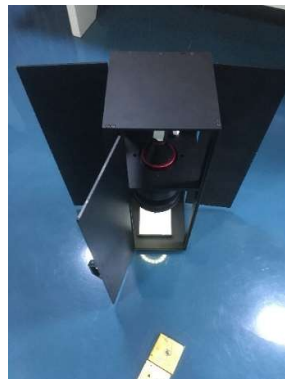


## Filter contamination analysis system simple manual

Photo of the inspection system appearance:



Photo when all three doors are opened:



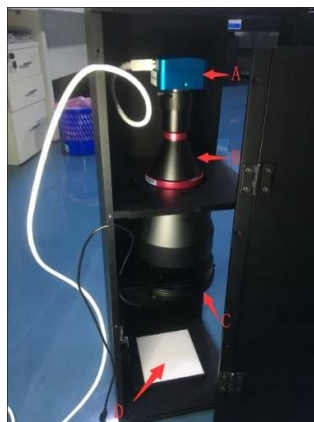
Part names:

A: Camera

B: Telecentric lens

C: Ring light

D: Holder



How to install camera:



Using C-mount to connect with camera,  
then connect camera with lens via connector.  
There are three screws to reinforce.



To change camera cable, the four screws in the photo need to be removed, then take down the door in order to change camera cable.

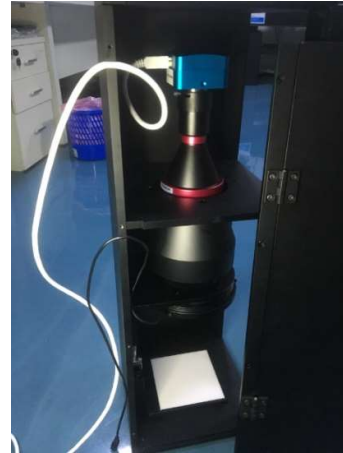


Image focus can be slightly adjusted by using the adjust rotary knob to change the distance between workpiece and lens (working distance).



The polarization effect can be created by moving the knob. If you need to find and analyze metal particles only, move the knob to the end so that all particles are acquired in **dark polarized picture**. Then move the knob reversely and some particles are acquired **brightly in non-polarized picture**.

If knob needs to be moved, placing specimen from the left or right side will make it easier.



## Light controller basic operation

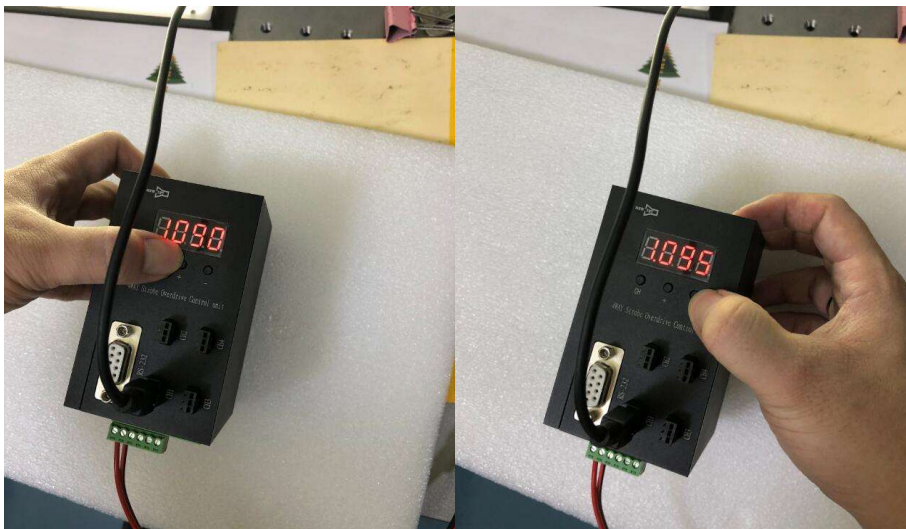
### 1. How to power on and power off:

Long press CH for 3 seconds to power on, device will self-check with flash on screen. Then it will stop flashing (in view mode).

Long press CH for 5 seconds to power off.



### 2. How to increase /decrease light: Press CH to enter setting mode (all digits are flashing), press +/- to control light. Then press CH again to confirm your setting (all digits stop flashing).



## 2 Channels Controller Manuel

**[NTC-C1024DF-2]** Constant current 2 channels digital controller. Provides high precision and brightness control for machine vision LED light sources as well as strobe control mode t. Controller can connect with computers using

RS232 serial port communication for long range control. 256 levels of brightness control.

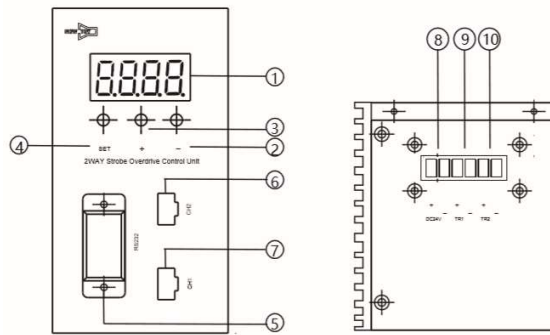
### 1. Features

- a) Each channel can individually control brightness with external trigger mode;
- b) Constant current output, more accurate in controller and more stable brightness;
- c) Long range parameters setting through RS-232 serial port;
- d) Optional external trigger mode.

