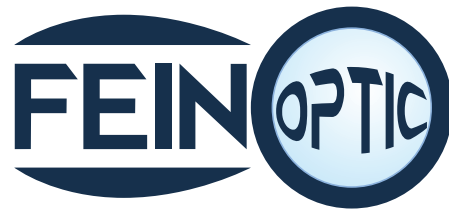


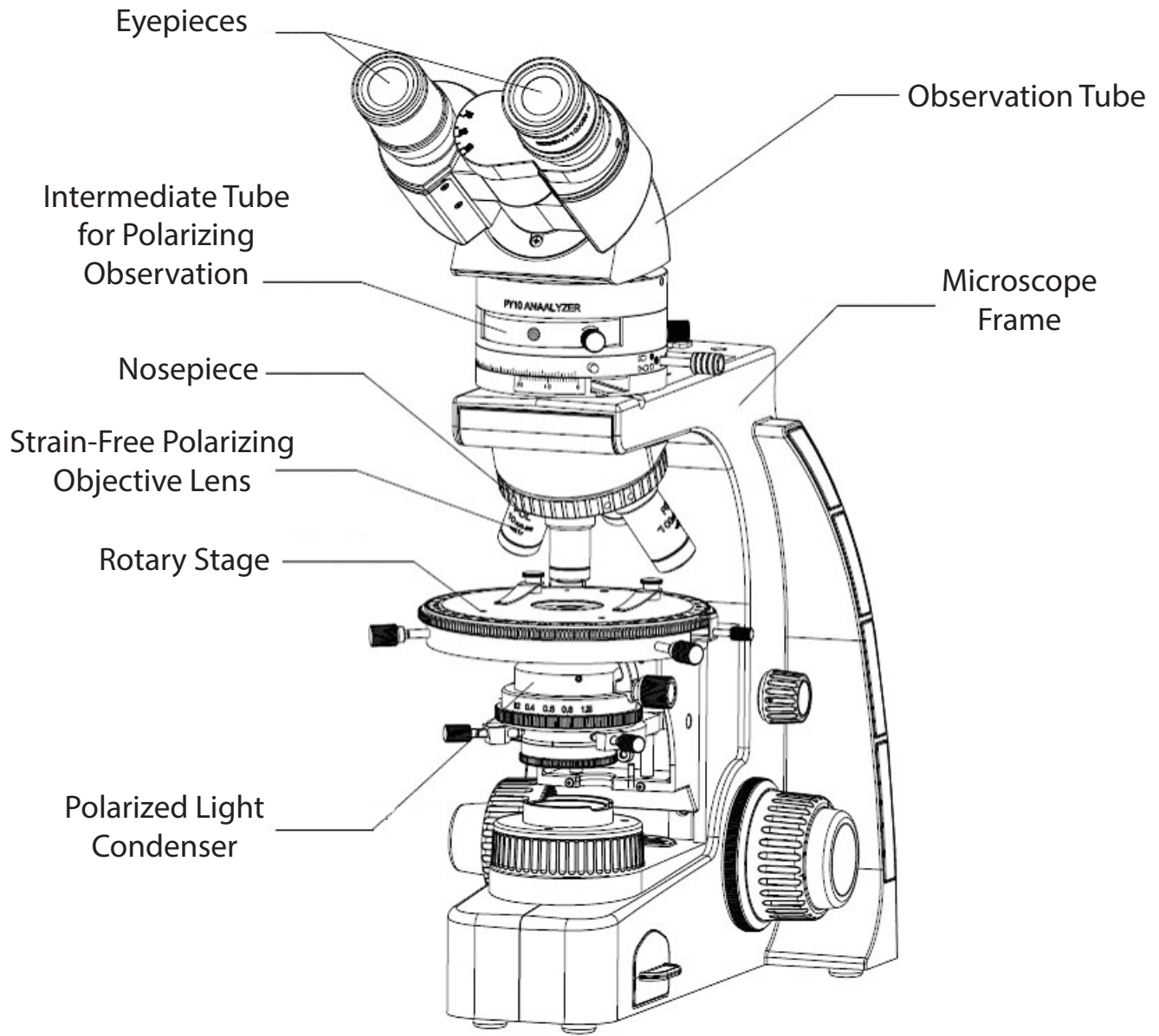
# R21POL Polarizing Microscope User's Manual

