

INSTRUCTIONS

CX33

Biological Microscope



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: CX33RTFS2, CX33LTFS2

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, U.S.A.

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 - Light from the objective -

Do not look directly at the light coming out from the objective or the light reflected from the specimen.

Be careful about the light coming out from the objective, since not only visible light but also light of invisible wavelengths (such as ultraviolet and infrared) may be emitted depending on the illumination methods.

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 before continuing the 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.

Connect the ground terminal of the power cord and that of the power outlet. 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.

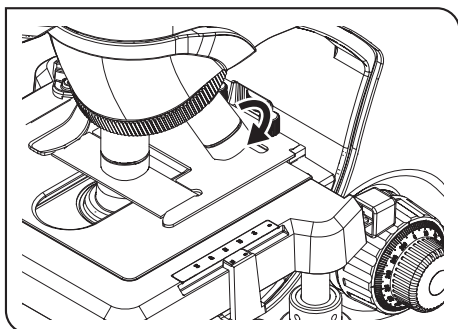
CAUTION - Safety symbols -

The following symbols are attached to the product.

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

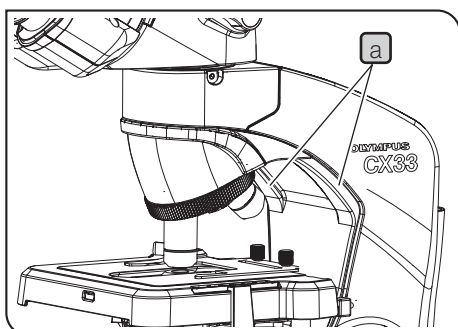
Symbol	Meaning
	Indicates a non-specific general hazard. Follow the description given after this symbol or in the instruction manual.
	Indicates that the main switch is ON.
	Indicates that the main switch is OFF.

Handling precautions

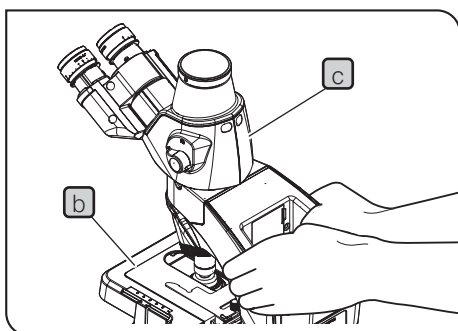

NOTE

- 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. Then, hold both sides of the arm **a** as shown in the picture on the left, and carry it carefully. (For procedures to store the AC adapter and the power cord, see "Storing the AC adapter and power cord" on page 32.)


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 and filters in advance, since they are in a risk of falling. Also, be careful not to touch the objective.
- 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.



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.



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.



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.

4. 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.



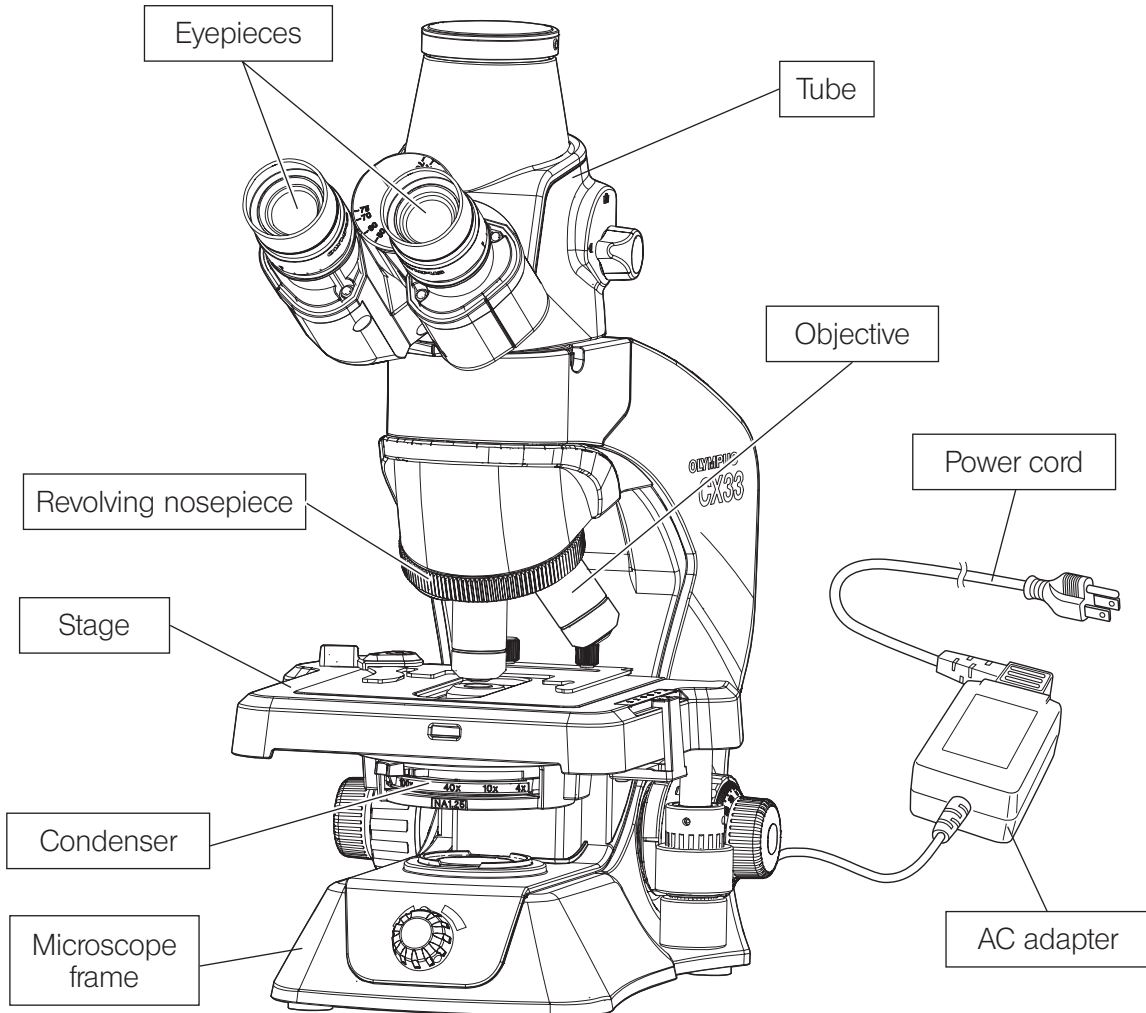
This product complies with the requirements of Regulation (EU) 2017/746 and The Medical Device (Amendment etc.) (EU Exit) Regulation 2020 concerning in vitro diagnostic medical devices. CE marking means the conformity to the former, and UKCA marking means the conformity to the latter.

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

This product complies with the emission and immunity requirements described in IEC61326 series. The electromagnetic environment should be evaluated prior to operation of this product.

