Instruction Manual

Primotech

Upright Microscope

We make it visible.

Primotech
Upright Microscope

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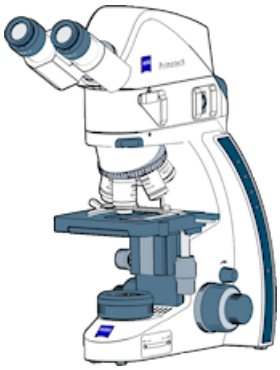
1 Introduction

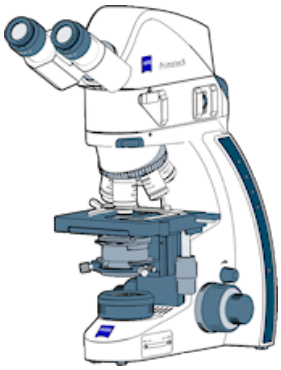
1.1 Welcome

Welcome to the Primotech User Documentation.

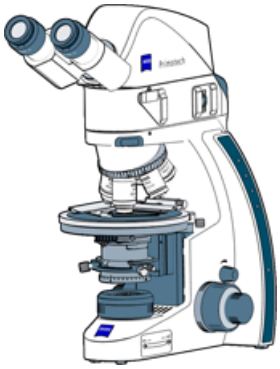
Primotech is the new family of upright microscope from ZEISS. Its design and intuitive controls result in a simple, robust, easy-to-use yet powerful microscope that helps you inspect a wide range of samples. Primotech microscopes can also be connected to an iPad to process and analyze images. Connecting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



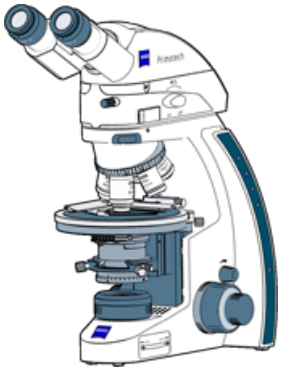
Primotech MAT



Primotech D/A MAT



Primotech D/A POL



Primotech D/POL Conoscopy

1.2 Primotech Features

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

Feature	Primotech MAT	Primotech D/A MAT	Primotech D/A POL	Primotech D/POL Conoscopy
Reflected light	Yes	Yes	Yes	-
Transmitted light	Yes	Yes	Yes	Yes
Condenser	-	Köhler	Köhler	Köhler
Stage	X-Y	X-Y, ESD	Rotatable	Rotatable
Centering of objectives	-	-	Yes	Yes
Main feature	Suitable for large sample heights (< 34 mm)	Suitable for medium sample heights (< 17 mm)	Designed for polarization analyses	Designed for conoscopy analyses

For a detailed list of components per microscope, see Scope of Delivery [▶ 56].

1.3 Overview of this Document

This document contains all the information you need to assemble your microscope, perform various types of examination, connect it to an iPad, as well as to perform troubleshooting and maintenance.

The majority of the documentation applies to all Primotech microscopes. General exceptions:

- Chapter 4 only applies to:
  - Primotech D/A MAT
  - Primotech D/A POL
  - Primotech D/POL Conoscopy
- Chapter 5 only applies to:
  - Primotech D/A POL
  - Primotech D/POL Conoscopy
- All topics related to reflected light do **not** apply to Primotech D/POL Conoscopy.

Individual details that are only specific to a certain microscope are indicated within each topic.

INFO

The appearance of the microscope in illustrations may differ from that of your microscope.

1.4 Intended Use

Primotech microscopes are all-purpose light microscopes primarily designed for industrial applications such as:

- Metallurgy
- Electronics
- Geoscience

Primotech microscopes are also designed for use in education.

Primotech microscopes, including their original accessories, must not be used for microscopic techniques other than those described in the Instruction Manual. Using the microscope for any other purpose is not allowed and could be hazardous.

Do not operate Primotech microscopes or any accessories in potentially explosive areas, in the presence of volatile anesthetics, or in the presence of combustible solvents, such as alcohol, benzene, or similar chemicals.

INFO

The Safety Information document is also considered to be part of the Primotech microscope. You must follow all the instructions provided in this document.

Primotech microscopes have been designed, produced, and tested in compliance with the standard DIN EN 61010-1 (IEC 61010-1) "Requirements for Electrical Measuring, Control, and Laboratory Instruments".

Primotech microscopes meet the requirements of EU directive 2006/95/EC Appendix 1 and carry the mark. CE

Radio interference suppression complies with DIN EN 61326-1.

Primotech microscopes must be disposed of in accordance with the WEEE Directive 2012/19/EC. For more information on disposal and recycling please consult your ZEISS representative.

2 System Overview

2.1 Overview

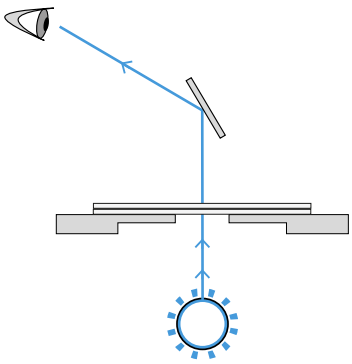
This chapter describes the main components and controls of Primotech microscopes, as well as the types of illumination supported.

2.2 Types of Illumination

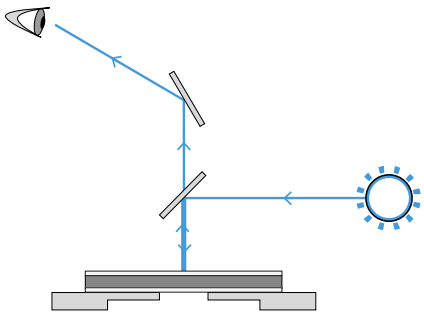
Primotech microscopes support both transmitted light and reflected light illumination.

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



Transmitted light



Reflected light

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:

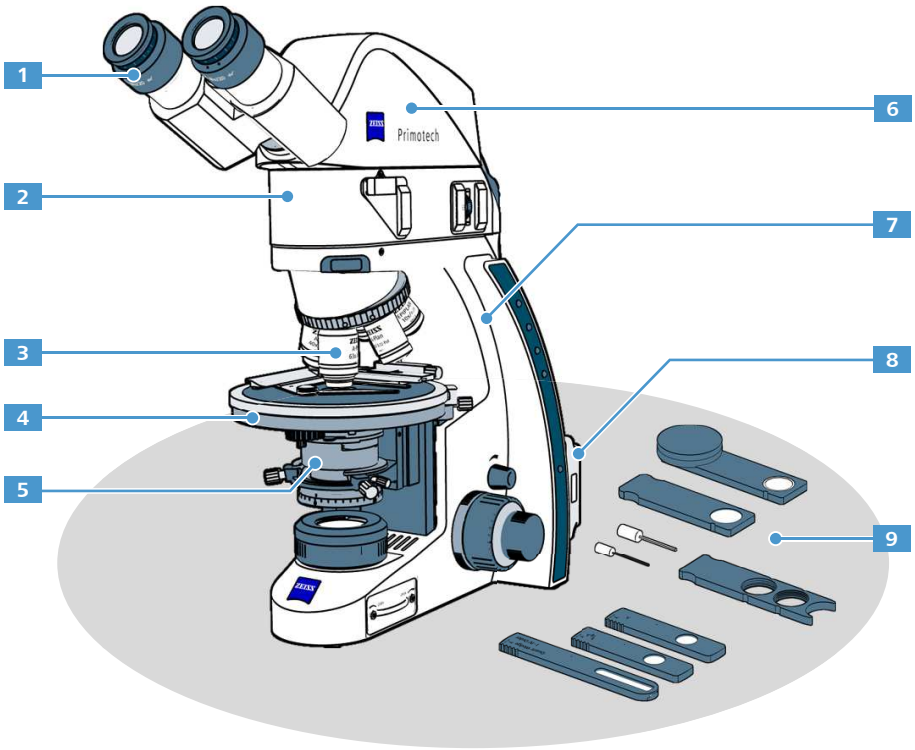
- Thick samples
- Surface examinations, especially of metallic or ceramic samples

INFO

Primotech D/POL Conoscopy does not feature reflected light.

2.3 Main Components

Primotech microscopes consist of the following main components. For a detailed list of the components of your microscope, see Scope of Delivery [▶ 56].



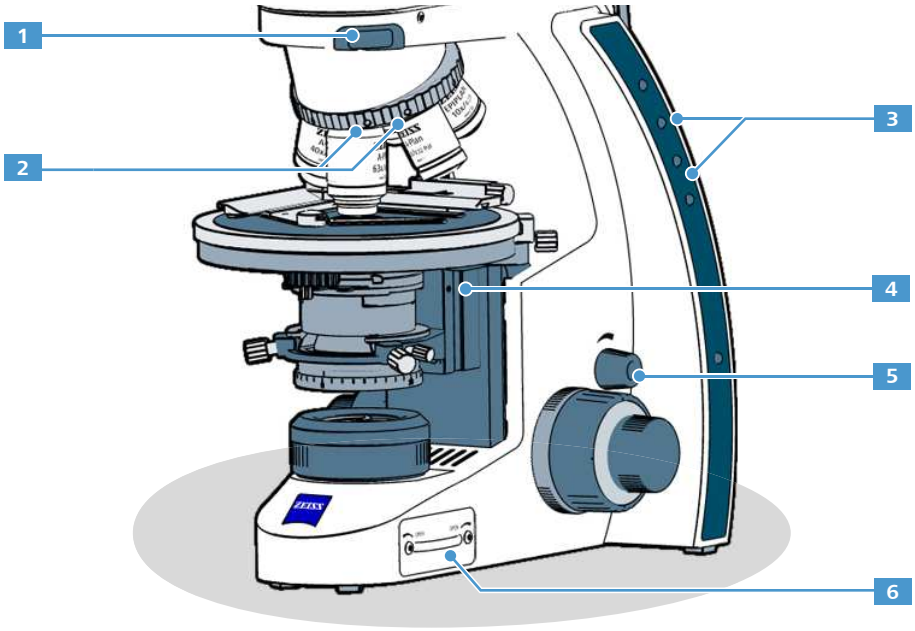
1. Eyepieces
2. Intermediate tube
3. Objectives
4. Stage
5. Condenser and aperture diaphragm
6. Tube
7. Microscope stand
8. Microscope Network Adapter (MNA)
9. Accessories: polarizers, analyzers, compensators, filter holders, and tools

2.4 Components and Controls

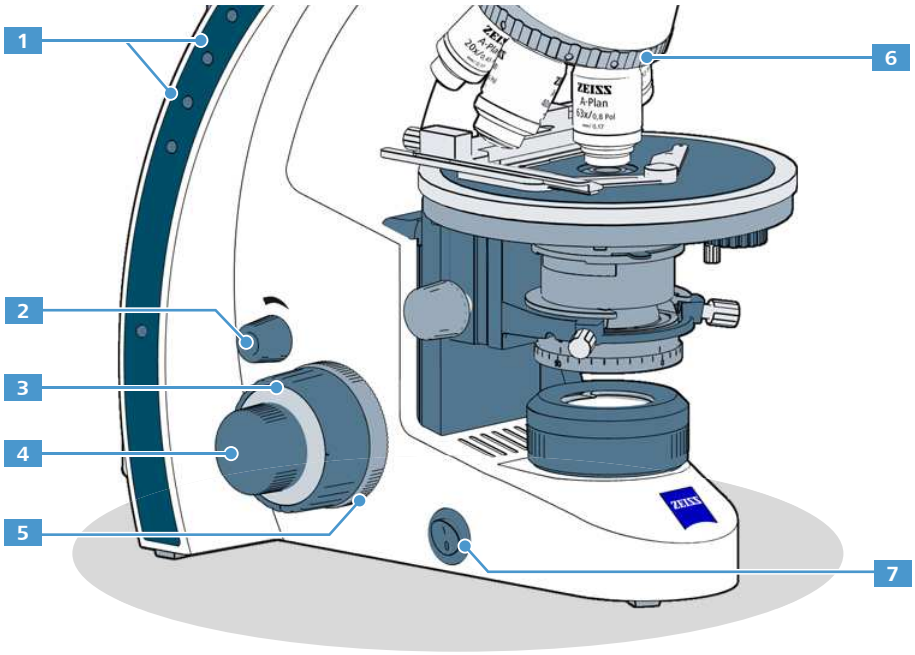
Primotech microscopes consist of various components and controls. The exact configuration depends on your microscope. For more information, see Scope of Delivery [▶ 56].

