



# DT1033

## LCD Digital Microscope



# Attention

## Dear Sir or Madam:

Thank you for using our YJ21-01 series microscopes. As one of the professional designers, manufacturers and distributors for optical instruments in China, since 1978, we have been working for supplying the new or old customers worldwide with high-quality and low-cost products. Being the newest product, we wish that our products could bring you success and satisfaction. We enjoy offering you the most suitable products and the best service.

This manual gives a minute description of the structure, principle, configuration, operating guide, troubleshooting, maintenance and some attention for DT1033 series biological microscope. Please read it carefully before you use, and keep it for long time.

In particular, the following notes must be understood thoroughly and obeyed strictly:

1. Permitted use:

This microscope is just only used for biological microscopy observation. Don't misuse it for other purpose.

2. No dismantle the equipment:

Unless you are a microscopic expert, or there is a special guide about doing so in the manual, please don't dismantle your microscope. Otherwise, it will damage the microscope seriously, and reduce greatly its accuracy and using-life. When you identify some troubles, and can't troubleshoot them by yourself according the manual, please contact us or our representative in your area.

3. Safety

---Before change a bulb, or need to open the base, ensure that the microscope has been disconnected with the power source. The new bulb must be the same specifications as the old one.

---When the illuminator is halogen lamp or incandescent lamp, the base near the lighting source may be very hot. Don't worry about it, but it must be treated carefully. Please take the combustible material (such as gasoline, paper, plastic and cloth) far away from the microscope.

---When change incandescent bulb or halogen bulb, wait until it is cool enough, otherwise the hot bulb will burn your fingers.

4. Use the correct power supply voltage

The power supply voltage must be fitted to the microscope; otherwise it will damage the circuit and bulb, even lead to insecurity.

5. Protecting optical parts

Never try to contact directly the optical surface of objectives, eyepieces and other optical parts with your finger. Fingerprints will seriously affect your observation results.

6. Don't leave any dust and fingerprints on the bulb, otherwise it may affect its life and illuminating efficiency.

7. Working surroundings requirements

Room temperature: 0°C-40°C

The highest relative humidity: 85%

High temperature and humidity can cause mildew and damage the instrument.

8. Microscope is a precision instrument, soft and gentle operation is necessary. Any rude action or hard shake may damage it.

## A) Application:

This series microscope is a high precision instrument designed and produced by our company. It is specially designed for clinical examination and teaching demonstration in medical and health establishments, laboratories, agricultural science and technology field, research institutes. It is used for routine work and research in biology, bacteriology cytology and pharmacology. Providing with some optional accessories, the microscope will be enlarged its functions in demonstrating, collecting, saving and analyzing of the miro-image.

## B) Principle:

The principle of the microscope is showed in Fig 1. The lamp(a) illuminates. The light from lamp is introduced to the condenser (b) and then converged on the specimen (c) by the condenser. The image of the specimen(c) is first magnified by the objective(d) and then further magnified by the eyepiece(f). The prism(e) is used to change the direction of the light.

Total magnification= ( magnification of objective ) multiply ( magnification of eyepiece )

## C) Structure and main specifications:

The structure of microscope is showed in Fig 2.

### 1. Eyepiece(1):

Usually,the microscope is only equipped with wide-field and plano-scope eyepiece WF10X. If you need, we will also provide you wide-field eyepieces as WF5X, WF6X, WF12.5X, WF15X, WF16X, WF20X, or Huygenian eyepieces as 5X, 6X, 10X, 12.5X, 15X, 16X. The specifications of WF10X are showed as following:

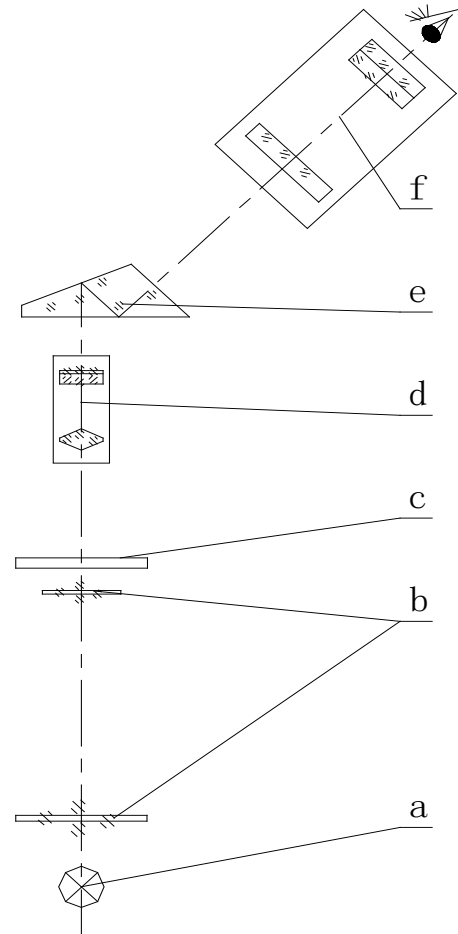
Wide Field Plane-scope Eyepiece	Magnification	Diameter of Viewing Field	Working Distance	Remark
WF10X	10	18mm	24.95mm	with point

### 2. Objective(4):

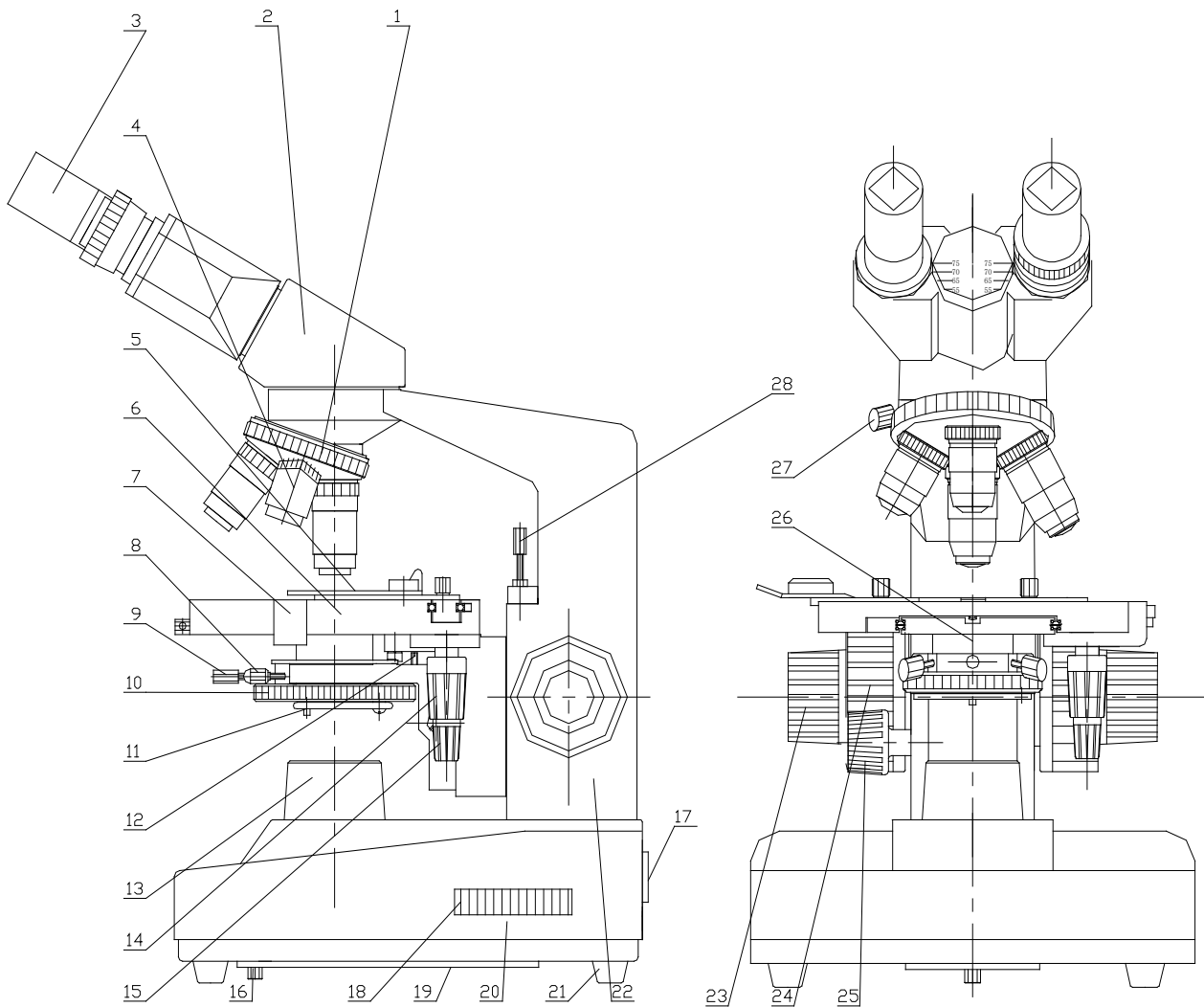
In this microscope, the standard outfit of the objective system is DIN achromatic objectives which are 4X, 10X, 40X (spring loaded), 100X (spring loaded, oil immersion). The objective 100X is a immersion lens. When the 100X objective is used, between its top and the cover glass, should drop some immersion oil and be sure to make the air bubble out. If there is some air bubble in oil, you may rotate the nosepiece once more, or add more oil again. After finish observing, the top of the objective(100X and 40X) and the cover glass should be cleaned at once. Otherwise the remained dry oil will impair the imaging quality in the next observing. According to your requirement, we can also provide you infinity system plane-scope achromatic objectives, infinity system achromatic objectives, plane-scope achromatic objectives, and semi-plan achromatic objectives.