1 Standard combination

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



Option units

- Eyepiece (2 pieces)
WHSZ15X-H



- Filter holder
CH2-FH

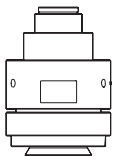


- Darkfield ring
CH2-DS

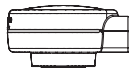


- 20X objective
100X objective
- Eyepiece micrometer
(Ø24mm, Thickness: 1.5mm)
- Ø45mm filter

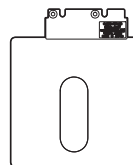
- Camera adapter
U-TV1xC



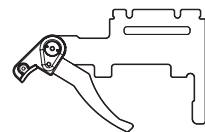
- Camera
DP22 or DP27



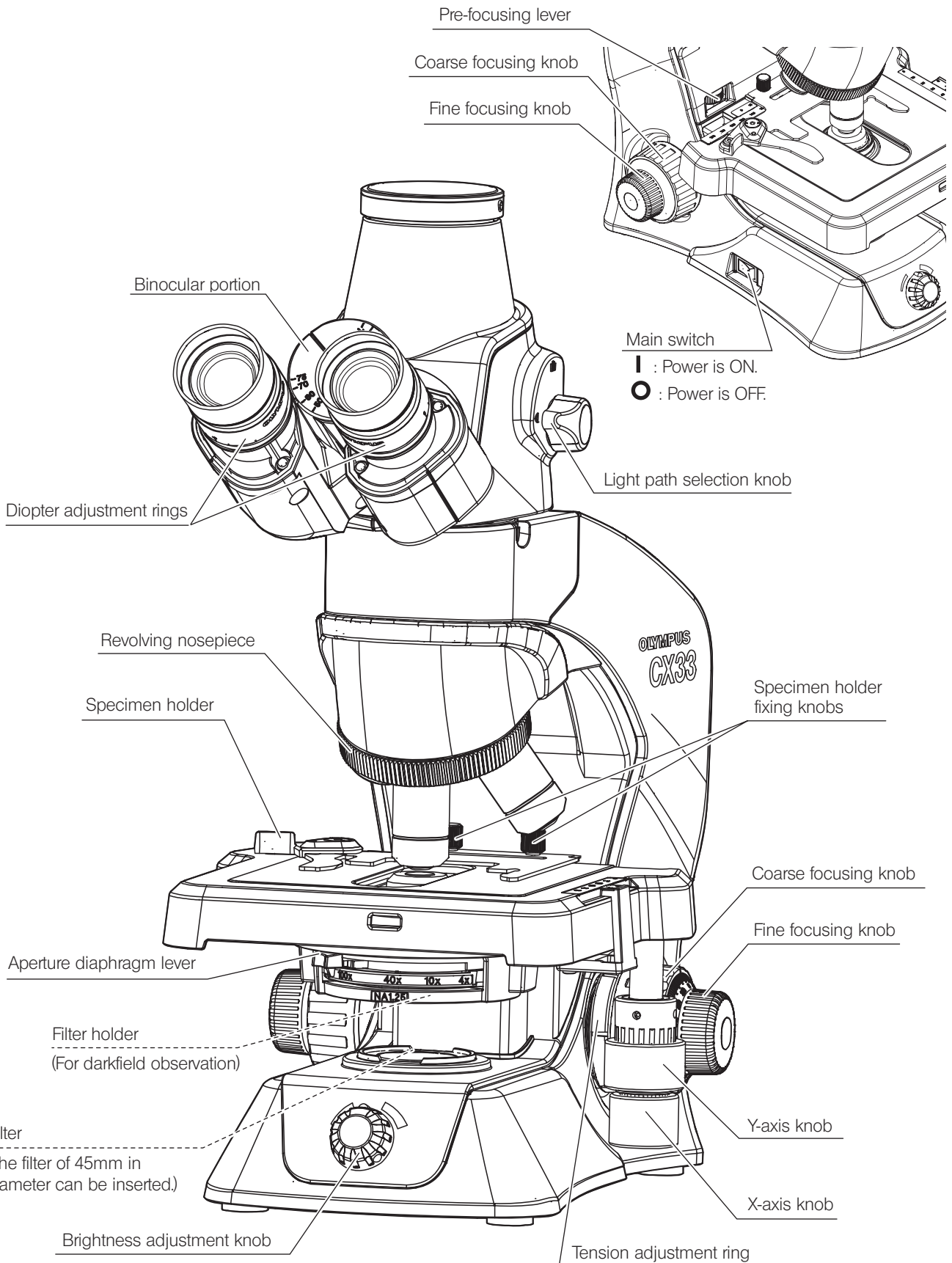
- Specimen hold plate
CX3-SHP



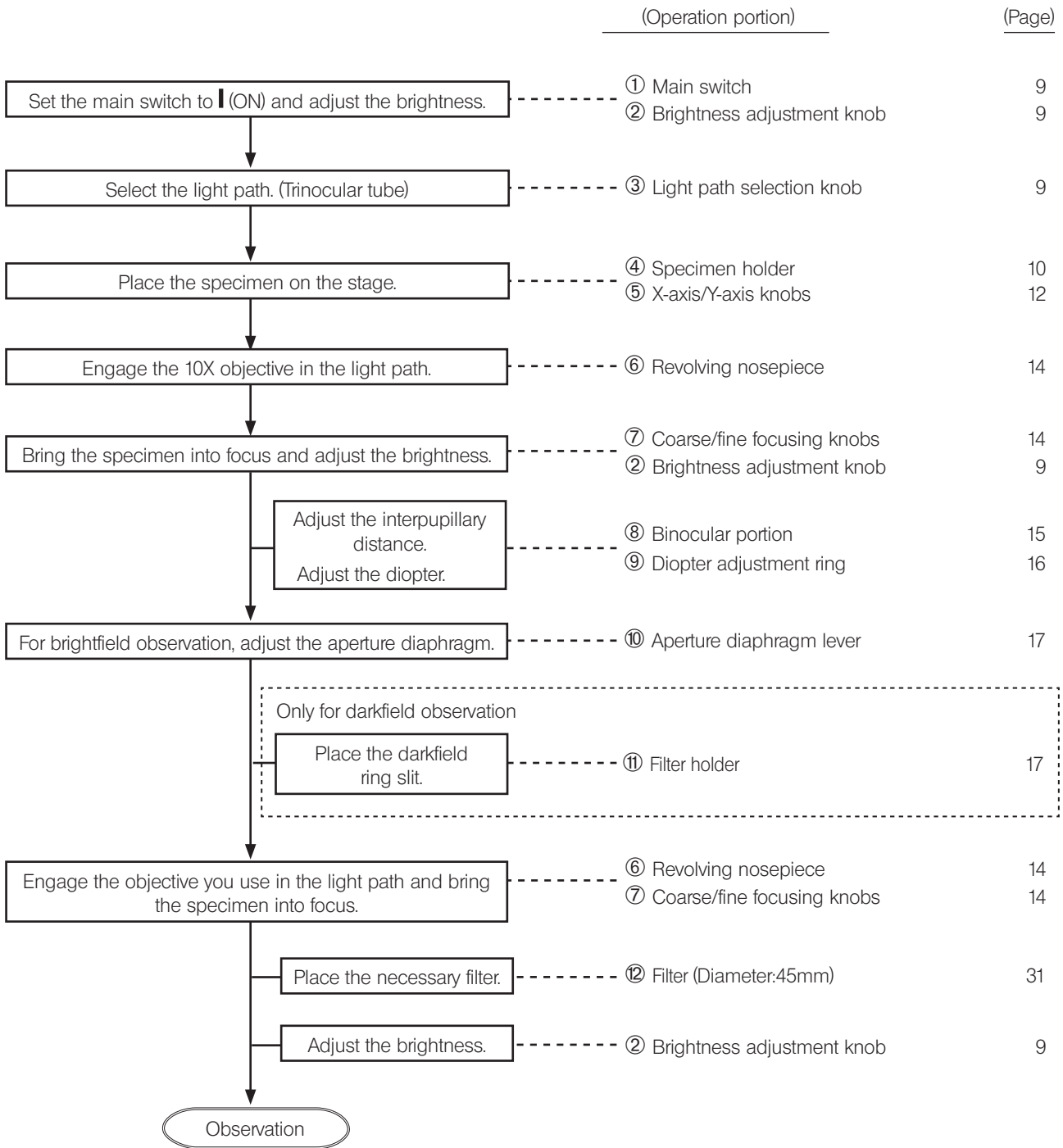
- Specimen holder
CX3-HLDT

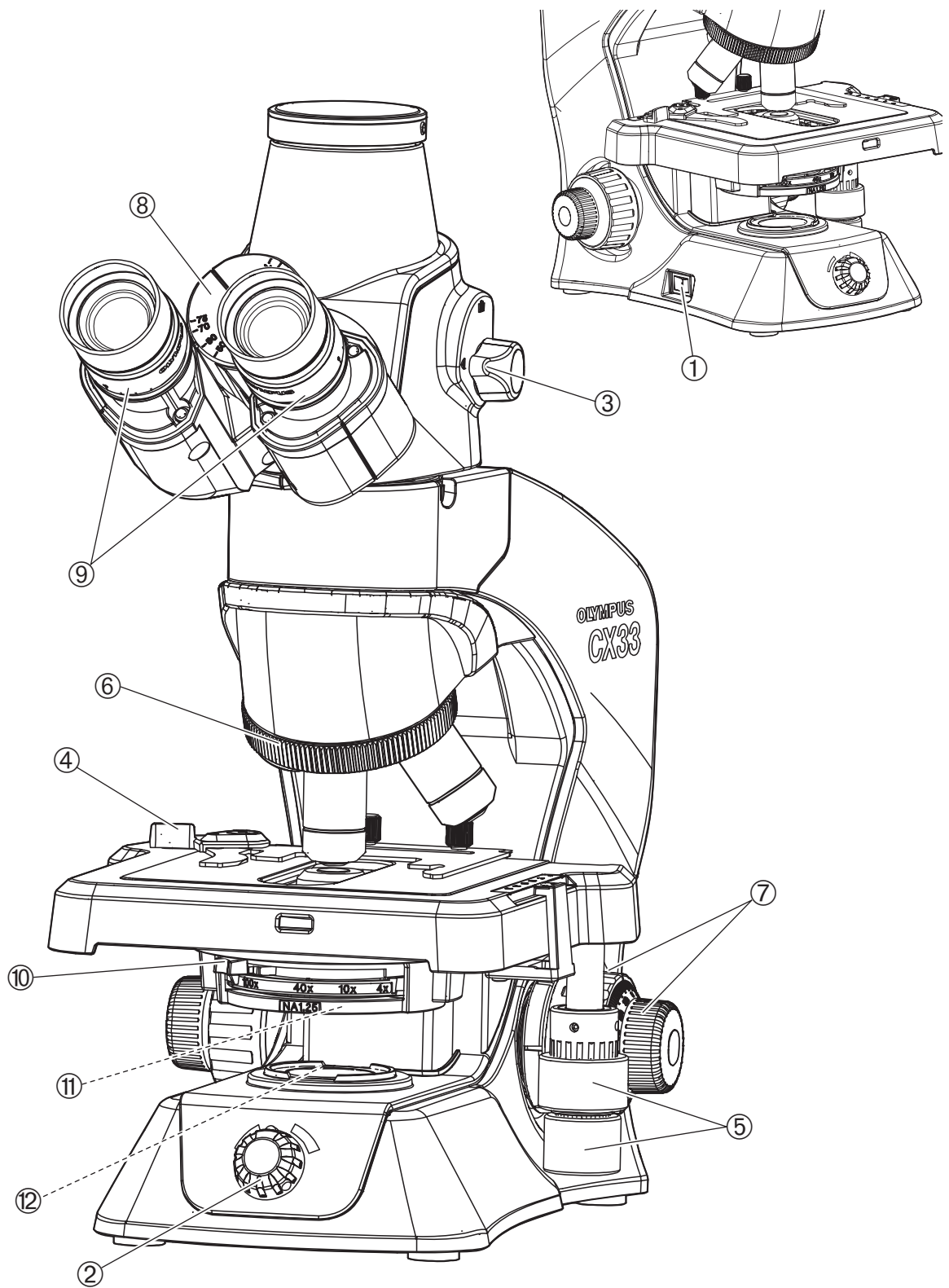


2 Nomenclature of operating portions



3 Outline of brightfield/darkfield observation methods

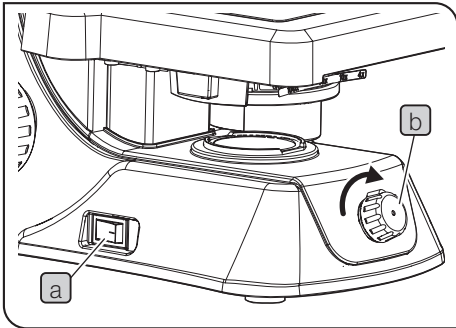




TIP Make a copy of this observation procedure guide and put it near the microscope to use for observation.

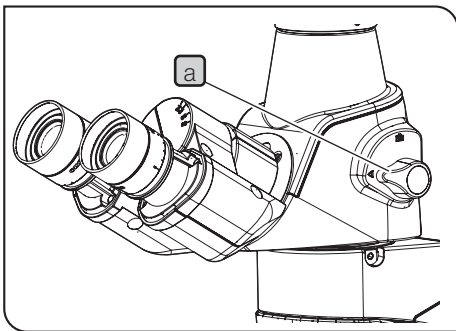
4 Observation procedures

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.

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

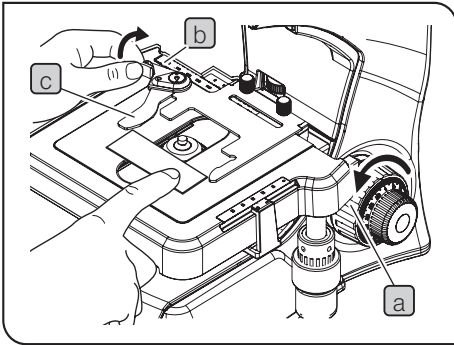
 : Camera

NOTE

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

3 Placing the specimen

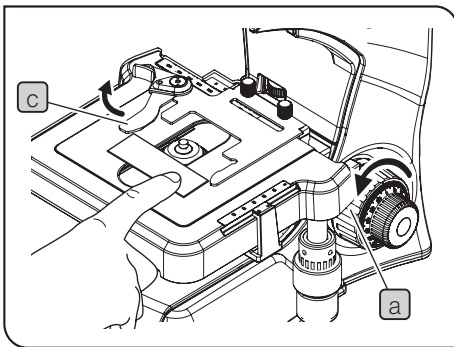
