Motic®

# BA310Met-H

## Metallurgy Microscope
## Instruction Manual

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MOTIC INCORPORATION LTD.

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.

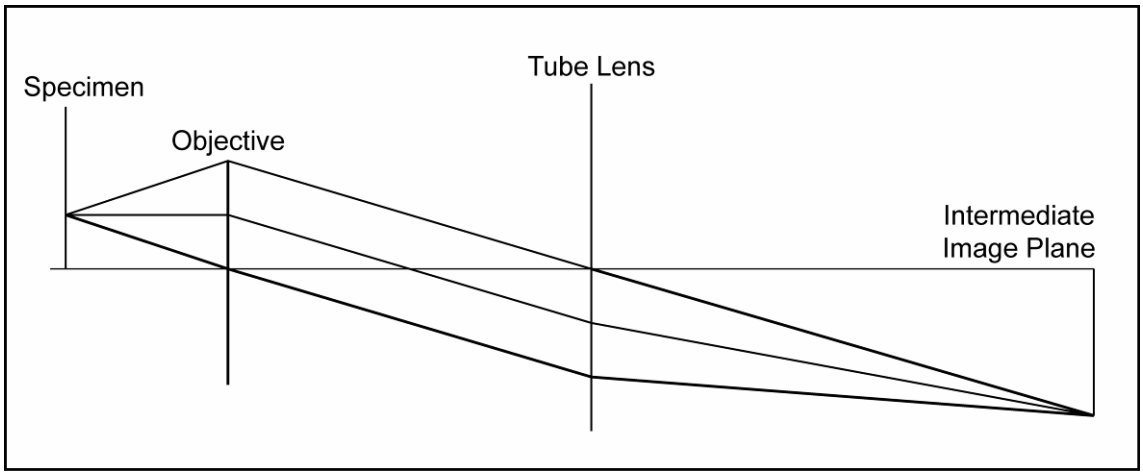
Therefore, all descriptions and illustrations in this instruction manual, including all specifications are subject to change without notice.

## INFINITY OPTICAL SYSTEM

An optical configuration (in which the specimen is located at the front focal plane of the objective) gathers light transmitted through or reflected from the central portion of the specimen and produces a parallel bundle of rays projected along the optical axis of the microscope toward the tube lens.

A portion of the light reaching the objective originates from the periphery of the specimen, and enters the optical system at oblique angles, moving forward diagonally but still in parallel bundles toward the tube lens. All of the light gathered by the tube lens is then focused at the intermediate image plane, and subsequently enlarged by the eyepiece.

The real merit of the infinity based system lies in its ability to accommodate modular accessories in the optical path and produce a flexible design.



