The X5FCAM4K8MPA Auto Focus HDMI/WiFi/USB Multi-outputs C-mount CMOS Camera Help Manual

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1 X5FCAM4K8MPA Camera Application

Figure 1 The X5FCAM4K8MPA Camera

The X5FCAM4K8MPA is a camera designed by ToupTek that includes multiple modes of output (HDMI/WiFi/USB), where X in 'X5FCAM' means a CMOS camera with multiple interfaces, and F means auto focus. It uses ultra-high-performance CMOS sensor. The camera can be directly connected to an HDMI display, or it can be connected to a computer via WiFi or USB, and the image and video can be saved in an SD card /USB flash drive for on-site analysis and subsequent research.

Enhanced with an embedded ARM core, this camera integrates various functions inside. With the help of a USB mouse and well-designed UI on the HDMI monitor, all functions could be easily controlled.

The X5FCAM4K8MPA camera comes with the built-in Auto Focus system, which can realize Auto Focus on specific areas of the sample.

By inserting a WiFi module or connecting to a computer via a USB cable, the user can directly control the camera's hardware with the software ToupView or ToupLite. The X5FCAM4K8MPA camera can be used for tool field inspection, microscope observation, etc.

The basic characteristic is listed as below:

- Sony STARVIS 2 back-illuminated CMOS sensor
- 4K HDMI/ WiFi / USB multiple video synchronous outputs
- 4K/1080P auto switching according to monitor resolution
- Support 4K 60fps low delay HDMI output mode, with an average delay of 40ms
- SD card/USB flash drive for captured image and video storage, support local preview and playback
- New browsing function, providing rich file operation functions, image to image comparison, image to real-time video comparison, multi-image EDF and other functions
- Provide multiple focusing methods, and the size of the focusing area can be modified; Provide AF+EDF, facilitating the synthesis of high depth of field images in multiple focus areas at high magnification
- Excellent ISP with local tone mapping and 3D denoising
- Provide real-time video EDF function and real-time video WDR output function
- Provide two sets of default ISP parameters for biological microscope and stereo microscope
- Embedded XCamView for the control of the camera and image processing, supporting automatic edge finding and measurement functions
- ToupView/ToupLite software for PC
- iOS/Android applications for smart phones or tablets

2 X5FCAM4K8MPA Camera Datasheet and Functions

Order Code	Sensor & Size(mm)	Pixel(μm)	G Sensitivity Dark Signal	Sensor Output (FPS/Resolution)	Binning	Exposure(ms)
X5FCAM4K8MPA	Sony IMX678(C) 1/1.8"(7.68x4.32)	2.0x2.0	3541mv with 1/30s 0.15mv with 1/30s	60@3840*2160	1x1	0.019~1000

Camera Model	Video Saving(FPS/Resolution)	HDMI2.0(FPS/Resolution)	USB3.0(FPS/Resolution)	WiFi(FPS/Resolution)
X5FCAM4K8MPA	60@3840*2160 60@1920*1080	60@3840*2160 60@1920*1080	30@3840*2160 45@2688*1512 60@1920*1080	30@3840*2160 60@1920*1080 60@1280*720

Figure 2 Available Ports on the Back Panel of the Camera Body

Interface or Button	Function Description
USB Mouse	Connect USB mouse for easy operation with embedded XCamView software
USB3.0	Connect USB flash drive to save pictures and videos Connect 5G WiFi module to transfer video wirelessly in real time Connect USB microphone for audio and video recording
USB Video	Connect PC or other host device to realize video image transmission
HDMI	Comply with HDMI2.0 standard. 4K/1080P format video output and supporting automatic switch between 4K and 1080P format according to the connected monitors
SD	SD card slot, comply with SDIO3.0 standard and SD card could be inserted for video and images saving
ON/OFF	Power switch
LED	LED status indicator
DC12V	Power adapter connection (12V/1A)
Video Output Interface	**Function Description**
HDMI Interface	Comply with HDMI2.0 standard;60fps@4K or 60fps@1080P
WiFi Interface	Connecting 5G WiFi adapter (USB3.0 slot) in AP/STA mode
USB Video Interface	Connecting USB Video port of PC for video transfer H264/MJPEG format video
Other Function	**Function Description**
Video Saving	Video format：8M(3840*2160) H264/H265 encoded MP4 file Video saving frame rate：60fps in Low Delay mode; 30fps in WDR mode
Image Capture	8M (3840*2160) JPEG/TIFF image in SD card or USB flash drive (Default SD card priority, priority can be modified in settings)
Measurement Saving	Measurement information saved in different layer with image content Measurement information is saved together with image content in burn in mode
ISP	Exposure(Automatic / Manual Exposure) / Gain， White Balance(Manual / Automatic / ROI Mode)，Sharpening， 3D Denoise， Saturation Adjustment，Gamma Adjustment， Contrast Adjustment，Brightness Adjustment，Hue Adjustment, Color to Gray， 50HZ/60HZ Anti-flicker Function
Image Operation	Zoom In/Zoom Out(Up to 10X), Mirror/Flip, Freeze, EDF, Cross Line, Overlay, PIP , Auto Focus , Browser(including Picture Browsing , Video Playback , Video Compare , Picture Compare , EDF , Image Processing), Measurement Function
Embedded RTC(Optional)	To support accurate time on board
Restore Factory Settings	Restore camera parameters to its factory status
Multiple Language Support	English / Simplified Chinese / Traditional Chinese / Korean / Thailand / French / German / Spanish / Japanese / Italian / Russian / Dutch / Portuguese
Software Environment under WiFi/USB Video Output	
White Balance	Auto White Balance

Color Technique	Ultra-Fine Color Engine
Capture/Control SDK	Windows/Linux/macOS/Android Multiple Platform SDK(Native C/C++, C#/VB.NET, Python, Java, DirectShow, Twain, etc)
Recording System	Still Picture or Movie
Operating System	Microsoft® Windows® 8 / 8.1 / 10 / 11(32 & 64 bit) OSx(Mac OS X) Linux
PC Requirements	CPU: Equal to Intel Core2 2.8GHz or Higher
	Memory: 4GB or More
	USB interface: USB2.0 interface or higher
	Display:19" or Larger
	CD-ROM
Operating Environment	
Operating Temperature (in Centidegree)	-10°~ 50°
Storage Temperature (in Centidegree)	-20°~ 60°
Operating Humidity	30~80%RH
Storage Humidity	10~60%RH
Power Supply	DC 12V/1A Adapter

3 Dimension of X5FCAM4K8MPA Camera

Figure 3 Dimension of X5FCAM4K8MPA

4 X5FCAM4K8MPA Camera Packing Information

Figure 4 X5FCAM4K8MPA Camera Packing Information

Standard Packing List			
A	Gift box : L:25.5cm W:17.0cm H:9.0cm (1pcs, 1.7Kg/ box)		
B	X5FCAM4K8MPA Camera		
C	Power Adapter: Input: AC 100~240V 50Hz/60Hz, Output: DC 12V 1A American standard: Model: POWER-U-12V1A(MSA-C1000IC12.0-12W-US): UL/CE/FCC European standard: Model: POWER-E-12V1A(MSA-C10001C12.0-12W-DE): UL/CE/FCC EMI standard: FCC Part 15 Subpart B EMS standard: EN61000-4-2,3,4,5,6		
D	USB Mouse		
E	HDMI Cable		
F	USB3.0 A male to A male gold-plated connectors cable /2.0m		
G	CD (Driver & utilities software, Ø12cm)		
Optional Accessory			
H	SD Card(16G or above; Speed: class 10)		
I	Adjustable lens adapter	C-Mount to Dia.23.2mm Eyepiece Tube (Please choose 1 of them for your microscope)	108001/AMA037 108002/AMA050 108003/AMA075
J	Fixed lens adapter	C-Mount to Dia.23.2mm Eyepiece Tube (Please choose 1 of them for your microscope)	108005/FMA037 108006/FMA050 108007/FMA075
	Note: For I and J optional items, please specify your camera type(C-mount, microscope camera or telescope camera), ToupTek engineer will help you to determine the right microscope or telescope camera adapter for your application;		
K	108015(Dia.23.2mm to 30.0mm Ring)/Adapter rings for 30mm eyepiece tube		
L	108016(Dia.23.2mm to 30.5mm Ring)/ Adapter rings for 30.5mm eyepiece tube		
M	Calibration kit		106011/TS-M1(X=0.01mm/100Div.); 106012/TS-M2(X, Y=0.01mm/100Div.); 106013/TS-M7(X=0.01mm/100Div., 0.10mm/100Div.)
N	USB flash drive		
O	USB WiFi adapter		

5 Software and App

The software or the APP can be downloaded from the following link：

Windows: https://www.touptekphotonics.com/download/

Linux & macOS: https://www.touptekphotonics.com/download/

iOS: https://itunes.apple.com/us/app/toupview/id911644970

Android: https://play.google.com/store/apps/details?id=com.touptek.tpview

6 X5FCAM4K8MPA Camera Configurations

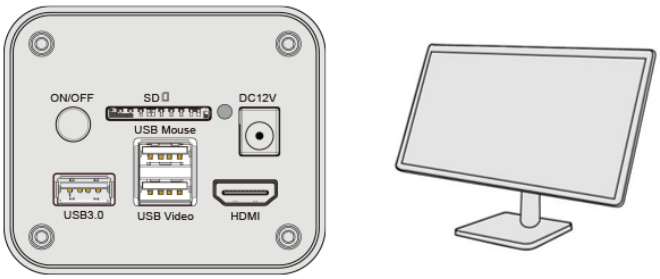
You can use the X5FCAM4K8MPA camera in 4 different ways. Each application requires different hardware environment.

6.1 Camera working standalone with built-in XCamView software

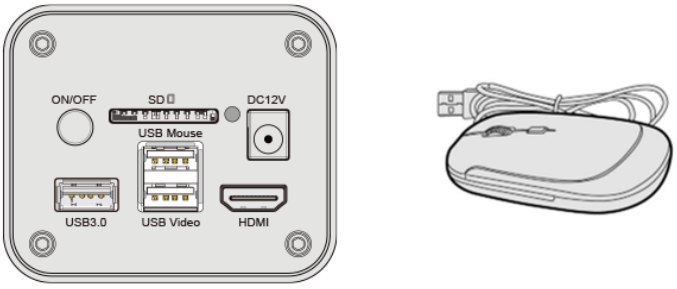
For this application, apart from the microscope, you only need an HDMI monitor, the supplied USB mouse, and the camera embedded XCamView software. A computer or a network connection is not required to operate the camera in this application. The steps to start the camera are listed as below:

Figure 5 X5FCAM4K8MPA Camera with the HDMI Monitor

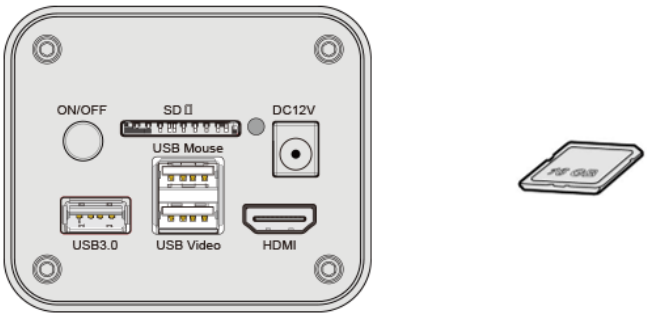
Connect the camera to a HDMI monitor using the HDMI cable;



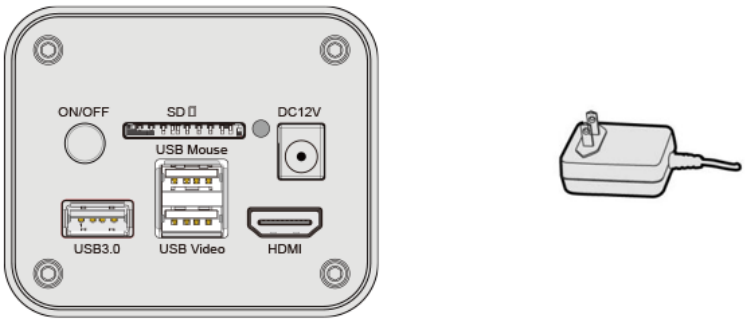
Insert the supplied USB mouse to the camera's USB Mouse port;



Insert the supplied SD card/USB flash drive into the X5FCAM4K8MPA camera SD card slot/USB3.0 slot;



Connect the camera to the power adapter and turn it on;



Turn on the monitor and view the video in the XCamView software. Move the mouse to the left, top or bottom of the XCamView UI, different control panel or toolbar will pop up and users could operate with the mouse at ease.

