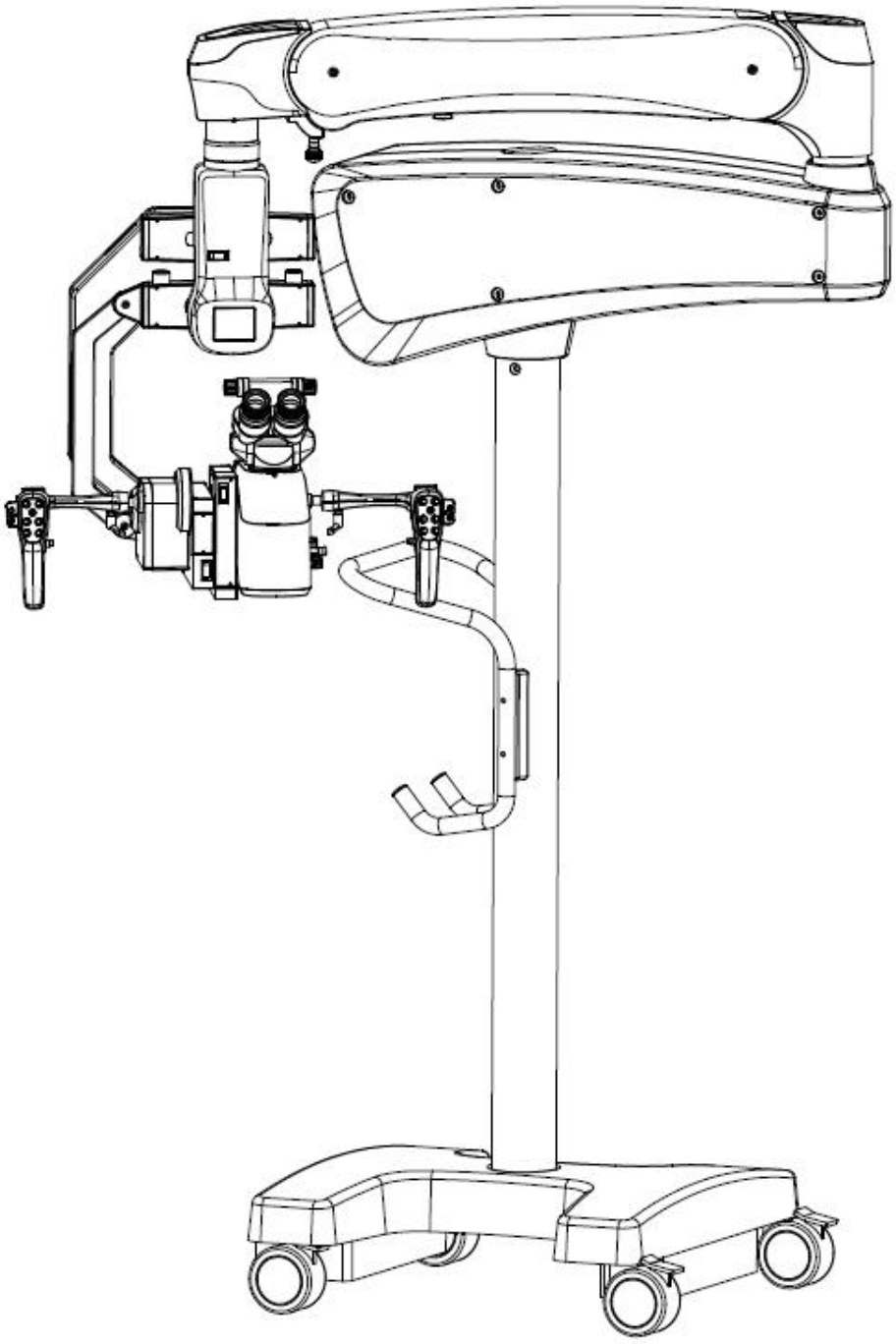
zumax

OMS3500 Max
USER MANUAL



CE The CE mark indicates that the product complies with the European medical device regulation (EU) 2017/745

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Contents

1 Safety Information

1.1 Intended use

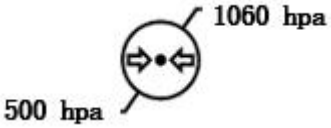
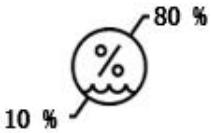
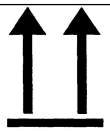
The surgical microscope is applicable to the microsurgery and fine examination of the clinical subjects .

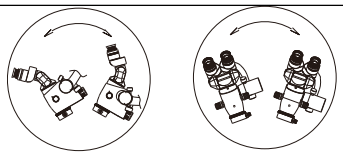
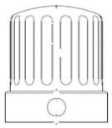
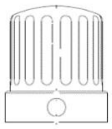
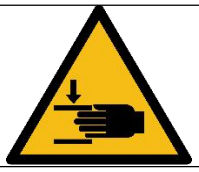
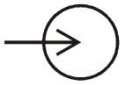
1.2 Precautions

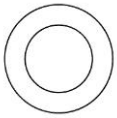
1、Do not use this device in an environment prone to fire or an environment with dust, airborne debris or with high temperatures. Use it in a clean and dry indoor setting only.
2、Check that all the wires are correctly and firmly connected before using. Ensure that the instrument is well grounded.
3、Please pay attention to all the rated electrical values of any connecting terminal.
4、Only use fuse according to the specifications and rated values stipulated by our product.
5、Use the power cable supplied with this instrument only.
6、Do not touch the surface of the lens and prism by bare hand or with solid objects that may damage the surface.
7、Turn off the main power first before replacing the illumination bulb and fuse.
8、To prevent the instrument from falling or tipping over, the instrument should be placed on a floor where the inclination angle is less than 10º.
9、Turn off the power and cover the instrument with dust-proof hood when it is not in use.
10、In case there is any trouble, please first refer to the trouble-shooting guide. If it still cannot be resolved, please contact the authorized distributor or our After-sales Service Department.

1.3 Symbols and Labels

Symbol	Title of symbol
	Follow instructions for use
Rx Only	Federal law restricts this device to sale by or on the order of a Physician or practitioner.
	Warning
	Caution

	Terminal of the protective grounding.
	Weight limit
	Manufacturer
	Temperature limit
	Atmospheric pressure limitation
	Humidity limitation
	Keep dry
	Upward
	Fragile, handle with care
	Serial number
	Medical device
	Date of manufacture
	Photo/Video

	Light switch
	Magnification adjustment
	illumination adjustment
	Focus adjustment
	Electromagnetic brake control switch
	Balance adjustment
	Filter knob
	Magnification knob
	Warning：Risk of Pinching Hand
	Foot pedal connection point
	illuminant power plug
	Microphone connect

	**Bidirectional limit**
	**Depth of field enhancement toggle button**
	**Pushing prohibited**
	**Authorized Representative in the European Community**

1.4 Liability and Warranty

For details of warranty and liability, please refer to the provisions of the warranty clause. Modifications to this device are not allowed. The manufacturer is not responsible for damage caused by unauthorized tampering with the system. In addition, it will lose any right to claim within the scope of the warranty.

1.5 Requirement for operation

Very first use

- The installation of this equipment is completed by ZUMAX service engineer or authorized representative of local dealer.
- Please check whether all cables and connecting parts have been installed in place before use.
- The screws which connect parts have been firmly tightened.
- The main plug can only be connected to a socket with a fault-free protective grounding conductor.

- When connecting the device to any network, make sure that there is no dangerous voltage on the network.

More requirements about the ceiling mount

- The ceiling bracket has been correctly installed by the construction personnel in charge
- The ceiling bracket meets the specifications contained in our “Planning Manual”.

Before use

- When adding accessories and/or components, make sure that the allowable total weight of the device does not exceed the maximum load.
- Make sure to compensate for any additional weight before each use; This will allow the microscope to be balanced in all positions of the operating range.
- Please confirm whether the up and down movement of the Suspension Arm works well, so as to avoid the weightlessness of the microscope drop on the patient.
- Check the screws which connect parts have been firmly tightened.
- Four casters are with locker, please make sure at least two are locked.

During use

- Please make sure that the light source is not aimed at the patient's eyes.
- Pay attention to the position and the height of the arms, do not hit the assistant or patient.
- Please do not cover the heat elimination grooves of power source.

After use

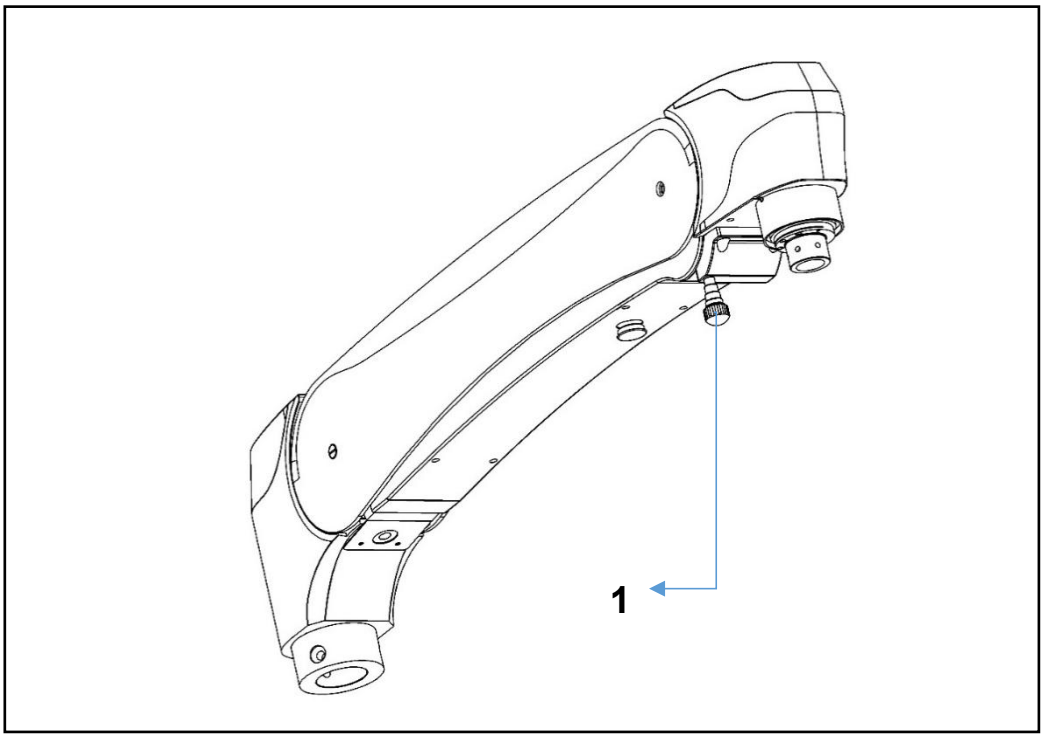
- After each use, please turn off the main power switch of the device.
- Pay attention to the position and the height of the arms, do not hit the assistant or patient.
- Move microscope to its standby position and lock the fixation knob of each moving joint.

