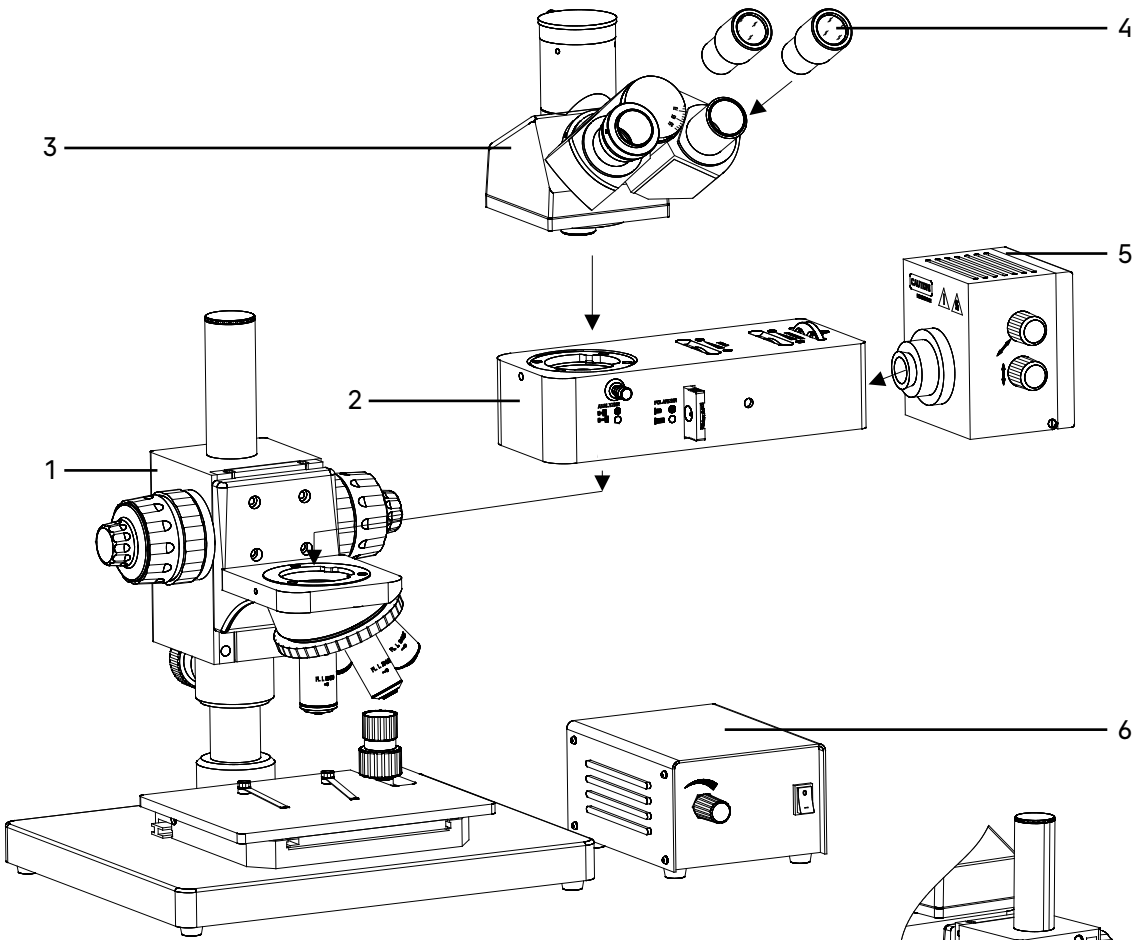


Fig. 2. Assembling the microscope

1. Unpack the microscope and check the scope of delivery using Section 8 of the User Manual.
2. Take out the stand with the base and body of the microscope **1** and place it on a stable work table, remove packaging and the dust cover.
   Prior to work, adjust the microscope body to the desired height. To do this, loosen the knob **2** of the locking support collar 1 (Fig. 2b). Raise (lower) the collar to the desired height. Loosen the knob **4** and move the microscope body **3** to the top part of the collar.
   To prevent the microscope body from unintentionally lowering, tighten the lifting mechanism knobs as far as they will go.

