MAGUS LUM 400
FLUORESCENCE 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

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 use any other oily substance instead of proper immersion oil made specifically for the given purpose, as this will degrade the image quality and damage the lenses.

11. Do not touch the lens surfaces with your fingers. Use a brush and special lens-cleaning solution to keep the lenses clean.
12. 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.
13. The fluorescence light source is a mercury lamp. The design of the mercury lamphouse does not allow light rays from the lamp to reach the eyes of the observer and others. To avoid burns, do not touch the surfaces of the mercury lamphouse during operation and for 15 minutes after the lamp has been switched off. Do not connect the lamphouse cable to the power supply or replace the lamp in the lamphouse when the microscope power supply is on. In order to extend the service life of the mercury lamp, it is recommended to switch off the lamp if you have more than an hour break in operation.

CONTENTS

MAGUS Lum 400 Fluorescence 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 OF THE MICROSCOPE

PURPOSE

The microscope is used for observing specimens in reflected light using the fluorescence technique and in transmitted light using the brightfield, darkfield, polarization, and phase-contrast techniques. The microscope can be used to examine stained and unstained biological objects, such as smears and sections.

The fluorescence technique is based on the ability of substances to emit light when excited by light of a certain wavelength. The wavelength of the emitted light is longer than the wavelength of the excitation light. The wavelength difference underlies the fluorescence microscopy observations. The technique employs the excitation with ultraviolet, violet, blue or green light. The specimen glows blue, cyan, green-yellow, or red light, respectively.

The microscope is used in biomedical laboratories, biotechnology, material science, pharmaceutical research, agriculture, environmental studies, and forensics. The microscope can be used for scientific purposes, laboratory diagnosis, and education.

The microscope design allows for capturing and displaying specimen images in real time on the computer screen using a special camera.

SPECIFICATIONS (TABLE 1)

Magnification, x	40–1000 (1250, 1500, 2000, 2500)**
Tube length	Infinity (∞)
Microscope head	Eyepiece diameter: 30mm, Trinocular, Gemel head (Siedentopf, 360° rotatable) 30° inclined Interpupillary distance: 48–75mm Diopter adjustment (left barrel): ±5dp Microscope head magnification: 1x
Eyepieces, magnification, x/field, mm	10x/22mm 10x/22mm with a scale*, scale division value: 0.1mm 12.5x/14mm*, 15x/15mm*, 20x/12mm*, 25x/9mm*
Revolving nosepiece	5 objectives
Optical design	Infinity plan achromatic and fluo objectives, parfocal distance: 45mm
Objectives, magnification, x/aperture	PL 4x/0.10 PL 10x/0.25 PL FL 40x/0.85 (spring loaded) PL 100x/1.25 (spring loaded, oil) PL FL 10x/0.35* PL 20x/0.40* PL 60x/0.80*
Stage	Rackless XY mechanical stage Stage size: 180mm×150mm Moving range: 75mm×50mm
Condenser	Abbe condenser (N.A. 1.2). Centerable. With adjustable aperture diaphragm Height-adjustable. Dovetail mount
Field diaphragm	Adjustable iris

Focusing mechanism	Coaxial coarse & fine focusing knobs on both sides Focusing range: 21mm Coarse focusing travel: 39.8mm/circle Fine focusing scale value: 2μm Coarse focusing lock knob Coarse focusing tension adjusting knob
Transmitted light source	12V/30W halogen bulb with adjustable brightness
Reflected light source	100W mercury lamp
Power supply	AC voltage 85–265V, 50/60Hz Fuse specifications: 250V, 3.0A (halogen bulb), 250V, 15.0A (mercury lamp)
Fluorescence filters: filter type, excitation wavelength / dichroic mirror / emission wavelength	Ultraviolet (UV), 320–380nm / 425nm / 435nm Violet (V), 380–415nm / 455nm / 475nm Blue (B), 450–490nm / 505nm / 515nm Green (G), 495–555nm / 585nm / 595nm
Phase-contrast device*	Phase-contrast turret condenser Phase-contrast objective (10x, 20x, 40x, 100x) Centering telescope
Darkfield condenser*	Darkfield condenser Oil darkfield condenser Darkfield slider
Polarizer/analyzer set*, installation method	Polarizer – installed on the collector in a frame Analyzer – installed in the slot above the revolving nosepiece
Operating temperature range	+5... +35°C
Operating humidity range	20... 80%

*** 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 a built-in power supply, transmitted light source, focusing mechanism, stage, condenser, and revolving nosepiece
- epi-fluorescence illuminator
- mercury lamphouse
- mercury lamphouse power supply
- trinocular head
- set of objectives and eyepieces
- set of spare parts and accessories
- packaging
- user manual.

See Section 8 of the User manual for a full kit contents.
The general view of the microscope is given in Fig. 1 and 2.

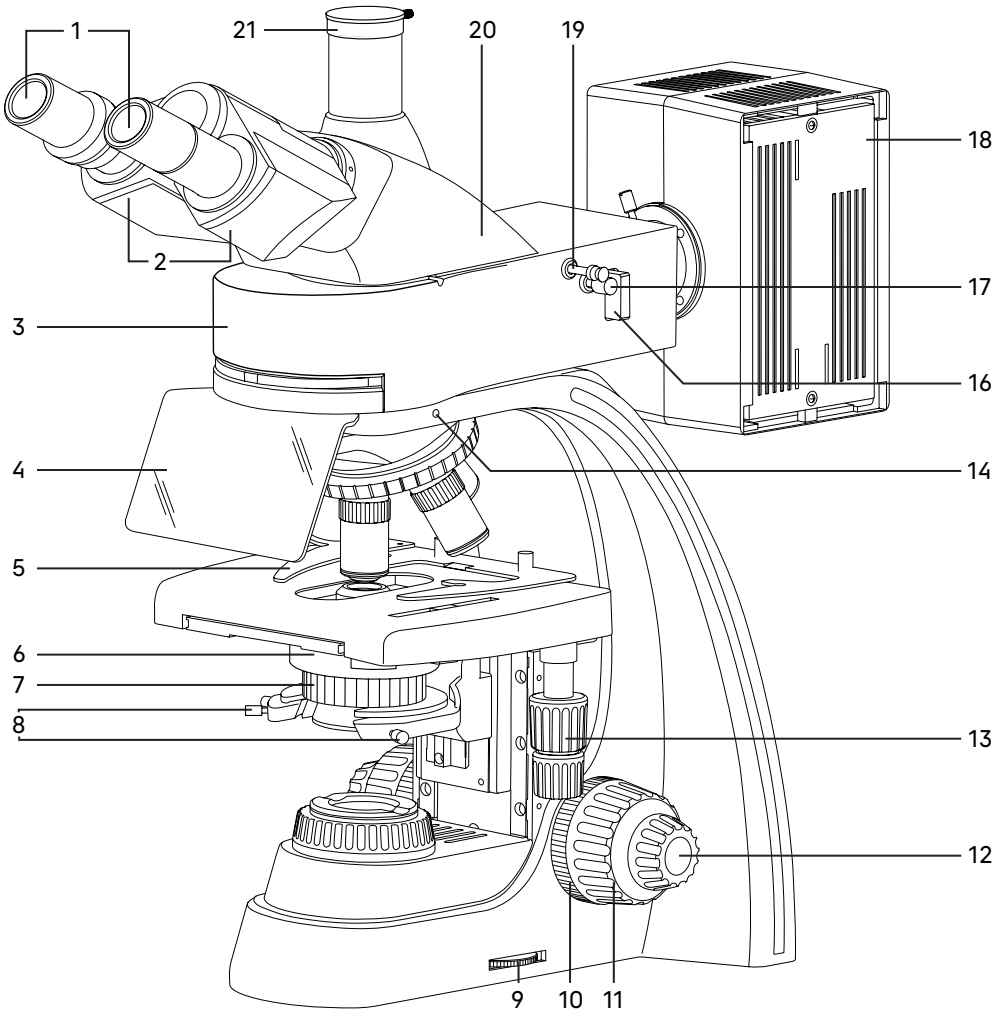


Fig. 1. MAGUS Lum 400 Fluorescence Microscope. View from the right

1. Eyepieces
2. Eyepiece tubes
3. Epi-fluorescence illuminator
4. UV shield
5. Specimen holder
6. Abbe condenser
7. Transmitted-light aperture diaphragm ring
8. Abbe condenser centering knobs
9. Transmitted light brightness adjustment ring
10. Coarse focusing tension adjusting ring
11. Coarse focusing knob
12. Fine focusing knob
13. X/Y stage control knob
14. Epi-fluorescence illuminator locking screw
15. Head locking screw
16. Filter slider (shutter/neutral density filter/free slot)
17. Field aperture centering knob of the epi-fluorescence illuminator
18. Mercury lamphouse
19. Diaphragm adjustment knob of the epi-fluorescence illuminator
20. Microscope head
21. Trinocular tube