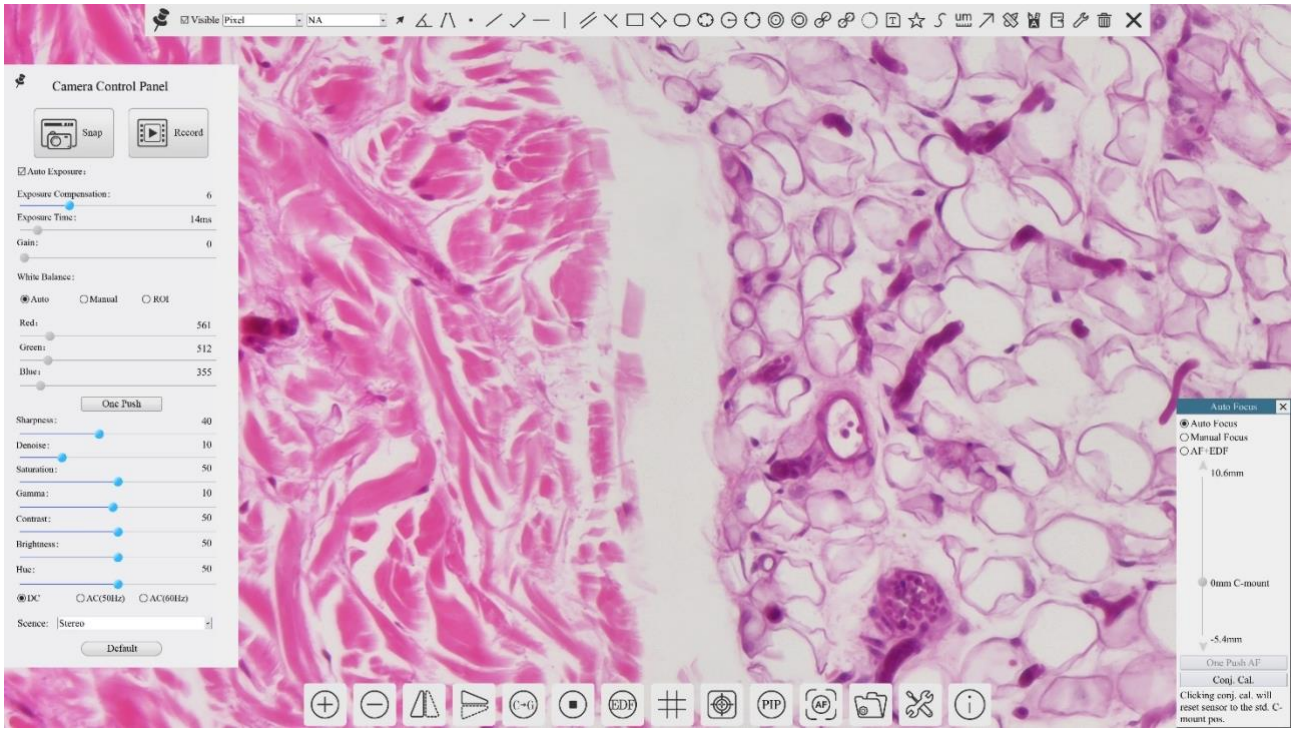


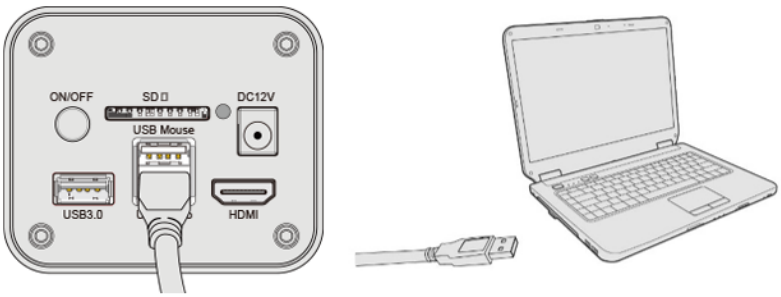
Figure 6 XCamView And X5FCAM4K8MPA Camera in HDMI Mode

6.2 Connecting camera to computers with USB3.0 port

For Windows user (Windows 8/10/11 (32/64 bit)), please use ToupView.

For macOS and Linux user (macOS 10.10 or above or Linux distributions with kernel 2.6.27 or higher), please use ToupLite. The steps to start the camera are listed below:

Start the camera according to Sec. 6.1. After the camera is running, connect camera to computer with USB cable. Please use "USB Video" slot, The upper left corner of the HDMI graphics interface displays "USB3.0 Mode" or "USB2.0 Mode", indicating that a connection has been established with the PC.



Install ToupView/ToupLite on your PC or install ToupView App on the mobile device; Run the software ToupView/ToupLite, clicking the camera name in the Camera List group to start the live video as shown in Figure 7.

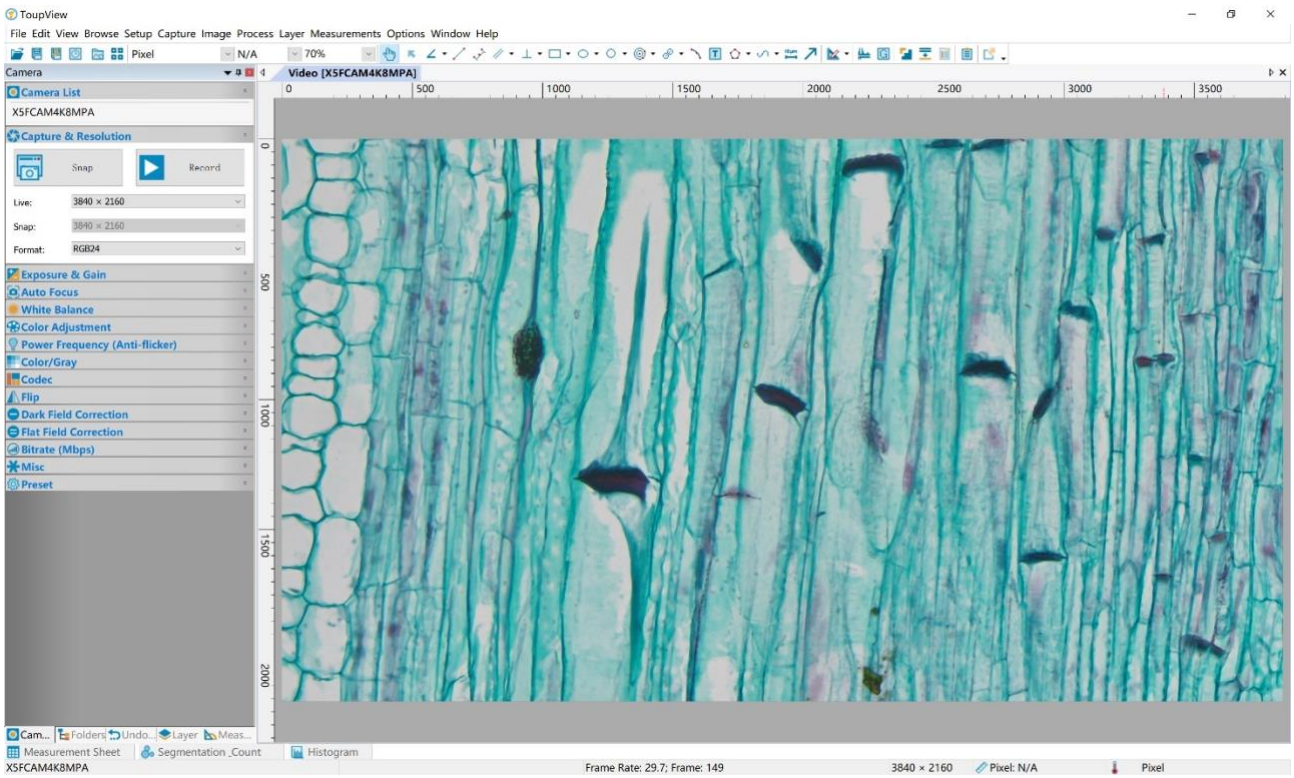


Figure 7 ToupView and X5FCAM4K8MPA Camera in USB Mode

6.3 Camera working in WiFi mode (AP mode)

Please make sure your PC is WiFi enabled.

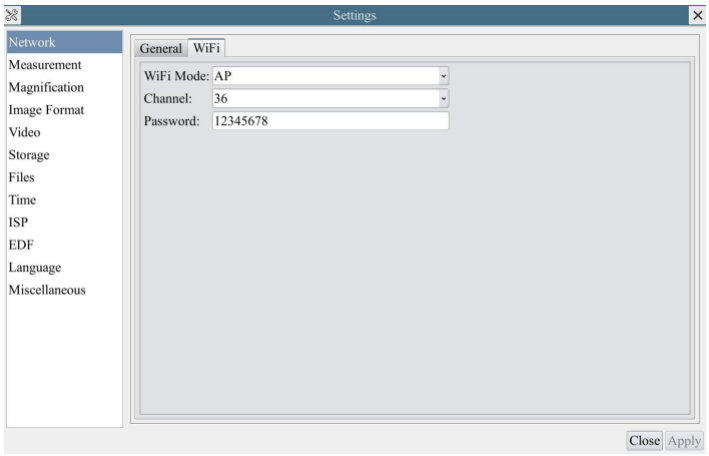
Figure 8 The PC or Mobile Device Connect to the Camera through WiFi

For Windows user (Windows 8/10/10/11 (32/64 bit)), please use ToupView.

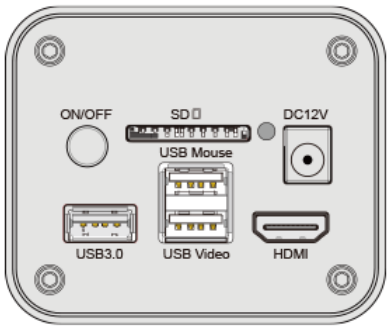
For macOS and Linux user (macOS 10.10 or above or Linux distributions with kernel 2.6.27 or higher), please use ToupLite. When connecting the camera with a mobile device, the free ToupView App is required. Just make sure that the mobile device uses iOS 11 or higher/Android 5.1 or higher operating systems.

