Installation and Operating Instructions

Cole-Parmer®

MSU-600 Series Compound Microscopes

Models 78904-16, -18, -21, -24, -27, -30, -33

CE

Contents

Introduction

Thank you for purchasing the Cole-Parmer MSU-600 Series compound microscope. These powerful and ergonomic MSU-600 microscopes are ideal for life sciences, biomedical research, materials science, and universities.

Please read this manual carefully before using this product to ensure correct and safe usage

- The content of this manual is subject to change without notice
- The appearance of the actual product can differ from the models described in this manual
- Not all equipment mentioned in this manual has to be part of the set you have purchased

1.0 General safety instructions

Intended use: As a non-medical device
This microscope is intended for general observation of cells and tissues. The microscope is intended to be used with transmitted/reflected illumination and with the specimen fixed on a slide.

1.1 Dangers associated with the operation

- Improper use could result in injury, malfunction or damage to property. It must be ensured that the operator informs every user of existing hazards
- Danger of electrocution. Disconnect the power to the entire lighting system before installing, adding or changing any component
- Not to be used in corrosive or explosive environments
- Avoid direct exposure of eyes to the collimated light beam or direct light from the light guides or fibers
- To avoid a hazard to children, account for all parts and keep all packing materials in a safe place

1.2 Photobiological safety LED, important safety instructions

- Avoid direct eye exposure to any LED light source while it is on
- Before looking into the eyepieces of the microscope, lower the intensity of the LED illumination to a low level
- Avoid high-intensity exposure and long exposure to LED light because this can cause acute damage to the retina of the eye

1.3 Prevention of biological and infectious hazards

Infectious or bacterial or viral biohazard substances under observation may be a risk to the health of humans and other living organisms. Special precautions should be taken:

- **Biological hazards:** keep a logbook of all the biological substances or pathogenic microorganisms that were under observation with the microscope and show it to everybody before they use the microscope or before they do some maintenance work on the microscope! Agents can be bacterial, spores, enveloped or non-enveloped virus particles, fungi or protozoa
- **Contamination hazard:**
  - A sample that is properly enclosed with a cover glass, never comes in direct contact with the microscope parts. In that case prevention of contamination lies in the handling of the slides, as long as the slides are decontaminated before use and are treated normally and are not damaged, there is virtually zero risk of contamination
  - A sample that is mounted on a slide without cover glass, can come in contact with components of the microscope and be a hazard to humans and/or the environment. Therefore, check the microscope and accessories on possible contaminations. Clean the microscope surfaces and its components as thoroughly as possible and should you identify a possible contamination, inform the local responsible person in your organization
  - Microscope operators could be contaminated from other activities and cross-contaminate components of the microscope. Therefore, check the microscope and accessories on possible contaminations. Clean the microscope surfaces and its components as thoroughly as possible and should you identify a possible contamination, inform the local responsible person in your organization. It's recommended to wear sterile gloves when preparing the slides and manipulating the microscope in order to reduce contamination by the operator
- **Infection hazard:** direct contact with the focusing knobs, stage adjustments, stage and eyepieces/tubes of the microscope can be a potential source of bacterial and/or viral infections. The risk can be limited by using personal eyeshades or eyepieces. You can also use personal protections such as operation gloves and/or safety goggles which can be frequently changed to minimize the risk
- **Disinfectant hazards**: before cleaning or disinfection check if the room is adequately ventilated. If not, wear respiratory protective equipment. Exposure to chemicals and aerosols can harm human eyes, skin and respiratory system. Do not inhale vapours. During disinfection, do not eat, drink or smoke. Used disinfectants must be disposed according to local or national regulations for health and safety

1.4 Disinfection and decontamination

- Exterior casing and mechanical surfaces must be wiped with a clean cloth dampened with a disinfectant
- Soft plastic parts and rubber surfaces can be cleaned by gently wiping a clean cloth dampened with a disinfectant. Discoloration can occur if alcohol is used
- The front lens of eyepieces and objectives are sensitive to chemicals. We recommend not to use aggressive disinfectants but to use lens paper or a soft fiber-free tissue damped in cleaning solution. Cotton swabs can also be used. We recommend you use personal eyepieces without eyeshades in order to minimize risk
- Never immerse or dip the eyepiece or objective into a disinfectant liquid! This will damage the component
- Never use abrasive compounds or cleaners that can damage and scratch coating surfaces of optics
- Clean and disinfect all possible contaminated surfaces of the microscope or contaminated accessories properly before storing for future use. Disinfection procedures must be effective and appropriate
- Leave the disinfectant on the surface for the required exposure time, as specified by the manufacturer. If the disinfectant evaporates before the full exposure time, reapply disinfectant on the surface
- Against bacteria, use a 70% aqueous solution of isopropanol (isopropyl alcohol) and apply for at least 30 seconds. Against viruses, we recommend to refer to specific alcohol or non-alcohol based disinfection products for laboratories

Before returning a microscope for repair or maintenance through a Cole-Parmer dealer, a RMA (return authorization form) and a decontamination statement must be filled in! This document must be shipped together at all times with the microscope.