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# 1. DESCRIPTION

### 1.1 Application:

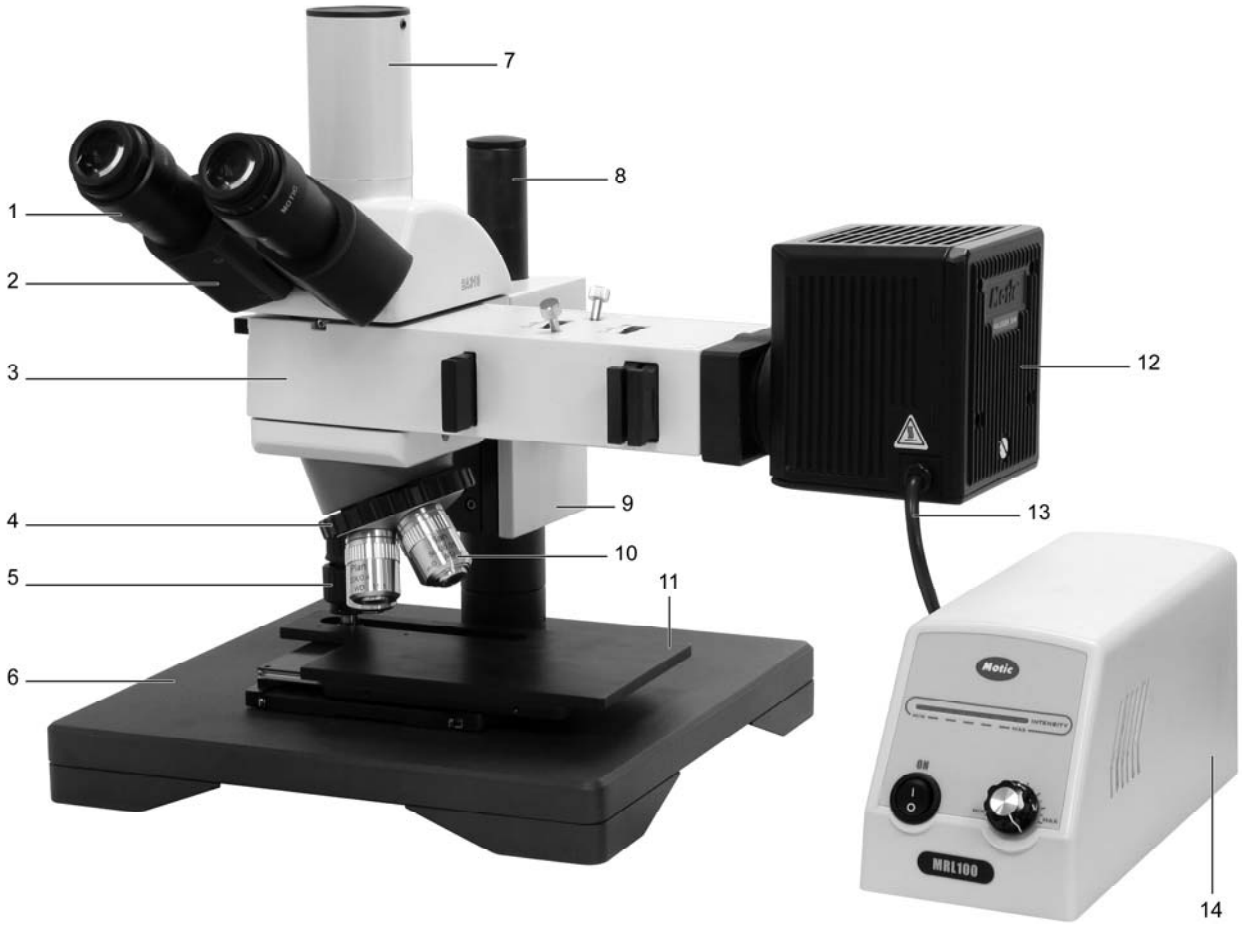
The Motic BA310Met-H is suitable for use in all areas of research and industry observing opaque material, e.g. in

a. Metallography
b. Mineralogy
c. Mechanical engineering
d. Electronics

Except bright field observation, BA310Met-H is also used for polarized light observation.
BA310Met-H can be installed with digital camera, video camera for photomicrography.