The stand contains the following components and controls:

1. DIN 6x20 slot for compensators
2. Objective centering screws
3. Reflected light intensity indicators
4. Condenser limit screw
5. Reflected light intensity control
6. Transmitted illumination light source



1. Transmitted light intensity indicators
2. Transmitted light intensity control
3. Coarse focus drive
4. Fine focus drive
5. Adjust torque of focus wheels
6. Rotatable nosepiece to select objective
7. Power switch

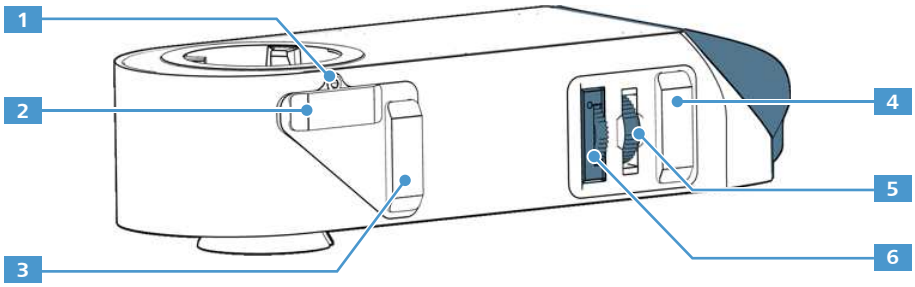


2.4.1 Intermediate Tubes

Two different intermediate tubes are available. The standard intermediate tube is supplied with the following microscopes:

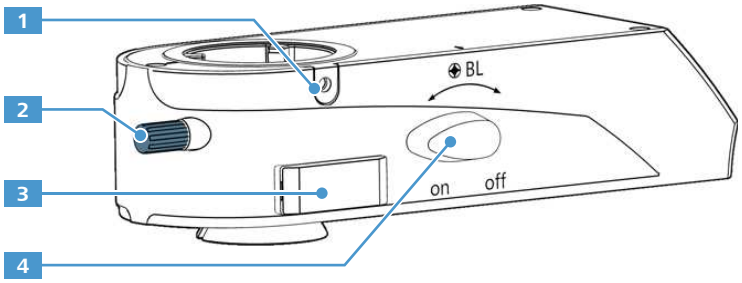
- Primotech MAT
- Primotech D/A MAT
- Primotech D/A POL

1. Tube mounting screw
2. Slot for analyzer
3. Slot for polarizer (reflected light)
4. Slot for filters (e.g. color)
5. Aperture diaphragm (reflected light)
6. Oblique illumination slider



The intermediate tube with Bertrand lens is supplied with Primotech D/POL Conoscopy.

1. Tube mounting screw
2. Bertrand lens focus
3. Slot for analyzer (transmitted light)
4. Swing Bertrand lens into beam path

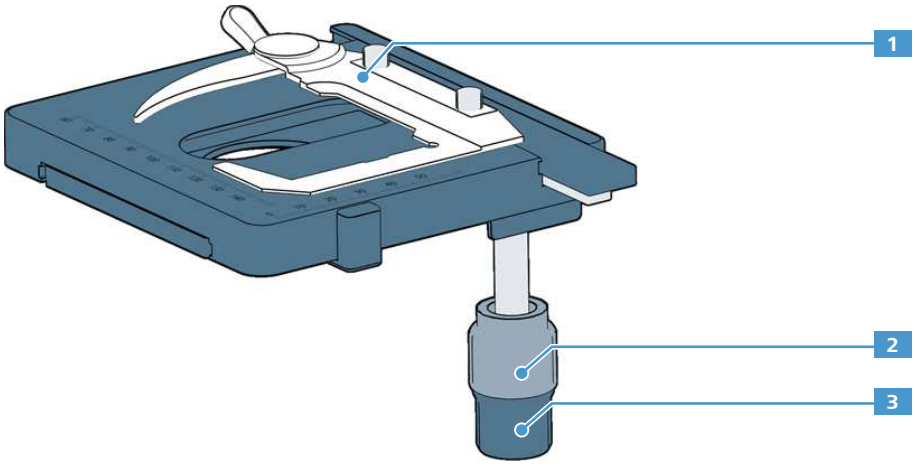


2.4.2 Stages

Two different stages are available. The X-Y stage is supplied with the following microscopes:

- Primotech MAT
- Primotech D/A MAT

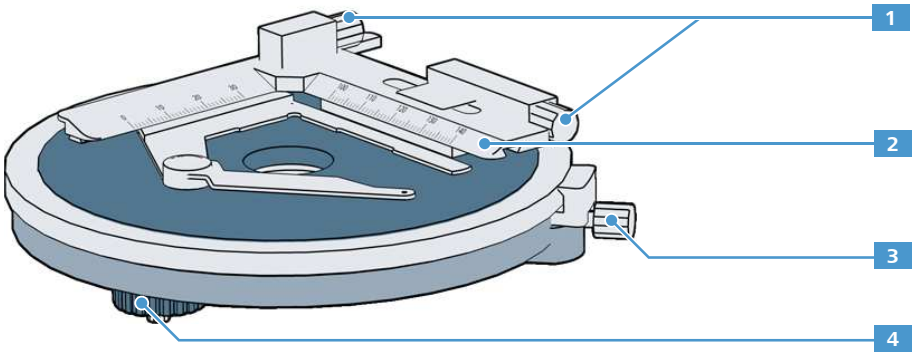
1 Object guide
2 Move sample along y axis
3 Move sample along x axis



The rotatable stage is supplied with the following microscopes:

- Primotech D/A POL
- Primotech D/POL Conoscopy

1 Move sample on stage
2 Object guide
3 Stage rotation lock
4 45° click-stop

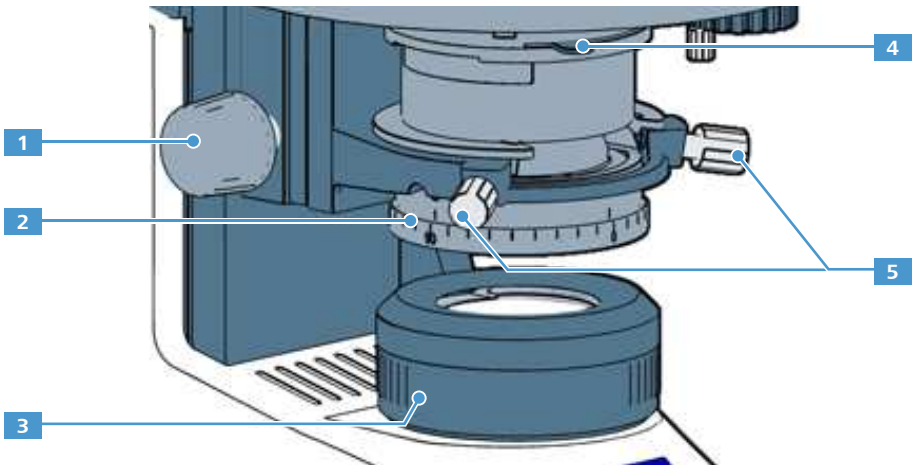


2.4.3 Condenser

The Köhler condenser is supplied with the following microscopes:

- Primotech D/A MAT
- Primotech D/A POL
- Primotech D/POL Conoscopy

1. Adjust condenser position
2. Rotatable polarizer (transmitted light) Not available for Primotech D/A MAT.
3. Luminous field diaphragm
4. Aperture diaphragm (transmitted light)
5. Condenser centering screws



3 First Steps

3.1 Overview

This chapter describes how to get started with your Primotech microscope, from assembling it and performing general one-off calibrations, through to acquiring your first image.

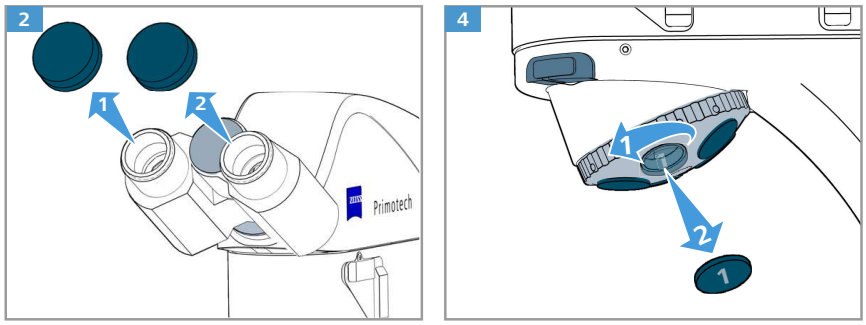
3.2 Assembling the Microscope

The Primotech microscope stand is supplied with the following standard components already attached:

- Tube
- Stage (rotatable or X-Y stage, as applicable)
- Light sources (transmitted or reflected, as applicable)
- Condenser (if available)

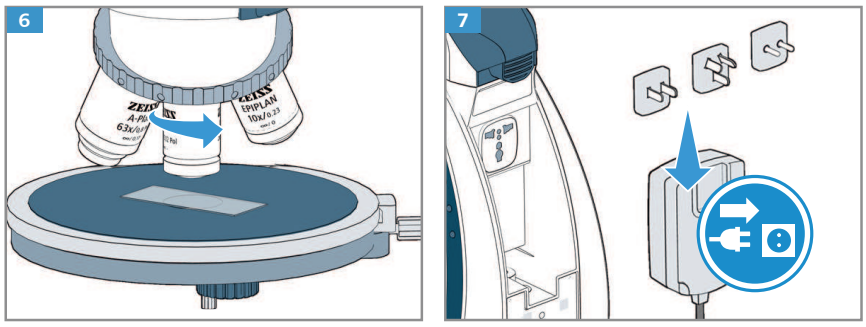
Procedure

1. Place the microscope stand on a stable, flat, and smooth surface.
2. Remove the dustcaps from the tube.
3. Remove the two eyepieces from the protective tubes and push them into the tube.
4. Unscrew the dustcap labeled **1** from the nosepiece.



5. Unscrew the objective with the lowest magnification out of its protective tube and screw it into the nosepiece.
6. Insert the remaining objectives in the nosepiece in order of increasing magnification.

7 Attach the power adapter that is appropriate for your country to the plug.



8 Attach the cables between the tube and the rear of the microscope:

- Network cable between the network port of the tube and the top of the MNA
- 12 V power cable between the power socket of the tube and the rear of the microscope stand

This does not apply to Primotech D/POL Conoscopy.

9 Plug the microscope into a power socket and press the power switch.

The lowest LED on each side of the stand illuminates.

INFO

Dirt and dust may impair the performance of the microscope. Use the dust cover to protect the microscope when not in use.

- Do not place the dust cover over the microscope while the microscope stand is turned on.
- Wait 10 minutes for the microscope to cool before placing the dust cover over the microscope.

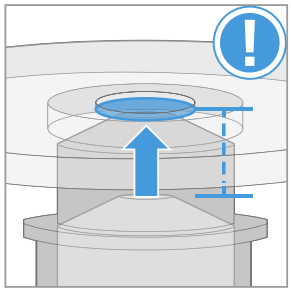
3.3 Inserting the Sample

Primotech microscopes are suitable for a wide range of samples, for example material or mineral samples.

The samples should be prepared according to your standard company or institution guidelines and be within the guidelines specified in the technical data (see Physical Dimensions and Key Specifications [▶ 54]).

Procedure

1 Ensure the condenser tip (if available) is below the stage surface.



For more information, see Specifying the Condenser Position [▶ 27].

2 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.

4 If you know the area of interest already, move the sample so that the area is illuminated.

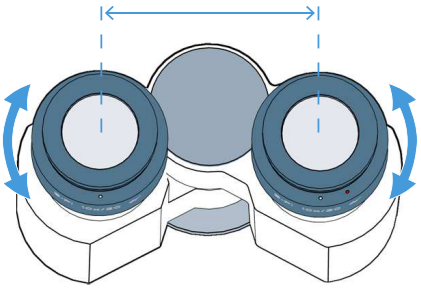
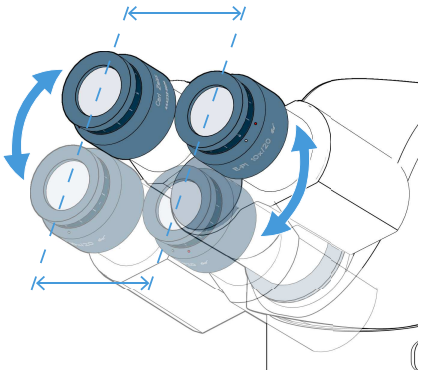
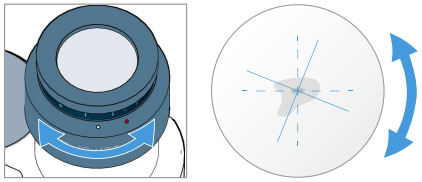
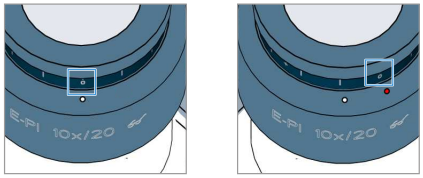
- To move the sample on the rotatable stage, turn the corresponding screw on the object guide.
- To move the sample on the static stage, turn the corresponding knob of the coaxial drive under the stage.

5 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.

