

INSTRUCTIONS

CX23

Biological Microscope

With trinocular tube



To ensure the safety, obtain optimum performance and to familiarize yourself fully with the use of this microscope, we recommend that you study this manual thoroughly before operating this microscope, and always keep this manual reachable when operating this product.

Optical Microscope and Accessory



In accordance with European Directive on Waste Electrical and Electronic Equipment, this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately.

Refer to your local distributor in EU for return and/or collection systems available in your country.

NOTE: This product has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this product in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

FCC Supplier's Declaration of Conformity

Hereby declares that the product

Product name: Optical Microscope

Model Number: CX23RTFS2, CX23LTFS2

Conforms to the following specifications:

FCC Part 15, Subpart B, Section 15.107 and Section 15.109

Supplementary Information:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party Name: Evident Scientific, Inc.

Address: 48 Woerd Ave Waltham, MA 02453, USA

Phone Number: 781-419-3900

For Korea only

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

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Safety precautions

If the product is used in a manner not specified by this manual, the safety of the user may be imperiled. In addition, the product may also be damaged. Always use the product according to this instruction manual.

The following symbols are used in this instruction manual.

 **CAUTION** : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

 **NOTE** : Indicates a potentially hazardous situation which, if not avoided, may result in damage to the product or other property.

 **TIP** : Indicates the useful knowledge or information for use.

CAUTION Prevention of infection

Wear protective equipment such as gloves, etc.

When you observe the specimens which have potentiality of infection, wear protective equipment such as gloves, etc. to prevent the specimens from touching your skin directly.

When you maintain the product which may have contacted the specimens which have potentiality of infection, wear protective equipment such as gloves, etc., or clean the product before operation.

After observation, clean the portions where specimens contacted directly.

Remove the specimen when moving the product.

When moving this product, be sure to remove the specimen first, since it is in danger of dropping and spattering.

In case the specimen is damaged, promptly take the infection prevention measures.

When disposing of the product, follow the regulations and rules of your local government.

When disposing of the product which contacted the specimens which have potentiality of infection, follow the regulations and rules of your local government.

CAUTION - Installation of the product

Install the microscope on a sturdy, level table or bench.

For safety in particular, do not place a mat, etc. under the product.

CAUTION - LED (light emitting diode)

Do not look directly at the light from LED for a long time.

If you feel that the light from LED is too bright during observation, adjust the light intensity using the brightness adjustment knob and continue observation. The LED built in this product is basically eye-safe. However, do not look directly at the light from LED for a long time while feeling too bright, since it may cause damage to your eyes.

⚠ CAUTION - Electric safety

Always use the AC adapter and power cord provided by us.

If the proper AC adapter and the power cord are not used, the electric safety and the EMC (Electro-Magnetic Compatibility) performance of the product cannot be assured. If no power cord is provided, please select the proper power cord by referring to the section "Proper selection of the power cord" at the end of this instruction manual.

Always connect the ground terminal.

Check that the ground terminal of the power cord and that of the power outlet are connected properly. If the product is not grounded, our intended electric safety and EMC performance of the product cannot be assured.

Do not use this product near the sources of strong electromagnetic radiation.

Proper operation may be interfered. Be sure to evaluate the electromagnetic environment before operating the product.

Disconnect the power cord in case of emergency.

In case of emergency, disconnect the power cord from the power cord connector of the product or from the power outlet.

Install the product at the location where you can reach the power cord connector or the power outlet with your hand to disconnect the power cord immediately.

This product complies with the emission and immunity requirements described in IEC61326 series.

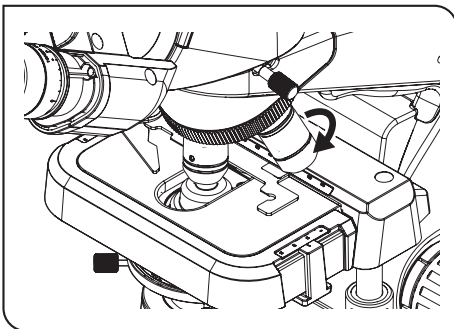
⚠ CAUTION - Safety symbols

The following symbols are attached to the product.

Study the meaning of the symbols and always use the product in the safest possible manner.

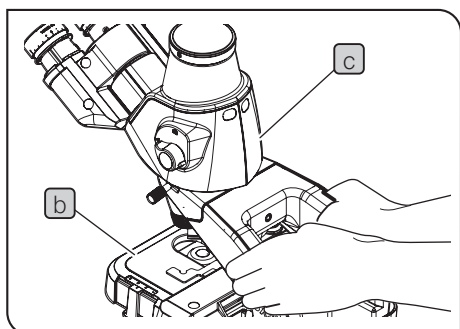
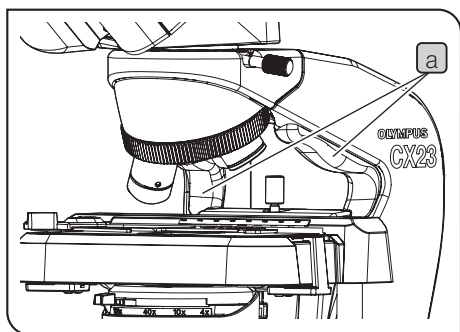
Symbol	Meaning
⚠	Indicates a non-specific general hazard. Follow the description given after this symbol or in the instruction manual.
I	Indicates that the main switch is ON.
○	Indicates that the main switch is OFF.

Handling precautions



NOTE

- This product is a precision instrument. Handle it with care and avoid subjecting it to a sudden or severe impact.
- Never disassemble any part of the product. Otherwise, failure could be caused.
- The objectives are screwed in tightly to prevent them from being loosened during transportation. When removing the objective, rotate it in the arrow direction as shown in the picture on the left, using the slip prevention rubber sheet, etc.
- Be sure to use the specified objectives (objectives provided with the microscope frame and CX-Plan series). If incorrect objectives are combined, the performance cannot be delivered.
- The tube of this microscope is removable, but do not attach the tube of other microscopes.



1. Be careful not to apply the impact or let the dirt/dust attached to the microscope when carrying it.
2. Do not use the product in areas where it may be subjected to direct sunlight, high temperature and/or humidity, dust or vibrations. (For conditions of operating environments, see "7 Specifications" on page 25.)
3. When installing the microscope, assure sufficient space around the microscope.
4. When carrying this microscope, disconnect the AC adapter from the microscope, and store the AC adapter and the power cord in the microscope frame. Then, hold both sides of the arm as shown in the lower left picture, and carry it carefully. It is easy to hold the arm by putting the balls of fingers to the finger contact part **a**. (For procedures to store the AC adapter and the power cord, see "Storing the AC adapter and power cord" on page 31.)

- NOTE**
- Do not hold the stage **b** or the tube **c**, since they may be damaged. When carrying the microscope, be sure to remove the specimen, filter, auxiliary lens and field diaphragm unit in advance, since they are in a risk of falling.
 - Do not carry the microscope keeping the AC adapter connected to the microscope. The AC adapter or the microscope may be damaged by hitting the output connector of the AC adapter.
 - When carrying the microscope, be careful not to touch the objective.

Maintenance and storage

1. Do not leave stains or fingerprints on the lenses and filters. If they get dirty, blow away dust with a commercially available blower and gently wipe the lens or filter with a piece of cleaning paper (or clean gauze). Only when cleaning fingerprints and oil stains, slightly moisten a piece of cleaning paper with commercially available absolute alcohol and wipe them off with it.

CAUTION

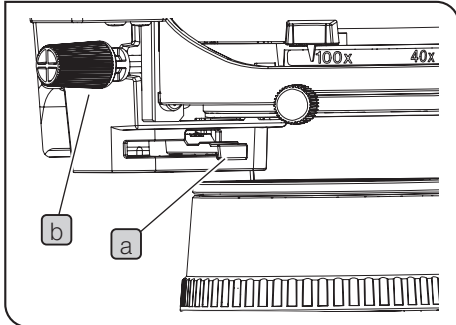
Since the absolute alcohol is highly flammable, it must be handled carefully. Be sure to keep it away from open flames or potential sources of electrical sparks. For example, the electrical equipment that is switched ON and OFF may cause the ignition of a fire. Also, always use absolute alcohol only in a well-ventilated room.

2. Wipe the portions other than the lens with a dry soft cloth. If the dirt cannot be removed by dry-wiping, moisten a soft cloth with diluted neutral detergent and wipe the dirty surface with it.

NOTE Do not use organic solvents because they may deteriorate the coated surface or plastic parts.

3. After using this product, store it in a dry place or cover it with a dust cover. If you need the dedicated dust cover, contact us.

NOTE Do not use a highly sealable cover, such as a plastic bag, etc. as a dust cover. The humidity in the microscope may increase to damage the product.



- When cleaning the condenser, move the lever **a** to the left end completely and use the condenser height adjustment knob **b** to lower the condenser and remove it (see the picture on the left). Then, clean the top lens portion thoroughly. When attaching the condenser, engage the condenser with the attaching guide of the microscope frame, and then push up the condenser until it stops.

NOTE

Be careful not to attach the condenser to the other microscope frame by mistake. If the condenser is combined to the incorrect microscope frame, the performance will be deteriorated.

TIP

If the field diaphragm unit and the auxiliary lens unit are attached, remove the field diaphragm unit and the auxiliary lens unit first and then, remove the condenser.

- When disposing of this product, be sure to follow the regulations and rules of your local government. Contact us for any questions.

Intended use

This product has been designed to be used to observe magnified images of specimens in various routine work and research applications.

This includes the observation of living cells or of specimen taken from tissues to gain physiological or morphological information at hospitals or laboratories. Typical field of applications are genetics, human blood and tissue examination, neurology, pharmacology and cellular biology.

Do not use this instrument for any purpose other than its intended use.



This product complies with the requirements of Regulation (EU) 2017/746 and The Medical Device (Amendment etc.) (EU Exit) Regulation 2020 concerning in vitro diagnostic medical devices. CE marking means the conformity to the former, and UKCA marking means the conformity to the latter.



This product is applied with the requirements of EMC standard IEC/EN61326-2-6 and IEC/EN61326-1 concerning electromagnetic compatibility.

- Immunity: Professional healthcare facility environment

This product complies with the emission and immunity requirements described in IEC61326 series.