Handle with care

- This product is a high quality optical instrument. Delicate handling is required
- Avoid subjecting it to sudden shocks and impacts
- Impacts, even small ones, can affect the precision of the objective

Handling the LED

Note: Always disconnect the power cord from your microscope before handling the LED bulb and power unit and allow the system approximately 35 minutes to cool down to avoid burns

- Never touch the LED with your bare hands
- Dirt or fingerprints will reduce the life span and can result in uneven illumination lowering the optical performance
- Use only MSU-600 Series original replacement LEDs
- Use of other products will cause malfunctions and void warranty
- During use of the microscope the power unit will get hot; never touch it while in operation and allow the system approximately 35 minutes to cool down to avoid burns

Dirt on the lenses

- Dirt on or inside the optical components, such as eyepieces, lenses, etc., affect the image quality of your system negatively
- Always try to prevent your microscope from getting dirty by using the dust cover, prevent leaving fingerprints on the lenses and clean the outer surface of the lens regularly
- Cleaning optical components is a delicate matter. Please read the cleaning instructions further on in this manual

Environment, storage and use

- Maximum altitude: 2000 m
- Pollution degree: 2
- This product is a precision instrument and it should be used in a proper environment for optimal use
- Install your product indoors on a stable, vibration free and level surface in order to prevent this instrument to fall thereby harming the operator
- Do not place the product in direct sunlight
- The ambient temperature should be between 5 to +40°C and humidity should be between 20 to 80% RH. Although the system is anti-mold treated, installing this product in a hot, humid location may still result in the formation of mold or condensation on lenses, impairing performance or causing malfunctions
- Never turn the right and left focus knobs in opposite directions at the same time or turn the coarse focus knob past its farthest point as this will damage this product
- Never use undue force when turning the knobs
- Make sure that the microscope system can dissipate its heat (fire hazard)
- Keep the microscope approximately 15 cm free from walls and obstructions
- Never turn the microscope on when the dust cover is in place or when items are placed on the microscope
- Keep flammable fluids, fabric, etc. well out of the way

Disconnect power

Always disconnect your microscope from power before doing any maintenance, cleaning, assembling or replacing LEDs to prevent electric shocks

Prevent contact with water and other fluids

Never allow water or other fluids to come in contact with your microscope, this can cause short circuiting your device, causing malfunction and damage of your system

Moving and assembling

- This microscope is a relatively heavy system, consider this when moving and installing the system
- Always lift the microscope by holding the main body and base of the microscope
- Never lift or move the microscope by its focusing knobs, stage or head
- When needed, move the microscope with two persons instead of one

2.0 Models

The MSU-600 Series compound microscope is available with observation methods such as brightfield, phase contrast, and darkfield. Models with polarization and metallurgical attachments are suitable for materials science applications. Please note: On coleparmer.com you can find the latest updates about MSU-600 models and accessories

Model	Type	Objectives*	Working distance	Stand	Illumination	Power	Weight
78904-16	Binocular	4x/10x/S40x/S100x, semi-plan	48 to 76 mm	Rackless integrated X-Y mechanical stage	3 W NeoLED	100–240 VAC, 50/60 Hz	24.1 lb (10.9 kg)
78904-18	Trinocular	4x/10x/S40x/S100x, semi-plan	48 to 76 mm	Rackless integrated X-Y mechanical stage	3 W NeoLED	100–240 VAC, 50/60 Hz	25.3 lb (11.5 kg)
78904-21	Trinocular	4x/10x/S40x/S100x, plan	48 to 76 mm	Rackless integrated X-Y mechanical stage	3 W Kohler NeoLED	100–240 VAC, 50/60 Hz	25 lb (11.3 kg)
78904-24	Trinocular	10x/20x/S40x/S100x, plan, phase contrast	48 to 76 mm	Rackless integrated X-Y mechanical stage	3 W Kohler NeoLED	100–240 VAC, 50/60 Hz	25 lb (11.3 kg)
78904-27	Trinocular	4x/10x/S40x/S100x, plan, darkfield	48 to 76 mm	Rackless integrated X-Y mechanical stage	5 W LED	100–240 VAC, 50/60 Hz	25 lb (11.3 kg)
78904-30	Trinocular	5x/10x/20x/50x, plan, metallurgical	48 to 76 mm	Rackless integrated X-Y mechanical stage	3 W Kohler NeoLED; Epi-NeoLED illumination	100–240 VAC, 50/60 Hz	23.2 lb (10.5 kg)
78904-33	Trinocular	5x/10x/20x/50x, plan, polarization	48 to 76 mm	160 mm diameter rotating stage	3 W Kohler NeoLED; 50 W halogen Epi-illumination	100–240 VAC, 50/60 Hz	27.1 lb (12.3 kg)

*The S40x, S60x and S100x objectives are equipped with a spring mount, to prevent damage to the front lens and the slide. The Numeric Aperture - N.A. – of the objective is an indication for the resolving power of the objective

The total magnification can be calculated by multiplying the magnification of the eyepiece with the magnification of the objective. The magnifications are displayed in the table below:

Eyepiece	Objective	Magnification
10x	4x	40x
10x	10x	100x
10x	20x	200x
10x	40x	400x
10x	50x	500x
10x	100x	1000x

3.0 Components of the microscope

The names of the several parts are listed below and are indicated in the picture:

A. Camera focus adjustment part	I. Dioptric adjustment
B. Trinocular tube	J. Nosepiece for 5 objectives
C. Microscope head	K. Objectives
D. Height adjustment condenser	L. Stage with X-Y mechanical stage
E. Slide protection handle	M. Condenser with iris diaphragm
F. Coaxial coarse-and fine adjustment	N. X-Y stage controls
G. Light intensity adjustment knob	O. Kohler iris diaphragm
H. Eyepieces	P. Collector lens
	Q. Auto-off sensor

4.0 Preparing the microscope for use

Carefully remove the items from their packing and place them on a flat, firm surface. Please do not expose the microscope to direct sun light, high temperatures, damp, dust or acute shake. Please make sure the worktable is flat and horizontal.

