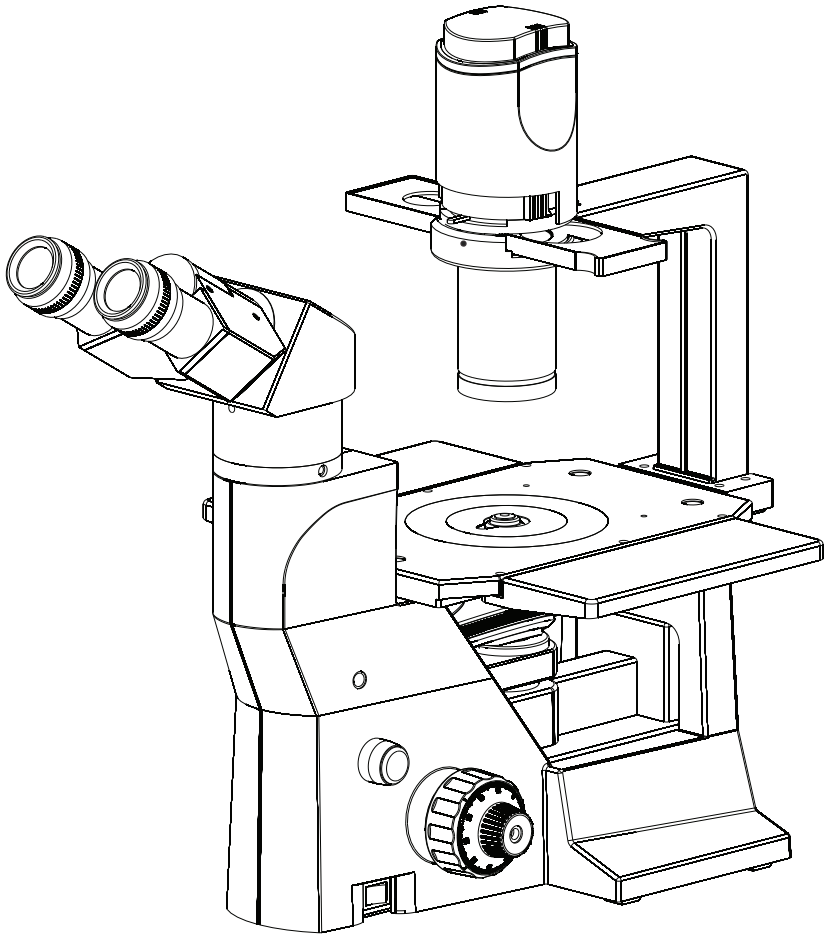
LABOMED
ideas for vision

TCM 400
Inverted Tissue Culture 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 TCM 400 inverted microscope sets a new standard for inverted tissue culture 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 TCM 400.

With its ergonomic and aesthetically configured design, the TCM 400 is the instant choice for culture studies in modern bioscience. Its infinity-corrected true-color optical system, choice of observation tubes, soft-feel turret movement, stage extenders and micromanipulators 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

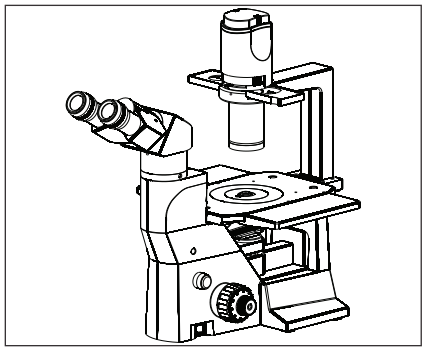


Fig. 1

1. After the microscope has been used to observe a specimen containing bacteria, clean all parts that came in contact with the specimen to prevent infection.
- Be sure to remove the specimen before moving this product.
- If the specimen is damaged by incorrect operation, clean all surfaces that may have come in contact with the specimen.

2. To avoid 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

3. Install the microscope on a sturdy, level table or bench and do not obstruct the air vents in the base of the unit. Do not place the microscope on a flexible surface, as this could block the air vents and cause overheating.
4. Always use the power cord provided by LABOMED. If the proper power cord is not used, the safety performance of the product cannot be warranted.
5. When installing the microscope, route the power cord away from the microscope frame. If the power cord comes in contact with the base of the microscope, it could melt from overexposure to heat.
6. Always make sure that the grounding terminal of the microscope and that of the wall outlet are properly connected. If the unit is not grounded, LABOMED cannot warrant electrical safety.
7. Never allow metal objects to enter the air vents of the microscope frame, as this could result in injury to the user and damage to the microscope.
8. After using the microscope, be sure to disconnect the power cord from the connector socket of the microscope or from the wall outlet.

SAFETY SYMBOLS

The following categories describe the degree of danger 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.

Caution

If the microscope is used in a manner not specified in this manual, the safety of the user may not be warranted. In addition, the equipment may be damaged. Always use the equipment as outlined in this instruction manual.

1 GETTING STARTED

1. A microscope is a precision instrument with delicate glass components. Handle it with care.
2. Do not use the microscope where it is exposed to direct sunlight, high temperature, humidity, dust or vibration. (For the operating conditions, see chapter 13, “TECHNICAL SPECIFICATIONS”.)
3. The microscope is ventilated by natural convection. Be sure to leave enough space (10cm or more) around the body when installing the unit.

⚠ **To prevent damage, do not hold the microscope by the stage or observation tube.**
Be sure to remove the specimen from the stage clip when transporting the unit, to avoid damaging the specimen slide.

2 MAINTENANCE AND STORAGE

1. Clean all glass components by wiping them gently with the cleaning cloth provided. To remove fingerprints or oil smudges, wipe with the cleaning cloth slightly moistened with a mixture of petroleum ether (85%) and isopropanol (15%).

Since solvents such as petroleum ether and isopropanol are highly flammable, they must be handled carefully. Keep these chemicals away from open flames and potential sources of electrical sparks, for example electrical equipment that is being switched “ON” or “OFF”. Always use these chemicals only in a well-ventilated room.