The specifications of the DIN achromatic objective system are showed as following:

DIN Achromatic Objective	Magnification	Numerical Aperture	Focal Distance	Working Distance	Cover Glass Thickness	Remark
4X	4	0.10mm	31.04mm	37.5mm	0.17mm	
10X	10	0.25mm	17.13mm	7.316mm	0.17mm	
40X	40	0.65mm	4.65mm	0.632mm	0.17mm	Spring
100X	100	1.25mm	2.906mm	0.198mm	0.17mm	Spring, Oil



**Fig 1.The Principle Draft**



- |  |   |  |
|--|---|--|
| <b>1.Nosepiece</b>                           | <b>2.Viewing Head</b>                         | <b>3.Eyepiece</b>                            |
| <b>4.Objective</b>                           | <b>5.Specimen Clamp</b>                       | <b>6.Mechanical Stage</b>                    |
| <b>7.Vernier for Stage Moving Lengthwise</b> | <b>8.Screw for Centring the Condenser</b>     | <b>10.Iris Diaphragm Plate</b>               |
| <b>9.Screw for Fixing the Condenser</b>      | <b>11.Filter Holder</b>                       | <b>12.Screw for Condenser Height</b>         |
| <b>13.Light Collector</b>                    | <b>14.Knob for Moving Stage Lengthwise(Y)</b> | <b>15.Knob for Moving Stage Crosswise(X)</b> |
| <b>16.Screw for Bulb Changing</b>            | <b>17.Switch</b>                              | <b>19.Bulb Case</b>                          |
| <b>18.Plate for Adjusting Brightness</b>     | <b>20.Base</b>                                | <b>21.Rubber Feet</b>                        |
| <b>22.Arm</b>                                | <b>23.Fine Focusing Knob</b>                  | <b>24.Coarse Focusing Knob</b>               |
| <b>25.Knob for Condenser Up or Down</b>      | <b>26.ABBE Condenser</b>                      | <b>28.Screw for Stage Height Limitin</b>     |

**Fig 2. The Structure Draft**

- 3. Mechanical tube length: 160mm
- 4. Conjugated distance between object and image: 195mm
- 5. Viewing heads and microscope models:

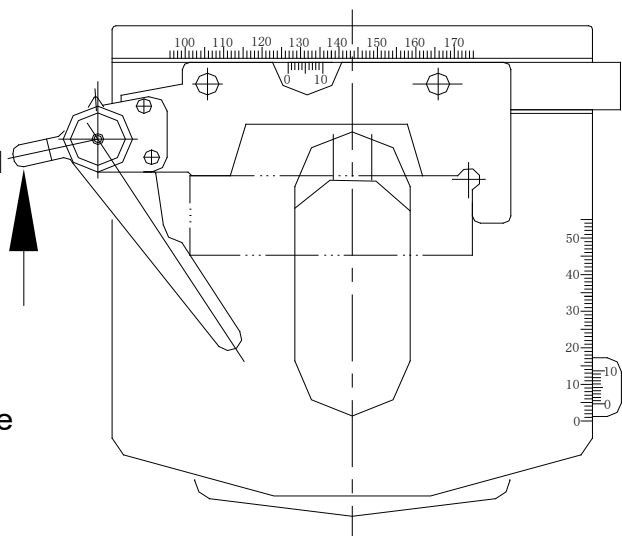
The viewing heads are used to change the direction of the ray transmitting. Equipped different type viewing heads, there are six model microscopes introduced to you for different effects.

#### 6. Nosepiece(1):

The advanced and precise construction of the nosepiece guarantees smooth rotation, clear and positive location, and meets the requirement of par-focal and par-centred objectives.

#### 7. Mechanical stage(6):

The stage of this microscope is double layers mechanical stage showed in Fig 3. Its size is 125(L)X130(W)mm. Push the rod of the clamp in the arrow direction showed in Fig 3, and insert the specimen into the clamp carefully. Leave your finger away from the clamp, the clip will turn back slowly, and then the specimen will be holded and moved with the clamp. Rotate the knob(14) to move the clamp lengthwise in 30mm. Rotate the knob(15) to move the clamp crosswise in 60mm. The moving precision is 0.1mm in both directions.



**Fig 3. Mechanical Stage**

#### 8. ABBE condenser(26) :

The numerical aperture(N.A.) is 1.25. The screw(9) is used to fix the condenser easily on the microscope without any tools. The center of the condenser in microscope can be adjusted by rotating the black-head screws(8) without any tools as following steps: a)turn the objective 4X or 10X in working; b)turn the plate(10) to make the diaphragm diameter smaller; c)lower the condenser to make the image of the diaphragm sharp by rotating the knob(25); d)rotate the screws(8) to concentre the image of the diaphragm with the eyepiece viewing field. The condenser has been adjusted coaxial with the objective before the microscope is finished. If not, there will be large different in the veiwing field: one side may be dark and another side may be bright. Rotate the knob(25), built-in rack and pinion mechanical system controls the condenser up or down. Usually, raise the condenser higher when 100X or 40X objective is used; Down the condenser lower when 10X or 4X objective is used. The highest position of the condenser raising up is limited to lower 0.2mm below the stage surface before the microscope is finished. When it is necessary to readjust, do as following steps: a)loose the nut on the screw(12); b)put a slide on the stage; c)raise the condenser up to 0.2mm about lower below the slide; d)rotate the screw(12) to touch the bottom of the stage; e)fix the screw(12) with the nut.

Turn the diaphragm plate(10) to adjust the diameter of the iris diaphragm from ? 2 to ? 30mm to match with the numerical aperture of objective in using. When the diameter of the iris diaphragm is 70-80% of the objective's numerical aperture, the image observed is sharp in contrast. Look into the tube without eyepiece, you can see the image of the iris diaphragm.

The filter holder(11) can be turned out to insert the filter when you need. The color of the filter may be blue, or green, or yellow.

#### 9. Focusing system:

It is a coaxial coarse and fine focusing system with rack and pinion mechanism. Its focusing range is 20mm, and its precision of fine focusing is 0.01mm. Rotate the coarse focusing knob(24) to raise the stage up or down quickly. Rotate the fine focusing knob(23) to raise the stage up or down slowly.

#### 10. Illumination system:

Usually, the illuminator of this series microscope is 6V/20W halogen lamp.(It also may be 20W incandescent lamp, or 5W fluorescent, or 3.5V/1W LED lamp). Turn the plate (18) to adjust the brightness. So the image backdrop will be not too bright under the lower-powered objectives, or too weak under the higher-powered objectives. LED lamp

is soft in light to suit the operator for a long time micro-observation. When the current and voltage don't overstep their limits, its average life can reach to 100000 hours. It is very securely because the bulb's temperature is lower than 30°C even in a long time using. Equipped with rechargeable and high-capacity NiMH batteries, it can avoid the trouble of power supply shortage.