Specimen holder for observing one specimen



- 1 Rotate the coarse focusing knob **a** in the arrow direction to fully lower the stage.
- 2 Press the specimen holding lever knob **b** backward (arrow direction) to open the lever **c**, and slide the specimen from front to back on the stage to place it.
- 3 After placing the specimen, return the specimen holding lever **c** gently.

NOTE Place the specimen carefully. If you return the specimen holding lever **c** with excess force or release your hand from the specimen holding lever knob **b** in the middle, the lever may collide with the specimen to damage it.

Placing the specimen with one hand



- 1 Rotate the coarse focusing knob **a** in the arrow direction to fully lower the stage.
- 2 Place the specimen on the front side of the stage.
- 3 Spread the specimen holding lever **c** at the edge of the specimen as shown in the picture on the left, and slide the specimen from front to back on the stage to place it.

TIP For procedures to attach the specimen holder (option), see page 30.

When using the specimen hold plate CX3-SHP

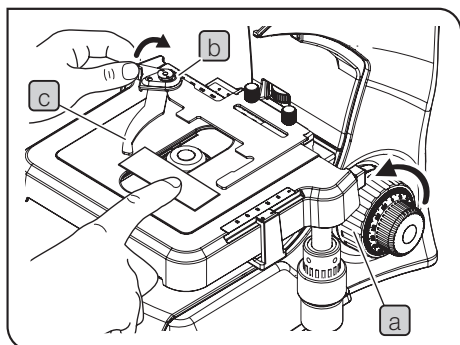
(Option)

- 1 Rotate the coarse focusing knob **a** in the arrow direction to fully lower the stage.
- 2 Place the specimen on the resin sheet **b**.