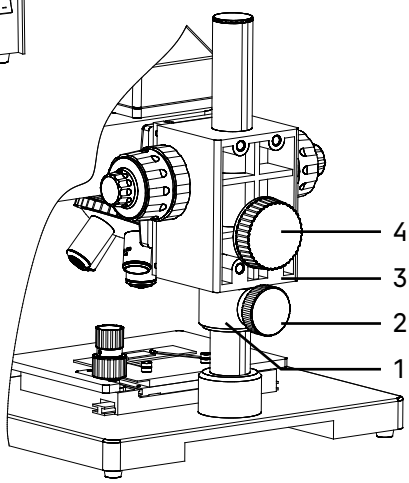


Fig. 2b. Adjusting the height of the microscope body

3. Take out the reflected light illuminator **2** and lamphouse **5**. Install the illuminator using the mount on the microscope body and secure it with the Allen wrench. Mount the lamphouse on the side of the illuminator, connect the power cord to the microscope.
4. Take out the trinocular microscope head **3** and eyepieces **4**. Attach the trinocular head to the top of the illuminator and secure it. Insert the eyepieces into the tubes, making sure they are tightly seated.
5. Take out the power supply unit **6** and connect the power cord.
6. Make sure that all the components are securely and safely mounted.
7. Check and sort the supplied accessories and tools in the correct order. Keep them in proper order to avoid confusion.
8. Keep the packaging should you need to transport the microscope.

4 BRIGHTFIELD OBSERVATION PROCEDURE

SWITCHING ON THE ILLUMINATION

Before switching on the ON/OFF switch, make sure that the input voltage of the microscope power supply matches the local mains voltage. If not, do not switch on the microscope. Improper input voltage may result in a short circuit or fire.

Turn the switch **1** to "I" position to light the halogen bulb. Adjust the brightness using the knob **2** to make it comfortable for the user.

Do not keep the brightness adjustment knob in the maximum brightness position for a long period. This may shorten the life of the bulb. Before switching off the microscope, reduce the light intensity to the minimum.

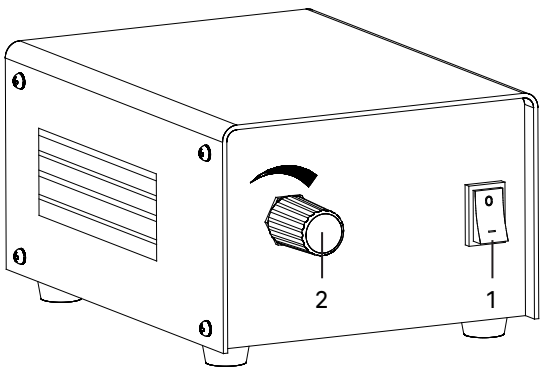


Fig. 3. Switching on the illumination and adjusting the brightness

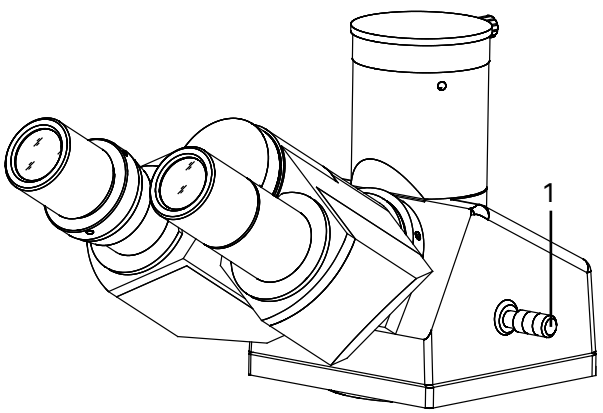


Fig. 4. Using the beam splitting

USING THE BEAM SPLITTER LEVER

Check the position of the beam splitter lever **1**.

When the knob is in the pulled-out position, the light path is switched to the trinocular tube.

PLACING THE SPECIMEN

Place the specimen **3** on the stage **4**. Adjust the image by moving the knobs **1** and **2** so that the observed section of the specimen is directly under the objective.

The stage features an XY control system. The control knobs are coaxial, i.e. located on the same axis.

The knob **2** controls Y-axis movement, the knob **1** controls X-axis movement. Stage moving range: 35mm×30mm.