### 2. Parameter Description

Model	NTC-C1024DF-2
Power Supply	DC24V
Electricity Current for Each Channel	10mA - 1A
Channels	2
Brightness Levels	0 - 255 [0 is off, 255 is maximum]
External Trigger Mode	Switch/ Continuous/ Strobe
External Trigger Voltage	5 ~ 24V
Trigger Delay	< 50us
Common Trigger Pulse width	1ms-999ms
Serial Port Communication	RS-232
Serial Port Baud Rate and Data Format	9600/8/1/No
Working Environment	Temperature 0 ~ 40°C / Humidity 25% ~ 85%
Outline	98X60x68(mm)
Installation mode	DIN
Weight	0.45kg

### 3. Description of Display Panel and Port



NO	Interface	Description
1	LED Display Panel	Starting from left, the first digit is the present control channel. Last three digits are the present control value.
2	Decrease Button	
3	Increase Button	
4	SET Button	
5	RS232 Serial Port	
6	Channel 2 Light source Port	Total 2 channels of light output, each channel operates separately.
7	Channel 1 Light source Port	External trigger signal source for synchronous strobe operation.
8	24V Power Supply Input	

9	Channel 1 External Trigger Input	Connecting external trigger signal for synchronous strobe operation, trigger pulse time is editable.
10	Channel 2 External Trigger Input	

#### [Digital Display] Brightness/External Trigger Mode

1. XXX Channel 1 Brightness Value 2. XXX Channel 2 Brightness Value
3. X Channel 1 Trigger Mode 4. X Channel 2 Trigger Mode

XXX / X Flash is setting mode, no flash is view mode

#### [SET] Setting/ on off button

In View Mode, press SET button and enter setting mode to adjust the parameters of channels.  
In Setting Mode, press SET button and enter View Mode to automatically save the parameters.  
Hold SET button for 5 seconds to shut down the controller. Hold SET button for 3 seconds to turn on controller. Controller will start a self-inspection before it is operational status

#### [+ / - ] Adjust Button

In View Mode, press +/- button to switch channel.  
In Setting Mode, press +/- button to change the brightness or trigger mode.

#### [RS-232] Serial Port Communication

[RS-232 cable is direct connecting cable (one end is needle type, the other end is hole type: 2-2,3-3,5-5), Connect PC serial port and controller RS232 plug with extension cable. 2 pin TxD, 3 pin RxD, 5 pin GND]

#### [CH1/CH2] Light Source Port

#### [DC24/TR1/TR2] Power Supply input and External Trigger Input Port

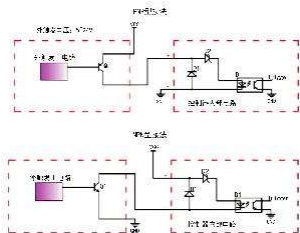
(DC24V power supply input/channel 1/channel 2 external trigger input)

### 4. [Trigger Mode Description]

Nixie Tubed Display	Trigger Mode	Description
0	Switch Mode (Low electrical level effective)	
1	Switch Mode (High electrical level effective)	
2	Continuous Mode	
3	Strobe Mode (for rising edge)	
4	Strobe Mode (for falling edge)	

Output period is settable (through RS232)1ms-999ms. Default 500ms

### 5. [External Trigger Connect Mode]



### 6. [Connect Steps]

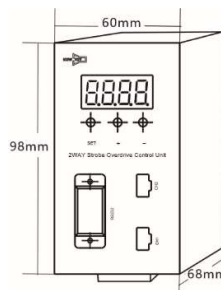
- Step 1. Connect the light source and controller.
- Step 2. If external trigger control is needed, connect the external trigger signal source with controller trigger port.
- Step 3. Connect power supply (DC 24V), turn on the power switch. Nixie tube goes on with displaying the channel number means it's electrified.  
If using PC to control light source brighten please connect RS232 cable with PC while the controller is

off.

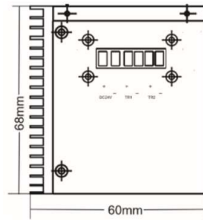
## 7. [Dimension Figure]

Mechanical Specifications:

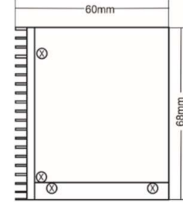
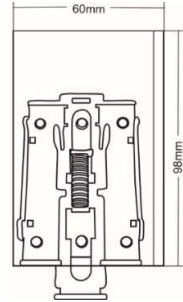
Front View