NOTE

- The outside of the aperture **c** of the resin sheet is not illuminated by the light from the condenser, the specimen cannot be observed. When operating the X-axis knob, be careful not to cover the aperture of the stage with the resin sheet.
- The specimen hold plate cannot be used in combination with the 100X oil immersion objective because the optical performances cannot be delivered sufficiently during observation using the 100X oil immersion objective.
- The specimen hold plate cannot be used for the darkfield observation because the shadow appears in the center of the field of view during darkfield observation.

TIP For fixing the stage, see page 13.



When using the specimen holder CX3-HLDT

(Option)

- 1 Rotate the coarse focusing knob **a** in the arrow direction to fully lower the stage.
- 2 Press the specimen holding lever knob **b** backward (arrow direction) to open the lever **c**, and slide the specimen from front to back on the stage to place it.
- 3 After placing the first specimen until it touches the end, place the second specimen so that it touches the first specimen.
- 4 After placing the specimens, return the specimen holding lever **c** gently.

NOTE

Place the specimen carefully. If you return the specimen holding lever **c** with excess force or release your hand from the specimen holding lever knob **b** in the middle, the lever may collide with the slide glass to damage it.

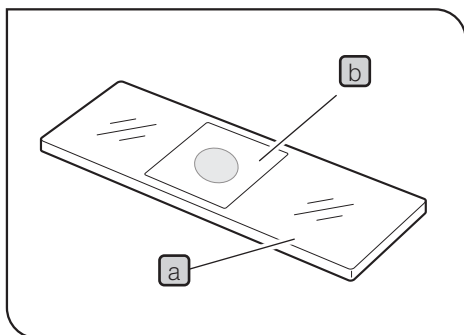
Slide glass

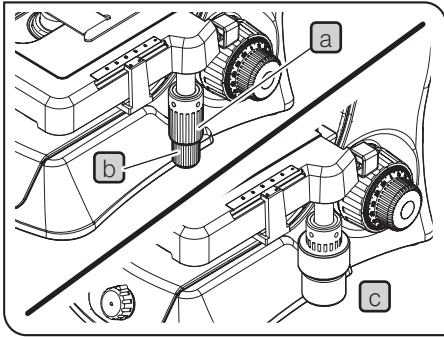
It is recommended to use the following slide glasses **a**.

Length: 76 mm, Width: 26 mm, Thickness: 0.9 to 1.4 mm
(Thickness: 0.9 to 1.2 mm for darkfield observation)

NOTE

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





Moving the specimen

- Rotating the upper Y-axis knob **a** moves the specimen in the Y-axis direction (front and back).
- Rotating the lower X-axis knob **b** moves the specimen in the X-axis direction (right and left).

Stage movable range: Depth 52 mm x Width 76 mm

NOTE

- Do not move the specimen by touching the specimen holder directly by hand, since it will damage the rotary mechanism of the knobs.
- The rotation torque of X-axis and Y-axis knobs become heavier near the end of movable range of X-axis and Y-axis. In this case, stop rotating the knob.

TIP

- If the stage knob rubber **c** is attached and it is difficult to operate the stage, remove the stage knob rubber. If you want to change the height of the stage knob rubber, move the stage knob rubber up and down to adjust it.
- When attaching the stage knob rubber, insert the larger one to the Y-axis knob (upper side) and the smaller one to the X-axis knob (lower side) from below.

Scale of specimen position

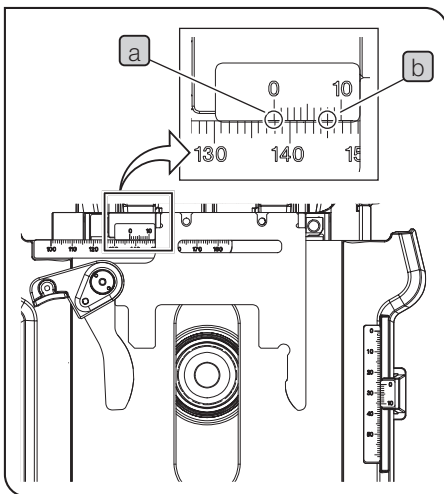
By reading and taking a note of X-axis and Y-axis scales of the observation position on the specimen, you can return to the original observation position easily even if the specimen is moved.

< Reading the scale >

- 1 Read the "0" position of the outside scale (vernier scale) by the inside scale (main scale). [**a**]
The scale indicates the unit of 1 mm.
- 2 Read the position where the outside scale line coincides with the inside scale line by the outside scale (vernier scale). [**b**]
The scale indicates the unit of 0.1 mm.

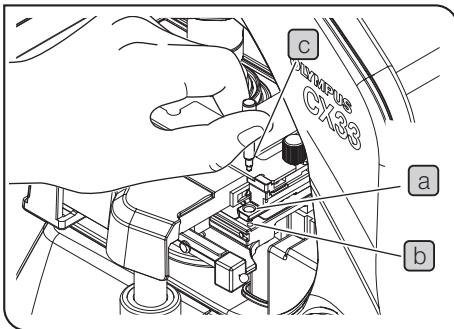
TIP

The position shown in the left picture can be read as 1378 mm.



Fixing the stage

If you want to move the observation position by moving the specimen with your finger without using the specimen holder, the stage can be fixed so that it does not move unexpectedly.

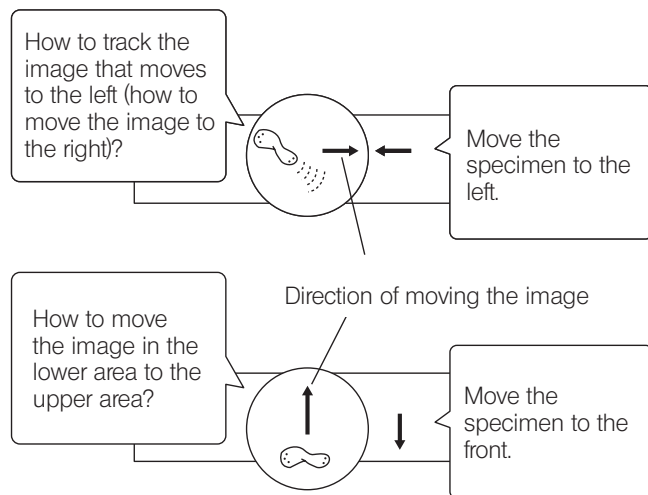


- 1 Move the X-axis/Y-axis knobs to match the hole **a** at the back right of the stage with the screw hole **b**.
- 2 Put the stage fixing knob **c** through the hole **a**, and screw it in the screw hole **b** to fix the stage.

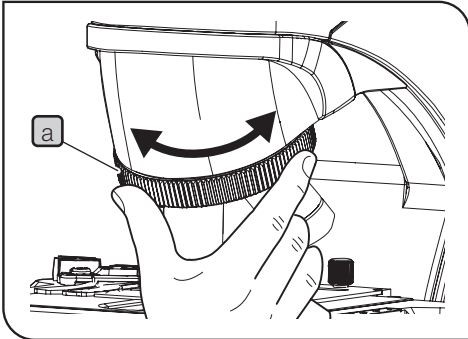
NOTE The stage fixing knob is provided with the microscope. Be sure to store the stage fixing knob in the safe place.

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.



4 Selecting the objective



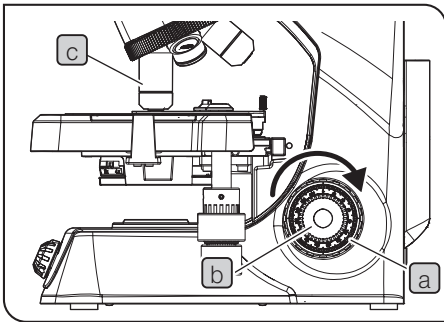
- 1 Hold the revolving nosepiece **a** and rotate it so that the intended objective comes exactly above the specimen.