✦ Please use the dust proof cover provided by ZUMAX to cover the lens part of the microscope.

1.6 Security measures of balancing system

Lower limit screw [1]

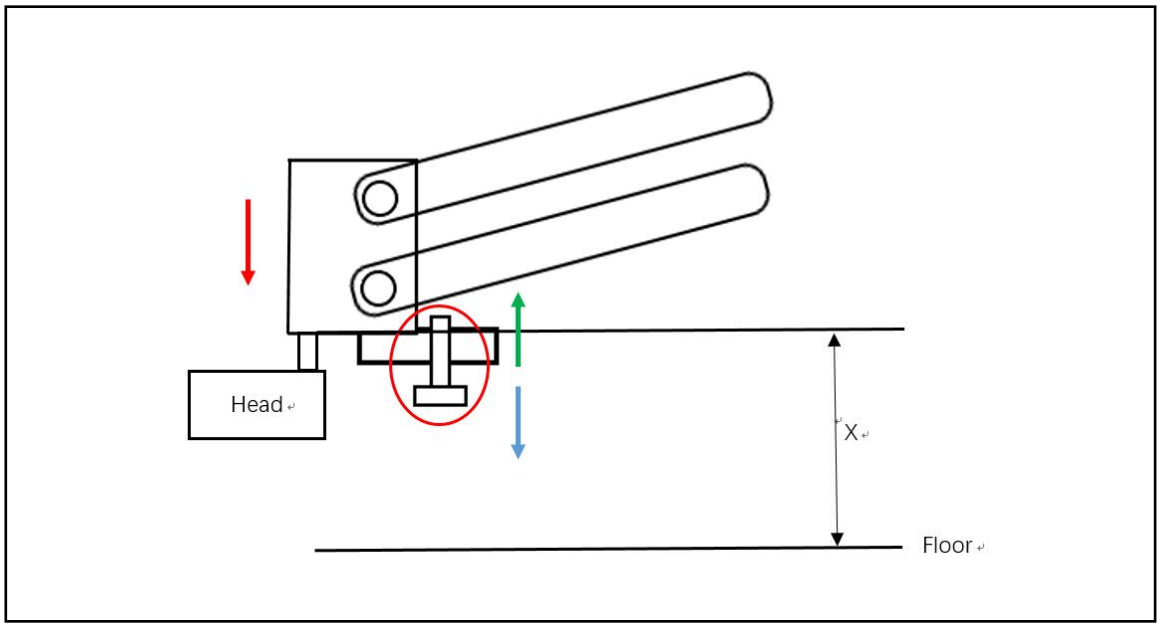
The minimum limit of the Suspension Arm can be set according to the needs of operator.



The red circle in the picture is a limit screw. When the gas spring of the Suspension Arm fails or the balance adjustment is not performed, the microscope will drop when it is started (red arrow direction), which acts as a limit (to prevent damage to the patient).

✦ When the screw rotates clockwise (in the direction of the green arrow), the maximum distance X from the lower limit to the ground increases.

✦ When the screw is turned counterclockwise (in the direction of the blue arrow), the maximum distance X from the lower limit to the ground decreases.



2 System Structure

2.1 Floor Stand

OMS3500 Max R2 Surgical microscope with the microscope main body, the Base Arm, the Suspension Arm, the magnetic brake arm and the base with casers. The microscope can be easily moved in the operating room.

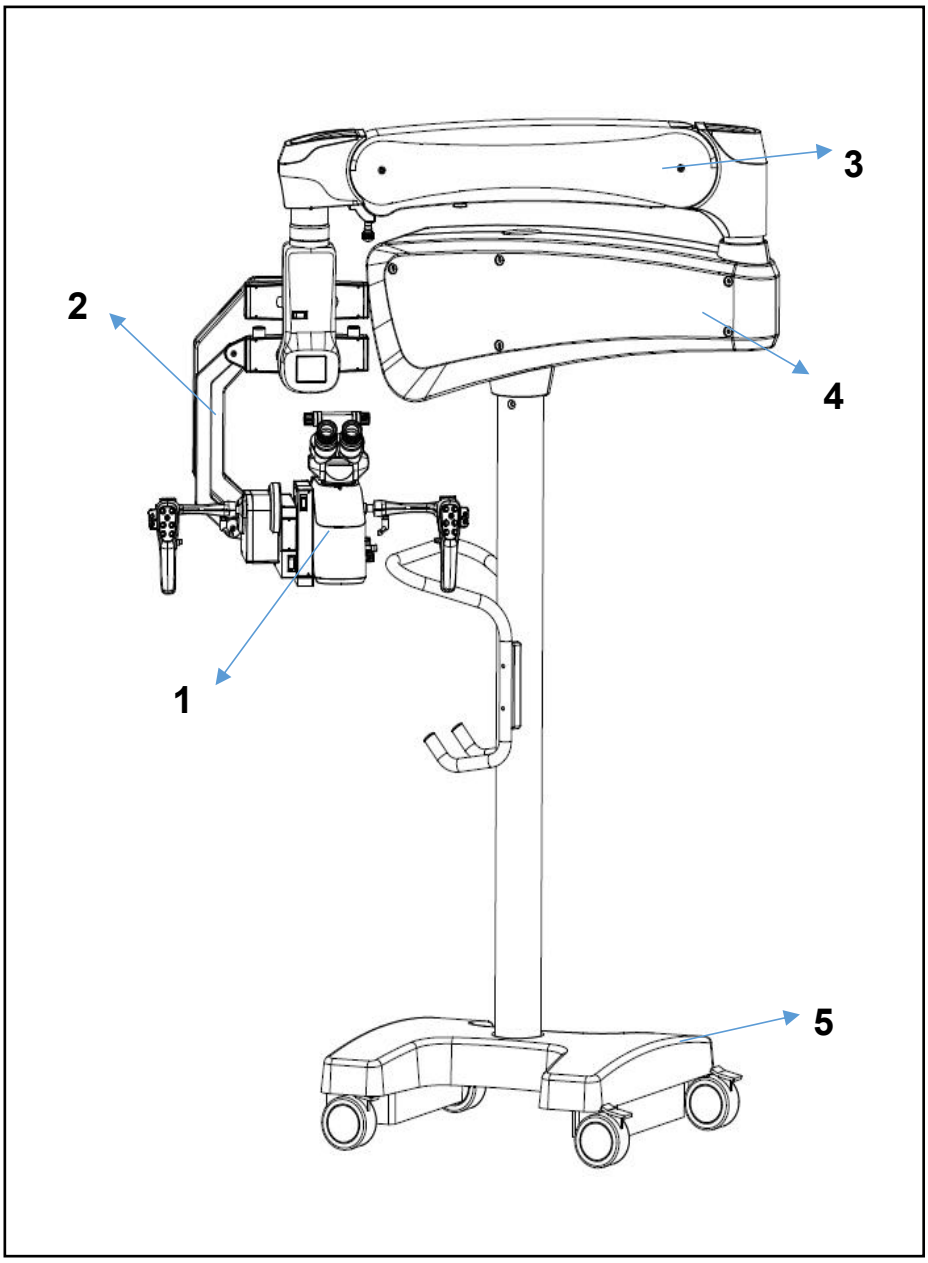
1.Microscope main body

2.Magnetic Balancing arm

3.Suspension Arm

4.Base Arm

5.Base with casers



2.2 Binocular Tube with Eyepieces

0°-180° inclinable binocular tube

0°-180° inclinable tube, f=170mm

1.Adjustable range of pupil distance is between 55mm to 75mm Eyepieces.

2.PD adjusting knob.

3.Magnification of eyepieces is 12.5x/17.7B, adjustable diopter is ±7D.

MagPlus 1.5™ 0°-180° inclinable binocular tube（optional）

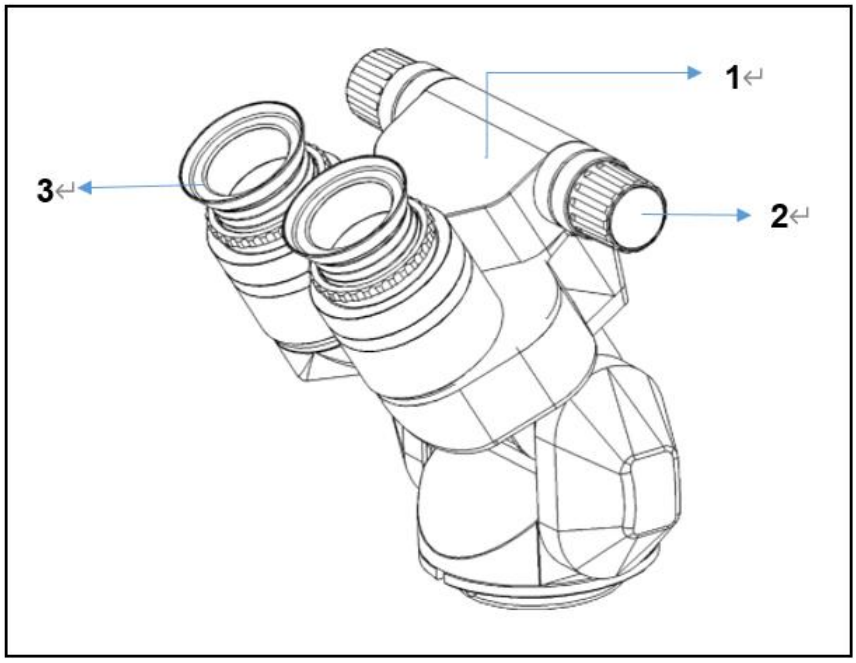
MagPlus 1.5™ 0°-180° inclinable tube, f=170mm/f=250mm

