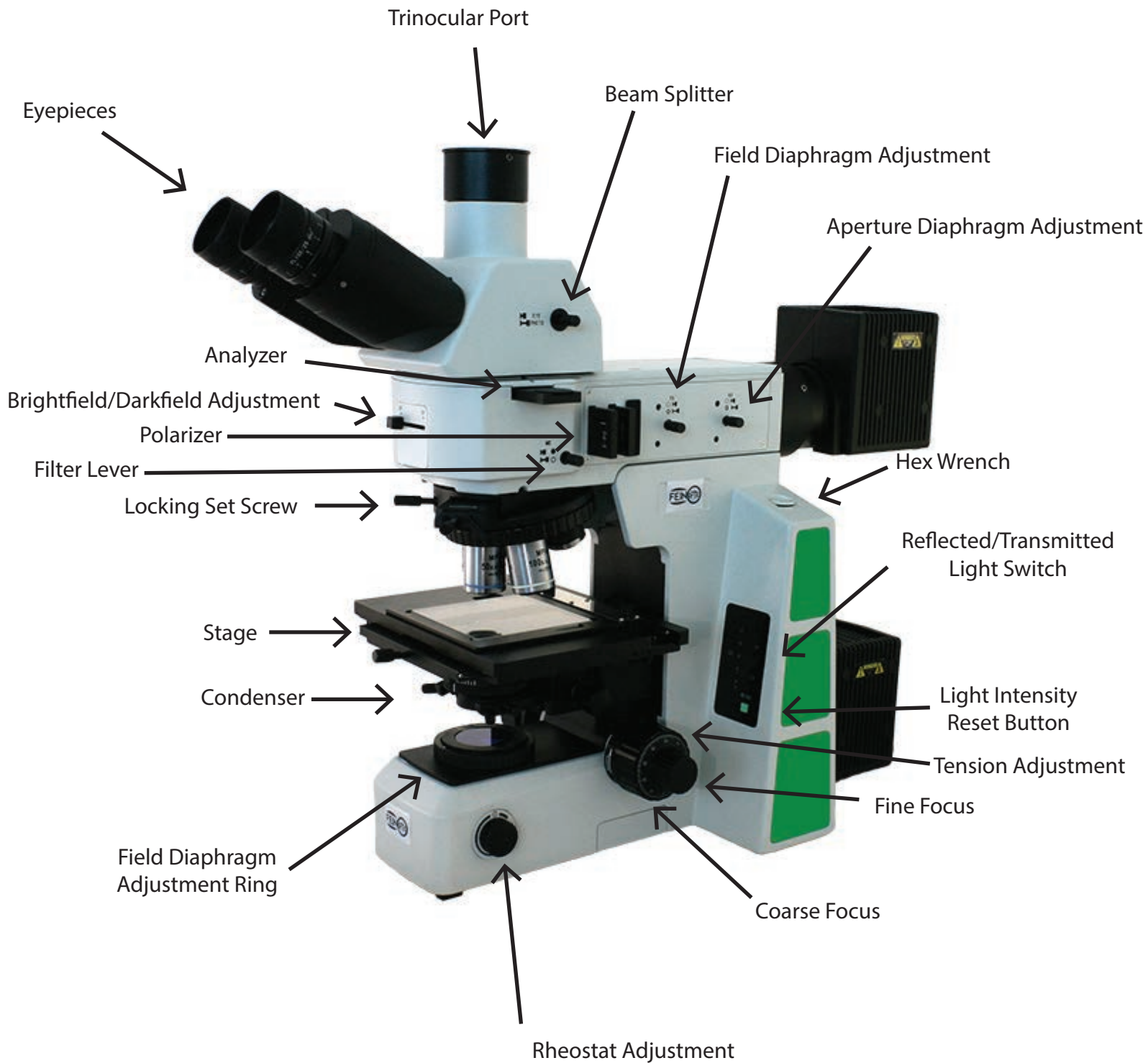


M50 Microscope User's Manual

for M50 and M50RT Metallurgical Microscopes



Microscope Components:



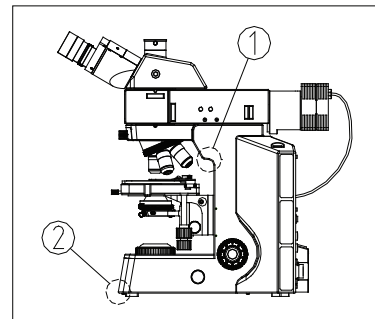
M50RT Reflected & Transmitted Light Metallurgical Microscope

Note that M50 Reflected Light only is similar except it has no transmitted light.

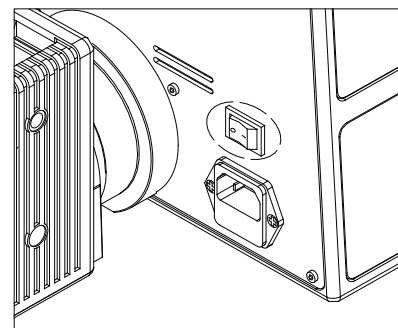
Before Use:



Do not shake or drop the microscope. Do not expose the microscope to direct sunlight or store in high temperature, damp or dusty areas. Make sure the workspace is horizontal. Indoor temperature should be between 41-104°F with a maximum relative humidity 80%. When moving the microscope, use one hand to hold the arm (1) and the other hand to hold the front of the base (2). Do NOT hold the microscope by the stage, focusing knob, head or light source when carrying it.



When working, make sure the light source has enough room for any heat to dissipate. Before replacing the fuse, make sure the power switch is in the "O" (off) position. Voltage range of 100~240V is supported. Make sure voltage is in this range. Only use the power cord supplied with the microscope.