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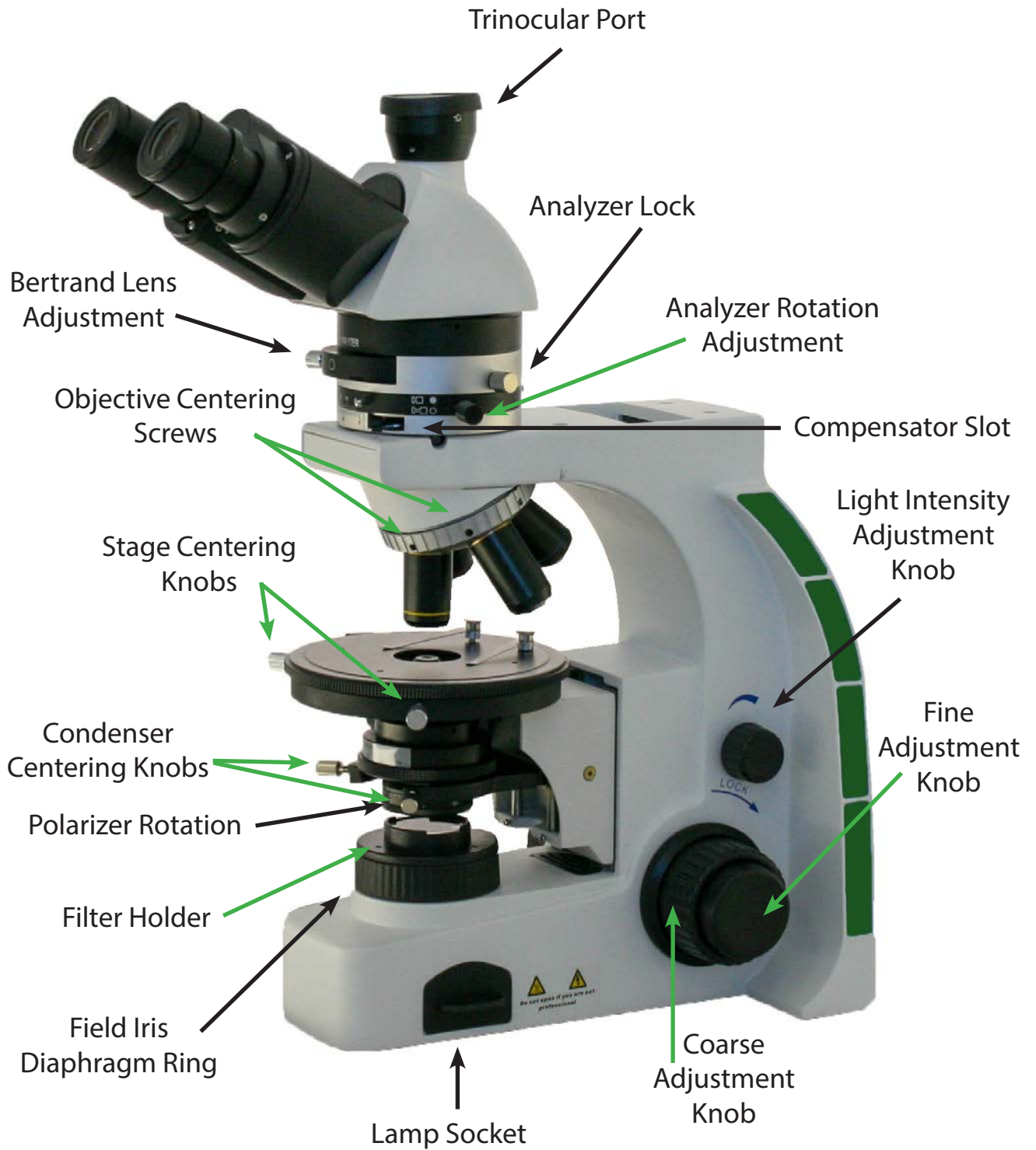


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# Microscope Components



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# Microscope Components

Bertrand Lens Focusing Knob

PY10 ANALYZER

Analyzer Lock

Analyzer Rotation Knob

Analyzer Rotation Assist Knob

Test Plate and Compensator Insertion Slot



Stage Rotation Lock

Stage Centering Knobs

Condenser Height Adjustment

Condenser Centering Knobs

Polarized Light Adjustment

Field Iris Diaphragm Ring

## Before Use



Do not shake or drop the microscope.



Do not expose the microscope to direct sun, high temperatures, high humidity, dust, or damp environments. Use a flat work surface.



When moving the microscope use both hands, holding the handle at the back (1) and the frame at the front (2) as shown in the image at right.



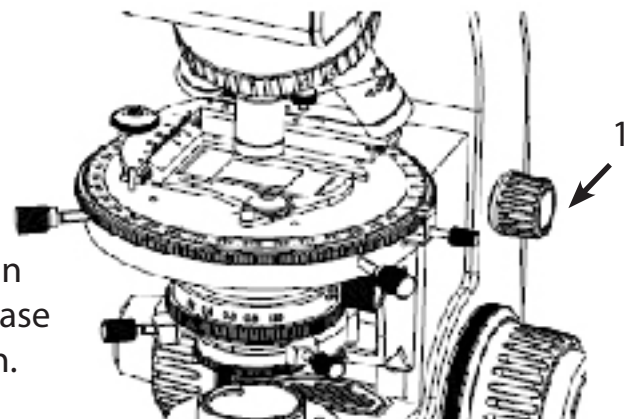
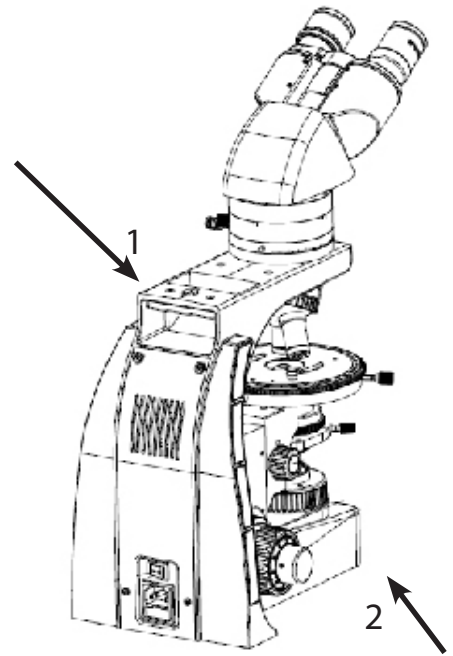
Set the power switch to off "O" before replacing a bulb or fuse, and wait until the lamp is cool. The power switch is located on the back of the microscope.



