



BS-2093A Series

Inverted Biological Microscope

Instruction Manual



BS-2093A



BS-2093AF

To ensure the safety and obtain satisfactory performance, please study this operation instruction thoroughly before your operation.

 ATTENTIONS

1. Please clean sample-touching part after using.
 - Following the **Fig.1** step to move the instrument, make sure the sample is taken away. Use one hand holding ① position, the other hand holding ② position.
 - Once the sample is damaged, must take steps to avoid pollution.
 - If rising microscope's height with other parts, must keep it in horizontal position, avoid incline and sample slip.

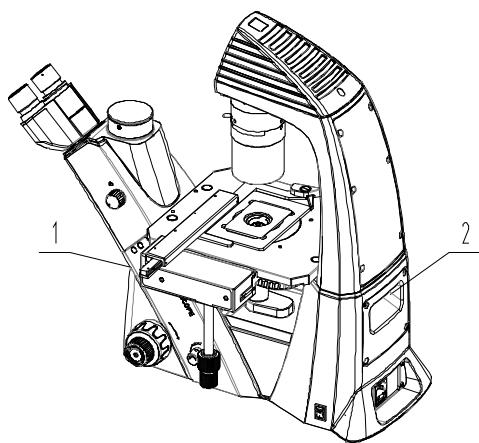


Fig.1 Carrying Diagram

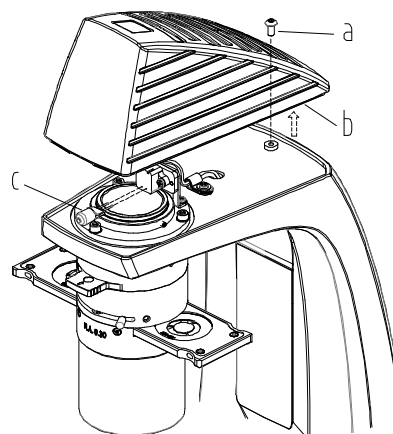







Fig.2 Replace Bulb

- a. Take Screw Off
- b. Remove Lamp Cover
- c. Replace Bulb

2. Before replacing the lamp, first turn off power switch at off position **O**, and unplug it in case of electric shock and burn. If microscope is in use or after use, the bulb and lamp house must be cooled off completely before proceeding, please see **Fig.2**, Loosening screw and replace bad bulb with required bulb. The power supply must be cut off before bulb replacement.
3. Microscope must be placed on stable and horizontal table.
4. Only use our power line, wrong power line can't guarantee instrument safety and performance.
5. The microscope ground terminal must be tightly connected with plug ground terminal.
6. If unexpected situation happens, please pull the plug out.
7. Disassembly only by the professionals. The microscope has been adjusted before shipping, Unprofessional-person should not disassemble and remove any other parts.
If you have any questions, please contact with manufacturer or local distributor.
8. Wide voltage input 100~240V, 47-63Hz, if not in this range, it may cause damage for equipment.
9. Don't open microscope lower plate when in use or else exposed electrical element will lead to electric shock. Before replacing the lamp or fuse, please turn off power switch and pull out the plug from the socket.
10. Do not use alcohol, gasoline, paper and other combustibles near the instrument, to prevent fire! !

Safety Mark

MARK	MEANING
	Surface will be hot, don't touch it.
	Please read manual instruction carefully at first. Misuse will lead to body damage or instrument damage.
	It is near the fuse socket, means be care of electric leakage.
	Main switch " ON "
	Main switch " OFF "


1) PREPARATION

- a. Microscope is precise instrument, carefully operation, avoid collisions and shaky. Using environment should not be in direct sunlight, high temperature or high humidity and dusty, avoid violent shaky.
- b. Tension for coarse focusing knob can adjustable.
- c. Please leave enough space (10cm) for ventilation.
- d. Please follow Fig.1 to carry microscope.
 - ★ Firstly, take away sample, filters and round stage parts avoid damage .
 - ★ If the microscope is leaning slightly, not in good position, rubber gasket may be fall off.

2) MAINTENANCE AND STORE

- a. Please use gauze with 70% ether and 30% alcohol mixed liquor to gently wipe the lens, Alcohol and ether are inflammable material, please take them away from fire. Be careful for turn on and off power. Please keep indoor air ventilation.
- b. Please use soft fabric to clean other parts with neutral detergent besides glass parts.
- c. If not in use, please put dust cover on microscope.
- d. Please collect packing material for storage and carry after unpack carton.

CONTENTS

 Attentions.....	1
1. Parts Name	4
2. Observation Steps.....	6
3. Operation.....	7
3.1 Main Body.....	7
3.1.1 Turn On Light Source.....	7
3.1.2 Aperture Diaphragm	7
3.1.3 Usage of Filter.....	7
3.2 Focusing Unit	8
Adjustment of Coaxial Coarse Focusing Knob Tension	8
3.3 Observation Tube.....	8
3.3.1 Adjustment Of Interpupillary Distance.....	8
3.3.2 Adjustment Of Diopter	8
3.3.3 Locking Eyepiece.....	9
3.4 Stage	9
3.4.1 Fixed Stage	9
3.4.2 Mechanical Stage	9
3.5 Condenser.....	10
3.6 Fluorescence Attachment	11
3.6.1 Mechanism of Fluorescence Production	11
3.6.2 Parts Name	13
3.6.3 Fluorescence Observation Processes.....	14
3.6.4 Mercury Lamp Power House.....	14
3.6.5 Replacement of Mercury Bulb.....	15
3.6.6 Replacement of Mercury Lamp Fuse	16
4. Trouble Shooting.....	17
5. Installation	18
5.1 Installation Diagram.....	18
5.2 Installation Steps.....	19
5.2.1 Installation And Replacement of Bulb	19
5.2.2 Replacement Of Fuse	19
5.2.3 Connecting Power Line	19
5.2.4 Installation Of Phase Contrast Slider	20
5.2.5 Installation Of Photography System.....	20
5.2.5.1 Video System (Optional)	20
5.2.5.2 Digital Photography System(Optional)	21