## 1.2 Nomenclature

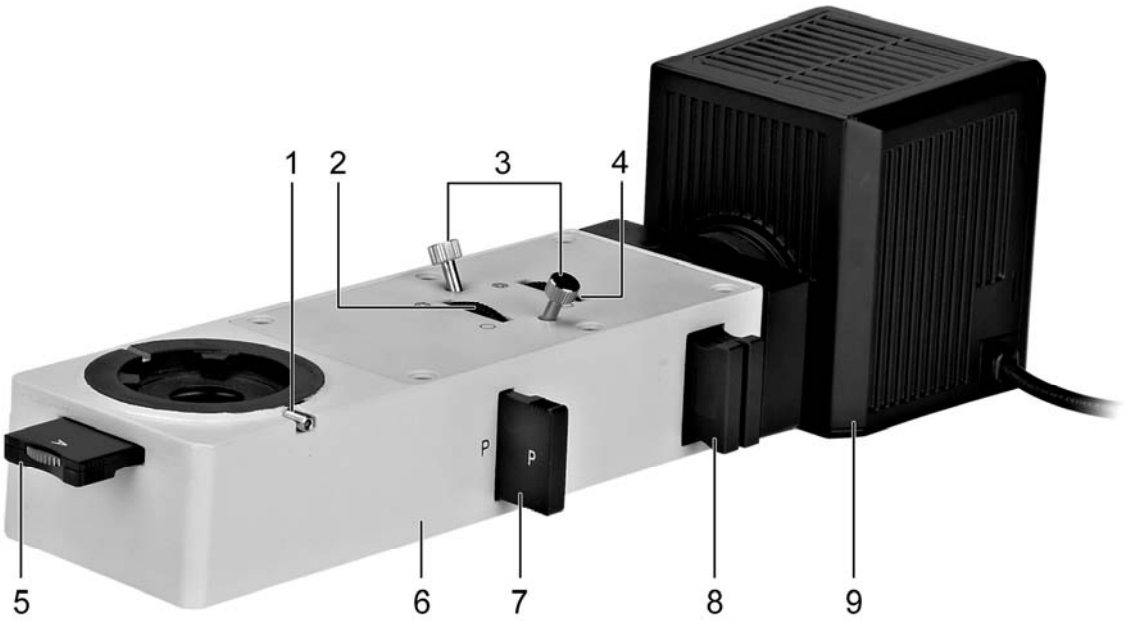
### 1.2.1 BA310Met-H




(Fig.1)

| | | |
|---|---|---|
| 1. Eyepiece | 2. Bincular eyepiece tube | 3. EPI illuminator |
| 4. Revolving nosepiece | 5. XY-axis travel knobs | 6. Stand |
| 7. Photo port | 8. Pole | 9. Focusing block |
| 10. Metallography objective | 11. Mechanical stage (optional) | 12. Lamp house |
| 13. Lamp house power cable | 14. MRL100 Power unit | |

1.2.2 EPI Illuminator




(Fig.2)

| | |
|---|---|
| 1. Clamp screw | 2. Field diaphragm adjustment wheel |
| 3. Field diaphragm centering screw | 4. Aperture diaphragm adjustment wheel |
| 5. Analyser | 6. Main body |
| 7. Polariser | 8. Filter silder |
| 9. 50W Halogen lamp house | |

### 1.3 Main Specifications

| **Model** | **BA310Met-H** |
|---|---|
| Total Magnification | 50x ~ 500x (optional, magnification max.: 1000x) |
| Eyepieces | High eye-point, N-WF 10x (FN20), Diopter adjustable |
| Infinite Metallurgical Plan Objectives | 5x/ 0.13, 10x/ 0.30, 20x/ 0.40, 50x/ 0.55 (optional 100x/ 0.80) |
| Observation Tube | 30° Inclined Siedentopf Trinocular Head |
| Interpupillary Distance | 55 ~ 75mm |
| Nosepiece | Reversed quadruple |
| Focusing Block | Coaxial movement; 30mm stroke; 0.2mm/ turn<br>2μm minimum increments |
| Epi illumination | 12V/ 50W halogen; reflected light system |
| Filters (for Epi illumination) | Frosted glass, Blue, Yellow, Green |
| Mechanical Stage | Dimension: 180mm X 140mm,<br>Movement Range: 100mm X 80mm |
| Stand | Stand dimension: 300mm X 300mm |

## 2. OPERATION ENVIRONMENT

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.

- 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.

## 3. ASSEMBLING THE MICROSCOPE

### 3.1 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 the 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.
- Illumination
  Halogen: 12V/ 50W

### 3.2 Illumination (halogen lamp)

- The quartz halogen lamp, used as a light source, has higher luminance and color temperature than
  conventional tungsten lamps. The luminance is approximately four times greater.
- As long as the lamp voltage is kept constant, the halogen lamp maintains the same level of brightness and color temperature regardless of whether it is new or nearing the end of its life.

### 3.3 Focusing block

- Focusing block is assembled on pole of the stand, and it could be fixed at any position by the lock screw.
- The fixture dimension for focusing block is Ø32mm.
- Movement range for focusing block is 30mm.

### 3.4 Stand

- Stand has a pole whose height is 300mm and diaMeter is Ø32mm.
- Adjustor on the pole could prevent focusing block from sliding down.

### 3.5 Mechanical Stage

- Mechanical stage is assembled on the stand.

### 3.6 Objectives

- Lower the stage completely. Screw the objectives into the revolving nosepiece so that clockwise rotation of the nosepiece brings the next higher magnification objective into position**.**

### 3.7 EPI Illuminator

- Loosen the arms clamp screw (Fig.3-1). Insert the round dovetail adapter on the EPI illuminator into the dovetail mount on the microscope arm.
- For the best image quality, install the EPI illuminator horizontally.