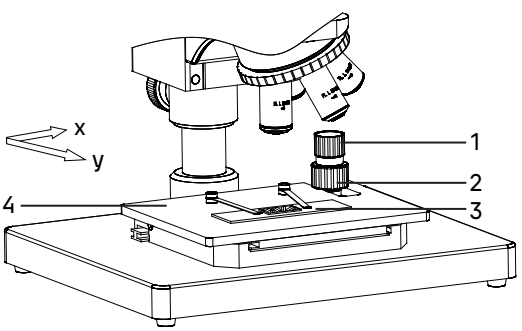


Fig. 5. Placing the specimen

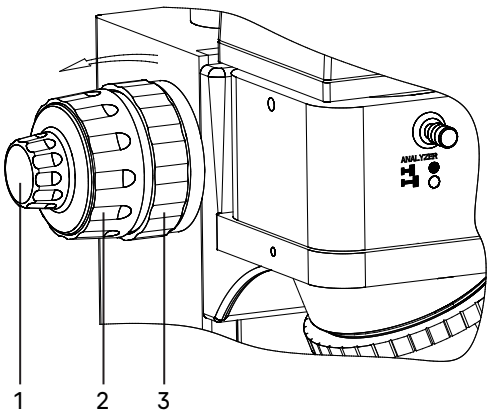


Fig. 6. Focusing on the specimen

FOCUSING ON THE SPECIMEN

Focusing on the specimen is achieved by coarse and fine focusing knobs.

Perform the focusing using the 10x objective.

Rotate the coarse focusing knob **2** to raise the objective as far as it will go. Looking into the eyepiece and slowly rotating the focusing knob, lower the objective. When you see the specimen image in the field of view, stop rotating the coarse focusing knob.

Rotate the fine focusing knob **1** to focus on the specimen and get a crisp image.

The tension of the coarse focusing knob is adjustable and is preset by the manufacturer for convenient use. If you need to adjust the tension of the coarse focusing, rotate the coarse focusing tension adjusting knob **3**.

By rotating it clockwise, you loosen the tension, and by rotating it counter-clockwise, you tighten it.

ADJUSTING THE EYEPIECE TUBES

To compensate for the observer's ametropia, rotate the diopter adjustment ring **1** on the left eyepiece tube to "0" position, as shown in Fig. 7.

While looking through the right eyepiece (with your left eye closed), bring the specimen into focus. While looking through the left eyepiece (with your right eye closed) and not touching the focusing knobs, bring the specimen into sharp focus in the left eyepiece by rotating the diopter adjustment ring **1**.

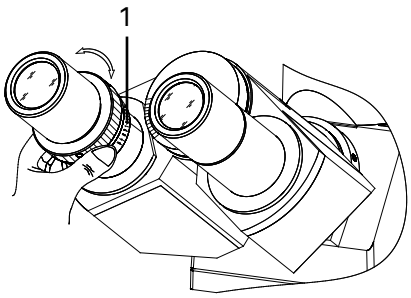


Fig. 7. Adjusting the diopter adjustment mechanism

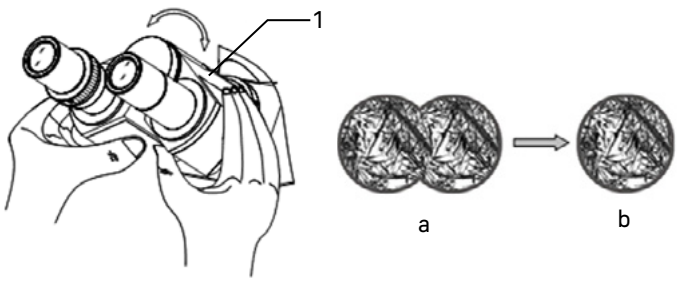


Fig. 8. Adjusting the interpupillary distance

Adjust the interpupillary distance. Adjust the distance between the eyepieces to your interpupillary distance by rotating the eyepiece tubes **1** around the central axis until you see a single circular image when looking through the eyepieces with both eyes (Fig. 8 a, b).

CENTERING THE LIGHT SOURCE

The manufacturer performs centering of the light source in the optical path before shipping the microscope. Re-centering may be required after transportation.

The light source is centered as follows:

1. Place a sheet of white paper **2** (approximately 40mmx50mm) on the stage and secure it with the clips **1**, as shown in Fig. 9a.
2. Remove one of the objectives from the revolving nosepiece and place the free slot (a slot without an objective) into the optical path, as shown in Fig. 9b.
3. Open the field and aperture diaphragms. A brightly illuminated spot will appear on the paper showing the filament, as shown in Fig. 9f.

4. If the filament image is blurry, adjust the position of the collector using the knob **7**.
5. If the filament image is offset from the center of the light spot, manipulate the lateral alignment knob **5** and the vertical alignment knob **6** to center the light source.