Microscope Maintenance:



Wipe lenses gently with a soft tissue. Carefully wipe off fingerprints on the lens surface with a tissue moistened with a small amount of 3:7 mixture of alcohol and ether or dimethylbenzene, or a microscope cleaning solution.



Do not use organic solution to wipe the surfaces of other components. If needed use neutral detergent.



If the microscope becomes wet, power it off immediately and wipe all surfaces dry. Do not disassemble the microscope.

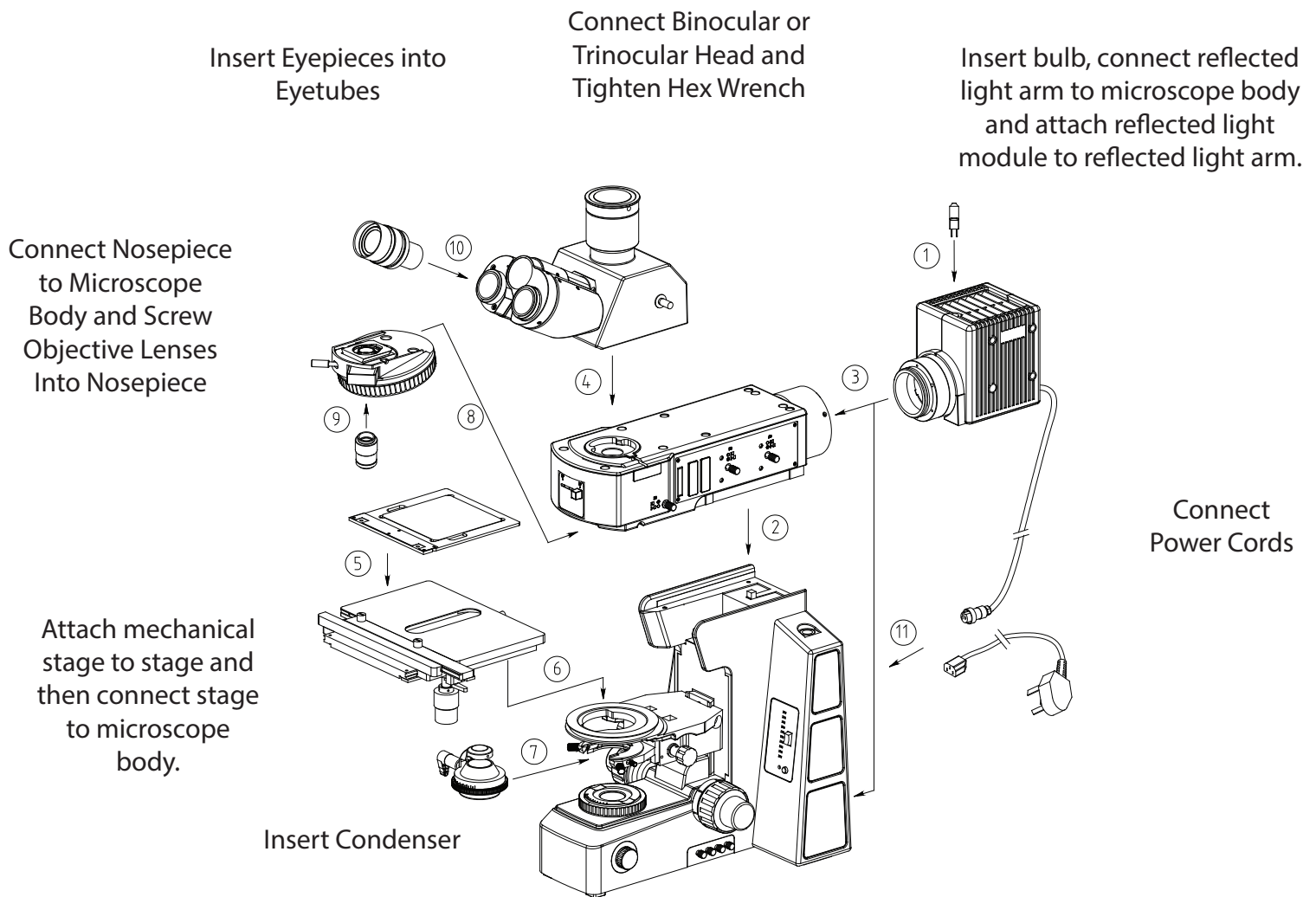


When not in use, cover the microscope with the dust cover.

Microscope Assembly:

Follow the numbered diagram below when assembling the microscope.

If assembling the M50 (reflected light only) microscope, omit step 7.





Halogen Bulb Replacement & Assembly (Reflected or Transmitted Light)

Unplug microscope.

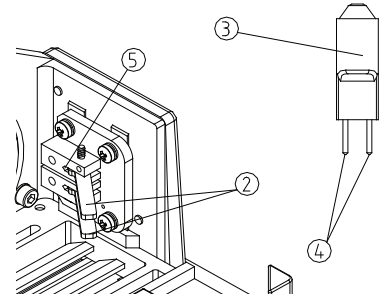
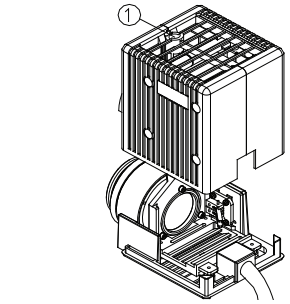
Loosen the set screw (1) and remove the light housing.

Open the bulb clasps (2) and holding the bulb (3) with lens tissue or a glove, insert the pins (4) into the bulb holder (5). The bulb will be vertical after assembly.

