



CC3 Cabinet Calibration

User Manual

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1 Software Introduction

The CC3 calibration platform is NovaStar's newest calibration software that supports both screen calibration and cabinet calibration. This document mainly introduces cabinet calibration.

At the moment, cabinet calibration supports brightness and chroma calibration, high-precision brightness and chroma calibration, low-grayscale calibration, full-grayscale calibration 1.0, full-grayscale 1.0 + low-grayscale calibration, and curved-surface correction. With the advantages of fast calibration speed and high accuracy, cabinet calibration makes it suitable for SMD and COB screens that have mixed bins from the same batch, effectively improving display uniformity and image quality.

Cabinet calibration is performed by screen manufacturers on individual cabinets before shipment.

2 Software Installation

Prerequisites

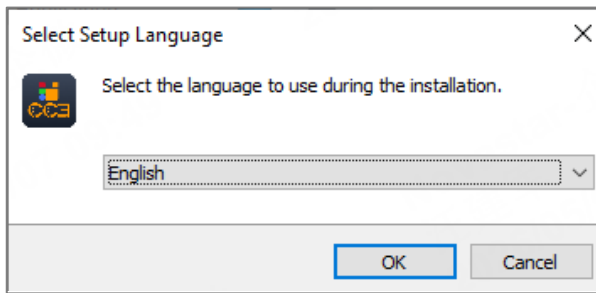
- Obtain the installation package for CC3.
- A computer that meets the following requirements:
 - Operating system: Windows 10 (64-bit only), Windows 11
 - Screen: Recommended resolution 1920×1080
 - CPU: 3.0 GHz or greater
 - RAM: 16 GB or greater
 - Network adapter: Intel(R) Ethernet Connection network adapter
- If there is an older version of the software already installed, it needs to be uninstalled before installing the new version. Overwriting the existing installation is not supported.

The software UI screenshots in this document are provided using Windows 10 as an example.

Procedure

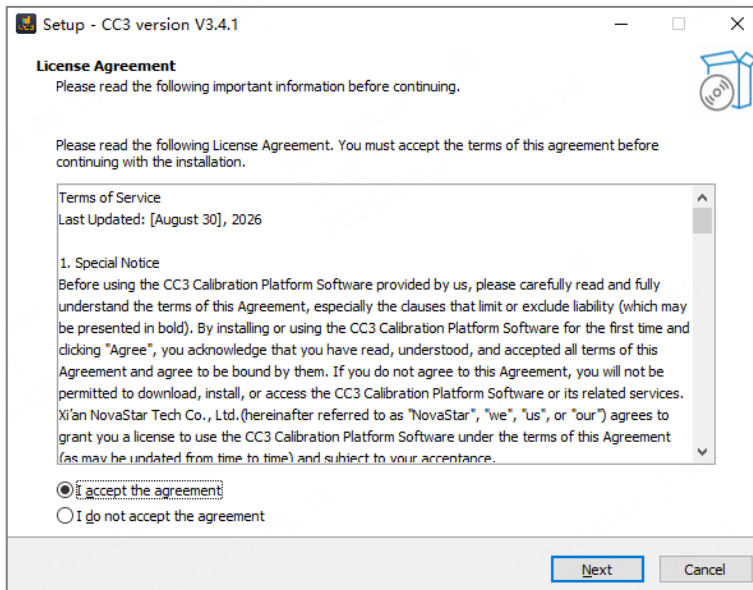
- Step 1 Double-click the installation package, select the language to use during installation (Simplified Chinese, English) in the pop-up window, and click **OK**.

Figure 2-1 Installation language



Step 2 Review the CC3 license agreement, select **I accept the agreement**, and click **Next**.

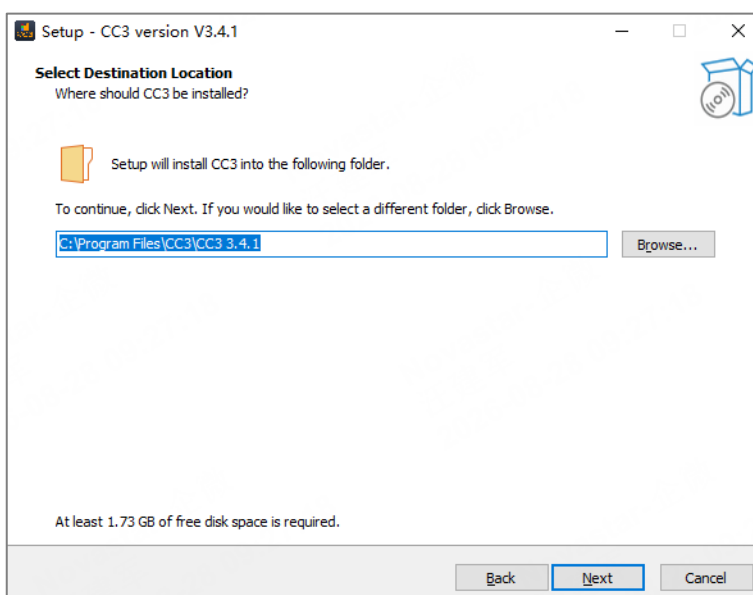
Figure 2-2 License agreement



Step 3 Choose the installation directory and click **Next**.

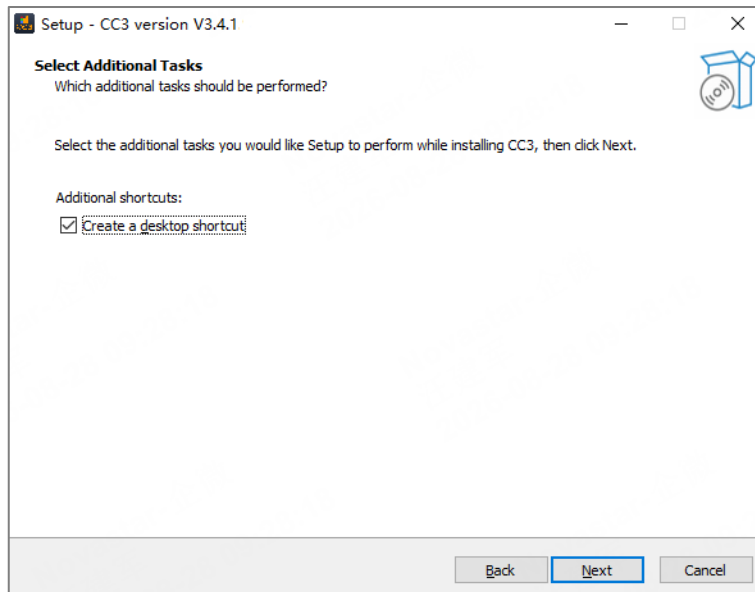
The default directory is “C:\Program Files\CC3\CC3 3.4.1”. You can click **Browse** to select another directory. It is recommended to install it on a disk with large free storage space.

Figure 2-3 Installation location



Step 4 On the **Select Additional Tasks** screen, check **Create a desktop shortcut**, and click **Next**.

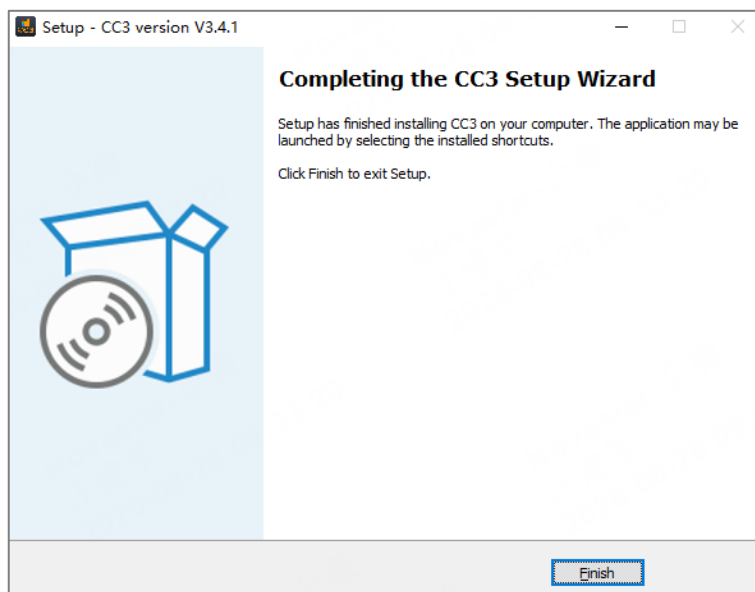
Figure 2-4 Creating desktop shortcut



Step 5 Confirm that the destination location and additional task settings meet the requirements, and click **Install**.

Step 6 Once the installation is completed, click **Finish** and the system will automatically exit the installation screen.

Figure 2-5 Installation complete



Installation Result



If the installation is successful, a shortcut **CC3** for CC3 will appear on your desktop.

 Note

If you encounter any security alerts from your anti-virus software or firewall during installation, make sure to select the option to allow the installation.

3 UI Introduction

3.1 Startup Screen

Once the CC3 software is opened, the startup screen appears, as shown in [Figure 3-1](#). Here, users can create calibration projects, manage them, and configure software settings. For a detailed introduction to the startup screen, see [Table 3-1](#).

Figure 3-1 CC3 startup screen

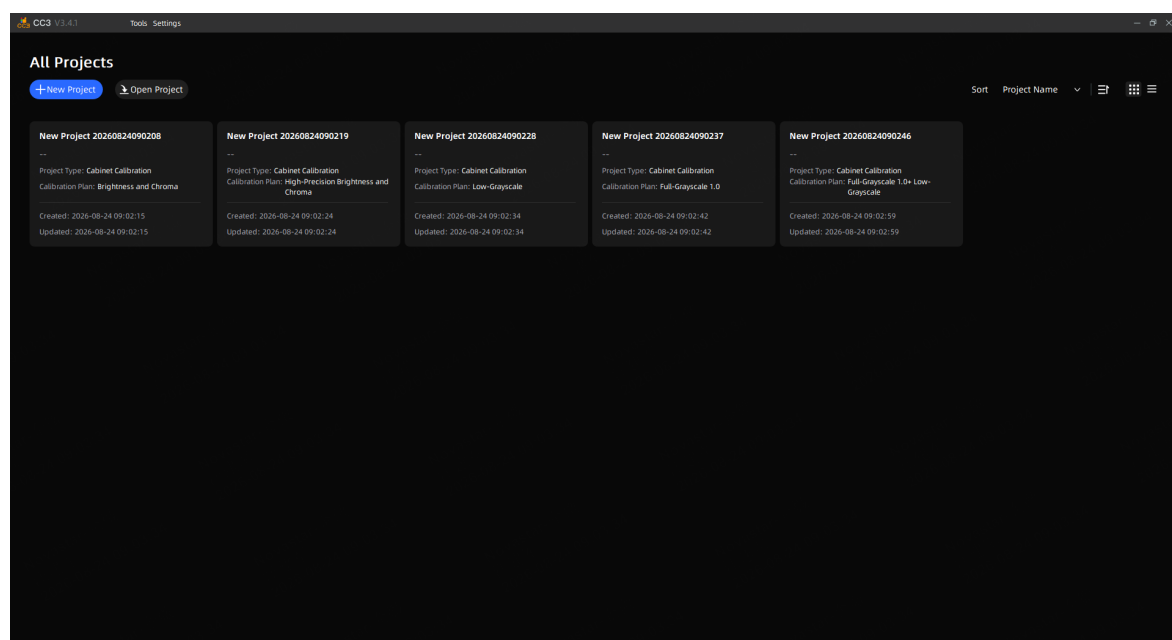


Table 3-1 Startup screen introduction

Item	Description
New project	Click New Project , then fill in and set the relevant information to create a calibration project. For the specific screen and operation of creating a project, please refer to the chapter 6 Create a Calibration Project .
Open Project	Click the project name to open a saved calibration project and access the project screen. Click Open Project to open a locally saved calibration project.
Sort	You can select Project Name , Date Created , or Last Used from the drop-down menu. Click  or  to sort in ascending or descending order according to the selected sorting method.

Item	Description
	Calibration projects are displayed in the form of cards.
	Calibration projects are displayed in a list.
Calibration project	When existing calibration projects are displayed in a list view, the system shows the calibration project list and project details, including the project name, description, type, calibration plan, project path, date created, last used time, and available operations. The following operations can be performed on a project: • Edit project description: Click  to access the project editing screen, where you can change the project description. • Export coefficients: Click  to export the calibration coefficients of the current project. • Copy calibration project: Click  to copy the parameters of the calibrated large cabinets, so that you can quickly perform brightness and chroma calibration on other small cabinets with the same module specifications. • Delete project: Click  to delete the current project.
Calibration tools	• Coefficient Splitting Tool: Splits the calibration database of calibrated cabinets according to the specified settings. • Coefficient Simulation Tool: Simulates and previews the calibration results stored in the cabinet calibration database.
Settings	Authorization/Correction Files: Import and manage camera authorization/correction files.
	Update Log: Displays the details of software updates compared to the previous version.
	Manual: Scan the QR code, click the obtain the latest documentation link, or click Offline Manual to access the CC3 software user manual.
	Language: Set the interface display language of the software. Currently, Simplified Chinese and English are supported. (Language change requires a restart.)
	About: Displays the current software version information, NovaStar official website link, and copyright information.
	Check for Updates at Startup: Automatically checks whether CC3 is up to date each time it starts.  : Enables automatic update checks at startup. Each time CC3 starts, it automatically checks for updates.  : Disables automatic update checks at startup. CC3 does not automatically check for updates when it starts.

3.2 Project Home Screen

Open a calibration project to access the project home screen, as shown in [Figure 3-2](#).

Figure 3-2 Project home screen

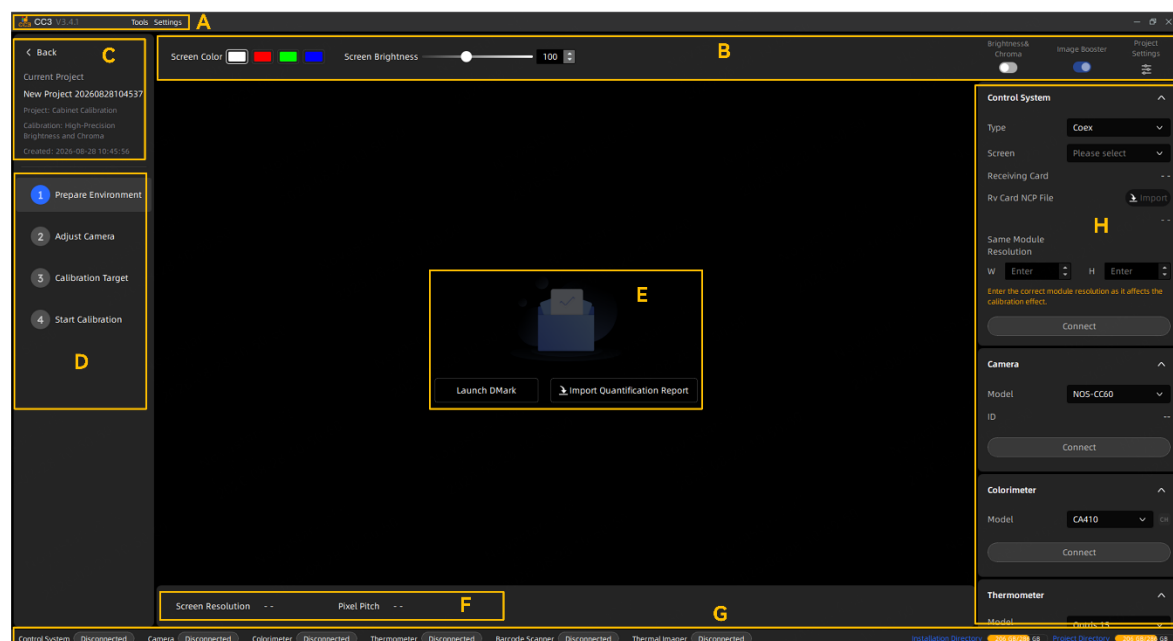


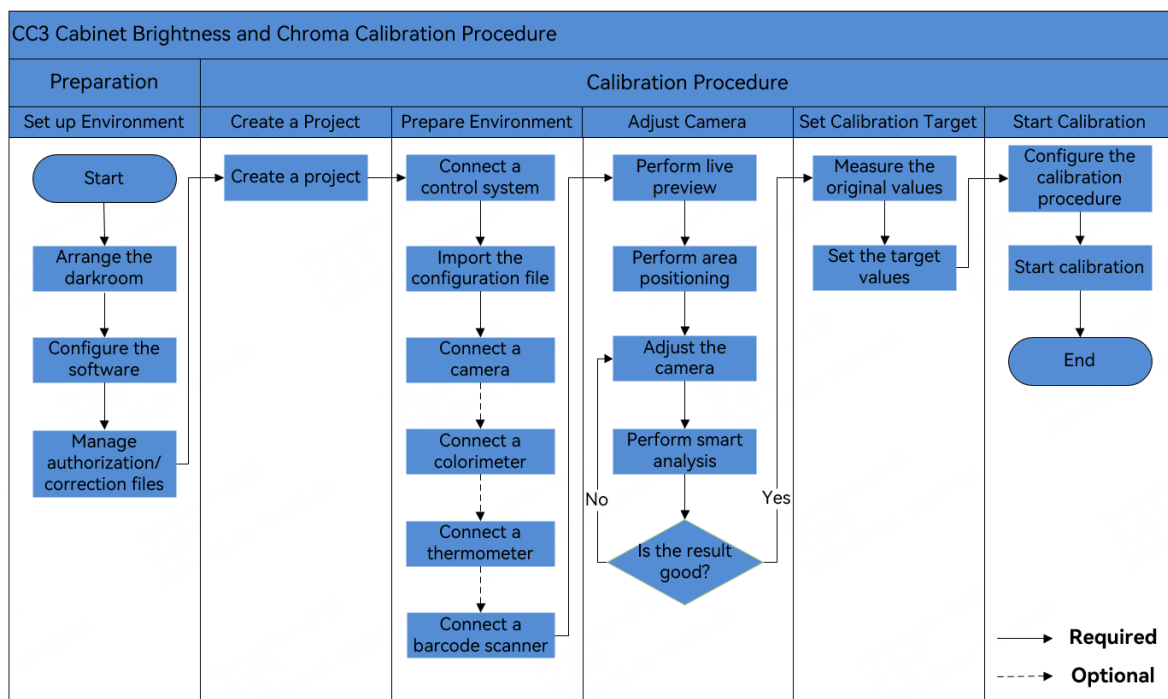
Table 3-2 Project home screen introduction

Area	Item	Description
A	CC3	Software logo and name.
	Tools	Coefficient splitting and simulation tools.
	Settings	Perform software-related settings.
B	Screen Color	Select the color displayed on the screen.
	Screen Brightness	Set the grayscale brightness displayed on the screen.
	Calibration Switches	Turn on or off calibration effect switches. The calibration switches supported depend on the type of the project created. Note The Image Booster switch here is only used to view the display effect before and after it is turned on, and will not change the project settings.
	Project Settings	Capture Interval (ms): When there is a significant delay for the controller in displaying the image, the capture interval can be appropriately increased. Image Save Path: Displays the path where images are stored. Click View to access the save path and see the captured images, and click Browse to change the save path.

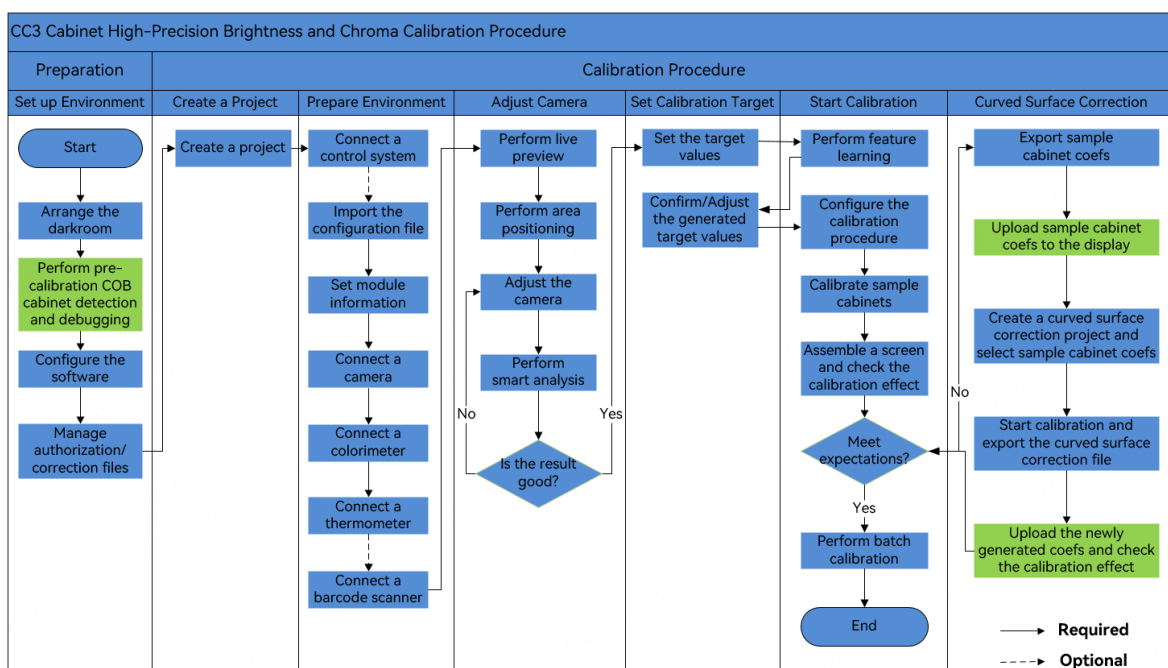
Area	Item	Description
		Brightness Threshold (%): Set the maximum brightness difference between cabinets. When the difference exceeds the threshold, the system will not be able to perform calibration.
		Image Save Type: Set whether to "Save all process data" and "Save all raw images" as needed. They are unchecked by default. When checked, all images and data during the calibration process can be saved, which consumes a large amount of memory. If you need to troubleshoot issues, you can save them and send all data back to NovaStar engineers.
C	Project Information	View current project information, including project name, project type, and project creation time. Click Back in the top-left corner to exit the current project management screen and return to the startup screen.
D	Navigation Menu	Calibration navigation menu. • Prepare Environment: Connect a control system, camera, colorimeter, thermometer, and barcode scanner. • Adjust Camera: Preview the images captured by the camera, set the calibration grayscale and area positioning, adjust the camera, and analyze the camera parameters to ensure the parameter analysis results meet the calibration requirements. • Calibration Target: Obtain the original brightness and chroma values of the screen, and set the target values to complete the calibration target configuration. • Start Calibration: Start calibration, view calibration results, and export calibration coefficients.
E	Quantification Report	• Supports measuring the cabinet using the DMark tool and displaying the measurement results. • Supports importing evaluation reports to view the basic display parameters of the screen before calibration.
F	Screen Details	View screen resolution and pixel pitch information.
G	Device Status	• View the connection status of devices such as the control system, camera, and colorimeter. • Check the total and free space of the disk where the CC3 software is installed. • Check the total and free space of the disk where the current CC3 project is saved.
H	Parameter Settings Area	Set calibration parameters for each stage of calibration.

4 Basic Calibration Procedure

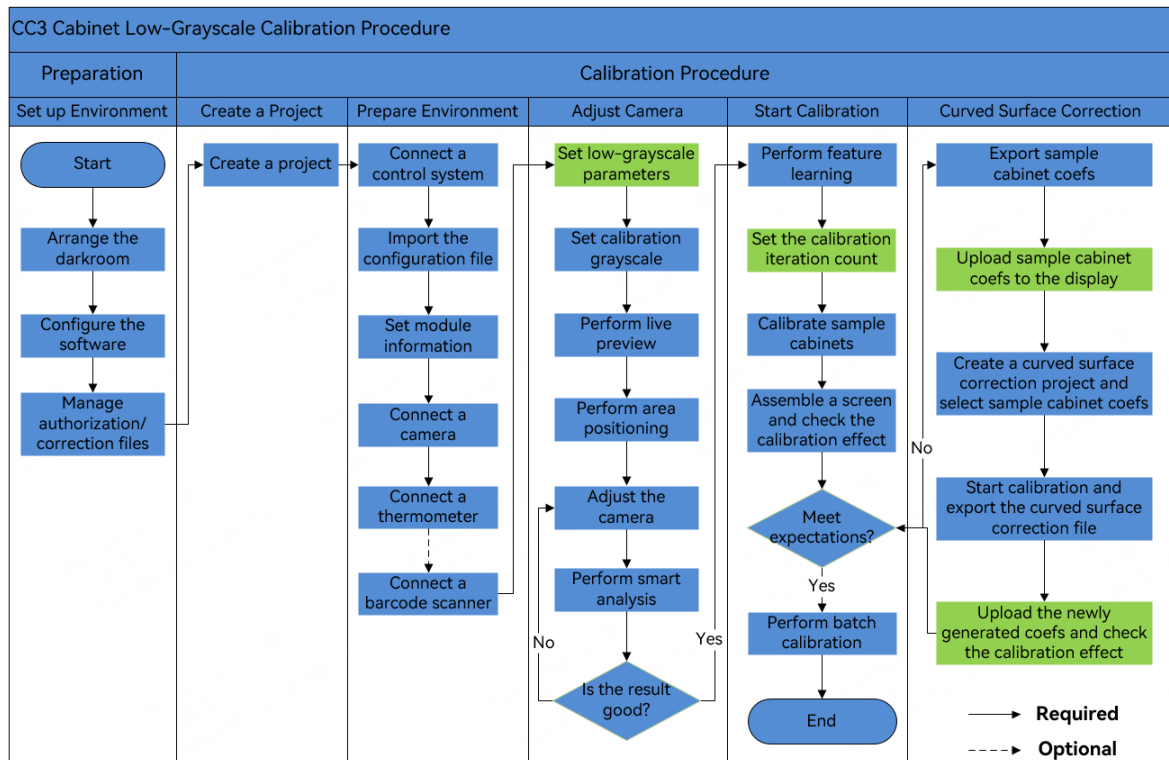
4.1 Brightness and Chroma Calibration



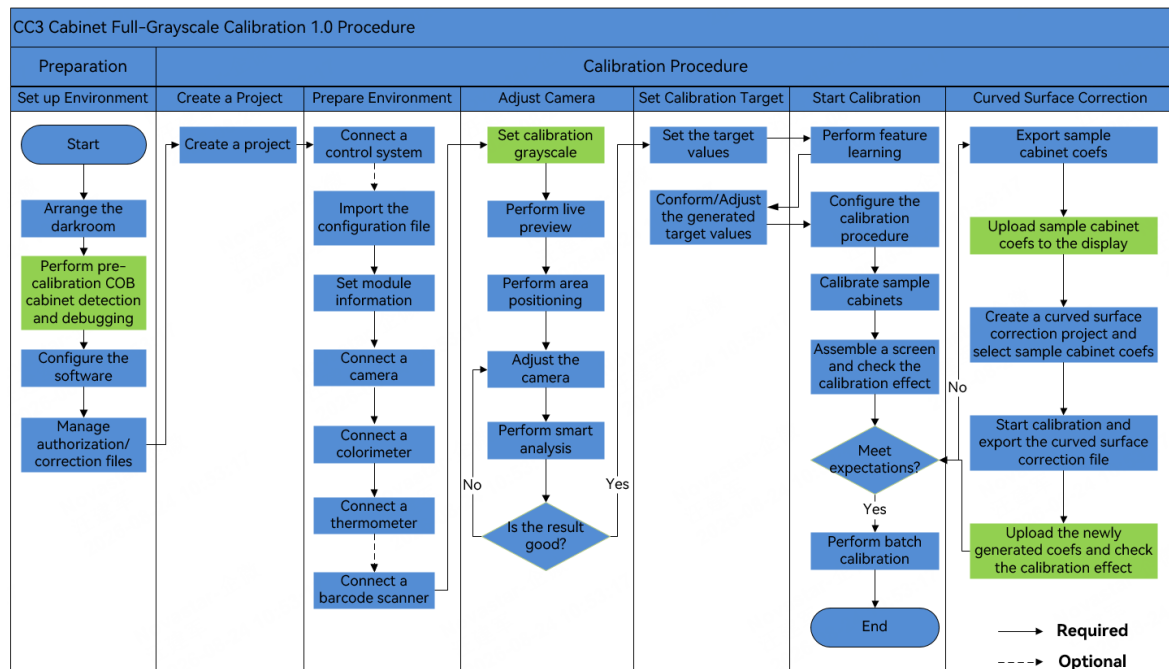
4.2 High-Precision Brightness and Chroma Calibration