Voltage range of 100~240V (47-63Hz) is supported.

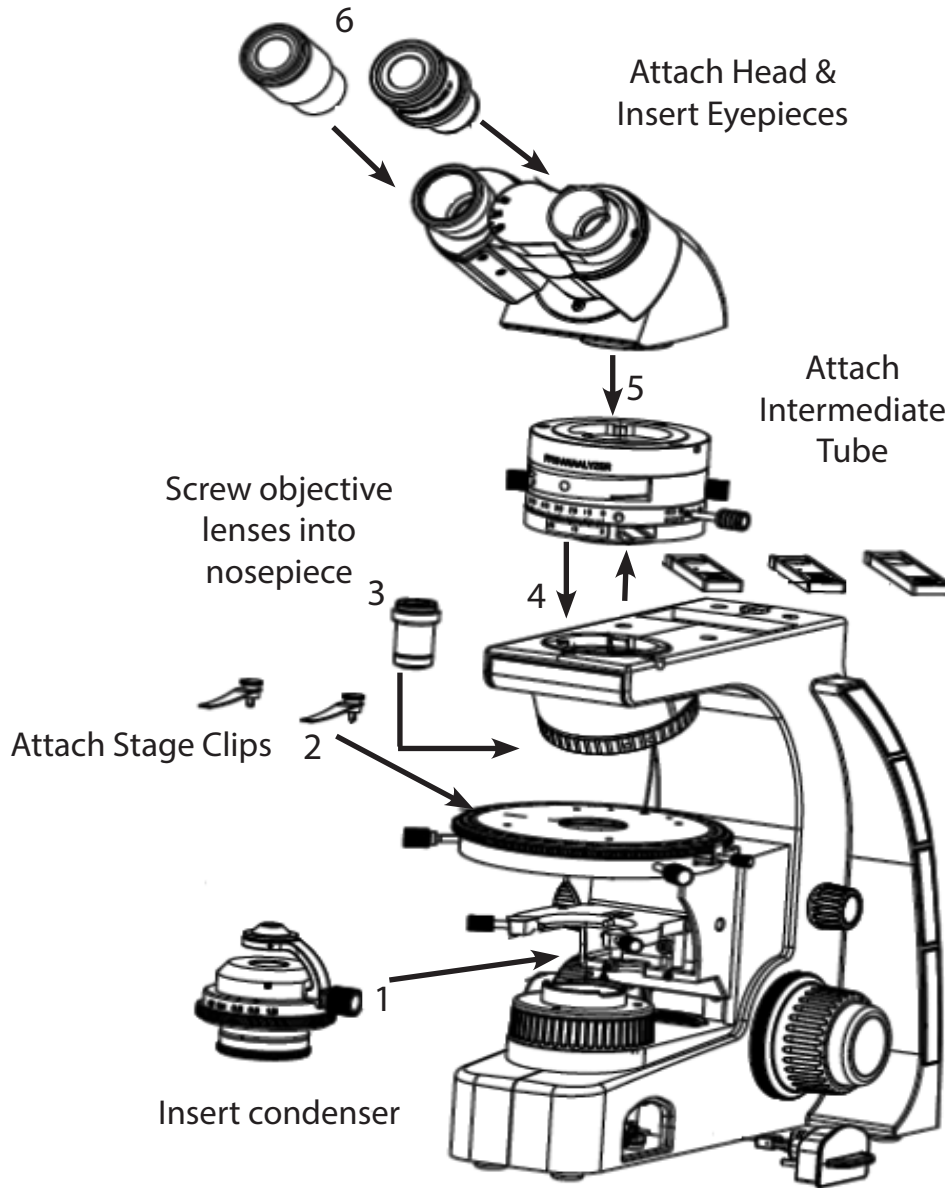


Turn the rheostat control knob (1) to the minimum and turn the power switch to the on "I" position. Rotate the rheostat knob to increase or decrease the brightness of the illumination.



# Microscope Assembly

Follow the numbers below when assembling the microscope.

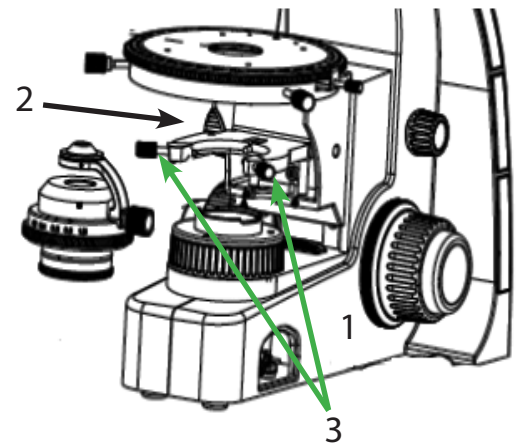






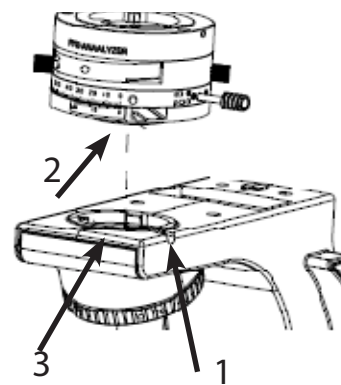
## Assemble the Condenser:

Rotate the coarse focus knob (1) to raise the stage to its highest position.  
Rotate the condenser height knob (2) to move the condenser to its lowest position.  
Loosen the condenser set screws (3).  
Swing out the front lens of the condenser with the scale facing forward. Align the set screws of the condenser with the groove in the condenser holder and push the condenser in all the way.  
Tighten the condenser set screws (3) and raise the condenser back to its highest position.