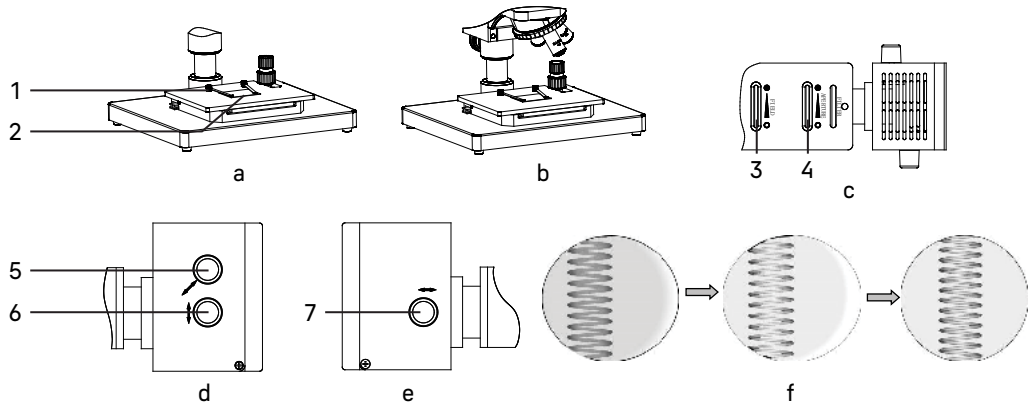


Fig. 9. Centering the light source

SETTING UP KÖHLER ILLUMINATION

In the light optical microscope, the image quality depends equally on the optics and on the illumination system, so adjusting the illumination is an important preparatory step. The illumination system affects the image resolution, comfort during long observation, and photo quality when using digital cameras.

The Köhler illumination is one of the features of professional microscopes. Proper set-up of Köhler illumination offers the following benefits:

— the highest possible resolution on each objective

— focusing on the specimen image, removing the images of artifacts: dust on the illuminator or on the slide, glare

— even illumination of the entire field of view with no edge darkening.

Set up Köhler illumination as follows:

1. Place the 10x objective into the optical path.
2. Open the aperture diaphragm **3** and close the field diaphragm **1**. A light spot will be visible in the field of view, as shown in Fig. 10.
3. If the light spot is offset from the center of the field of view, as shown in Fig. 10a, adjust the centering screw **2** using two Allen wrenches so that the center of the field diaphragm aligns with the center of the field of view, as shown in Fig. 10b.
4. Open the field diaphragm until its image fills the field of view, as shown in Fig. 10c.

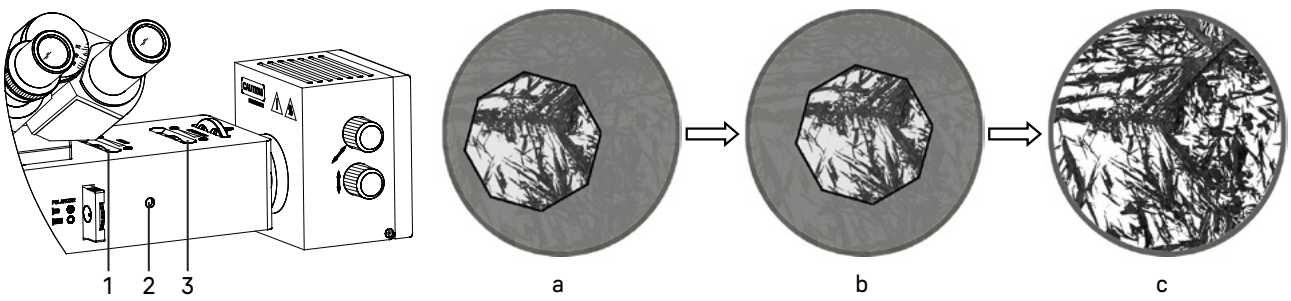


Fig. 10. Setting up Köhler illumination

The aperture diaphragm **3** is pre-centered at the factory and requires no additional centering. When using low-magnification objectives, increase the aperture diaphragm opening; when using high-magnification objectives, reduce the aperture diaphragm opening.

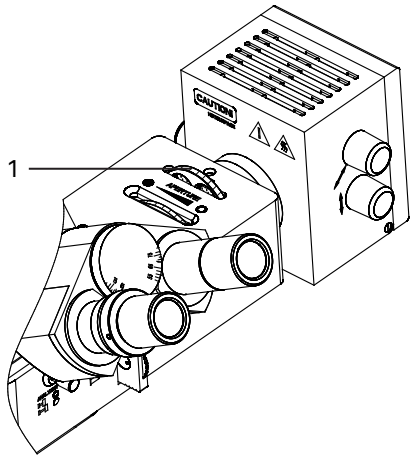


Fig. 11. Using the color filters

USING THE COLOR FILTERS

A round slider with color filters is installed on the top of the reflected light illuminator.

Choose the required filter color to match the specimen and microscopy technique: brightfield or polarization microscopy.

Set the appropriate position by rotating the slider.

A properly selected color filter allows you to smooth out optical distortions.

