Motic®

B1 SERIES

Biological Microscope
Instruction Manual

Note If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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MOTIC INCORPORATION LTD.

CE c UL us LISTED E250223

We are constantly endeavouring to improve our instruments and to adapt them to the requirements of modern research techniques and testing methods. This involves modification to the mechanical structure and optical design of our instruments.

Therefore, all descriptions and illustrations in this instruction manual, including all specifications are subject to change without notice.

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MICROSCOPE TERMINOLOGY

Abbe Condenser

A two-lens sub-stage condenser located below the stage of a microscope and functions to collect light and direct it onto the object being examined. Its high numerical aperture makes it particularly suited for use with most medium- and high-magnification objectives.

Aperture, Numerical (N.A.)

The numerical aperture is an important factor determining the efficiency of the condenser and objective. It is represented by the formula: (N.A. = **ηsinα**), where **η** is the refractive index of a medium (air, water, immersion oil etc.) between the objective and the specimen or condenser, and **α** is half of the maximum angle at which light enters or leaves the lens from or to a focused object point on the optical axis.

Cover Glass Thickness

Transmitted light objectives are designed to image specimens that are covered by a thin cover glass (**cover slip**). The thickness of this small glass piece is now standardized at 0.17 mm for most applications.

Diaphragm, Condenser

A diaphragm, which controls the effective size of the condenser aperture. A synonym for the condenser illuminating aperture diaphragm.

Depth of Focus

The axial depth of the space on both sides of the image plane within which the image is sharp. The larger the N.A. of objective, the shallower the depth of focus.

Field of View (F.O.V.)

That part of the image field, which is imaged on the observer's retina, and hence can be viewed at any one time. The field of view number is now one of the standard markings of the eyepiece.

Filter

Filters are optical elements that selectively transmit light. It may absorb part of the spectrum, or reduce overhaul intensity or transmit only specific wavelengths.

Immersion Oil

Any liquid occupying the space between the object and microscope objective. Such a liquid is usually required by objectives of 3-mm focal length or less.

Magnification

The number of times by which the size of the image exceeds the original object. Lateral magnification is usually meant. It is the ratio of the distance between two points in the image to the distance between the two corresponding points in the object.

Micrometer: *um*

A metric unit of length measurement
= $1x10^{-6}$ meters or 0.000001 meters

Diopter adjustment

The adjustment of the eyepiece of an instrument to provide accommodation for the eyesight differences of individual observers.

Real field of view

The diameter in millimetres of the object field.

$$\text{Real field of View} = \frac{\text{Eyepiece Field of View}}{\text{Objective Magnification}}$$

Resolving Power

A measure of an optical system's ability to produce an image which separates two points or parallel lines on the object.

Resolution

The result of displaying fine details in an image

Total Magnification

The total magnification of a microscope is the individual magnifying power of the objective multiplied by that of the eyepiece.

Nanometer (nm)

A unit of length in the metric system equal to 10^{-9} meters.

Working Distance

This is the distance between the objective front lens and the top of the cover glass when the specimen is in focus. In most instances, the working distance of an objective decreases as magnification increases.

X–axis

The axis that is usually horizontal in a two-dimensional coordinate system. In microscopy X-axis of the specimen stages is considered that which runs left to right.

Y–axis

The axis that is usually vertical in a two-dimensional coordinate system. In microscopy Y-axis of the specimen stages is considered that which runs front to back.

1.SAFETY INSTRUCTIONS

1.1 General safety instructions

Please be sure to read these instructions before using microscope. Additional information is available upon request from our maintenance department or authorized agency. To ensure safe operation and guarantee good performance of the microscope please pay attention to the precautions and warnings specified in the *Operation Instructions*. In this *Operation Instructions* manual, the following symbols indicate:

Caution! Electric shock hazard!

Caution! Danger!

1.2 Instrument safety

The microscope has been designed, manufactured and inspected according to the IEC 61010-1:2001 *Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use*.

1.3 Unpacking, transportation & storage

The original shipping container should be kept for use in long term storage or return shipment.
Please comply with the temperature requirements for transport and storage.