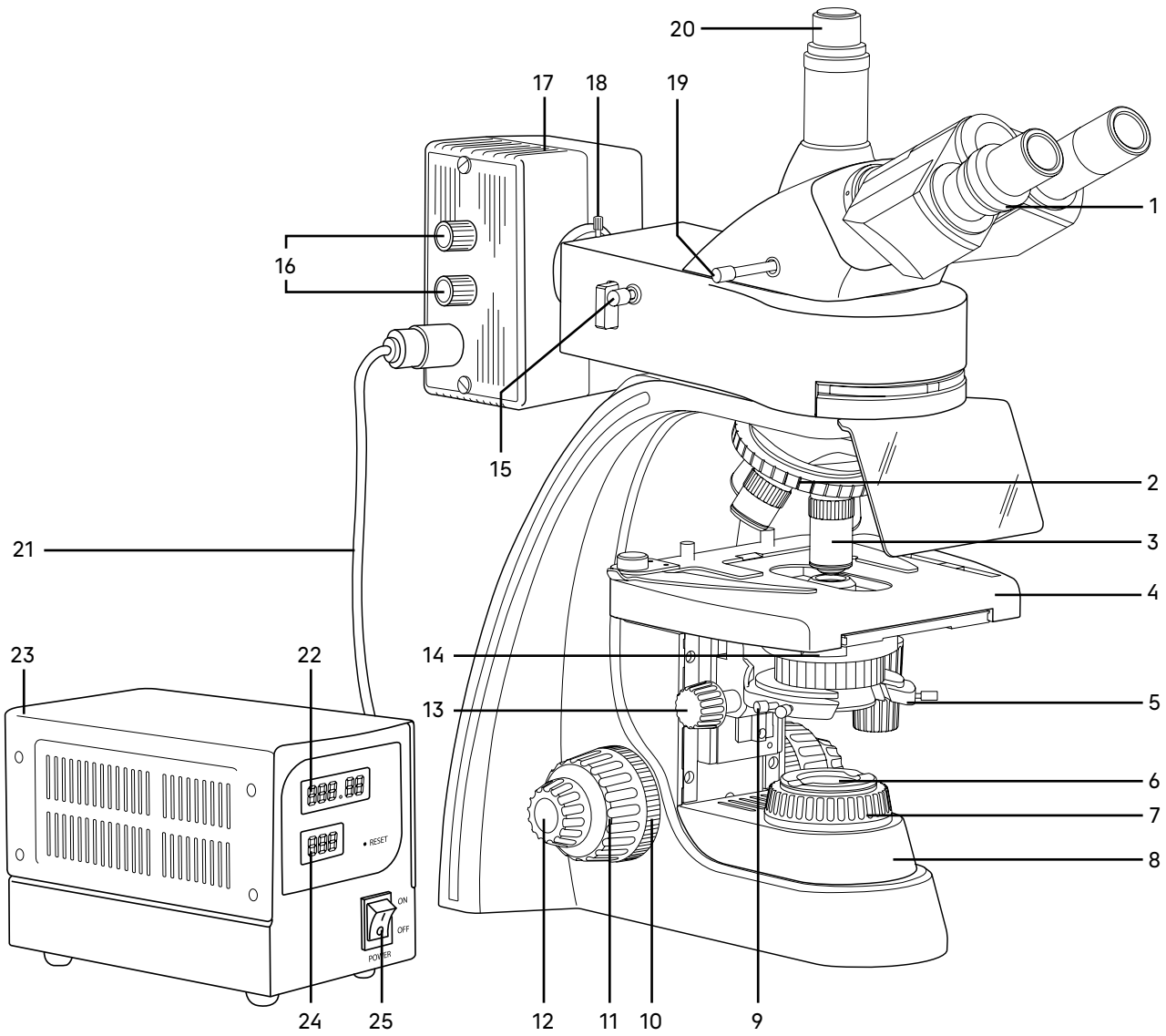


Fig. 2. MAGUS Lum 400 Fluorescence Microscope. View from the left

1. Diopter adjustment ring
2. Revolving nosepiece
3. Objective
4. Stage
5. Transmitted-light condenser mount
6. Collector
7. Transmitted-light field diaphragm ring
8. Stand and base
9. Condenser locking screw
10. Coarse focusing lock knob
11. Coarse focusing knob
12. Fine focusing knob
13. Condenser focus knob
14. Abbe condenser slot for darkfield and phase-contrast slider
15. Field diaphragm centering knob of the epi-fluorescence illuminator
16. Mercury lamphouse centering knobs
17. Mercury lamphouse
18. Collector adjustment knob
19. Beam splitter lever
20. C-mount adapter
21. Mercury lamphouse power cord
22. Mercury lamp run time counter
23. Mercury lamphouse power supply
24. Supply current display
25. ON/OFF switch

2 MICROSCOPE PARTS

STAND

The stand 8 (Fig.2) is a one-piece structure with the base. The base has Y-shaped stable ergonomic design.

Parts attached to the microscope stand:

— revolving nosepiece 2 (Fig. 2) with objectives 3 (Fig. 2)

— stage 4 (Fig. 2)

— condenser mount 5 (Fig. 2)

— collector with field diaphragm 6 (Fig. 2).

Inside the stand is the focusing mechanism and the power supply of the transmitted light illuminator. The power supply converts AC voltage to the required voltage to power the halogen bulb.

The ON/OFF switch is located on the back of the microscope stand. The power is on when the switch is in "–" position. The power is off when the switch is in "0" position.

The ring 9 (Fig. 1) is used to adjust the supply voltage of the transmitted light source.

The back panel of the microscope stand contains a fuse holder and a connector for the AC power cord, which connects the microscope to an AC outlet.

There is a handle on the back of the stand which makes it easy to carry the microscope.

FOCUSING MECHANISM

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

Focusing on the specimen is achieved by adjusting the height of the stage 4 (Fig. 2). Coarse focusing is performed by rotating the coaxial knobs 11 (Fig. 1, 2) on both sides of the microscope stand.

Fine focusing is performed by rotating the knobs 12 (Fig. 1, 2) on both sides of the microscope stand. Fine focusing allows for precise focusing on the specimen and re-focusing the microscope to get an accurate image resolution when changing objectives and specimens.

The coarse focusing tension adjustment is performed by the ring 10 (Fig. 1) between the stand and the coarse focusing knob on the right side. The ring adjusts the coarse focusing tension so that the tension is comfortable for the user, but the stage does not lower spontaneously during operation.

The coarse focusing lock knob 10 (Fig. 2) is located on the left side. Once the coarse focusing is completed, we recommend rotating the knob clockwise as far as it will go. This secures the coarse focusing position to allow for rapid re-focusing after the specimen is changed.

The coarse and fine focusing range is at least 21mm. Coarse focusing travel: 39.8mm/circle.

Fine focusing scale value: 2μm.

The stopper in the stand is used to set the limit of the stage height to prevent accidental damage to the specimen.

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 microscope head is trinocular.

The microscope head 20 (Fig. 1) provides the visual observation of the specimen image. It is installed in the mounting hole of the top flange of the epi-fluorescence illuminator 3 (Fig. 1) and secured with the clamping screw 15 (Fig. 1). When installing the microscope head, turn the eyepieces towards the stage.

The interpupillary distance is adjusted by rotating the eyepiece tubes 2 (Fig. 1) 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°.

Microscope head magnification: 1x.

Eyepiece diameter: 30mm.

The eyepiece diopter adjustment is intended to compensate for the observer's ametropia. It is located on the left eyepiece tube – ring 1 (Fig. 2). The second eyepiece tube is fixed.

The Gemel head design allows for the 360° rotation of the tubes, adjusting the eyepoint height for the convenience of users of different heights. With an interpupillary distance being 64mm, a 180° rotation changes the eyepoint height by 50mm.

A C-mount adapter 20 (Fig. 2) is installed in the trinocular tube 21 (Fig. 1) of the microscope head to fix the camera. The camera is used to transmit the image to a computer screen or monitor/TV. You can switch the light path to the trinocular tube using the lever 19 (Fig. 2). The lever has two positions: 100/0 and 0/100.

EYEPIECES

The microscope kit includes eyepieces 1 (Fig. 1). The eyepieces have high 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

Revolving nosepiece 2 (Fig. 2) allows for the installation of five objectives 3 (Fig. 2). 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 to the upper part of the microscope stand. 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

Objectives 3 (Fig. 2) are designed for the infinity-corrected tube length. Parfocal distance – 45mm, linear field of view – 22mm. They are designed to observe the specimen with the 0.17mm coverslip or without a coverslip. The microscope is equipped with 4x, 10x, 40x (fluorescence), 100x plan achromatic objectives. Optional plan achromatic 20x and 60x objectives and a plan achromatic fluorescent 10x objective are available.

The optics of a special plan achromatic fluorescent objective (fluo) is made of fluorescent-free grades of optical glass and glued with a special fluorescent-free adhesive. These objectives have the "PL FL" inscription. A 40x objective is typically used in the fluorescence microscopy. The microscope kit includes a 40x fluo objective. In rare cases, a 10x objective is used. The 10x fluo objective is not included in the kit and is optional.

Each objective has the following inscriptions: "PL FL" or "PL" correction type, linear magnification, numerical aperture, "∞" tube length, "0.17" or "–" coverslip thickness, magnification color code according to the international standard. Objectives with the "∞/0.17" inscription may be used with specimens with 0.17mm thick coverslips. Objectives with the "∞/–" inscription may be used for use with specimens with or without coverslips. The "oil" inscription on the 100x objective means that the objective is designed to work with the oil immersion.

The specifications of the objectives (Table 2):

Objective identification	System	Magnification	Numerical aperture	Working distance, mm	Coverslip, mm	Color marking
PL 4x/0.10 ∞/–	dry	4x	0.10	19.8	–	red
PL 10x/0.25 ∞/–	dry	10x	0.25	5.0	–	yellow
PL FL 10x/0.35 ∞/–	dry	10x	0.35	2.3	–	yellow
PL 20x/0.40 ∞/0.17	dry	20x	0.40	8.8	0.17	green
PL FL 40x/0.85 ∞/0.17	dry	40x	0.85	0.4	0.17	light blue
PL 60x/0.80 ∞/0.17	dry	60x	0.80	0.4	0.17	blue
PL 100x/1.25 oil ∞/0.17	oil immersion	100x	1.25	0.3	0.17	white

The 40x, 60x and 100x objectives have a spring-loaded mount to prevent mechanical damage to the front lens and the object.

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

Special non-fluorescent immersion oil must be used with oil immersion objectives.

CONDENSER

The basic microscope kit comes with the oil immersion brightfield N.A. 1.25 Abbe condenser. The microscope can be optionally equipped with an oil or dry darkfield condenser and a darkfield slider.

The condenser 6 (Fig. 1) is installed using the mount 5 (Fig. 2) under the microscope stage. It features a dovetail mount. The condenser is mounted using the guides with the specimen stage raised and the mount lowered. You can move the condenser along the optical path of the microscope using the condenser focus knob 13 (Fig. 2) located on the left of the observer under the stage. The condenser focusing range: at least 33mm.

The condenser has a slot 14 (Fig. 2) for darkfield and phase-contrast sliders.

The condenser mount has a spring-loaded holder, which allows for centering the condenser in the optical path using two screws 8 (Fig. 1). The condenser is secured in the holder by the screw 9 (Fig. 2).

The iris aperture diaphragm is adjusted (opened/closed) by the ring 7 (Fig. 1). For best image quality, the aperture diaphragm of the brightfield condenser should be closed to approximately 1/3 of the objective exit pupil diameter.

Darkfield and phase-contrast condensers can be mounted in the condenser holder instead of the Abbe condenser.

STAGE

The X/Y stage 4 (Fig. 2) allows for moving the specimen in two mutually perpendicular directions using the knobs 13 (Fig. 1) located on the same axis.