When moving the microscope, use the left hand to hold the transport handle (A) at the back of the microscope and with the right hand the bottom of the microscope.

Caution! Holding the microscope by the stage, the stage focusing knob will damage the microscope.

Insert the power cord into the back of the microscope and use the cable storage system to store excessive cable while in use or the entire cable after use (B).

Caution! If the bacterial solution or water splatters over the stage, objective or head, pull out the power cord immediately and dry the microscope.

For safety reasons, make sure the power switch is turned off, the plug removed before replacing the led unit or fuse.

4.1 Assembling steps

The steps mentioned below are often not necessary but described for your convenience nonetheless:

Mounting the objectives

- Rotate the coarse focusing knob to lower the stage to the lowest position
- Install the objectives into the objective nosepiece from the lowest magnification to the highest in a clockwise direction from the rear of the microscope. When using the microscope, start by using the low magnification objective (4X or 10X) to search for specimen and focus, and then continue with a higher magnification objective to observe

Assembling the microscope head

- Remove the black cover from the upper side of the stand as indicated in picture A (below), using the Allen wrench supplied with the microscope
- Remove the transparent cover on the bottom of the head (picture B)
- Place the head of the MSU-600 on the stand and fix it with the Allen wrench as indicated in picture C. The dovetail on the bottom fits into the slot on the top of the body

Placing the eyepieces

- Remove the cover of eyepiece tube
- Insert the eyepiece into the eyepiece tube (picture D)

Locking the eyepieces

For models without diopter adjustment, please find the screw for locking the eyepiece on the tube ring (picture E). Please note that location can be slightly rotated from model to model. For models with diopter adjustment, take out the eyepiece (picture F) and look into the tube to find the right position of screw (picture G).

The eyeshades (optional)

Each eyepiece has a rubber eyeshade. This prevents damage to the lens, and stray light. The eyeshade can simply be slipped over the eyepiece

Connecting the power cord

The MSU-600 series supports a wide range of operating voltages: 100 to 240 VAC. Please use a grounded power connection

- Make sure the power switch is off before connecting
- Insert the connector of power cord into the power socket, and make sure it connects well
- Insert the other connector into the mains socket, and make sure it connects well.

Do not bend or twist the power cord, it will get damaged. Use the special cord supplied by Cole-Parmer. If it's lost or damaged, choose one with the same specifications

5.0 Operation

5.1 Setting up the illumination

For optimal effect in contrast and resolution one should follow the below procedure:

- Place a specimen on the object stage and focus using the 4x objective with a fully opened iris diaphragm
- Turn light intensity to the lowest position, then look through the eyepiece(s) and turn up to comfortable intensity level
- Turn the condenser in the highest position (for phase contrast models, please set condenser to brightfield position)
- Close the iris diaphragm, until it is just visible on the edge of the field of view

The microscope is properly set for use with the 4x objective. For each other magnification in brightfield use this procedure should be repeated to ensure the best balance between contrast and resolution. Phase contrast use will be explained further on in this manual.

Caution: The maximum light intensity when using the 4x and 10x can damage the eyes!

5.2 Placing the specimen slide

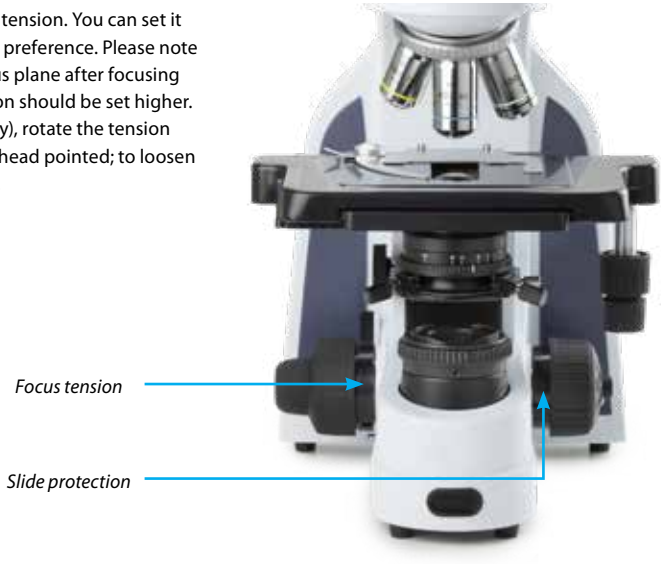
- Push the arm of the specimen holder backwards
- Release the arm slowly clamping the slide with the cover glass facing up
- Rotating the X and Y-axis knob will move the specimen to the center for alignment with the center of the objective

5.3 Focusing and slide protection

- Select the objective 4x to the optical path
- Observe the right eyepiece with right eye. Rotate the coarse focusing knob until the image appears
- Rotate the fine focusing knob for detailed focusing
- When focused with S100x objective, lock the slide protection handle. The slide protection handle protects the slide by limiting the travel of the table. This way the objective will not touch and damage your slides

5.4 Adjusting the focusing tension

The focusing knobs can be adjusted for tension. You can set it from light to heavy according your own preference. Please note that when the specimen leaves the focus plane after focusing or the stage declines by itself, the tension should be set higher. To tighten the focusing arm (more heavy), rotate the tension adjustment ring according to the arrowhead pointed; to loosen it, please turn it in the reverse direction.