3.4 Adjusting the Eyepieces

The eyepieces can be used with or without glasses, and can be adjusted to compensate visual impairments. You can adjust various properties of the eyepieces to enhance your viewing experience:

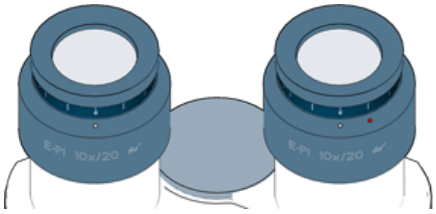
Property	Procedure	Graphic
Distance between the eyepieces ("interpupillary distance")	Swing the eyepiece tubes symmetrically up or down. The setting is correct when you see one round image when looking through the two eyepieces.	
Viewing height	Each separation has a high and a low viewing height. Swing the eyepieces to their upper or lower position at the desired separation.	
Rotation of the crosshair Eyepieces with a crosshair are indicated by the additional red dot	To rotate the crosshair, rotate the entire eyepiece. Only Primotech D/A POL and Primotech D/POL Conoscopy are supplied with an eyepiece with a crosshair	
Use with glasses	Turn the ring of each eyepiece so that it is in the zero position. For eyepieces with a red dot, the zero should be next to the red dot. For other eyepieces the zero should be next to the white dot.	

Use without Glasses If you have visual impairments and wish to observe the sample without glasses, you can adjust the eyepieces to compensate for the impairments:

Procedure

1. Ensure the left eyepiece is in the zero position.

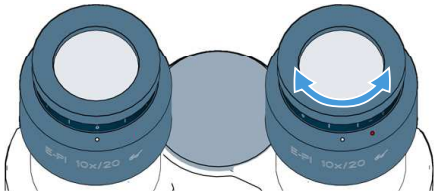
   The zero on the ring should be next to the white dot of the eyepiece.



2. Select a magnification between 10x and 20x.
3. Look at the sample through the left eyepiece with your left eye only.
4. Raise or lower the stage until the sample is in focus.

   For more information, see Selecting Objectives and Focusing [▶ 20].

5. Look at the sample through the right eyepiece with your right eye only.



6. Turn the right eyepiece ring until the sample is in focus.

   A diopter scale on the ring also helps you find the correct setting.

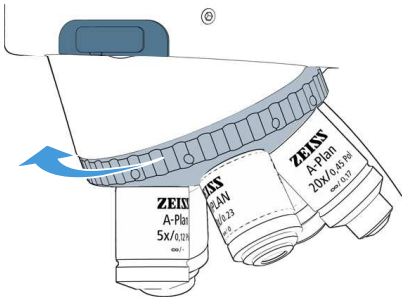
The sample should now be in focus when you look at it with both eyes. Once you have adjusted the eyepieces, you should subsequently only change the focus of a sample by turning the focus wheel. For more information, see Selecting Objectives and Focusing [▶ 20].

3.5 Selecting Objectives and Focusing

Selecting Objectives To select a different magnification:

Procedure

1 Rotate the objective nosepiece until the objective with the desired magnification is at the front.



Ensure the nosepiece is rotated to a click-stop position.

Ensure the sample is sufficiently far below the objective that they do not collide.

2 For Primotech D/A POL and Primotech D/POL Conoscopy, ensure the objective is centered.

For more information, see Centering the Objectives [▶ 33].

Focusing To focus the sample:

Prerequisites

- The eyepieces have been adjusted [▶ 18]

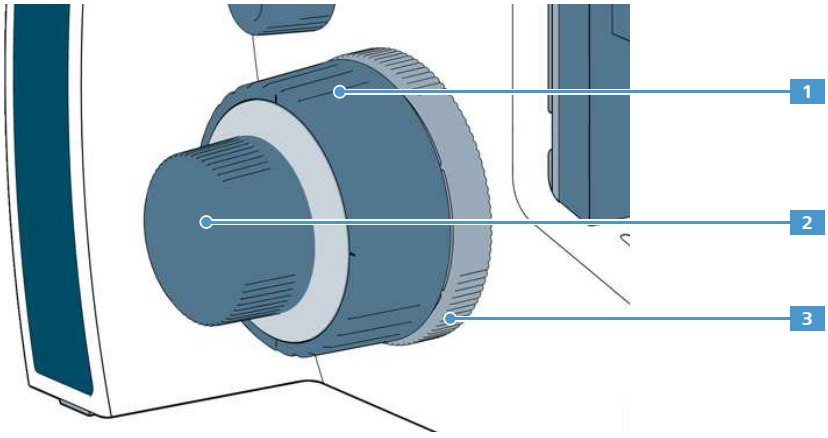
Procedure

1 Select the lowest magnification (e.g. 5 x).

2 Look through the eyepieces and turn the focus wheel to raise or lower the stage until the sample is in focus.

Ensure that the stage does not collide with the objective during focusing.

- Turn the larger wheel for coarse focus 1.
- Turn the smaller wheel for fine focus 2.



3 To view the sample in more detail, select a higher magnification and repeat step 2.

4 You can adjust the torque of the focus wheel by tightening or loosening the ring between the focus wheel and the microscope stage 3.

3.6 Adjusting the Illumination Properties

You can adjust the following illumination properties:

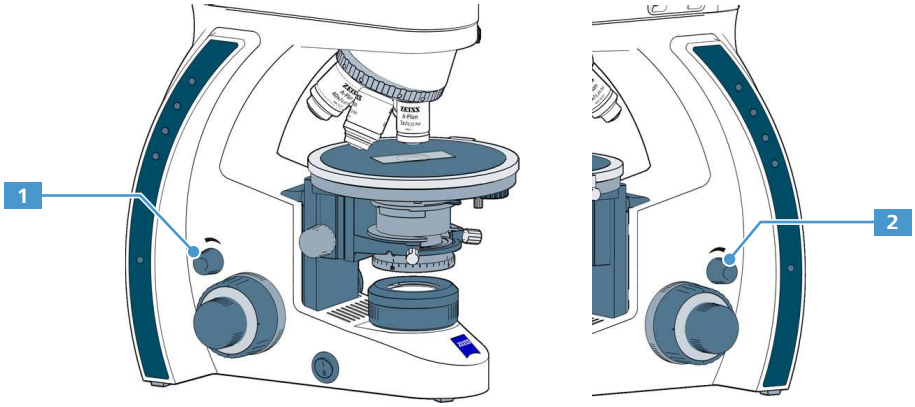
- Brightness of transmitted illumination
- Brightness of reflected illumination
- Color of reflected illumination
- Oblique illumination for reflected illumination

INFO

Reflected illumination is not available for Primotech D/POL Conoscopy.

3.6.1 Adjusting the Illumination Brightness

You can freely adjust the brightness of either the reflected light or transmitted light (if available):



1 Transmitted light
2 Reflected light (not available for Primotech D/POL Conoscopy)

The LEDs on the corresponding side of the microscope stand indicate the brightness of the illumination. You can adjust the brightness of the light sources independently or use both sources concurrently.

INFO

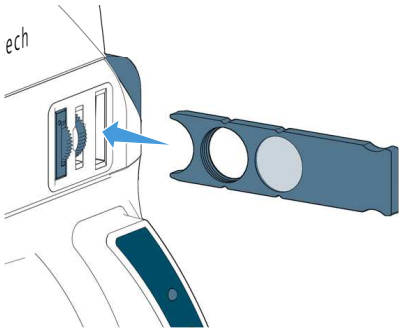
Using reflected light on transparent samples may create reflections which lead to inappropriate illumination of the sample.

3.6.2 Adjusting the Color of Reflected Illumination

Primotech microscopes come with the conversion filters to change the color 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

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



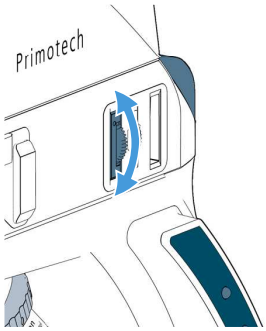
2. To use a conversion filter with transmitted light, place the conversion filter disc on the luminous field diaphragm.

3.6.3 Using Oblique Reflected Illumination

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, turn the wheel on the intermediate tube.

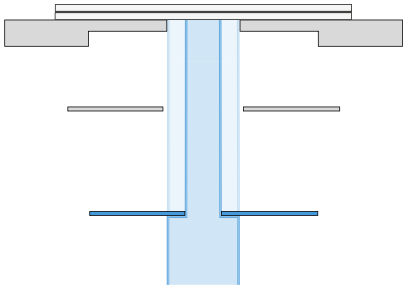


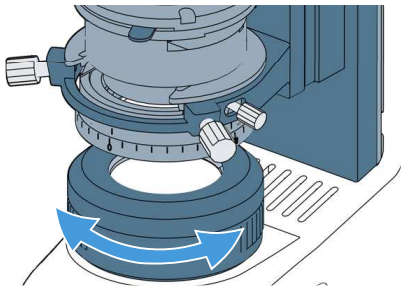
The wheel has three settings:

- Illumination from the left
- Standard illumination / no oblique illumination
- Illumination from the right

3.6.4 Adjusting the Transmitted Illumination Size

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.





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.

3.7 Adjusting the Resolution and Depth of Field

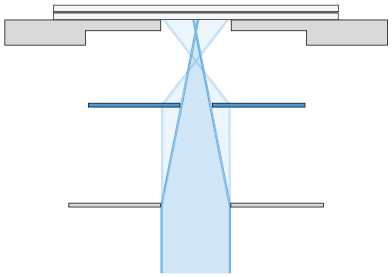
The aperture diaphragm controls the size and shape of the cone of light from the condenser. This in turn affects the resolution, depth of field, and contrast of the image.

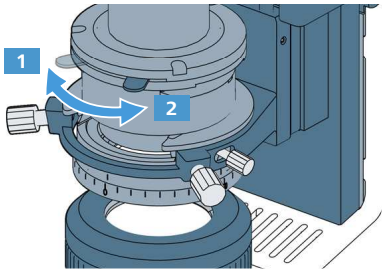
Resolution refers to the size of object that can be observed: a higher resolution means smaller objects can be observed. Depth of field refers to the range of distances over which an object appears in focus: a large depth of field means that objects at different distances from the eyepiece are in focus. A short depth of field means that only objects at a specific distance are in focus.

The resolution is inversely proportional to the depth of field and contrast:

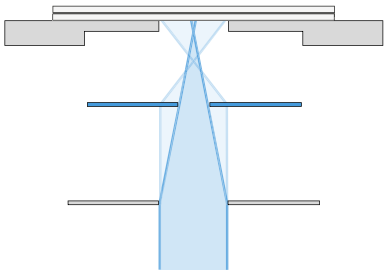
- Opening the diaphragm increases the resolution but decreases the depth of field and contrast.
- Closing the diaphragm decreases the resolution but increases the depth of field and contrast.

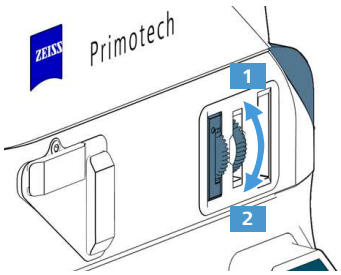
Procedure **1** To adjust the aperture diaphragm for transmitted light, slide the lever left 1 (open) and right 2 (close).





2 To adjust the aperture diaphragm for reflected light, turn the wheel up 1 (open) and down 2 (close).





3 To achieve an optimal image, the size of the cone should be matched to the aperture of the objective.

INFO

- Altering the diaphragm also affects the brightness of the sample but it should not be used for this purpose.

  To change the brightness, adjust the illumination or insert a filter. For more information, see Adjusting the Illumination Properties [▶ 21].

- If you select a different objective you need to subsequently re-adjust the corresponding aperture diaphragm.

3.8 Imaging with Primotech and Matscope

You can connect Primotech microscopes that include a camera to a network. If the network has wireless capabilities, you can then connect to the microscope using an iPad and the free Matscope app.

The app enables you to view, analyze, and store images from the microscope, resulting in an easy-to-use imaging system with measurement capabilities.

If multiple Primotech microscopes are connected to the same network, all of them can be accessed from a single iPad. Similarly, multiple iPads can all access one microscope.

INFO

It is strongly recommended to use an encrypted wireless network with strong passwords.

Before the app is used to perform measurements, it should be calibrated for each objective. This is performed using the calibration slide. For more information, see www.zeiss.com/matscope/installation.

The microscope network adapter (MNA) is used to connect the microscope to the network via a standard Ethernet cable. The MNA also performs the following functions:

- It communicates the magnification of the objectives to the iPad.
- It stores the scaling information so that calibration only has to be done once and is then available on any other iPad.

INFO

An advanced MNA is additionally available which unlocks advanced features in the app.

Prerequisites

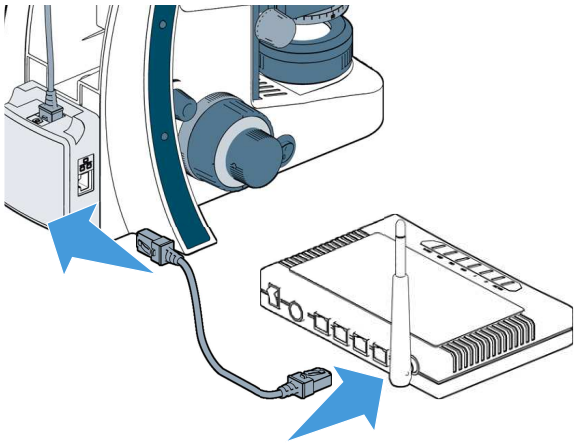
- The microscope is switched on
- The microscope has a Tube 30°/20 with int. 3 MP camera or Tube 30°/20 with int. 5 MP camera
- You are using an iPad 2 or newer
- The network to which you wish to connect has a wireless access point or wireless router for the iPad to connect to.
  For more information, see www.zeiss.com/matscope
- Optional: A shared folder on the network that can be accessed by Matscope, to easily exchange files with PCs and back up the image data

Procedure

1 Connect the MNA to the network via a standard Ethernet cable.

If you do not have an MNA, you can connect the camera directly to the network via a standard Ethernet cable.