2. Do not use organic solvents to clean microscope components other than the glass components. To clean non-glass components, use a lint-free, soft cloth slightly moistened with a diluted neutral detergent.
3. Do not disassemble any part of the microscope, as this could result in malfunction or reduced performance.
4. When the microscope is not in use, make sure that the frame has cooled completely before storing the unit in a dry cabinet or covering it with the dust cover (provided).
5. To clean the condenser, remove it by rotating it counterclockwise. Wipe the front lens of the condenser with optical cleaning solution (the mixture suggested above) and lens tissue.
6. Be sure to observe your local rules and regulations for product disposal.

3 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)



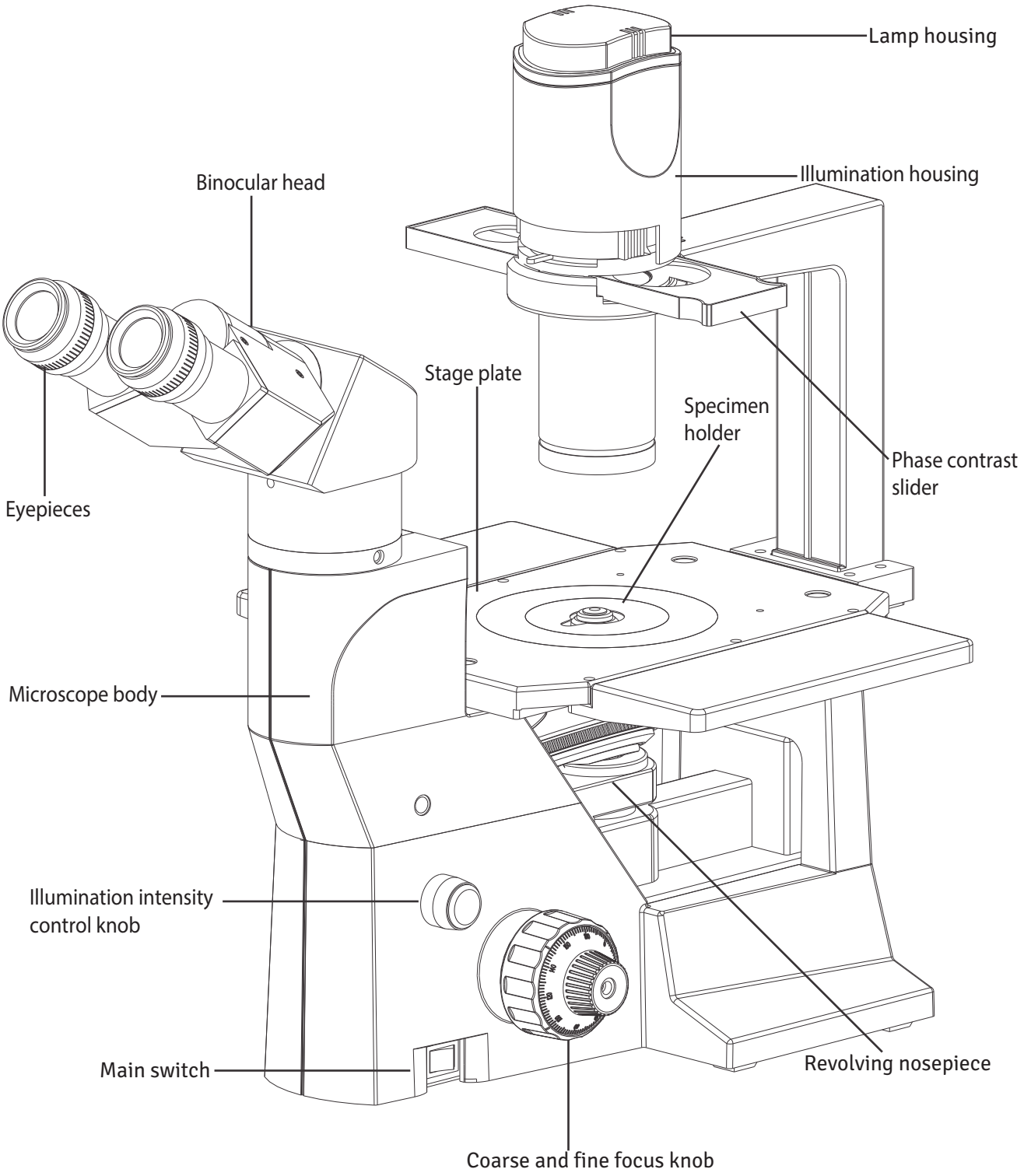
Spiral motion (✓)