1. Parts Name

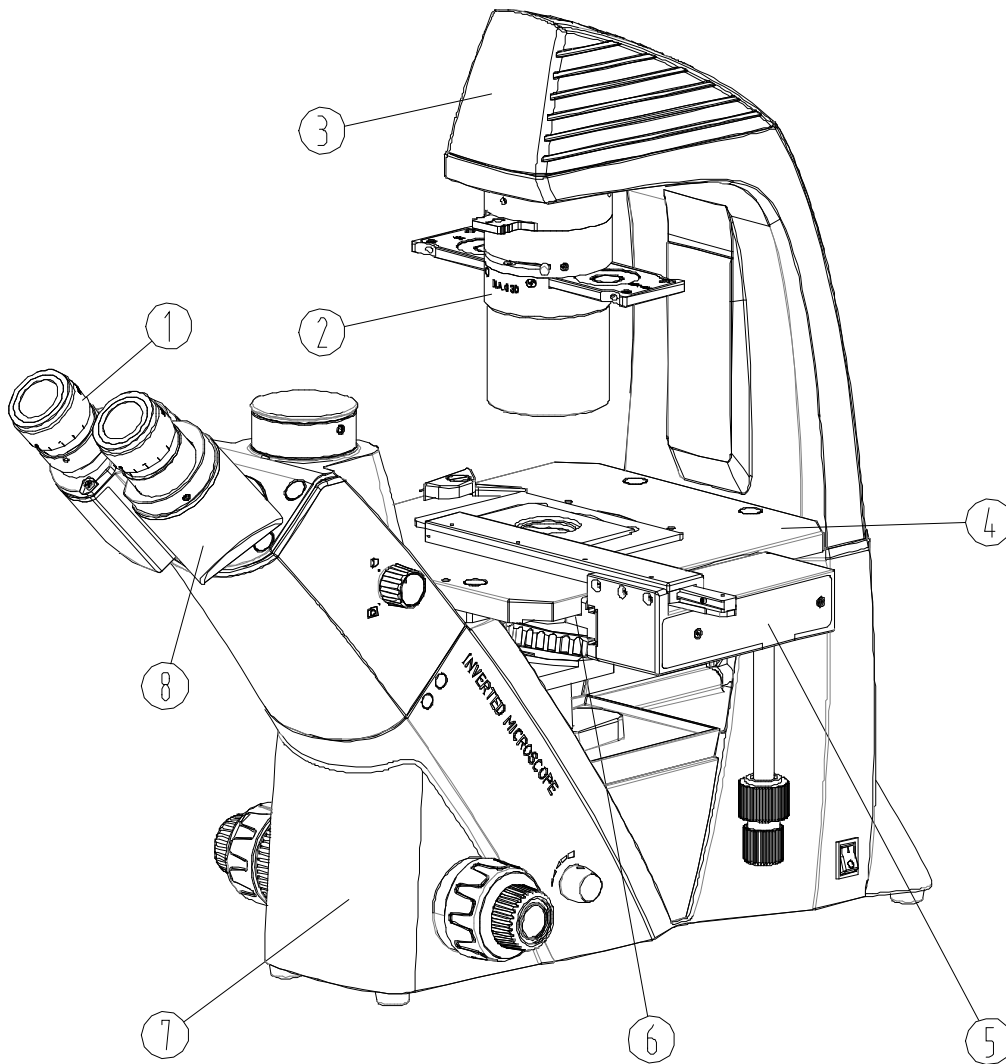


Fig.3 Main Parts Name

- 1) Eyepiece**
- 2) Condenser**
- 3) Lamp Cover**
- 4) Fixed Stage**
- 5) Attached Mechanical Stage**
- 6) Nosepiece**
- 7) Main Body**

8) Seidentopf Trinocular Head

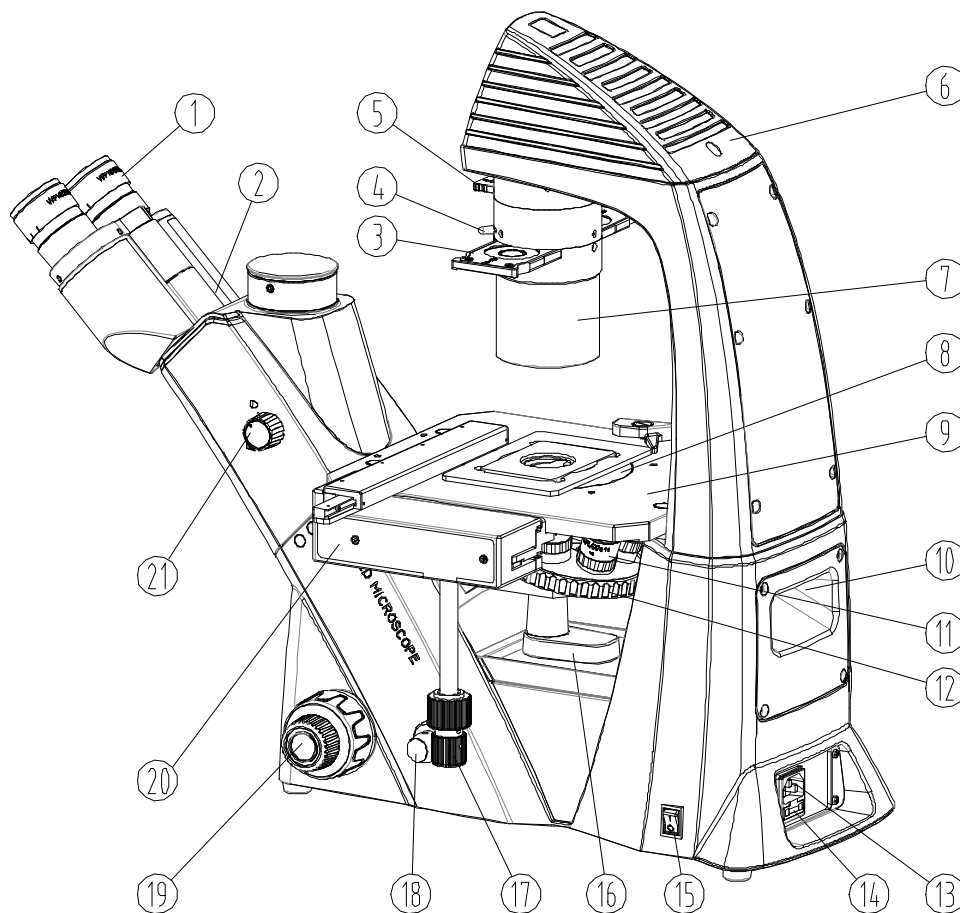
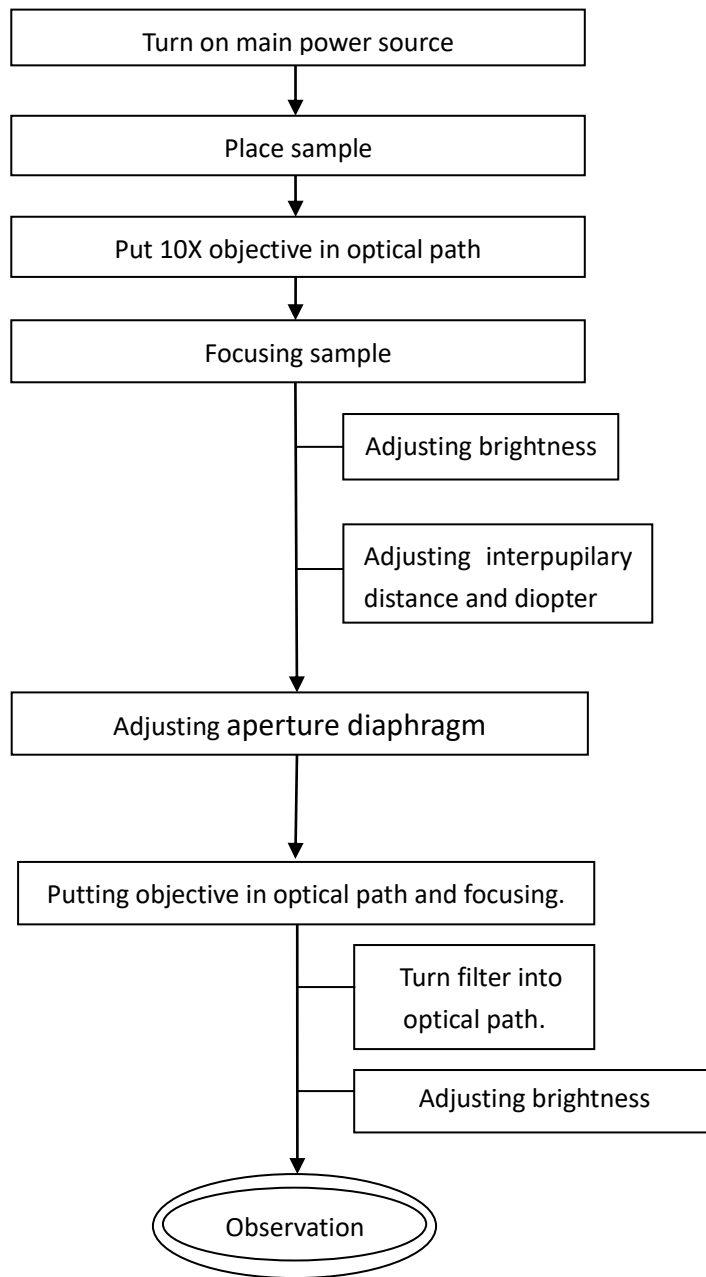