Stage size: 180mm×150mm. Moving range: 75mm×50mm. Scale value: 1mm, vernier scale: 0.1mm.

The stage has no X-axis rack and pinion, which improves ergonomics. The belt-driven mechanism allows for smooth movement of the specimen. The specimen is fixed on the stage using the specimen holder 5 (Fig. 1), for which the holder is pulled aside. The specimen holder is secured to the stage with two screws. With the specimen holder removed, the specimen can be moved manually.

In the reflected light microscopy, a dark insert is installed in the stage to remove all stray light from transmitted light sources.

EPI-FLUORESCENCE ATTACHMENT

The general view of the epi-fluorescence attachment is given in Fig. 3.

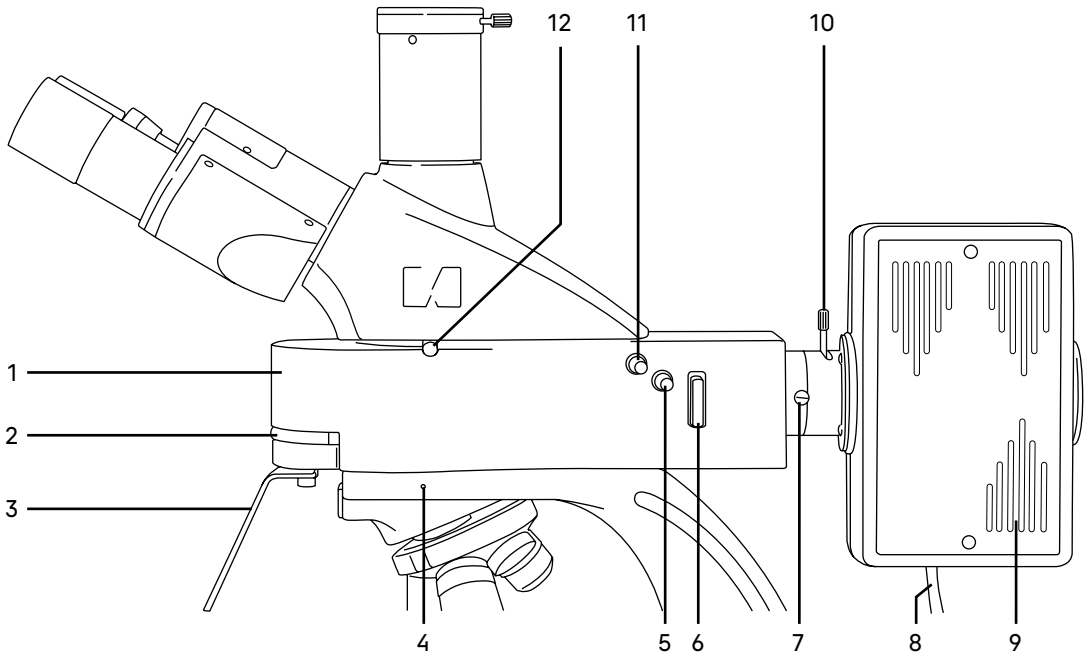


Fig. 3. Epi-fluorescence illuminator

1. Illuminator body
2. Turret wheel
3. UV shield
4. Illuminator locking screw
5. Field diaphragm centering knob of the epi-fluorescence illuminator
6. Filter slider
7. Lamphouse locking screw
8. Mercury lamphouse power cord
9. Mercury lamphouse
10. Collector adjustment knob
11. Diaphragm adjustment knob of the epi-fluorescence illuminator
12. Head locking screw

Epi-fluorescence illuminator

The illuminator body 1 (Fig. 3) is installed in the mounting hole of the top flange of the stand and secured with the screw 4 (Fig. 3).

There is an adapter on the illuminator, which connects it to the mercury lamphouse 9 (Fig. 3). The UV shield 3 (Fig. 3) is attached to the illuminator with two screws.

The metal plate of the filter slider 6 (Fig. 3) is installed in the slot of the illuminator body. The plate has three positions:

1. neutral density filter to reduce the intensity of light and cut off long wavelength ultraviolet rays
2. shutter to completely block the light flow
3. free slot.

There is a rotating turret inside the illuminator with four fluorescence filter sets. The turret is moved by rotating the wheel 2 (Fig. 3). The locked position of the knob under the symbol means that the corresponding filter set is in the optical path.

Each fluorescence filter set is combined of an excitation filter (EX), dichroic mirror (DM), and emission filter (EM) placed in a special cube. The excitation filter transmits only that part of the wavelength range that is able to efficiently excite a particular dye within the specimen. The dichroic mirror selectively reflects light of the excitation wavelength and transmits light of the emitted wavelength. The emission filter attenuates all of the light from the excitation filter and efficiently transmits the fluorescence light in the specified wavelength range.

The turret wheel can be locked in one of the five positions corresponding to one of the four filters mounted on the turret: blue (B), green (G), violet (V), and ultraviolet (UV), or the neutral position (0). The marking of each filter corresponds to the color of the excitation light and its symbol is inscribed on the wheel 2 (Fig. 3).

In the fluorescence microscopy, you should select filters based on the fluorochrome (fluorescent dye).

If the knob is under the "0" position, observations are made in transmitted light using the brightfield technique or other contrast techniques, provided that the appropriate equipment (phase-contrast slider, darkfield condenser or polarizer) is used.

The excitation spectrum range: 320–555nm.

The emission spectrum range: 435–700nm.

The microscope employs broadband color filters. The excitation occurs in a selected wavelength range, and the emission filter transmits the entire spectrum with a wavelength longer than the specified wavelength. The G position (Green) means that the fluorescence filter introduced in the optical path emits monochromatic radiation of the green spectrum range of 495–555nm from the overall radiation of the light source (250–900nm). The fluorescence of the specimen parts in the reflected light, once the light has passed the emission filter, is observed in the wavelength range of 595–700nm, which corresponds to orange-red color. The other three fluorescence filter cubes function in a similar manner.

The specifications of the reflected light illuminator (Table 3):

Filter type	Excitation wavelength, nm	Dichroic mirror, nm	Emission wavelength, nm
Ultraviolet (UV)	320–380	425	435
Violet (V)	380–415	455	475
Blue (B)	450–490	505	515
Green (G)	495–555	585	595

Mercury lamphouse

The mercury lamphouse 9 (Fig. 3) is secured to the epi-fluorescence illuminator 1 (Fig. 3) with the screw 7 (Fig. 3). Inside the mercury lamphouse, there is a collector that projects the image of the light source, the glowing discharge arc of the mercury lamp, into the exit pupil of the objective. The collector is moved along the optical path of the microscope using the knob 10 (Fig. 3).

Attention: While removing the mercury lamphouse from the illuminator body, make sure that the microscope power supply is off!

The lamphouse cover 2 (Fig. 4) is secured to the lamphouse using two screws 1 (Fig. 4). There is a mercury lamp holder on the inside of the cover. The mercury lamp 6 (Fig. 4) is installed in the rings 7 (Fig. 4) and fixed with the screws 8 (Fig. 4). The anode and cathode have different diameters, so the installation rings have respectively different diameters.

Attention: Do not touch the glass surface of the mercury lamp!

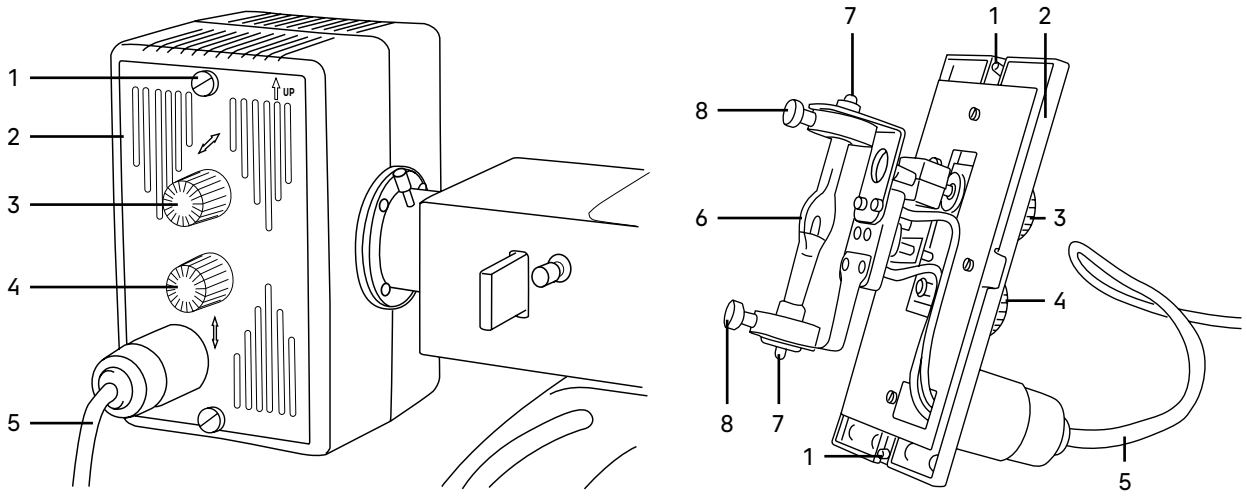


Fig. 4. Mercury lamphouse

1. Lamphouse cover locking screw
2. Lamphouse cover
3, 4. Lamp adjustment knobs
5. Lamphouse power cord
6. Mercury lamp
7. Lamp installation rings
8. Lamp locking screws

Centering the mercury lamp in the optical path is performed by the knobs 3 and 4 (Fig. 4). The knob 4 moves the lamp holder vertically, and the knob 3 moves it horizontally.

There is a power cord attached to the lamphouse cover. The cord is not removable.

Mercury lamphouse power supply

The power supply is intended to ignite and supply the mercury lamp with direct current.

The external view of the mercury lamphouse power supply is shown in Fig. 5.

