MAGUS LUM VD500 LCD
FLUORESCENCE INVERTED 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.
12. 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.

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.

Monitor

1. Make sure that the input voltage of the monitors matches that of the local power supply. Using the power supply with the wrong input voltage may cause a short circuit or fire.
2. Do not use the damaged power source.
3. Do not use the damaged power cord.
4. Do not insert foreign objects into the slot on the monitor body.
5. Do not expose the monitor to high temperatures or humidity for a long time.
6. If water splashes on the monitor, immediately switch the power off, unplug the power cord, and wipe off the water with a dry cloth.
7. Protect the monitor from shocks, excessive stress from other objects.
8. Store the monitor away from corrosive environments, household and car heaters, switched-on light bulbs and open flames.

CONTENTS

MAGUS Lum VD500 LCD Fluorescence Inverted 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 OF THE MICROSCOPE

PURPOSE

The microscope is designed on the basis of an inverted microscope equipped with a fluorescence filter assembly. The microscope is intended for studying liquid precipitates, cell colonies, living cells, tissue cultures, and other specimens in nutrient medium in laboratory glassware.

The microscope employs the fluorescence technique for reflected light observations. 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 also employs the brightfield and phase-contrast techniques for transmitted light observations. The phase-contrast technique allows for the observation of unstained low-contrast objects, colorless transparent specimens and living microorganisms.

The microscope illumination system is designed to work with the glassware up to 55mm high. It is also possible to use the glassware up to 165mm high with a bottom thickness of 1.2mm.

The microscope is used for immunochemical diagnosis and chromosome analysis, detection of latent bacterial and viral infections. It is applied in biomedical laboratories, biotechnology, pharmaceutical research, agriculture, and environmental studies. 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

Microscope	
Magnification, x	100–400 (40–500, 600, 800, 1000)**
Tube length	Infinity (∞)
Microscope head	Trinocular (Siedentopf type) Eyepiece diameter: 30mm 45° inclined Microscope head magnification: 1x Interpupillary distance: 48–75mm The eyepiece tubes are 180° rotatable to increase the eyepoint height The light path splitting ratio: 100/0 and 50/50 The side camera port: 100/0 or 0/100 splitting
Eyepieces, magnification, x/field, mm	10x/22mm, eye relief: 10mm; 10x/22mm with a scale, scale division value: 0.1mm*; 12.5x/14mm*, 15x/15mm*, 20x/12mm*, 25x/9mm*
Revolving nosepiece	6 objectives
Optical design	Infinity plan achromatic, parfocal distance: 45mm; long focal length
Objectives magnification, x/aperture/working distance, mm	PL L 10x/0.25/4.3; PL L 20x/0.40/8.0; PL L 40x/0.60/3.5 (spring-loaded); phase-contrast: PL L 10x/0.25/4.3 PHP2; PL L 20x/0.40/8.0 PHP2; PL L 40x/0.60/3.5 PHP2 (spring-loaded); PL 4x/0.10*
Condenser	Numerical aperture: 0.6 Working distance: 55mm Screw type fastening Phase-contrast turret The rotatable turret allows for working with glassware up to 165mm high

Stage	Fixed stage Stage size: 227mm×208mm Glass stage plate with a diameter of 118mm Mechanical XY stage attachment Moving range: 77mm×134.5mm Dish holders: 1. 86mm×129.5mm; Ø90mm 2. 34mm×77.5mm; Ø68.5mm 3. 57mm×82mm; Ø60mm 4. 29mm×77.5mm; Ø35mm
Field diaphragm	Adjustable iris
Focusing mechanism	Coaxial coarse & fine focusing knobs on both sides Fine focusing scale value: 2µm Coarse focusing lock knob and coarse focusing tension adjusting knob
Illumination method	Transmitted and reflected light
Reflected light source	100W mercury lamp
Transmitted light source	12V/30W halogen bulb with adjustable brightness
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 with an open slot and phase annuli for 10x, 20x and 40x phase-contrast objectives. Centering telescope
Power supply	AC voltage 85–265V, 50/60Hz Fuse specifications: 250V, 15A (mercury lamp); 250V, 3A (halogen bulb)
Operating temperature range, °C	5... 35
Operating humidity range, %	20... 80

Camera

Number of megapixels	8
Sensor	SONY Exmor/Starvis CMOS
Color/monochrome	color
Maximum resolution, pix	3840x2160
Sensor size	1/1.2" (11.14x6.26mm)
Pixel size, µm	2.9x2.9
Light sensitivity	1028mV with 1/30s
Signal/noise ratio	0.13mV with 1/30s
Exposure	0.14ms–1000ms
Video recording	+
Frame rate, fps at resolution, pix	30@3840x2160 (HDMI), 30@1920x1080 (Wi-Fi), 30@3840x2160 (USB 3.0)
Image format	*.jpg, *.tif
Video format	*.h264/*.h265, *.mp4
Spectral range, nm	380–650 (IR-filtered)
Shutter type	ERS (electronic rolling shutter)
System requirements	Windows 8/10/11 (32 and 64 bit), Mac OS X, Linux, up to 2.8 GHz Intel Core 2 or higher, minimum 4GB RAM, USB 2.0 ports, RJ45, CD-ROM, 19" or larger display (with USB connection)
Software	HDMI: built-in, USB: MAGUS View
Mount type	C-mount
Illuminator body	metal
Power supply	12V/1A AC power adapter

Monitor	
Type of matrix	IPS
Screen diagonal, inch	13.3
Screen resolution, pix	3840x2160 (4K)
Aspect ratio	16:9
Brightness, cd/m2	400
Number of displayed colors	16.7m
Contrast ratio	1000:1
Horizontal/vertical viewing angle, °	178/178
Viewable screen size (WxH), mm	295x165
Pixel pitch (WxH), mm	0.154x0.154
Display refresh rate, Hz	60
Type of matrix backlight	LED
LED backlight lifetime, h	50000
Interface	HDMI
Power supply	AC 110–220V, DC 5–12V/1A (Type-C)
Power consumption, W	12 (maximum)
Dimensions without package (WxHxD)	250mm×580mm×630mm
Package dimensions (WxHxD)	385mm×615mm×820mm
Weight without package	21.8kg
Weight with package	26.8kg

*** 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 a built-in power supply, transmitted light source, focusing mechanism, fixed stage, revolving nosepiece, condenser mount, and trinocular tube
— trinocular head
— fluorescence filter assemblies
— mercury lamphouse
— mercury lamphouse power supply
— condenser
— set of objectives and eyepieces
— set of dish holders
— digital camera
— monitor
— 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.