The steps to start the camera are listed below:

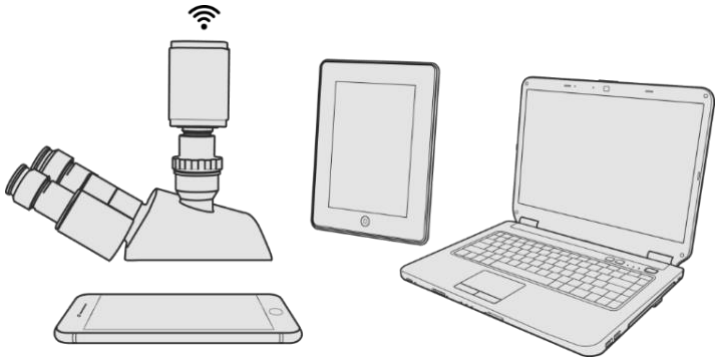
Start the camera according to Sec. 6.1. After the camera is running, move the mouse to the bottom of the GUI and clicking the button on the Synthesis Camera Control Toolbar at the bottom of the video window, a small window called Settings will pop up as shown below. Click Network> WiFi property page and choose the AP in the WiFi Mode edit box(The factory default configuration is AP mode).



Plug the USB WiFi adapter into the camera's USB3.0 port, the upper left corner of the HDMI graphics interface will display "AP mode";



Install ToupView/ToupLite on your PC or install ToupView App on the mobile device, connect the PC or mobile device to the camera's WiFi AP point; The network name (SSID) and the WiFi password (The default one is 12345678) can be found on the camera's Setting>Network> WiFi page in AP mode.



Start ToupView/ToupLite software or ToupView App and check the configuration. Normally, the active X5FCAM4K8MPA cameras will be automatically recognized. The live image of each camera is shown in Figure 9. For the display, the Camera List group is used in ToupView/ToupLite software, and the Camera Thumbnail is used in ToupView App.

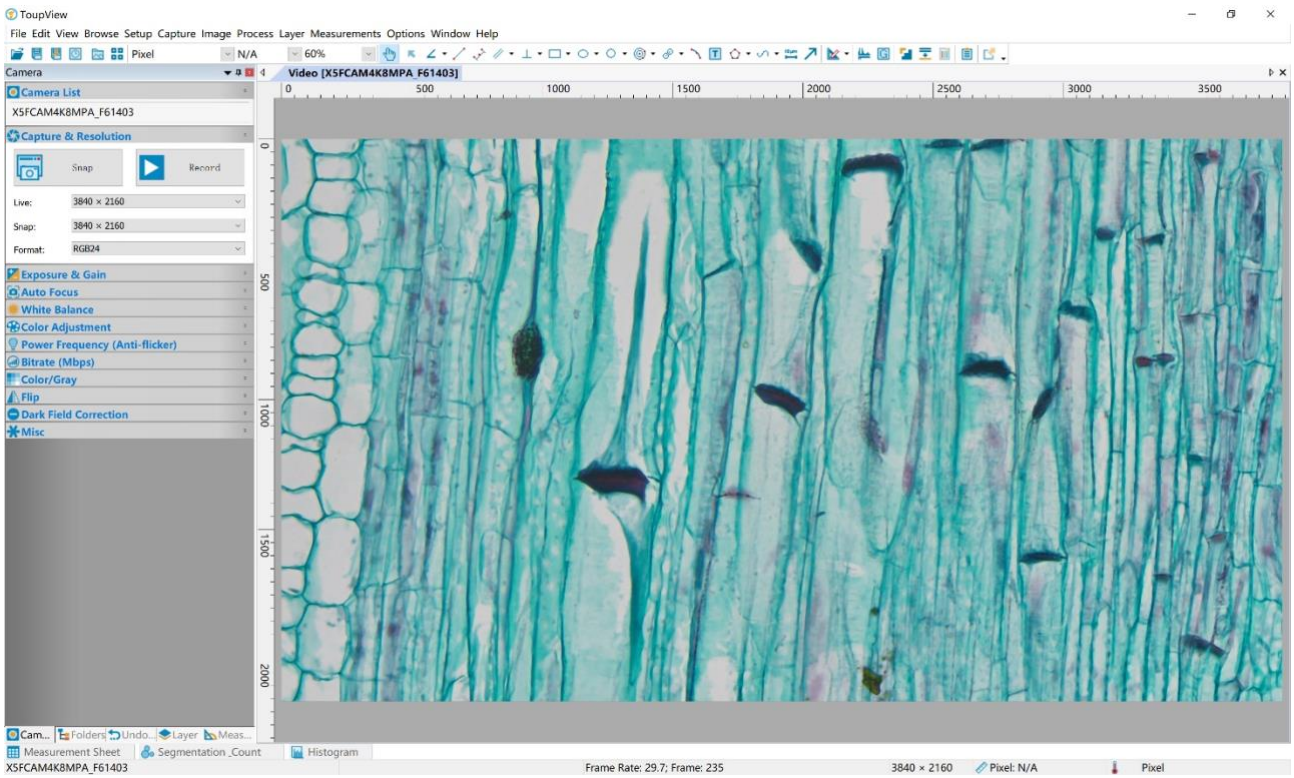


Figure 9 ToupView and X5FCAM4K8MPA Camera in WiFi AP Mode

6.4 Connecting multi-cameras to the router through the WiFi STA mode for the network application

Multi X5FCAM4K8MPA cameras are connected to router through the WiFi STA mode, and the user can control the HDMI camera on the computer or mobile device through WiFi.

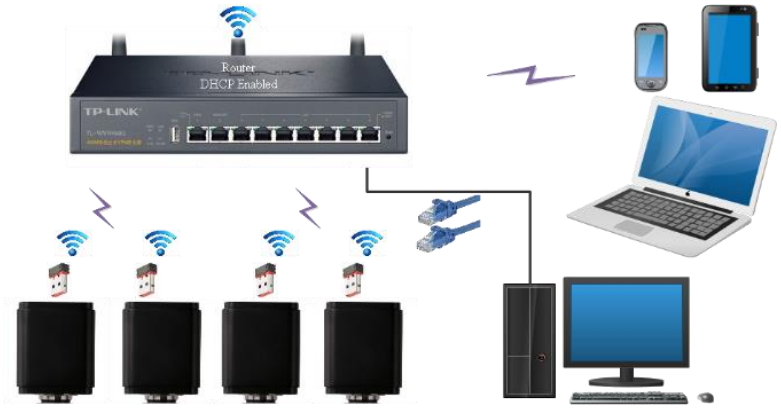
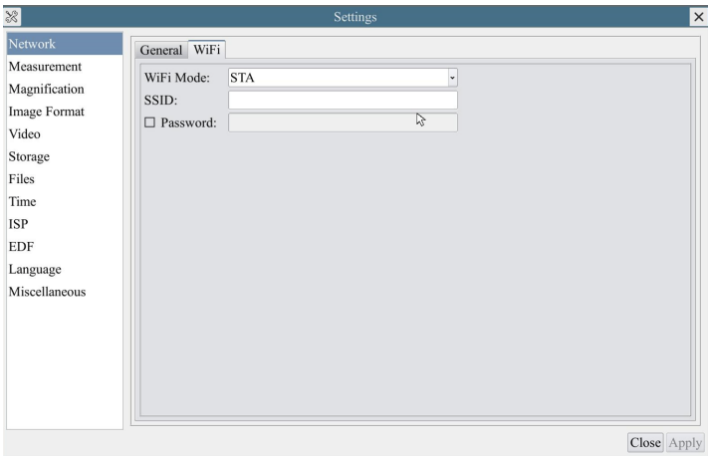


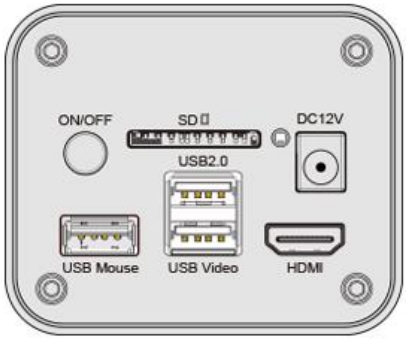
Figure 10 Multi X5FCAM4K8MPA Cameras Connecting to the Router through the WiFi Style

Start the camera according to Sec. 6.1. After the camera is running, move the mouse to the bottom of the video window and clicking the button on the Synthesis Camera Control Toolbar at the bottom of the video window, a small window called Settings will pop up as shown below. Clicking Network> WiFi property page and choosing the STA in the WiFi Mode edit box(The factory default configuration is AP mode). Input the to be connected router's SSID and Password as shown below:

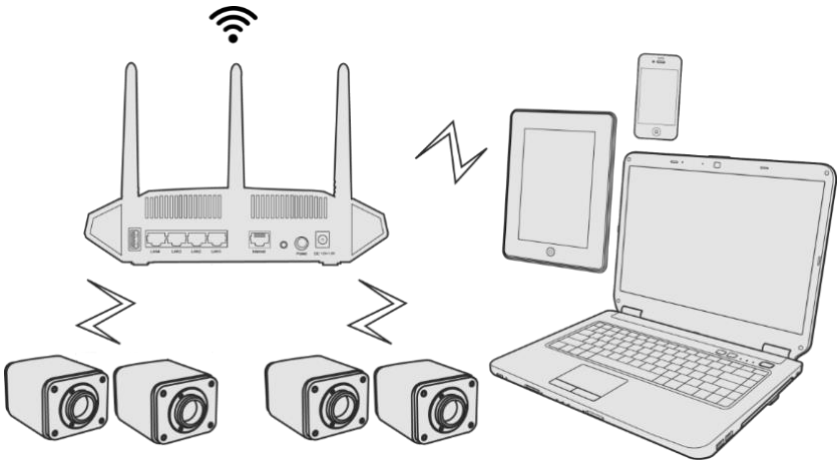


Install ToupView /ToupLite software on your PC. Alternatively, install the free ToupView App on the mobile device;

Plug the USB WiFi adapter into the camera's USB3.0 port(for those connected to router with WiFi STA mode), the upper left corner of the HDMI graphics interface will display "STA Mode";



Finally, as shown below, 4 X5FCAM4K8MPA cameras are connected to the same router with WiFi STA mode (The number of the cameras is determined by the router performance).



Make sure that your PC or your mobile device is connected to the LAN or WiFi of the router; Start ToupView/ToupLite software or ToupView App and check the configuration. Normally, active X5FCAM4K8MPA cameras are automatically recognized. The live image of each camera is displayed. For the display, Camera List group is used in ToupView/ToupLite software, and Camera Thumbnail is used in ToupView App; Select theX5FCAM4K8MPA camera you are interested in. To do so, double click the camera's name in Camera List tool window if you use ToupView /ToupLite software; If you use ToupView App, tap the camera's thumbnail in Camera List page(See Figure 11)

About the routers/switches

It is suggested that routers/switches supporting WiFi 5G should be selected to achieve better wireless connection experience.

