Motic®

PantheraTEC
Metallurgy Instrument
Operation Manual

Note If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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MOTIC HONG KONG LIMITED

English:

Please familiarize yourself with the Instruction Manual provided in English language. Other Language versions are available as download on Motic web services under the Address:
https://moticeurope.com/en/resources#section-instructions

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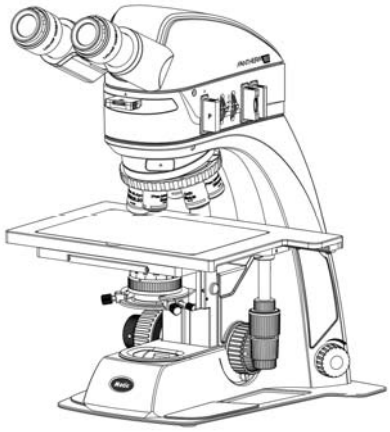
1. INTRODUCTION

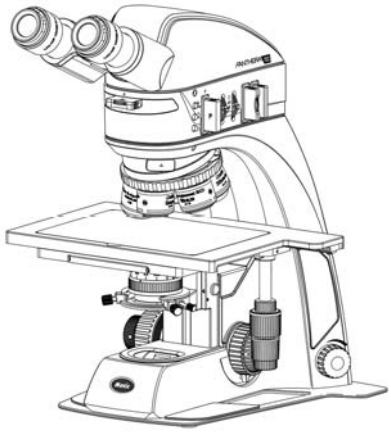
1.1 Welcome

Welcome to the PantheraTEC User Documentation.

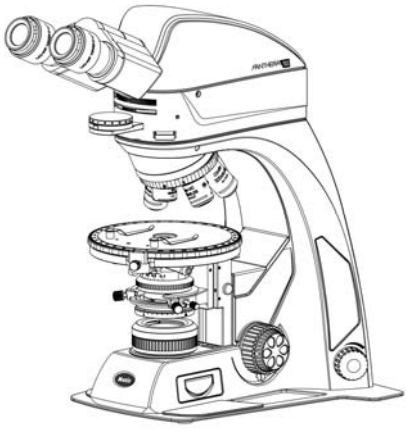
PantheraTEC is the new family of upright microscope from Panthera. Its design and intuitive controls result in a simple, robust, easy-to-use yet powerful microscope that helps you inspect a wide range of samples. PantheraTEC microscopes can also be connected to an iPad or HDMI touch screen to process and analyze images. Connecting the microscope to a WLAN network even enables multiple users to view a sample simultaneously.



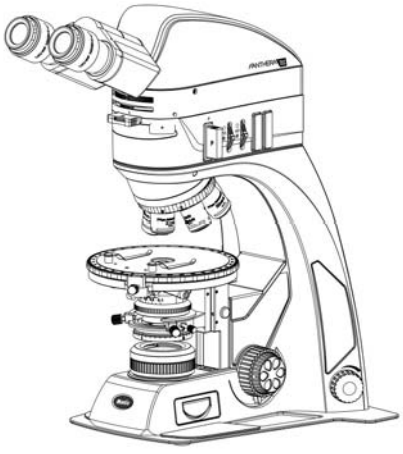
PantheraTEC – BF



PantheraTEC – BD



PantheraTEC – POL



PantheraTEC – EpiPOL

1.2 PantheraTEC Features

Four types of PantheraTEC microscopes are available. The different microscopes have different features and are suitable for different applications:

Feature	PantheraTEC–POL		PantheraTEC–EpiPOL	
Model	POL	POL Digital	EpiPOL	EpiPOL Digital
Reflected Light	-		Yes	
Transmitted Light	Yes		Yes	
Condenser	Yes		Yes	
Stage	360º Rotatable		360º Rotatable	
Centering of objectives	Yes		Yes	
Main feature	Designed for conoscopy analyses		Designed for polarization analyses	
Smart CAM - ImagingOnDevice	-	Yes	-	Yes
Contrast Techniques	POL		Brightfield / POL	

Feature	PantheraTEC–BF			PantheraTEC–BD		
Model	BF	BF- T	BF-TD	BD	BD-T	BD-TD
Reflected Light	Yes			Yes		
Transmitted Light	-	Yes From LED condenser		-	Yes From LED condenser	
Condenser	-	LED condenser		-	LED condenser	
Stage	3x2” / 6x4” mechanical stage			3x2” / 6x4” mechanical stage		
Centering of objectives	-			-		
Main feature	Suitable for large sample heights (< 35 mm)			Suitable for large sample heights (< 35 mm)		
Smart CAM - ImagingOnDevice	-	-	Yes	-	-	Yes
Contrast Techniques	Brightfield / Simple POL			Brightfield / Smart Darkfield / Simple POL		

1.3 General Notes On Instrument Safety

1.3.1 General safety notes and Instruction

Please familiarize yourself with this Operation Manual before starting to use the Instrument.

In case additional information or support is needed, please contact Motic after sales Service.

To ensure safe operation and optimal function of the Instrument, strictly observe the precautions and warnings given in this Operation manual.

Please observe the following indicators:

	CAUTION, Risk of Danger
	This symbol indicates a possible hazard to the user of the instrument.
	CAUTION, Risk of Danger
	This symbol indicates a possible hazard to the user of the instrument.
	CAUTION, Risk of Danger
	This symbol indicates a possible hazard to the user of the instrument.
	CAUTION, Risk of Danger
	Disconnect the plug-in power unit from line power before opening the Instrument.
	INFO
	This symbol refers to a useful information or hint.
	Disposal
	This symbol refers you a advice that must be observed under all circumstances
	Instrument ON
	This symbol refers to the switched on (electrical system active) status of the instrument
	Instrument OFF
	This symbol refers to the switched off (electrical system inactive) status of the instrument
	Risk of Danger This symbol refers to potential hazardous electrical voltage/current and must be observed at all circumstances!

1.3.2 Instrument safety, FCC and EMC conformity

This Instrument has been designed, produced and tested in compliance with required safety standards and regulations. UL, CE, FCC, EMC

“Safety of equipment used for *measurement control and laboratory use”*

CE Panthera Microscope Series Products are in conformity with the requirements of the CE Directive 98/79/EC Annex 1 and carries the CE mark accordingly.
Conform to Class B Noise immunity is in compliance with EN 61326 and EMC and Radio-noise suppression is in compliance with EN 5501 1

The instruments listed in this document are disposed of in compliance with WEEE Directive 2002/96/EC.

Lamp bulbs, LED Modules, lamphouses and Lampdrawers become very hot during and after a period of operation. Risk of burn – Do not touch the lamp during or immediately after period of operation.

Don’t pick the microscope up from the bottom during equipment operation.

Proper handling of the microscope will ensure years of trouble free service.
If repair become necessary, please contact your Motic agency or our Technical Service directly.

1.3.3 Transporting, unpacking, storage of the Instrument

Please observe and follow the safety notes for transportation, unpacking and storage given in this document:

- The microscope is delivered as set, packed into commercial standard plastic and cardboard packaging; Please re-use the original packaging only for any transportation.
- It is advised to keep and use the original packaging for longer storage or return to the manufacturer to avoid losing the warranty.
- At receiving and unpacking the equipment, please verify that all parts specified on the delivery note are present.
- Keep Transport and storage temperatures as specified in this Manual.
- Set the microscope up on a stable worktable with solid and smooth top surface suitable for Instrument use.
- Do not touch optical surfaces.

1.3.4 Instrument Disposal

Please observe the following safety notes for the disposal of the microscope:
Defective Instruments, accessories and consumables should be disposed in compliance with the provisions of the local law.

1.3.5 Use of the Instrument

The microscope Instrument as well its accessories must not be used for microscopic techniques or purposes other than those described in this Operating Manual.
Please always observe the following safety notes when using the microscope:

Motic cannot assume any liability for other applications then the intended use, including the included modules and components. This includes to service or repair work that is not carried out by authorized Motic service personnel. In case of non-compliance, all warranty claims and liabilities shall be forfeited.

The microscope Instrument should only be operated by trained personnel who are familiar with this Operation Manual and therefore aware of the possible dangers involved.

This Microscope is a high-precision instrument that can be impaired in its performance or even be destroyed when handled improperly.

This Instrument is equipped with a build in power supply allowing electric-net voltages to be used in the range between 100 - 240 V ± 10%, 50/60 Hz. In case of any irregularity on the electrical system observed, please switch of the Instrument, keep it safe guarded and consult the Motic after sales service.

Please only use rated Power cords as described in the Appendix of this Document

Always disconnect the power cable, before opening the instrument and changing the lamp or LED source.

Wait for the lamp to cool down before replacing it and do not touch the new bulb.

The instrument may only be opened by qualified Motic service staff.

The operation of the instrument in explosion-risk environments is not allowed.

1.3.6 Intended use of the Microscope

This Microscope is an optical instrument that has been designed to be used to observe and document magnified images of specimens in teaching, Metallurgy, Electronics and Geoscience applications.
Do not use this instrument for any other purpose than its intended use.

CE This Instrument complies with the requirements of directive 98/79/EG concerning in-vitro diagnostic medical devices. CE marking shows the conformity to the directive.

NOTE: This Instrument has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Regulations. These limits are designed to provide protection against harmful interference during operation in a commercial environment. This equipment uses and generates frequencies and energy, if not properly installed in accordance with the instruction manual, those may cause interference to radio communications. Operation of this Instrument in a residential area is not permitted.

FCC WARNING: Changes or modifications would void the Instruments FCC compliance and is therefore not permitted.

1.3.7 Instrument warranty

The Instrument should only be used for microcopy applications mentioned and instructed in this operation manual. Please note the following information on the instruments warranty.

- If possible defects Motic must be notified immediately and steps are taken to minimize damage.
- If notified of such a defect Motic will evaluate the defect and if within warrant, rectify it at his discretion, either by repairing the instrument or by delivering a replacement.
- Natural wear, or defects caused by improper use are not covered by the Instrument warranty.
- Motic shall not be liable for damage caused by faulty operation, negligence or tampering with the Instrument.
- Altering or tampering of the instrument shall lead to a forfeit of all warranty claims

2. NOMENCLATURE

2.1 Overview

This chapter describes the main components and controls of PantheraTEC microscopes, as well as the types of illumination supported.

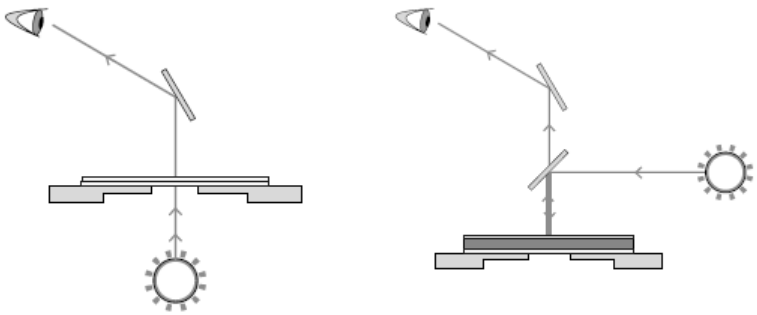
2.2 Types of Illumination

PantheraTEC microscopes support both transmitted light and reflected light illumination.

Transmitted Light

In transmitted light illumination, the light source is below the sample. The light passes through the sample before being focused into the eyepieces. Transmitted light is particularly suitable for the following scenarios:

- Thin samples
- Polarization examinations
- Conoscopy examinations



Reflected Light

In reflected light illumination, the light source is above the sample. The light is reflected from the surface of the sample before being focused into the eyepieces. Reflected light is particularly suitable for the following scenarios:

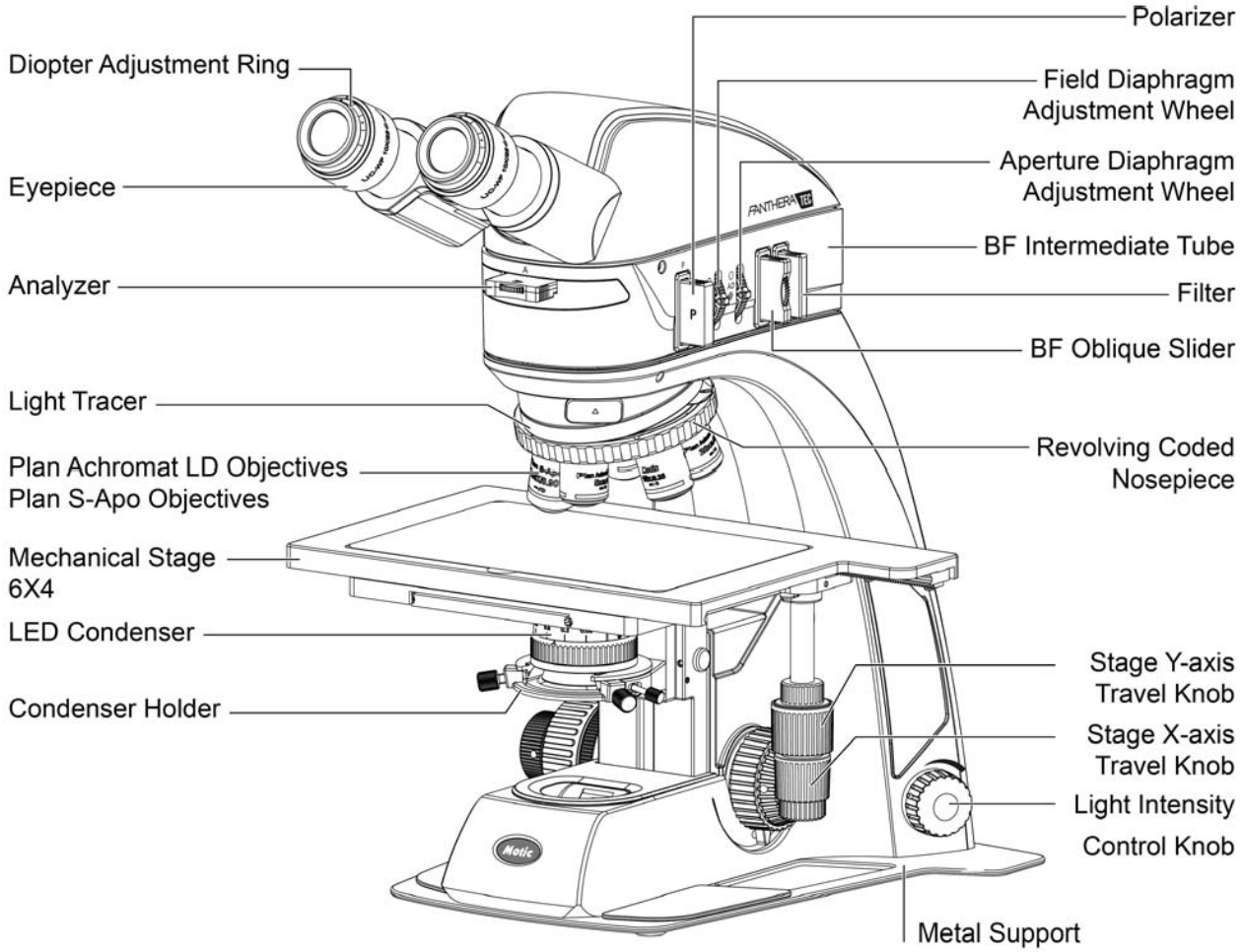
- Thick samples
- Surface examinations, especially of metallic or ceramic samples