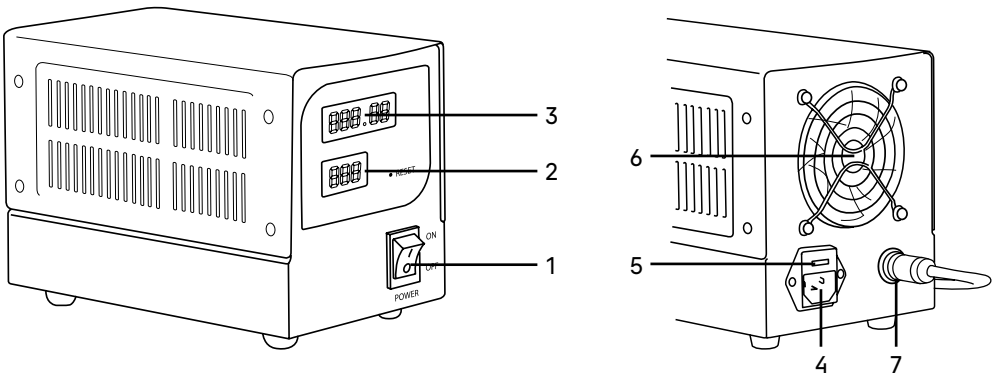


Fig. 5. Mercury lamphouse power supply

1. ON/OFF switch
2. Supply current display
3. Mercury lamp run time counter;
4. AC power connector
5. Fuse holder
6. Power supply fan
7. Connector for the mercury lamphouse power cord

The mercury lamphouse power cord is plugged into the connector of the power supply 7 (Fig. 5). The power supply is connected to the AC power outlet using an AC power cord. The AC power cord is plugged into the connector 4 (Fig. 5). The mercury lamp power supply is turned on by the switch 1 (Fig. 5). After ignition, it takes at least 10 minutes for the mercury lamp to become fully operational.

Attention! Do not turn the mercury lamp off for 15 minutes after ignition! Do not re-ignite the mercury lamp for 15-20 minutes after it was turned off!

3 UNPACKING AND ASSEMBLING THE MICROSCOPE

The assembly procedure is given in Fig. 6.

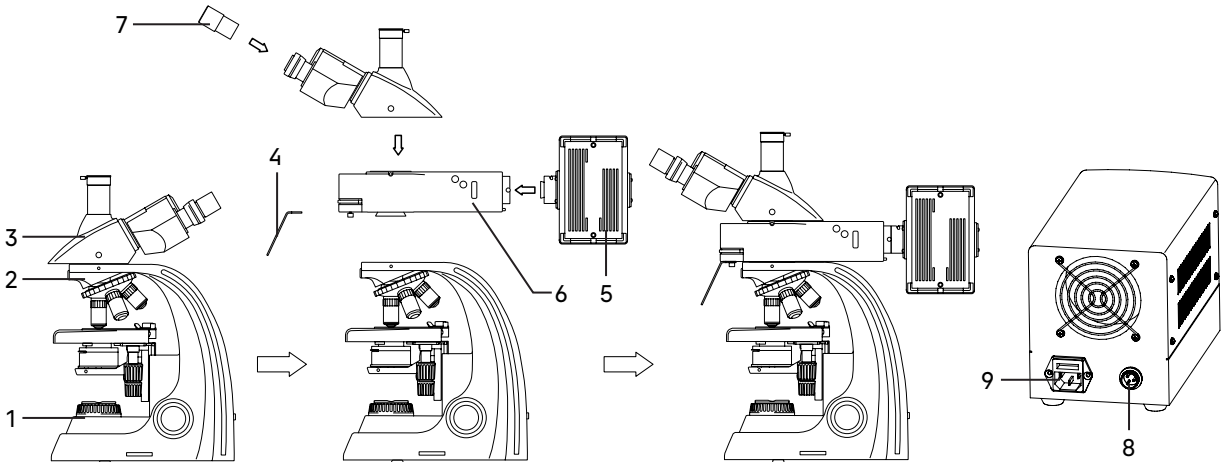


Fig. 6. Assembling the microscope

1. Remove the microscope from the package.
2. Check the scope of delivery using Section 8 of the User Manual.
3. Inspect the microscope and its components for damage.
4. Remove the microscope stand **1** and the head **3** from the package. If the microscope head is mounted on the stand, carefully remove them together.
5. Loosen the attachment screw **2** using an Allen wrench. If the microscope head was secured on the stand, remove it from the stand.
6. Remove the epi-fluorescence illuminator **6** and the mercury lamphouse **5** from their packages. Remove dust covers from the epi-fluorescence illuminator.
7. Place the epi-fluorescence illuminator **6** on the microscope stand **1**. Secure it with the screw **2** using an Allen wrench. Secure the UV shield **4** with two screws on the front of the epi-fluorescence illuminator.
8. Place the mercury lamphouse **5** on the epi-fluorescence illuminator **6**. Secure the attachment screw.
9. Install the mercury lamp, as shown in Fig. 6b.

Attention! For transportation, a plastic rod is installed in place of the mercury lamp to avoid damage.

Use the screwdriver to loosen the screws **1**. Open the cover **2**. Loosen two screws **5** on the lamp socket **6** and remove the plastic rod. Remove the mercury lamp **4** from the package and insert its ends into the socket rings. Position the center of the lamp in line with the two center screws and Phillips screw **7**. Tighten the screws **5**. The anode and cathode have different diameters. The lamp socket rings have respective inside diameters. Re-install the lamp cover and secure it with two screws **1**.

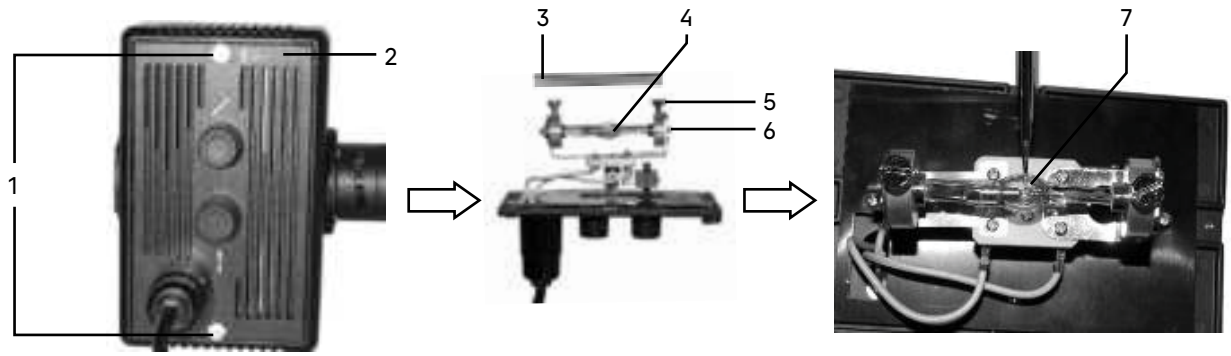


Fig. 6b. Installing the mercury lamp

10. Connect the power cord of the mercury lamphouse to the power supply connector **8**. Plug the AC power cord into the connector **9**. Plug the power cord into an AC outlet.
11. Place the microscope head **3** on the epi-fluorescence illuminator **6**. Secure the attachment screw using an Allen wrench.
12. Remove the dust caps from the eyepiece tubes. Insert the eyepieces **7** into the eyepiece tubes. Rotate the eyepieces, making sure they are tightly seated in the tubes.
13. Connect the AC power cord to the connector on the back panel of the stand. Plug the power cord into an AC outlet.
14. Make sure that all the components are securely and safely mounted.
15. Check and sort the supplied accessories and tools in the correct order. Keep them in proper order to avoid confusion.
16. Keep the packaging should you need to transport the microscope.

4 BRIGHTFIELD OBSERVATIONS IN TRANSMITTED LIGHT

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.

Set the filter turret wheel 2 (Fig. 3) to "0" position.
Set the plate 7 (Fig. 3) into a "shutter" position.
Make sure that the power cord is plugged into the connector on the back panel of the microscope stand.
Turn the ON/OFF switch **1** to "–" position (ON).
Adjust the brightness using the ring **2** so that the light brightness is 70% of full power.

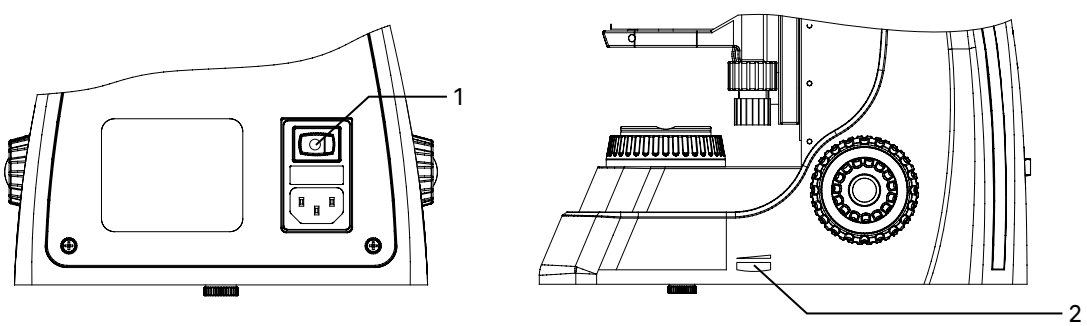


Fig. 7. Switching on the illumination and adjusting the brightness

Do not keep the brightness adjustment ring 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.

PLACING THE SPECIMEN

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

The stage attachment features an XY control system. The control knobs are coaxial – they are located on the same axis.

The knob **2** controls Y-axis movement, the knob **3** controls X-axis movement. Moving range: 70mm in X-axis direction and 50mm in Y-axis direction.

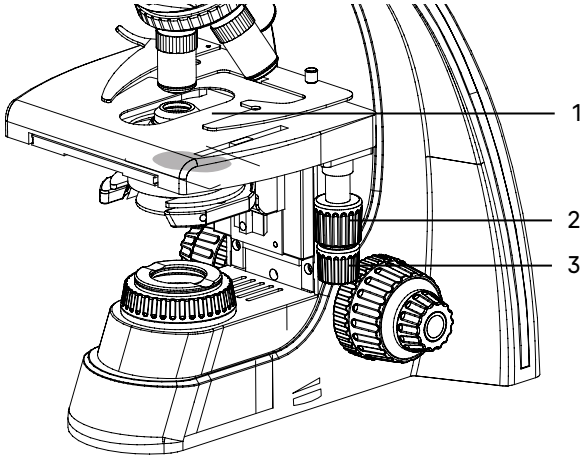


Fig. 8. Placing the specimen

FOCUSING ON THE SPECIMEN

Place the 4x objective into the optical path (we recommend starting with low and medium magnification objectives that have a sufficiently large field of view and working distance).

By turning the coarse focusing knob **2**, raise the stage carefully until the coverslip almost touches the objective front lens.