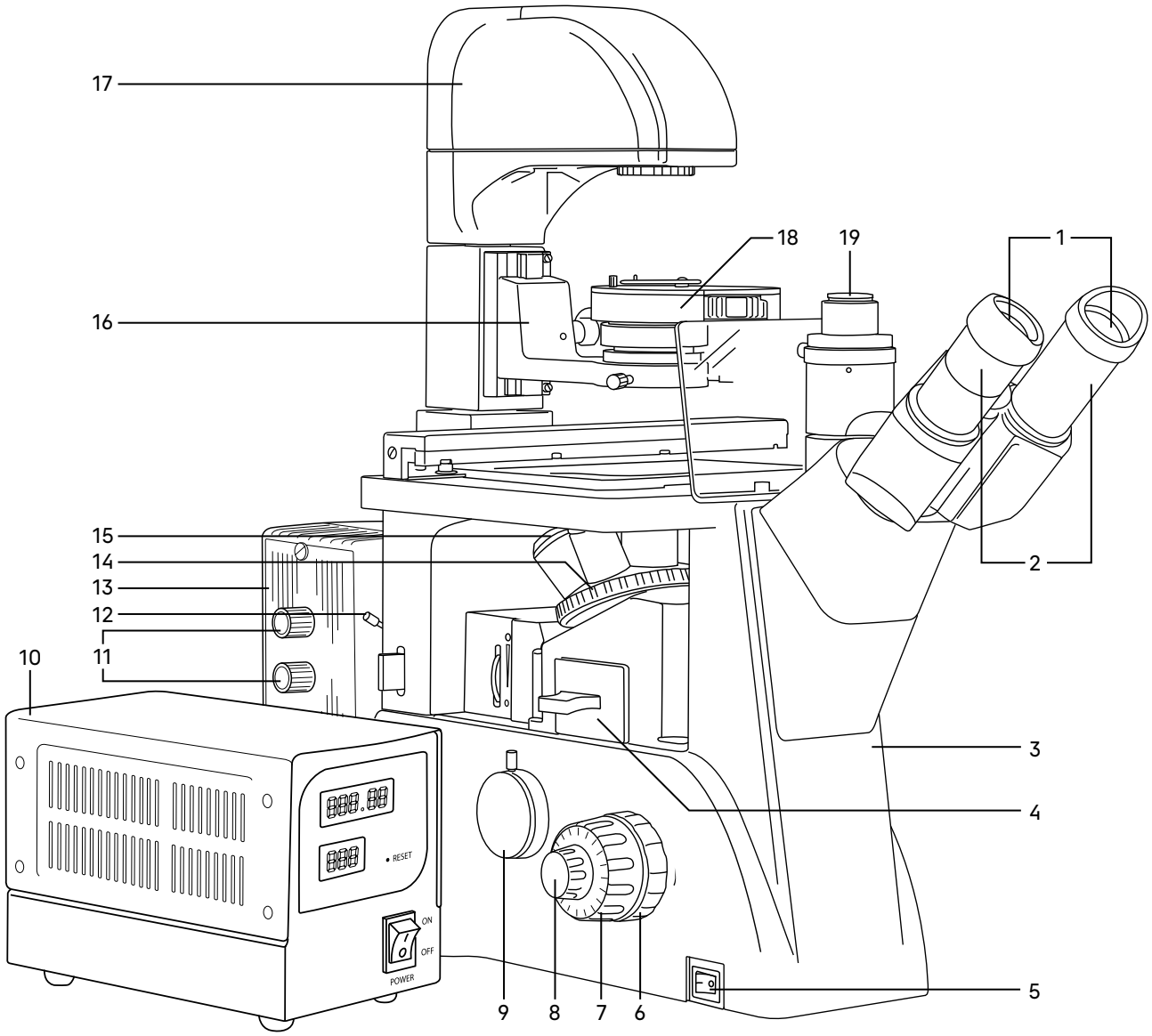


Fig. 1. MAGUS Lum VD500 LCD. View from the left

1. Eyecups
2. Eyepieces
3. Stand
4. Fluorescence filter assembly
5. ON/OFF switch
6. Coarse focusing tension adjusting ring
7. Coarse focusing knob
8. Fine focusing knob
9. Side camera port
10. Mercury lamphouse power supply
11. Mercury lamp adjustment knobs
12. Collector adjustment knob
13. Mercury lamphouse
14. Revolving nosepiece
15. Objectives
16. Condenser mount
17. Transmitted light illuminator
18. Condenser
19. C-mount adapter

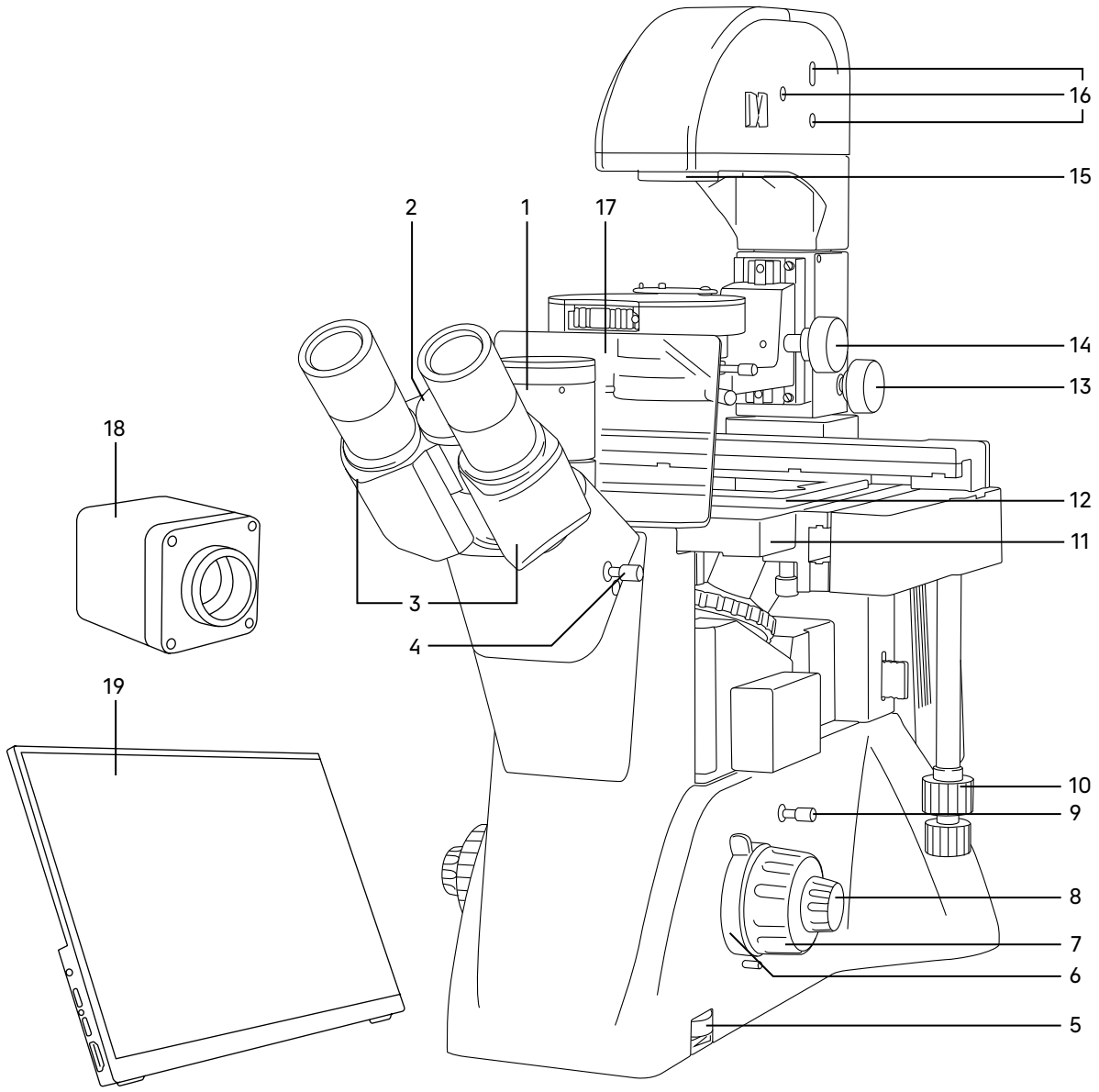


Fig. 2. MAGUS Lum VD500 LCD. View from the right

1. Trinocular tube
2. Interpupillary distance adjustment ring
3. Eyepiece tubes
4. Knob for switching the light path to the trinocular tube
5. Brightness adjustment ring
6. Coarse focusing lock knob
7. Coarse focusing knob
8. Fine focusing knob
9. Knob for switching the light path to the side camera port
10. Object moving knob
11. Stage
12. Dish holder
13. Condenser moving knob
14. Condenser focus knob
15. Collector with field diaphragm
16. Halogen bulb adjusting screws
17. UV shield
18. Camera
19. Monitor

2 MICROSCOPE PARTS

STAND

The stand has stable ergonomic design.

Parts attached to the microscope stand 3 (Fig. 1):

— revolving nosepiece 14 (Fig. 1) with objectives

— stage 11 (Fig. 2)

— condenser mount 16 (Fig. 1)

— transmitted light illuminator 17 (Fig. 1)

— microscope head 3 (Fig. 2)

— mercury lamphouse 13 (Fig. 1).

Inside the stand is the focusing mechanism and the power supply unit for the illuminator. The power supply converts AC voltage to the required voltage to power the halogen bulb.

There is an ON/OFF switch 5 (Fig. 1) on the left side of the stand. The power is on when the switch is in "–" position. The power is off when the switch is in "0" position.

There is a ring 5 (Fig. 2) on the right to adjust the supply voltage of the 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 camera port 9 (Fig. 1) on the left side of the stand. The microscope is equipped with a C-mount adapter, which is installed in the port and secured with a screw. The camera is mounted on the adapter. The camera is used to transmit the image to a computer screen or monitor/TV.

Fluorescence filter assemblies are installed inside the stand. The mercury lamphouse is mounted on the back panel of the stand.

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 revolving nosepiece with objectives. Coarse focusing is performed by rotating the coaxial knobs 7 (Fig. 1, 2) on both sides of the microscope stand.

Fine focusing is performed by rotating the knobs 8 (Fig. 1, 2) on both sides of the microscope stand. 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.

The coarse focusing tension adjusting knob 6 (Fig. 1) is the ring between the stand 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 with objectives does not lower spontaneously during operation.

The coarse focusing lock knob 6 (Fig. 2) is located on the right 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.

Fine focusing scale value: 2μm.

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 provides the visual observation of the specimen image. The microscope head is pre-installed on the stand 3 (Fig. 1). The eyepiece tube assembly is inserted into the head socket and secured with a screw. When installing the eyepiece tubes 3 (Fig. 2), turn them upwards or downwards to adjust it to the observer's height.

The interpupillary distance is adjusted by rotating the eyepiece tubes 2 (Fig. 2) in the range of 48–75mm. The distance between the eyepieces matching the observer's interpupillary distance is marked on the adjustment scale 2 (Fig. 2).

For convenience, the microscope head is inclined at 45°.

Microscope head magnification: 1x.

Eyepiece diameter: 30mm.

The eyepiece tubes do not have diopter adjustment to compensate for the observer's ametropia. The diopter adjustment is on the eyepiece.

An imaging system with a monitor is installed in the trinocular tube 1 (Fig. 2) using a C-mount 1x adapter 19 (Fig. 1). You can switch the light path to the trinocular tube using the lever 4 (Fig. 2). The lever has two positions: 100/0 and 50/50.