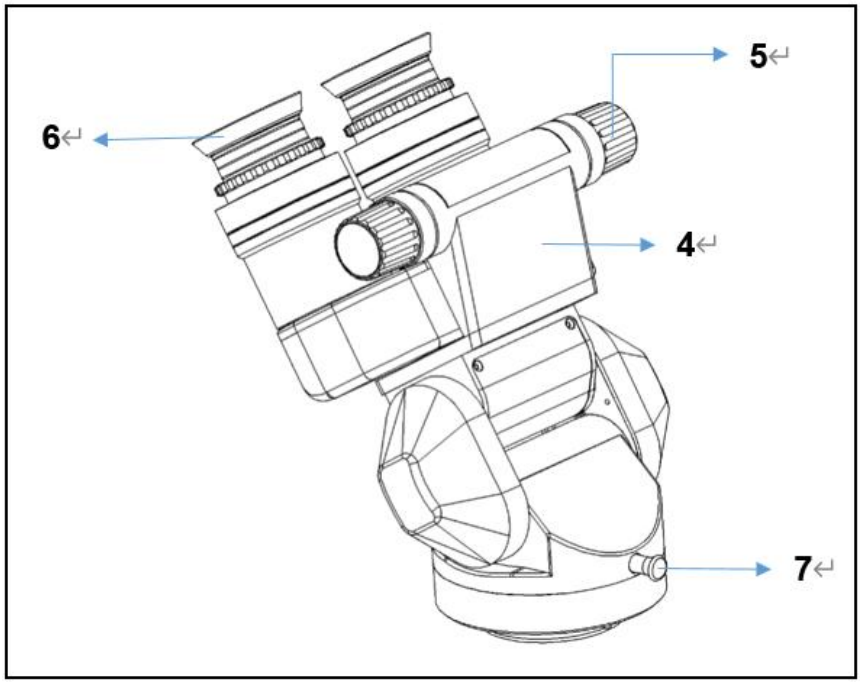
4.Adjustable range of pupil distance is between 55mm to 75mm Eyepieces.

5.PD adjusting knob.

6.Magnification of eyepieces is 12.5x/17.7B, adjustable diopter is ±7D.

7.f170mm and f250mm switchable lever.





2.3 Microscope Main Body

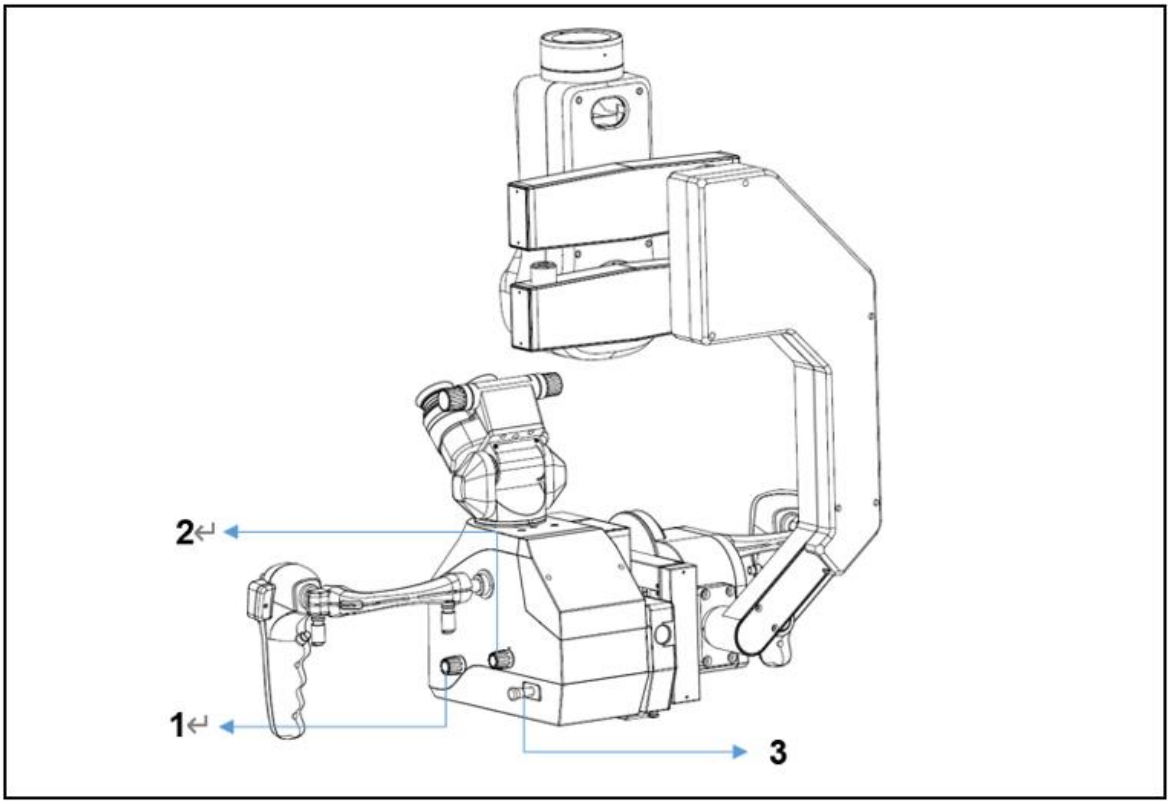
1、Focus knob.

Use this knob to manually adjust the focal length, focusing range is between 200mm-600mm.

2、Optical filter knob.

Rotate this knob to select Yellow filter, green filter and Anti-Reflect module. After switching polarizers, the microscope eye vision system will automatically cut into the polarized light road.

3、Twin switchable lighting source.



1、illuminating light plus button.

2、illuminating light reduction button.

3、The short press is used to return to the focal length of the previous record. Long press to record the current focal length.

4、Multi -function control stick.

The direction key controls the front and back, left and right.

Mid-key short press to autofocus.

Mid-key long press to focus speed adjustment.

5、Magnification and lapse linking button.

6、Zoom up button.

7、Zoom down button.

8、Focus up button.

9、Focus down button.

10、Electromagnetic lock ON/OFF switch.

11、Electromagnetic lock ON/OFF switch.

Using this switch can control the Electromagnetic lock be ON or OFF.

12、Photo/Video button

Kick button to take photos. Long kick button to record video, kick it again to exit video recording

13、The switching light button, and long pressing can be switched to the function required by 1.5X eyepiece.

14、Multi -function control stick

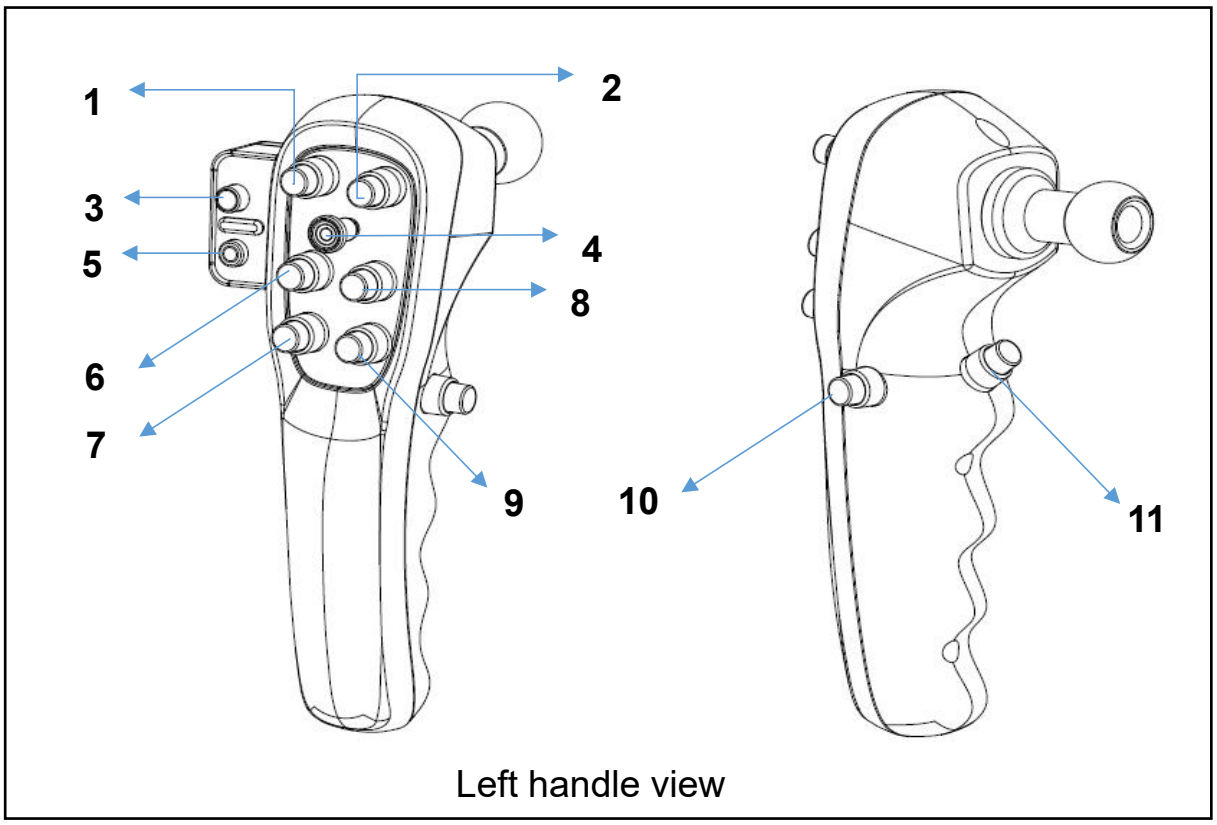
The direction key controls the front and back, left and right.

Mid -key short press to autofocus.