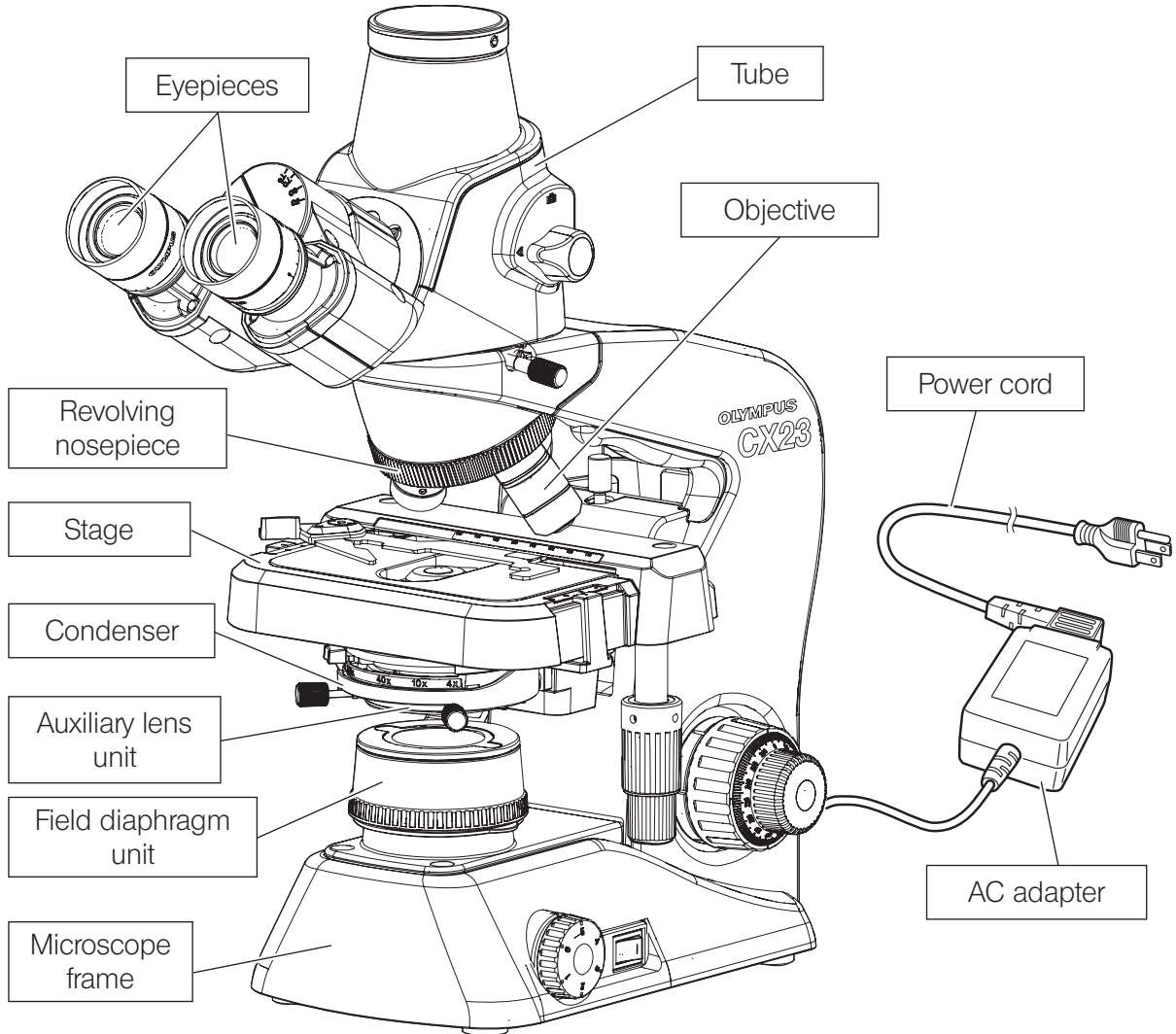
This product is designed for use in a professional healthcare facility environment. It is likely to perform incorrectly if used in a home healthcare facility environment. If it is suspected that performance is affected by electromagnetic interference, correct operation may be restored by increasing the distance between this product and the source of the interference.

The electromagnetic environment should be evaluated prior to operation of this product.

Do not use this product in close proximity to the sources of strong electromagnetic radiation to prevent interference with the proper operation.

1 Standard combination

Refer to the drawing below and make sure that all necessary components are included in the product you purchased.

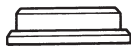


Option units

- Eyepiece (2 pieces)
WHSZ15X-H



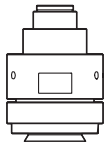
- Filter holder
CH2-FH



- Darkfield ring slit
CH2-DS



- Camera adapter
U-TV1XC



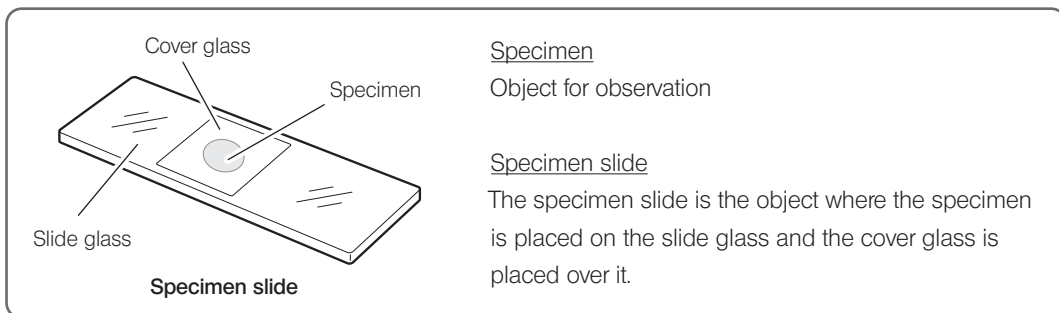
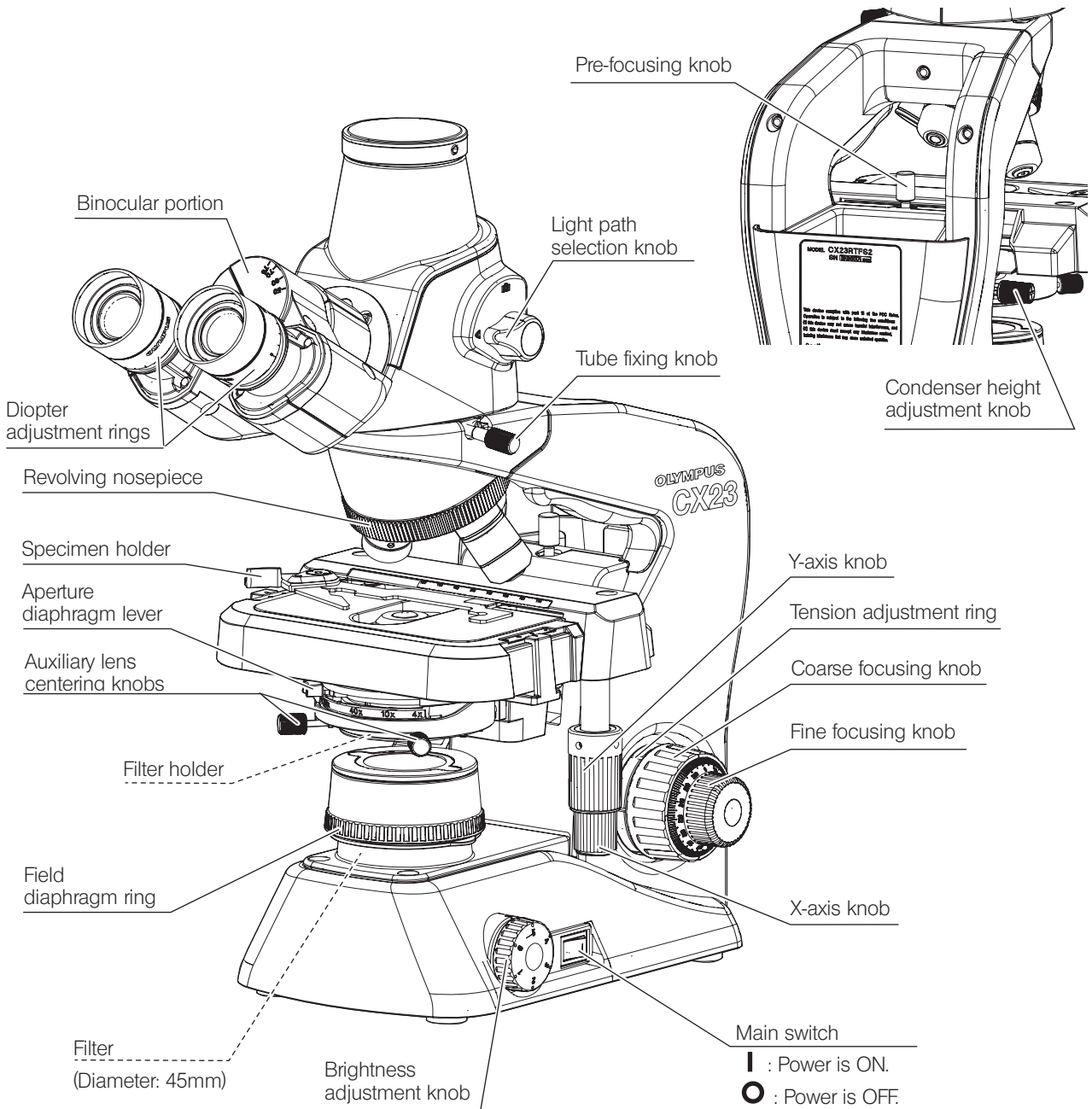
- Camera
DP22 or DP27



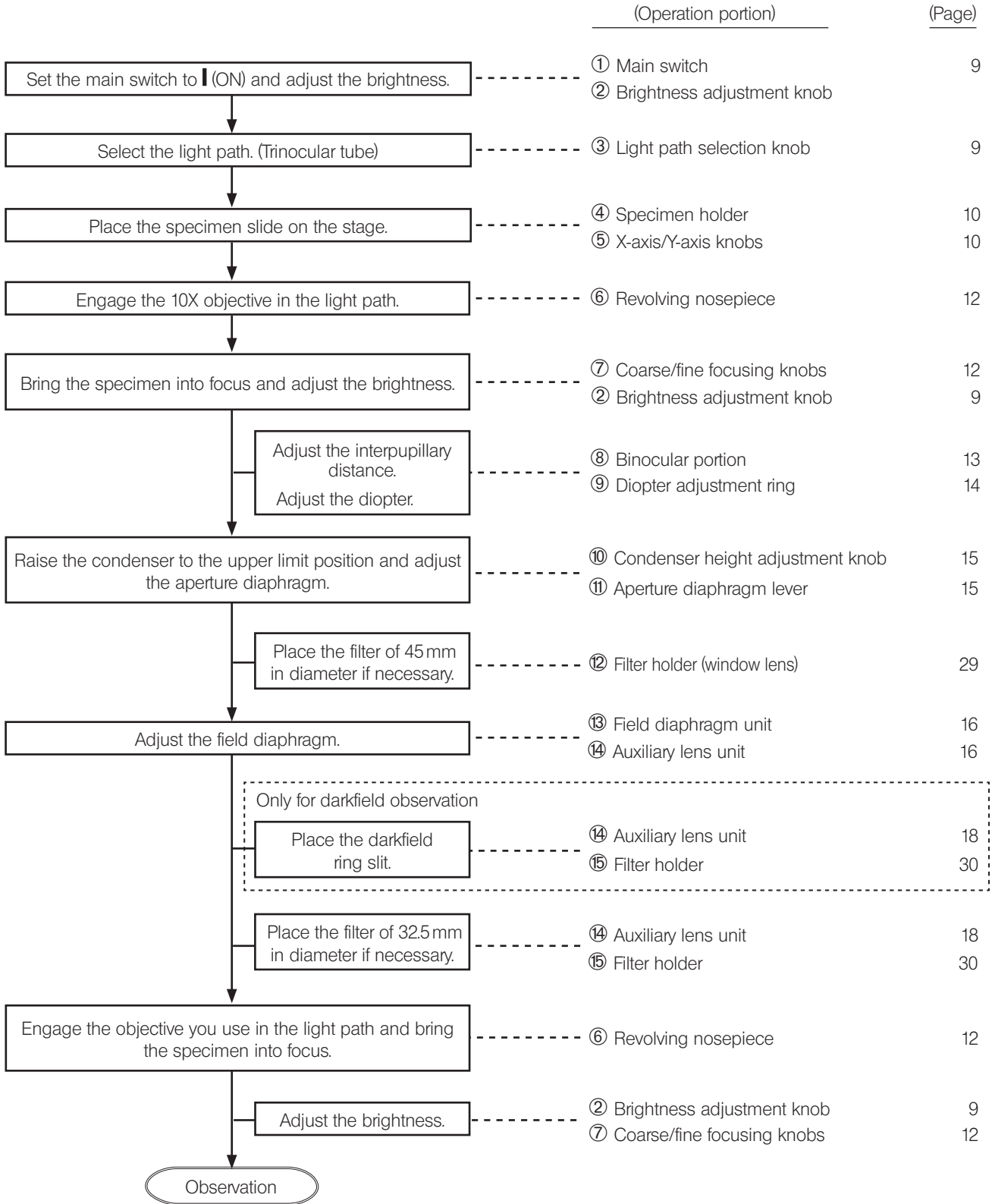
- 20X Objective
100X oil immersion objective