EYEPIECES

The microscope kit includes eyepieces 2 (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.

There is a diopter adjustment on one of the eyepieces to compensate for the observer's ametropia.

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

REVOLVING NOSEPIECE

The revolving nosepiece 14 (Fig. 1) allows for the installation of six objectives. 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 installed on the stand under the stage. The objectives are screwed clockwise into the revolving nosepiece in order of increasing magnification. The objectives are turned "away from the observer".

OBJECTIVES

Objectives 15 (Fig. 1) are designed for the infinity-corrected tube length. Parfocal distance – 45mm, linear field of view – 22mm. The objectives have long focal length and are intended to be used with glassware with a bottom thickness of 1.2mm.

Each objective has the following inscriptions: "PL L" or "PL L PHP2" 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 10x/0.25 PHP2	Phase-contrast	10x	0.25	4.3	yellow
PL L 10x/0.25	Brightfield	10x	0.25	4.3	yellow
PL L 20x/0.40 PHP2	Phase-contrast	20x	0.40	8.0	green
PL L 20x/0.40	Brightfield	20x	0.40	8.0	green
PL L 40x/0.60 PHP2	Phase-contrast	40x	0.60	3.5	light blue
PL L 40x/0.60	Brightfield	40x	0.60	3.5	light blue

The 40x 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.

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

TRANSMITTED LIGHT ILLUMINATOR

The microscope illuminator allows for setting up Köhler illumination.

The illuminator 17 (Fig. 1) is fixed on the microscope stand. The light source – 12V/30W halogen bulb – is adjusted to the optical path and collector lens using three screws 16 (Fig. 2). A collector with a field diaphragm, which is adjusted to match the magnification of the objective positioned in the optical path, is fixed in the lamp house.

The essential part of the illuminator is the condenser. The condenser mount 16 (Fig. 1) is fixed on the microscope stand. It can be moved using the knob 14 (Fig. 2). The condenser 18 (Fig. 1) is installed in the condenser mount. Screw type fastening. The condenser can be used for the brightfield and phase-contrast techniques. The rotating turret accommodates annular diaphragms used with 10x, 20x, 40x phase-contrast objectives and an open slot for the light beam to pass through. The annular diaphragms are changed by rotating the knurled part of the turret until it locks into place. The number corresponding to the magnification of the applied phase contrast objective is shown in the condenser window, the number "0" corresponds to the free slot. Below the rotating turret, there is an iris diaphragm which allows setting a specific aperture for using brightfield objectives. To achieve greater contrast, you can use the color filters supplied with the microscope. Color filters are fitted in the swing-out filter holder.

The condenser is centered in the optical path using two screws.

When using tall glassware, you can remove the condenser from the optical path. The knob 13 (Fig. 2) is used to fix the device.

STAGE

The stage 11 (Fig. 2) is fixed on the microscope stand. There is an attachment on the stage that enables movement of the specimen in two mutually perpendicular directions. The specimen is moved using the knobs 10 (Fig. 2) located on the same axis.

Stage size: 227mm×208mm. Moving range: 77mm longitudinal, 134.5mm lateral.

The stage design allows for using various laboratory glassware – flasks, well plates, dishes, cuvettes. The microscope kit includes a glass stage plate with 118mm diameter and dish holders:

— 86mm×129.5mm; Ø90mm

— 34mm×77.5mm; Ø68.5mm

— 57mm×82mm; Ø60mm

— 29mm×77.5mm; Ø35mm.

REFLECTED LIGHT ILLUMINATOR

The fluorescence filter assembly 4 (Fig. 1) is installed in the slot of the microscope stand on the left side under the revolving nosepiece 14 (Fig. 1). The microscope kit includes two assemblies. Each assembly has a free slot for the transmitted light observations and three filter sets mounted in the holder for the reflected light microscopy.

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 marking of each filter cube matches the color of the excitation light and is inscribed on the front panel. One assembly contains blue (B) and green (G) filter. The other one contains violet (V) and ultraviolet (UV) filter sets. The "0" position is for the transmitted light observations using the brightfield or phase-contrast techniques.

The excitation spectrum range: 320–555nm.

The emission spectrum range: 435–700nm.

The microscope employs broadband 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.

Specifications of the four fluorescence filters (Table 3):

Position	Excitation wavelength, (EX), nm	Dichroic mirror wavelength (DM), nm	Emission wavelength (EM), nm	Color effect
Ultraviolet (UV)	320–380	425	435	Violet
Violet (V)	380–415	455	475	Blue
Blue (B)	450–490	505	515	Yellow-green
Green (G)	495–555	585	595	Red

MERCURY LAMPHOUSE

There is a connection adapter on the back panel of the stand. It is used for mounting the mercury lamphouse 13 (Fig. 1). The lamphouse position is secured with a screw.

Inside the 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 12 (Fig. 1).

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

The cover is attached to the lamphouse with two screws. There is a mercury lamp holder on the inside of the cover. The mercury lamp is installed in the rings and secured with screws. The anode and cathode have different diameters, so the installation rings have respectively different diameters. Centering the mercury lamp in the optical path is performed by the knobs 11 (Fig. 1).

MERCURY LAMPHOUSE POWER SUPPLY

The power supply is intended to ignite and supply the mercury lamp with direct current. The general view of the power supply is given in Fig. 3.

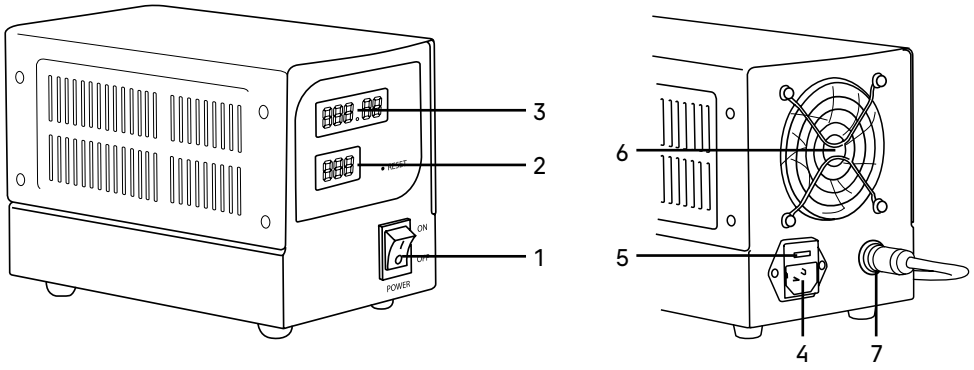


Fig. 3. Mercury lamphouse power supply

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. 3). 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. 3). The mercury lamp power supply is turned on by the switch 1 (Fig. 3). 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!

CAMERA

The digital camera equipped with the SONY CMOS Exmor/Starvis sensor delivers high light sensitivity and low noise performance. It is an autonomous camera that does not require connection to a computer or the installation of additional software.

The camera is mounted in the trinocular tube of the microscope head and the side port.

The camera is powered via a 12V/1A AC power adapter.

MONITOR

The monitor is designed to use a visualization system of the MAGUS microscope. It is connected to the camera mounted on the microscope to display the real-time images.

The monitor is installed on the table or shelf on a folding mount or attached directly to the camera or microscope stand.

The monitor is powered by AC, DC 5-12V/1A (Type-C).

3 UNPACKING AND ASSEMBLING THE MICROSCOPE

The assembly procedure is given in Fig. 4.