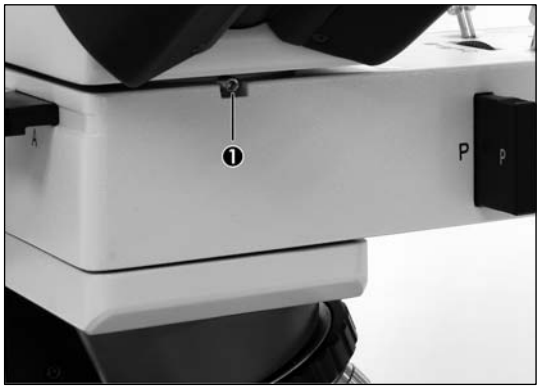

(Fig.3) Clamp screw

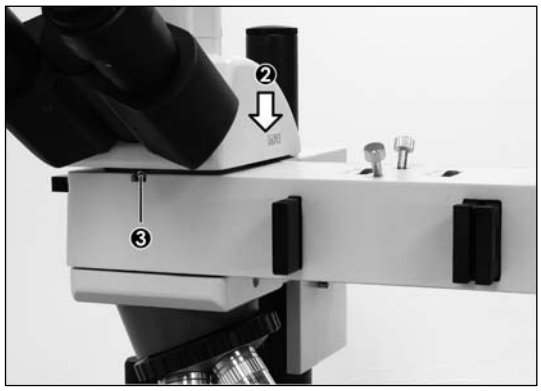
- Plug the power cord from lamp house to the outlet on the rear panel of the MRL 100.


(Fig.4)

### 3.8 Eyepiece Tube

- Loosen the eyepiece clamp screw (Fig.5a-1) and insert the dovetail adapter on the eyepiece tube into the dovetail mount on the microscope arm (Fig.5b-2). Tighten the eyepiece tube clamp screw to secure the eyepiece tube in place(Fig.5 b-3).




(Fig.5a)(Fig.5b)

### 3.9 Eyepieces

- Use the same magnification eyepieces for both the eyes.
- Insert each eyepiece into the eyepiece sleeve, and tighten the clamp screws.

### 3.10 Filters

- Pull out the slider on EPI illuminator and Place the filter and/or ground glass in the filter holder on the slider and make sure the frosted side of ground glass is faced to the lamp.
- Push the slider to make sure the filter/ground glass stay in the optical path.

# 4. MICROSCOPY

### 4.1 Power switch and Illumination Brightness Adjustment

- "I" on power switch stands for **ON** and "**O**" stands for **OFF**
- Set the power switch to "I" (**ON**).
  The green line control lamp in the switch must light up.
  The halogen lamp 12V/50 W in the EPI illuminator must light up.
- When the Brightness adjustment knob is turned clockwise to the high brightness position, the light intensity increases.


(Fig.4) **MRL 100 Power Unit**

- Check the power cord connection before switch on.
- If the specimen has high reflectivity, take note to low down the brightness before eyepieces. observation.
- A remote brightness adjustment knob is available a option to MRL100.

### 4.2 Coarse and Fine Focusing

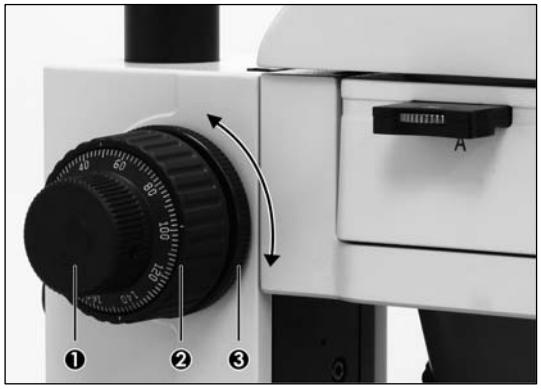
- Focusing is carried out with the coarse and fine focus knobs at the left and right of the microscope stand.
- One rotation of the fine focus knob moves the focusing block 0.2mm. The fine focus knob is 2 microns.