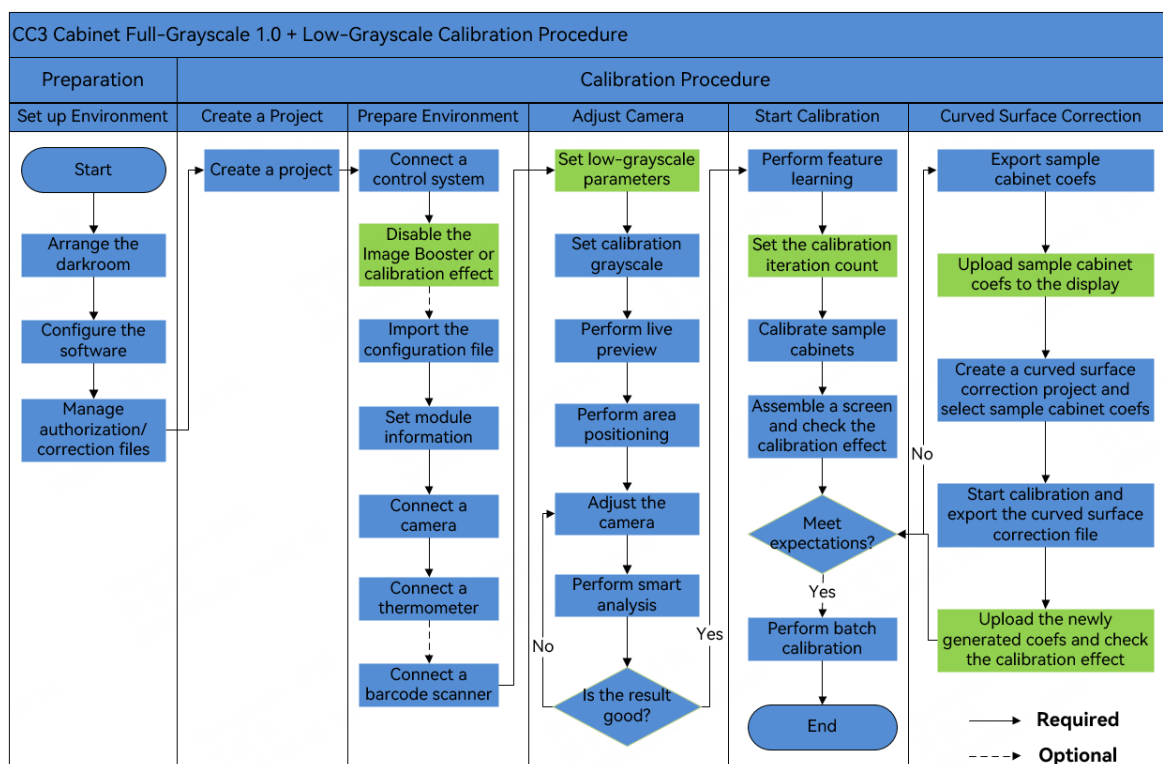
4.3 Low-Grayscale Calibration



4.4 Full-Grayscale Calibration 1.0

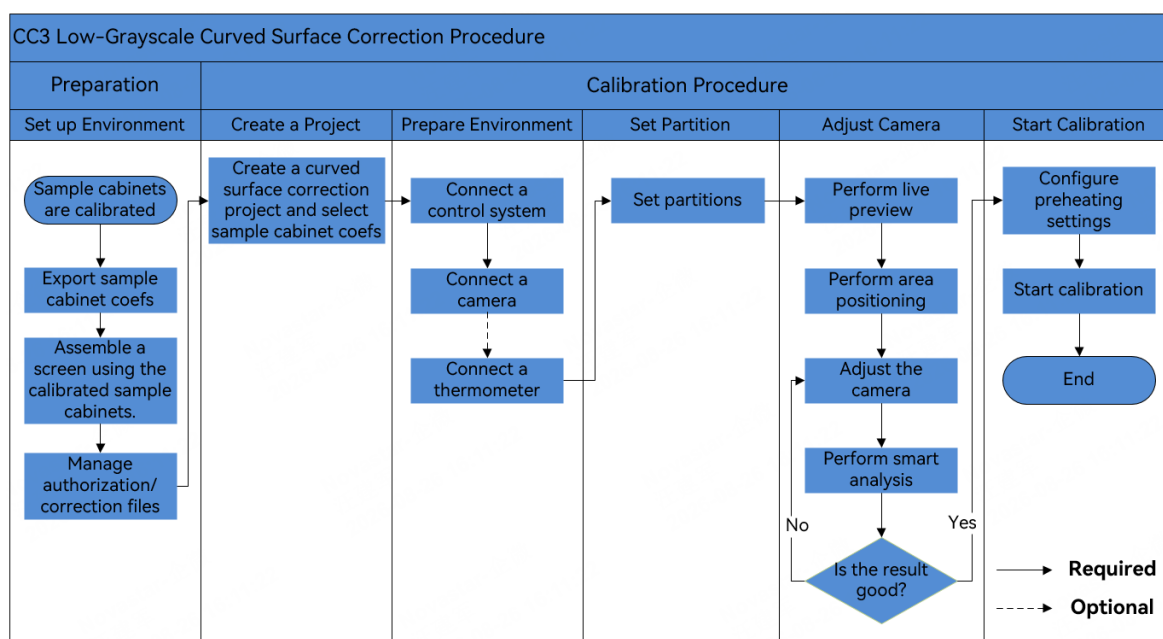


4.5 Full-Grayscale 1.0 + Low-Grayscale Calibration

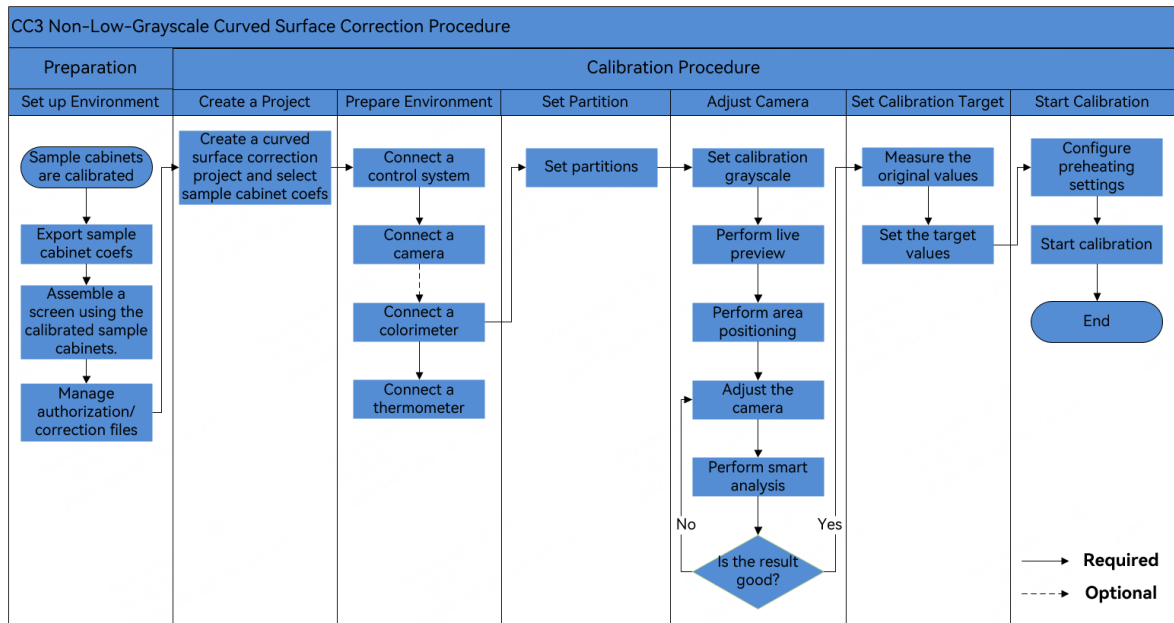


4.6 Curved Surface Correction

4.6.1 Low-Grayscale Curved Surface Correction



4.6.2 Non-Low-Grayscale Curved Surface Correction



5 Calibration Preparation

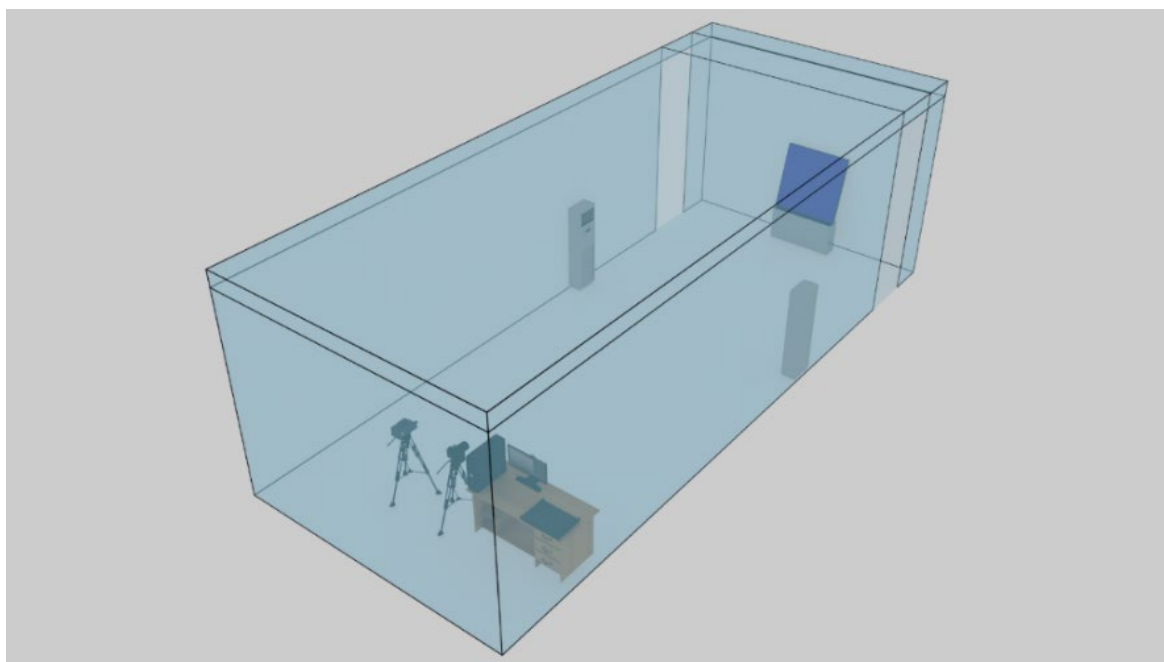
If you are performing calibration for the first time, there are some pre-calibration preparations that need to be completed. These include arranging the darkroom, configuring the software, and managing the authorization/correction files.

5.1 Arrange the Darkroom

5.1.1 Darkroom Requirements

Cabinet calibration is a process that requires a carefully controlled environment and must be carried out in a darkroom.

Figure 5-1 Darkroom



To achieve the desired outcome from cabinet calibration, the darkroom should meet the following conditions:

- The calibration darkroom should be sealed to prevent any external light interference. The interior walls should be covered with low-reflective black materials to minimize the amount of reflected light.
- Install a hygrothermograph in the darkroom to track temperature and humidity changes. Install air conditioners in the darkroom and activate them half an hour before each calibration to adjust the temperature and humidity levels to the client's specifications. When calibrating cabinets of the same batch, the temperature fluctuation should not exceed $\pm 1^{\circ}\text{C}$.
- Use an efficient process for moving around cabinets to minimize potential delays in replacing cabinets.
- The recommended darkroom width is 3 meters.
- The length of the darkroom should be greater than the calibration distance of the camera (the distance between the camera and the screen), providing around 2 to 3 meters of space for computers, cameras, cabinets, and personnel activities.
 - The camera's calibration distance is primarily related to the cabinet pixel pitch and resolution. Depending on the calibration camera used, there are different recommended distances. See [Table 5-1](#), [Table 5-2](#), [Table 5-3](#) and [Table 5-4](#) for the recommended calibration distances for some common cabinets.
 - If the darkroom length exceeds 20 meters, please consider marking the ground to assist in accurately positioning the calibration distance.

Once the camera position is determined, mark the tripod's location on the ground.

Table 5-1 Cabinets compatible with the common calibration distances – NOS-CC60 (135mm) imaging colorimeter

Distance Between Camera and Screen (m)	Recommended Compatible Screen Size (Pixel)		Compatible Pixel Pitch (mm)
	Width	Height	
1.2	228	152	0.21
1.3	249	166	0.23
1.4	270	180	0.25
1.5	292	195	0.27
1.6	313	209	0.29
1.7	334	223	0.31
1.8	355	237	0.33
1.9	377	251	0.35
1.94	384	256	0.35
2	398	266	0.36
2.1	419	280	0.38
2.2	441	294	0.40
2.3	462	308	0.42
2.39	480	320	0.44
2.4	483	322	0.44
2.5	505	337	0.46
2.6	526	351	0.48
2.7	547	365	0.50
2.8	569	379	0.52
2.9	590	394	0.54
3	611	408	0.56
3.14	640	427	0.58
4	824	550	0.75
5	1038	692	0.95
6	1251	834	1.14

Distance Between Camera and Screen (m)	Recommended Compatible Screen Size (Pixel)		Compatible Pixel Pitch (mm)
	Width	Height	
7	1464	976	1.34
8	1677	1119	1.53
9	1890	1261	1.73

Table 5-2 Cabinets compatible with the common calibration distances – NOS-CC60 (50mm) imaging colorimeter

Distance Between Camera and Screen (m)	Recommended Compatible Screen Size (Pixel)		Compatible Pixel Pitch (mm)
	Width	Height	
1.163	640	427	0.59
1.2	662	442	0.61
1.3	720	480	0.66
1.4	778	519	0.71
1.5	835	557	0.77
1.6	893	595	0.82
1.7	950	634	0.87
1.8	1008	672	0.92
1.9	1065	711	0.98
2	1123	749	1.03
2.1	1180	787	1.08
2.2	1238	826	1.13
2.3	1296	864	1.18
2.4	1353	902	1.24
2.5	1411	941	1.29
2.6	1468	979	1.34
2.7	1526	1018	1.40
2.8	1583	1056	1.45
2.9	1641	1094	1.50
3	1699	1133	1.55

Distance Between Camera and Screen (m)	Recommended Compatible Screen Size (Pixel)		Compatible Pixel Pitch (mm)
	Width	Height	
4	2274	1517	2.08
5	2850	1900	2.61
6	3425	2284	3.13
7	4000	2668	3.66
8	4577	3052	4.19
9	5152	3436	4.71

Table 5-3 Cabinets compatible with the common calibration distances – C3200 industrial camera

Distance Between Camera and Screen (m)	Recommended Compatible Screen Size (Pixel)		Compatible Pixel Pitch (mm)
	Width	Height	
1	509	382	0.69
1.3	662	497	0.89
1.5	764	573	1.03
1.7	866	650	1.17
2	1019	765	1.38
2.5	1274	956	1.72
2.8	1427	1071	1.93
3	1529	1147	2.07
5	2548	1913	3.45
9	4587	3443	6.21
10	5097	3826	6.9
14	7136	5356	9.66

Table 5-4 Recommended pixel pitch for some common cabinets – digital camera

Pixel Pitch (mm)	Cabinet Width / Height (Pixel)	Calibration Distance Range (m)	Recommended Calibration Distance (m)
10	128	7.4~18.4	12.9
7.5	160	6.9~17.2	12.05
6.66	144	5.5~13.8	9.65

Pixel Pitch (mm)	Cabinet Width / Height (Pixel)	Calibration Distance Range (m)	Recommended Calibration Distance (m)
3.9	256	5.8~14.3	10.05
2.54	135	3.8~9.4	6.6
1.25	480	3.5~8.6	6.05
0.83	540	2.6~6.5	4.55

5.1.2 Hardware Setup

After the darkroom environment is in place, set up all the required devices in the darkroom according to the system architecture.

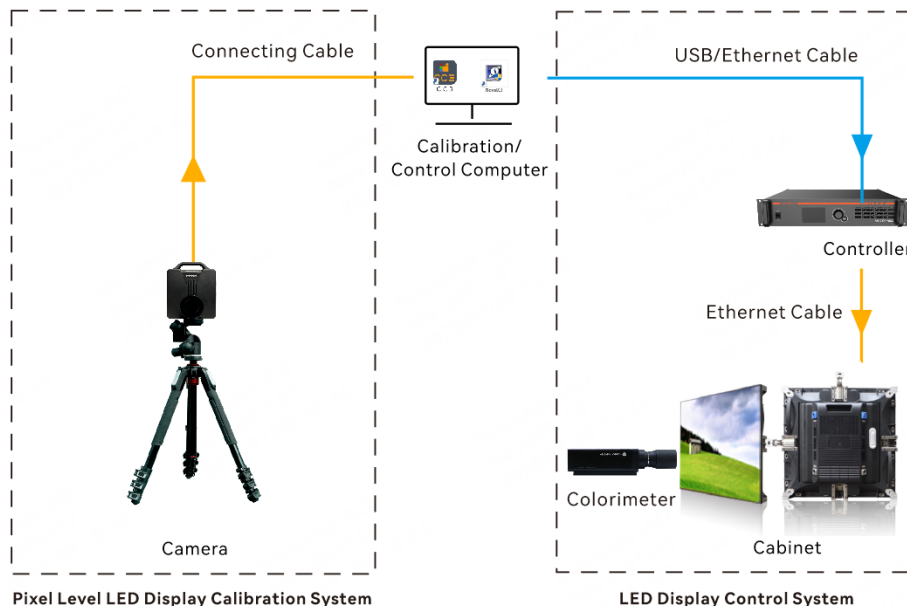
5.1.2.1 System Architecture

When using different control systems and different cameras, the system architectures and cables used are different. Please see [Table 5-5](#) for detailed device information and connection instructions.

Mars Control System

When using the Mars control system, only one computer is needed.

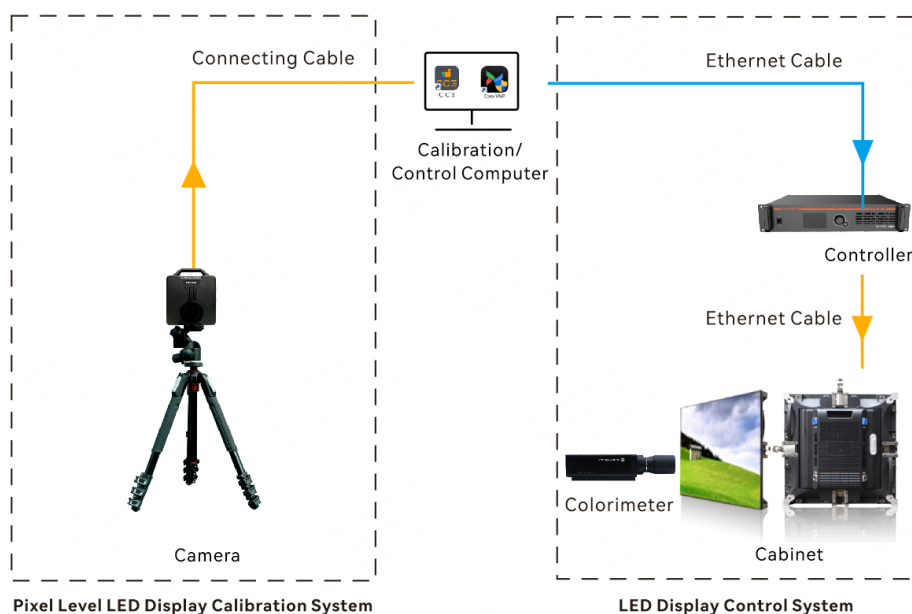
Figure 5-2 System architecture – Mars control system



Coex Control System

When using the Coex control system, only one computer is required.

Figure 5-3 System architecture – Coex control system



5.1.2.2 Configuration List

Table 5-5 Device information and connection instructions

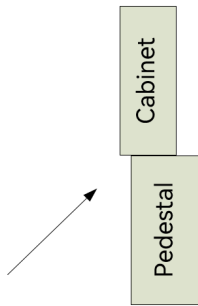
Calibration Device	Description
Computer	Either a desktop or a laptop would suffice. - When using the Mars control system, only one computer is needed. Install NovaLCT (V5.4.8 and later) for screen control and the calibration software for calibration. - When using the Coex control system, only one computer is needed. Install VMP for screen status adjustment and the calibration software for calibration. - Before calibration, make sure that the calibration computer and graphics card have the same resolution and the scaling is set to 100%. In addition, the dynamic range of the graphics card must be set to Full.
Controller	It converts audio and video signals from the computer and sends them to the LED screen. Before calibration, turn off the scaling function of the controller.
Receiving card	It is installed inside the cabinet to receive audio and video signals and light up the screen. Currently, the cabinet calibration supports the setups of both one receiving card in one cabinet and multiple receiving cards in one cabinet.
Cabinet	The cabinet to be calibrated. Use an Ethernet cable to connect the cabinet to the controller regardless of the control system type.

Calibration Device	Description
	Comprehensive cabinet aging should be carried out before calibration. It is not recommended to perform calibration on cabinets that have experienced different durations of aging.
Pedestal	It is used to support the cabinet. - A pedestal with positioning pins is recommended to facilitate placing and fixing the cabinet according to standards. - The outer surface of the pedestal must be made of low reflective materials.
Imaging colorimeter / camera	It is used to capture LED screen images. The NOS-CC60 imaging colorimeter, C3200 industrial camera, and Canon EOS 90D\80D\70D\R7 digital cameras are supported. When using a digital camera, only the brightness and chroma calibration plan is supported.  Note The tripods for the NOS-CC60 and C3200 are not interchangeable. Please use the matched tripod for calibration.
Authorization dongle (Digital camera only)	USB authorization dongle. When using a digital camera, insert the authorization dongle into the calibration computer before calibration.
Colorimeter (Optional)	It is used to measure the cabinet brightness and chroma. The measured values serve as the original values for the calibration. The CA410 and CS2000 colorimeters are supported. A colorimeter should be connected for the cabinet high-precision brightness and chroma, full-grayscale 1.0, and full-grayscale 1.0 + low-grayscale calibration plans. No colorimeter is needed for the cabinet brightness and chroma, or low-grayscale calibration plans.
Thermometer (Optional)	It is used to measure the cabinet temperature. The Optris T15 and Raytek MI3 thermometers are supported. A thermometer must be connected for the cabinet high-precision brightness and chroma, low-grayscale, full-grayscale 1.0, and full-grayscale 1.0 + low-grayscale calibration plans.
Barcode scanner (Optional)	It is used to scan the QR code on the cabinet to read the cabinet ID. The Honeywell MS3780 (with USB port or COM port) barcode scanner is supported.

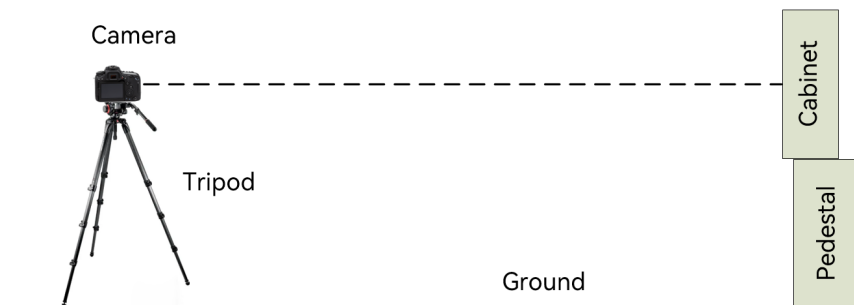
5.1.2.3 Cabinet Placement Requirements

- The cabinet needs to be placed on the pedestal to prevent any interference from light that is reflected off the ground.

- The front surface of the cabinet should protrude slightly from the pedestal to ensure that the LEDs are not blocked when capturing data.



- The camera must face the cabinet center.



Note

- During calibration, do not move the camera or change the camera parameters.
- During calibration, do not move the pedestal.
- During calibration, place cabinets in the same position, otherwise the calibrated cabinets will have a poor display mosaic effect after they are spliced together.

5.2 Configure the Software

5.2.1 Network Connection

The calibration software requires different network configurations for different control systems.

- Mars control system

When using the Mars control system, only one computer is needed.

If an Ethernet cable is used to connect the computer and the controller, you need to ensure that they are on the same network segment.

- Coex control system

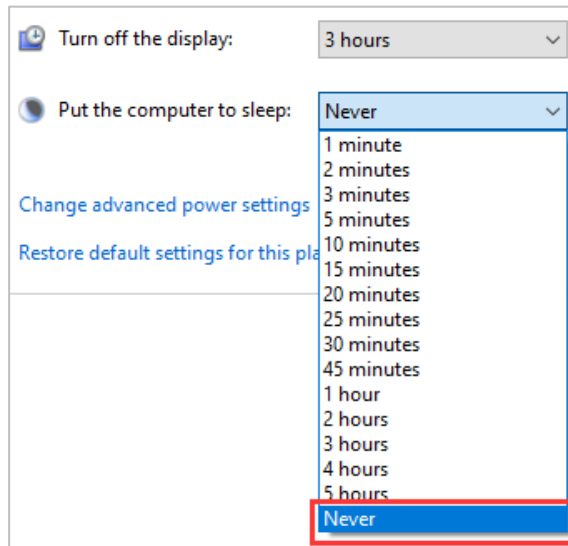
Only one computer is required to complete the entire calibration procedure. It is necessary to ensure that the computer and controller are on the same network segment.

Note

If the computer does not have enough Ethernet ports available, you can use a USB-to-Ethernet adapter.

5.2.2 Disable Computer Sleeping

- Step 1 Right click a blank area on the desktop of the control computer and select **Personalize**.
- Step 2 On the displayed page, select **Screen Saver** in the lower-right corner.
- Step 3 Choose Change power settings > Change plan settings.
- Step 4 Set the computer sleeping settings to **Never**.

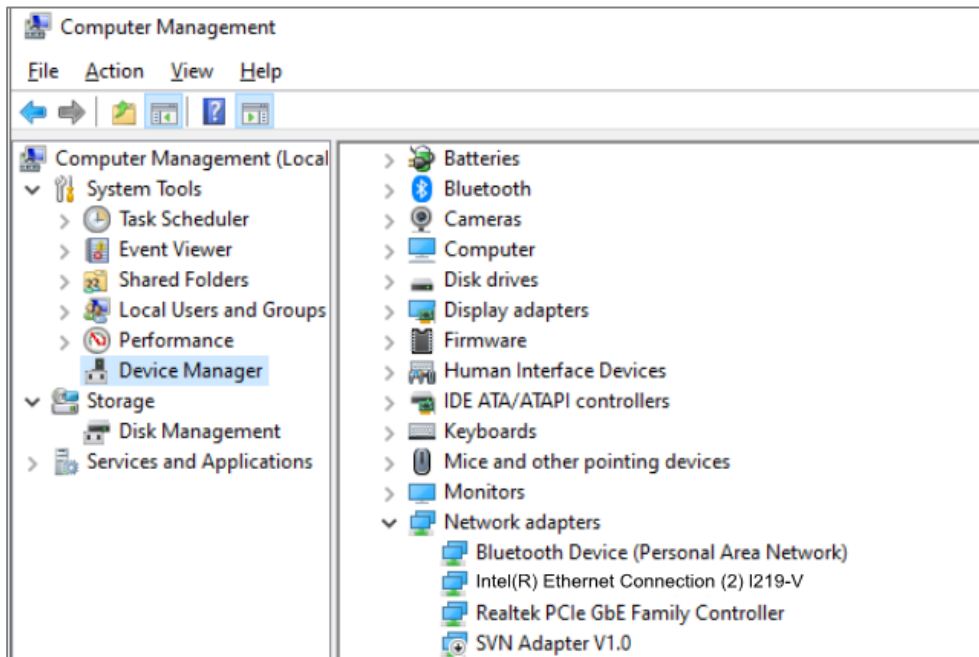


5.2.3 Jumbo Packet Settings

If you use the C3200 industrial camera for calibration, the calibration computer requires jumbo packet settings.

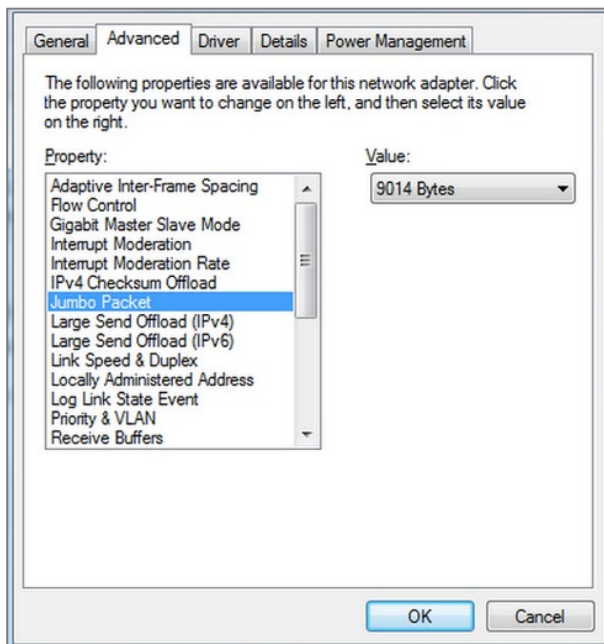
You can follow the steps below to perform manual settings.

- Step 1 Right click the computer icon on the desktop and select **Manage** to open the **Computer Management** page.
- Step 2 Click **Device Manager** on the left panel and then select **Network adapters**.



Step 3 In the drop-down options under **Network adapters**, double click the computer's primary network adapter. At the same time, make sure that the C3200 calibration camera is connected to the computer's primary network adapter.

Step 4 In the displayed properties window, click the **Advanced** tab and change the following adapter parameters.



- Set Jumbo Packet to 9014 Bytes.
- Set Receive Buffers to 2048.

Step 5 Click **OK**.

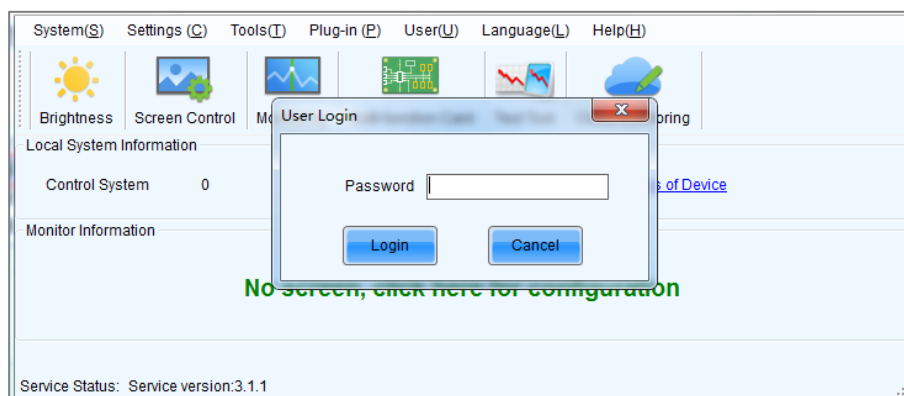
5.2.4 NovaLCT Settings

When using the Mars control system, the NovaLCT should be used during calibration. In NovaLCT, you will need to complete the screen connection and listening settings.

Step 1 Open NovaLCT.

Step 2 Choose **User > Advanced Synchronous System User Login**, enter the password (initial password: admin), and click **Login**.

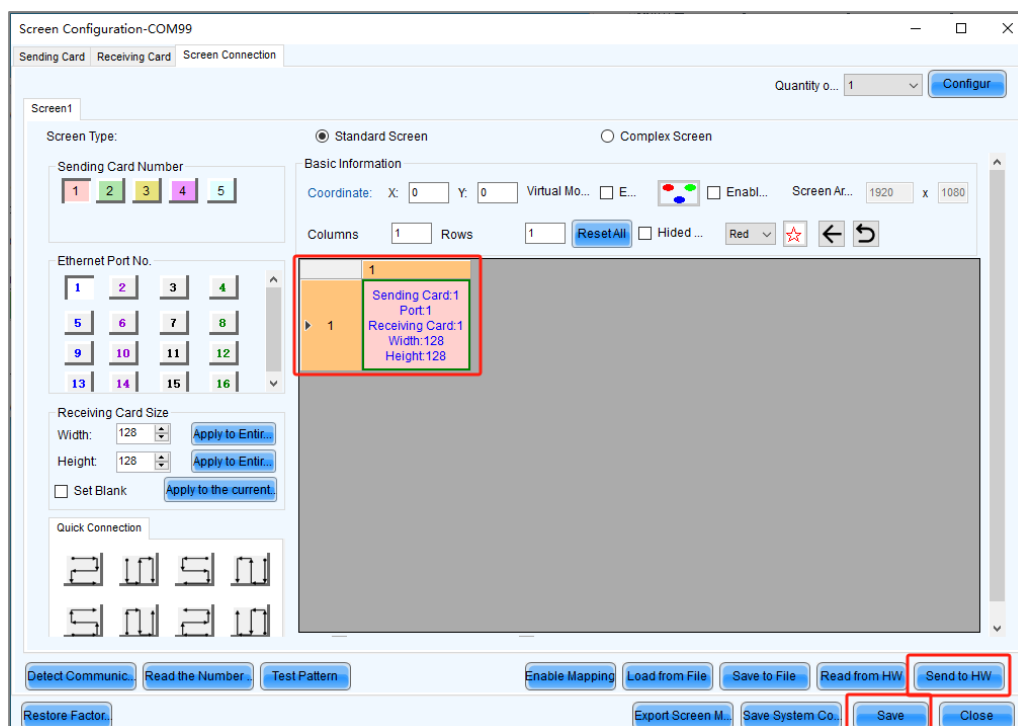
Figure 5-4 Login



Step 3 Complete screen connection.

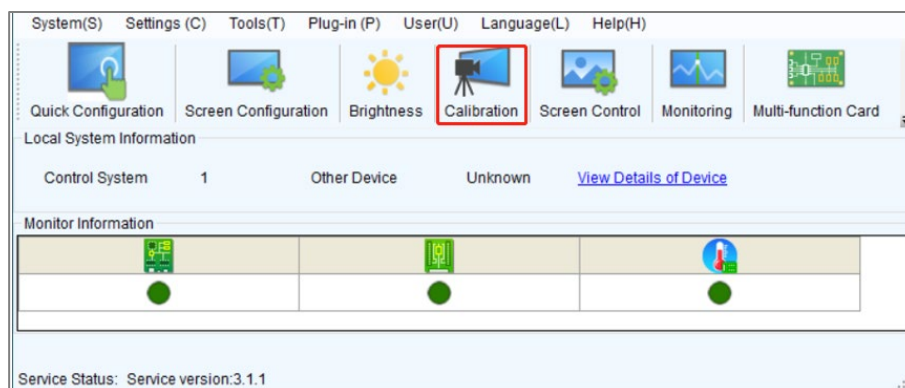
1. On the main window, click **Screen Configuration** and select the current communication port to enter the **Screen Configuration** screen.
2. Select the **Screen Connection** tab and complete screen connection.
3. Click **Send to HW** and then click **Save**.

Figure 5-5 Screen connection



Step 4 On the main window, click **Calibration** to open the calibration page.

Figure 5-6 Calibration button

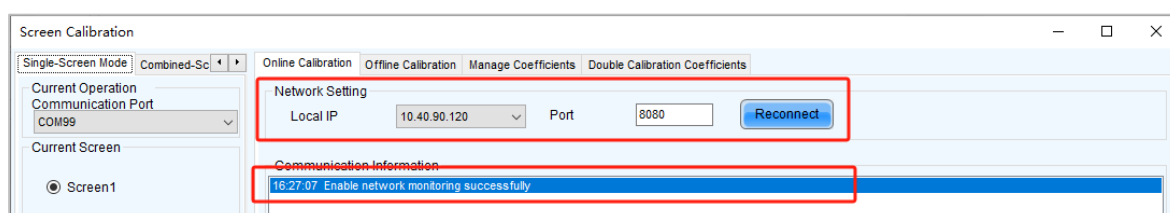


Step 5 On the Screen Calibration screen, set Local IP and Port under Network Setting.

- Local IP: Indicates the IP address of the control computer.
- Port: The default value is 8080.

If a message saying **Enable network monitoring successfully** is displayed, it means that NovaLCT is ready to listen. However, if a message indicating that the listening process failed appears, please check if there is a port conflict. In case there is a conflict, please change the port number and try again.

Figure 5-7 Ready for calibration



5.2.5 VMP Settings

When using the Coex control system, the VMP should be used and screen configuration needs to be completed in VMP. For details, please refer to the VMP user manual. During screen configuration, make sure the screen connection starts from the upper left corner.

Figure 5-8 Correct screen connection



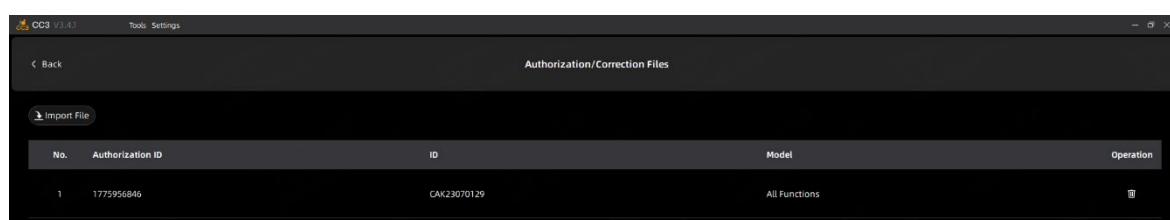
5.3 Manage Authorization/Correction Files

5.3.1 Imaging Colorimeter/Industrial Camera

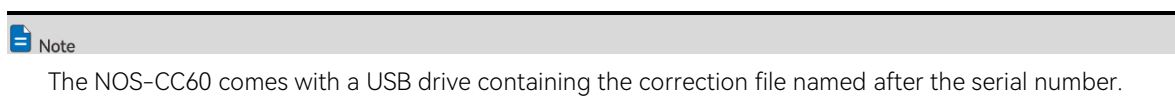
For the NOS-CC60 imaging colorimeter and C3200 industrial camera, an authorization/correction file should be imported during calibration preparation. Each device needs its individual authorization/correction file.