- Transport (within package)
  Permissible environment temperature: -40 ~ +70°C
- Storage
  Permissible environment temperature: +10 ~ +40°C
  Permissible relative humidity: Below 31°C, max. humidity is 80%; at 40°C, linearly decreases to 50%

1.4 Waste disposal

Important: Any damaged microscope must not be treated as general waste; it should be disposed of according to relevant regulations.

1.5 Operation

When using the microscope, please pay attention to the following safety instructions:

- If it is used for any purpose other than the specified ones, including any individual component or part, the manufacturer will not take any responsibility.
- After-sales service or repair done by unauthorized personnel will void the warranty.
- Anyone who uses the instrument should receive instruction on the proper handling of the instrument and safety practices for microscopy. The microscope shall be placed only on a firm, flat workbench for operation.
- Since the microscope is a precision instrument, improper operation will impair or spoil its performance.
- The power unit is integrated in the main unit of the microscope: the grid supply voltage is within 100-240V~ 50Hz-60Hz.

The microscope must be connected only to the normal power socket with a grounding terminal. Any extension cord without ground protection is not allowed to avoid failure of the protection function.

If there is any electrical failure (of the fuse system, ground protection or transformer), turn off and unplug the unit immediately. Make sure the microscope is set aside so it will not be used again and contact the Motic service department or a Motic microscope repair agency to have it repaired.

Please be sure to turn off the power before opening the instrument to replace the lamp or replace the fuse! Only use a fuse for the rated current.

Safety instructions for the use of immersion oil.

Immersion oil is irritating to skin; avoid contact with skin, eyes and clothing.

Skin contact: wash with soap and plenty of water until the immersion oil is completely removed.

Eye contact: flush immediately with plenty of water for at least 5 minutes. If irritation persists, seek medical advice.

Dispose of immersion oil properly. Do not discharge into surface water or sewage.

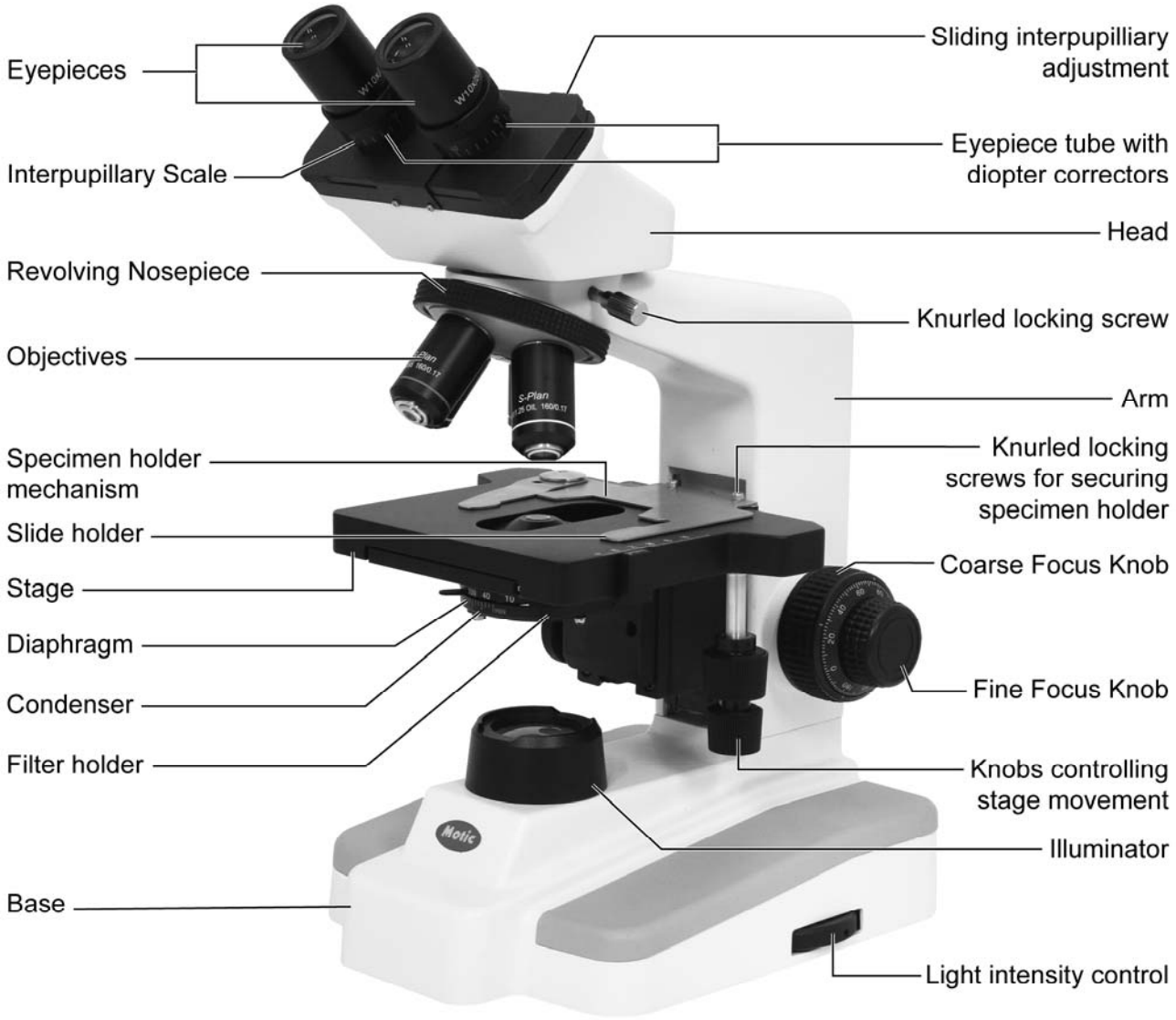
The microscope is not equipped with any special device to protect against corrosive, latent infective, toxic, radioactive or other hazardous samples. Therefore, when examining any such sample you must comply with the relevant laws and regulations, in particular the provisions related to accident prevention.