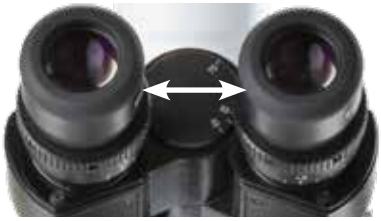


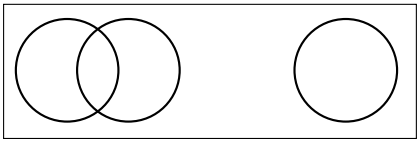
5.5 Eyepieces

Using a binocular (or trinocular) tube is less tiring for the eyes than the use of a monocular tube. In order to obtain a smooth "compound" image, one should go through the steps below.

5.5.1. The interpupillary distance

The correct interpupillary distance is reached when one round image is seen in the field of view (see image below). This distance can be set by either pulling the tubes towards each other or pulling them from each other. This distance is different for each observer and thus should be set individually. When more users are working with the microscope it is recommended to remember your interpupillary distance for a quick set-up during new microscopy sessions. The MSU-600's swiveling eyepiece tube can be rotated 360°. You can select corresponding eye point height according to your own preference.





Field of view before adjustment | *Field of view after adjustment*

5.5.2. The correct eye point

The eye point is the distance from the eyepiece to the user's pupil. To obtain the correct eye point, move the eyes towards the eyepieces until a sharp image is reached at a full field of view.

5.5.3. Adjusting the diopter(s)

In order to compensate for human eye differences, distortion, thickness differences in cover glasses and tune for the best parfocality between objectives, one can use the diopter to do so. Take a good prepared slide for your reference:

5.5.3.1 Microscope models equipped with one diopter adjustment

- Position the diopter marking on the zero point
- Look into both eyepieces and focus on the specimen
- Close the right eye and look into the eyepiece with diopter adjustment, rotate the diopter adjustment from "+" to "–" until the selected area get as sharp as possible

5.5. 3.2 Microscope models equipped with two diopter adjustments

- Set (both) the diopter adjustments of the eyepieces to "0"
- Select the 10x objective, look for a interesting area on the specimen and focus on this area
- Select the 40x objective and focus on the specimen

Warning: **don't change the coarse and fine adjustment any more.**

- With your dominant eye open (close your other eye), rotate the diopter adjustment from "+" to "–" until the selected area get as sharp as possible as with the 40x objective
- If during this operation the image becomes unsharp, take your eyes from the eyepieces and turn the diopter adjustment, **without looking into the eyepieces**, a few divisions back from "-" to "+" .
- Look into the eyepieces again and turn the diopter adjustment from "+" to "-" until the selected area on your specimen gets the optimal sharpness
- Repeat for your non-dominant eye, and with the second diopter

Verification:

- Take your eyes from the eyepieces and look for 2 seconds to a far point in the room in order to "reset" your eyes
- Look again into the eyepieces. If the adjustment is not good, repeat the operation until you reach the same sharpness for the 10x and 40x objective **without** touching the coarse and micrometric adjustments

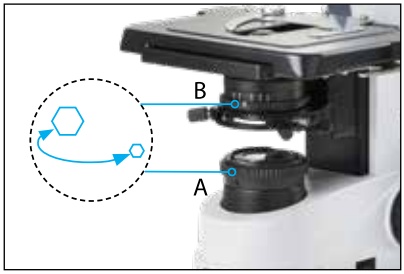
5.6 Abbe condenser

Beneath the object stage an Abbe condenser N.A. 12.5 is mounted. The condenser is factory pre-centered but can be adjusted in height by means of a rack and pinion movement and knob. With this, one can focus the light on the specimen by which the contrast can be optimized. If needed the following procedure can be used to center the condenser:

1. Move the condenser to the highest position
2. Select the 10x objective into the light path and focus the specimen
3. Rotate the field diaphragm adjustment ring to put the field diaphragm to the smallest position
4. Rotate the condenser up/down knob, and adjust the image to be clearest
5. Adjust the center adjustment screw and put the image to the center of the field of view
6. Open the field diaphragm gradually. If the image is in the center all the time and inscribed to the field of view, the condenser has been centered correctly

5.7 The field (Köhler) diaphragm (A)

By limiting the diameter of the beam entering the condenser, the field diaphragm can prevent stray light and enhance the image contrast. When the image is just on the edge of the field of view, the objective can show the best performance and obtain the clearest image. The diaphragm is factory pre-centered.



5.8 Adjusting the Aperture Diaphragm (B)

- The diaphragm is used to adjust the Numerical Aperture of the condenser. When the N.A. of the condenser matches the N.A. of the objective, the highest possible resolution is obtained
- When contrast is low, rotate the diaphragm adjustment ring to 70% to 80% of the N.A. of objective. This will improve the contrast of the image. The diaphragm is factory pre-centered.