- Step 1 Open CC3 calibration software, click **Settings** in the top-left corner and then click **Authorization/Correction Files**.
- Step 2 Check the serial number (SN) on the rear panel of the connected imaging colorimeter/industrial camera and record the SN.
- Step 3 On the **Authorization/Correction Files** screen, click **Import File** and select the corresponding authorization/correction file.
 - For the NOS-CC60 imaging colorimeter, select a correction file (.calib).
 - For the C3200 industrial camera, select an authorization file (.auth).

Figure 5-9 Importing file



- Step 4 Click **Open** to import the authorization/correction file.



To delete the imported authorization/correction file, click .

5.3.2 Digital Camera

For the digital camera, the CC3 calibration software uses a method of binding a dongle and a camera for managing authorizations. Each camera corresponds to one dongle. During calibration preparation, insert the dongle corresponding to the used camera into the USB port of the calibration computer.

6 Create a Calibration Project

- Step 1 Open CC3 and click **New Project** to access the **New Project** page.

Figure 6-1 New project

New Project

Project Name
New Project 20260828084846 *

Project Path
C:/Users/ /Desktop Browse

Project Description
Enter
0/200

Regular Screen Irregular Screen COG

Project Type
☐ Screen Calibration ☒ Cabinet Calibration ☐ Effect Optimization

Single-Layer Calibration
☒ Brightness and Chroma ☐ High-Precision Brightness and Chroma ☐ Low-Grayscale

Multi-Layer Calibration
☐ Full-Grayscale 1.0 ☐ Full-Grayscale 1.0+ Low-Grayscale

Calibration Configuration
Image Booster ☒ Enable ☐ Disable

Cancel OK

Step 2 Set the project name, save path, and description to help you quickly find the project later.

The project name defaults to ***New Project YearMonthDayHourMinuteSecond*** and you can change to a different name you like.

Step 3 Select a calibration type and plan as needed.

- Project Type: Select **Cabinet Calibration** or **Effect Optimization**. This manual introduces cabinet calibration and effect optimization of calibrated cabinets.
- Calibration Plan
 - Brightness and Chroma Calibration: This feature is for SMD screens with uniform bin mixing and excellent chroma consistency between modules in order to maintain the screen's color gamut and improve post-calibration brightness uniformity.
 - High-Precision Brightness and Chroma Calibration: This feature is for COB modules with mura differences or SMD screens with mixed bins from different batches in order to ensure a high level of uniformity in both brightness and chroma.
 - Low-Grayscale Calibration: This feature is for screens that use special driver ICs and have poor performance at low grayscale levels in order to achieve a smooth linear transition for low grayscale.
 - Full-Grayscale Calibration 1.0: This feature is for screens where the mura pattern changes non-linearly across different grayscales in order to ensure a smooth gradual transition through all grayscale levels.
 - Full-Grayscale 1.0 + Low-Grayscale Calibration: This feature is for screens that use special driver ICs and have poor low-grayscale effects and mura nonlinearity issues in order to achieve uniformity at low grayscale and across the full grayscale range.
 - Curved Surface Correction: This feature assists in feature collection for transition issues that persist after the calibrated cabinets are spliced.

Step 4 Configure the Image Booster switch. Before enabling it, ensure the Image Booster file has been sent, as failing to do so can result in a black screen during calibration.

It must be enabled for full-grayscale calibration 1.0 and full-grayscale 1.0 + low-grayscale calibration plans.

Step 5 Click **OK** to complete creating the project. The software automatically opens the project and enters the project home screen.

7 Calibration Operation Instructions

The CC3 calibration software supports six cabinet calibration plans: brightness and chroma calibration, high-precision brightness and chroma calibration, low-grayscale calibration, full-grayscale calibration 1.0, full-grayscale 1.0 + low-grayscale calibration, and curved surface correction. After the calibration preparation is completed, you can click the links below to jump to view the corresponding operation steps as needed.

- [7.2 Brightness and Chroma Calibration](#)
- [7.3 High-Precision Brightness and Chroma Calibration](#)
- [7.4 Low-Grayscale Calibration](#)
- [7.5 Full-Grayscale Calibration 1.0](#)
- [7.6 Full-Grayscale 1.0 + Low-Grayscale Calibration](#)
- [7.7 Curved Surface Correction](#)

7.1 Measure Display in DMark

7.1.1 DMark Introduction

DMark is a display measurement tool that can professionally measure a display from the perspective of full-link tuning or display performance, suitable for objective evaluation of display effects.

7.1.2 DMark Measurement Setup

7.1.2.1 Environment Requirements

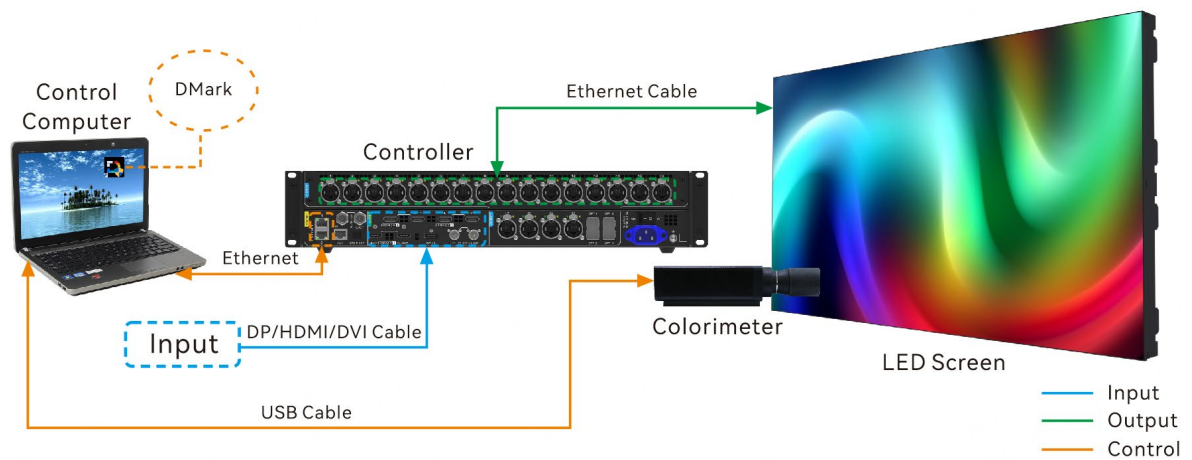
Table 7-1 Environment requirements

Category	Item	Requirements	Quantity
Hardware	Measurement environment	A darkroom.	1

Category	Item	Requirements	Quantity
	Screen	The cabinet to be measured is in normal status.	Subject to the actual environment.
	Controller	- Currently supported controllers include MX40 Pro and KU20, both requiring firmware V1.5.0 or later. - When a signal source (PC) is used to display on the screen, a controller is optional.	Subject to the actual environment.
	Control computer	Basic requirements: - Operating system: Windows 10 (64-bit) or later. (ARM-based Windows systems are not supported.) - CPU: i5 or higher. - RAM: 8 GB or greater. - Drivers: Driver software for the colorimeter, high-speed photometer, power meter, and thermometer must be installed. Other data acquisition devices do not require driver software.	1
		Other requirements: - When using the controller's internal source for display, the control computer must be on the same network segment as the controller. - When using a signal source (PC) to display on the screen: - If there is a controller, the control computer must be on the same network segment as the controller. - The desktop resolution must match the EDID resolution in VMP. - The projection mode must be set to Extend. - The scaling must be set to 100%.	
	Colorimeter (Required)	Models: Konica Minolta CA-P427, Konica Minolta CA-VP427A, Konica Minolta CA-P427H, CR200.	1
Software	VMP	Version: V1.5.0 or later.	1

7.1.2.2 Hardware Connection

Figure 7-1 Hardware connect example



Colorimeter connection instructions:

1. Connect the colorimeter to the control computer using a USB cable.
2. Place the colorimeter's measurement lens closely against the display surface, ensuring the measurement area is aligned with the target display area.

7.1.3 DMark Measurement Instructions

7.1.3.1 Connect Devices

Note

- When the hardware connection is normal, the software will automatically establish a communication connection with the controller (currently MX40 Pro and KU20 supported) and the capture devices.
- When using DMark for measurement, you only need to connect the controller and colorimeter. Other devices do not need to be connected.

- Step 1 In the CC3 calibration project, select Environment Preparation on the left and click **Launch DMark** to launch the DMark software.
- Step 2 Hover the mouse over device status bar, and the relevant configuration for device connection will pop up.
- Step 3 On the **Connect Device** screen, confirm that the following items are normal, and then click **Next**.
- The connection between the software, controller, and capture devices is normal. (Click  to refresh the connection status.)
 - : Connection normal.
 - : Connection abnormal.

- The test pattern meets the requirements.
 - Controller's internal source: The screen synchronizes with the controller's output, as the controller generates the measurement image based on parameters and commands from the control computer. Functions such as switching frame rates or color gamuts, and toggling calibration or Image Booster switches are supported.
 - Signal source (PC): The screen synchronizes with the PC signal source output without applying control system adjustments. Functions such as switching frame rates or color gamuts, and toggling calibration or Image Booster switches are not supported.

Associated parameter **Control Computer Pattern Display Position**: The display position (main monitor or extended monitor) and offset of the test pattern.
- The screen parameters are consistent with the actual ones. (If parameters cannot be read back, you can click **Import Cabinet File** to complete the screen parameter settings.)
 - Area 1: Parameter values come from the customer information and requirements files.
 - Area 2: Cabinet parameters read back by the software. When using the controller's internal source for display, click **Read Cabinet Parameters** to read back the parameters again. When using the signal source (PC) for display, readback is not supported.
 - Area 3: When using the signal source (PC) for display, gamma-related parameters are displayed and can be adjusted according to the actual condition of the cabinet.
 - Area 4: Manually check the target color gamut. After checking "Custom", you can adjust the parameter for the custom color gamut.

7.1.3.2 Execute Measurement

On the DMark home screen, complete all subjective auxiliary measurements and automatic tests in sequence.

Note

The measurement execution is divided into the following two parts:

- Subjective auxiliary measurement: User participation is required during the measurement process, i.e., selecting the measurement result based on the actual situation according to the interface prompts.
- Automatic test: After the user places the colorimeter in the specified position, the software automatically executes the measurement without manual intervention.

7.1.3.2.1 Subjective Auxiliary Measurement

Note

During the measurement, for questions marked as optional, it is recommended not to answer them unless necessary. If you need to reset the measurement results and problem description, click **Reset Results**.

Step 1 Click **Next** on the home screen to start the measurement.

- Step 2 Observe whether the image display is normal at the current frame rate (the input image is displayed normally, with no flashing pixels, flickering, artifacts, or black screen), and perform the following corresponding operations.
- Normal: Select **Display normal**.
 - Abnormal: Select **Display abnormal**.
- Step 3 Observe the screen display at the current frame rate to check for any color block anomalies in the screen area corresponding to the chip.
- No issues: Select **Display normal**.
 - Issues present: Select **Display abnormal** based on the actual situation.
- Step 4 Observe the screen display at the current frame rate to check for any high-contrast coupling issues (faint glowing around the edges of the screen), and perform the corresponding operations below.
- No issues: Select **Display normal**.
 - Issues present: Select **Slight** or **Obvious** based on the actual situation.
- Step 5 Observe the screen display at the current frame rate to check for any cross-board coupling issues, and perform the following corresponding operations.
- No issues: Select **Display normal**.
 - Issues present: Select **Slight** or **Obvious** based on the actual situation.
- Step 6 Observe the screen display at the current frame rate to check for any first-scan dimming issues (horizontal/vertical lines with a width equal to the scan count), and perform the following corresponding operations.
- No issues: Select **Display normal**.
 - Issues present: Select **Display abnormal**.
- Step 7 Observe the screen display at the current frame rate to check for any afterglow issues (faint glowing above/below the diagonal line), and perform the following corresponding operations.
- No issues: Select **Display normal**.
 - Issues present: Select **Upper afterglow**, **Lower afterglow**, or **Upper and lower afterglow** according to the actual situation.
- Step 8 Observe the module by dragging the **Display Grayscale** slider, and select the two physical modules with the largest brightness difference. Aim the colorimeter at module 1 you are currently capturing, and click **Capture Module 1** (the live test data captured by the colorimeter will be displayed below). Repeat this step until the data capture of the two modules is completed, and then click **Next**.

7.1.3.2.2 Automatic Test

- Step 1 Place the colorimeter at the center of the crosshair on the screen.
- Step 2 Click **Capture Ambient Data** to capture environment-related data. For ambient illuminance, you need to measure it with an illuminance meter and manually input it.

Step 3 Click **Ambient Light Detection** to detect light leakage on the screen. If the detection fails, check the placement of the colorimeter and place it as close to the screen surface as possible.

After the ambient light detection passes, click **Start Automatic Test** and wait patiently for the automatic test to complete. After the test is completed, manually close the DMark software and view the measurement results in the CC3 software.

7.2 Brightness and Chroma Calibration

7.2.1 Prepare Environment

In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution, connect a camera, colorimeter, thermometer and barcode scanner, and view the screen details.

7.2.1.1 Connect a Control System

The CC3 calibration software is compatible with both the Mars and Coex control systems from NovaStar. The default system is "Coex". Please make sure to select the correct control system type for your needs.

Notes

- Ensure the computer firewall is disabled before connecting to the control system.
- When using Mars controllers, use NovaLCT software for calibration. For the Coex controllers, use VMP software. Check the NovaStar website for specific controller model classifications, and do not mix controllers during calibration.
- A static IP address is required for the sending card.

Connect Coex Control System

Step 1 Open CC3, create or open a calibration project and enter the project home screen.

Step 2 On the **Prepare Environment** screen, set **Type** to **Coex** in the **Control System** area on the right.

Figure 7-2 Connecting Coex control system

Control System

Type: Coex

Screen: Please select

Receiving Card: --

Rv Card Config File: Import

Same Module Resolution

W: Enter H: Enter

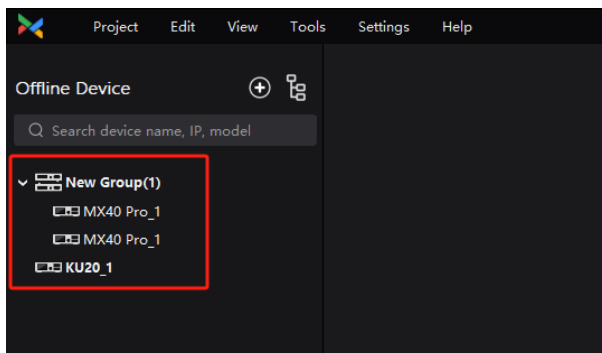
Enter the correct module resolution as it affects the calibration effect.

Connect

Step 3 From the **Screen** drop-down list, select the device that loads the screen to be calibrated.

When selecting the device, you can first confirm the name of the device loading the screen to be calibrated in the device list of the VMP, and then select the corresponding device name from the **Screen** drop-down list in the calibration software.

Figure 7-3 Device list in VMP



Only the unlocked devices can be selected. The locked devices cannot be selected.

Step 4 Click **Connect** to complete the connection between CC3 and the control system.

After the system is successfully connected, you can view the current receiving card model and version information next to Receiving Card, and the resolution and pixel pitch information of the current screen will be displayed at the bottom of the screen.

Step 5 Import the configuration file (.ncp or .rcfgx) used by the cabinet to be calibrated.

1. Click Import next to Rv Card Config File.
2. In the displayed window, select the desired file.
3. Click **Open**.

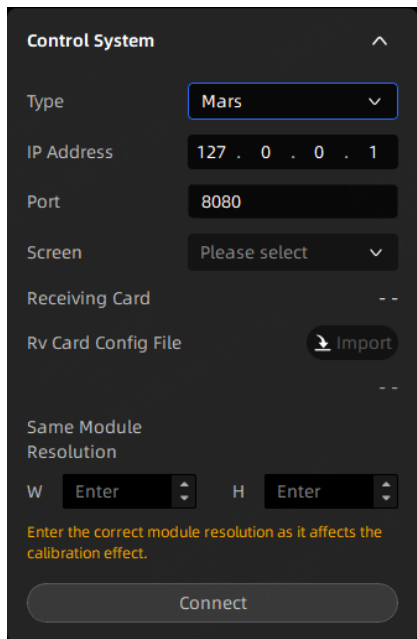
Connect Mars Control System

To connect Mars system, complete relevant settings in NovaLCT first. See [5.2.4 NovaLCT Settings](#).

- Step 1 Open CC3, create or open a calibration project and enter the project home screen.
- Step 2 On the **Prepare Environment** screen, set **Type** to **Mars** in the **Control System** area on the right, enter the IP address and port number set in NovaLCT, and click **Connect**.

After the system is successfully connected, you can view the current receiving card model and version information next to Receiving Card, and the resolution and pixel pitch information of the current screen will be displayed at the bottom of the screen.

Figure 7-4 Connecting Mars control system



- Step 3 Import the configuration file (.ncp or .rcfgx) used by the cabinet to be calibrated.
1. Click Import next to Rv Card Config File.
 2. In the displayed window, select the desired file.
 3. Click **Open**.

 Note

If the control system connection fails, please check to make sure:

- The firewall has been disabled.
- The software is running normally.
- NovaLCT is ready to listen for the Mars control system.

7.2.1.2 Same Module Resolution

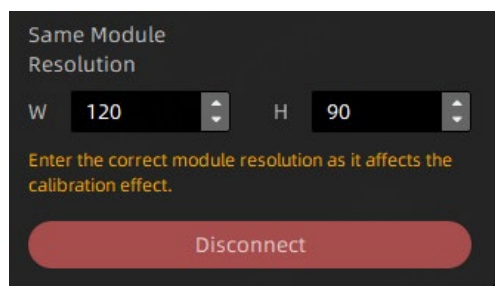
After the control system is successfully connected, you need to configure the module resolution information.

- Step 1 Check whether the modules have the same resolution.
- Same: Go to [Step 2](#).
 - Different: Go to [Step 3](#).

Step 2 Set the module width and height next to **W** and **H**.

Step 3 Skip this section.

Figure 7-5 Same module resolution



Note

To ensure better calibration effects, please fill in the actual module resolution.

7.2.1.3 Connect Camera

The NOS-CC60 imaging colorimeter supports all the calibration plans, while Canon EOS 90D\80D\70D\R7 digital cameras supports only the brightness and chroma calibration plan.

Step 1 Plug in the camera and connect it to the calibration computer.

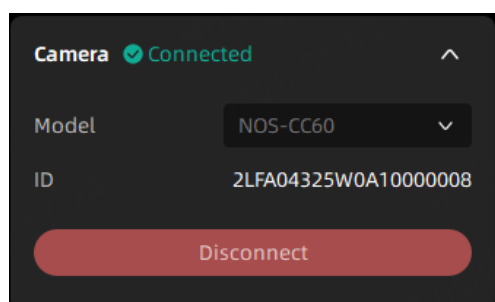
- NOS-CC60/Digital camera: Use a USB cable to connect it to the calibration computer.
- C3200: Use an Ethernet cable to connect it to the calibration computer.

Step 2 Go to the project home screen and select the **Prepare Environment** tab.

Step 3 In the **Camera** area on the right, select the model of the connected camera.

Step 4 Click **Connect** to connect the camera to the calibration software.

Figure 7-6 Connecting camera



Note

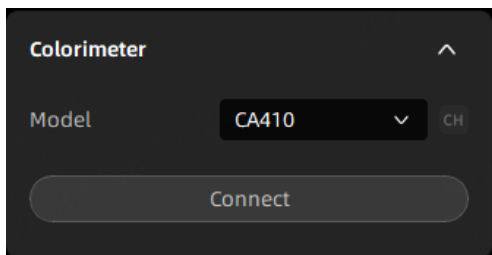
Due to compatibility issues between the C3200 camera and some computers, the camera connection may fail. In such cases, you can try disabling the network adapter connected to the C3200 and then enabling it again. The camera can be managed by using the tool that is installed together with the calibration software. See [9.2 How to use the auxiliary tool for C3200 camera?](#).

7.2.1.4 Connect a Colorimeter (Optional)

The CC3 calibration software supports the CA410 and CS2000 colorimeters. For the cabinet high-precision brightness and chroma, full-grayscale 1.0, and full-grayscale 1.0 + low-grayscale calibration plans, a colorimeter should be connected. For the cabinet brightness and chroma calibration plan, no colorimeters are needed.

- Step 1 Plug in the colorimeter and connect it to the calibration computer using the USB cable.
- Step 2 Go to the project home screen and select the **Prepare Environment** tab.
- Step 3 In the **Colorimeter** area on the right, select the model of the connected colorimeter.

Figure 7-7 Connect colorimeter



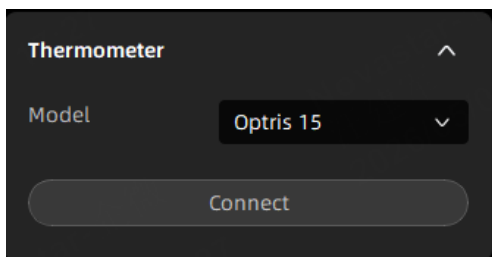
- Step 4 Click **Connect** to connect the colorimeter to the calibration software.
- After successful connection, the **Connect** button next to **Colorimeter** changes to **Disconnect**.

7.2.1.5 Connect a Thermometer (Optional)

The CC3 calibration software supports Optris T15 and Raytek MI3 thermometers.

- Step 1 Plug in the thermometer and connect it to the calibration computer using the USB cable.
 - Step 2 Go to the project home screen and select the **Prepare Environment** tab.
 - Step 3 In the **Thermometer** area on the right, click **Connect** to connect it to the calibration software.
- After successful connection, the **Connect** button next to **Thermometer** changes to **Disconnect**.

Figure 7-8 Connecting thermometer



7.2.1.6 Connect a Barcode Scanner (Optional)

The CC3 calibration software supports the Honeywell MS3780 (with USB port or COM port) barcode scanner.

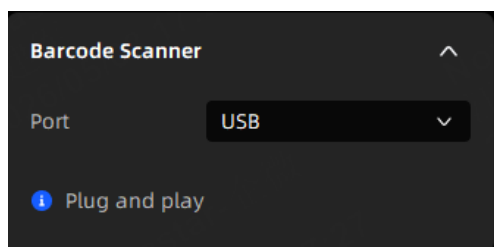
- Step 1 Use the COM or USB cable that comes with the barcode scanner to connect the barcode scanner to the calibration computer.

Step 2 Go to the project home screen and select the **Prepare Environment** tab.

Step 3 In the **Barcode Scanner** area on the right, select the port type of the connected barcode scanner.

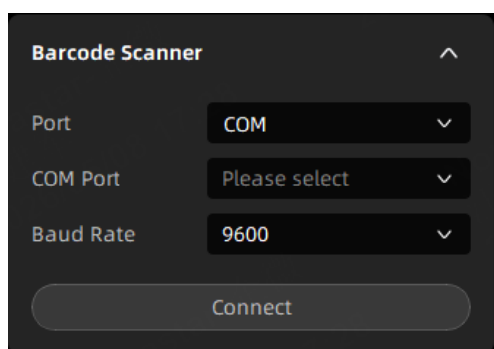
- USB port: Simply connect this type of barcode scanner to the device, and it is ready to use. No further operations required.

Select **USB** next to **Port**.



- COM port:

Select **COM** next to **Port**.



1. From the **COM Port** drop-down list, select a port number used for communication between the barcode scanner and the calibration computer.
2. From the **Baud Rate** drop-down list, select a baud rate value for the barcode scanner.
3. Click **Connect** to connect the barcode scanner to the calibration software.

After successful connection, the **Connect** button next to **Barcode Scanner** changes to **Disconnect**.

7.2.1.7 Evaluation Report (Optional)

The CC3 calibration software supports cabinet measurement via DMark or direct import of evaluation reports to view the display effect evaluation and performance parameters of the screen before calibration.

- DMark measurement: Please refer to the operation steps in [7.1 Measure Display in DMark](#) to measure the cabinet to be calibrated. After the measurement is completed, the measurement results are directly displayed on the current interface.
- Import Quantification Report: Directly import the screen evaluation report (.rep) generated by the DMark software.

7.2.2 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

7.2.2.1 Set Calibration Grayscale

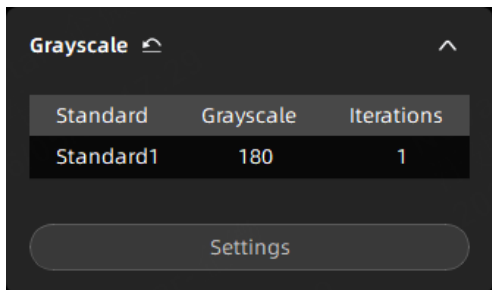
Set grayscale values for functions such as live preview, smart analysis and calibration.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

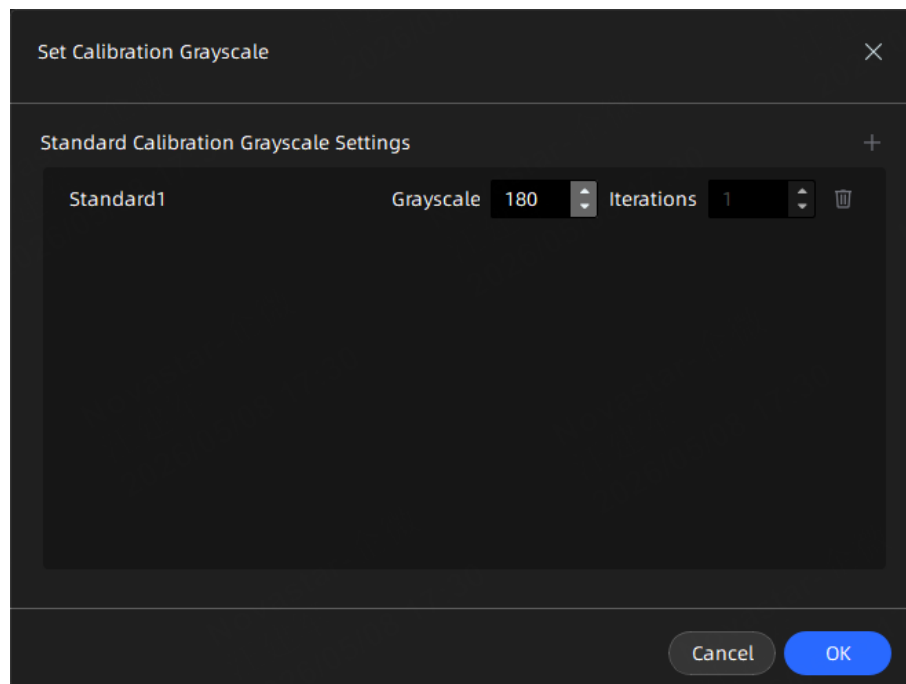
Figure 7-9 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Grayscale: The default value is 180, and the value range is 0 to 255. Cabinet calibration only supports settings of one layer of calibration grayscale.
- Iterations: It defaults to 1, and can be set between 1 and 10. Higher iteration counts will increase processing time. It can be adjusted on-site according to the actual situation of the screen, or you can contact NovaStar engineers for assistance.

Figure 7-10 Setting calibration grayscale



7.2.2.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Digital Camera

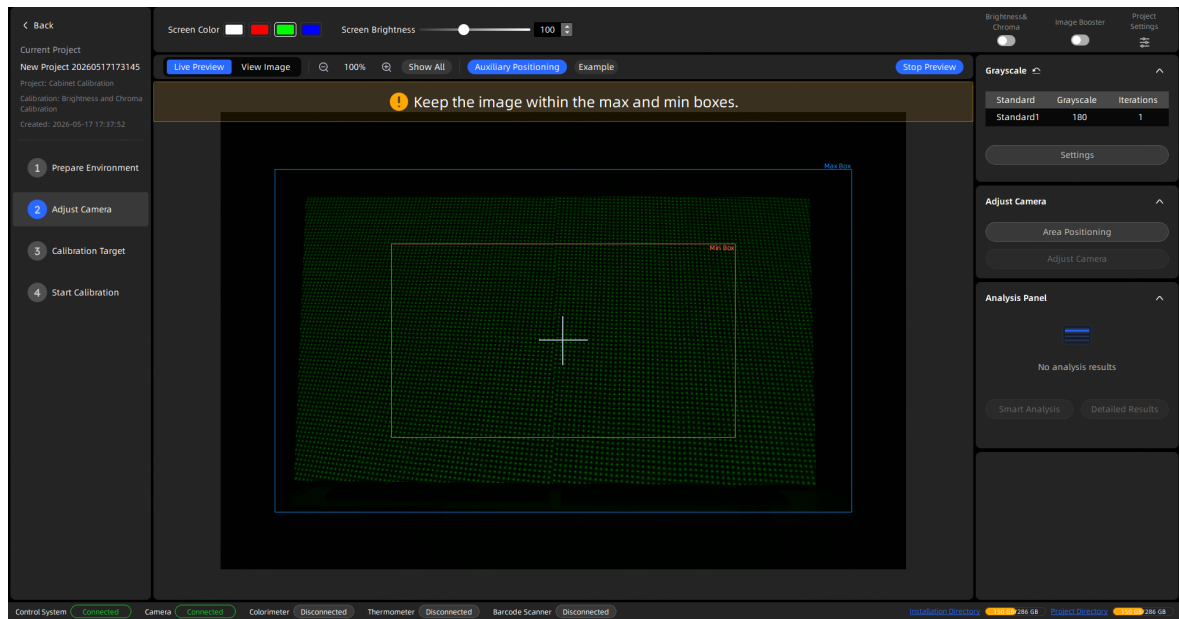
For digital cameras, the calibration software does not support live preview. You need to preview the captured images on the camera's LCD screen.

Industrial Camera

For industrial cameras, the calibration software supports live preview.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-11 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.2.2.3 Adjust Camera Parameters

Adjust camera parameters of different colors for live preview and calibration.

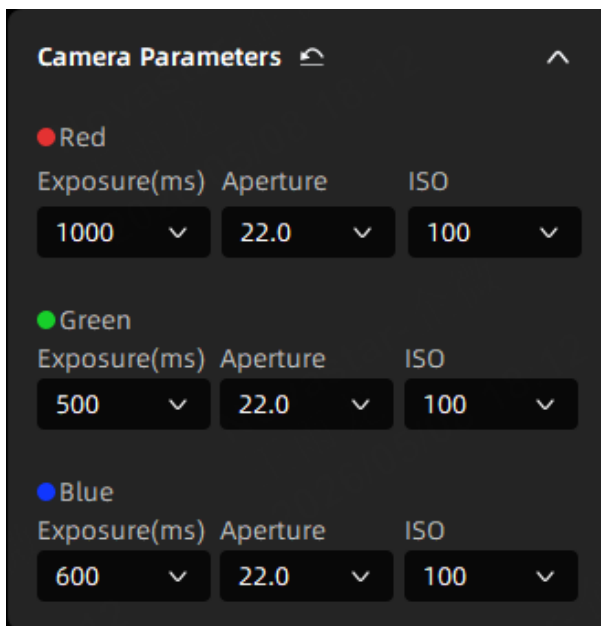
For imaging colorimeters and industrial cameras, only exposure time can be adjusted in the software. For digital cameras, the exposure time, aperture and ISO can be adjusted in the software.

Digital Camera

In the **Camera Parameters** area on the right, click the **Exposure**, **Aperture** and **ISO** drop-down arrows of each color, select a value to adjust the corresponding parameter, and make the smart analysis results fall within the recommended range.

- The value range may be different for different camera models.
- Click next to **Camera Parameters** to restore the parameter values of all the colors to their default values.