If you are using a router, ensure you plug the cable into one of the LAN ports.



2 Connect the iPad to the wireless network.

Ensure the iPad is within range.

3 Download and install the Matscope app from the Apple App Store.

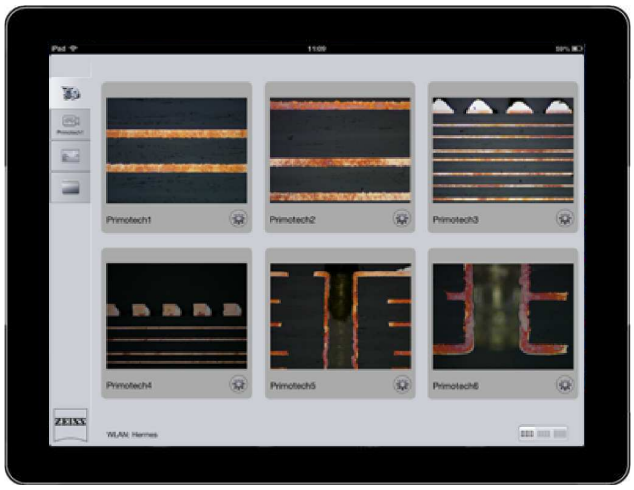
For more information, see www.zeiss.com/matscope/installation

4 Open the **Matscope** app  .

5 Follow the on-screen step-by-step instructions within Matscope to configure the microscope(s).

The intuitive user interface and the instructions guide you through all the steps to acquire and analyze an image.

After completing the configuration, the microscope image or a list of available microscopes is displayed.



6 If you need help, tap the Zeiss logo in the corner.

4 Adjusting the Condenser Settings

4.1 Overview

This chapter describes how to adjust properties of the condenser, such as its position, maximum height, and how to set the optimum contrast. Only the following microscopes have a condenser:

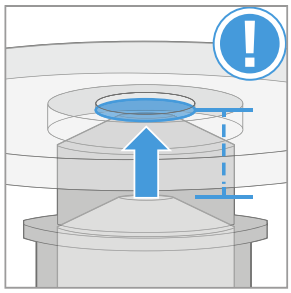
- Primotech D/A MAT
- Primotech D/A POL
- Primotech D/POL Conoscopy

4.2 Specifying the Condenser Position

The condenser is located beneath the stage. It concentrates the light from the light source into a cone that illuminates the specimen with uniform intensity over the entire field of view.

Procedure

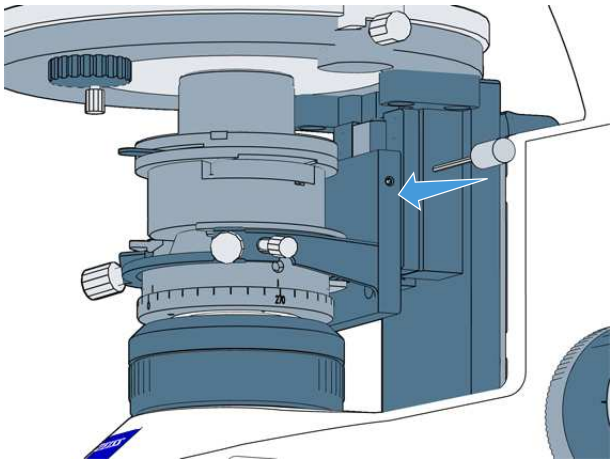
1. To raise or lower the condenser, turn the condenser vertical adjustment knob.
2. Raise the condenser carefully and ensure that it does not collide with the bottom of the sample.



Maximum Height If desired, you can prevent the condenser from colliding with the bottom of the sample by specifying the maximum height (Z position) of the condenser:

Procedure

1. Insert the 0.5 mm hex key in the condenser clamp screw.



2. Loosen the condenser clamp screw.
3. Look at the stage from above and carefully raise the condenser until the tip is just below the sample.
4. Tighten the condenser clamp screw.

The condenser cannot move above this upper limit.

4.3 Adjusting the Köhler Illumination

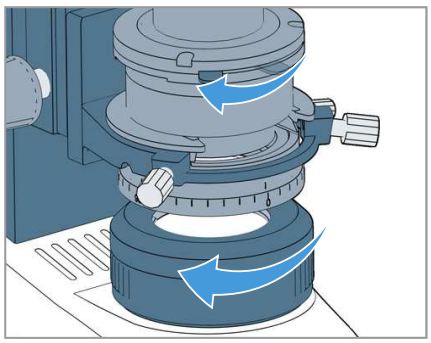
The condenser with Köhler illumination ensures a uniform illumination of the sample during transmitted light analyses. You can adjust the contrast of the illumination according to your preferences. The following is only a guide, the exact settings depend on your preferences.

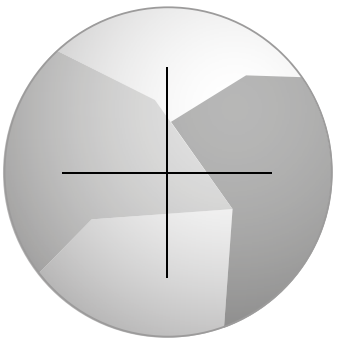
Prerequisites

- The area of the sample in the field of view has high contrast
- The illumination brightness is low
- The upper limit of the condenser has been set to prevent collision with the sample

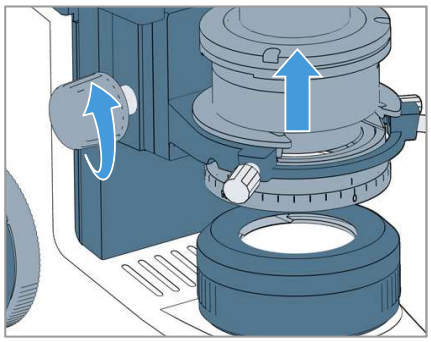
Procedure

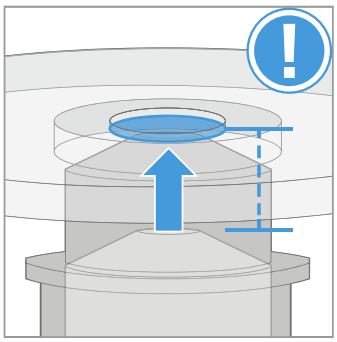
1. Select the lowest magnification and bring the area of interest into focus.
2. Open the luminous field diaphragm and the aperture diaphragm fully.



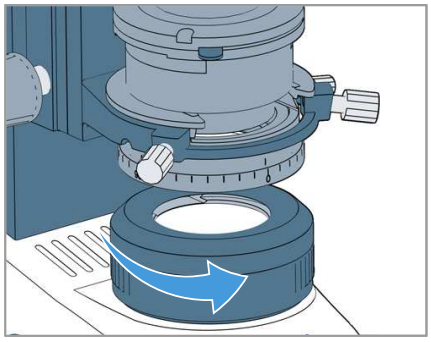


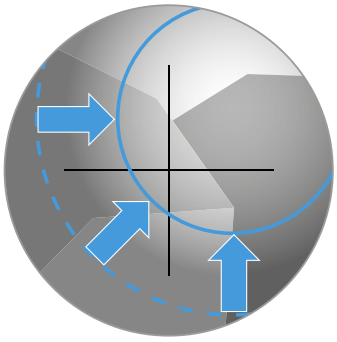
3. Raise the condenser to its maximum vertical position.



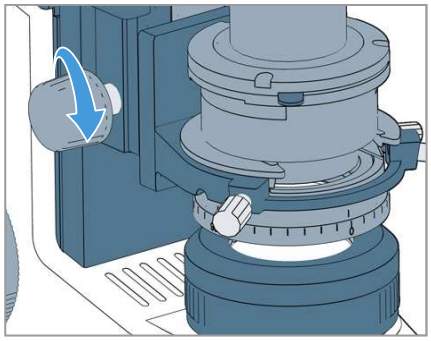


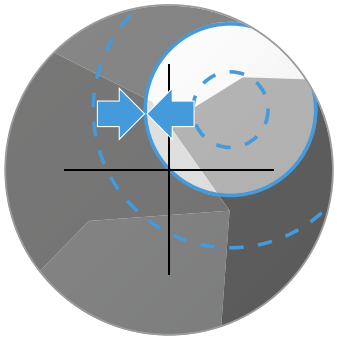
4. Close the luminous field diaphragm until the bright area is half the size of the field of view.



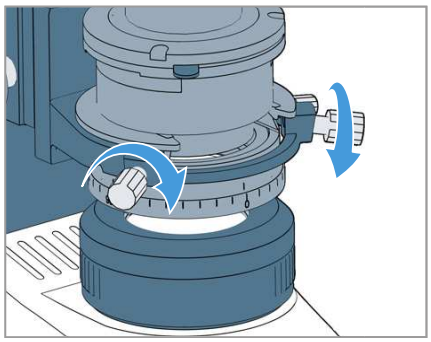


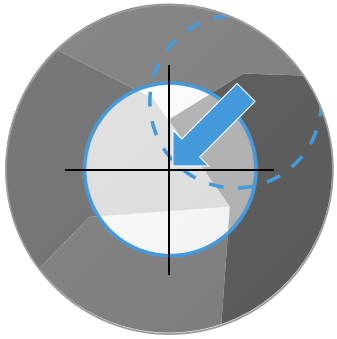
5 Lower the condenser until the edges of the luminous field diaphragm are in focus.



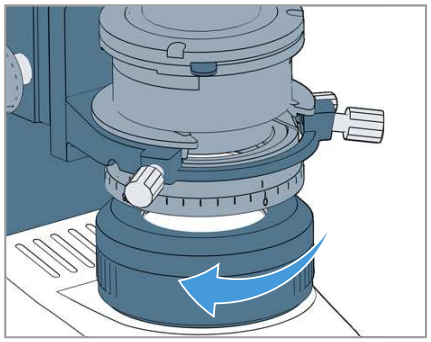


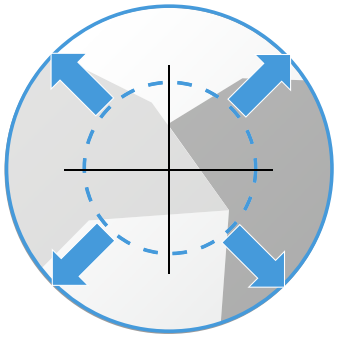
6 Turn the condenser centering screws until the bright area is centered in the field of view.





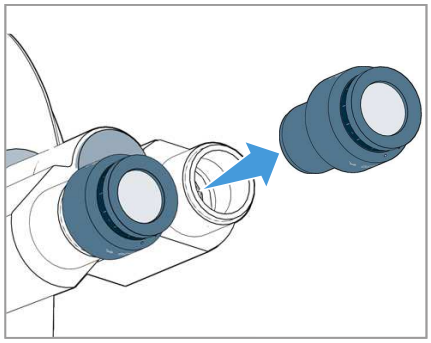
7 Open the luminous field diaphragm until the edge just disappears out of the field of view.





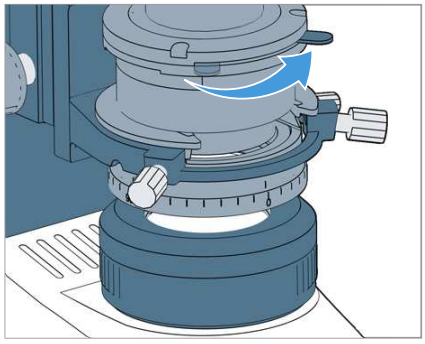
8 Remove one of the eyepieces and look directly into the eyepiece tube.

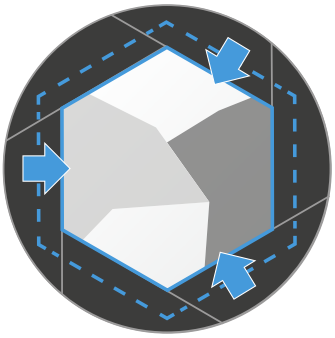
This enables you to see the edges of the aperture diaphragm in focus.



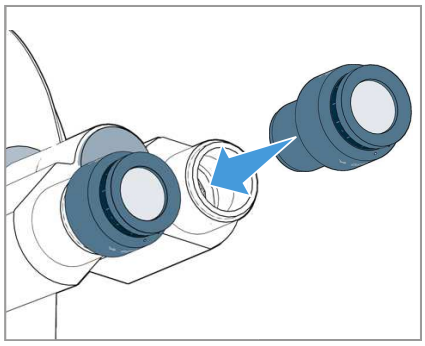
9 Close the aperture diaphragm until the image has the optimal contrast.