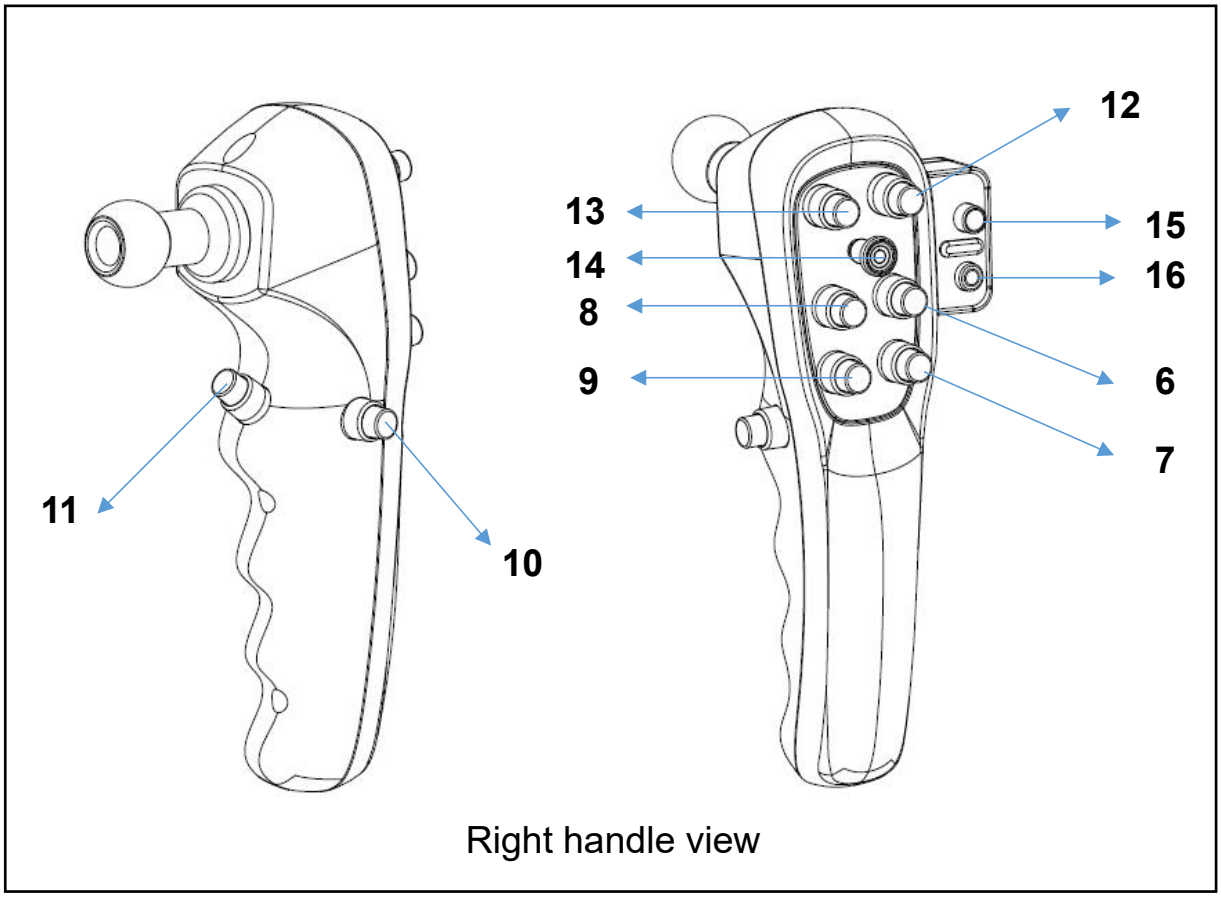
Mid -pressing long press to move the speed of movement left and right

15、Fluorescence switching buttons

16、Magnification and lapse linking button



Left handle view



Right handle view

2.4 LCD Display Panel

1、WD: Working distance, range 200mm-600mm

2、ZM: Zoom Magnification, range 0.4x-2.4x

3、BR: Brightness

Brightness percentage display, range 1%,2%,3%,5%,10%~100%

4、Fluorescence switch indicator mark

5、Change angle (F170/F250) Double -eyed lens cylinder uses F250 focal length when the focal length of the system magnification compensation icon

6、MF: Magnification Factor, range 1.3x-18.5x

When the 180 ° variable -angle tube (F170/F250) is selected, at the focal length of the F250, the total amplification multiplier display range: 1.9 x ~ 27.7 x;

7、MS: Magnification Scale, range 0.6x-9.4x

For this function, you need to order a 12.5X Eyepiece with target reticle separately, use the following formula to get the result：

Reticle Space x Measurement Scale=Objective Real Length

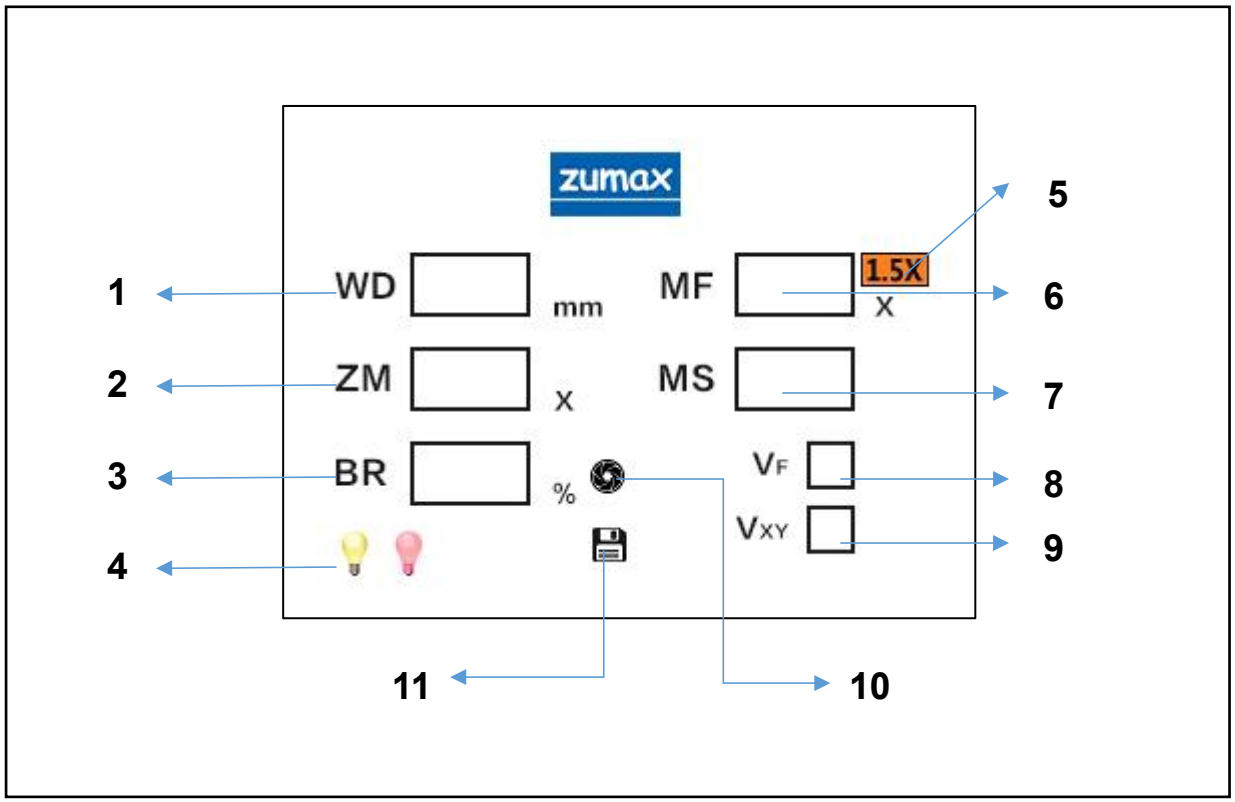
When the 180 ° variable -angle tube (F170/F250) is selected, at the focal length of the F250, the scalar ratio display range is 0.4 x ~ 6.2 x;

8、Magnification adjustment speed

9、Electric balance arm adjustment speed

10、Electric lapse switch indicator mark

11、Record the current focal length mark



2.5 Pedal switch (optional)

1、Foot switch (optional): illumination of light reduction button

2、Foot switch (optional): lighting plus button

3、Foot switch (optional): magnifying the multiplier reduce button

4、Foot switch (optional): focal length reduce button

5、Foot switch (optional): magnifying the multiplier plus button

6、Foot switch (optional): focus increase button

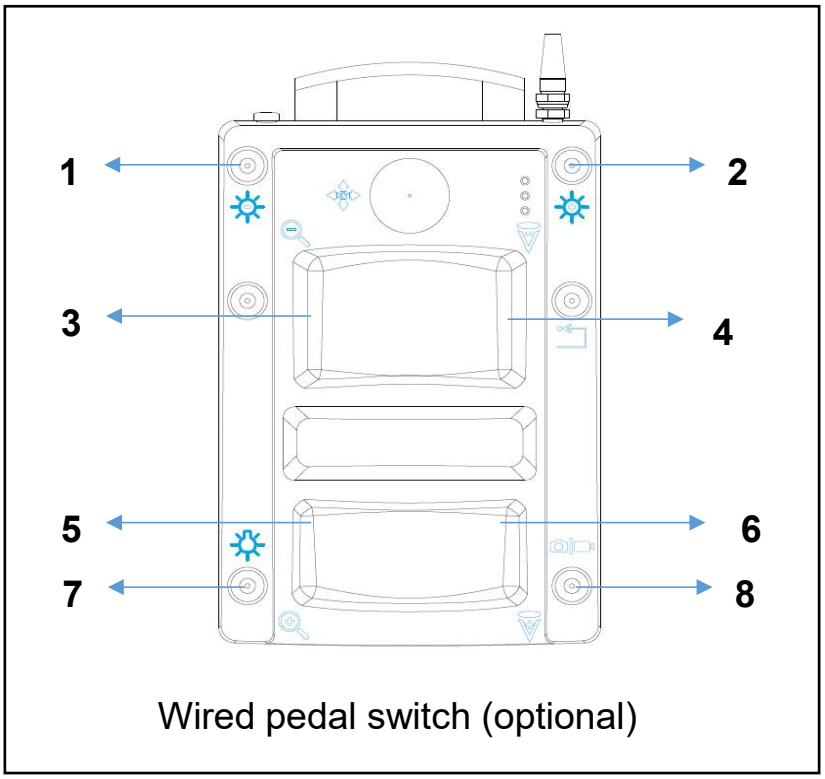
7、Foot switch (optional): lighting button

