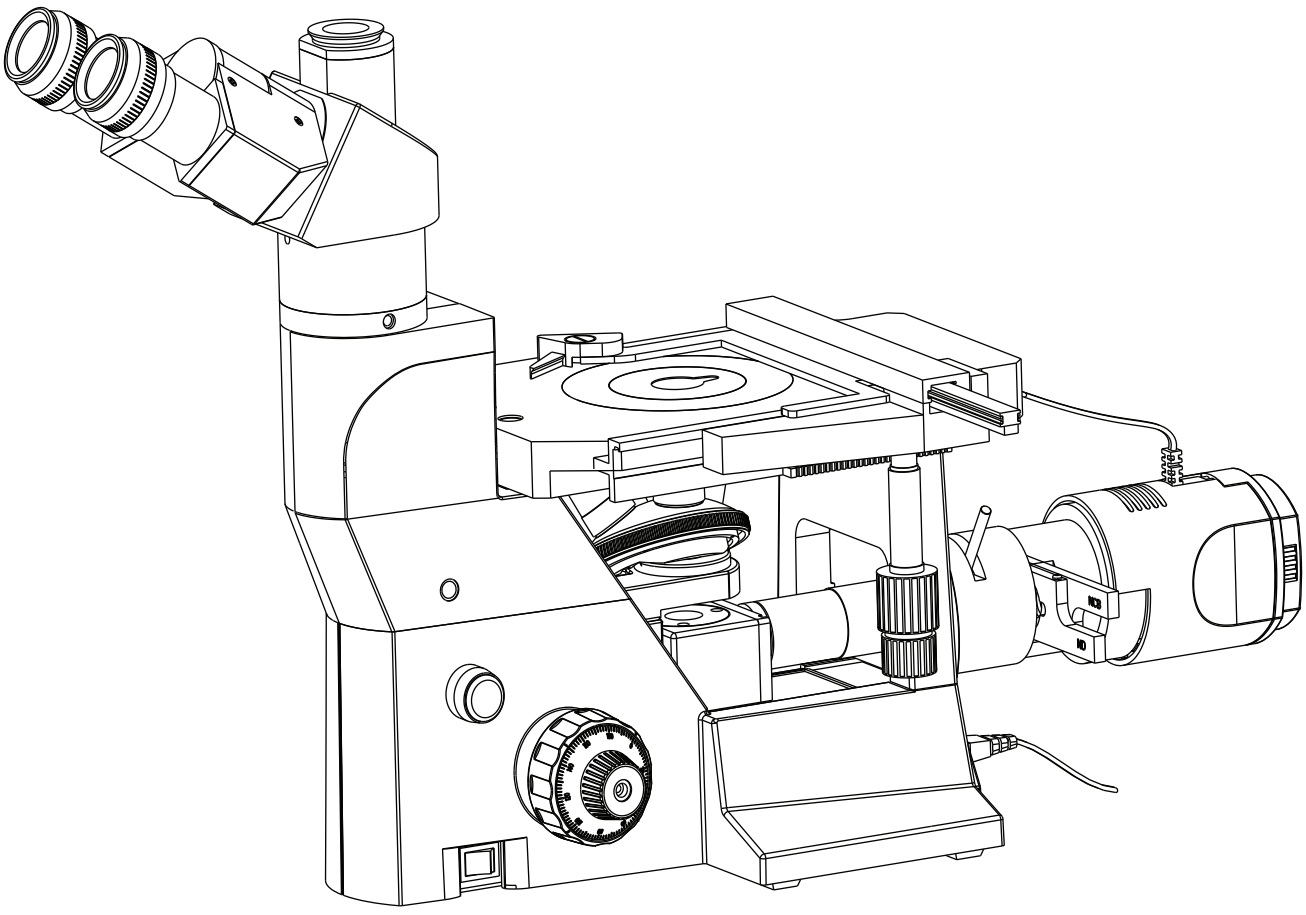
LABOMED
ideas for vision

MET 400
Inverted Metallurgical Microscope

User Manual



To ensure correct use of this instrument and to avoid injury during operation,
read this manual completely before use.

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1 INTRODUCTION

The MET 400 inverted microscope sets a new standard for inverted metallurgical microscopes.

It combines high performance and distinctive styling with the high-quality craftsmanship for which LABOMED is known. Excellent images and ease of use are the foundation of the LABOMED MET 400.

With its ergonomic and aesthetically configured design, the MET 400 is the instant choice for metallurgical studies and related sciences. Its infinity-corrected true-color optical system, choice of observation tubes, soft-feel turret movement and stage with micromanipulation offer outstanding performance.

The user should be aware that the protection provided by the equipment may be impaired if it is used with accessories not provided or recommended by the manufacturer, or in a manner not specified by the manufacturer.