POLARIZED LIGHT OBSERVATIONS

Polarized light observations are made to study the double refraction properties of anisotropic materials, such as crystals, biomedical polymers, and liquid crystals. This microscopy technique is widely used in geology, mechanics, metallurgy, and electronics.

The microscope kit includes a polarizer/analyzer set, which consists of a polarizer and an analyzer.

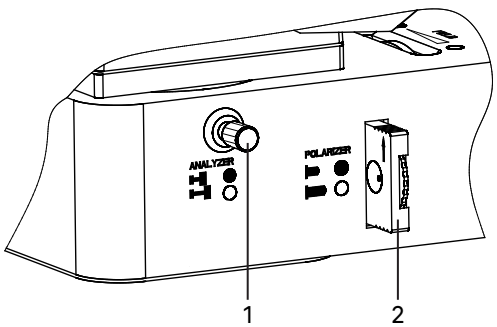


Fig. 12. Polarized light observations

To enable the polarization observations, place the polarizer **2** and analyzer **1** into the optical path. To do so, install the analyzer to ▶ ● position, the analyzer knob – to ■ ● position. Rotate the ring to adjust the polarizer to the position where the field of view is dark. Adjust the light intensity so that it is close to the maximum – the desired fragments will be clearly visible in this position.

Once you have completed polarized light observations, reduce the brightness. Prolonged observations at maximum brightness may cause visual impairment!

CALCULATING THE TOTAL MAGNIFICATION

The total magnification is the eyepiece power multiplied by the objective power.

For example, if the eyepiece is 10x/22mm, and the objective is 50x/0.70, the total magnification of the microscope is 10x50 = 500x.

CALCULATING THE FIELD OF VIEW

The field of view is calculated by dividing the eyepiece field number by the objective magnification.

For example, if the eyepiece is 10x/22mm, and the objective is 50x/0.70, the field of view of the microscope is 22mm/50x=0.44mm.

A stage micrometer (calibration slide) is used to accurately determine the field of view of the microscope.

USING THE CAMERA

The digital camera is intended for the brightfield observations.

The camera is equipped with a 6.3MP sensor producing a realistic image in 3072x2048 pixels. The camera is recommended to be used with 4x, 10x, 20x, and 40x objectives. The camera allows capturing more details with low magnification objectives.

The microscope is designed to observe a specimen through the eyepieces and to photograph the specimen. The microscope has a trinocular tube. The light splitting ratio is 100/0 and 0/100. The beam splitting is performed by the lever **4**.

It is important that you choose the proper camera to solve specific tasks with a microscope: using low or high magnification objectives, in the bright field or using other contrast techniques. You should pay attention to the camera's light sensitivity, pixel and sensor size, resolution, and data rate. The wrong camera will not allow taking good quality pictures, which will distort the results of the observation.

To enable the camera:

— Loosen the attachment screw **1** and remove the dust cap **2**.

— Connect the camera **5** to the C-mount adapter from the microscope kit.

— Fit the camera **5** into the trinocular tube **3** and secure it with the screw **1**.

— Place the 10x objective into the optical path. Looking through the eyepieces, bring the specimen into sharp focus.

— Switch on the camera as described in the camera's user manual.

— Pull out the knob **4**. If the image is blurry, adjust the focus using the fine focusing knob.

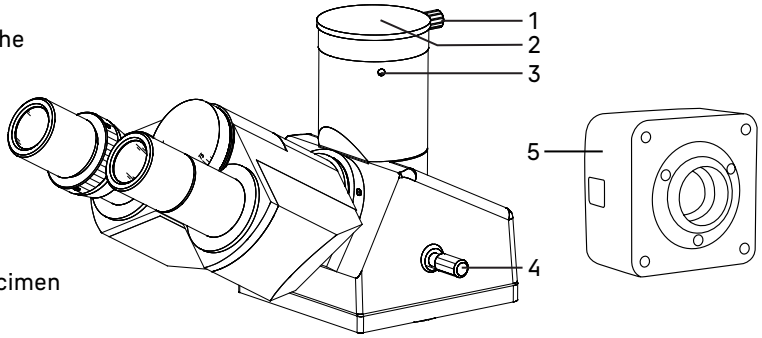


Fig. 13. Using the trinocular tube

If there is a strict requirement to synchronize the image in the eyepieces and camera (coincidence between the image center and direction), you should adjust the camera image. There are three centering screws on the trinocular tube. Adjust it as follows:

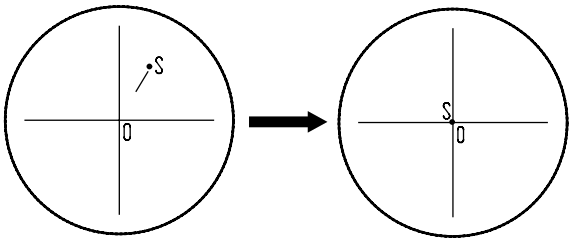


Fig. 14. Adjusting the camera image

— Set the beam splitter lever **4** to the eyepiece position. While observing the specimen through the eyepieces, find a distinctive point in the field of view (an easily identifiable target, such as point S in Fig. 14a), move the specimen on the stage so that the point is in the center of the field of view, as shown in Fig. 14b. To do this, you should use a special calibration slide with a reticle instead of a specimen slide and an eyepiece with a reticle in place of an ordinary one.

— Look at the specimen on a monitor or display screen and make sure that the image of the point is in the center of the field of view. If the image deviates from the center of the field of view, adjust three centering screws on the trinocular tube to move the point towards the center.

— Move the specimen and check whether the image of the specimen on the monitor or display screen moves in the same direction as the specimen does. If the image moves in another direction, you should adjust the camera position. Loosen the lock screw 1, rotate the camera to make the displayed image direction in line with the direction of stage movement, and then secure the screw.

5 USING OPTIONAL EQUIPMENT

EYEPIECE WITH A SCALE

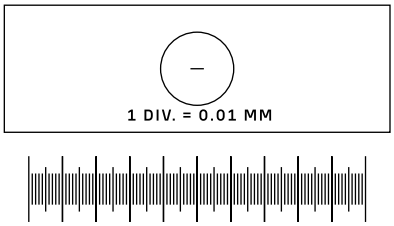


Fig. 15. Calibration slide

The eyepiece with a scale or reticle can be used to make comparative analysis of the linear dimensions of the individual components of an object. The scale is installed in the plane of the field diaphragm of the 10x eyepiece. The eyepiece with a scale is installed in the tube in place of the eyepiece of your microscope.

You should use a special stage micrometer (calibration slide) to determine the linear dimensions (in millimeters or microns).

The calibration slide is a transparent glass (of the same size as the specimen slide) that has a micrometer scale with a scale division of 0.01mm etched on the surface.

Place the calibration slide on the stage instead of the specimen. Using the scale of the calibration slide, calibrate the eyepiece scale for each objective that will be used for measurements. To do this, bring the image focus of the calibration slide scale into sharp focus in the plane of the eyepiece scale and rotate the eyepiece in the tube, setting the strokes of both scales in parallel. Determine how many divisions of the calibration slide fit in the eyepiece scale (with the medium and high magnification objectives) or how many divisions of the eyepiece scale are covered by the entire calibration slide (for low magnification objectives).

Work out the value for one eyepiece division using each objective by formula **E = TL/A**, where:

E – eyepiece division value

T – stage division value specified on the stage micrometer (0.01mm)

L – number of stage micrometer divisions

A – number of eyepiece divisions.

We recommend entering the obtained data in a size chart:

Objective magnification	Eyepiece division value
5	
10	
20	
50	

Using these data to determine the actual linear size of the specimen, you just need to count the number of divisions of the eyepiece scale aligned with the area of the specimen being measured, and multiply this number by the scale division value specified in this table.

CALIBRATION SLIDE WITH A CAMERA

The calibration slide (stage micrometer) is used to calibrate the image analysis software for measurements in actual units. In the calibration mode, you should capture an image of the micrometer scale with every objective magnification and indicate the known distance. That lets you establish a scale of the image in actual units (micrometer, millimeter, etc.). Calibration:

1. Place the calibration slide on the microscope stage.
2. Select the desired objective and set the maximum camera resolution.
3. Get a contrast image of the scale on the monitor screen and capture the image.
4. Select the 'Calibrate' function in the software you are using.
5. Double-click on the maximum visible distance and enter the value in actual units.
6. Enter the calibration setting and check the result. The program will save the calibration factor.
7. You can select any measurement unit later, and all the results will be re-calculated in accordance with this selection.