Release the bulb clasps (2) back to their original position, locking the bulb into place. Replace the light housing and tighten the set screw (1).

Replacement Bulb: 12v, 100w Halogen, part# 12v100wH

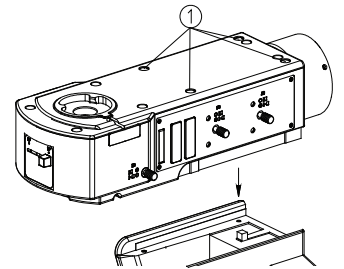
View more images on page 16.



Assemble the Vertical Illuminator

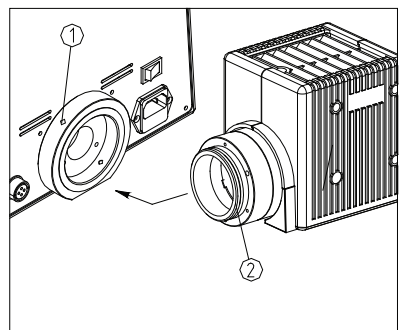
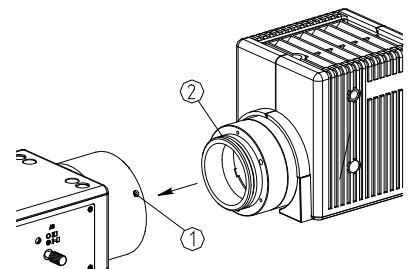
Remove the caps (1) on the illuminator.

Place the vertical illuminator on the microscope body and tighten the set screws and replace the caps (1).



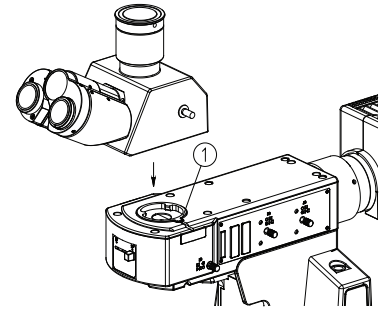
Assemble the Illuminator Light Source

Loosen the set screw (1) on the light source connector. Push the light source group connector (2) into the illuminator connector and tighten the set screw (1).



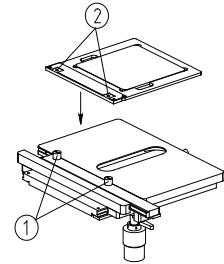


Assemble the head by loosening the set screw (1), inserting the head onto the reflected light illuminator, and then tightening the set screw (1) again when finished.



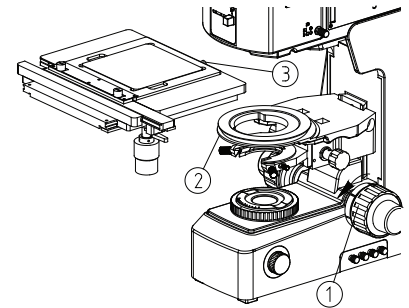
Assemble the Glass Stage (M50RT)

Loosen the set screws (1) on the stage. Match the holes (2) on the glass stage with the screw holes on the stage, set in place and retighten the set screws (1).



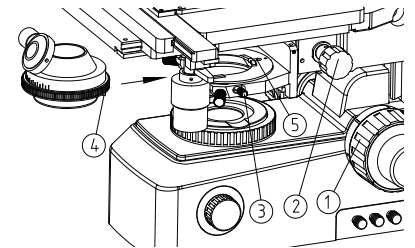
Assemble the Stage

Rotate the coarse focus knob (1) counterclockwise to move the stage bracket (2) to the lowest position. Loosen the set screw (3) on the stage. Line up the "V" notches on the bottom of the stage with the "V" in the stage. Retighten the set screw (3).



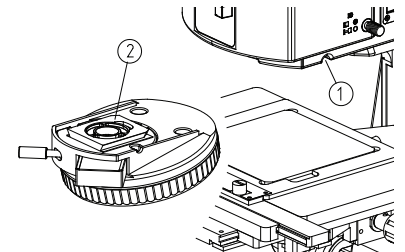
Assemble the Condenser (M50RT)

Rotate the coarse focus knob (1) to raise the stage to its highest position. Rotate the condenser height knob (2) to move the condenser bracket to its lowest position. Loosen the condenser set screw (3). Swing out the front lens of the condenser with the scale facing forward. Line up the locking screw (4) on the condenser with the notch (5) in the condenser bracket. Slide the condenser all the way into the holder. Retighten the set screw (3) and raise the condenser back to the highest position with the condenser height knob (2).



Assemble the Nosepiece

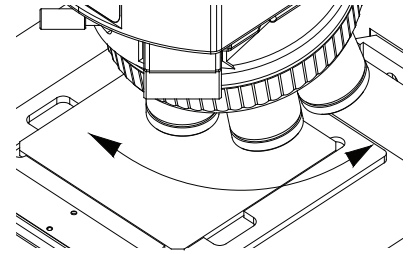
Loosen the set screw (1) on the vertical illuminator arm. Match the dovetail interface (2) of the nosepiece with the dovetail groove on the illuminator and push it all the way in. Retighten the set screw (1).





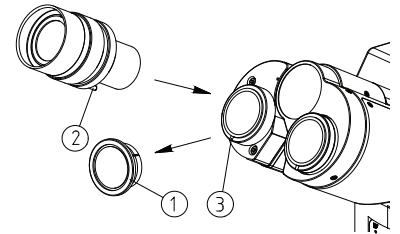
Assemble the Objectives

Rotate the coarse focus knob counterclockwise to lower the stage. Install the lowest magnification objective into the nosepiece. Install the remaining objectives into the nosepiece from lowest to highest magnification in a clockwise direction.