INFO

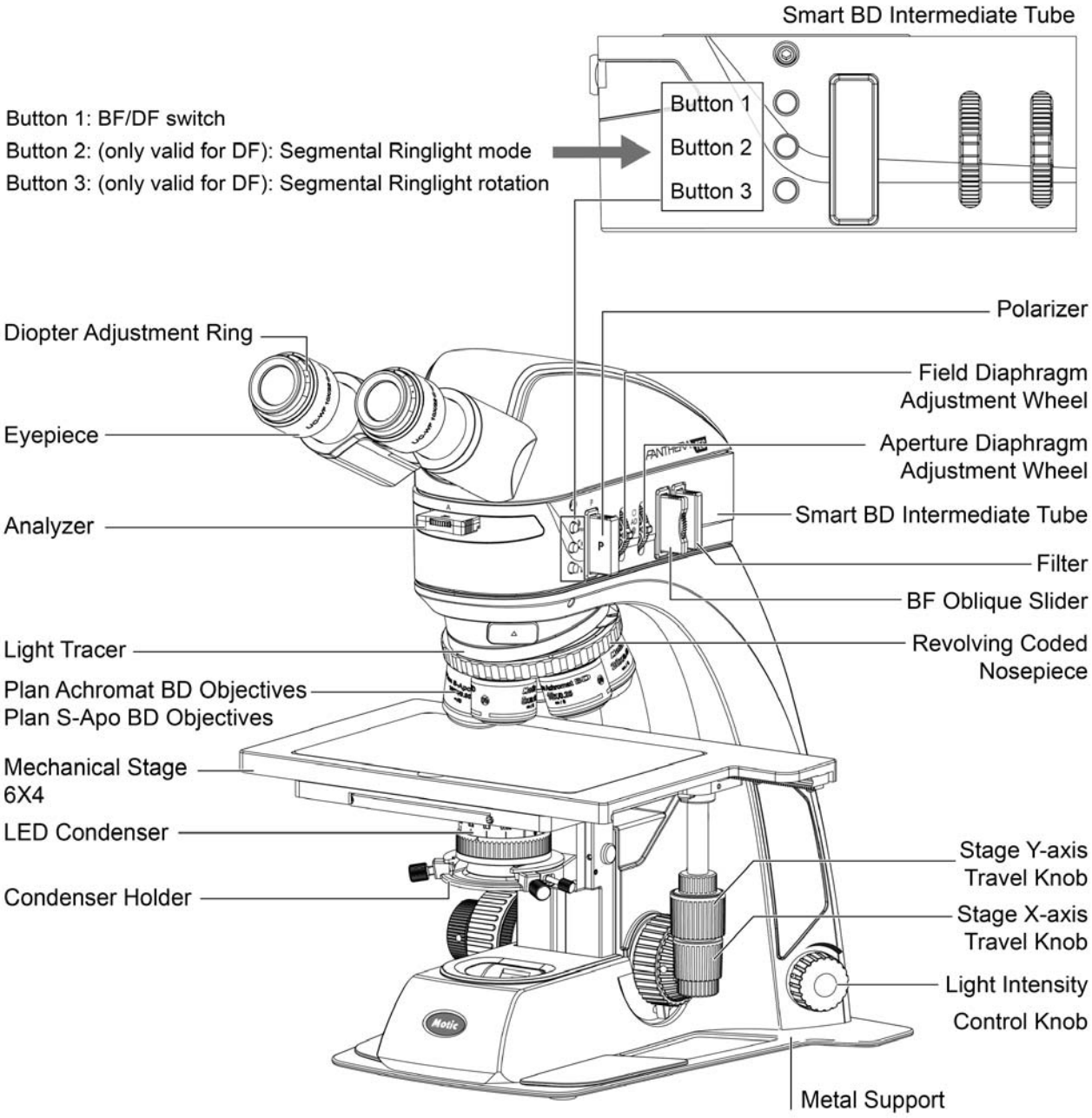
PantheraTEC - POL does not feature reflected light.

2.3 Main Models

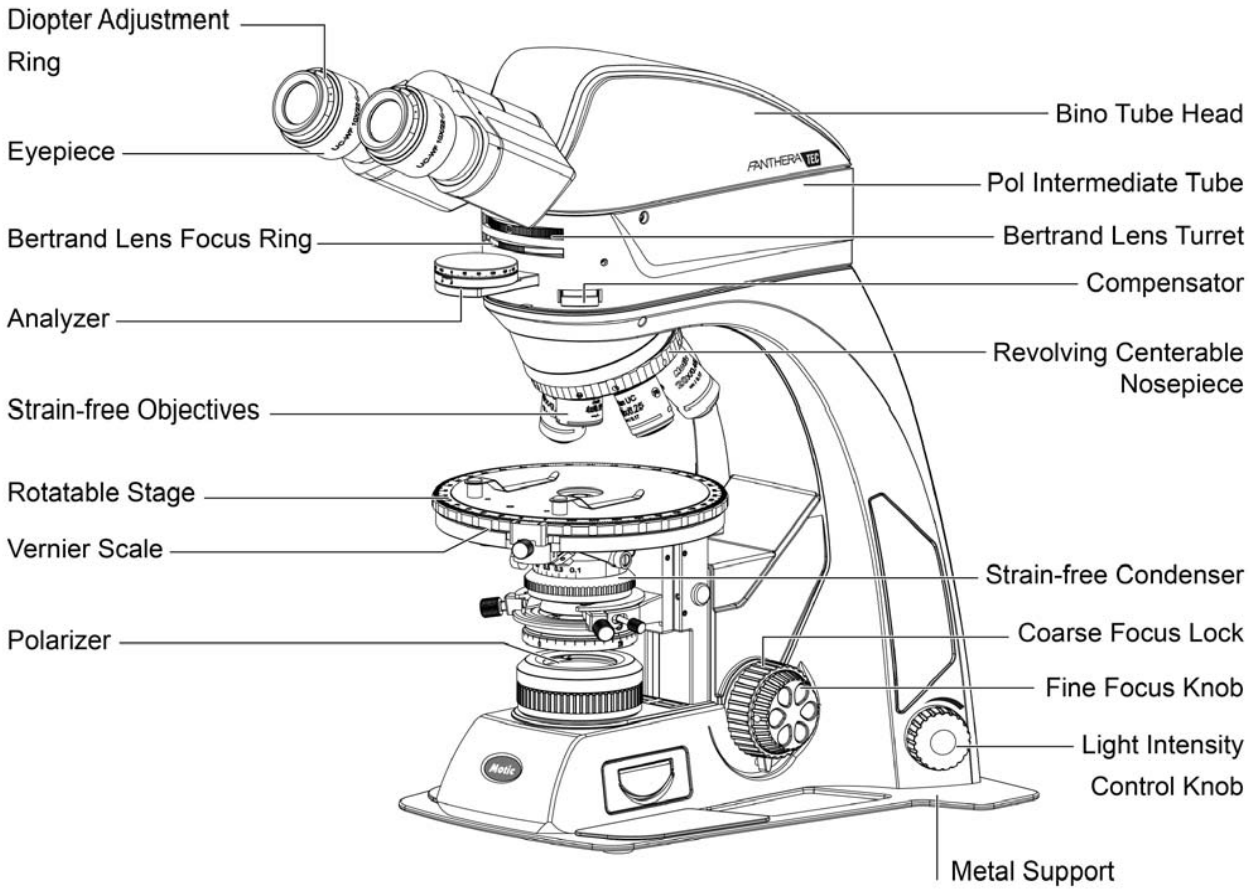
2.3.1 PantheraTEC-BF



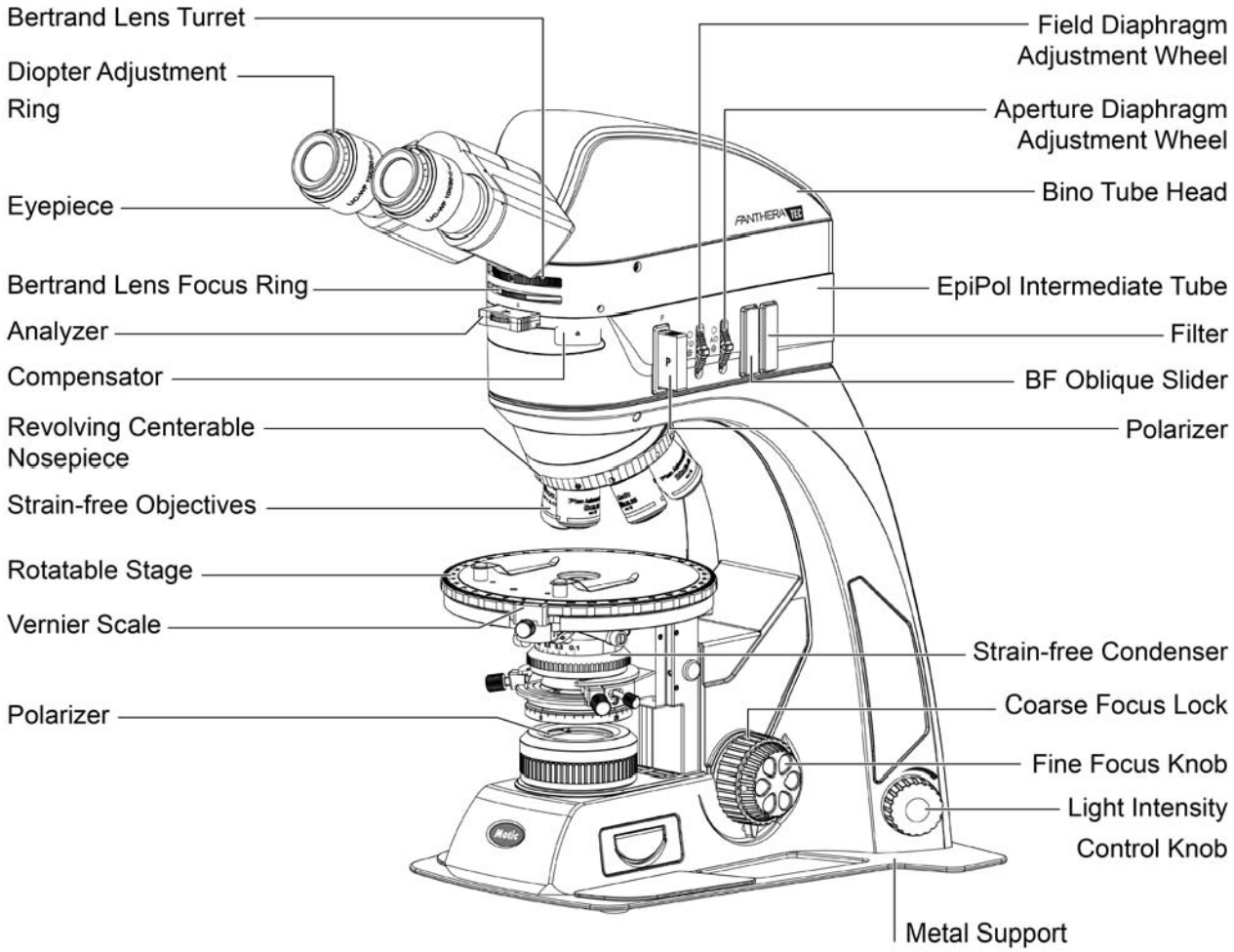
2.3.2 PantheraTEC-BD



2.3.3 PantheraTEC-POL



2.3.4 PantheraTEC-EpiPOL



Objective Lenses:

PantheraTEC-BF

Magnification	**N.A.**	**W.D (mm)**
Plan Achromat LD 5X	0.13	20.3
Plan Achromat LD 10X	0.25	17.5
Plan Achromat LD 20X	0.40	8.1
Plan S-APO 50X	0.80	1
Plan S-APO 100X (optional)	0.90	0.5

PantheraTEC-BD

Magnification	N.A.	W.D (mm)
Plan Achromat BD 5X	0.13	17.3
Plan Achromat BD 10X	0.25	16.3
Plan Achromat BD 20X	0.40	7.3
Plan S-APO BD 50X	0.80	1
Plan S-APO BD 100X (optional)	0.90	0.5

PantheraTEC-POL

Magnification	N.A.	W.D (mm)
Strain-free Plan UC 4X	0.1	30.5
Strain-free Plan UC 10X	0.25	17.4
Strain-free Plan UC 20X(optional)	0.45	0.8
Strain-free Plan UC 40X	0.65	0.6
Strain-free Plan UC 60X	0.8	0.35
Strain-free Plan UC 100X/1.25 Oil (optional)	1.25	0.16

PantheraTEC-EpiPOL

Magnification	N.A.	W.D (mm)
Plan Achromat LD 5X	0.13	20.3
Plan Achromat LD 10X	0.25	17.5
Plan Achromat LD 20X	0.40	8.1
Strain-free Plan UC 40X	0.65	0.6
Strain-free Plan UC 60X (optional)	0.8	0.35
Strain-free Plan UC 100X/1.25 Oil (optional)	1.25	0.16

Working distance WD: The distance from the cover glass top surface to the nearest point of the objective.

Numerical aperture NA: The NA is a performance indicator. The higher NA, the higher the resolving power. It describes the ability of the lens to collect light under steep entry angles.

Resolution: The ability to differentiate two points, or minimum distance under which two points can be differentiated.

Focal depth: The area along the optical axis where a focused image appears to be sharp. If the aperture iris diaphragm is stopped down, the focal depth becomes bigger. As greater the NA of an objective is, as shorter the focal depth it is.

Field number: A value that indicates the diameter of the image of the field diaphragm that is formed by the lens in front of it in mm.

Field of view: The actual size of the field of view in millimeters in the Eyepiece.

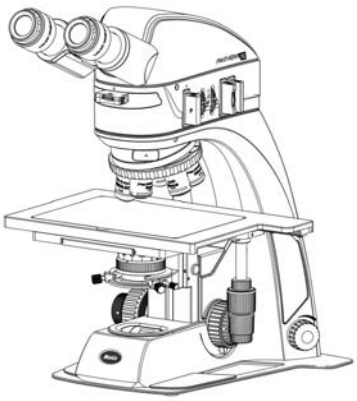
Total magnification: Objective magnification multiplied by the eyepiece magnification.

3. SETTING UP THE INSTRUMENT

Avoid placing the instrument in locations exposed to direct sunlight, dust, vibration, high temperature, high humidity and where it is difficult to unplug the power supply cord.