5.9 Use of the S100x oil-immersion objective

The MSU-600 Series is equipped with an S100x N.A. 1.25 oil immersion objective. Please follow these instructions for use:

1. Remove the dust protection from the revolving nosepiece to mount the S100x objective
2. Focus the image with the S40x objective
3. Turn the revolving nosepiece so the S100x objective almost reaches the click-stop
4. Put a small drop of immersion oil on the center of the slide
5. Now turn the S100x objective so that you feel the click stop
6. The front lens is in contact with the immersion oil
7. Look through the eyepiece and focus the image with the fine adjustment knobs
8. The distance between the lens of the objective and the slide is very small!
9. In case there are small bubbles visible turn the S100x objective a couple of times left/right so that the front of the objective moves in the oil and the bubbles will disappear
10. After using the S100x objective turn the table with the fine adjustment knobs downwards until the front lens doesn't touch the oil any longer
11. Always clean the front lens of the S100x objective with a lens paper moistened with a drop of isopropanol
12. Clean the slide after use as well

5.10 Safety device

To prevent damage to the objective lens or the slide, all types are equipped with a pre-fixed safety device. It is recommended to use slides of 1.0 – 1.2 mm thickness in combination with cover glasses of 0.13 mm or 0.17 mm thickness.

5.11 Illumination

The illumination has the following specifications:

- LED : 3W NeoLED
- Power supply : Primary 100–240 VAC, 50/60 Hz

5.12 Auto-Off Function

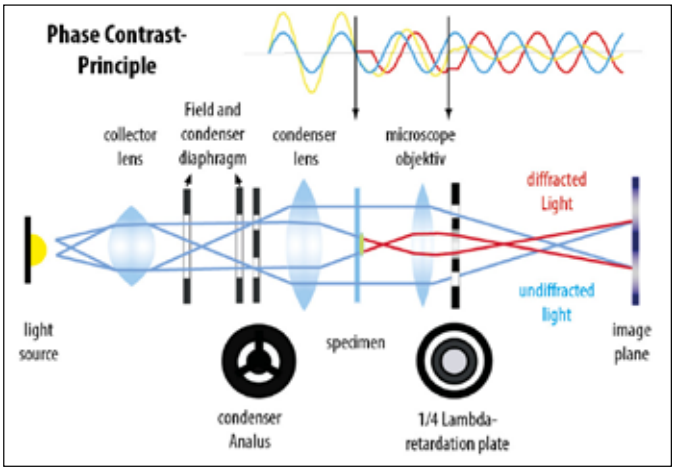
After 20 to 30 minutes of non-use, the light source will turn off automatically. The indicator LED (1) will flash once every 3 seconds. To turn the light back on, press function button (2). To turn off the auto-off function, press the button (2) for 3 seconds. This will cause the red indicator LED (1) to turn off and the microscope light to stay on. Press the button for another 3 seconds, it will make indicator LED (1) flash and the auto-off function is back on.

6.0 Phase contrast (model 78904-24)

6.1 Use of phase contrast

The phase contrast method was designed in 1934 by the Dutchman Frits Zernike to observe very thin or transparent objects. This technique uses the fact that light travelling through tissue undergoes a phase shift due to diffraction.

By recombining the phase shifted light with the background light, a contrasted image appears in the eyepiece.



6.2 Using the Phase contrast slider

- Keep the phase contrast slider face up (text up); insert it from left to right into the condenser slider socket as the direction of the arrow pointed
- Each slider has 3 positions, 2 phase contrast positions and in the center of the slide the brightfield position for normal use without phase contrast. Each phase contrast objective used has to be matched with the phase contrast ring on the slider. For example: when the 10x phase contrast objective is used the slider should be positioned to match the 10 phase diaphragm.

Note: The phase diaphragms in the sliders are pre-centered and do not need to be adjusted in operation

6.3 Using the Zernike phase contrast set

Any MSU-600 model with a Zernike phase contrast set comes with the condenser and objectives already mounted and centered on your microscope. If you suspect misalignment or want to check the alignment please see the next section for "6.4 Centering the phase rings". The height of condenser can be adjusted in height by means of a rack and pinion movement. In this way the light beam is concentrated in the specimen for an optimum resolution.

6.4 Centering the phase rings

The Zernike phase disc has five positions:

- "DF" for darkfield observation (up to 400x),
- "BF" for brightfield observation, this position also has an iris diaphragm
- And "10/20", "40" "100" which are corresponding to phase contrast observation using 10×, 20×, 40×, 100× objectives respectively

Centration screws

Zernike condenser position indication

When the condenser is in the DF or BF position the objectives can be used for either darkfield or bright field. For phase contrast, the condenser position should match the objective used. Meaning that when the condenser is in position "40" the objective used should also be 40x

- Rotate 10× infinity plan phase contrast objective into the field of view, then set the condenser to match the objective (marker "10/20")
- Take the eyepiece out of the tube and insert the centering telescope in its place. Observed from centering telescope, the dark and bright ring images should coincide with each other as shown in the figures below. If the ring images can't be observed clearly, first try and focus the centering telescope. If this does not solve the issue raise or decline the condenser
- If the bright ring and dark ring images are not coincided as shown below, adjust the position of the ring with the two screw keys on the side of the condenser to move the ring until bright and dark ring images superimpose. Repeat for all objectives/Zernike disc positions

Not centered

Centered properly

7.0 Maintenance and cleaning

Always place the dustcover over your MSU-600 microscope after use. Keep the eyepieces and objectives always mounted on the microscope to avoid dust entering the instrument

7.1 Cleaning the optics

When the eyepiece lens or front lens of the 10x or S40x objective are dirty they can be cleaned by wiping a piece of lens paper over the surface (circular movements). When this does not help put a drop of alcohol on the lens paper. Never put isopropanol or alcohol directly on the lens!
It is not necessary – and not recommended – to clean the lens surfaces at the inner side of the objectives. Sometimes dust can be removed with high pressured air. There will never be dust in the objectives if the objectives are not removed from the revolving nosepiece

Caution
Cleaning cloths containing plastic fibers can damage the coating of the lenses!