Assemble the Eyepieces

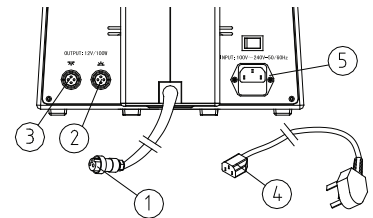
Remove the covers (1) from the eyetubes. Match the positioning screw (2) to the groove (3) in the eyetube and insert the eyepiece into the eyetube until it touches the bottom.





Connect the Power Cord

Make sure the main switch is set to "O" off. Connect the transmitted light source (M50RT) plug (1) with the microscope aviation socket (2) and insert the plug. Match the reflected light aviation plug into the microscope aviation socket (3) and insert the plug. Insert one end of the power cord (4) into the power socket (5) on the microscope. Insert the other end of the power cord into the power socket.


Don't use force when inserting power cords. Only use the power cord supplied with the microscope.

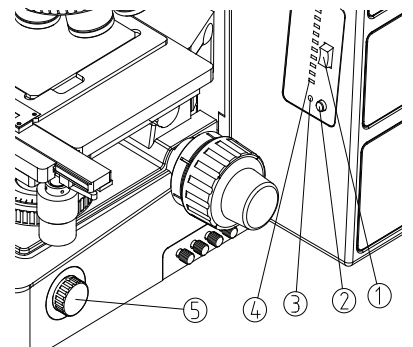


Adjust Illumination

Set the power switch to "-" to turn on the microscope. Set the switch (1) to  for transmitted illumination and to  for reflected illumination. Adjust the light rheostat control (5) until the illumination is comfortable for observation. Rotate the knob clockwise to increase brightness and counterclockwise to reduce voltage and brightness.

Press the light intensity reset button (2) to reset the light intensity to the preset position. Rotate the set screw (3) with a flathead screwdriver to set the light intensity. Rotate it clockwise to raise the intensity and counterclockwise to lower the intensity. The number on the voltage indicator (4) shows the voltage. Using bulbs in a lower intensity state (lower voltage) will extend bulb life.

The light intensity of this microscope is preset for the best photomicrography by LBD filter. About 8V at the  sign.

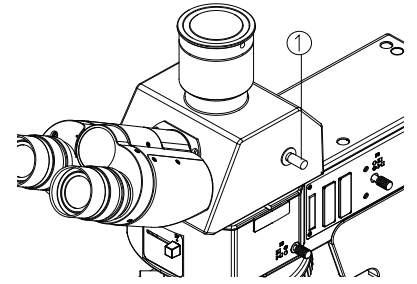




Adjust the Beam Splitter

Push the beam splitter (1) in to direct light to the binocular eyepieces.

Pull the beam splitter out to let light travel to the trinocular port (camera) for photography.



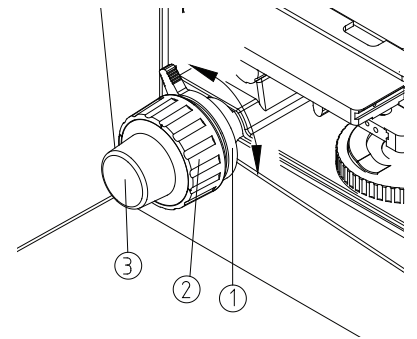
Adjust the Focusing

Set the eyepiece diopters to "0" when using diopter adjusted eyepieces.

Place a slide on the stage. Move the 5x objective into the light path. The observation surface should be vertical to the objective. Loosen the coarse adjustment upper limit knob (1) and observe with the right eyepiece. Rotate the coarse focusing knob (2) until the image appears in the field of view. Then lock the coarse adjustment upper limit knob.

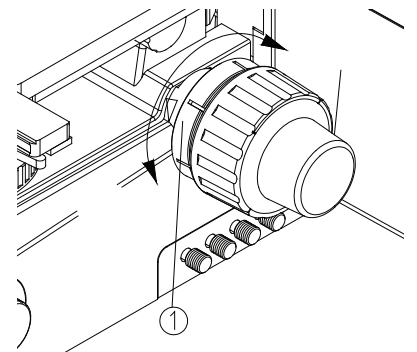
The coarse adjustment upper limit knob can prevent the sample from touching the objective when focusing. The coarse adjustment upper limit knob does not affect the fine focus knob. Rotate the fine focusing knob (3) for a clear image.

When observing with the 5x objective, open both the aperture diaphragm and the field diaphragm to the maximum position and swing out the front condenser lens.



Adjust the Focusing Tension

If the coarse focus knob is hard to turn or the stage drifts after focusing and the sample falls out of focus, rotate the tension adjustment ring (1). Rotate the adjustment ring clockwise to loosen the focus and counterclockwise to tighten.

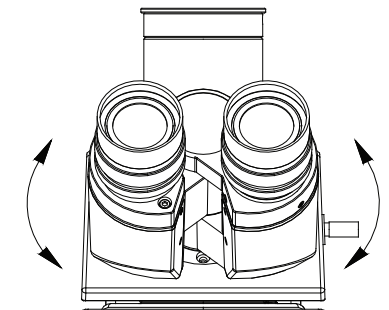


Adjust the Interpupillary Distance

When using both eyepieces for observation, hold the left and right bases of the prism and rotate them around the axis to adjust the interpupillary distance until you see only one field of view and it is comfortable for observation.

Interpupillary distance is adjustable from 50-76mm.

When setting interpupillary distance note the setting for your eyes if multiple people are using the microscope. This makes it is easy to return to your personal setup.