Fig.4 Control Parts

- | | |
|-------------------------------|--------------------------------------|
| 1) Eyepiece | 12) Nosepiece |
| 2) Seidentopf Trinocular Head | 13) Power Socket |
| 3) Phase Contrast Slider | 14) Fuse Box |
| 4) Aperture Diaphragm Lever | 15) Power Switch |
| 5) Filter Slider | 16) Surplus Water Plate |
| 6) Lamp Cover | 17) Attachable Mechanical Stage Knob |
| 7) Condenser | 18) Potentiometer Knob |
| 8) Round Stage | 19) Coarse & Fine Focusing Knobs |
| 9) Fixed Stage | 20) Attachable Mechanical Stage |
| 10) Handle | 21) Switch Knob |
| 11) Objective | |

2. Observation Steps



3. Operation

3.1 Main Body

3.1.1 Turn On Light Source (Fig. 5)

- a. Turn potentiometer knob ① to the minimum, turn on power switch to ② position I (ON).
- b. Rotating potentiometer knob ① to increase and decrease brightness for good illumination.

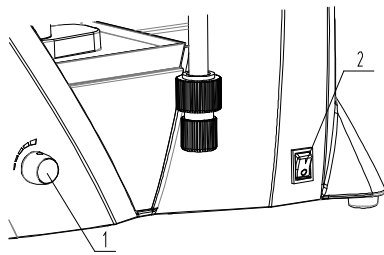


Fig. 5 Power Switch

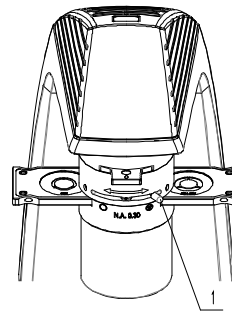


Fig.6 Adjustment of Aperture Diaphragm

3.1.2 Aperture Diaphragm (Fig.6)

Gently moving diaphragm lever ① to adjust aperture diaphragm for best image contrast.

3.1.3 Usage of Filter

- a. Take out the filter holder ②.
- b. Insert filter ① into filter holder ② and pull filter holder into the socket.

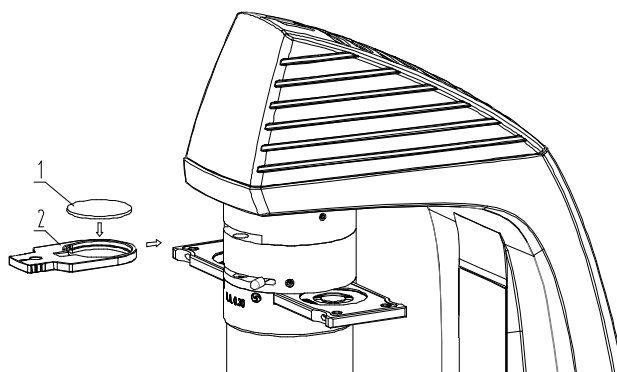


Fig.7 Filter Installation

3.2 Focusing Unit

Adjustment of Coaxial Coarse Focusing Knob Tension (Fig.8)

- Coarse focusing knob tension can be adjustable, hold adjustable ring ① and rotate it. Anti-clockwise direction is decrease, clockwise direction is increase.
- If stage is decreasing automatically, the sample is deviating from the focusing point, means tension too low, clockwise rotating adjustable ring ① to increase tension.

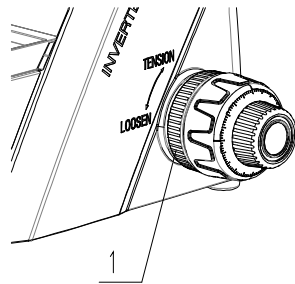


Fig.8 Tension Adjustment For Coarse Focusing Knob



Don't rotate coarse and fine focusing knobs with reverse direction at the same time.

3.3 Observation Tube

3.3.1 Adjustment of Interpupillary Distance

Please adjusting binocular tube to make left and right field coincide completely. Indication point ● is interpupillary distance.