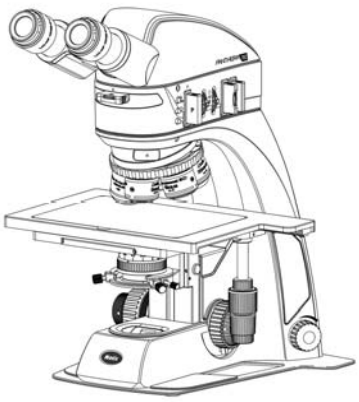
3.1 Operating environment

- Indoor use
- Altitude: Max 2000 meters
- Ambient temperature: 15°C to 35°C
- Maximum relative humidity: 75% for temperature up to 31°C decreasing linearly to 50% relative humidity at 40°C
- Supply voltage fluctuations: Not to exceed ±10% of the normal voltage.
- Pollution degree: 2 (in according with IEC60664)
- Installation / Overvoltage category: 2 (in according with IEC60664)
- Air pressure of 75kPa to 106 kPa
- Avoid frost, dew, percolating water, and rain



PantheraTEC-BF

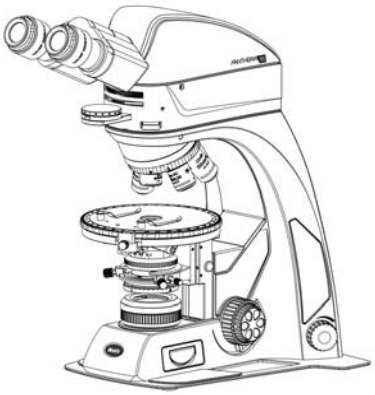
- SmartLight digital brightness control
- ImagingOnDevice
- QR-Link, ImageRecall (Optional)
- Compact EpiBF intermediate design with 3W LED; powered By Stand; BrightField, simple Pol Features
- LED condenser, integration with condenser and collector to ensure the max.35mm Z range. Auto setting mode and Manual setting mode for selection
  (only for PantheraTEC-BF-T/TD)



PantheraTEC-BD

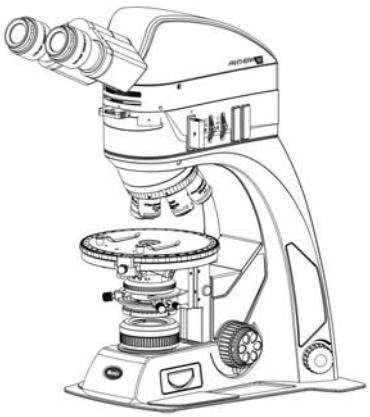
- SmartLight digital brightness control
- ImagingOnDevice
- QR-Link, ImageRecall (Optional)

- Compact EpiBD intermediate design with Smart 3W LED, powered by stand; BrightField, DarkField, simple Pol features. It provides the Segmentable ringlight mode selection for Industry quick inspections with five different segment modes
- LED condenser, integration with condenser and collector to ensure the max.35mm Z range. Auto setting mode and Manual setting mode for selection
  (only for PantheraTEC-BD-T/TD)



PantheraTEC-POL

- SmartLight digital brightness control
- ImagingOnDevice
- QR-Link, ImageRecall (Optional)
- Compact intermediate design, sharing with the same housing; POL feature with Bertrand lens system
- Rotatable stage
- Strain-free optical system
  Interchangeable 3W LED (Optional) and 30W HAL (Standard); Full Koehler illumination



PantheraTEC-EpiPOL

- SmartLight digital brightness control
- ImagingOnDevice
- QR-Link, ImageRecall (Optional)
- Compact intermediate design, sharing with the same housing; BrightField, POL feature with Bertrand lens system
- Rotatable stage
- Strain-free optical system
- Interchangeable 3W LED (Optional) and 30W HAL (Standard); Full Koehler illumination

Please familiarize yourself with the instructions given in this Operation Manual.
In case of unresolved questions, please contact Motic after sales Service or consult Motic Webservices for further instructions.

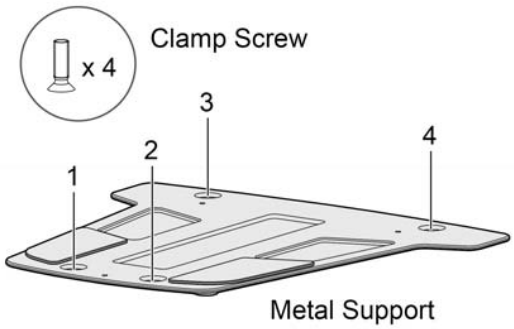
4. ASSEMBLING THE MICROSCOPE

4.1 Verifying input voltage

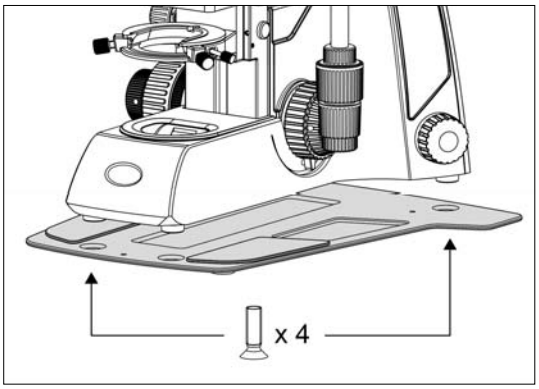
- The automatic voltage selection works with a broad range of settings, please check the power rating of your country is admitted before the use of the Instrument under chapter specification. However, always use a power cord that is rated for the voltage used in your area and that has been approved to meet local safety standards. Using the wrong power cord could cause fire or equipment damage.
- If using an extension cord, use only a power supply cord with a protective earth (PE) wire.
- In order to prevent electric shock, always turn the power switch on the power supply off before connecting the power cord.

4.2 Metal Support

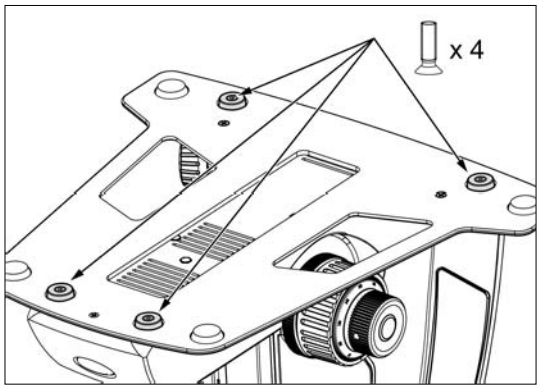
- To make sure the PantheraTEC series more stable, every TEC series of microscopes comes with the metal support.
- Screw the metal support from the underneath with the provided clamp screws.



(Fig. 1-1)



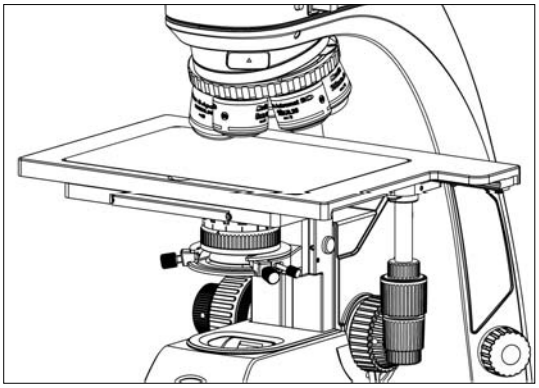
(Fig. 1-2)



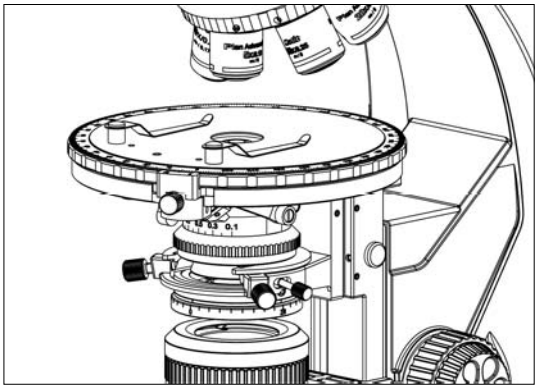
(Fig. 1-3)

4.3 Stage

- Lower the stage so that the sample can fit below the objectives. The condenser automatically moves together with the stage. Ensure that the stage is low enough so that none of the objectives collide with the sample when rotating the objective nosepiece.
- 3 Place the sample on the center of the stage. You can use the object guide (if available) to fix the sample in place. The object guide has non-overlapping axis scales (e.g. 0-60 mm and 100-140 mm) so that any coordinate pair is unambiguous.
- If you know the area of interest already, move the sample so that the area is illuminated.
  To move the sample on the rotatable stage, turn the corresponding screw on the object guide.
  To move the sample on the static stage, turn the corresponding knob of the coaxial drive under the stage. (For PantheraTEC-POL/EpiPOL)
- If the microscope has a rotatable stage, turn it to the desired angle by pushing the stage surface. You can apply the 45° click-stop control under the stage to rotate the stage in 45° steps. (For PantheraTEC-POL/EpiPOL)



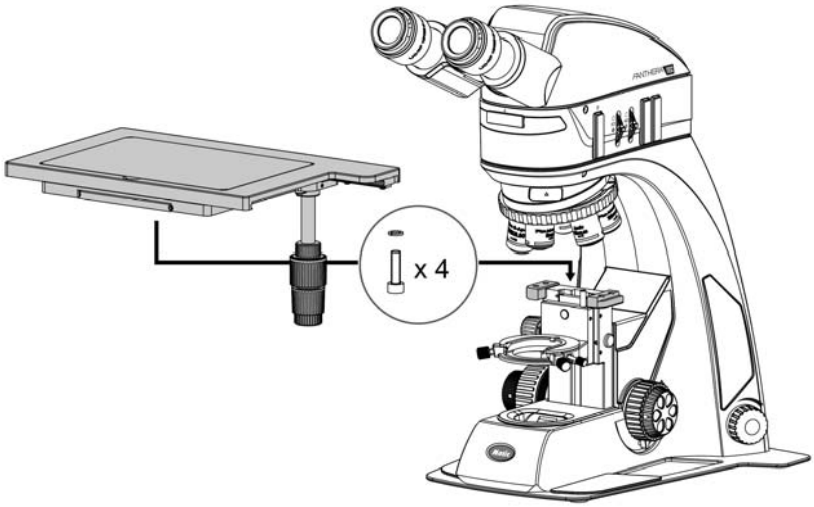
(Fig. 2-1)
(For PantheraTEC-BF/ BD)



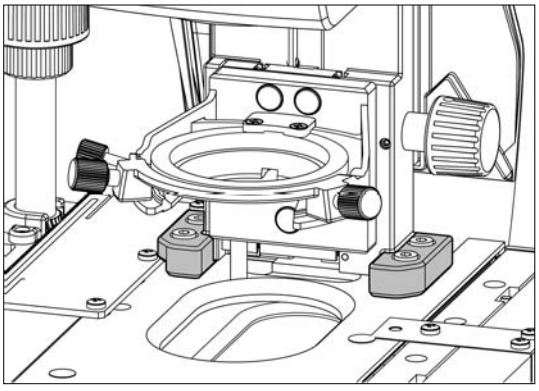
(Fig. 2-2)
(For PantheraTEC-POL/EpiPOL)

4.3.1 Way to install the 6X4 stage (For PantheraTEC-BF/BD)

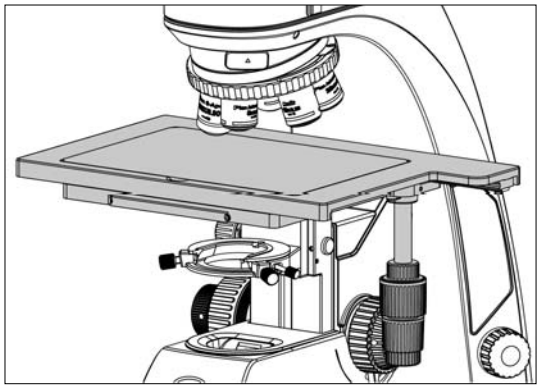
- To protect the 6X4 stage with long travel range, the 6X4 stage is taken from the stand and packed separately in the package.
- Take the 6X4 stage from the package and use the provided Allen key and screws to lock the stage from the underneath.



(Fig. 3-1)



(Fig. 3-2)



(Fig. 3-3)

- To make sure the 6X4 stage screwed tightly into the stage carrier from the underneath with the provided screws.

4.4 Objectives

- Lower the stage completely. Screw the objectives into the revolving nosepiece so that clockwise rotation of the nosepiece brings the next higher magnification objective into position.

Note: The PantheraTEC-POL/EpiPOL microscope allows you to center three objective positions in relation to the reference objective position.

4.5 Condenser

4.5.1 PantheraTEC-POL/EpiPOL

- Raise the stage by turning the coarse focus knob.
- Completely lower the condenser carrier by turning the condenser focus knob.
- Insert the condenser into the dovetail mount with aperture scale facing forward towards the user.
- Secure it with the condenser clamp screw. (Fig. 4-1)
- Turn the condenser focus knob to raise the condenser as far as it will go. (Fig. 4-2)

4.5.2 PantheraTEC-BF/BD

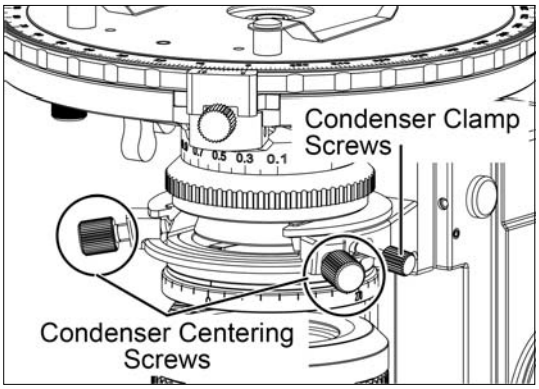
a. LED condenser is integrated condenser and collector. In Auto setting mode, it will read the pre-set NA and required intensity automatically when the objective magnification is changed, no need to turn the N.A manually. In Manual setting mode, one can adjust the N.A. if needed. Total 6 settings: Auto/0.02/0.3/0.6/0.9/DF. (Fig. 4-3)

b. When the system recognized the start objective hole, the ringliht LED indicator will twinkle 2 times.

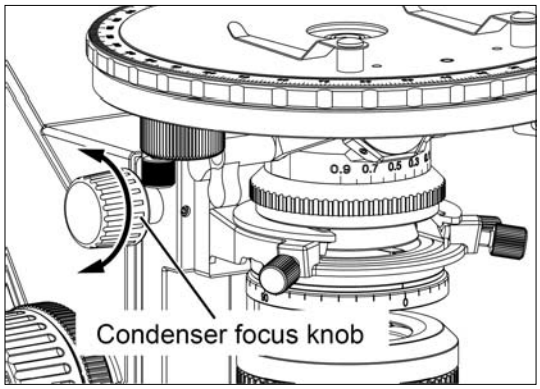
c. When the Auto function is selected, the objectives are pre-set in the right coded objective hole. It will read the pre-set NA as following and required intensity automatically when the objective magnification is changed, no need to turn the N.A manually. Meanwhile, the intensity of objective NA will be memorized after 3s and will be recalled when you go back to the same objective.

d. When DF function is selected, it will read the preset required intensity automatically when the objective magnification is changed. Meanwhile, the intensity will be memorized when the intensity is changed and will be recalled when you go back to the same objective.