Looking into the right eyepiece (with the left eye closed) and lowering the stage slowly, bring the image into sharp focus using the coarse **2** and fine **1** focusing knobs.

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 knob, rotate the coarse focusing tension adjusting knob **4**. By rotating it counter-clockwise, you tighten the tension, and by rotating it clockwise, you loosen it.

The rotary knob **3** is used to lock the coarse focusing. This function ensures that the stage is secured in the upper position. The coarse focusing lock knob is convenient for quick specimen change. When the stage is locked in the preset position, you can quickly bring the image to sharp focus after changing the specimen by rotating the coarse focusing knob as far as it will go and re-focus by a fine focusing knob.

Note that when the coarse focusing lock knob is locked in position, you should not rotate the coarse focusing knob after the stage has reached the stop. This may cause the focusing mechanism to break.

If a new specimen has a different slide thickness and you fail to focus on the object, unlock the coarse focusing lock knob.

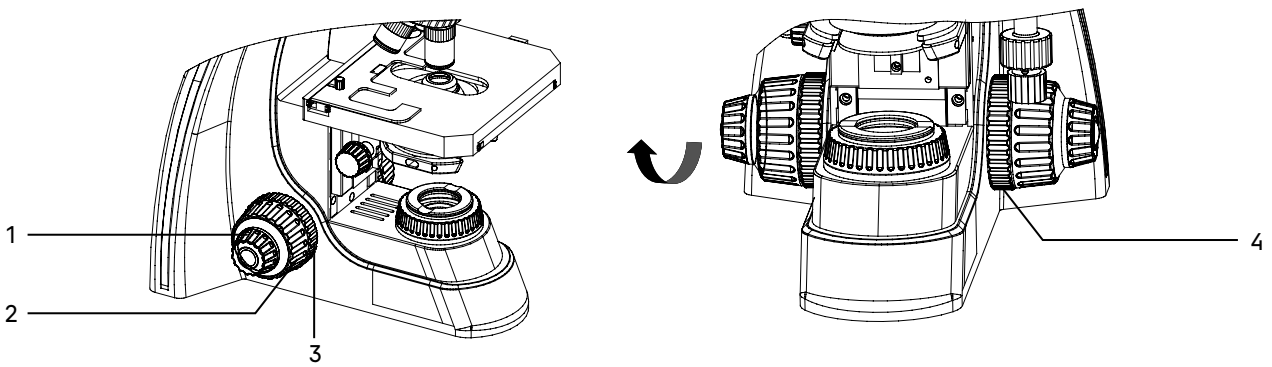
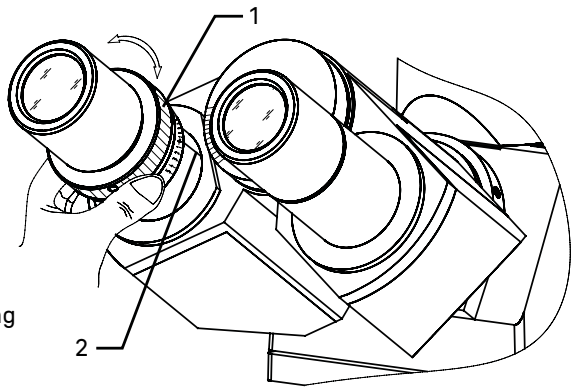


Fig. 9. Focusing on the specimen

ADJUSTING THE EYEPIECE TUBES

Use the diopter adjustment of the left eyepiece tube to compensate for the observer's ametropia. Start by setting the diopter adjustment to the zero. To do this, rotate the ring **1** to adjust the scale "0" to the indicator **2**.

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**.



1. Diopter adjustment ring
2. Indicator.

Fig. 10. Adjusting the diopter adjustment mechanism

The adjustment range is ±5 diopters. The number on the ring corresponds to the diopter adjustment of the eyes. The indicator on the side is used for marking.

We recommend memorizing your diopter adjustment value for future reference.

Adjust the distance between the eyepieces to your interpupillary distance by rotating the eyepiece tubes around the central axis until you see a single circular image when looking through the eyepieces with both eyes.

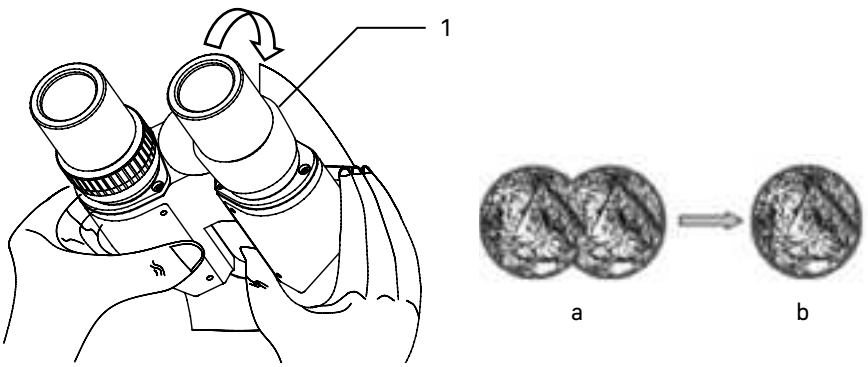


Fig. 11. Adjusting the interpupillary distance

We recommend memorizing your interpupillary distance for future reference.

The eyepiece tubes are 360° rotatable to change the eyepoint height for the users of different heights. With an interpupillary distance being 64mm, a 180° rotation changes the eyepoint height by 50mm.

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:

— Proceed as described above: switch on the illuminator, place the specimen on the stage **1**, focus, and adjust the eyepieces.

— Open the field diaphragm **3** and the condenser aperture diaphragm **2**, raise the condenser all the way up using the condenser focus knob **5**.

— While looking through the eyepieces, close the field **3** and aperture **2** diaphragms so that only the center of the field of view is illuminated.

— Move the image to the center of the eyepiece field of view using the condenser centering screws **4**.

— Carefully moving the condenser up and down by rotating the condenser focus knob **5**, place the condenser into the working position. In this position, the edges of the octagon-shaped image of the closed field diaphragm are sharp and the diffracted blue-green color at the edge of the diaphragm is directed beyond the edge of the diaphragm and not into the field of view.

— Open the field diaphragm **3** until it just disappears outside of the field of view. Additional centering may be required.

— Remove the eyepiece from the right tube with no diopter adjustment and, while observing the objective exit pupil, open the aperture diaphragm to 2/3 of the objective exit pupil. This value will be slightly less than the objective aperture.

— Insert the eyepiece into the tube.

— Proceed to the brightfield observations.

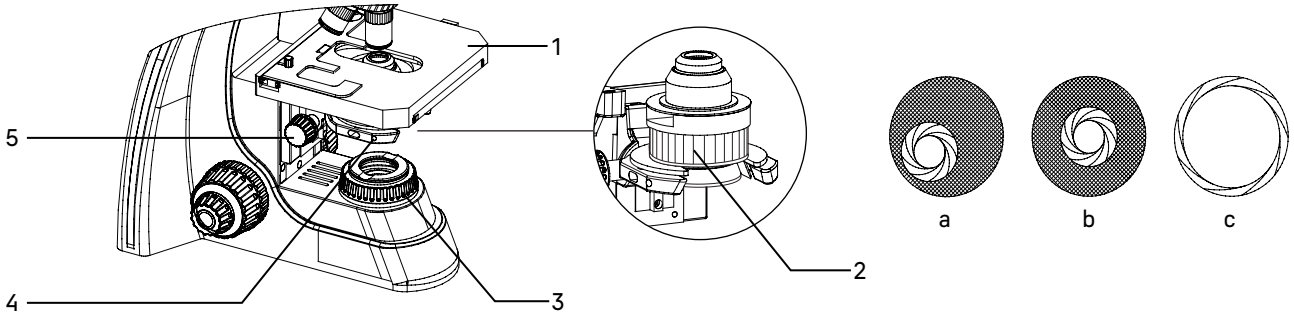


Fig. 12. Centering the condenser

1. Stage
2. Aperture diaphragm ring
3. Field diaphragm
4. Condenser centering knob
5. Condenser focus knob

When you switch to the objectives of other magnifications, do not change the height of the condenser, only adjust the opening of the field and aperture diaphragms.

While adjusting the illumination, you should keep in mind that changing the size of the field diaphragm only affects the size of the illuminated field. For each objective, you should open the field diaphragm so far that its image is close to the edge of the microscope's field of view, not outside of the field. Magnification and field of view values are inversely proportional. High magnification will give a small field of view. Therefore, when you switch to higher magnification objectives, close the field diaphragm. When you switch to lower magnification objectives, open the field diaphragm.

The size of the aperture diaphragm affects the image contrast. Do not increase the image brightness by opening the aperture diaphragm, as this will result in loss of contrast and low resolution. The brightness is only adjustable with the brightness adjustment ring. The greater the magnification of the objective, the larger is its aperture, and the larger is the opening of the condenser diaphragm. The final opening of the aperture diaphragm depends not only on the objective but also on the specimen, so the aperture diaphragm is opened in such a way that the best contrast of the specimen image is produced.

Use 1-1.2 mm thick slides to ensure proper operation of the illumination system.

USING OIL IMMERSION OBJECTIVES

Using the 40x objective, place the specimen section you want to observe in the center of the field of view. Place a drop of the immersion oil on the slide.

Do not use substitutes instead of special immersion oil as it may significantly worsen the image quality and cause malfunction of the objective.

Place the 100x oil objective into the optical path. Observing the gap between the objective and the slide from the side, raise the stage slowly using the coarse focus knob until the drop of oil on the slide comes in contact with the objective lens. This results in an immersion medium between the front lens of the objective and the slide. Use the fine focusing knob to sharpen the focus quality of the image. There should be no bubbles in the immersion medium. Otherwise, lower the stage to break with the oil drop and re-focus the microscope on the specimen.

When finished, remove the immersion oil with a clean cloth or cotton wool. Clean the surfaces, which were covered with immersion oil, with cotton wool rolled on a wooden stick and lightly moistened with special O-xylene mixture.

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 40x/0.85, the total magnification of the microscope is 10 x 40 = 400x.

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 40x/0.85, the field of view of the microscope is 22mm/40x = 0.55mm.

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

5 FLUORESCENCE OBSERVATIONS

Before starting fluorescence observations, adjust the microscope to work in transmitted light using the brightfield technique, as described above.