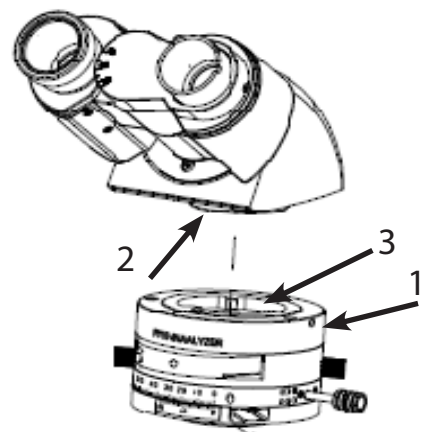
## Assemble the Intermediate Tube:

Completely loosen the set screw (1) found on the body of the microscope with the provided Allen wrench.  
Fit the circular dovetail (2) located on the bottom of the Intermediate Tube into the observation tube mount (3). Use the set screw to secure the Intermediate Tube into place.



## Mounting the Observation Tube:

Completely loosen the set screw (1) found on the Intermediate Tube with the provided Allen wrench.  
Fit the circular dovetail (2) located on the bottom of the observation tube into the observation tube mount (3).  
Re-tighten the set screw (1).



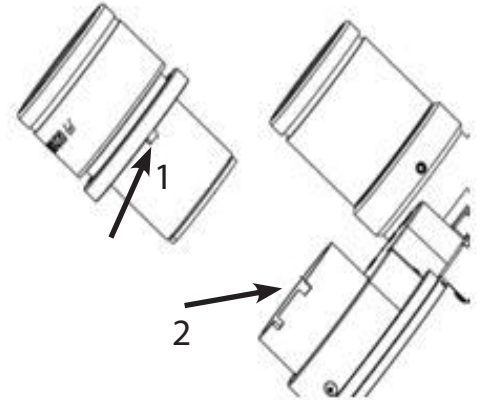


## Assemble the Eyepieces:

Remove the eyetube covers.

Insert the eyepiece into the left eyetube until it touches the bottom.

Install the eyepiece with the cross-line reticle into the right eyetube and insert the square pins (1) of the location ring into the square groove (2) of the eyetube.



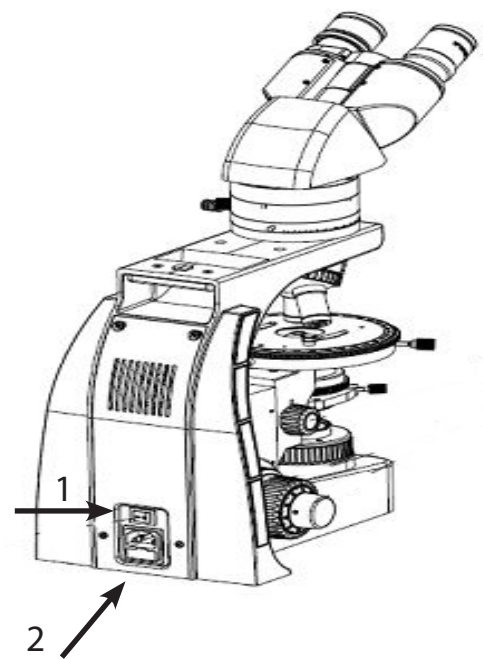
## Connecting the Power Cord:

The power cord is vulnerable when bent or twisted. Never subject it to excessive force.

Make sure the main switch (1) is set to "O" (OFF) before connecting the power cord.

Insert the compatible end of the power cord into the microscope power socket (2).

Be sure to supply power from a grounded, 3-conductor power outlet using the proper power cord.

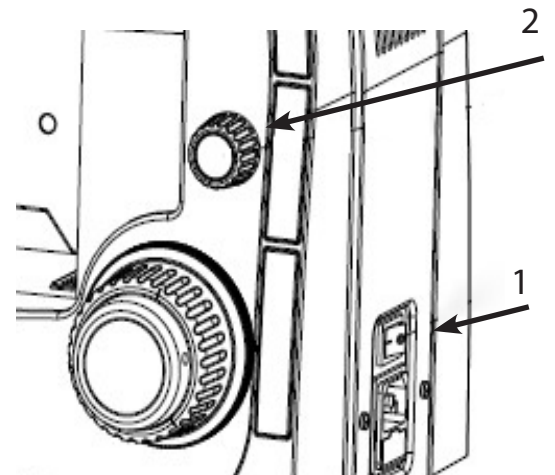






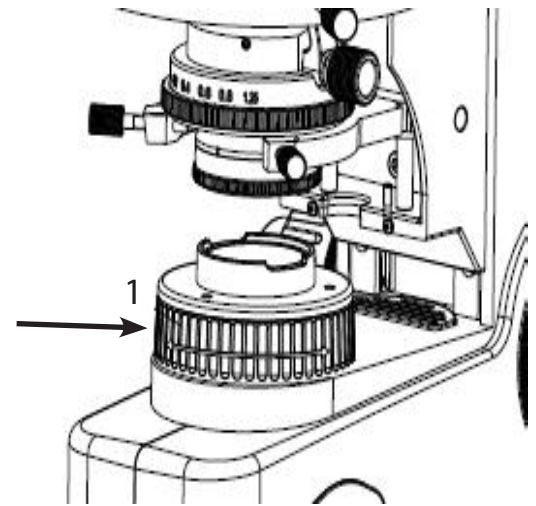
## Turning the Lamp ON:

Set the main switch (1) to "I" (ON). Rotate the light intensity adjustment knob (2) in the direction of the arrow to increase the brightness. Rotating in the opposite direction will decrease the brightness.



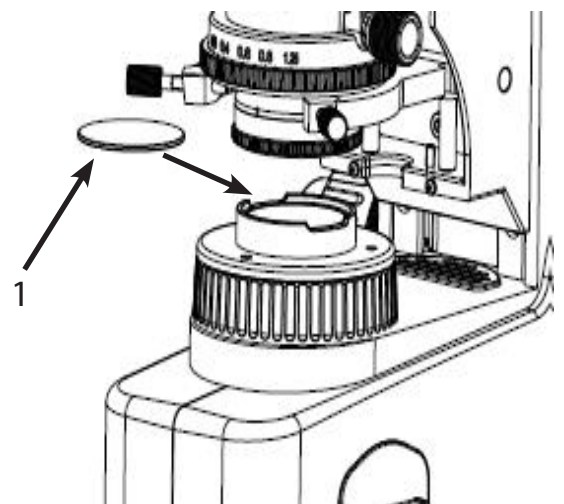
## Using the Field Iris Diaphragm:

Rotate the field iris diaphragm ring (1) according to the objective power ensuring the image of the diaphragm circumscribes the field of view. This restricts the diameter of the light beam entering the objective and excludes extraneous light, improving image contrast. Minimize the diaphragm diameter when using the 100x objective so the iris diaphragm is not visible in the field.



## Using the Filters:

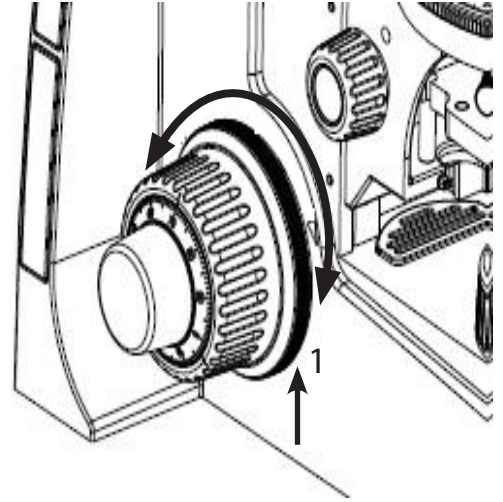
Drop one or stacked 38mm diameter filter(s) (1) into the window lens on the frame.





## Adjust the Focusing Tension:

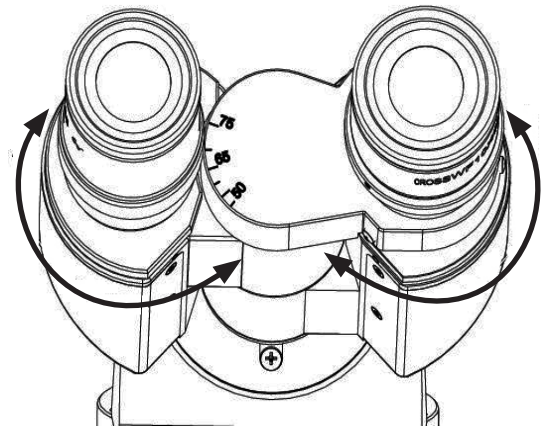
If the coarse focus knob is hard to turn or the stage drifts after focusing and the sample falls out of focus, rotate the tension adjustment ring (1). Rotate the adjustment ring clockwise to loosen the focus and counterclockwise to tighten.



## 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.

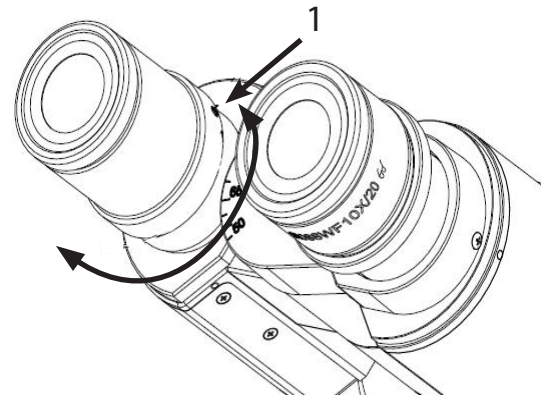
When setting interpupillary distance note the setting for your eyes if multiple people are using the microscope. This makes it easy to return to your personal setup.



## Adjusting the Diopter:

While looking through the right eyepiece with your right eye, turn the coarse and fine focus adjustment knobs to bring the specimen into focus.