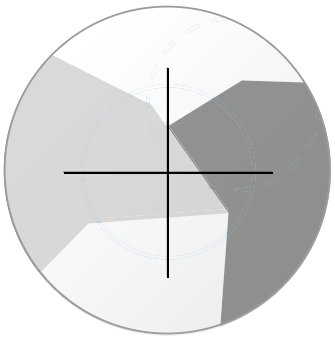
This is typically the case when the bright area fills approximately 2/3 of the field of view.





10 Reinsert the eyepiece.





The sample should now have the highest possible contrast.

5 Polarization and Conoscopy

5.1 Overview

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:

- Primotech D/A POL
- Primotech D/POL Conoscopy

If you purchase optional polarizers, you can then also perform polarization with Primotech MAT and Primotech D/A MAT. For more information, contact your ZEISS representative.

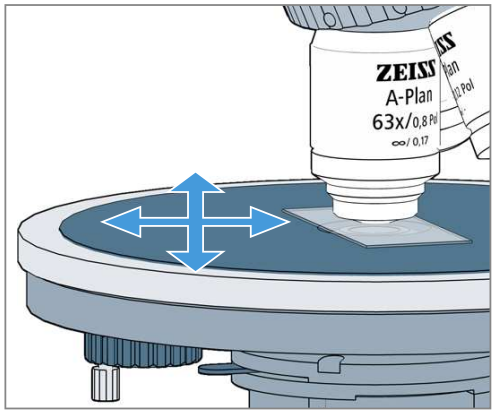
5.2 Centering the Objectives

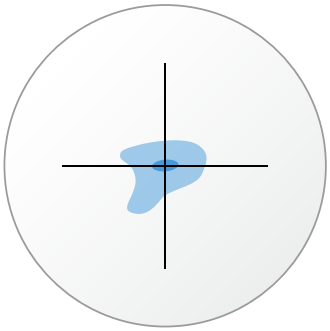
When viewing a sample on the rotating stage, it is important that the objective is located exactly above the center of rotation of the stage.

Therefore, the objectives of Primotech D/A POL and Primotech D/POL Conoscopy can be centered. The centering procedure should also always be performed after changing an objective.

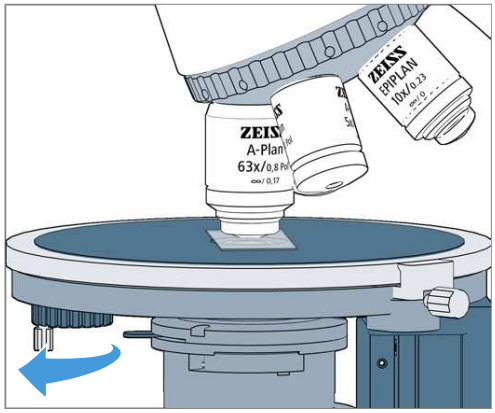
Procedure

1 Move the object guide to place a distinctive object in the sample at the center of the crosshair by moving the sample on the table.

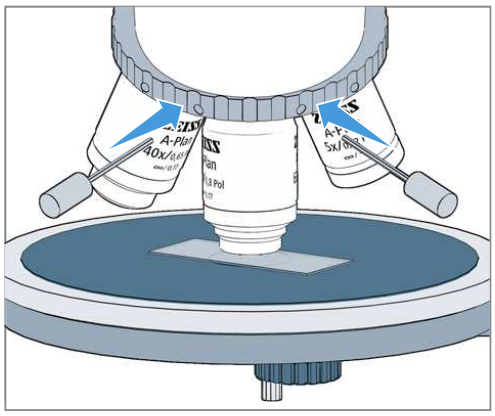




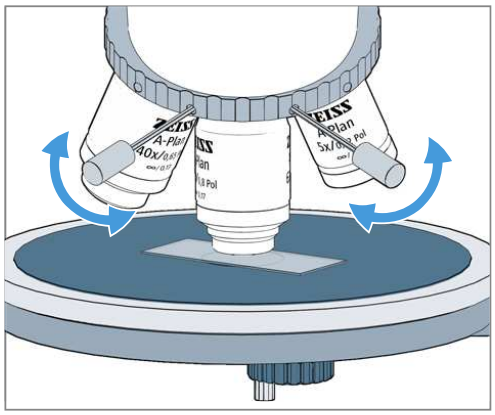
2 Slowly rotate the stage until the object is at the furthest point from the crosshair.



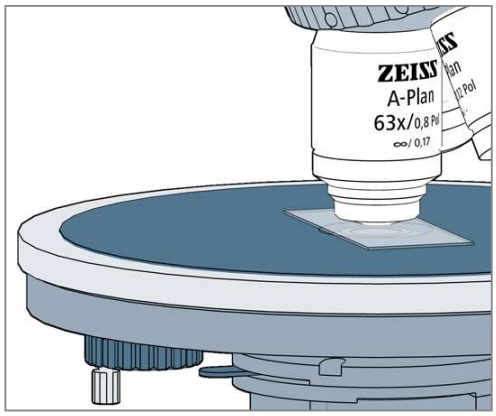
3 Insert the 0.5 mm hex key into the screws on either side of the objective.

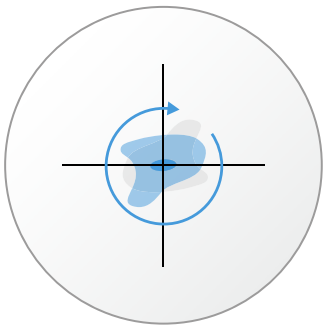


4 Turn the screws to move the object **half the way** back to the center of the crosshair.



5 Repeat the steps above until the object no longer moves when the stage is rotated.





INFO

Each objective needs to be centered individually.

5.3 Polarization Examinations

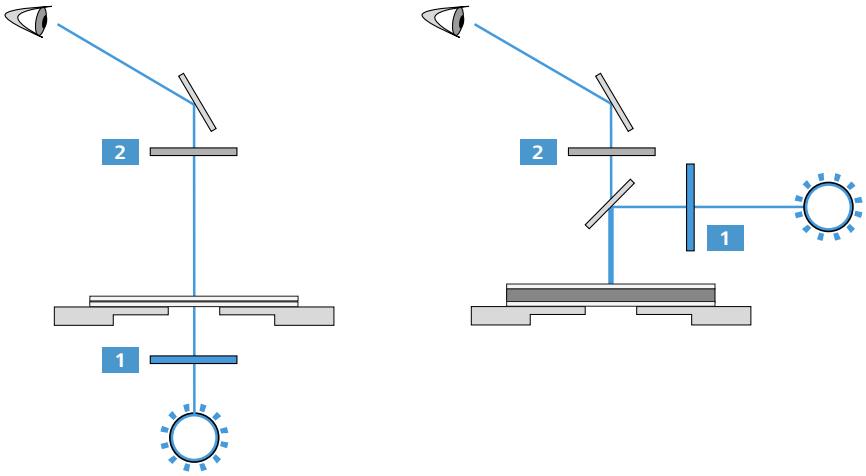
Polarization examinations allow you to analyze how a sample changes the properties of light interacting with the sample, specifically the direction in which the light oscillates. Such examinations can be performed with both transmitted or reflected light.

To perform a polarization examination, you can insert polarizing elements in the beam path, on either side of the sample. The polarizing elements only allow light that oscillates in a certain direction to pass.

Polarizers and Analyzers

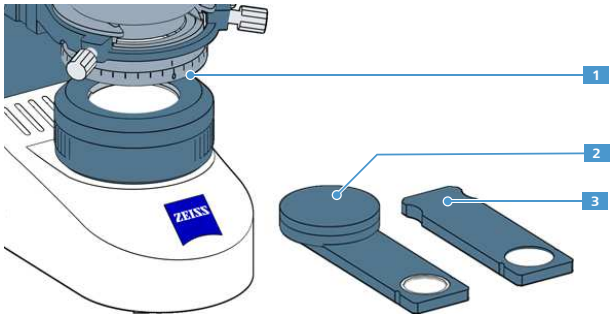
The polarizing elements are referred to as either **Polarizers** or **analyzers** depending on their location in the beam path:

- The element between the light source and the sample is referred to as the polarizer 1
- The element between the sample and the eyepiece is referred to as the analyzer 2



Rotating the sample, polarizer, or analyzer alters the amount – and color – of the light received in the eyepiece. Thus it is possible to deduce properties of the sample, for example the orientation of the crystals within it or their refractive index.

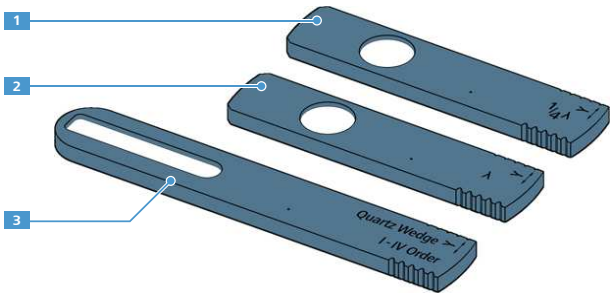
The following polarizers / analyzers are available for Primotech:



1 Rotatable polarizer in the microscope stand
2 Rotatable analyzer slider
3 Fixed analyzer slider

Compensators

Compensators enhance the intensity of colors in a sample making it easier to identify and differentiate samples. Various compensators are available for Primotech microscopes. Each increases the path difference of beams polarized in a certain direction by a multiple of the wavelength (λ) of visible light. The following compensators are suitable for **transmitted light**.



1 λ / 4
2 λ
3 Quartz wedge
A special form of compensator that ranges from 0 λ to 4 λ over its length

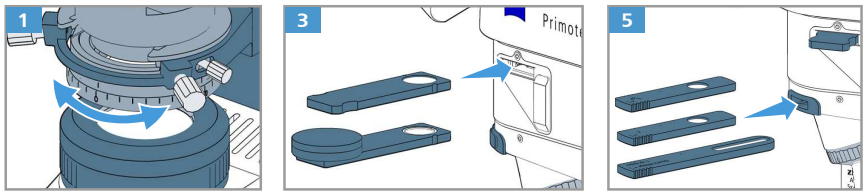
5.4 Performing Polarization Examinations with Transmitted Light

Prerequisites

- You are using Primotech D/A POL or Primotech D/POL Conoscopy
- 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 [▶ 33])

Procedure

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



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.

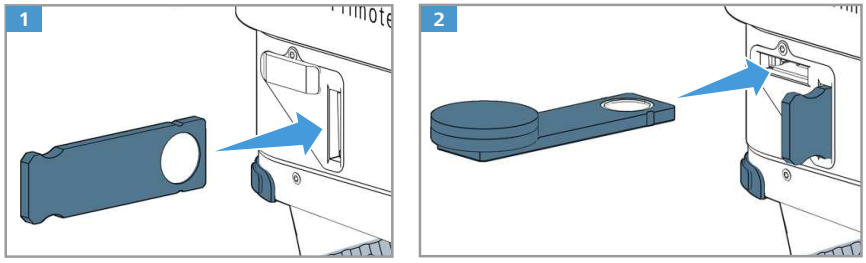
5.5 Performing Polarization Examinations with Reflected Light

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.



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.

5.6 Conoscopy Examinations

In conoscopy examinations, the sample is illuminated by a wide cone of light. This means that individual beams within the cone travel through the sample at different angles.

In certain types of sample, these beams interact with each other to create an interference pattern. This interference pattern can be used to infer properties of the sample. Conoscopy refers to the examination of interference patterns caused by such samples.

Conoscopy can only be performed with Primotech D/POL Conoscopy as it contains a Bertrand lens which can be inserted into the beam path. The Bertrand lens causes the interference patterns to be in focus when looking through the eyepieces rather than the sample itself.

5.7 Performing Conoscopy Examinations

INFO

Conoscopy can only be performed with transmitted light.

Prerequisites

- You are using Primotech D/POL Conoscopy
- The sample is illuminated by transmitted light only
- The objective has an aperture > 0.6 (e.g. the 40x or 63x objective)
- The objectives are centered (see Centering the Objectives [▶ 33])

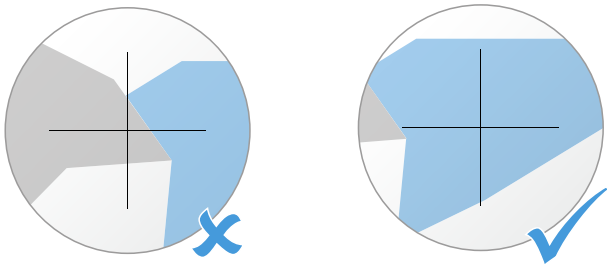
Procedure

1. Select the objective with the largest magnification.

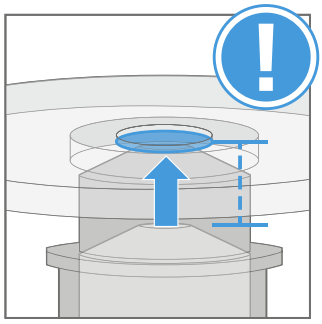
   A minimum of 40x should be used. The 63x objective is recommended for conoscopy examinations.