The position of the bulb in microscope is very important to the imaging quality. When the lighting centre is not coaxial with the objective, there will be large difference in the eyepiece viewing field: one side may be dark and another side may be bright. The bulb has been placed correctly in our factory. When change the bulb, please keep it centring.

**Caution:**

**----Before change a bulb, ensure that the microscope has been disconnected with the power source.**

**----The new bulb must be the same specifications as the old one.**

**----When the illuminator is halogen lamp or incandescent lamp, the base near the lighting source may be very hot. Don't worry about it, but it must be treated carefully. Please take the combustible material(such as gasoline, paper, plastic and cloth) far away from the microscope.**

**----When change incandescent bulb or halogen bulb, wait until it is cool enough, otherwise the hot bulb will burn your fingers .**

**----Don't leave any dust and fingerprints on the bulb, otherwise it may affect its life and illuminating efficiency.**

Lay the microscope on its side, Loosen the screw(16) under the bottom, open the bulb case(19) to change the bulb.

## **D) How to use and assemble:**

1. Unpack the microscope and its parts carefully. Check and sort out all parts according to the packing list;

2. For the convenience of packaging and delivering, the components and parts may be separated from the mainframe. Before using, please assemble them together according to the structure draft(Fig 2).

1) Install the viewing head:

The viewing head of model XSP21-01M, or XSP21-01S, or XSP21-01V is fixed on the mainframe. But the binocular head of model XSP21-01B and the trinocular head of model XSP21-01T are usually separated from the mainframes. Loosen the screw(27) and take off the plastic plate cover on the body(22). Take the plastic plate cover on the viewing head. Finally install the viewing head on the body(22) and fix it with the screw(27). Don't try to loose another two screws for centring the viewing head on the body(22).

2) Install the objectives(4):

Usually, the objectives are fixed stably on the nosepiece by us. Sometimes, they are separated from the mainframe. Screw the plastic dust cover out off the nosepiece(1) and take the objectives out off their plastic bottles. Screw them on the nosepiece(1) by their magnification order from low to high.

3) Install the eyepiece(3):

Take off the plastic dust cover from the eyepiece tube and insert the eyepiece needed.

3. The operating steps:

1) Select a position to work where little direct light falls on the instrument. Keep the microscope far away from a large window and not to face the window, because the direct light may adversely affect the contrast and resolution of the image.

The following working surroundings are required:

a) Room temperature: 0°C-40°C                      The highest relative humidity: 85%

b) High temperature and humidity can cause mildew and damage the instrument.

c) Keep the microscope away from dust. When it is not used, please put the dust cover over it.

d) Keep the microscope away from vibration.

2) Insert the micro-slide specimen into the clamp(5). Be sure that the cover glass is facing towards the objective. Otherwise you will not be able to focus your specimen at using higher powered objective(40X, or 100X).

3) Place a lower powered objective(4X, or 10X) into position and simply turn on the illuminator.

**Caution:**

**The power supply voltage must be fitted to the microscope; Otherwise it will damage the circuit and bulb, even lead to insecurity.**

4) Rotate the knobs(14,15) to move the specimen so that it is centred over the in-stage condenser.

5) Focus the objective on the specimen by turning the coarse focusing knob(24) until the image of your specimen is bright and clear. You can find the focal plane and focusing upwards by using the lower powered objective, and then you can bring the specimen into sharp focus by turning the fine focusing knob(23).

6) The specimen now is in sharp focus. Rotate the nosepiece(1) to the other objectives and focus using only the fine focusing knob(23). Since the optics on the microscopes are Par-focal and Par-centered, only slightly turn the fine focusing knob(23) to make the image bright and clear.

**Note:**

**It is important to note that the 4X and 10X objectives can never come into contacting with your micro-slide specimen because of our built-in stop. The 40X and 100X objectives may occasionally touch the micro-slide specimen. But because they have retractable mounts, the micro-slide specimen will not be damaged.**

7) To make the image clearer, you can adjust diameters of the iris diaphragm to match with the numerical aperture of objective in use(Section 8. ABBE condenser in P.5).

**E) Trouble Shooting:**

If there are some troubles in operating, recheck the instrument carefully as the following describing before connect us or our representative in you area.

1) Troubles in operating:

Troubles	Causes	Remedies
The specimen goes out of focus.	The stage is limited too low.	Adjust the the upper focusing limit.
The slide is often broken by objective	The stage is limited too high.	Adjust the the upper focusing limit.
Can't focus in using high powered objective.	The specimen is mounted on the stage upside down or the cover glass is too thick.	Reverse the specimen or choose the standard cover glass(0.17mm).
The objective always touches with the slide when changing.	The cover glass is too thick.	Choose the standard cover glass (0.17mm).
Move the specimen no smoothly.	The clamp is not fixed stably.	Fix the clamp stably on the stage.
Incomplete binocular vision.	Interpupillary distance is not correctly adjusted.	Correct the interpupillary distance .
	Dioper adjusting is incomplete.	Complete the dioper adjusting.
	The brightness is not suitable.	Checkthe illuminator and adjust its brightness.

## 2. Troubles in optical system:

<b>Troubles</b>	<b>Causes</b>	<b>Remedies</b>
Field of view is cut off, or illuminated irregularly.	The nosepiece is not changed properly.	Slightly rotate the nosepiece until it clicks into position.
	The centre of the bulb is not coincidence with the centre of the objective.	Position the bulb correctly.
	There are dust or dirt on the glass surface of the lenses.	Remove the dust and dirt.
Dust and dirt is visible in the field of view.	There are dust or dirt on the glass surface of the lenses.	Remove the dust and dirt.
	There are dust or dirt on the specimen surface.	Remove the dust and dirt.
	The condenser is too low.	Raise the condenser up.
Image quality is poor: insufficient contrast and image details lack definition.	There is no cover glass on the slide.	Put the cover glass on the slide.
	The cover glass is too thick or thin.	Choose the cover glass 0.17mm thick.
	The specimen is mounted on the stage upside down.	Reverse the specimen.
	The top lens of the objective is dirty.	Clean it.
	There are dust or dirt on the glass surface of the lenses.	Remove the dust and dirt.
	Immersion objective is used without immersion oil.	Apply immersion oil.
	There are bubbles in the immersion oil.	Drive the bubbles out.
	Special immersion oil is not used.	Use the special immersion oil.
	There are dust or dirt on the surface of the prisms.	Remove the dust and dirt.
	The diameter of the iris diaphragm is too large or small.	Adjust the diameter of the iris diaphragm.
One side of the viewing field is dark.	The condenser is not correctly positioned in the light path or inclined.	Position the condenser.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	The clamp is not fixed stably.	Fix the clamp stably on the stage.
Image moves while focusing	The specimen is not caught stably by the clamp.	Catch the specimen stably.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
The image is yellow.	Blue filter is not used.	Apply the blue filter.
The viewing field is too dark.	The diameter of the iris diaphragm is too small.	Adjust the diameter of the iris diaphragm larger.
	The condenser is too low.	Raise the condenser up.
	There are dust or dirt on the glass surface of the lenses.	Remove the dust and dirt.



### 3. Troubles in electric system:

Troubles	Causes	Remedies
The bulb does not light when turn on.	Loose electric connection.	Secure the connection.
	No insert the bulb.	Insert the bulb correctly.
	Fuse is burned out.	Replace the bulb.
	Fuse is burned out.	Replace the fuse.
Reduced bulb life.	Bulb is not a standard one.	Use a standard bulb.
	Bulb is voltolized.	Reduce bulb voltage.
Illuminator is too dark.	Bulb is not a standard one.	Use a standard bulb.
	Mains voltage is too low..	Adiust the mains voltage.
Light flickers and the intensity is unstable.	Mains voltage is unstable.	Use a voltage stabilizer.
	Bulb's filament is likely to burn out.	Replace the bulb.
	Loose electric connection.	Secure the connection.

### F) Maintenance and care of your microscope:

1. Unpack the microscope carefully to prevenet the accessories as lenses from falling down and damaging.

2. All lenses are calibrated, don't try to dismantle them apart by yourself.

3. Nosepiece and focusing system is advanced and precise in construction, and don't try to dismantle them apart by yourself. Please connect with an authorized technician when they are in trouble.