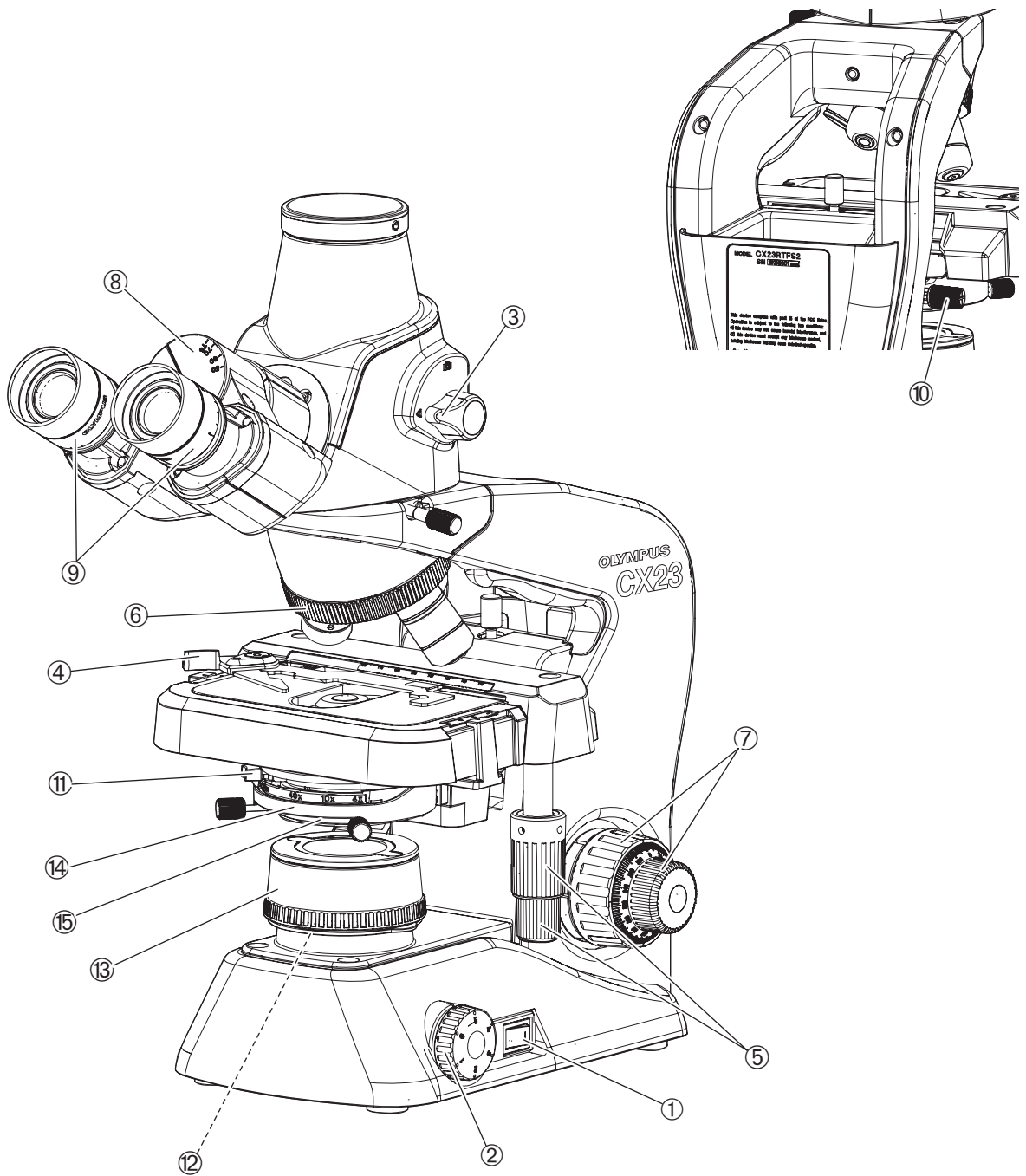
- Eyepiece micrometer
(Ø24 mm, Thickness: 1.5 mm)

2 Nomenclature of operating portions



3 Outline of brightfield/darkfield observation methods

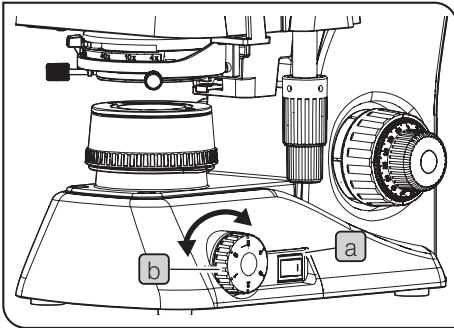




TIP Make a copy of this observation procedure guide and put it near the microscope to use for observation.

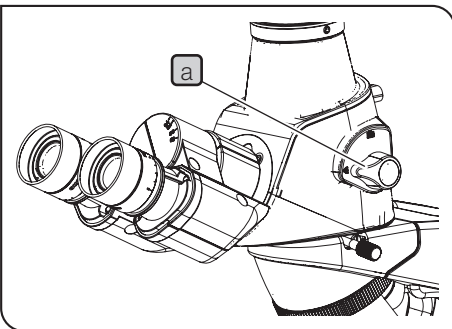
4 Observation procedures

1 Turning ON the LED illumination



- 1 Set the main switch **a** to I (ON).
- 2 Rotating the brightness adjustment knob **b** in the arrow direction increases the brightness and rotating it in the opposite direction decreases the brightness. The values shown around the knob represent the rough indication of brightness.

2 Selection between the eyepiece light path and the camera light path



You can select the light path for observing the image with eyepieces or the light path for observing the image on monitors, etc. via camera.

- 1 Rotate the light path selection knob **a** of the trinocular tube to select the light path. (Light intensity ratio: 100:0)

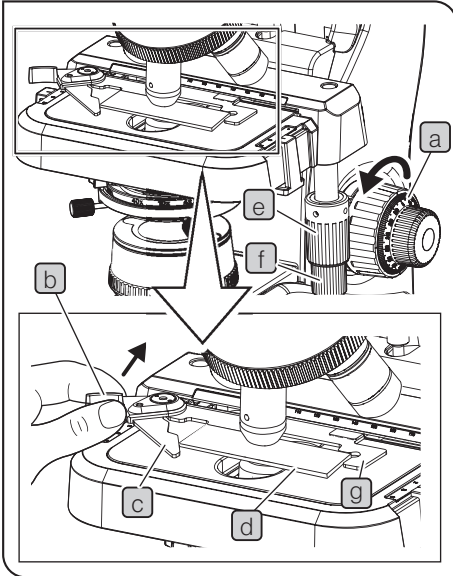
 : Eyepiece

 : Camera

NOTE

Be sure to rotate the light path selection knob completely until it stops to acquire the proper observation image.

3 Placing the specimen slide



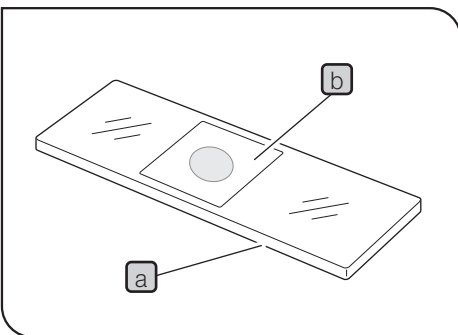
- 1 Rotate the coarse focusing knob **a** in the arrow direction to fully lower the stage.
- 2 Press the holding lever knob **b** backward (arrow direction) to open the specimen holding lever **c**, and place the specimen slide **d** by sliding it on the stage from front toward back.
- 3 After placing the specimen slide, return the holding lever **c** gently.
- 4 Rotating the upper Y-axis knob **e** moves the specimen slide in the Y-axis direction (front/back) and rotating lower X-axis knob **f** moves the specimen slide in the X-axis direction (right/left).
(Stage movable range: Depth(front/back) 30mm x Width (right/left) 76mm)

- NOTE**
- Place the specimen slide carefully. If you return the holding lever **c** with excess force or release your hand from the holding lever knob **b** in the middle, the lever may collide with the specimen slide to damage it.
 - Do not move the specimen slide by touching the specimen holder **g** directly with hand, since it may damage the rotary mechanism of X-axis/Y-axis knobs.
 - The rotation torque of X-axis and Y-axis knobs becomes heavier near the end of movable range of X-axis and Y-axis knobs. In this case, stop rotating the knob.

Slide glass

It is recommended to use the slide glass **a** with a length of 76 mm, width of 26 mm and thickness between 0.9 and 1.4 mm.

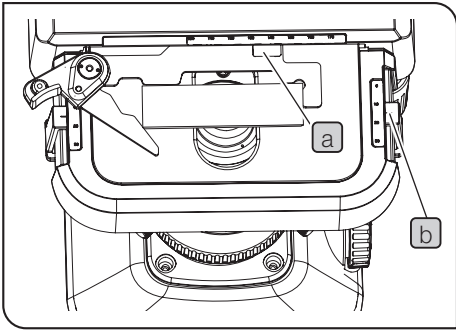
- NOTE**
- Use the cover glass **b** with a thickness of 0.17mm to fully deliver the performance of objective.



Stage operation in X/Y direction

Scale of specimen position

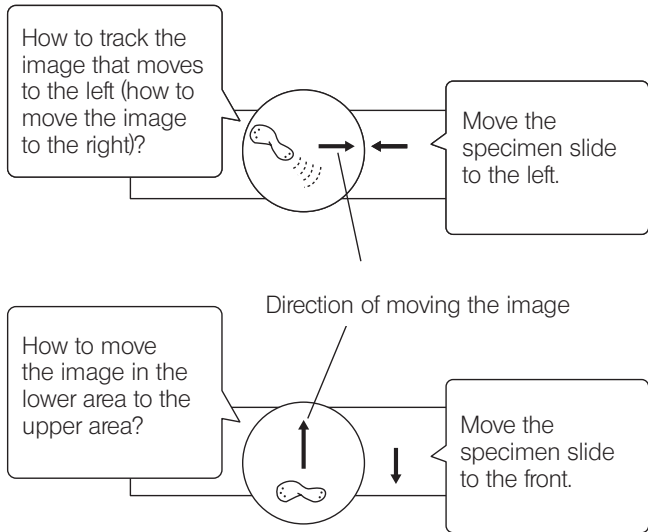
By reading and taking a note of X-axis and Y-axis scales (coordinates) of the specimen observation position on the specimen slide, you can return to the original observation position easily even if the specimen is moved.



