Hikrobot Co., Ltd.

HDMI Measurement Microscope Camera

User Manual

HIKROBOT

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The symbols that may be found in this document are defined as follows.

Symbol	Description
Danger	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.
Caution	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance degradation, or unexpected results.
Note	Provides additional information to emphasize or supplement important points of the main text.

Available Model

This manual is applicable to the HDMI Measurement Microscope Camera.

Contact Information

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Contents

Chapter 1 Safety Instruction

The safety instructions are intended to ensure that the user can use the device correctly to avoid danger or property loss. Read and follow these safety instructions before installing, operating and maintaining the device.

1.1 Safety Claim

- To ensure personal and device safety, when installing, operating, and maintaining the device, follow the signs on the device and all safety instructions described in the manual.
- The note, caution and danger items in the manual do not represent all the safety instructions that should be observed, but only serve as a supplement to all the safety instructions.
- The device should be used in an environment that meets the design specifications, otherwise it may cause malfunctions, and malfunctions or component damage caused by non-compliance with relevant regulations are not within the scope of the device's quality assurance.
- Our company will not bear any legal responsibility for personal safety accidents and property losses caused by abnormal operation of the device.

1.2 Safety Instruction

⚠Caution:

- Do not install the device if it is found that the device and accessories are damaged, rusted, water ingress, model mismatch, missing parts, etc., when unpacking.
- Avoid storage and transportation in places such as water splashing and rain, direct sunlight, strong electric fields, strong magnetic fields, and strong vibrations.
- Avoid dropping, smashing or vigorously vibrating the device and its components.
- It is forbidden to install the indoor device in an environment where it may be exposed to water or other liquids. If the device is damp, it may cause fire and electric shock hazard.
- Place the device in a place out of direct sunlight and ventilation, away from heat sources such as heaters and radiators.
- In the use of the device, you must be in strict compliance with the electrical safety regulations of the nation and region.
- Use the power adapter provided by the official manufacturer. The power adapter must meet the Limited Power Source (LPS) requirements. For specific requirements, please refer to the device’s technical specifications.
- Do not cover the device's plug or outlet for disconnecting power supply.
- It is strictly forbidden to wire, maintain, and disassemble the device is powered on.

Otherwise, there is a danger of electric shock.

- Before powering on the device, please confirm that the device is installed in good condition, the wiring is firm, and the power supply meets the requirements.
- If the device emits smoke, odor or noise, please turn off the power and unplug the power cord immediately, and contact the dealer or service center in time.
- It is strictly forbidden to touch any terminal of the device when operating it. Otherwise there is a danger of electric shock.
- It is strictly forbidden for non-professional technicians to detect signals during device operation, otherwise it may cause personal injury or device damage.
- It is strictly forbidden to maintain the device is powered on, otherwise there is a danger of electric shock.
- Avoid aiming the lens at strong light (such as lighting, sunlight, or laser beams, etc.), otherwise the image sensor will be damaged.
- Please keep the image acquisition window clean. It is recommended to wipe it with a clean cloth that is moistened with alcohol (75% or less). When the product is not in use, dust protection is required. Damage caused by improper maintenance will not be liable for warranty.
- If the device does not work properly, please contact your dealer or the nearest service center. Never attempt to disassemble the device yourself (we shall not assume any responsibility for problems caused by unauthorized repair or maintenance).
- Please dispose of the device in strict accordance with the relevant national or regional regulations and standards to avoid environmental pollution and property damage.

Note:

- Check whether the device's package is in good condition, whether there is damage, intrusion, moisture, deformation, etc. before unpacking.
- Check the surface of the device and accessories for damage, rust, bumps, etc. when unpacking.
- Check whether the quantity and information of the device and accessories are complete after unpacking.
- Store and transport the device according to the storage and transport conditions of the device, and the storage temperature and humidity should meet the requirements.
- It is strictly prohibited to transport the device in combination with items that may affect or damage the device.
- Quality requirements for installation and maintenance personnel:
  - Qualification certificate or working experience in weak current system installation and maintenance, and relevant working experience and qualifications. Besides, the personnel must possess the following knowledge and operation skills.
  - The basic knowledge and operation skills of low voltage wiring and low voltage electronic circuit connection.
  - The ability to comprehend the contents of this manual.
- Please read the manual and safety instructions carefully before installing the device.
- Do not contact the device with strong acids, alkalis, oils, greases or organic solutions such as thinners.

- Do not expose the device directly to flashlights, high-frequency switch lighting devices, or to sunlight, which may affect the performance.

1.3 Electromagnetic Interference Prevention

- Make sure that the shielding layer of cables is intact and 360° connected to the metal connector when using shielded cables.
- Do not route the device together with other equipment (especially servo motors, high-power devices, etc.), and control the distance between cables to more than 10 cm. Make sure to shield the cables if unavoidable.
- The control cable of the device and the power cable of the industrial light source must be wired separately to avoid bundled wiring.
- The power cable, data cable, signal cable, etc. of the device must be wired separately. Make sure to ground them if the wiring groove is used to separate the wiring and the wiring groove is metal.
- During the wiring process, evaluate the wiring space reasonably, and do not pull the cables hard, so as not to damage the electrical performance of the cables.
- If the device is powered on and off frequently, it is necessary to strengthen the voltage isolation, and consider adding a DC/DC isolation power supply module between the device and the adapter.
- Use the power adapter to supply power to the device separately. If centralized power supply is necessary, make sure to use a DC filter to filter the power supply of the device separately before use.
- The unused cables of the device must be insulated.
- When installing the device, if you cannot ensure that the device itself and all equipment connected to the device are well grounded, you should isolate the device with an insulating bracket.
- To avoid the accumulation of static electricity, ensure that other equipment (such as machines, internal components, etc.) and metal brackets on site are properly grounded.
- During the installation and use of the device, high voltage leakage must be avoided.
- Use a figure-eight bundle method if the device cable is too long.
- When connecting the device and metal accessories, they must be connected firmly to maintain good conductivity.

Chapter 2 Overview

2.1 Introduction

The HDMI measurement microscope camera is a device with HDMI interface and has an embedded operating system to support multi-image processing and measurement. It can be directly connected to a monitor or to the client software, providing image acquisition in real time. The HDMI measurement microscope camera is applicable to the electronic semiconductor, PCBA, biomedical industry, etc.

2.2 Key Features

- Provides HDMI interface and USB interface for transmission.
- Provides storage of image and video via TF card or USB flash drive.
- Supports image-related parameter adjustment and auxiliary tools.
- Supports measurement functions and report generation.

Note

Refer to the device's datasheet for specific parameters.

Chapter 3 Appearance and Indicator

3.1 Appearance

Note

- Appearance may differ by device models, but the interface types are the same. Please refer to the actual one.
- Appearance here is for reference only. Refer to the device's datasheet for detailed dimension information.

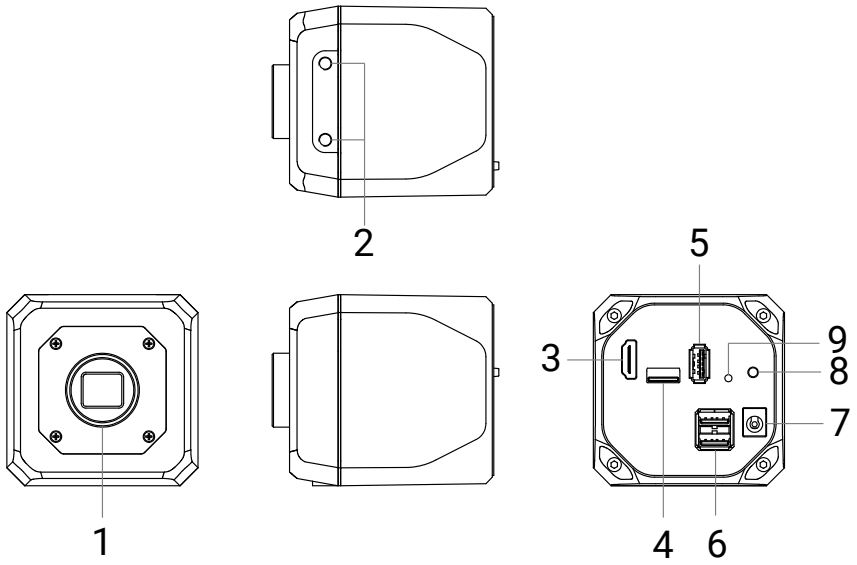


Figure 3-1 Appearance

Table 3-1 Component Description

No.	Component	Description
1	Lens Mount	It is used to install the lens. Refer to the device's datasheet for specific lens mount information.
2	Screw Hole	It refers to the M5 screw hole which is used to fix the device to the installation position.
3	HDMI Interface	It is used to connect to a monitor for image acquisition in real time.
4	Micro SD Card Interface	It can insert the TF card to achieve the following functions: ● Upgrade firmware. Refer to section ***Firmware Upgrade***. ● Execute capture or recording, and save images or videos in the TF card. Refer to section ***Capture Tool***.

No.	Component	Description
		● Execute image-related operations. Refer to section ***Image Management***. **Note** It is recommended to use a TF card with a capacity of less than 128 GB. If the TF card has an extremely high storage capacity, network lags may occur during the image capture.
5	USB 3.0 Interface	● It is used to connect to a wired or wireless mouse. You can operate on the camera. ● It is used to insert the USB flash drive in FAT32 format for firmware upgrade, storage of captured images or videos, and operation of captured images. Refer to section ***Firmware Upgrade***, ***Capture Tool***, or ***Image Management***. ● It is used to connect to the USB interface of the industrial PC to operate on the client software. Refer to section ***Client Software Operation*** for details.
6	USB 2.0 Interface	It is used to connect to a wired or wireless mouse, or insert the USB flash drive in FAT32 format. The functions are the same as that of the USB 3.0 interface.
7	Power Interface	It refers to the 12 VDC to 24 VDC power jack for powering the device.
8	Switch	It refer to the power switch. Short-press to power on, and long-press to power off.
9	LED Indicator	It indicates the device's status. Refer to section ***LED Indicator***.

3.2 LED Indicator

The device's LED indicator is used to indicate the operation status of the device.

Note

When the indicator is flashing slowly and flashing very slowly, its unlit interval is 1 sec and 2 sec respectively.

Table 3-2 Indicator Description

No.	Indicator Color	Status	Device Status Description
1	Red	Solid	● The device is being powered up. ● The firmware upgrade fails.
2	Red	Flashing slowly	The HDMI cable is not connected normally, and the connection of the client software fails.

No.	Indicator Color	Status	Device Status Description
3	Red	Flashing very slowly	Exception of data transmission occurs.
4	Blue	Solid	The device is acquiring images.
5	Red and blue	Flash alternatively	The firmware is upgrading.
6	Purple	Flashing	The device is in minimum system. **Note** ● When the device is in the minimum system, the monitor will no longer show any images, and only the firmware upgrading can be executed. At this time, you can insert a USB flash drive which contains the files of firmware upgrading and the upgrade.txt file into the device, and the device will resume normal operation after the automatic upgrade. ● For MV-CM3120C-1H device, when the device is in the minimum system, you can execute firmware upgrade via USB 3.0 cable.

Chapter 4 Device Installation and Debugging

4.1 Installation Preparation

You need to prepare following accessories before device installation.

Table 4-1 Accessories

No.	Name	Quantity	Description
1	DC Power Supply	1	You should select an appropriate power adapter according to the device power supply and consumption. You need to purchase separately.
2	HDMI Cable	1	It is used to connect to a monitor. You need to purchase separately.
3	USB 3.0 cable	1	It is used to connect to the client software. You need to purchase separately.
4	Monitor	1	● For MV-CM3040C-1H device, the monitor with a resolution of 1920 × 1080 is recommended. You need to purchase separately. ● For MV-CM3120C-1H device, the monitor with a resolution of 3840 × 2160 is recommended. You need to purchase separately.
5	Mouse	1	It refers to the wired or wireless mouse with USB 2.0 or USB 3.0 interface. You need to purchase separately.
6	Lens	1	It refers to the lens that is suitable for the device. You need to purchase separately.
7	Lens Adapter	1	If the lens you used does not match with lens mount of the device, you need to use a lens adapter. You need to purchase separately.
8	TF Card	1	It refers to the supplied TF card with a capacity of 64 GB. You need to purchase separately.
9	Dongle	1	For MV-CM3040C-1H(MSD) device, the dongle is provided by default.

Note

- The device mentioned in this manual is an electronic product that requires operation and storage under dry conditions. In case of hot and humid, acidic and alkaline environment, please take isolation and protection measures to avoid corrosion damage

of the device's internal components.
- When the lens is used, it is necessary to prevent humid environment and avoid steam from entering inside, causing fogging.

4.2 Install Device

Before You Start

- Make sure that the device in package is in good condition and all assembly parts are included.
- Make sure that all related devices are powered off during the installation.

Steps

1. Fix the device to the installation position.
2. Install the lens to the device.
3. Use a DC power supply to power the device.

Note

The independent power supply is required.

4. Use a HDMI cable to connect the device to the monitor, or use a USB 3.0 cable to connect it to the industrial PC or other transmission devices for operation on the client software.
5. (Optional) If you need to connect to the monitor, connect the wired or wireless mouse via the USB 2.0 or USB 3.0 interface.

4.3 Debugging

After the device is connected to the monitor, short-press the switch button to power on, and the window of image acquisition is shown on the monitor.

Note

The images below are for reference only, and the actual device you purchased shall prevail.

- Use the mouse to expand the settings page on the right of the window, and you can set the image-related parameters and view device information on the settings page.