Button View

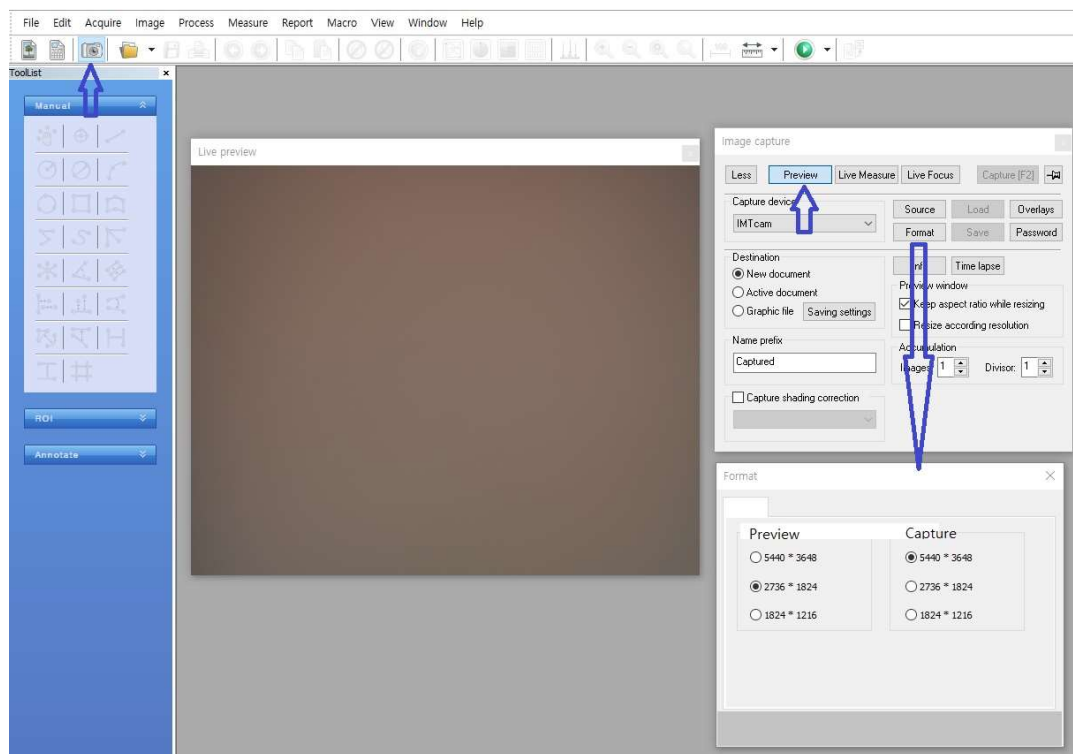


Top View



## Image capture and analysis manual

Acquire> Image capture menu or click camera icon. The following menu window will appear.



If you click "Preview", preview screen will appear. In "Format", select the middle or bottom resolution for Preview, and always select the highest resolution for Capture. Be sure to use Preview and Capture menus for the highest resolution image acquisition.



You can uncheck the "Resize according to resolution" option in the preview window menu and check the "Keep aspect ratio while resizing" option to fix the position and size of the preview window size.

For image acquisition, you can click "Capture" or use the F2 function key. Please always acquire images in "Preview" and "Capture" mode. If you need to find and analyze metal



particles only, please obtain the following two types of images. Specimen must be placed in the same place while acquiring two types of images. In other words, do not move specimen. If you need to find and analyze particles regardless of type, it is enough to acquire one image with polarizing effect.

The polarization effect can be created by moving the knob. If you need to find and analyze metal particles only, move the knob to the end so that all particles are acquired in **dark polarized picture**.

Then move the knob reversely and some particles are acquired **brightly in non-polarized picture**.

If knob needs to be moved, placing specimen from the left or right side will make it easier.

## Calibration

Calibration is a necessary process to obtain actual measurement results. The program displays spatial measurements, such as object length and area, as the location and number of pixels. Calibration is the task of defining how many pixels on an image correspond to a few micrometers, a few inches, a few miles, or a few nanos.

The scale of 1 DIV 0.1 mm is often used.



Use the **Measure > Calibration** command to work with spatial calibration. It is used to create a new spatial scale, to modify the existing spatial scales, to select the calibration

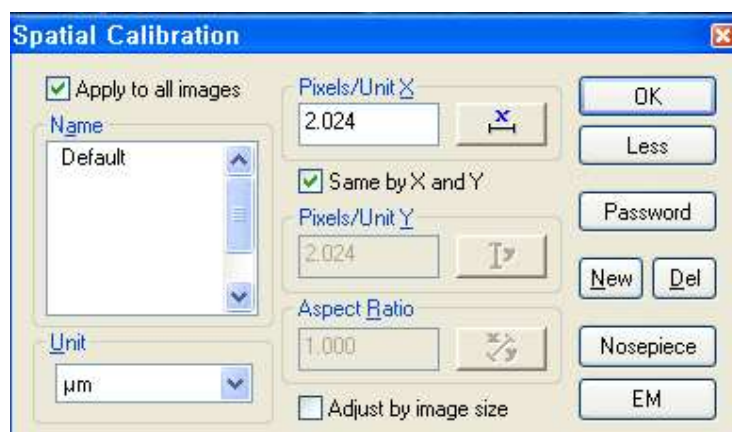
for measuring your image, and to draw a calibration marker in your image. By default, the program expresses spatial measurements in terms of pixels, but you can use this command if you want to measure objects in terms of microns, inches, nanos, or miles.

## Spatial Calibration dialog

When you select the **Measure > Calibration...** command, the “**Spatial Calibration**” dialog box is displayed. You can find an example of this dialog box.

### Calibration window


This dialog contains the existing calibration. You can apply any of them to the image. This dialog box allows you to create a new calibration. You can also modify the name, unit name, pixels-per-unit and aspect ratio values of the desired calibration. The calibration with the “**Default**” name is the default program calibration, and cannot be modified.




The **Name** list box contains the names of the existing calibrations. You can select the calibration you want to apply to the image by highlighting its name in his control. If you want to use the program default calibration, select “**Default**”. If the “**Default**” calibration is the only listed one, you can create a new one by clicking the **New** button and specifying its values.

The **Unit** combo box contains all available unit names. You can choose the desired one for the selected calibration. You can also type the name of your unit in this field.


