MAGUS BIO 260T | DH260
BIOLOGICAL MICROSCOPE

MAGUS

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, adapter, or power cord may damage the microscope or cause a fire. The power cord must be grounded reliably.
5. Do not apply excessive force to the power cord: do not bend or twist it.
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. 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.
8. 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.
9. 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.
10. 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.

11. 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.
12. Do not touch the lens surfaces with your fingers. Use a brush and special lens-cleaning solution to keep the lenses clean.
13. Bulb installation. This microscope employs LED bulbs as a light source. The bulbs should be replaced by the equipment vendor or in a qualified service center. If you replace the LED yourself, the illumination function may be impaired.

CONTENTS

MAGUS Bio 260 Biological 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 for observing objects 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 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.

SPECIFICATIONS (TABLE 1)

Microscope

	MAGUS Bio 260T	**MAGUS Bio DH260**
Magnification, x	40–1000 (**40–1250/1500/2000)	
Tube length	Infinity (∞)	
Microscope head	Trinocular Fixed splitting ratio: 50 (eyepieces) / 50 (trinocular tube)	Binocular, with built-in camera
	Eyepiece diameter: 30mm Gemel head (Siedentopf, with adjustable eyepiece height) Inclination 30° Interpupillary distance: 47–78mm Microscope head magnification: 1x	
Eyepieces, magnification, x/field, mm	10x/20 with diopter adjustment ±5dp, eye relief *10x/22 with a scale, *10x/22 with a grid, *10x/22 with a reticle, *12.5x/16 *15x/16, *20x/12	
Revolving nosepiece	5 objectives, coded	
Optical design	Infinity plan achromatic objectives (∞), parfocal distance: 60mm	
Objectives, magnification, x/aperture	4x/0.10, 10x/0.25, 40x/0.65, 100x/1.25 (oil) *2x/0.06; *20x/0.40; *60x/80; *50x/0.95 oil; *100x/1.10; *plan apochromatic 60x/1.42 oil	
Stage	Rackless XY mechanical stage Stage size: 230mm×150mm Moving range: 78mm×54mm	
Condenser	Abbe condenser (NA 1.25). Centerable. With adjustable iris diaphragm. Height-adjustable. With a cap for darkfield and phase-contrast sliders. Dovetail mount	
Field diaphragm	Adjustable iris	
Focusing mechanism	Coaxial coarse & fine focusing knobs on both sides Moving range: 30mm Coarse focusing travel: 37.7mm/circle Fine focusing travel: 0.2mm/circle Fine focusing scale value: 2µm Coarse focusing tension adjusting knob	

Camera	–	+
C-mount camera adapter	0.5x	–
Transmitted light source	3W LED	
Intelligent lighting control system	Automatic brightness adjustment during objective change, status display on LCD screen, standby mode, eco mode	
LCD screen	+	+
Wi-Fi	–	+
Phase-contrast device 1*	10–40x phase-contrast slider 100x phase-contrast slider Centering telescope Phase-contrast objective (10x, 20x, 40x, 100x)	
Phase-contrast device 2*	Phase-contrast turret condenser Centering telescope Set of phase-contrast objectives (10x, 20x, 40x, 100x)	
Darkfield technique*	Oil darkfield condenser NA 1.3–1.26 Dry darkfield condenser NA 0.7–0.9 Darkfield slider	
Fluorescence technique*	Reflected light illuminator	
Polarizer/analyzer set*, installation method	Polarizer – on the collector Analyzer – in the slot above the revolving nosepiece	
AC power supply Voltage Frequency	100V–240V 50/60 Hz Fuse: T500mA/L250V	
Microscope dimensions, max, mm	395x230x430	395x230x405
Package dimensions, max, mm	470x320x670	470x320x670
Net weight, kg	11.5	11.1
Weight with package, max, kg	12.2	12.1
Operating temperature range	0... +70°C	
Operating humidity range	0...80% (at the temperature below 31 °C)	

Camera (MAGUS Bio DH260)

Color/monochrome	color
Number of megapixels	8
Maximum resolution, pix	3840x2160
Sensor size	1/1.8"
Pixel size, µm	2x2
Auto focus	–
Interface	Wi-Fi
Video recording	+
Frame rate, fps at resolution, pix	30
Mounting place	built-in
Power supply	from the microscope power cord

*** 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 the transmitted light source, focusing mechanism, stage, condenser, and revolving nosepiece

— microscope head

— set of objectives and eyepieces

— set of spare parts and accessories

— packaging

— user manual.

See Section 7 of the User manual for a full kit contents.
The general view of the microscope is given in Fig. 1, 2 and 3.