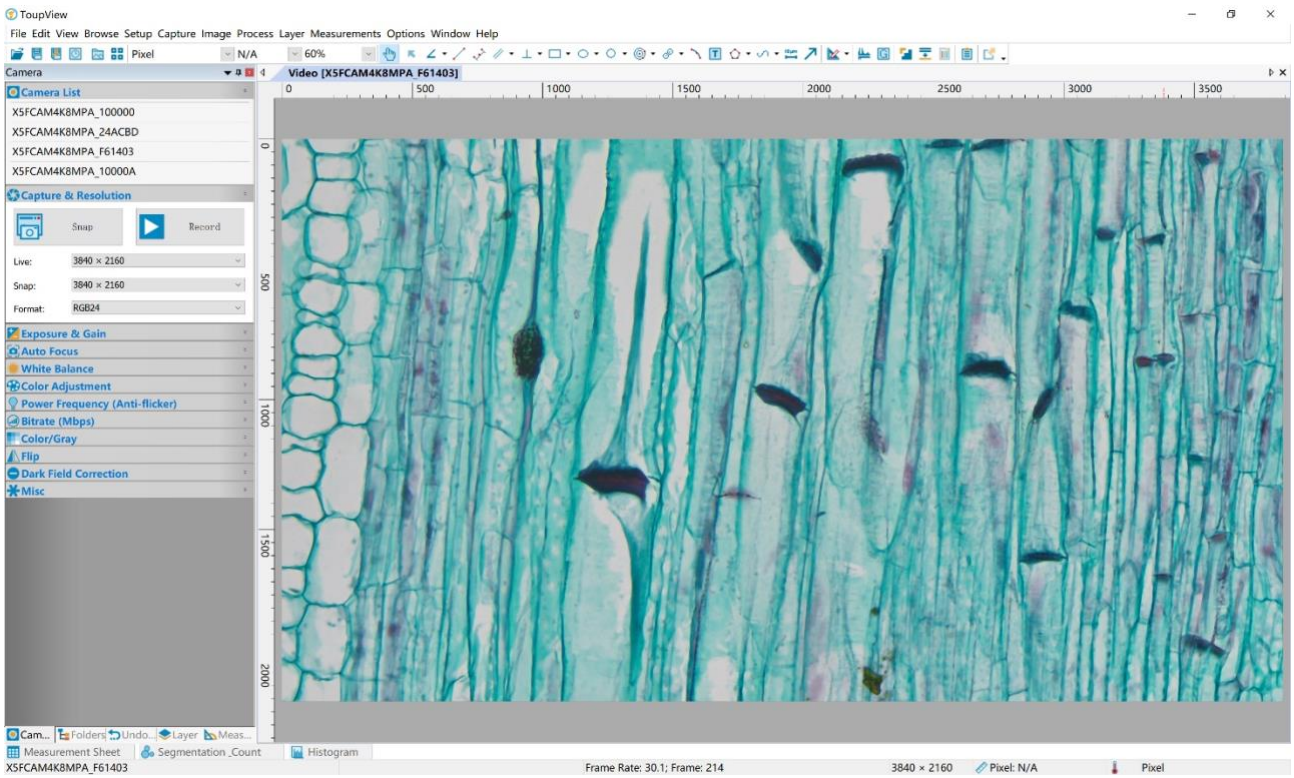


Figure 11 ToupView and X5FCAM4K8MPA Camera in WiFi STA mode

7 Brief Introduction of X5FCAM4K8MPA UI and Its Functions

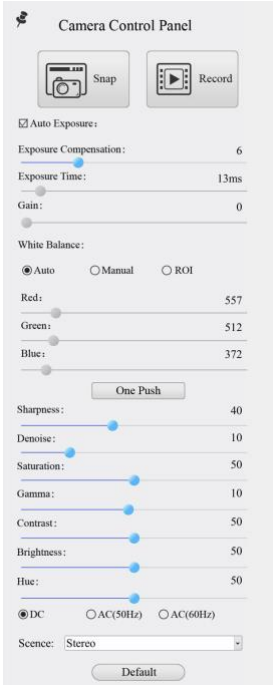
7.1 XCamView UI

The X5FCAM4K8MPA UI shown in Figure 6 includes a Camera Control Panel on the left of the video window, a Measurement Toolbar on the top of the video window and a Synthesis Camera Control Toolbar on the bottom of the video window.

Notes	
1	To show the Camera Control Panel, move your mouse to the left or right of the video window. See Sec.7.2 for details
2	Move the mouse cursor to the top of the video window, a Measurement Toolbar will pop up for calibration and measurement operations. When user left-clicks the Float/Fixed button on the Measurement Toolbar, the Measurement Toolbar will be fixed. In this case the Camera Control Panel will not pop up automatically even if users move mouse cursor to left or right side of the video window. Only when user left-clicks the button on the Measurement Toolbar to exit from measuring procedure will they be able to do other operations on the Camera Control Panel, or the Synthesis Camera Control Toolbar. During the measuring process, when a specific measuring object is selected, an Object Location & Attributes Control Bar will appear for changing location and properties of the selected object. See Sec.7.3 for details.
3	When users move mouse cursor to the bottom of the video window, the Synthesis Camera Control Toolbar will pop up automatically. See Sec.7.4 for details.
4	When users move mouse cursor to the bottom of the video window, the Synthesis Camera Control Toolbar will pop up automatically. Clicking the button and the Auto Focus Control Panel will appear for autofocus operation.

7.2 The camera control panel on the left or right side of the video window

The Camera Control Panel controls the camera to achieve the best video or image quality according to the specific applications; It will pop up automatically when the mouse cursor is moved to the left or right side of the video window (in measurement status, the Camera Control Panel will not pop up. The Camera Control Panel will only pop up when the measurement process is finished or terminated while user's cursor on the left edge of the video window). Left-clicking button to achieve Display/Auto Hide switch of the Camera Control Panel.

Camera Control Panel	Function	Function Description
	Snap	Capture image and save it to the SD card or USB flash drive
	Record	Record video and save it to the SD card or USB flash drive
	Auto Exposure	When Auto Exposure is checked, the system will automatically adjust exposure time and gain according to the value of exposure compensation
	Exposure Compensation	Available when Auto Exposure is checked. Slide to left or right to adjust Exposure Compensation according to the current video brightness to achieve proper brightness value
	Exposure Time	Available when Auto Exposure is unchecked. Slide to left or right to reduce or increase exposure time, adjusting brightness of the video
	Gain	Adjust Gain to reduce or increase brightness of video. The Noise will be reduced or increased accordingly
	Red	Slide to left or right to decrease or increase the proportion of Red in RGB on video
	Green	Slide to left or right to decrease or increase the proportion of Green in RGB on video
	Blue	Slide to left or right to decrease or increase the proportion of Blue in RGB on the video
	Auto	White Balance adjustment according to the window video every time the button is clicked
	Manual	Adjust the Red、Green or Blue item to set the video White Balance
	ROI	Check the ROI item will display a red ROI rectangle on the video window, drag it to the interested area will perform the White Balance according to the area video data
	One Push	Perform a global white balance based on image conditions
	Sharpness	Adjust Sharpness level of the video
	Denoise	Slide left or right to Denoise the video
	Saturation	Adjust Saturation level of the video
	Gamma	Adjust Gamma level of the video. Slide to the right side to increase Gamma and to the left to decrease Gamma.
	Contrast	Adjust Contrast level of the video. Slide to the right side to increase Contrast and to the left to decrease Contrast.
	Brightness	Adjust Brightness level of the video. Slide to the right side to increase Brightness and to the left to decrease Brightness.
	Hue	Adjust Hue level of the video. Slide to the right side to increase Hue and to the left to decrease Hue.
	DC	For DC illumination, there will be no fluctuation in light source so no need for compensating light flickering
	AC(50HZ)	Check AC(50HZ) to eliminate flickering caused by 50Hz illumination
	AC(60HZ)	Check AC(60HZ) to eliminate flickering caused by 60Hz illumination

	Scence	Select different default parameters according to the type of microscope
	Default	Restore all the settings in the Camera Control Panel to default values Right click to select different default parameters according to the type of microscope

7.3 The Measurement Toolbar on top of the video window

The Measurement Toolbar will pop up when moving mouse cursor to any place near the upper edge of the video window. Here is the introduction of the various functions on the Measurement Toolbar:

Figure 12 The Measurement Toolbar on the Upper Side of the Video Window

Icon	Function
	Float/ Fix switch of the Measurement Toolbar
Visible	Show / Hide Measurement Objects
Pixel	Select the desired Measurement Unit
NA	Select Magnification for Measurement after Calibration
	Object Select
	Angle
	4 Points Angle
	Point(Point Counter)
	Arbitrary Line
	3 Points Line
	Horizontal Line
	Vertical Line
	3 Points Vertical Line
	Parallel
	Rectangle
	3 Points Rectangle
	Ellipse
	5 Points Ellipse
	Circle
	3 Points Circle
	Annulus
	3 Points Annulus
	Two Circles and its Center Distance
	3 Points Two Circles and its Center Distance
	Arc
	Text
	Polygon
	Curve
	Scale Bar
	Arrow
	Execute Calibration to determine the corresponding relation between magnification and resolution, which will establish the corresponding relationship between measurement unit and the sensor pixel size. Calibration needs to be done with the help of a micrometer. For detailed steps of carrying out Calibration please refer to ToupView help manual.
	Auto Measurement: Two Points Parallel, Circle Detect, Annulus Detect, Rectangle Detect,Polygon
	Export the Measurement information to CSV file(*.csv)
	Measurement Setup
	Delete all the measurement objects
	Exit from Measurement mode
	When the measurement ends, left-click on a single measuring object and the Object Location & Properties Control Bar will show up. User could move the object by dragging the object with the mouse. But more accurate movement could be done with the control bar. The icons on the control bar mean Move Left, Move Right, Move Up, Move Down, Color Adjustment and Delete.

Note:

1) When user left-clicks Display/Hide button on Measurement Toolbar, Measurement Toolbar will be fixed. In this case Camera Control Panel will not pop up automatically even if moving the mouse cursor to the left edge of the video window. Only when user left-click the button on Measurement Toolbar to exit from the measurement mode will they be able to doing other operations on Camera Control Panel or Synthesis Camera Control Toolbar.

2) When a specific Measurement Object is selected during the measurement process, Object Location & Attributes Control Bar will appear for changing the object location and properties of the selected objects.

7.4 Icons and functions of the Synthesis Camera Control Toolbar at the bottom of the video window

Figure 13 The Synthesis Camera Control Toolbar on the Bottom of the Video Window

Icon	Function	Icon	Function
	Zoom In the Video Window		Zoom Out the Video Window
	Horizontal Flip		Vertical Flip
	Color/gray		Video Freeze
	EDF		Display Cross Line
	Image Overlay		PIP
	Auto Focus		Browse images and videos in the SD Card
	Settings		Check the Version of XCamView

The Browsing function, for detailed introduction, please refer to Section 7.4.1.

The Setting function, for detailed introduction, please refer to Sections 7.4.2 to7.4.14.

7.4.1 Browse

Clicking the to browse the dxf, images, videos, and other files saved on the SD card or USB flash drive, as shown in the following figure.

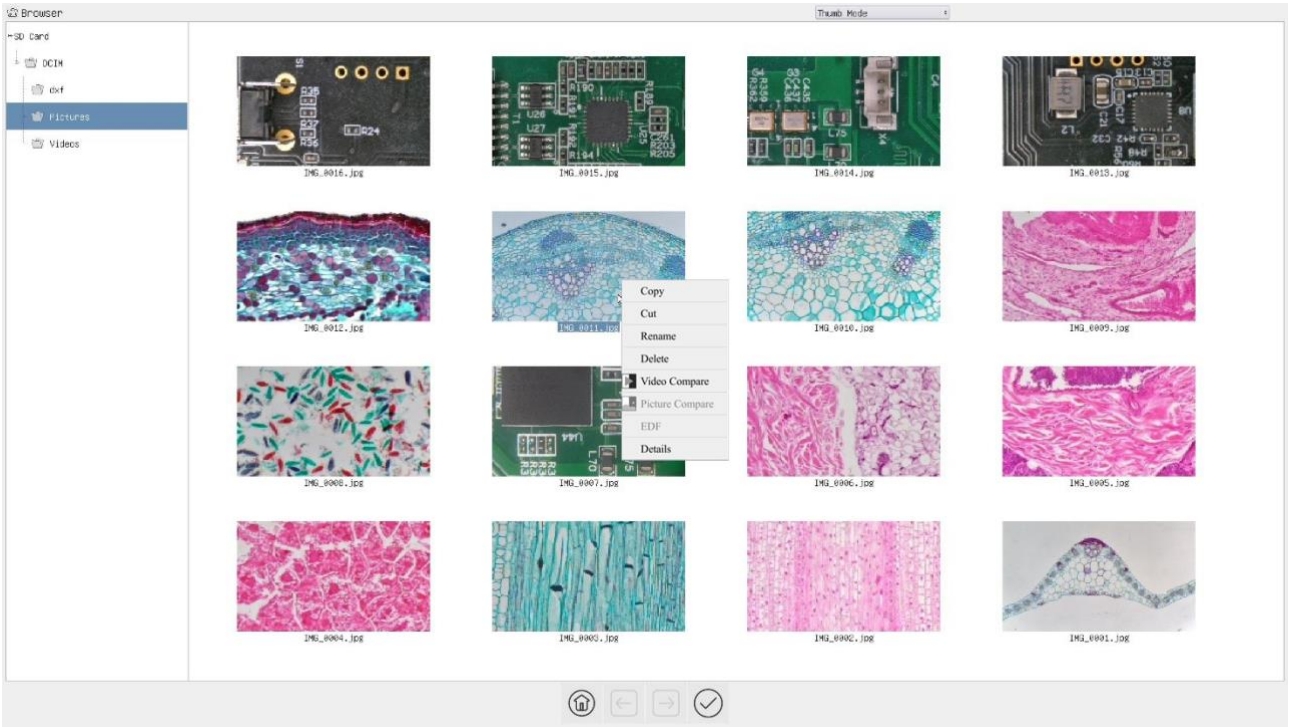


Figure 14 Browsing UI

There are two browsing modes: List mode and Thumb mode. The default is Thumb mode.