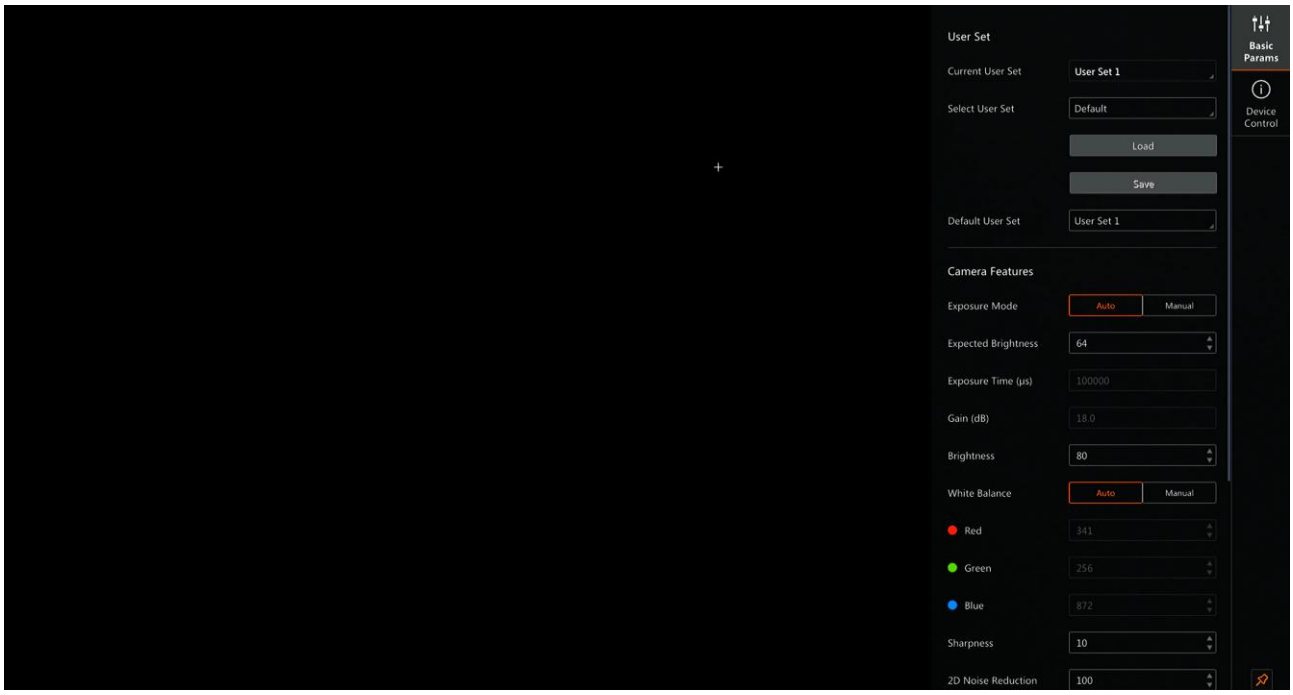


Figure 4-1 Settings Page

- Use the mouse to expand the toolbar on the left of the window, and you can execute capture, recording, storage, measurement, and report exporting on this page.

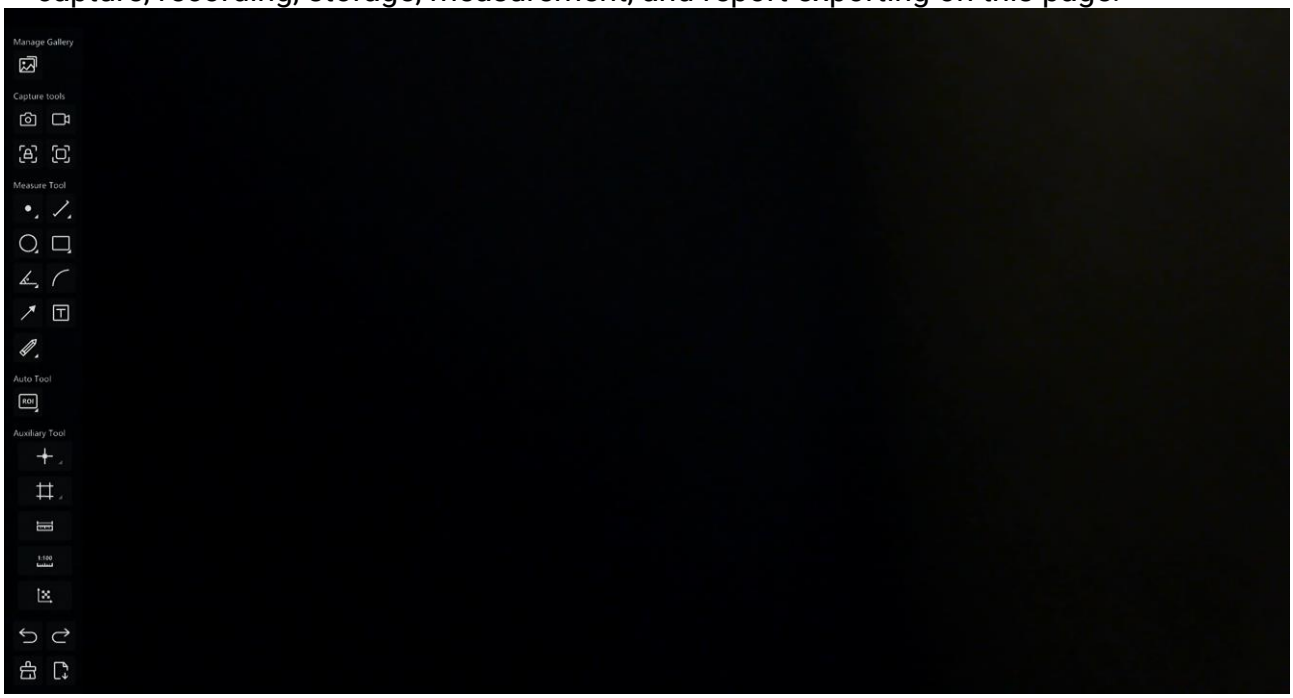


Figure 4-2 Toolbar Page

- Click in the lower-right corner of the settings page or in the lower-left corner of the toolbar to fix the page.
- Click in the lower-right corner of the settings page or in the lower-left corner of the toolbar to move the page.

Note

If you do not click to lock the position of the page after moving, the page will automatically collapse and return to its original position as soon as the mouse cursor exits the page.

- You can zoom in or zoom out the image via mouse wheel, and view the image scaling at the bottom of the window in the real time.

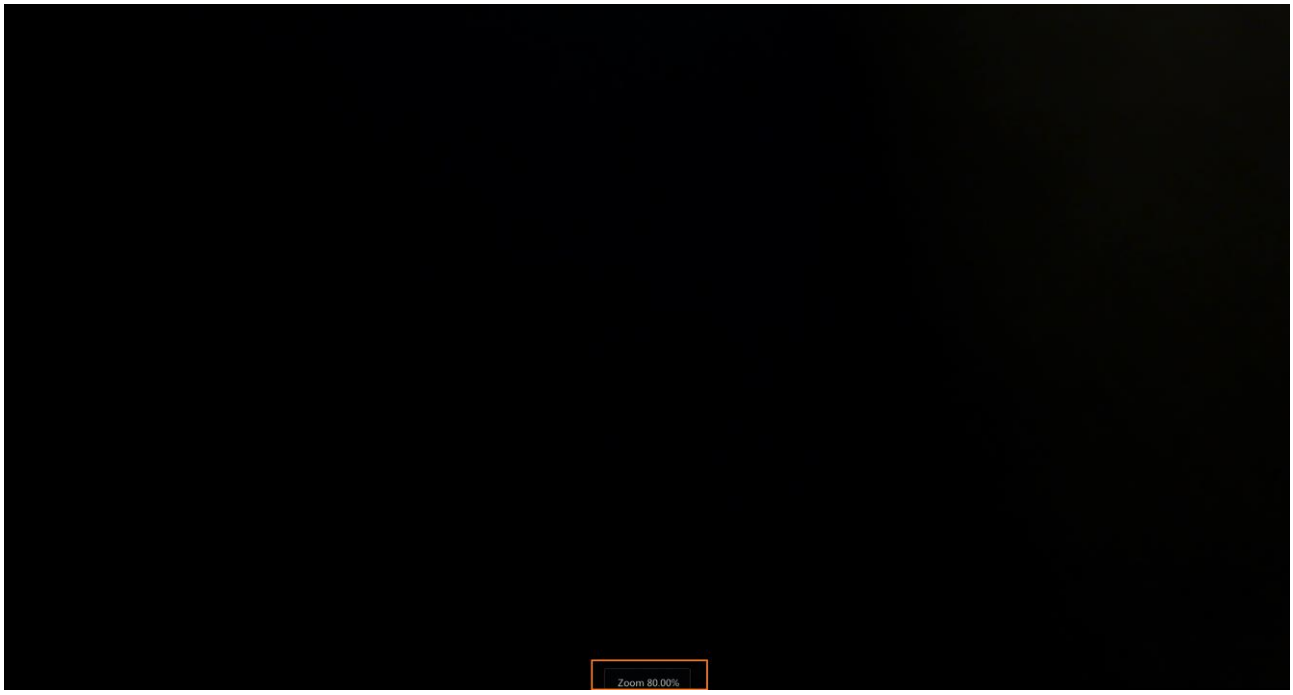


Figure 4-3 Zoom In/Out

4.4 Install Client Software

MicroMaster client software is used to connect and set device's parameters, acquire images, and measurement.

Note

- The MicroMaster client software is compatible with 64-bit Windows 7/10/11 operating systems.
- The graphic user interface may differ by different versions of the client software you use.
- The client software has integrated driver required by hardware, and no need to download and install other drivers.
- You can download the client software from ***en.hikrobotics.com***.

Steps

1. Double click the MicroMaster installation package.

2. Select the language.
3. Read and check **Terms of the License Agreement**.

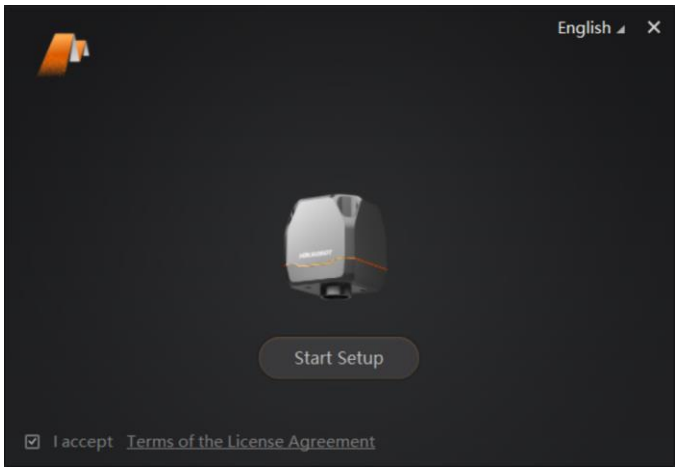


Figure 4-4 Installation Interface

4. Click **Start Setup**.
5. Select installation directory, driver and others.

- **Select Driver**: You can check **GIGE**, **USB 3.0** and **PCIE** according to actual demands. **USB 3.0** is selected by default.
- **Others**: Check **Enable Jumbo Frame for All NICs** to enhance network transmission performance. Check **PCIe-CML**, **PCIe-CXP**, **PCIE-GEV**, **PCIE-XoF** to enumerate the corresponding frame grabbers.

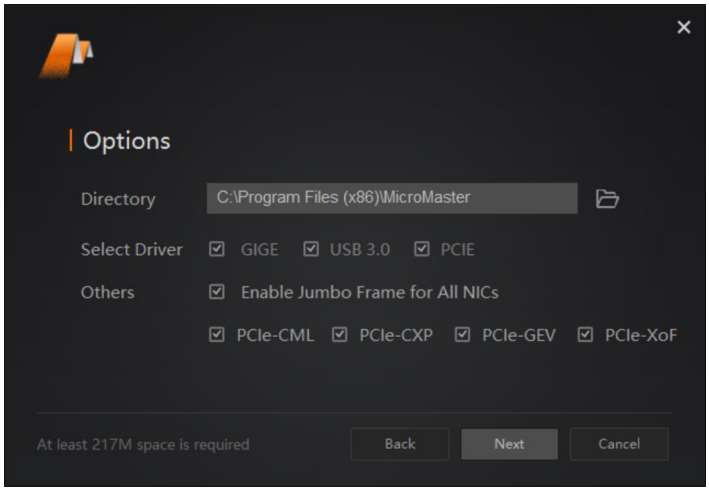


Figure 4-5 Installation Options

Note

- Regarding options, it is recommended to keep default settings.
- **PCIe-CML**, **PCIe-CXP**, **PCIE-GEV**, **PCIE-XoF** can be checked only when **PCIE** is checked.
- **PCIe-CML**, **PCIe-CXP**, **PCIE-GEV**, **PCIE-XoF** supports frame grabbers developed by our company only.

6. Click **Next** to install.
7. Finish the installation process according to the prompts.

4.5 Client Software Operation

This section introduces the basic process from connecting a camera to the client software to drawing a measurement tool on the live view display. Refer to ***MicroMaster Client User Manual*** for details.

Note

When the device is connected to the monitor and client software simultaneously, the settings and operations on the client software will prevail, and the operations on the monitor will be disabled. When the device is disconnected from the client software, the operations on the monitor will be re-enabled.

Steps

1. Run the MicroMaster client software.
2. Select **Camera Mode** in the upper-left corner of the toolbar.
3. Connect an available camera to the client software.
   1) On the main window, click to open the **Camera List** window.
   2) Select an available camera and click to connect it to the client software.

The client software displays the device's information, as shown below.