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

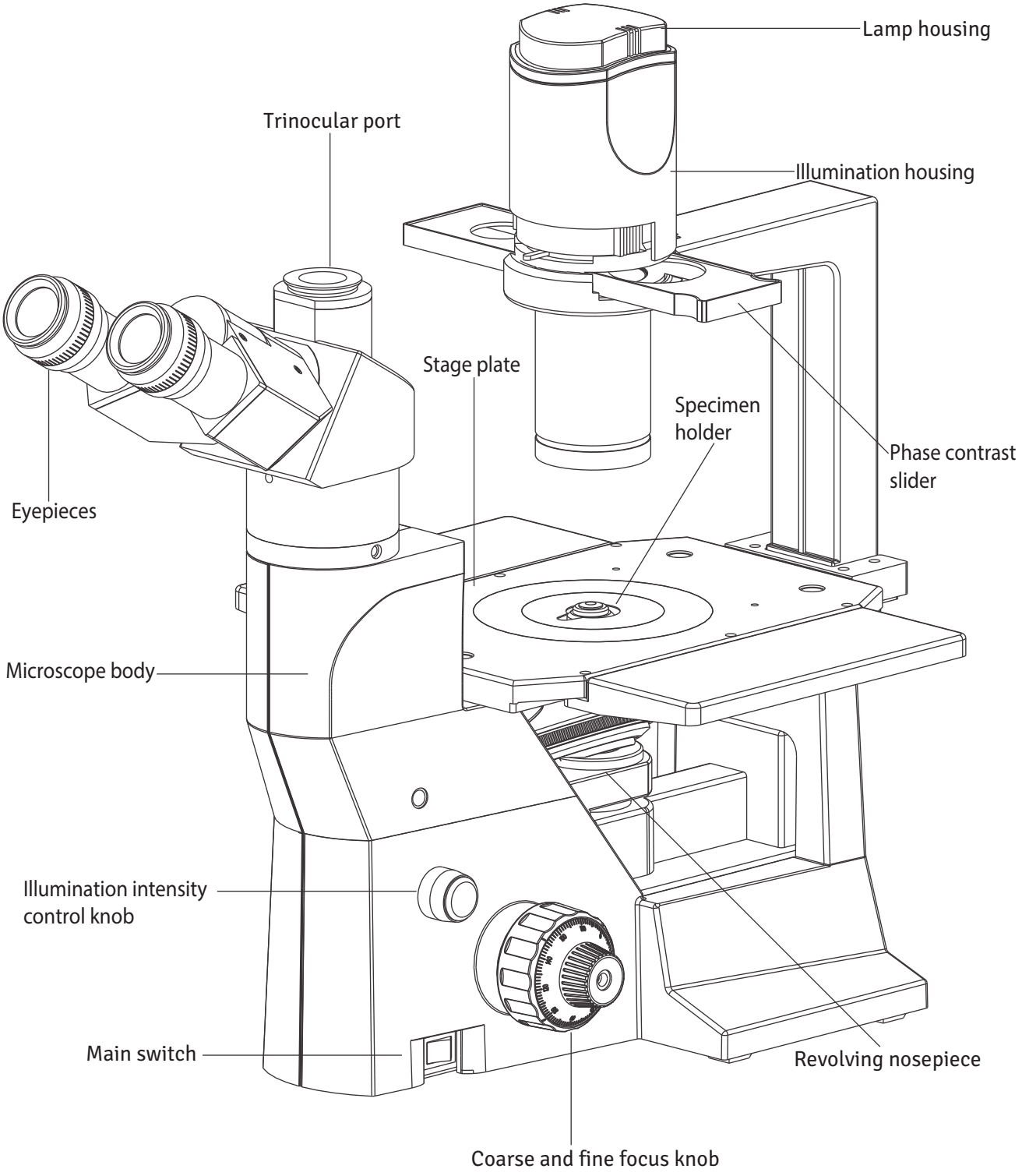
Cleaning painted surfaces

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.