Right click on an empty area to create a new folder.

Right click on an image file to Copy, Cut, Rename, Delete, Video Compare, and view detailed information(Details). Clicking on a thumb to select the 1st image, and clicking on another thumb to select the 2nd image (or selecting 2 images

with frame), then clicking the right mouse button to bring up the context menu and select Picture Compare to analyze and compare the two images. Clicking on a thumb to select 2~5 (or box select 2~5) pictures focusing on different targets in the same scene, you can perform depth of field compositing on the selected pictures.

Right click on a video file to Copy, Cut, Rename, Delete, Video Compare, and view detailed information(Details).

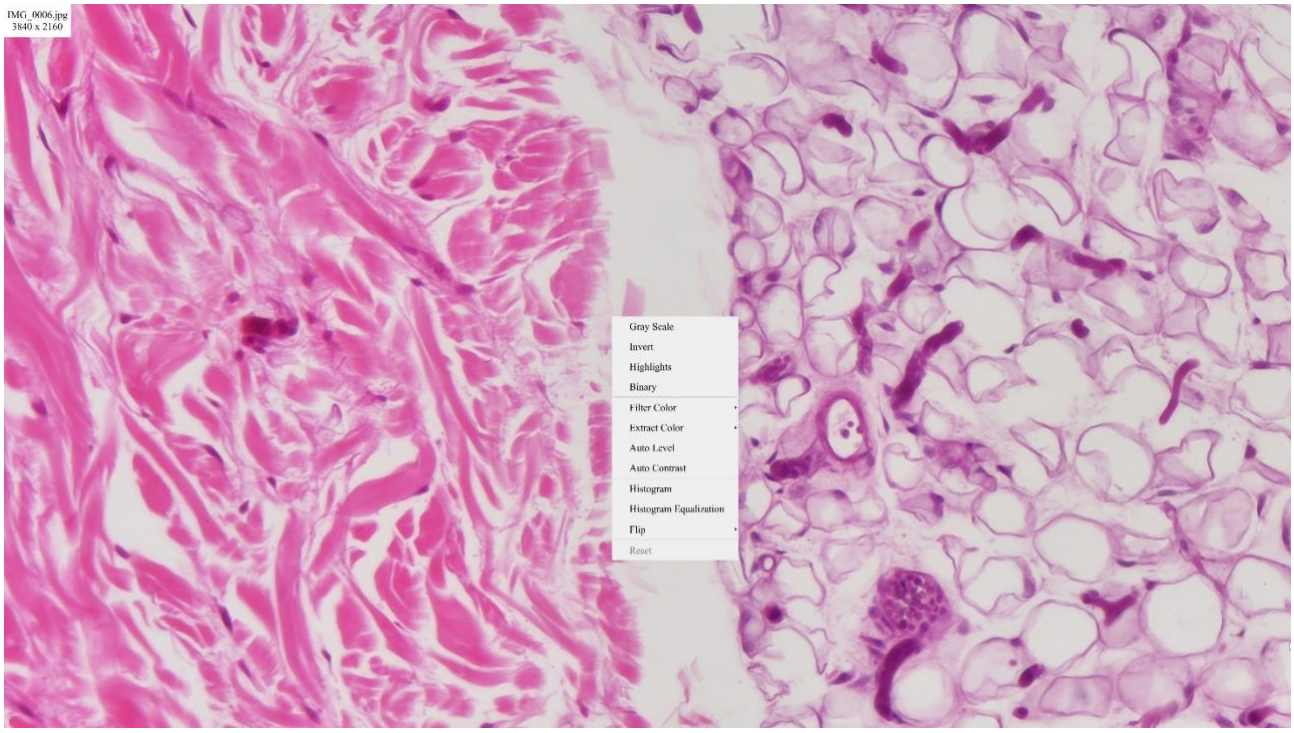


Figure 15 Image Processing

Double-click the thumbnail of the picture with the left mouse button to open the picture, and then right-click the picture to Gray Scale, Invert, Highlights, Binary, Filter Color, Extract Color, Auto Level, Auto Contrast, Histogram, Histogram Equalization, Flip, and other image processing functions, and then after the processing is completed, you can choose reset to revert back to the original picture, and also you can choose save or save as in the lower sidebar of the picture. The description of each function is as follows:

Gray Scale	Choose Gray Scale command to convert a color image to a Gray Scale image
Invert	Choose Invert command to reverse the pixel values of the active image
Highlights	Choose Hightlights command to adjust the Hightlight parts of the images
Binary	Binary is a kind of gray level process. If the gray of the pixel is greater than the given threshold, the pixel's color will be changed into white. Otherwise, the pixel's color will be changed into black
Filter Color	Choose Filter Color command to filter a special color channel from a color image. Select either Red, or Green, or Blue color to filter. For every pixel, if select Red color to filter, only information about the Red channel will be discarded, the Green and Blue information will remain there.
Extract Color	Choose Extract Color command to extract a special color channel from a color image. Select either Red or Green, or Blue color to extract for every pixel, if selecting Red color to extract, only information about the Red channel will be kept, the Green and Blue information will be discarded.
Auto Level	The Auto Level command moves the level's sliders automatically to set highlight and shadow. It defines the lightest and darkest pixels in each color channel as white and black and then redistributes the pixels' color values proportionately
Auto Contrast	The Auto Contrast command automatically adjusts the overall contrastin an RGB image
Histogram	Used to show the distribution of brightness, R, G, B of an image over an image
Histogram Equalization	Used to improved image contrast
Flip	Flip image Horizontally/Vertically

7.4.2 Settings>Network>General

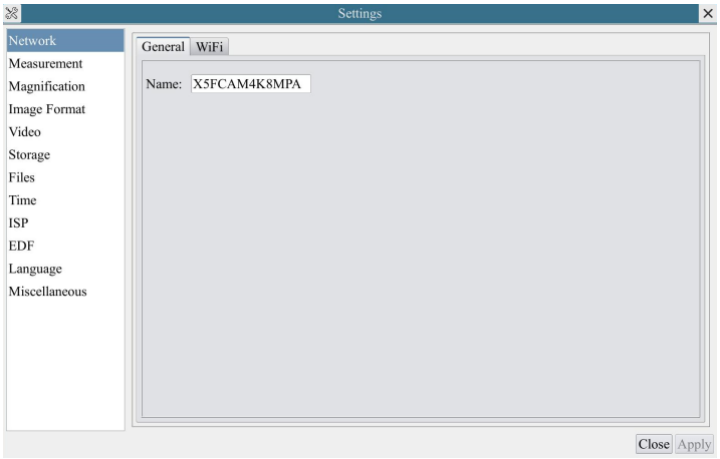


Figure 16 Comprehensive Network General Settings Page

Name	The current camera name recognized as the network name

7.4.3 Settings>Network> WiFi

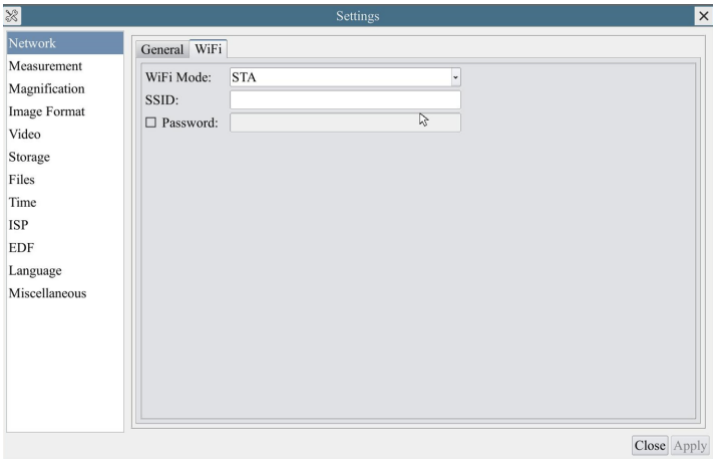


Figure 17 Network Setup

Wi-Fi Mode	AP/STA mode to select;
Channel/SSID	Channel for the AP mode and SSID for the STA mode. Here, the SSID is the router's SSID;
Password	Camera Password for the AP mode. Router Password for the STA mode

7.4.4 Settings>Measurement

This page is used for the define of the Measurement Object properties.

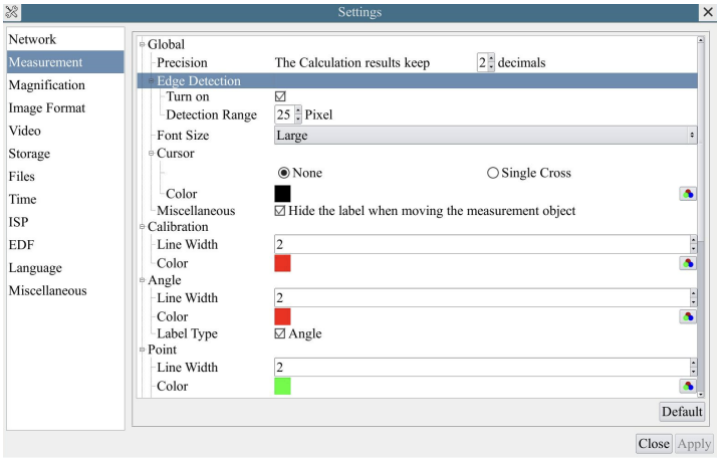


Figure 18 The Measurement Setup

Global	Precision	Used for setting digits behind the decimal point for measurement results;
	Edge Detection	Select whether to enable the automatic edge search function and set the detection range;
	Font Size	The font size of measurement data can be divided into three types: large, Middle, and Small;

	Cursor	Select whether the cursor is a single crosshair and set the color of the single cross;
	Miscellaneous	Whether to hide the label when moving the measurement objects;
Calibration	Line Width	Used for defining width of the lines for calibration;
	Color	Used for defining color of the lines for calibration;
	EndPoint	Type: Used for defining shape of the endpoints of lines for calibration: Null means no EndPoint, rectangle means rectangle type of endpoints. It makes alignment more easily;
Point, Angle, Line, Horizontal Line, Vertical Line, Rectangle, Circle, Ellipse, Annulus, Two Circles, Polygon, Curve		
	Left-click the  along with the Measurement command mentioned above will unfold the corresponding attribute settings to set the individual property of the Measurement Objects.	

7.4.5 Settings>Magnification

This page's items are formed by the Measurement Toolbar's Calibration command.