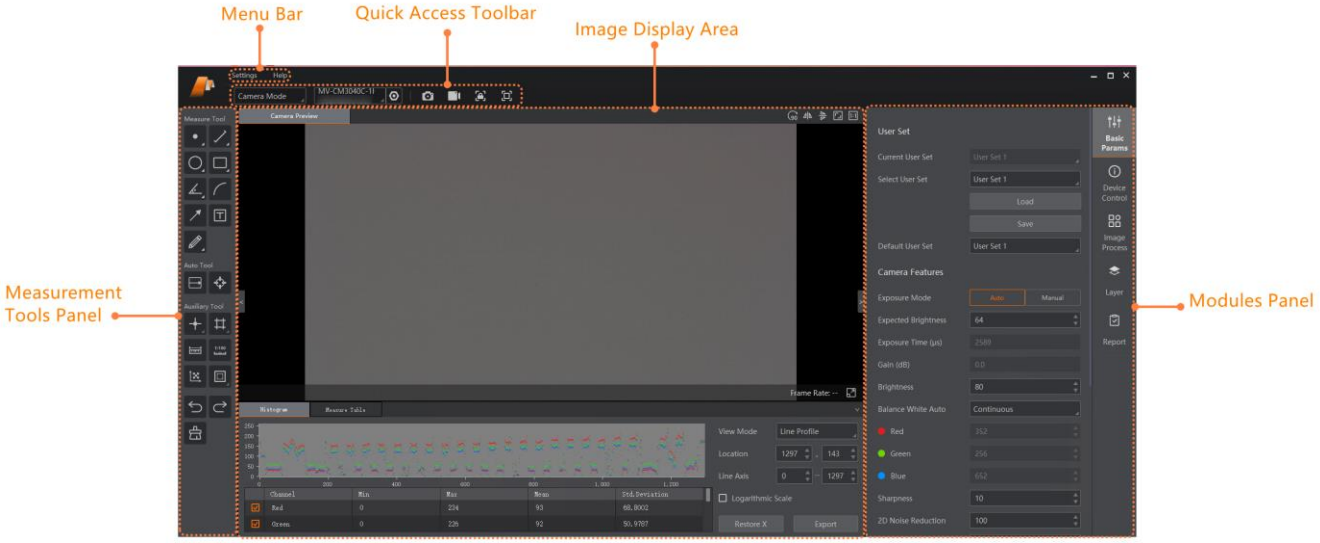


Figure 4-6 Main Window

Note

For specific main window of the client software, please refer to the actual one you got.

Table 4-2 Main Window Description

No.	Name	Description
1	Menu Bar	The menu bar provides quick entrances for basic functions and configurations in the client software, including **Settings** and **Help**.
2	Quick Access Toolbar	The quick access toolbar provides shortcuts for features including selecting a data source, screenshot, recording, and other operations.
3	Measure Tools Panel	This panel provides different tools for measurement. You can select and use tools as required.
4	Image Display Area	This area displays the data obtained. You can also use it to open local images, image histograms, and view measure results.
5	Modules Panel	The panel provides quick access to camera features configuration, device control, and other functionalities.

Note

For the functions in **Image Process**, the dongle is required.

4. Configure camera features and make the image clear in the modules panel.
5. Calibrate pixel size.
   1) Click in **Auxiliary Tool**.
   2) Specify the **Pixels** by entering a known value or drawing a straight line on the image.
   3) Enter the **Physical length**.
   4) Select a **Unit**.
   5) Click **OK** to calibrate the pixel size.
6. Use the **Measure Tool** to measure workpiece size, spacing, and other attributes as required.
7. (Optional) Go to **Report** and export report in required format.

Chapter 5 Basic Parameters

The following content introduces the device settings on the monitor. If you need to set parameters on the client software, refer to ***MicroMaster Client User Manual*** for details.

5.1 Set User Set Parameters

The device supports 4 sets of parameters, including 1 default set and 3 user sets. Go to **Basic Params** → **User Set** to save or load device settings.

- **Current User Set**: It displays the set that is in use.
- **Save User Set**: Select a user set in **Select User Set**, and click **Save** to save the parameter settings.
- **Load User Set**: Select a user set in the **Select User Set**, and click **Load** to load the parameter.
- **Default User Set**: You can also set default parameter by selecting a user set in **Default User Set**.

Note

- After setting user parameters, it is recommended to save user parameters and select them as the default parameters.
- The default user set can be loaded and cannot be edited.

Figure 5-1 User Parameter Settings

5.2 Set Exposure Mode

The device supports 2 types of exposure modes, including **Auto** and **Manual**. Go to **Basic Params** → **Camera Features** to set the exposure mode.

- **Auto**: In this mode, the camera automatically adjusts the **Exposure Time** and **Gain** until

an **Expected Brightness**, an average gray value, is reached.
During auto adjustment, the gain remains 0.0. When the exposure time is at its upper limit yet the expected brightness has not been reached, the gain value will be increased.

- **Manual**: You can set the values of the exposure time and the gain according to the needs. The higher the gain value, the brighter the image will be and the higher the image noise will be, which affects the image quality.

Figure 5-2 Set Exposure Mode

Note

- The range of the exposure time should be between 300 μs and 100000 μs.
- The range of the gain should be between 0 dB and 18 dB.

5.3 Set Brightness

You can adjust the value of the brightness.

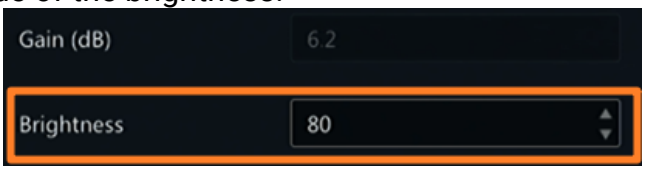
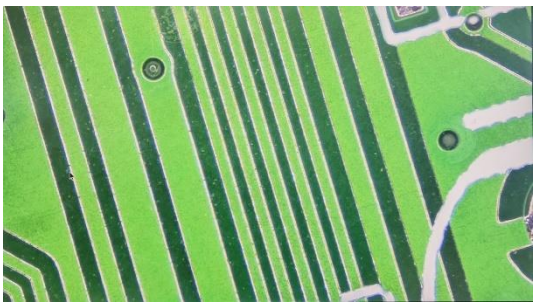
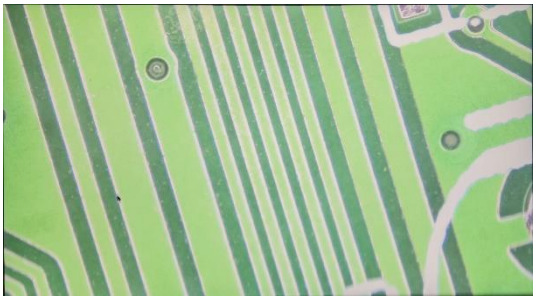


Figure 5-3 Set Brightness

Note

- The range of the brightness should be between 0 and 200.
- The higher the brightness value, the brighter the image will be.

Table 5-1 Brightness Example

Brightness Value	Image
Brightness=50	
Brightness=100	
Brightness=150	

5.4 Set White Balance

The white balance refers to the device color adjustment, depending on different light sources. Adjust the R/G/B ratio to ensure that the white regions are white under different color temperatures. Ideally, the proportion of R/G/B in the white region is 1:1:1.
The device supports 2 types of white balance mode, including **Auto** and **Manual**.
Auto: The white balance is adjusted automatically according to the actual scene.
Manual: You need to set the R, G, B ratio manually. The range is from 1 to 2047, and 1024 means the ratio is 1.0.

Figure 5-4 Set White Balance

It is recommended to correct white balance when there is great difference between the device's color effect and actual effect. You can correct white balance as shown below.

Steps

1. Put a white paper in the range of the device's field of view, and make sure the paper covers the entire field of view.
2. Set exposure and gain.

Note

It is recommended to set image brightness value between 120 and 160.

3. Select **Auto** as white balance mode.

If there is still great difference between correction effect and actual color, it is recommended to manually correct white balance according to the following steps.

Steps

1. Select **Manual** as white balance mode.
2. Manually adjust the R/G/B value until the image color is similar to the actual color.

Note

If the light source and color temperature in environment change, you need to correct white balance again.

5.5 Set Sharpness

The device supports the sharpness function that can adjust the sharpness level of the image edge. You can adjust the sharpness value.

Figure 5-5 Set Sharpness

5.6 Set 2D Noise Reduction

The function of 2D noise reduction can increase the image's SNR and improve its quality.

Figure 5-6 Set 2D Noise Reduction

Note

- The larger the value, the higher the SNR will be and the better the image quality will be.
- The range of the 2D noise reduction should be between 0 and 200.

5.7 Set Saturation

Adjusting the saturation changes the colorfulness of the colors. A higher saturation, for example, makes colors easier to distinguish. Image examples of different saturation values are shown below.

Table 5-2 Saturation Example

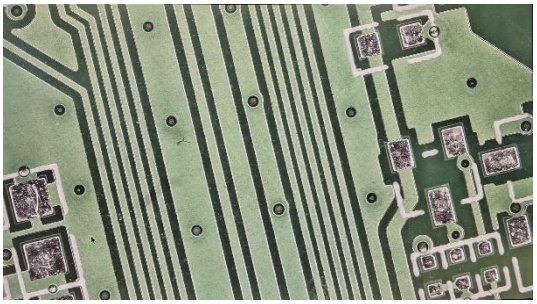
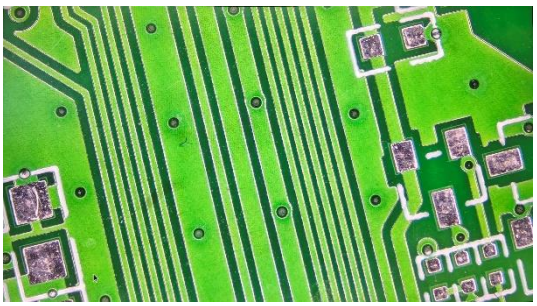
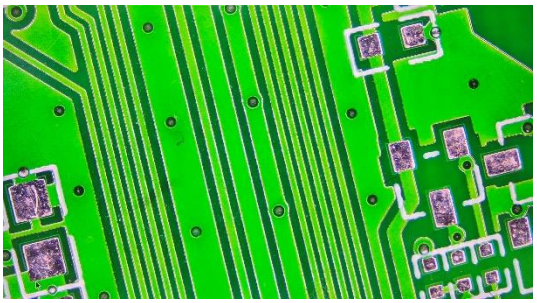
Saturation Value	Image
Saturation=25	
Saturation=100	
Saturation=175	

Figure 5-7 Set Saturation

Note

- The range of saturation is between 0 and 200.

5.8 Set Contrast Ratio

The device supports the contrast ratio function that adjusts the intensity of light and darkness and color. The larger the contrast ratio, and more clear the image is.

Figure 5-8 Set Contrast Ratio

Note

The range of contrast ratio is from 0 to 200.

5.9 Set Gamma Correction

The device supports Gamma correction function. Generally, the output of the device's sensor is linear with the photons that are illuminated on the photosensitive surface of the sensor. Gamma correction provides a non-linear mapping mechanism as shown below.

- Gamma between 0.5 and 1: image brightness increases, dark area becomes brighter.
- Gamma between 1 and 4: image brightness decreases, dark area becomes darker.

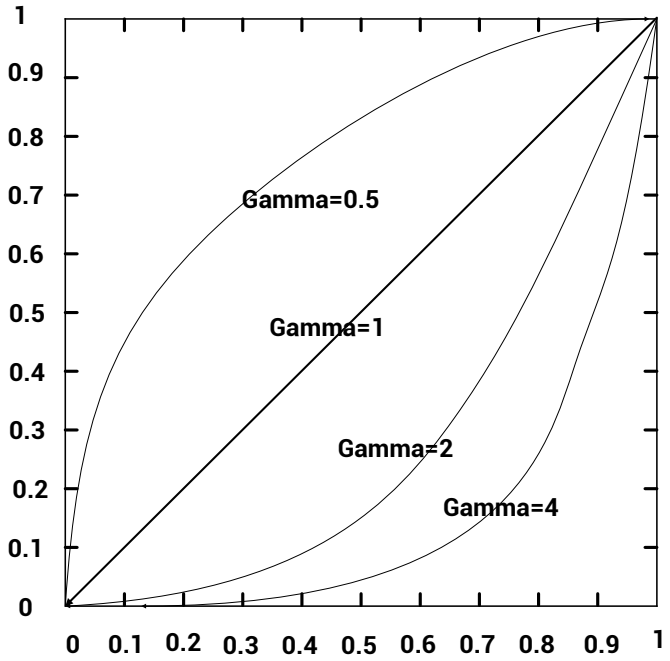
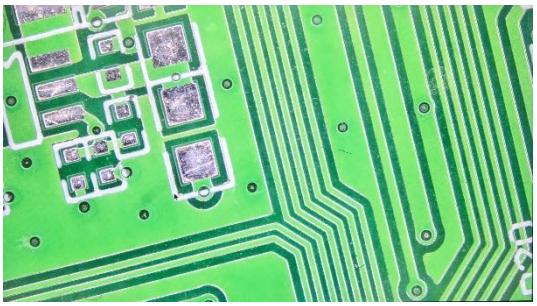
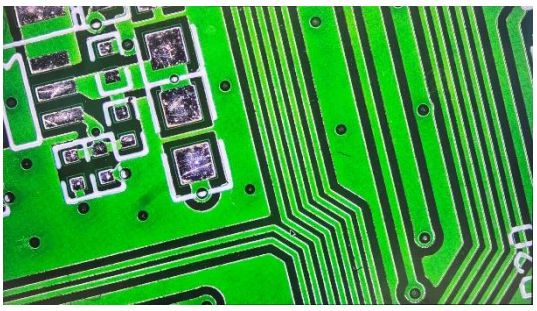
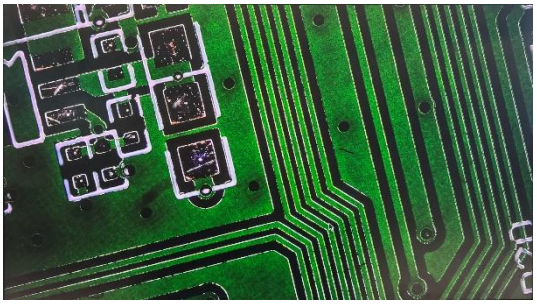


Figure 5-9 Set Gamma Correction

Table 5-3 Gamma Correction Example

Gamma Value	Image
Gamma=0.5	
Gamma=1	

Gamma Value	Image
Gamma=2	

You can set the Gamma value in the settings page.

Figure 5-10 Set Gamma Correction

Note

The range of Gamma correction is from 0 to 4.

5.10 Set Test Mode

The device supports test mode function. When there is an exception in real-time image, you can check whether image in test mode have similar problem to determine the reason. This function is disabled by default, and at this point, the output image is a real-time image. If this function is enabled, the output image is a test image.

Go to **Basic Params** → **Test Mode** to set the test mode according to the actual demands.