4. Keep the mechanical parts from dust, and add a few no corrosiveness lubricating grease into the sliding sections at regular intervals. Keep the optical elements clean when wipe the instrument.

5. Keep the instrument in dry and cool place. Disconnect it with the power source and put the dust cover over it after use. If it will be not used for a longer time, it is the best way to screw the objectives out and place them into the lens-bottles, and screw the dust covers on the nosepiece.

### G) Microscope with CCD camera:

When a CCD camera is used, it is better to choose model **XSP21-01V** or **XSP21-01T** microscope.

1. See Fig 4., and connect the CCD camera with the microscope as following steps:

1) Take the plastic dust cover off from the viewing head and screw the vertical tube in;

2) Screw the plastic dust cover off from the CCD camera and screw the CCD Linker in it;

3) Connect "VIEDO OUT" terminal in the CCD camera to "VIEDO IN" terminal in colour TV with a singlar line. Plug the DC12V power supply line into the power socket of CCD camera .Switch the power source on and the "PL" pilot lamp lights. Set the exposure mode to "AUTO" position(to "MANU" position, need a auto-iris joint) for auto exposing;

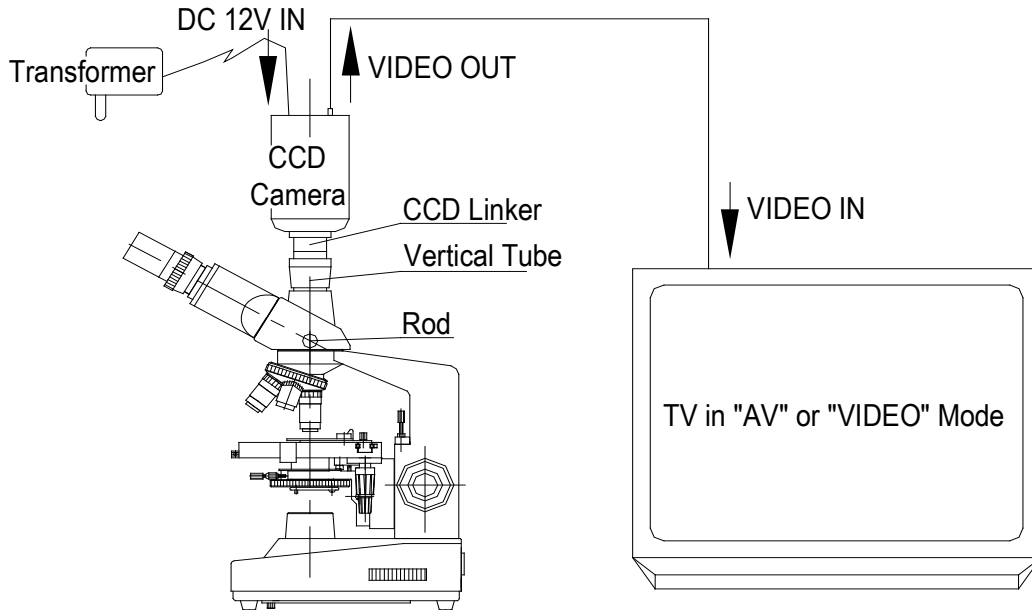
4) Switch on the TV and select "AV " or "VIDEO" mode;

5) Push the rod of trinocular head in completely and adjust the microscope in the best working state according to the manual. Then pull the rod out completely. Wait a moment, the micro-picture will be showed in the TV screen. Focus slightly by the fine focusing knob and adjust the position of the condenser and the diameter of the iris diphragm to make the picture clearer.

2. Trouble shooting:

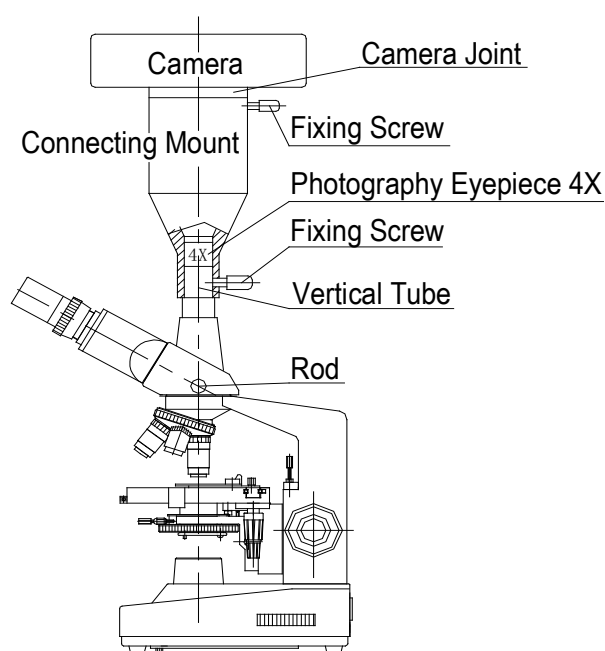
While the microscope is fuctioning normally, but on TV there is no picture, or the picture is not high in quality, please check the instrument as following describing:

- 1). Whether the "VIDEO OUT" terminal of the CCD camera is connected correctly to the "VIDEO IN" terminal of Color TV by a signal line, or not?
- 2). Whether the CCD camera is powered, and its "PL" pilot lamp is lighting?
- 3). Whether the TV is turned on the mode "AV" or "VIDEO"?
- 4). Whether the rod on the right of trinocular head is pushed out?
- 5). Whether the microscope is focused correctly? At this time, you can see a clear image in the eyepiece viewing field. Now, if the image showed in the TV screen is not clear, you can adjust the height of the vertical tube by rotating it. If the change is not obvious, focus slightly by the fine focusing knob and adjust the position of the condenser and the diameter of the iris diaphragm
- 6). If the picture is disturbed seriously, please adjust the microscope illuminator brighter.



**Fig 4. Microscope with CCD Camera**

## H) Microscope with camera:



**Fig 5. Microscope with Camera**

3) Insert the photography eyepiece 4X into the camera mount(Sometimes there is not a photography eyepiece 4X as the customer's requirement). Join the camera with the mount and fix it stably.

4) Push the rod of trinocular head in completely and adjust the microscope in the best working state according to the manual. Then pull the rod out completely. A micro-image will appear in the camera previewing window. Focus slightly by the fine focusing knob and adjust the position of the condenser and the diameter of the iris diaphragm to make the image clearer.

5) Take a picture.

## I) Microscope with electron eyepiece:

When the electron eyepiece is used, you can choose model XSP21-01V, or XSP21-01S, or XSP21-01T microscope. So you can observe by using common eyepiece at the same time of showing the micro-image in the PC screen. The electron eyepiece is also used in model XSP21-01M or XSP21-01B microscope.

See Fig 6., and connect the camera with the microscope as following steps:

1) Prepare a PC required:

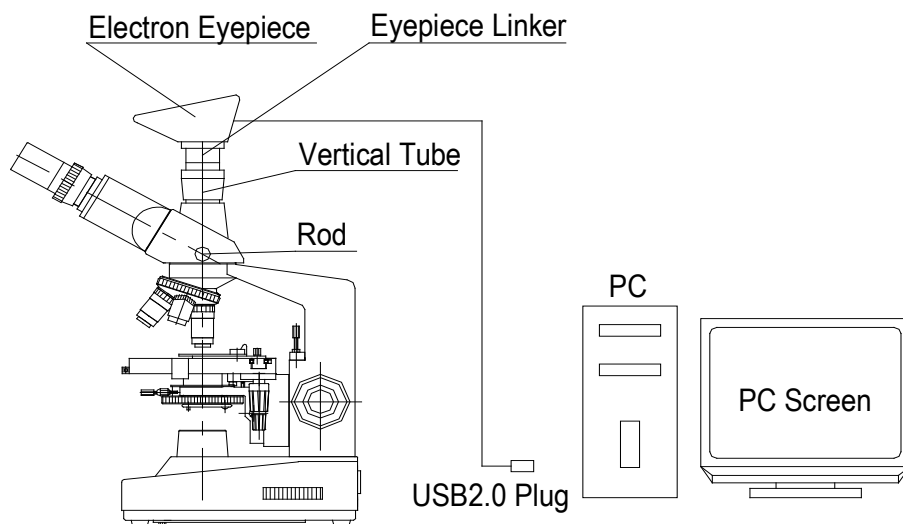
Hardware : USB2.0 Connecting Socket; CPU: Intel P4; EMS Memory: 256M  
Hard Disk: 512M; PC Screen Resolution: 1024\*768