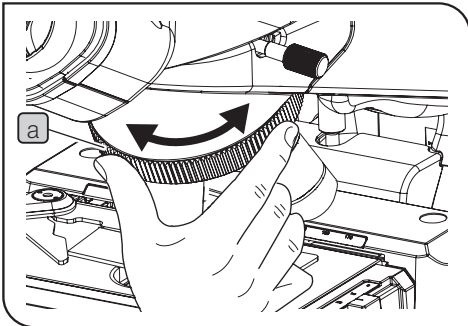
- 1 The X-axis scale is read at the position on the specimen holder **a**.
- 2 The Y-axis scale is read at the position of index line **b**.

How to track an observation image

NOTE The up-down and left-right movements of the image observed through eyepieces are opposite to the movements of the specimen slide.



4 Selecting the objective



- 1 Hold the revolving nosepiece **a** and rotate it so that the intended objective comes exactly above the specimen slide.

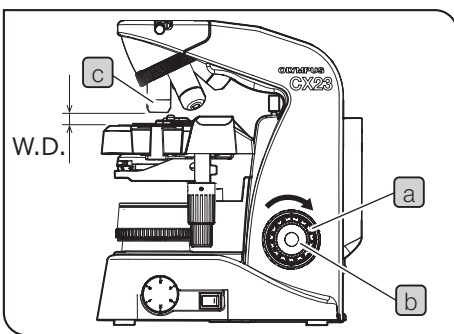
NOTE

- Do not rotate the revolving nosepiece by holding the objective.
- Be careful if you rotate the revolving nosepiece while observing the edge of the specimen slide with the high magnification objective (40X, etc.), the objective may interfere with the specimen holder.

TIP

For attaching and removing the objectives, see page 29.

5 Focusing on the specimen



- 1 Rotate the coarse focusing knob **a** in clockwise direction (arrow direction) facing the microscope from right side to move the objective **c** to the specimen slide as close as possible.
- 2 While observing the specimen through the eyepieces, slowly rotate the coarse focusing knob **a** in the direction opposite to the arrow to lower the stage.
- 3 When the specimen comes into view, rotate the fine focusing knob **b** to bring the specimen into focus precisely.

Working distance (WD)

The WD means the distance between the objective at the position where the specimen is focused and the specimen slide.

Magnification of objective	4X	10X	20X	40X	100X
W.D. (mm)	278	8.0	2.5	0.6	0.13

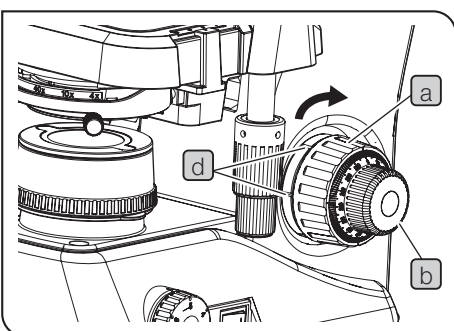
Adjusting the tension of the coarse focusing knob

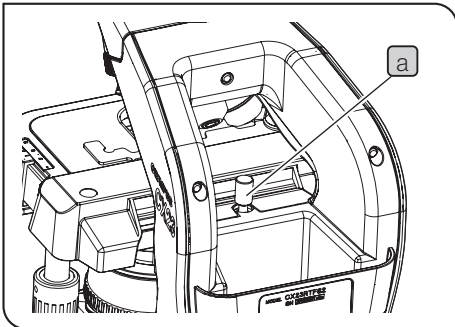
The tension of the coarse focusing knob can be adjusted.

Insert a commercially-available flathead screwdriver into the groove **d** of the tension adjustment ring. Rotating it clockwise (in the arrow direction) increases the tension and counterclockwise decreases the tension of the coarse focusing knob **a**.

TIP

If the stage descends by its own weight or the focus obtained with the fine focusing knob **b** is lost soon, the tension is set too loose. In this case, rotate the tension adjustment ring in the arrow direction to increase the tension.





Using the pre-focusing lever

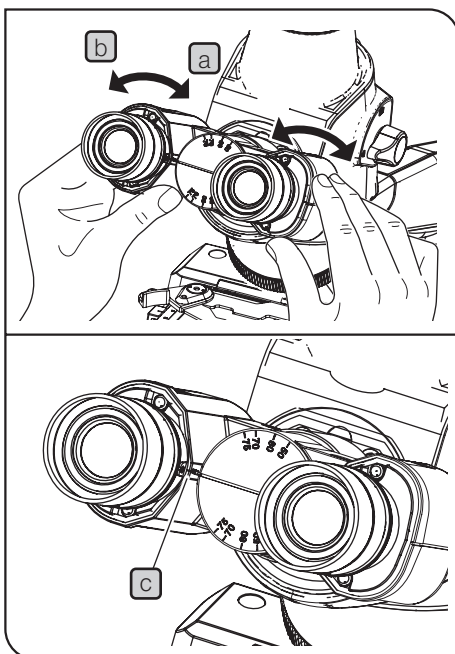
The pre-focusing lever prevents the specimen slide from being damaged by collision between the specimen slide and objective.

- 1 After bringing the specimen into focus with the objective which has the shortest WD, rotate the pre-focusing lever **a** clockwise until it stops.
- 2 To provide a certain margin for focusing range, rotate the pre-focusing lever **a** by about half turn backward from the stopped position.

NOTE If the pre-focusing lever is not positioned appropriately, the stage may not rise and the specimen may not be focused. In this case, adjust the pre-focusing lever position again.

TIP It is recommended to use the pre-focusing lever, but if you don't need it, place it at the upper limit position.

6 Adjusting the interpupillary distance



The interpupillary distance adjustment is to adjust the distance between two eyepieces according to the distance between your eyes. This makes it possible to observe a single image and to reduce eye strain during observation.

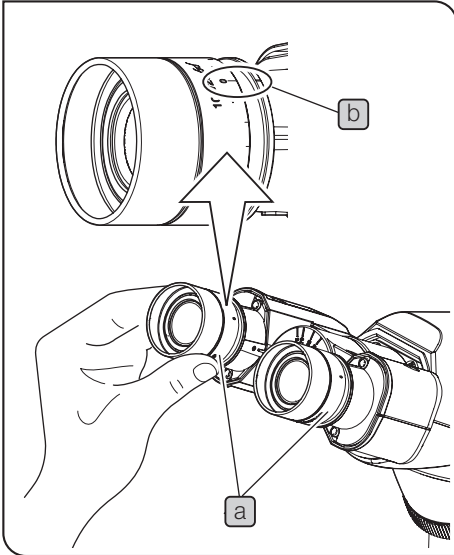
- 1 Keep the right and left eyepieces horizontally. While looking through the eyepieces, move the binocular portion either in **a** or **b** direction until the right and left fields of view coincide completely. The value shown by the indicator (protrusion) **c** on the left side eyepiece sleeve represents your interpupillary distance.

TIP

- Note your interpupillary distance so that it can be easily adjusted next time.
- You can adjust your interpupillary distance by moving the binocular portion either to upper or lower side. Select the upper side or the lower side according to your observation posture.

7

Adjusting the diopter.



The diopter adjustment is to compensate for the difference in eyesights of left and right eyes of the observer.

- 1 Rotate the diopter adjustment rings **a** of the right and left eyepieces and move each scale "0" to each index **b**.
- 2 Engage the 10X objective in the light path and rotate the coarse/fine focusing knobs to bring the specimen into focus.
- 3 Change to the 40X objective, and rotate the coarse/fine focusing knobs to bring the specimen into focus.
- 4 Change to the 10X objective. While looking through the right eyepiece with your right eye, rotate the diopter adjustment ring **a** to bring the specimen into focus. In the same manner, while looking through the left eyepiece with your left eye, rotate the diopter adjustment ring to bring the specimen into focus.
- 5 Change to the 40X objective again, and rotate the coarse/fine focusing knobs to bring the specimen into focus.
- 6 Change to the 10X objective. While looking through the right and left eyepieces, confirm that the specimen is in focus.

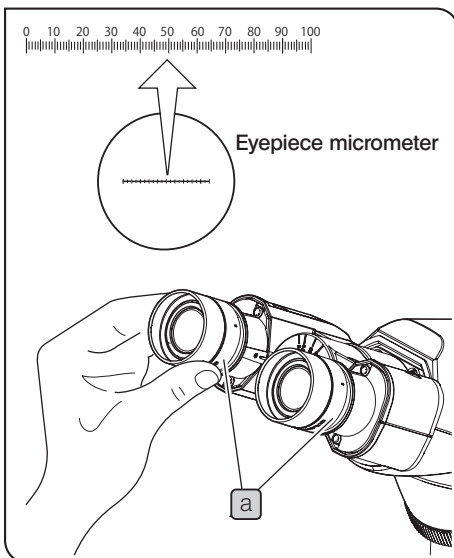
TIP

If the specimen is not in focus, repeat from **4** to **6**.

When the eyepiece micrometer is attached to the eyepiece

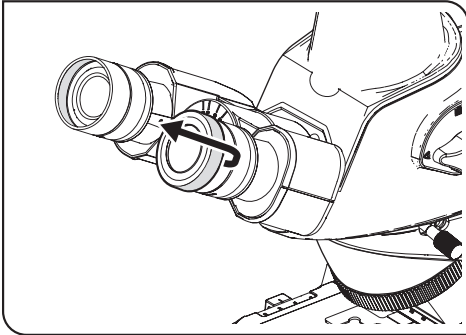
TIP

For attaching the eyepiece micrometer, see page 28.



- 1 While looking through the eyepiece equipped with the eyepiece micrometer, rotate the diopter adjustment ring **a** to adjust so that the scales and lines of the eyepiece micrometer can be viewed clearly.
- 2 Engage the 10X objective in the light path. While looking through the eyepiece equipped with the eyepiece micrometer, rotate the coarse/fine focusing knobs to bring the specimen into focus.
- 3 While looking through the eyepiece which is not equipped with the eyepiece micrometer, rotate the diopter adjustment ring **a** to bring the specimen into focus.

Using the eye shades



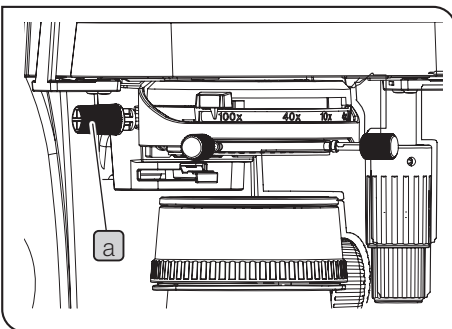
When wearing eyeglasses

Use the eye shades in the normal, folded-down position.

When not wearing eyeglasses

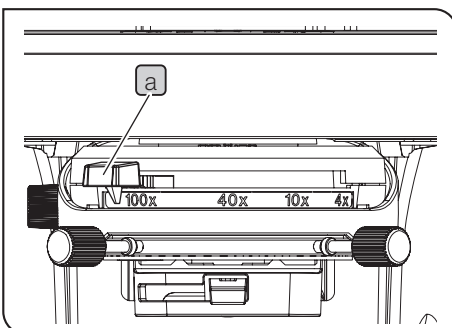
Extend the folded eye shades in the arrow direction. Since the eye shades prevent the unnecessary light from entering between eyepieces and eyes, you can observe the specimen comfortably.