8、Foot switch (optional): photo or video button

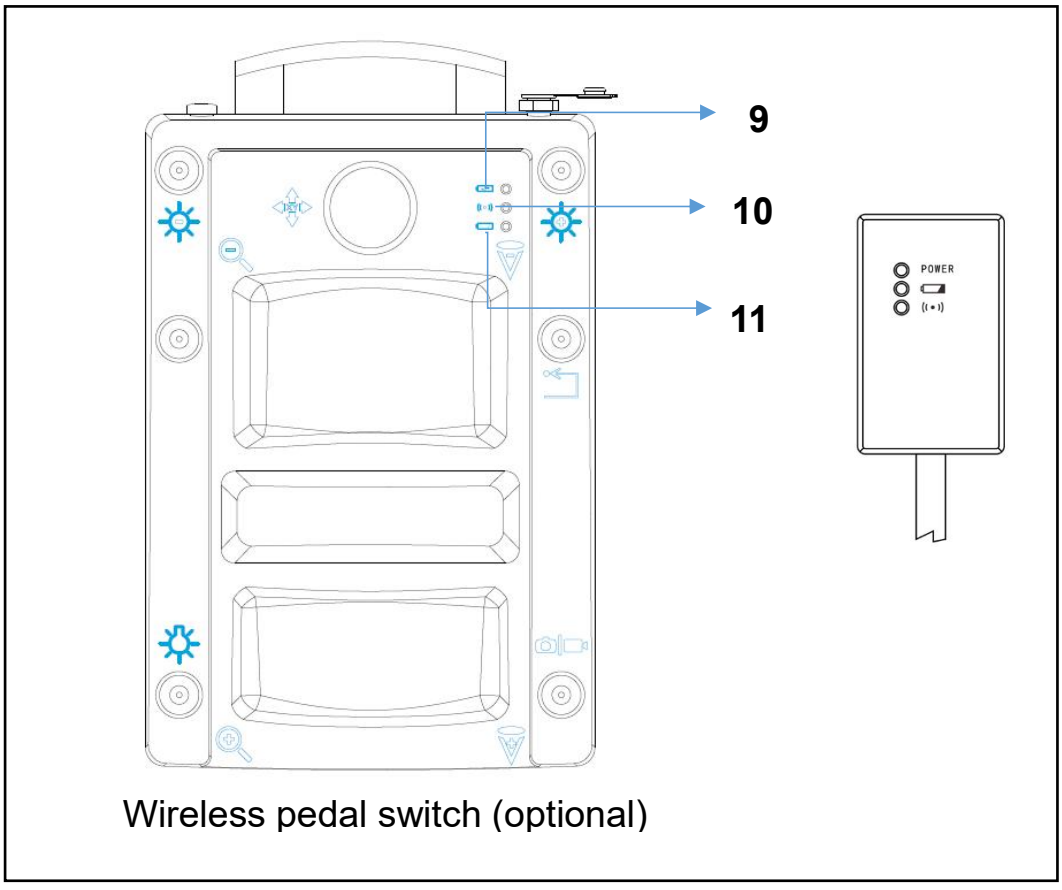
9、Power connection indicator light

10、Signal connection indicator light

11、Battery capacity indicator light



Wired pedal switch (optional)



Wireless pedal switch (optional)

2.6 Magnetic Balancing Arm

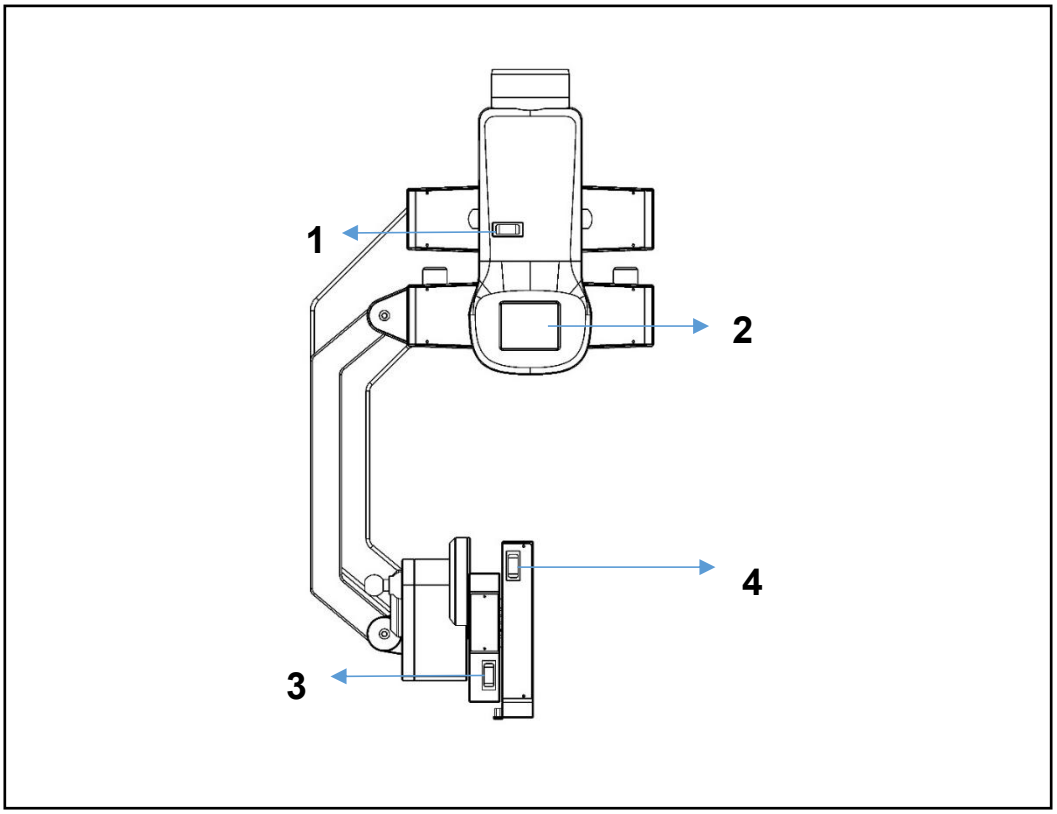
The balancing arm is controlled by 3 electromagnetic locks. The unlock button is on the handles. Press and hold one of the buttons to unlock. The balancing arm can move freely. Release the button then the balance arm will be locked instantly.

1、Electric balancing arm center of gravity adjustment button

2、LCD Display

3、Rights up and down center of gravity balance adjustment button for

4、Microscope Main Body tilt control button



2.7 illumination System

OMS3500 Max Surgical microscope use integrated LED light module which directs the light from the microscope head.

1、Integrated LED module(Twin switchable lighting source+ Auxiliary lighting)

The OMS3500 MAX microscopes are already equipped with three-light sources as standard.

2、Fluorescent light module (optional)

You can add a fluorescent module at the auxiliary lighting.

3、Secondary lighting (optional)

The illuminance can reach up to 300,000 LUX after add the secondary lighting at the working distance 200mm.

4、Anti-reflect module (optional)

Anti-reflective module, when measuring some objects with smooth surfaces or reflective effects, the surface of the object will have a certain specular reflection effect on the illumination light, and the reflected light will be directly received by the human eye or imaging device, and then it will be in the image. A very bright spot appears during the process, which adversely affects the observation effect. At this time, it is necessary to add polarizers with different directions in the illumination light path and the observation light path to filter out the strong interference light reflected by the mirror.

5、The fluorescent radiography mode (optional)

The fluorescent radiography mode is the optional function of the surgical microscope.

The fluorescent light source is turned on and turned off by the reused key according to the brightness of the brightness. The fluorescent radiography mode is used in the field of infrared fluorescent regions in the field of art. It is used in conjunction with the approved listing and the scope of applications. The fluorescence module is used for excitation within the wavelength range of 700nm to 780nm, and fluorescent visualization in the wavelength range of 820 nm to 900 nm. Because the fluorescent signal is near the infrared band, the human eye cannot be observed, but the focus area of the resolution of the surgical microscope and the release of fluorescent launch can be achieved to achieve fluorescent visualization.

2.8 Magnification System

1、Eyepieces

The OMS3500 Max microscopes are equipped with 12.5X eyepieces as standard.

2、Motorized Zoom Magnification Changer

The continuously zoom magnification changer is more convenience, very faster to adjust the magnification. It can be controlled by the joy sticks on the left or right handle. The working rang of the magnification is 1.3x-18.5x.

3、VarioDist Objective Lens

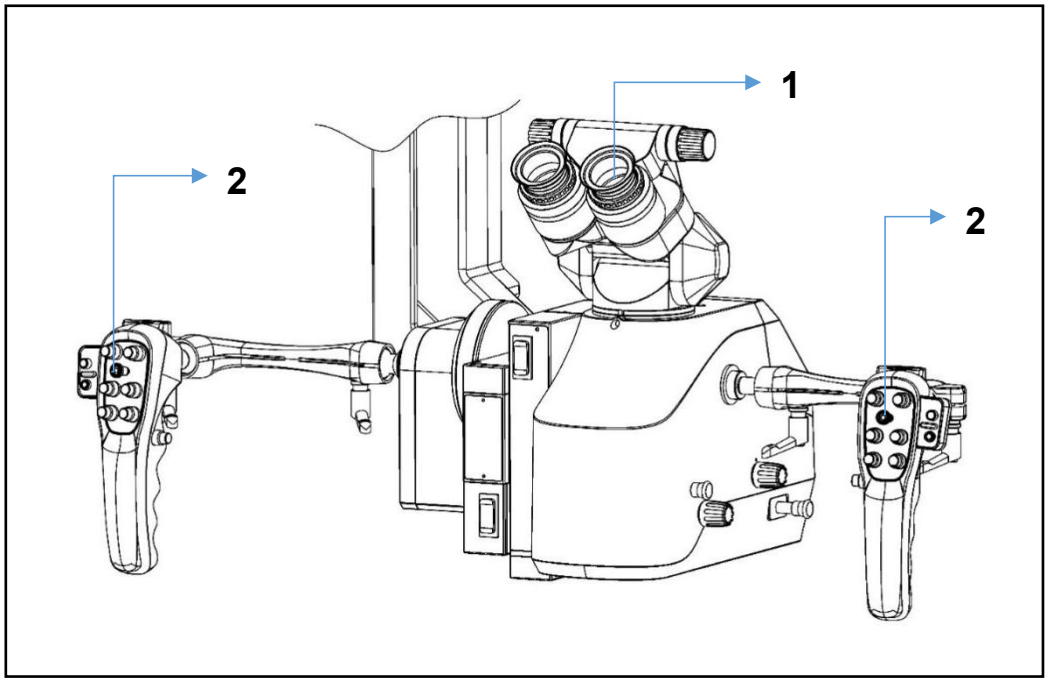
Working range 200mm-600mm.