Software: win2000(with Mend sp4); or winxp (with Mend sp2) and directx 9.0;

2) Insert the driver CD into your PC and run the installing program as the promoting information (See **Appendix B: Digital Camera Head**);

3) Prepare the microscope for using. Insert the electron eyepiece into the microscope tube, and connect it correctly with your PC;

4) Adjust the microscope in the best working state according to the manual and find a clear image in the eyepiece viewing field. (When a trinocular viewing head is used, first push the rod of the head in completely and adjust the microscope in the best working state. Then pull the rod out completely.) Wait a moment, the micro-picture will be showed in the PC screen. Focus slightly by the fine focusing knob and adjust the position



**Fig 6. Microscope with Electron Eyepiece**

User-friendly sophisticated micro-image process software help you to preview, measure, compare, count, save and delete. (See **Appendix B: Digital Camera Head** )

## **J) XSP21-01DN digital microscope:**

1) Prepare a PC required:

Hardware : USB2.0 Connecting Socket; CPU: Intel P4; EMS Memory: 256M  
Hard Disk: 512M; PC Screen Resolution: 1024\*768

Software: win2000(with Mend sp4); or winxp (with Mend sp2) and directx 9.0;

2) Insert the driver CD into your PC and run the installing program as the promoting information (See **Appendix B: Digital Camera Head** );

3) Prepare the microscope for using. Connect it correctly with your PC;

4) Push the rod of the viewing head in completely and adjust the microscope in the best working state. Then pull the rod out completely. Wait a moment, the micro-picture will be showed in the PC screen.

Generally, when low-powered objective(4X, or 10X) is used, the picture in the PC screen will be too bright to observe after the rode of the viewing head is pulled out. You can adjust the microscopeto get a satisfied picture in the PC screen as the following ways:

- 1) Turn the plate(19) to make the illuminator darker;
- 2) Turn the plate(10) to make the diameter of the iris diaphragm smaller;
- 3) Rotate the knob(23) to lower the ABBE condenser.

When high-powered objective(40X, or 100X) is used, adjust the microscope to get a satisfied picture as the opposite way:

- 1) Turn the plate(19) to make the illuminator brighter;
- 2) Turn the plate(10) to make the diameter of the iris diaphragm larger;
- 3) Rotate the knob(23) to lift the ABBE condenser higher.

Finally, focus slightly by the fine focusing knob to make the picture clearer. User-friendly sophisticated micro-image process software help you to preview, measure, compare, count, save and delete.

## **Appendix A: Eyepieces and Objectives for Option**

### **1. Eyepieces for Option:**

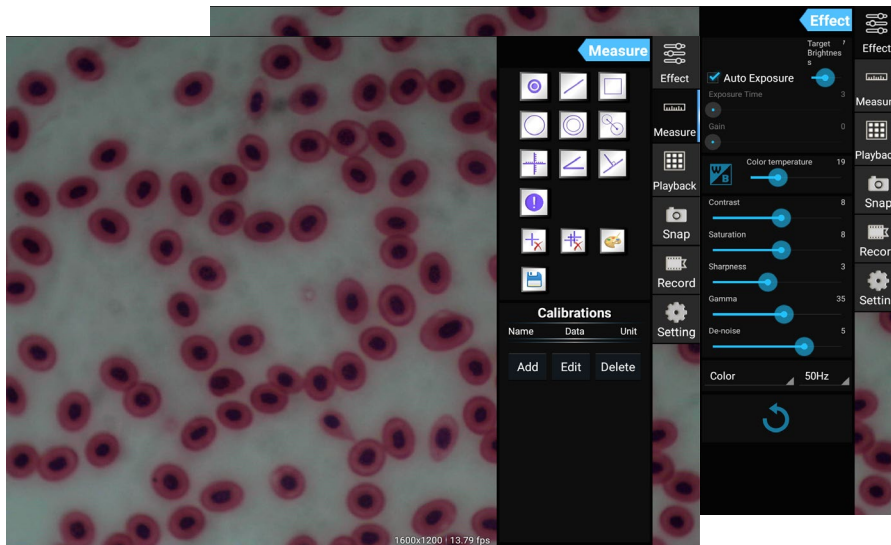
<b>Name</b>	<b>Specifications</b>
Wide-field and plano-scope eyepiece	WF5X, WF6X, WF10X, WF12.5X, WF15X, WF16X, WF20X
Huygenian eyepiece	5X, 6X, 10X, 12.5X, 15X, 16X

### **2. Objectives for Option:**

<b>Name</b>	<b>Specifications</b>
DIN Achromatic Objective	4X, 10X, 20X(S), 40X(S), 60X(S), 100X(S,Oil)
Infinity System Planecope Achromatic Objective	4X, 10X, 20X(S), 40X(S), 60X(S), 100X(S,Oil)
Infinity System Achromatic Objective	4X, 10X, 20X(S), 40X(S), 60X(S), 100X(S,Oil)
Planecope Achromatic Objective	4X, 10X, 20X(S), 40X(S), 60X(S), 100X(S,Oil)
Semi-Planecope Achromatic Objective	4X, 10X, 20X(S), 40X(S), 60X(S), 100X(S,Oil)

# LCD Digital Camera Manual

## Real-Time Measurement Software for Android



# 1. Introduction

This APP is a camera application for android device. This APP can adjust image parameter, measure the objects, and capture image and video from the camera.




This APP also provided simple image processing feature for particles analysis.

# 2. Camera User Interface



1. Preview Image – show live video of the camera.
2. Tool Panel – Control panels, capture, adjust parameter, measurement, etc.
  - 2.1 Camera parameter adjustment.
  - 2.2 Measurement
  - 2.3 Image and video playback.
  - 2.4 Take pictures and record video.
  - 2.5 Setting

### 3. Capture and Playback

 Snap	Click “Snap” button to take a picture. Select picture size in the setting interface.
 Record	Click “Record” button to start video recording, click again to stop video recording. If preview size is smaller than 1080p, the video size is same as preview size. If preview size is bigger than 1080p, the video size will down to a size smaller than 1080p.
 Playback	Show picture just captured. Play video file which just saved.  The picture will be opened in <b>Image Analysis</b> interface.

### 4. Adjust image parameter of camera


When the color of image is not very good, adjust the effect of image by “Effect” panel.

#### Exposure:

**Auto mode:** Brightness of the image will be automatically adjusted, you can also adjust the target brightness.

**Manual mode:** Manually adjust exposure time and gain.

#### White Balance:

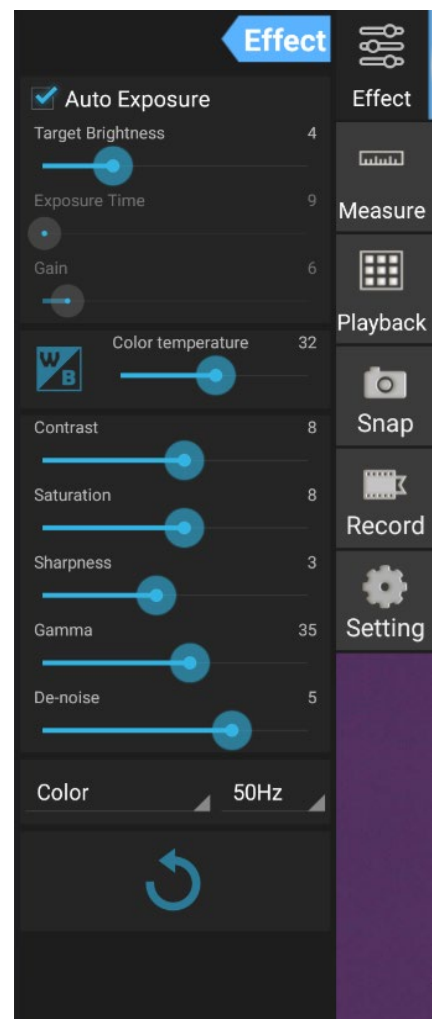
**Once AWB:** Click  icon to trigger once auto white balance.

**Manual WB:** Manually adjust color temperature.

#### Color Adjustment

Contrast, Saturation, sharpness and gamma of the image can be adjusted too.