2. Focus the sample and move it so that only one mineral grain is in the field of view.

   This ensures the interference patterns are based only on a single grain.



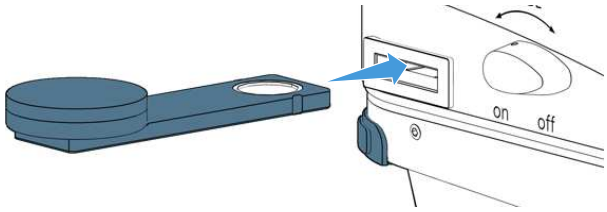
3 Move the condenser to the maximum vertical position to increase the size of the beam.



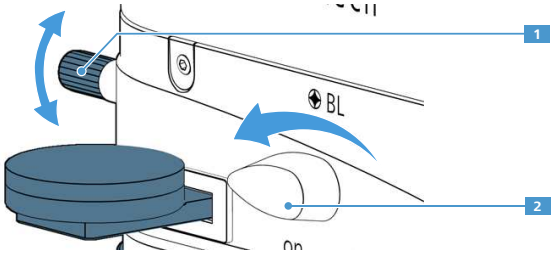
4 Open the aperture diaphragm and the luminous field diaphragm completely.

5 Turn the polarizer ring under the condenser to the 0° position.

6 Insert the rotatable analyzer into the horizontal slot of the intermediate tube.



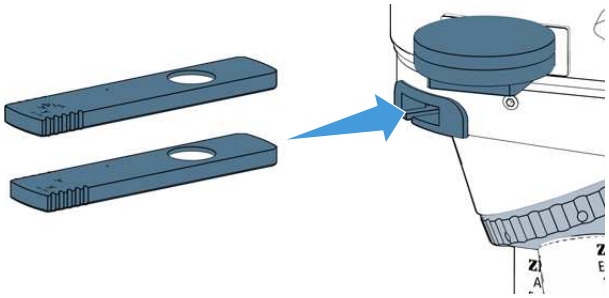
7 Turn the lever 2 to the left to insert the Bertrand lens into the beam path. You can alter the focus of the Bertrand lens by turning the screw 1.



8 Observe the interference patterns through the eyepiece.

You can rotate the stage to change the orientation of the sample.

9 If desired, insert a compensator into the 45° slot of the stand to further investigate and analyze the properties of the sample.



6 Changing Components

6.1 Overview

This chapter describes how to change or replace components, for example to attach a higher-resolution camera, replace the light source, or upgrade to an advanced MNA.

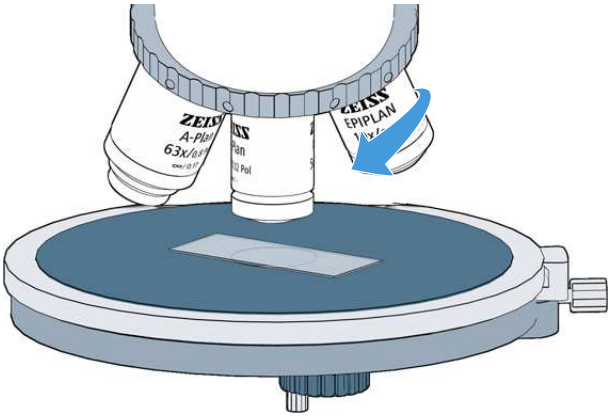
6.2 Changing Objectives

Any standard Zeiss objective with the appropriate thread can be used with a Primotech microscope. The name of the objective (e.g. Epi-plan 5x/0.13 W0.8) contains the following information:

- Series (Epi-Plan)
- Magnification (5x)
- Numerical aperture (0.13)
- Screw connection (W0.8)

Procedure

1. Lower the stage.
2. Rotate the nosepiece so that the objective to be changed is at the back or side.
3. Unscrew the objective and remove it from the nosepiece.



4. Screw the objective into the protective tube.
5. Unscrew the new objective from its protective tube.
6. Screw the new objective into the nosepiece.
7. If you are using Primotech D/A POL or Primotech D/POL Conoscopy, center the objective.

   For more information, see Centering the Objectives [▶ 33].

8 If you are using the Matscope app to view the sample via an iPad, you may need to recalibrate the app.

For more information, see www.zeiss.com/matscope

To achieve an optimal image, the size of the aperture diaphragm should be matched to the aperture of the objective. Thus, when you change an objective, you should also adjust the aperture diaphragm. For more information, see Adjusting the Resolution and Depth of Field [▸ 23].

6.3 Changing the Tube

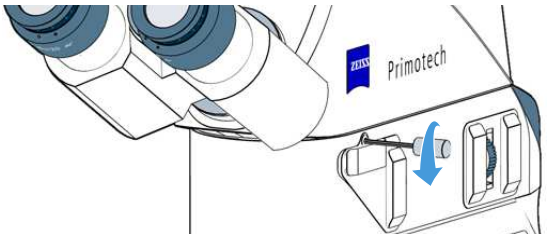
Procedure

1 Unplug the cables between the tube and the rear of the microscope:

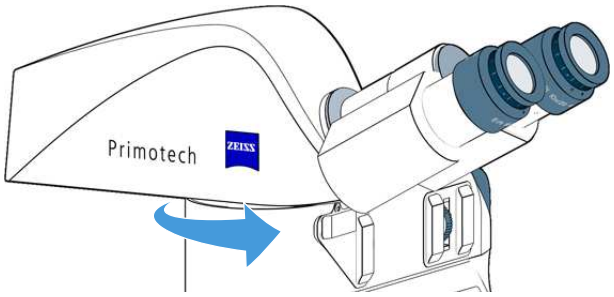
- Network cable between the network port of the tube and the top of the MNA
- 12 V power cable between the power socket of the tube and the rear of the microscope stand

This does not apply to Primotech D/POL Conoscopy.

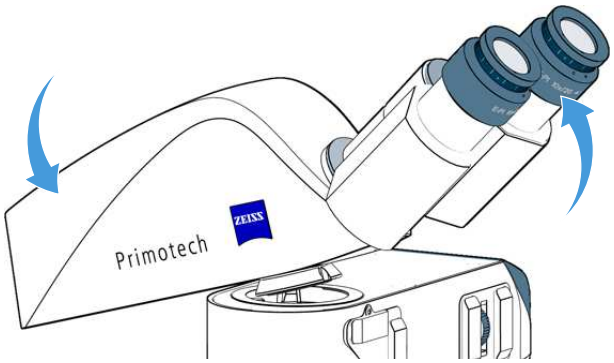
2 Use the 2.5 mm hex key to loosen the tube mounting screw on the right side of the tube.



3 Rotate the tube 90° counter-clockwise.



4 Tilt the tube upwards and lift it out of the support.



Inserting Tubes To insert a tube:

Procedure

1. Place the tube on the support with the eyepieces pointing to the right.
2. Tilt eyepiece end of the tube upwards so that the dovetail of the mount fits under the support.
3. Lower the tube so that it is flush with the intermediate tube.
4. Rotate the tube 90° clockwise so that the eyepieces are at the front of the microscope. Alternatively, rotate the tube 90° counter-clockwise to save space.
5. Use the 2.5 mm hex key to tighten the hexagonal bolt on the right of the tube.
6. Attach the cables between the tube and the rear of the microscope:
   - Network cable between the network port of the tube and the top of the MNA
   - 12 V power cable between the power socket of the tube and the rear of the microscope stand

   This does not apply to Primotech D/POL Conoscopy.

6.4 Replacing the Light Source

If the transmitted illumination light source stops working, the entire light source needs to be replaced, even if only the bulb has stopped working.

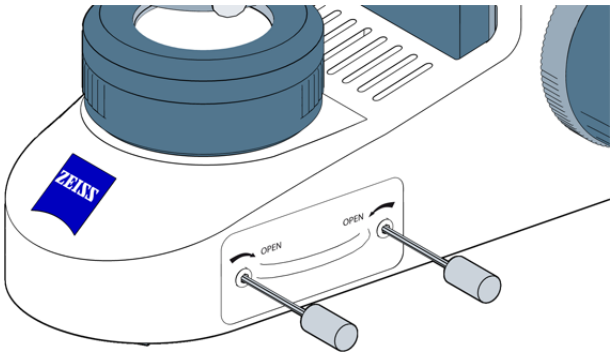
INFO

The reflected illumination light source cannot be changed.

To change the transmitted illumination light source:

Procedure

1. Use the 1.5 mm hex key to loosen the two hexagonal bolts of the light source in the direction of the arrows.



2. Grip the handle of the light source and slide it out of the stand.
3. Slide in the replacement light source.

   Use cotton gloves to avoid fingerprints on the new light source.
4. Use the 2.5 mm hex key to tighten the two hexagonal bolts.

6.5 Changing the Microscope Network Adapter

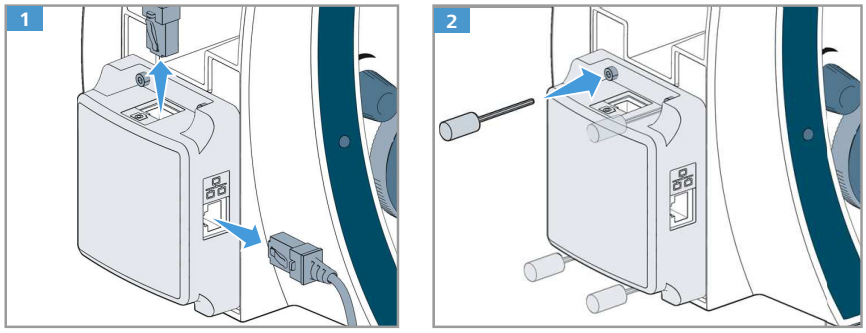
The procedure for changing a microscope network adapter (MNA) is the same for the standard and advanced MNA.

Removing the MNA

To remove the MNA:

Procedure

1. Unplug the Ethernet cables connected to the MNA.
2. Use the 2.5 mm hex key to undo the four hexagonal bolts of the MNA.



3. Carefully remove the MNA from the stand.

Attaching the MNA

To attach the MNA:

Procedure

1. Place the MNA on the rear of the stand.
2. Use the 2.5 mm hex key to tighten the four hexagonal bolts of the MNA.
3. Attach the cables to the MNA:
   - Network cable from the camera to the MNA
   - Network cable from the MNA to the router

7 Maintenance and Disposal

7.1 Routine Cleaning and Care

The maintenance to be carried out by the customer is limited to the following activities:

- Cleaning the **external** optical surfaces of the following components
  - Objectives and eyepieces
  - Condenser
  - Polarizers/analyzers and compensators
  - All other glass surfaces
- Cleaning all other surfaces

INFO

Do not clean the internal optical surfaces. Touching or cleaning these surfaces may lead to serious damage to the optical system.

Cleaning the Optical Surfaces

To clean the **external** optical surfaces of components:

Procedure

1. Switch the device off completely and pull the mains plug.
2. Remove the component from the microscope or move the stage so that the component can be accessed.

   For a list of components that can be removed and the corresponding instructions, see Disassembling the Microscope [▸ 47].
3. Gently rub the optical surfaces with an optical cleaning cloth dipped in an optical cleaning solution (mixture of 85% petroleum ether and 15% isopropanol).
   - Rub the surfaces in a circular motion from the center outwards.
   - To avoid scratches, do not use dry lens paper or a dry cloth.
   - Make sure that no fluid enters the system.
4. Once the optical surfaces have dried, reinsert the component into the microscope.

   For more information, see Assembling the Microscope [▸ 15].

Cleaning Other Surfaces

To clean all other surfaces except the optical surfaces:

Procedure

1. Switch the device off completely and pull the mains plug.
2. Wipe the surfaces with a clean cloth moistened with water to which a small amount of cleaning agent has been added.
   - Do not use a solvent.
   - Make sure that no fluid enters the system.
3. Dry the surfaces with a lint-free cloth.

INFO

The device manufacturer cannot be held responsible for damage caused by improper use, negligence, or unauthorized intervention in the system, in particular removal or replacement of device components or the use of unsuitable accessories from other manufacturers. Such actions will render all warranty claims invalid.

7.2 Corrective and Preventive Maintenance

To maintain the availability and performance of your Primotech system at a fully predictable budget we recommend you enter into a Protect service agreement with your ZEISS representative.

Damaged devices or components may only be repaired or replaced in accordance with the manufacturer's maintenance specifications. This may include the exchange of components by the end user.

Modifications to and retrofitting of system components may only be carried out in accordance with manufacturer's specifications. Such actions may need to be carried out by the manufacturer, ZEISS representative, or persons authorized and trained for the purpose by the manufacturer.

Replacement Parts

Primotech does not require scheduled preventive maintenance by a ZEISS representative. Worn or defective components can be replaced by the end user. Please contact your ZEISS representative to order a replacement. After receiving the replacement, please use the corresponding packaging material to return the defective component.