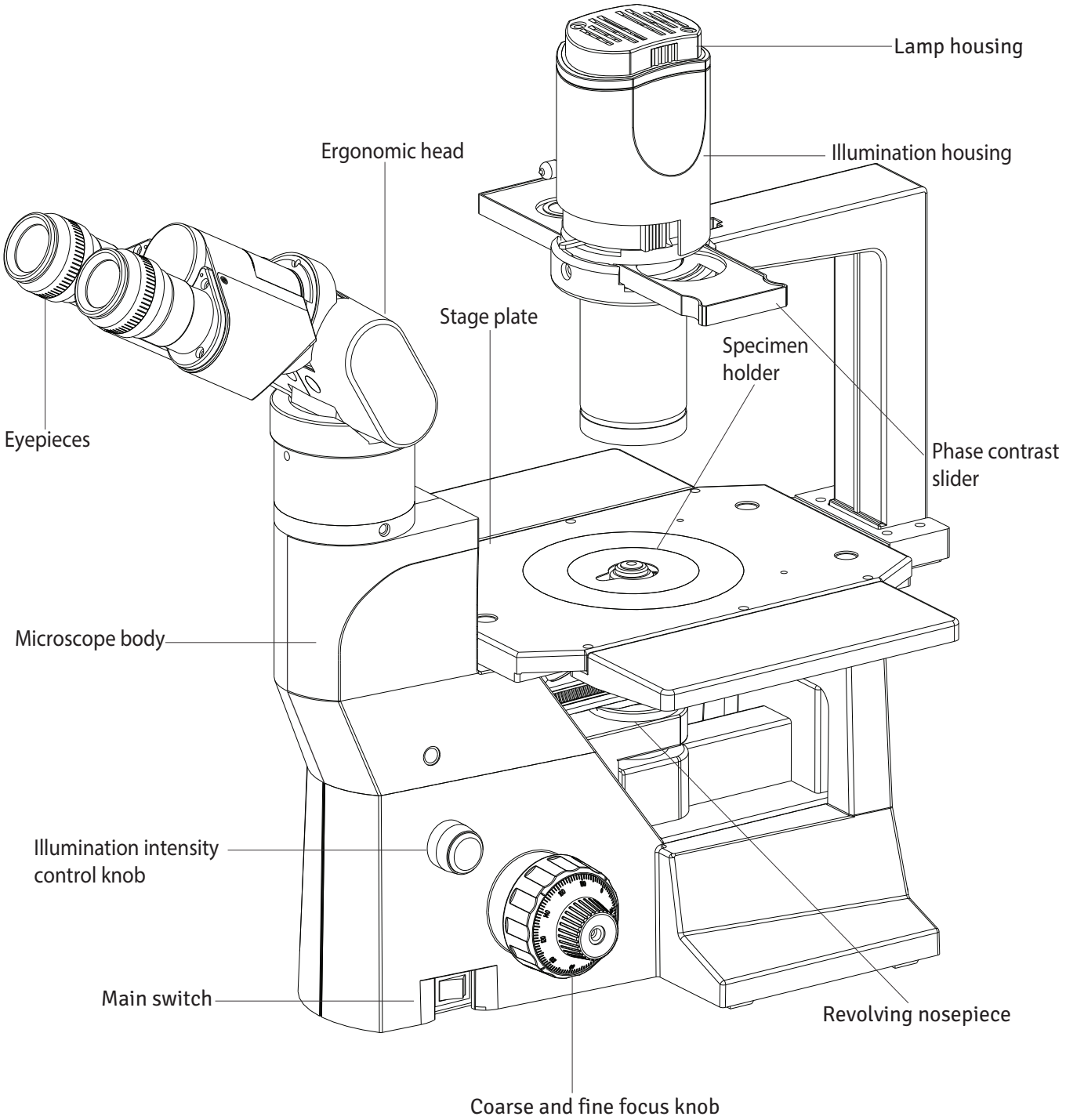
3 TCM 400 BINOCULAR



4 TCM 400 TRINOCULAR



5 TCM 400 ERGONOMIC



6 UNPACKING YOUR MICROSCOPE

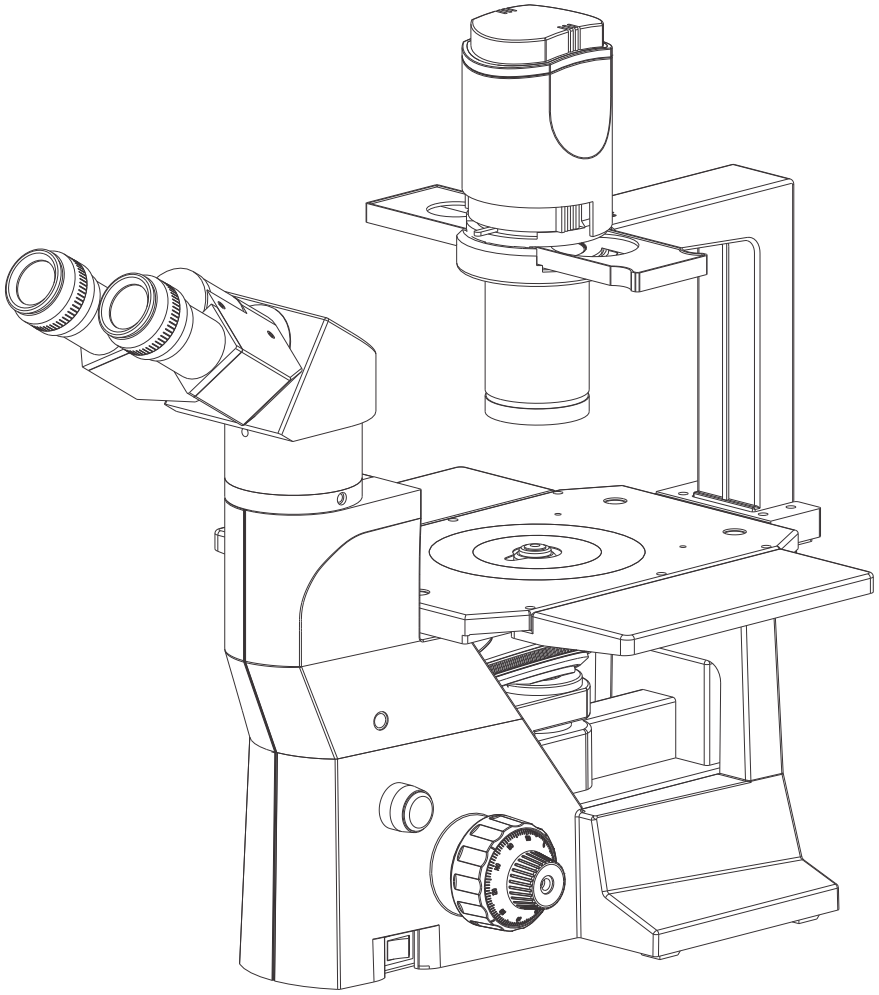
The TCM 400 is securely packed in custom-configured foam packing to protect it from shocks and damage in transit.

Make sure that you have received all of the following components before discarding the packing material:

a. Microscope body
b. Observation tubes, as ordered
c. Eyepieces
d. Illumination housing
e. Stage extension plates
f. Specimen plate
g. Phase slider
h. Phase telescope
i. Objectives, as ordered
j. Blue filter
k. Green filter
l. Frosted filter
m. Installation tools
n. Power cord
o. Spare fuses, as ordered
p. Spare bulb, as ordered
q. Adapter for telescope
r. Dust cover

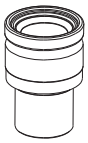
7 STANDARD COMPONENTS

After removing your microscope from its packaging, 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 shown here.