1.6 Quality Warranty

The microscope and the attached accessories are only allowed to be used for microscope examination as described in this manual. The manufacturer takes no responsibility for any other use.

- The manufacturer guarantees that the product is free from any defect in material or workmanship on the date of delivery.
- If any defect is found, notify the manufacturer immediately.
- Upon receipt of the Notification of Defect as described above, the manufacture is responsible to solve the problem either by repairing the defective instrument or replacing it with a new instrument of the same model.
- The manufacturer provides no warranty for any failure or defect due to normal wear and tear or improper use of the product.
- The manufacturer takes no responsibility for any damage caused by operation error, negligence or unauthorized dismantling of the instrument, or the use of spare parts from other manufacturers.

2.NOMENCLATURE



MOTIC B1 (Binocular)

3.SETTING UP THE INSTRUMENT

The microscope shall be placed only on a firm, flat workbench for operation.
Avoid placing the instrument in locations exposed to direct sunlight, dust, vibration, high temperature, high humidity and where it is difficult to unplug the power supply cord.
Please do not touch the optical lens surfaces.

3.1 Operating environment

- Indoor use
- Altitude: Max 2000 meters
- Ambient temperature: 5°C to 40°C
- Maximum relative humidity: 75% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C
- Supply voltage fluctuations: Not to exceed ±10% of the normal voltage
- Pollution degree: 2 (in according with IEC60664)
- Installation/Overvoltage category: 2 (in according with IEC60664)
- Air Pressure of 75kPa to 106kPa
- Avoid frost, dew, percolating water, and rain

3.2 Verifying input voltage

The automatic voltage selection works with a broad range of settings. However, always use a power cord that is rated for the voltage used in your area and that has been approved to meet local safety standards.
Using the wrong power cord could cause fire or equipment damage.
In case of using an extension cord, use only a power supply cord with a protective earth (PE) wire.
In order to prevent electric shock, always turn the power switch on the power supply off before connecting the power cord.
Transmitted illumination electrical specifications:

- **LED**
  Input: 100-240V~, 50-60Hz
  Output: 12V 2A or 12V 0.5A
  LED: 3.4V / 3W

4.ASSEMBLING THE MICROSCOPE

The components for microscopes are shipped detached for protection. Open the Styrofoam packing with care and do not leave any components attached to the packing being removed.
Do not discard any of the packing materials until all of the components have been identified. If any damage occurs during transit, contact both the carrier and your supplier immediately.