8 Adjusting the condenser position



- 1 Raise the condenser height adjustment knob **a** to the upper limit position.

9 Adjusting the aperture diaphragm (AS)



The aperture diaphragm is a diaphragm to adjust the numerical aperture of the condenser.

Adjusting the numerical aperture of the condenser appropriately with respect to the numerical aperture of each objective allows you to observe the specimen with the best contrast and resolution. (For details, see page 22.)

- 1 The magnifications of objectives (4X, 10X, 40X, 100X) are displayed on the front side of the condenser. Move the aperture diaphragm lever **a** to the position of the magnification same as the objective in use.

NOTE For darkfield observation, open the aperture diaphragm.

10 Adjusting the field diaphragm (FS)

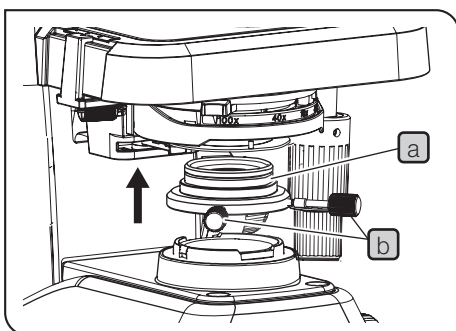
The field diaphragm is a diaphragm to adjust the illumination area of the specimen.

By adjusting the illumination area slightly wider than the field of view depending on objectives to be used, the excess light can be blocked to acquire the image with good contrast.

NOTE When carrying the microscope, remove the field diaphragm unit or the auxiliary lens unit in advance, since they may be dropped.

1 Attach the auxiliary lens unit and field diaphragm unit.

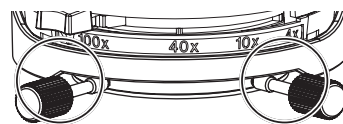
TIP If the filter holder is attached to the condenser, remove the filter holder.



Auxiliary lens unit

Insert the auxiliary lens unit **a** to the lower area of the condenser until the click sound is heard.

NOTE • Attach the centering knob **b** of the auxiliary lens unit to match with the notch of the condenser (see the picture below).



• When removing the auxiliary lens unit **a**, be sure to hold it and push it down.

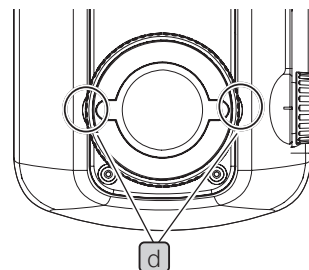
Do not press down the centering knob **b** too strongly to prevent the auxiliary lens from shifting the position.

TIP If the filter of 45mm in diameter needs to be attached, place it on the filter holder (window lens) of the microscope frame prior to attaching the field diaphragm unit.

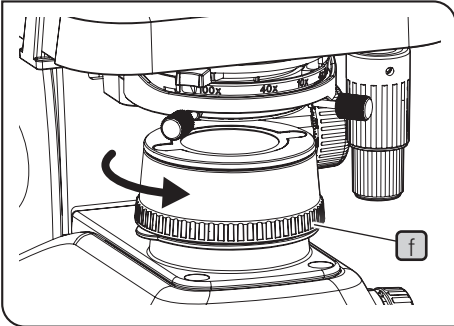
Field diaphragm unit

Insert the field diaphragm unit **c** to the upper area of the window lens of the microscope frame until the click sound is heard.

NOTE Attach the field diaphragm unit **c** so that the protrusions **d** at the bottom come to the right and left viewing from the front of the microscope in order to match the tab (2 positions) with the tab holes of the microscope frame.



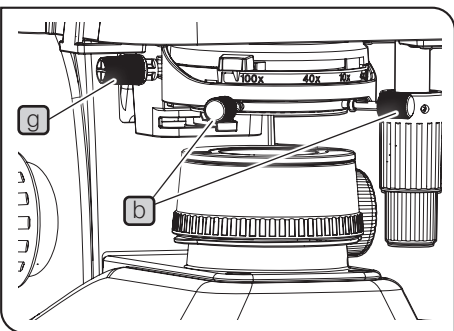
2 Engage the 10X objective in the light path to bring the specimen into focus.



- 3** Rotate the field diaphragm ring **f** in the direction shown in the picture on the left to narrow down the field diaphragm. (Picture A shown below)

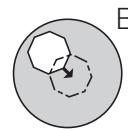


TIP The field diaphragm image in view is slightly blurred.

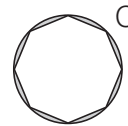


- 4** Rotate the condenser height adjustment knob **g** to bring the field diaphragm image into focus.

- 5** Rotate the auxiliary lens centering knob **b** (2 pcs.) to adjust so that the field diaphragm image comes to the center of the field of view. (Picture B shown below)

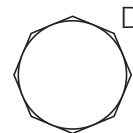


- 6** Rotate the field diaphragm ring in the direction opposite to **3** to open the field diaphragm slowly until its image inscribes the field of view. (Picture C shown below)



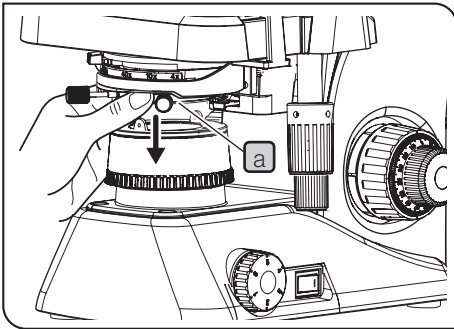
TIP If the field diaphragm image is decentered in the field of view, slightly narrow down the field diaphragm and repeat **5** and **6**.

- 7** Open the field diaphragm slightly until its image circumscribes the field of view. (Picture D shown below)



11 Attaching the darkfield ring slit (for darkfield observation only)

For darkfield observation, the darkfield ring slit CH2-DS (option) must be attached to the condenser.



1 Remove the auxiliary lens unit **a** attached to the condenser.

NOTE When removing the auxiliary lens unit **a**, be sure to hold it and push it down.

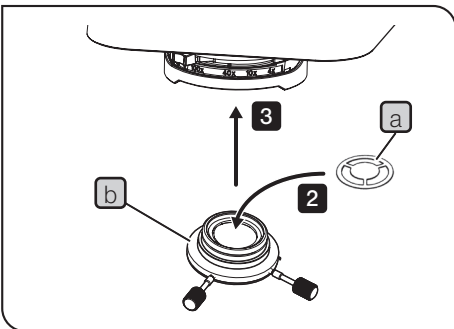
2 Insert the darkfield ring slit **b** into the auxiliary lens unit **a**.

TIP One filter of 32.5mm in diameter can be inserted to the auxiliary lens unit in addition to the darkfield ring slit.

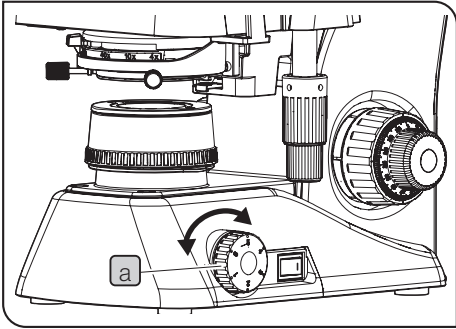
3 Insert the auxiliary lens unit **a** which includes the darkfield ring slit into the bottom of the condenser until the click sound is heard.

TIP • For the observation without auxiliary lens unit and field diaphragm unit, the filter holder CH2-FH (option) is necessary. (For attaching the filter holder, see page 30.)

• The darkfield observation is not available with the 100X oil immersion objective.



12 Observation

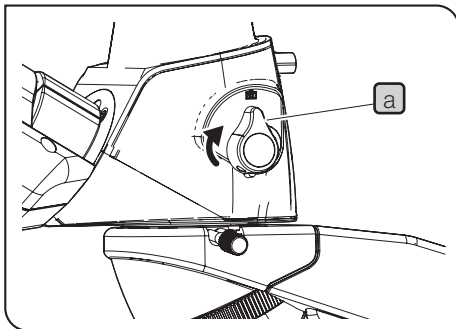



- 1** Engage the objective to be used in the light path and bring the specimen into focus. (See page 12.)
- 2** Rotate the brightness adjustment knob **a** to adjust the brightness of the LED illumination. (See page 9.)

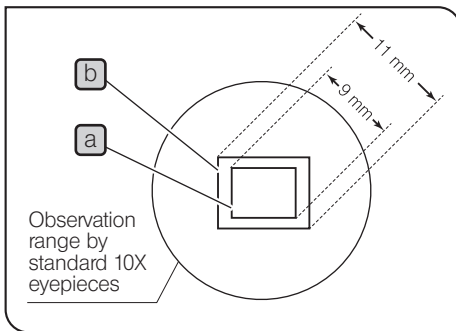
13 Acquiring the image with the camera

The observed image can be acquired by attaching the camera adapter and the digital camera for microscope to the trinocular tube. (For attaching the camera adapter and the camera, see page 30.)

NOTE When using the camera adapter, be sure to adjust the parfocality. Otherwise, the image through eyepieces and the image acquired by the camera are not in same focus. For procedures to adjust the parfocality, refer to the instruction manual of the respective camera adapter.



- 1** Rotate the light path selection knob **a** of the trinocular tube to move it to  position.



When using the camera adapter 1 x (U-TV1XC)

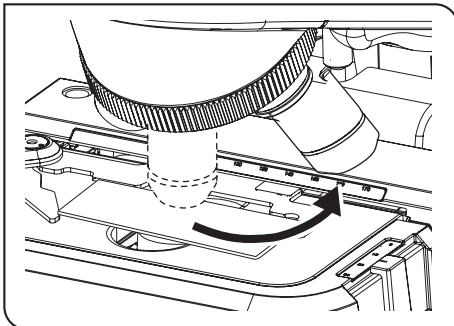
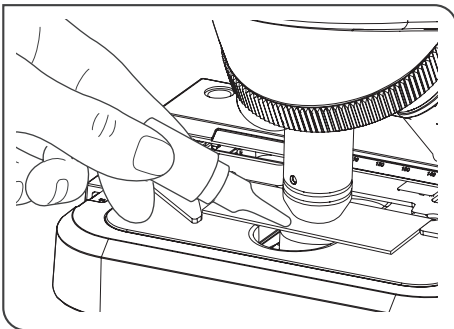
TIP The image acquisition range is determined by the size of the image sensor used in the camera and the magnification of the camera adapter. The comparison between the observation range by standard 10X eyepieces and the image acquisition range by the camera is shown in the picture on the left.

- a** Digital camera for microscope (DP22)
Image sensor size (diagonal): 1/1.8-inch (9mm)
- b** Digital camera for microscope (DP27)
Image sensor size (diagonal): 2/3-inch (11mm)

14 Using the 100X oil immersion objective

NOTE

- Apply the immersion oil specified by us to the tip of the 100X oil immersion objective. Otherwise, the observed image is not in focus.
- Always use the immersion oil provided by us. Using the immersion oil which is not provided by us cannot deliver the intended optical performance.



- 1 Use the low magnification objective to bring the specimen into focus.
- 2 Apply the immersion oil on the specimen slide before changing to the 100X oil immersion objective.

TIP

When applying the oil between the slide glass and the top surface of the condenser, apply a drop of oil on the top surface of the condenser first and then place the slide glass.

- 3 Rotate the revolving nosepiece to engage the oil immersion objective in the light path, and rotate the fine focusing knob to bring the specimen into focus.