2 SAFETY INFORMATION

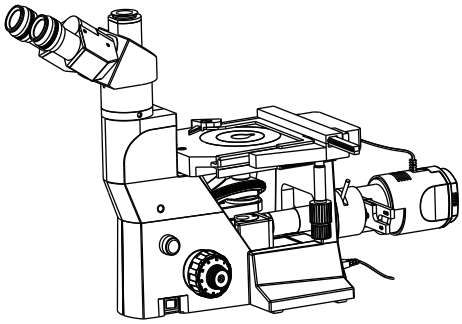


Fig. 1

1. It is important to follow the safety instructions carefully to avoid any personal injury or damage to this instrument. For your safety, read this manual thoroughly. Do not discard it; keep it for easy reference during operation.

2. To avoid potential electrical hazards when replacing the halogen bulb, set the main switch of the microscope to OFF and disconnect the power cord from the wall outlet beforehand. Whenever you replace the bulb, allow the lamp socket and bulb to cool before touching them (Fig. 1).

Applicable replacement bulb: 6V 30W halogen bulb, P/N EL-455

SAFETY SYMBOLS

The following categories describe the degree of danger or damage likely to result from user error made in ignorance of these symbols.

Symbol	Explanation
	Hot parts symbol. This symbol is placed on the bulb housing and on other parts to indicate that they may be hot. Never touch these parts immediately after the equipment has been used. Allow sufficient time for them to cool before touching them. In the event of user error, injury is possible.
 WARNING	In the event of user error, death or serious injury is possible.
 ATTENTION	In the event of user error, the product may be damaged.
	The icons are explained below.
	This icon denotes “Refer to User Manual” and “Caution”.
	This icon represents protective earth.
	This icon represents alternating current.
	This icon indicates that the power switch is OFF.
	This icon indicates that the power switch is ON.
Labeling Information	
SN	The number following this symbol indicates the serial number of the equipment.
REF	The characters following this symbol indicate the catalog number of the equipment.

3 UNPACKING YOUR MICROSCOPE

The MET 400 is securely packed in custom-configured foam packing to protect it from shocks and damage in transit.

After removing your microscope from its packing, make sure that all of the following contents are present. Please note that the contents of your microscope may vary, as the optional configuration, contrast method or viewing body ordered may differ from the standard configuration listed here:

1. Microscope body

2. Observation tubes, as ordered

3. Pair of eyepieces

4. 2 filter sliders (ND and NCB)

5. Stage plate (fitted on the body)

6. Objective set, standard: 5x, 10x, 20x and 50x

7. Epi illuminator assembly with two filter slots

8. Installation tool: 3mm Allen key

9. Power cord

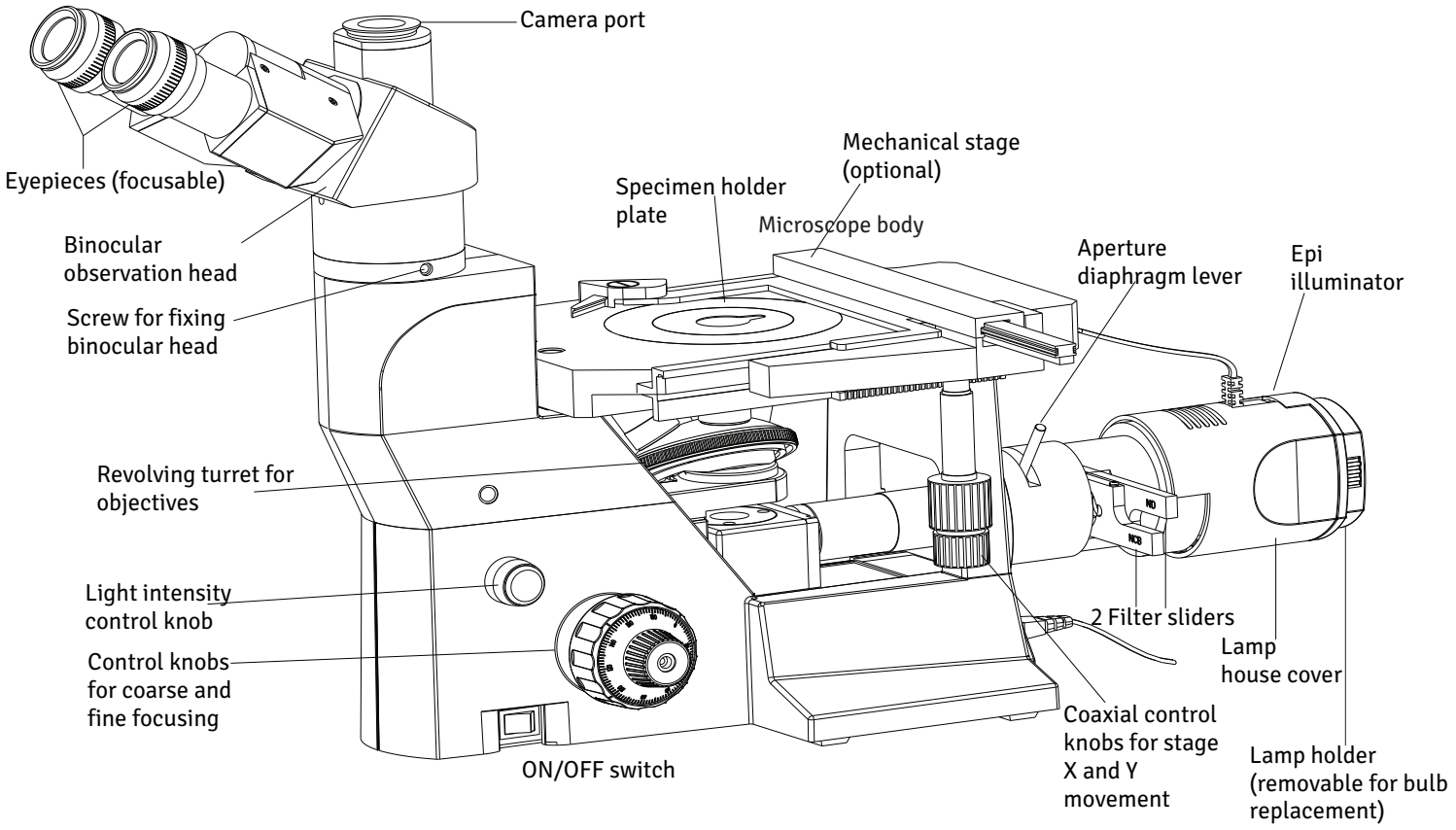
10. Mechanical stage (optional), if ordered