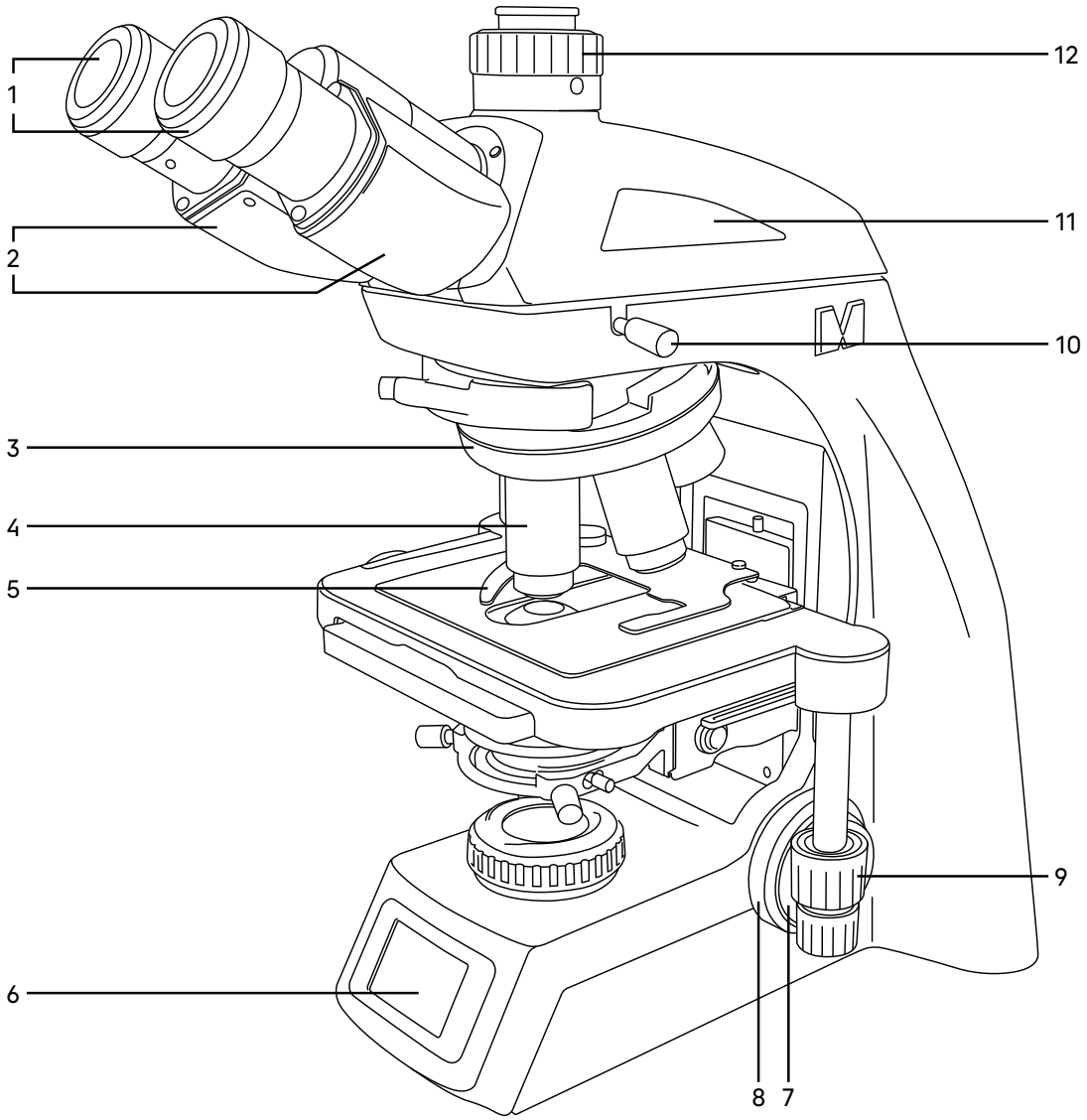


Fig. 1. MAGUS Bio 260 Biological Microscope. View from the right

1. Eyepieces
2. Eyepiece tubes
3. Revolving nosepiece
4. Objectives
5. Specimen holder
6. LCD-screen
7. Fine focusing knob
8. Coarse focusing knob
9. XY stage control knob
10. Head locking screw
11. Microscope head
12. Trinocular tube (MAGUS Bio 260T)

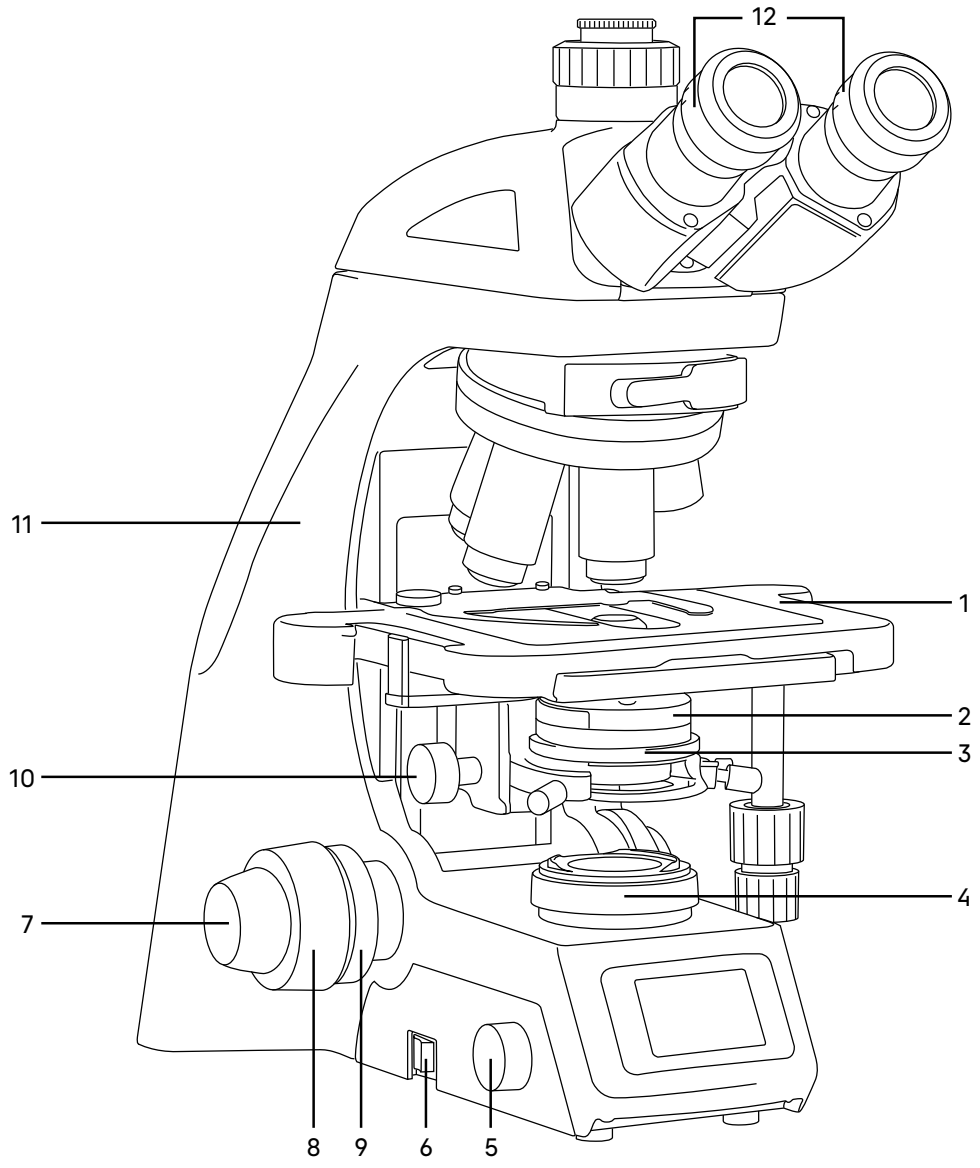


Fig. 2. MAGUS Bio 260 Biological Microscope. View from the left

1. Stage
2. Aperture diaphragm ring
3. Abbe condenser
4. Collector
5. Lighting control knob
6. ON/OFF switch
7. Fine focusing knob
8. Coarse focusing knob
9. Coarse focusing tension adjusting knob
10. Condenser focus knob
11. Stand
12. Diopter adjustment ring