Click the reset button  to restore the parameters.

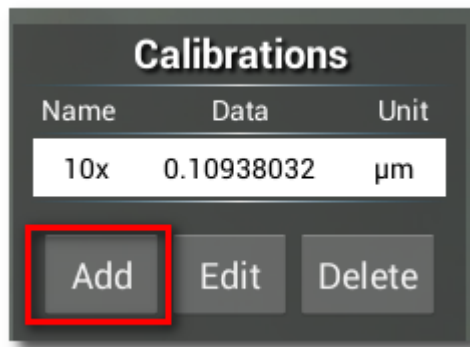


## 5. Measurement

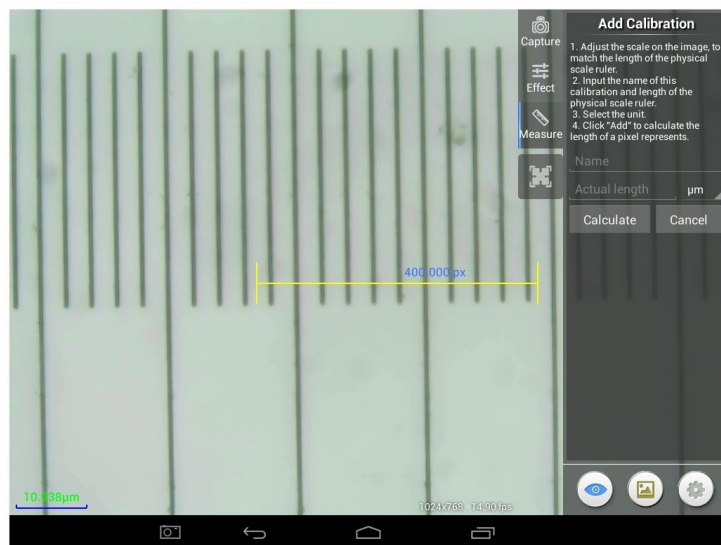
### 5.1 Calibration

We need calibrate the ruler before measurement, Specific combination of magnification of microscope and the preview size of camera need specific calibration.

Swap the tool pane to measurement, click “Add” to add a new calibration, Click “Edit” to recalibrate the exist calibration.



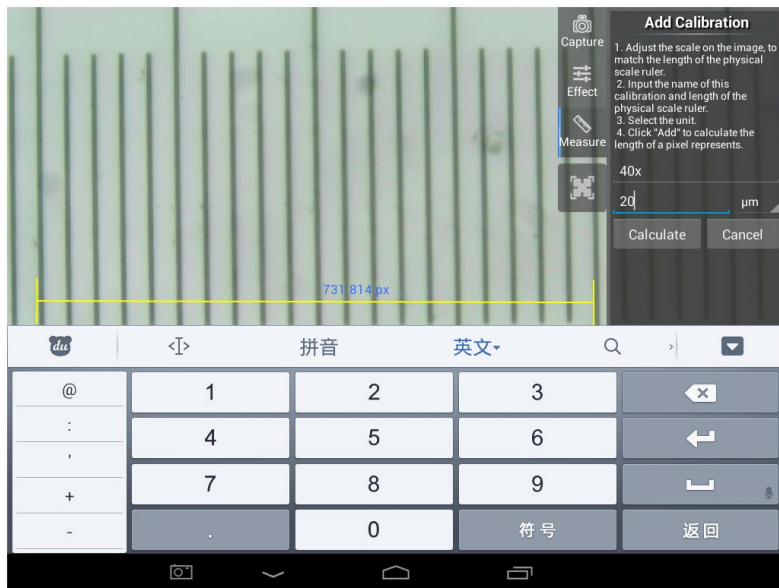
Enter calibration mode



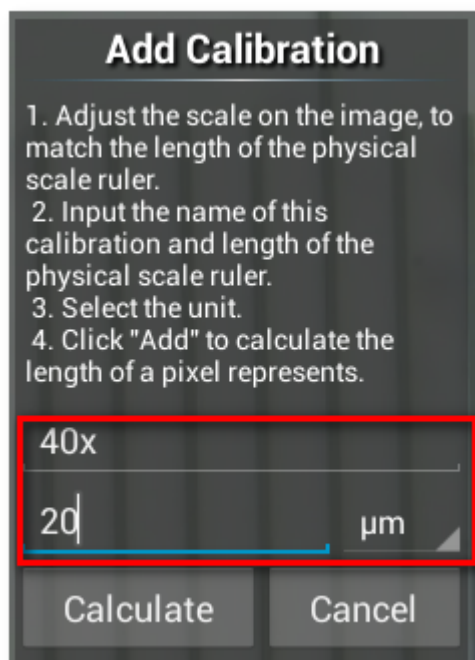


Follow the Tips:

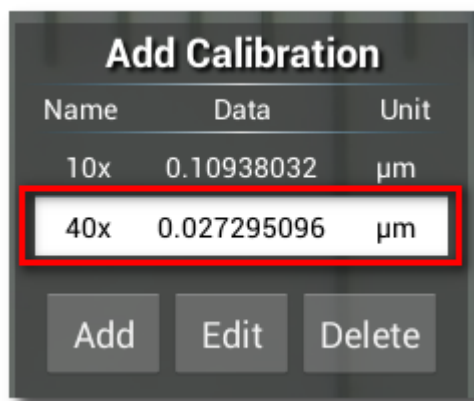
1. Drag the yellow ruler, let endpoints of the ruler close to physical ruler's scale. We use the 0.01mm physical ruler, each big grid is 10 $\mu$ m, we pick two grid, that's 20 $\mu$ m.

















2. Input the name of the calibration and the physical length of the ruler. We input 40x for the name, that means the magnification of objective is 40X, Then input the physical length of the ruler, that is 20 $\mu$ m.



3. Click "Calculate" to calculate the calibration value for current objective and preview size, and save to list.

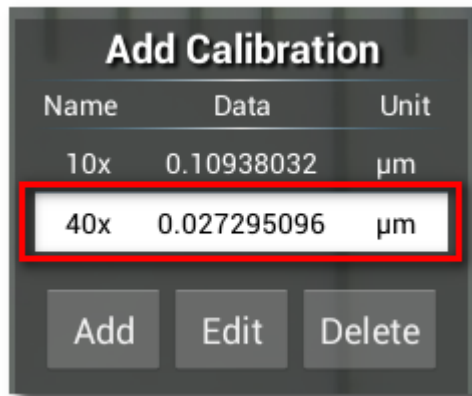


## 5.2 Measure tool

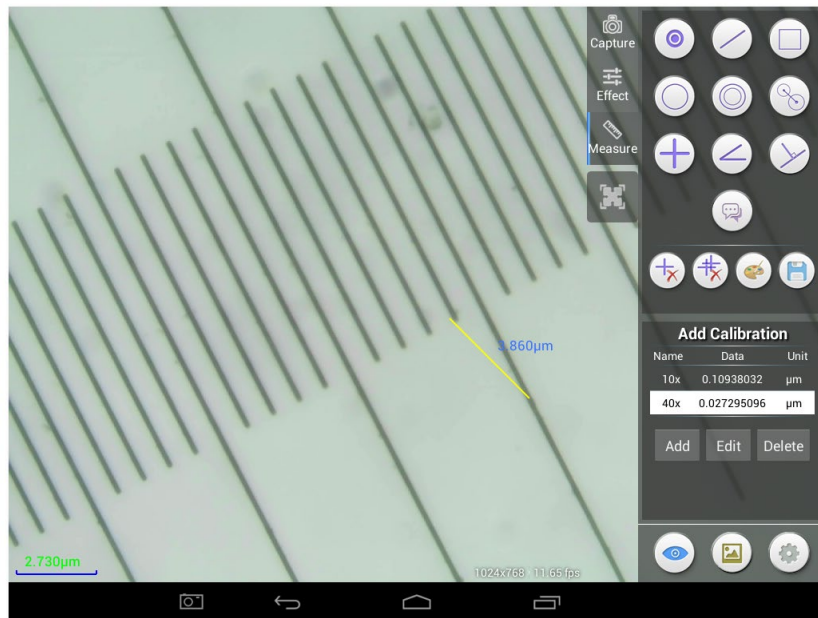
ICON	Function	Description
	point counting	Add a point counting marker on the image.
	Line	Measure distance of two points.
	Rectangle	Measure width, length and area of rectangle
	Circle	Measure area of circle
	Cross	Cross hair
	Angle	Angle measurement
	TwoCircles	Measure distance of two circle.
	Perpendicular	Measure length of perpendicular
	Concentric	Measure radius of two circles.
	Text Annotation	Draw text annotation on the image.
	Option	Change stroke width and color of rulers, and the size and color of the text.
	export	Export the image with measurement rulers.
	Delete	Delete the selected ruler
	Delete	Delete all