The **Pixels/Unit X** field contains the pixels-per-unit value that displays the number of pixels that represent a single unit in both the horizontal and vertical directions. You may either enter the desired value directly into this field by typing the value,

or you can click the  button to specify the values from an object of the known




length in your image. Usually users click 1/100mm scale with the  button to obtain the pixels-per unit value.

- The **Same by X and Y** flag allows you to specify that the calibration has different pixel-per-unit values in horizontal and vertical directions.
- The **Pixels/Unit Y** field contains the pixels-per-unit value that displays the number of pixels that represent a single unit in the vertical direction when the pixels-per-unit value in the vertical direction differs from the same one in the horizontal direction. You may either enter the desired value directly into this

field by typing the value, or you can click the  button to specify the values from an object of the known length in your image.

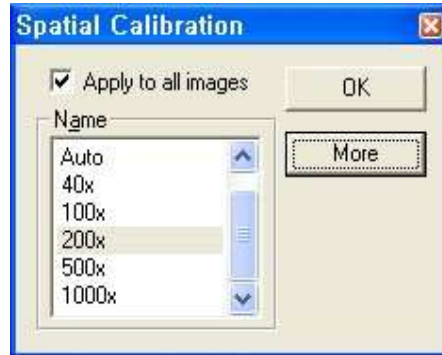
- The **Aspect Ratio** field contains the value that represents the relationship between the horizontal and vertical axes in your image. This value is the ratio of the pixels-per-unit value in the horizontal direction to the pixels per-unit value in the vertical direction. It is used to compensate for distortion on an image acquired with a camera having an aspect ratio different from that of the displaying device. You may either enter the value directly into the **Aspect**

**Ratio** field by typing the value, or you can click the  button to specify the value from an object that is known to be square in your image. You may also indirectly specify the **Aspect Ratio** by setting the **Pixels/Unit Y** value to a value that is not equal to the **Pixels/Unit X** value. In this case the program will automatically calculate and update the **Aspect Ratio** value.

- Click the **OK** button to apply the selected calibration to your image.
- Click the **New** button to create a new calibration.
- Click the **Delete** button to remove the highlighted calibration. The “**Default**” calibration cannot be removed. Click the **Reset** button to return the highlighted calibration to its initial state, which means its values will become the same as the “**Default**” calibration.



**Tip:** In order not to modify or delete the calibration value by mistake after completing the process, click the **fewer buttons** to minimize the window that only contains names of calibration ratios. You can return it to its original size by clicking the **More** button below OK (this will be changed into **Less**, and vice versa).




To apply the desired calibration to the image, you need to highlight its name in the **Name** list box and click the **OK** button.

### Modify existing calibration


The “**Spatial Calibration**” dialog box allows you to modify any of the existing calibrations excluding “**Default**”.

Proceed as follows:

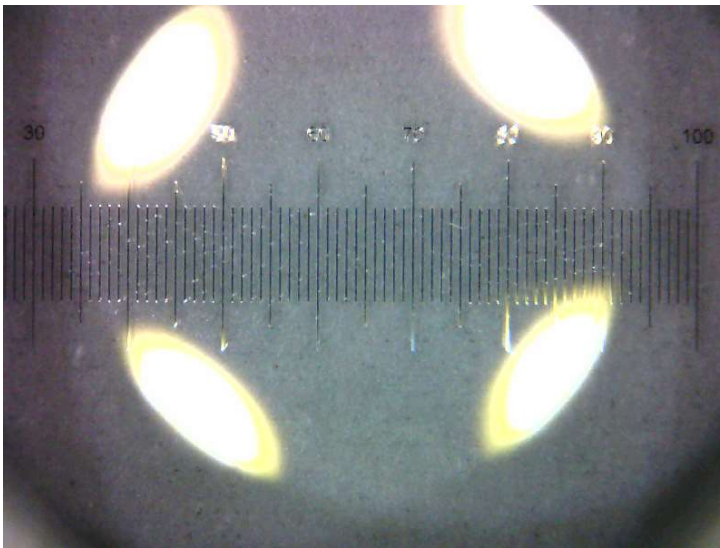
1. If you want to change the name, unit name, pixel-per-units and aspect ratio values of the desired calibration you need to highlight its name in the **Name** list box and typing a new name in the in-place edit box over the previous one.
2. You may change the unit name by choosing the appropriate name in the **Unit** combo box. You can also type the name of your unit in this field.
3. Now you may either enter the pixels-per-unit value directly into the **Pixels/Unit X** field by typing the value,

or you can click the  button to specify the values from an object of the known length in your image. When you select this button, the “**Properties**” tab window containing the “**Units**” tab will be displayed, and a defining line will be placed in your image. The below shows an example of the “**Units**” tab.

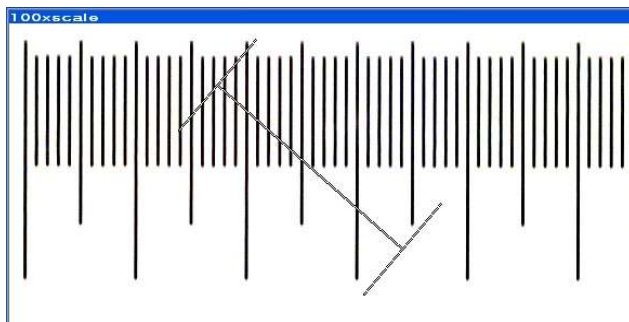


4. In the **Number of units** field of this window you need to specify the you must place the defining line over the length of the object to specify its size in pixels: position and then stretch the defining line so that its length is equal to the length of the reference object. Then click  button to complete the measurement. The program will calculate the calibration by dividing the number of pixels under the defining line by the unit number you have specified in the “Units” tab. The result will be placed in both the **Pixels/Unit X** and **Pixels/Unit Y** fields.