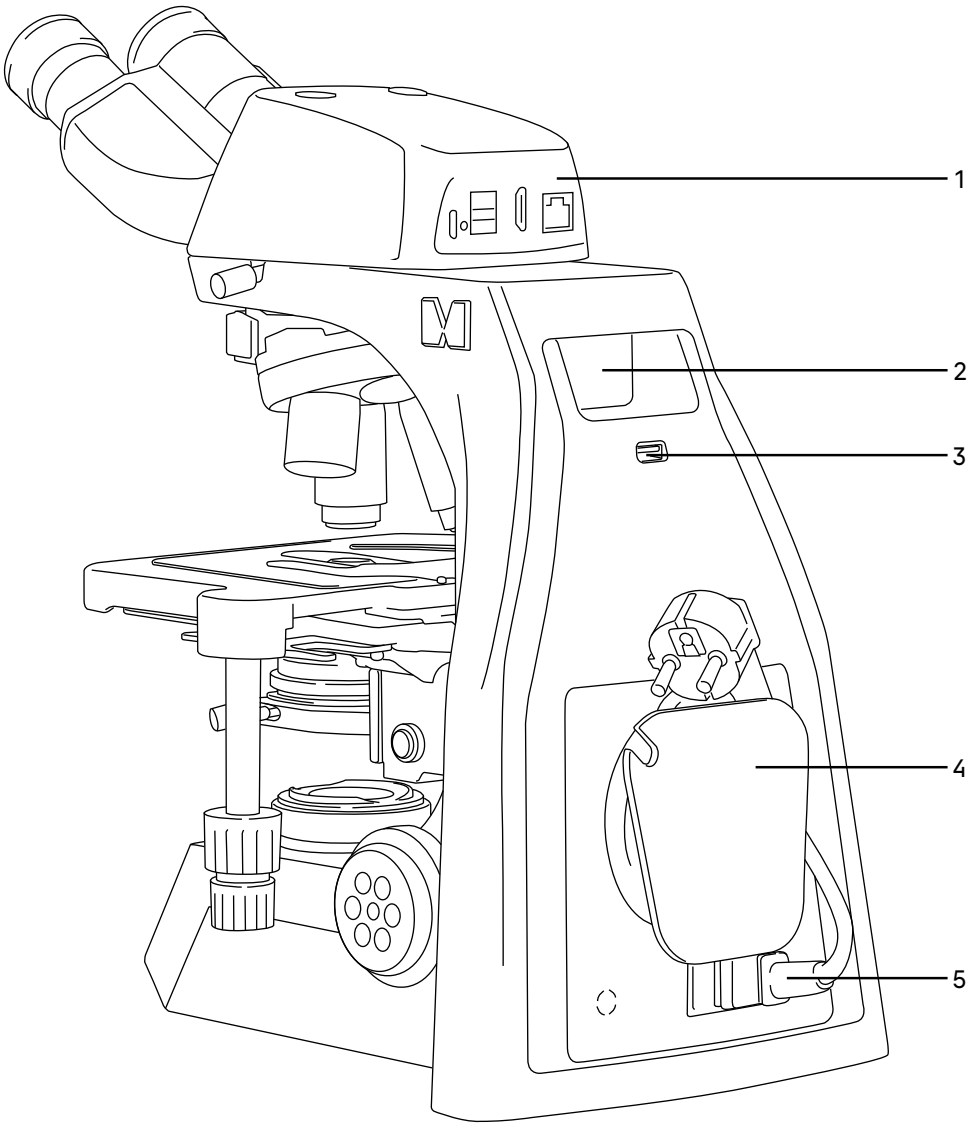


Fig. 3. MAGUS Bio 260 Biological Microscope. Rear view

1. Microscope head with built-in camera (MAGUS Bio DH260)
2. Carrying handle
3. USB-port
4. Power cord holder
5. Power connector

2 COMPONENTS

STAND

The stand 11 (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 3 (Fig. 1) with objectives 4 (Fig. 1)

— stage 1 (Fig. 2)

— condenser 3 (Fig. 2)

— collector 4 (Fig. 2)

Inside the stand is the focusing mechanism.

There is a holder at the back of the stand for winding the power cord. The microscope converts AC voltage to the voltage suitable for LEDs. The connector 5 (Fig. 3) is used to connect the power supply.

There is an ON/OFF switch on the left side of the stand base.

The knob 5 (Fig. 2) is used to adjust the illumination brightness.

FOCUSING MECHANISM

The focusing mechanism is located inside the microscope stand. The mechanism has coaxial design: Coarse and fine focusing knobs are mounted on the same axis.

Focusing on the specimen is achieved by adjusting the height of the stage 1 (Fig. 2). Coarse focusing is performed by rotating the knobs 8 (Fig. 1, 2) on both sides of the microscope stand.

Fine focusing is performed by rotating the knobs 7 (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 adjusting knob 9 (Fig. 2) 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 stage does not lower spontaneously during operation.

The coarse and fine focusing range is at least 30mm. Coarse focusing travel: 37.7mm/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 rotate the coarse/fine focusing knobs in opposite directions.

MICROSCOPE HEAD

There are two types of microscope heads: trinocular (binocular with a trinocular tube) and binocular with a built-in camera.

The head provides the visual observation of the specimen image. The microscope head is installed in the mounting hole on the top of the microscope stand 11 (Fig. 2) and secured with a clamping screw 10 (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 47–78mm. 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 both eyepiece tubes – ring 12 (Fig. 2).

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 40mm.

The trinocular microscope head: A C-mount adapter is installed in the vertical port 12 (Fig. 1) to fix the camera. The camera is used to transmit the image to a computer screen or monitor/TV. The beam splitting ratio (eyepieces/ trinocular tube) is 50/50.