Strain-free condenser used for PantheraTEC-POL/EpiPOL

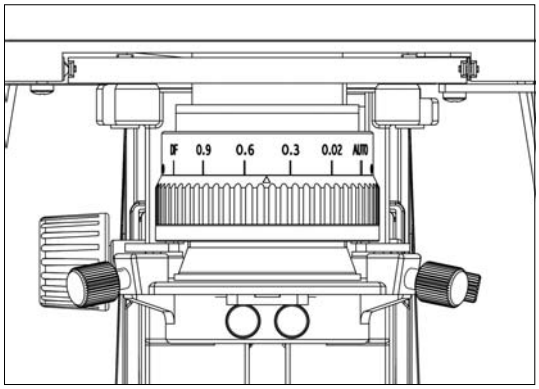


(Fig. 4-1)



(Fig. 4-2)

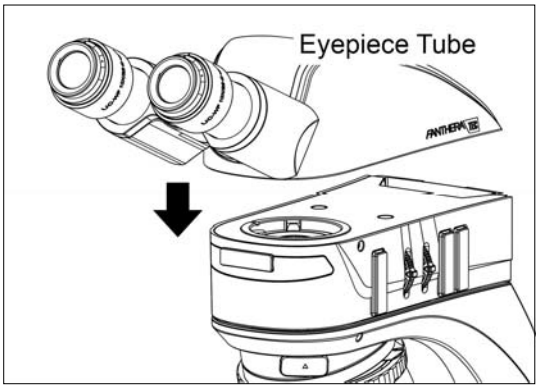
LED Condenser used for PantheraTEC-BF/BD



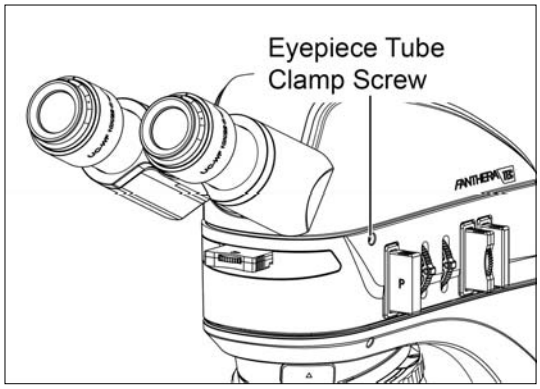
(Fig. 4-3)

4.6 Eyepiece tube

- Loosen the eyepiece clamp screw (Fig. 5-2). Insert the round dovetail mount on the eyepiece tube into the round dovetail mounts on the intermediate tube (Fig. 5-1). Tighten the eyepiece tube clamp screw to secure the eyepiece tube in place. (Fig. 5-2)



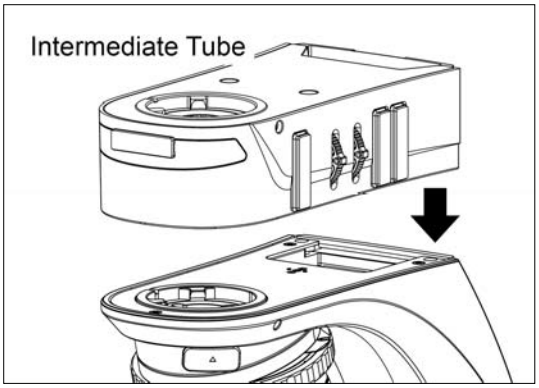
(Fig. 5-1)



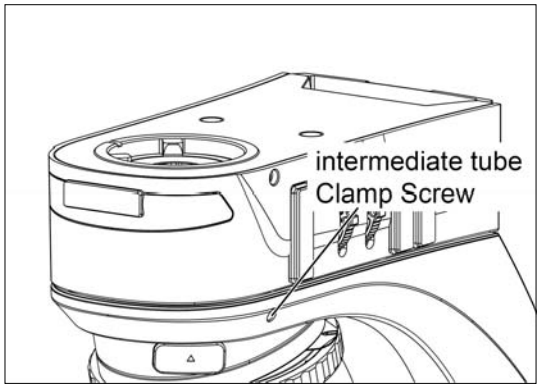
(Fig. 5-2)

4.7 Intermediate tube

- To mount the intermediate tube, start loosening the intermediate tube clamp screw on the microscope arm.
- Insert the intermediate tube into the round dovetail mount on the microscope arm.
- The orientation pin on the lower side of the intermediate tube has to fit to the receiving groove on the microscope arm.
- Secure in position with the clamp screw.



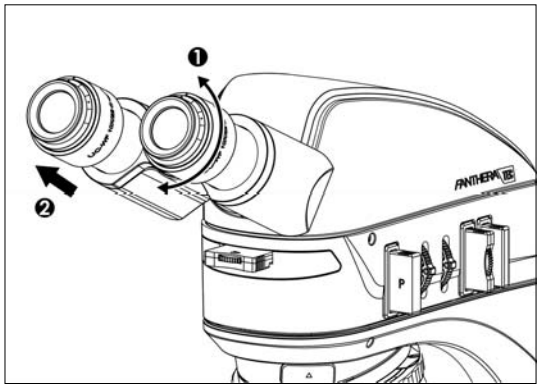
(Fig. 6-1)



(Fig. 6-2)

4.8 Eyepieces

- Use the same magnification eyepieces for both the eyes.
- To secure the eyepiece in the eyepiece sleeve, tighten the clamp screws.
- Twist the eyepiece (anti-clockwise or clockwise) with 20~30 degree (Fig. 7.1) and pull the eyepieces gently out when removing the eyepiece. (Fig. 7.2)

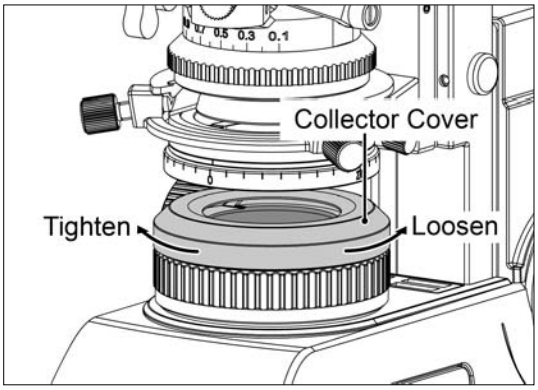


(Fig. 7)

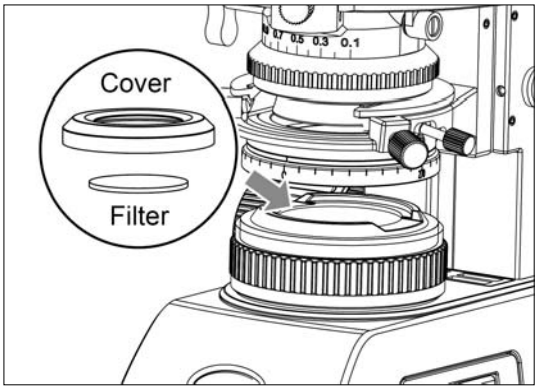
4.9 Filters

For PantheraTEC POL/EpiPOL

- Remove the collector cover (Fig. 8-1) and place the filter in the filter holder located around the field lens (Fig. 8-2), screw back the collector cover (Fig. 8-1), taking care that dust, dirt and fingerprints do not get on the filter and the field lens.



(Fig. 8-1)



(Fig. 8-2)

- **Filter selection:**

Filter	Function
Blue Filter (Colour Balancing Filter)	For routine microscopy and photomicrography
Green Interference (546nm)	For retardation measurement and contrast adjustment

- A diffuser is built into the base of the microscope.

4.10 Power cord

- Connect the socket of the of the power cord to the AC inlet on the rear of the base of the microscope. Plug in the other end of the cord to an AC outlet with ground conductor.

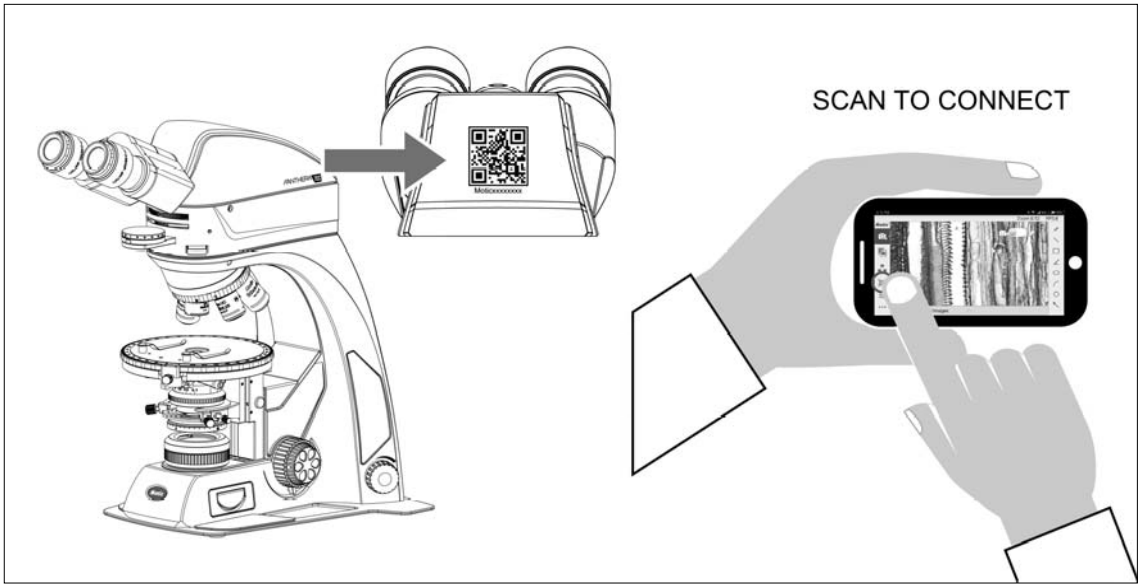
5. DIGITAL PARTS (SETUP AND OPERATION)

5.1 How to use QR-Link (PantheraTEC-BF/BD-TD, PantheraTEC-POL/EpiPOL Digital)

In case you do not have the Panthera APP yet, please scan the QR-Code on the backside Type Label to download Panthera APP in Android or IOS system, and get connected to the correct APP store via Motic servicing Servers. In case of any issue, please visit the Website **http://www.motic.com/Panthera/app.html**

Connect the same network with Panthera. If Panthera is hotspot, SSID format is like Motic***. No password required.

Use QR-Link to connect to ImagingOnDevice
To connect to PantheraTEC Digital Imaging system, open the Panthera APP and scan the QR-code on the top of the Tube head cover. The connection should be activated almost immediately.

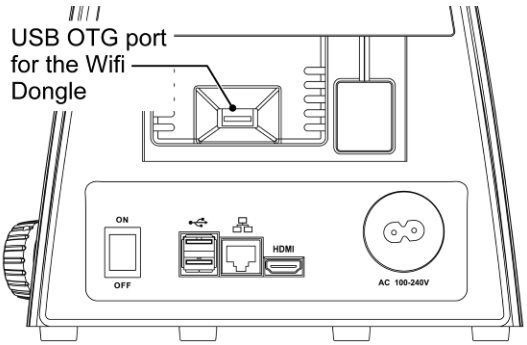


5.2 ImagingOnDevice

5.2.1 PantheraTEC Digital Series BacksideConnection Panel

Panthera Series is providing the user with an unseen combination of build in Digital Capabilities.

“Plug in your HDMI Screen, mouse and keyboard and start enjoy the simplicity of working with Motic Panthera Series.”



- Direct Connect to Screen
- Projector

- Plug your Mouse or Keyboard
- Take care your data with a USB-Stick

- Connect to remote Location
- Online consultation and Discussion
- Digital Classroom

- Optional WIFI via USB Stick

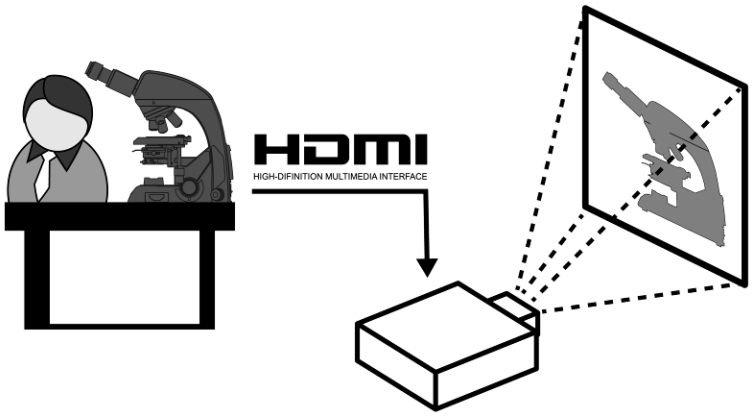
PantheraTEC Digital model Backpanel Connections

1x	HDMI	Full HD 1080i
1x	Ethernet LAN	1Gbit/s
2x	USB 2.0	Plug and Play
1x	USB 2.0 OTG (Wifi dongle support)	Accessories port

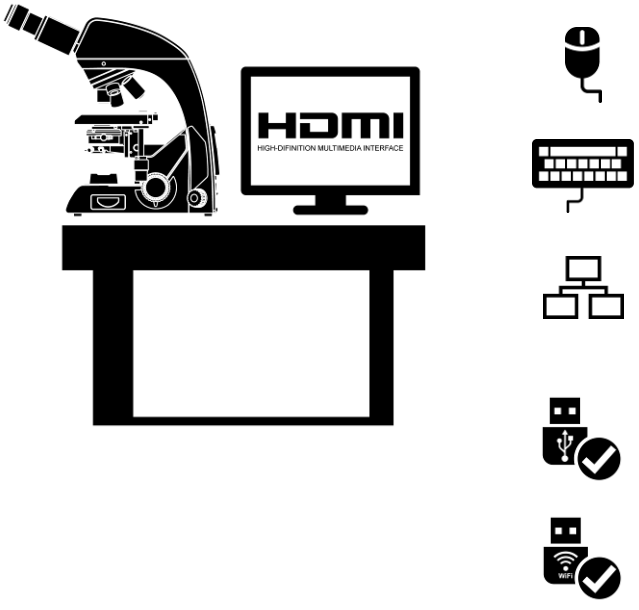
To plug accessories like HDMI Screen, Mouse or Keyboard, turn off the Instrument plug in the accessories and turn the Instrument on again.

5.3 **TeachingOnDevice** (PantheraTEC-BF/BD-TD, PantheraTEC-POL/EpiPOL Digital)

PantheraTEC digital Microscope Series are providing direct HDMI, USB, LAN Network connectivity. Just plug a HDMI capable Device, mouse and a Keyboard in the backside of the Instrument and start to work.



Connect your PantheraTEC digital Microscope to a touch enabled HDMI Screen and conveniently use a keyboard to enter your reports.