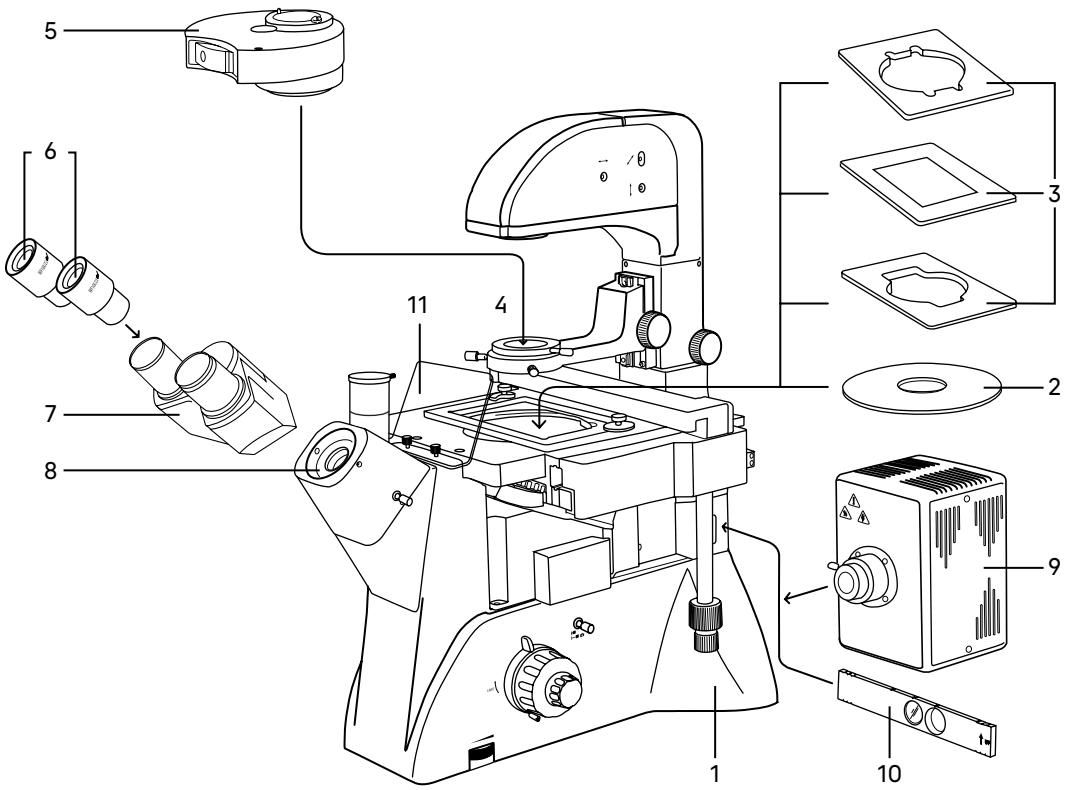


Fig. 4. Assembling the microscope

1. Unpack the microscope and check the scope of delivery using Section 8 of the User Manual.
2. Take out the stand **1** and place it on a stable work table, remove protective packaging and dust cover.
3. Take out the eyepiece tube assembly **7**, remove the dust cover. Insert the assembly into the socket **8**. Move the eyepiece tubes upwards or downwards to adjust them to the observer's height. Secure the eyepiece tube assembly with a screw using an Allen wrench from the microscope kit.
4. Remove the dust caps from the eyepiece tubes. Insert the eyepieces **6** into the eyepiece tubes. Rotate the eyepieces, making sure they are tightly seated in the tubes.
5. Insert the objectives into the sockets of the revolving nosepiece in increasing order of magnification.
6. Remove the desired dish holder **3** from the package and place it in the stage attachment for moving the specimen in X/Y directions. If you do not need to move the specimen in X/Y directions, loosen the screws and remove the attachment. Place the round glass stage plate **2** into the stage opening.
7. Unpack the condenser **5** and place it in the condenser holder **4**. Rotate the turret, as shown in Fig. 4a, and secure it with a screw.
8. Install the color filter slider **10**.
9. Install the mercury lamphouse **9** and the mercury lamp, as shown in Fig. 4b.

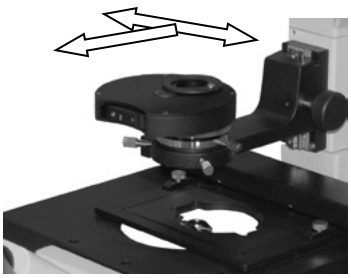


Fig. 4a. Installing the condenser

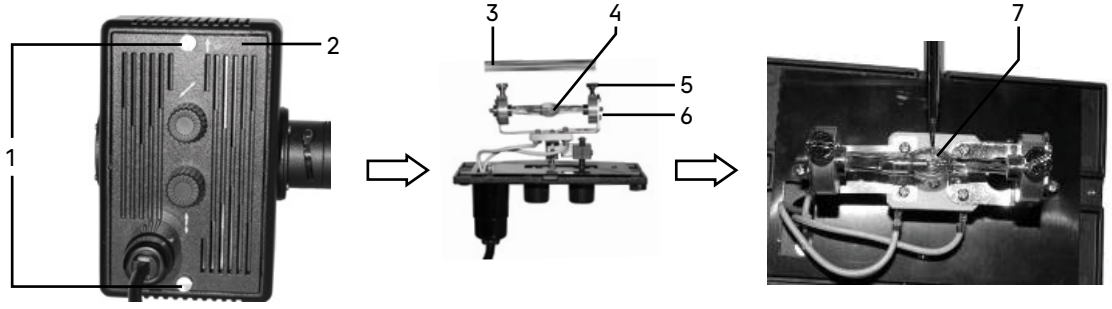
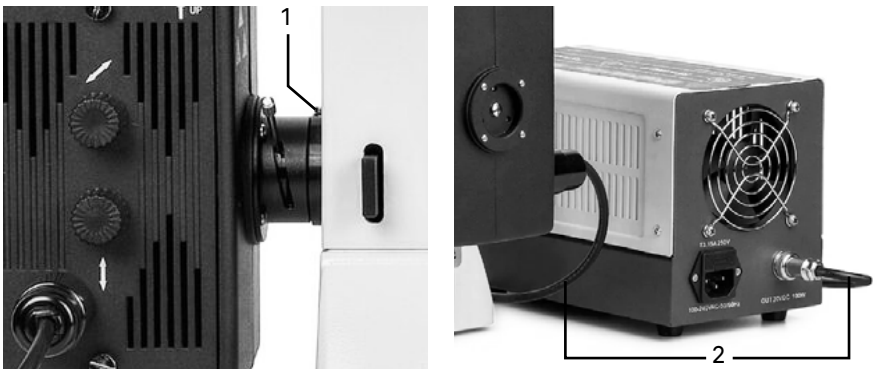


Fig. 4b. Installing the mercury lamp

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 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**.



Remove the dust cap on the back panel of the microscope stand. Loosen the screw **1** to attach the lamphouse to the stand. Attach the lamphouse as shown in Fig. 4c and fix the screw **1**. Connect the power cord **2** to the power supply.

Fig. 4c. Installing the mercury lamphouse power supply

10. Place the UV shield **11** and secure it with the screws.
11. Plug both power cords into the power connector on the stand and into the mercury lamphouse power supply. Plug both power cords into an AC outlet.
12. Make sure that all the components are securely and safely mounted.
13. Check and sort the supplied accessories and tools in the correct order. Keep them in proper order to avoid confusion.
14. 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 ON/OFF switch **1** to "–" position. Adjust the brightness using the ring **2** so that the light brightness is 70% of full power.

Fig. 5. 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.

USING THE BEAM SPLITTER LEVER

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

Set it to the 'eyepiece observation' position matching the symbol .

Symbol means that the light path is switched to the camera port.

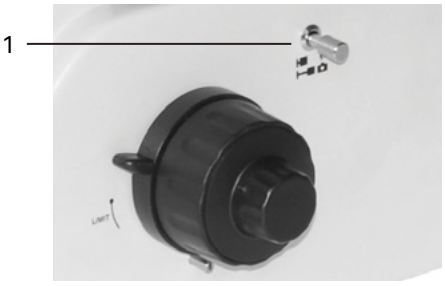


Fig. 6. Using the beam splitter lever

ADJUSTING THE HEIGHT AND POSITION OF THE CONDENSER

The condenser height is pre-calibrated at the factory before shipping. To adjust it, follow the steps below:

— Rotate the condenser focus knob **2** so that two marks **1** are aligned. This position of the condenser is the best for most observations.

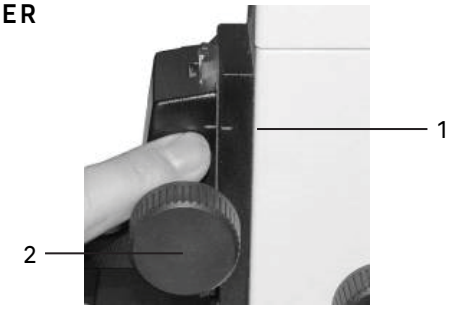


Fig. 7. Adjusting the height of the condenser

Fig. 8. Rotating turret

— Rotate the knurled part of the condenser turret **1** until it is locked in the transmitted light position "0".

ADJUSTING THE EYEPIECE TUBES

Rotate the diopter adjustment ring **1** to find the position, at which the height of both eyepieces will be the same.

Adjust the interpupillary distance. Adjust the distance between the eyepieces to your interpupillary distance by rotating the eyepiece tubes **2** around the central axis until you see a single circular image when looking through the eyepieces with both eyes (Fig. 9 a, b).

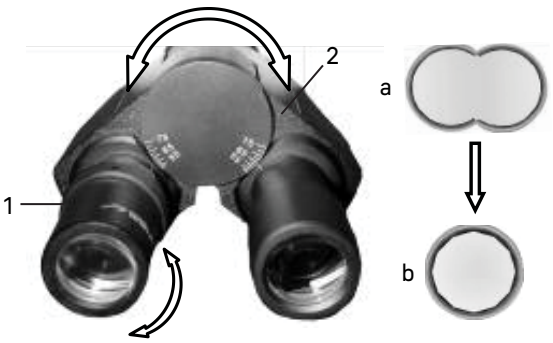


Fig. 9. Adjusting the interpupillary distance

Fig. 10. Adjusting the diopter

ADJUSTING THE DIOPTER

One of the eyepieces has a diopter adjustment **1** to compensate for the difference in vision between the user's eyes.

Place the 40x objective into the optical path. While looking through the eyepiece without diopter adjustment (with the other eye closed), bring the specimen into focus. While looking through the eyepiece with diopter adjustment (with the other eye closed) and not touching the focusing knobs, bring the specimen into sharp focus by rotating the diopter adjustment ring.