The binocular microscope head with a built-in camera makes it more convenient to work with digital devices.

EYEPIECES

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

Eyepiece diameter: 30mm.

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

Eyepieces with a different magnification and a 10x eyepiece with 0.1mm scale are not included and are optional.

REVOLVING NOSEPIECE

The revolving nosepiece 3 (Fig. 1) allows for the installation of five objectives 4 (Fig. 1). Objectives are changed by rotating the knurled ring of the revolving nosepiece until the objective fits into place.

Do not rotate the revolving nosepiece by holding the objectives.

The revolving nosepiece rotates clockwise and counter-clockwise.

The revolving nosepiece is mounted 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".

The revolving nosepiece is coded. The microscope's intelligent system automatically remembers the brightness selected by the user for each objective. When objectives are changed, it automatically sets the illumination level. The intelligent system saves time and improves the user's comfort when the work requires frequent change of objectives.

OBJECTIVES

Objectives 4 (Fig.1) are designed for the infinity-corrected tube length. Parfocal distance – 60mm, 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, 100x plan achromatic objectives. Objectives of other magnification, correction type and immersion system are available as an option.

Each objective has the following inscriptions: "Plan" 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 "W" inscription on the 100x objective means that the objective is designed to work with the water immersion.

The specifications of the objectives (Table 2):

Objective identification	System	Magnification	Numerical aperture	Working distance, mm	Coverslip, mm	Color marking
Plan 2x/0,06 ∞ /–	dry	2x	0.06	8.7	–	red
Plan 4x/0,10 ∞ /–	dry	4x	0.10	30	–	red
Plan 10x/0,25 ∞/–	dry	10x	0.25	10.2	–	yellow
Plan 20x/0,40 ∞/0,17	dry	20x	0.4	4.8	0.17	green
Plan 40x/0,65 ∞/0,17	dry	40x	0.65	1.5	0.17	light blue
Plan 50x/0,95 oil ∞/0,17	oil immersion	50x	0.95	0.074	0.17	light blue
Plan 60x/0,80 ∞/0,17	dry	60x	0.80	0.3	0.17	blue

Plan APO 60x/1,42 oil ∞ /0,17	oil immersion	60x	1.42	0.25	0.17	blue
Plan 100x/1,25 oil ∞/0,17	oil immersion	100x	1.25	0.2	0.17	white
Plan 100x/1,10W ∞/0,17	water immersion	100x	1.10	0.16	0.17	white

The 50x, 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 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 condenser 3 (Fig. 2) is installed under the microscope stage. The condenser is mounted using the guides with the specimen stage raised and the mount lowered. The condenser is secured in the mount with the screw on the right. The condenser mount has a spring-loaded holder, which allows for centering the condenser in the optical path using two screws.

You can move the condenser along the optical path of the microscope using the condenser focus knob 10 (Fig. 2) located on the left of the observer under the stage. The condenser focusing range is at least 26mm.

The iris aperture diaphragm is adjusted (opened/closed) by the ring 2 (Fig. 2). The condenser has marking of the objective magnification. For best image quality, the aperture diaphragm of the condenser should be closed to approximately 1/3 of the objective exit pupil diameter. In this position, the diaphragm control is aligned with the digit of the objective introduced in the optical path, providing a good contrast image.

The aperture diaphragm is designed to adjust contrast, not brightness. You should reduce the diaphragm opening if you need to increase contrast.

STAGE

The X/Y stage 1 (Fig. 2) allows for moving the specimen in two mutually perpendicular directions using the knobs 9 (Fig. 1) located on the same axis.

Stage size: 230mmx150mm. Moving range: 78mm×54mm. 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 between the specimen holder 5 (Fig. 1) and the clip, for which the clip 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.

ILLUMINATOR

The illuminator built into the base of the microscope includes a collector 4 (Fig. 2) and a LED light source.
The illuminator is switched on by means of an ON/OFF switch 6 (Fig. 2) on the left panel of the stand. The brightness is adjusted using the knob 5 (Fig. 2).

The bulb is powered from the AC power supply through a power source built into the microscope stand.

BUILT-IN DIGITAL CAMERA (DH260)

1. Type-C port
2. USB-mouse port
3. HDMI port
4. LAN port

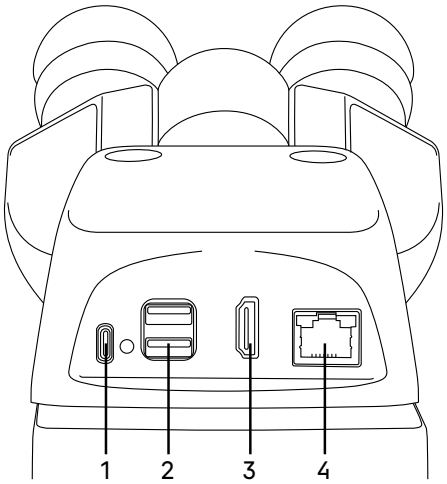


Fig. 4. General view of the microscope head with a built-in camera

HDMI mode

Use an HDMI cable to connect the digital microscope head to an HDMI monitor **3**. Connect the USB mouse to port **2**. Connect the camera to the power adapter (supplied). Switch on the microscope. Connect the adapter to a power outlet **1**.

The digital camera has built-in software that will allow you to set exposure, brightness, color temperature, remove noise, adjust the red, blue, and green channels, as well as perform calibration and measurement.

Wi-Fi mode

Make sure your PC supports WI-Fi.

1. Install the S-EYE software on your PC.
2. Switch on the microscope. Connect the camera via the AC adapter to the power supply **2**.
3. Find the camera access point among the available networks and enter the password: 12345678.
4. Open the S-EYE software and select the WI-Fi connection type, netcam protocol. Specify 192.168.6.1 in the address bar.

3 UNPACKING AND ASSEMBLING

The assembly procedure is given in Fig. 5.