Daylight (blue) filter



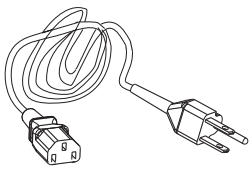
Paired eyepieces



Allen wrench 3mm



Frosted filter



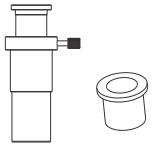
Power cord



6V 30W halogen bulb



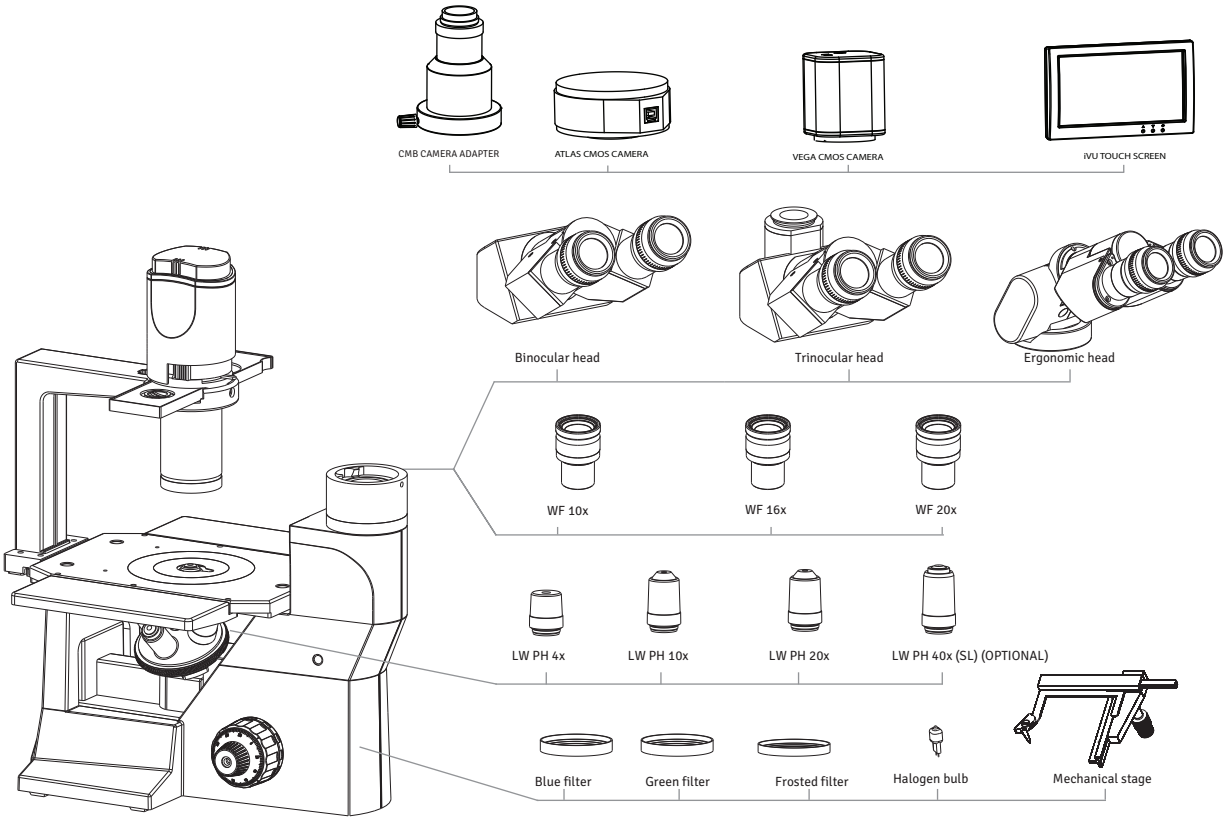
Green filter



Phase telescope with adapter

8 OPTIONAL ACCESSORIES

SYSTEM DIAGRAM OF OPTIONAL ACCESSORIES



INSTALLATION AND OPERATION OF OPTIONAL ACCESSORIES

1 CAMERA MODULE SYSTEM

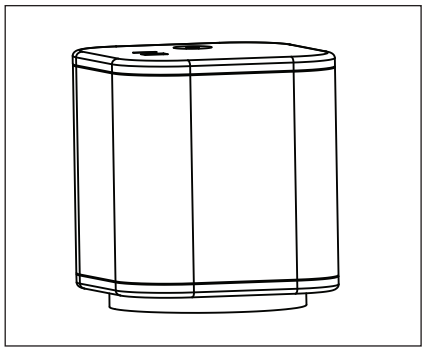


Fig. 2

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

2 OPTIONAL EYEPIECES

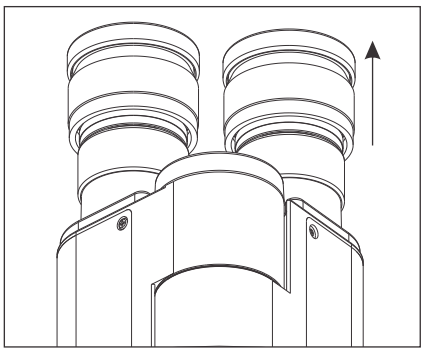


Fig. 3.1

10X eyepieces are provided. To replace them:

1. Pull the 10X eyepieces out of the eyepiece tubes of the observation head.
2. Insert the desired eyepieces into the empty eyepiece tubes (Fig. 3.1).

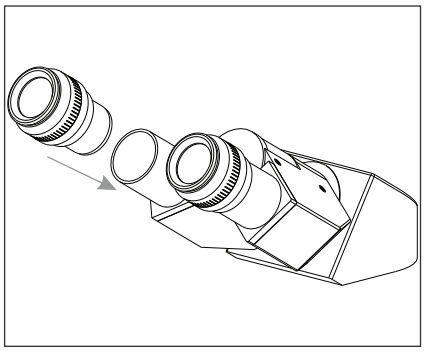


Fig. 3.2

9 INITIAL SETUP AND ASSEMBLY

1 MOUNTING THE OBJECTIVES

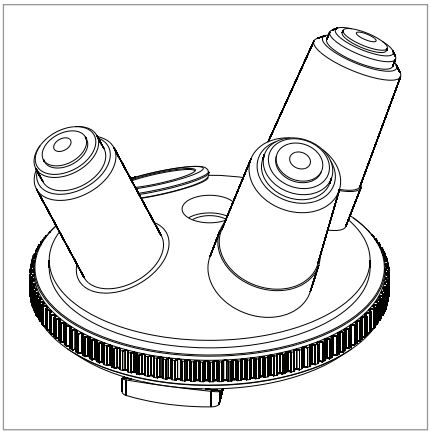


Fig. 4

Lower the nosepiece by turning the coarse adjustment knob toward the back, and remove the dust prevention caps from the nosepiece.

Screw the lowest-magnification objective 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, which makes it easier to change magnification (Fig. 4).

Clean the objectives periodically.

⚠ Be sure to cover any unused threaded positions with
⚠ the dust prevention caps to keep dirt and dust from getting inside.

2 OBSERVATION HEAD

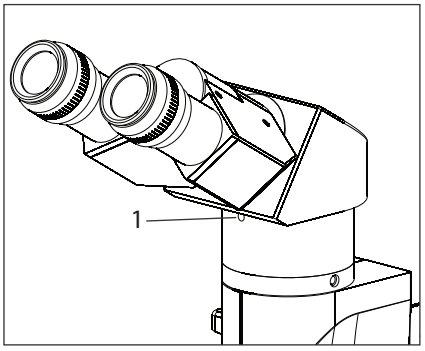


Fig. 5

Install the observation head using the following procedure:

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 the dovetail at the bottom of the head in the dovetail cavity of the microscope arm.
3. Tighten the head locking screw (1) after positioning the observation head as desired (see Fig. 5).

3 MOUNTING THE EYEPIECES

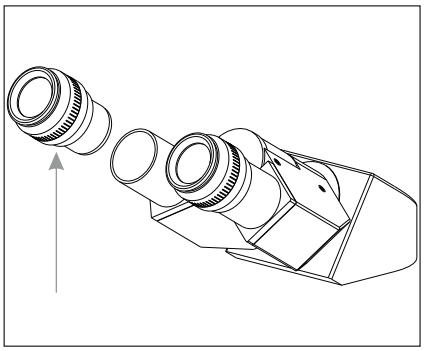


Fig. 6

Insert the eyepieces into the eyepiece tubes of the observation head as follows:

1. Remove the protective caps from the eyepiece tubes.
2. Insert the 10x eyepieces into the eyepiece sleeves and tighten the thumbscrew.