1 DIV: 0.1mm



1 DIV: 0.01mm for microscopy measurement



An example of the “defining line”.

5. If you want the calibration to have a different pixels-per-unit value in the horizontal and vertical directions, you must clear the **Same by X and Y** flag. Then the **Pixels/Unit Y** and **Aspect Ratio** fields will be enabled; otherwise these fields will be disabled.
6. If **Same by X and Y** is not set you need to specify the **Pixels/Unit Y** value. There are two ways to do it: You can either enter the desired value directly into the **Pixels/Unit Y** field by typing the value, or you can click the  button to specify the values from an object of the known height in your image. The procedure of defining of the **Pixels/Unit Y** value is the same for defining the **Pixels/Unit X** value. After the **Pixels/Unit Y** value is calculated, the result will be placed in the **Pixels/Unit Y** fields. If the **Pixels/Unit Y** value is not equal to the **Pixels/Unit X** value, the program will automatically calculate and update the **Aspect Ratio** value. You may either enter the **Aspect Ratio** value directly into the **Aspect Ratio** field by typing the value, or you can click the  button to specify this value from an object that is known to be square in your image. When you select this button, a *defining line* will be placed in your image. Using your mouse, you need to position the defining line diagonally over your square object and stretch the defining line so that its length is equal to the diagonal length of the square object, from corner-to-corner. Then click the  button to complete the measurement. The program will calculate the **Aspect Ratio** and update the **Pixels/Unit Y** value if it is necessary.
7. After your calibration is defined you can apply it to your image by clicking the **OK** button.
8. The program will store the new calibration automatically when you close the **"Spatial Calibration"** dialog box.

### Creating a new calibration

You can create a new calibration by clicking the **New** button in the **"Spatial Calibration"** dialog box and entering your calibration values in the appropriate fields. When a new calibration is created, the program places its name in the **Name** list box and activates the calibration fields. By default, the program assigns the name **"Spatial0"** to a new calibration; however, you may change it to something more descriptive. You may want to modify the unit name, pixel-per-units, and aspect ratio values of the just created calibration. You can do it the same way as described above.

The program will store the new calibration automatically when you close the **"Spatial**

**Calibration**” dialog box.

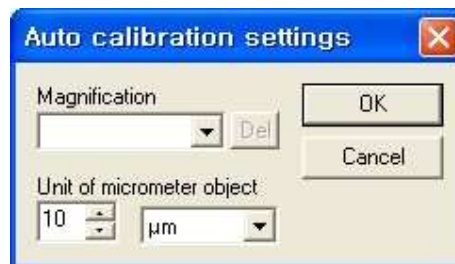
**Auto Calibration:** **Auto Calibration** allows the program to calculate the pixel-per-units value automatically and you only need to set the unit for the calibration scale and the distance between the scale marks. That is, you do not need to move the defining line at all. This function greatly improves the accuracy and repetition.

**Measure > Calibration > Auto** command shows the dialog box below.

**Magnification** means the magnification of the microscope. This only provides a name, not the actual calibration value. The magnification offers a drop-down style, and you also can type the name of magnification manually. In this case, you can delete what you want by clicking the **Del** button in the dialog box.

**Unit of micrometer object** sets the actual distance between the scale marks in the scale for calibration. The example below set the scale with a 10-um distance. **It can be changed.**

**OK** button will perform the Auto calibration.



An Example of the “**Auto**” dialog box.

### Save and load calibration

Calibration settings can be saved and loaded using special text files with **clb** extension. Command **Measure > Calibration > Save active...** is used to save the current selected calibration in its own file. This command is active only when active calibration is not the **Default**.

Command **Measure > Calibration > Save all...** is used to save all calibration currently represented in the program. All calibrations are stored in one common file. This command is active only when at least one calibration, except **Default**, is available in the program.

To open an existing file with calibration(s) use the **Measure > Calibration > Open** command. It is necessary to restart the “**Spatial Calibration**” dialog (if it was currently opened, of course) for changes.

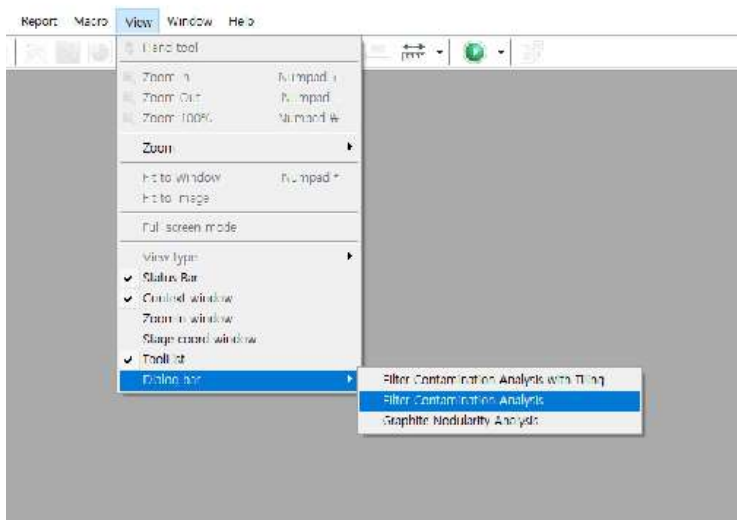
If you want to re-install the program and use the calibration, you do not need to perform a new calibration and just use **Measure > Calibration > Open** command and open \*.clb file. Take note that the program does NOT open \*.clb calibration file with **File > Open** command.