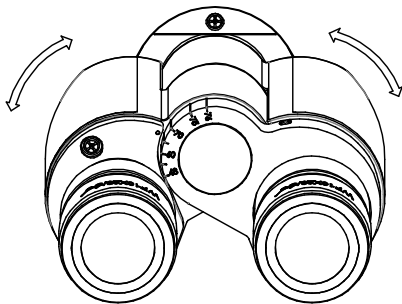


Fig.9 Adjustment of Interpupillary Distance

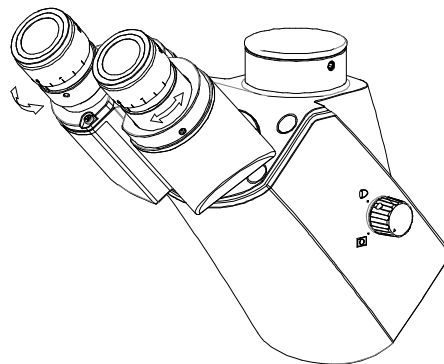


Fig.10 Adjustment of Diopter

3.3.2 Adjustment of Diopter (Fig.10)

Please turn adjusting ring scale 0 to scale line at the first use.

- a. With right eye to observation by right eyepiece, focusing the sample by coarse and fine focusing knob.
- b. With left eye to observation by left eyepiece, focusing the sample by coarse and fine focusing knob.

3.3.3 Locking Eyepiece

Eyepiece can be tightened by using thumb screw ① (Fig.11). If want to change eyepiece, must unscrew it at first.

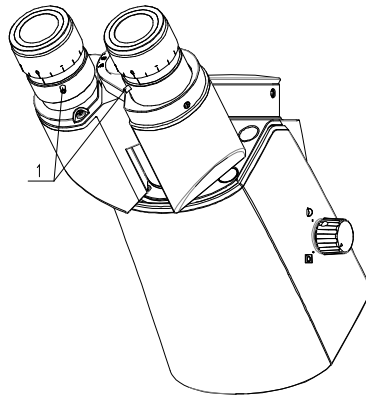


Fig.11 Locking Eyepiece

3.4 Stage

3.4.1 Fixed Stage

- a. Insert standard round plate ① in stage.
- b. Install the clamps 2 on the stage by screw joint.

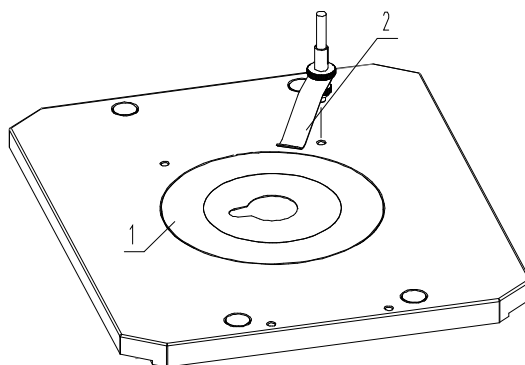


Fig.12 Fixed Stage

3.4.2 Mechanical Stage

- a. Mechanical stage can be moved freely at X and Y direction.
- b. Insert standard stage round plate 1 in stage. (also don't insert round plate as needed).
- c. Install attached mechanical stage 2 in stage with knurled screw 3 or hexagon socket cap screws.
- d. Put stage plate 4 in stage as needed and fixed with clamps.

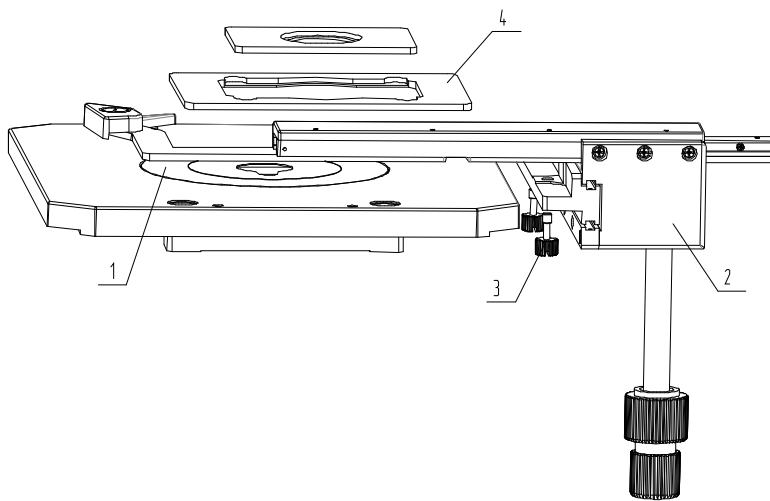


Fig.13 Mechanical Stage

3.5 Condenser

- ◎ According to culture dish size to decide if remove condenser.
 - a. Use hexagon socket screwdriver to loosen thumb screw ① can remove condenser ②.
 - b. When removing condenser, please hold condenser ② with hand in case of broken.

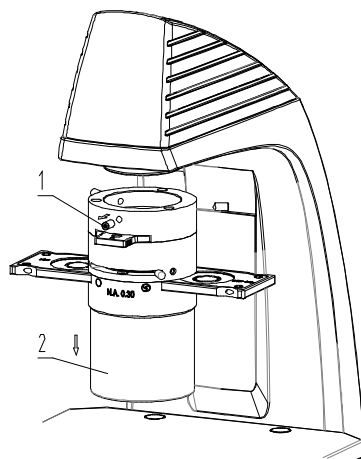


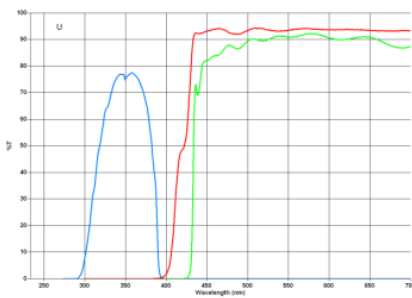
Fig.14 Condenser Installation

3.6 Fluorescence Attachment

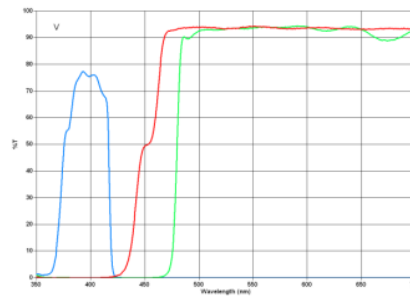
- © **BS-2093 inverted biological microscope can configured with fluorescence attachment (lamp house, power supply etc.)**

3.6.1 Mechanism of Fluorescence Production

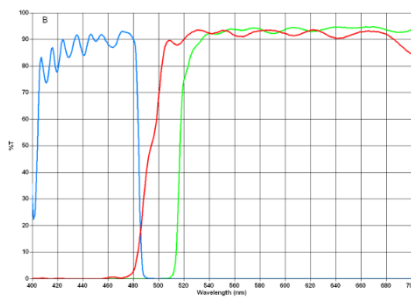
Ultraviolet(U), Violet(V), Blue(B), Green(G) transmittance characteristic curve.