6 TROUBLESHOOTING

Potential problems and remedies (Table 4):

Problem	Cause	Remedy
	ELECTRICAL COMPONENTS	
No illumination in the field of view	The ON/OFF switch is off	Switch on the ON/OFF switch
	The halogen bulb is damaged	Replace the halogen bulb
	The fuse has blown	Replace the fuse
	Poor electrical contact	Check all the connectors. Have it repaired by a qualified electronics technician
	The installed bulb does not comply with the specifications	Use the appropriate bulb
	OPTICS AND IMAGE REPRODUCTION	
Darkened edges of the view field and uneven illumination of the field of view	The revolving nosepiece is not clicked in the observation position (the objective is not in the optical path)	Rotate the revolving nosepiece into the fixed position, i.e. position the objective into the optical path
	The diaphragm is not properly centered or closed too much for this objective	Center the diaphragm. Open the diaphragm to illuminate the entire field of view
	There is dirt on the objective or eyepiece	Remove dust using a special puffer or brush. Clean the lens surfaces with a tissue moistened with O-xylene
Dust is visible in the field of view	There is dust on the eyepiece lens	Remove dust using a special puffer or brush
Poor image quality (low resolution, poor contrast)	The objective is damaged	Have the objective repaired by a qualified technician or replaced
	The aperture diaphragm is opened too wide	Adjust the opening to match the numerical aperture of the objective used
	The objective is not correctly engaged in the optical path	Rotate the revolving nosepiece until it clicks into place correctly
The focal plane of the image is tilted (brighter on one side and darker on the other)	The specimen does not lie flat on the stage	Place the specimen flat on the stage, securing it with the specimen holder
	MECHANICAL COMPONENTS	
The image does not remain sharp during observation	The coarse focusing tension adjusting knob is loosened, causing the revolving nosepiece to lower spontaneously	Adjust the coarse focusing tension adjusting knob
	The microscope body slides down unintentionally	Fix the microscope body at the desired height using the knobs
The coarse focusing knob is too tight to rotate	The coarse tension adjusting knob is overtightened	Loosen the tension of the coarse focusing knob
The specimen image when viewed with two eyes in two eyepieces does not coincide	The eyepiece tubes of the binocular head are not adjusted to the observer's interpupillary distance	Adjust the microscope head

7 SCOPE OF DELIVERY

The scope of delivery (Table 5).

Component	Pcs	Note
MICROSCOPE		
MAIN COMPONENTS		
Stand with base and stage	1	
Microscope body	1	
Reflected light illuminator	1	
Lamphouse	1	
Trinocular microscope head	1	
Revolving nosepiece	1	
Power supply unit	1	
Polarizer/analyzer set	1	
Color filter slider	1	
REPLACEABLE PARTS		
Infinity plan achromatic objective: PL L 5x/0.12 WD 26.1mm	1	
Infinity plan achromatic objective: PL L 10x/0.25 WD 20.2mm	1	
Infinity plan achromatic objective: PL L 20x/0.40 WD 8.8mm	1	
Infinity plan achromatic objective: PL L 50x/0.70 WD 3.7mm	1	
Infinity plan achromatic objective: PL L 40x/0.60 WD: 3.9mm	1	Optional
Infinity plan achromatic objective: PL L 60x/0.70 WD: 2.1mm	1	Optional
Infinity plan achromatic objective: PL L80x/0.80 WD: 1.2mm	1	Optional
Infinity plan achromatic objective: PL L 100x/0.85 (dry) WD 0.4mm	1	Optional
10x/22mm eyepiece with eye relief	2	
10x/22mm eyepiece with a scale	1	Optional
12.5x/14mm eyepiece	2	Optional
15x/15mm eyepiece	2	Optional
20x/12mm eyepiece	2	Optional
25x/9mm eyepiece	2	Optional
C-mount camera adapter	1	
Eyecups	2	
Monitor	1	Optional
Calibration slide	1	Optional
ACCESSORIES AND SPARE PARTS		
Head locking screw	1	
Set of Allen wrenches	1	
Allen wrench	1	
12V/30W halogen bulb	1	In the lamphouse
Fuse	1	
Microscope power cord	1	
Reflected light illuminator power cord	1	
Dust cover	1	
User manual	1	
DIGITAL CAMERA		
Digital camera	1	
USB cable	1	
Flash drive with drivers and software	1	
User manual	1	

8 CARE AND MAINTENANCE

REPLACING THE BULB AND THE FUSE

Before replacing the bulb or fuse, turn the ON/OFF switch 1 to "0" position (off). Unplug the power cord from the power outlet. Wait about 30 minutes for the bulb to cool down.

1. **Replacing the bulb**

— unplug the power cord from the connector

— loosen the lock screw using a screwdriver and remove the back cover of the lamphouse, as shown in Fig. 16b.