While looking through the left eyepiece with your left eye, rotate only the diopter adjustment ring (1) to focus on the specimen.

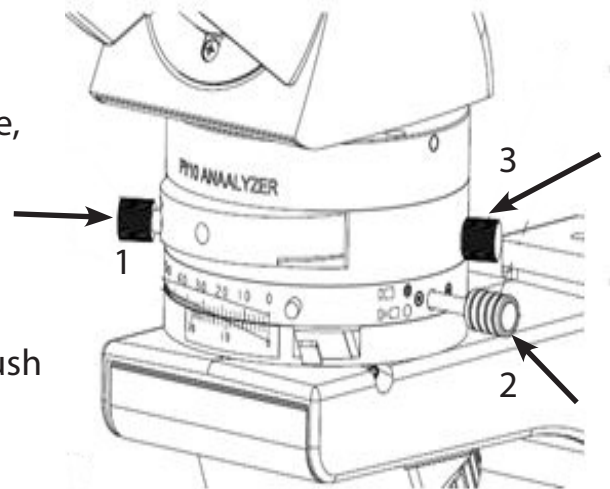




## Using the Bertrand Lens:

To engage the Bertrand lens into the light path, slide the Bertrand lens focusing knob (1) horizontally so the circular (IN) indication comes on the front. The Bertrand lens can be disengaged from the light path and the circular (OUT) indication will show on the front.

To adjust the focus of the conoscopic image, turn the Bertrand lens engaging/focusing knob (1).



## Using the Analyzer:

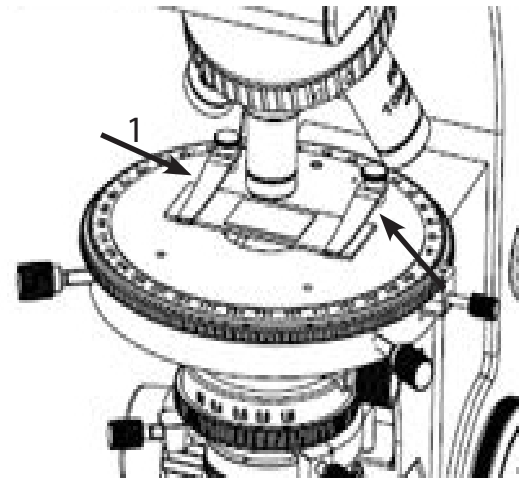
To engage the analyzer in the light path, push in the analyzer engaging/rotation knob (2). The analyzer can be disengaged from the light path by pulling out the knob.

Loosening the analyzer clamping knob (3) makes it possible to rotate the analyzer up to 180°.



## Placing the Specimen on the Stage:

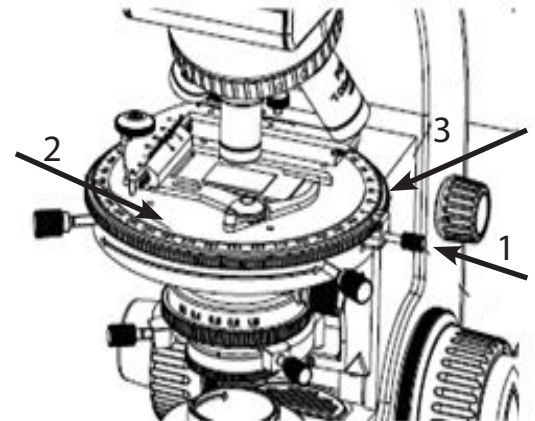
Place the specimen on the center of the stage and hold it in place using the stage clips (1).





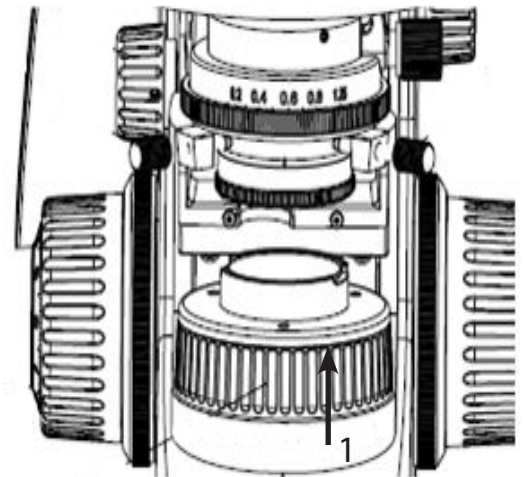
## Rotating the Stage:

Loosen the stage rotation clamping knob (1) to allow the stage to rotate horizontally up to 360°. The rotation angle can be read on the scale on the stage (2). The stage has 360° partial scale, minimum graduation 1°. Readout down to 6' is possible by using the vernier (3).



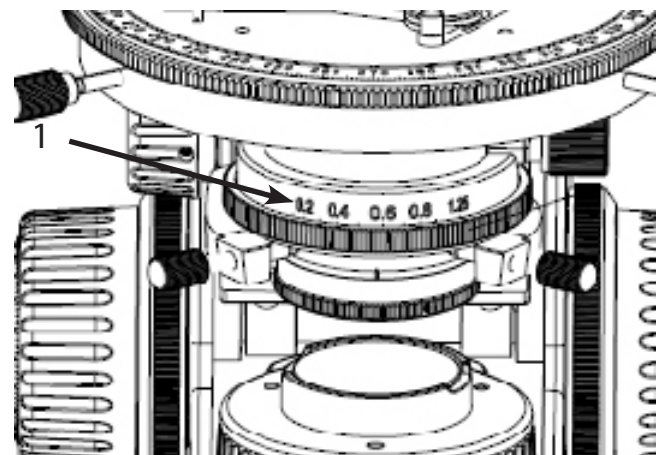
## Centering the Field Iris Diaphragm:

Engage the 10x objective in the light path and bring the specimen into focus. Rotate the field iris diaphragm ring (1) counterclockwise to stop down the iris slightly.