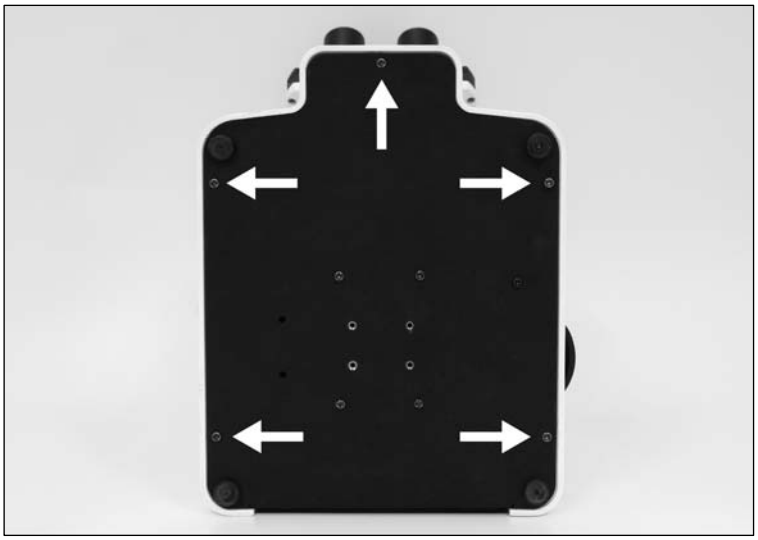
When handling the components, especially the optical parts, avoid touching any lens surfaces with bare hands or fingers as fingerprints and grease stains affect image quality.

All the steps described for the assembly of the microscope must be undertaken with extreme care and without forcing the placement of the distinct parts and elements of the microscope.

4.1 Illumination

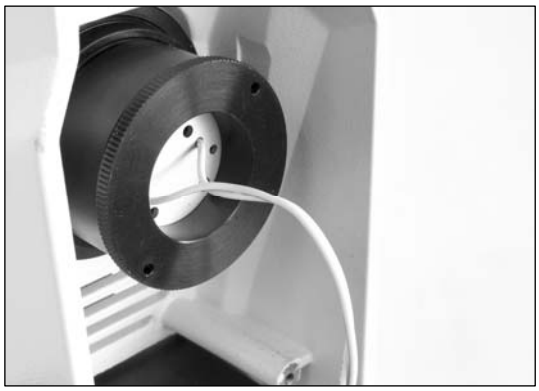
The following points describe how to replace the bulbs.
Make sure that the brightness control is in the minimum position before turning on or off the power switch.

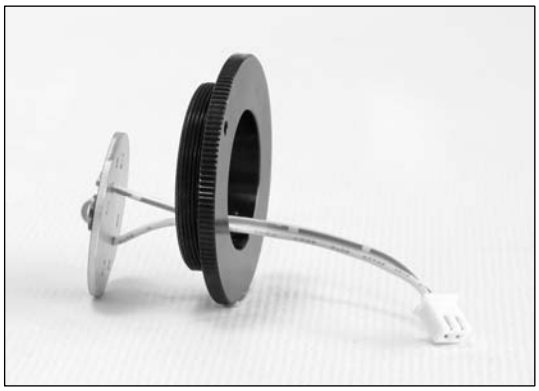
- Unscrew five hexagonal screws retaining the base plate.



- Disconnect the LED connection cables from the power supply printed circuit board.

- Loosen LED board locating ring, take away LED board locating ring.





Install the new LED

- Take out a qualified LED groups with power and PIN, nest the pressure ring and reverse action steps as above.
- At the time of installation, the LED group centre should be adjusted to the center of collector as possible, which is called the axis centre.
- When installing the bulb, do not touch the glass surface of the bulb with bare fingers.
- Doing so will cause fingerprints, grease, etc., to burn onto the bulb surface, reducing the Illumination provided by the bulb. If the surface is contaminated, wipe it clean using lens tissue.

4.2 Specimen holder

Attach the specimen holder, using the two mounting holes.

4.3 Objectives

Lower the stage completely by turning the coarse focus knob. Screw the objectives into the revolving nosepiece so that clockwise rotation of the nosepiece brings the next higher magnification objective into position.

4.4 Condenser

- Raise the stage by turning the coarse focus knob.
- Completely lower the condenser carrier by turning the condenser focus knob.
- Insert the condenser into the mount with aperture scale facing forward towards the user.
- Secure it with the condenser clamp screw.
- Turn the condenser focus knob to raise the condenser as far as it will go.