Figure 7-12 Camera parameters

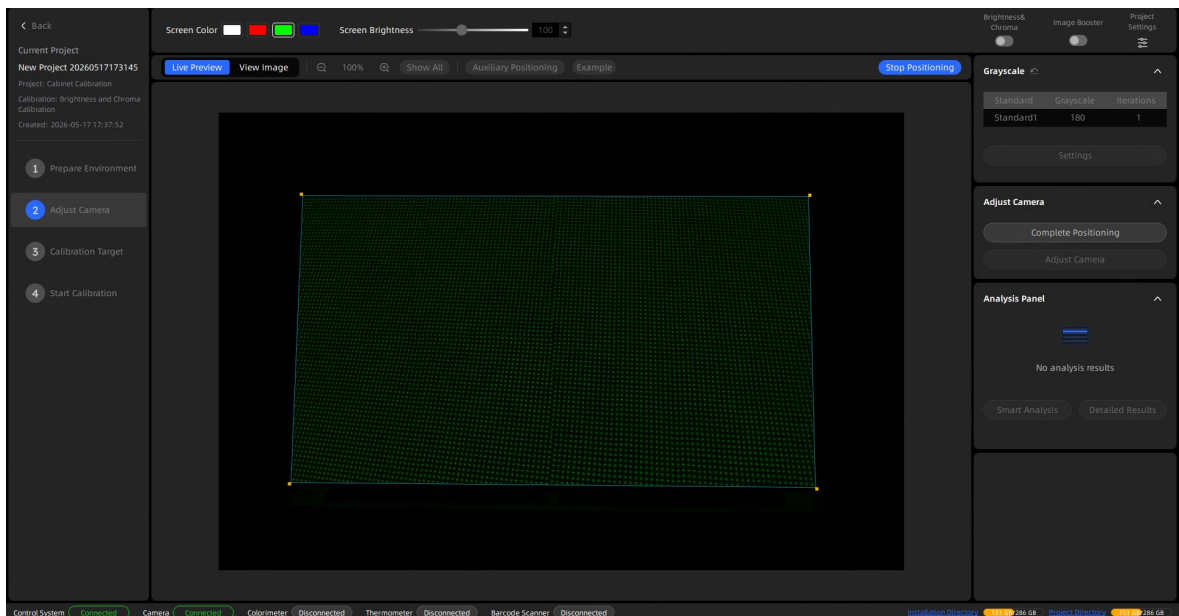


7.2.2.4 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right.

Figure 7-13 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

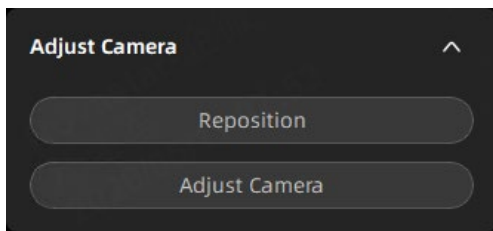
After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

7.2.2.5 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

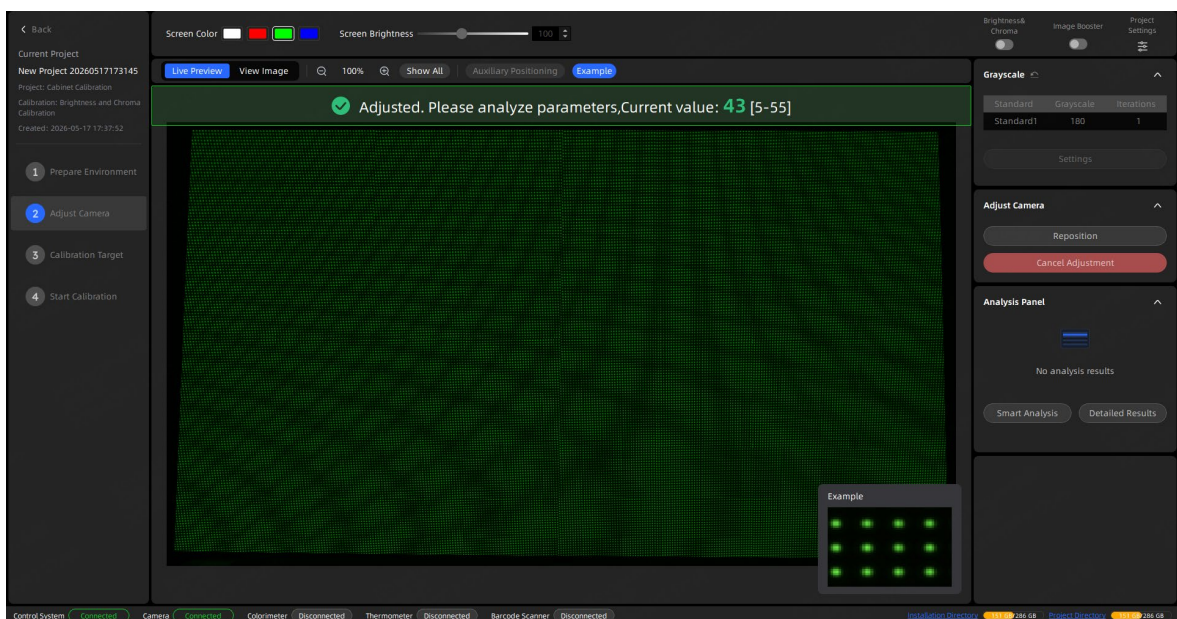
Figure 7-14 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the values on the screen.

Figure 7-15 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements, which may vary depending on the type of camera.

- Industrial camera: The image should fall between the maximum and minimum boxes.
- Digital camera: The image should be located in the center of LCD screen, and the image should take only 4/5 of the LCD screen.

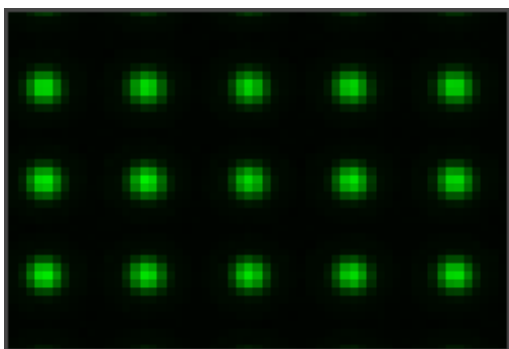
Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED imaging requirements vary depending on the camera being used.

- Industrial camera: The LED image should be clear, as shown below.



- Digital camera: The LED image should achieve the desired level of blurriness, as shown below.



7.2.2.6 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

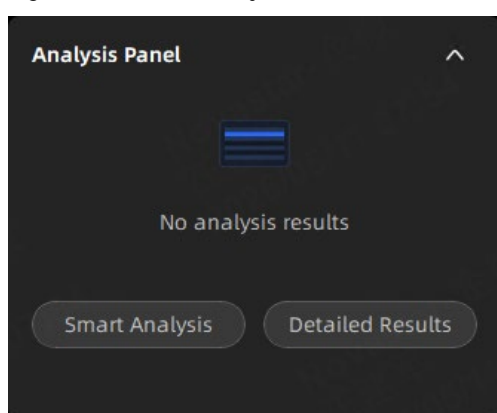
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

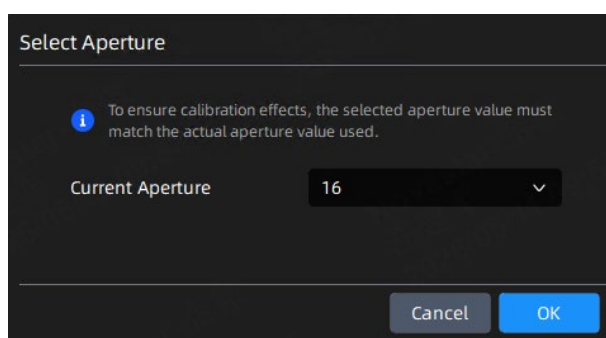
Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-16 Smart analysis – industrial camera



Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-17 Setting camera aperture



Step 3 Click **OK** to complete the aperture settings and start smart analysis.

Step 4 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 5](#).

Step 5 Adjust the abnormal values by adjusting the camera-related parameters.

- Industrial camera
 - If the peak brightness is less than 60, increase the aperture size or exposure time.
 - If the peak brightness is greater than 80, decrease the aperture size or exposure time.
 - If the image size is less than 5%, turn the focus ring to let the image become blurry.
 - If the image size is greater than 60%, turn the focus ring to let the image become clearer.
- Digital camera
 - If the peak brightness is less than 60, decrease the aperture value or increase the exposure time or ISO.
 - If the peak brightness is greater than 80, decrease the exposure time.
 - If the image size is less than 5%, turn the focus ring to let the image become blurry.
 - If the image size is greater than 60%, turn the focus ring to let the image become clearer.

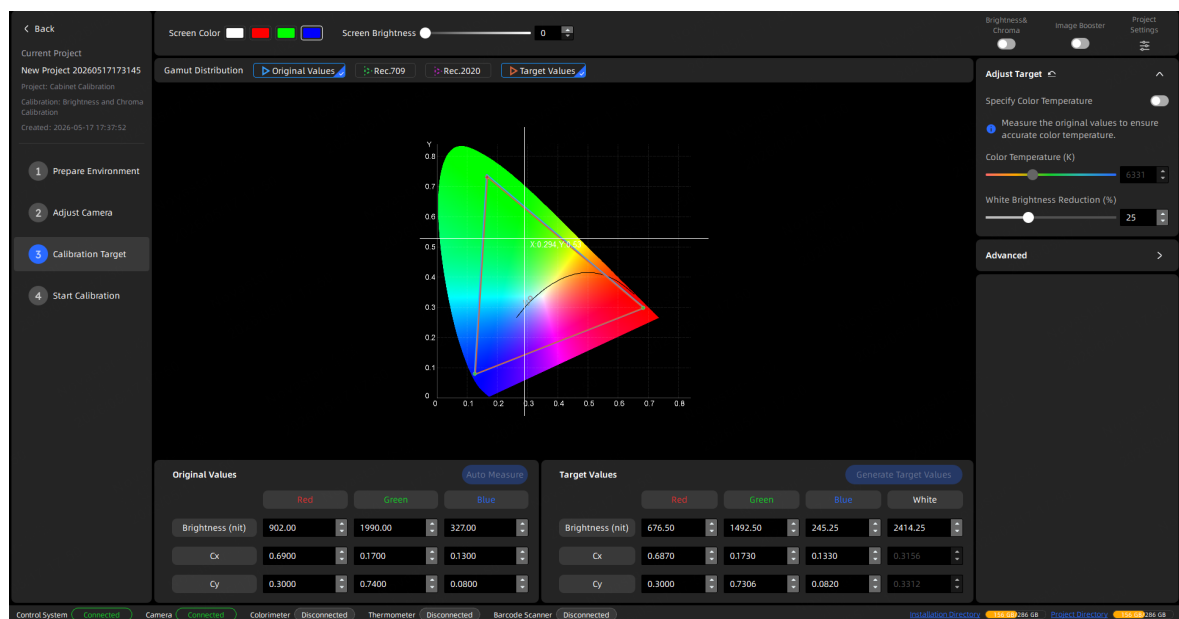
Note

After the smart analysis is completed, if any parameters of the camera are modified, you must perform area positioning and smart analysis again; otherwise the calibration effect will be affected.

7.2.3 Calibration Target

Obtain the original values of the cabinet brightness and chroma, and set the target values to complete the calibration target settings.

Figure 7-18 Calibration target



7.2.3.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the cabinet to be calibrated. They are used to calculate the calibration target values.

- Colorimeter Not Connected

The default original values in the software can be used.

- Colorimeter Connected

Use the colorimeter to measure the optical characteristics of the cabinet as original values.

Prerequisites

The control system and colorimeter are connected normally, and the colorimeter is properly placed:

- CA410 colorimeter: It should touch the cabinet closely.
- CS2000 colorimeter: It should be placed in the same position as the camera.

Procedure

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 In the **Original Values** area at the lower left, click the **Auto Measure** button on the left, and the software will automatically obtain the original values of brightness and chroma measured by the colorimeter and automatically calculate the target values.

Figure 7-19 Measuring original values

The screenshot displays two side-by-side panels. The left panel, titled 'Original Values', has an 'Auto Measure' button at the top right. It contains three tabs: 'Red', 'Green', and 'Blue'. Under each tab, there are three input fields: 'Brightness (nit)', 'Cx', and 'Cy'. The right panel, titled 'Target Values', has a 'Generate Target Values' button at the top right. It contains four tabs: 'Red', 'Green', 'Blue', and 'White'. Under each tab, there are three input fields: 'Brightness (nit)', 'Cx', and 'Cy'. All input fields have numerical values and up/down arrows for adjustment.

Section	Color	Brightness (nit)	Cx	Cy
Original Values	Red	902.00	0.6900	0.3000
	Green	1990.00	0.1700	0.7400
	Blue	327.00	0.1300	0.0800
Target Values	Red	676.50	0.6870	0.3000
	Green	1492.50	0.1730	0.7306
	Blue	245.25	0.1330	0.0820
	White	2414.25	0.3156	0.3312

Manually adjust the original values: Hold the colorimeter to measure the original values and manually enter the measured values in the **Original Values** area. Click **Generate Target Values** on the right, and the system will automatically calculate and fill the calculation results into **Target Values**.

After any modification of the original values, you need to click **Generate Target Values** so that new target values can be generated and applied to the calibration procedure.

7.2.3.2 Set Target Values

Prerequisites

Before calibration, adjust the color temperature value in the receiving card configuration file or NCP file to match or closely align with the screen's shipment color temperature requirements.

Procedure

Based on the obtained original values, adjust the brightness reduction or color temperature to obtain the target values that meet the requirement.

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 Set the target values in any of the following ways:

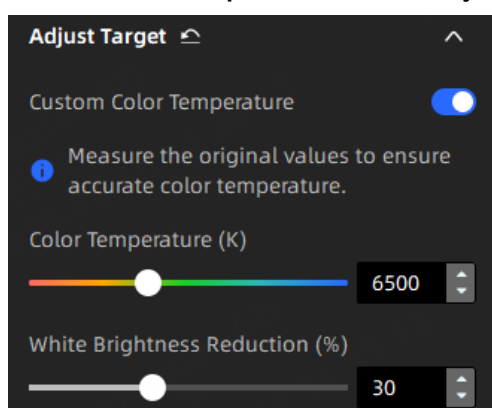
 Note

To balance white brightness reduction with color temperature, first disable **Custom Color Temperature**. Adjust the white brightness reduction as needed, then enable **Custom Color Temperature** and set it to the desired value.

- Set the target color temperature

1. In the **Adjust Target** area on the right, turn on **Custom Color Temperature**.

Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



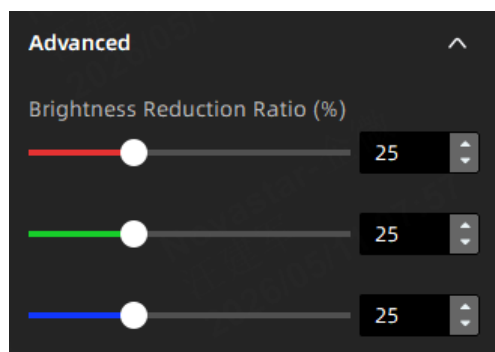
2. Drag the **Color Temperature** slider, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

Click  next to **Adjust Target** to restore both the original and target values to their default values. This will also turn on **Custom Color Temperature**.

- Advanced editing

- Manually adjust brightness reduction ratio

- a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
- b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.

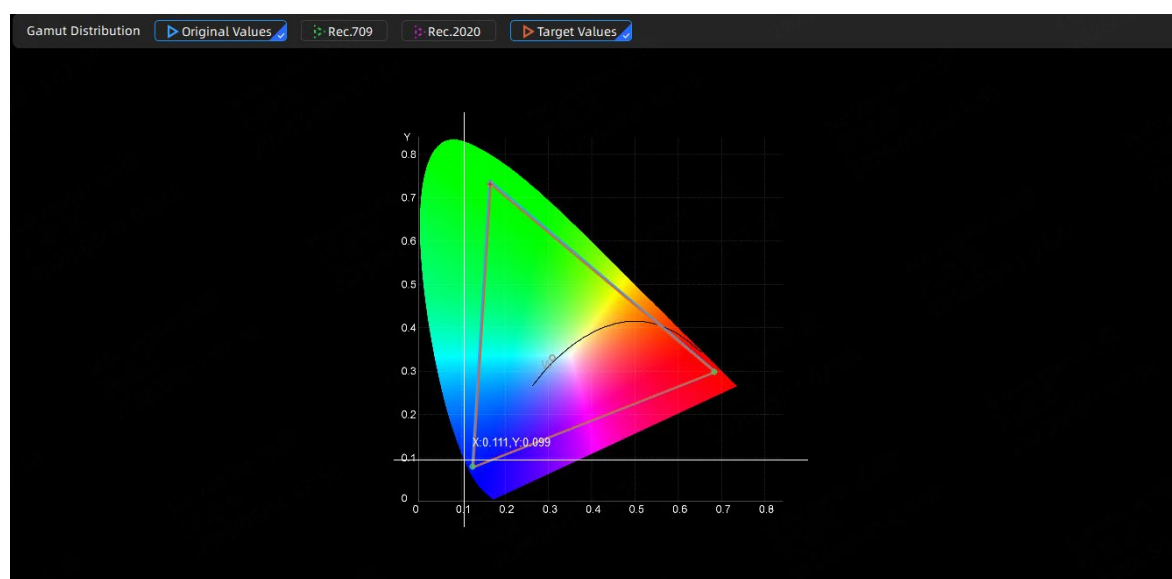
- Set the target values in the color gamut distribution chart

In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

7.2.3.3 Color Gamut Distribution Chart

Check the chroma range of the original and target values, visually view the chroma distribution information of the LEDs, and change the target values.

Figure 7-20 Color gamut distribution chart



Related Operations

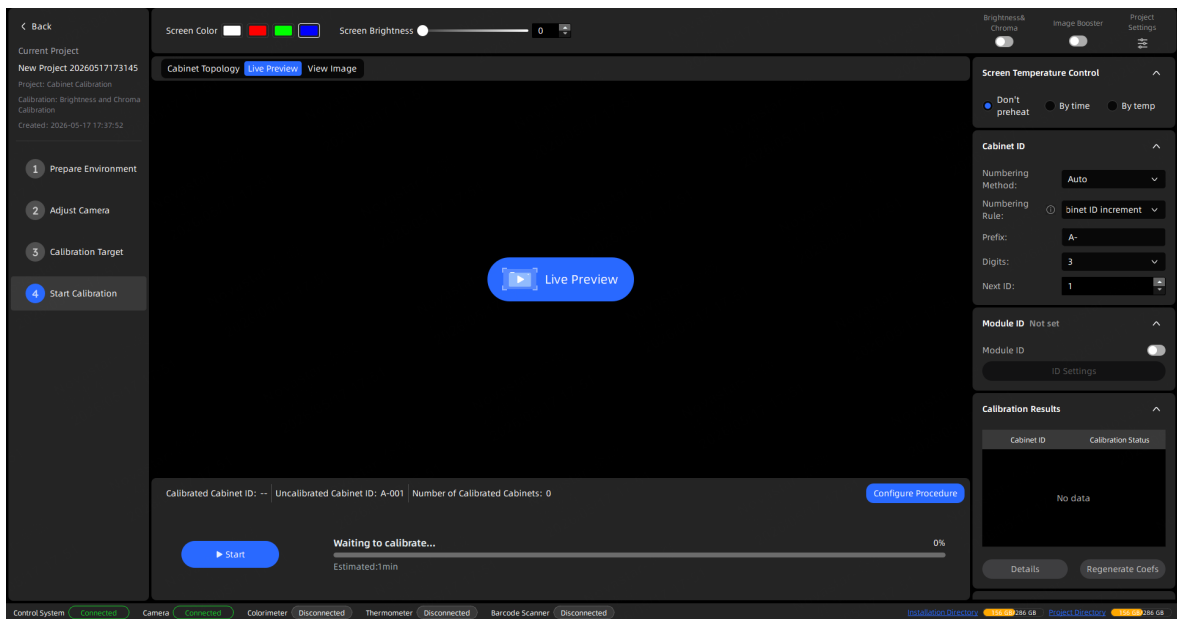
- Click the **Original Values**, **Rec.709**, **Rec.2020**, and **Target Values** buttons above the color gamut chart to show or hide the corresponding color gamut ranges on the color gamut distribution chart. They are shown by default.

- In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values. Before adjusting the target values, you need to enable **Advanced** editing.

7.2.4 Start Calibration

Configure the calibration parameters and procedure, start calibration, view calibration results and export calibration coefficients.

Figure 7-21 Starting calibration



- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

Note

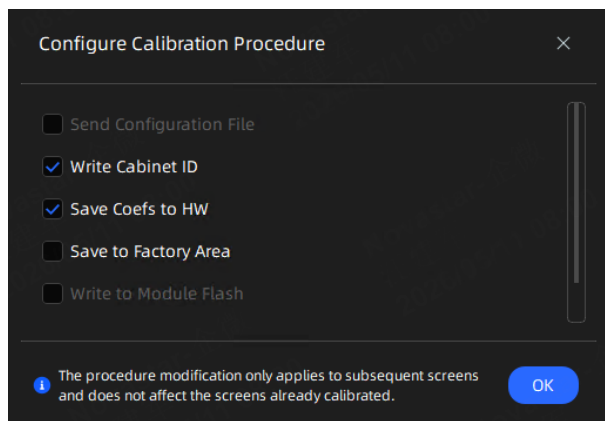
For digital cameras, the calibration software does not support live preview. Please preview the captured images on the camera's LCD screen.

7.2.4.1 Configure Calibration Procedure

You have the option to customize the calibration procedure based on the condition of the cabinet to be calibrated.

- Step 1 Click **Configure Procedure** in the lower right corner to open the **Configure Procedure** page.
- Step 2 Check the relevant calibration steps as needed.

Figure 7-22 Configuring procedure



- **Send Configuration File**
Send the configuration file to the receiving card. If the configuration file used in the cabinet to be calibrated is an NCP file, CC3 does not support sending the configuration file.
- **Write Cabinet ID**
Write the cabinet ID to the receiving card.
- **Save Coefs to HW**
The parameters after calibration will be automatically saved into the receiving card of the cabinet.
- **Save to Factory Area**
Save the calibration coefficients to the factory area of the receiving card. After the coefficients are adjusted or lost, you can apply the factory area coefficients to the application area and the coefficients will be restored to the original data.
- **Write to Module Flash**
Write the calibration coefficients to the module flash memory for backup.
- **Save Rv Card Parameters**
Save the receiving card configuration file to hardware to prevent the loss of the file after the screen is powered off and on again. If the configuration file used in the cabinet to be calibrated is an NCP file, there is no need to send or save the configuration file.

Step 3 After the procedure is configured, click **OK** below.

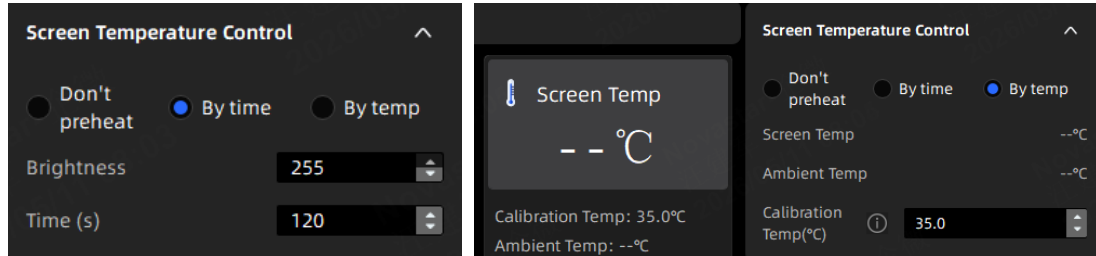
7.2.4.2 Configure Screen Temperature Control

Configuring screen temperature control is to light up the cabinet and allow it to display an image for a designated amount of time until it reaches a stable display state.

In the **Screen Temperature Control** area on the right side of the **Start Calibration** screen, you can select **Don't preheat**, **By time**, or **By temp**.

- **Don't preheat**: Start calibration directly without preheating the cabinet.
- **By time**: Set the cabinet brightness and preheating time during preheating. The default brightness is 255 and the time is 120 seconds. You can change them as needed.

- By temperature (thermometer required): Set a calibration temperature, and the system will preheat the cabinet to the calibration temperature before starting calibration. It is recommended to use the highest grayscale to display a white image on a cold screen for 90s, and set the resulting temperature as the calibration temperature.

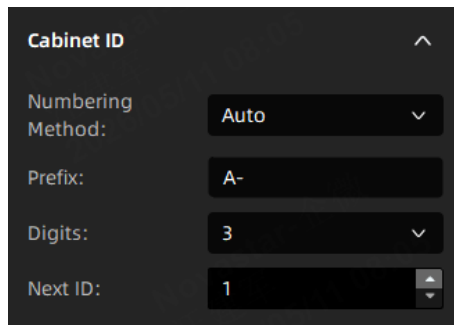


7.2.4.3 Set Cabinet ID

This function is used to set the ID of the next cabinet to be calibrated.

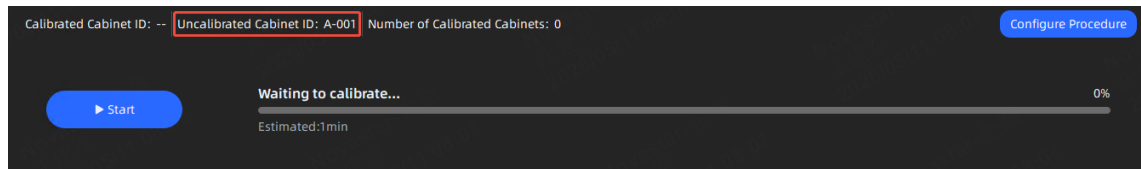
The cabinet ID can be set automatically (default), manually, or through readback. If the screen manufacturer has its own cabinet ID rules, manual setting is the preferred option. If cabinet IDs have been pre-written in batches to the receiving card via the control software, you can choose to read back the IDs.

- Automatically set the cabinet ID
 - In the **Cabinet ID** area on the right of the **Start Calibration** screen, set **Numbering Method** to **Auto**.



- Set the prefix, digits and next ID. These three values together will create the cabinet ID.
 - Prefix: Set the cabinet ID prefix. It defaults to **A-** and can be customized. It cannot exceed 10 characters and does not support special characters including \/:*?]
 - Digits: Set the number of digits in the cabinet ID (excluding the prefix). It defaults to 3 digits, ranges from 1 to 10 and can be customized.
 - Next ID: Set the ID of the next cabinet to be calibrated, that is, the starting number of the cabinet ID. It defaults to 1 and will automatically increase according to the number of cabinets to be calibrated.

After setting, the cabinet ID will be displayed in the lower left corner of the screen, as shown in the figure below. **A-001** is the ID of the next cabinet to be calibrated.

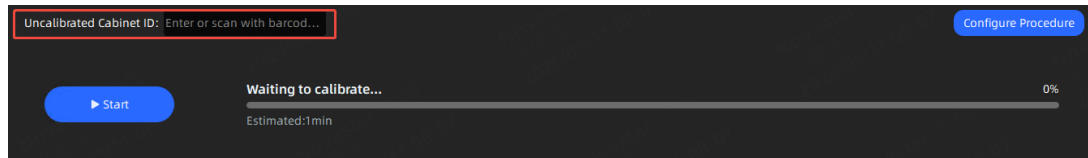


- Manually set the cabinet ID

Manually set the ID of the cabinet to be calibrated.

1. In the **Cabinet ID** area on the right of the **Start Calibration** screen, set **Numbering Method** to **Manual**.

You will need to manually enter the cabinet ID in the entry box next to **Uncalibrated Cabinet ID**.



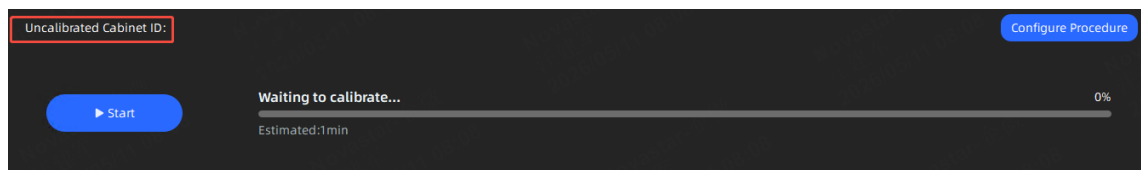
2. In the entry box next to **Uncalibrated Cabinet ID**, enter the cabinet ID or use a barcode scanner to scan the code.
 - The ID length cannot exceed 20 characters.
 - The entered characters cannot contain special characters like \/:*?]
 - When using a barcode scanner, you need to connect the barcode scanner to the system. After the barcode scanner scans the barcode on the cabinet, the calibration will automatically start.

- Read back the cabinet ID

Read back the cabinet ID that was pre-written in batches to the receiving card via the control software.

In the **Cabinet ID** area on the right of the **Start Calibration** screen, set **Numbering Method** to **Read**. The system will automatically read the cabinet ID written to the receiving card and display it at the bottom of the page.

After clicking **Start**, the system will automatically read and display the cabinet ID.



7.2.4.4 Set Module ID

Set the module ID and write it to the hardware. If the module is replaced, the receiving card will automatically detect the module ID change when it is powered on and then upload the calibration coefficients stored in the module's flash memory to the receiving card. This function requires support from the receiving cards.

Prerequisites

- The cabinet to be calibrated has module flash memory and supports module ID writing.
- The module flash memory arrangement is set and saved to the receiving card.
- The receiving card configuration file is imported.
- The **Write Module ID** step is checked in procedure configuration.

Note

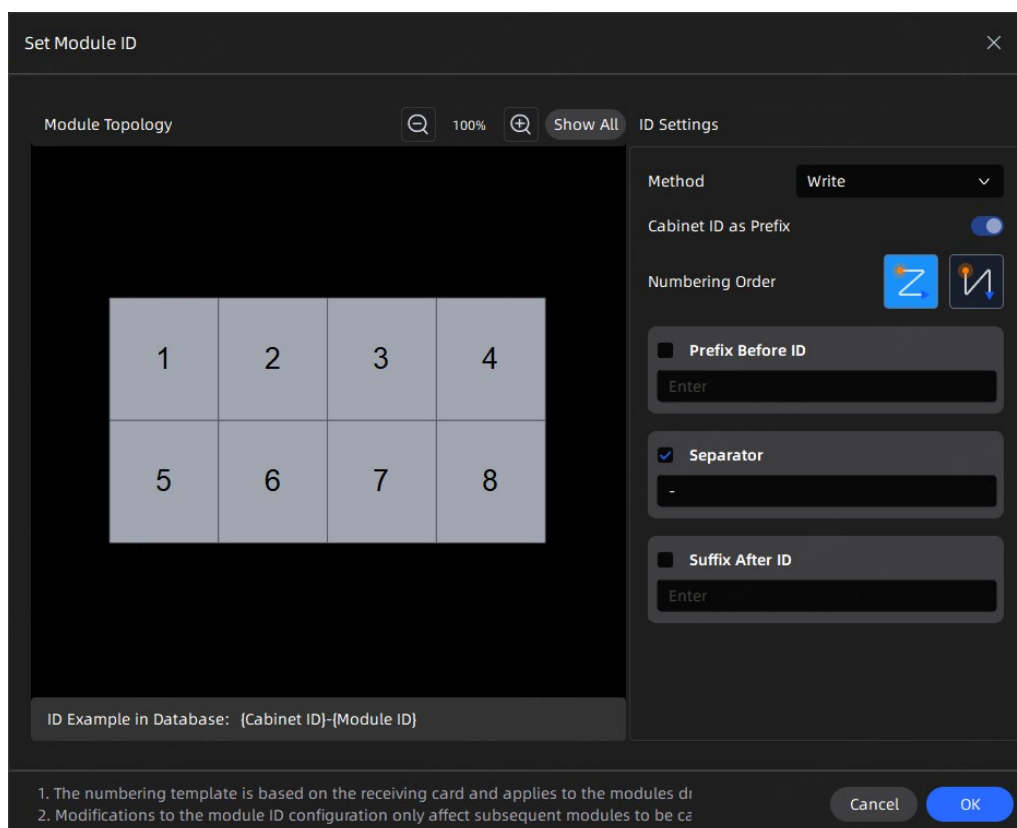
- When using the Mars control system, you need to manually set the module flash memory arrangement in NovaLCT. See [9.3 How to set module flash memory arrangement?](#) for details.
- When using the Coex control system, you need to manually set the module flash memory arrangement in Cabinet Tool. See [9.3 How to set module flash memory arrangement?](#) for details.

Procedure

Step 1 In the **Module ID** area on the right of the **Start Calibration** screen, click the **ID Settings** button to enter the **Set Module ID** window, as shown in [Figure 7-23](#).

This button is available only if the **Write Module ID** step is checked in procedure configuration.

Figure 7-23 Setting module ID



Step 2 In the window, set the module ID in either of the following ways.

- Set the numbering method to automatically set the module ID

Note: The module ID does not support special characters including \/:*?<>|

- Numbering Order: Select the order of setting the module ID, including "Z" type (default) and "N" type.
- Prefix Before ID: It is not checked by default. When it is checked, a fixed character will be added at the beginning of the cabinet ID.
- Separator: It is checked by default. The separator defaults to - and can be customized. When it is unchecked, the module ID will have no separators.
- Suffix After ID: It is not checked by default. When it is checked, a fixed character will be added at the end of the cabinet ID.

After the numbering method is set, click **Number** below. The ID of each module will be displayed on the module topology according to the method.

- Edit the module ID on the module topology

On the module topology, double click a module to edit its ID.

7.2.4.5 Start Calibration

Brightness and chroma calibration can be done automatically or manually.