**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.

### 4.3 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.

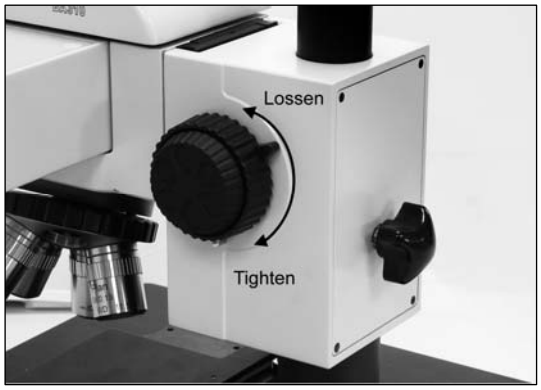



(Fig.4)

1. Coarse focus torque adjustment ring 2. Coarse focus knob 3. Fine focus knob

### 4.4 Stage upper limit stop adjustment

- With the specimen in focus, turn the stage upper limit stop knurled ring (Fig.5) clockwise until it reaches the stop.




(Fig.5) Stage Upper Limit Stop

### 4.5 Adjustor

Pole has adjustor. When raising the stage upper limit stop. Need to adjust and fix the adjustor beneath the stage upper limit stop, prevent from stage upper limit stop accident slide.

### 4.6 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.


(Fig.6)

1. Interpupillary Distance scale

### 4.7 Diopter Adjustment

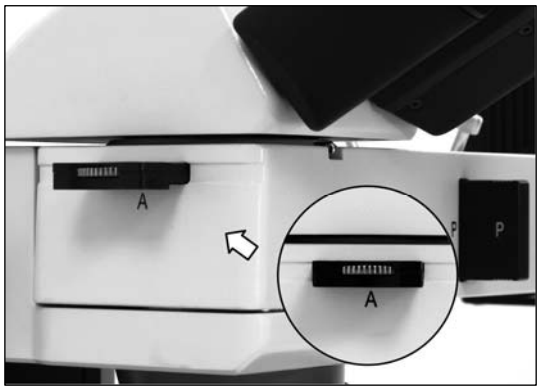
- Diopter adjustment compensates for the differences in vision between the left and right eyes. In addition to making observation through both eyes easier, this adjustment also reduces the extent to which focusing is lost when the objective magnification is changed. In particular, this occurs when a low magnification objective is used.
- Before adjusting the diopter, using 10x objective to focusing the specimen.
- Set the diopter on both eyepieces to the “0” position. Change to 40x magnification and focus the image of the specimen.
- Changes to 4x or 10x magnification, rotate eyepiece diopter compensate tube only to focus the image of the specimen without adjust coarse and fine knob.
- Repeat twice of the above steps.


(Fig.7)

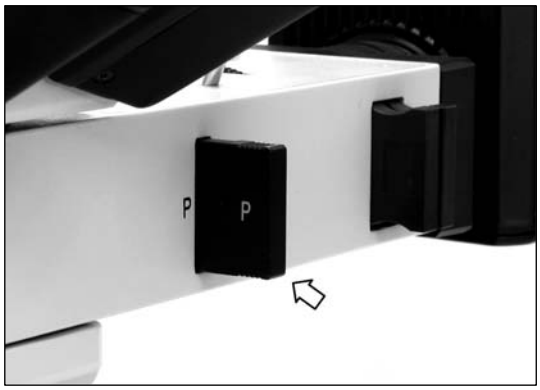
1. Diopter adjustment compensation ring  2. Diopter scale

**4.8 Use of Polariser and Analyser**

- Insert the polariser (marked with “P”) into the front slot of EPI.
- Insert the Analyser (marked with “A”) into the side slot of EPI.
- Analyser is rotatable and the color of specimen with polarization will be changed when rotating.