7.2 Maintenance of the stand

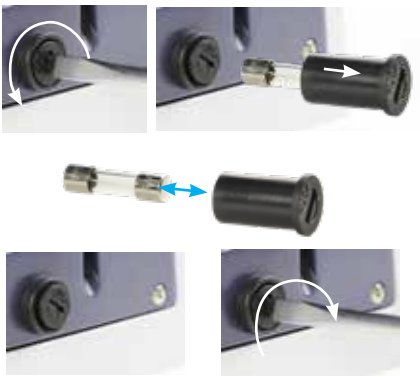
Dust can be removed with a brush. In case the stand or table is really dirty the surface can be cleaned with a non-aggressive cleaning product

All moving parts - like the height adjustment or the coaxial course and fine adjustment - contain ball bearings that are not dust sensitive. With a drop of sewing-machine oil the bearing can be lubricated

7.3 Replacing the fuse

To change the fuse, following the procedure below:

- Unplug the system from power and place the microscope with back toward you
- Find the fuse cover that will appear as a round protrusion with a slot
- Use a small flathead screwdriver or other flat object (coin, etc) to gently push the fuse cover in and turn the cover counter clockwise. You need to turn the cover about 3/4 of a turn
- The fuse cover will pop out with the fuse attached
- Remove the fuse from the cover and examine the fuse. If the thin piece of metal going from one end of the fuse to the
  other has a gap, then the fuse is bad
- If the fuse is bad, install a replacement fuse in the cover
- Gently push the fuse cover with the new fuse back into the body until it is flush with the unit. Turn the cover clockwise about 3/4 to secure the cover back into the unit
- Fuse specification: 250v 500mA



Note: Fuse may blow in order to prevent internal damage to the microscope. And in most cases, replacing with a correctly rated fuse will resolve the issue. However, should you encounter a blown fuse frequently, please contact your distributor for further assistance

8.0 Digital cameras

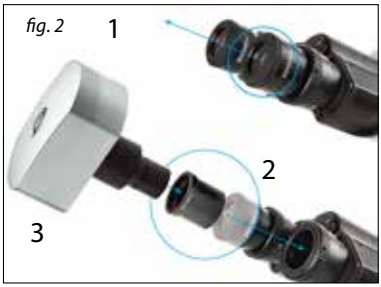
Digital cameras are designed to be used on the photo port of the microscope head (fig. 1). It is also possible to use the digital camera in combination with a binocular head (fig.2). For MSU-600 Series, simply remove the eyepiece [1] and place the 30mm adapter ring into the eyepiece tube [2] then place the camera with mounted c-mount adapter in the eyepiece tube [3]. Focus the digital image with the coarse and fine controls of the microscope.

For trinocular models, slide the camera with mounted C-mount adapter into the 23.2 mm tube of the photo port. For focussing, slowly unscrew the tube (A) you will be able to match parfocality of the camera with the view through the eyepieces by moving the camera up and down inside the 23.2 mm tube. Take an easy-to-view specimen and focus the image through the microscope's eyepieces (with diopter adjustment set on "0"). Afterwards, perform the height adjustment procedure above while watching the image on the computer screen. In this case, once you have obtained parfocality in the device, tighten screw (A) again. Screw (B) is only used to fix the 23.2mm tube on the photo port.

Follow the manual that comes with the camera for camera operation

fig. 1

fig. 2



9.0 Accessories and spare parts

For current accessories and spares, please visit website coleparmer.com

10.0 Warranty

These microscopes come with a five (5) year factory warranty against manufacturing defects, covering labor and parts. Warranty does not apply for consumable accessories and parts such as bulbs, batteries, fuses, cords, optical components, or any add-on accessories such as mechanical specimen holders that are not built into the microscope stage as an integral part of the original manufacture, etc. Warranty does not cover microscopes, lenses cameras or other accessories that have become inoperable due to dirt or damage due to misuse or lack of maintenance.

Note: Buyers are responsible for return shipping and handling cost for warranty services. Warranty covers parts and labor only.