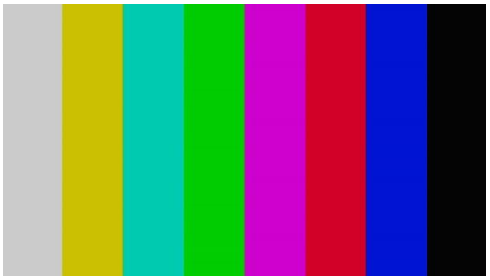
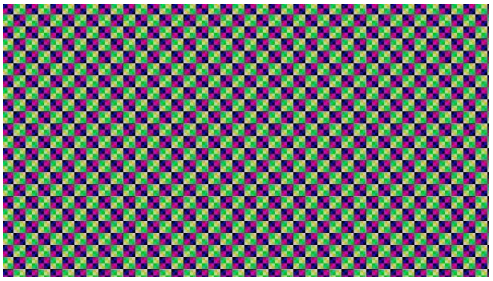
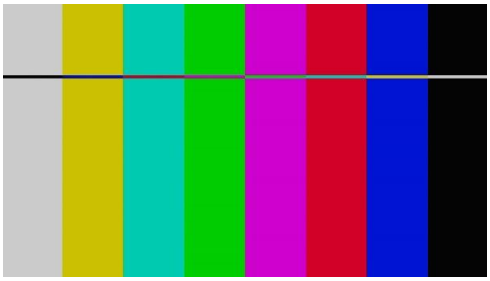
Figure 5-11 Set Test Mode

The device offers 3 test patterns, including **Vertical Color Bar**, **Color Square**, and **Rolling Bar Effect**.

Note

The test pattern may differ by device models.

Table 5-4 Image Example of Test Pattern

Test Pattern	Image
Vertical Color Bar	
Color Square	
Rolling Bar Effect	

5.11 Set HDR

Dynamic range describes the ratio between the image's brightest and darkest parts. A high dynamic range image contains the whole tonal range of the scenes and a high level of detail.

Go to **Basic Params** → **HDR** to enable this function.

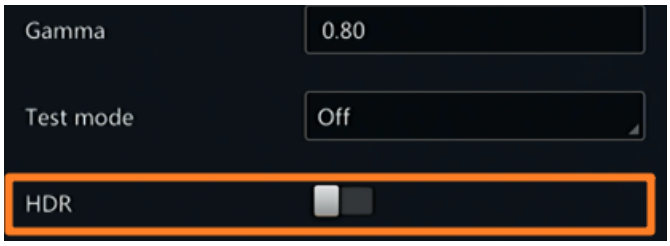


Figure 5-12 Set HDR

5.12 Set Image Reverse

Horizontal Flip (Reverse X) refers to the image reverses in a horizontal way, and **Vertical Flip** (Reverse Y) refers to the image reverses in a vertical way.
You can enable **Horizontal Flip** or **Vertical Flip** according to actual demands.

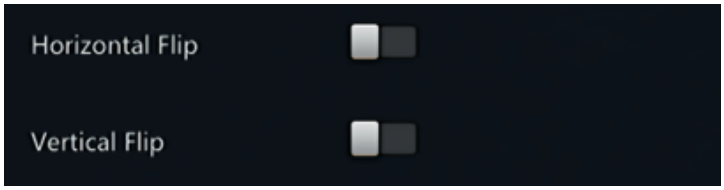


Figure 5-13 Set Image Reverse

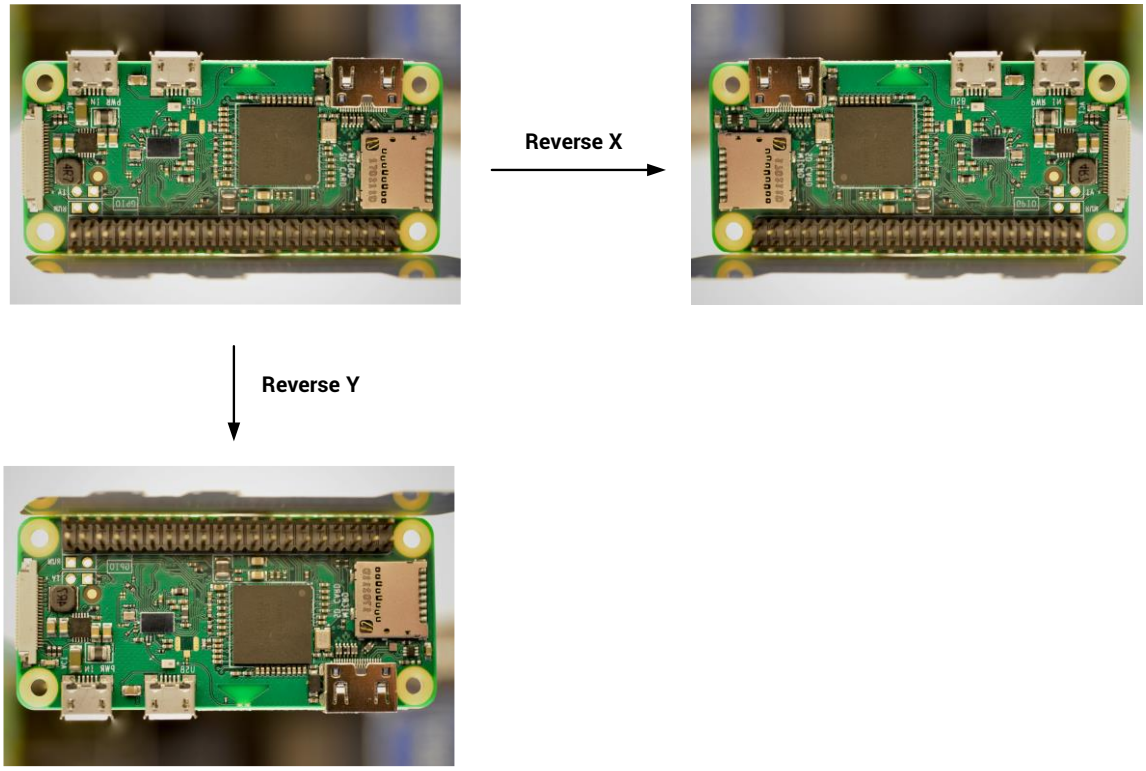


Figure 5-14 Image Reverse Comparison

5.13 Set Digital WDR

The device supports the digital WDR function that the device acquires images to digitally brighten too-dark areas and dim too-bright areas for easy viewing.

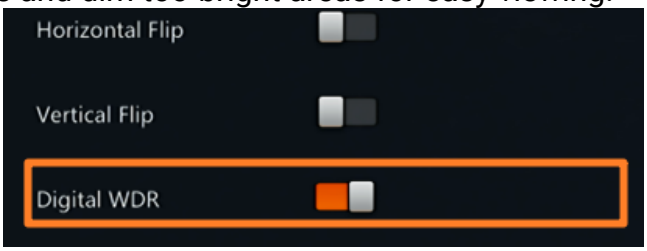


Figure 5-15 Set Digital WDR

5.14 Set Picture Format

You can set the format of real-time captured and saved picture. BMP and JPG formats are allowed.

Chapter 6 Device Control

In **Device Control**, you can view device information, select storage, change language and time, restart or upgrade the device, etc.

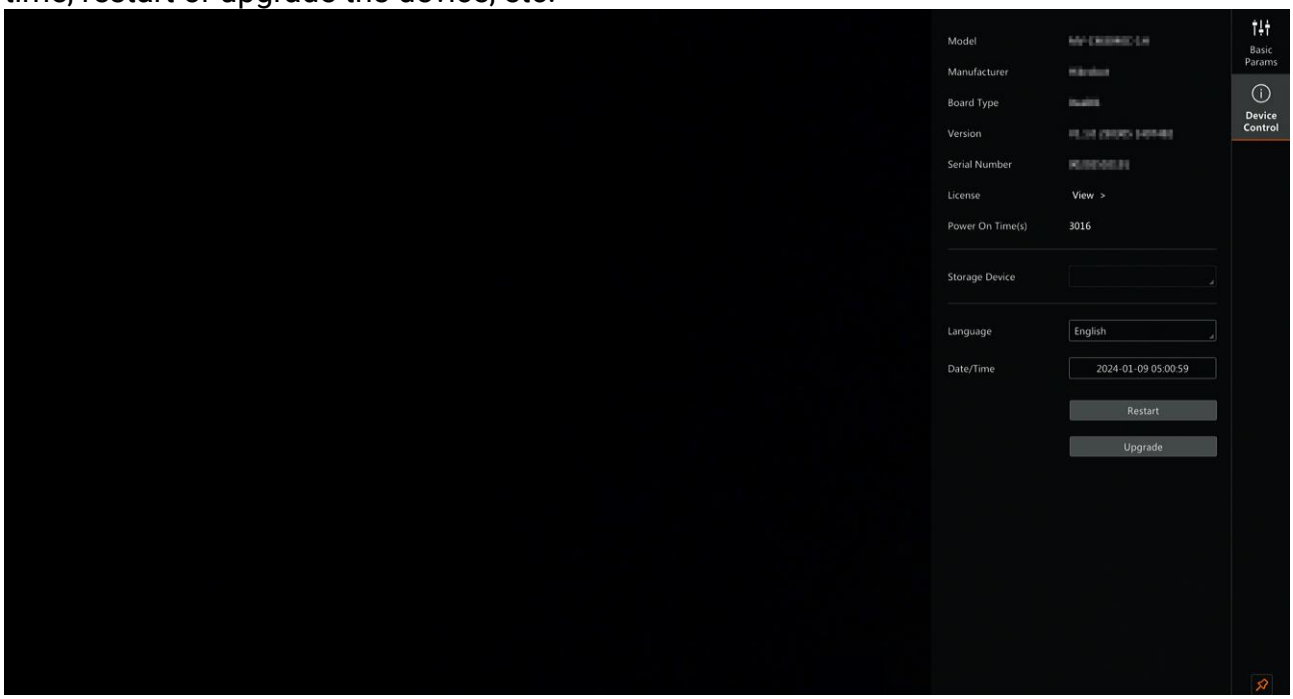


Figure 6-1 Device Control

6.1 Device Information

The device-related parameters are shown below.

Table 6-1 Device Information

Parameter	Read/Write	Description
Model	Read Only	It is the model of the device.
Manufacturer	Read Only	It is the manufacturer information about the device.
Board Type	Read Only	It is the device type.
Version	Read Only	It is the version of the device.
Serial Number	Read Only	It is device's serial number.
License	Read Only	Click **View** to view the license.
Power On Time(s)	Read Only	It is the period of time when device is

Parameter	Read/Write	Description
		powered up.

6.2 Storage Settings

You can select **TF Card** or **USB Drive** to save the captured images or videos. If there is no need to use a specific storage device, you can click **Eject** on the right side of the corresponding storage device.

6.3 Language and Time Settings

You can change the language or set the current time in **Language** or **Date/Time**.

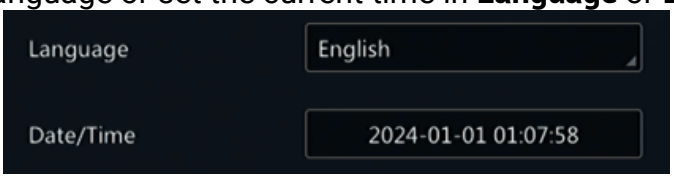


Figure 6-2 Language and Time Settings

6.4 Device Restart

The device will restart in 3 seconds after you click **Restart** and confirm in the pop-up window.

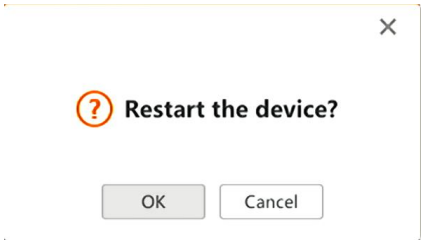


Figure 6-3 Device Restart

6.5 Firmware Upgrade

You can use the TF card or USB flash drive with a format of FAT32 to upgrade the device's firmware.

Steps

1. Insert the TF card into the Micro SD card interface, or the USB flash drive into the USB interface of the device. Make sure the mv_digicap.dav file exists in the root directory of the TF card or the USB drive.

2. Go to **Device Control** and click **Upgrade**.
3. Select the **TF Card** or **USB Drive**.
4. Click **Confirm**.

Note

- The firmware upgrading process will be shown on the screen. It may take a few minutes. Please wait patiently.
- During firmware upgrading, do not power off or restart the device.

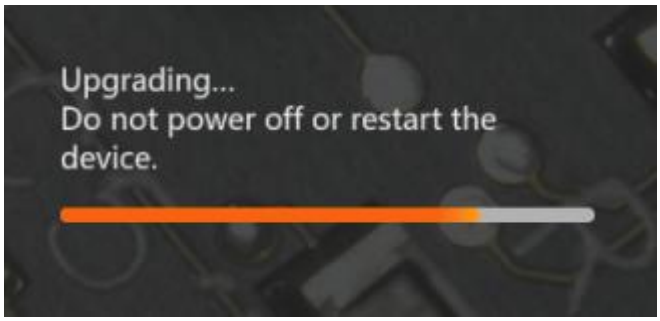


Figure 6-4 Upgrading Process

Chapter 7 Tool Functions

The following content introduces the tool functions and measurement methods on the monitor. If you need to operate on the client software, refer to ***MicroMaster Client User Manual*** for details.

7.1 Image Management

Click to go to the gallery, and you can operate on the captured images.

Note

- The gallery only shows the images saved in the selected storage device. Refer to section ***Storage Settings*** for details.
- The images below are for reference only, and the actual device you purchased shall prevail.
- The functions in image management may differ by device models.