(Fig.8-1)



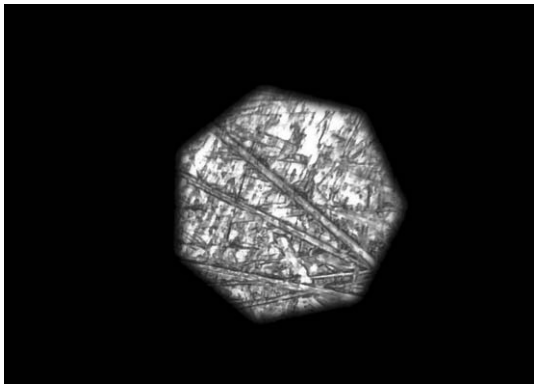

(Fig.8-2)

**4.9 Field Diaphragm Centering**

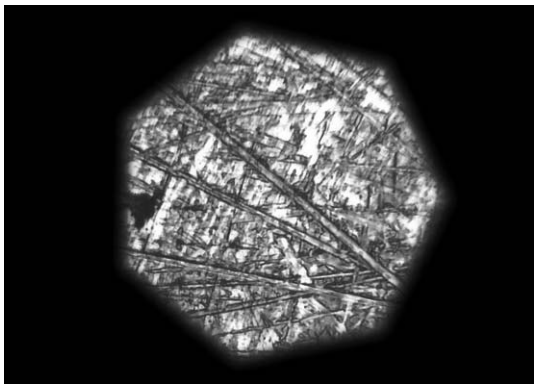
- BA310Met-H Microscope field of view is pre-focusing; clear diaphragm image can be obtained after the specimen is in focus.
- Adjust the aperture diaphragm until aperture diaphragm is 2/3 of field then center the aperture diaphragm via the knurled knob on the top of EPI illuminator.
- Set the aperture diaphragm slightly bigger than the field of view by turning the adjustment wheel.

(Fig.9)

1. Field Diaphragm  2. Field Diaphragm centering handle



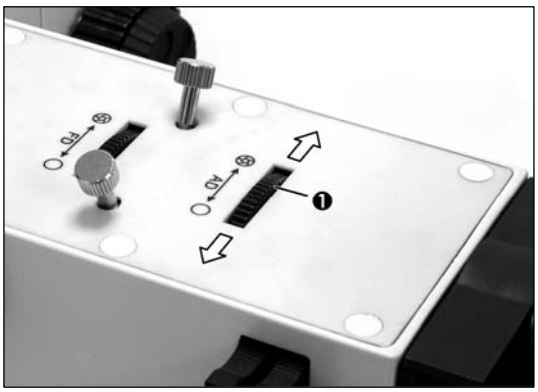
(Fig.10-1)



(Fig.10-2)

**4.10 Aperture Diaphragm Adjustment**

- Move the aperture diaphragm adjustment ring; zoom in or out the aperture diaphragm into the suited position with the objective's value.
- Adjust the suitable size of aperture diaphragm to avoid overexposure, stray light and improve the contrast.




(Fig.11)

1. Aperture diaphragm adjustment ring

**4.11 Brightness and Contrast Adjustment**

- Blue filter is used for increasing color temperature in routine bright field microscopy
- Frost filter reduces irregularity in the illumination field, but also reduces the brightness.
  To ensure enough brightness and better image quality, remove the frost filter out of light path when using the high magnification objectives and low reflectivity of sample.
- For the best contrast and image quality, adjust the condenser aperture diaphragm ever accordingly when the objective changed.

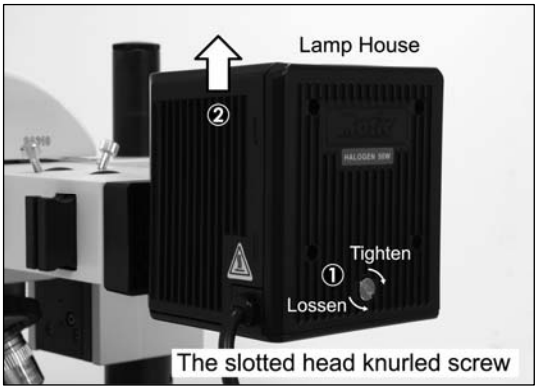
**4.12 Blub Replacement**

**Warning**

Ensure to shut down the power supply before take off the bulb to avoid electric shock.