## Adjusting Aperture Iris Diaphragm:

The aperture iris diaphragm adjusts the numerical aperture (NA) of the illumination system. Aligning the NA of the illumination system (1) with the NA of the objective lens being used improves the contrast and resolution as well as the focal depth of the observed image. If the microscopy sample has low contrast, set the aperture iris diaphragm to 70-80% of the aperture number on the objective lens.





# Polarized Light Observation

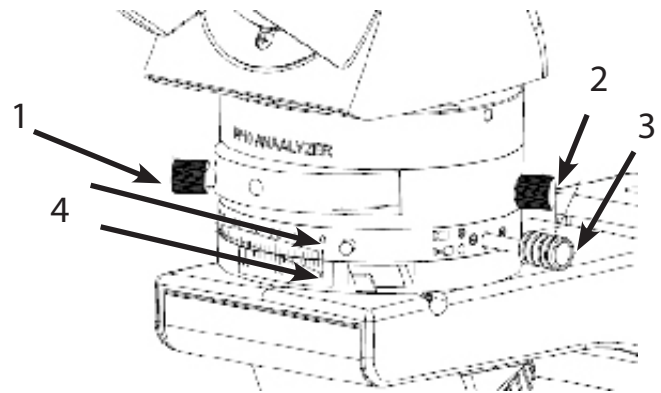


## Preparation for Polarized Light Observation:

Prior to utilizing polarized light for microscopy, remove the specimen from the stage, disengage the quarter wave plate and tint plate from the light path.



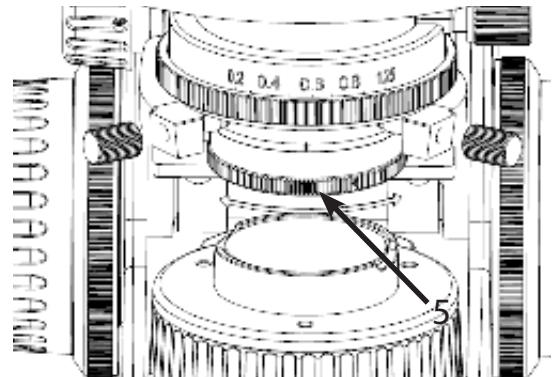
Set the Bertrand Lens engaging/focusing knob (1) to the out position to disengage the Bertrand lens from the light path.



Loosen the analyzer lock (2).  
Push in the analyzer engaging/rotation knob (3).  
Align the two "0" marks on the scale (4).  
Re-tighten the analyzer lock (2).



Slide the polarizer rotating adjustment (5) to make the field of view dark.



# Centering Objective Lenses

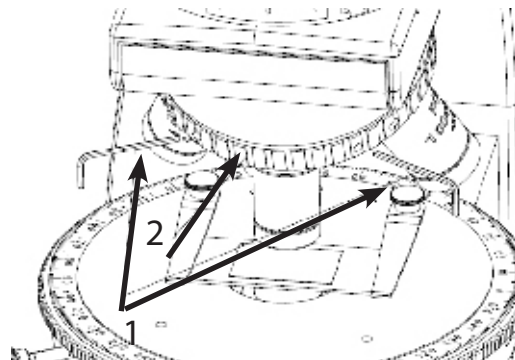


## Centering The Objective Lenses:

Remove the sample from the stage and move the objective lens (10x or 40x) you wish to use for conoscopic observation into the light path.

To set the reference light axis, engage the analyzer in the light path and prepare for polarized light observation (see previous page).

Set the Bertrand lens engaging/focusing knob to the (IN) position and observe the image. You may want to adjust the analyzer slightly to brighten the image.



Insert the two centering screws (1) provided for the objective lens turret (2) into the two centering holes on the turret and turn them so that the center of the conoscopic image lies over the cross-lines in the eyepiece.

Set the Bertrand Lens engaging/focusing knob to the OUT position and disengage the analyzer from the light path.

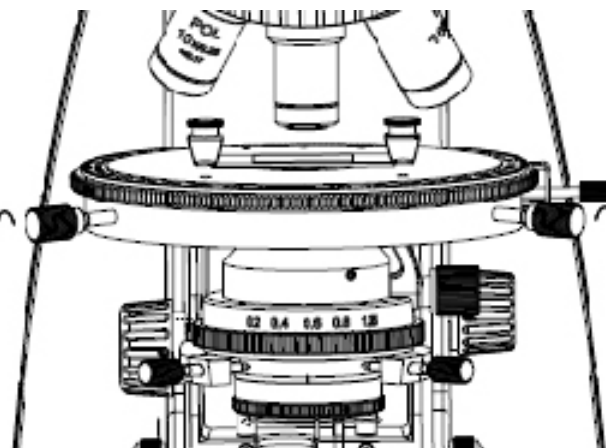
Place the sample on the stage and center the rotary stage (instructions below).