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 slide glass 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 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.

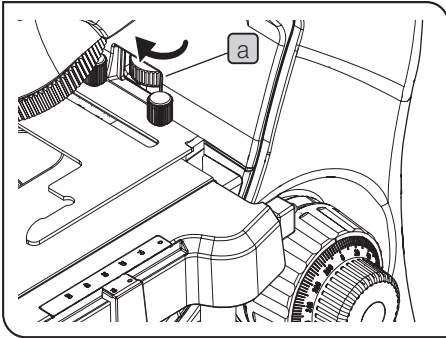
Adjusting the tension of the coarse focusing knob

The tension of the coarse focusing knob can be adjusted. Insert a commercially-available flathead screwdriver into the groove **c** of the tension adjustment ring. Rotating it clockwise (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 from being damaged by collision between the specimen and objective.



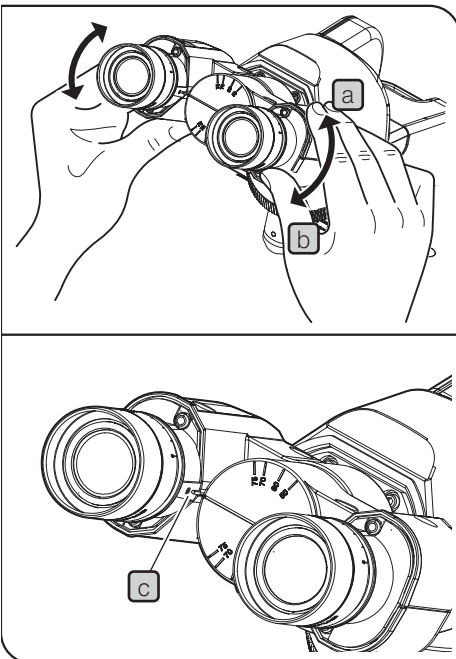
- 1 After bringing the specimen into focus with the high magnification objective, rotate the pre-focusing lever **a** in the arrow direction until it stops.
- 2 To provide a certain margin for focusing range, rotate the pre-focusing lever **a** by about half turn in the direction opposite to the arrow direction 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 to prevent the specimen from damage, but if you do not use the pre-focusing lever, rotate the pre-focusing lever in the direction opposite to the arrow direction until it stops.

6 Adjusting the interpupillary distance



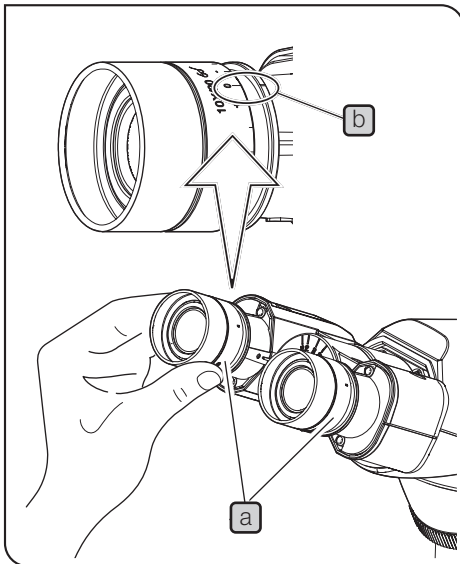
The interpupillary distance adjustment is to adjust the distance between two eyepieces according to the distance between your eyes. This makes it possible to observe a single image and to reduce eye strain during observation.

- 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, and check that the specimen is in focus by looking through the right and left eyepieces.

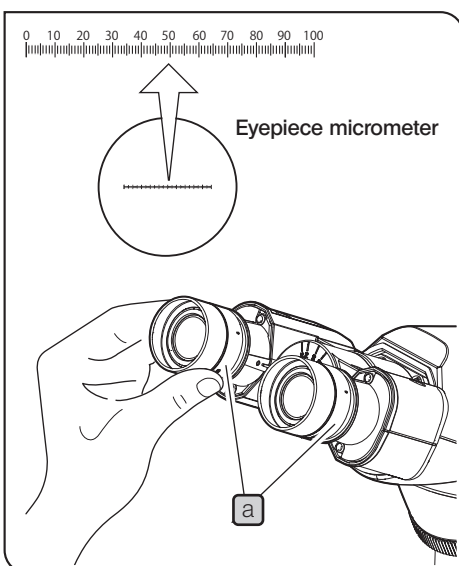
TIP

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

When the eyepiece micrometer is attached to the eyepiece

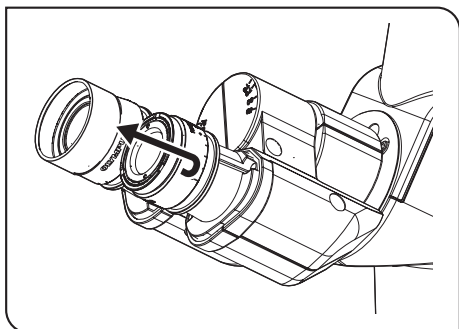
TIP

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.

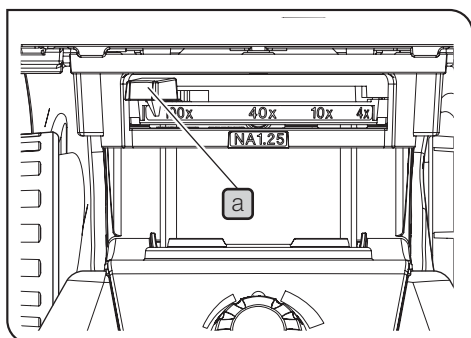
When not wearing eyeglasses

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 aperture diaphragm (AS)

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

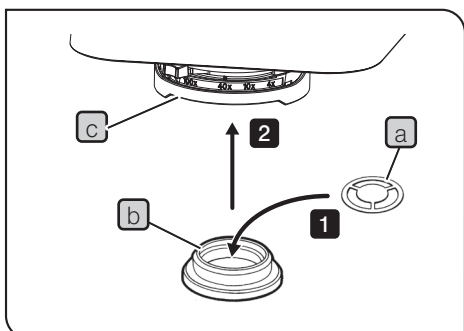
Adjusting the numerical aperture of the condenser appropriately with respect to the numerical aperture of each objective allows you to observe the specimen with the best contrast and resolution. (For the aperture diaphragm, see page 22.)



- 1 Move the aperture diaphragm lever **a** to right and left direction to match the index with the magnification of the objective in use.

NOTE For darkfield observation, open the aperture diaphragm.

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



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

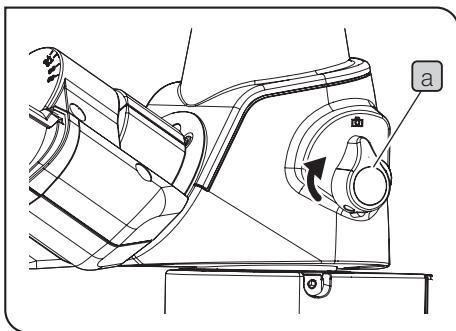
- 1 Insert the darkfield ring CH2-DS **a** into the filter holder CH2-FH **b**.
- 2 Push the filter holder **b** which includes the darkfield ring into the bottom of the condenser **c** until the click sound is heard.


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

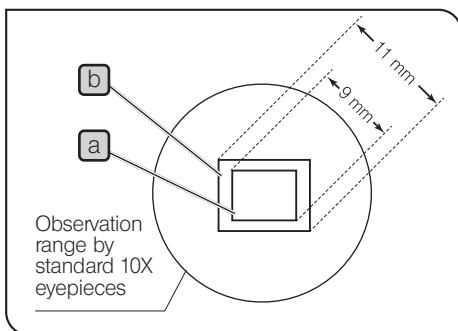
10 Acquiring the image with the camera

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 focused at the same position. 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. (See page 9.)