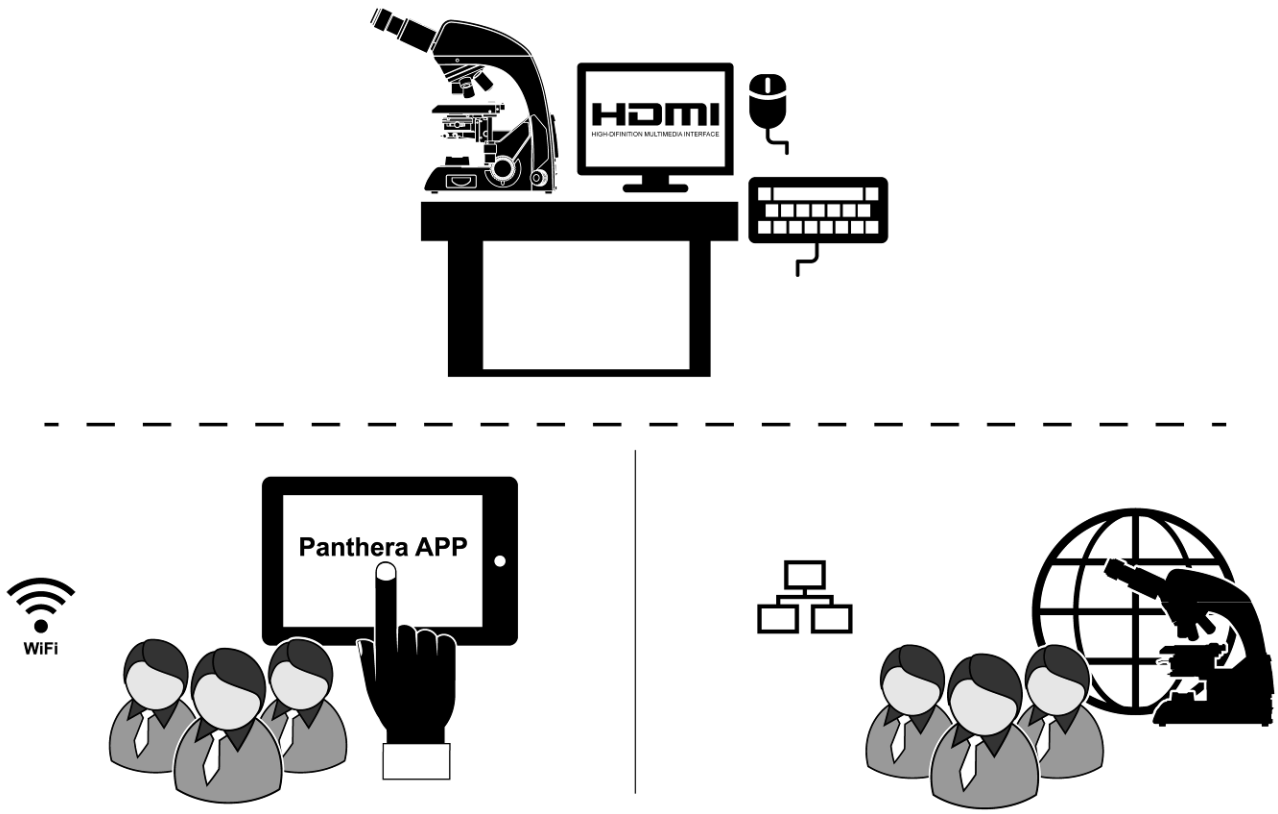


Plug and Play Accessories:

- 3 Button Wheel mouse for ease of use and roll to zoom
- USB Keyboard, simply connect the Keyboard of your choice
- 1Gbit Lan connection port for high speed remote consultaion on Motic DssStore or simply network sharing
- Plug your personal USB stick to transport your imagery
- Connect your Panthera to the local Wifi or share your image via **QR-Link**.

5.3.1 PantheraTEC ImagingOnDevice realtime sharing **ImagingOnDevice** with **QR-Link** clients

Local: ImagingOnDeviceRemote: QR-Link Clients



Please refer to "5.1 How to use QR-Link".

5.3.2 ImageRecall

PantheraTEC ImagingOnDevice stores relevant Data into the EXIF-Header of each Image being made. User can recall the same Illumination settings using the ImageRecall feature in order to allow a easy reconstruction of the before Experiment.

Motic EXIF Header

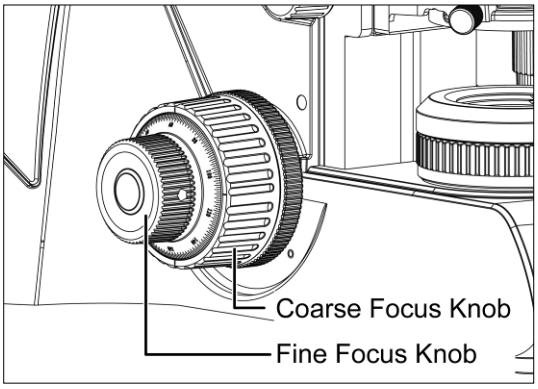
- Objective Lens Type with Specs
- Brightness Settings
- Camera settings

6. USAGE OF MICROSCOPE COMPONENTS

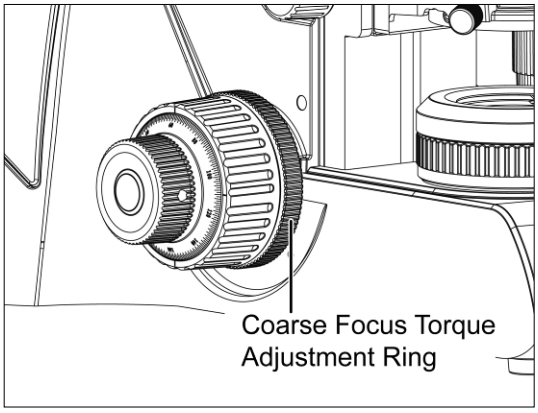
6.1 Coarse and fine focusing (Fig. 9-1)

- Focusing is carried out with the coarse and fine focus knobs at the left and right of the microscope stand.
- The direction of vertical movement of the stage corresponds to the turning direction of the focus knobs.
- One rotation of the fine focus knob moves the stage 0.2mm. The graduation on the fine focus knob is 2 microns.

- Never attempt either of the following actions, since doing so will damage the focusing mechanism:
- Rotate the left and right knob while holding the other.
- Turning the coarse and fine focus knobs further than their limit.



(Fig. 9-1)



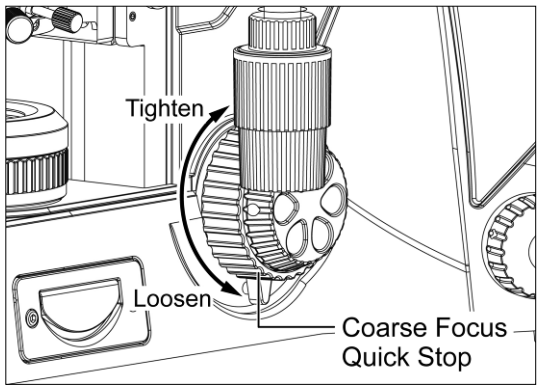
(Fig. 9-2)

6.2 Coarse focus torque adjustment (Fig. 9-2)

- To increase the torque, turn the torque adjustment ring located behind the left-hand coarse focus knob in the direction indicated by the arrow. To reduce the torque, turn the ring in the direction opposite to that indicated by the arrow.

6.3 Coarse focus quick stop (Fig. 10)

- The coarse focus quick stop makes the stage can fixed at any position at which the specimen is in focus i.e. by using the handle to lock the coarse focus knob.
- With the specimen in focus, turn the handle to fix the knob.
- When the coarse focus quick stop is in position, the stage cannot be raised from that position. However, the fine focus knob can move the stage regardless of the limit but will only lower the stage.
- Lower the stage by using the coarse focus knob.

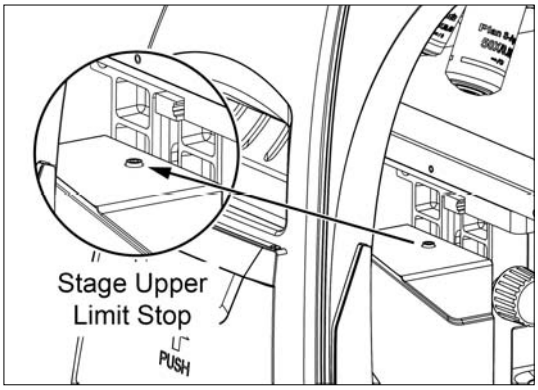


(Fig. 10)

6.4 Stage upper limit stop adjustment (Fig. 11)

(Upper Stage Limit is pre-set at the factory; please only adjust if necessary)

- The Stage Upper Limit stop marks the stage position at which the specimen is in focus i.e. by restricting the movement of the coarse focus knob.
- With the specimen in focus, turn the stage upper limit stop knurled ring clockwise until it reaches the stop.
- When the stage upper limit stop is in position, the stage cannot be raised from that position.
- Lower the stage by using the coarse focus knob anticlockwise



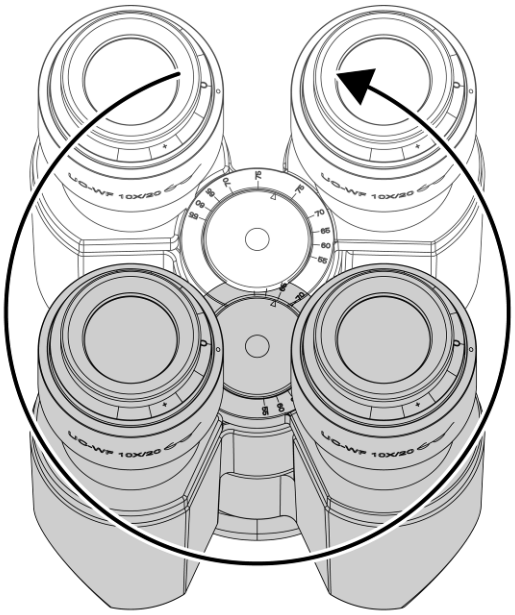
(Fig. 11)

6.5 Interpupillary distance adjustment

Every human eye is different, to adjust the Instrument to best performance adjustment can be necessary. Interpupillary distance adjustment enables the user to observe the specimen with both eyes without fatigue

- Before adjusting the interpupillary distance, bring a specimen into focus using the 10x objective.
- Adjust the interpupillary distance so that both the right and left field of view become one.
- This adjustment will enable the user to observe the specimen with both eyes

PantheraTEC Series Microscopes are equipped with a swivelling Trinocular to provide the flexibility to adjust the view height for individual viewers convenience (Fig. 12)
(only for PantheraTEC-BF/BD series).

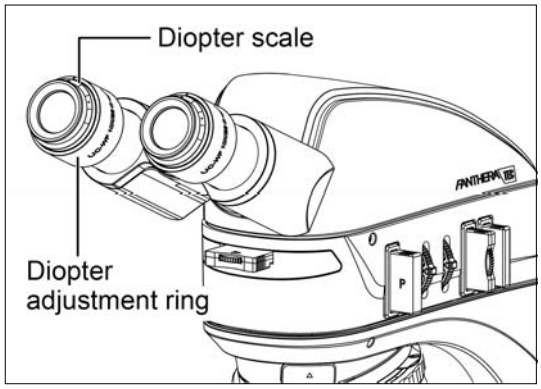


360°swiveling movement, interpupillary distance 50 and 75mm
(Fig. 12)

6.6 Diopter adjustment

Every human eye is different, to adjust the Instrument to best performance adjustment can be Necessary

- Set the diopter on both eyepieces to the **"0"** position.
- Change to 10X Magnification and the image of the specimen into focus using one eye only.
- Change to the other eye and follow below steps.
  - Correct the focus for the second eye by using only the Diopter adjustment Ring (Fig. 13), do not use the coarse / fine focusing knob!
  - Change to a higher magnification to verify the result and if necessary repeat the procedure to match the sharpness for higher magnification.
  - Keep this final diopter position for all magnification / lenses. The diopter position for each user can be recorded from the scale (Fig. 13), so it can easily be reset.



(Fig. 13)

6.7 Illumination Properties Adjustment

You can adjust the following illumination properties:

- Reflected illumination and transmitted illumination switch
- Brightness of transmitted illumination
- Brightness of reflected illumination
- Color of reflected illumination
- Oblique illumination for reflected illumination

INFO

Reflected illumination is not available for PantheraTEC-POL

6.7.1 How to switch the reflected illumination and transmitted illumination

Switch to the reflected illumination, push and turn up the intensity knob, then the reflected illumination of intermediate tube is turned on.

Push and turn down the intensity knob, the reflected illumination is turned off and switch to the transmitted illumination.

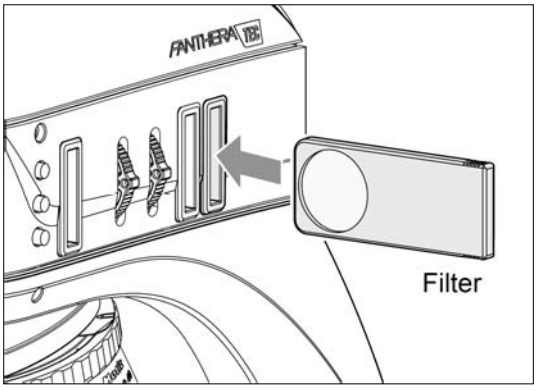
INFO

Using reflected light on transparent samples may create reflections which lead to inappropriate illumination of the sample.

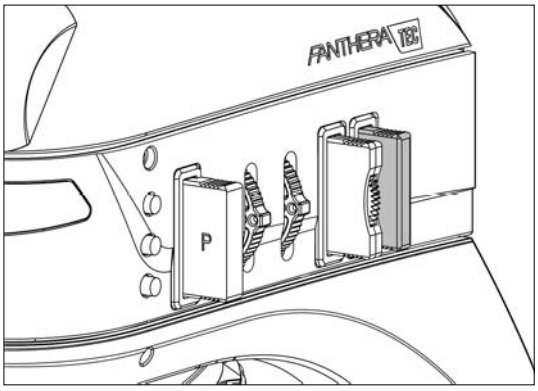
6.7.2 Adjusting the Color of Reflected Illumination (For PantheraTEC-BF/BD)

PantheraTEC - BF/BD microscopes come with the conversion filters to change the colour temperature or profile of the reflected illumination. Conversion filters can be used, for example, to make the color profile of the LED light similar to that of a halogen light.

Procedure: To use a conversion filter with reflected light, insert the filter slider into the vertical slot on the intermediate tube.



(Fig. 14-1)

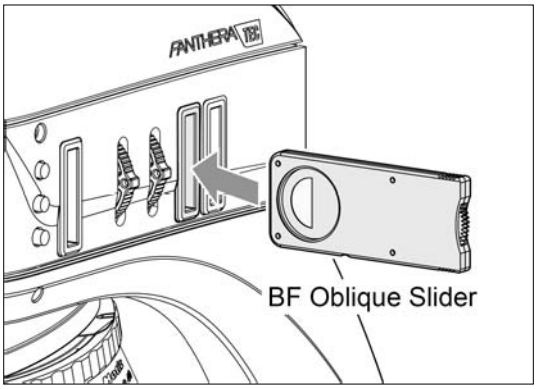


(Fig. 14-2)

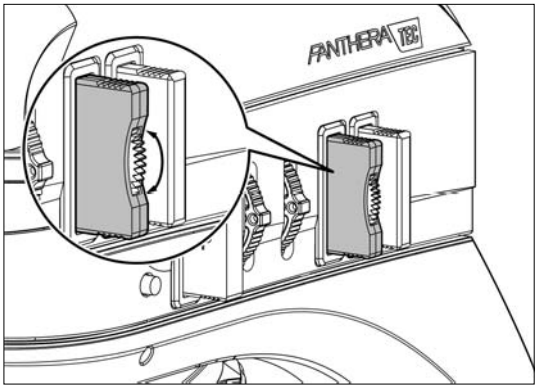
6.7.3 Using Oblique Reflected Illumination (For PantheraTEC-BF/BD)

You can adjust the reflected illumination (if available) so that the light is projected obliquely onto the sample. This enhances the appearance of height differences on its surface.