Placing the specimen, focusing on the specimen and adjusting the microscope head for the fluorescence observations are done in the same way as for the transmitted light observations.

During fluorescence observations:

— In order to prevent the fluorescence of the prepared specimens from quenching, carry out observations under low light conditions as far as practicable – use dark curtains, switch off the overhead light.

— Microscopy observations are performed as soon as the specimens are stained with fluorescent dyes and dried. If immediate microscopy is not possible, it is recommended that specimens be stored in a cool place in an opaque container or wrapped in black paper. Storing specimens in a place exposed to direct sunlight or ultraviolet light will result in fluorescence quenching, and, consequently, false results.

— In order to prevent the fluorescence from quenching, the specimens should be placed in the optical path 5-10 minutes after switching on the lamphouse power supply, when the mercury lamp becomes fully operational.

— To extend the life of the mercury lamp, do not switch the power supply on and off frequently. If you need to switch it off, wait about 15 minutes after ignition. When you need to re-ignite it, wait 10–15 minutes and make sure the mercury lamp has cooled down. Frequent switching on and off will shorten the life of the mercury lamp and affect the operation of the power supply.

— It is necessary that you select correct fluorescence filters suitable for the fluorochrome (fluorescent) dyes used to stain the specimen. For example, if you choose the green filter for the specimen stained by Auramine O, there will be no or too little fluorescence.

— The optical system must not contain self-illuminating objects. For example, if you use cedar wood oil as an immersion fluid, it will produce an extra turquoise glow. Use special immersion oil for the fluorescence microscopy.

— In order to prevent the fluorescence of the specimen from quenching due to excessive excitation, you should use the filter slider 7 (Fig. 3) and enable a neutral density filter. If you leave the free slot in the optical path, the specimen will burn out during focusing, leading to false results.

1. Switching on the illuminator

Switch off the transmitted light illuminator by turning the switch **1** to position "0" (off). The transmitted light illuminator, if switched on, will adversely affect the results of fluorescence observations.

Lower the Abbe condenser all the way down. Install the black plate **2** into the stage above the condenser. The plate protects the specimen from stray light that can affect the image quality and observation results.

Make sure that the UV shield **3** is installed on the microscope and secured with screws.

Make sure that the mercury lamphouse power cord **4** is connected to the power supply **5** and the AC power cord **6** is plugged into an AC outlet. Turn on the mercury lamphouse power supply – turn the ON/OFF switch **7** to "I" position (on). The mercury lamp will be in a steady-state operation mode in 5–10 minutes.

2. Selecting the fluorescence filter

The rotating turret accommodates four fluorescence filters: blue (B), green (G), violet (V), and ultraviolet (UV). Rotate the ring **8** to select one of the filters in accordance with the used fluorochrome. The marking of each filter corresponds to the color of the excitation light and is inscribed on the wheel as a symbol.

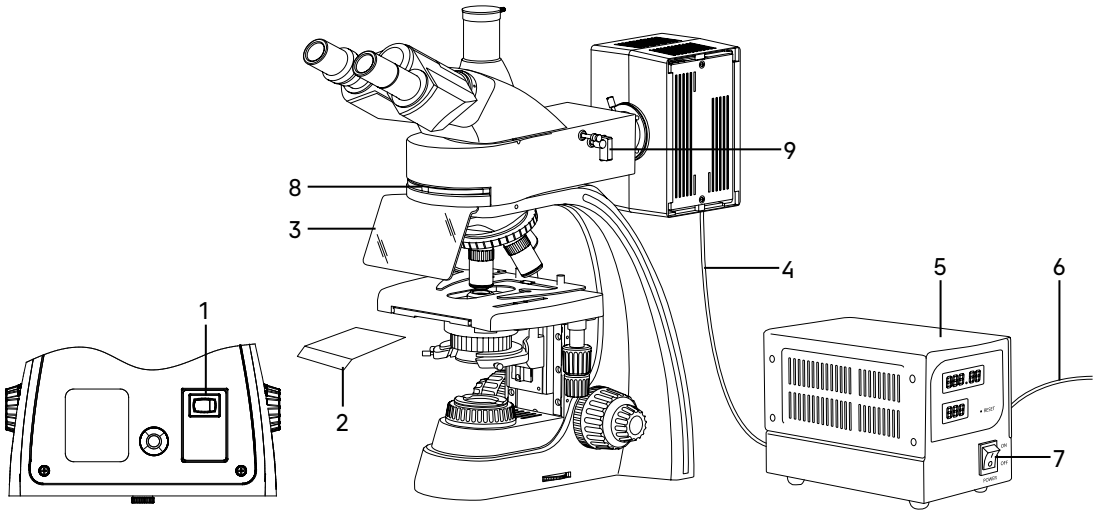


Fig. 13. Switching on the epi-fluorescence illuminator

3. Using the filter slider

The filter slider **9** has three positions: neutral matt density filter, free slot, and shutter. Once inserted in the illuminator slot, the plate is locked in one of the three positions.

Use the "shutter" position when you have completed the observations or during a break in order to avoid excessive excitation light exposure and prevent the specimen from fluorescence fading.

Use the "neutral matt density" position in case of prolonged light exposure or under intense illumination of the specimen, which may distort the specimen configuration and affect the image quality and microscopy results.

Use the "free slot" position if you need to step up the intensity of the excitation light. The fluorescence lifetime may be shortened due to rapid fading.

4. Using the field diaphragm of the illuminator

The field diaphragm of the reflected light illuminator is pre-centered before shipping from the factory, but the adjustment may be lost during transportation. The centering of the field diaphragm should be checked.

— Place the 10x objective into the optical path.

— Push the knob **2** as far as it will go to close the field diaphragm. A bright spot should be visible in the center of the field of view, as shown in Fig. 14b.

— If the bright spot is not in the center of the field of view, as shown in Fig. 14a, you will need to center the diaphragm. Use two centering screws **1** located on both sides of the illuminator to align the center of the diaphragm with the center of the field of view, as shown in Fig. 14b.

— Open the field diaphragm until its image fills the field of view, as shown in Fig. 14c.

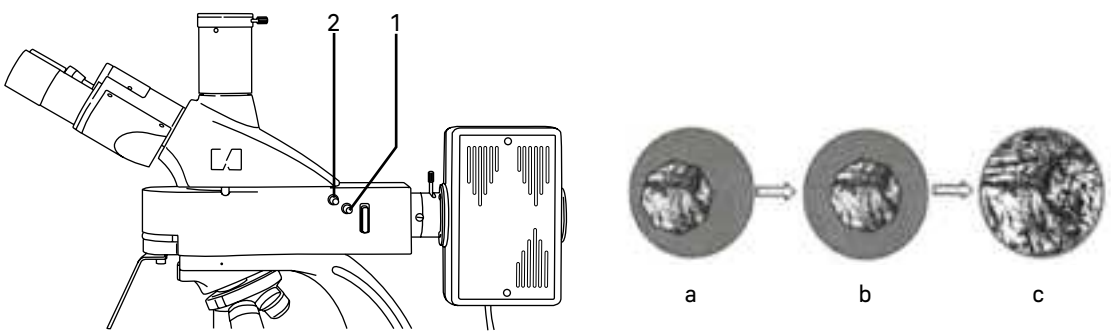


Fig. 14. Centering the field diaphragm of the reflected light illuminator

5. Centering the mercury lamp

The optical fluorescence system is pre-centered at the factory. Since the mercury lamp is packaged separately, the center of the mercury lamp may deviate from the light path when it is re-installed. You should center the lamp before operation.

Draw a crosshair on a small piece of white paper, approximately 40x50mm. Place the paper with **1** with a crosshair on the stage. Make sure that the mercury lamp is on, the fluorescent filter is placed into the optical path, and the filter slider is in the "free slot" position. Bring the image of the crosshair into sharp focus, move the sheet of paper so that the center of the crosshair is in the center of the eyepiece field of view.

Remove one of the objectives from the revolving nosepiece and place the free slot (a slot without an objective) into the optical path. Observe the sheet of paper from the side (not through the eyepieces). A bright bow-shaped light spot will appear on the paper. Use the collector adjustment knob **2** to achieve the sharpest focus of the light spot (discharge arc) and mercury lamp electrodes on the paper surface.

Use the knobs **3** and **4** to center the mercury lamp – bring the image of the light spot to the center of the crosshair on the paper. The knob **3** controls the vertical movement, the knob **4** controls the horizontal movement.

Re-install the removed objective into the revolving nosepiece. The microscope is prepared for the fluorescence observations. You can move the filter slider into a "neutral matt density" position, place the specimen on the stage, focus the microscope and start observations.

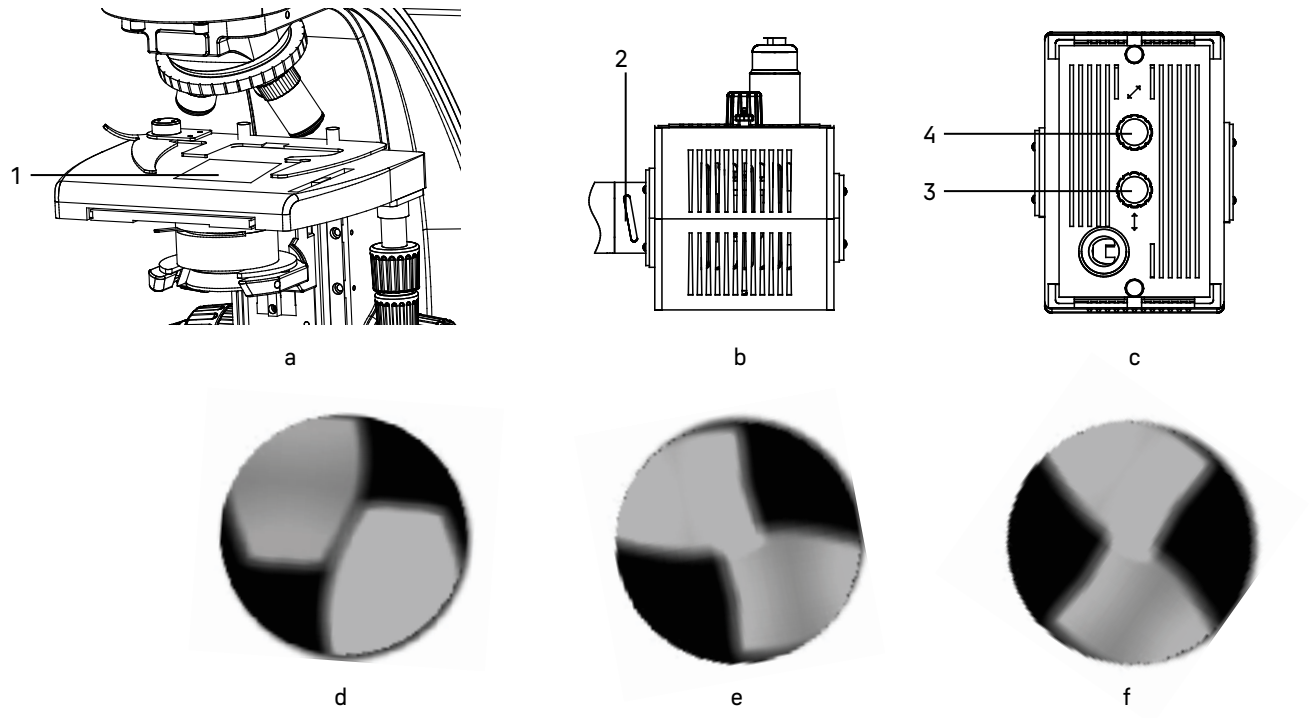


Fig. 15. Centering the mercury lamp

6 USING OPTIONAL EQUIPMENT

DARKFIELD CONDENSER

The optional darkfield condenser is used in the darkfield microscopy technique. This technique is used to obtain the image of unstained transparent weakly absorbing samples and therefore invisible when observed in the bright field.