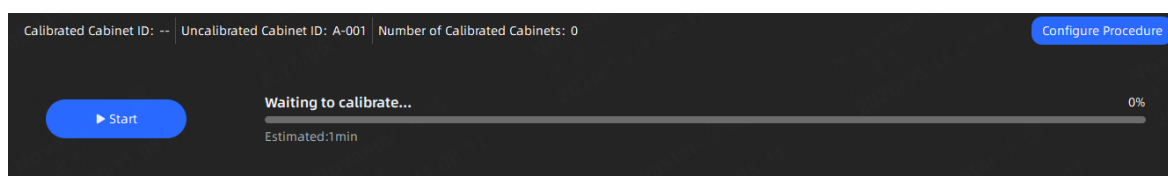
Automatic Calibration

Ensure that the following prerequisites have been met before operation.

- All devices are connected normally.
- Camera parameters and target values have been set.
- Cabinet ID settings are completed.
- Make sure the camera faces the cabinet to be calibrated during calibration.

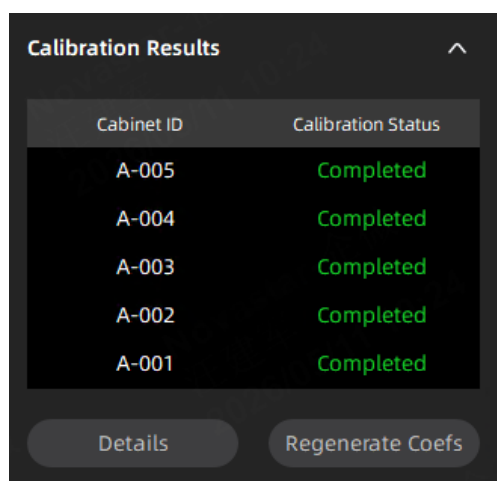
Step 1 On the **Start Calibration** screen, click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-24 Starting calibration



Step 2 In the **Calibration Results** area on the right, view the calibration result of the current batch.

Figure 7-25 Calibration results

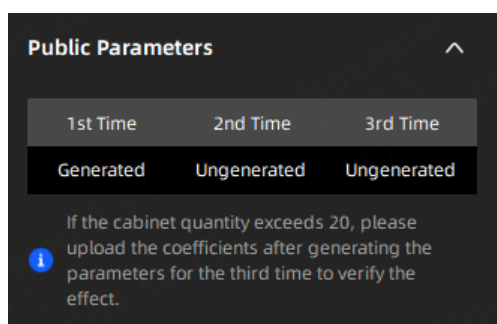


Cabinet ID	Calibration Status
A-005	Completed
A-004	Completed
A-003	Completed
A-002	Completed
A-001	Completed

Details Regenerate Coefs

Step 3 Generate public parameters.

Figure 7-26 Public parameters



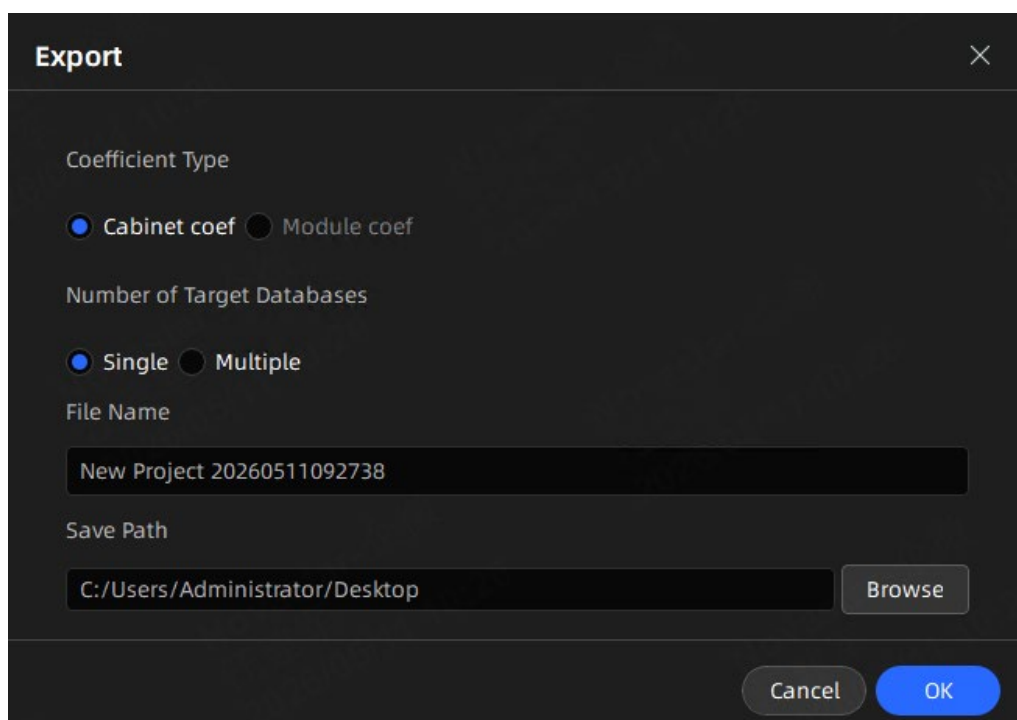
1st Time	2nd Time	3rd Time
Generated	Ungenerated	Ungenerated

If the cabinet quantity exceeds 20, please upload the coefficients after generating the parameters for the third time to verify the effect.

- First public parameter generation: When the system completes the calibration of the first 5 cabinets and starts the calibration of the 6th cabinet, it automatically generates this parameter and automatically updates the first 5 cabinets to the data after the public parameter generation.
- Second public parameter generation: When the system completes the calibration of the first 10 cabinets and starts the calibration of the 11th cabinet, it automatically generates this parameter and automatically updates the first 10 cabinets to the data after the public parameter generation.
- Third public parameter generation: When the system completes the calibration of the first 20 cabinets and starts the calibration of the 21st cabinet, it automatically generates this parameter and automatically updates the first 20 cabinets to the data after the public parameter generation.

Step 4 In the **Export Coefs** area on the right, click the **Export Coefficients** button to export the generated public coefficients to the local drive.

Figure 7-27 Exporting coefficients

The image shows a dark-themed 'Export' dialog box with a close button (X) in the top right corner. It contains several settings: 'Coefficient Type' with radio buttons for 'Cabinet coef' (selected) and 'Module coef'; 'Number of Target Databases' with radio buttons for 'Single' (selected) and 'Multiple'; a 'File Name' text field containing 'New Project 20260511092738'; and a 'Save Path' text field containing 'C:/Users/Administrator/Desktop' with a 'Browse' button to its right. At the bottom are 'Cancel' and 'OK' buttons.

- Coefficient Type: Select to export coefficients by cabinet or by module.
- Number of Target Databases: Select to save as a single database or multiple databases.
- File Name/Folder Name: Set the name of a single database or the folder name of multiple databases when exporting coefficients.
- Save Path: Select the storage location for the exported coefficients by clicking **Browse**.

Step 5 Build the calibrated cabinets into a screen, upload the coefficients exported in [Step 4](#) to the screen via NovaLCT, and view the calibration effect.

Note

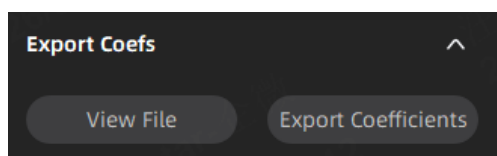
When checking the calibration effect after calibration, use the CC3 software to display the test pattern or adjust the brightness.

7.2.4.6 View Calibration Coefficient File

Step 1 In the **Export Coefs** area on the right, click the **View File** button, and the software will automatically open the folder where the coefficients are stored.

Step 2 View the calibration coefficient file.

Figure 7-28 Viewing calibration coefficient file



7.2.4.7 Brightness and Chroma Calibration for Large and Small Cabinets

After completing the calibration for a large cabinet, you can quickly calibrate a small cabinet that has identical LED module specifications by directly copying the parameters from the calibrated large cabinet.

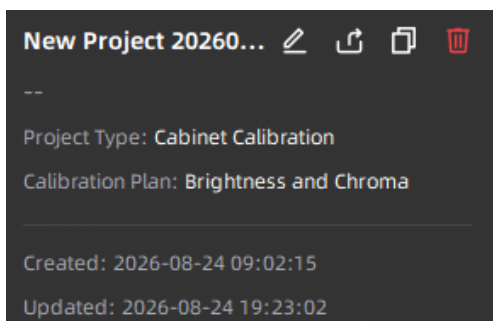
Prerequisites

- The brightness and chroma calibration for the large cabinet has been completed.
- The LED module specifications of the large and small cabinets are identical.
- The calibration environment for the small cabinet (including camera parameters, camera position, etc.) remains consistent with that of the large cabinet.
- The small cabinet has been configured in the control system.

Procedure

- Step 1 On the CC3 startup screen, click  in the upper right corner of the completed cabinet calibration project to duplicate it for the small cabinet calibration.

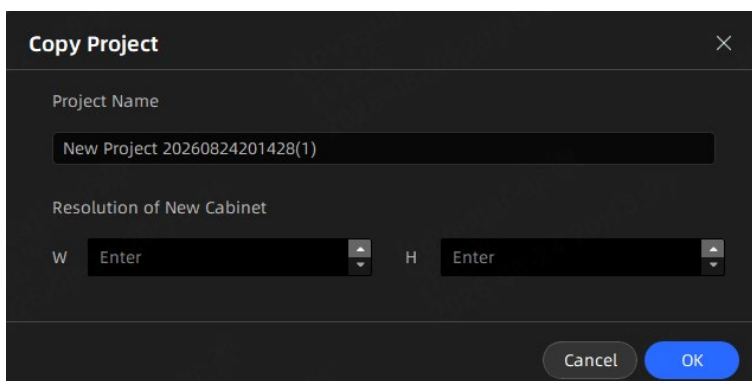
Figure 7-29 Duplicating a brightness and chroma calibration project.



- Step 2 Fill in the information for the small cabinet to be calibrated.

- Under **Project Name**, enter the project name.
- Under **Resolution of New Cabinet**, enter the width and height of the small cabinet.

Figure 7-30 Filling in small cabinet information



Step 3 Click the name of the duplicated calibration project to enter the small cabinet calibration screen.

Step 4 On the **Prepare Environment** screen, connect the devices according to the requirements in 7.2.1 Prepare Environment.

Step 5 Click **Start Calibration** to enter the calibration startup screen.

Refer to the requirements from 7.2.4.1 Configure Calibration Procedure to 7.2.4.5 Start Calibration to perform the brightness and chroma calibration for the small cabinet.

7.3 High-Precision Brightness and Chroma Calibration

7.3.1 Prepare Environment

In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution and partition, connect a camera, colorimeter, thermometer and barcode scanner. The preparation steps are the same as those for the brightness and chroma calibration. For details, see [7.2.1 Prepare Environment](#).

Notes

- Only the NOS-CC60 imaging colorimeter is supported. Digital cameras and the C3200 industrial camera are not supported.
- A colorimeter and a thermometer must be connected to capture the brightness, color, and temperature information from the display during feature learning.

7.3.2 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

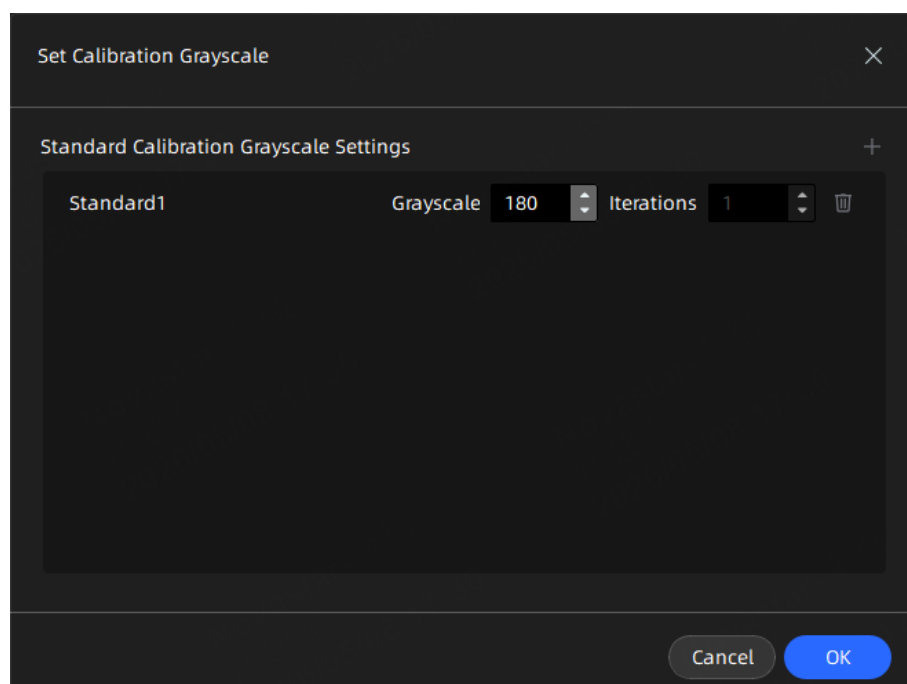
7.3.2.1 Set Calibration Grayscale

Set grayscale values for functions such as live preview, smart analysis and calibration.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

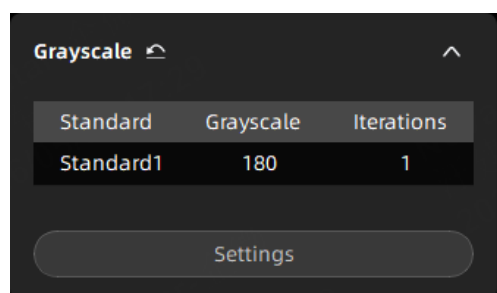
Step 2 In the **Grayscale** area on the right, click **Settings** to enter the grayscale settings screen.

Figure 7-31 Setting calibration grayscale



- Grayscale: The default value is 180, and the value range is 1 to 255. This plan only supports settings of one layer of calibration grayscale.
- Iterations: It should be set to 1 and cannot be changed.
- Click  next to **Grayscale** to restore the grayscale values to the default values.

Figure 7-32 Calibration grayscale

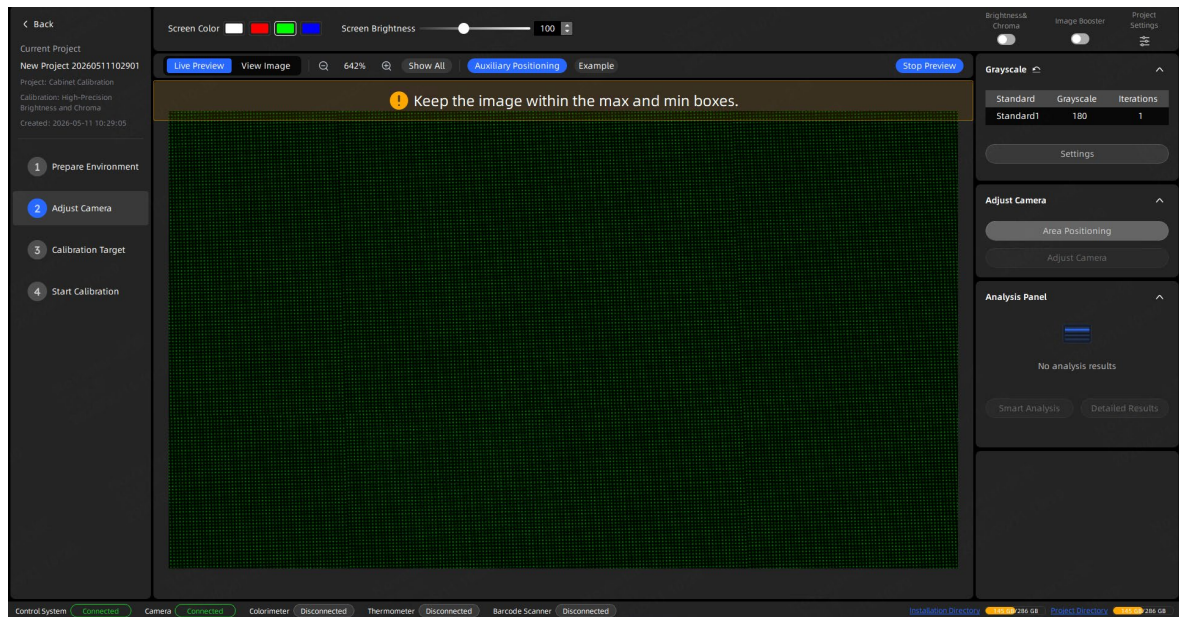


7.3.2.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or scroll the mouse wheel to zoom the view to assist in adjusting the live preview image.

Figure 7-33 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

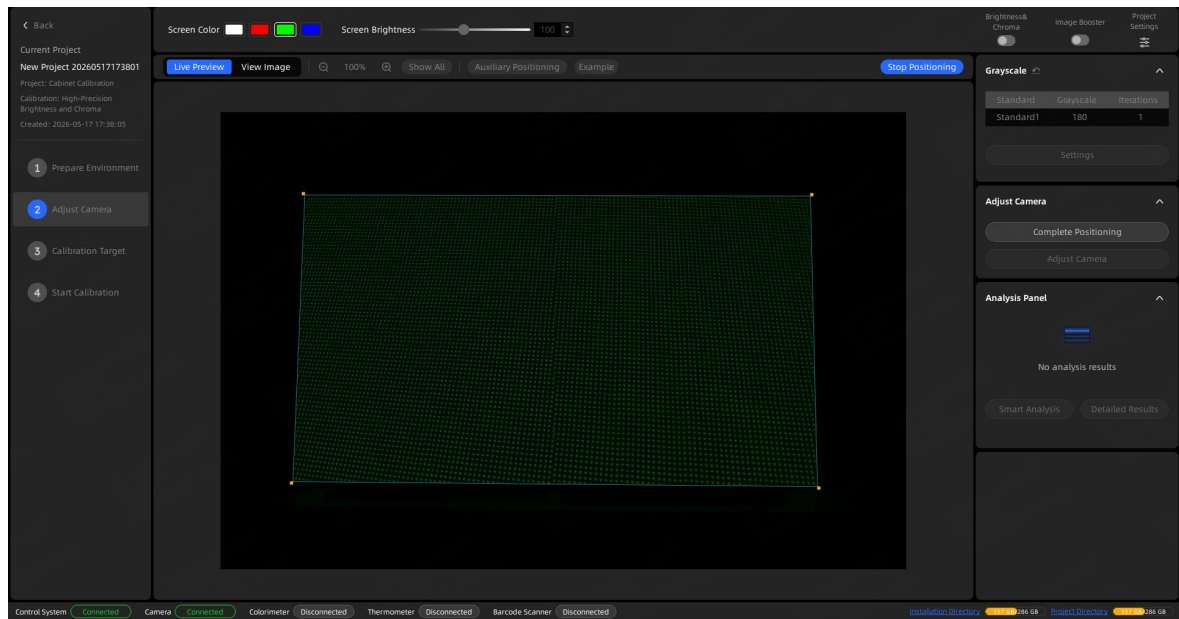
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.3.2.3 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

- Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-34 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

7.3.2.4 Adjust Camera

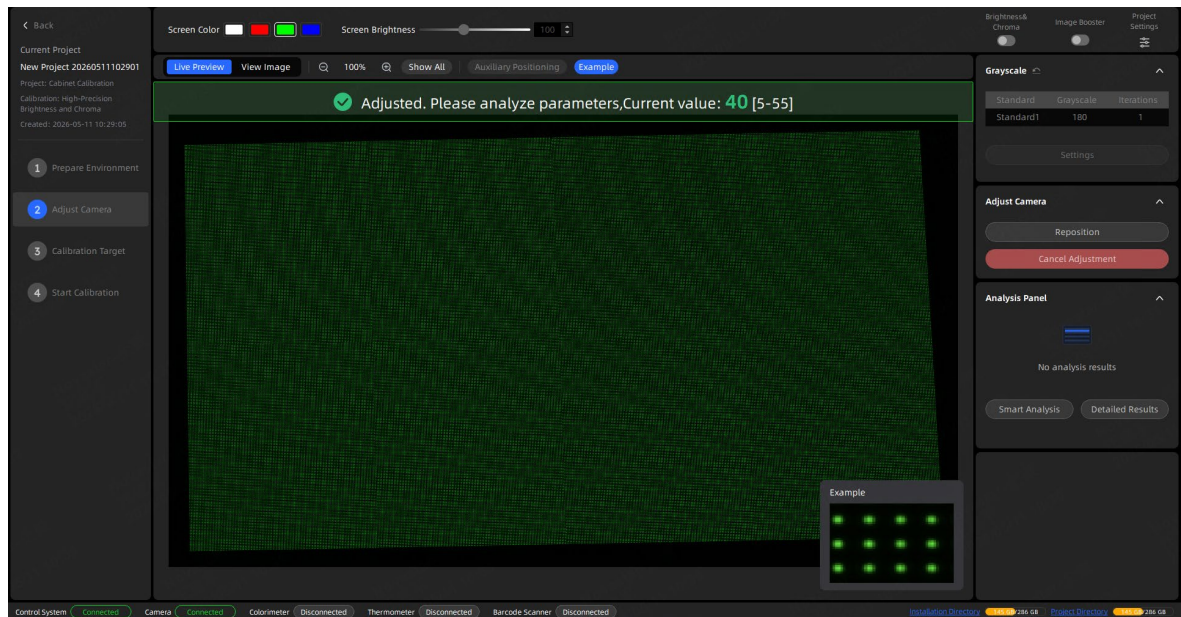
The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the values on the screen.

Figure 7-35 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

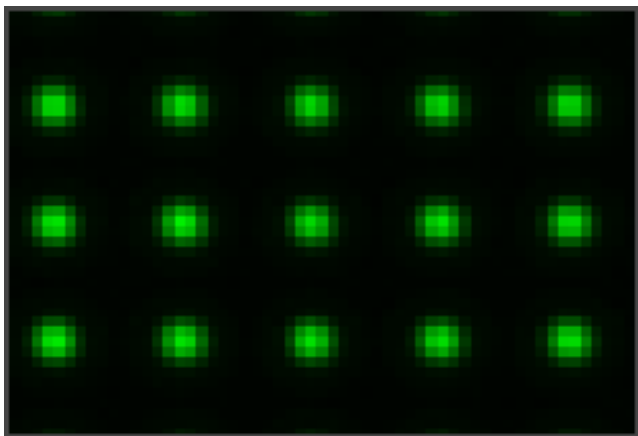
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should be clear, as shown below.



7.3.2.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

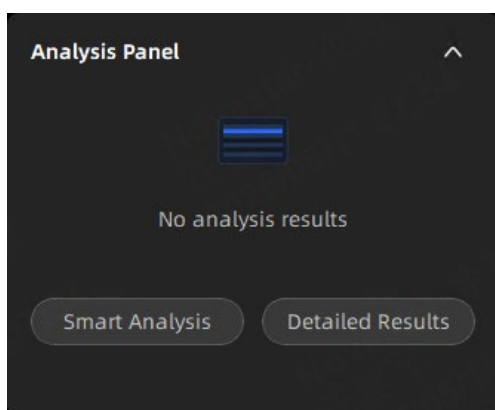
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

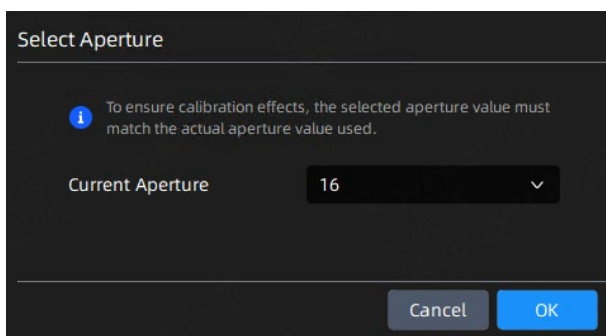
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-36 Smart analysis



- Step 2 When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-37 Setting aperture information



- Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.
- If a white value is displayed next to the color, the value is normal and the smart analysis is completed.

- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Note

- The high-precision brightness and chroma calibration plan currently only supports collecting all grayscale with one aperture.
- During parameter analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscale. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform camera parameter analysis again.
- If the aperture is adjusted, you must return to the aperture selection step to reset the value to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the smart analysis is completed, if any parameters of the camera are modified, you must perform area positioning and smart analysis again; otherwise the calibration effect will be affected.

7.3.3 Calibration Target

7.3.3.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the cabinet to be calibrated. They are used to calculate the calibration target values.

The high-precision brightness and chroma calibration plan does not need to capture original values. The original values will be captured during the feature learning process and automatically refreshed after feature learning is completed.

7.3.3.2 Set Target Values

Prerequisites

Before calibration, adjust the color temperature value in the receiving card configuration file or NCP file to match or closely align with the screen's shipment color temperature requirements.

Procedure

Adjust the white brightness reduction or color temperature according to the client's expected shipping standards. After feature learning, new recommended target values will be generated based on the captured original values.

Step 1 On the project home screen, select the **Calibration Target** tab.

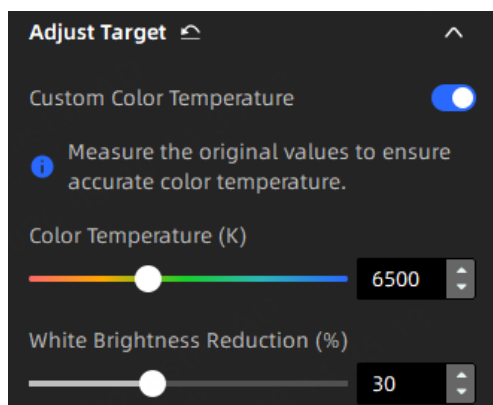
Step 2 Set the target values using one or a combination of the following ways.

 Note

To balance white brightness reduction with color temperature, first disable **Custom Color Temperature**. Adjust the white brightness reduction as needed, then enable **Custom Color Temperature** and set it to the desired value.

- Enable **Custom Color Temperature**.

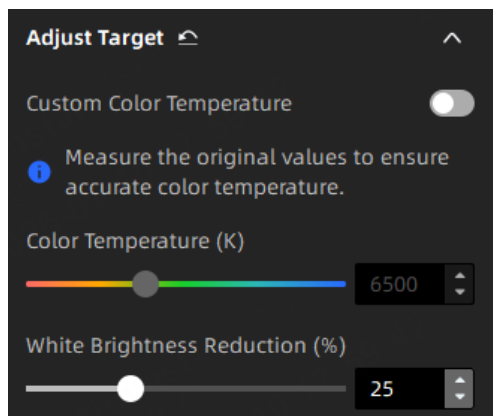
Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



Drag the **Color Temperature** slider, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

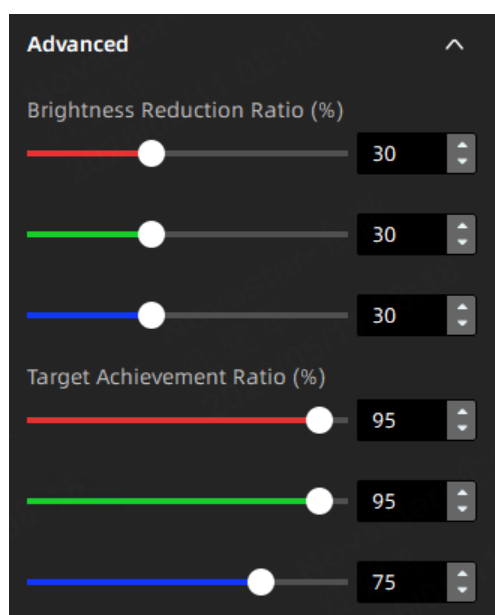
- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio
 - a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
 - b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.
- Set the target values in the color gamut distribution chart

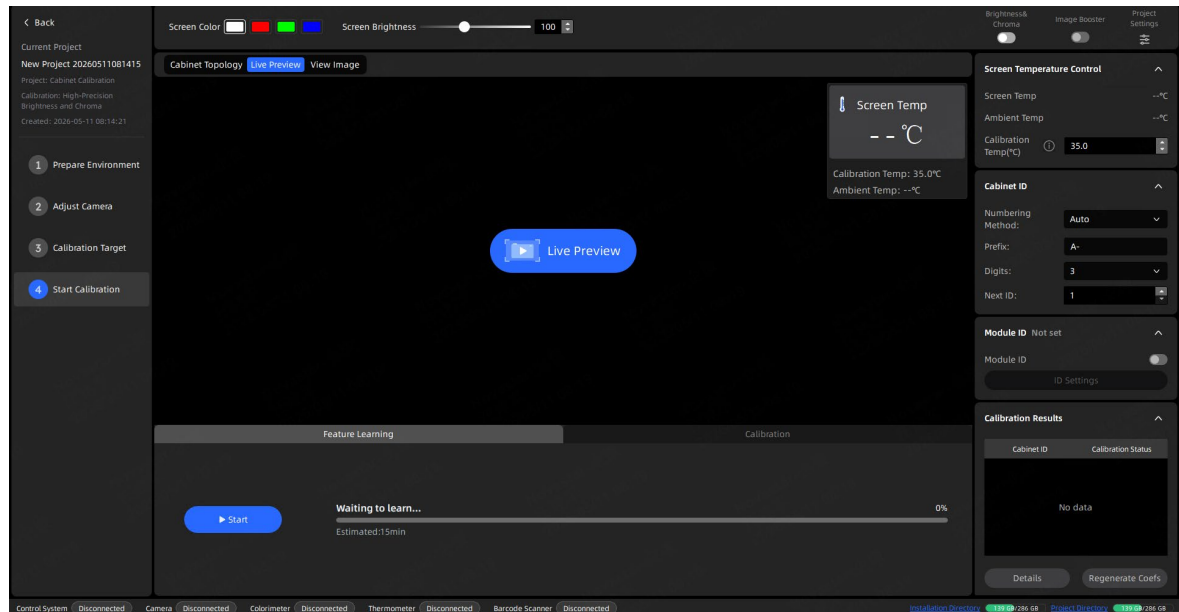
In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.
- Click ↺ next to **Adjust Target** to restore both original and target values to the default values.

7.3.4 Start Calibration

Perform feature learning on sample cabinets, configure the calibration parameters and procedure, start

calibration, view calibration results and export calibration coefficients.

Figure 7-38 Starting calibration



- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.3.4.1 Control Screen Temperature

Before feature learning, you need to set the screen temperature during calibration.

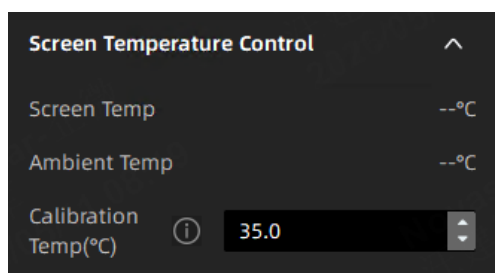
Prerequisites

- The thermometer is connected.
- The cabinets to be calibrated are placed in the darkroom. For specific requirements of the darkroom environment, please refer to [5.1.1 Darkroom Requirements](#).

Procedure

Select a normal cabinet, power it on, use the highest grayscale to display a white image on a cold screen for 90s, and set the resulting temperature as the calibration temperature.

Figure 7-39 Controlling screen temperature



7.3.4.2 Feature Learning

Learn the public characteristics of cabinets in the same batch to ensure that the calibration speed and effect can be effectively improved in the subsequent batch calibration process.

Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the feature learning process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

Step 1 Select sample cabinets for feature learning and ensure the brightness difference of the samples should be within 7%.

Step 2 On the **Start Calibration** screen, click the **Feature Learning** tab to access the feature learning screen.

Step 3 Click **Start** and the system will automatically capture the feature data of the current cabinet.

There are strict requirements for the cabinet temperature during feature learning.

- If the current cabinet temperature is 0.3°C higher than the set calibration temperature, the system will prompt you to power off the cabinet to cool it down.
- If the current cabinet temperature is 0.3°C lower than the set calibration temperature, the system will automatically heat the cabinet to the calibration temperature.

Step 4 When CC3 automatically reaches the colorimeter measurement step, it will pop up the colorimeter configuration information.

Figure 7-40 Configure colorimeter

Configure Colorimeter [X]

Please connect a colorimeter and set the capture area.

Model: CA410 [v] [Connect]

Start Coordinates: X 25 [v] Y 25 [v]

Side Length: 25 [v]

i 1. Capture areas cannot be located at the module seams, and the area expanded threefold must not exceed the cabinet.
2. It is recommended that the capture area be 2 pixels larger than the colorimeter's measurement aperture.
3. After setting, keep the colorimeter facing the capture area without moving until the capture is completed.

[OK]

If the colorimeter connection has been completed during environment preparation, **Connected** will be displayed on the right side of **Model**. If the colorimeter is not connected, select the currently used colorimeter next to **Model** and click **Connect** to complete the connection.

A white capture area of **Side Length** size will be displayed on the cabinet. In **Start Coordinates**, you can set the position of the colorimeter capture area. Once done, align the capture head of the colorimeter with the white color block on the cabinet.