NOTE

If the immersion oil contains air bubbles, the image will be degraded. Make sure that the oil is free of air bubbles. To remove bubbles, rotate the revolving nosepiece slightly to move the oil immersion objective back and forth for once or twice.

TIP

The numerical aperture (NA) shown on the condenser is the one when oil is applied between the slide glass and the top surface of the condenser. When oil is not applied, the NA becomes less than the number shown.

- 4 After use, lower the stage and rotate the revolving nosepiece, and remove the objective attached with the immersion oil from the specimen slide.
- 5 Wipe off the immersion oil thoroughly from the tip of the objective and the tip of the condenser lens with the cleaning paper or the gauze slightly moistened with absolute alcohol. Wipe off the immersion oil from the specimen slide in the same procedures.

NOTE

If you leave the immersion oil without wiping it off, the immersion oil may be adhered to cause the incorrect observation.

CAUTION

Follow the cautions indicated on the label of the immersion oil.

5 Glossary of optical performance terminology

Total magnification

The size of the specimen image to be observed is obtained by multiplying the eyepiece magnification by the objective magnification. This value is referred to as the total magnification.

Example: Eyepiece (10X) x Objective (40X) = 400X

Resolution

The resolution is the ability of the lens to separate the image created by multiple proximal points.

The resolution is mainly determined by the ability of the objective and scarcely related to that of the eyepieces.

The function of the eyepieces is to just magnify an image already resolved by the objective.

Field number

The field number is the diameter of the image viewed through eyepieces indicated in millimeters.

Even with the same magnification, the larger the field number is, the larger field of view can be observed at a time.

Standard 10X eyepiece: 20mm

WHSZ15 x -H: 16mm

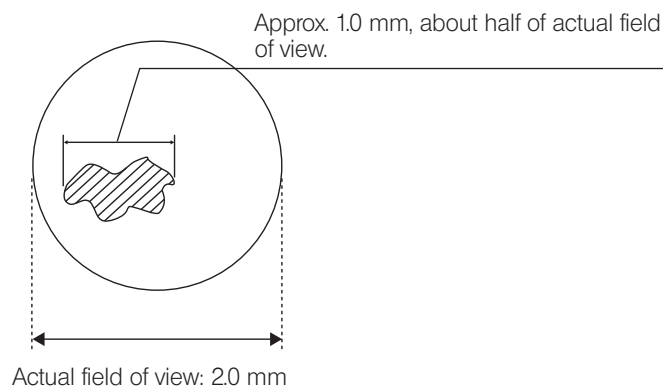
Actual field of view

The actual field of view is the size of the specimen actually viewed through eyepieces. This makes it possible to find out the approximate size of the specimen.

$$\text{Actual field of view} = \frac{\text{Field number}}{\text{Magnification of objective}}$$

Example : If the field number of the eyepiece is 20 and the magnification of the objective is 10X,

$$\text{Actual field of view} = \frac{20}{10} = 2.0 \text{ mm}$$

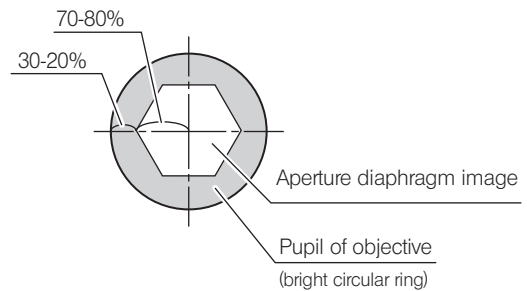


Aperture diaphragm

The aperture diaphragm is a diaphragm to adjust the numerical aperture of the condenser.

Adjusting the numerical aperture of the condenser appropriately with respect to the numerical aperture of each objective allows you to observe the specimen with the best contrast and resolution.

In general, since the contrast of the specimen to be observed with microscope is low, it is appropriate to adjust the numerical aperture of the condenser to approximately 70 to 80% of the numerical aperture of the objective. The rough indication is that the aperture diaphragm image viewed when looking into the tube without eyepieces looks as the picture shown on the right.



Numerical aperture of objective and numerical aperture of condenser suitable for observation

Objective	Magnification	Numerical aperture of objective NA	Numerical aperture of condenser suitable for observation of specimen with microscope (when setting to 70% of objective)
Plan objective	4X	0.10	$0.10 \times 0.7 = 0.07$
	10X	0.25	$0.25 \times 0.7 = 0.175$
	20X	0.40	$0.40 \times 0.7 = 0.28$
	40X	0.65	$0.65 \times 0.7 = 0.455$
	100XO	1.25	$1.25 \times 0.7 = 0.875$

6 Troubleshooting

If problems occur, please review the following list and take remedial action as needed.

If you cannot solve the problem after checking the entire list, please contact us for assistance.

Problem	Cause	Remedy	Page
1. The LED illumination does not light.	The AC adapter or power cord is disconnected.	Connect the power cord to a power outlet securely.	31
2. The brightness of observed field of view is uneven.	The light path selection knob of the tube is not positioned correctly.	Be sure to rotate the light path selection knob completely until it stops.	9
	The objective is not engaged in the light path properly.	Rotate the revolving nosepiece until it clicks to engage the objective in the light path.	12
	The condenser is lowered too much.	Raise it to the upper limit.	15
	The field diaphragm unit is not attached properly.	Attach the field diaphragm unit properly.	16
	The field diaphragm is not adjusted correctly.	Adjust the field diaphragm correctly.	16
	The auxiliary lens unit is not attached properly.	Attach the auxiliary lens unit properly.	16
	The objective, eyepiece, condenser, window lens or/and specimen slide are dirty.	Clean them thoroughly.	3
3. Dust or stains are visible in the observed field of view.	The objective, eyepiece, condenser, window lens or/and specimen slide are dirty.	Clean them thoroughly.	3
4. The observed image glares.	The condenser is lowered too much.	Raise it.	15
	The aperture diaphragm is narrowed down too far.	Move the position of the knob of aperture diaphragm lever to the same magnification display position as the magnification of the objective in use.	15
5. The observed image is blurred in white or unclear.	The objective is not engaged in the light path properly.	Rotate the revolving nosepiece until it clicks to engage the objective in the light path.	12
	The objective, eyepiece, condenser, window lens or/and specimen slide are dirty.	Clean them thoroughly.	3
	The immersion oil is not used with an oil immersion objective.	Use the immersion oil.	20
	The immersion oil contains bubbles.	Remove the air bubbles.	20
	The specified immersion oil is not used.	Use the immersion oil provided by us.	20

Problem	Cause	Remedy	Page
6. One-sided blur is found. The image looks as if flowing.	The objective is not engaged in the light path properly.	Rotate the revolving nosepiece until it clicks to engage the objective in the light path.	12
	The specimen slide is not placed on the stage properly.	Place the specimen slide on the stage properly and secure it using the specimen holder	10
7. The high magnification objective collides with the specimen slide before the specimen comes into focus.	The specimen slide is placed upside down.	Place the specimen slide facing up the cover glass side.	10
8. The tension of the coarse focusing knob is too heavy.	The tension adjustment ring is tightened too firmly.	Loosen the tension adjustment ring to get proper tension.	12
9. The specimen is not in focus. (The stage cannot be raised.)	The pre-focusing lever is positioned too low.	Raise its position.	13
10. The stage descends by its own weight or the focus is lost due to slippage of the coarse focusing knob.	The tension adjustment ring is loosened too much.	Loosen the tension adjustment ring to get proper tension.	12
11. The stage cannot be lowered enough.	The condenser is lowered too much.	Raise the condenser.	15
12. The field of view is not matched between two eyes.	The interpupillary distance is not adjusted correctly.	Adjust it correctly.	13
	The difference in diopter of two eyes is not corrected properly.	Correct it properly.	14
	Different eyepieces are used between the left side and right side.	Use the same eyepiece on the left side and right side.	30
13. When changing the objective from lower magnification to higher magnification, the objective collides with the specimen slide .	The specimen slide is placed upside down.	Place the specimen slide facing up the cover glass side.	10
	The cover glass is too thick.	Use a cover glass with thickness of 0.17 mm.	10
14. When changing the magnification, the specimen is defocused significantly.	The diopter is incorrect.	Adjust the diopter of eyepieces correctly.	14

Repair request

If you cannot solve the problems even though taking actions described in "Troubleshooting", please contact us for assistance. Please provide us the following information at that time.

Product name and abbreviation (Ex.: Biological Microscope CX23RTFS2)

Product number

Phenomena

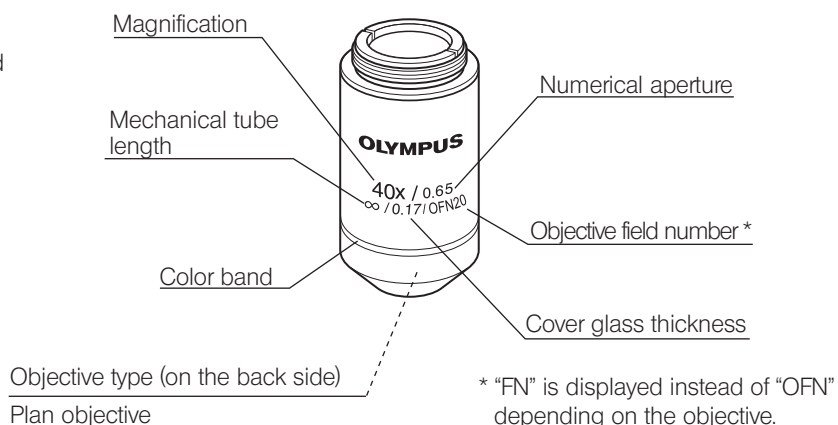
7 Specifications

Item	Specification	
Optical system	Infinity optical system	
Microscope frame	CX23RTFS2 / CX23LTFS2	
Illumination system	Built-in 0.5 W LED illumination system Microscope frame (rated input power): 5-6 V 0.5 A $\overline{\text{---}}$ AC adapter (rated input power): 100-240 V \sim 50-60 Hz 0.4 A AC adapter (rated output power): 5 V $\overline{\text{---}}$ 2.5 A	
Focusing mechanism	Stage height adjustment mechanism Movement distance per scale of fine focusing knob: 2.5 μ m Movement distance per rotation of fine focusing knob: 0.3mm Movable range: 15mm Pre-focusing lever is provided. Tension of coarse focusing knob is adjustable.	
Revolving nosepiece	4-hole revolving nosepiece is fixed.	
Tube	Type	Trinocular tube (fixed type)
	Field number	20 (when using standard 10X eyepieces)
	Tube tilting angle	30°
	Interpupillary distance adjustable range	48 to 75mm
	Light path selection	2 level selection: Eyepiece 100% or Camera100%
Stage	Movable range	X direction: 76mm Y direction: 30mm
	Specimen holder	One specimen slide can be held.
Condenser	Model type	Abbe condenser
	Numerical aperture	1.25 (when immersed with oil) to 0.10
	Aperture diaphragm	Built in
Field diaphragm	Diaphragm diameter is changeable.	
Dimension / Weight	198 (W) x 392 (D) x 430 (H) mm / Approx. 6.3 kg (Not including AC adapter)	
Operating environment	<ul style="list-style-type: none"> • Indoor use • Altitude: Max. 2000 meters • Ambient temperature: 5 to 40 °C (41 to 104 °F) • Humidity: Max. 80% (31 °C or less) (without condensation) In case of over 31 °C (88 °F), the humidity in operating environment is decreased linearly through 70% at 34 °C (93 °F), 60% at 37 °C (99 °F), and to 50% at 40 °C (104 °F). • Supply voltage fluctuation: \pm10 % • Pollution degree: 2 (in accordance with IEC60664-1) • Installation (overvoltage) category: II (in accordance with IEC60664-1) 	
Transportation / storage environments	<ul style="list-style-type: none"> • Ambient temperature: -25 to 65°C (-13 to 149 °F) • Humidity: 0% to 90% (without condensation) 	

8 List of optical performances

The following table shows the optical performances when combining eyepieces and objectives.