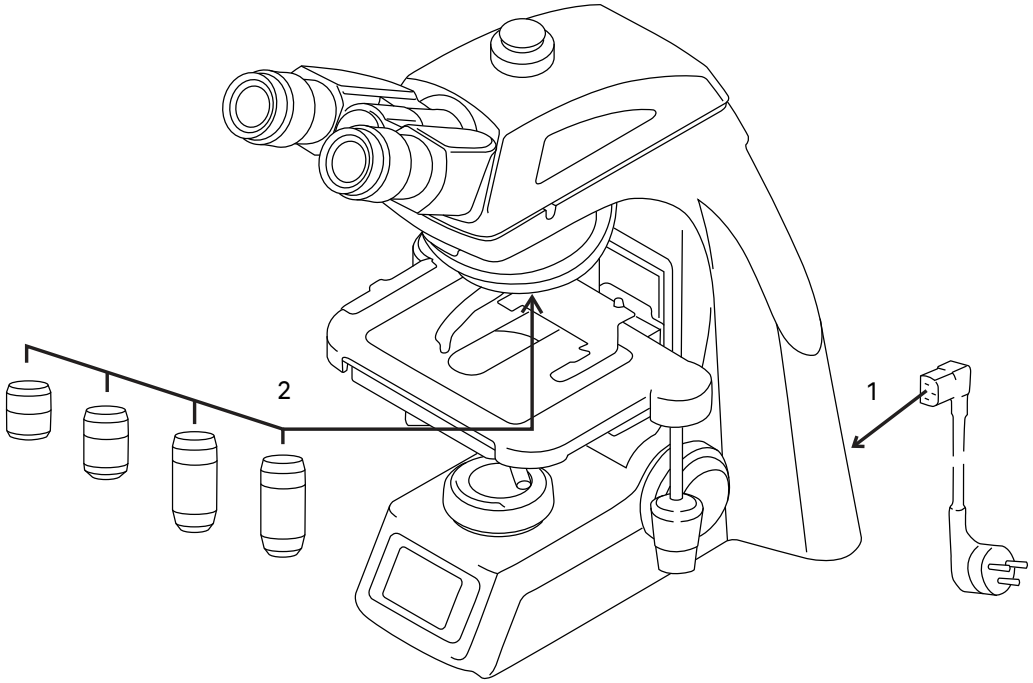


Fig. 5. Assembling the microscope

1. Remove the microscope from the package.
2. Check the scope of delivery using Section 7 of the User Manual.
3. Inspect the microscope and its components for damage.
4. Remove the microscope stand with the stage and condenser attached.
5. Connect the power cord to the microscope and a power outlet. In doing so, make sure that the ON/OFF switch is in the "OFF" position.
6. Switch on the microscope power supply. Rotate the coarse focusing knob to lower the stage as far as it will go. Rotate the coded revolving nosepiece by hand until the LCD screen shows the programmed position for the 4x objective. Screw in the 4x objective into the slot. Similarly, screw in all the objectives in increasing order of magnification.
7. Install the color filter on the collector as necessary (not included in the standard delivery).
8. Check and sort the supplied accessories and tools in the correct order. Keep them in proper order to avoid confusion.

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.

Make sure that the power cord is plugged into the connector on the back panel of the microscope stand. Plug the microscope to a power outlet.

Turn the ON/OFF switch 1 to "–" position (ON).

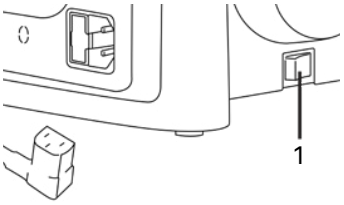


Fig. 6. Switching on the illumination

ADJUSTING THE LCD SCREEN FUNCTIONS

The intelligent lighting system is controlled by the knob **1**.

1. Lighting control knob

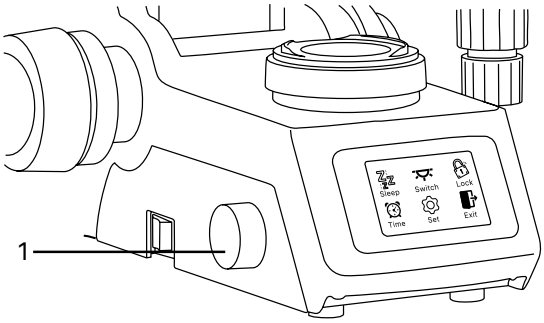
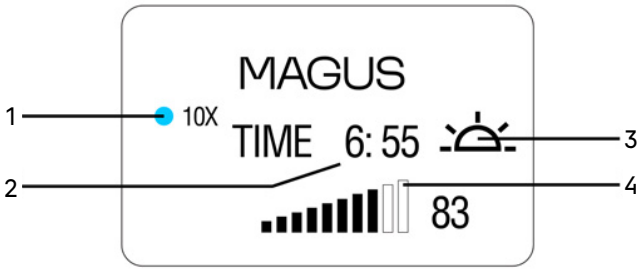


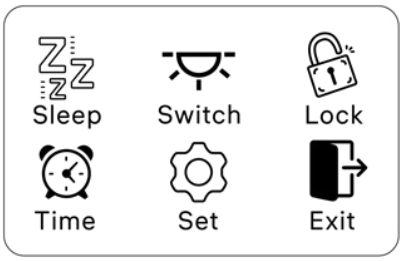
Fig. 7. Intelligent lighting control



1. Objective in the optical path
2. Eco-mode time setting
3. Illuminator position
4. Brightness adjustment (1–100)

Fig. 8. General view of LCD screen

The brightness of the bulb is decreased/increased by turning the knob clockwise/counterclockwise. Other functions are described below.



Settings

To enter the function setting interface, press and hold the lighting control knob 1 (Fig. 7) for 3 seconds. Rotate the knob to switch functions. Press the knob to select the desired function. Please note, the microscope operates in transmitted light, so before making adjustments you must select the icon , which means illumination from below.

Sleep mode

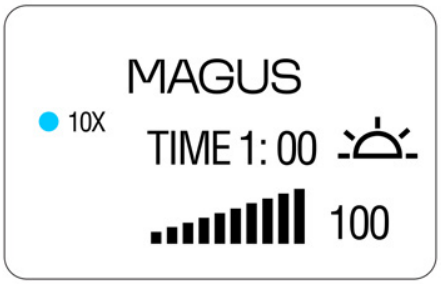
Press the knob once to enter the standby mode. SLEEP will appear on the screen. Press the knob again to exit the Sleep mode.