Note

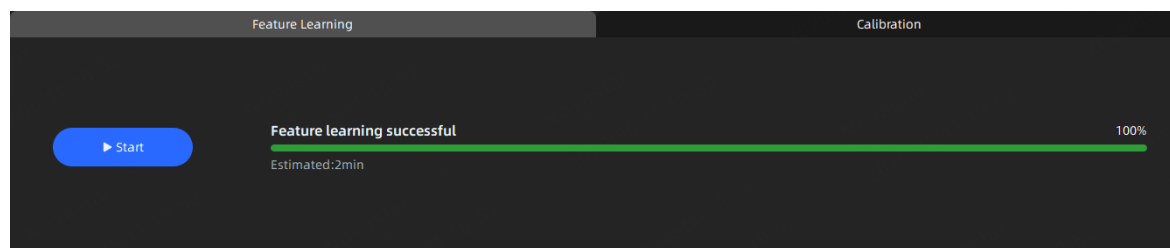
- When configuring the capture area, please refer to the instructions on the colorimeter configuration screen, otherwise it will affect the feature learning effect.
- Capture areas cannot span across modules and it is recommended that the capture area be 2 pixels larger than the diameter of the colorimeter's measurement aperture. During the capture process, keep the colorimeter facing the capture area without moving.

Step 5 Click **OK**, and CC3 will capture chroma through the colorimeter.

After the chroma capture is completed, CC3 will pop up instructions to remove the colorimeter. You need to remove the colorimeter first, and then click **OK**.

Step 6 When the progress bar turns green and prompts "Learning successful", feature learning is completed.

Figure 7-41 Feature learning completed



7.3.4.3 Confirm Target Values

After feature learning, new target values will be automatically generated based on the captured original brightness and chroma values of the sample cabinets, as well as your settings for white brightness reduction and color temperature.

At this time, you need to return to the **Calibration Target** screen to confirm the target values.

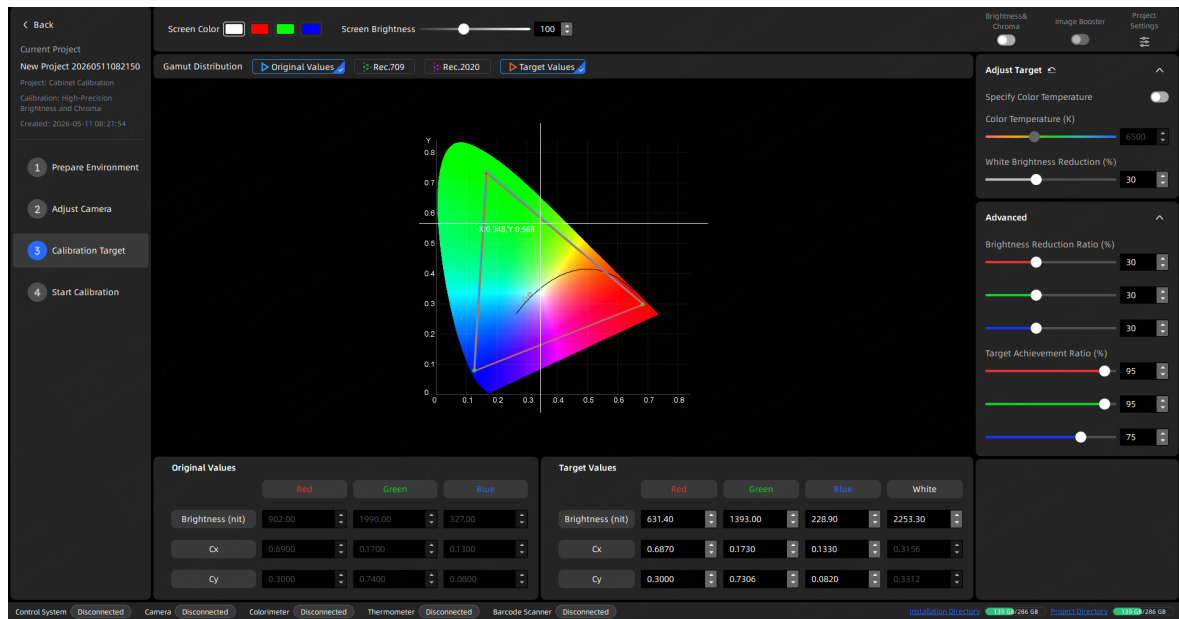
1. Check whether the target values generated by feature learning meet the shipping standards.

It is recommended to use the target values generated by feature learning to ensure optimal calibration results. If there are strict shipping standards, you may also fine-tune the existing parameters.

2. Adjust the target values as needed.

When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Figure 7-42 Confirming target values



7.3.4.4 Set Cabinet ID and Module ID

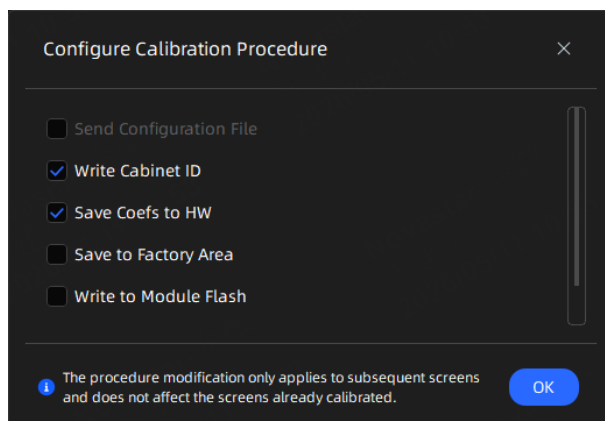
The cabinet and module IDs can be set. The procedure is the same as for brightness and chroma calibration. See [7.2.4.3 Set Cabinet ID](#) and [7.2.4.4 Set Module ID](#).

7.3.4.5 Configure Calibration Procedure

You have the option to customize the calibration procedure based on the condition of the cabinet to be calibrated.

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab, and then click **Configure Procedure** in the lower right corner to open the **Configure Procedure** window.
- Step 2 Check the relevant calibration steps as needed.

Figure 7-43 Configuring procedure



- Send Configuration File

Send the configuration file to the receiving card. If the configuration file used in the cabinet to be calibrated is an NCP file, CC3 does not support sending the configuration file.

- Write Cabinet ID

Write the cabinet ID to the receiving card.

- Save Coefs to HW

The parameters after calibration will be automatically saved into the receiving card of the cabinet.

- Save to Factory Area

Save the calibration coefficients to the factory area of the receiving card. After the coefficients are adjusted or lost, you can apply the factory area coefficients to the application area and the coefficients will be restored to the original data.

- Write to Module Flash

Write the calibration coefficients to the module flash memory for backup.

- Save Rv Card Parameters

Save the receiving card configuration file to hardware to prevent the loss of the file after the screen is powered off and on again. If the configuration file used in the cabinet to be calibrated is an NCP file, there is no need to send or save the configuration file.

Step 3 After the procedure is configured, click **OK** below.

7.3.4.6 Calibrate Sample Cabinets

Calibrate the sample cabinets that have undergone feature learning and assemble them into a screen (3x3 cabinets at least recommended) to verify the calibration effect.

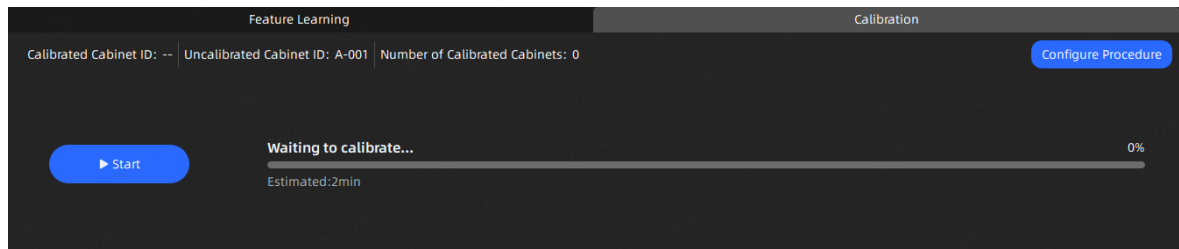
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- Target values are confirmed.
- The calibration procedure is configured, and cabinet ID settings are completed.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

Step 1 On the **Calibration** tab page in the lower part of the **Start Calibration** screen, click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

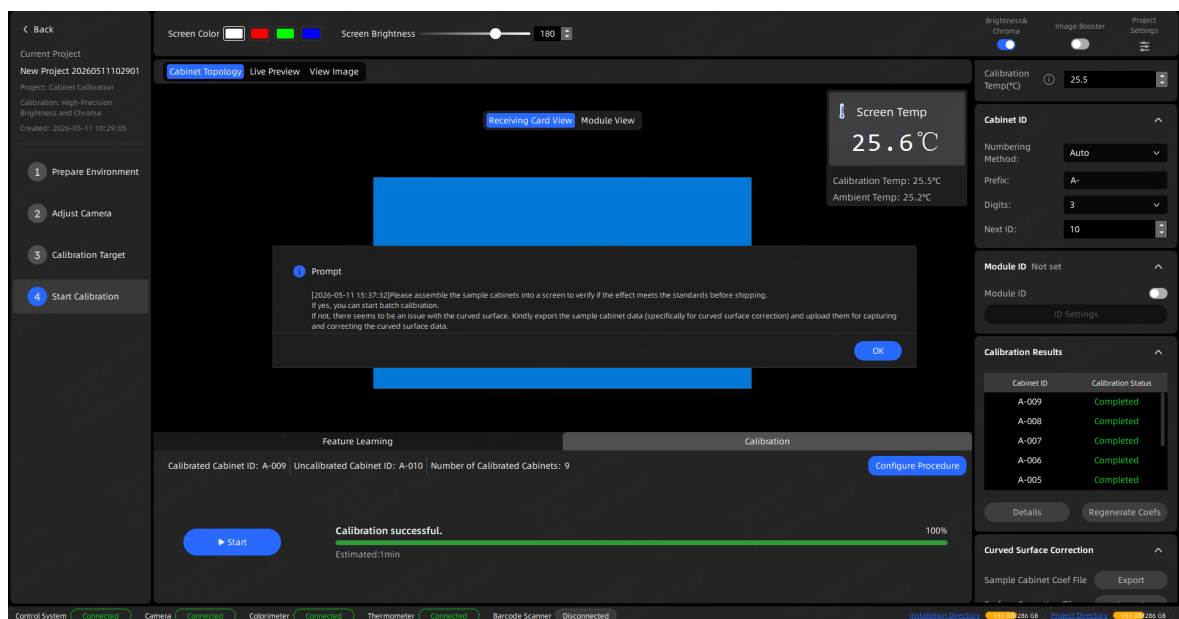
Figure 7-44 Calibrating sample cabinets



Step 2 Recalibrate at least 9 sample cabinets, assemble the calibrated sample cabinets into a screen to verify the calibration effect.

Step 3 Evaluate the full-screen calibration results to determine if there are any curved surface transition issues.

Figure 7-45 Assembling sample cabinets into a screen



- If the calibration results are satisfactory, refer to [7.3.4.8 Batch Calibration](#) to complete the batch calibration of cabinets.
- If the calibration results do not meet expectations, first refer to [7.3.4.7 Curved Surface Correction](#) to complete curved surface correction before proceeding with batch calibration.

Note

- When checking the calibration effect after calibration, use the CC3 software to display the test pattern and adjust the brightness.
- After completing the sample cabinet calibration, the camera parameters, camera position, and sample cabinet position must remain unchanged to ensure the results of the batch calibration.

7.3.4.7 Curved Surface Correction

If curved surface issues are present after sample cabinet calibration, refer to this section to implement the curved surface correction procedure. This will enhance the overall visual effect of the batch of cabinets when assembled, ensuring smooth curved surface transitions and achieving higher display quality.

Related Information

If the customer expects uniform display performance at higher screen temperatures, capture the data after the screen has been preheated. Otherwise, proceed with data capture on a cold screen.



Note

When performing curved surface correction, do not move or adjust the calibration environment used during sample cabinet calibration.

Procedure

In the **Curved Surface Correction** area on the right, click **Export** to save the coefficient files of sample cabinets to your local computer.

Please refer to the operating steps in [7.7 Curved Surface Correction](#) to perform the correction.

7.3.4.8 Batch Calibration

High-precision calibration can be done automatically or manually.

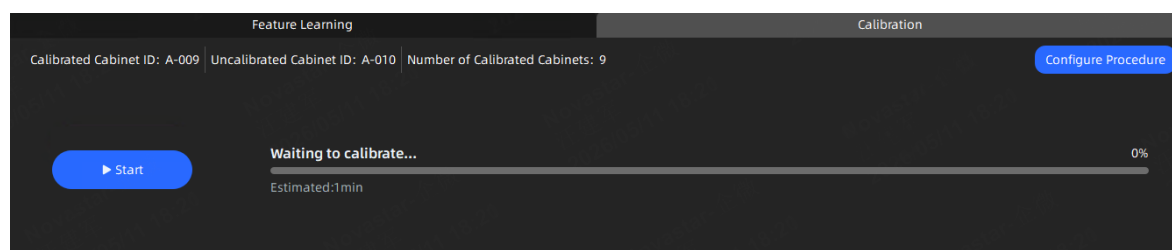
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The curved surface effect of the sample cabinet correction meets the expected results.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Start Calibration

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab to access the calibration screen.
- Step 2 Click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-46 Starting calibration



Step 3 View the calibration progress and the status.

During calibration, the execution progress, status and other information of each calibration step will be displayed. You can cancel, pause and end calibration based on the actual situation.

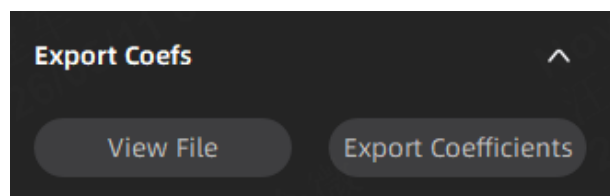
- If the execution is successful, the progress bar will be green and the progress will display 100%.
- If the execution fails, an "Error" message, the failed step name, and the failure reason will be displayed above the progress bar. Troubleshoot the issue based on the provided reason. After troubleshooting is complete, click the step name again.

Step 4 In the **Calibration Results** area on the right, view the calibration result.

7.3.4.9 View and Export Calibration File

After calibration is complete, you can view or export the calibration coefficients in the **Export Coefs** area at the bottom right of the **Start Calibration** screen.

Figure 7-47 Viewing calibration coefficient file



View Calibration Coefficients

Click **View File**, and the software will automatically open the folder where the coefficients are stored.

Export Coefficients

Step 1 Click **Export Coefficients** to open the coefficient export screen.

Figure 7-48 Exporting coefficients

Export

Coefficient Type

☒ Cabinet coef ☐ Module coef

Number of Target Databases

☒ Single ☐ Multiple

File Name

New Project 20260511092738

Save Path

C:/Users/Administrator/Desktop Browse

Cancel OK

- Step 2 Configure the coefficient type for calibration coefficient export. Currently, only **Cabinet Coef** can be selected.
- Step 3 Select to save as a single database or multiple databases.
- Single: Export the coefficients of all currently calibrated cabinets to a single database file.
 - Multiple: Export coefficients for all currently calibrated cabinets by cabinet ID. The name of the exported database file is "*Cabinet ID + Export Time*".
- Step 4 Under **File Name** or **Folder Name**, set the name of the file or folder where the exported coefficients are located
- Step 5 Under **Save Path**, set the save path for the exported coefficients.
- Step 6 Click **OK**, and the system will automatically export coefficients.
- Step 7 After the export is complete, click **OK** to finish coefficient export.

7.4 Low-Grayscale Calibration

7.4.1 Prepare Environment

In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution and partition, connect a camera, thermometer and barcode scanner. The preparation steps are the same as those for the brightness and chroma calibration. For details, see [7.2.1 Prepare Environment](#).

Notes

- Only the NOS-CC60 imaging colorimeter is supported. Digital cameras and the C3200 industrial camera are not supported.
- A thermometer must be connected to capture the temperature information from the display during feature learning.
- It is recommended to use this in conjunction with a controller. Please select the following models with the latest firmware from the official NovaStar website.

Control System: COEX series devices (latest version).

7.4.2 Adjust Camera

Click **Adjust Camera** to enter the camera adjustment screen. Here, you can preview the images captured by the camera, set the low-grayscale parameters, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

7.4.2.1 Configure Low-Grayscale Parameters

Since different chips require different values, please follow the parameters recommended by the chip manufacturer for configuration. Some low-grayscale parameters affect display performance, so it is advisable to verify and apply them before conducting smart analysis and calibration.

- Step 1 In the **Low-Grayscale Parameters** area on the right, configure the parameters based on the used chip.

Figure 7-49 Low-grayscale parameters

Other manufacturers' chip

The screenshot shows the 'Low-Grayscale Parameters' interface for other manufacturers' chips. It includes a 'Step' dropdown set to 1, a 'Max Coef' dropdown set to 15, and 'Initial Coefs' for R, G, and B channels, each set to 14. There is an 'Apply' button below these settings. Further down, there is a 'Low-Grayscale Uniformity' dropdown and a 'Calibration Grayscale Gamma' dropdown set to 128, with another 'Apply' button at the bottom.

TBSilicon chip

The screenshot shows the 'Low-Grayscale Parameters' interface for TBSilicon chips. It includes a 'Step' dropdown set to 1, a 'Max Coef' dropdown set to 15, and 'Initial Coefs' for R, G, and B channels, each set to 7. There is an 'Apply' button below these settings. Further down, there is a '* Current Value' section with R, G, and B channels each set to 64, a 'Brightness coef' dropdown set to 1, and an 'Apply' button at the bottom.

- **Step:** This sets an incremental value on top of the initial low-grayscale coefficient, used for calculating parameters during the low-grayscale calibration process.
- **Max Coef:** To prevent coefficients from exceeding the receiving card's range and causing display anomalies, you can set the maximum value for the low-grayscale calibration coefficient. All coefficients generated through calibration will not exceed this value.
- **Initial Coefs:** This sets the initial baseline for red, green, and blue colors during the camera calibration. Subsequent calibration coefficients will iterate based on this baseline.
- **Low-Grayscale Uniformity:** Enter a low-grayscale uniformity value to make the non-uniform characteristics of the display more apparent in low-grayscale segments, facilitating later calibration.
- **Calibration Grayscale Gamma:** This sets the gamma for calibration grayscale. A higher value results in brighter calibration grayscale, which can enhance low-grayscale brightness for calibration.
- **Current:** This sets the current value. When using the TBS chip, which supports variable current, the entered current will serve as the calibration current. Higher current results in brighter calibration grayscale. This parameter is visible and configurable when the cabinet chip is a TBS chip. The default value is 64.
- **Brightness Coef:** This sets the brightness coefficient. For displays with a scan count below 32, it's recommended to select 1 or 2. For those above 32, select 4 or 8. This parameter is visible and configurable when the cabinet chip is a TBS chip.

Step 2 Click **Apply** to send the parameters to the cabinet to be calibrated.

Note

- It is recommended to use the default values for all low-grayscale parameters for calibration, as they cover most use cases. If default values do not yield satisfactory results, contact NovaStar official technical support for tuning and optimization.
- After low-grayscale calibration is complete, restore the **Calibration Grayscale Gamma** parameter to its original value, as failing to do so may affect subsequent calibration or debugging results.

Reference

Recommended low-grayscale parameter values differ based on the cabinet's chip. The table below provides the recommended values for several IC manufacturers.

Chip Manufacturer	Model	Step	Max Coef	Initial Coefs (RGB)	Low-Grayscale Uniformity
Chipone	2260	2	15	5 or 9	0 or 3
	2270	2	15	5 or 9	0 or 3
Sunplus	XM11202G	1	255	6	1
	XM11480G	3	255	15	1

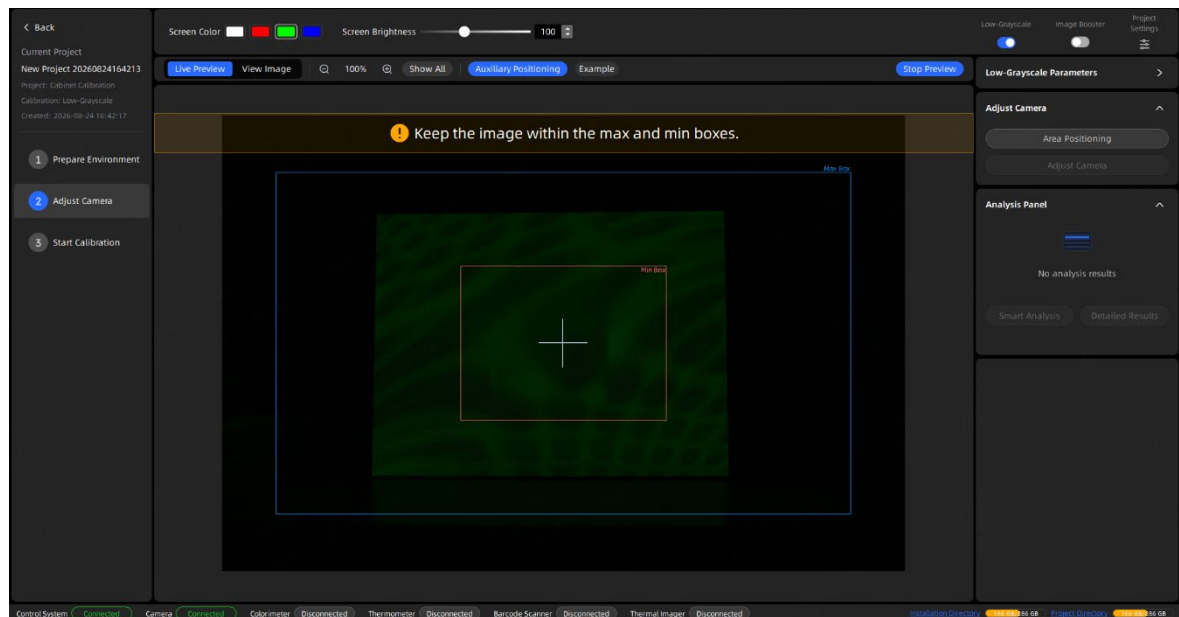
7.4.2.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.

Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-50 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

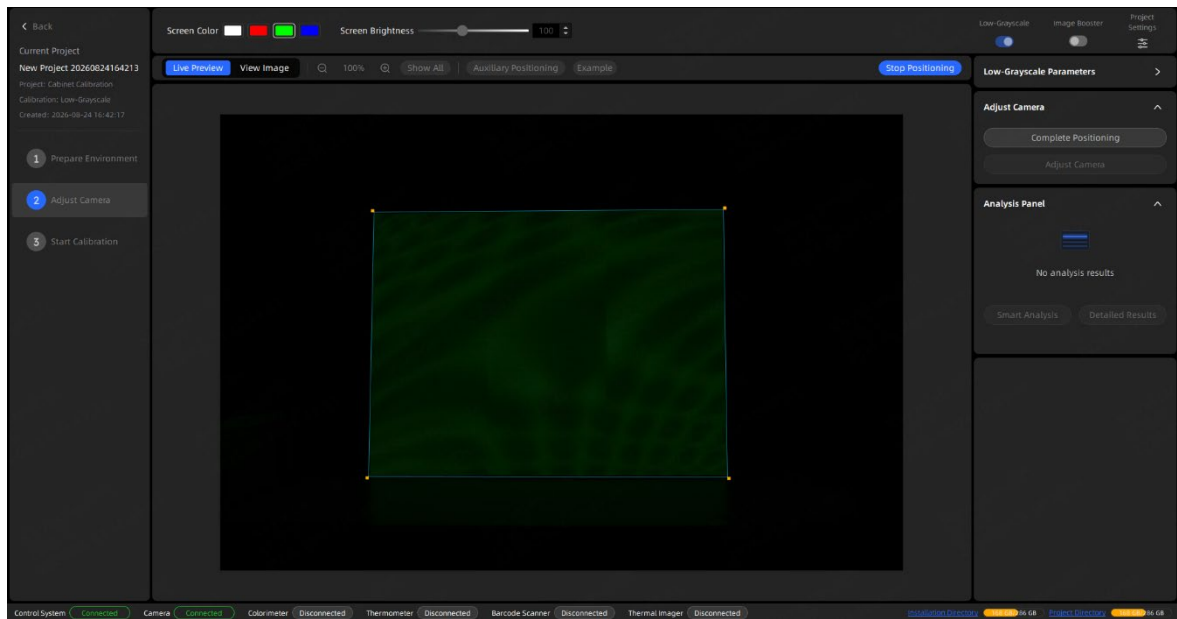
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.4.2.3 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-51 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

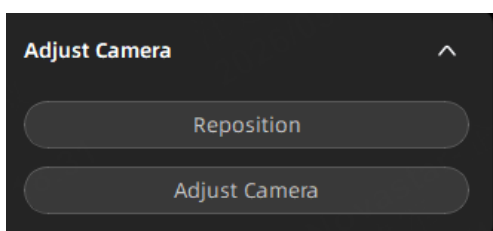
7.4.2.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Before proceeding with camera adjustment, ensure you have configured the low-grayscale parameters as described in [7.4.2.1 Configure Low-Grayscale Parameters](#).

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

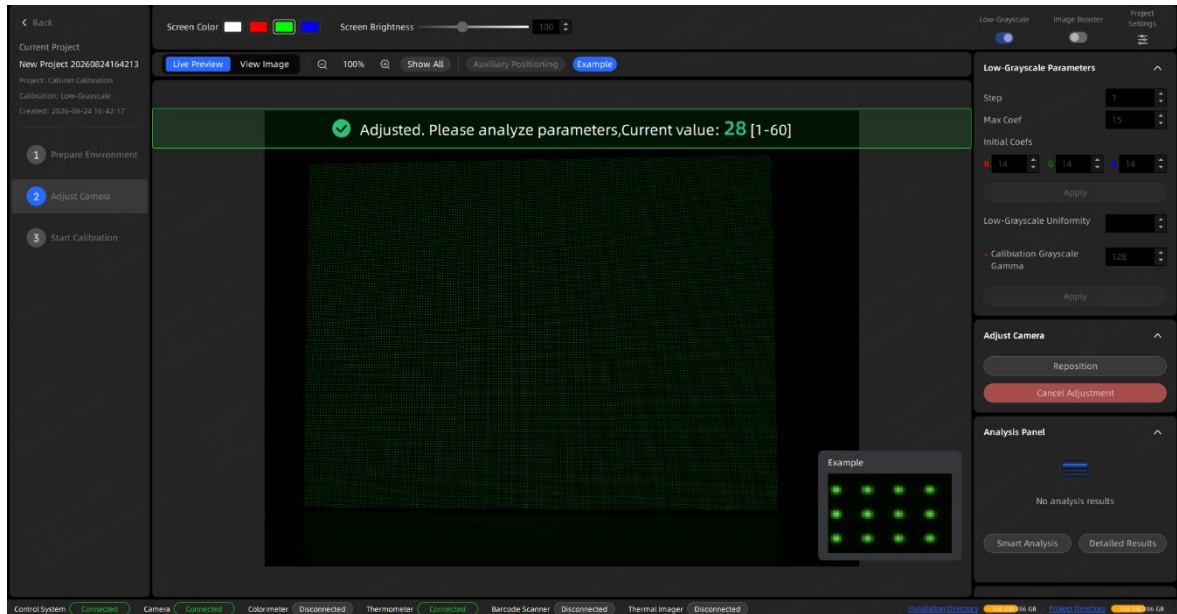
Figure 7-52 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-53 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

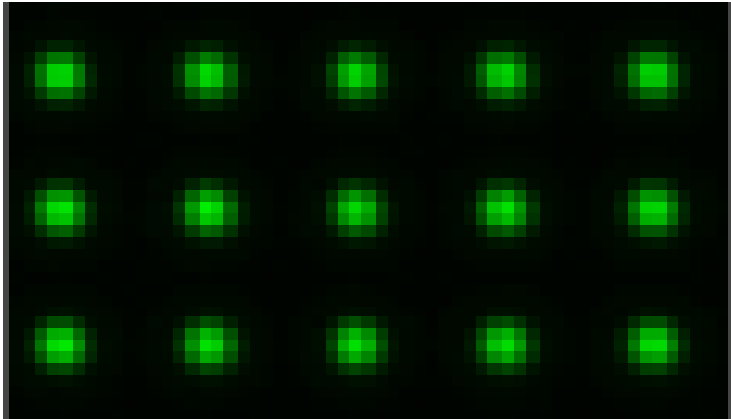
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

This plan does not support enabling Super Resolution Imaging. When this feature is disabled, the LED image should be clear, as shown below.



7.4.2.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

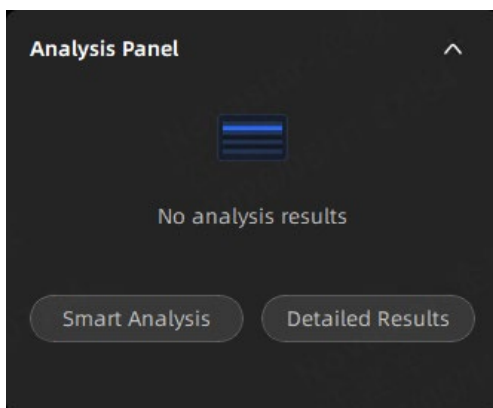
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

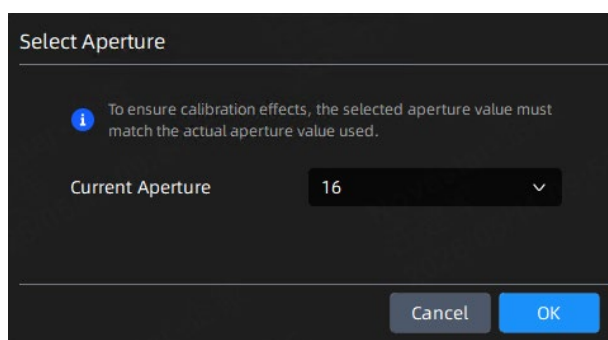
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-54 Smart analysis



- Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-55 Aperture settings



Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the smart analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 1%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Step 5 (Optional) Click **Detailed Results**. In the pop-up window, you can view the real-time analysis of the XYZ filters for each color at each captured grayscale level, along with the exposure time and gain.

Figure 7-56 Detailed results

Color	Exposure	Gain	Aperture	Peak Brightness 60-80	Image Size 1-60
R	350	100	22	69	26
G	150	100	22	70	29
B	1500	100	22	68	30

Note

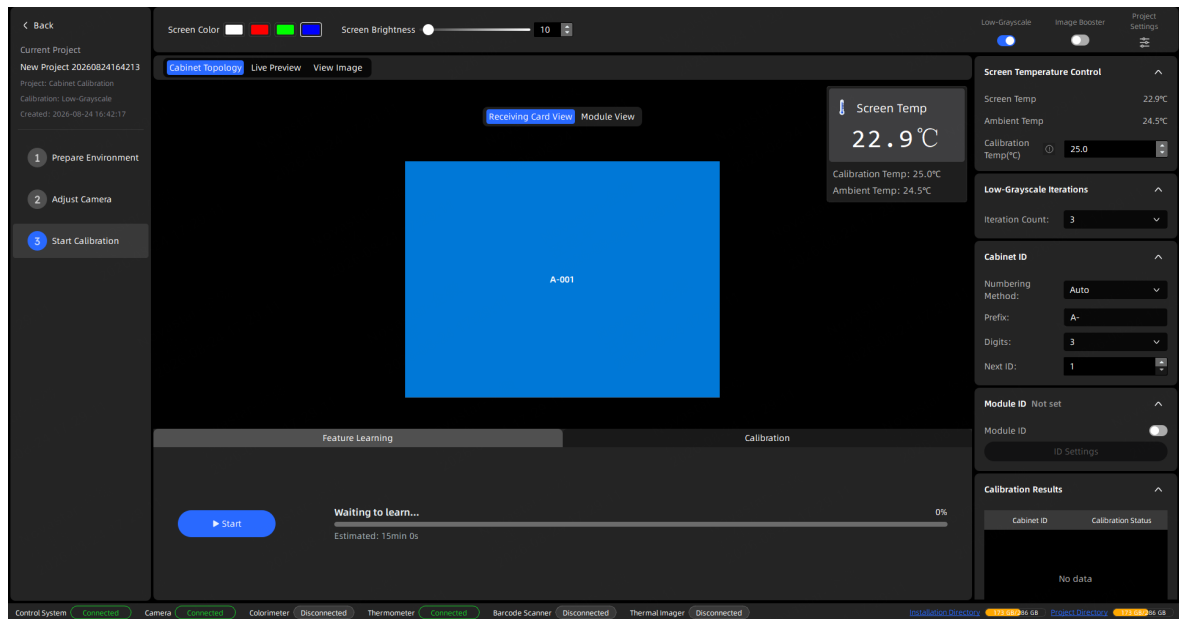
After the smart analysis is completed, if any parameters of the camera are modified, you must perform area positioning and smart analysis again; otherwise the calibration effect will be affected.

7.4.3 Start Calibration

Perform sample cabinet feature learning, configure the calibration parameters and procedure, start calibration and curved surface correction, view calibration results and export calibration coefficients.