11. Specimen holder plate

12. Petri dish holders in three different sizes

13. Two hand rests

4 DIAGRAM SHOWING PARTS



TRINOCULAR MET 400
Fig. 2

5 INSTALLING THE INCIDENT LIGHT ILLUMINATOR

ILLUMINATOR

The illuminator unit is fixed to the main microscope body with 3 screws, using the Allen wrench supplied with the illuminator. Three tapped holes are provided in the base unit, as shown in the diagram below.

Important note: Make sure that the power cord is not connected at this stage.

After the illuminator assembly is properly fixed, connect the cable from the lamp house to the socket provided in the base of the microscope, as shown in the picture below.

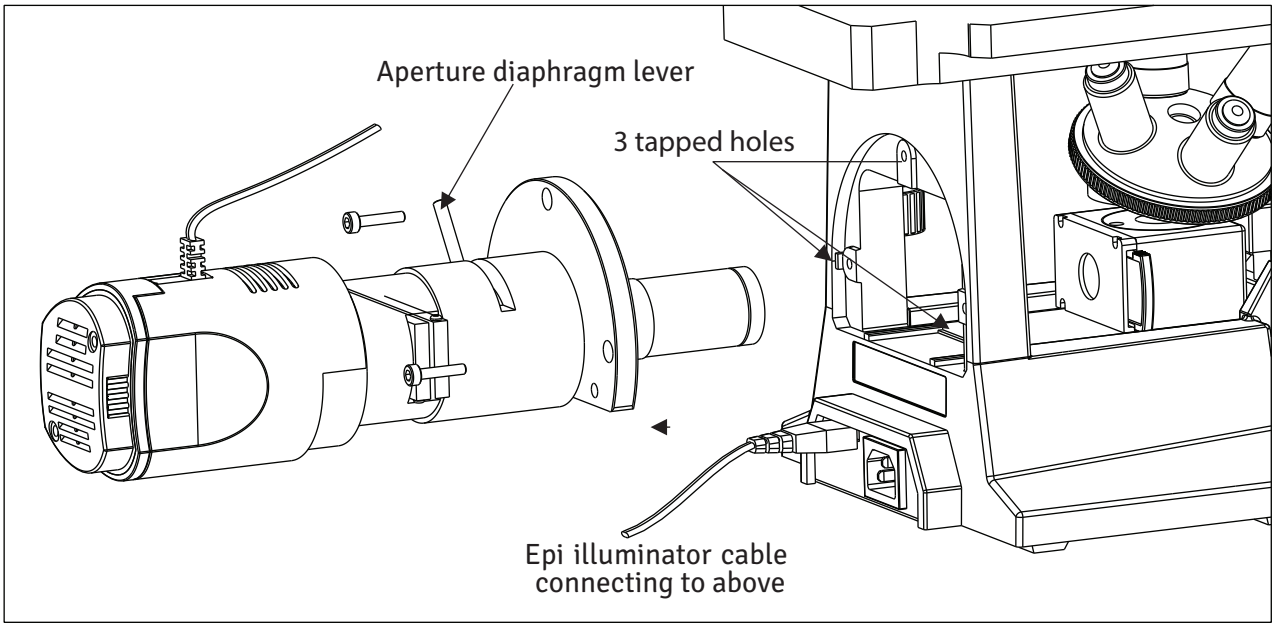


Fig. 3

Adjusting the Aperture Diaphragm

To achieve good resolution, contrast and depth of focus in the optical image, it is necessary to control the numerical aperture of the illumination system with the lever provided on the illuminator (see the diagram above).