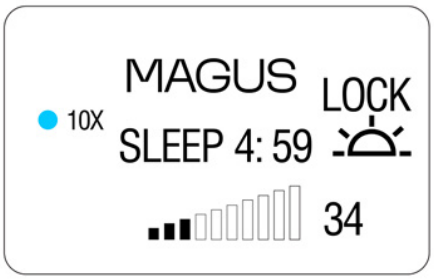
Time setting for the Sleep mode

There is an eco mode in the microscope: If you do not operate it for a certain time interval, it enters a standby mode. The user can set the time for the microscope to enter the Sleep mode.

To set the time for the Sleep mode, press and hold the knob 1 (Fig. 7) for 3 seconds. The minute indicator will start blinking. Rotate the knob to increase/decrease the time. You can set up the time from 1 minute upwards. The maximum time is 8 hours.

To switch from minutes to hours, press the knob once. Once the desired time has been set, the digit will blink 3 times. The time is set.





Brightness adjustment lock

You can set brightness when using a specific objective and lock the value to prevent it from being modified by another user.

Set the desired bulb brightness on each objective. Press the knob twice. LOCK will appear on the LCD screen. When locked, the brightness adjustment knob does not operate. When the objective is changed, the brightness is changed automatically.

To release the lock, press the knob twice again. LOCK will disappear from the screen.

Adjusting the revolving nosepiece

The revolving nosepiece is coded by default, and usually users do not need to change them. If you need to make changes, you should do as follows:

— select Set on the LCD screen

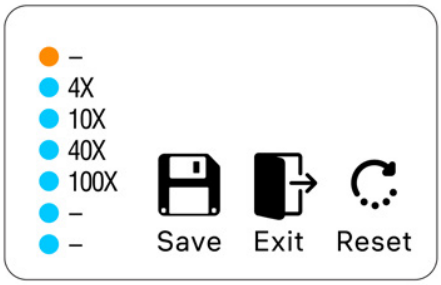
— screw in the objective and introduce it into the optical path

— press the knob 1 (Fig. 7) to enter the position setting for this objective

— rotate the knob to select the corresponding magnification of the objective on the LCD screen

— press the knob once to complete the revolving nosepiece adjustment.

Once you have completed the settings for the other hole positions one after another, turn the knob to Save to save the settings.



PLACING THE SPECIMEN

Place the specimen **1** on the stage by gently pushing aside the clip of the specimen holder. 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, i.e. located on the same axis. The stage system does not have rack and pinion.

The knob **2** controls Y-axis movement, the knob **3** controls X-axis movement. Moving range: 78mm in X-axis direction and 54mm in Y-axis direction.

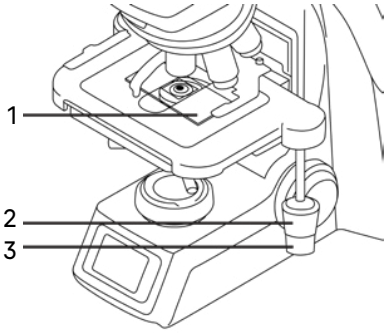


Fig. 9. Placing the specimen

FOCUSING ON THE SPECIMEN

1. 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).
2. By turning the coarse focusing knob **2**, raise the stage carefully until the coverslip almost touches the objective front lens.
3. Looking into the right eyepiece (with the left eye closed) and lowering the stage slowly, bring the image into sharp focus using the coarse and fine focusing knobs **1**.
4. 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 **3**. By rotating it counter-clockwise you tighten the tension, and by rotating it clockwise you loosen it.

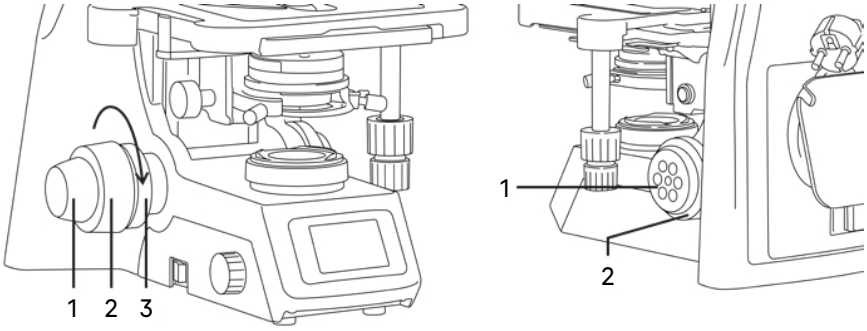


Fig. 10. Focusing on the specimen

ADJUSTING THE EYEPIECE TUBES

Use the diopter adjustment ring to compensate for the observer's ametropia. The adjustment range is ±5 diopters. To start the adjustment, set the diopter adjustment **2** on both tubes to the middle position.

While looking through the eyepiece installed in one tube (with the other eye closed), bring the specimen into focus. While looking through the eyepiece installed in the other tube (with the other eye closed), bring the specimen into sharp focus by rotating the diopter adjustment ring **2** and not touching the focusing knobs.

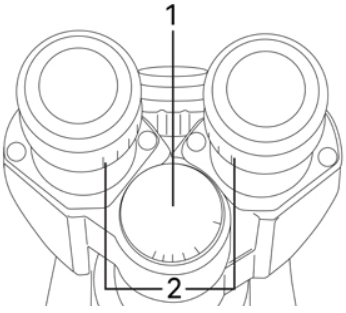


Fig. 11. Adjusting the eyepiece tubes

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. The distance between the eyepieces matching the observer's interpupillary distance is marked on the adjustment scale **1** on the microscope head. We recommend memorizing your interpupillary distance for future reference.

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 and bring the specimen into focus using coarse and fine focusing knobs.

— Open the field diaphragm **2** and the condenser aperture diaphragm 4; raise the condenser all the way up using the condenser focus knob **1**.

— While looking through the eyepieces, close the field and aperture diaphragms so that only the center of the field of view is illuminated – Fig. 12a.

— Move the image to the center of the eyepiece field of view using the condenser centering screws **3** – Fig. 12b.