4.5 Eyepiece tube

Loosen the eyepiece tube clamp screw. Insert the round dovetail mount on the eyepiece tube into the round dovetail mount on the microscope arm. Tighten the eyepiece tube clamp screw to secure the eyepiece tube in place.

4.6 Eyepieces

Use the same magnification eyepieces for both eyes.
Inserting or removing the eyepieces is facilitated by twisting the eyepieces when pushing in or pulling out.
Monocular version: Before inserting or removing the eyepiece loose the clamp screw.

4.7 Filters

A special diffuser system is build into the illumination beam path and guaranties a homogeneous light distribution.

4.8 Power cord

Connect the socket of the of the power cord to the AC inlet on the rear of the base of the microscope. Plug in the other end of the cord to an AC outlet with ground conductor.

5.MICROSCOPE HANDLING

5.1 Illumination brightness adjustment

Turn the brightness adjustment knob fully clockwise to the low brightness position.

Set the power switch to **"I"** (ON).

The green line control lamp in the switch must light up.

When the Brightness adjustment knob is turned counterclockwise to the high brightness position, the light intensity increases.

5.2 Interpupillary distance adjustment

Before adjusting the interpupillary distance, bring a specimen into focus using the 10x objective.

- Adjust the interpupillary distance so that both the right and left field of view become one.
- This adjustment will enable the user to observe the specimen with both eyes

5.3 Diopter adjustment

Diopter adjustment compensates for the differences in vision between the left and right eyes. In addition to making observation through both eyes easier, this adjustment also reduces the extent to which focusing is lost when the objective magnification is changed. In particular, this occurs when a low magnification objective is used.

- Set the diopter on both eyepieces to the "0" position.
- Change to 10x Magnification and focus the image of the specimen with one eye only.
- Use the Eye which is most convenient for first focussing.
- When the best focus position is reached, close this eye and use the other eye for the following steps.

- Correct the focus for the second eye by using only the diopter ring, do not use the coarse/fine focusing knob!
- Change to a higher magnification to verify the result and if necessary repeat the procedure to match the sharpness for higher magnification.
- Keep this final diopter position for all magnification/lenses. The diopter position for each user can be recorded from the scale, so it can easily be reset.

5.4 Beam splitter lever (trinocular version)

The beam splitter lever of the trinocular eyepiece tube can be used to select the amount of light distributed between the trinocular eyepiece tube and the vertical phototube.

- When the beam splitter lever is pushed in, 100% of the light will enter the eyepieces.
- When it is in the mid-position, adjusted until a click is heard, 100% of the image is directed to the trinocular port for photographs or video images.
- When pulled out, the light beam will be divided as follows:
  30% of the image is directed to the binocular eyepieces, and 70% to the trinocular port.

5.5 Coarse and fine focusing

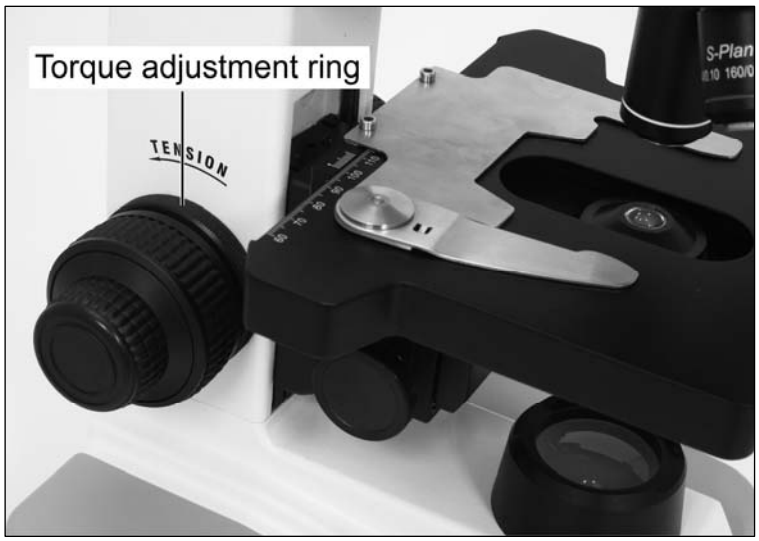
- Focusing is carried out with the coarse and fine focus knobs at the left and right of the microscope stand.
- The direction of vertical movement of the stage corresponds to the turning direction of the focus knobs.
- One rotation of the fine focus knob moves the stage 0.2mm. The graduation on the fine focus knob is 1 micron.