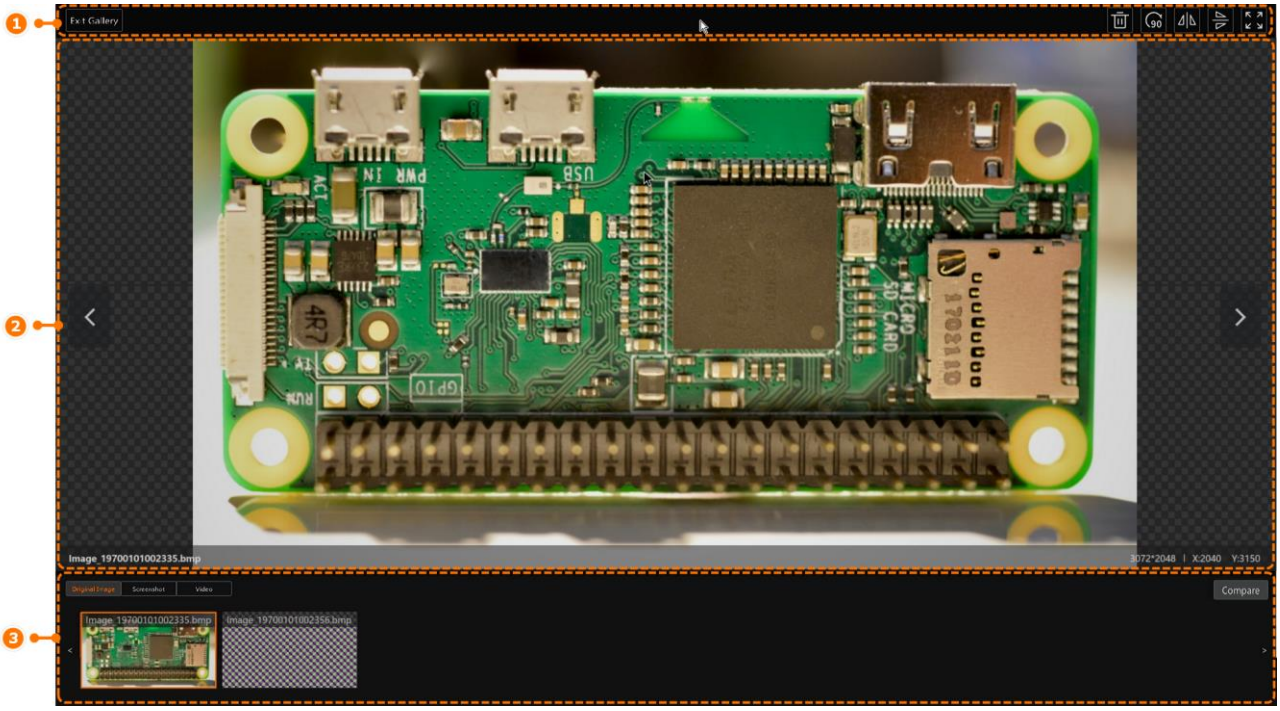


Figure 7-1 Gallery

Table 7-1 Interface Description

No.	Name	Description
1	Operation Panel	You can operate on the captured images in this panel. ● Exit Gallery: Click to exit the gallery interface.

No.	Name	Description
		● : Click to delete the selected and displayed image or screenshot. ● : Click to rotate the selected and displayed image or screenshot 90 degrees clockwise. ● : Click to flip the selected and displayed image or screenshot horizontally. ● : Click to flip the selected and displayed image or screenshot vertically. ● : Click to display the selected image in full screen. ● : Click to exit the full-screen display.
2	Display Panel	Show the selected image/screenshot, and related information. ● Scroll the mouse wheel to zoom in or zoom out the image. ● The image name is displayed in the lower-left corner of the window. ● The image resolution and the X and Y coordinates of the mouse position are displayed in the lower-right corner of the window.
3	Thumbnail Preview Panel	Show all original images or screenshots in thumbnail form. You can select a image/screenshot, and it will be displayed in the image display panel. Image comparison also supported. ● Original Image: Click to view all captured images in real time. ● Screenshot: Click to view all screenshots with measurement data. ● Compare: Select two images for comparison. Refer to section ***Image Comparison*** for details.

7.2 Image Comparison

For some device models, you can use this function to compare the real-time image and the stored image.

Click to go to image comparison interface, and all the captured images will be shown in the upper-right corner. You can select a captured image and compare with the real-time image. After comparison, click **Exit**.

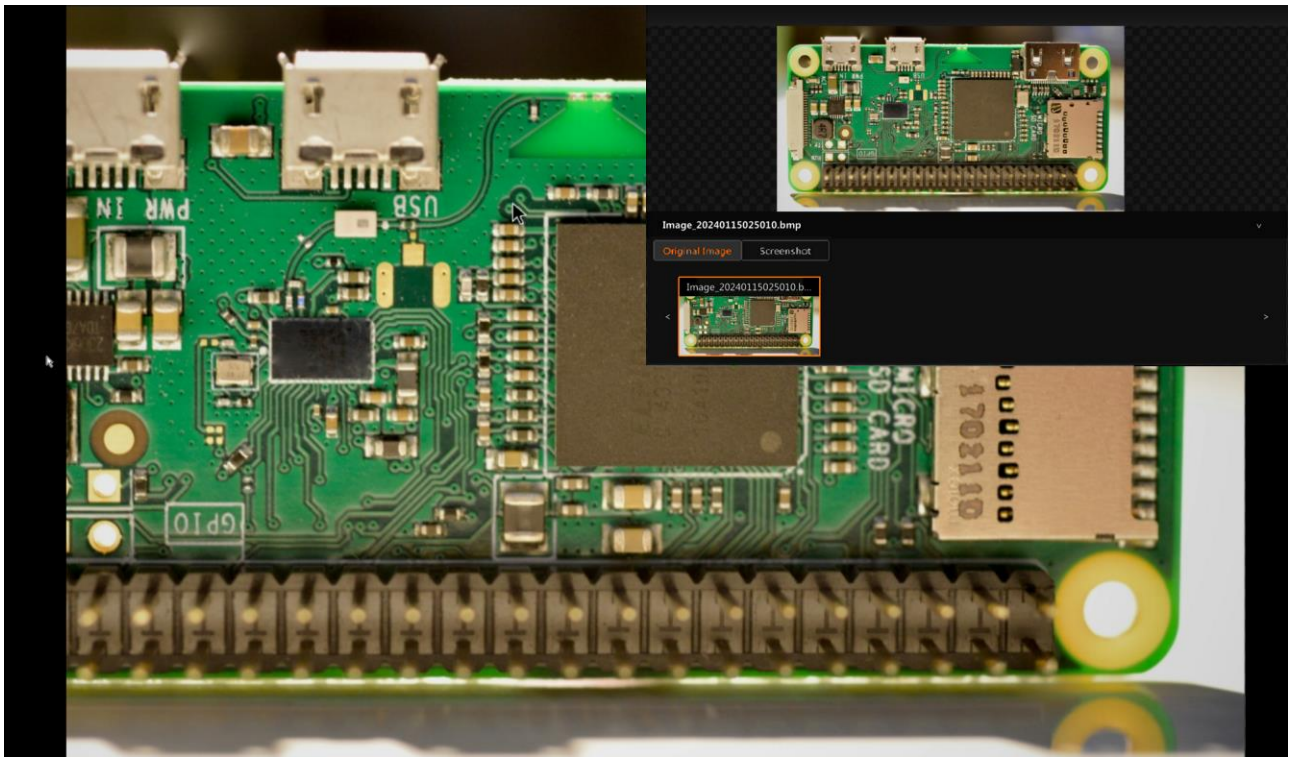


Figure 7-2 Image Comparison

7.3 Capture Tool

You can use capture tool for image capture, video recording, image freezing, and screenshot.

Note

The storage device should be selected first before you use the capture tool. Refer to section ***Storage Settings*** for details.

Table 7-2 Capture Tool Description

No.	Operation	Icon	Description
1	Capture		Click to capture a single image, and the image will be automatically saved in the selected storage device.
2	Record		Click to record a video. Click **Stop** to stop recording, and the video will be automatically saved in the selected storage device.
3	Freeze		Click to freeze the current display. At this time, when you scroll the mouse wheel, the display will no longer zoom in or out, and you will be unable to open the gallery, take screenshots, or record videos. In addition, the image cannot be updated in the frozen status. The changes will only take effect after you

No.	Operation	Icon	Description
			cancel the frozen status.
4	Screenshot		Click to take a screenshot which contains measurement data, and the screenshot will be automatically saved in the selected storage device.

7.4 Manual Measurement Tool

The device provides many measurement tools. You can manually draw a shape on the image, and the device will automatically measure the shape-related attributes, such as point-to-line distance, length, angle, perimeter, and area. You can select a measurement tool according to the actual needs.

Measure by Point

Draw a point or two points on the image, and the device will automatically measure the position of the single point and point-to-point distance. Go to **Measure Tools**, and click to open the tool.

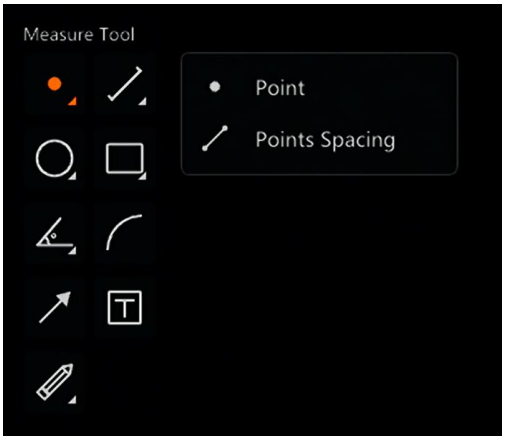


Figure 7-3 Measure by Point

Table 7-3 Point Tool Description

No.	Tool	Icon	Description
1	Point		Click the icon and draw a point on the image, and the device will automatically measure the coordinates of the point.
2	Points Spacing		Click the icon and draw two points on the image, and the device will automatically measure the distance between the points.

Measure by Line

Draw a point or a line on the image, and the device will automatically measure the line length, point-to-line distance, and distance between two lines. Go to **Measure Tools**, and click to open the tool.

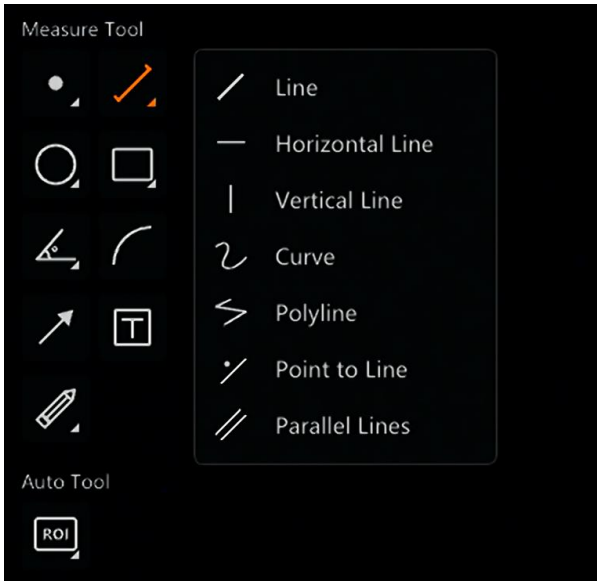


Figure 7-4 Measure by Line

Table 7-4 Line Tool Description

No.	Tool	Icon	Description
1	Line		Click the icon and draw a line on the image, and the device will automatically measure the length of the line.
2	Horizontal Line		Click the icon and draw a horizontal line on the image, and the device will automatically measure the length of the line.
3	Vertical Line		Click the icon and draw a vertical line on the image, and the device will automatically measure the length of the line.
4	Curve		Click the icon and draw a curve on the image, and the device will automatically measure the length of the curve.
5	Polyline		Click the icon and draw a polyline on the image, and the device will automatically measure the length of the polyline.
6	Point to Line		Click the icon and draw a point and a line on the image, and the device will automatically measure the vertical distance between the point and the line.
7	Parallel Lines		Click the icon and draw two parallel lines on the image, and the device will automatically measure the vertical distance between the two lines.

Measure by Circle

Draw a circle on the image, and the device will automatically measure the radius, circumference, and area of the circle, and center distance between two circles. Go to **Measure Tools**, and click ○ to open the tool.

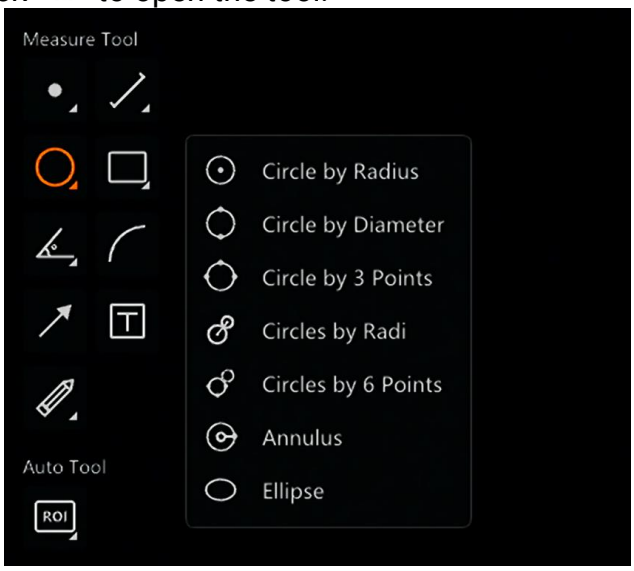


Figure 7-5 Measure by Circle

Table 7-5 Circle Tool Description

No.	Tool	Icon	Description
1	Circle by Radius		Click the icon and draw a circle on the image. You can adjust the circle size by its radius, and the device will automatically measure the radius, circumference, and area of the circle.
2	Circle by Diameter		Click the icon and draw a circle on the image. You can adjust the circle size by its diameter, and the device will automatically measure the radius, circumference, and area of the circle.
3	Circle by 3 Points		Click the icon and select three non-collinear points on the image to draw a circle, and the device will automatically measure the radius, circumference, and area of the circle. The center of the circle is the intersection point of the perpendicular bisector of the line segment between the point 1 and the point 2, and the perpendicular bisector of the line segment between the point 2 and the point 3.
4	Circles by Radi		Click the icon, select two centers of circles on the image, and adjust their radii to draw two circles. The device will automatically measure the distance

No.	Tool	Icon	Description
			between the two centers.
5	Circles by 6 Points		Click the icon and select six points on the image to draw two circles, and the device will automatically measure the distance between the centers of the two circles. Any three non-collinear points are used to draw the first circle, and the other three non-collinear points to draw the second circle.
6	Annulus		Click the icon and draw an annulus by determining the center and radius of the outer circle. The device will automatically measure the radii and circumferences of the inner and outer circles, as well as the area of the annulus. The annulus's area is the outer-circle area minus the inner-circle area. The center of the inner circle coincides with that of the outer circle, and the radius of the inner circle is half that of the outer circle by default. **Note** After the annulus is drawn and the measurement mode is exited, you can adjust the sizes of the inner and outer circles. Refer to section ***Drawing Settings*** for details.
7	Ellipse		Click the icon and determine the major axis and minor axis to draw an ellipse. The device will automatically measure the minor axis, major axis, circumference, and area of the ellipse.