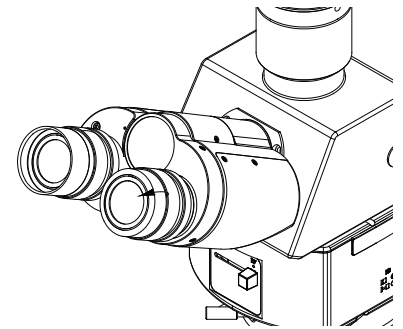




Using the Eyeshields

The rubber eyeshields on the microscope can be turned down if the user wears glasses to prevent the glasses from touching the eyepieces and avoid damaging both the glasses and the eyepieces.

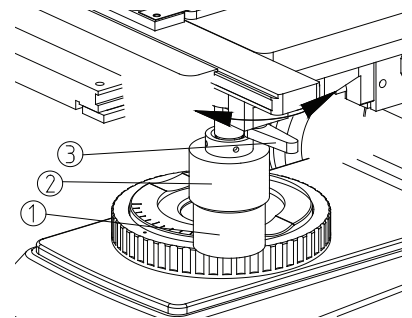
Open up the eyeshields to prevent stray light from disturbing observation.



Adjust the Stage

When using the microscope, move the stage by rotating the X-Axis adjustment knob (1) and the Y-Axis adjustment knob (2).

The moving range of the X-Axis and Y-Axis is 105 x 102mm. Rotate the spanner (3) back to tighten and forward to loosen the tension of the Y-Axis movement. When the spanner (3) is fully locked the Y-Axis direction can not be adjusted.



Adjust the Stage for Reflected Illumination

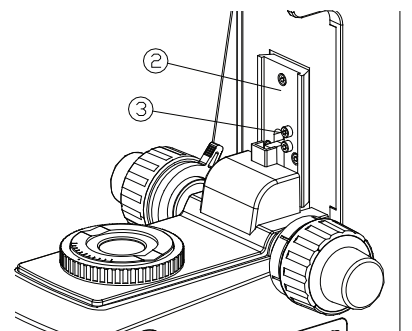
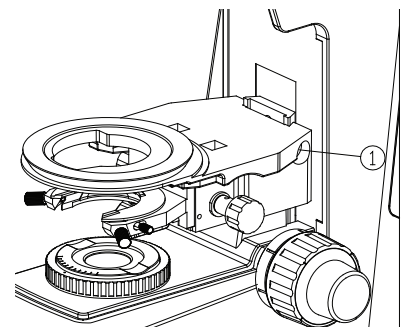
The microscope can adjust for a sample height of 35mm. Move the stage to its lowest position and remove the stage from the microscope.

Loosen the stage bracket set screw (1) and remove the stage bracket.

Rotate the coarse focus knob and raise the back board (2) to the position where the limit screw (3) can be seen.

Loosen and remove the limit screw (3).

Reinstall the stage bracket and the stage.





Center the Condenser for Transmitted Light (M50RT)

Rotate the condenser height knob (1) to raise the condenser to the highest position.

Rotate the spanner (2) to move the swing-out lens into the light path.

Use the swing-out lens when using an objective higher than 10x.

Move the 10x objective into the light path and focus.

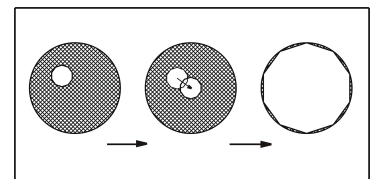
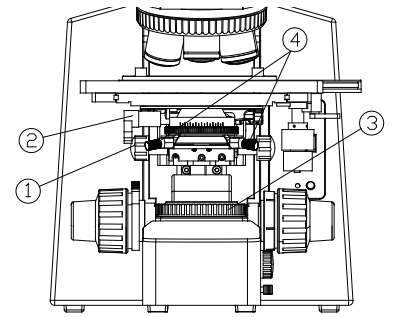
Rotate the field diaphragm adjustment ring (3) to put the field diaphragm to the smallest position, making it possible to view the image of the field diaphragm through the eyepiece.

Rotate the condenser height knob (2) to adjust the image to its clearest state.

Adjust the condenser center adjusting screw (4) to place the image in the center of the field of view.

Open the field diaphragm gradually. If the image is in the center all of the time and inscribed in the field of view, then the condenser has been centered correctly. (See image at right).

When using the microscope, open the field diaphragm a little to place the image in the field of view.



Adjust the Field Diaphragm

By limiting the diameter of light entering the condenser, the field diaphragm can strengthen image contrast. When the image is just on the edge of the field of view, the objective performs best and obtains the clearest image.

For Reflected Illumination:

Pull the field diaphragm adjustment pole (1) out to minimize the field diaphragm. The field diaphragm image can be observed in the eyepiece.

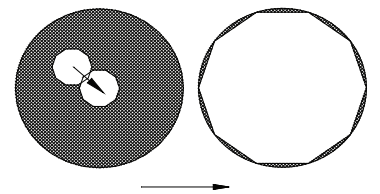
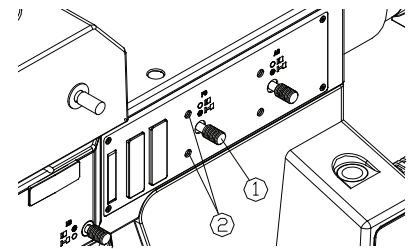
Adjust the two field diaphragm centering screws (2) until the image is in the center.

Open the field diaphragm gradually. If the image is inscribed in the field of view, then the field diaphragm has been centered properly.

When using the microscope enlarge the field diaphragm a little to make the image circumscribed in the field of view.

For Transmitted Illumination (M50RT):

Rotate the field diaphragm adjustment ring (3 from top image) clockwise to enlarge the field diaphragm and counterclockwise to decrease it.