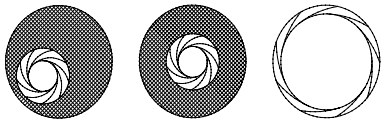
— Carefully moving the condenser up and down by rotating the condenser focus knob **1**, place the condenser into the working position. In this position, the edges of the octagon-shaped image of the closed field diaphragm are sharp and the diffracted blue-green color at the edge of the diaphragm is directed beyond the edge of the diaphragm and not into the field of view.

— Open the field diaphragm **2** until it just disappears outside of the field of view – Fig. 12c. Additional centering may be needed.

— Remove the eyepiece from the tube and, while observing the objective exit pupil, open the aperture diaphragm **4** 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.



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

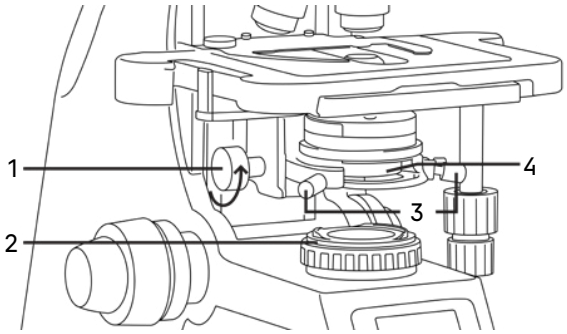


Fig. 12. Centering the condenser

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/0.65, 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/0.65, 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 USING OPTIONAL EQUIPMENT

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. 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.

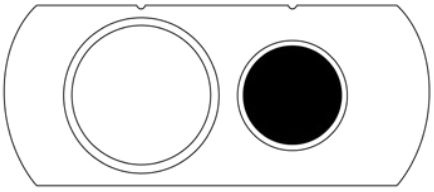


Fig. 13. Darkfield slider

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.

The darkfield technique is based on illuminating the specimen with a hollow cone of light whose inner aperture exceeds the numerical aperture of the objective, so that no direct ray from the illuminator can enter the objective. The microscope field of view remains dark. The specimen is illuminated with oblique side rays. Particles in the specimen scatter light. Part of rays are scattered toward the objective and a bright image of the specimen appears on a dark background.

The darkfield microscopy is used to image live unstained biological samples. This technique allows only the outline of the object to be viewed, and so it is not used to study the the internal structure.

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 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 illuminator brightness 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.

PHASE-CONTRAST DEVICE

The phase-contrast device is designed for studying 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 microscope allows using two types of phase-contrast devices: Zernicke condenser installed in the condenser mount instead of the regular condenser and phase-contrast sliders installed in the Abbe condenser slot. 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 (covered with a dust cap) 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.

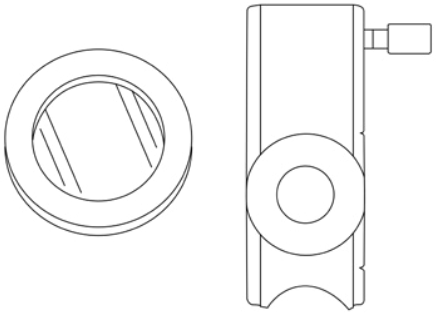


Fig. 14. Polarizer/analyzer set

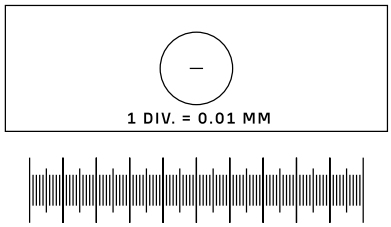


Fig. 15. Calibration slide

USING THE EYEPIECE WITH A SCALE

The eyepiece with a scale or grid 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 with the scaled side facing up. 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
2	
4	
10	
20	
40	
50	
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 (BIO 260T)

The Bio 260T microscope is designed to observe a specimen through the eyepieces and to photograph the specimen. The vertical camera port (trinocular tube) is located on the top of the microscope head. There is a C-mount adapter **2** mounted in the trinocular tube to use the camera. When not in operation, it is covered with the dust cap **1**. The diopter adjustment on the adapter aligns the focus of the camera port so that the image is both in focus in the eyepieces and on the monitor.

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

To enable the camera:

— Remove the dust cap.

— Connect the camera to the adapter.

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

— If the image is blurred, adjust the focus using the diopter adjustment of the adapter to ensure an accurate and sharp image.

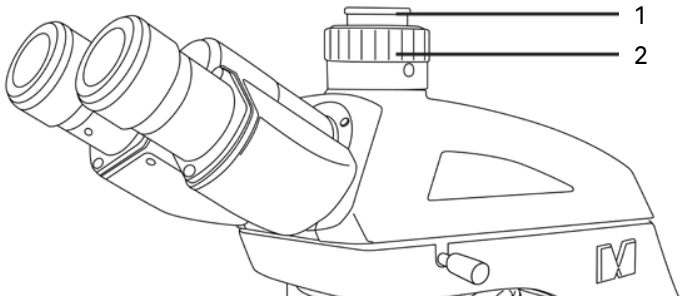


Fig. 16. Using the trinocular tube (Bio 260T)

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.

6 TROUBLESHOOTING

Potential problems and remedies (Table 3):

Problem	Cause	Remedy
	ELECTRICAL COMPONENTS	
No illumination in the field of view	The ON/OFF switch is off	Turn the ON/OFF switch to ON
	The bulb is burned out	Replace the bulb. Contact an electronics technician at the service center
	The circuit board connector has poor contact	Repair the connector. Contact an electronics technician at the service center
	The fuse has burned out	Replace the fuse
	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 not aligned with the optical path	Center the condenser
	The shutter in the condenser is in the wrong position and blocking part of the light	Move the shutter to the middle position
	The condenser is too low	Set up Köhler illumination
	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 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

7 SCOPE OF DELIVERY

The scope of delivery (Table 4)