7.3 Support

If you need support, please contact your ZEISS representative or use the following addresses:

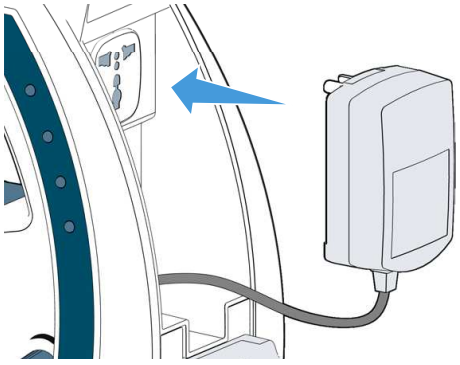
- http://microscopy.zeiss.com/microscopy/en_de/website/forms/sales-and-service-contacts.html
- http://microscopy.zeiss.com/microscopy/en_de/service-support/microscopy-contact.html

7.4 Disassembling the Microscope

If the microscope is not going to be used for a short period of time (days), place the dust cover over it. If it is not going to be used for a longer period of time, disassemble and store the microscope.

Procedure

1. Press the power switch to turn off the microscope.
2. Remove any samples from the stage.
3. Lower the stage and move it to a central position.
4. Unplug the power supply (plug) and store it in holder on the rear.



5. Unscrew the objective with the lowest magnification and place it in its protective tube.
6. Screw the dustcap labeled **1** into the nosepiece.
7. Repeat these steps for the other objectives.
8. Remove the eyepieces from the tube and place the protective caps on the tube.
9. Place the eyepieces in the corresponding protective packaging.

10 Unplug the cables between the tube and the rear of the microscope:

- Network cable between the network port of the tube and the top of the MNA
- 12 V power cable between the power socket of the tube and the rear of the microscope stand

This does not apply to the Primotech D/POL Conoscopy.

11 Place the microscope stand in its original packaging or the case for transport and storage.

7.5 Disposal of Primotech

Electronic equipment must not be disposed of in the domestic waste. It has to be disposed according to your national regulations and guidelines.

Samples inspected using Primotech must be disposed according to the valid legal standards and company regulations.

7.6 Warranty

The manufacturer guarantees that the instrument has no material or production defects when delivered. You must inform us of any defects immediately and do everything to minimize any damage. If the manufacturer is informed of such a defect, he is obligated to rectify it; it is his decision whether he does this by repairing the instrument or by delivering an instrument free of any defect. No guarantee is provided for defects caused by natural wear (wearing parts and consumables in particular) and improper use.

The instrument manufacturer is not liable for damage caused by faulty operation, negligence, or any other tampering with the instrument, particularly the removal or replacement of instrument components, or the use of accessories from other manufacturers. This invalidates all warranty claims.

With the exception of the work specified in this manual, no maintenance or repair of Primotech may be undertaken. Repairs may only be performed by a ZEISS representative. Should any defect occur with the instrument, please contact your ZEISS representative.

8 Troubleshooting

The following table lists possible issues with Primotech and corresponding remedies. If the suggestions do not resolve the issue, search the Online Help or contact your ZEISS representative.

Category	Symptom	Remedy
Illumination	Image is too dark	Check the desired illumination type is on. If so, increase the brightness (see Adjusting the Illumination Brightness [▸ 21]). Check the polarizer and analyzer are inserted correctly. If so, rotate the sample (see Performing Polarization Examinations with Transmitted Light [▸ 37]). Check the diaphragms are open sufficiently (see Adjusting the Transmitted Illumination Size [▸ 23]).
	Light source is defective	Check the microscope stand is plugged in (see Assembling the Microscope [▸ 15]). Replace the light source (see Replacing the Light Source [▸ 43]).
	The field of view is not completely visible	Ensure the nosepiece is rotated into a click-stop position. Change the height of the condenser (see Specifying the Condenser Position [▸ 27]). Adjust the opening of the aperture diaphragm (see Adjusting the Resolution and Depth of Field [▸ 23]). Adjust the opening of the luminous field diaphragm (see Adjusting the Transmitted Illumination Size [▸ 23]). Check the filters, polarizers, and/or compensators are inserted correctly.
	Contrast is insufficient	Perform Köhler settings again (see Adjusting the Köhler Illumination [▸ 29]). When using transmitted light, make sure that reflected light illumination is turned off.
	Hotspot when inspecting a semi-translucent sample with reflected light	Cover or lower down the condenser in order to prevent it from reflecting light (see Specifying the Condenser Position [▸ 27]).

Category	Symptom	Remedy
Focus and appearance	Image is out of focus.	Raise or lower the stage (see Selecting Objectives and Focusing [▶ 20]). Adjust the eyepieces (see Adjusting the Eyepieces [▶ 18]). Clean the objectives and other optical surfaces (see Routine Cleaning and Care [▶ 45]).
	Object of interest disappears from field of view when rotating the stage	Center the objective (see Centering the Objectives [▶ 33]).
	Image too bright	Reduce the power of the light source.
	Edges of image too bright	Close the aperture diaphragm (see Adjusting the Resolution and Depth of Field [▶ 23]).
Hardware	Condenser cannot be raised	Check the maximum height of the condenser (see Specifying the Condenser Position [▶ 27]).
	Stage moves downwards by itself	Adjust the torque of the focus wheel (see Selecting Objectives and Focusing [▶ 20]).
Tube 30°/20 with int. 3 MP camera	Camera is not shown in Matscope app	Check the iPad's WLAN settings. Check the iPad and microscope are in the same network. Check the iPad is within range of the WLAN. Check that the LEDs on the network port of the tube are blinking. If not, check cabling and network. Make sure that you have waited at least 30 seconds after switching on the microscope. Make sure that there is a DHCP service in the network you are connecting the tube to. If all of the above points have been checked and confirmed, do a factory reset of the camera by pressing and holding the reset button for 10 seconds (using a bent paper clip, for example). The camera will reset itself and restart - this may take up to three minutes.

9 Technical Data and Conformity

9.1 Power Requirements and Operating Data

The Primotech system must be connected to the AC network via the central power supply by a country-specific mains power cable.

Property	Value
Protection class	II
Degree of protection	IP 20
Electrical safety	In accordance with DIN EN 61010-1 (IEC 61010-1) including CSA and UL regulations
Overvoltage category	II
Radio interference suppression	In accordance with EN 55011
Resistance to interference	In accordance with DIN EN 61326-1
Line voltage for power supply	100 to 240 V ±10% The supply voltage does not need to be transformed.
Line frequency	50 to 60 Hz
Power consumption of power supply (plug)	Max. 70 VA; secondary voltage of external power supply 12 V
Power supply (plug) output	12 V DC; max. 2.5 A
Microscope 12 V / 6 V DC	Adjustable from 1.5 V to 6 V
LED class of complete device	LED risk group 1 according to DIN EN 62471

Light Source - LED

Property	Value
Type	White light LED, LED risk group 1 according to DIN EN 62471
Color temperature	5000 K
Homogenous field illumination	20 mm diameter
Suitable for objectives with magnification	5x - 63x for transmitted light 5x - 100x for reflected light
Analogous brightness adjustment	5x to 100x approx. 15 to 100%
LED lifetime	10 000 hours

Tube 30°/20

Property	Value
Viewing angle	30°
Viewing height	380 - 415 mm
Interpupillary distance	Adjustable, 48 - 75 mm

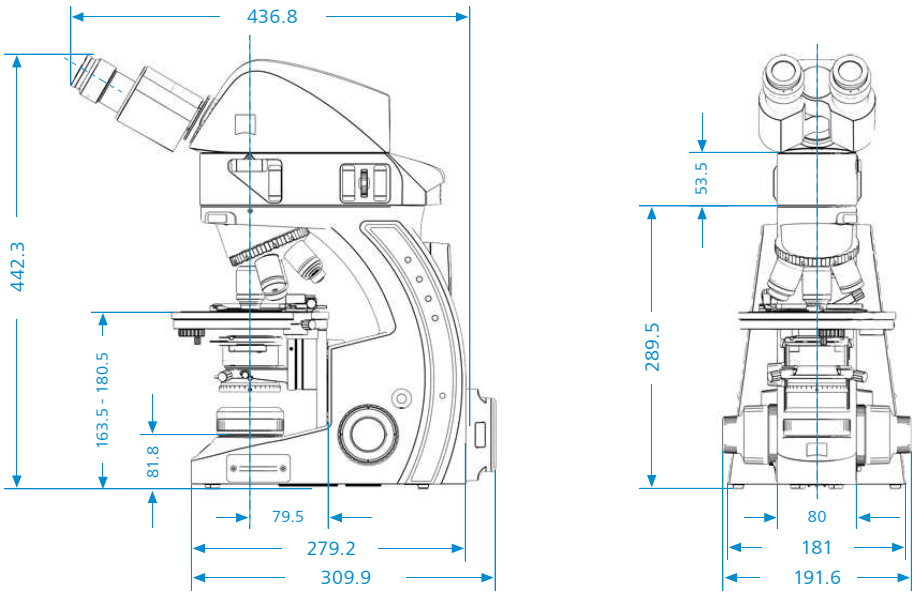
Tube 30°/20 with int. 3 MP camera

Property	Value
Viewing angle	30°
Viewing height	380 - 415 mm
Interpupillary distance	Adjustable, 48 - 75 mm
Optical split ratio	50% / 50%
Camera adapter magnification	0.39x
Camera field of view, diagonal	73% of eyepiece field of view (sensor cropped for performance reasons)
Sensor	Micron MT9P031, 1/2.5" (7.13 mm diag.) CMOS, 24 bit color, 2560 x 1920 pixels, 2.2 µm pixel size Spectral sensitivity without IR filter 400 - 700 nm
Live / Video recording over LAN / WLAN	■ 640 x 480 pixels (VGA) ■ 20 fps, latency: ~400 ms ■ Bitrate: 1.5 / 3 / 6 Mbit/s
Snap resolution	3 MP / 2048 x 1536 pixels, YUV color
Auto white balance	Yes (Auto/Lock)
Electrical interfaces	■ 12 V DC power input (provided by the microscope via interconnection cable) ■ Network (RJ45), 100 Mbit/s
Buttons	Reset button (backside)

9.2 Physical Dimensions and Key Specifications

Dimensions and Key Specifications

Property	Primotech MAT	Primotech D/A MAT	Primotech D/A POL	Primotech D/POL Conoscopy
Microscope stand (width x depth x height)	Approx. 192 x 467 x 442 mm (incl. eyepieces, network adapter, not including base plate)	Approx. 192 x 467 x 442 mm (incl. eyepieces, network adapter, not including base plate)	Approx. 192 x 467 x 442 mm (incl. eyepieces, network adapter, not including base plate)	Approx. 192 x 467 x 442 mm (incl. eyepieces, network adapter, not including base plate)
Weight	Approx. 8.5 kg	Approx. 9.5 kg	Approx. 10.1 kg	Approx. 9.1 kg
Stage travel range	75 x 50 mm	75 x 50 mm	35 x 30 mm	35 x 30 mm
Stage surface size	140 x 135 mm	140 x 135 mm	ø = 160 mm	ø = 160 mm
Maximum sample weight	500 g	500 g	500 g	500 g
Maximum sample height	34 mm	17 mm	17 mm	17 mm



9.3 Environmental Requirements

Primotech must be installed and operated in an enclosed space.

Category	Property	Value
Transport (in packaging)	Permissible ambient temperature	-40 to +70 °C
Storage	Permissible ambient temperature	+10 to +40 °C
	Permissible air humidity (without condensation)	max. 75 % at 35 °C
Operation	Permissible ambient temperature	+10 to +40 °C
	Permissible air humidity	max. 75 % at 35 °C
	Air pressure	800 hPa to 1060 hPa
	Height above sea level	max. 2000 m
	Degree of pollution	2

9.4 Scope of Delivery

The following standard components are supplied with all products:

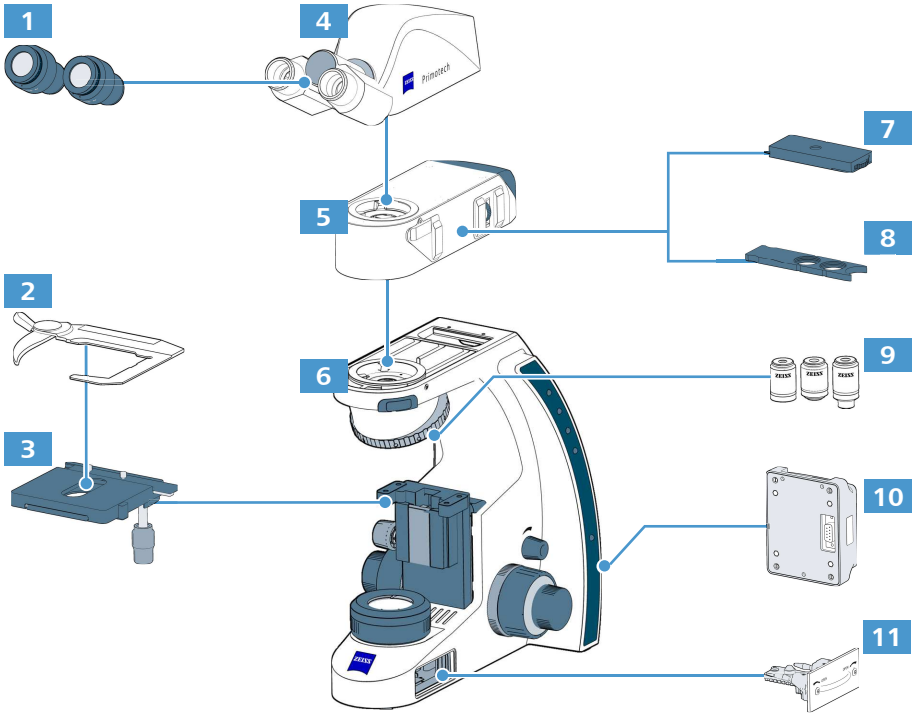
- Power cable including country-specific plug adapters
- Base plate
- Calibration slide for Matscope App
- Dust cover to protect the microscope when not in use
- Zeiss toolkit, including
  - 1.5 mm hex key
  - 2.5 mm hex key
- Documentation
  - Safety information (printed)
  - Quick start guide (printed)
  - Instruction manual (on USB stick)

Furthermore, an optional case for transport and storage (434002-9000-000) is available for all stands.