Measure by Polygon

Draw a polygon on the image, and the device will automatically measure the perimeter and area of the polygon. Go to **Measure Tools**, and click  to open the tool.

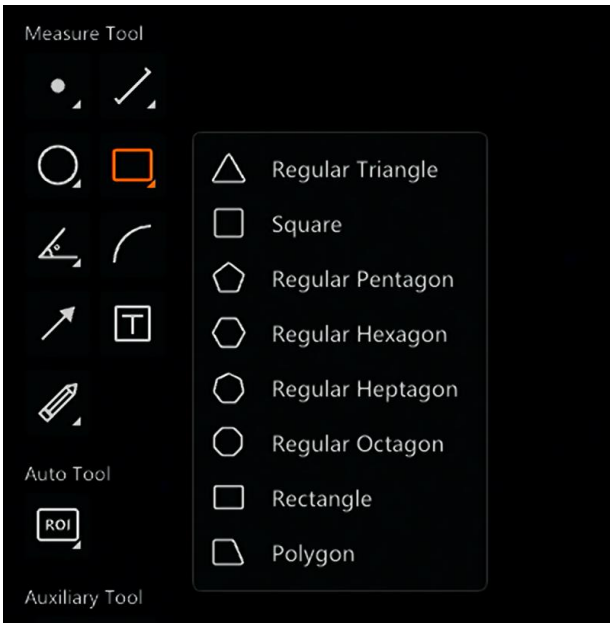


Figure 7-6 Measure by Polygon

Table 7-6 Polygon Tool Description

No.	Tool	Icon	Description
1	Regular Triangle		Click the icon and draw a regular triangle on the image, and the device will automatically measure the perimeter and area of the regular triangle.
2	Square		Click the icon and draw a square on the image, and the device will automatically measure the perimeter and area of the square.
3	Regular Pentagon		Click the icon and draw a regular pentagon on the image, and the device will automatically measure the perimeter and area of the regular pentagon.
4	Regular Hexagon		Click the icon and draw a regular hexagon on the image, and the device will automatically measure the perimeter and area of the regular hexagon.
5	Regular Heptagon		Click the icon and draw a regular heptagon on the image, and the device will automatically measure the perimeter and area of the regular heptagon.
6	Regular Octagon		Click the icon and draw a regular octagon on the image, and the device will automatically measure the perimeter and area of the regular octagon.
7	Rectangle		Click the icon and adjust the length and width to draw a rectangle on the image, and the device will automatically measure the perimeter and area of the rectangle.
8	Polygon		Click the icon, select some angles, and adjust side length to draw a polygon on the image. The device will

No.	Tool	Icon	Description
			automatically measure the perimeter and area of the polygon.

Measure by Angle

Draw an angle on the image, and the device will automatically measure the angle. Go to **Measure Tools**, and click to open the tool.

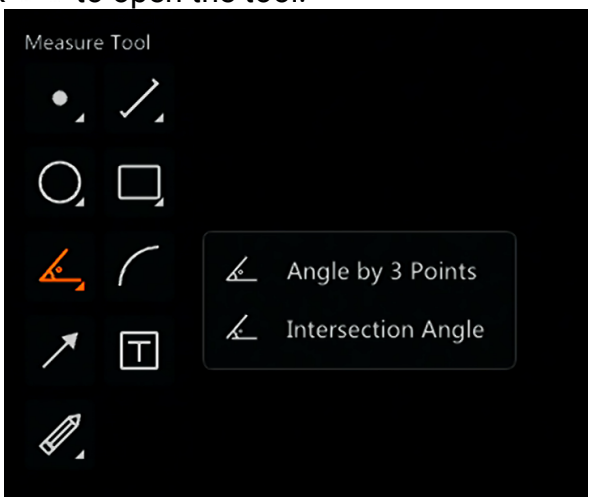


Figure 7-7 Measure by Angle

Table 7-7 Angle Tool Description

No.	Tool	Icon	Description
1	Angle by 3 Points		Click the icon and select three points on the image to draw an angle. The device will automatically measure the angle.
2	Intersection Angle		Click the icon and select four points on the image to draw two lines. The device will automatically measure the angle between the lines.

Measure by Arc

Go to **Measure Tools**, click to open the tool, and draw an arc on the image. The device will automatically measure the length and angle of the arc.
The angle of an arc is the angle between the center of the circle and the two endpoints of the arc.

Measure by Other Tools

You can draw an arrow, add a text, and use a pen to draw on the image.

Figure 7-8 Measure by Other Tools

Table 7-8 Other Tools Description

No.	Tool	Icon	Description
1	Arrow		Click the icon, and draw an arrow on the image.
2	Text		Click the icon, and add a text on the image.
3	Pen		Click the icon and set pen size. Hold down the left mouse button and drag the mouse to draw a line or a shape on the image, and release to finish the drawing.

Drawing Settings

You can adjust line width, color, and font size on the image.

- **Adjust All**

After the drawing is finished, you can right-click the image, and click **Global Font Size** to edit font size of all texts and **Global Color** to edit color of all shapes and texts. Click Cancel Drawing to exit the measurement mode.

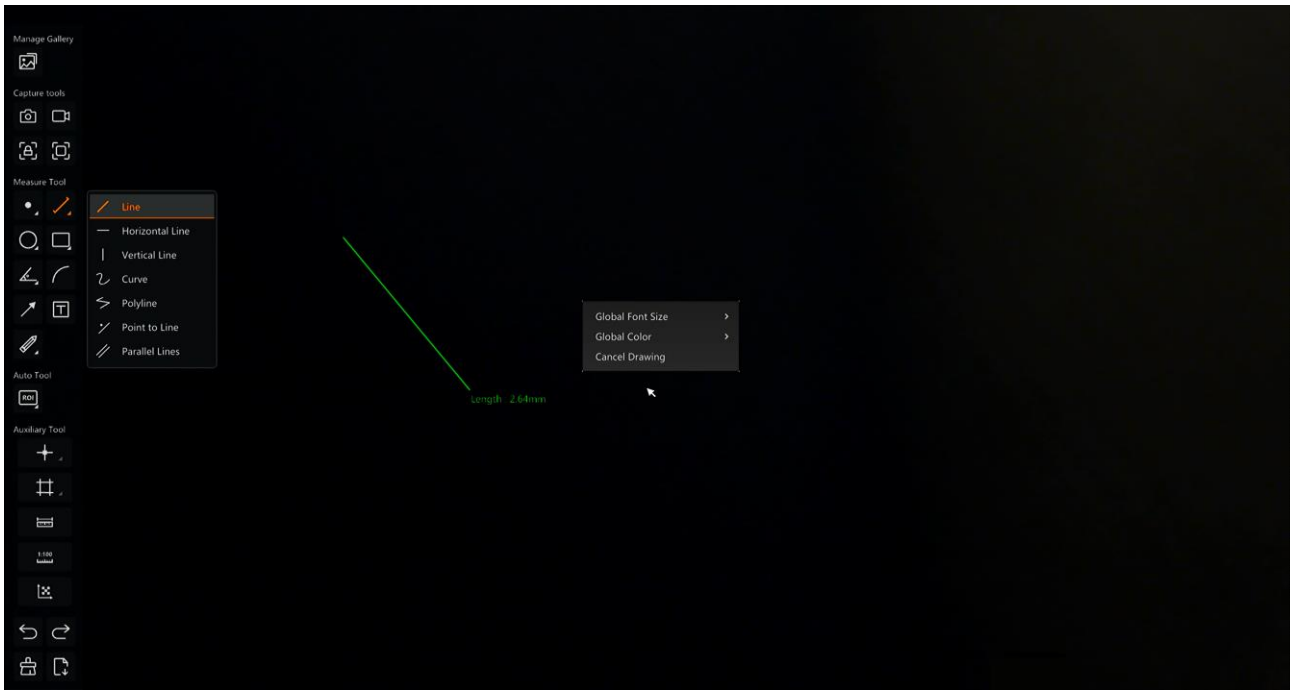


Figure 7-9 Adjust All

- **Adjust One**

After exiting the measurement mode, you can select a shape or a text to edit.

  - **Move shape/text**: Hold down the left mouse button and drag the mouse to move the selected shape. Place the mouse cursor on the text. When the cursor changes to a crosshair, you can drag the text.

Note

The text of measurement result is moved along with the shape and cannot be moved independently.

  - **Edit shape**: Select a shape and a rectangle will be shown on the image. Hold down the left mouse button and drag the rectangle to adjust shape, size, and length.
  - **Edit line width**: Right-click the selected shape, and click **Line Width** to edit the line width.
  - **Edit color**: Right-click the selected shape or text, and click **Color** to edit the color of the shape or text.

Note

The text color of measurement result is adjusted along with the shape and cannot be adjusted independently.

  - **Edit font size**: Right-click the selected shape or text, and click **Font Size** to edit the font size of the measurement result text and the customized text.
  - **Lock shape/text**: Right-click the selected shape or text, and click **Lock** to lock the shape or text on the image. At this time, the shape or the text cannot be moved and edited. You can click **Unlock** if you need to move or edit.

- **Delete shape/text**: When the shape or the text is unlocked, you can right-click the selected one, and click **Delete** to delete.

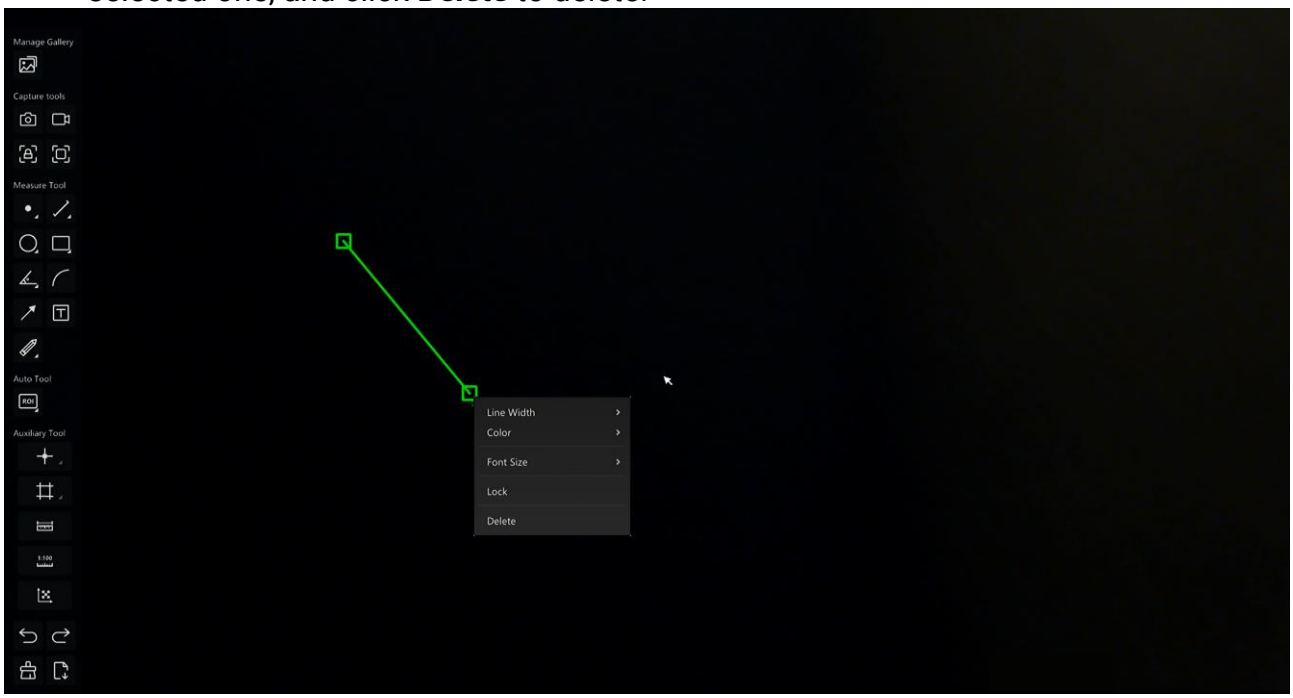


Figure 7-10 Adjust One

7.5 Auto Measurement Tool

You can use the auto measurement tool to search for the required lines or circles in ROI, and the device will automatically measure the length of the line, circumference and area of the circle.

7.5.1 Line/Circle Measurement

Drawing Operation

Steps

1. Click  or  to open the tool.
2. Draw a ROI or multiple ROIs according to the prompt.
3. Right click on the image and select **Cancel Drawing** to finish drawing.

Other Operations

After exiting auto measurement mode, you can execute the following operations.

- **Adjust ROI**: Hover over the ROI, and drag to resize.
- **Move ROI**: Hover over the ROI, and click to drag.

- **Edit algorithm parameter**: Right click on the ROI, and select **Edit Algorithm Params**. Refer to section ***Algorithm Parameter Settings*** for details.
- **Change to manual measurement tool**: Right click on the ROI, and select **To Manual Tool**.

Note

After you change to manual measurement tool, the circle tool will be changed to Circle by Radius, and the line tool to Line. This operation cannot be reverse.

- **Adjust line width and text**: Right click on the ROI, and select the corresponding functions. Refer to section ***Drawing Settings*** for details.

7.5.2 Algorithm Parameter Settings

You can set algorithm-related parameters of line or circle. After settings, the device will automatically measure the length of the line, circumference and area of the circle in the ROI according to the algorithm parameters.
Right click on the ROI, and select **Edit Algorithm Params**.