### 5.3 Measure with line ruler

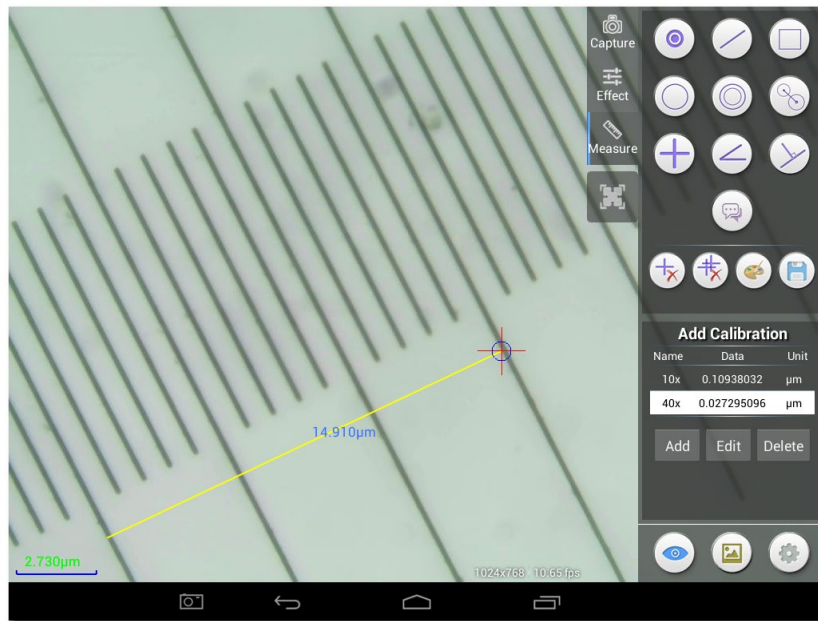
Choose an calibration, the selected item will show with white background and black text.



Choose line ruler from right side bar. There will be an line ruler show on the image.



Use the line ruler to measure the physical ruler.



We measured 1.5 big grid, the line ruler show 14.910µm, that represent the result is right.

## 6. Image Analysis

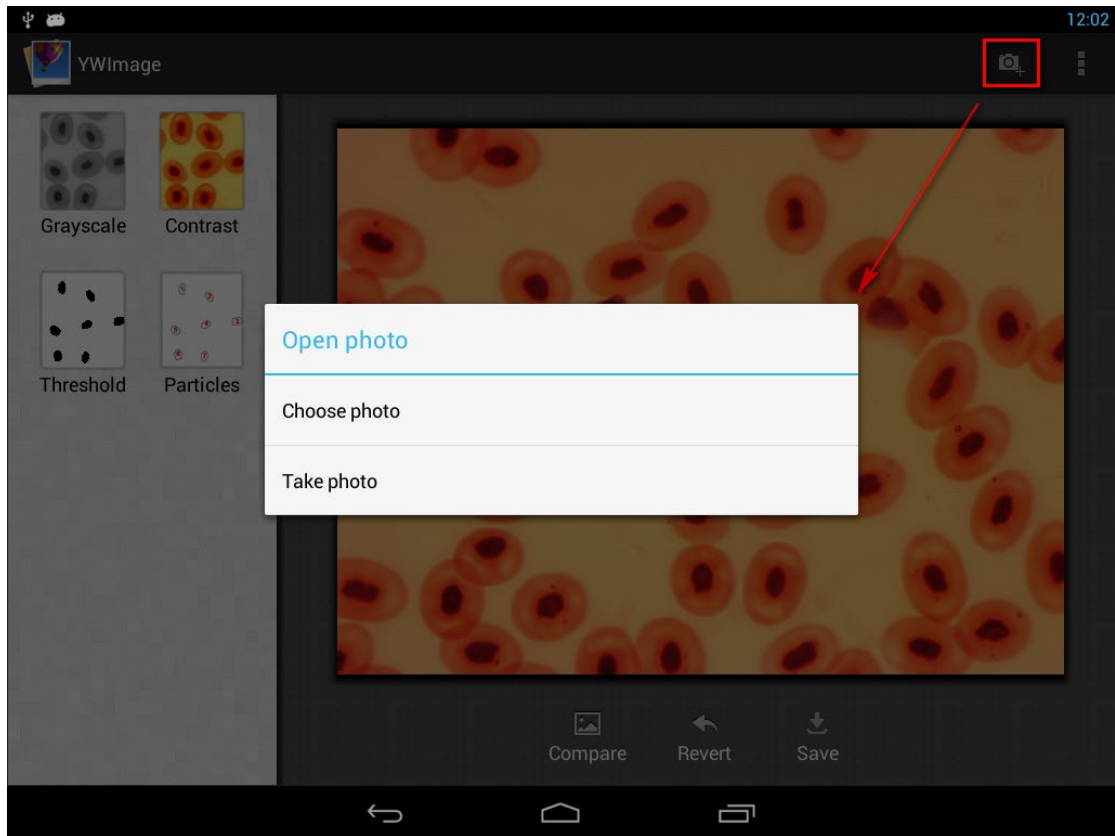
Image is an application which used to process microscopic images on Android devices. It depends on computer vision library OpenCV.

Currently, version 1.0 of Image provides functions like gray scale, contrast, binarization and particles analysis.

### 6.1 Examples of particle analysis

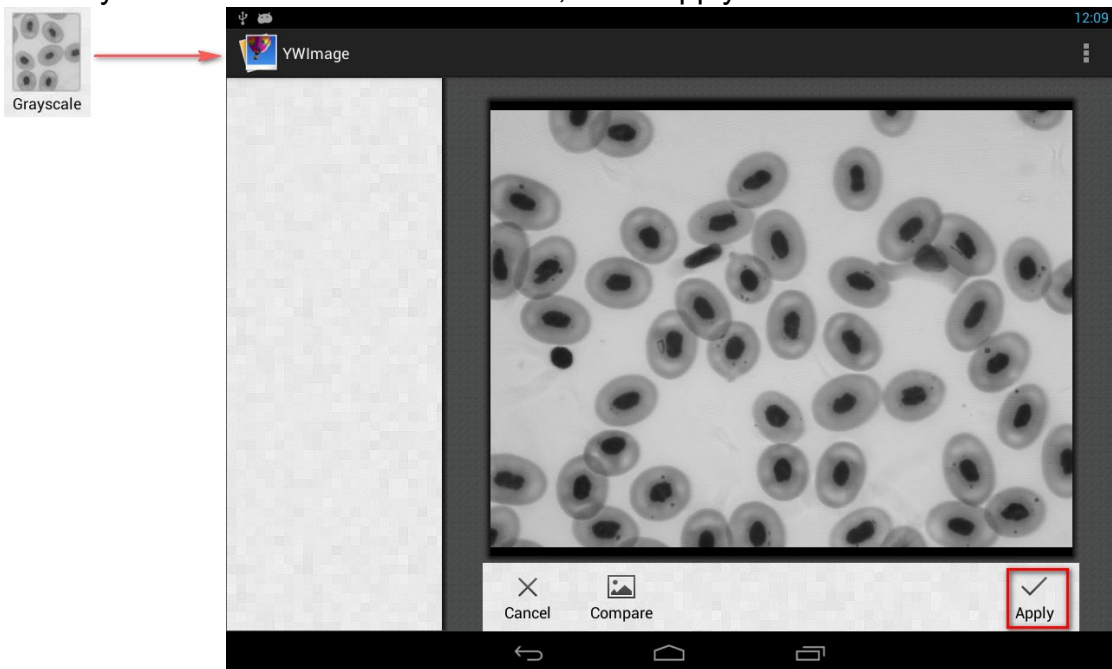
#### 6.1.1 Load image file

Click the camera icon to the upper right corner of the screen, you can choose a picture or take picture from Camera application.