Finally, place a different sample on the stage and turn only the centering screws for the objective lens so that the center coincides with the center of the field of view even when the stage has been rotated.



## Centering The Rotary Stage:

1. Place the sample on the stage.
2. Find a point on the sample and center it in the cross-line eyepiece.
3. Loosen the stage rotation clamping knob and turn the 2 stage centering knobs to bring the center of the stage to the center of the cross-lines.
4. Move the sample and bring a second point into the center of the cross-line eyepiece.
5. Repeat steps 3 and 4 a few times until the center of the stage rotation coincides with the center of the eyepiece cross-line.







## Orthoscopic Observation:

Use an objective between 4x - 100x.

1. Using the intermediate tube for polarized observation, set the Bertrand lens engaging/focusing knob to the OUT position to disengage the Bertrand lens from the light path.
2. Engage the analyzer in the light path and begin observation. This is the cross-Nicol position. If open-Nicol conditions are required, disengage the analyzer from the light path. If para-Nicol conditions are required, set the analyzer to the 90° position.
3. Rotate the stage to set the observation target position of the specimen to dark (off). Then rotate the stage by 45° from there to set the diagonal position. The retardation value should be measured in this position.
4. The compensator is used to produce sensitive colors and inserted in the test plate slot. Push the plate all the way into the slot to engage the plate in the light path, and pull it out until it clicks to disengage it from the light path.



## Conoscopic Observation:

Use an objective between 20x - 100x.

1. Engage the analyzer in the light path and set it to the cross-Nicol position (see above).
2. When the intermediate tube for polarizing observation is used, set the Bertrand lens engaging/focusing knob to the (IN) position to engage the Bertrand lens in the light path.
3. Open the aperture iris diaphragm.
4. Turn the Bertrand lens engaging/focusing knob to focus on the conoscopic image as accurately as possible.
5. If the peripheral part of the conoscopic image is dark, move the condenser up and down to find the height at which the peripheral part is the brightest.

TROUBLE	POSSIBLE CAUSE	SOLUTION
Field of view is dark even when light is on	The Bertrand lens is in the light path.	Disengage Bertrand lens.
	Analyzer is set to the cross-Nicol position.	Disengage analyzer from light path.
Field of view is cut off or not evenly illuminated.	Revolving nosepiece is not clicked into position.	Click nosepiece into position.
	Test plate is inserted only partially.	Check test plates.
	Field iris diaphragm is not centered.	Center field iris diaphragm.
	Field iris diaphragm is closed too much.	Open field iris diaphragm.
	Objective, eyepieces, or condenser are dirty.	Clean optics.
Dust or spots visible in observation field.	Condenser lens is dirty.	Clean condenser.
	Eyepieces are dirty.	Clean eyepieces.
	Objective lenses are dirty.	Clean objective lenses.
	Sample is dirty.	Clean slide or cover glass.
Glare or hot spot on observed image.	Condenser is set too low.	Raise condenser.
	Aperture iris diaphragm is closed too much.	Open aperture iris diaphragm.
Observed image is poor: image is not sharp, contrast is low, or details are not clear and crisp.	Objective is not engaged correctly in the light path.	Rotate nosepiece into position.
	Objective is dirty.	Clean objective lens.
	Specimen is dirty.	Clean the specimen.
	Eyepieces are dirty.	Clean the eyepieces.
	Condenser is dirty.	Clean the condenser.
Part of image is not in focus.	The sample is not flat on the stage.	Adjust the sample.
	Objective is not fully in the light path.	Click objective into position.
Cross-Nicol condition can not be obtained.	Analyzer is disengaged from light path.	Engage analyzer.
Conoscopic image can not be obtained.	Bertrand lens is not in the light path.	Engage Bertrand lens.
Coarse focus knob tension is too tight.	The coarse tension adjustment ring is set too tight.	Loosen the tension adjustment ring.
Stage drifts or falls or focus knob slips.	Coarse tension adjustment ring is too loose.	Tighten focus tension adjustment ring.

TROUBLE	POSSIBLE CAUSE	SOLUTION
Coarse focus adjustment can not raise stage high enough.	Rack stop is limiting the stage position.	Adjust the rack stop.
Coarse focus adjustment can not lower the stage enough.	Condenser holder is too low.	Raise the condenser.
Objective lens runs into specimen before clear focusing is obtained.	The specimen is upside down.	Adjust the specimen.
Field of view of both eyepieces does not match.	Interpupillary distance is not adjusted properly.	Adjust interpupillary distance.
	Diopter compensation for the eyes is not set.	Adjust eyepiece diopter.
	Left and right eyepieces are different.	Use correct eyepieces
Rotating the stage makes the specimen invisible.	The stage is not centered.	Center the stage.
	The objectives have not been centered.	Center the objectives.
Objective hits the specimen when an objective is switched to a higher magnification.	The sample is upside down.	Turn the sample over.
	Cover glass is too thick.	Use a cover glass with thickness of 0.17mm.
Light does not illuminate.	Bulb is not mounted properly.	Attach bulb properly.
	Bulb is burned out.	Replace bulb.
	Power cord is not plugged in.	Plug in microscope.
Bulb burns out easily.	Specified bulb is not being used.	Replace with correct bulb.