Note

- After settings, click Apply to execute auto searching of line or circle.
- The settings will only be executed for the select ROI.

Line-Related Parameters

Line-related parameters are shown in the figure and table below.

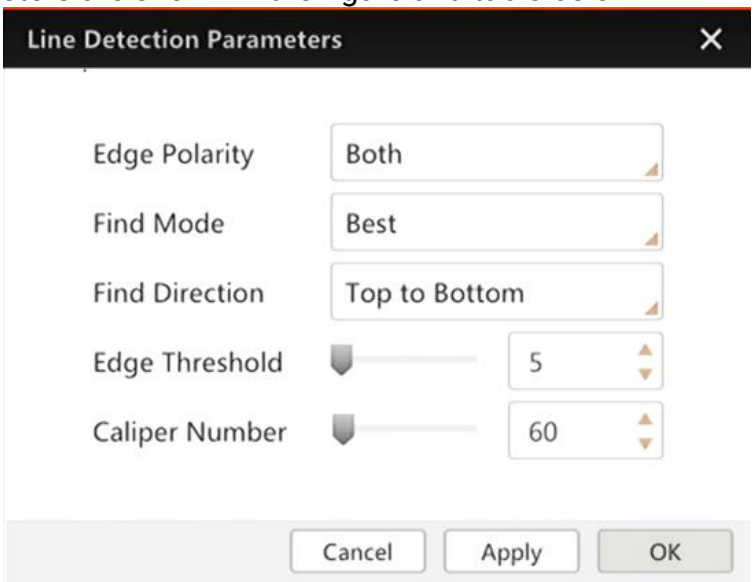


Figure 7-11 Line-Related Parameters

Table 7-9 Parameter Description

No.	Parameters	Description
1	Edge Polarity	You can select **Dark to Light**, **Light to Dark**, and **Both**. ● **Dark to Light**: On the search direction, if the grayscale value changes from low to high when crossing an edge, the edge polarity is set to be from dark to light. ● **Light to Dark**: On the search direction, if the grayscale value changes from high to low when crossing an edge, the edge polarity is set to be from light to dark. ● **Both**: Both of the above are detected.  **Figure 7-12 Edge Polarity**
2	Find Mode	You can select **Strongest**, **First**, and **Last**. ● **Strongest**: Detect the set of maximum edge points configured in the **Edge Threshold**, and then integrate the points to form a line. ● **First/Last**: Detect the first or the last line which meets the requirements.
3	Find Direction	You can select **Top to Bottom** and **Left to Right**. ● **Top to Bottom**: Detect edge points which meet the requirements from top to bottom. ● **Left to Right**: Detect edge points which meet the requirements from left to right.
4	Edge Threshold	It is used to detect edge points of the line, and its range is from 0 to 255. The larger the value, the stronger the anti-noise capacity. However, the number of detected edge points will decrease, and some target edges may be missed. You can set the edge threshold according to the actual demands. If the edge of the real-time captured image is obvious and clear, the threshold can be appropriately increased. If the edge is blurred, it is not recommended to set the threshold too large.
5	Caliper Number	It is used to set the number of areas for detecting edge points. The larger the value, the higher the accuracy. The larger the drawn ROI, the more calipers are recommended to be set.

Circle-Related Parameters

Circle-related parameters are shown in the figure and table below.

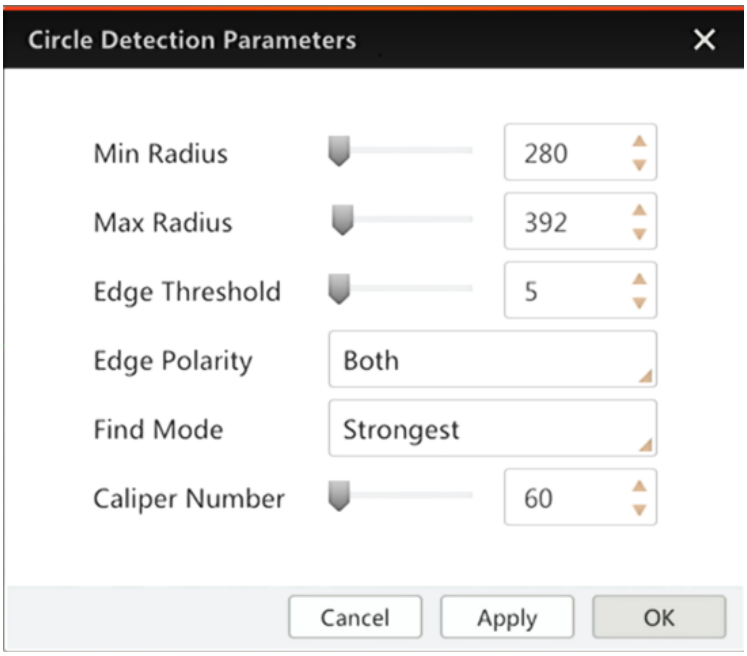


Figure 7-13 Circle-Related Parameters

Table 7-10 Parameter Description

No.	Parameters	Description
1	Min Radius	It is used to search for the minimum radius of the circle. In the ROI, the circles with a radius smaller than **Min Radius** will not be found and not be measured.
2	Max Radius	It is used to search for the maximum radius of the circle. In the ROI, the circles with a radius larger than **Max Radius** will not be found and not be measured.
3	Edge Threshold	It is used to detect edge points, and its range is from 0 to 255. The larger the value, the stronger the anti-noise capacity. However, the number of detected edge points will decrease, and some target edges may be missed. You can set the edge threshold according to the actual demands. If the edge of the real-time captured image is obvious and clear, the threshold can be appropriately increased. If the edge is blurred, it is not recommended to set the threshold too large.
4	Edge Polarity	You can select **Dark to Light**, **Light to Dark**, and **Both**. ● **Dark to Light**: From the circle inside to outside, if the grayscale value changes from low to high when crossing an edge, the edge polarity is set to be from dark to light. ● **Light to Dark**: From the circle inside to outside, if the grayscale value changes from high to low when crossing an edge, the edge polarity is set to be from light to dark. ● **Both**: Both of the above are detected.

No.	Parameters	Description
5	Find Mode	You can select **Strongest**, **First**, and **Last**. ● **Strongest**: Detect the set of maximum edge points configured in the **Edge Threshold**, and then integrate the points to form a line. ● **First/Last**: Detect the first or the last line which meets the requirements.
6	Caliper Number	It is used to set the number of areas for detecting edge points. The larger the value, the higher the accuracy. The larger the drawn ROI, the more calipers are recommended to be set.

7.6 Auxiliary Tool

You can use auxiliary tool to add crosshair, grid, ruler, scale, or mask, and calibrate the device.

7.6.1 Crosshair

The device supports displaying crosshairs for image partitioning. You can edit the crosshairs according to the needs.

Steps

1. Select in **Auxiliary Tool**.
2. Right-click the image, and select **Add Crosshair**. The crosshair and the coordinates of the intersection point will be added at the clicking position.

Figure 7-14 Add Crosshair

3. (Optional) Adjust the position of the crosshair according to the needs.
- Method 1: Press and drag the intersection point of the crosshair.
- Method 2: Click in the lower-right corner of the icon, and set **X-axis** and **Y-axis**.

4. (Optional) Right-click a crosshair, and edit **Line Width**, **Color**, and **Font Size**.

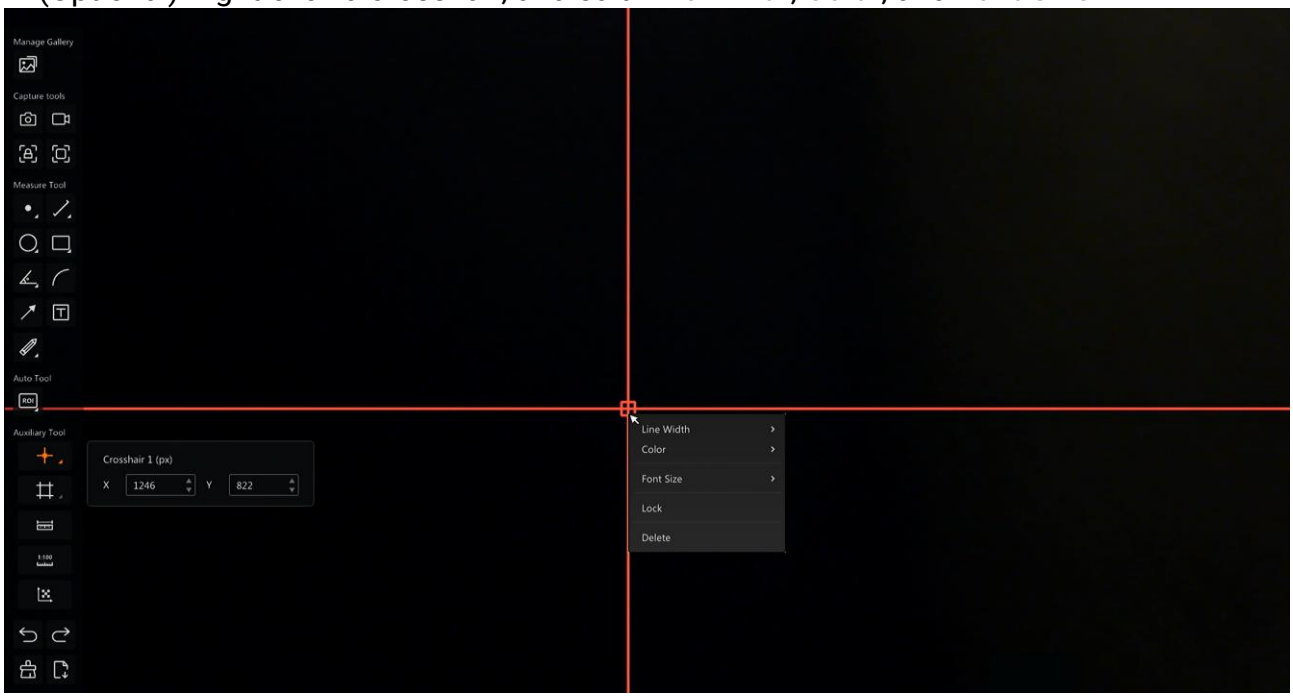


Figure 7-15 Edit Crosshair

5. (Optional) Right-click a crosshair, and click **Lock** to lock the crosshair on the image.

Note

When the crosshair is locked, the line width and color retain the style before modification, while the font size of the intersection point coordinates is displayed in the modified style.

6. (Optional) Right-click the image, and select **Clear All Crosshairs** to clear all crosshairs. Or right-click a crosshair, and select **Delete** to delete the selected crosshair.

Note

After the device is restarted, all crosshairs will be cleared by default.

7. (Optional) Click again to hide all crosshairs.

7.6.2 Grid

The device supports displaying grid lines for image partitioning. You can edit the grid lines according to the needs.

Steps

1. Add the grid lines on the image. There are three methods:

- Method 1: Right-click the image, and select **Add Horizontal Gridline** or **Add Vertical Gridline**. The grid lines will be added at the clicking position.

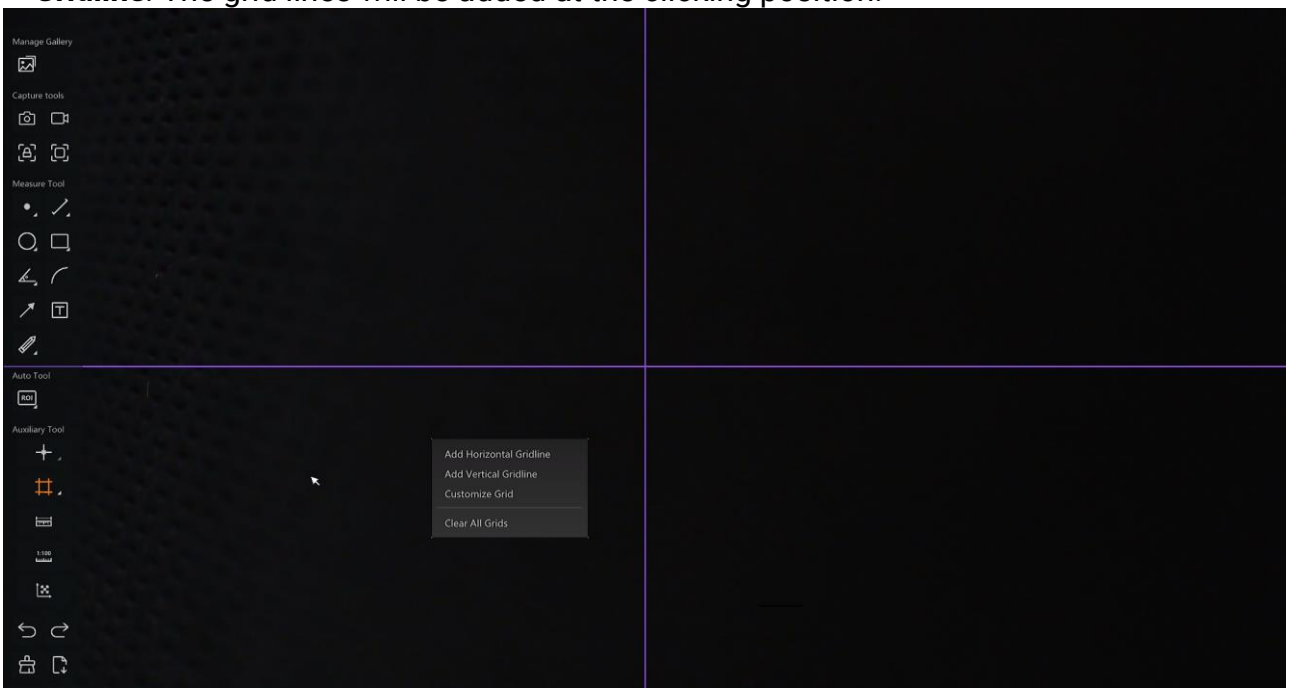


Figure 7-16 Add Grid Line (Method 1)

- Method 2: Right-click the image, select **Customize Grid**, and edit the number of horizontal grid lines and vertical grid lines. The grid lines will be shown on the image and spaced equally.