**Password** option does not allow changing the existing calibration if one does not know the password.

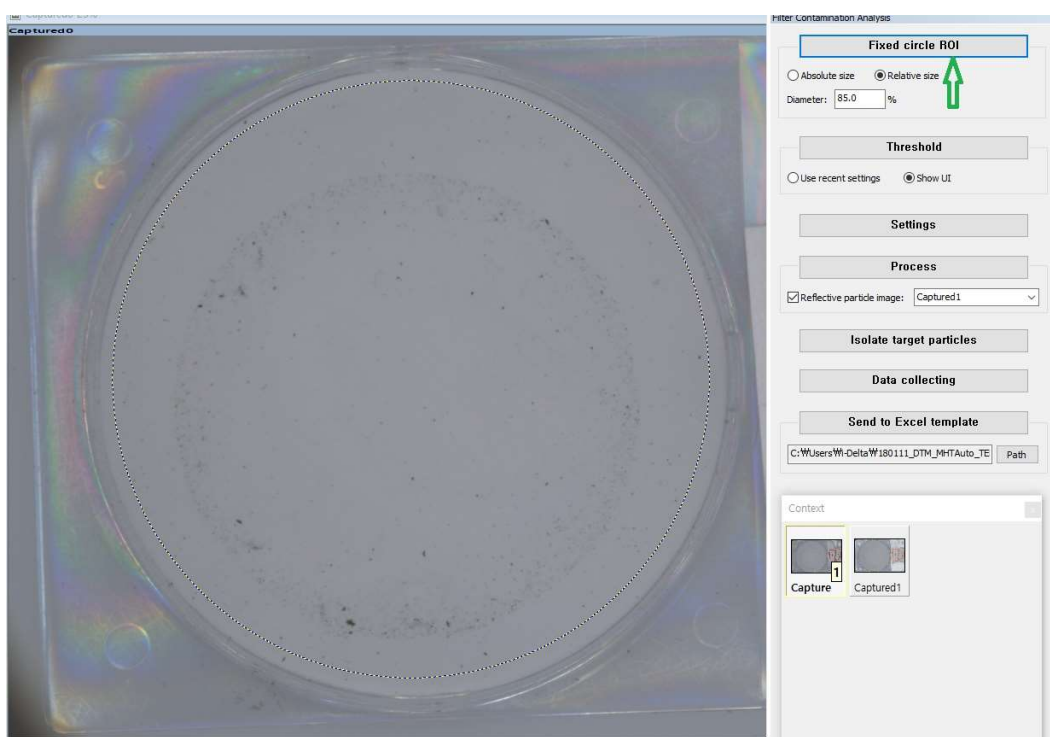
**Adjust by resolution** option lets calibration be adjusted to the image size automatically. With the option one can use all camera capture resolution with the same calibration. Calibration is adjusted to the captured image size automatically.

**Tip:** You can easily select the saved calibrations with the dropdown menu which appears by pressing the arrow on the right side of the toolbar button

Please choose “Filter contamination analysis” of Dialog bar in View menu.