Reducing the aperture increases the contrast and the depth of focus. Increasing the aperture increases the brightness and resolution.

1. Place a specimen with a plain surface on the stage.
2. Focus on the specimen with the 10X objective.
3. Remove one of the eyepieces and look through the eyepiece tube to make sure that the diaphragm image is visible in the pupil of the objective.
4. We recommend setting the aperture diaphragm image to about 3/4 of the objective pupil. Adjust the aperture lever to obtain the image quality you require.

6 INITIAL SETUP AND ASSEMBLY

1 OBSERVATION HEAD

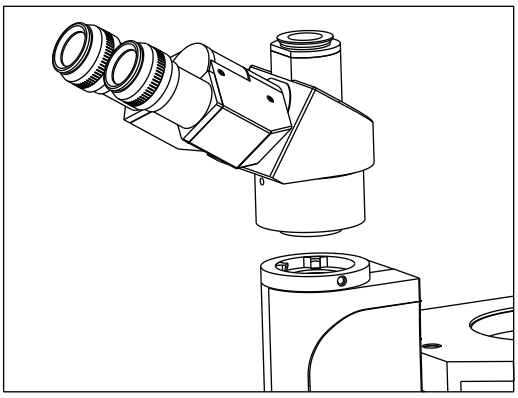


Fig. 4

The base unit is assembled with the coaxial focus mechanism, turret and stage plate, as described in the procedure below:

Install the observation head using the following procedure, as shown in Fig. 4:

1. Using the 3mm Allen wrench (provided), loosen the head locking screw (1) and remove the dust cover caps from the dovetail cavity and from the observation head dovetail.
2. Mount the observation head by engaging it in the dovetail cavity of the microscope arm.
3. Tighten the head locking screw (1) after positioning the observation head as desired (see Fig. 4).

2 MOUNTING THE OBJECTIVES

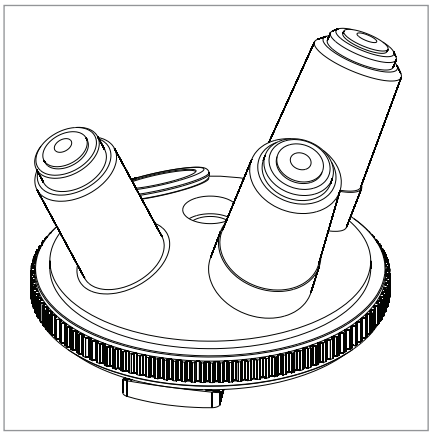


Fig. 5

Lower the nosepiece by turning the coarse adjustment knob toward the back. Remove the dust prevention caps from the nosepiece.

Screw the objective with the lowest magnification into the revolving nosepiece from the left side of the microscope. Turn the nosepiece clockwise and mount the remaining objectives in ascending order of magnification (Fig. 5).

⚠ **Clean the objectives periodically.**
⚠ **Be sure to cover any unused threaded position on the nosepiece with the dust prevention caps to keep dirt and dust from getting inside.**

3 MOUNTING THE EYEPIECES

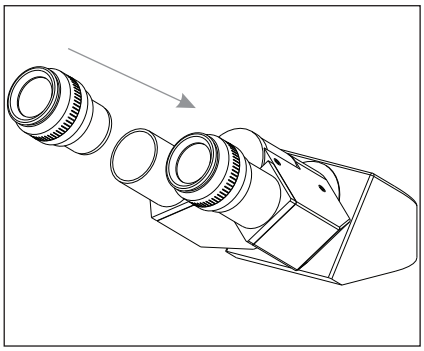


Fig. 6

Insert the eyepieces into the eyepiece tubes of the observation head after removing the protective caps from the tubes.

For diopter adjustment of the eyepieces, see page 7.

4 ADJUSTING THE INTERPUPILLARY DISTANCE (IPD)

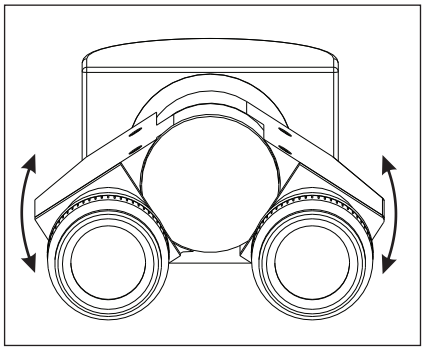


Fig. 7

The interpupillary distance adjustment aligns the two eyepieces with the pupils of both eyes so that you observe a single microscopic image through the two eyepieces in stereo vision. This greatly helps to reduce fatigue and discomfort during observation.