We recommend setting up the darkfield illumination with the oil condenser as follows:

— Raise the stage all the way up using the coarse focusing knob. Lower the condenser all the way down using the condenser focus knob. Loosen the screw of the brightfield condenser holder while leaving the centering screws untouched. Remove the Abbe condenser and install the darkfield condenser in the condenser mount instead. Secure it with a screw.

— Place a drop of immersion oil on the front lens of the darkfield condenser.

— Rotate the adjustment ring to increase the bulb intensity to maximum. Place the specimen on the stage.

— While observing the gap between the condenser front lens and the specimen slide from the side, use the condenser focus knob to raise the condenser so that the immersion oil contacts the slide.

— Place a drop of immersion oil on the coverslip, place the 100x objective into the optical path and focus on the specimen. You should see the darkfield effect in the field of view (brightly shining particles of the specimen on a dark background).

— For best darkfield illumination, carefully adjust the condenser height and center it with the screws.

For good darkfield performance, specimens with a slide thickness of no more than 1.2mm and a coverslip thickness of no more than 0.17mm should be used.

When using the darkfield technique with the immersion objective having a high aperture, the objective captures not only the light scattered by the specimen particles, but also the direct rays that create a light background and deteriorate the image contrast. Therefore, all unwanted light should be removed from the room, if possible.

When finished, remove the immersion oil with a clean cloth or cotton wool. Clean the surfaces, which were covered with immersion oil, with cotton wool rolled on a wooden stick and lightly moistened with special O-xylene mixture.

The darkfield illumination settings for using dry objectives with the N.A. 0.9 condenser are similar apart from the immersion oil.

DARKFIELD SLIDER

The darkfield slider is designed for the darkfield microscopy on objectives with apertures up to 0.9. The slider is a plate with two round openings. One opening is free for the brightfield technique. The second opening holds the darkfield diaphragm. The slider is inserted in the slot of the Abbe condenser 10 (Fig. 2). Make sure that the slider is inserted with the marks facing up. The condenser aperture diaphragm must be fully open. The slider makes it easy to switch from one observation technique to another.

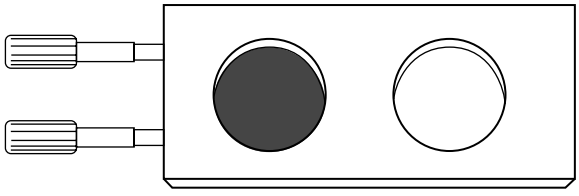


Fig. 16. Darkfield slider

PHASE-CONTRAST DEVICE

The phase-contrast device is designed for the study of low-contrast objects which are invisible in transmitted light of the brightfield microscopy. The phase-contrast technique allows for the observation of unstained low-contrast objects, colorless transparent specimens and living microorganisms. For example, it is used in medicine to calculate the number of platelets in clinical blood tests, visualize and count red blood cells in urine. It is also used in ecology to examine living organisms in water.

The phase-contrast device is installed in the condenser mount in place of the Abbe condenser. When using the phase-contrast device, refer to the specification and follow the device operation manual.

POLARIZER/ANALYZER SET

The polarization technique requires using the polarizer/analyzer set which consists of an analyzer and a polarizer.

1. Place the analyzer into the slot above the revolving nosepiece.
2. Place the polarizer on the collector.
3. Switch the light to maximum brightness.
4. Turn the polarizer to a position where the field of view in the eyepieces is the darkest.
5. Place the specimen on the stage. You can start observing in the polarized light.

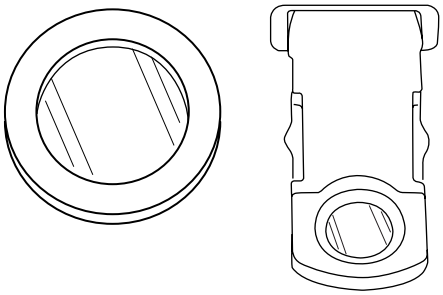


Fig. 17. Polarizer/analyzer set

USING THE EYEPIECE WITH A SCALE

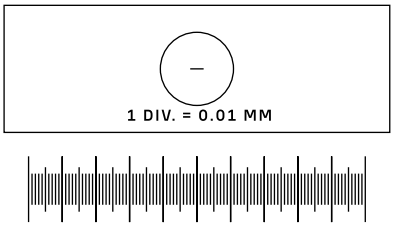


Fig. 18. Calibration slide

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:

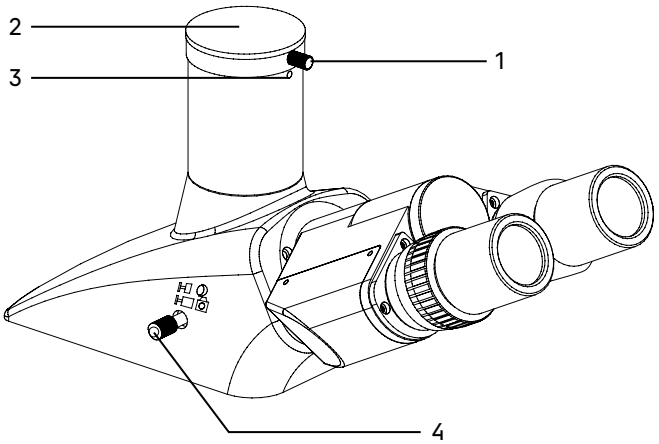
Objective magnification	Eyepiece division value
4	
10	
20	
40	
60	
100	

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.

USING THE CAMERA

The microscope is designed to observe a specimen through the eyepieces and to photograph the specimen. The trinocular tube is located on the top of the microscope head. When not in operation, it is covered with the dust cap **2**. You can switch to the trinocular tube using the knob **4**. The knob is located on the left side of the microscope head.

It is important that you choose the proper camera to capture objects in the fluorescent light. You should pay attention to light sensitivity: the larger the pixel size and sensor size, the crisper and more realistic the image appears. When choosing between a monochrome and color camera with the same sensor, give preference to the monochrome camera as it has higher light sensitivity. When choosing between a global and rolling shutter, select the global one. A good fluorescence camera should have a cooling system. The wrong camera will not allow taking good quality pictures, which will distort the results of the observation.



1. Dust cap screw
2. Dust cap
3. Trinocular tube centering screw
4. Beam splitter lever

Fig. 19. Using the camera

To enable the camera:

— Loosen the screw **1**. Remove the dust cap **2** from the trinocular tube.

— The microscope kit includes a C-mount adapter. Connect the camera to the adapter.

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

— Pull out the beam splitter lever **4** as far as it will go. The knob is in the pushed-in position when the trinocular tube is not used.

— Switch on the camera according to the manual, adjust the image.

— If the image is blurred, adjust the focus using the fine focusing knob to ensure an accurate and sharp image.

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 using three centering screws **3**. Do it as follows:

— 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. 20a), move the specimen on the stage so that the point is in the center of the field of view, as shown in Fig. 20b. 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.

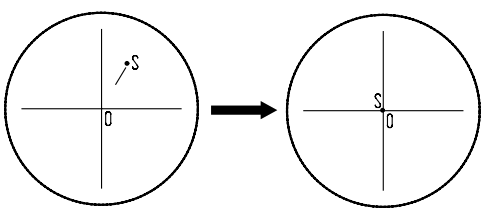


Fig. 20. Adjusting the camera image

— Pull out the beam splitter lever **4** to the camera position. Look at the specimen on a monitor or display screen and make sure that the image of the target 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 **3** on the trinocular tube to move the target 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.

USING THE 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.