— remove the faulty lamp **2** and install a new one

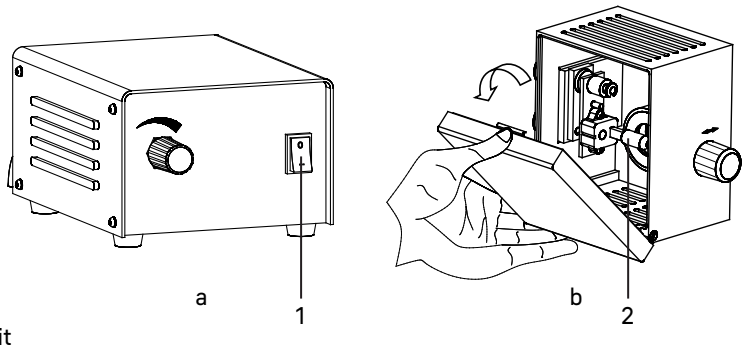


Fig. 16. Replacing the bulb

Use a cloth when installing the bulb. Fingerprints on the bulb surface shorten its life.

— install the cover on the lamphouse and secure it with a screw

— connect the power cord, turn the ON/OFF switch **1** to "–" position

— center the lamp as described above.

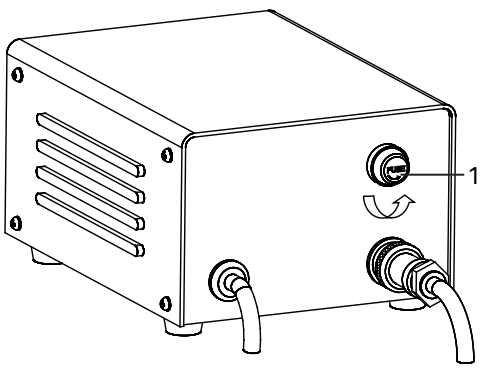


Fig. 17. Replacing the fuse

2. **Replacing the fuse**

The fuse is built into the connector. It is replaced as follows:

— loosen the screw **1** of the fuse socket, remove the faulty fuse and install a new one

— plug the power cord into the AC outlet and turn on the ON/OFF switch to "–" position to check the fuse for proper operation.

MAINTENANCE

1. Once you have finished using the microscope, switch off the power supply. When not using the microscope for a long time, switch off the power supply.
2. The microscope should be kept clean. Do not install the dust cover unless the microscope is completely cooled down and dry.

3. Cleaning lenses:
   Remove dust from the lenses with a soft brush. Significant contamination can be removed using a soft cloth moistened with a small amount of a mixture of alcohol and ethyl ether (mixture proportion: 20–30% alcohol and 70–80% ethyl ether) or special O-xylene solution. Wipe the lenses from the center outward.

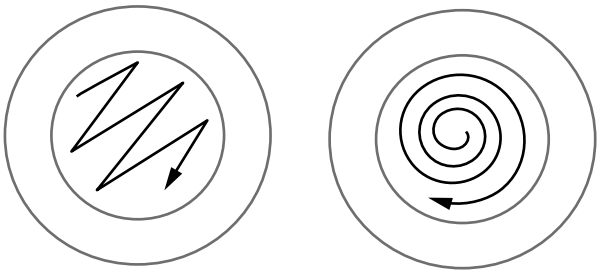


Fig. 18. Cleaning lenses

4. Cleaning the surfaces: wipe with a clean soft cloth; significant contamination can be wiped off with a neutral detergent.

   Do not wipe the microscope stand with any organic solvent (e.g., alcohol, ethyl ether or its diluted solution). This may cause damage to the coating of the microscope stand surface.
5. Cleaning the camera: blow off dust and small particles or brush them off with a soft brush, then clean the surface with a soft, clean cloth moistened with alcohol or ether.
6. Storage: when not using the microscope for a long time, switch off the power, wait for the lamp to cool down, cover the microscope with a dust cover. Store the microscope in a dry, ventilated and clean place, with no exposure to acids, alkalis, or steam, otherwise mold may form on the lenses.

   It is recommended to apply a layer of rust-preventive coating to the moving parts of the microscope.
7. Periodic inspection: the microscope should be regularly inspected and serviced to maintain its performance.

9 MAGUS WARRANTY

MAGUS provides a **5-year international warranty** from date of purchase (valid for the entire life of the instrument). The Levenhuk company warrants the product to be free from defects in materials and workmanship. The Seller warrants that the MAGUS product you have purchased meets specification requirements, provided that the Buyer complies with terms and conditions of transport, storage, and operation of the product. The warranty period for accessories is **6 (six) months** from the date of purchase.

For more information on warranty terms and conditions, see www.magusmicro.com

For warranty service, please contact your nearest Levenhuk representative office.

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