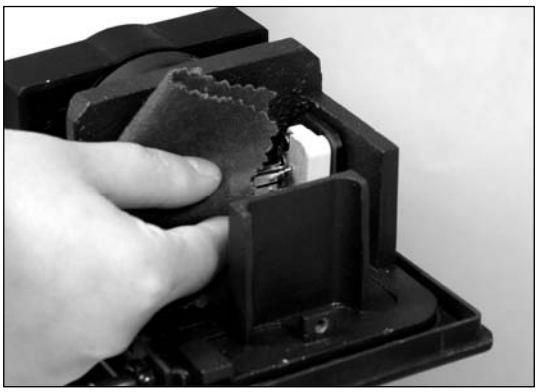
Do not touch the lamp during or immediately after period of operation.
Make sure the lamp has cooled sufficiently before attempting to replace the lamp.

a. Fully loosen the slotted head knurled screw on the backside of lamp house, take off the lamp house cover (Fig.12-1)
b. Remove the old bulb with a piece of gauze and insert the new bulb's pins all the wayinto the pin holes on the lamp socket. (Fig.12-2)




(Fig.12-1)


(Fig.12-2)



(Fig.12-3)

c. Do not touch the surface of bulb with your finger directly during assembling the bulb, otherwise you will keep fingerprint and grease on the bulb surface. The brightness of illumination will be low if we leave the fingerprint or grease on the bulb surface. Please use the lens tissue to clean the bulb if it is dirty (Fig.12-3)

d. Put back the lamp house cover, and lock the slotted head knurled screw tighten.

## 5. PHOTOMICROGRAPHIC PROCEDURE

> **!** This is high precision production; infelicity handling and operation will reduce or damage the function of production.

- To ensure vibration free operation, set the microscope on a sturdy vibration free table or a bench with a vibration proof device.
- For the same total magnification, select a combination of the highest possible objective Magnification and lowest possible projection lens magnification to achieve the utmost image definition and contrast.
- To ensure optimal illumination, check the position and centring of the lamp andposition of the condenser.
- Select a blue filter for routine application.
- Adjusting the field diaphragm is important for the purpose of limiting extraneous light that may cause flare and lower the contrast. Stop down the diaphragm to achieve an illuminated area slightly larger than that of the field of view.
- A change of depth of focus, contrast and resolution of image is attainable with anaperture setting that is 2/3 of the objective N.A.

## 6. TROUBLESHOOTING TABLE

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

**1. Optical**

| Problem | Possible Cause |
|---|---|
| Vignetting or uneven brightness in the field of view or field of view only partially visible | Lamp not installed properly or lamp dirty |
| | Frost glass is not placed in properly |
| | Use error specimen ( low reflection) |
| | Aperture diaphragm is too small |
| | Polarizing inset not on the orientation position |
| | Nosepiece is not on the orientation position |
| | Light path is not in position on the levers of switch orientation |
| Field of view dirty | Dust on specimen surface |
| | Dust on objective, filter, condenser or eyepiece |
| Poor image quality ( low resolution, poor contrast) | Lower brightness or incorrect illumination |
| | Aperture diaphragm is not match with objective aperature |
| | Use the cover glass specimen |
| | Dust or scratch on objective lens surface |
| | Grease on eyepiece |
| Image tilting | Stage surface tilting |
| | Specimen holder did not orientate correctly on stage |
| | Slide did not orientated in correct position |
| Image tinged yellow | Low voltage of bulb |
| | Check use of blue filter |
| Insufficient parfocality of objectives | Check adjustment of the eyepiece diopter |
| No cohesion of binocular image | Left right eyepiece magnification or the field of view spec is different |
| | Check interpupillary distance is correctly adjusted |
| | Check adjustment of the eyepiece diopter |

| | |
|---|---|
| Eye strain or fatigue | Check Interpupillary distance |
| | Check Diopter adjustment |
| | Field of view of left and right eyepiece differ |
| | Inadequate illumination |

**2. Electrical**

| | |
|---|---|
| Lamp does not light | Power supply not plugged in |
| | Lamp not installed |
| | Lamp burnt out |
| Inadequate brightness | Specified lamp not being used |
| Bulb blows out immediately | Specified lamp not being used |
| Light flickers | Connectors are not securely connected |
| | Lamp near end of service life |
| | Lamp not securely plugged into socket |

# 7. CARE AND MAINTENANCE

### 7.1 Lenses and Filters

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

### 7.2 Cleaning of painted or plastic components

- Do not use organic solvents (thinners, alcohol, ether, etc.). Doing so could result in discoloration 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.

### 7.3 Instrument storage

- 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 desiccators with drying agent.

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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