4.1 BASE UNIT

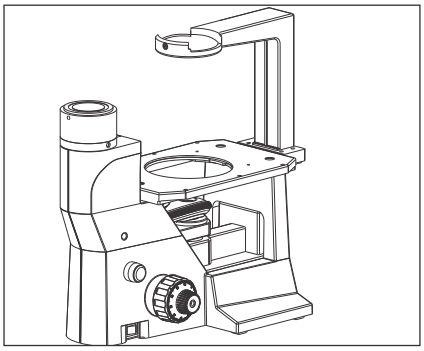


Fig. 7

The base unit is assembled with the coaxial focus mechanism, turret, stage plate and lamp house arm, as shown in Fig. 7.

4.2 INSTALLING THE TRANSMITTED LIGHT ILLUMINATOR

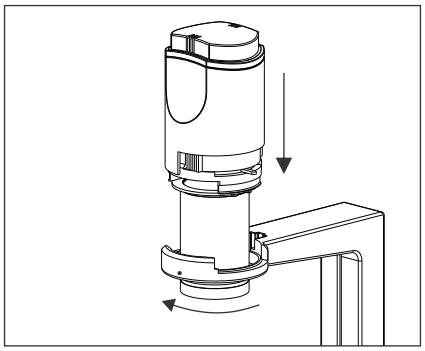


Fig. 8.1

1. Insert the illuminator into the arm opening and rotate the illuminator 90° clockwise so that the letters “NA 0.30” face directly to the front (see Fig. 8.1).

2. Tighten the clamping screw with the 3.0mm Allen wrench provided with the microscope (see Fig. 8.2).

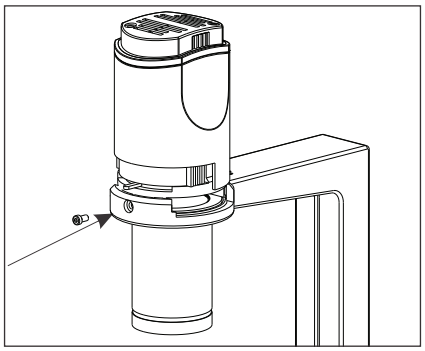
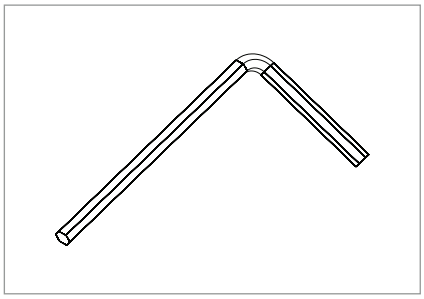


Fig. 8.2



Allen wrench 3.0mm

4.3 PHASE SLIDER AND FILTER

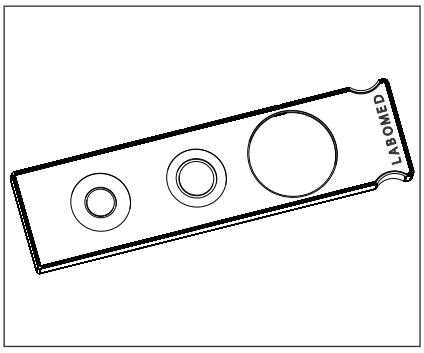


Fig. 9

1. Hold the phase slider face up (with “LABOMED” facing upward), with your finger on the right, and slide it gently into the slot, as shown in Fig. 9.

The phase slider has click stops at three positions: 4x, 10x/20x and brightfield stop.

2. If ordered, the 40x objective is supplied with a spare slider.

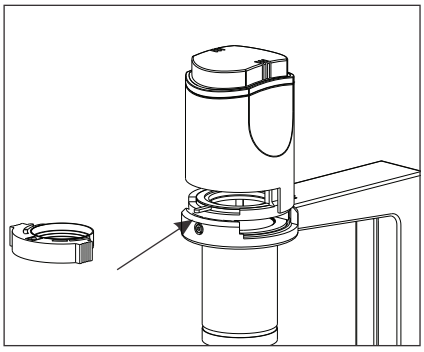


Fig. 10

3. The blue filter is placed in the filter holder cartridge. The cartridge fits easily into the lamp house. Hold the cartridge between your index finger and thumb and slide it in (see Fig. 10).

4.4 OBSERVATION HEAD

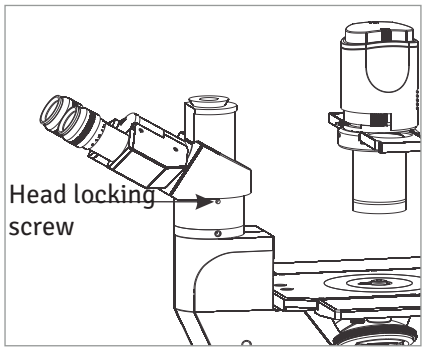


Fig. 11

1. Loosen the head locking screw with the 2.0mm Allen wrench (provided with the microscope), but not so far that it comes out (see Fig. 11).

2. Place the observation head on the stand and engage the dovetail ring at the bottom of the head in the recess on the stand.

3. Tighten the head locking screw after rotating the binocular head to your preferred viewing direction.

5.0 ADJUSTING THE INTERPUPILLARY DISTANCE AND DIOPTER

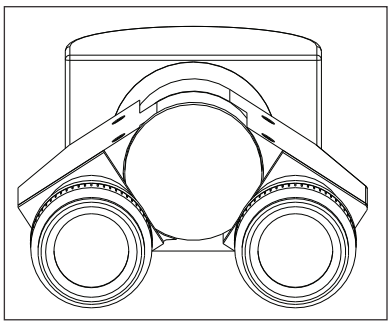


Fig. 12

While looking through the eyepieces, move both eyepieces until the left and right fields of view coincide completely. This sets your IPD.

5.1 ADJUSTING THE DIOPTER

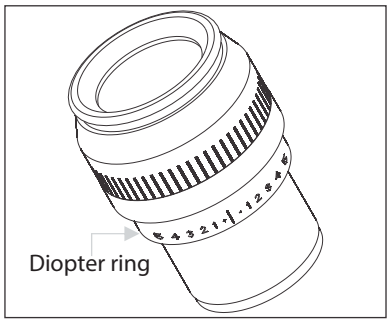


Fig. 13

Set the diopter adjustment of the left eyepiece to “0”. While looking through the left eyepiece with your left eye, turn the coarse and fine focus knobs to bring the specimen into focus.