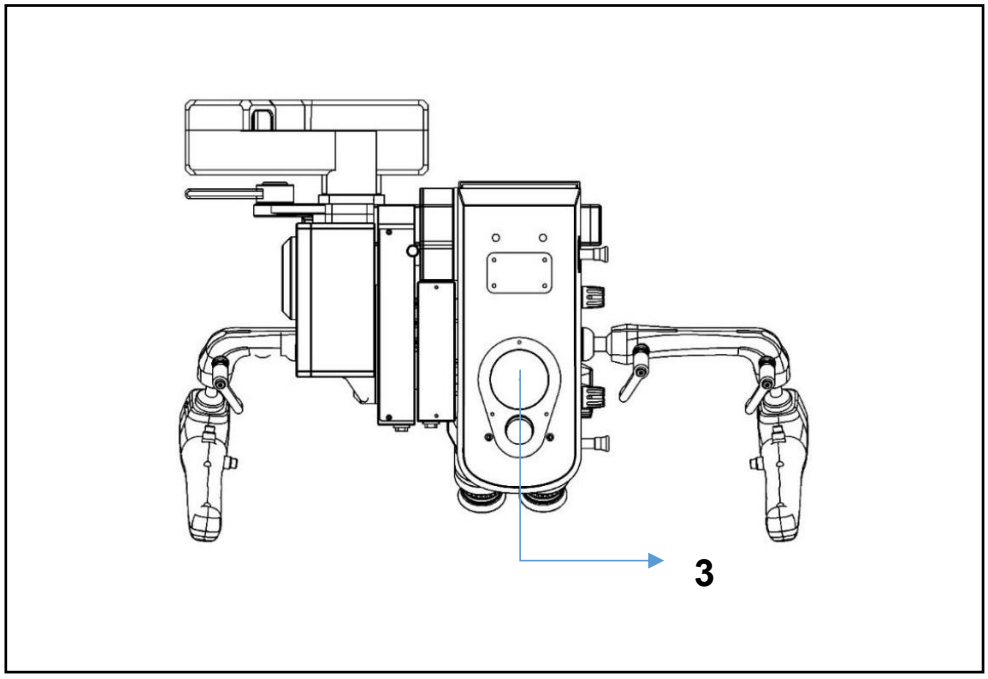
$$\text{End magnification} = \frac{\text{Tube focal length}}{\text{OB Lens focal length}} \times \text{Magnification changer factor} \times \text{eyepieces factor}$$

Example:

Tube focal length: f=170mm, Objective lens focal length f=250mm, Magnification changer factor 0.5x, Eyepieces factor 12.5X

$\frac{170}{250}$ x 0.5 x12.5= 4.25 4.25x is the magnification in this example





2.9 Power and Video Connections

1、**Main Power socket and Fuse socket**

Pull out the power table, right side is fuse socket.

100-127V~50/60Hz T5 AL250V

200-240 V~50/60Hz T3.15 AL250V

2、Main Power Switch

To turn on or turn off the main power of the microscope.

3、USB Socket;

Used to connect USB storage devices and mouse.

4、Network port

5、HDMI1.4 interface

Used to transmit video signals, the full high -definition output interface can only display 2D.

6、HDMI2.0 interface

Used to transmit video signals, 4K output interface and support 3D display.

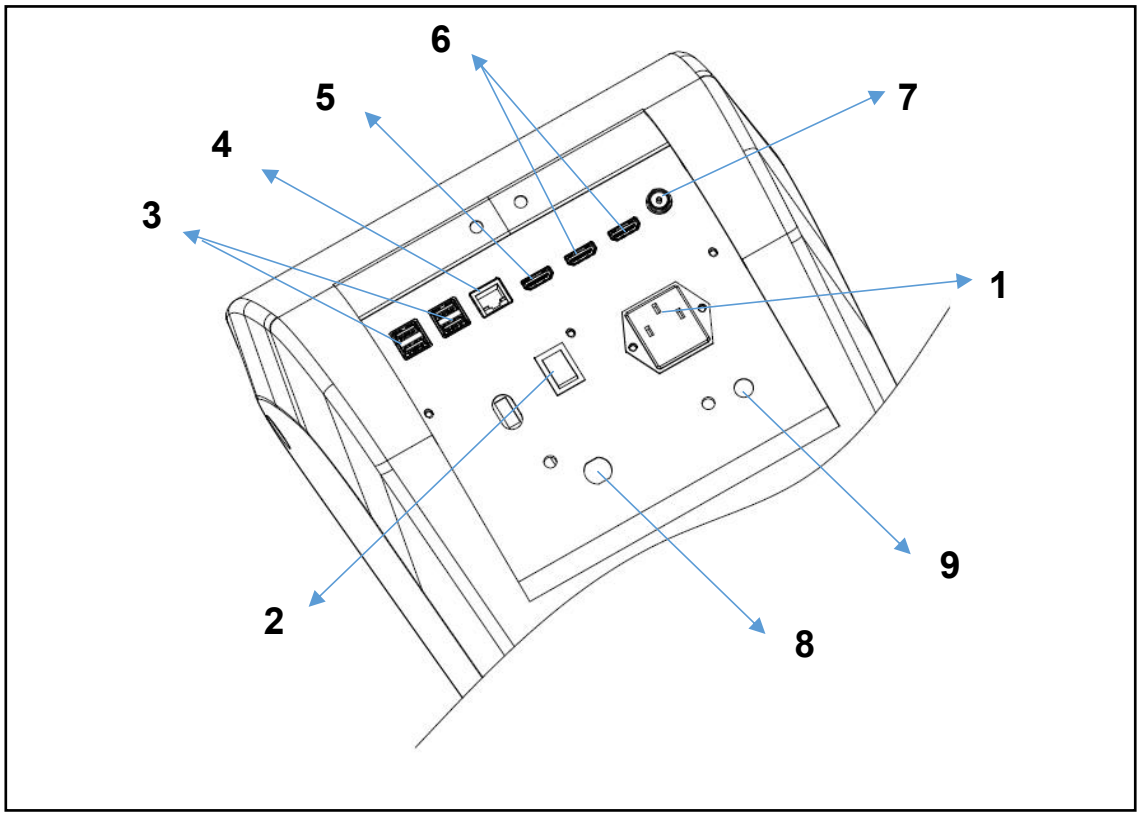
7、12G-SDI socket

Used to transmit video signals Foot Pedal interface

8、Foot switch socket (optional)

Wireless receiver used to connect wired pedal switches or wireless pedal switching facilities.

9、Audio socket



3 Preparations for Operate

3.1 Adjusting the balance of Suspension Arm

- **Hold the Suspension Arm, press the electromagnetic brake switch, and adjust the small horizontal arm to the horizontal state.**

Caution: The Base Arm must be held in the horizontal position.

Caution: The Suspension Arm must be held firmly before release the fixation screw [1].

Caution: Please confirm the lower limit screw has been released.

- **Use a 8 mm Allen Key into the screw which under the Suspension Arm end [1].**

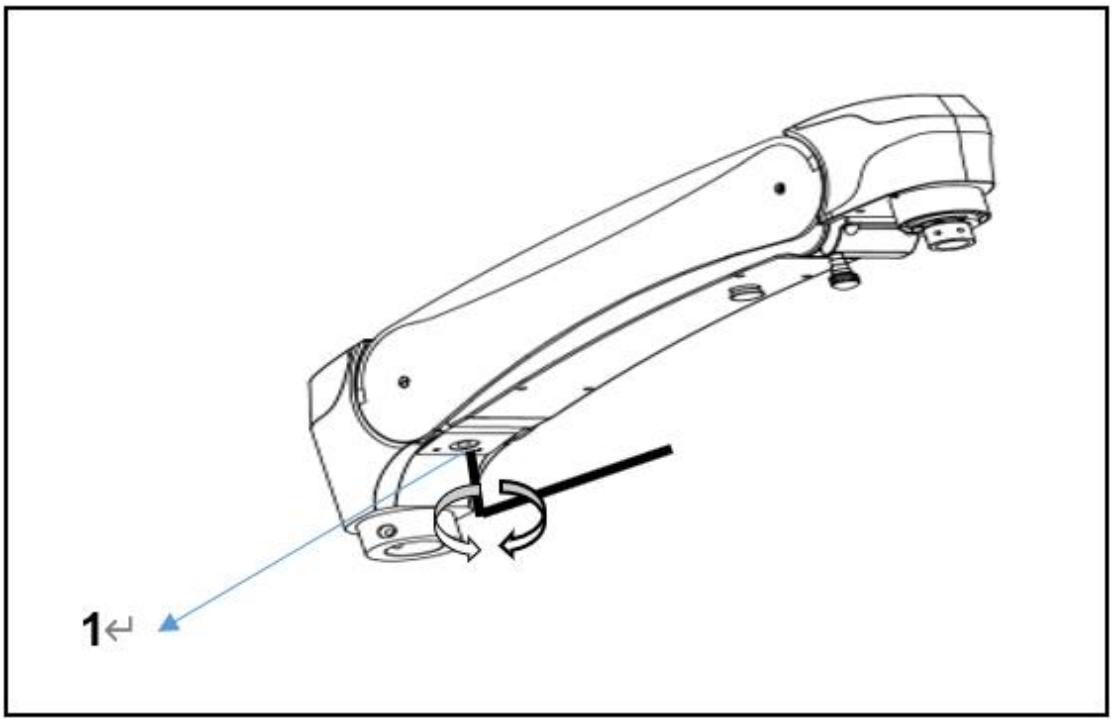
- **To balance the Suspension Arm, move the arm up and down slightly while tightening the adjusting screw.**
- **Continue to tighten the screws until sufficient spring force is obtained to compensate for the weight of the microscope and accessories.**

Caution: When you need to move the Suspension Arm up and down, the Allen Key can't be stayed in the screw hole.