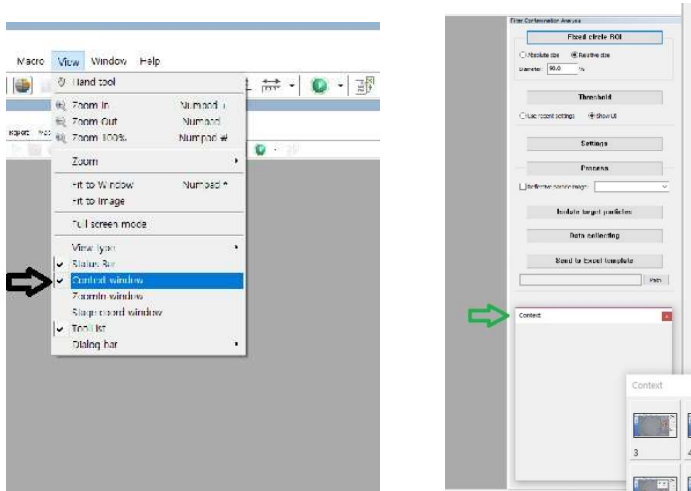






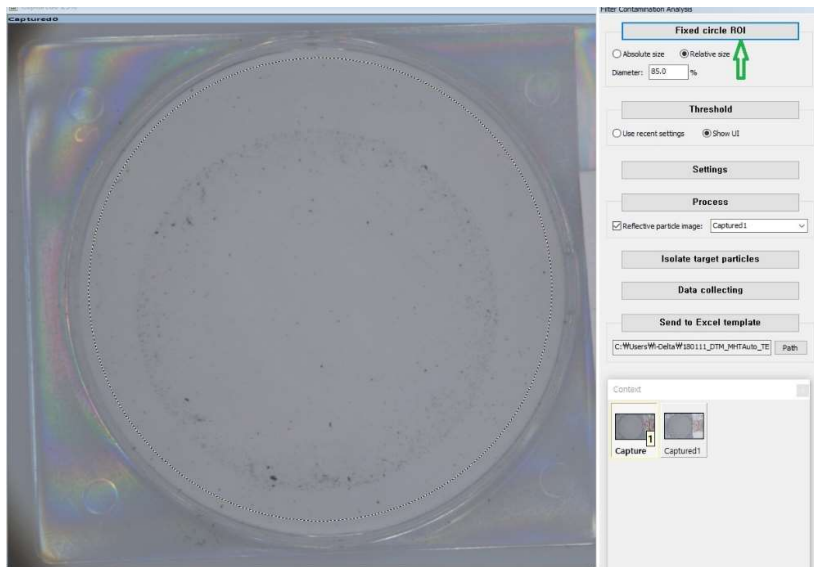
All analysis will be run in this Dialog bar. For the analysis of unrelated particles, only a slightly darker image with polarization is used. When only metal particles are analyzed, one slightly darker image with polarized light and one brighter image without polarized light are used. All types of measurements are measured with only one image that is slightly darker with polarized light. The remaining non-polarized image is used only as reference image to automatically find metal particles.

If you accidentally close the Context window, select the Context window again from the View menu as shown below.

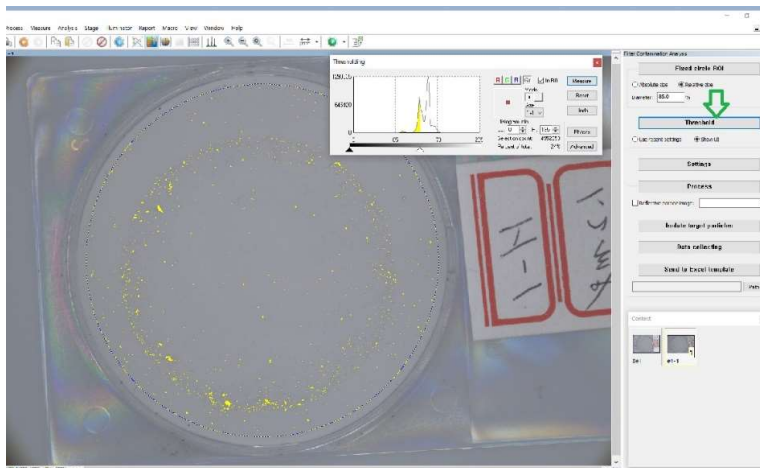


"Find ROI" determines the area to be measured. It is usually applied at 85%. However,

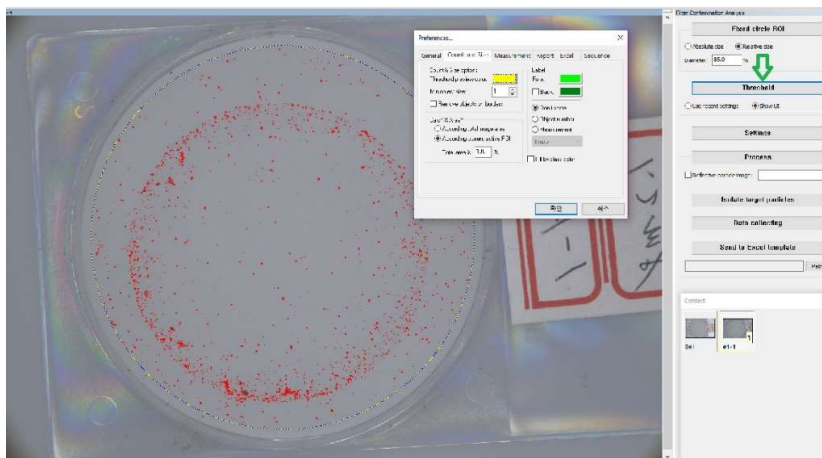
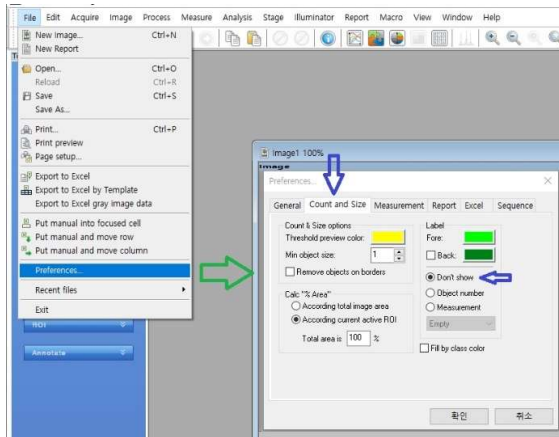
adjust the values according to the requirements of the sample and user.