Adjust the Aperture Diaphragm

The aperture diaphragm decides the numerical aperture (NA) of the illumination system. If the NA of the illumination system matches with the NA of the objective, the microscope will obtain better resolution, contrast, and increased depth of field.

For Reflected Illumination:

Changing the direction of the aperture diaphragm is the same procedure as the field diaphragm - adjust it with the aperture diaphragm adjustment pole (1). Adjust the two aperture diaphragm centering screws (2) to move the image of the aperture diaphragm into the center of the aperture. The eyepiece can be removed to view through the eyetube.

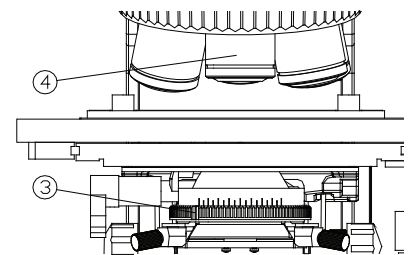
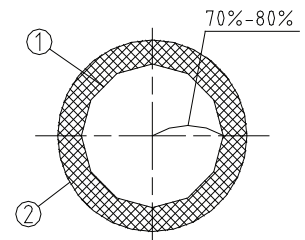
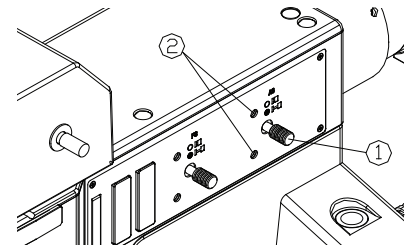
Adjust the aperture diaphragm adjusting pole (1) until the image shown at right is obtained. (1) is the image of the aperture diaphragm and (2) is the edge of the objective.

For Transmitted Illumination (M50RT):

Adjust the aperture diaphragm adjustment ring (3) to control the size of the diaphragm. Remove the eyepiece if necessary until the image of the rings shown above is obtained.

Set the scale on the condenser NA to 80% of the value of the objective NA (4).

When using the microscope adjust the aperture diaphragm according to the size of the sample image and for best contrast.



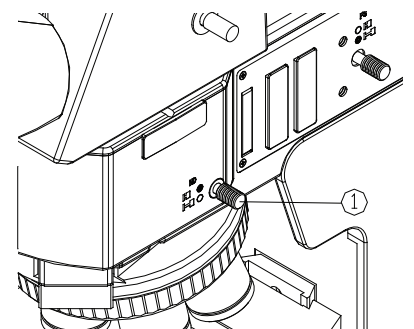
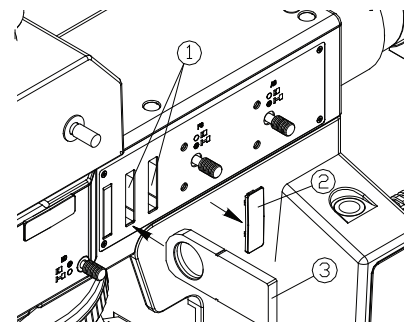
Using the Color Filters

The color filters can make the background light more suitable and strengthen image contrast.

For Reflected Illumination:

When the external color filter and the ND filter are used, first remove the dust cover (2) on the reflected illuminator filter socket (1). Insert the filter (3) into the socket as shown at right. Replace the dust cap when not in use.

When the internal ND50 filter is used, push the filter pole (1) in to move the filter into the light path. When the filter pole is pulled out the filter is moved out of the light path.



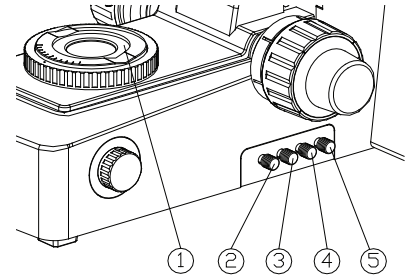
Using the Color Filters (continued)



For Transmitted Illumination (M50RT):

When an external color filter is used, place a 45mm diameter filter into the groove in the condenser base (1). Place the rough surface of the filter facing down.

When an internal filter is used, pull the filter pole (2-5) out to move the filter into the light path. When pushed in, the filter is moved out of the light path.



FILTERS & FUNCTION:

(2) = ND6 Neutral Density filter used for light intensity adjustment, transmission is 6%.

(3) = ND25 Neutral Density filter used for light intensity adjustment, transmission is 25%.

(4) = LBD Chroma Balance Daylight Color Filter

(5) = Optional Filter, Empty

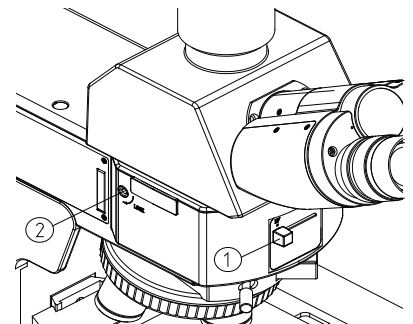
Switching Between Brightfield / Darkfield

Switch between brightfield and darkfield by moving the BD lever (1) to the left for brightfield and to the right for darkfield.

Move the ND50 filter on the reflected illuminator into the light path and lock the set screw (2). The ND50 filter will now always be in the light path when using brightfield observation.

In darkfield observation, open the aperture diaphragm and field diaphragm to their maximum positions.

BF indicates brightfield observation, DF indicates darkfield.