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.

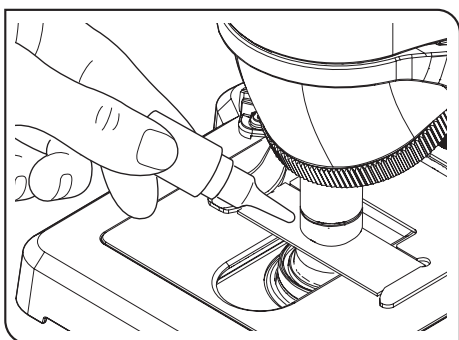
a Digital camera for microscope (DP22)
Image sensor size (diagonal): 1/1.8-inch (9mm)

b Digital camera for microscope (DP27)
Image sensor size (diagonal): 2/3-inch (11mm)

11 Using the 100X oil immersion objective

NOTE

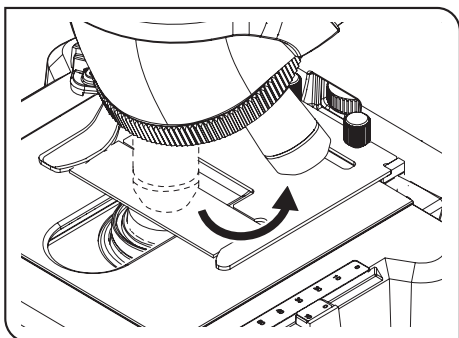
- Apply the immersion oil specified by us to the tip of the 100X oil immersion objective. Otherwise, the observed image is not in focus.
- Always use the immersion oil provided by us. Using the immersion oil which is not provided by us cannot deliver the intended optical performance.



- 1 Apply the immersion oil on the observation position of the specimen before engaging the 100X oil immersion objective into the light path.

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.



- 2 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.

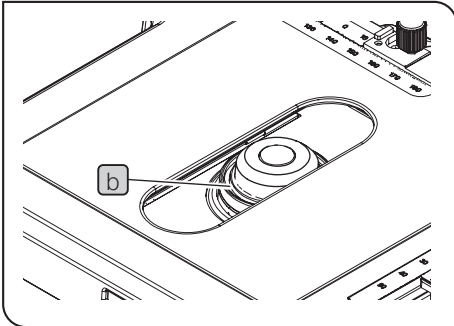
NOTE

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.

- 3 After use, lower the stage and rotate the revolving nosepiece, and remove the objective attached with the immersion oil from the specimen.
- 4 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 in the same procedures.



NOTE

- If you leave the immersion oil without wiping it off, the oil may be adhered to cause the incorrect observation.
- The oil pan **b** can temporarily store the immersion oil flowed down from the condenser lens. Clean the oil pan regularly to prevent the immersion oil from overflow.
- If the immersion oil is overflowed from the oil pan **b**, wipe off the immersion oil with the cleaning paper or the gauze slightly moistened with absolute alcohol. If the immersion oil is in the unreachable area, use the tweezers to pick up the cleaning paper or the gauze and wipe off the immersion oil.

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

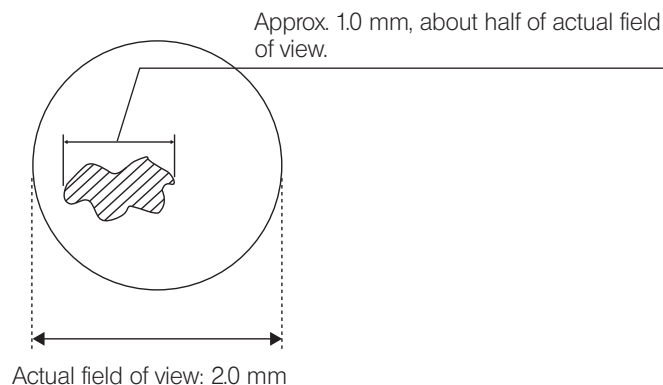
Actual field of view

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,

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



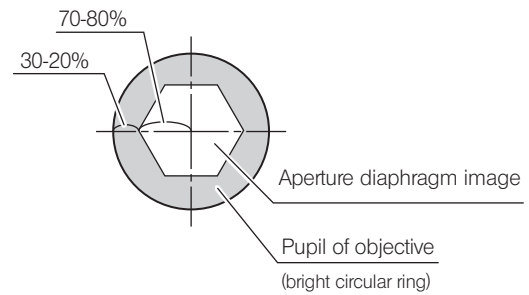
Aperture diaphragm

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 for 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 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.	14
	The objective, eyepiece, condenser, window lens or/and specimen are dirty.	Clean them thoroughly.	4
2. Dust or stains are visible in the observed field of view.	The objective, eyepiece, condenser, window lens or/and specimen are dirty.	Clean them thoroughly.	4
3. The observed image glares.	The aperture diaphragm is narrowed down too far.	Move the knob position of aperture diaphragm lever to the position of the same magnification as the magnification of the objective in use.	17
4. 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.	14
	The objective, eyepiece, condenser, window lens or/and specimen are dirty.	Clean them thoroughly.	4
	The immersion oil is not used with an oil immersion objective.	Use the immersion oil.	19
	The immersion oil contains bubbles.	Remove the air bubbles.	19
	The specified immersion oil is not used.	Use the immersion oil provided by us.	19
5. 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.	14
	The specimen is not placed on the stage properly.	Place the specimen on the stage properly and secure it using the specimen holder	10
6. The high magnification objective collides with the specimen before the specimen comes into focus.	The specimen is placed upside down.	Place the specimen with the cover glass side facing up.	10
7. 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.	14
8. The specimen is not in focus. (The stage cannot be raised.)	The pre-focusing lever is positioned too low.	Raise its position.	15

Problem	Cause	Remedy	Page
9. 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.	Tighten the tension adjustment ring to get proper tension.	14
10. The field of view is not matched between two eyes.	The interpupillary distance is not adjusted correctly.	Adjust it correctly.	15
	The difference in diopter of two eyes is not corrected properly.	Correct it properly.	16
	Different eyepieces are used for right side and left side.	Use the same eyepiece for right side and left side.	29
11. When changing the objective from lower magnification to higher magnification, the objective collides with the specimen.	The specimen is placed upside down.	Place the specimen with the cover glass side facing up.	10
	The cover glass is too thick.	Use a cover glass with thickness of 0.17 mm.	10
12. The LED illumination does not light.	The AC adapter or power cord is disconnected.	Connect the power cord to a power outlet securely.	32
13. When changing the magnification, the specimen is defocused significantly.	The diopter is incorrect.	Adjust the diopter of eyepieces correctly.	16

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 CX33RTFS2)