Notes

11.0 Supplementary Manuals

11.1 Supplementary Manual for Darkfield Model 78904-27

11.1 Supplementary Manual for Darkfield Model 78904-27 (cont.)

Assembly and use of a darkfield condensor

Installation and setting

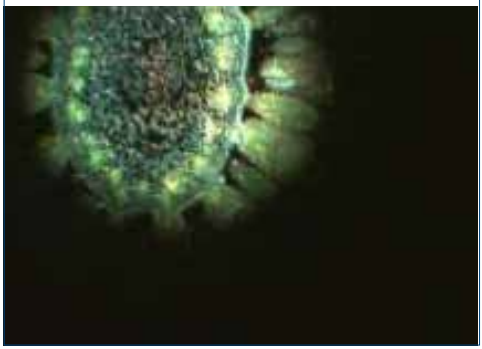
1. Remove the brightfield condenser by unwinding the screw marked with the arrow. Set up the dark field condenser and tighten the screw

2. Turn the condenser to the highest position and place a drop of immersion oil on the lens

3. Lower the condenser slightly, place the slide. In this way, the immersion oil should not yet touch the object rinse

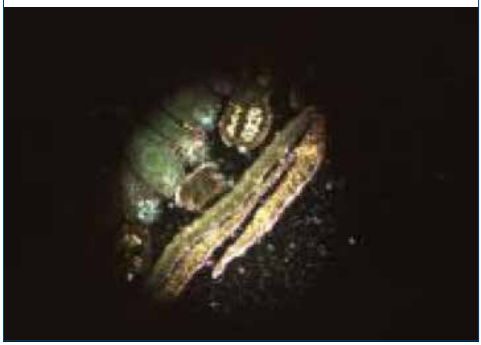
4. Gently turn the condenser up again. When the oil touches the slide, it is clearly visible through the slide

5. Focus the image with the least magnification (probably with 4x lens)

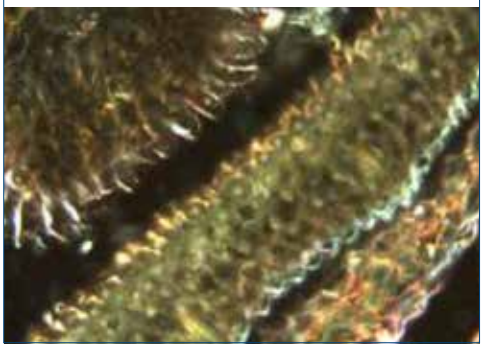


11.1 Supplementary Manual for Darkfield Model 78904-27 (cont.)

6. Center the condenser with the screws of the condenser



7. The condenser is now ready for use



8. To use the 100x lens and/or the special 100x lens with built-in iris aperture, you must also put immersion oil on the prepared slided

9. Focus the lens. On the S100x/1.25 oil immersion objective (A) and S100x/1.25 IOS super contrast objective (B) you can adjust the background by changing the opening of the inner lens aperture. The aperture canbe changed by turning the ring

A

B

11.2 Supplementary Manual for Metallurgical Model 78904-30

11.2 Supplementary Manual for Metallurgical Model 78904-30 (cont.)

Components

A. Microscope head
B. Aperture diaphragm
C. Field diaphragm
D. Two slots for color filters
E. Condenser focusing knob
F. Brightness adjustment knob
G. Main body of metallurgical attachment
H. Power adapter input

11.2 Supplementary Manual for Metallurgical Model 78904-30 (cont.)

Assembly of the microscope

1. Loosen the clamping screw (2, A) on the microscope and remove the binocular (or trinocular) head from the body of microscope
2. Insert the main body of the metallurgical attachment into the upper part of the microscope and tighten the clamping screw
3. Insert the binocular viewing head into the main body of the metallurgical attachment and tight the clamping screw (2, B) to fix the head

2

Adjusting the Illumination

1. Adjust the condenser knob (1, E) to the position where the image brightness in view is homogenous
2. Adjust the field diaphragm (1, C) and aperture diaphragm (2, B) until the two diaphragm sizes are properly selected

- Aperture diaphragm: the aperture diaphragm (iris diaphragm) is designed for matching the objective's numerical aperture, not to be used for adjusting brightness. Adjust the diaphragm size until it is just out of the field of view. When switching objectives, the aperture diaphragm size should be changed along with it.
- Field diaphragm: is used to reduce stray light. Adjust the diaphragm size until it is just out of the field of view for best operation

11.3 Supplementary Manual for Polarization Model 78904-33

11.3 Supplementary Manual for Polarization Model 78904-33 (cont.)

Introduction

This manual is meant as a supplement to the standard manual and only describes the functions and use of the polarization elements of your microscope.

Basic controls

Stage Rotation

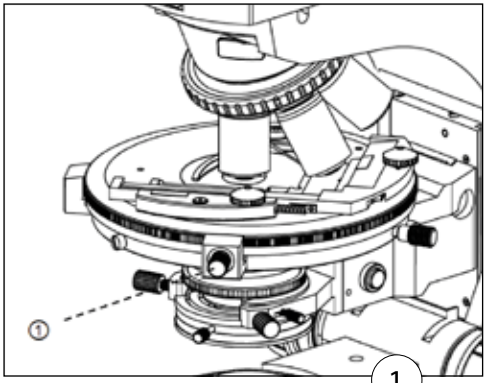
When the stage rotation clamping knob (1) is loosened, the stage can be rotated 360° horizontally.

Using the Bertrand Lens

By revolving the Bertrand lens dial (3), the Bertrand lens can be selected. At the "O" position, the lens is removed from the light path. At the "B" position, the lens is engaged.

Focusing the Bertrand Lens

During conoscopic observation, to focus the conoscopic image, turn the Bertrand lens focusing ring (4) slightly until a clear interference image is obtained in the eyepiece.