Replacing the Fuse

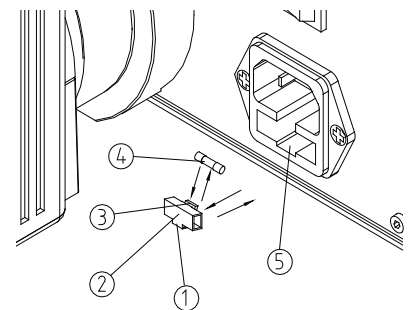
Before replacing the fuse, set the main power switch to "O" off and unplug the microscope.

Hold the flute (1) under the fuse holder (2) and remove the fuse holder (2) from the socket (5).

Remove the fuse group (4) from the flute (3) and replace it with a new fuse.

Push the fuse holder (2) into the socket (5) until it clicks into place.

Fuse: 250V, 3.15A.





Using Simple Polarization

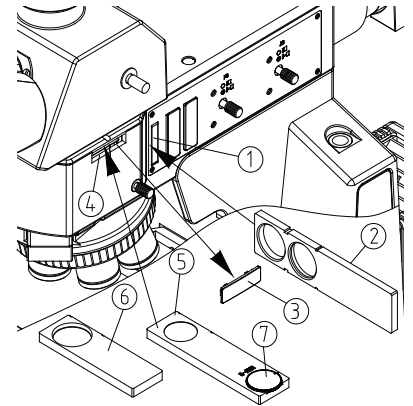
The simple polarizer includes the polarizer and analyzer. Remove the dust cover (1) from the reflected illuminator socket and insert the polarizer (2) into the socket as shown.

Pull out the color filter when using the polarizer.

Remove the dust cover (3) on the reflected illuminator analyzer socket (4) and insert the 360° rotating analyzer (5) or a fixed analyzer (6) into the reflected illuminator analyzer socket (4) until fully seated.

The polarizer and analyzer are orthogonal when the 360° rotating analyzer is zero adjusted (or the fixed analyzer is used).

Dialing the rotatable analyzer drive plate (7) can change the orthogonal state of the polarized light.

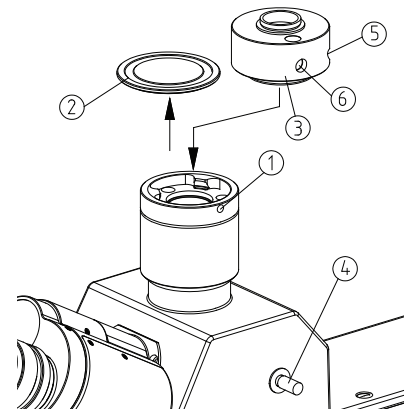


Using the C-Mount Adapter

Loosen the set screw (1) on the trinocular head and remove the dust cover (2). Remove the dust cover from the c-mount adapter (3). Insert the adapter into the trinocular head and tighten the set screw (1).

Connect the camera to the c-mount adapter.

For observation pull out the beam splitter (4). If the image is not clear loosen the set screw (5) and adjust the focusing mechanism (6) until the image is clear, then retighten the screw.



Using DIC

Place the microscope in brightfield observation and focus using a 10x or 20x objective.

Put the polarizer and analyzer into the light path with orthogonal state (the field of view should be the darkest).

Loosen the set screw (1) in front of the nosepiece and pull out the dust cover. Insert the DIC slider (2) into the slot and retighten the set screw (1).

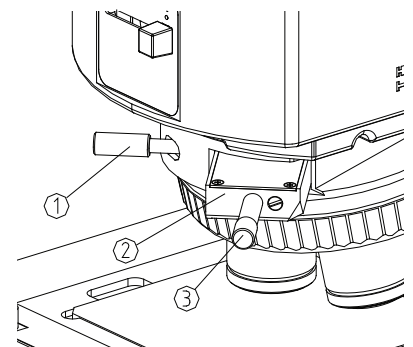
Rotate the adjustment knob (3) to unify the interference colors in the field of view and choose a suitable background interference color to reach the best effect of differential interference contrast. An embossed effect is the most obvious.

The fine adjustment knob (3) can control the background interference color changing it from gray to mauve.

Adjust the aperture diaphragm at the same time to achieve the best contrast effect.

DIC is very sensitive therefore ensure there is no stain or dust on the sample.

Birefringent materials will not be affected by DIC.



Microscope Objectives:

Objective Type	Part # / Magnification	Numerical Aperture	Working Distance
Semi APO Brightfield / Darkfield	BD-SAPO-M5 / 5x	0.15	19.5mm
	BD-SAPO-M10 / 10x	0.30	10.9mm
	BD-SAPO-M20 / 20x	0.45	3.2mm
	BD-SAPO-M50 / 50x	0.80	1.3mm
	BD-SAPO-M100 / 100x	0.90	1.0mm
Semi APO Brightfield	BF-SAPO-M5 / 5x	0.15	19.5mm
	BF-SAPO-M10 / 10x	0.30	10.9mm
	BF-SAPO-M20 / 20x	0.50	3.2mm
	BF-SAPO-M50 / 50x	0.80	1.2mm
	BF-SAPO-M100 / 100x	0.90	1mm