7 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 fuse has blown	Replace the fuse
	The circuit board connector has poor contact	Have the connector repaired by a qualified electronics technician
	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 condenser is incorrectly positioned – lowered too far or skewed	Adjust the condenser – set up Köhler illumination
	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 or oil on the objective, eyepiece, or condenser surfaces	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
Fluorescence is not observed	The wrong fluorescence filter has been selected	Select the filter to match the selected fluorescent dye
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

Poor image quality (low resolution, poor contrast)	The objective is damaged	Have the objective repaired by a qualified technician or replaced
	Inappropriate coverslip thickness	Use the specimen with the coverslip of standard thickness (0.17mm)
	The specimen is mounted upside down	Place the specimen with the coverslip facing up
	There is immersion oil on the front lens of the dry objective (most often 40x). Immersion oil has dried on the front lens of the 100x objective	Remove immersion oil from the front lens surfaces with a tissue moistened with O-xylene
	Immersion oil is not applied with the 100x objective	Apply immersion oil
	Immersion oil contains bubbles	Remove immersion oil from the objective, condenser, specimen, slide and re-apply
	Inappropriate immersion oil is used	Replace the oil
	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
MECHANICAL COMPONENTS		
The image does not remain sharp during observation	The coarse focusing tension adjusting knob is loosened, causing the stage to lower spontaneously	Adjust the coarse focusing tension adjusting knob
The coarse focusing knob is too tight to rotate	The coarse tension adjusting knob is overtightened	Loosen the tension of the coarse focusing knob
When switching from the low magnification objective to the high magnification objective, the objective touches the slide	The specimen slide is mounted upside down	Mount the slide with the specimen (coverslip) facing up
	The coverslip is too thick	Use the coverslip of the standard thickness
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
POTENTIAL MALFUNCTIONS OF THE REFLECTED LIGHT ILLUMINATOR		
The mercury lamp does not ignite or has gone out	The power supply does not work	Check the ON indication on the mercury lamphouse power supply. If there is no indication, unplug the power supply from the AC outlet and replace the fuse
	Wrong installation of the mercury lamp	Switch off the mercury lamphouse power supply. Unplug the lamphouse power cord from the power supply. If the lamphouse is hot, wait until it has cooled. Make sure that the lamp is properly installed in the lamphouse
	The mercury lamp is faulty (the bulb is cloudy)	Replace the mercury lamp
The fluorescence intensity of the sample has decreased significantly	The mercury lamp is faulty (the bulb is cloudy)	Replace the mercury lamp

8 SCOPE OF DELIVERY

The scope of delivery (Table 5)

Component	Pcs	Note
MICROSCOPE		
MAIN COMPONENTS		
Stand (with the transmitted light illuminator, power source and focusing mechanism built into the base)	1	
Epi-fluorescence illuminator	1	
Mercury lamphouse	1	
ICO Infinitive trinocular microscope head	1	
Revolving nosepiece	1	Mounted on the stand
Stage	1	Mounted on the stand
Mercury lamphouse power supply	1	
REPLACEABLE PARTS		
Centerable Abbe condenser	1	
A 0.9 darkfield condenser	1	Optional
A 1.36–1.25 oil darkfield condenser	1	Optional
Darkfield slider	1	Optional
Phase-contrast device	1	Optional
Polarizer/analyzer set	1	Optional
4x/0.10 plan achromatic objective ∞/–	1	
10x/0.25 plan achromatic objective ∞/–	1	
10x/0.35 plan achromatic objective ∞/–	1	Optional
20x/0.40 plan achromatic objective ∞/0,17	1	Optional
40x/0.85 plan achromatic objective ∞/0.17 (spring loaded)	1	
60x/0.80 plan achromatic objective ∞/0.17 (spring loaded)	1	Optional
100x/1.25 plan achromatic objective (oil) ∞/0.17 (spring loaded)	1	
10x/22mm eyepiece	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
Eyecup	2	
UV protective glass (shield)	1	
Filter slider	1	In the epi-fluorescence illuminator
Black protective plate for under-stage installation	1	
C-mount camera adapter	1	
Monitor	1	Optional
Digital camera	1	Optional
Calibration slide	1	Optional
ACCESSORIES AND SPARE PARTS		
Allen head screw for the epi-fluorescence illuminator	1	Installed in the stand socket
Head locking screw	1	Installed in the illuminator socket
Mercury lamphouse locking screw	1	Installed in the illuminator adapter socket
UV shield locking thumbscrew	2	Installed in the illuminator socket
Allen wrench or screwdriver	2	
Dust cap (of various designs)	6	Supplied
Transmitted light source: 12V/30W halogen bulb	1	In the microscope stand

Fluorescence light source: 100W mercury lamp	1	In the epi-fluorescence illuminator
Color filter set for transmitted illumination	1	
3A/250V Fuse	2	Installed in the illumination system
15A/250V Fuse	2	Installed in the mercury lamphouse power supply
Bottle of immersion oil	1	
AC Power cord	2	
Mercury lamphouse power cord	1	Installed on the lamphouse
Dust cover	1	
User manual	1	

9 CARE AND MAINTENANCE

REPLACING THE FUSE AND THE HALOGEN BULB IN THE MICROSCOPE STAND (FOR THE TRANSMITTED LIGHT ILLUMINATOR)

Before replacing the bulb and fuse, turn the ON/OFF switch to "0" position (off). To avoid burning your hands, wait 10 minutes for the lamp to cool down.

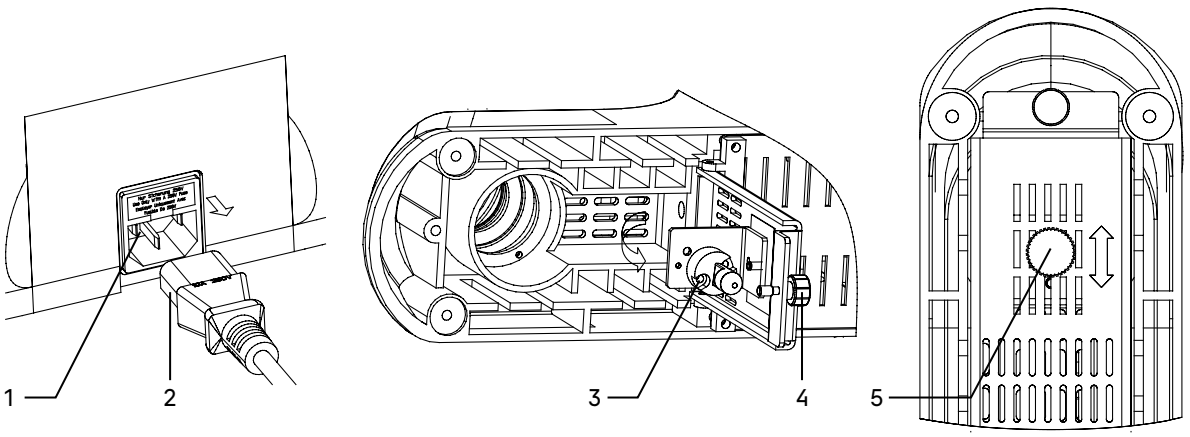


Fig. 21. Replacing the halogen bulb and fuse

Unplug the power cord from the AC outlet and remove it from the connector on the back panel of the stand **2**.

Carefully lay the microscope on its side. Loosen the lock screw **4**, open the cover of the lamp housing. Replace the halogen bulb **3** with a new one. Do not touch the bulb with bare hands, as fingerprints on the surface may shorten its life. Use the handle **5** for centering the bulb. Re-install the cover and secure it with two screws **4**.

The fuse holder is located on the back panel of the stand above the AC power input **1**. Using a flathead screwdriver, hook and remove the fuse block from the fuse holder. Replace the blown fuse with a new one. Return the fuse block to the holder. Plug the power cord into the connector and an AC outlet, turn on the ON/OFF switch to check the fuse for proper operation.

For convenience, there is a slot for a spare fuse at the base of the fuse block. Once you have used the spare fuse from the block, we recommend placing a new fuse in the slot. This will save time for searching a new fuse when the fuse is blown during operation.

REPLACING THE MERCURY LAMP AND FUSE (FOR THE EPI-FLUORESCENCE ILLUMINATOR)

1. Replacing the mercury lamp

Switch off the mercury lamphouse power supply. Unplug the power cord from the power outlet. Wait approximately 30 minutes for the mercury lamp and lamphouse to cool down.

— Loosen the attachment screws **1** and remove the cover **2** from the lamphouse.

— Hold the lamp socket **6** and loosen two locking screws **3**. Remove the faulty lamp **4** and install a new mercury lamp. Align the centers of two electrodes with two screws **5** to facilitate the mercury lamp centering procedure.

Important! Do not touch the glass surface of the lamp with your bare hands. Use the gloves from the kit or wrap the lamp with a clean cloth. Fingerprints may reduce light intensity and destroy the lamp. If you accidentally touch the lamp glass surface, use a clean cloth moistened with alcohol to wipe off the fingerprints.

— Re-install the cover on the lamphouse. An «up» arrow indicates the top of the cover. Tighten the attachment screws.

— Plug the power cord to the mercury lamphouse.

Important! It is strictly forbidden to turn on the lamp until the lamp cover is re-installed. Exposure to the uncovered lamp will cause eye and skin burn.

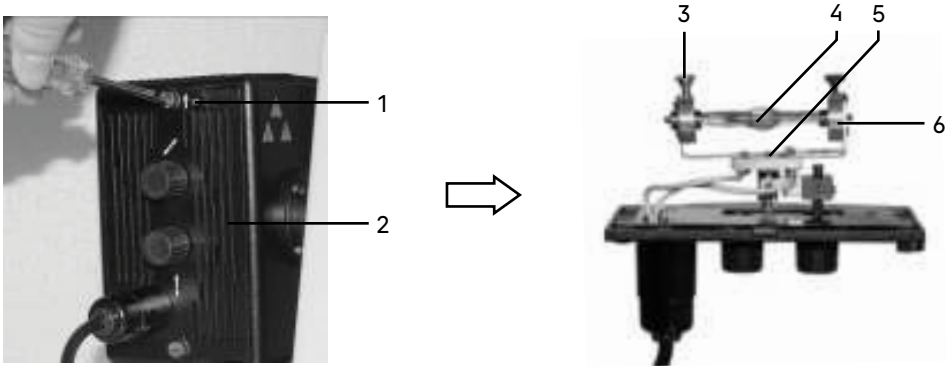


Fig. 22. Replacing the mercury lamp

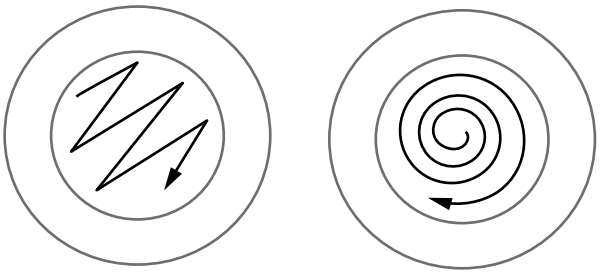
2. Replacing the fuse in the mercury lamphouse power supply

Unplug the AC power cord from the power outlet and from the mercury lamphouse power supply. The fuse holder is located on the back panel of the power supply above the AC input connector. Using a flathead screwdriver, hook and remove the fuse block from the fuse holder. Replace the blown fuse with a new one. Return the fuse block to the holder. Plug the power cord into the connector and an AC outlet, turn on the ON/OFF switch to check the fuse for proper operation.

For convenience, there is a slot for a spare fuse at the base of the fuse block. Once you have used the spare fuse from the block, we recommend placing a new fuse in the slot. This will save time for searching a new fuse when the fuse is blown during 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.



Incorrect Correct

Fig. 23. 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.

10 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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