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 (approximately 40x50mm) **1** on the condenser as shown in Figure 11a. While doing so, move the filter holder **2** aside.
2. Open the field diaphragm. A brightly illuminated spot will appear on the paper showing the filament as shown in Figure 11b.
3. If the filament image is blurry, adjust the position of the collector using the adjusting knob **3**.

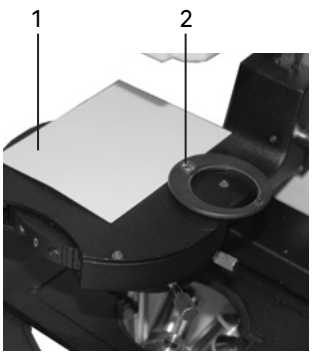


Fig. 11a. Centering the light source

4. If the filament image is offset from the center of the light spot, manipulate the lateral alignment knob **4** and the vertical alignment knob **5** to center the light source.

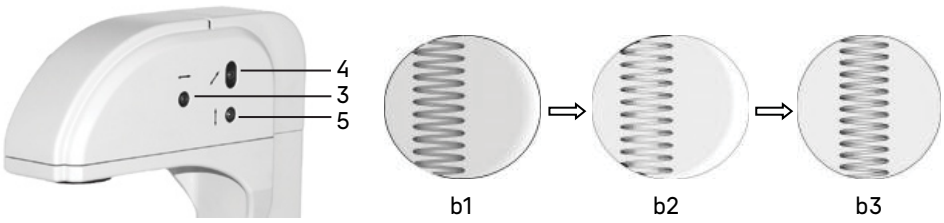


Fig. 11b. Adjusting the image

PLACING THE SPECIMEN

Choose the appropriate dish holder from the kit based on its shape and size (Fig. 12).

Install the dish holder on the stage. Fix the slide **1** or the dish with the studied sample in it.

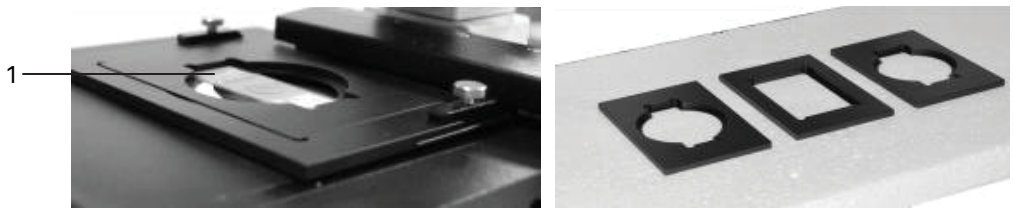


Fig. 12. Choosing and installing the dish holder

Adjust the image by moving the XY control knobs **1** and **2** so that the observed section of the specimen is directly above the objective.

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

The knob **1** controls Y-axis movement, the knob **2** controls X-axis movement. The specimen holder moving range: Y-axis movement – 77mm, X-axis movement – 134.5mm.

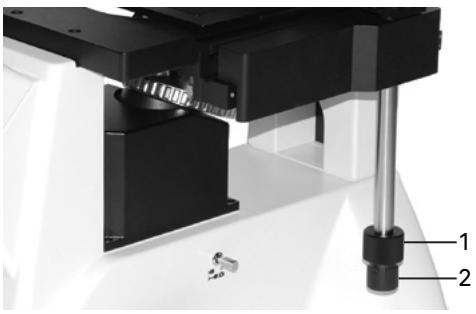


Fig. 13. Moving the specimen holder

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 revolving nosepiece **1** to place the 10x objective in the optical path, as shown in Fig. 14. The revolving nosepiece is rotated until locked.

Rotate the coarse focusing knob **3** to raise the objective as far as it will go. Looking into the eyepiece and slowly rotating the focusing knob, lower the objective.

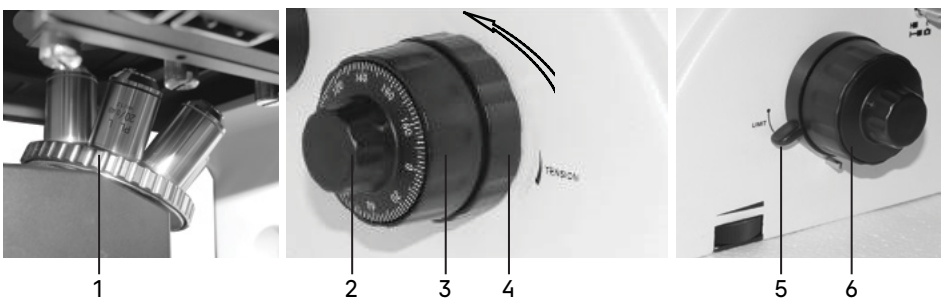


Fig. 14. Focusing on the specimen

When you see the specimen image in the field of view, stop rotating the coarse focusing knob.

Rotate the fine focusing knob **2** to focus on the specimen and get a crisp image.

Fix the coarse focusing lock knob **5** as shown by the arrow in Figure 14.

When using high magnification objectives, raise the objective all the way up by rotating the coarse focusing knob and enable the coarse focusing lock knob. After that, focus on the specimen using the fine focusing knob.

Adjust the coarse focusing tension.

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

Too high a tension can affect the microscope performance and cause inconvenience in the operation.

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:

— Place the 10x objective into the optical path.

— Open the aperture diaphragm **2** and close the field diaphragm **1**. A light spot will be visible in the field of view showing the edges of the diaphragms, as shown in Fig. 15.

— If the light spot is blurry, adjust the height of the condenser using the knob **4**.

— If the light spot is offset from the center of the field of view, as shown in Fig. 15a a, adjust the position of the aperture diaphragm using the centering screws **3** so that the center of the aperture diaphragm aligns with the center of the field of view, as shown in Fig. 15b.

— Open the field diaphragm until its image fills the field of view, as shown in Fig. 15c.

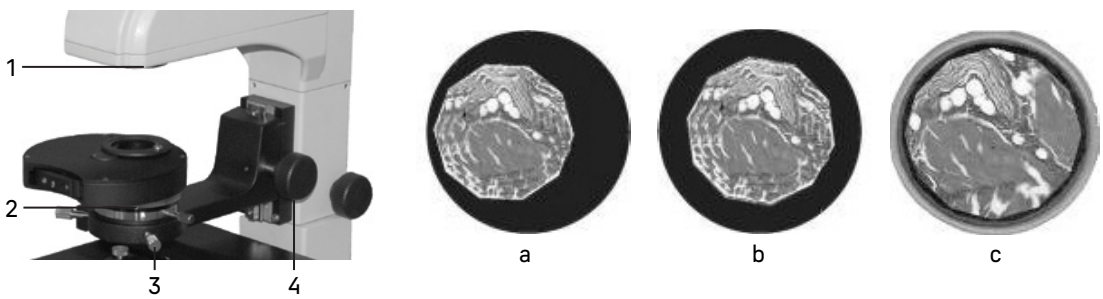


Fig. 15. Setting up Köhler illumination

OBSERVING SPECIMENS IN TALL GLASSWARE

The microscope is equipped with a stage attachment **1** that enables movement of the specimen in longitudinal (Y) and lateral (X) directions. The object is moved by Y-axis **2** and X-axis **3** coaxial knobs, as shown in Fig. 16.

The attachment has a rack and pinion gear. Once the limit is reached, do not rotate the knobs **2** and **3** as this may cause the gear to break.

When observing specimens in tall glassware, remove the condenser **4** from the optical path. To do this, loosen the screw on the right side of the stand and turn the stand with the condenser counter-clockwise, as shown in Fig. 17.

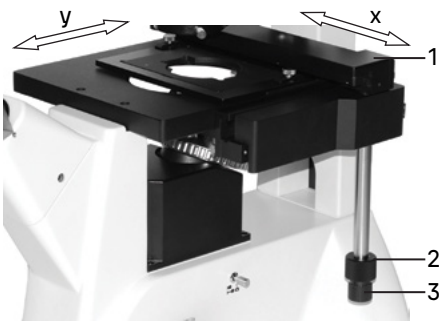


Fig. 16. Moving the specimen

Remove the mechanical XY attachment from the stage. To do this, use the screwdriver to loosen **3** attachment screws **5** below the stage and remove the attachment. Put the attachment aside – lay it flat on a surface with the handle facing up so that it will not fall or be damaged.