Product number

Phenomena

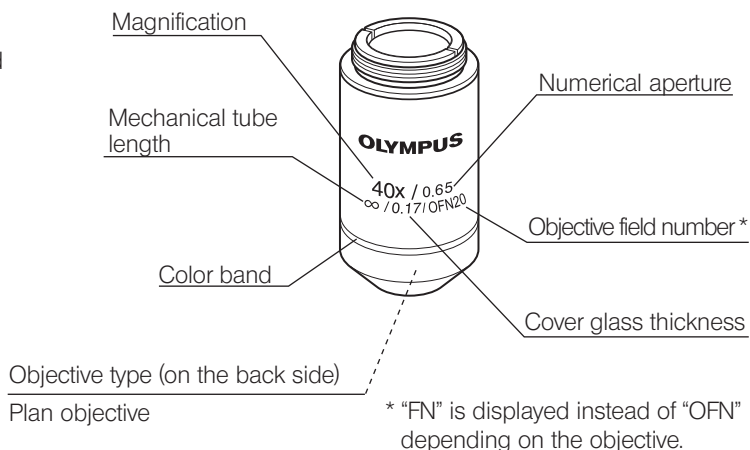
7 Specifications

Item	Specification		
Optical system	Infinity optical system		
Microscope frame	CX33RTFS2 / CX33LTFS2		
Illumination system	Built-in LED light source Microscope frame (rated input power): 5 V 0.85 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 (Upward by 1.5 mm and downward by 13.5mm from focal position) Equipped with pre-focusing lever; Tension adjustable coarse focusing knob		
Revolving nosepiece	Fixed 4-hole revolving nosepiece		
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: 52mm	
	Specimen holder	CX33LTFS2	CX33RTFS2
		Possible to hold 2 slide glasses	Possible to hold 1 slide glass
Option	CX3-SHP (Specimen hold plate)	CX3-SHP (Specimen hold plate) CX3-HLDT (Specimen holder)	
Condenser	Model type	Abbe condenser	
	Numerical aperture	1.25 (when immersed with oil)	
	Aperture diaphragm	Illumination aperture diaphragm blade, manual open/close type	
Dimension / Weight	211 (W) x 390 (D) x 430 (H) mm / Approx. 7.0 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	278	-	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	

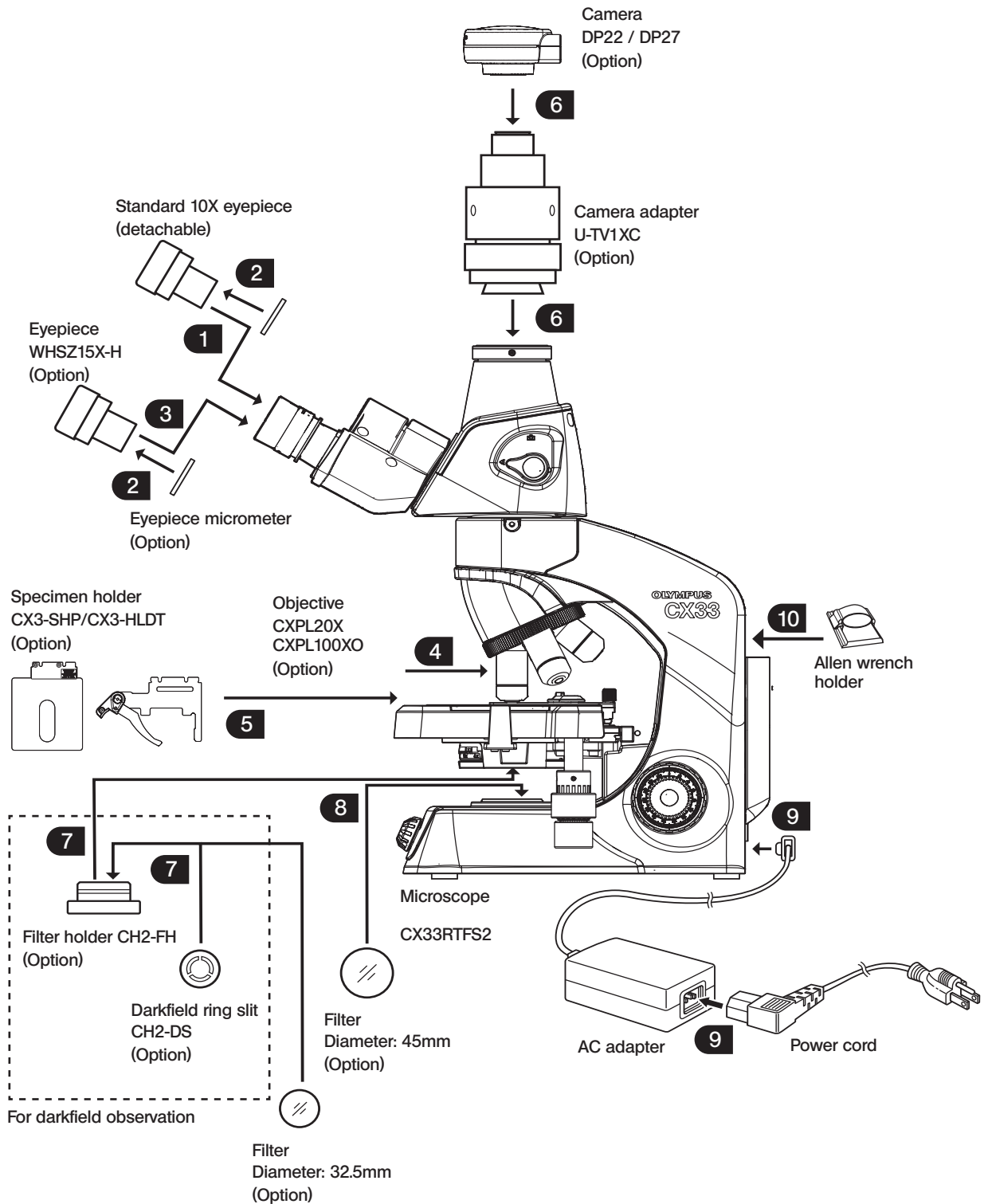
Glossary

- 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.
- 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.
- Total magnification:** Magnification of objective x Magnification of eyepiece
- 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.

9 Assembly

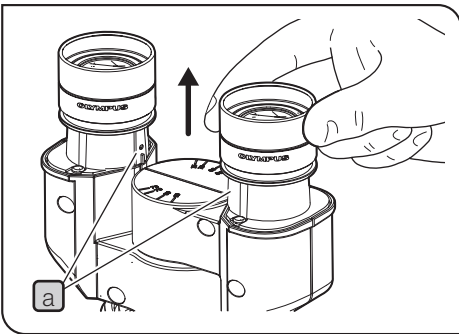
9-1 Assembly diagram

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

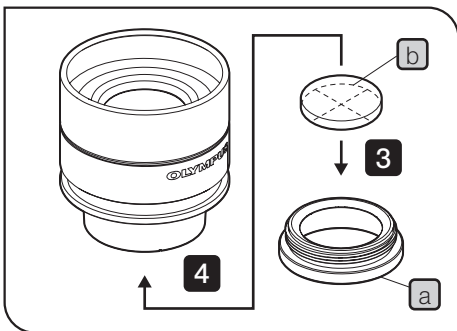


TIP The standard 10X eyepieces are clamped with screws.

- 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 The size of the eyepiece micrometer which can be attached to eyepieces of this product is 24 mm in diameter and 1.5mm in thickness.



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

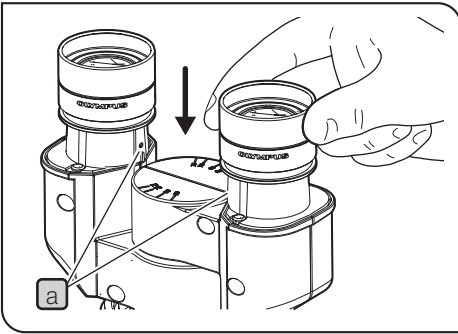
NOTE Be careful not to leave dirt on the eyepiece micrometer **b**, since it will be noticeable during observation.

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

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

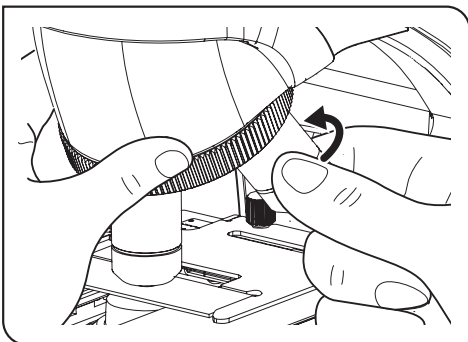
- 5 Attach the eyepieces to the tube, and tighten the clamping screws.

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 it in the arrow direction paying attention not to drop it.