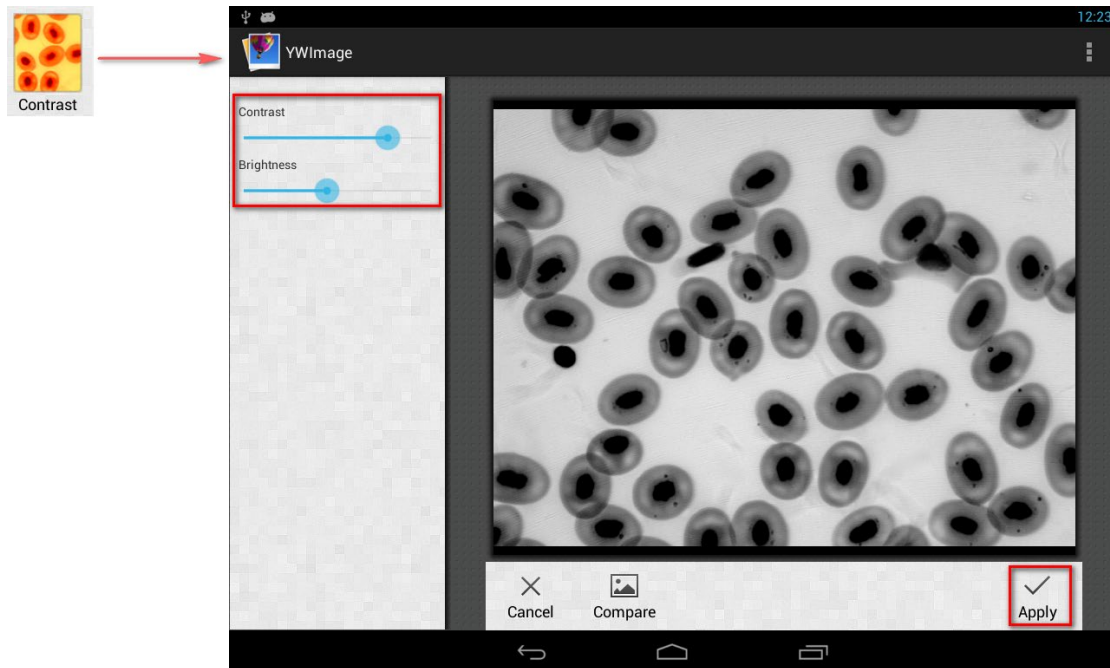
### 6.1.2 Convert the image into grayscale

Choose “Grayscale” function from left sidebar, click “Apply” button to confirm conversion.



### 6.1.3 Adjust contrast and brightness

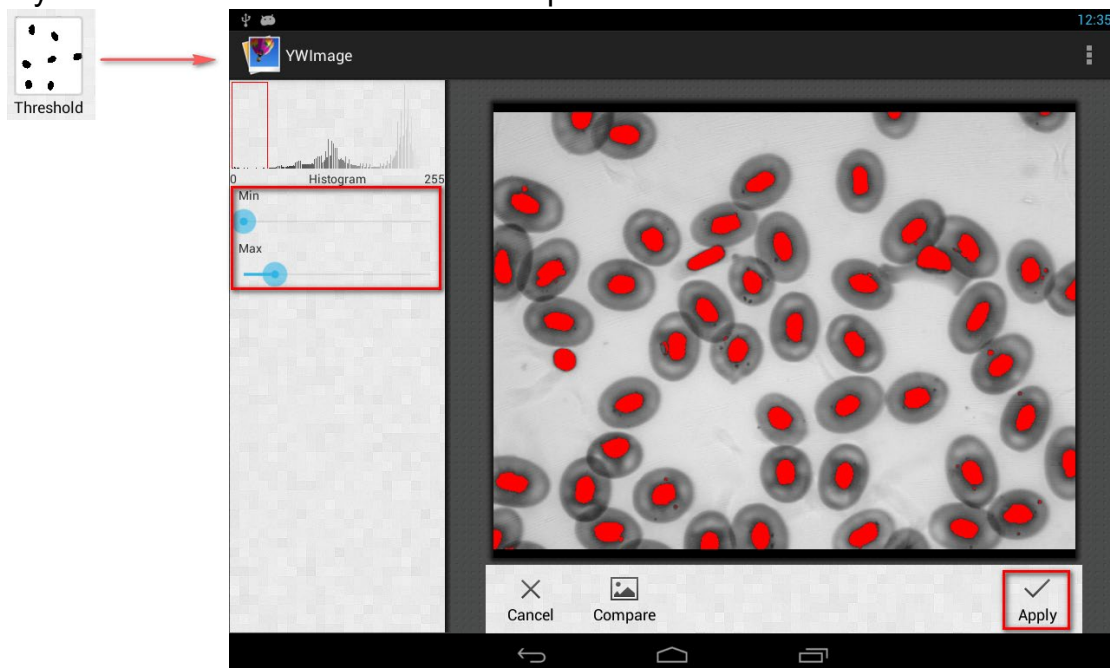
Adjust contrast and brightness of the grayscale image, increase the difference between the objects and background



### 6.1.4 Binarization

With the binarization tool, you can change the minimum and maximum value of threshold. The intensity of all the pixels within the threshold range will be set to red. After applying binarization, the red area's RGB value will be set to (0, 0, 0), the other area's RGB value will be set to (255, 255, 255).

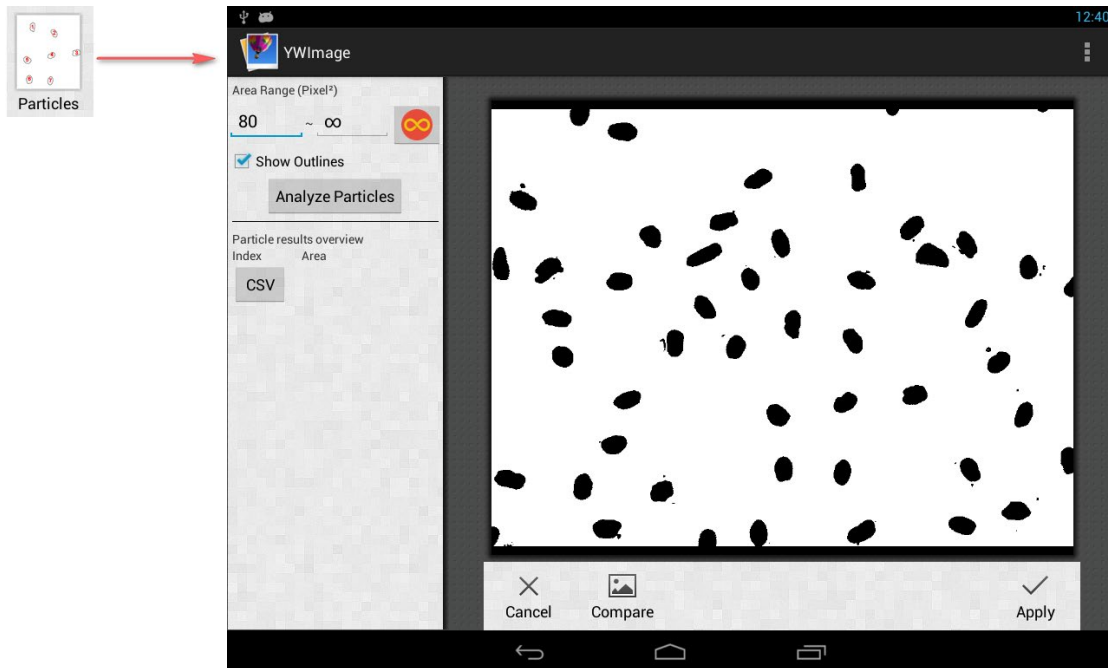
Note: Try to make the red area do not overlap each other.




### 6.1.5 Particle analysis

After applying binarization, open the particle analysis tool:





First of all, Because some noise or dirty point was not clear by binarization. You need set the range of particle's size. Reduce the range of particle's size will make the result much more precision.

To restore the maximum value to infinity, Click the  button.

Check the “Show Outlines” checkbox to show border and number of particles after analysis. Click “Analyze Particles” button to start analysis, the result will show blow.



Click “CSV” button to export to data to report file, the default path is: /mnt/sdcard/Image/Reports