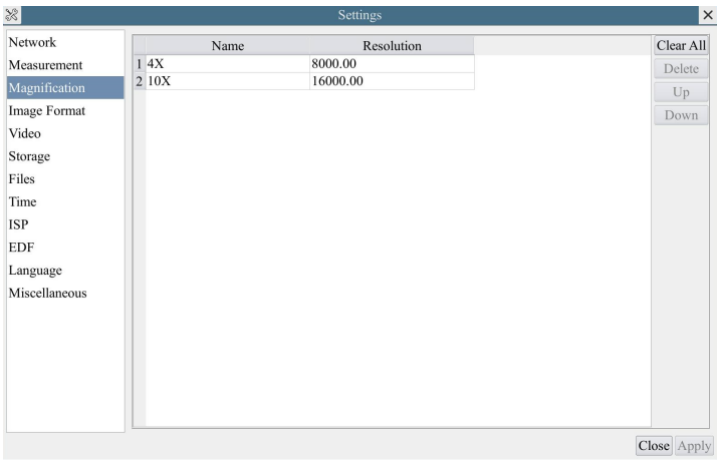


Figure 19 Comprehensive Magnification Settings Page

Name	Names such as 10X, 40X, 100X are based on magnification of the microscopes. For continuous zoom microscopes, ensure that the selected magnification coincides with the scale alignment line on the microscope zoom knob; Users could also edit the name of the magnification with other information, for example, microscope mode, users name, etc.
Resolution	Pixels per meter. Image device like microscopes have high Resolution value;
Clear All	Click the Clear All button will clear the calibrated magnifications;
Delete	Click Delete to delete the selected magnification;
Up	Select a row in the magnification and click Move Up to move up the currently selected magnification;
Down	Select a row in the magnification and click Move Down to move up the currently selected magnification;

7.4.6 Settings>Image Format

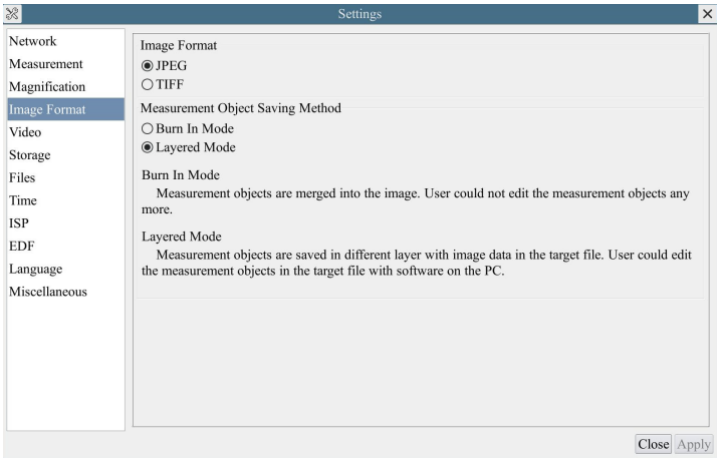


Figure 20 Comprehensive Image Format Settings Page

Image Format	JPEG: The extension of JPEG file can get very high compression rate and display very rich and vivid images by removing redundant images and color data. In other words, it can get better image quality with the least disk space. If measurement objects are available, the measurement objects will be burned into the image and the measurement cannot be edited. TIFF: TIFF is a flexible bitmap format mainly used to store images including photos and artistic images.
Measurement Object Saving Method	Burn in Mode: The measurement objects are merged into the current image. User could not edit the measurement objects any more. This mode is not reversable. Layered Mode: The measurement objects are saved in different layer with current image data in the target file. User could edit the measurement objects in the target file with some software on the PC. This mode is reversable.

7.4.7 Settings>Video

Figure 21 Comprehensive Setting of Video page

Video Resolution	Select a Video Resolution of 1920x1080 or 3840x2160;
Video Playback	Fast Forward/Reverse internal in second unite for Video Playback
Video Encode	Select the Video Encode format. Can be H264 or H265. Compared with H264, H265 has a higher H265 compression ratio which is primarily used to further reduce the design flow rate, in order to lower the cost of storage and transmission

7.4.8 Settings>Storage

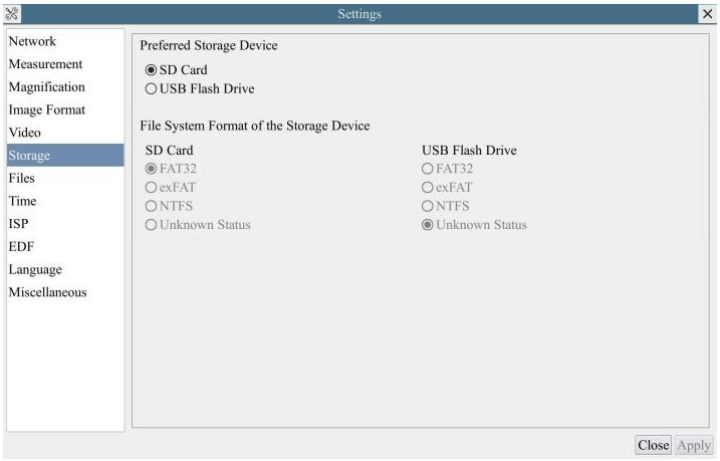


Figure 22 Comprehensive Setting of Storage Page

Preferred Storage Page	SD Card: Select it to save the video and image to the SD Card. USB Flash Drive: Select it to save the video and image to the USB Flash Drive.
File System Format of the Storage Device	List the file system format of the current storage device FAT32: The file system of SD Card is FAT32. The maximum video file size of single file in FAT32 file system is 4G Bytes; exFAT: The file system of SD Card is exFAT. The maximum video file size of single file in FAT32 file system is 16E Bytes; NTFS: The file system of SD Card is NTFS. The maximum video file size of single file is 2T Bytes. Unknown Status: SD Card not detected or the file system is not identified;
Note: For USB Flash Drive, USB 3.0 interface is preferred.	

7.4.9 Settings>Files

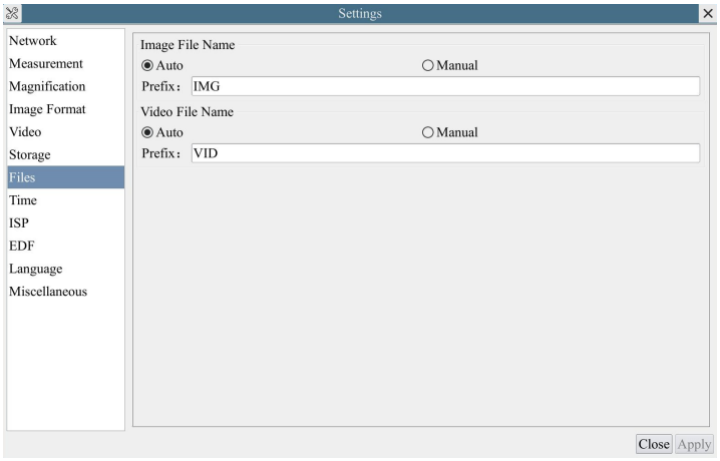


Figure 23 Comprehensive Setting of Files Name

Image or Video File Name Paradigm	Provide Auto or Manual naming paradigm for Image or Video file;
Auto	With specified name as the Prefix and XCamView will add digital after the Prefix for the Image or Video file;
Manual	A file dialog will pop up to enter the Image or Video file name for the captured Image or Video.

7.4.10 Settings>Time

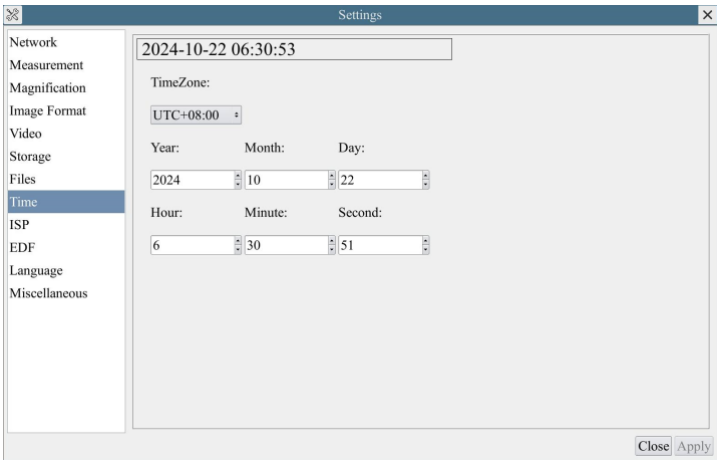


Figure 24 Time Setting

Time	User can set Year, Month, Day, Hour, Minute and Second ital.in this page.

7.4.11 Settings>ISP

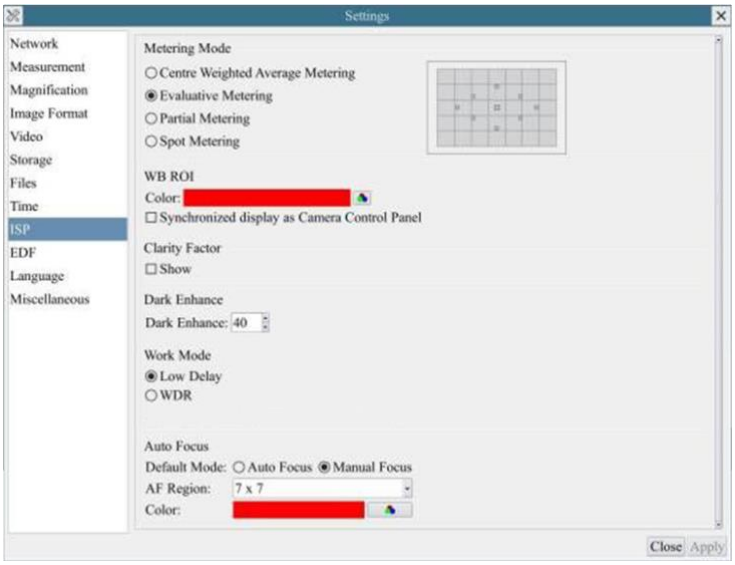


Figure 25 Comprehensive Setting of ISP Page

Metering Mode	Select the Metering mode as the Central Weighted Average Metering, Evaluative Metering, Partial Metering, or Spot Metering;
WB ROI Color	Choosing the ROI rectangle line color and whether it is synchronized display as Camera Control Panel;
Clarity Factor	Select to display the clarity factor in the video window, otherwise the clarity factor will not be displayed;
Dark Enhance	Define the intensity value of dark enhancement;
Work Mode	Select the working mode as Low Delay/WDR, and adjust the exposure ratio when selecting the WDR mode; Low Delay: The average delay is 40ms, and the highest frame rate is 60fps; WDR: By synthesizing 2 frames into 1 frame, the dynamic range is improved, and the highest frame rate is 30fps;
Auto Focus	Select the default mode for startup as Auto Focus/Manual Focus, and adjust the AF area and focus frame color;

7.4.12 Settings>EDF

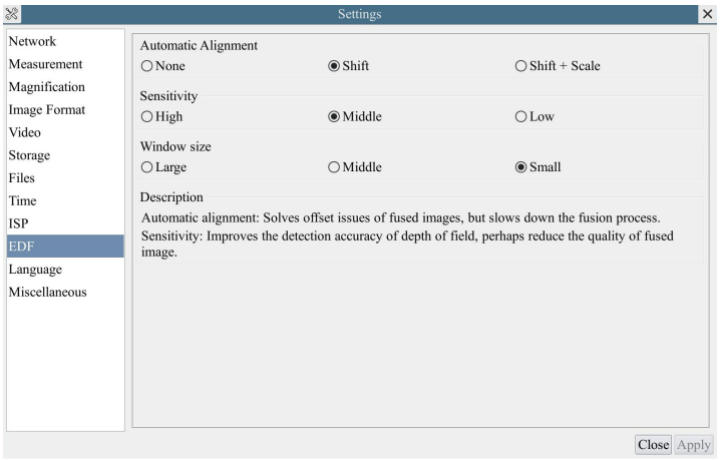


Figure 26 Comprehensive Setting of EDF

Automatic Alignment	Optionally turn on auto-alignment when there is significant displacement or scaling between images;
Sensitivity	Select the sensitivity of EDF;
Window size	Select the window size for displaying real-time images during EDF;
Description	Automatic alignment: Solves offset issues of fused images, but slows down the fusion process. Sensitivity:Improves the detection accuracy of depth of field,perhaps reduce the quality of fused image.