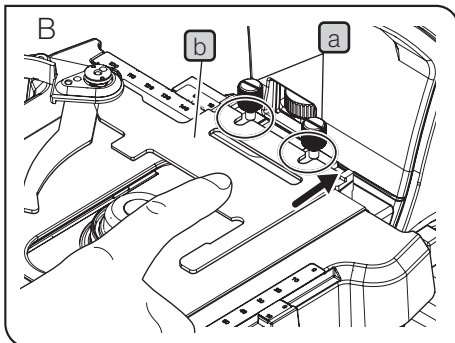
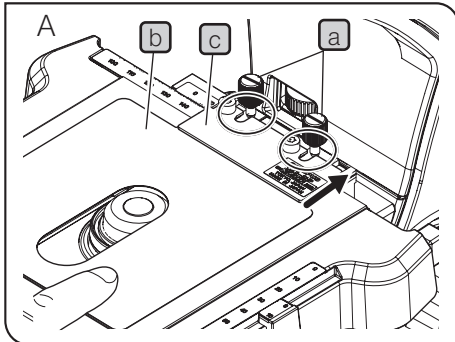
Removing the objective

- 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 objectives in the order of 4X, 10X, 20X and 40X.

5 Attaching the specimen holder CX3-SHP or CX3-HLDT



- 1 Rotate the coarse focusing knob to fully lower the stage.
- 2 Loosen the specimen holder fixing knob **a** (2 pcs.) of the stage plate and remove the standard specimen holder by pulling it toward front side.

TIP You can also loosen the specimen holder fixing knob **a** by inserting the coin into the groove of the specimen holder fixing knob **a** and rotating it in counterclockwise direction.

- 3 **When using the specimen hold plate CX3-SHP**
Put the metal plate **c** over the resin sheet (one sheet only) **b** by matching respective U-shape grooves, and engage U-shape grooves to the screws **a**. (Picture A shown on the left)

TIP Be sure to peel off the protection sticker attached to both surfaces of the resin sheet **b** before use.

When using the specimen holder CX3-HLDT

Insert the U-shape groove of the specimen holder **b** in the specimen holder fixing knob **a**. (Picture B shown on the left)

- 4 While pushing the specimen holder toward the back (arrow direction), tighten the specimen holder fixing knob **a** (2 pcs.).

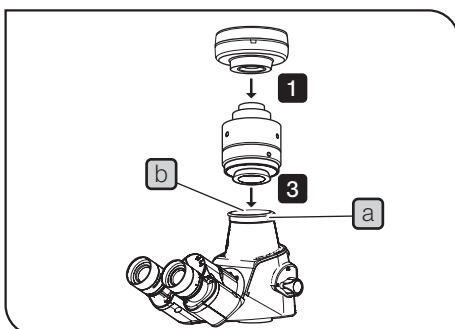
TIP You can also tighten the specimen holder fixing knob **a** by inserting the coin into the groove of the specimen holder fixing knob **a** and rotating it in clockwise direction.

6 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.

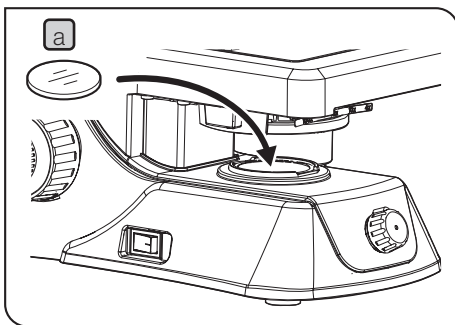


- 1 Attach the camera to the camera adapter.
- 2 Loosen the clamping screws **a** of the camera adapter of the trinocular tube sufficiently using the provided allen wrench, and remove the cap **b**.
- 3 Insert the camera adapter into the camera adapter attaching part of the trinocular tube.
- 4 Tighten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

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

For details, see page 17.

8 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 of 45mm in diameter can be inserted in stack (Insertable thickness: up to 1.6mm)

NOTE

If it is difficult to attach the filter due to the narrow space, rotate the coarse focusing knob to raise the stage.

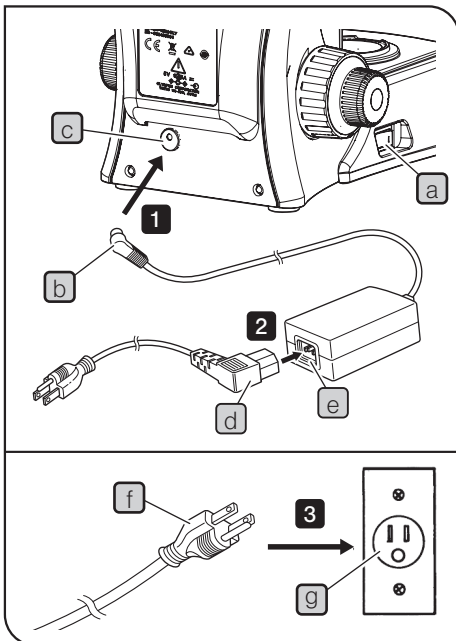
9

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.

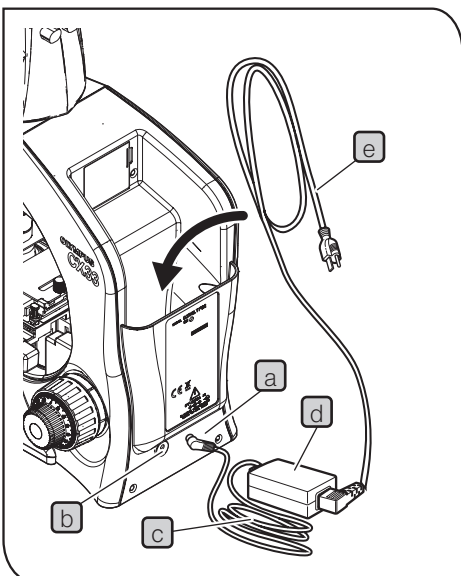
Storing the AC adapter and power cord

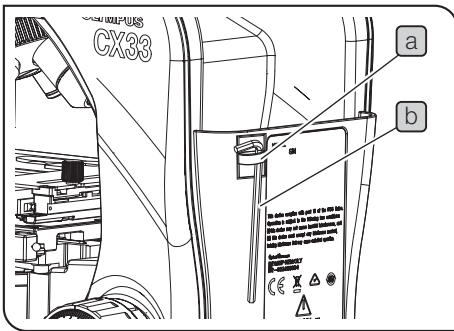
NOTE Be sure to set the main switch to **○** (OFF) before storing the AC adapter and the power cord.

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

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

3 Bundle the AC adapter cord **c** and store it at the back of the microscope together with the AC adapter **d** and the power cord **e**.



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.
















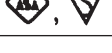



Country	Agency	Certification mark	Country	Agency	Certification mark
Argentina	IRAM		Italy	IMQ	
Australia	SAA		Japan	JET	
Austria	ÖVE		Netherlands	KEMA	
Belgium	CEBEC		Norway	NEMKO	
Canada	CSA		Spain	AEE	
Denmark	DEMKO		Sweden	SEMKO	
Finland	FEI		Switzerland	SEV	
France	UTE		United Kingdom	ASTA BSI	
Germany	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 Materiekkontroll (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
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6666 Inatomi, Tatsuno-machi, Kamiina-gun, Nagano 399-0495, Japan

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Caffamacherreihe 8-10, 20355 Hamburg, Germany



EVIDENT EUROPE GmbH UK Branch

Part 2nd Floor Part A, Endeavour House, Coopers End Road, Stansted CM24 1AL, U.K.

EVIDENT SCIENTIFIC, INC.

48 Woerd Ave Waltham, MA 02453, U.S.A.

EVIDENT AUSTRALIA PTY LTD

97 Waterloo Road, Macquarie Park, NSW 2113, Australia

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