Procedure: To change the direction of the oblique illumination, insert the BF oblique slider into the vertical slot on the intermediate tube and turn the wheel to change the illumination angles.



(Fig. 15-1)



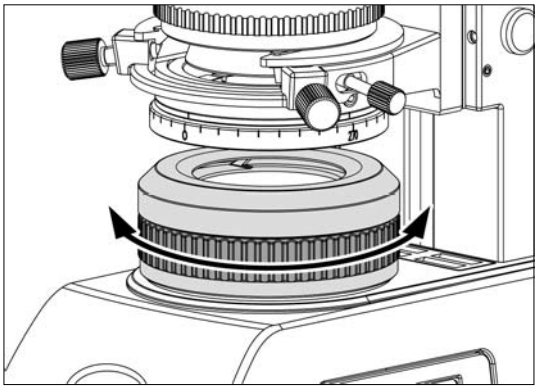
(Fig. 15-2)

Four kinds of oblique illumination slider are available

- 1/6 segmental Illumination
- 1/3 segmental Illumination
- 1/2 segmental Illumination
- full field Illumination

6.7.4 Adjusting the Transmitted Illumination Size (For PantheraTEC-POL/EpiPOL)

The luminous field diaphragm specifies how much of the object is illuminated without altering the brightness itself. Opening the diaphragm causes more of the sample to be illuminated.



(Fig. 16)

Procedure:

1. To adjust the luminous field diaphragm, turn the corresponding ring.
2. Adjust the diaphragm such that it just disappears from the field of view when looking through the eyepieces.

6.7.5 PantheraTEC without smartCAM (Free and Store mode):

To adjust the Brightness, turn the Light Intensity Control Knob and observe the brightness change until the desired brightness has been reached.

If the Illumination has not been changed for 3s the actual value will be stored for this Objective magnification.

The light value stored is independently for each Objective lens and will be automatically restored once the user returns to this Objective lens on the Instrument.

6.7.6 PantheraTEC with smartCAM (Free and Store mode, Best Camera Illumination mode):

There are two different Illumination modes available at PantheraTEC with PI feature.

To change from one mode to the other, push the Light Intensity knob 3 times.

A) Free and Store mode:

To adjust the Brightness, turn the Light Intensity Control Knob and observe the brightness change until the desired brightness has been reached.

If the Illumination has not been changed for 3s the actual value will be stored for this Objective magnification.

The light value stored is independent for each Objective lens and will be automatically restored once the user returns to use this Objective lens.

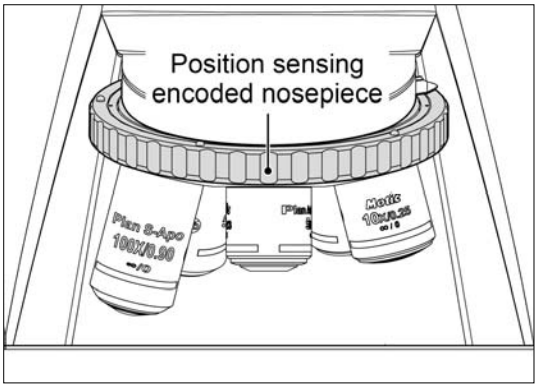
B) Best Camera Illumination mode:

To activate this mode, please push 3 times in a row onto the light adjustment knob.

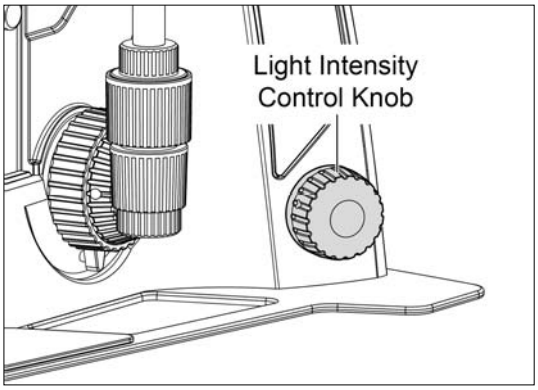
The LED indicator will show the response. Now the Microscope will automatically adjust the illumination and all camera settings to the best camera image illumination settings.

This settings will be constantly evaluated and computed by the system and adjusted according to the magnification and slide condition.

Free and Store is the preset standard Illumination mode.



(Fig.17-1)



(Fig.17-2)

6.7.7 Restore factory default for intensity (For PantheraTEC smartCAM version)

- Turn the Instrument off by switching the main switch on the backside of the Instrument.
  Keep the intensity knob pressed and switch instrument on.
  Keep holding the intensity control knob for 10s.

Now system is being reset to factory values.

Default intensity value for each objective is chosen to 50% of total brightness

6.7.8 Standby mode (For PantheraTEC smartCAM version)

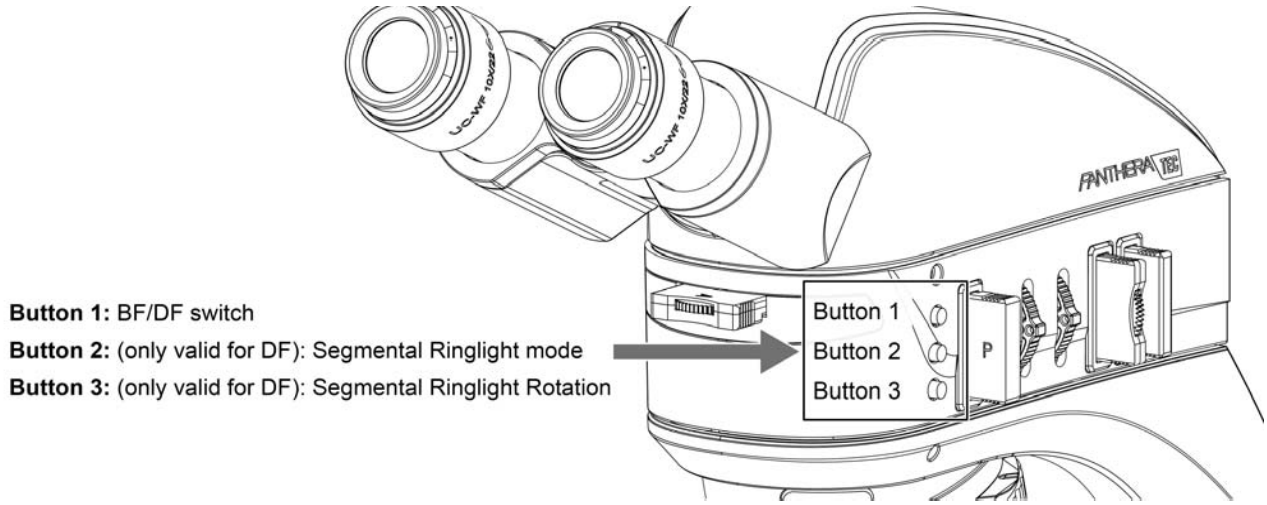
Standby mode self activates after 15min of idling time, in order to conserve energy, protect the specimen from overexposure.

- To activate Standby just double click the intensity knob or leave the microscope for 15 minutes, the standby mode turn on.
- Once touch the intensity knob or nosepiece, standby model turn off. Intensity will be adjusted to the last memorized status.

LED Indicator shows breathing status, to indicate it's in standby

6.8 **Smart EpiBD segmental illumination adjustment** (For PantheraTEC-BD)

PantheraTEC-BD provides the segmentable Smart Ringlight mode selection for quick inspections at the Darkfield, defects detecting and quality control in industrial manufacturing process which can be performed quicker, easier and more efficient with the further improved contrast by this new Darkfield observation method.



(Fig. 18)

Procedure:

Button 1: BF/DF switch

- Press Button1, switch to Brightfield observation, button 1 LED light turns on
- Press Button 1 again, then switch to the Darkfield observation, the button 2 and button 3 LED lights will turn on

Button 2 (only valid for DF): Segmental Ringlight mode selection

When switching to the Darkfield observation, the Button 2 and 3 LED lights will turn on. Five different segmentable ringlight modes for selection by pressing button 2 which can meet your different industry quick inspections demand.

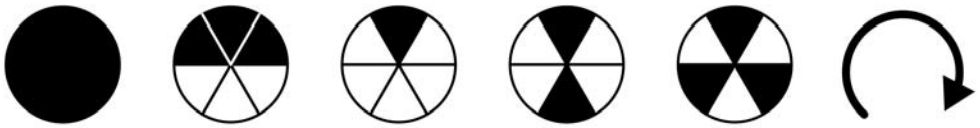
Five different segment modes sequence: full → one-sixth-circle → 2-opposite one-sixth-circle → 3-opposite one-sixth-circle → half (another half version) → goes back to the full field.

Procedure:

1. **Full:** When switching from the BF to DF, it firstly comes to the full mode with the button 2 and button 3 LED lights turning on

2. **One-sixth-circle:** one more press, it comes to the one-sixth-circle mode, the button 2 will twinkle on time, button 3 keeps lighting
3. **2-opposite one-sixth-circle:** one more press, it comes to the 2-opposite one-sixth-circle mode, the button 2 will twinkle 2 times, button 3 keeps lighting
4. **3-opposite one-sixth-circle:** one more press, it comes to the 3-opposite one-sixth-circle mode, the button 2 will twinkle 3 times, button 3 keeps lighting
5. **Half (another half version):** one more press, it comes to half mode, the button 2 will twinkle 3 times, but button 3 will turn off
6. **Full:** one more press, it comes back to the full mode

Five segment modes (only valid for DF):

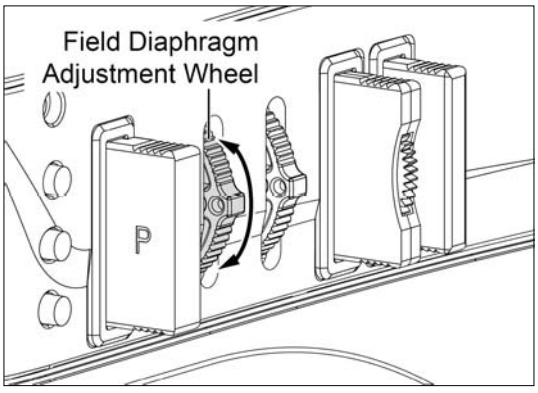


Button 3 (only valid for DF): Segmental Ringlight rotation

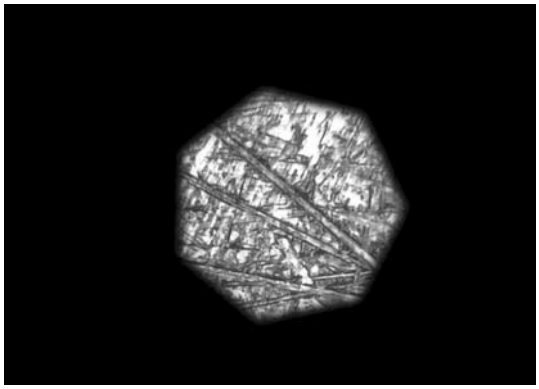
After setting the segment illumination, you can turn the light direction manually in every 60°by pressing button 3 for quickly inspect for scratches, defects or residues without moving your specimen.

6.9 Use of Field Diaphragm (For PantheraTEC-BF/BD/PantheraTEC-EpiPOL)

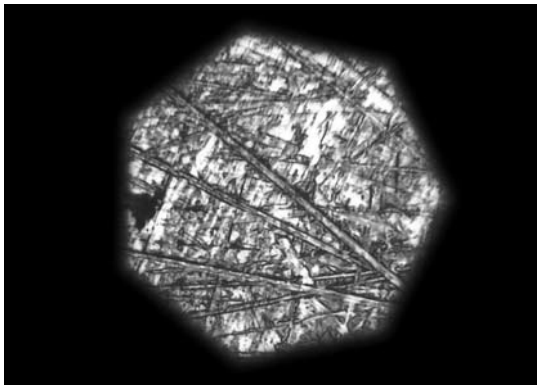
- Clear diaphragm image can be obtained after the specimen is in focus.
- Adjust the aperture diaphragm until aperture diaphragm is 2/3 of field
- Set the aperture diaphragm slightly bigger than the field of view by turning the adjustment wheel.



(Fig. 19)



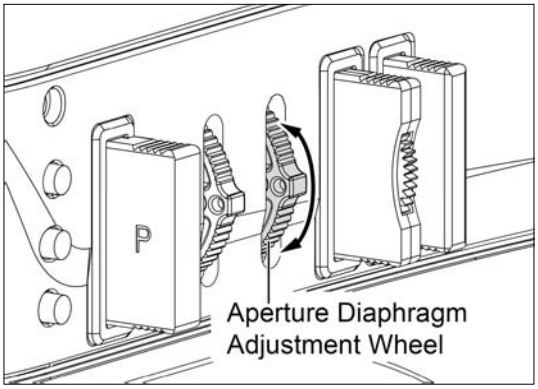
(Fig. 20-1)



(Fig. 20-2)

6.10 Use of Aperture Diaphragm (For PantheraTEC-BF/BD/PantheraTEC-EpiPOL)

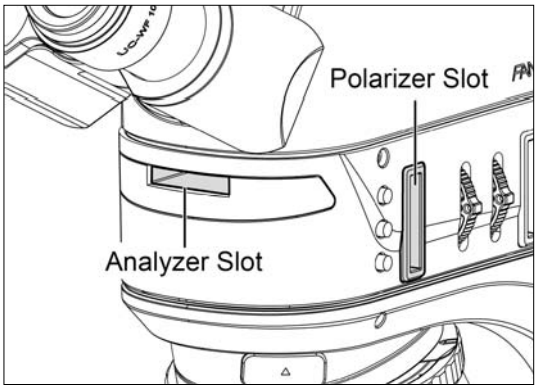
- The condenser aperture diaphragm is provided for adjusting the numerical aperture (N.A.) of the illuminating system of the microscope, it decides the resolution of the image, contrast, depth of focus and brightness.
- Stopping down will lower the resolution and brightness but increase the contrast and depth of focus.
- It is recommended that the aperture diaphragm is set at 2/3 of the objective N.A to get the best contrast and image quality.
- To adjust the aperture diaphragm:
  Adjust the condenser aperture diaphragm lever referring to the condenser aperture scale, or by observing the diaphragm image visible on the exit pupil inside the eyepiece tube, or by using a centering telescope after removing one of the eyepieces and focusing on the aperture diaphragm.



(Fig. 21)

6.11 Use of Polarizer and Analyzer (For PantheraTEC-BF/BD/PantheraTEC-EpiPOL)

- Insert the polarizer (marked with **"P"**) into the front slot of EPI.
- Insert the Analyzer (marked with **"A"**) into the side slot of EPI.
- Analyzer is rotatable and the color of specimen with polarization will be changed when rotating.