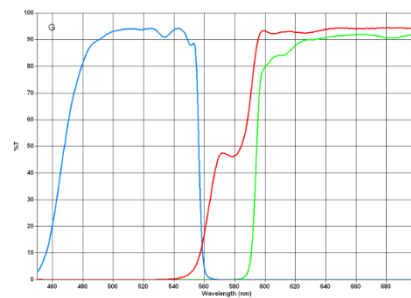
UV (Ultraviolet)Excitation



V (Violet) Excitation



B(Blue Light)Excitation



G (Green Light)Excitation

Fluorescence is a kind of photoluminescence in natural world. This kind of material will emit more longer wavelength light than irradiation light wavelength, if stop light, emitted light will be disappeared. The longer wavelength is fluorescent light. The substance which can launch the fluorescent is called fluorescence material.

Stimulate the principle: Now use blue-ray as example (B light, the wavelength of 490nm), when the light is emitted from the DC mercury lamp, after condenser and stimulated color filter, get the exciting light wavelength of 490 nm or so, then through color spectroscopy reflection into the objective, color spectroscopy has the nature of selective reflection in a certain spectrum area. It will completely reflect all light which is shorter than a certain wavelength and all light which is longer than a certain wavelength of light will totally through it. According to this feature, color spectroscopy can be designed corresponds to the excitation light beam splitter, it reflects the light of wavelength under 490 nm, and the wavelength is more than 490 nm light can through. So such a wavelength of 490 nm or so exciting light after color spectroscopy, greater than 490 nm light through color spectroscopy to be removed, and the excitation under 490 nm light irradiation by fluorescence objective can converge on the fluorescent specimens, specimen inspire greater than 490 nm wavelength of fluorescence(effective fluorescence wavelength of 525nm) and fluorescence imaging by objective gathering, and through the color spectroscopy

(with a small amount of under 490 nm exciting light is reflected back to the light source and not through) and cut-off filter (cutoff wavelength less than 525 nm light), pure fluorescent light beam for observation and photography.

Fluorescent Attachment Diagram

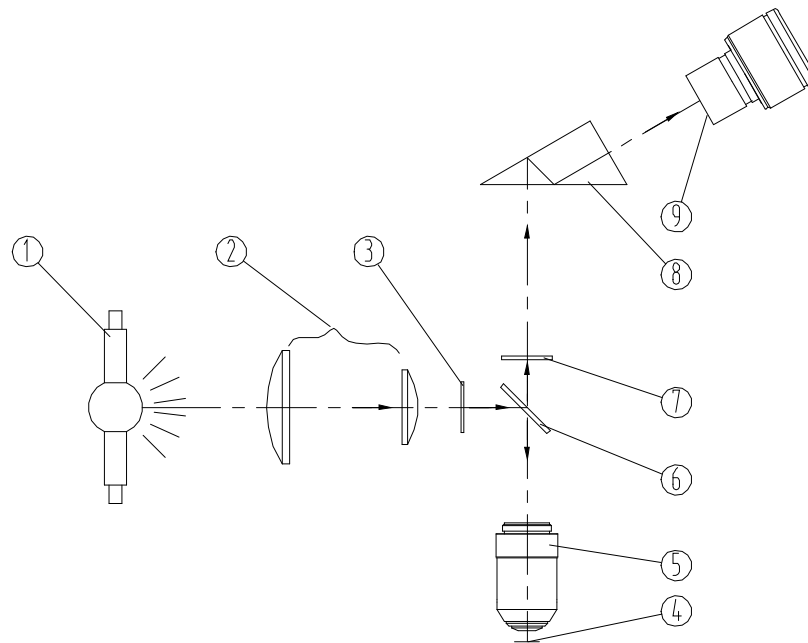


Fig.15 Fluorescent Attachment Diagram

- 1) Mercury Lamp
- 2) Condenser
- 3) Excitation Filter
- 4) Specimen
- 5) Objective
- 6) Color Spectroscope
- 7) Filter for Resistance
- 8) Prisms Group For Inverting Light Path Direction
- 9) Eyepiece

3.6.2 Parts Name

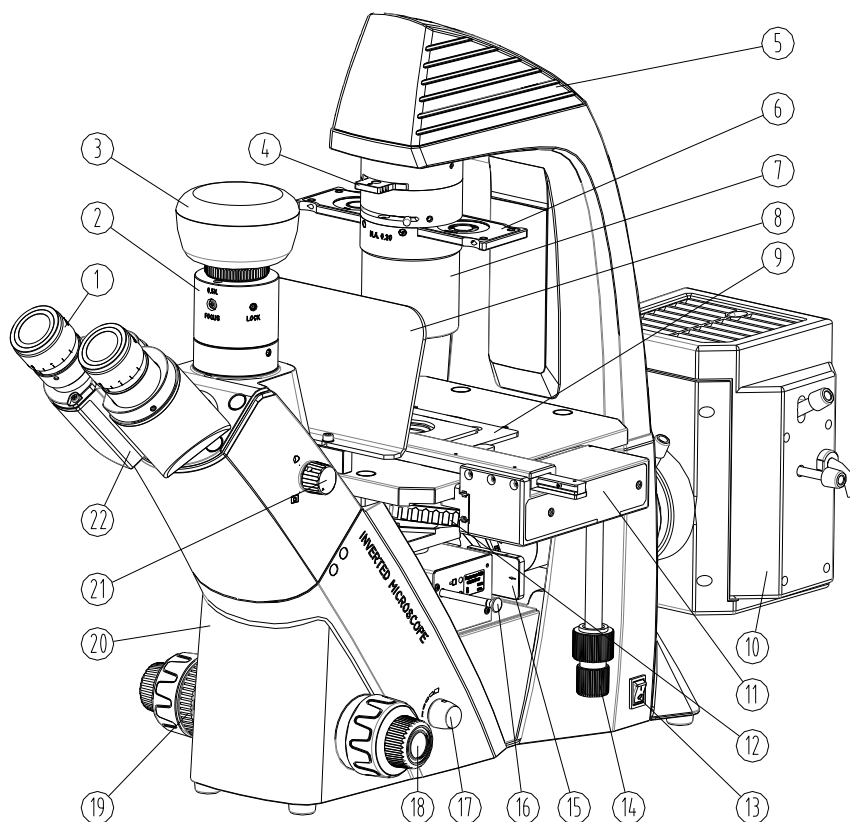


Fig.16 Parts Name

- 1) Eyepiece
- 2) C-mount
- 3) Digital Camera
- 4) Filter
- 5) Lamp Cover
- 6) Phase Contrast Slider
- 7) Condenser
- 8) UV Protecting Plate
- 9) Stage Plate
- 10) Mercury Lamp
- 11) Attached Mechanical Stage For 96-hole Plate
- 12) Nosepiece
- 13) Power Switch
- 14) Mechanical stage hand knob
- 15) Diaphragm Slider
- 16) Fluorescent Transforming Handle
- 17) Potentiometer Knob
- 18) Coarse & Fine Focusing Knobs
- 19) Tension Adjusting Knob