Caution: Clockwise rotation is to increase the pressure of the gas spring, counter clockwise is to release the pressure

- **When adding or removing accessories, readjustment of the balance of the Suspension Arm is necessary.**
- **The loading weight of the accessories should not exceed the maximum loading weight of the arm, otherwise the gas spring may be damaged.**

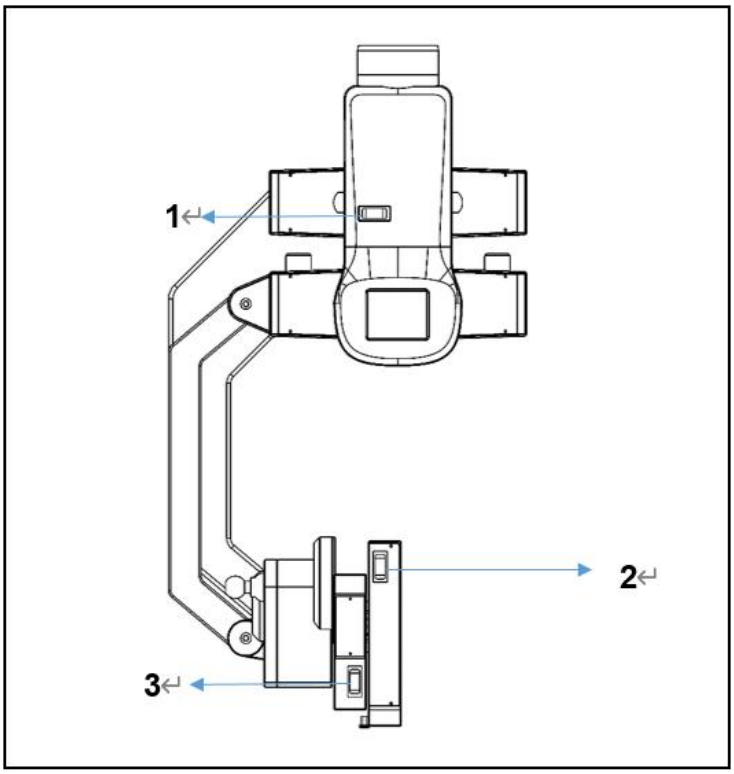
WARNING: NEVER BALANCE THE MICROSCOPE WHILE THE PATIENT IS UNDER THE MICROSCOPE.



3.2 Adjusting the balance of Magnetic Balancing Arm

- **Press the handle electromagnetic brake unlock button (need to hold the electromagnetic lock control button in real time during the adjustment process).**
- **Use the multi -function joystick of the handle to adjust the left and right balance (you can also use the button [1]).**
- **Use the multifunctional joystick of the handle to adjust the front and rear balancing back and forth (you can also use the button[3]).**
- **Use the button to adjust the upper and lower heart positions of the lens**

Caution: Electromagnetic brakes are intermittently working, and the maximum continuous working time is 2 minutes. If you need to work again, you should start after 10 minutes.



3.3 Initial Setup of the microscope

1、Put a flat bill under the microscope.

2、Set the Magnification Changer to the lowest magnification, e.g. 0.3X, in order to maximize the field of view.

3、Move the microscope up and down for focusing and find the center position of the target on the monitor./

4、Adjust the inter-pupillary distance by PD knob slowly and get the two images into one.

5、Screw in the eyecups until the silver coil is no longer visible if you wear glasses. Screw out the eyecups with about 2-3 silver coils, if you don‘t wear glasses.

6、Set the Magnification changer to the highest Magnification

7、Adjust the knob of the objective lens until you viewing the most sharpness image on the monitor.

Note: Please do not move your microscope up and down any more after step 8.

8、Close your Left eye, adjust the Right Diopter Ring till you view the sharpness image through Right eyepiece

9、Then close your Right eye, adjust the Left Diopter Ring till you view the sharpness image through Left eyepiece.

10、After the diopters are set, please do not forget to record them so that they can use the microscope in the future and set their own values directly.

11、Set the focal length of VarioDist Lens to Median again, you will get the most sharpness image through eyepieces now, the image resolution on the monitor and the sharpness observed in the eyepieces are also the same.

4 Operation of microscope

4.1 Position of the microscope

After finding the basic location of the doctor and patient, the location of the microscope needs to be determined. Usually, the microscope and the ground maintain a vertical angle, some treatment conditions need to change the angle of the microscope.

- **Move the microscope arm up and down to the right working range.**
- **Adjust the illumination.**
- **Select the filter which will be used.**
- **Adjust the magnification**

Caution: Please make sure that the light source is not aimed at the patient's eyes.

Caution: Pay attention to the position and the height of the arms, do not hit the assistant or patient.

4.2 Using the Handles

The magnetic brakes provide an easy and precise positioning of the microscope. Just press the buttons on the Multi-functional handles to release handbrakes and bring the microscope in the location required. The buttons on the handle also provide the following operation functions

- **Photo/Video button**
- **LED light switch**
- **Joy stick, push up is to increase the magnification, push down is to reduce the magnification, push left and right to adjust the fine focus**
- **Light intensity adjusting knob**
- **Focus Speed Switch**

4.3 Image Storage

The storage medium of the model with HD integrated camera is an SD card, and the model with 4K integrated camera uses a U disk.

Press the control button on the handle, the captured pictures or videos will be automatically stored on the SD card or U disk, and then read through the computer.

Caution: SD card speed ≤ 100M / S, U disk 3.0.

4.4 Light Source Switching

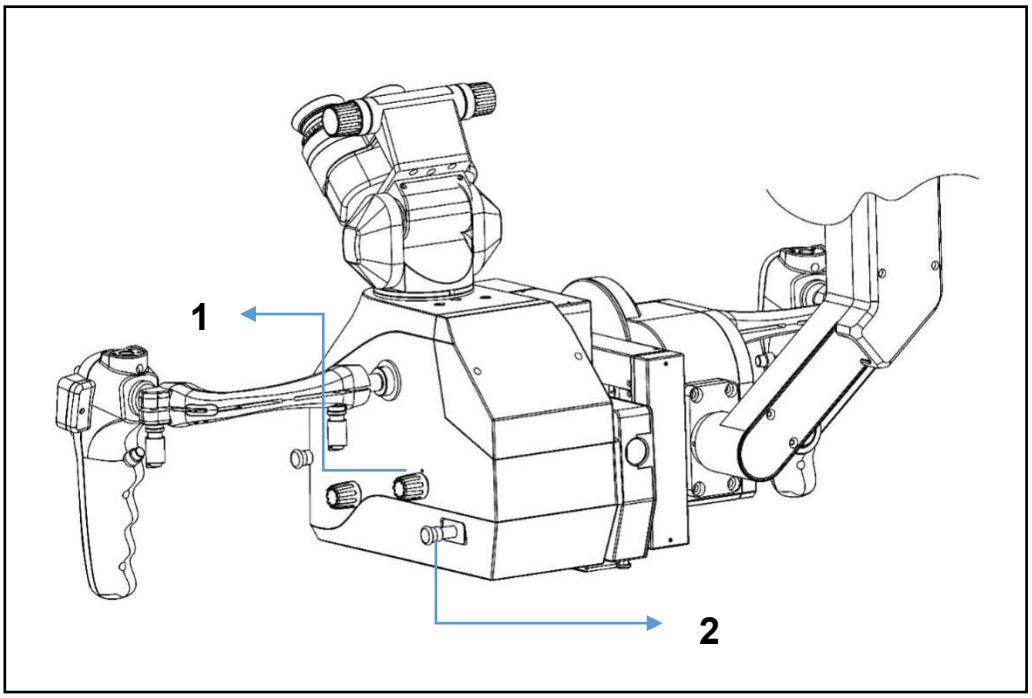
On the left side of the microscope body, there is a knob [1] for illumination and filter's switching.

Anti-Reflect module, large spot, yellow filter, green filter, small spot and Micro spot.

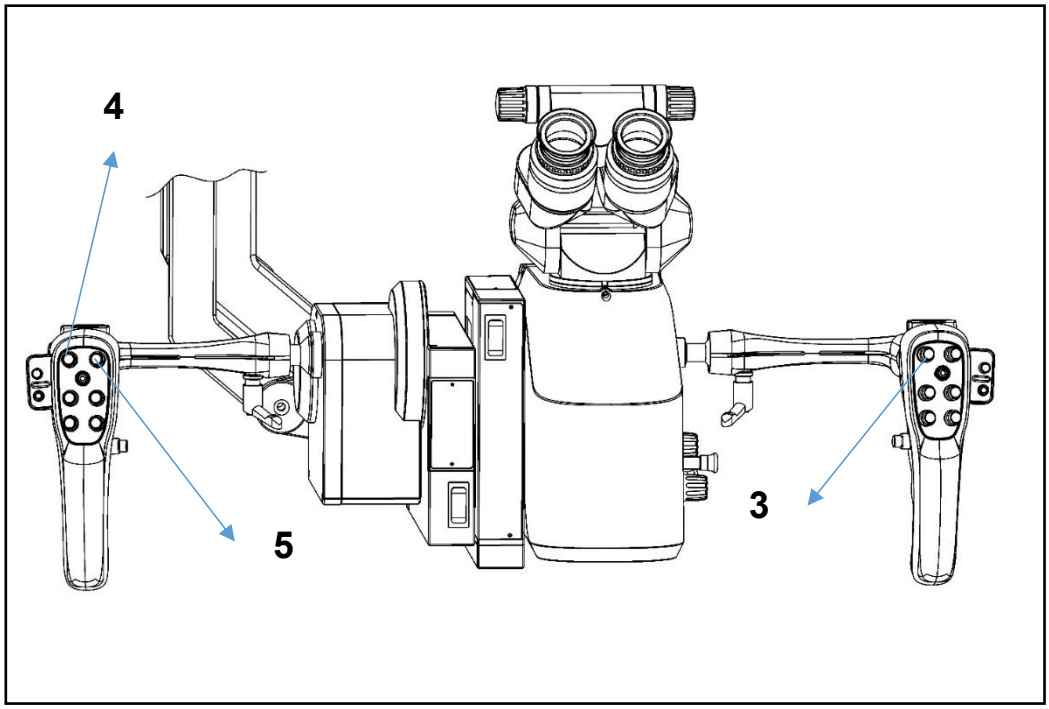
The OMS3500 Max microscopes are already equipped with twin-light sources as standard [2]. Pull out the lever to switch to the second light source.

If you choose a fluorescent module [2], there is no twin-light module, you can only choose one.

You can use the buttons on the multi-function handle to control the switch and brightness adjustment of the light source.



- LED light switch [3]
- Light intensity adjusting knob [4] [5]



5 Care and Maintenance

5.1 Cleaning the surface of device

The outer surface of the device can be wiped with a damp cloth for 6-8 minutes. Remaining stains wipe the mixture with 75% C2H5OH for 4-6 minutes to clean it off. Do not use any corrosive materials detergents or surfaces may be damaged.