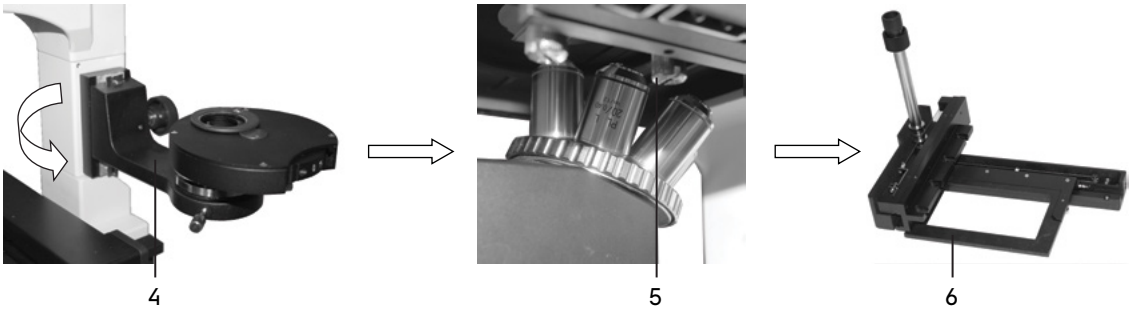


Fig. 17. Preparing specimens for observations in tall glassware

ADJUSTING THE TENSION OF THE OBJECT MOVING KNOBS

The manufacturer adjusts the tension of the object moving knob. You can adjust the tension as needed:

1. Remove the mechanical XY stage attachment (see explanations of Fig. 17).
2. Adjusting the Y-axis knob (Fig. 18a): remove the Phillips screw **4**, remove the cover **3**, loosen the Phillips screw **1** slightly, and adjust the screw **2** with an Allen wrench.
3. Adjusting the X-axis knob (Fig. 18b): loosen the Phillips screw **5** slightly, adjust the screw **6** with an Allen wrench.

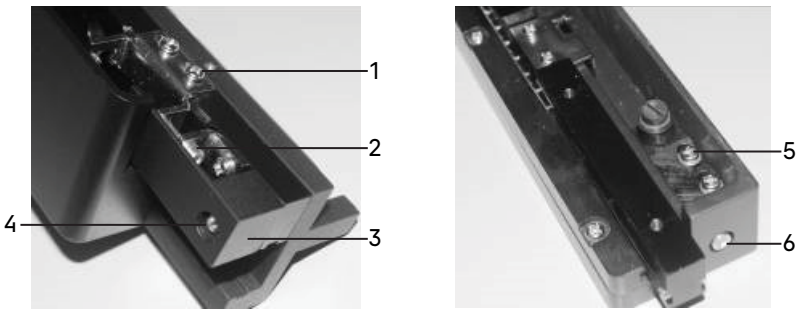


Fig. 18. Adjusting the tension of the object moving knobs

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/0.60, 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/0.60, 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.

USING THE CAMERA

The digital camera is equipped with an 8MP sensor and it produces a realistic image in 4K resolution (3840x2160 pixels) when connected via HDMI or USB 3.0. When connected via Wi-Fi, the image resolution is Full HD (1920x1080 pixels).

The microscope is designed to observe a specimen through the eyepieces and to photograph the specimen. The microscope has two ports: on the microscope head and on the stand. The monitor is conveniently mounted in the trinocular tube of the microscope head, and the digital camera – in the side camera port. The beam splitting ratio in the trinocular tube is 100/0 or 50/50, in the side port – 100/0 or 0/100.

Beam splitting in the camera port is performed by the lever **3** located on the right side. The camera port is located on the left side of the stand and covered with a dust cap **2**.

When choosing a camera for capturing objects in the fluorescence light, light sensitivity is particularly important: the larger the pixel size and sensor size, the crisper and more realistic the image appears.

To enable the camera:

— Loosen the attachment screw **1** of the side camera port. Remove the dust cap **2**.

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

— Fit the camera into the side camera port and secure it with the screw **1**.

— Place the 10x objective into the optical path. Set the beam splitter lever **3** to position . Looking through the eyepieces, bring the specimen into sharp focus.

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

— Set the lever **3** to position . If the image on the screen is blurry, adjust the focus using the fine focusing knob.

Fig. 19. Using the side camera port

Using the trinocular tube, you can view the image both in the eyepieces and on the screen. Otherwise, it functions in a similar way:

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

— Connect the camera **4** to the C-mount adapter.

— Fit the camera into the trinocular tube 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 the beam splitter lever **3**. If the image on the screen is blurry, adjust the focus using the fine focusing knob.

When choosing the camera port, keep in mind that you will view upright images in the main (trinocular) port.

The image in the side port is inverted, mirrored from one of the surfaces. The image on the screen can be corrected using the "Flip" function.

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. Do it as follows:

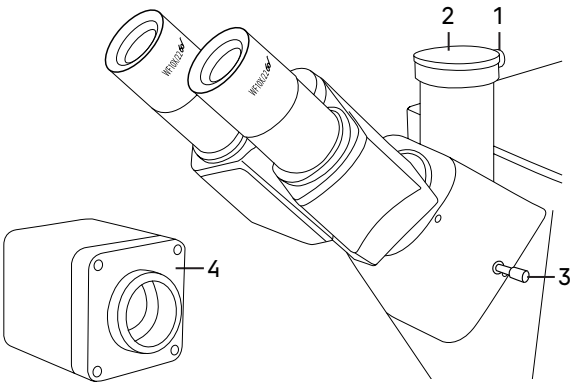


Fig. 20. Using the trinocular tube

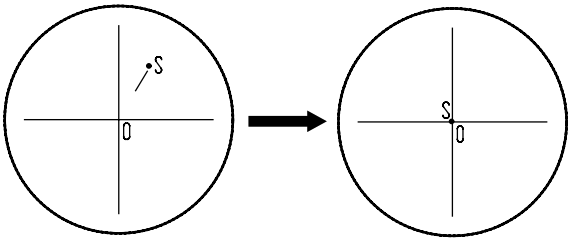


Fig. 21. Adjusting the camera image

— Set the beam splitter lever **3** to the eyepiece/camera 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. 21a), move the specimen on the stage so that the point is in the center of the field of view, as shown in Fig. 21b. 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, then secure the screw.

USING THE MONITOR

The IPS matrix delivers a bright image with large viewing angles, which allows you to look at the display even at an angle with no color distortion.

To display the image on the screen:

— Attach the monitor **4** to the camera **1** using the fasteners from the kit.

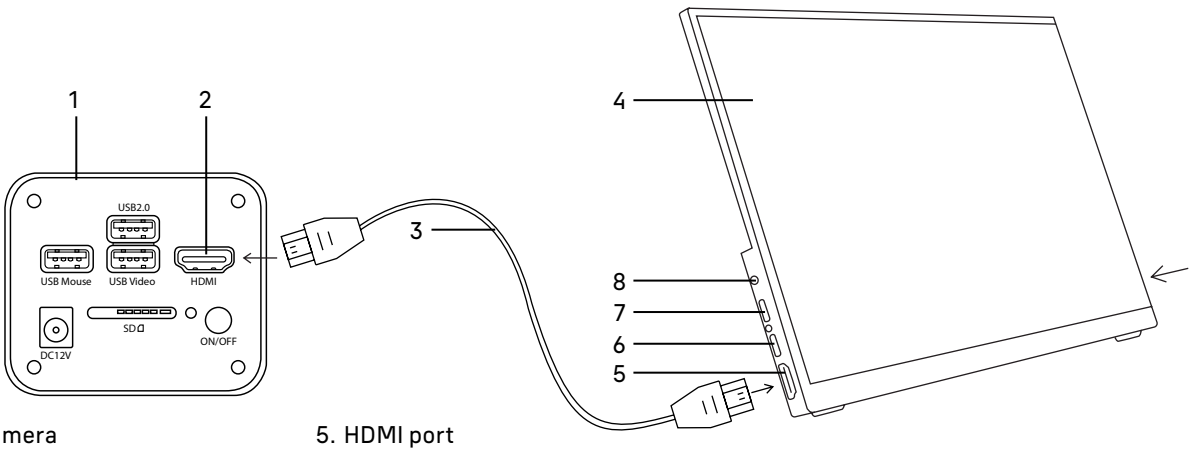
— Connect the monitor to the camera using the HDMI cable **3**.

— Connect the monitor and camera to AC power using the DC/DC Type-C adapter and power adapter (supplied). If the camera and monitor are remote from each other, each device is powered separately using the power adapter supplied with both the camera and monitor.

— Switch on and adjust the camera as per the user manual and the above steps in the previous section.

— Switch on the monitor by pressing the lower button on the side panel as indicated by the arrow (not shown in Figure 22).

If the image on the screen is blurred, rotate the fine focusing knob to get an accurate image.



1. Camera
2. HDMI port
3. HDMI cable
4. Monitor
5. HDMI port
6. USB Type-C power connector
7. USB Type-C power connector
8. Audio output

Fig. 22. Using the monitor

5 PHASE-CONTRAST TECHNIQUE

The condenser allows utilizing the phase-contrast technique. Brightfield observations are performed as described above in the user manual. The following instructions apply only to the phase-contrast operation mode.

Adjusting the phase-contrast device:

1. Take the 10x phase-contrast objective from the microscope kit and place it into the optical path. Swing the corresponding condenser phase annulus into the optical path by rotating the turret **1** so that number "10" is shown in the window (Fig. 23a). Adjust the height of the condenser, as shown in Fig. 7.

When using other phase-contrast objectives, place the corresponding phase-contrast annulus into the optical path.