While looking through the eyepieces, move both eyepieces laterally until the left and right fields of view coincide completely. The position of the index dot (▪) indicates the interpupillary distance value.

Note your interpupillary distance so that it can be quickly set again in the future. This is especially important if several users work with the microscope.

5 ADJUSTING THE DIOPTER

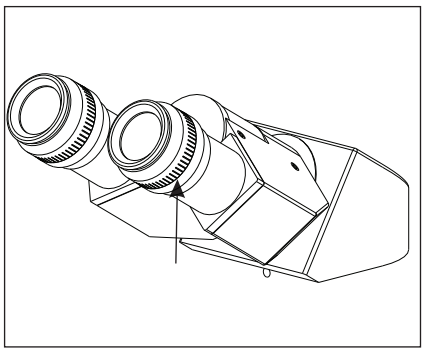


Fig. 8

Set the diopter adjustment to the "0" position by matching the fiducial lines on both eyepieces. Then, looking through one eyepiece (either left or right), turn the coarse and fine focus knobs to bring the specimen into focus.

Then look through the other eyepiece and optimize the focus on that side by adjusting the diopter scale of that eyepiece.

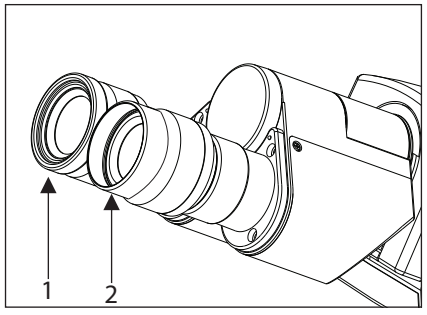


Fig. 9

Using the Eye Guards

When wearing eyeglasses
Use the eye guards in the normal, folded-down position. This prevents the eyeglasses from being scratched (Fig. 9, part 1).

When not wearing eyeglasses
Extend the folded eye guards outward (direction of the arrow) to keep ambient light out of your line of vision (Fig. 9, part 2).

7 MOUNTING THE MECHANICAL STAGE

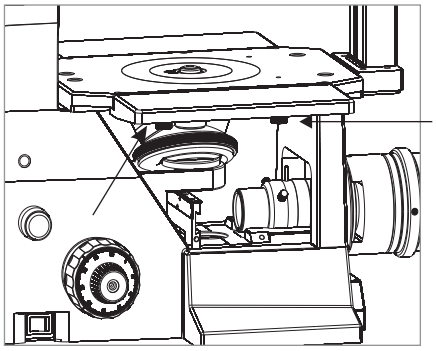


Fig. 10.1

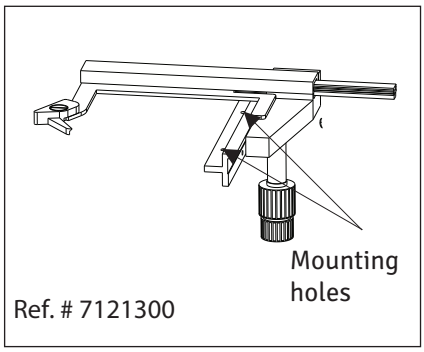


Fig. 10.2

The mechanical stage is mounted on the right side of the square stage with the two clamping screws (provided) underneath the plain square stage (shown by arrows in Fig. 10.1).

8 BULB REPLACEMENT

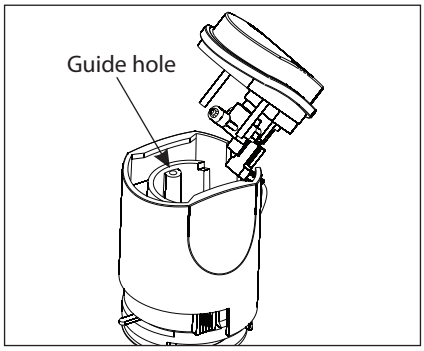


Fig. 11

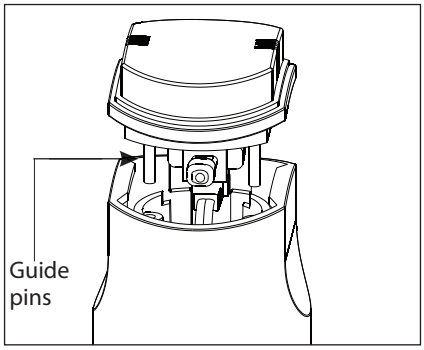


Fig. 12

Make sure that the power cord is not connected.

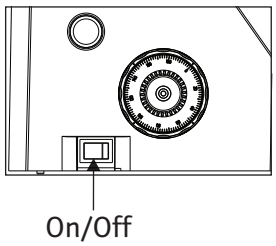
Use only the recommended 6V-30W high-intensity halogen bulb. Applicable replacement bulb: 6V-30W halogen bulb, P/N EL-455.