(Fig. 22)

6.12 Polarization and Conoscopy Adjustment (For PantheraTEC-POL/EpiPOL)

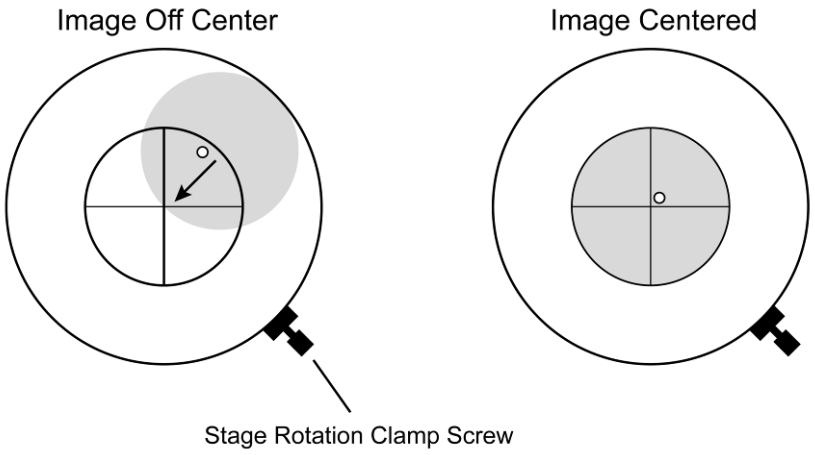
This chapter describes how to perform polarization and conoscopy examinations, as well as providing an introduction to the basic principles of such examinations.

Polarization and conoscopy can be performed with the following microscopes:

- PantheraTEC POL
- PantheraTEC EpiPOL

6.12.1 Centering the objective

- PantheraTEC-POL/EpiPOL Polarizing microscope allows for centering of three objectives in relation to a reference objective.
- Before centering the objectives, look through the binocular tube at the field of view, pick out an easily recognizable target and move the target in the middle to the cross line by moving the sample.
- Rotate the stage
  a. The target now rotates in a circle while touching at one point the intersection of the cross lines.
  b. Rotate the stage until the target is farest away from the intersection. By means of the centering screws bring it half way to the intersection point.
  c. Move the target again to the intersection point by moving the slide. Repeat the procedure until the target rotates on the intersection point.



***** Please Note :**

Usually the user is adviced to turn the nosepiece turret using the knurled nosepiece ring.

Due to some user would use the body of the Objective to turn the nosepiece turret, there could be a gradually de-centering effect depending in the number of incidents.

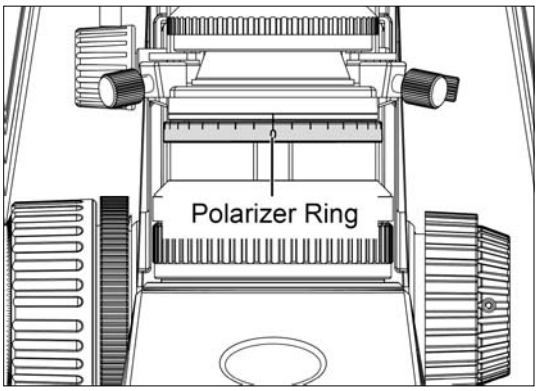
6.12.2 Performing Polarization Examinations with Transmitted Light

Prerequisites:

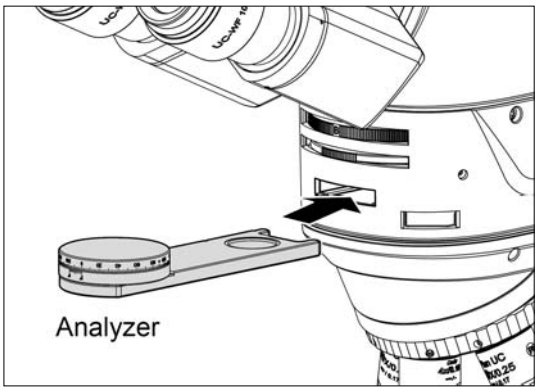
- You are using PantheraTEC POL or PantheraTEC EpiPOL
- The sample is illuminated by transmitted light only
- No polarizers or analyzers are in the beam path
- The objectives are centered (see Centering the Objectives)

Procedure:

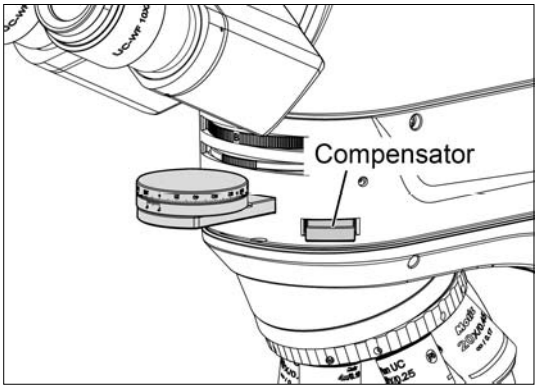
1. Turn the polarizer ring under the sample to the 0° position.



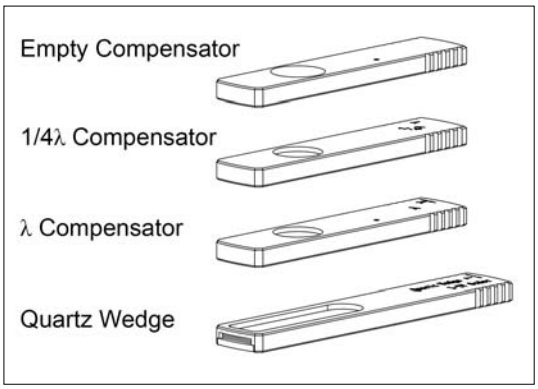
(Fig. 23-1)



(Fig. 23-2)



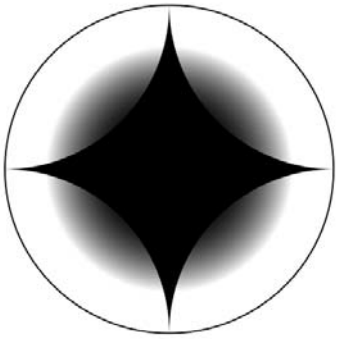
(Fig. 23-3)



(Fig. 23-4)

2. If desired, observe the sample in the polarized light, for example to determine the fracture direction of a material.
3. Insert the fixed analyzer into the horizontal slot of the intermediate tube. Alternatively, insert the rotatable analyzer, set to the 0° position, into the slot.
4. Rotate the stage and observe how the sample changes color.
5. To investigate the sample further, insert a compensator in the 45° slot on the microscope stand. There are 1/4 λ compensator, λ compensator, Quartz wedge for optional. Detailed compensator introduction please refer to 6.12.5.

Dark cross image is formed on the exit pupil of the objective



Notes

- Rotate the Bertrand lens turret to “B” position and bring the Bertrand lens in the optical path to enable the exit pupil of the objective to be seen through the eyepiece. Rotate the polarizer so that a dark cross image is formed on the exit pupil as shown in the figure above.

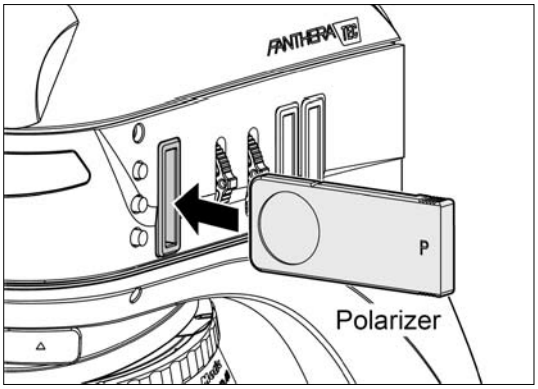
6.12.3 Performing Polarization Examinations with Reflected Light (For PantheraTEC-EpiPOL)

Prerequisites:

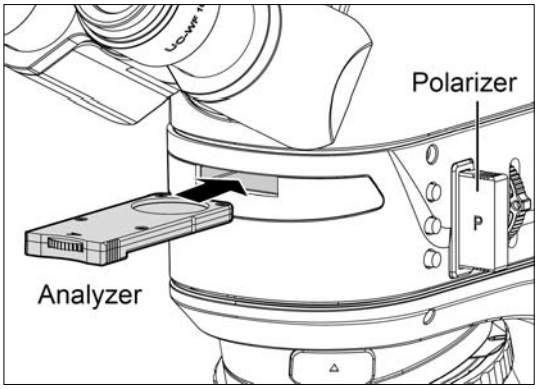
- The sample is illuminated by reflected light only
- No polarizers or analyzers are in the beam path

Procedure:

1. Insert the fixed polarizer into the vertical slot of the intermediate tube.



(Fig. 24-1)

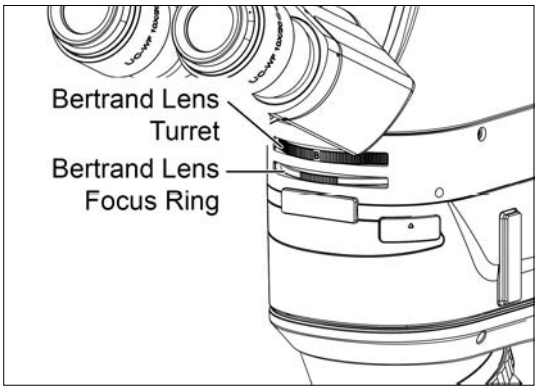


(Fig. 24-2)

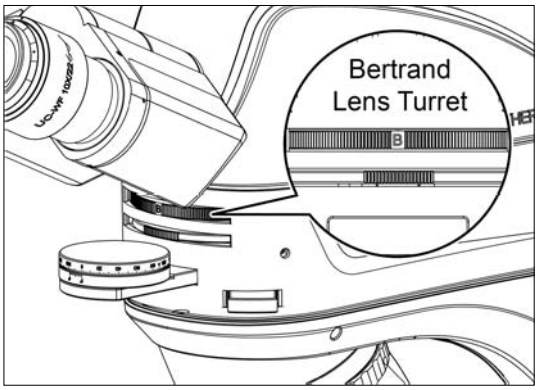
2. Insert the rotatable analyzer, set to the 0° position, into the horizontal slot of the intermediate tube.
3. If desired, rotate the sample and observe how the sample changes.

6.12.4 Focusing and centering the Bertrand lens

- Rotate the Bertrand lens turret to “B” position and bring the Bertrand lens in the optical path.
- Bring 40x Objective into optical path.
- Use the Bertrand lens focus ring under the Bertrand lens turret to focus on the image of the condenser aperture diaphragm that is stopped down to 70 – 80% of the numerical aperture of the objective.
- Use the Bertrand lens centering screws to bring the image of the condenser aperture to the center of the field of view.
- The centering procedure is the same as that for the condenser except that the condenser aperture diaphragm image is used instead of the field diaphragm image.



(Fig. 25-1)



(Fig. 25-2)

6.12.5 Compensators

- All polarizing microscopes are equipped with a compensator in the optical beam path between polarizer and analyzer.
- Compensators are sections of optically anisotropic material which, when inserted in the microscope between crossed polarizers, produce a defined optical path difference of mutually perpendicular plane-polarized light waves.

a. 1/4λ-plate - The 1/4λ-plate is also called mica plate and has an optical path difference around 140nm (yellow light has λ = 580nm, therefore 1/4λ = 580/4 = 145nm).

b. 1λ-plate (sensitive tint or first-order red) - The 1λ-plate is a gypsum plate of a thickness to give1λ optical path difference for green light of 550 nm. This wavelength is therefore extinguished with the resulting interference colour having the typical tint of the first-order red/violet. This magenta colour is sometimes named ‘sensitive tint’.

c. Quartz Wedge – This device has a range of 4 orders and is commonly employed for qualitative retardation measurements of petrographic specimens or other birefringent materials whose retardation value falls within the wedge limit.

6.12.5.1 Measuring Retardation from 1λ to 4 λ

- Observing extinction position
  a. Observe the position where the part of the specimen to be measured becomes darkest by rotating the stage under crossed polars.

- Observing subtraction position
  b. Rotate the stage 45° to the diagonal position; here the specimen appears to be at it's brightest. Insert the appropriate compensator into the slot; verify the interference colour of the part to be measured. Rotate the stage another 90° to get the associated colour. With those 2 observed colours, the +/- position of the sample can be determined.

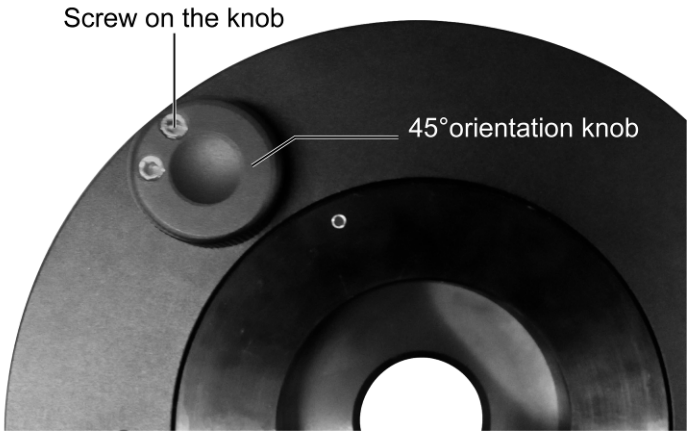
6.12.5.2 Measuring retardation

a. Slide the quartz wedge along the length of the slot, and the interference colour will change.
b. Stop sliding the quartz wedge where the dark band covers the part of the specimen to be measured. Remove the specimen and compare the interference colour (at the same position without the specimen) with the Interference Colour Chart to ascertain the amount of retardation.
c. Measuring the retardation or ascertaining by interference colour should be done with field of view diaphragm stopped down to the part to be measured.

Note: With monochromatic light the coloured fringes are seen as alternating dark and bright bands.

6.12. 6 45° Click-stop

- Use 2.5mm allen key to lose the screw in the stage 45°orientation knob.
- Rotate the 45°orientation knob clock wise and tighten the 45°orientation knob screw with 2.5mm allen key.
- At this time, the rotary stage has a click-stop. Set the rotary stage at “0” position and each rotation will click-stop at every 45°.
- User can set up this function by themselves.



7. PHOTOMICROGRAPHIC PROCEDURE

- To ensure vibration free operation, set the microscope on a sturdy vibration free table or a bench with a vibration proof device.
- Pull the optical path selection lever of the trinocular eyepiece tube all of the way out to the limit, theratio of light entering the observation tube and standard phototube will be 20:80.
- For the same total magnification, select a combination of the highest possible objective magnification and lowest possible projection lens magnification to achieve the utmost image definition and contrast.
- To ensure optimal illumination, check the position and centring of the lamp and position of the condenser.
- Select a blue filter for routine application. An additional colour-compensating filter can also be used depending on the colour rendition.
- Adjusting the field diaphragm is important for the purpose of limiting extraneous light that may cause flare and lower the contrast. Stop down the diaphragm to achieve an illuminated area slightly larger than that of the field of view.
- A change of depth of focus, contrast and resolution of image is attainable with an aperture setting that is 2/3 of the objective N.A.
- For specific photomicrographic procedures, refer to the manual of the specific camera being used.