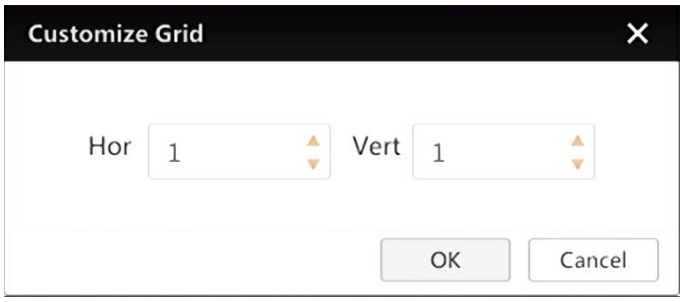


Figure 7-17 Add Grid Line (Method 2)

- Method 3: Click in the lower-right corner of the icon, edit the number of horizontal grid lines and vertical grid lines, and click **Apply**. The grid lines will be shown on the image and spaced equally.

Figure 7-18 Add Grid Line (Method 3)

2. (Optional) Select a horizontal grid line or a vertical grid line to drag according to the needs.
3. (Optional) Select **Horizontal Line** or **Vertical Line** in **Grid Layout**, and click **Auto Arrange** to arrange the grid lines equally.
4. (Optional) Right-click a horizontal grid line or a vertical grid line, and edit **Line Width** and **Color**.

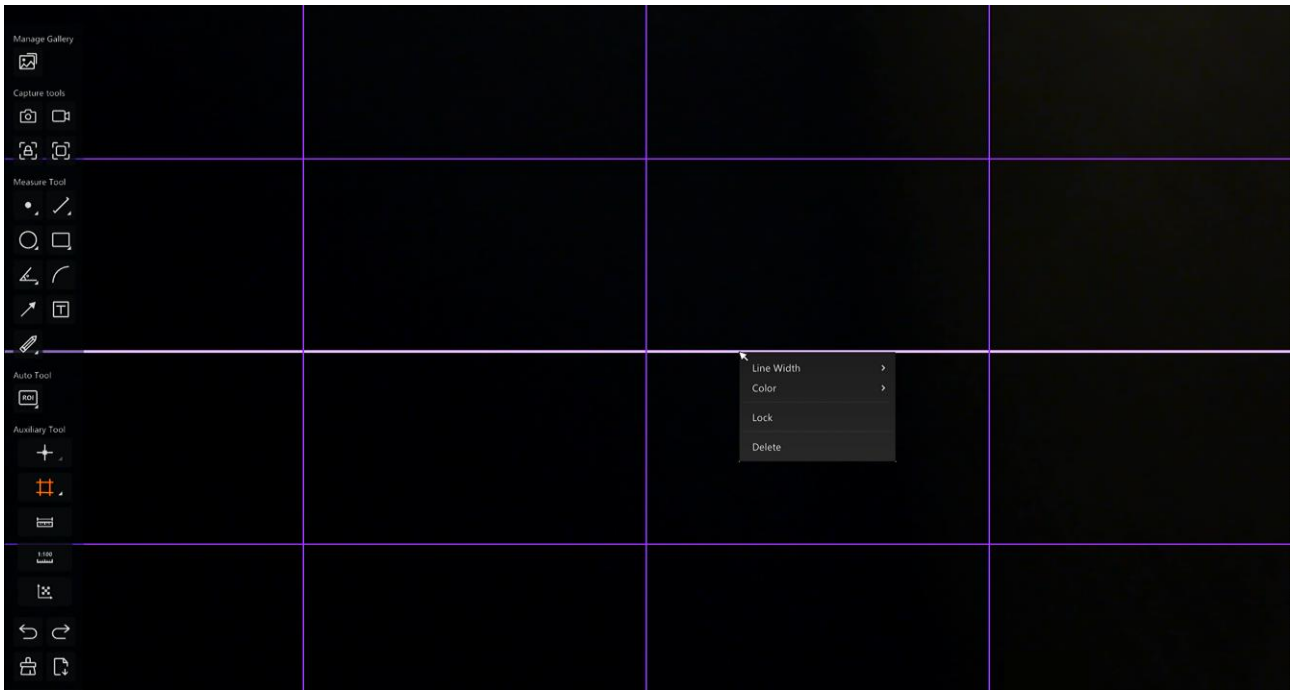


Figure 7-19 Edit Grid Line

5. (Optional) Right-click a horizontal grid line or a vertical grid line, and click **Lock** to lock the grid line on the image.

Note

When the grid line is locked, the line width and color retain the style before modification.

6. (Optional) Right-click the image, and select **Clear All Grids** to clear all grids. Or right-click a grid line, and select **Delete** to delete the selected grid line.

Note

After the device is restarted, all grid lines will be cleared by default.

7. (Optional) Click again to hide all grid lines.

7.6.3 Ruler

The device supports displaying rulers on the left and top sides of the image for accurate measurement. You can click to show the ruler.

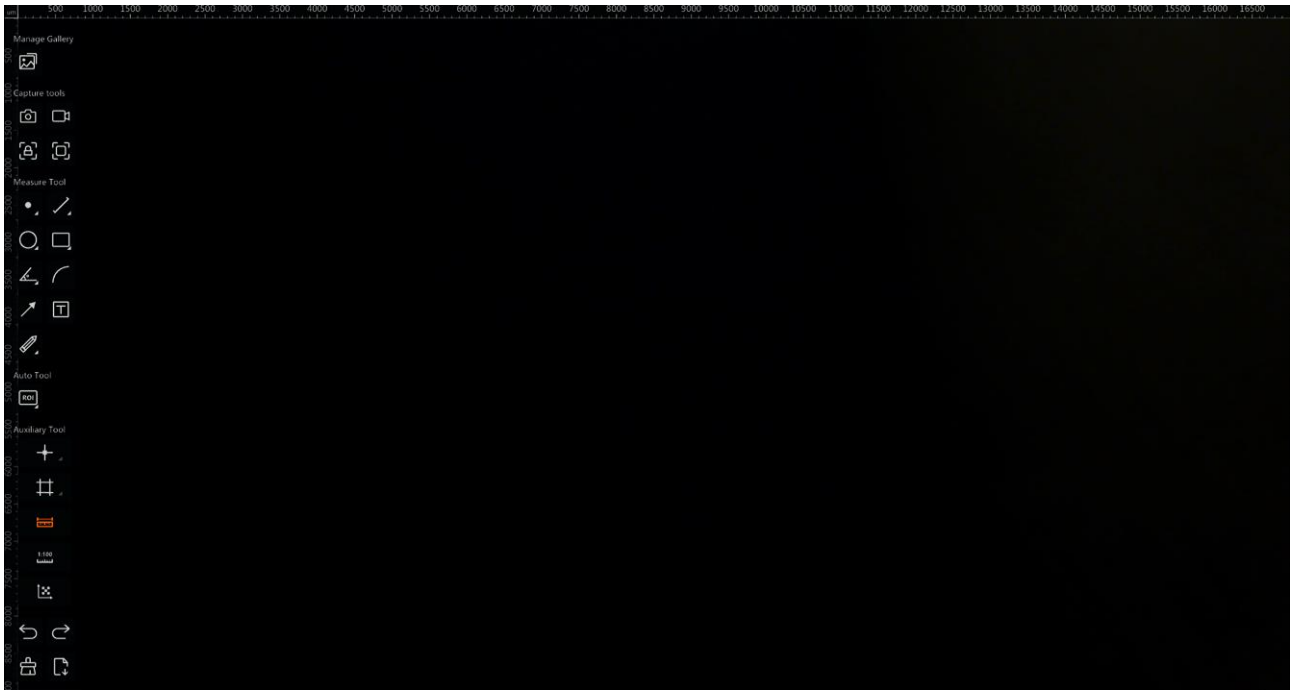


Figure 7-20 Show Ruler

7.6.4 Scale

The device supports displaying a scale in the lower-left corner of the image for accurate measurement. You can click  to show the scale.

Figure 7-21 Show Scale

7.6.5 Calibration

Calibration is required after the device is restarted or zooming in/out of the image is executed.

Steps

1. Click and a window of device calibration will appear.

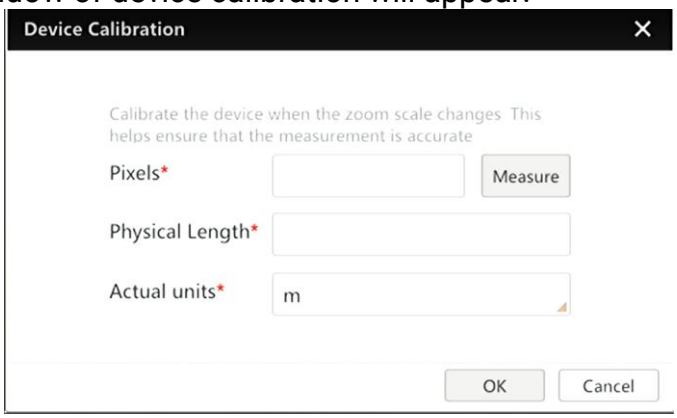


Figure 7-22 Device Calibration

2. Click **Measure**, and follow the prompt to draw a straight line on the image.

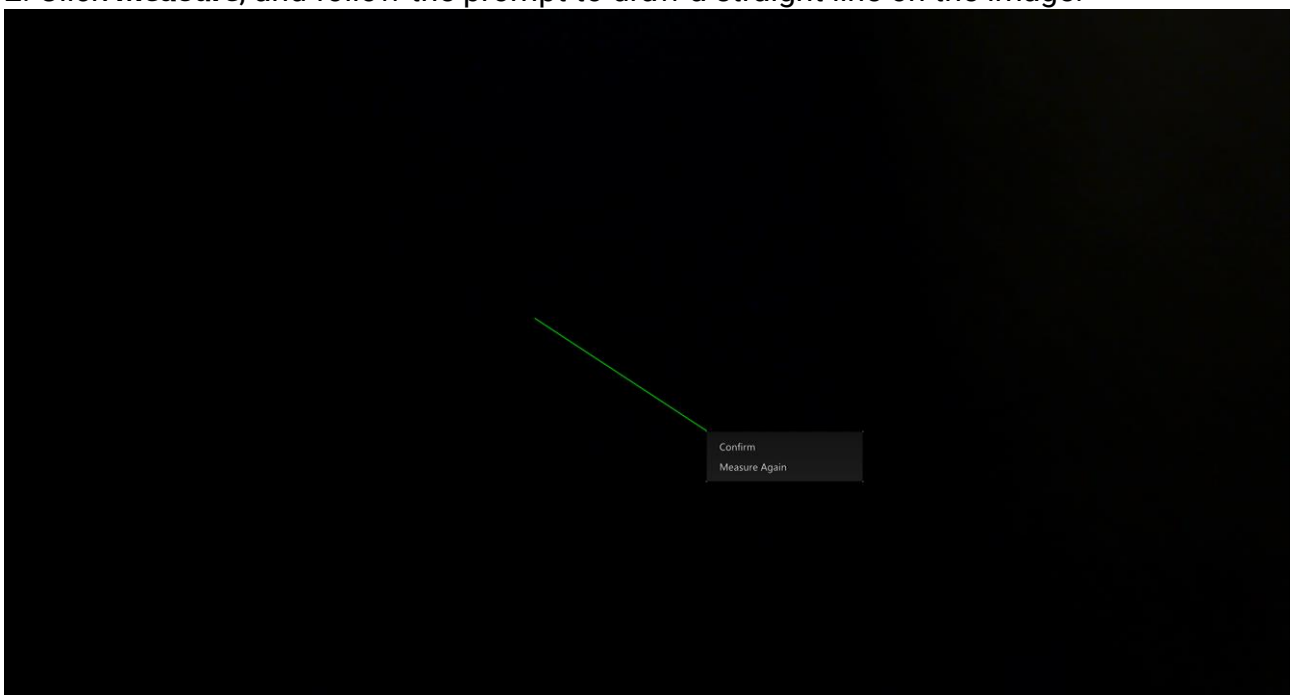


Figure 7-23 Draw Straight Line

3. Click **Confirm**, and the measurement result of the straight line will be automatically entered in the **Pixels** in the window of device calibration.

Note

You can click **Measure Again** to redraw a straight line.

4. Enter the length of the straight line in **Physical Length**, and select the unit of the length in **Unit**.
5. Click **OK** to finish the device calibration.

7.6.6 Mask

The device supports adding a mask in the image to highlight regions of interest.
Click  in the **Auxiliary Tool** to display the mask in the image. After the mask is displayed, you can drag the image in non-masked areas.
You can also click the small triangle at the lower-right corner of the icon to adjust mask-related parameters.

- **X/Y**: Set the position of the upper-left corner point for the mask's highlighted area.
- **Width/Height**: Set the width and height of the mask's highlighted area.
- **TP**: Set the transparency of the mask. Higher values result in more transparent masked areas. The value of 100 means full transparency.

7.7 Other Measurement Operations

The following measurement operations are also supported.

Table 7-11 Operation Description

No.	Operation	Icon	Description
1	Undo		Click the icon to cancel the effect of a previous action or operation.
2	Redo		Click the icon to perform the action again that has been reversed.
3	Clear		Click the icon to clear all measurement tools on the image.
4	Export Report		Click the icon to export the measurement report to the selected storage device. The supported formats of report file are PDF or CSV.

Note

The exported CSV file uses the UTF-8 encoding format. You need to convert it to the ANSI encoding format first before opening it, or you can open an Excel, and go to **Data → From Text** to import the UTF-8 encoded CSV file.

Chapter 8 Revision History

Table 8-1 Revision History

Version	Revision Date	Revision Details
V1.1.0	Nov. 19, 2025	● Edit Section ***Image Management***. ● Add Section ***Image Comparison***. ● Edit Section ***Auto Measurement Tool***. ● Add Section ***Mask***.
V1.0.1	May 16, 2025	● Edit Section ***Installation Preparation***. ● Edit Section ***Client Software Operation***.
V1.0.0	Mar. 14, 2025	Original version.

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