Pull out the lamp socket and remove the blown bulb using a soft cloth. Gently insert the new bulb. **Do not squeeze or press the bulb too hard, as this can damage the bulb and injure your hand.**

Fit the lamp socket by aligning the guide pins with the guide holes. Push the lamp socket gently into the lamp house (Fig. 11, 12).

7 SUMMARY OF BRIGHTFIELD OBSERVATION PROCEDURE

Set the main switch to “ON”.



Place the specimen on the stage, polished surface facing the objective below.

Engage the 10X objective in the light path.

Adjust the observation tube and eyepieces.
Adjust the interpupillary distance.
Adjust the diopter setting.

Adjust the aperture diaphragm of the epi illuminator (see p. 5).

Engage the objective to be used in the light path and bring the specimen into focus.

Engage the required filters.

Adjust the brightness.

Observe the specimen.

8 DETAILED OBSERVATION PROCEDURE

1 TURNING ON THE LAMP

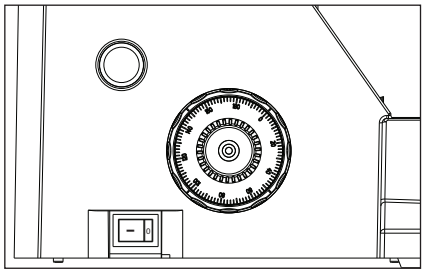


Fig. 13

1. Set the main switch to “I” (ON), as shown in Fig. 13.
2. Turning the light intensity knob in the direction of the arrow increases the brightness; turning it in the opposite direction decreases the brightness. The intensity bar on the knob indicates the direction of increasing intensity.

2 PLACING THE SPECIMEN ON THE STAGE

Place the metallurgical specimen on the stage plate. The specimen should have a sufficiently polished, reflective surface.
If a mechanical stage is mounted on your microscope, use the appropriate holder plates (see details on page 13).

3 ADJUSTING THE FOCUS

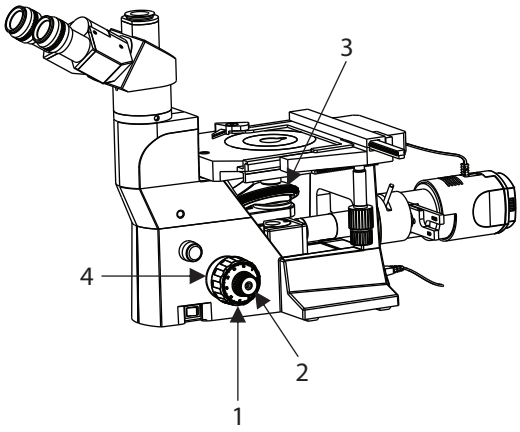


Fig. 14

Focus procedure: using the coarse and fine focus knobs

1. Rotate the coarse adjustment knob (1) clockwise so that the objective (3) is as close as possible to the specimen (we recommend starting with 10X).
2. While observing the specimen through the eyepieces, slowly rotate the coarse adjustment knob (1) counterclockwise to lower the objectives.
3. When the specimen is coarsely focused (an image is observed), rotate the fine adjustment knob (2) to focus on fine detail.
4. Adjusting the torque of the coarse focus knob: rotating the tension adjustment ring toward the coarse knob increases the focusing torque; rotating it toward the stand decreases the focusing torque.