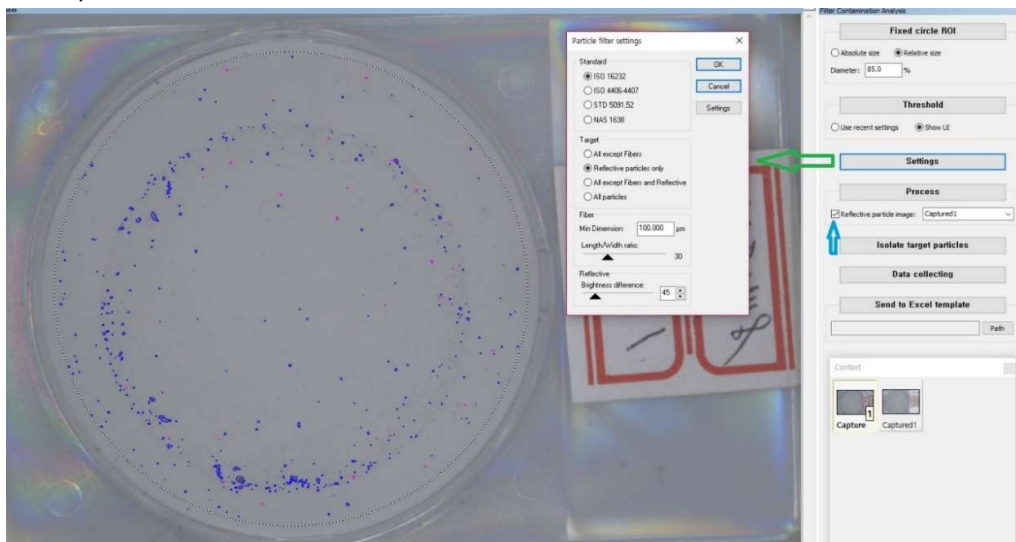
Please click "Threshold". The "Use recent settings" option will auto-advance to the previously set settings. The "Show UI" option shows the Threshold UI as shown below. Always check "In ROI" here. If not checked, the entire image will be analyzed.

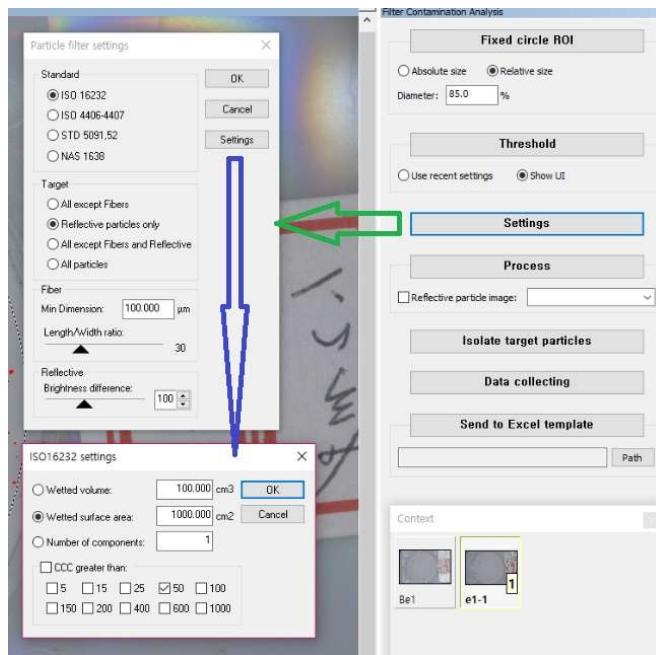


If you see the number of each object after the threshold, please select "Do not show" as shown below.



"Settings" shows the following menu window. Here you will select the required industry standard, the type of particles to analyze, and the difference in brightness to be judged by metal particles. The brightness difference in "Reflective" should be 50. It can be adjusted according to the type of sample and user's needs. Lower values will find more metal particles.





When searching and analyzing metal particles, be sure to check the "Reflective particle image" option. Choose a brighter non-polarized image to reference. In this case, all particles of the selected non-polarized image are automatically calculated for the brightness of the corresponding particles of the polarized image.

1. Select "Process" and the particles will be classified automatically.
2. Then click "Isolate target particles", and only the particles you are looking for are left.
3. Click "Data collecting" to measure the sorted particles.
4. Click "Send to Excel template" to convert the data to a short form corresponding to the selected industry standard. In this case, you must click "Path" and specify the location where the Excel template created according to the industry standard is stored.
5. Click "Send to Excel template" twice. After selecting the darker polarized image used for the measurement, click on it. After selecting the auto-generated data collector in blue, click on it. Otherwise both data and image are not exported into Excel template together.

Number	Class	Area, mm <sup>2</sup> /mm	Max Length, mm	Line Length, mm	Line Width, mm
22	Reflective	0.005	0.210	0.115	0.080
10	Reflective	0.005	0.165	0.287	0.080
4	Reflective	0.013	0.164	0.247	0.055
6	Reflective	0.019	0.170	0.250	0.076
12	Reflective	0.017	0.160	0.242	0.073
7	Reflective	0.015	0.155	0.224	0.070
9	Reflective	0.012	0.145	0.204	0.061
5	Reflective	0.013	0.141	0.208	0.060
1	Reflective	0.013	0.129	0.205	0.060
27	Reflective	0.010	0.126	0.162	0.050
21	Reflective	0.009	0.110	0.171	0.055
10	Reflective	0.008	0.109	0.160	0.051
17	Reflective	0.007	0.101	0.148	0.052
21	Reflective	0.007	0.101	0.156	0.048
19	Reflective	0.006	0.100	0.142	0.048
23	Reflective	0.006	0.056	0.140	0.040
7	Reflective	0.005	0.086	0.131	0.042
15	Reflective	0.006	0.084	0.134	0.045
25	Reflective	0.004	0.079	0.123	0.040
3	Reflective	0.006	0.077	0.133	0.040
25	Reflective	0.004	0.077	0.120	0.039
11	Reflective	0.003	0.069	0.103	0.035
12	Reflective	0.003	0.066	0.094	0.036
6	Reflective	0.003	0.060	0.090	0.035
11	Reflective	0.003	0.060	0.100	0.034
19	Reflective	0.003	0.058	0.089	0.032
20	Reflective	0.000	0.030	0.040	0.023

For now, you will work with the Excel program.

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