Click **Start Calibration** on the left to enter the corresponding screen.

Figure 7-57 Start Calibration



- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.4.3.1 Control Screen Temperature

Before feature learning, you need to set the screen temperature during calibration.

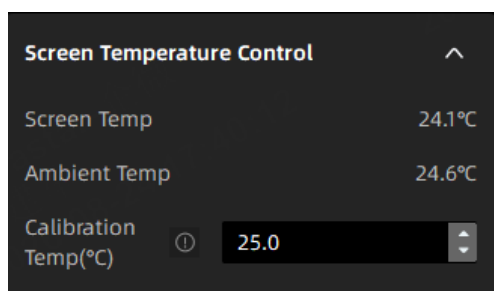
Prerequisites

- The thermometer is connected.
- The cabinets to be calibrated are placed in the darkroom. For specific requirements of the darkroom environment, please refer to [5.1.1 Darkroom Requirements](#).

Procedure

Select a normal cabinet, power it on, let it display a 100-grayscale white pattern on a cold screen for 90s, and set the resulting temperature as the calibration temperature.

Figure 7-58 Controlling screen temperature



7.4.3.2 Set Low-Grayscale Iterations

Click the **Iteration Count** drop-down list to select the number of times to perform low-grayscale calibration. This can be set based on the uniformity of the display and calibration experience, with a default of 3 times.

Figure 7-59 Setting low-grayscale iterations



7.4.3.3 Feature Learning

Learn the public characteristics of cabinets in the same batch to ensure that the calibration speed and effect can be effectively improved in the subsequent batch calibration process.

Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the feature learning process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

Step 1 Select sample cabinets for feature learning and ensure the brightness difference of the samples should be within 7%.

Step 2 On the **Start Calibration** screen, click the **Feature Learning** tab to access the feature learning screen.

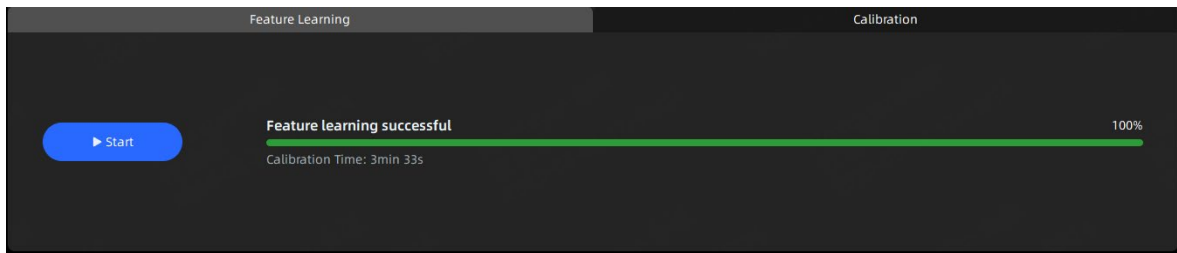
Step 3 Click **Start** and the system will automatically capture the feature data of the current cabinet.

There are strict requirements for the cabinet temperature during feature learning.

- If the current cabinet temperature is 0.3°C higher than the set calibration temperature, the system will prompt you to power off the cabinet to cool it down.
- If the current cabinet temperature is 0.3°C lower than the set calibration temperature, the system will automatically heat the cabinet to the calibration temperature.

Step 4 When the progress bar turns green and prompts "Feature learning successful", feature learning is completed.

Figure 7-60 Feature learning completed



7.4.3.4 Set Cabinet ID and Module ID

The cabinet and module IDs can be set. The procedure is the same as for brightness and chroma calibration. See [7.2.4.3 Set Cabinet ID](#) and [7.2.4.4 Set Module ID](#).

7.4.3.5 Configure Calibration Procedure

Click the **Calibration** tab, and then click **Configure Procedure** in the lower right corner to open the **Configure Procedure** window. The procedure is the same as for brightness and chroma calibration. See [7.2.4.1 Configure Calibration Procedure](#).

7.4.3.6 Calibrate Sample Cabinets

Calibrate the sample cabinets that have undergone feature learning and assemble them into a screen (3x3 cabinets at least recommended) to verify the calibration effect.

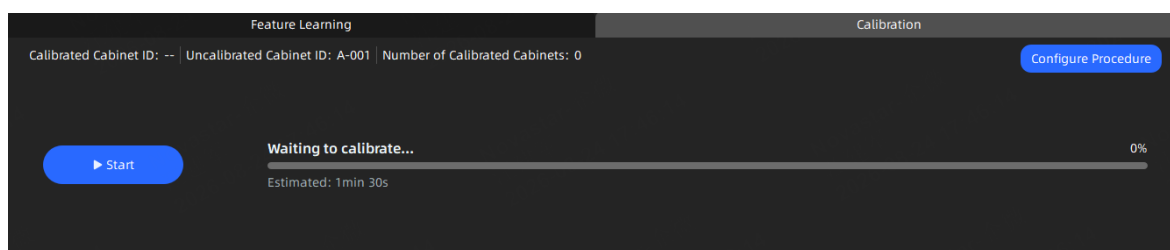
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The calibration procedure is configured, and cabinet ID settings are completed.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

- Step 1 On the **Calibration** tab page in the lower part of the **Start Calibration** screen, click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-61 Calibrating sample cabinets



Calibrate at least 9 sample cabinets before proceeding to the following operations.

- Step 2 Assemble the calibrated sample cabinets into a screen (3x3 cabinets at least recommended) and verify the calibration effect.
- Step 3 Evaluate the full-screen calibration results to determine if there are any curved surface transition issues.
- If the calibration results are satisfactory, refer to 7.4.3.8 Batch Calibration to complete the batch calibration of cabinets.
 - If the calibration results do not meet expectations, first refer to [7.4.3.7 Curved Surface Correction](#) to complete curved surface correction before proceeding with batch calibration.

Note

- When checking the calibration effect after calibration, use the CC3 software to display the test pattern and adjust the brightness.
- After completing the sample cabinet calibration, the camera parameters, camera position, and sample cabinet position must remain unchanged to ensure the results of the batch calibration.

7.4.3.7 Curved Surface Correction

If curved surface issues are present after sample cabinet calibration, refer to this section to implement the curved surface correction procedure. This will enhance the overall visual effect of the batch of cabinets when assembled, ensuring smooth curved surface transitions and achieving higher display quality.

Related Information

If the customer expects uniform display performance at higher screen temperatures, capture the data after the screen has been preheated. Otherwise, proceed with data capture on a cold screen.

Note

When performing curved surface correction, do not move or adjust the calibration environment used during sample cabinet calibration.

Procedure

In the **Curved Surface Correction** area on the right, click **Export** to save the coefficient files of sample cabinets to your local computer.

Please refer to the operating steps in [7.7 Curved Surface Correction](#) to perform the correction.

7.4.3.8 Batch Calibration

Low-grayscale calibration can be done automatically or manually.

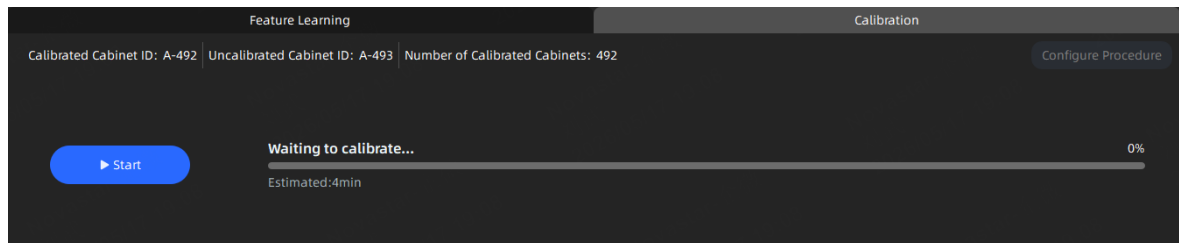
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The curved surface effect of the sample cabinet correction meets the expected results.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Start Calibration

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab to access the calibration screen.
- Step 2 Click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-62 Cabinet calibration



- Step 3 View the calibration progress and the status.

During calibration, the execution progress, status and other information of each calibration step will be displayed. You can cancel, pause and end calibration based on the actual situation.

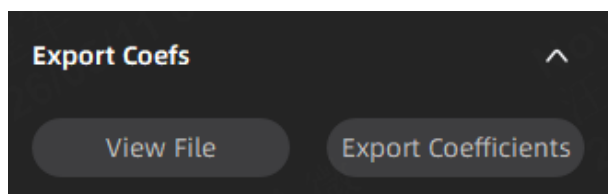
- If the execution is successful, the progress bar will be green and the progress will display 100%.
- If the execution fails, an "Error" message, the failed step name, and the failure reason will be displayed above the progress bar. Troubleshoot the issue based on the provided reason. After troubleshooting is complete, click the step name again.

- Step 4 In the **Calibration Results** area on the right, view the calibration result.

7.4.3.9 View and Export Calibration File

After calibration is complete, you can view or export the calibration coefficients in the **Export Coefs** area at the bottom right of the **Start Calibration** screen.

Figure 7-63 Viewing calibration coefficient file



View Calibration Coefficients

Click **View File**, and the software will automatically open the folder where the coefficients are stored.

Export Coefficients

Step 1 Click **Export Coefficients** to open the coefficient export screen.

Figure 7-64 Exporting coefficients

A dark-themed 'Export' dialog box with a close button (X) in the top right corner. It contains the following fields and options: 'Coefficient Type' with radio buttons for 'Cabinet coef' (selected) and 'Module coef'; 'Number of Target Databases' with radio buttons for 'Single' (selected) and 'Multiple'; 'File Name' with a text input field containing 'New Project 20260511092738'; 'Save Path' with a text input field containing 'C:/Users/Administrator/Desktop' and a 'Browse' button to its right. At the bottom right are 'Cancel' and 'OK' buttons.

Step 2 Configure the coefficient type for calibration coefficient export. Currently, only **Cabinet Coef** can be selected.

Step 3 Select to save as a single database or multiple databases.

- Single: Export the coefficients of all currently calibrated cabinets to a single database file.

- Multiple: Export coefficients for all currently calibrated cabinets by cabinet ID. The name of the exported database file is "*Cabinet ID + Export Time*".

Step 4 Under **File Name** or **Folder Name**, set the name of the file or folder where the exported coefficients are located

Step 5 Under **Save Path**, set the save path for the exported coefficients.

Step 6 Click **OK**, and the system will automatically export coefficients.

Step 7 After the export is complete, click **OK** to finish coefficient export.

7.5 Full-Grayscale Calibration 1.0

7.5.1 Prepare Environment

In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution and partition, connect a camera, colorimeter, thermometer and barcode scanner. The preparation steps are the same as those for the brightness and chroma calibration. For details, see [7.2.1 Prepare Environment](#).

Notes

- Only the NOS-CC60 imaging colorimeter is supported. Digital cameras and the C3200 industrial camera are not supported.
- A colorimeter and a thermometer must be connected to capture the brightness, color, and temperature information from the display during feature learning.

7.5.2 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

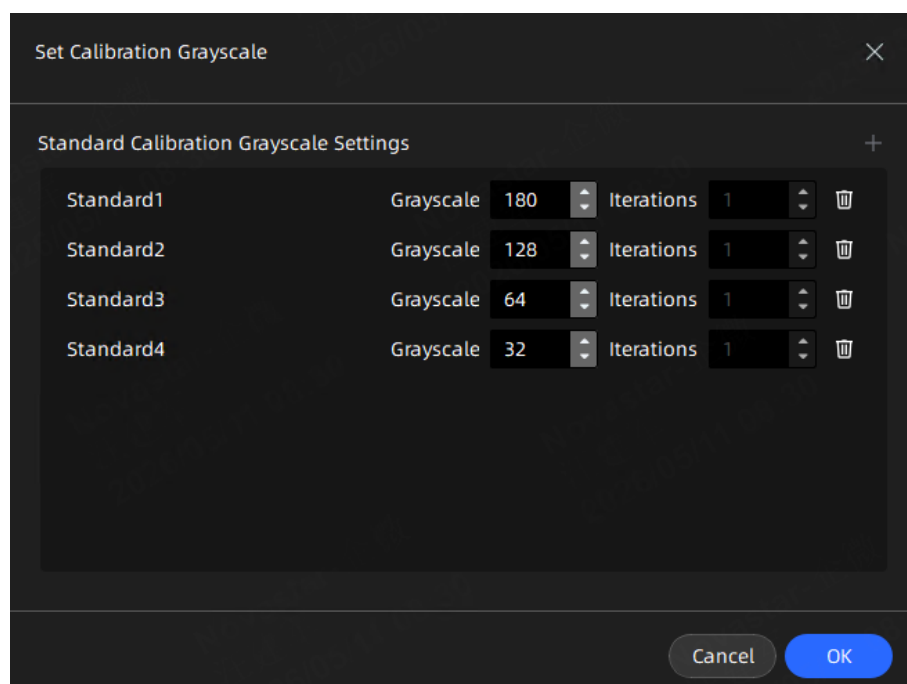
7.5.2.1 Set Calibration Grayscale

Set grayscale values for functions such as live preview, smart analysis and calibration. The full-grayscale calibration 1.0 plan supports settings of multiple layers of capturing grayscale.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

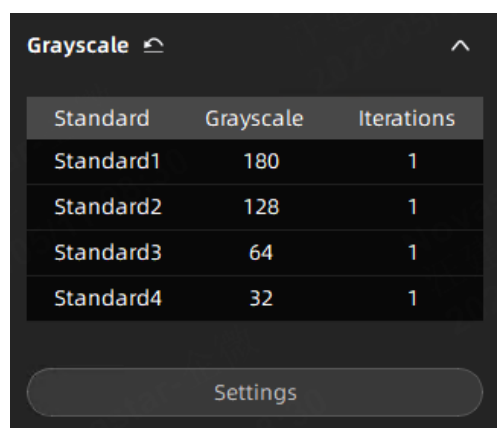
Step 2 In the **Grayscale** area on the right, click **Settings** to enter the grayscale settings screen.

Figure 7-65 Setting calibration grayscale



- The number of layers of grayscale supported depends on the receiving card used.
 - The A10s Pro and CA50E receiving cards support up to 4 layers of grayscale, with the default values being 32, 64, 128, and 180.
 - The A8s Pro receiving card supports up to 2 layers of grayscale, with the default values being 64 and 180.
 - Iterations: The default is 1.
- For regular screens, the default capturing grayscale settings can be used for calibration. If the calibration results of default grayscale settings do not meet the requirements, you can determine the appropriate calibration grayscale and calibration layers for the current batch of cabinets based on the screen linearity analysis performed during the pre-calibration COB cabinet inspection/debugging process.
- Click  next to **Grayscale** to restore the grayscale values to the default values.

Figure 7-66 Calibration grayscale



7.5.2.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

Digital Camera

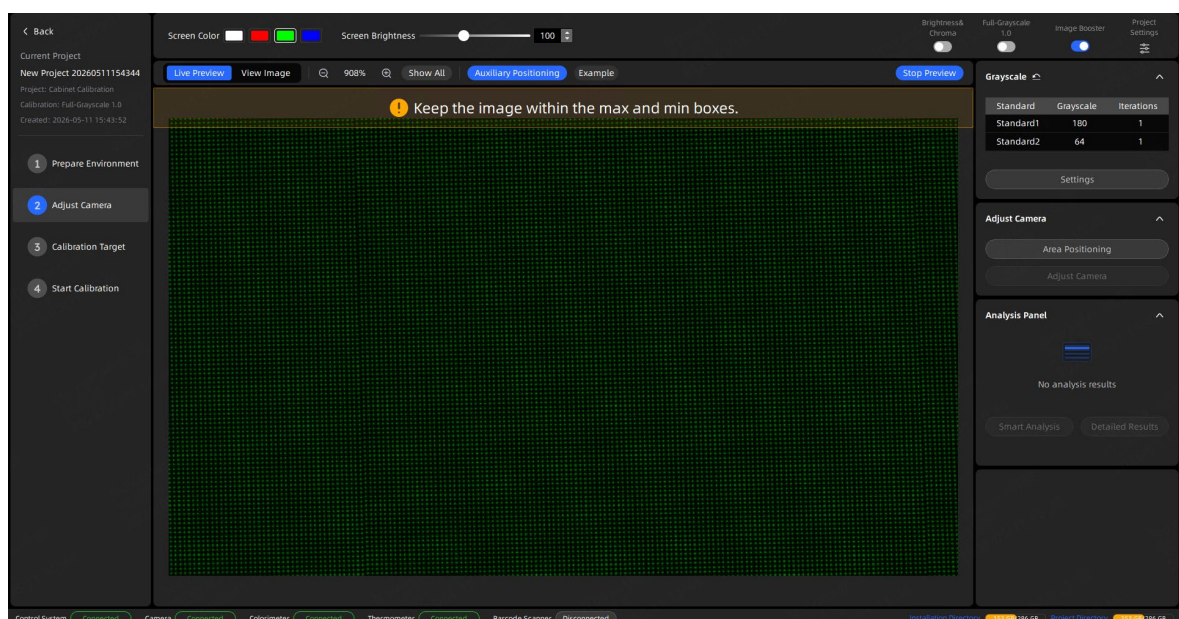
For digital cameras, the calibration software does not support live preview. You need to preview the captured images on the camera's LCD screen.

Industrial Camera

For industrial cameras, the calibration software supports live preview.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or scroll the mouse wheel to zoom the view to assist in adjusting the live preview image.

Figure 7-67 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

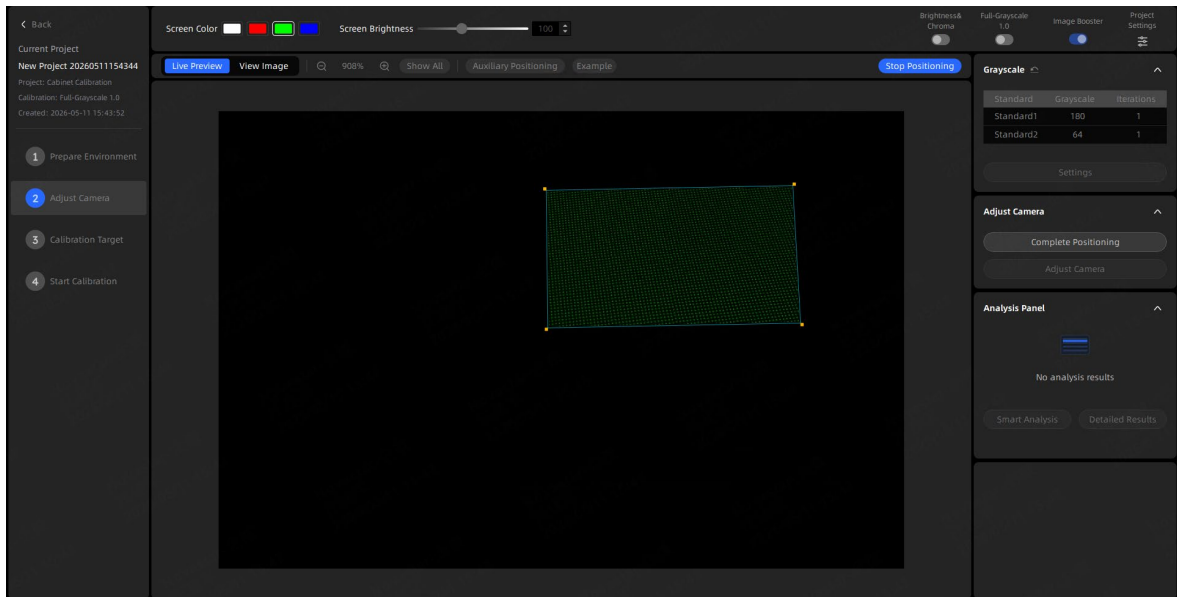
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.5.2.3 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-68 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

7.5.2.4 Adjust Camera

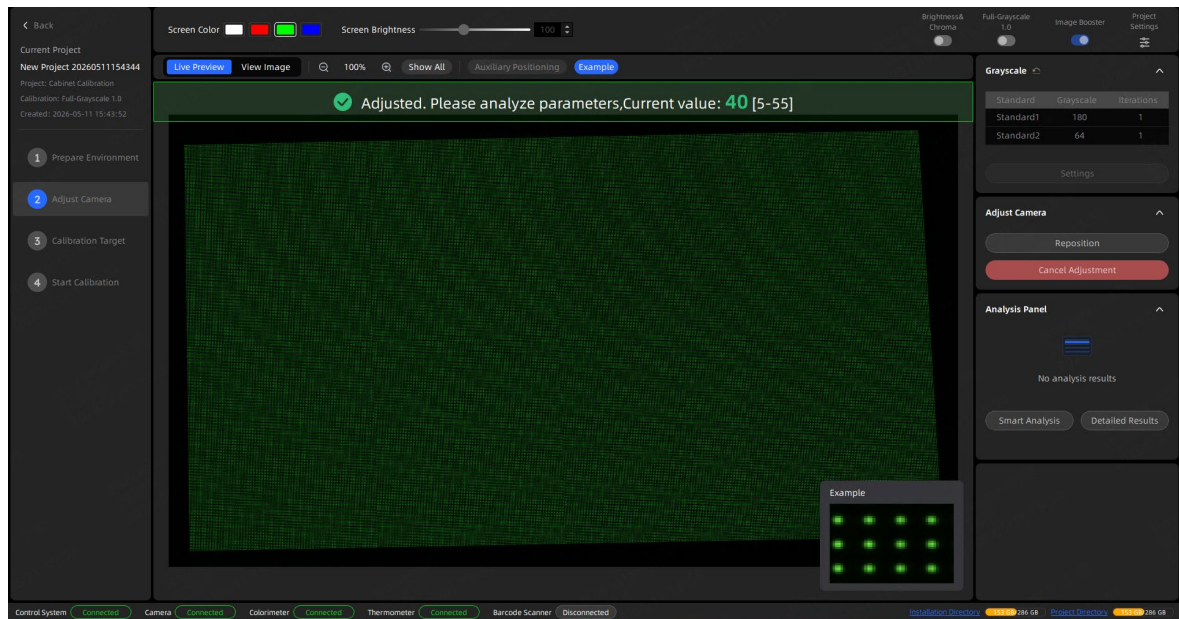
The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the values on the screen.

Figure 7-69 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

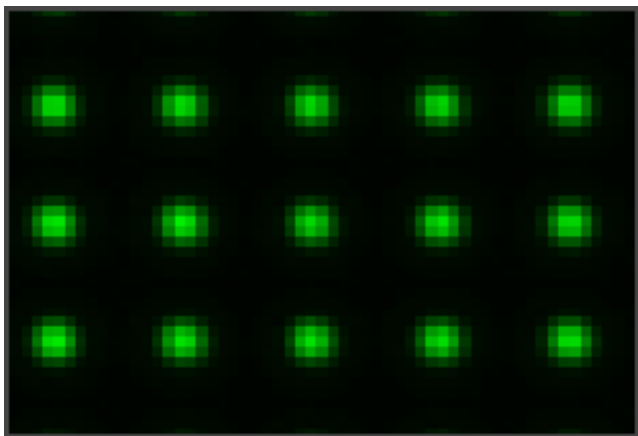
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should be clear, as shown below.



7.5.2.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

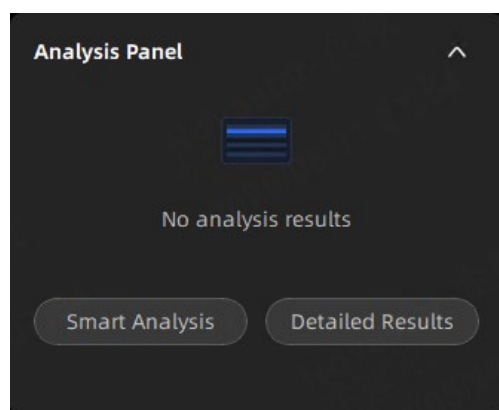
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

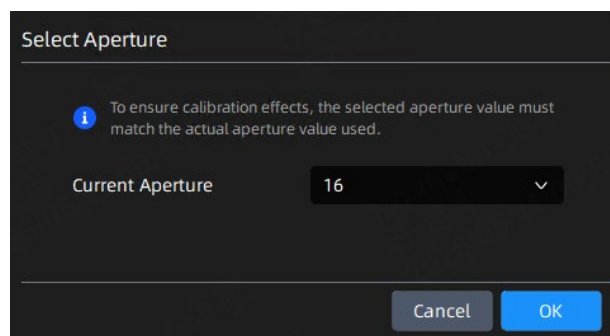
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-70 Smart analysis



- Step 2 When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-71 Setting aperture information



- Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.
- If a white value is displayed next to the color, the value is normal and the smart analysis is completed.

- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

Note

- The full-grayscale calibration 1.0 plan currently only supports collecting all grayscales with one aperture.
- During smart analysis, the software will automatically determine whether the current aperture settings can calibrate all grayscales. If the currently set calibration grayscale exceeds the camera's capture capability range, please set the grayscale within the range prompted by the pop-up window or adjust the camera parameters, and perform smart analysis again.
- If the aperture is adjusted, you must return to the aperture selection step to reset the value to ensure that the actual aperture value of the camera is consistent with the software settings.
- After the smart analysis is completed, if any parameters of the camera are modified, you must perform area positioning and smart analysis again; otherwise the calibration effect will be affected.

7.5.3 Calibration Target

7.5.3.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the cabinet to be calibrated. They are used to calculate the calibration target values.

The full-grayscale calibration 1.0 plan does not need to capture original values. The original values will be captured during the feature learning process and automatically refreshed after feature learning is completed.

7.5.3.2 Set Target Values

Prerequisites

Before calibration, adjust the color temperature value in the receiving card configuration file or NCP file to match or closely align with the screen's shipment color temperature requirements.

Procedure

Adjust the white brightness reduction or color temperature according to the client's expected shipping standards. After feature learning, new recommended target values will be generated based on the captured original values.

Step 1 On the project home screen, select the **Calibration Target** tab.

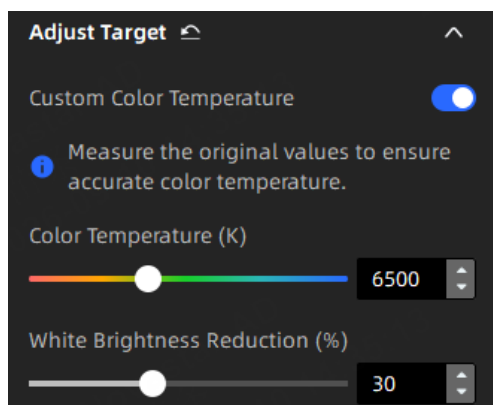
Step 2 Set the target values using one or a combination of the following ways.

 Note

To balance white brightness reduction with color temperature, first disable **Custom Color Temperature**. Adjust the white brightness reduction as needed, then enable **Custom Color Temperature** and set it to the desired value.

- Enable **Custom Color Temperature**.

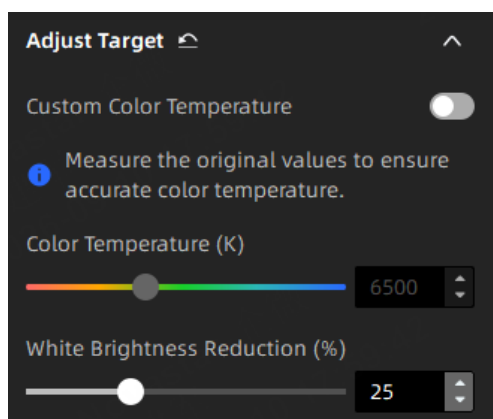
Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



Drag the **Color Temperature** and **White Brightness Reduction** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

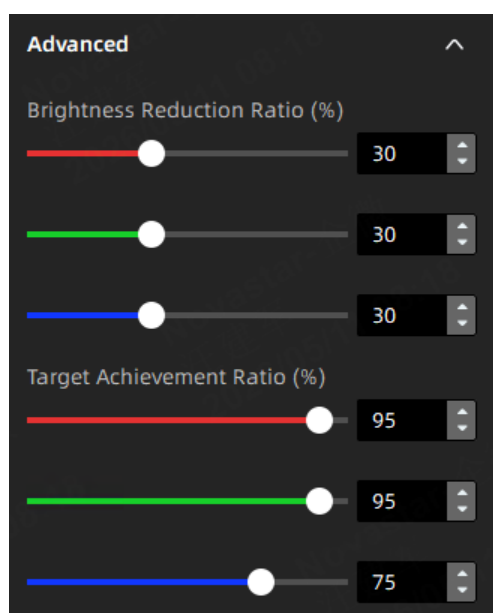
- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio
 - c. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
 - d. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.
- Set the target values in the color gamut distribution chart

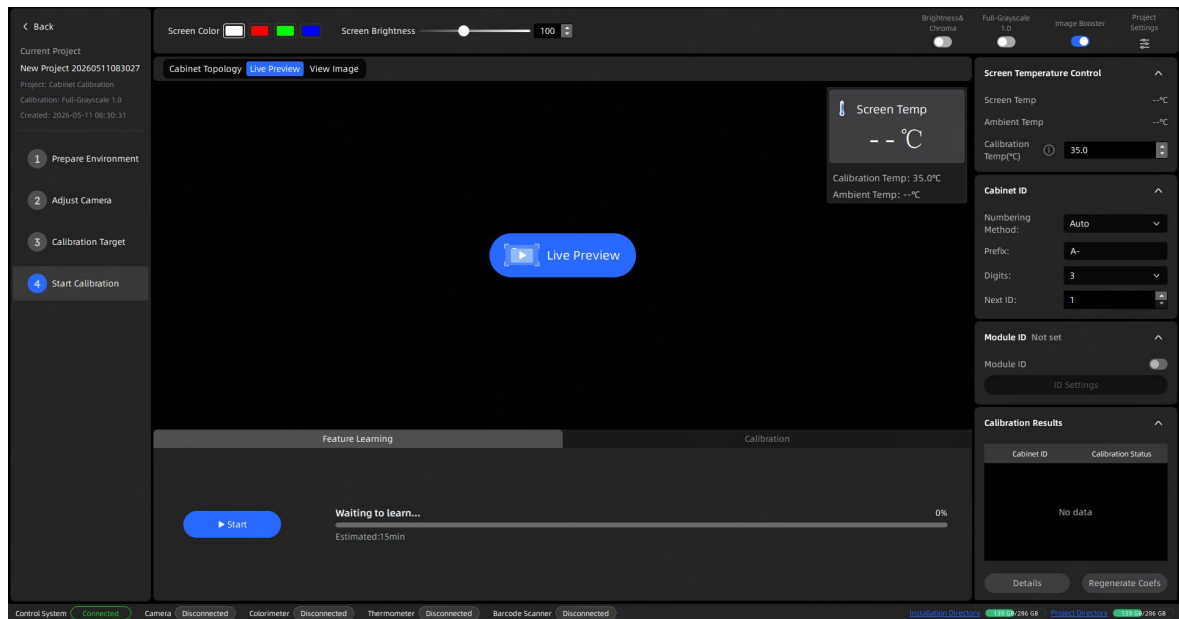
In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

- Click ↺ next to **Adjust Target** to restore both original and target values to the default values.

7.5.4 Start Calibration

Perform feature learning on sample cabinets, configure the calibration parameters and procedure, start calibration, view calibration results and export calibration coefficients.

Figure 7-72 Starting calibration



- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.5.4.1 Control Screen Temperature

Before feature learning, you need to set the screen temperature during calibration.

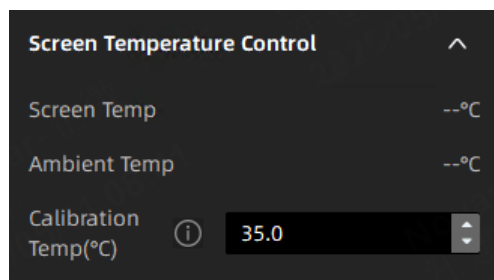
Prerequisites

- The thermometer is connected.
- The cabinets to be calibrated are placed in the darkroom. For specific requirements of the darkroom environment, please refer to [5.1.1 Darkroom Requirements](#).

Procedure

Select a normal cabinet, power it on, use the highest grayscale to display a white image on a cold screen for 90s, and set the resulting temperature as the calibration temperature.

Figure 7-73 Controlling screen temperature



7.5.4.2 Feature Learning

Learn the public characteristics of cabinets in the same batch to ensure that the calibration speed and effect can be effectively improved in the subsequent batch calibration process.

Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the feature learning process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

Step 1 Select sample cabinets for feature learning and ensure the brightness difference of the samples should be within 7%.

Step 2 On the **Start Calibration** screen, click the **Feature Learning** tab to access the feature learning screen.

Step 3 Click **Start** and the system will automatically capture the feature data of the current cabinet.

There are strict requirements for the cabinet temperature during feature learning.

- If the current cabinet temperature is 0.3°C higher than the set calibration temperature, the system will prompt you to power off the cabinet to cool it down.
- If the current cabinet temperature is 0.3°C lower than the set calibration temperature, the system will automatically heat the cabinet to the calibration temperature.