- 20) Main Body
- 21) Trinocular Lever
- 22) Seidentopf Trinocular Head

3.6.3 Fluorescence Observation Processes

According to bright field observation methods to adjust microscope, take following steps to make observation:

- Put mercury lamp power supply power plug into the power socket, please firstly check the power supply voltage whether conform to the requirements of the instrument and supply voltage.
- Open the mercury lamp power switch, mercury lamp power voltage fluctuation may not be greater than $220V \pm 20V$,otherwise affect the start of mercury lamp. It takes about 10 minutes to reach stable state, the maximum luminous efficiency.
- Put 10X objective in optical path. Put fluorescent specimen on the slide, with fixed clamp, regulating stage vertical moving handle to make the objective in the optical path.
- Through push and pull the fluorescent transform handle, fluorescence excitation cube will be moved into light path .
- Adjusting coarse and fine focusing knob to get clear image.
- Adjusting the center of the low and high pressure mercury lamp.

After getting clear image by focusing , using condenser axial adjustment knob, mercury lamp arc light can be seen in the eyepiece . If arc light regiment not in the center of the field, by adjusting the vertical and horizontal adjustment knob of mercury lamp light box to make the center of the arc light group in the field of view, adjusting the mirror, make the brightness to the brightest. When arc light group in the center, adjusting condenser axial adjustment knob to make arc light group into the whole field, fluorescence observation can be made.

Try to avoid frequent open mercury lamp power supply, it will reduce mercury lamp working life. Once closed, mercury should be restart after five minutes later.

3.6.4 Mercury Lamp Power House

a) Main Parameter

Input Voltage: AC100~240V 47~63Hz

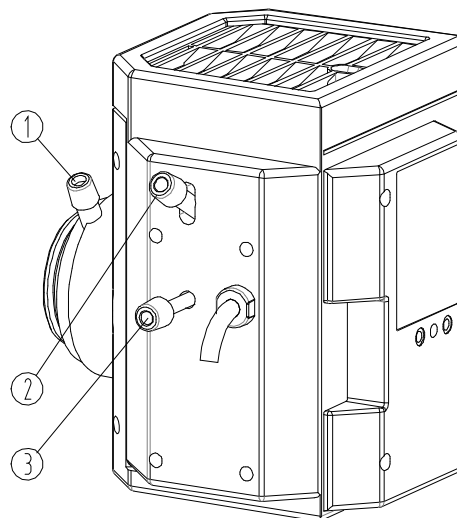
Output Voltage: DC18V~40V Maximum

Stable Output Current: 3.6A ~4.9A

Start Stable time: 2 minutes

Fig.17 Adjustment for Mercury Lamp House

- 1) Condenser Adjusting Knob
- 2) Vertical Adjusting Knob for Mercury lamp
- 3) Horizontal Adjusting Knob for Mercury lamp



b) Use of Power Supply

- Determine the input voltage is conform to the requirements of the instrument, can open the main power switch, open the indicator lights on the rear panel is light, indicating the power switch on.
- Gently press the trigger switch, power box above positive press switch in place can let go, don't have to hold for a long time. If you don't can trigger mercury lamp, please check the mercury lamp light boxes closed is complete.
- Mercury lamp light will be stable after 2 minutes commonly, lamp power consumption between 90 W and 135 W.
- Mercury lamp service life is 100 hours or so, so use for a period of time after the brightness will decrease.
- After replacing mercury lamp, power box timers need to reset, pressing the reset which on the front side of power box.
- Don't often press the power box timer reset button, also can't often time, according to otherwise it will affect the service life.
- Don't no-load test output voltage, also don't open source box to adjust or modified, in order to avoid damage to mercury lamp or power box.

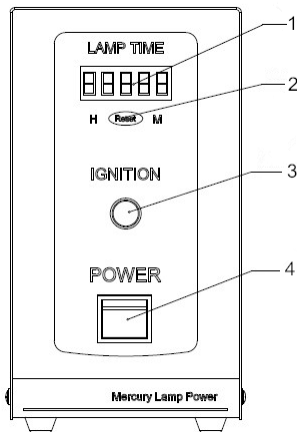


Fig.18 Front Side

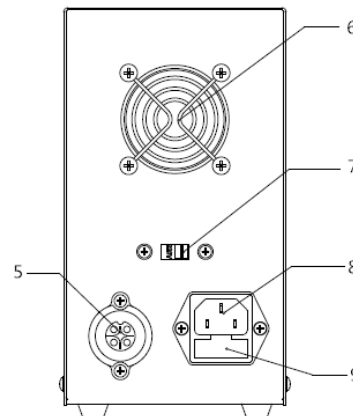


Fig.19 Back Side

- 1) Timer 2) Reset 3) Trigger Switch 4) Power Switch 5) Output Socket 6) Cooling Fan
7) Voltage Transfer Switch 8) Input Power Plug 9) Fuse Holder

3.6.5 Replacement of Mercury Bulb

Cut off the power supply, with inner hexagon screwdriver to adjust the socket head screw which in the rear of the mercury lamp light box, then slowly remove the mercury lamp light box upper portion, upside down on top of the desktop. Unscrew two mercury lamp set screw, remove the old mercury lamp, change new mercury lamp, then tighten the two fixed screw will recover lamp holder, open screw tightening the mercury lamp holder. Then according to the mentioned methods for mercury lamp in front of the center.

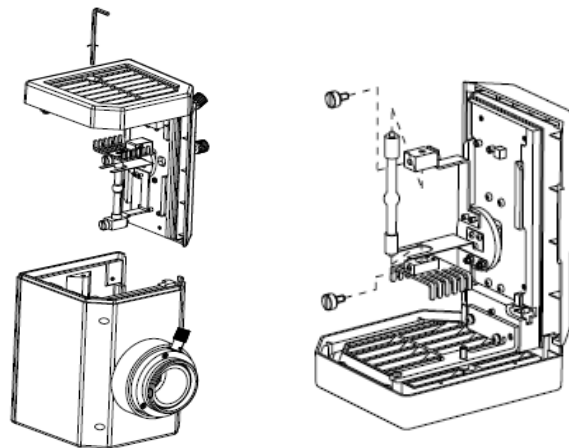


Fig.20 Replacement of Mercury Lamp

- Don't remove mercury lamp under the condition of electricity from inside the box! Danger!
- Mercury lamp must be replaced after cooling.
- Note mercury lamp installation in negative direction, and the lamp glass shell on uneven parts from the direction of the condenser.
- With gauze dipped in a little alcohol ether 4:6 mixture to wipe the lamp glass shell surface, there is no dust, fingerprints, etc contamination tubes.