2. Mount the specimen on the stage, focus the microscope.
3. Remove the eyepiece from the tube and insert the centering telescope **2** instead. You will see a dark ring **5** and a light ring **6** in the field of view.
4. If the images of the ring edges are blurred, adjust the position of the movable part on the centering telescope **3**, focus on the rings.
5. In the phase-contrast technique, rings **5** and **6** must coincide. If they do not coincide, center the diaphragm ring by means of the screws **4**, which are adjusted by an Allen wrench **7**. The image shall be as shown in Fig. 23e.
6. Replace the centering telescope with a regular eyepiece.

When changing to a different objective, the corresponding phase annulus of the condenser should be centered.

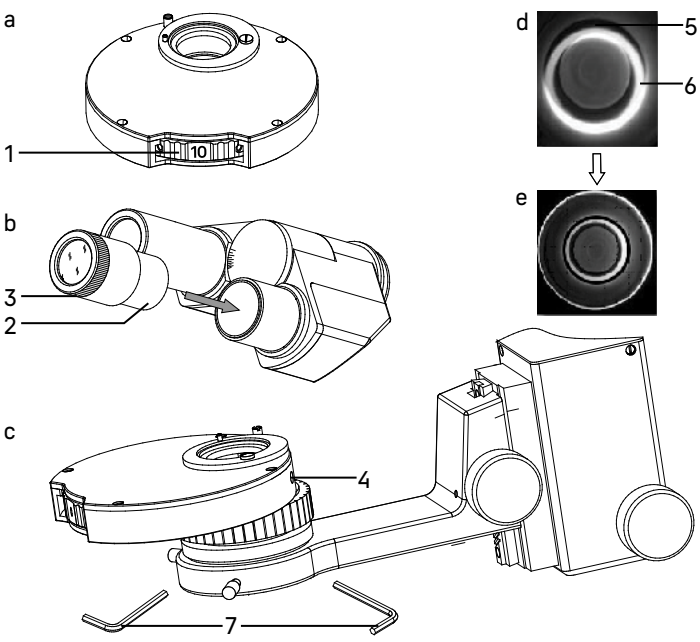


Fig. 23. Adjusting the phase-contrast device

6 FLUORESCENCE OBSERVATIONS

Transmitted light observations are performed as described above in the user manual. The following instructions apply only to the reflected light observations using the fluorescence technique.

Select the appropriate fluorescence filters to match the dyes applied.

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. While focusing on the specimen, a neutral density filter should be placed into the optical path.

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.

The microscope kit includes two fluorescence filter assemblies **1** and **2**. One assembly contains blue (B) and green (G) filter sets. The other one contains violet (V) and ultraviolet (UV) filter sets. Select the assembly with the appropriate type of filter set and install it in the slot on the left panel of the microscope stand below the revolving nosepiece.

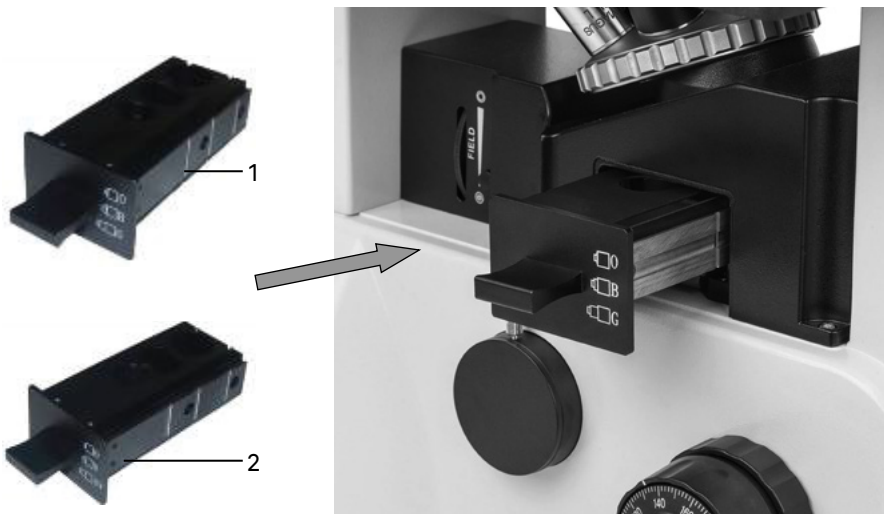


Fig. 24. Installing the fluorescence filter assembly

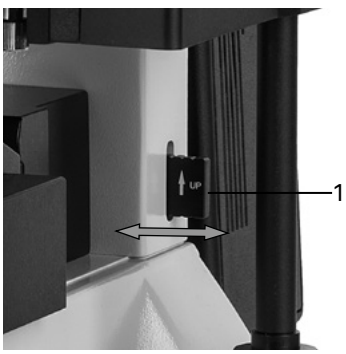


Fig. 25. Using the color filter

Move the assembly to the correct position. The assembly has three positions: two of them for the fluorescence observations, and one – for the transmitted light observations. The assembly should be fixed in the center of the light beam. Incorrect position will affect the observations.

Switch off the transmitted light illuminator by turning the switch **5** to position "0" (off). The transmitted light illuminator, if switched on, will adversely affect the results of fluorescence observations.

The microscope kit includes a color filter slider **1**. The slider has three fixed positions: shutter, neutral density filter, free slot. The shutter position is used when you need to switch to the transmitted light observations for a short period. Use the shutter position to keep the mercury lamp on. When focusing on the specimen, use the neutral density position to prevent the fluorescence from quenching. The free slot is used during fluorescence observations.

Switch on the mercury lamphouse power supply. Wait 5–10 minutes for the mercury lamp to be in a steady-state operation mode.

Adjust the field diaphragm **1** so that the entire field of view is illuminated. If a smaller field of view is required when using the camera, close the aperture to 60-70% of the field.

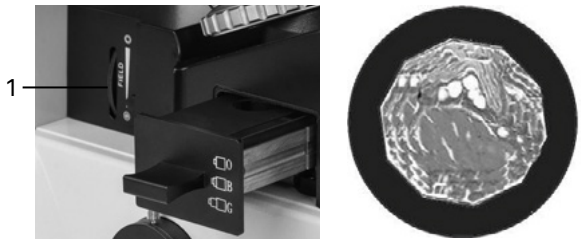


Fig. 26. Adjusting the field diaphragm

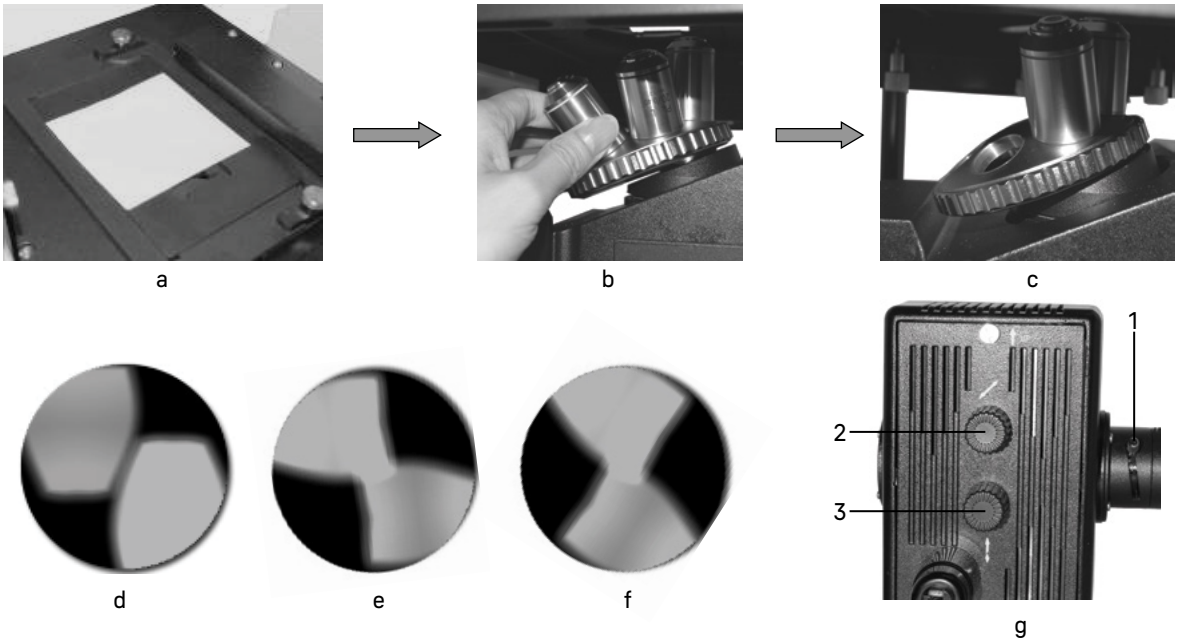


Fig. 27. Centering the mercury lamp

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 a crosshair on the stage. Make sure that the mercury lamp is on, the fluorescence 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 **1** to achieve the sharpest focus of the light spot (discharge arc) and mercury lamp electrodes on the paper surface.

Use the knobs **2** and **3** to center the mercury lamp – bring the image of the light spot to the center of the crosshair on the paper. The knob **2** controls the horizontal movement; the knob **3** controls the vertical movement.

Re-install the removed objective into the revolving nosepiece. The microscope is prepared for the fluorescence observations.