Optical Troubleshooting

Problem	Cause	Solution
Light is bright, but field of view is dark.	Field diaphragm is not large enough.	Open the field diaphragm.
	Condenser is too low or not centered.	Adjust the condenser.
	Polarizer or analyzer blocking light.	Remove polarizer/analyzer.
	Beam splitter is pulled out.	Push the beam splitter in.
Side of the field of view is dark or uneven.	Nosepiece is not clicked into position.	Rotate nosepiece into place.
	Stain or dust has accumulated on the condenser, objective, eyepieces or light source.	Clean surfaces of condenser, objectives, eyepieces and light source.
	The filter, polarizer or analyzer is not in position.	Remove / reinsert filters and sliders.
	Beam splitter is not in correct position.	Adjust the beam splitter.
Dust is observed in the field of view.	Dust has accumulated on the specimen.	Clean the sample.
	Dust is on the objective or eyepiece.	Clean the objective and eyepieces.
Image is not clear.	A cover slip is being used.	Remove cover slip.
	The sample is not vertical to the objective.	Adjust sample.
	Aperture diaphragm not open.	Adjust aperture diaphragm.
	Stain or dust is on the lens.	Clean eyepiece / objective.
	Beam splitter is not in correct position.	Adjust beam splitter.
One side of field of view is dark or the image moves while focusing.	Specimen is not fixed.	Adjust sample on stage.
	Nosepiece is not clicked into position.	Click nosepiece into place.
	Condenser is not centered properly.	Center the condenser.
Eyes fatigue quickly during use or the right field of view doesn't match with the left.	Interpupillary distance is not set properly.	Adjust interpupillary distance.
	Diopter adjustment is not set properly.	Adjust the diopters.
	Different eyepieces are being used in the left and right eyetube.	Use the same eyepieces in each eyetube. Use the Fein Optic WF PL10x/22 Eyepieces.



Mechanical & Electrical Troubleshooting

Problem	Cause	Solution
Mechanical Troubleshooting:		
Objective touches sample when moving from low magnification to high.	The stage is too high.	Lower the stage.
Coarse focusing knob is too tight.	Tension knob is too tight.	Loosen tension knob slightly.
Stage drifts or falls.	Tension knob is too loose.	Tighten tension knob slightly.
Coarse focusing knob won't raise higher.	The random upper limit knob is locked.	Loosen the random upper limit knob.
Coarse focusing knob won't lower far enough.	The base of the condenser is too low.	Raise the condenser.
Image jumps when stage is touched.	Stage is not fastened properly.	Reattach the stage.
Electrical Troubleshooting:		
Light does not work.	Power is not turned on.	Check power cable connection.
	Bulb is not installed properly.	Check light connection.
	Bulb is burned out.	Replace Bulb.
Bulb burns out quickly.	Incorrect bulb is being used.	Replace bulb with part # 12v100wH (transmitted) or 12v100wH (reflected).
Field of view is not bright enough.	Incorrect bulb is being used.	Replace bulb with part # 12v100wH (transmitted) or 12v100wH (reflected).
	Rheostat adjustment is turned down.	Adjust the rheostat control.
Bulb flickers or the brightness is not stable.	The connector pins or the wires for the bulb are not connected properly.	Check wire connections and connector pins for the bulb.
	The bulb needs to be replaced.	Replace bulb with part # 12v100wH (transmitted) or 12v100wH (reflected).

Bulb Replacement:



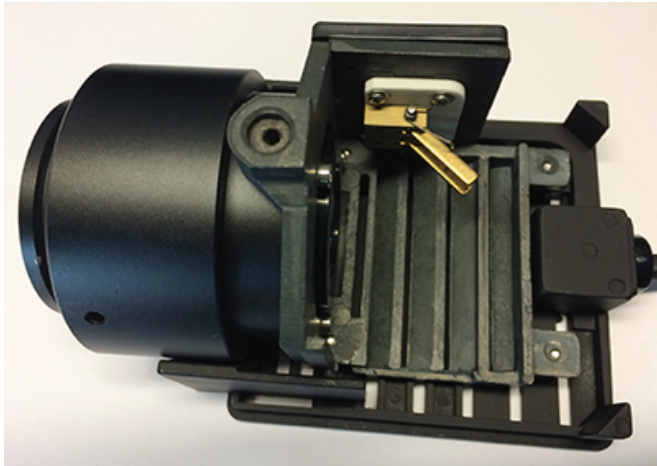
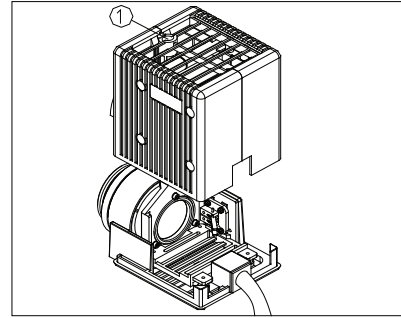
Replacement Bulb for M50 and M50RT reflected and transmitted light = 12v100wH



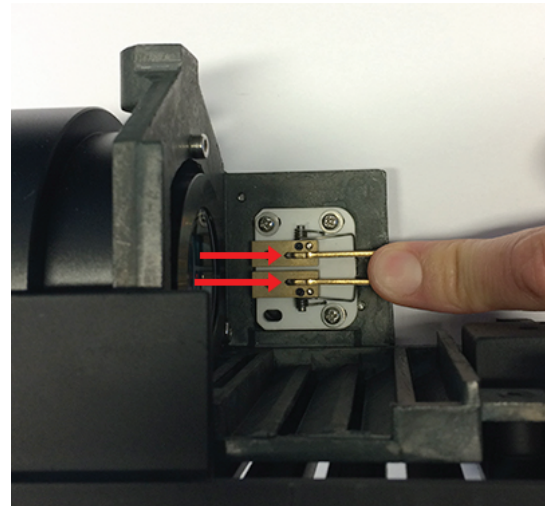
To **replace the reflected or transmitted light**, loosen the set screw (1) with the hex wrench to remove the light housing.

Depress the two metal prongs as shown at right and insert the 12V 100W halogen pins of the bulb into the slot where the red arrows are pointing. Release the metal prongs and they will hold the bulb in place.

Replace the light housing and reconnect the reflected illuminator to the microscope body.



Inside of light housing once cover is removed.



Depress prongs & insert bulb pin at red arrows.