Set the diopter adjustment of the right eyepiece to “0”. While looking through the right eyepiece with your right eye, turn only the diopter adjustment ring to focus on the specimen (see Fig. 12 and 13).

6.0 MOUNTING THE STAGE EXTENSION AND MECHANICAL STAGE

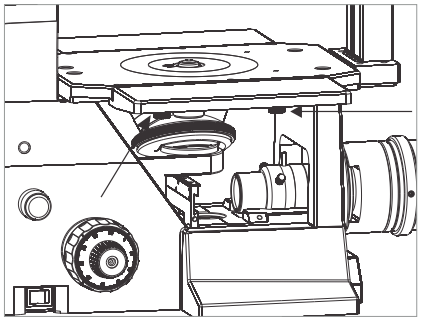


Fig. 14.1

The stage extension plate can be mounted on the left side, the right side or both sides of the stage to enlarge the stage surface. However, the stage extension plate and the mechanical stage cannot be used on the same side at the same time.
Stage extension plate: Screw the studded clamping screws into the plain stage from underneath. Tighten them by hand until the plate is securely attached (see Fig. 14.1 and 14.2).
Mechanical stage: This can be attached on either side of the stage, in the same way as the stage extension plate (see Fig. 14.3).

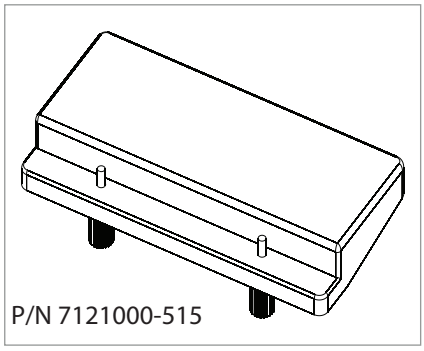


Fig. 14.2

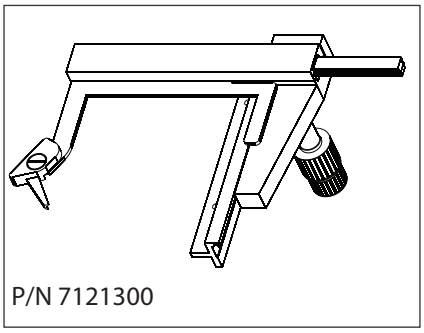


Fig. 14.3

7.0 BULB REPLACEMENT

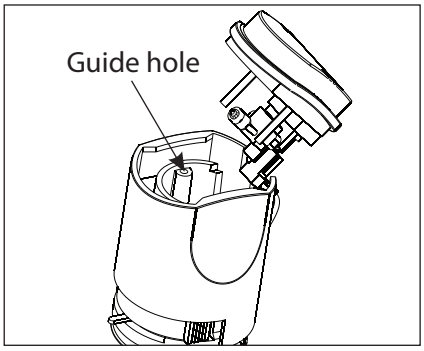


Fig. 15

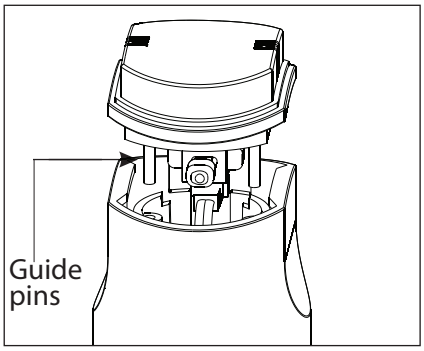


Fig. 16

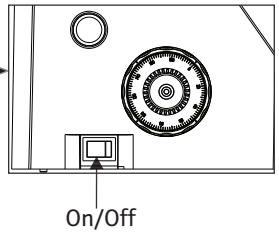
Use only the recommended 6V-30W high-intensity halogen bulb.

Pull open 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 condenser guide holes. Push the lamp socket gently into the transmitted light illuminator (Fig. 15, 16).

10 SUMMARY OF BRIGHTFIELD OBSERVATION PROCEDURE

Set the main switch to “ON”.



Place the specimen on the stage.

Engage the 10X objective in the light path.

Bring the specimen into focus.

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

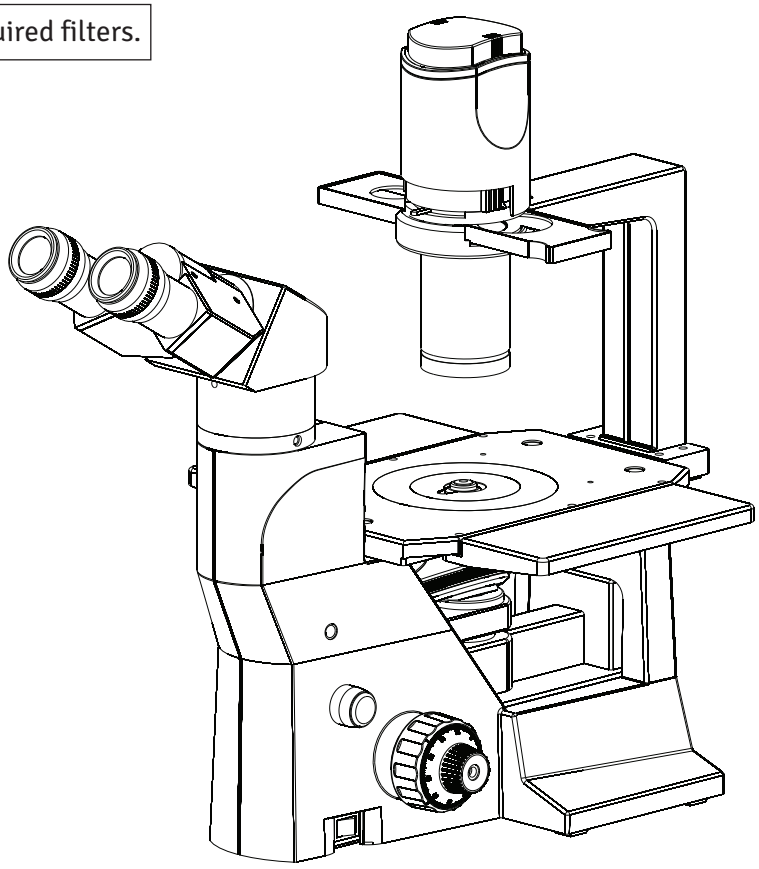
Adjust the aperture iris diaphragm.