7 USING OPTIONAL EQUIPMENT

USING THE EYEPIECE WITH A SCALE

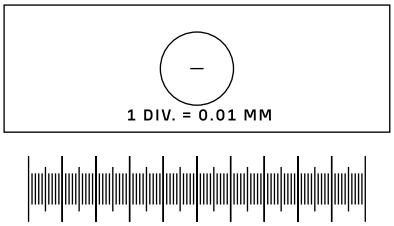


Fig. 28. Calibration slide

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
10	
20	
40	

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 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.

8 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 condenser is incorrectly positioned – lowered too far or raised	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
	The objective is damaged	Have the objective repaired by a qualified technician or replaced
Poor image quality (low resolution, poor contrast)	Inappropriate dish bottom thickness	Use the glassware with a standard bottom thickness (1.2mm)
	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
The phase contrast is not visible	The wrong phase annulus was selected	Choose the proper phase annulus to match the selected phase-contrast objective
	The phase ring is not centered	Center the phase ring
	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
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
The specimen image cannot be brought to sharp focus	The surface of the dish bottom is not clean enough	Clean the dish bottom
	The dish bottom thickness is considerably greater than 1.2mm	Replace the glassware

9 SCOPE OF DELIVERY

The scope of delivery (Table 5.)

Component	Pcs	Note
MICROSCOPE		
MAIN COMPONENTS		
Stand with a built-in power supply, transmitted light source, focusing mechanism, condenser mount, and trinocular tube	1	
Fluorescence filter assembly	2	
Mercury lamphouse	1	
Trinocular microscope head	1	
Revolving nosepiece	1	Mounted on the stand
Fixed stage	1	Mounted on the stand
Mechanical XY stage attachment	1	On the stage
Phase-contrast turret condenser with an open slot and phase annuli for phase-contrast objectives	1	
Color filter slider	1	
REPLACEABLE PARTS		
Infinity plan achromatic objective: PL 4x/0.10 WD 21.0mm	1	Optional
Infinity plan achromatic objective: PL L PHP2 10x/0.25 phase-contrast WD 4.3mm	1	
Infinity plan achromatic objective: PL L 10x/0.25 WD 4.3mm	1	
Infinity plan achromatic objective: PL L PHP2 20x/0.40 phase-contrast WD 8.0mm	1	
Infinity plan achromatic objective: PL L 20x/0.40 WD 8.0mm	1	
Infinity plan achromatic objective: PL L PHP2 40x/0.60 phase-contrast WD 3.5mm	1	
Infinity plan achromatic objective: PL L 40x/0.60 WD 3.5mm	1	

10x/22mm eyepiece with eye relief	2	
10x/22mm eyepiece with a scale	1	Optional
15x/15mm eyepiece	2	Optional
20x/12mm eyepiece	2	Optional
25x/9mm eyepiece	2	Optional
Centering telescope	1	
Round glass stage plate	1	
Set of dish holders	1	
UV shield	1	
C-mount camera adapter	1	
Mercury lamphouse power supply	1	
Calibration slide	1	Optional
ACCESSORIES AND SPARE PARTS		
Head locking screw	1	Installed in the stand socket
Set of Allen wrenches (screwdrivers)	1	
Dust cap	4	Supplied
12V/30W halogen bulb	1	In the transmitted light illuminator
100W mercury lamp	1	
Color filter	3	Optional
15A/250V Fuse	2	Installed in the illumination system
3A/250V Fuse	2	Installed in the illumination system
AC Power cord	2	
Dust cover	1	
User manual	1	
DIGITAL CAMERA		
Digital camera	1	
HDMI cable (1.5m)	1	
USB 3.0 cable (1.5 m)	1	
USB mouse	1	
32GB SD memory card	1	
Wi-Fi USB-adapter	2	
EU-plug 12V/1A AC power adapter	1	
Flash drive with drivers and software	1	
Fasteners (mounting plate and screws)	1	
User manual	1	
MONITOR		
Monitor	1	
HDMI cable	1	
AC power adapter	1	
DC/DC Type-C adapter	1	
Fasteners (Allen wrench and screws)	1	

10 CARE AND MAINTENANCE

REPLACING THE BULB AND THE FUSE

Before replacing the bulb or fuse, turn the ON/OFF switch to "0" position (off). Unplug the power cord from the power outlet. Wait about 10 minutes for the bulb to cool down.

1. **Replacing the bulb**

— Unplug the power cord **2** from the connector. Loosen the screw **3**, remove the lamphouse cover in the direction indicated by the arrow in Fig. 29c. Remove the faulty bulb and replace it with a new one. Attach the cover, secure with the screw.

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

— Plug the power cord, turn on the ON/OFF switch.

— Center the bulb as described earlier in this user manual.

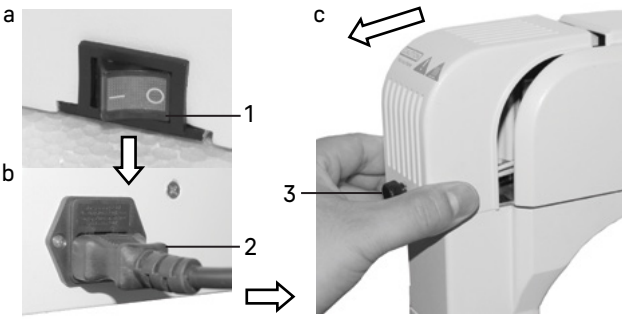


Fig. 29. Replacing the bulb

2. **Replacing the fuse**

The fuse of the microscope's lamp house is part of the electrical circuitry used to power the halogen bulb. The fuse is built into the inlet power connector **3**. It is replaced as follows:

— Using a flathead screwdriver **1**, remove the fuse holder **2**. Replace the blown fuse with a new one. Install the fuse holder back into the inlet power connector.

— Plug the power cord and turn on the ON/OFF switch to check the fuse for proper operation.

The fuse of the mercury lamp power supply is also located in the power connector and is replaced in the same manner.

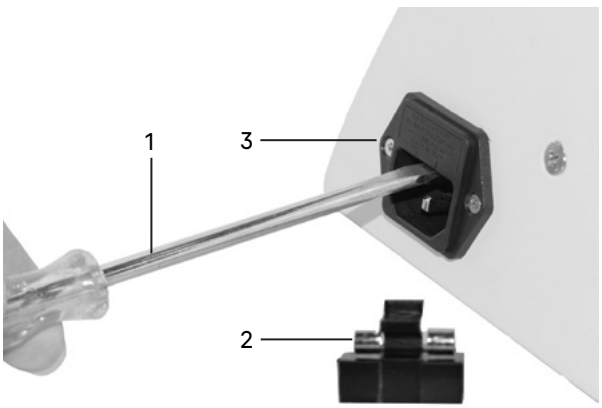


Fig. 30. Replacing the fuse

3. **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.

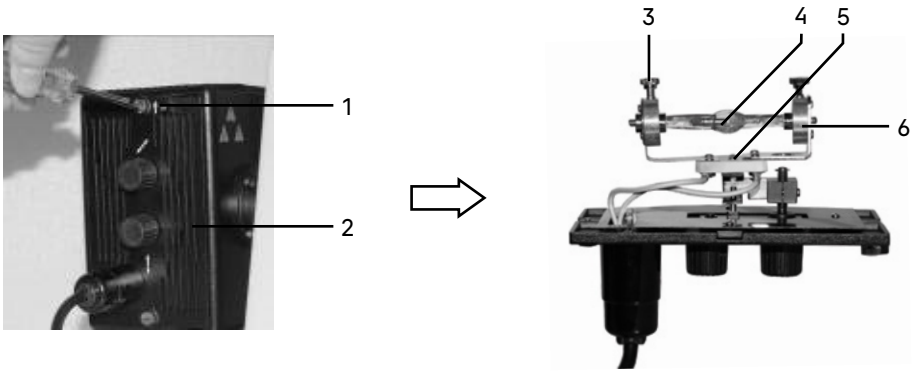


Fig. 31. Replacing the mercury lamp

— 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.

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.

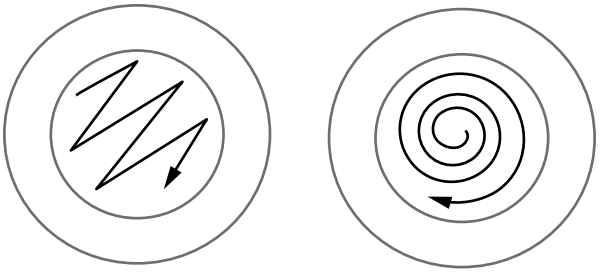


Fig. 32. Cleaning lenses

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. Monitor cleaning: brush the dust and small particles with a soft brush. If there are liquid drops on the screen, remove them with a dry cloth or soft tissue. Use special alcohol wipes to remove heavy soiling.

   Always switch off the monitor before cleaning. Do not use aggressive agents to clean difficult stains, as this may cause damage to the device.
7. 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.
8. Periodic inspection: the microscope should be regularly inspected and serviced to maintain its performance.

11 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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