7.4.13 Settings>Language

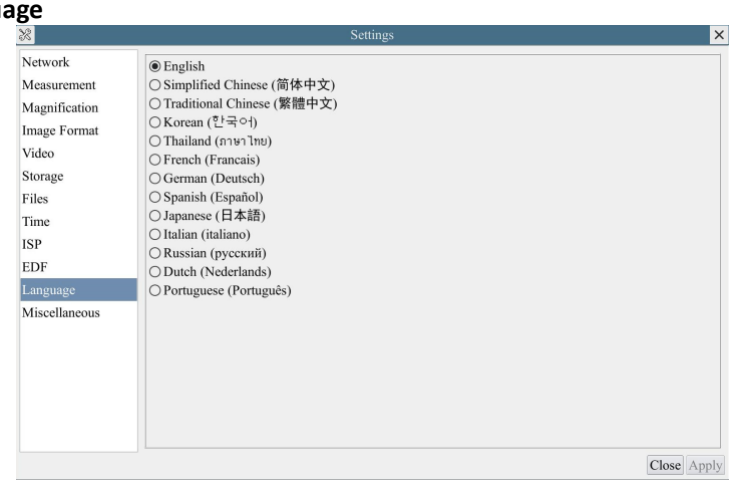


Figure 27 Comprehensive Setting of Language Selection Setting Page

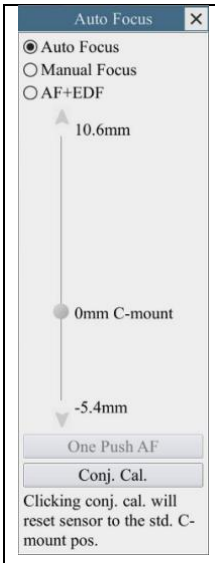
English	Set language of the whole software into English;
Simplified Chinese	Set language of the whole software into Simplified Chinese;
Traditional Chinese	Set language of the whole software into Traditional Chinese;
Korean:	Set language of the whole software into Korean;
Thailand	Set language of the whole software into Thailand;
French	Set language of the whole software into French;
German	Set language of the whole software into German;
Spanish	Set language of the whole software into Spanish;
Japanese	Set language of the whole software into Japanese;
Italian	Set language of the whole software into Italian;
Russian	Set language of the whole software into Russian;
Dutch	Set language of the whole software into Dutch;
Portuguese	Set language of the whole software into Portuguese;

7.4.14 Settings>Miscellaneous

Figure 28 Comprehensive Miscellaneous Settings Page

Ruler	Select to display the ruler in the video window, otherwise not to display the ruler. You can choose the ruler color;
Measurement	Select to display the measurement toolbar in the video window, otherwise not to display the measurement toolbar;
Overlay	Select to support saving graphics overlay information in fusion mode, otherwise it will not support;
Grids	Select to support saving mesh information in fusion mode, otherwise not to support;
Monitor Working Mode	Select to display the Monitor Working Mode in the video window, otherwise the Monitor Working Mode will not be displayed;
Cursor	Choosing the Cursor size according to the screen resolution or personal preference;
Camera Control Panel Display Location	Select the camera control panel to display on the left, right, or both sides of the HDMI interface;
Camera Parameters Import	Import the Camera Parameters from the SD Card or USB flash drive to use the previously exported Camera Parameters;
Camera Parameters Export	Export the Camera Parameters to the SD Card or USB flash drive to use the previously exported Camera Parameters;
Reset to factory defaults	Restore camera parameters to its factory status;

7.5 Auto Focus Control Panel on the right side of the Video Window



Auto Focus	With Auto Focus button checked, the system will start autofocus according to status of the specimen till it stays in focus;
Manual Focus	With Manual Focus checked, users should reset position of the camera sensor by using the mouse to scroll up and down till the specimen stays in focus;
AF+EDF	With AF+EDF checked, system turns on the autofocus mode, which requires the user to change the focus area in sequence to focus on multiple different targets in the same scene. After all targets are successfully focused, move the mouse to the bottom of the video window, click , and then the camera will perform EDF on the previously focused images and output the fused image.
One Push AF	Click One Push AF button can carry out autofocus operation for just once;
Conjugate Correction	Left-click the Conjugate Correction button can reset the camera sensor to standard C-mount position. Conjugate Correction allows users to get sensor position calibrated while ensuring that the camera video window is clear as well as image seen from eyepiece is clear. Suggest users do Conjugate Correction when using the camera for the first time to ensure the camera sensor at the standard C-mount position. This ensures the object plane, eyepiece image plane and camera adapter image plane at the standard position; Note: 1) When height of the specimen changes, users must make sure the sensor at the standard C-mount position while adjusting the coarse and fine focus knob of microscope to focus; 2) Before doing measurement please do Conjugate Correction to make sure accuracy of the measurement results (please refer to Measurement Toolbar> Conjugate Correction for details).

7.6 Focus Region in the Video Window

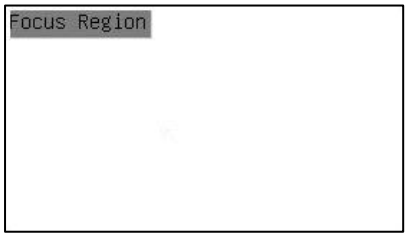


Figure 29 Focus Region

The Focus Region is used for selecting the region of interest for Auto Focus operation. When user clicks the button on the Synthesis Camera Control Toolbar, the Focus Region will show up as well with the Auto Focus Control Panel. Users can click any part of video window to reset the focus region for Auto Focus operation.

8 X5FCAM4K8MPA Camera AF + EDF Function Description

AF + EDF is a new function that combines the camera's unique focus function with EDF. Users can focus on different areas in high-magnification scenes, and then fuse their respective clear areas to finally obtain a large depth-of-field image.

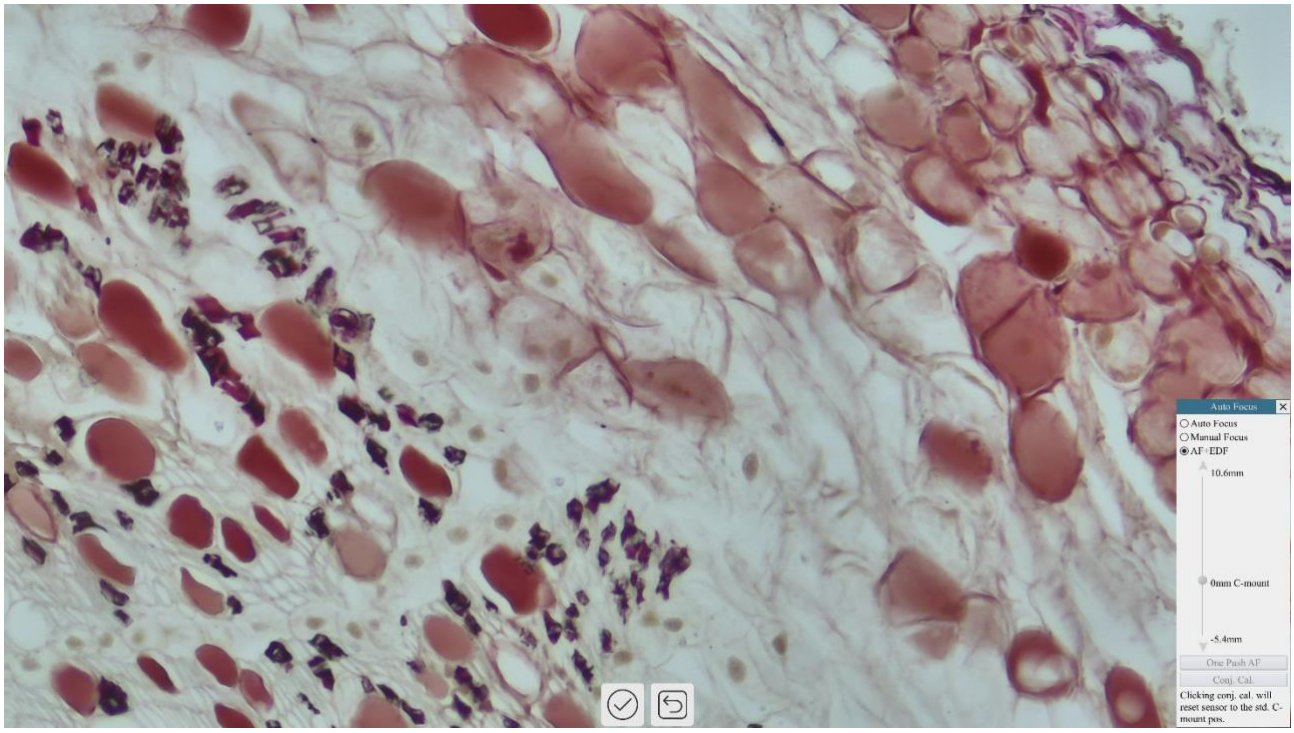


Figure 30 Auto Focus Control Panel

Specifically The usage steps are as follows:

- Click the AF+EDF option above the Auto Focus Control Panel. At this time, the word “EDF” will be displayed in the upper right corner of the video interface. The user clicks on the first focus area, and the system will perform an autofocus. If the focus is completed, "FOCUSED" will be displayed in the upper right corner. Once completed, the system will automatically obtain a frame of data containing the current clear area; use the mouse to switch to a different Focus Region, and the system will automatically focus again and obtain data. If the focus fails, “DEFOCUS” will be displayed in the upper right corner, and the system will not obtain the current frame data.
- Repeat the above steps. After obtaining clear data of multiple Focus Region, move the mouse to the bottom of the video interface and click . The camera will perform EDF on the cached frame data containing clear area information and output the fused picture. For use by users

The following are pictures obtained using the AF+EDF function of the X5FCAM4K8MPA camera:

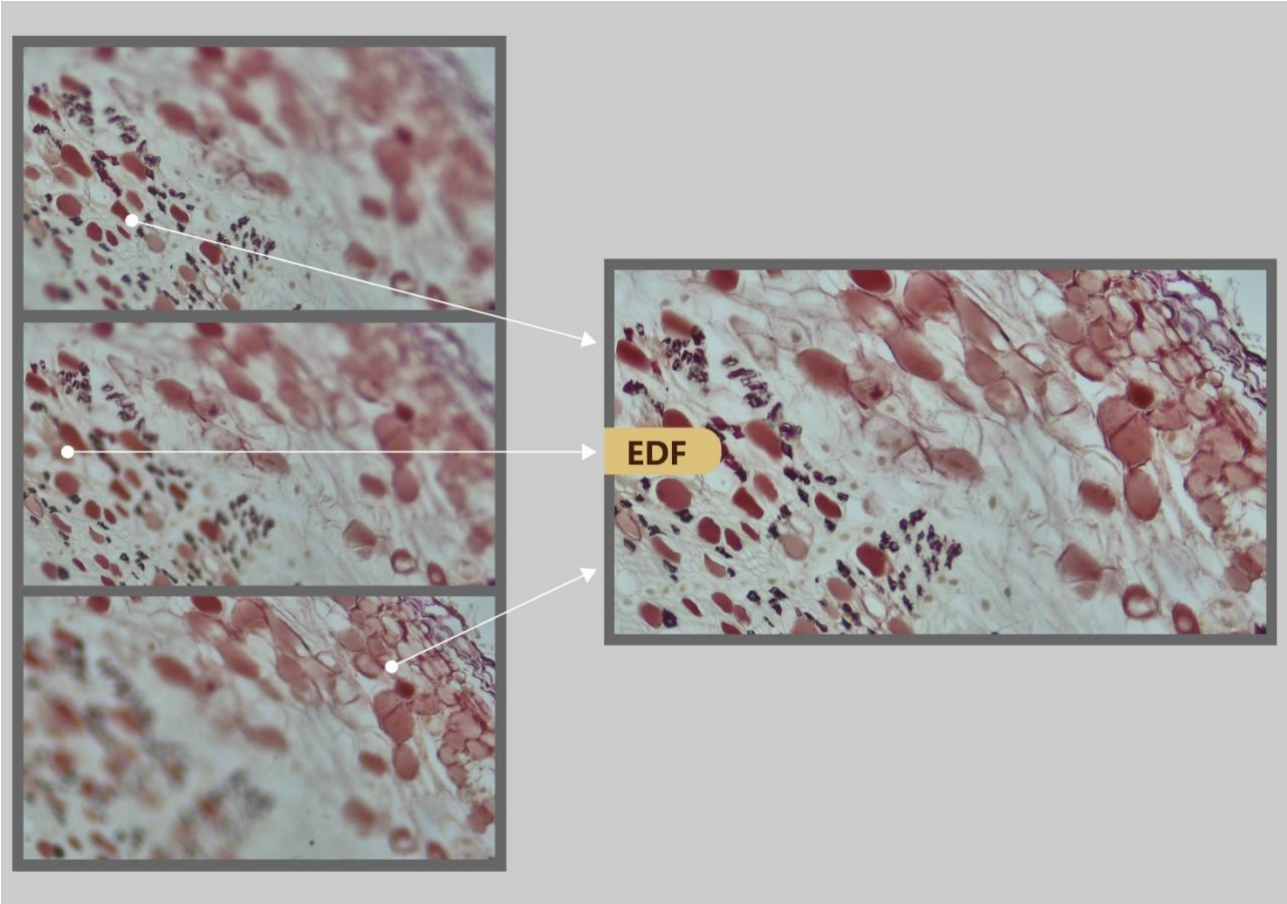


Figure 31 Cell Slice EDF Effect

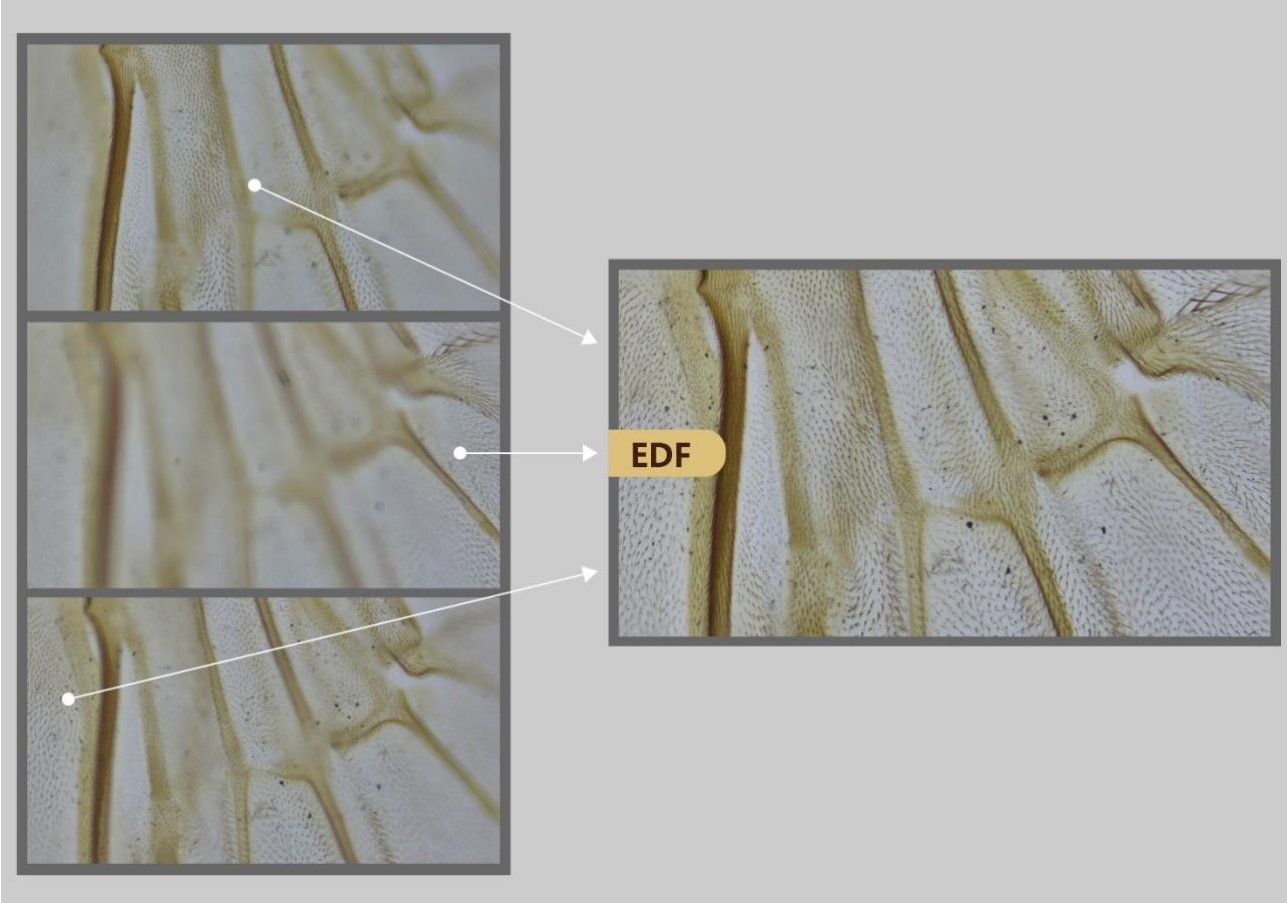


Figure 32 Insect Wings Slice EDF Effect

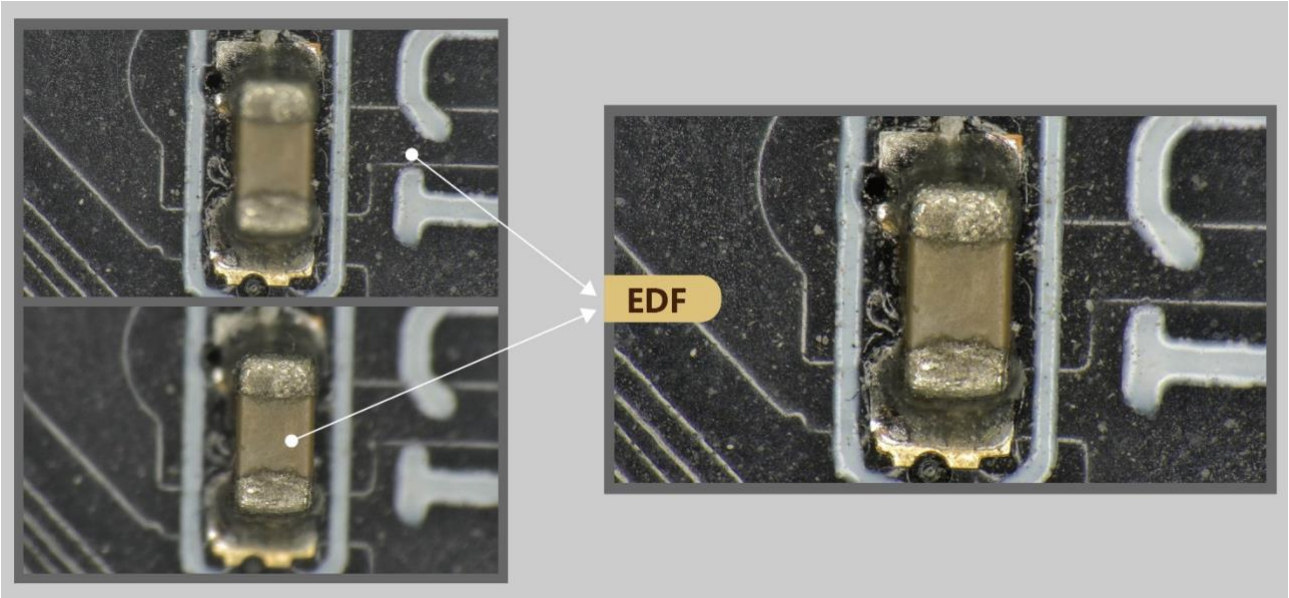


Figure 33 Circuit Board EDF Effect

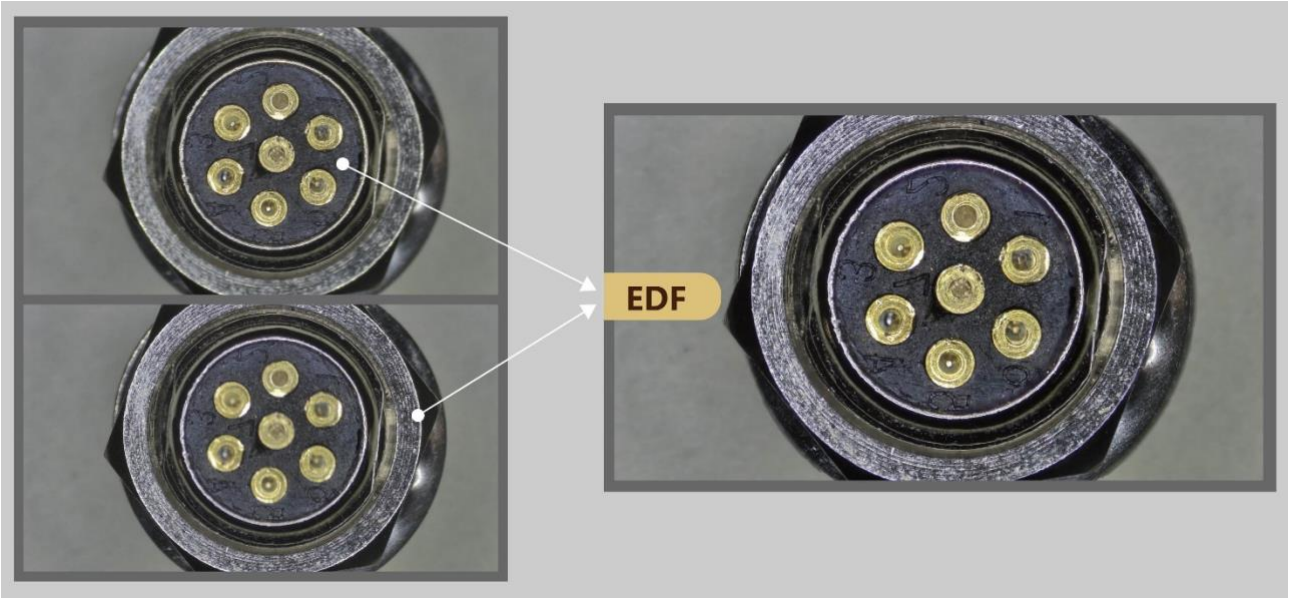


Figure 34 Artifact EDF Effect

9 Contacting Customer Service

Please contact your local distributor if you have any questions about the product.