5.2 Cleaning the surface of the optical lens

To prevent dust from contaminating the lenses, do not expose the optical lenses to air without the objective lens, Eyepiece tube and eyepiece. Please use a dust cover after using the microscope.

Cleaning the surface of optical lenses: To remove dirt, such as blood stains, please use.

Dip a special piece of paper or absorbent cotton in distilled water and wipe for 3-5 minutes to remove any remaining stains.

Wipe with 75% C2H5OH for 3-4 minutes to clean the mixture. If there is dust on the lenses, please blow.

Dust off the dust with a dustproof pen. Do not use any corrosive detergent to wipe the lenses, otherwise it may cause damage.

5.3 Sterilization

According to the instructions, use pure water or softened water to disinfect in the automatic cleaning and disinfection machine.

Temperature ≥ 90 ℃, time ≥ 60 seconds or A0 ≥ 600.

5.4 Disposal of wastes

The waste produced by this device is LED light source, mirror paper or nonfat cotton. Please do not discard it. If there is a special waste treatment facility nearby, please use it as far as possible. The discarded instruments are processed according to the local environmental protection law. Please do not pollute the environment.

5.5 Replacing the LED

Please contact the after-sales service of manufacturer.

5.6 Replacing the Fuse

The fuse is integrated with main power input socket.

Please replace the fuse according to the following steps:

- **Turn off the main power switch.**
- **Pull out the power plug from the main power plug.**
- **Find the fuse socket on the right side of power plug, take out the fuse socket from the side with a small screwdriver.**
- **Take out the melted fuse.**
- **Insert a new fuse and insert the fuse socket back again.**
- **Plug in power cable.**
- **Turn on the main power switch.**

Specification of fuse：

100-127V~50/60Hz T5 AL250V

200-240 V~50/60Hz T3.15 AL250V

Caution： Please use the fuse specially designed for this device.

5.7 Replacing the power supply cords

Replacement the power supply cords should by the manufacturer specifies service person.

Warning: To avoid the unacceptable risk, please use the special cords for the device.

6 Trouble-shooting Guide

In case there is any trouble, please first refer to the trouble-shooting guide. If you can not solve the problems by yourself, please contact the authorized distributor or our after-sales service department.

Trouble	Possible reason	Remedy
Equipment not working	Main power switch is not turned on	Turn on the main power switch or plug in power cable
	Main power down	Contact a local electrician
Illumination does not work	Main power is not turned on	Switch on the main power
	The fuse tube has been melted	Replace the fuse
	Power cable broken-down	Replacing the power cable
	Main power down	Contact a local electrician
	Electric part broken	Contact the after-sales service department
	The LED power cable is not inserted to the joint correctly	Insert it to the joint correctly
	Microscope not in working area but in "parking position"	Move the Suspension Arm to working area
	The LED has burnt	Contact the after-sales service department
	Illumination brightness adjusting button is in low position	Adjust the button a higher position
Bulb turns on and off during the surgery.	Something covered the heat elimination grooves	Take away the cover and clean the heat elimination grooves
	Blower fan defect	Contact the after-sales service department
	Electric part defect	Contact the after-sales service department
The microscope is obstructed when making movement downwards	The star handle fixation screw of the Suspension Arm was fixed too tightly	Re-adjust the star handle fixation screw
Magnification change defect	-	Contact the after-sales service department
Filters defect or can not be switched	-	Contact the after-sales service department

7 Technical specification

Basic Configuration

Magnification System	Motorized Zoom System, with apochromatic 1:6 ratio;
	1.8x-19.4x with 12.5x eyepieces
	Magnification factor γ=0.4X-2.4X
	11.6mm-124mm with 12.5x eyepieces
Tubes	0°-180° inclinable binocular tube with PD adjusting knob, f=170mm
Eyepieces	12.5x wide-field eyepieces, also suitable for eyeglass wearers
Objective/Focus	Motorized VarioDist Objective Lens, variable working distance 200-600mm
Illumination System	The maximum illuminance is not less than 100000 lx when the working distance of large objective mirrors is 200 mm
	The optional partial auxiliary lighting is 200 mm in the working distance. The auxiliary lighting device and the LED main light source are adjusted to the maximum value, and the maximum illuminance is not less than 300000 LX.
	The working distance of the large material mirror is 200 mm, the amplifier coefficient is 0.4 x, the diameter of the lighting spots is φ85 mm, and the error is ± 15%; the working distance of the large material mirror is 600 mm, the amplifier coefficient is 0.4 x, and the diameter of the lighting spots is φ215 mm, and the error is ± 15%.
	Twin switchable LEDs
	Yellow and Green filters
Controls	FreeMov 6-Electromagnetic brakes
	Multi-functional handles, below buttons to lock/unlock 3 brakes, Side buttons to lock/unlock 6 brakes, joysticks for motorized zoom +/-, Motorized foucs +/-, 4 buttons for taking photo/video, lighting +/-
	SmartMon LCD display, displaying current working distance, zoom factor, magnification, measurement factor, LED brightness
Construction	Floor Stand with "H" shaped base, 632x632mm

Electrical specifications

Rated voltage	100-127V~50/60Hz 200-240 V~50/60Hz
Input power	≤450 VA
Fuse	T3.15 AL 250 V (100-127V~) T5 AL250V (200-240 V~)

8 EMC (electromagnetic compatibility)

When using the device, the EMC precautions specified below must be observed.

- Only use spare parts approved by zumax for this device.
- Do not use any portable or mobile RF communication equipment in the vicinity of the device as this may impair the device's function.
- Do not use a mobile phone in the vicinity of the equipment because the radio interference can cause the equipment to malfunction. The effects of radio interference on medical equipment depend on a number of various factors and are therefore entirely unforeseeable.
- Please note the EMC guidelines on the following pages.

Warning: The microscope should not be used adjacent to or stacked with other equipment and that if adjacent or stacked use is necessary, the ME EQUIPMENT or MESYSTEM should be observed to verify normal operation in the configuration in which it will be use.

Warning: Use of ACCESSORIES, transducers and cables other than those specified, with the exception of transducers and cables sold by the MANUFACTURER of the microscope as replacement parts for internal components, may result in increased EMISSIONS or decreased IMMUNITY of the microscope.

Electromagnetic interference

Guidance and manufacturer's declaration – electromagnetic emissions		
The microscope is intended for use in the electromagnetic environment specified below. The customer or the user of the microscope should assure that it is used in such an environment.		
Emissions test	Compliance	Electromagnetic environment – guidance
RF emissions CISPR 11	Group 1	The microscope uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The microscope is suitable for use in all establishments other than domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEV 61000-3-2	N/A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	N/A	

Electromagnetic immunity for ME equipment and ME systems

Guidance and manufacturer's declaration – electromagnetic immunity			
The microscope is intended for use in the electromagnetic environment specified below. The customer or the user of the microscope should assure that it is used in such an environment.			
IMMUNITY test	IEC 60601 test level	Compliance level	Electromagnetic environment – guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 8 kV contact ± 15 kV air	± 8 kV contact ± 15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	± 2 kV for power supply lines. ± 1 kV for input/output lines	± 2 kV for power supply lines. ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line to line ±2 kV line to ground	±1 kV line to line ±2 kV line to ground	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	0% UT (100% dip in UT) for 0.5 cycle 0% UT (100% dip in UT) for 1 cycle 70 % UT (30 % dip in UT) for 25/30 cycles 0% UT (100% dip in UT) for 5 sec	0% UT (100% dip in UT) for 0.5 cycle 0% UT (100% dip in UT) for 1 cycle 70 % UT (30 % dip in UT) for 25/30 cycles 0% UT (100% dip in UT) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the microscope requires continued operation during power mains interruptions, it is recommended that the microscope be powered from an uninterruptible Power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	30A/m	30A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE UT is the a.c. mains voltage prior to application of the test level.			

Electromagnetic immunity for non-life-supporting ME equipment and ME systems

<table>
<tr><td colspan="4">Guidance and manufacturer's declaration – electromagnetic immunity</td></tr>
<tr><td colspan="4">The microscope is intended for use in the electromagnetic environment specified below. The customer or the user of the microscope should assure that it is used in such an environment.</td></tr>
<tr><td>IMMUNITY
test</td><td>IEC 60601
test level</td><td>Compliance
level</td><td>Electromagnetic environment
–
guidance</td></tr>
<tr><td>Conducted RF
EN 61000-4-6

Radiated RF
IEC 61000-4-3</td><td>3 Vrms
150 kHz~80
MHz

3 V/m
80 MHz~2.5
GHz</td><td>3 Vrms

3V/m</td><td>Portable and mobile RF communications equipment
should be used no closer to any part of the microscope, including cables, than
the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.
Recommended separation distance
$d=1.2\sqrt{P}$
$d=1.2\sqrt{P}$ 80 MHz~800 MHz
$d=2.3\sqrt{P}$ 800 MHz~2.7 GHz
where P is the output power rating of the transmitter in watts (W) according to the transmitter manufacturer's specifications and
d is the recommended safety distance in meters (m).
Field strengths from stationary RF transmitters, as determined by a site survey[a], should
be less than the compliance level in all frequency ranges.[b]
Interference may occur in the vicinity of equipment marked with the following symbol:  </td></tr>
<tr><td colspan="4">NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.</td></tr>
<tr><td colspan="4">a Field strengths of stationary transmitters such as base stations for mobile telephones and mobile land radio equipment, amateur radio stations, AM and FM radio broadcast and TV broadcast transmitters cannot be theoretically predicted accurately. To assess the electromagnetic environment with respect to stationary RF transmitters, a site study of the electromagnetic phenomena should be considered. If the measured field strength in the location where the device is used exceeds the compliance levels indicated above, the device should be monitored to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the ME equipment or ME system.
b Field strengths should be less than 3 V/m over the frequency range from 150 kHz to 80 MHz.</td></tr>
</table>

Recommended separation distances between portable and mobile RF communication systems and the microscope

Recommended separation distances between portable and mobile RF communication systems and the microscope.			
The microscope is intended for use in an electromagnetic environment where RF disturbances are controlled. The customer or the user of the microscope can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and the microscope depending on the output power of the communication equipment as specified below.			
Rated maximum output power of transmitter. W	Separation distance according to the frequency of the transmitter m		
	150 kHz to 80 MHz $d=1.2\sqrt{P}$	80 MHz to 800 MHz $d=1.2\sqrt{P}$	800 MHz to 2.7 GHz $d=2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.			