Never attempt either of the following actions, since doing so will damage the focusing mechanism:

- Rotate the left and right knob while holding the other.
- Turning the coarse and fine focus knobs further than their limit.

5.6 Coarse focus torque adjustment

To increase the torque, turn the torque adjustment ring located behind the left-hand coarse focus knob in the direction indicated by the arrow. To reduce the torque, turn the ring in the direction opposite to that indicated by the arrow.



5.7 Stage Upper Limit Stop adjustment:

(Upper Stage Limit is preset at the factory; please only adjust if necessary)

- The Stage Upper Limit Stop marks the stage position by restricting the movement of the coarse focus knob.
- With the specimen in focus, turn the stage upper limit stop screw clockwise until it reaches the stop.
- When the stage upper limit stop is in position, the stage cannot be raised from that position. However, the fine focus knob can move the stage regardless of the limit but will only lower the stage.
- Lower the stage by using the coarse focus knob anticlockwise.

5.8 Use of aperture diaphragm

- The condenser aperture diaphragm is provided for adjusting the numerical aperture (N.A.) of the illuminating system of the microscope, it decides the resolution of the image, contrast, depth of focus and brightness.
- Stopping down will lower the resolution and brightness but increase the contrast and depth of focus.
- An image with appropriate contrast in most cases can be obtained with an aperture diaphragm closed down to 2/3 of the maximum value.

Suggested apertures for each objective are as follows:

OBJECTIVE	**APERTURE OF IRIS**
4X	From fully closed to 1/8 open.
10X	From 1/8 to 1/4
40X	From 1/4 to 1/2
100X	From 1/2 to 3/4

6.PHOTOMICROGRAPHIC PROCEDURE

To ensure vibration free operation, set the microscope on a sturdy vibration free table or a bench with a vibration proof device.

- Pull the bean splitter lever of the trinocular eyepiece tube all of the way out to the limit.
  - When the beam splitter lever is pushed in, 100% of the light will enter the eyepieces.
  - The triple position tube is the most flexible tube by giving 2 photo positions:
    30:70 (visual: photo; for simultaneous observation by eyepiece and camera)
    0:100 (visual: photo; for low light situations)
- To ensure optimal illumination, check the position of the condenser.
- An additional colour-compensating filter can also be used depending on the colour rendition.
- A change in depth of focus, contrast and resolution of the image is attainable with an aperture setting of 2/3 of the maximum diaphragm diameter. Fine setting of the condenser aperture varies with the individual sample.
- For specific photomicrographic procedures, refer to the manual of the specific camera being used.

7.USING OIL IMMERSION OBJECTIVE

Oil immersion objectives are labelled with the additional engraving “Oil” and are to be immersed in oil between the specimen and the front of the objective.

The immersion oil supplied by Motic is synthetic, non-fluorescing and non-resining oil, with a refractive index of 1.515

Normally, cover glass must be used with oil immersion objectives with a few exceptions. Deviations from thickness are not important as a layer of immersion oil acts as compensation above the cover glass.

The small bottle of oil supplied with every immersion objective facilitates application of the oil to the cover slip.

- Remove any air bubbles in the nozzle of the oil container before use.
- Immersion oil must be used sparingly. After the examination, the oil should be wiped off the objective with a lens cleaning tissue and the residual film removed with soft cloth moistened with petroleum benzene or absolute alcohol.
- Locate the field of interest with a lower magnification objective. Swing the objective out of the light path, and add one drop of immersion oil over the site of the specimen. Swing in the oil immersion objective. There should be a small column of oil from the cover slip to the objective lens. Use the fine focus to make the image sharp.
- Freedom from air bubbles must be ensured. To check for air bubbles, remove an eyepiece, fully open the field and aperture diaphragms, and look at the exit pupil of the objective within the eyepiece tube. Air bubbles are recognized by a surrounding black ring. Bubbles may often be dislodged by moving the slide to and fro or by slightly rocking the revolving nosepiece back and forth. If not successful in clearing the bubbles then the oil must be wiped off and replaced with a fresh drop.