Component	Pcs		Note
	260T	DH260	
MAIN COMPONENTS			
Stand (with focusing mechanism and LCD screen)	1	1	
Trinocular microscope head	1		
Binocular microscope head with built-in camera	1	1	
Revolving nosepiece	1	1	Mounted on the stand
Stage	1	1	Mounted on the stand
Transmitted light LED illuminator	1	1	Mounted on the stand
REPLACEABLE PARTS			
Abbe condenser	1	1	
2x/0.06 plan achromatic objective ∞/–		1	Optional
4x/0.10 plan achromatic objective ∞/–	1	1	
10x/0.25 plan achromatic objective ∞/–	1	1	
20x/0.40 plan achromatic objective ∞/0.17	1	1	Optional
40x/0.65 plan achromatic objective ∞/0.17	1	1	
50x/0.95 plan achromatic objective (oil) ∞/0.17 (spring loaded)	1	1	Optional
60X/0,80 plan achromatic objective ∞/0.17 (spring loaded)	1	1	Optional
60x/1.42 plan apochromatic objective (oil) ∞/0.17 (spring loaded)	1	1	Optional
100x/1.25 plan achromatic objective (oil) ∞/0.17 (spring loaded)	1	1	
100x/1.10 plan achromatic objective ∞/0.17 (spring loaded)	1	1	Optional
10x/22mm eyepiece	2	2	
10x/22mm eyepiece with a scale	1	1	Optional
10x/22mm eyepiece with a center field pointer	1	1	Optional
10x/22mm eyepiece with a grid	1	1	Optional
10x/22mm eyepiece with a reticle	1	1	Optional
12.5x/16mm eyepiece	2	2	Optional
15x/16mm eyepiece	2	2	Optional
20x/12mm eyepiece	2	2	Optional
30x/8mm eyepiece	2	2	Optional
Darkfield slider	1	1	Optional
Dry darkfield condenser	1	1	Optional
Oil darkfield condenser	1	1	Optional
Reflected light illuminator with filter cubes and power adapter	1	1	Optional
Phase-contrast device: set of phase-contrast sliders; auxiliary centering telescope, set of phase-contrast objectives	1	1	Optional
Phase-contrast device: phase-contrast condenser, auxiliary centering telescope, set of phase-contrast objectives	1	1	Optional
Polarizer/analyzer set	1	1	Optional
UV shield	1	1	Optional
PlanF S-Apo 4x plan semi-apochromatic fluorescent infinity-corrected objective, parfocal height: 60mm	1	1	Optional

PlanF S-Apo 10x plan semi-apochromatic fluorescent infinity-corrected objective, parfocal height: 60mm	1	1	Optional
PlanF S-Apo 20x plan semi-apochromatic fluorescent infinity-corrected objective, parfocal height: 60mm	1	1	Optional
PlanF S-Apo 40x plan semi-apochromatic fluorescent infinity-corrected objective, parfocal height: 60mm	1	1	Optional
PlanF 100x (oil) plan semi-apochromatic fluorescent infinity-corrected objective, parfocal height: 60mm	1	1	Optional
Eyecups	2	2	On eyepieces
Set of color filters	1	1	Optional
C-mount camera adapter	1		
Camera	1	1	Optional
Calibration slide	1	1	Optional
Monitor	1	1	Optional
ACCESSORIES AND SPARE PARTS			
Head locking screw	1	1	
Allen wrench	1	1	
Trinocular tube dust cap	1	1	Supplied
Light source - 3W LED	1	1	Installed in the illuminator
Fuse: T500mA/L250V	2	2	Installed in the illumination system
Transmitted light filter	1	1	Optional
Power cord	1	1	
Bottle of immersion oil	1	1	Optional
Dust cover	1	1	
User manual	1	1	

8 CARE AND MAINTENANCE

REPLACING THE BULB AND THE FUSE

Elf the fuse has burned out, replace it with a fuse with the same specifications. Before replacing the fuse, turn the ON/OFF switch to "0" position (off). Unplug the power cord **1** from the microscope. The fuse socket **3** is combined with the microscope power connector **2**. Wait about 10 minutes for the bulb to cool down.

Using a universal screwdriver, hook and pull out the fuse holder **5**. There are two fuses **6** in the holder. Replace the blown fuse with a new one. Push the fuse holder back into the socket.

Plug the power cord and turn on the ON/OFF switch to check that the fuse is working.

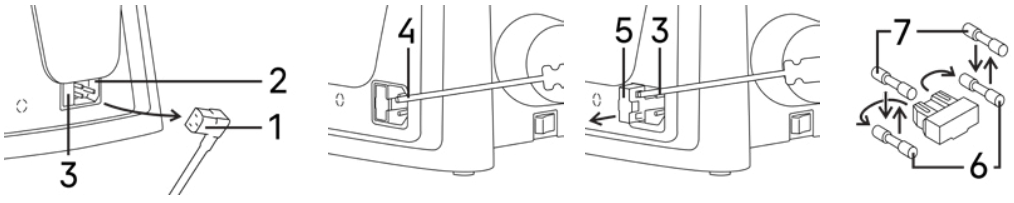


Fig. 17. Replacing the fuse

The microscope employs LED bulbs as a light source. The bulbs should be replaced by the equipment vendor or in a qualified service center. If you replace the LED yourself, the illumination function may be impaired.

MAINTENANCE

1. Once you have finished using the microscope, switch off the power supply. When not using the microscope for a long time, switch off the power supply.
2. The microscope should be kept clean. Do not install the dust cover unless the microscope is completely cooled down and dry.
3. Cleaning lenses:
   Remove dust from the lenses with a soft brush. Significant contamination can be removed using a soft cloth moistened with a small amount of a mixture of alcohol and ethyl ether (mixture proportion: 20-30% alcohol and 70-80% ethyl ether) or special O-xylene solution. Wipe the lenses from the center outward.

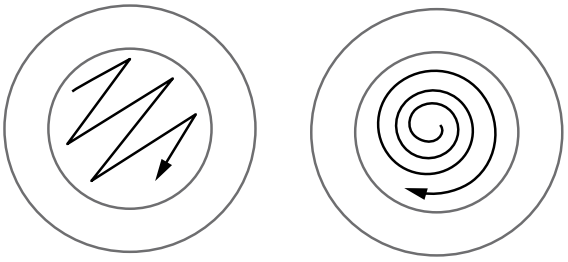


Fig. 18. Cleaning lenses

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

   Do not wipe the microscope stand with any organic solvent (e.g., alcohol, ethyl ether or its diluted solution). This may cause damage to the coating of the microscope stand surface.
5. 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.
6. Periodic inspection: the microscope should be regularly inspected and serviced to maintain its performance.

9 MAGUS WARRANTY

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

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

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

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