3.6.6 Replacement of Mercury Lamp Fuse

Turn off the power, pull out the plug and open fuse box .Mercury power supply fuse:

Φ5×20mm, 5.00A, 250V (The detail steps are as follows).

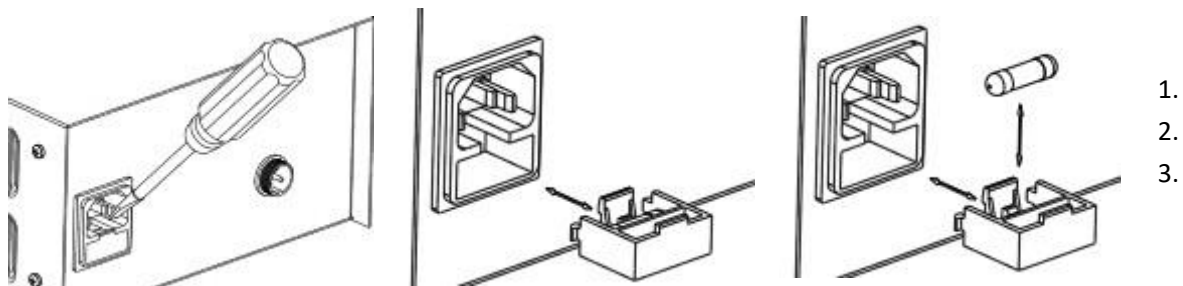


Fig.21 Replacement Of Power Box Fuse Tube

4. Trouble Shooting

Trouble	Causation	Remedy
1. Optical System		
a. Field incomplete or illumination irregular.	Nosepiece not in right location.	Readjust nosepiece in right position.
	Filter slider not in right place.	Readjust filter slider
	Phase Contrast Slider aren't moved out of optical path.	Moving out the slider.
b. Dirt or dust in objective field.	Lens of collector is dirty.	Thoroughly clean.
	Sample is dirty.	
	Eyepiece is dirty.	
c. Dazzling image	Aperture diaphragm isn't wide enough.	Readjust it.
d. Bad Image quality, for example, not sharp, low picture contrast, image detail not clear.	Objective isn't in right position.	Rotate nosepiece to locating position.
	Objective front lens is dirty.	Thoroughly clean.
	Culture dish bottom is thick.	Use normal size culture dish.
	Culture dish optical performance isn't good.	Use standard culture dish.
	Sample is dirty.	Thoroughly clean
e. Partial image isn't clear or unsteady.	Objective isn't in right position.	Rotate nosepiece to locating position.
	Sample isn't placed at right stage place.	Correctly placing sample and fixer it with holder.
f. The effect of phase contrast observation image is poor.	Annular spot don't focus with dish holder.	Readjust it.
	Culture dish bottom isn't flat.	Use standard culture dish.
2. Mechanical Focusing Unit		
a) Coarse focusing knob is too tight.	Tension too big.	Loosing tension adjusting ring , reset again.
b) Nosepiece glide down automatically.	Tension too small.	Tightening tension adjusting ring, reset again.
3. Binocular Observation Tube		
Field of Binocular observation tube isn't inconsistent.	Wrong interpupillary distance.	Correctly set again.
	Binocular diopter is incorrect.	
	Left eye and right eye with different eyepiece.	Change one eyepiece, to make it same as another eyepiece.
4. Nosepiece		
When using high power objective, it will touch the sample.	Improper sample.	Use right sample.
	Culture dish bottom is too thick.	Use standard dish.
5. Power System		
a) Bulb don't work.	No bulb.	Install bulb.
	Bulb or fuse is broken.	Change new bulb or fuse.
	Don't plug in power.	Plug in power safely.
b) Bulb is easy broken.	Don't use specified specification bulb.	Use specified specification bulb.
	No bulb.	Install bulb.

5. Installation

5.1 Installation Diagram

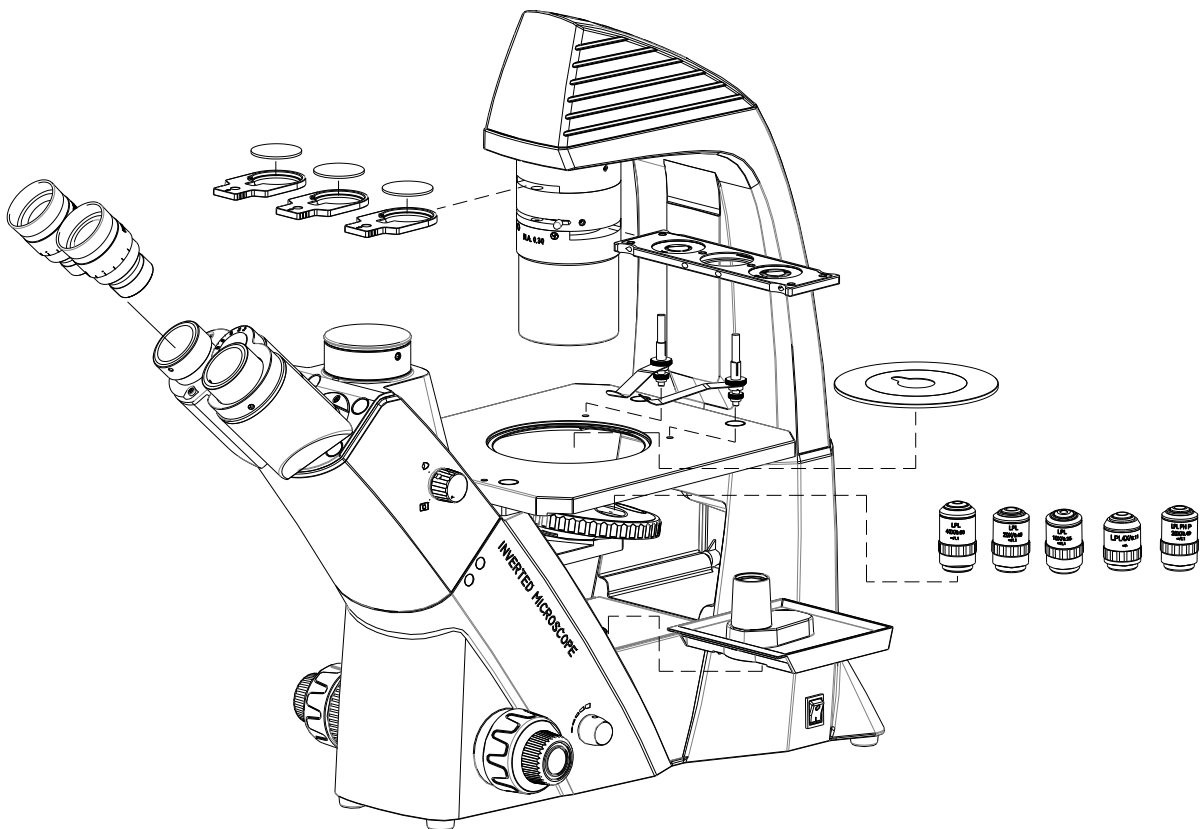


Fig.22

5.2 Installation Steps

5.2.1 Installation and Replacement of Bulb (Fig.2)



WARNING: Cut off the power line plug before replace bulb.