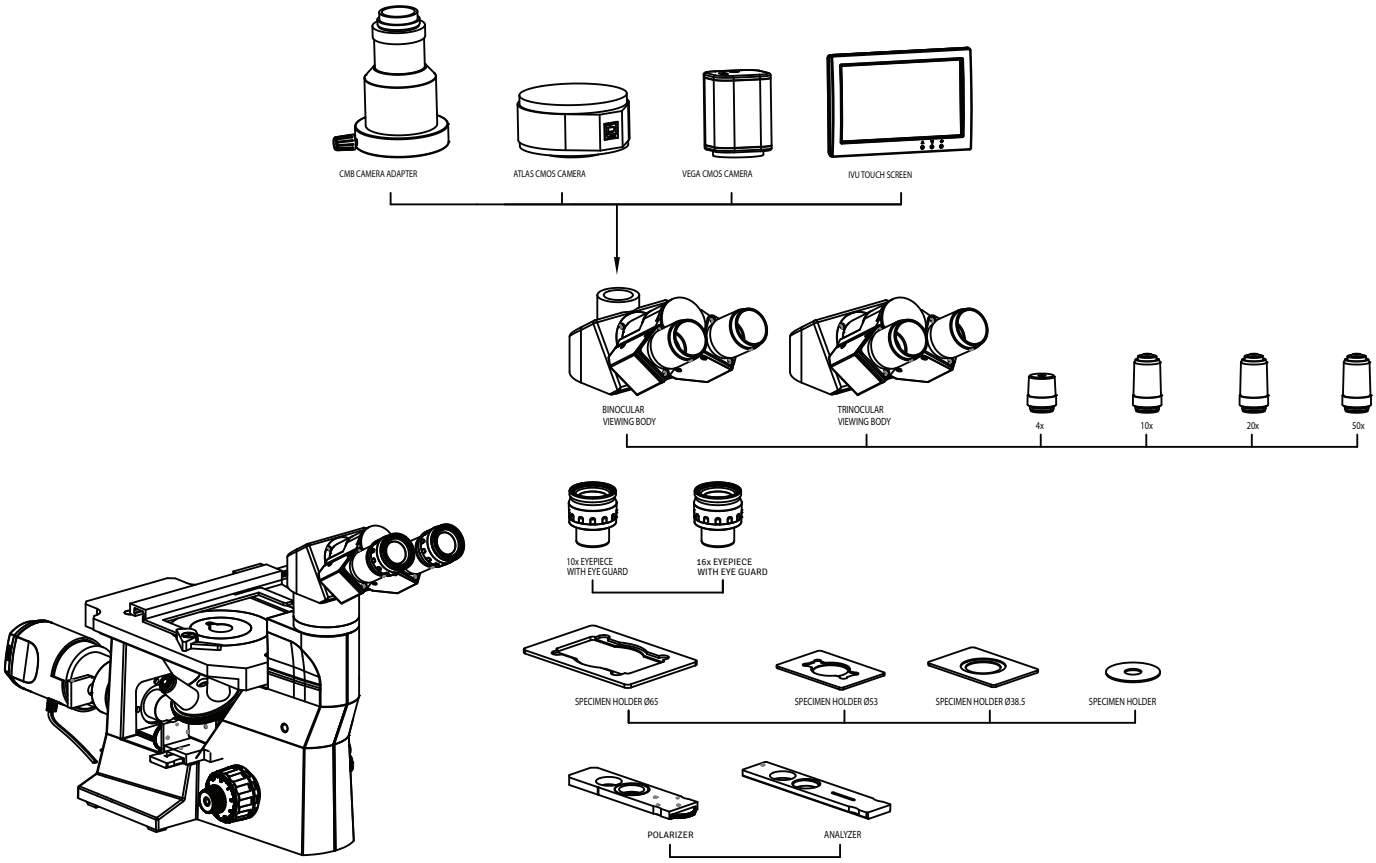
Working Distance (WD)

The WD is the distance between each objective and the specimen when the specimen is in sharp focus.

Objective Magnification	5X	10X	20X	50X
WD (mm)	17.5	6.8	11.1	8.2

9 OPTIONAL ACCESSORIES

SYSTEM DIAGRAM OF OPTIONAL ACCESSORIES



INSTALLATION AND OPERATION OF OPTIONAL ACCESSORIES

1 CAMERA MODULE SYSTEM

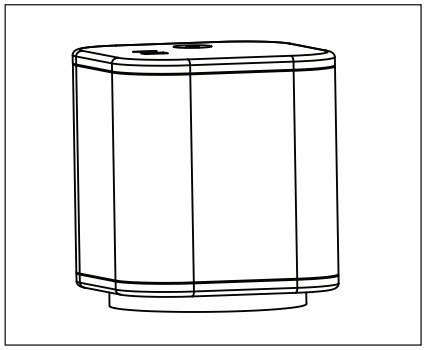


Fig. 15

1. Mount the 1/2″ video adapter on the trinocular observation head.
2. Mount the camera module system on the video adapter.

10 CARE AND MAINTENANCE

1 CARE AND MAINTENANCE

Your microscope has been engineered for a long and safe operating life with the least amount of maintenance. In general, routine maintenance is limited to keeping the working parts of the microscope lubricated and the optics clean. Always cover the microscope with the dust cover provided when it is not in use.

Optical cleaning

1. The objectives have been adjusted for a tight fit to prevent any damage during transportation. To remove an objective, rotate it counterclockwise while gripping it with a rubber sheet or similar to avoid slipping.
2. To clean the lens surfaces, remove dust with a soft brush or gauze (compressed-air dust cans are ideal). To remove fingerprints or grease, use a soft cotton cloth or lens tissue lightly moistened with cleaning solution (85% petroleum ether and 15% isopropanol). For cleaning the optics, use methanol. Use sufficient caution when handling methanol. Place the objectives and/or eyepieces on a dust-free surface (e.g. aluminum foil). All other optical components to be cleaned should be as accessible as possible.
3. Blow all loose dust particles away with a dust blower.
4. Remove all water-soluble dirt with distilled water. If this is unsuccessful, repeat with a solution of diluted liquid hand soap. Remove any remaining residue with a dry cotton swab.
5. To remove oil, first use a solution of diluted liquid hand soap. If this does not produce a satisfactory result, repeat the cleaning with a solvent (optical cleaning solution: 85% petroleum ether and 15% isopropanol).
6. Grease must always be removed with a solvent.
7. Clean with a spiral motion from the center to the rim. Never wipe with zig-zag movements, as this will only spread the dirt. On larger optical surfaces (e.g. tube lenses), the spiral motion first goes from the rim to the middle and is then followed by a center-to-rim cleaning motion. Several spiral wipes are normally recommended.