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

Adjust the brightness.

Engage the required filters.

Observe the specimen.



11 DETAILED OBSERVATION PROCEDURE

1 TURNING ON THE LAMP

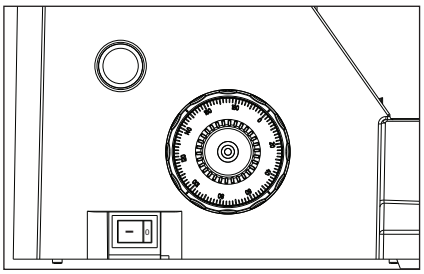


Fig. 17

1. Set the main switch to “I” (ON), as shown in Fig. 17.
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

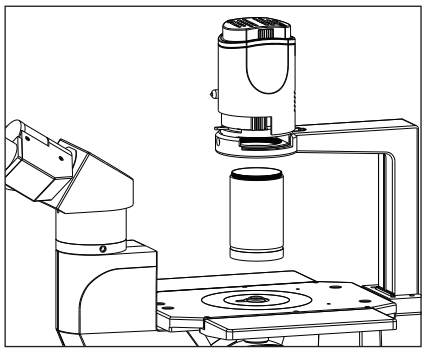


Fig. 18

Place the specimen on the stage plate. If the specimen is in a Petri dish, place it in the Petri dish holder.

If you are using a tall flask, remove the condenser front lens by rotating it counterclockwise so that the flask fits, as shown in Fig. 18.

If a mechanical stage is mounted on your microscope and you are using a glass slide or a 90-well plate, use the appropriate holders.

3 ADJUSTING THE FOCUS

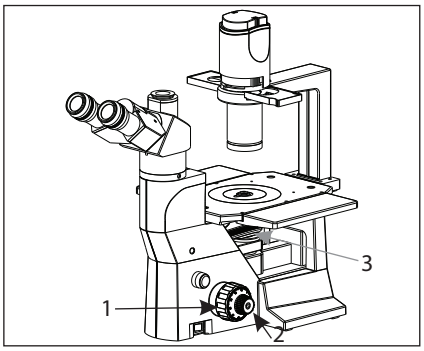


Fig. 19

Focusing procedure (Fig. 19)

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.

Working Distance (WD)
The WD is the distance between each objective and the specimen when the specimen is in sharp focus.

Objective Magnification	4X	10X	20X	40X
WD (mm)	16	7.2	5.35	2.0

4 ADJUSTING THE INTERPUPILLARY DISTANCE (IPD)

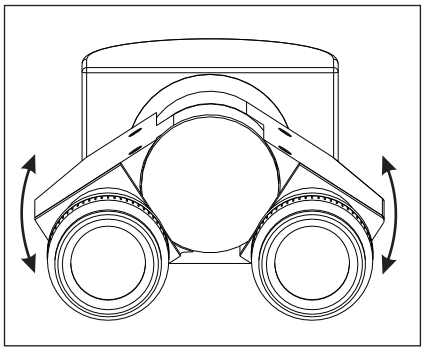


Fig. 20

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 useful when several users work with the microscope.

5 ADJUSTING THE DIOPTER

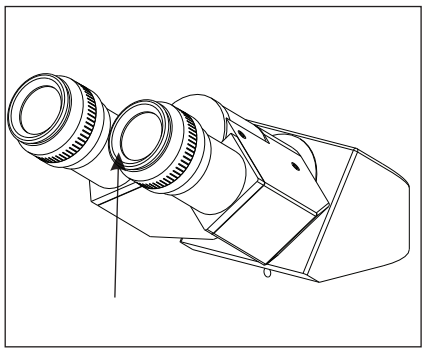


Fig. 21

Set the diopter adjustment of the left eyepiece to “0”. While looking through the left eyepiece with your left eye, turn the coarse and fine focus knobs to bring the specimen into focus.

Set the diopter adjustment of the right eyepiece to “0”. While looking through the right eyepiece with your right eye, turn only the diopter adjustment ring to focus on the specimen.

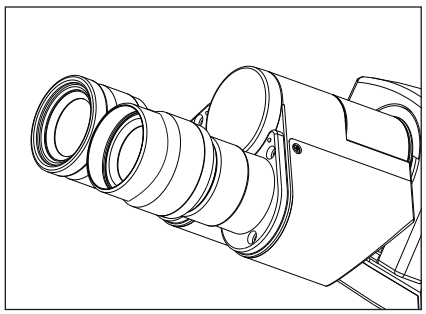


Fig. 22

Using the eye guards

When wearing eyeglasses
Use the eye guards in the normal, folded-down position. This prevents the eyeglasses from being scratched.

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

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.

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

13 TECHNICAL SPECIFICATIONS

1. Illumination	Built-in illumination system, halogen			
2. Focusing mechanism	Stage height adjustment mechanism Fine adjustment scale: 0.002mm per graduation Fine adjustment stroke: 0.2mm per turn Total stroke: 28mm Coaxial coarse and fine focusing on ball drive Coarse adjustment travel per rotation			
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 (with mechanical stage)		
	Movement range	115 x 75mm		
	Specimen holder	Slide and Petri dish		
6. Condenser	Type	Incident condenser (daylight filter detachable)		
	N.A.	0.30		
	Aperture iris diaphragm	Built-in		
7. Dimensions and weight	495.0mm (L) x 300.0mm (W) x 470.mm (H); 9.5 kg net			
8. Electrical	Lamp	Halogen, 6V-30W		
	Lamp life	Up to 500 hours		
	Input	100V-240V AC, 50/60 Hz		
9. 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			

Revision History

Rev. No.	Date of Release	DCR #	Change	App. By
1.3	April 14, 2022	DCR/06/22	Reviewed and updated for typo errors	S. Bal

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ideas for vision

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