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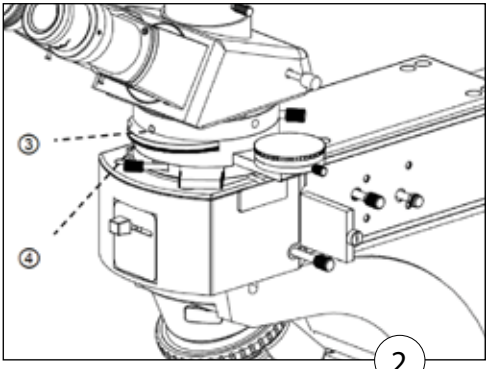

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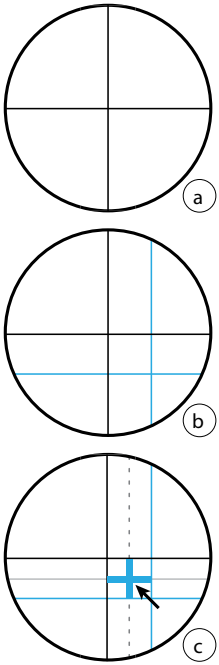
11.3 Supplementary Manual for Polarization Model 78904-33 (cont.)

Adjustments before observation

Centering the objectives

All 360° centering objectives of the MSU-600 Series material microscopes are pre-centered in our factory. However, during transportation or after a long period of inactivity, the centering of these objectives may have been shifted.

Please follow the steps below in order to re-center the objectives of a polarization microscope:



1. Remove one eyepiece from the microscope head
2. Insert the widefield eyepiece with a crosshairs into the tube of the eyepiece you just removed
3. Position a microscope slide with a crosshairs reticule under the stage clamps
4. Check if the 4x objective is positioned in the optical path
5. Position the round stage with the vernier on its "0" position
6. Position the middle of the crosshairs of the microscope slide on top of the cross-hairs of the eyepiece (a)
7. Rotate the stage by 180°. A displacement might be observed (b)
8. Move by hand, the middle of the crosshairs of the microscope slide, approximately half way to the eyepiece crosshairs (c)
9. Rotate the stage back to its "0" position
10. The 4x objective is equipped with two adjustable screws inside the revolving nosepiece for centering the objective. Use the centering screws to move the center of the eyepiece crosshairs towards the center of the crosshairs of the microscope slide
11. Repeat steps 7 to 10 until the objective is centered
12. Repeat for the other objectives using same procedure

If the centering cannot be done correctly:

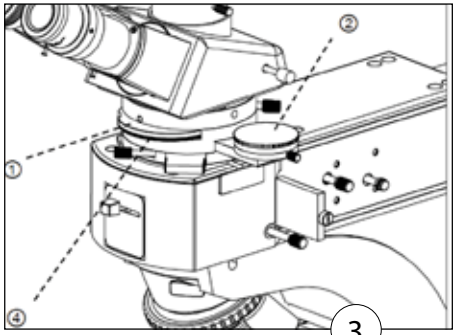
1. Check if the 4x objective is set in the central position of the centering screw's correction range. This means that when the centration is changed by using the screws in the revolver, the cross of the slide should be able to move to all directions in an equal amount
2. Repeat this for the other objectives
3. If the centering is still unsuccessful, please check if the mechanical stage is correctly centered. The stage is fixed by four screws at the bottom of the stage. Untighten the screws so the stage can be moved and align the stage around the lens of the condenser visually. Note that the condenser should first be aligned in the correct manner, the procedure is described in the general MSU-600 Series microscope user manual

11.3 Supplementary Manual for Polarization Model 78904-33 (cont.)

Orthoscopic observation

Orthoscopic observation is available for 4x to 100x objectives

1. Revolve the Bertrand lens dial (1) to "O" position in order to remove the Bertrand lens from optical path
2. Swing out the top lens of the condenser
3. For reflected illumination system, the polarizer is fixed and the analyzer can be rotated 360 degrees. Rotate the analyzer (2) until complete extinction is obtained
4. For transmitted illumination, the polarizer can be rotated 360 degrees, turn it until complete extinction is obtained
5. Place the specimen for orthoscopic observation
6. Insert test plates for further observation, test and study

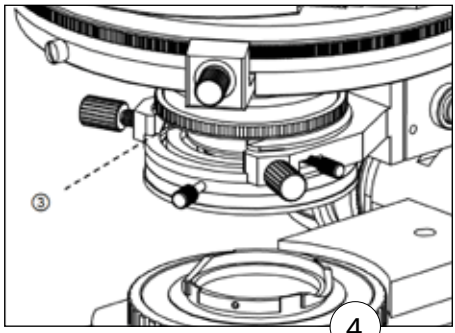


3

Conoscopic observation

Use 20x to 100x objectives

1. Engage the polarizer and analyzer for extinction position
2. Swing the condenser top lens into the light path
3. Revolve the Bertrand lens dial (1) to "B" position, to engae the lens into the light path
4. Open the aperture iris diaphragm (4) to its largest size
5. Revolve the focusing dial (5) of the Bertrand lens to focus on the conoscopic image



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Note: If the periphery of the conoscopic image is dark, move the condenser vertically to find the position where the periphery is brightest

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Pricing on any accessories shown can be found by keying the part number into the search box on our website.

The specifications listed in this brochure are subject to change by the manufacturer and therefore cannot be guaranteed to be correct.
If there are aspects of the specification that must be guaranteed, please provide these to our sales team so that details can be confirmed.

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Please contact us if this literature doesn't answer all your questions.