We recommend pure, volatile petroleum ether or optical cleaning solution as described above.



zig-zag motion (X) spiral motion (✓)

Wipe with a spiral movement. Do not use a zig-zag motion!

Cleaning painted surfaces

Do not use any organic solvent (e.g. thinner, xylene, ether, alcohol) to clean the painted surfaces of the instrument. Painted surfaces can be cleaned with a very lightly moistened microfiber cloth. Loose dust and dirt can be removed with a soft-hair brush used exclusively for this purpose.

11 SPECIFICATIONS

1. Illumination	Built-in incident illumination system, halogen lamp 6V-30W			
2. Focusing mechanism	Stage height adjustment mechanism Fine adjustment scale: 0.002mm per graduation Fine adjustment stroke: 0.2mm per turn Total stroke: 20mm Coaxial coarse and fine focusing on ball drive			
3. Revolving nosepiece	Quadruple, fixed positions			
4. Observation tube		Binocular	Trinocular	Ergonomic
	Field number	22	22	22
	Tube tilting angle	30°	30°	0° to 25°
	Interpupillary distance adjustment range	52-75	52-75	52-75
5. Stage	Size	240 x 160mm		
	Movement range	78 x 54mm with mechanical stage		
	Specimen holder	3 different shapes		
6. Dimensions and weight	495.0mm (L) x 300.0mm (W) x 470mm (H); 9.5 kg net			
7. Electrical	Lamp	Halogen, 6V-30W		
	Lamp life	Up to 100 hours		
	Input	100V-240V AC, 50/60 Hz		
8. Operating environment	Indoor use Altitude: max. 2000 meters Ambient temperature: 5° to 40°C (41° to 104°F) Maximum relative humidity: 80% for temperatures up to 31°C (88°F), decreasing linearly through 70% at 34°C (93°F) to 50% relative humidity at 40°C (104°F) Supply voltage: 100V AC to 240V AC Supply voltage fluctuations: not to exceed ±10% of the nominal voltage Power consumption: 50W; fuse: F5A/250V Power supply to the halogen lamp: 6V, 30W Pollution degree: 2 (in accordance with IEC 60664) Installation/overvoltage category: II (in accordance with IEC 60664)  CAUTION: HIGH VOLTAGE FUSE REPLACEMENT  WARNING: HIGH VOLTAGE POWER INLET  EARTH  WARNING: HIGH TEMPERATURE			

12 TROUBLESHOOTING GUIDE

Under certain conditions, the performance of the unit may be adversely affected by factors other than defects. If problems occur, review the following list and take corrective action as needed. If the problem persists, contact LABOMED or your local LABOMED dealer.

TROUBLE	CAUSE	REMEDY
1. The power is on, but the field of view is dark.	The socket pin from the illumination column is not connected to the back of the instrument. The bulb is burned out. The light intensity control is set too low. The objective is not in position. The fuse has blown.	Connect it securely. Replace the bulb. Set the illumination to the desired level. Make sure that the objective clicks into place. Replace the fuse (250V / 5A).
2. Dirt or dust is visible in the field of view.	Dirt/dust on the specimen. Dirt/dust on the eyepieces.	Clean the specimen. Clean them thoroughly.
3. Visibility is poor: - The image is not sharp. - Contrast is poor. - Details are indistinct.	The specimen is not correctly engaged. The aperture iris diaphragm is opened or stopped down too far in brightfield observation.	Replace it with a clean specimen. Clean the eyepieces gently. Adjust the aperture.
4. One side of the image is blurred.	The revolving nosepiece is not correctly engaged. The specimen is not correctly mounted on the stage.	Make sure that the revolving nosepiece clicks properly into place. Place it correctly on the stage.
5. The bulb flickers and the brightness is unstable.	The line voltage fluctuates. The bulb is nearly burned out. The power cord is not connected securely.	Use a voltage stabilizer. Replace the bulb. Connect it securely.
6. The coarse adjustment knob is too difficult to rotate.	The tension adjustment ring is too tight. The tension adjustment ring is too loose.	Adjust it appropriately. Tighten it appropriately.
7. The field of view of one eye does not match that of the other.	Incorrect interpupillary distance adjustment. Incorrect diopter adjustment.	Adjust the interpupillary distance. Adjust the diopter.

LABOMED
ideas for vision

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