The picture on the right shows the various performances indicated on the objectives.



Optical performance Objectives	Magnification	Numerical aperture NA	Working distance W.D. (mm)	Cover glass thickness (mm)	Resolution (μm)	10X Eyepieces (FN 20)			Remark
						Total magnification	Depth of focus (μm)	Actual field of view	
Plan objective (OFN 20) *	4X	0.10	27.8	-	3.36	40X	115.0	5.0	
	10X	0.25	8.0	-	1.34	100X	18.4	2.0	
	20X	0.40	2.5	-	0.84	200X	6.09	1.0	
	40X	0.65	0.6	0.17	0.52	400X	2.0	0.5	
	100XO	1.25	0.13	-	0.27	1000X	0.69	0.2	Oil immersed

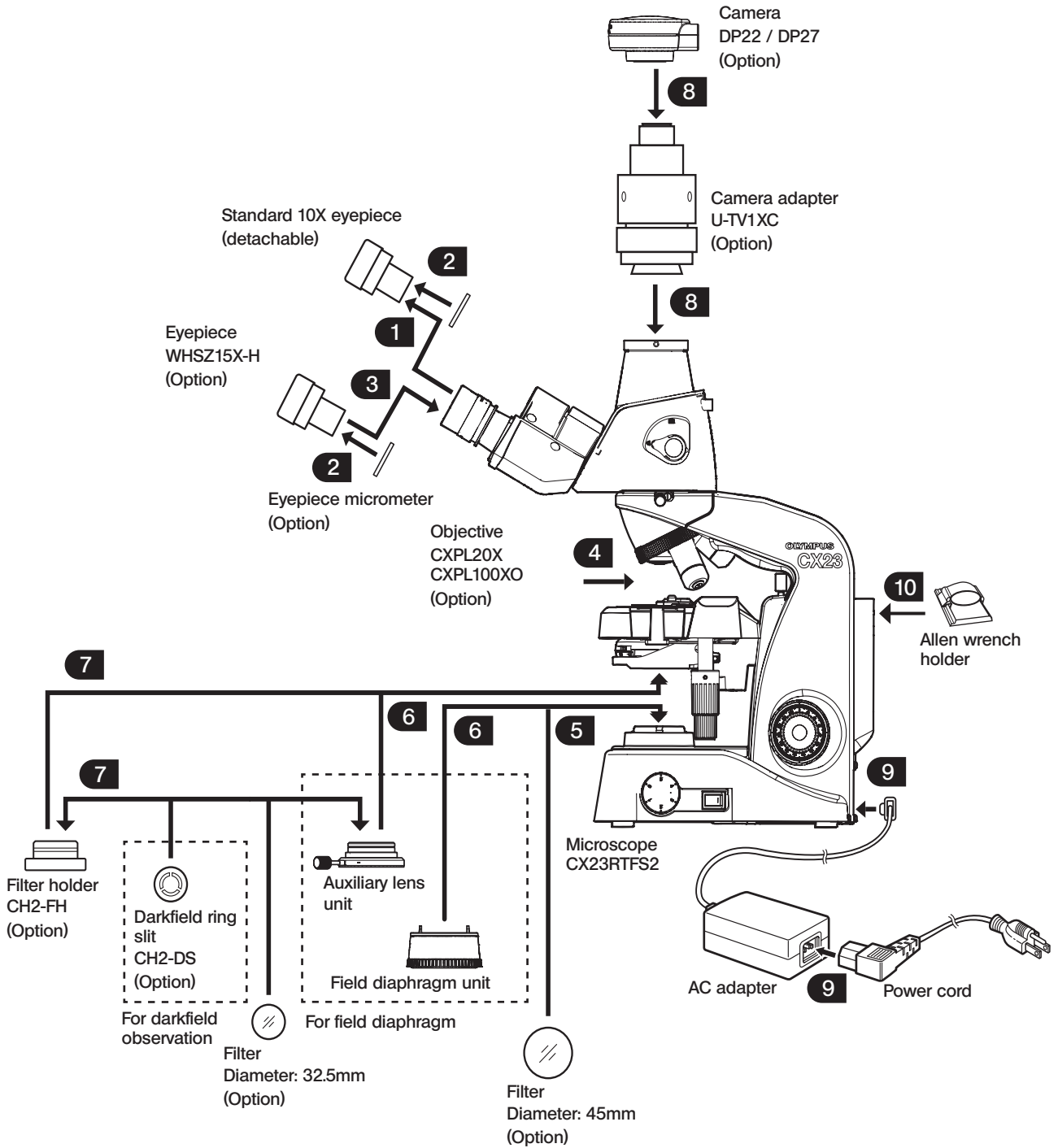
Glossary

- Numerical aperture: (NA)** The numerical aperture corresponds to F-number* of the camera and is related to the resolution. The resolution becomes higher when the numerical aperture becomes larger.
(*: F-number is a value obtained by dividing the focal distance of lens by the valid aperture diameter. This is used as an index to show the brightness of the lens.)
- Working distance: (W.D.)** Distance between the top surface of the cover glass and the tip of the objective. (See page 12.)
- Resolution:** The resolution is the ability of an objective to resolve adjacent two points in the image to the minimum limit, which is expressed as the distance between two points on the specimen surface.
- Field number: (FN)** The field number is the diameter of the image viewed through eyepieces, indicated in millimeters. (See page 21.)
- Total magnification:** Magnification of objective x Magnification of eyepiece (See page 21.)
- Focal depth: (Object side)** The focal depth is the depth range of the specimen focused. The depth becomes deeper by narrowing down the aperture diaphragm and it becomes shallower by increasing the aperture diaphragm of the objective.
- Actual field of view:** The actual field of view is a diameter of the field of view, expressed as the size (mm) on the specimen surface. (See page 21.)

9 Assembly

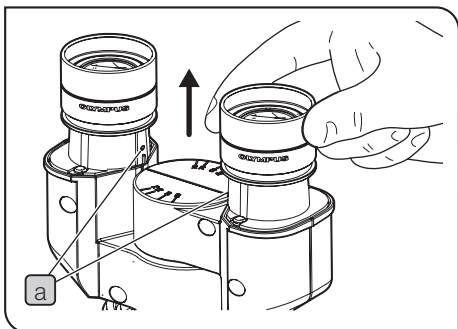
9-1 Assembly diagram

The number in the following diagram indicates the order to attach each unit.
The detail assembly procedures are described on and after next page.



9-2 Assembly procedures

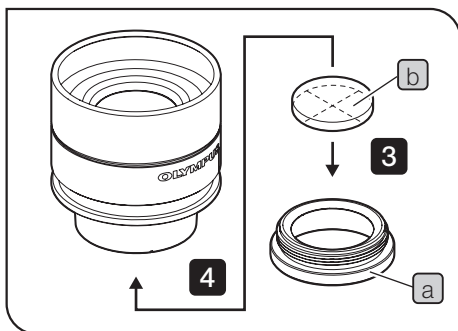
1 Removing the standard 10X eyepiece



TIP The standard 10X eyepieces are clamped with screws.

- 1 Loosen the clamping screws **a** of the 10X eyepieces using the small flathead screwdriver and remove the eyepieces.

2 Attaching the eyepiece micrometer



TIP Use the eyepiece micrometer of 24 mm in diameter and 1.5 mm in thickness.

- 1 To attach the micrometer, loosen the clamping screw of the right side eyepiece using a small flathead screwdriver and remove the eyepiece.
- 2 Hold the eyepiece frame, and remove the reticle holder **a**.
- 3 Insert the micrometer **b** in the removed reticle holder **a** with the display surface of the micrometer facing down.

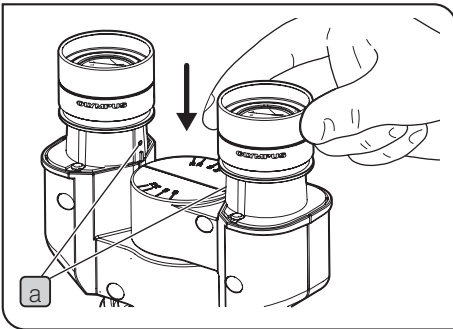
NOTE Be careful not to leave dirt on the eyepiece micrometer **a**, since it will be noticeable during observation.

- 4 Screw in the reticle holder **a** which includes the micrometer **b** to the bottom of the eyepiece.

NOTE Be sure to screw in the reticle holder **a** completely until it stops.

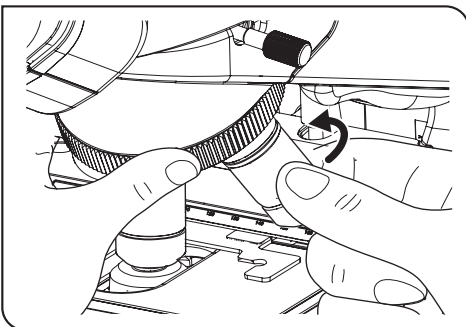
- 5 Attach the eyepieces to the tube, and tighten the clamping screws.

3 Attaching the eyepieces (Standard 10X eyepieces or WHSZ15X-H)



- 1 Insert WHC15X-H into the eyepiece sleeves and tighten the clamping screws **a** using the flathead screwdriver.

4 Attaching the objective CXPL20X or CXPL100XO



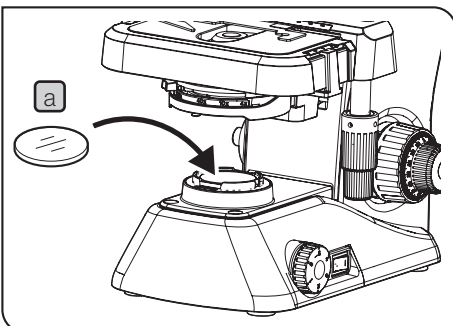
- 1 Screw in the objective to the mount hole of the revolving nosepiece completely by rotating in the arrow direction paying attention not to drop it.

Removing the objective

- 1 If the objective is screwed in too firmly, use the slip prevention rubber sheet, etc. to rotate the objective in the direction opposite to the attaching direction (arrow direction).

TIP When attaching the objective CXPL20X, remove the 40X objective first, and then attach in the order of 4X, 10X, 20X and 40X.

5 Attaching the filter of 45mm in diameter



If necessary, insert the filter **a** in the filter holder (window lens) at the base of the microscope frame.

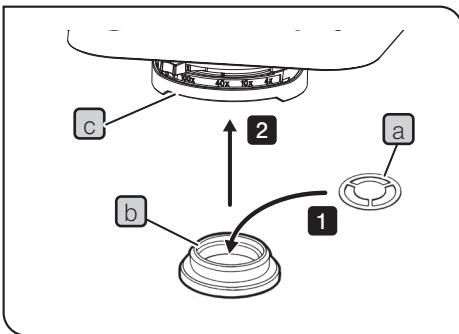
TIP One to several filters 45mm in diameter can be inserted in stack.