- a. Completely loosening screw on the top of the lamp house, pulling out lamp shade.
- b. Loosening bulb pins locking screw, using glove or gauze to hold the bulb and insert fully into the socket.
- c. Install the lamp again.

© Bulb: **6V30W** Halogen

5.2.2 Replacement of Fuse

WARNING: Turn off the power plug before replacement.



Fuse box is installed below the power socket, fuse rating: $\Phi 5 \times 20$ mm, 5A/250V.

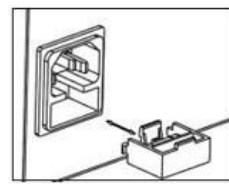
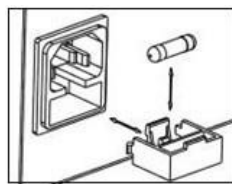
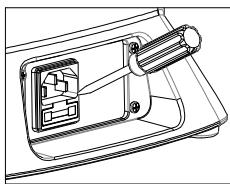
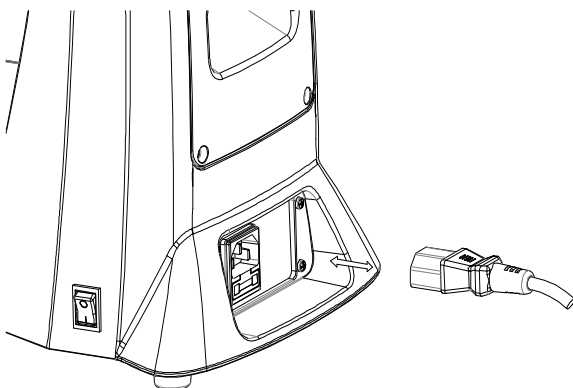


Fig.23 Replacement Of Fuse

5.2.3 Connecting Power Line



a. Don't curve or twine power line.

b. Make sure the main switch at off mark **O** when connecting power lines.

c. Must use three-phase plug which can connect ground electrode, Otherwise can't use the microscope.

If power line is close to lamp house or relevant device, it will melt and cause electric leakage. So don't close to lamp house.

Fig.24 Power cord Connection

5.2.4 Installation of Phase Contrast Slider

- a. Make phase contrast slider right-side up, insert the slot. (Fig.25)

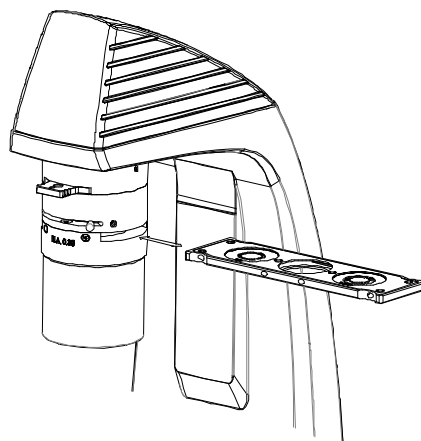
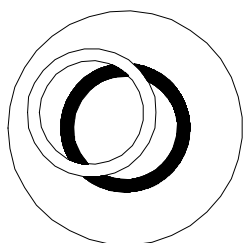


Fig.25 Phase Contrast Installation

- b. Put PH objective in optical path (the objective must be coincided with the annular plate power).
- c. Pull eyepiece out and insert centring telescope, observing bright ring (annular plate) coincide with dark ring (phase contrast plate), adjusting annular plate screw to make dark ring completely cover the bright ring.
- d. Pull the centring telescope out, use eyepiece to make phase contrast observation.

Before Coincide



After Coincide

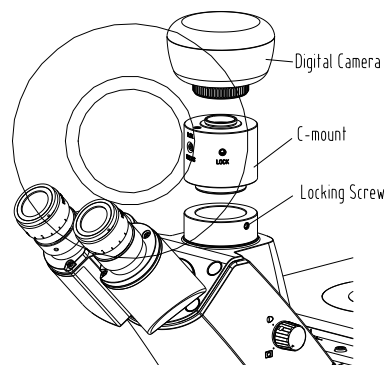


Fig.26 Phase Contrast Plate Adjustment

Fig.27 Installation of Video System

5.2.5 Installation of Photography Device

5.2.5.1 Video System (Optional)

- a) Remove the dust cover, use allen wrench to unscrew the locking screw at trinocular observation tube connector.
- b) Connecting C-mount with observation tube connector, digital camera with C-mount.
- c) Tightening the locking screw.
- d) Please take down the digital camera if not in use, keep in dry environment. Cover observation tube connector with cap for anti-dust.
- e) Please read operation manual about usage of digital camera and circuit connection.

5.2.5.2 Digital Photography System (Optional)

- a) Firstly, remove the dust cover, use allen wrench to unscrew the locking screw at trinocular observation tube connector.
 - b) Next, gently connect SLR digital camera with adaptor.
 - c) Then connect SLR digital camera with C-mount.
 - d) Finally, loosen photography eyepiece locking screw, adjust SLR digital camera direction according to user's need, then tightening the locking screw.
 - e) Please take down the digital camera if not in use, keep in dry environment. Cover observation tube connector with cap for anti-dust.
 - f) Please read operation manual about usage of SLR digital camera and circuit connection.
- © When installing SLR digital camera, should remove the lens and change to manual position M.
 - © Different adaptor with different SLR digital camera.

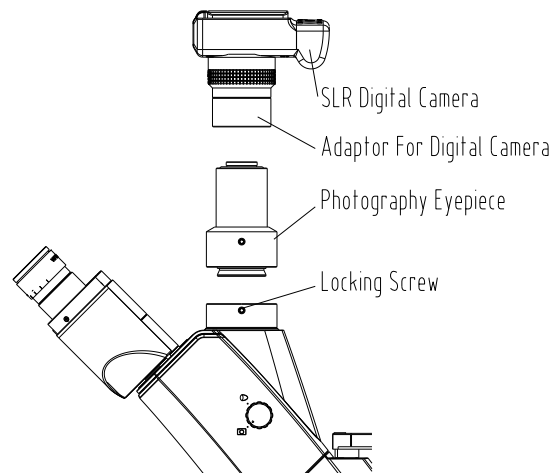


Fig.28 Installation Of SLR Digital Camera