The following sections list the standard and optional components of each stand.

9.4.1 Primotech MAT (430055-9000-100)

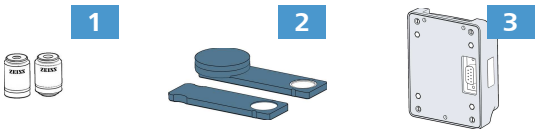
Standard components:



1. Eyepiece E-PL 10x/20 Br.foc.
2. Object guide
3. X-Y stage
4. Tube 30°/20 with int. 3 MP camera
5. Intermediate tube, reflected light illumination
6. Microscope stand
7. Slider for oblique illumination
8. Conversion filter slider (3200 K), d = 25 mm
9. Objectives:
   Epiplan 5x/0.13 W0.8" (442020-9902-000)
   Epiplan 20x/0.4 W0.8" (442040-9902-000)
   Epiplan 50x/0.65 W0.8" (442060-9902-000)
10. Microscope network adapter (430055-9100-000)
11. Transmitted light illumination

    Other (not shown): Leveling press, w. starter kit

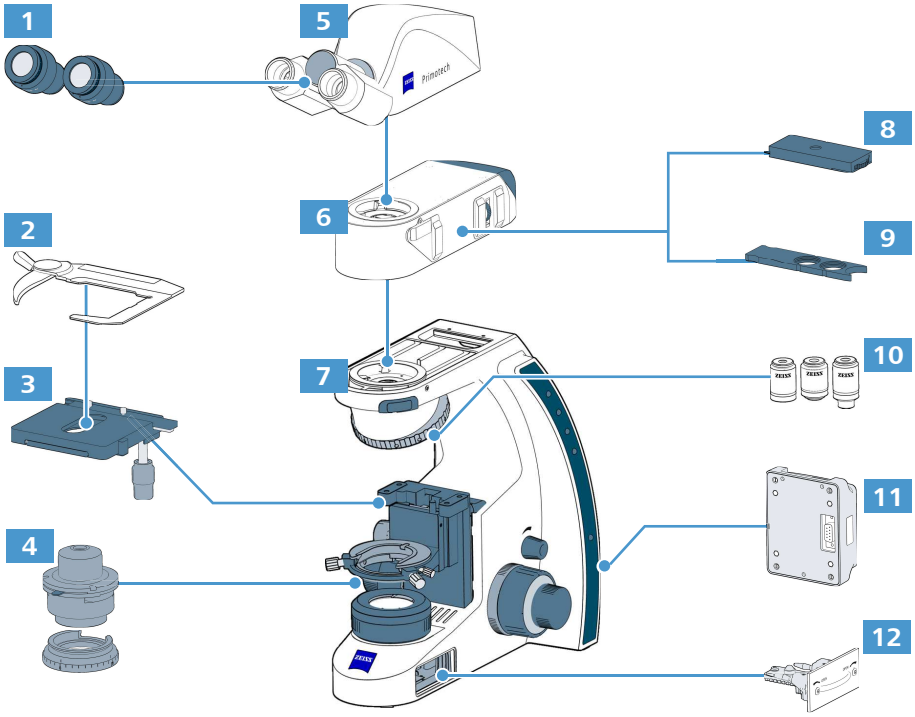
Optional components:



1. Objectives:
   Epiplan 10x/0.23 W0.8 (442030-9903-000)
   Epiplan 100x/0.8 W0.8 (442080-9901-000)
2. Analyzer slider D/A rotat. 360° (428108-9020-000)
   Polarizer slider A, fixed (428108-9030-000)
3. Advanced microscope network adapter (430055-9110-000)

9.4.2 Primotech D/A MAT (430055-9010-100)

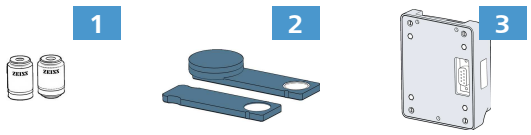
Standard components:



1. Eyepiece E-PL 10x/20 Br.foc.
2. Object guide
3. ESD stage
4. Köhler condenser incl. aperture diaphragm
5. Tube 30°/20 with integrated 3 MP camera
6. Intermediate tube, reflected light illumination
7. Microscope stand
8. Slider for oblique illumination
9. Conversion filter slider (3200 K), d = 25 mm
10. Objectives:
    Epiplan 5x/0.13 W0.8" (442020-9902-000)
    Epiplan 20x/0.4 W0.8" (442040-9902-000)
    Epiplan 50x/0.65 W0.8" (442060-9902-000)
11. Microscope network adapter (430055-9100-000)
12. Transmitted light illumination

    Other (not shown): Leveling press, w. starter kit

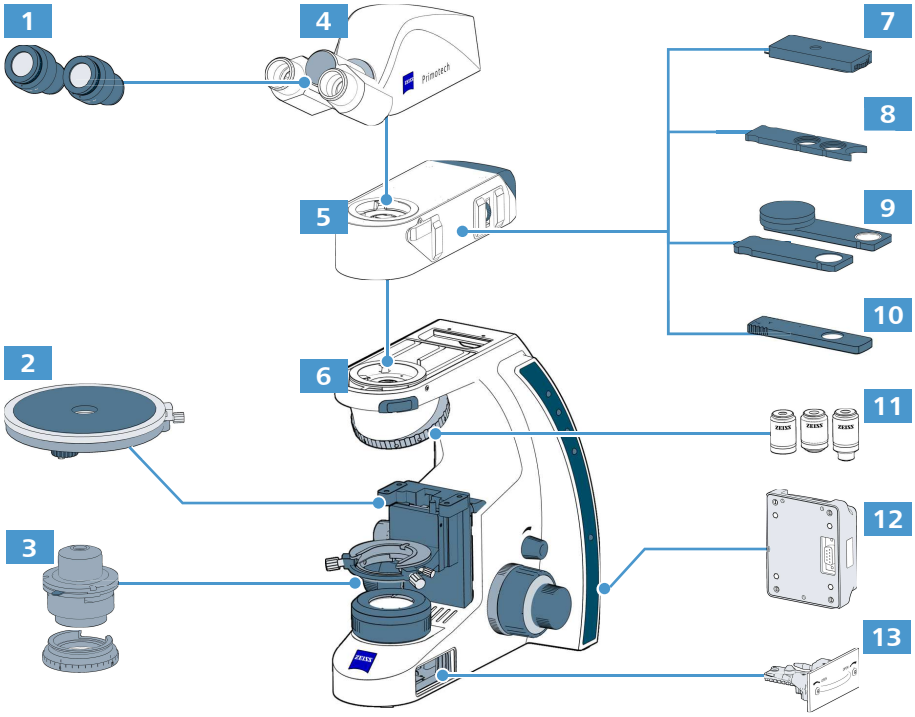
Optional components:



1. Objectives:
    Epiplan 10x/0.23 W0.8" (442030-9903-000)
    Epiplan 100x/0.8 W0.8" (442080-9901-000)
2. Analyzer slider D/A rotat. 360° (428108-9020-000)
    Polarizer slider A, fixed (428108-9030-000)
3. Advanced microscope network adapter (430055-9110-000)

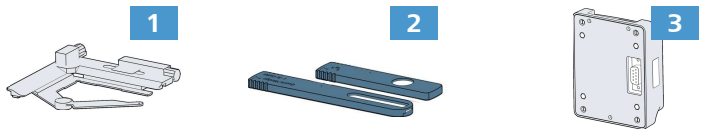
9.4.3 Primotech D/A POL (430055-9020-100)

Standard components:



1. Eyepiece E-PL 10x/20 Br.foc. pol with crossline graticule
2. Rotatable stage
3. Köhler condenser incl. aperture diaphragm and polarizer 360°
4. Tube 30°/20 with integrated 3 MP camera
5. Intermediate tube, reflected light illumination
6. Microscope stand
7. Slider for oblique illumination
8. Conversion filter slider (3200 K), d = 25 mm; Conversion filter (3200 K), d = 45 mm
9. Analyzer slider D/A rotat. 360°
   Polarizer slider A, fixed
10. Compensator λ, 6x20
11. Objectives:
    Epiplan 5x/0.13
    W0.8" (442030-9903-000)
    A-Plan 20x/0.45 Pol
    W0.8" (441043-9900-000)
    A-Plan 40x/0.65 Pol
    W0.8" (441053-9900-000)
12. Microscope network adapter (430055-9100-000)
13. Transmitted light illumination

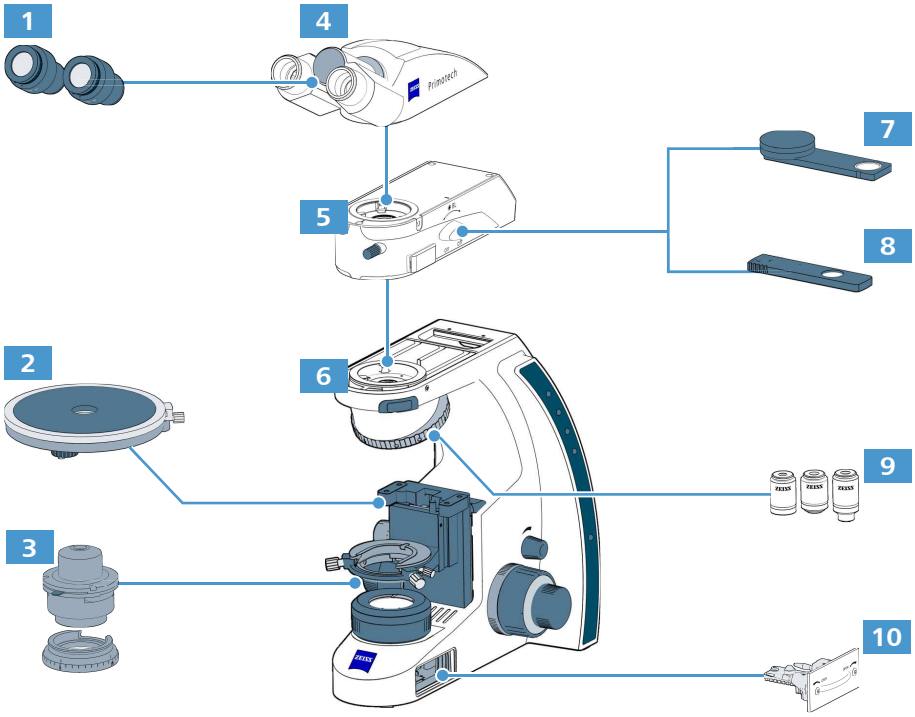
Optional components:



1. Object guide (432338-9000-000)
2. Compensator λ/4, 6x20 (427900-9010-000)
   Compensator wedge 0-4 λ, 6x20 (427900-9020-000)
3. Advanced microscope network adapter (430055-9110-000)

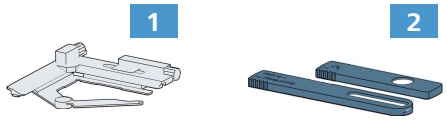
9.4.4 Primotech D/POL Conoscopy (430055-9030-100)

Standard components:



1. Eyepiece E-PL 10x/20 Br.foc. pol with crossline graticule
2. Rotatable stage
3. Köhler condenser incl. aperture diaphragm and polarizer 360°
4. Tube 30°/20
5. Intermediate tube, Bertrand system
6. Microscope stand
7. Analyzer slider D/A rotat. 360°
8. Compensator λ, 6x20
9. Objectives:
   A-Plan 5x/0.12 Pol W0.8" (441023-9900-000)
   A-Plan 40x/0.65 Pol W0.8" (441053-9900-000)
   A-Plan 63x/0.8 Pol W0.8" (441063-9900-000)
10. Transmitted light illumination

Optional components:



1. Object guide (432338-9000-000)
2. Compensator λ/4, 6x20 (427900-9010-000)
   Compensator wedge 0-4 λ, 6x20 (427900-9020-000)

A

B

C

D

E

F

G

I

K

L

M

O

P

Q

R

S

T

V

W

Z