NOTE If the field diaphragm unit is attached, remove the field diaphragm unit first and then, insert the filter **a** into the filter holder (window lens).

6 Attaching the auxiliary lens unit and field diaphragm unit

For details, see page 16.

7 Attaching the filter holder CH2-FH and darkfield ring slit CH2-DS



- 1 Insert the darkfield ring slit CH2-DS (a) into the filter holder CH2-FH (b).

TIP

One filter of 32.5mm in diameter can be inserted to the filter holder in addition to the darkfield ring slit.

- 2 Push the filter holder (b) which includes the darkfield ring slit into the bottom of the condenser (c) until the click sound is heard.

NOTE

If the field diaphragm unit and the auxiliary lens unit are attached, remove the field diaphragm unit and the auxiliary lens unit first and then, push the filter holder (b) into the bottom of the condenser (c).

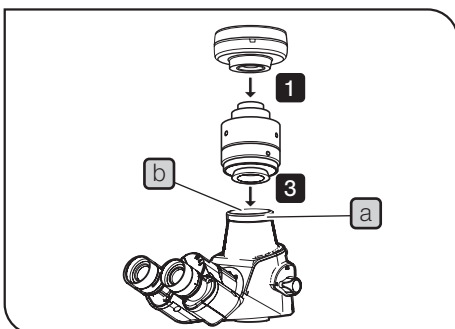
8 Attaching the camera adapter U-TV1XC and the camera

TIP

When attaching the camera adapter, also refer to the instruction manual of the camera adapter in use.

NOTE

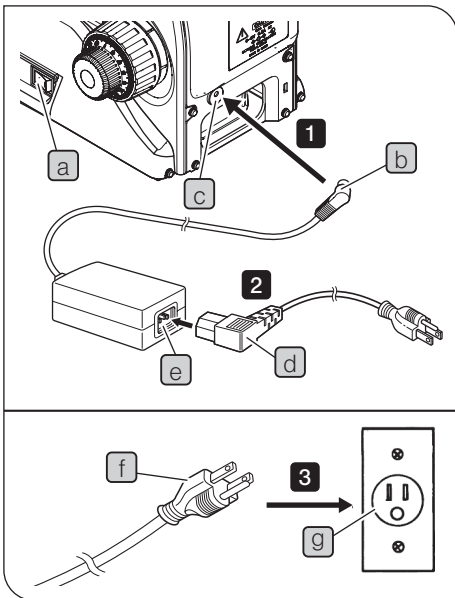
- Be sure to use the specified camera adapter and the camera. Using those not specified cannot ensure the stability of the microscope.
- When attaching the camera adapter, tighten the clamping screw by holding the short side of the Allen wrench. If you tighten the clamping screw by holding the long side of the Allen wrench too firmly, the camera adapter attaching part may be damaged.



- 1 Attach the camera to the camera adapter.
- 2 Loosen the clamping screws (a) of the camera adapter of the trinocular tube sufficiently using the provided allen wrench, and remove the cap (b).
- 3 Insert the camera adapter into the camera adapter attaching part of the trinocular tube.
- 4 Tighten the clamping screws (a) of the camera adapter completely.

9 Connecting the AC adapter and power cord

CAUTION • Always use the AC adapter and power cord provided by us. If the proper AC adapter and the power cord are not used, the electric safety and the EMC (Electro-Magnetic Compatibility) performance of the product cannot be assured. If no power cord is provided, please select the proper power cord by referring to the section “Proper selection of the power cord” at the end of this instruction manual.



NOTE • The power cord and AC adapter cord are vulnerable when bent or twisted. Never subject them to excessive force.
 • Be sure to set the main switch **a** to **○** (OFF) before connecting the AC adapter and the power cord.

1 Connect the output connector **b** of the AC adapter to the input connector **c** on the rear of the microscope.

NOTE Do not tilt the microscope to backward. Otherwise, the output connector **b** may be damaged.

2 Connect the connector portion **d** of the power cord to the connector **e** completely.

3 Connect the power cord's plug **f** to the power outlet **g** on the wall.

Storing the AC adapter and power cord

NOTE Be sure to set the main switch **a** to **○** (OFF) before storing the AC adapter and the power cord.

1 Disconnect the power cord's plug from the power outlet on the wall.

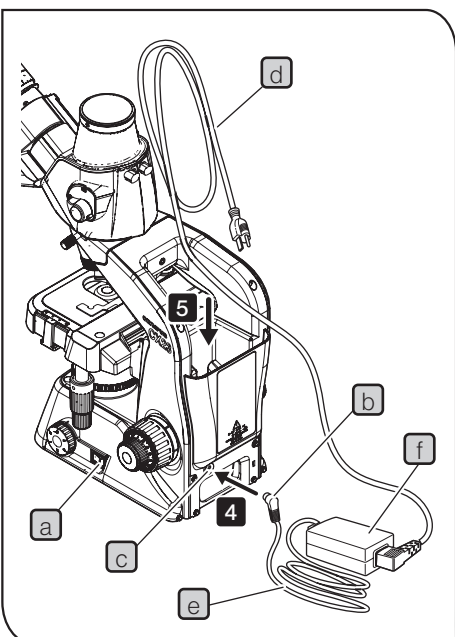
2 Disconnect the output connector **b** of the AC adapter from the input connector **c** on the rear of the microscope.

3 Bundle the AC adapter cord **e** as shown in the picture on the left and store it in the space at the bottom of the microscope together with the AC adapter **f**. In this case, remove the cable ties attached to the AC adapter cord **e**.

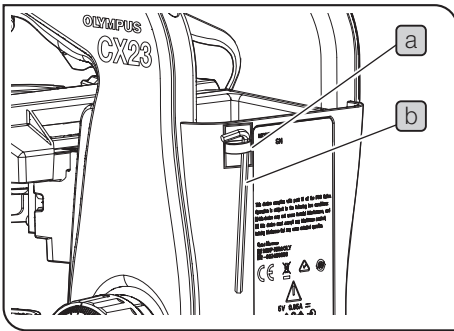
4 Store the AC adapter cord **e** and the AC adapter **f**, and then connect the output connector **b** of the AC adapter to the input connector **c**.

5 Bundle the power cord **d** and store it on the rear of the microscope.

TIP If using the Kensington lock, insert it to the microscope frame by making the AC adapter upside down.



10 Attaching the allen wrench holder



TIP

- It is recommended to attach the provided allen wrench holder **a** to the back of the microscope frame.
- The provided allen wrench **b** can be fixed to the provided allen wrench holder **a**.

■ Proper selection of the power supply cord

If no power supply cord is provided, please select the proper power supply cord for the equipment by referring to “Specifications” and “Certified Cord” below:

Caution : In case you use a non-approved power supply cord for our products, we can no longer warrant the electrical safety of the equipment.

Specifications

Voltage rating	125 V AC (for 100-120 V AC area) or, 250 V AC (for 220-240 V AC area)
Current rating	6 A minimum
Temperature rating	60 °C minimum
Length	3.05 m maximum
Fittings configuration	Grounding type attachment plug cap. Opposite terminates in molded-on IEC configuration appliance coupling.

Table 1 Certified cord

A 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 the agencies listed in Table 1. In case you are unable to buy locally the power supply cord which is approved by one of the agencies mentioned in Table 1, please use replacements approved by any other equivalent and authorized agencies in your country.




















Country	Agency	Certification mark	Country	Agency	Certification mark
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	JET	
Austria	ÖVE		Netherlands	KEMA	
Belgium	CEBEC		Norway	NEMKO	
Canada	CSA		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA BSI	
Germany	VDE		USA	UL	
Ireland	NSAI				

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 thread (Length of color section in mm)		
			Black	Red	Yellow
Comite Electrotechnique Belge (CEBEC)	CEBEC	<HAR>	10	30	10
Verband Deutscher Elektrotechniker (VDE) e.V. Prüfstelle	<VDE>	<HAR>	30	10	10
Union Technique de l'Electricite' (UTE)	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 Materielkontrollanstalter	SEMKO	<HAR>	10	10	50
Österreichischer Verband für 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 Materielkontroll (NEMKO)	NEMKO	<HAR>	10	10	70
Asociacion Electrotecnica Y Electronica Espanola (AEE)	<UNED>	<HAR>	30	10	70
Hellenic Organization for Standardization (ELOT)	ELOT	<HAR>	30	30	70
Instituto Portages da Qualidade (IPQ)	np	<HAR>	10	10	90
Schweizerischer Elektro Technischer Verein (SEV)	SEV	<HAR>	10	30	90
Elektriska Inspektoratet	SETI	<HAR>	10	30	90

Underwriters Laboratories Inc. (UL)
Canadian Standards Association (CSA)

SV, SVT, SJ or SJT, 3 X 18AWG
SV, SVT, SJ or SJT, 3 X 18AWG

10 Request to issue the Safety Confirmation

NOTE

To ensure operational safety of this product, the Safety Confirmation shown on the next page must be issued by the user when the user has this product maintained, repaired or serviced by Evident Corporation.

Since Evident is responsible for ensuring the safety of our distributors, maintenance personnel and personnel, we appreciate your cooperation in issuing the Safety Confirmation.

- The user must issue the Safety Confirmation each time this product is to be maintained, repaired or serviced by Evident.
- Copy the Safety Confirmation shown on the next page, fill it out, and submit it to Evident maintenance personnel.
- If the Safety Confirmation is not issued, we may not be able to provide maintenance, repairs or other services.
- If this product is contaminated, the user shall carry out decontamination work to the fullest extent possible prior to the arrival of our maintenance personnel.

Safety Confirmation when requesting repair/inspection

This safety confirmation is for asking you to fill out to ensure the health and safety of service personnel who pick up, repair, and/or inspect the products. Your cooperation would be highly appreciated.

Please note if the safety of service personnel cannot be ensured, your requests will not be accepted. Please check the applicable checkboxes and circle the applicable items shown in parentheses.

Date of request	
Request details	<input type="checkbox"/> Repair (Off-site / On-site) <input type="checkbox"/> Inspection (Off-site / On-site)
Product name	
Serial Number	
Biosafety level and Confirmation of disinfection/sterilization of product	<input type="checkbox"/> BSL1 <input type="checkbox"/> BSL2 <input type="checkbox"/> BSL3 <input type="checkbox"/> BSL4* <input type="checkbox"/> Not applicable <input type="checkbox"/> With my signature, I hereby confirm that this product has been disinfected/sterilized according to the disinfection/sterilization rules of our facility. <input type="checkbox"/> Disinfection/sterilization of this product has not been carried out. *We do not accept repairs/inspections of products used in the BSL4 environment.
Facility name	
Department	
Signature	
Contact details Telephone, E-mail, etc.	

Manufactured by



Evident Corporation

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Distributed by

EC REP

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UK Responsible Person

Evident Europe GmbH - UK Branch

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Evident Scientific, Inc.

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Evident Scientific Singapore PTE. LTD.

#04-04/05, 25 Ubi Rd 4, UBIX Singapore 408621

Evident Australia PTY LTD

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Life science solutions

Service Center



<https://www.olympus-lifescience.com/support/service/>

Official website



<https://www.olympus-lifescience.com>

Industrial solutions

Service Center



<https://www.olympus-ims.com/service-and-support/service-centers/>

Official website



<https://www.olympus-ims.com>