8.TROUBLESHOOTING TABLE

As you use your microscope, you may occasionally experience a problem.
The troubleshooting table below contains the majority of frequently encountered problems and the possible causes.

8.1 Optical

Problem	Possible Cause
Vignetting or uneven brightness in the field of view	Bulb not installed properly
	Condenser not mounted correctly
	Condenser is set too low
	Aperture diaphragm closed too far
	Revolving nosepiece not clicked into position
	Trinocular eyepiece tube optical path selector lever in intermediate position
Dust or dirt in the field of view	Aperture diaphragm closed too far
	Condenser is set too low
	Dust or dirt on specimen surface
	Dust or dirt on field lens, filter, condenser or eyepiece
Poor image (low contrast or resolution)	Condenser is set too low
	Aperture diaphragm closed too far
	No cover glass
	Too thick or thin cover glass
	Immersion oil not used with oil immersion lens
	Air bubbles in immersion oil
	Specified immersion oil not used
	Immersion oil on dry objective
	Greasy residue on eyelens
	Incorrect illumination

Poor image (low contrast or resolution)	Dried stain or oil on objective lens. Lens must be removed from the microscope and examined with a magnifier (an inverted eyepiece can be used) to check for dirt
Uneven focus	Stage installed on inclined plane
	Specimen holder not fixed securely on stage
	Specimen not secured in position
	Magnification or field of view of left and right eyepieces differ
	Diopter adjustment not made

8.2 Electrical

Bulb does not light	Power supply not plugged in
	Bulb not installed
	Bulb burnt out
Inadequate brightness	Specified bulb not being used
Bulb blows out	Specified bulb not being used
Bulb flickers	Connectors are not securely connected
	Bulb near end of service life

9.CARE AND MAINTENANCE

Do not disassemble

Disassembly may significantly effect the performance of the instrument, and may result in electric shock or injury and will void the terms of the warranty.

Never attempt to dismantle any parts other than described in this manual. If you notice any malfunction, contact your nearest Motic representative.

9.1 Cleaning the Microscope

9.1.1Lenses and filters

- To clean lens surfaces or filters, first remove dust using an air blower. If dust still persists, use a soft/clean brush or gauze.
- A soft gauze or lens tissue lightly moistened with a mixture of alcohol and ether (ratio; alcohol: 3 and ether: 7) should be used to remove grease or fingerprints.
- Use only the mixture of alcohol and ether to remove immersion oil from objective lenses.
- Because the mixture of alcohol and ether is highly flammable, be careful handling around open flame.
- Do not use same area of gauze or lens tissue to wipe more than once.

9.1.2 Cleaning of painted or plastic components

- Do not use organic solvents (thinners, alcohol, ether, etc.). Doing so could result in discolouration or in the peeling of paint.
- For stubborn dirt, moisten a piece of gauze with diluted detergent and wipe clean.
- For plastic components, only moisten a piece of gauze with water and wipe clean.

9.2 Disinfecting the Microscope

Follow the standard procedures for your laboratory.

9.3 When not in use

- When not in use, cover the instrument with vinyl dust cover and store in a place low in humidity where mould is not likely to form.
- Store the objectives, eyepieces and filters in a container or desiccator with drying agent.
- Proper handling of the microscope will ensure years of trouble free service.
- If repair becomes necessary, please contact your Motic agency or our Technical Service direct.

Note: If equipment is used in a manner not specified by the manufacturer, the warranty may be void.

10.WARNING LABELS

The following warning labels (or symbols) are found on the microscope, study the meaning of the warning labels (or symbols) and always use the equipment in the safest possible manner.

Warning Label / Symbol	Explanation
	Indicates that the surface becomes hot, and should not be touched with bare hands.
	Indicates that the main switch is ON.
	Indicates that the main switch is OFF.
~	Indicates alternating current.
⎓	Indicates direct current.
	CAUTION! Risk of danger. Please consult documentation in all cases where this symbol is used.

Don’t pick the microscope up from the bottom during equipment operation.

Proper handling of the microscope will ensure years of trouble free service.

If repair become necessary, please contact your Motic agency or our Technical Service directly

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