8. CARE AND MAINTENANCE

8.1 Do not disassemble

- Disassembly may significantly effect the performance of the instrument, and may result in electric shock or injury and will void the terms of the warranty.
- Never attempt to dismantle any parts other than described in this manual. If you notice any malfunction, contact your nearest Motic representative.

8.2 Cleaning the microscope

8.2.1 Lenses and filters

- To clean lens surfaces or filters, first remove dust using an air blower. If dust still persists, use a soft /clean brush or gauze.
- A soft gauze or lens tissue lightly moistened with Isopropyl alcohol should be used to remove grease or fingerprints.
- Use isopropyl alcohol) to remove immersion oil from objective lenses.

⚠ **Warning:**
Alcohol is highly flammable liquid, be careful handling around open flame and always observe the local security advise how to handle such substances

8.2.2 Cleaning of painted or plastic components

- Do not use organic solvents (thinners, alcohol, ether, etc.). Doing so could result in discolouration or in the peeling of paint.
- For stubborn dirt, moisten a piece of gauze with diluted detergent and wipe clean.
- For plastic components, only moisten a piece of gauze with water and wipe clean.

8.3 Disinfecting the Microscope

- Follow the standard procedures for your laboratory.

8.4 When not in use

- When not in use, cover the instrument with vinyl dust cover and store in a place low in humidity where mould is not likely to form.
- Store the objectives, eyepieces and filters in a container or desiccators with drying agent.
- Proper handling of the microscope will ensure years of trouble free service.
- If repair becomes necessary, please contact your Motic agency or our Technical Service direct.

Note:

- If equipment is used in a manner not specified by the manufacturer, the warranty may be void.
- To avoid getting wet, do not use the microscope near water.

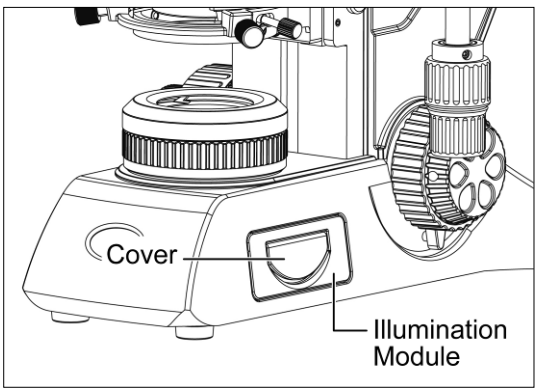
8.5 Bulb replacement

The lamp and the lamp house become very hot during and after a period of operation.
Risk of burn – Do not touch the lamp during or immediately after period of operation.
Make sure the lamp has cooled sufficiently before attempting to replace the lamp.

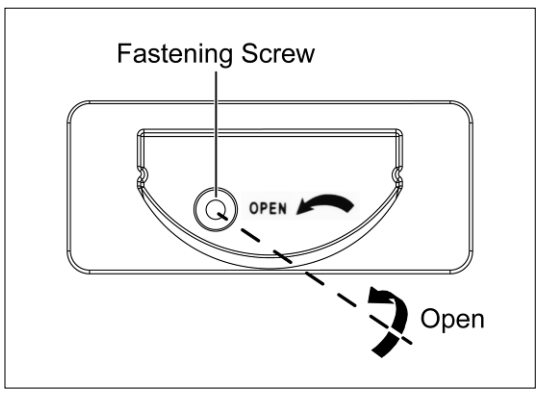
- In order to prevent electric shock always turn the power switch off and unplug the power cord before installing or replacing the bulb.

8.5.1 Replacing the 6V 30W halogen module or the LED module
(For PantheraTEC-POL/EpiPOL)

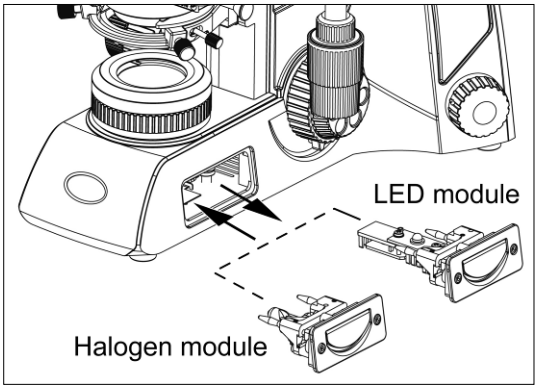
- Left up the cover of illumination module. (Fig. 26-1)
- Loosen the fastening screw of the illumination module. In doing so, slightly press the screw against the spring and turn it by 90° (counter clockwise). (Fig. 26-2)
- Pull the illumination module out of the stand. (Fig. 26-3)
- If the stand is equipped with a 6V 30W halogen lamp, remove the halogen lamp from the lamp carrier and insert the new halogen lamp. Do not touch the new lamp with naked fingers and this will reduce lamp life.
- If the stand is equipped with an LED lamp replace the complete illumination module including the LED.
- Push the illumination module back into the stand and lock it by means of the screw. In doing so, slightly press the screw against the spring and turn it by 90° (clockwise). (Fig. 26-4)



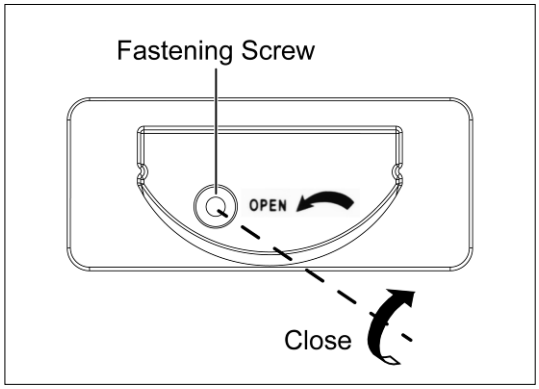
(Fig. 26-1)



(Fig. 26-2)



(Fig. 26-3)



(Fig. 26-4)

8.5.2 Electrical Specifications:

A. PantheraTEC–BF

Input: AC 100~240V 50~60Hz 0.55A

Reflected Lamp: 3W LED

Transmitted Lamp: 3W LED

B. PantheraTEC–BD

Input: AC 100~240V 50~60Hz 0.55A

Reflected Lamp: 3W LED

Transmitted Lamp: 3W LED

C. PantheraTEC–POL

Input: AC 100~240V 50~60Hz 1.2A

Transmitted Lamp: 3W LED or 6V 30W Hal

D. PantheraTEC–EpiPOL

Input: AC 100~240V 50~60Hz 1.2A

Reflected Lamp: 3W LED

Transmitted Lamp: 3W LED or 6V 30W Hal

E. EpiBF/EpiBD/EpiPOL intermediate tube

Input: 12V/1A

Lamp: 3W LED

9. TROUBLESHOOTING TABLE

As you use your microscope, you may occasionally experience a problem.

The troubleshooting table below contains the majority of frequently encountered problems and the possible causes.

9.1 Optical

Problem	Possible Cause
Vignetting or uneven brightness in the field of view or field of view only partially visible	Lamp not installed properly
	Lamp not centred
	Diffuser is in intermediate position
	Condenser not mounted correctly
	Condenser is not centred
	Condenser is set too low
	Condenser top lens not fully swung in/out
	Field diaphragm closed too far
	Aperture diaphragm closed too far
	Improper condenser objective combination
	Revolving nosepiece not clicked into position
	Trinocular eyepiece tube optical path selector lever in intermediate position
Dust or dirt in the field of view	Aperture diaphragm closed too far
	Condenser is set too low
	Dust or dirt on specimen surface
	Dust or dirt on field lens, filter, condenser or eyepiece
Poor image (low contrast or resolution)	Condenser is set too low
	Aperture diaphragm closed too far
	No cover glass
	Too thick or thin cover glass
	Immersion oil not used with oil immersion lens
	Air bubbles in immersion oil
	Specified immersion oil not used
	Immersion oil on dry objective
	Greasy residue on eyelens
	Incorrect illumination

Unequal focus	Stage installed on inclined plane
	Specimen holder not fixed securely on stage
	Specimen not secured in position
Image tinged yellow	Lamp voltage is set too low
	Blue filter is not being us
Focusing is not possible with high magnification objectives	Slide is upside down
	Cover glass is too thick
High magnification objectives strike the specimen when changing over from low to high magnification	Slide is upside down
	Cover glass is too thick
	Eyepiece diopter not adjusted
Insufficient parfocality of objectives	Eyepiece diopter not adjusted
No cohesion of binocular image	Magnification or field of view of left and right eyepieces differ
	Interpupillary distance not adjusted
	Eyepiece diopter not adjusted
Eye strain or fatigue	Interpupillary distance not adjusted
	Diopter adjustment not made
	Field of view of left and right eyepiece differ
	Inadequate illumination

9.2 Electrical

Problem	**Possible Cause**
Lamp does not light	Power supply not plugged in
	Lamp not installed
	Lamp burnt out
Inadequate brightness	Specified lamp not being used
Lamp blows out immediately	Specified lamp not being used
Lamp flickers	Connectors are not securely connected
	Lamp near end of service life
	Lamp not securely plugged into socket

10. SELECTION OF THE POWER SUPPLY CORD

Motic Instruments are certified and tested for safety and environmental conformity. Only power supply cords which are conform with below listed certification marks and countries are applicable.
CAUTION: Do not use non-approved power cord for Motic products, Motic can no longer warrant the electrical safety of the equipment.

Table 1 Certified Cord

	Specifications
Voltage Rating	125V AC (for 100-120V AC area) or, 250V AC (for 220-240V AC area)
Current Rating	6A minimum
Temperature Rating	60 C minimum
Length	3.05 m maximum
Fitting Configuration	Grounding type attachment pull cap Opposite terminates in molded-on EC con-figuration appliance coupling.

The power supply cord should be certified by one of the agencies listed in Table 1, or comprised of cordage marked with an agency marking per Table 1 or marked per Table 2. The fittings are to be marked with at least one of agencies listed in Table 1..

Country	**Agency**	**Certification Mark**	**Country**	**Agency**	**Certification Mark**
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	JQA,JET,TÜV,	
Austria	OVE			UL-APEX/MITI	
Belgium	CEBEC		Netherlands	KEMA	
Canada	CSA		Norway	NEMKO	
Denmark	DEMKO		Spain	AEE	
Finland	FEI		Sweden	SEMKO	
France	LTTE		Switzerland	SEV	
Germany	VDE		United Kingdom	ASTA BSI	
Ireland	NSAI		U.SA	UL	

Table 2 HAR Flexible Cord

Approval Organizations and Cordage Harmonization Marking Methods

Approval Organization	Printed or Embossed Harmonization Marking (May be located on jacket or insulation of internal wiring)		Alternative Marking Utilizing Black-Red-Yellow Thred (Length of color section in mm)		
			Black	Red	Yellow
Comite Electrotechnique Belge (CEBEC)	CEBEC	<HAR>	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V.	<VDE>	<HAR>	30	10	10
Union Technique de Electricity	USE	<HAR>	30	10	30
Instituto Italiano del Marchio di Qualita (IMQ)	IEMMEQU	<HAR>	10	30	50
British approvals Service for Electric Cables (BASEC)	BASEC	<HAR>	10	10	30
N.V. KEMA	KEMA-KEUR	<HAR>	10	30	30
SEMKO AB Svenska Elektriska Matenelkontrollanstalter	SEMKO	<HAR>	10	10	50
Österreichisher Verband fur Elektrotechnik (ÖVE)	<ÖVE>	<HAR>	30	10	50
Danmarks Elektriske Materialkontroll (DEMKO)	<DEMKO>	<HAR>	30	10	30
National Standards Authority of Ireland (NSAI)	<NSAI>	<HAR>	30	30	50
Norges Elektriske Materiellkontroll (NEMKO)	NEMKO	<HAR>	10	10	70
Asociacio Electroteca Y Electronica Espanola EE)	<UNED>	<HAR>	30	10	70
Hellenic Organization for Standardization	ELOT	<HAR>	30	30	70
Institute Portages da Qualidade (IPQ)	np	<HAR>	10	10	90
Schweizerischer Elektro TechnischerVerein (SEV)	SEV	<HAR>	10	30	90
Elektriska Inspektoratet	SETI	<HAR>	10	30	90

MICROSCOPE TERMINOLOGY

Abbe Condenser

A two-lens sub-stage condenser located below the stage of a microscope and functions to collect light and direct it onto the object being examined. Its high numerical aperture makes it particularly suited for use with most medium- and high-magnification objectives.

Aperture, Numerical (N.A.)

The numerical aperture is an important factor determining the efficiency of the condenser and objective. It is represented by the formula: (N.A. = ηsinα), where η is the refractive index of a medium (air, water, immersion oil etc.) between the objective and the specimen or condenser, and α is half of the maximum angle at which light enters or leaves the lens from or to a focused object point on the optical axis.

Cover Glass Thickness

Transmitted light objectives are designed to image specimens that are covered by a thin cover glass (cover slip). The thickness of this small glass piece is now standardized at 0.17

mm for most applications.

Diaphragm, Condenser

A diaphragm, which controls the effective size of

the condenser aperture. A synonym for the condenser illuminating aperture diaphragm.

Magnification

The number of times by which the size of the image exceeds the original object. Lateral magnification is usually meant. It is the ratio of the distance between two points in the image to the distance between the two corresponding points in the object.

Micrometer: *um*

A metric unit of length measurement
= $1x10^{-6}$ meters or 0.000001 meters

Nanometer (nm)

A unit of length in the metric system equal to 10^{-9} meters.

Phase–contrast (microscopy)

A form of microscopy, which converts differences in object thickness and refractive index into differences in image amplitude and intensity.

Real Viewfield

The diameter in millimetres of the object field.

$$\text{Real Viewfield} = \frac{\text{Eyepiece Field of View}}{\text{Objective Magnification}}$$

Example:

Eyepiece field of view = 20mm
Objective magnification = 10X
Diameter of the object field = 20/10
= 2.0mm

Diopter adjustment
The adjustment of the eyepiece of an instrument to provide accommodation for the eyesight differences of individual observers.

Depth of Focus
The axial depth of the space on both sides of the image plane within which the image is sharp. The larger the N.A. of objective, the shallower the depth of focus.

Field of View (F.O.V.)
That part of the image field, which is imaged on the observer's retina, and hence can be viewed at any one time. The field of view number is now one of the standard markings of the eyepiece.

Filter
Filters are optical elements that selectively transmit light. It may absorb part of the spectrum, or reduce overhaul intensity or transmit only specific wavelengths.

Immersion Oil
Any liquid occupying the space between the object and microscope objective. Such a liquid is usually required by objectives of 3-mm focal length or less.

Resolving Power
A measure of an optical system's ability to produce an image which separates two points or parallel lines on the object.

Resolution
The result of displaying fine details in an image

Total Magnification
The total magnification of a microscope is the individual magnifying power of the objective multiplied by that of the eyepiece.

Working Distance
This is the distance between the objective front lens and the top of the cover glass when the specimen is in focus. In most instances, the working distance of an objective decreases as magnification increases.

X–axis
The axis that is usually horizontal in a two-dimensional coordinate system. In microscopy X-axis of the specimen stages is considered that which runs left to right.

Y–axis
The axis that is usually vertical in a two-dimensional coordinate system. In microscopy Y-axis of the specimen stages is considered that which runs front to back.

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