Step 4 When CC3 automatically reaches the colorimeter measurement step, it will pop up the colorimeter configuration information.

Figure 7-74 Configuring colorimeter

Configure Colorimeter [X]

Please connect a colorimeter and set the capture area.

Model: CA410 [v] **Connect**

Start Coordinates: X 25 Y 25

Side Length: 25

i 1. Capture areas cannot be located at the module seams, and the area expanded threefold must not exceed the cabinet.
2. It is recommended that the capture area be 2 pixels larger than the colorimeter's measurement aperture.
3. After setting, keep the colorimeter facing the capture area without moving until the capture is completed.

OK

If the colorimeter connection has been completed during environment preparation, **Connected** will be displayed on the right side of **Model**. If the colorimeter is not connected, select the currently used colorimeter next to **Model** and click **Connect** to complete the connection.

A white capture area of **Side Length** size will be displayed on the cabinet. In **Start Coordinates**, you can set the position of the colorimeter capture area. Once done, align the capture head of the colorimeter with the white color block on the cabinet.

Note

When configuring the capture area, please refer to the instructions on the colorimeter configuration screen, otherwise it will affect the feature learning effect.

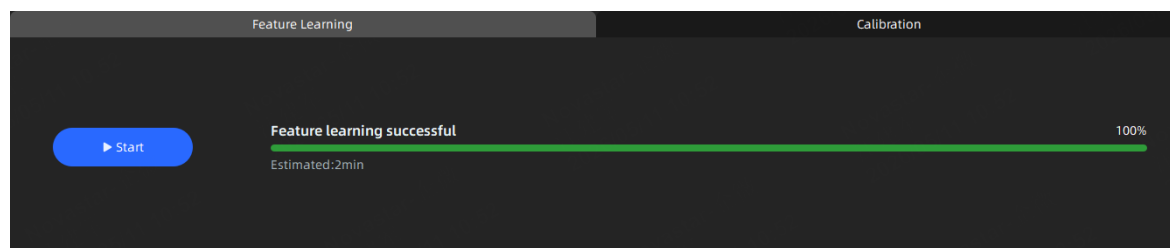
Capture areas cannot span across modules and it is recommended that the capture area be 2 pixels larger than the diameter of the colorimeter's measurement aperture. During the capture process, keep the colorimeter facing the capture area without moving.

Step 5 Click **OK**, and CC3 will capture chroma through the colorimeter.

After the chroma capture is completed, CC3 will pop up instructions to remove the colorimeter. You need to remove the colorimeter first, and then click **OK**.

Step 6 When the progress bar turns green and prompts "Learning successful", feature learning is completed.

Figure 7-75 Feature learning completed



7.5.4.3 Confirm Target Values

After feature learning, new target values will be automatically generated based on the captured original brightness and chroma values of the sample cabinets, as well as your settings for white brightness reduction and color temperature.

At this time, you need to return to the **Calibration Target** screen to confirm the target values.

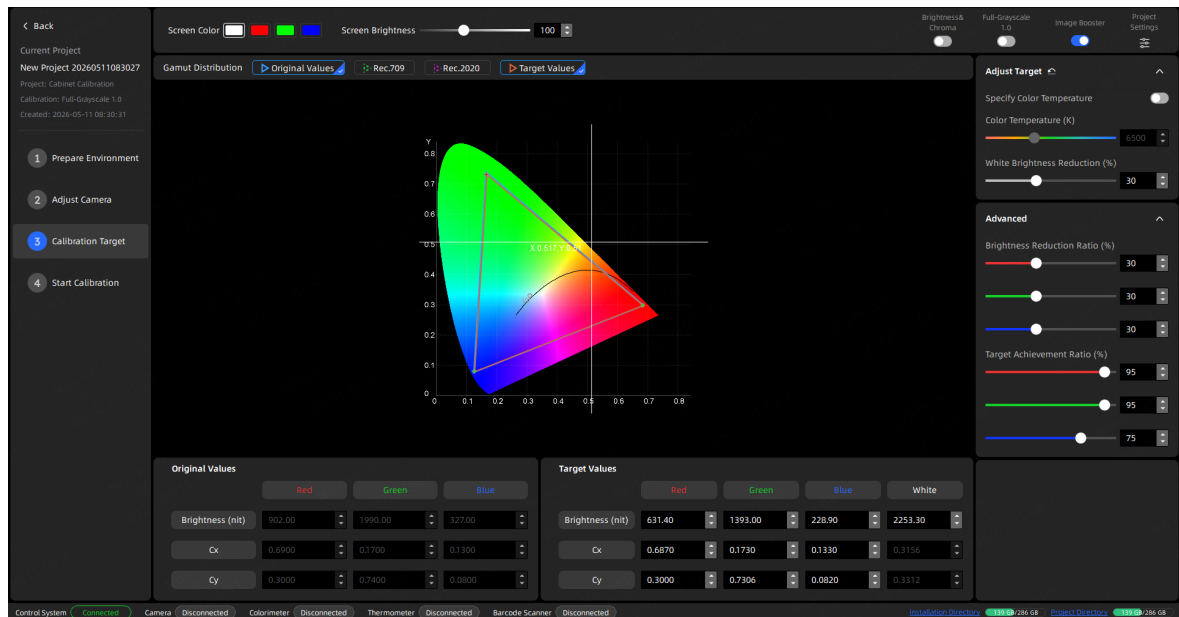
1. Check whether the target values generated by feature learning meet the shipping standards.

It is recommended to use the target values generated by feature learning to ensure optimal calibration results. If there are strict shipping standards, you may also fine-tune the existing parameters.

2. Adjust the target values as needed.

When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Figure 7-76 Confirming target values



7.5.4.4 Set Cabinet ID and Module ID

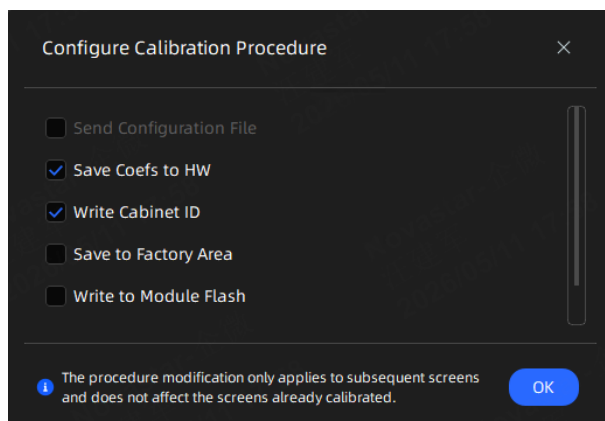
The cabinet and module IDs can be set. The procedure is the same as for brightness and chroma calibration. See [7.2.4.3 Set Cabinet ID](#) and [7.2.4.4 Set Module ID](#).

7.5.4.5 Configure Calibration Procedure

You have the option to customize the calibration procedure based on the condition of the cabinet to be calibrated.

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab, and then click **Configure Procedure** in the lower right corner to open the **Configure Procedure** window.
- Step 2 Check the relevant calibration steps as needed.

Figure 7-77 Configuring procedure



- Send Configuration File

Send the configuration file to the receiving card. If the configuration file used in the cabinet to be calibrated is an NCP file, CC3 does not support sending the configuration file.

- Save Coefs to HW

The parameters after calibration will be automatically saved into the receiving card of the cabinet.

- Write Cabinet ID

Write the cabinet ID to the receiving card.

- Save to Factory Area

Save the calibration coefficients to the factory area of the receiving card. After the coefficients are adjusted or lost, you can apply the factory area coefficients to the application area and the coefficients will be restored to the original data.

- Write to Module Flash

Write the calibration coefficients to the module flash memory for backup.

- Save Rv Card Parameters

Save the receiving card configuration file to hardware to prevent the loss of the file after the screen is powered off and on again. If the configuration file used in the cabinet to be calibrated is an NCP file, there is no need to send or save the configuration file.

Step 3 After the procedure is configured, click **OK** below.

7.5.4.6 Calibrate Sample Cabinets

Calibrate the sample cabinets that have undergone feature learning and assemble them into a screen (3x3 cabinets at least recommended) to verify the calibration effect.

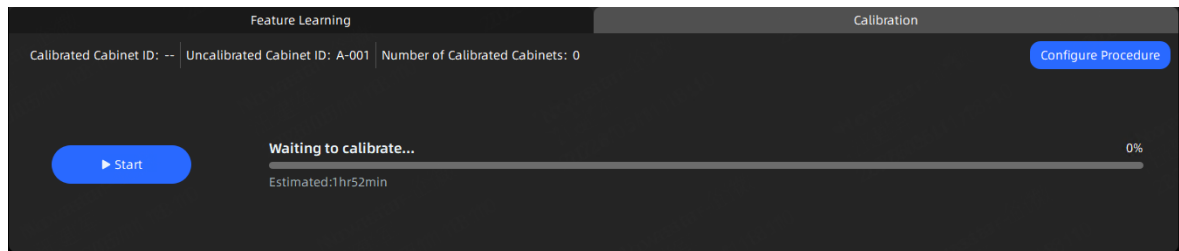
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- Target values are confirmed.
- The calibration procedure is configured, and cabinet ID settings are completed.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

Step 1 On the **Calibration** tab page in the lower part of the **Start Calibration** screen, click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

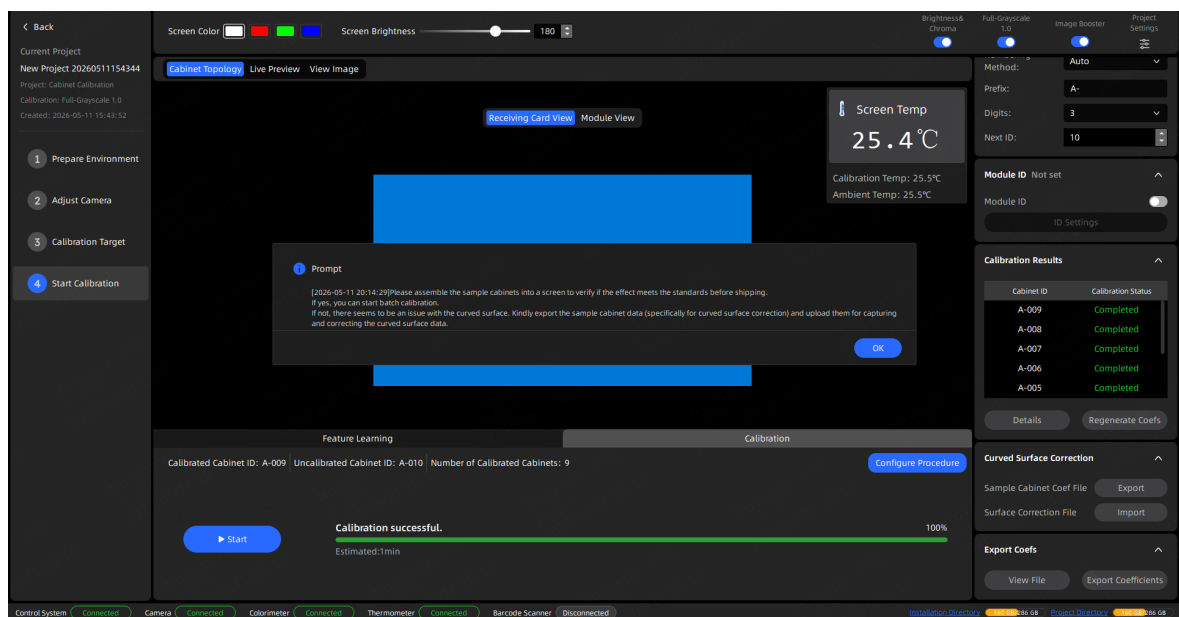
Figure 7-78 Calibrating sample cabinets



Step 2 Recalibrate at least 9 sample cabinets, assemble the calibrated sample cabinets into a screen to verify the calibration effect.

Step 3 Evaluate the full-screen calibration results to determine if there are any curved surface transition issues.

Figure 7-79 Assembling sample cabinets into a screen



- If the calibration results are satisfactory, refer to [7.5.4.8 Batch Calibration](#) to complete the batch calibration of cabinets.
- If the calibration results do not meet expectations, first refer to [7.5.4.7 Curved Surface Correction](#) to complete curved surface correction before proceeding with batch calibration.

Note

- When checking the calibration effect after calibration, use the CC3 software to display the test pattern and adjust the brightness.
- After completing the sample cabinet calibration, the camera parameters, camera position, and sample cabinet position must remain unchanged to ensure the results of the batch calibration.

7.5.4.7 Curved Surface Correction

If curved surface issues are present after sample cabinet calibration, refer to this section to implement the curved surface correction procedure. This will enhance the overall visual effect of the batch of cabinets when assembled, ensuring smooth curved surface transitions and achieving higher display quality.

Related Information

If the customer expects uniform display performance at higher screen temperatures, capture the data after the screen has been preheated. Otherwise, proceed with data capture on a cold screen.



Note

When performing curved surface correction, do not move or adjust the calibration environment used during sample cabinet calibration.

Procedure

In the **Curved Surface Correction** area on the right, click **Export** to save the coefficient files of sample cabinets to your local computer.

Please refer to the operating steps in [7.7 Curved Surface Correction](#) to perform the correction.

7.5.4.8 Batch Calibration

Full-grayscale calibration 1.0 can be done automatically or manually.

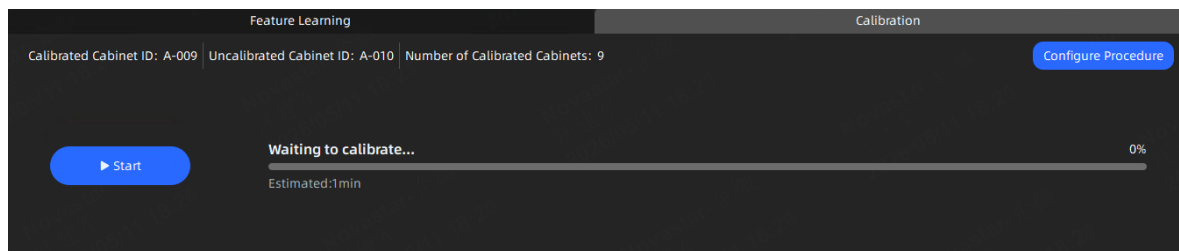
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The curved surface effect of the sample cabinet correction meets the expected results.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Start Calibration

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab to access the calibration screen.
- Step 2 Click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-80 Starting calibration



Step 3 View the calibration progress and the status.

During calibration, the execution progress, status and other information of each calibration step will be displayed. You can cancel, pause and end calibration based on the actual situation.

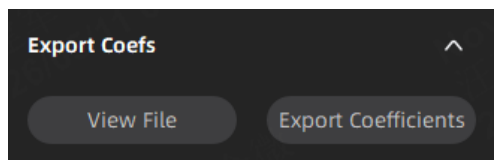
- If the execution is successful, the progress bar will be green and the progress will display 100%.
- If the execution fails, an "Error" message, the failed step name, and the failure reason will be displayed above the progress bar. Troubleshoot the issue based on the provided reason. After troubleshooting is complete, click the step name again.

Step 4 In the **Calibration Results** area on the right, view the calibration result.

7.5.4.9 View and Export Calibration File

After calibration is complete, you can view or export the calibration coefficients in the **Export Coefs** area at the bottom right of the **Start Calibration** screen.

Figure 7-81 Viewing calibration coefficient file



View Calibration Coefficients

Click **View File**, and the software will automatically open the folder where the coefficients are stored.

Export Coefficients

Step 2 Click **Export Coefficients** to open the coefficient export screen.

Figure 7-82 Exporting coefficients

Export

Coefficient Type

☒ Cabinet coef ☐ Module coef

Number of Target Databases

☒ Single ☐ Multiple

File Name

New Project 20260511092738

Save Path

C:/Users/Administrator/Desktop Browse

Cancel OK

Step 3 Configure the coefficient type for calibration coefficient export. Currently, only **Cabinet Coef** can be selected.

Step 4 Select to save as a single database or multiple databases.

- Single: Export the coefficients of all currently calibrated cabinets to a single database file.
- Multiple: Export coefficients for all currently calibrated cabinets by cabinet ID. The name of the exported database file is "*Cabinet ID + Export Time*".

Step 5 Under **File Name** or **Folder Name**, set the name of the file or folder where the exported coefficients are located

Step 6 Under **Save Path**, set the save path for the exported coefficients.

Step 7 Click **OK**, and the system will automatically export coefficients.

Step 8 After the export is complete, click **OK** to finish coefficient export.

7.6 Full-Grayscale 1.0 + Low-Grayscale Calibration

7.6.1 Prepare Environment

In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution and partition, connect a camera, thermometer and barcode scanner. The preparation steps are the same as those for the brightness and chroma calibration. For details, see [7.2.1 Prepare Environment](#).

Notes

- Only the NOS-CC60 imaging colorimeter is supported. Digital cameras and the C3200 industrial camera are not supported.
- A thermometer must be connected to capture the temperature information from the display during feature learning.

7.6.2 Adjust Camera

Preview the images captured by the camera, set the low-grayscale parameters, calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the smart analysis results meet the calibration requirements.

7.6.2.1 Configure Low-Grayscale Parameters

Since different chips require different values, please follow the parameters recommended by the chip manufacturer for configuration. Some low-grayscale parameters affect display performance, so it is advisable to verify and apply them before conducting smart analysis and calibration.

- Step 1 Go to the project home screen and select the **Adjust Camera** tab.
- Step 2 In the **Low-Grayscale Parameters** area on the right, configure the parameters based on the used chip.

Figure 7-83 Low-grayscale parameters

Low-Grayscale Parameter Settings ^

Step 1

Max Coef 15

Initial Coefs

R 7 G 7 B 7

Apply

* Current Value

R 64 G 64 B 64

Brightness coef 1

Apply

- Step: This sets an incremental value on top of the initial low-grayscale coefficient, used for calculating parameters during the low-grayscale calibration process. The default is 1, with an upper limit of 10.
- Max Coef: To prevent coefficients from exceeding the receiving card's range and causing display anomalies, you can set the maximum value for the low-grayscale calibration coefficient. All coefficients generated through calibration will not exceed this value. The default is 15.

- **Initial Coefs:** This sets the initial baseline for red, green, and blue colors during the camera calibration. Subsequent calibration coefficients will iterate based on this baseline.
- **Low-Grayscale Uniformity:** Enter a low-grayscale uniformity value to make the non-uniform characteristics of the display more apparent in low-grayscale segments, facilitating later calibration. The default is 1.
- **Calibration Grayscale Gamma:** This sets the gamma for calibration grayscale. A higher value results in brighter calibration grayscale, which can enhance low-grayscale brightness for calibration. The default is 64.
- **Current Value:** This sets the current value. When using the TBS5367 chip, which supports variable current, the entered current will serve as the calibration current. Higher current results in brighter calibration grayscale.
- **Brightness Coef:** This sets the brightness coefficient. For displays with a scan count of 32 or below, it's recommended to select 1 or 2. For those above 32, select 4 or 8.

Step 3 Click **Apply** to send the parameters to the screen awaiting calibration.



Note

- It is recommended to use the default values for all low-grayscale parameters for calibration, as they cover most use cases. If default values do not yield satisfactory results, contact NovaStar official technical support for tuning and optimization.
- After low-grayscale calibration is complete, restore the **Calibration Grayscale Gamma** and **Brightness Coef** parameters to their original values, as failing to do so may affect subsequent calibration or debugging results.

7.6.2.2 Set Calibration Grayscale

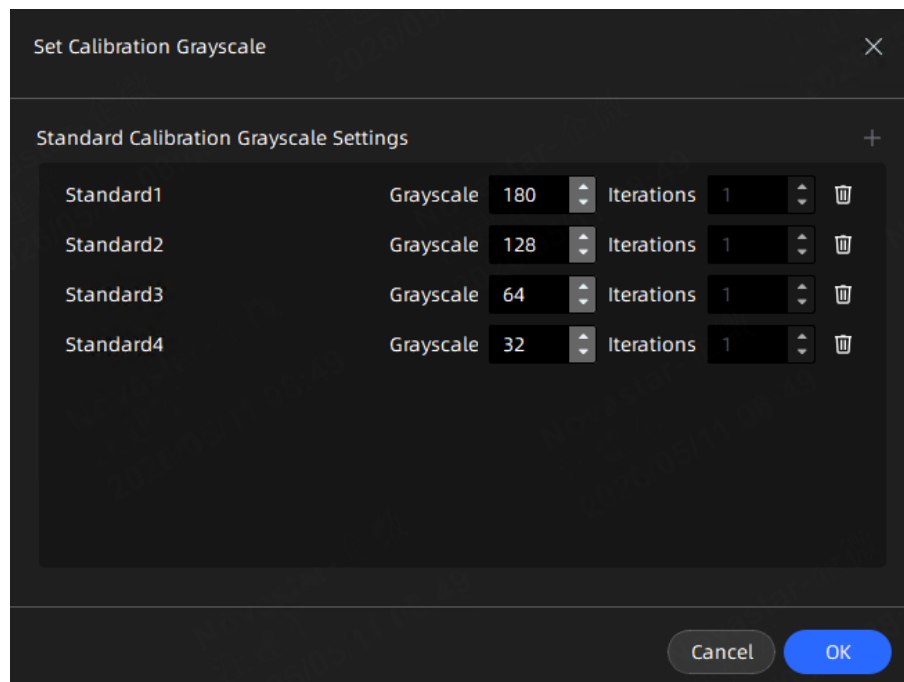
Set grayscale values for functions such as live preview, smart analysis and calibration.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, click **Settings** to enter the grayscale settings screen.

Click  next to **Grayscale** to restore the grayscale values to the default values.

Figure 7-84 Setting calibration grayscale



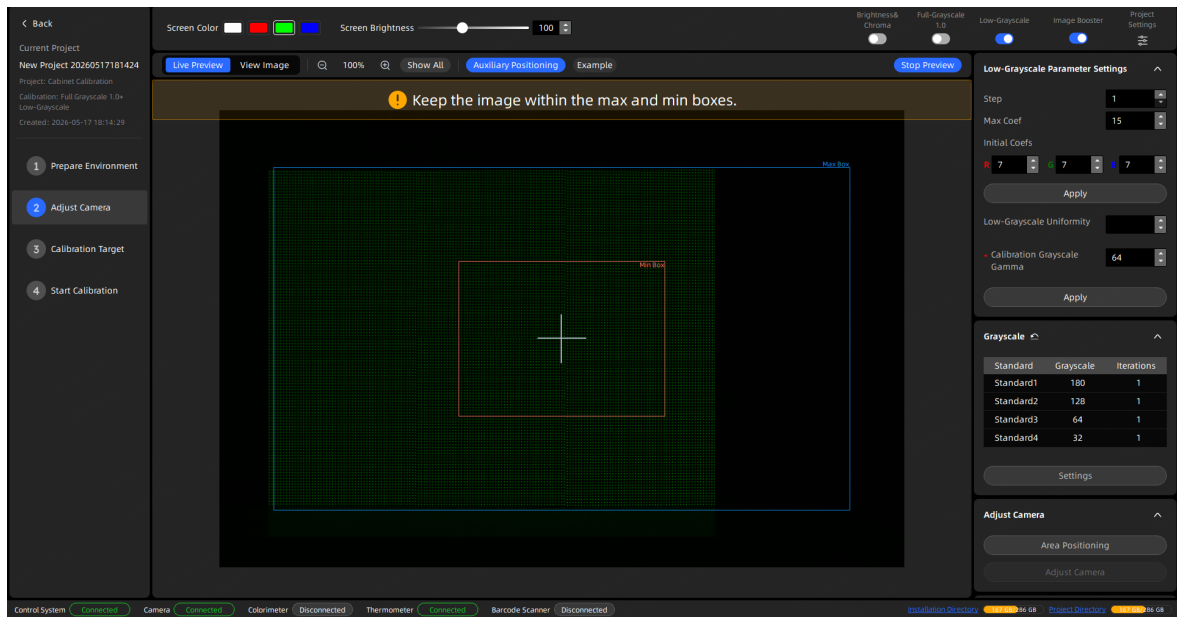
- Grayscale: The default values are 180, 128, 64, and 32. The value range is 0 to 255.
- Iterations: The default is 1.

7.6.2.3 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-85 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

Step 3 Adjust the camera position or lens according to the on-screen instructions so that the captured cabinet image falls between the maximum and minimum boxes.

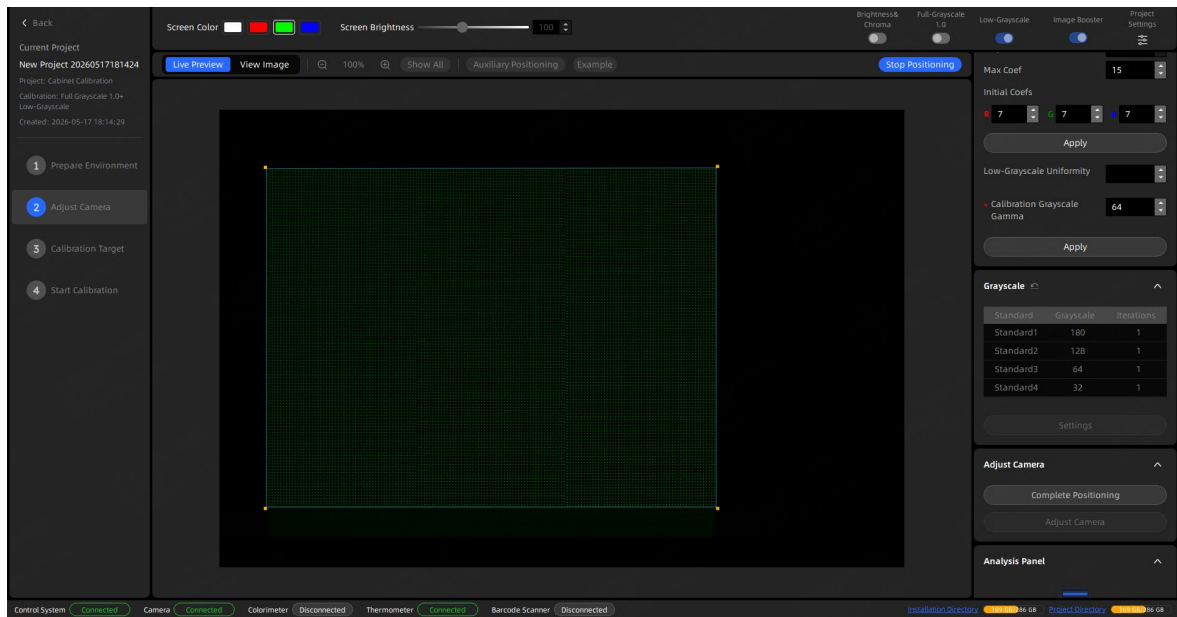
Step 4 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.6.2.4 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-86 Area positioning



Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.

During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.

Step 3 After the area positioning is completed, click **Complete Positioning** on the right.

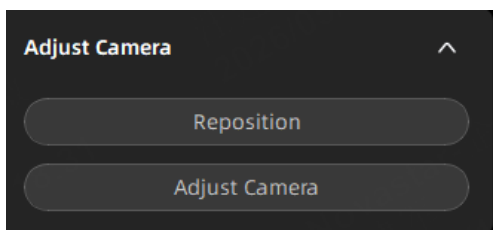
After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

7.6.2.5 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

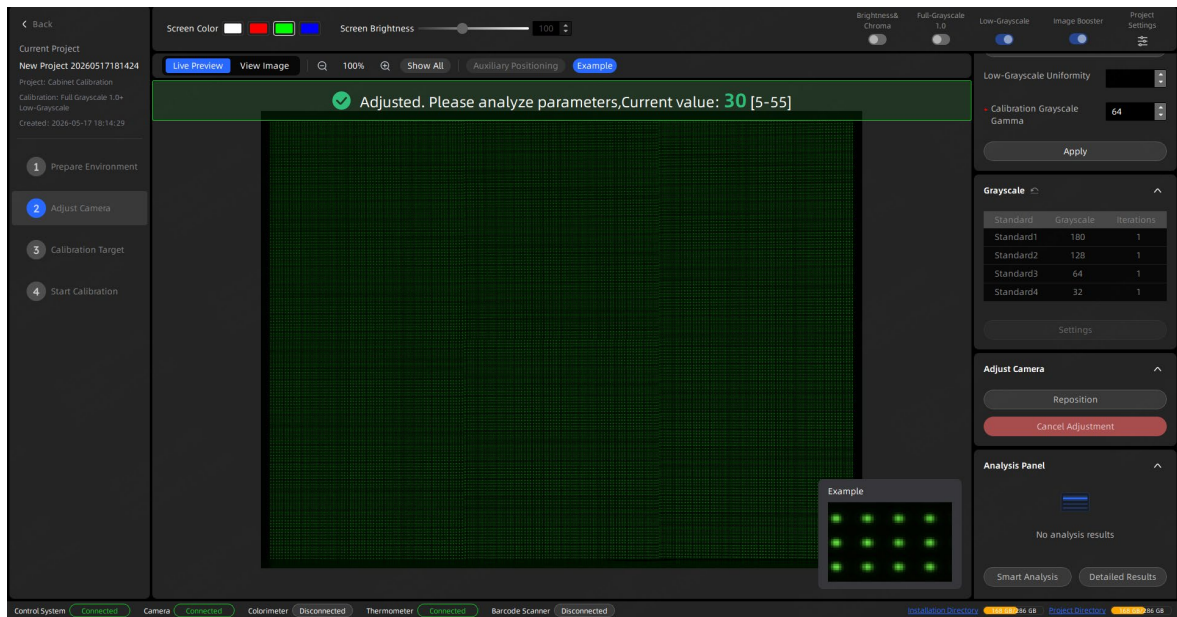
Figure 7-87 Adjusting camera



Step 2 Adjust the camera hardware parameters according to the prompts on the screen.

The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-88 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

Tips for Camera Imaging

- Ratio of image to viewport

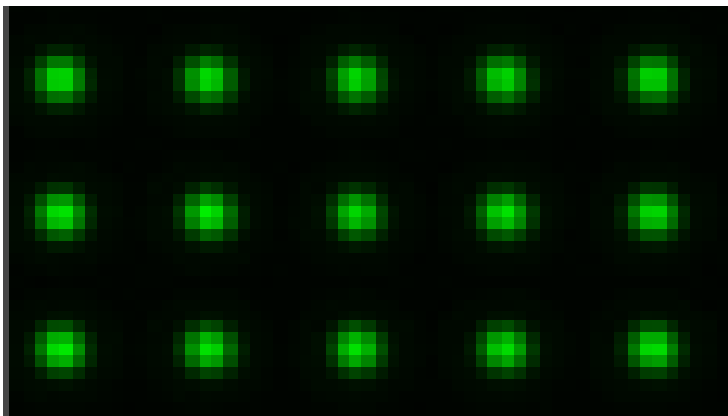
The resolutions and optical imaging quality of the areas on the edges of the lens sharply decrease. Even after optical correction, the calibration effect will still be impacted. Therefore, the image must meet specific requirements. The image should fall between the maximum and minimum boxes.

Note

Due to positioning limitations, the image of LEDs in the camera should be as rectangular as possible to avoid too much deformation.

- LED imaging requirements

The LED image should be clear, as shown below.



7.6.2.6 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

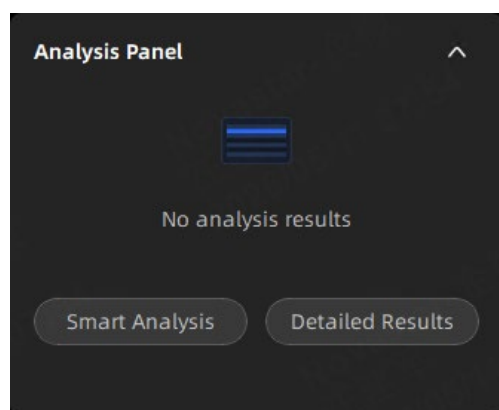
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

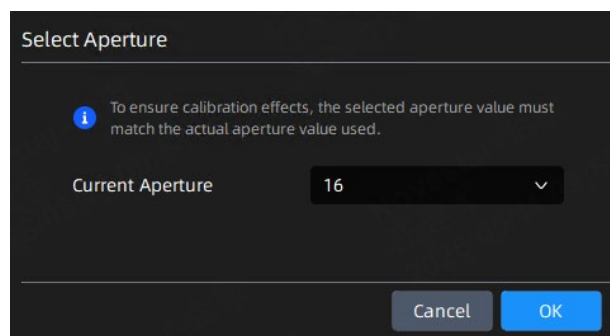
- Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-89 Smart analysis



- Step 2 When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-90 Aperture settings



- Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.
- If a white value is displayed next to the color, the value is normal and the smart analysis is completed.

- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 60, increase the aperture size or exposure time.
- If the peak brightness is greater than 80, decrease the aperture size or exposure time.
- If the image size is less than 5%, turn the focus ring to let the image become blurry.
- If the image size is greater than 60%, turn the focus ring to let the image become clearer.

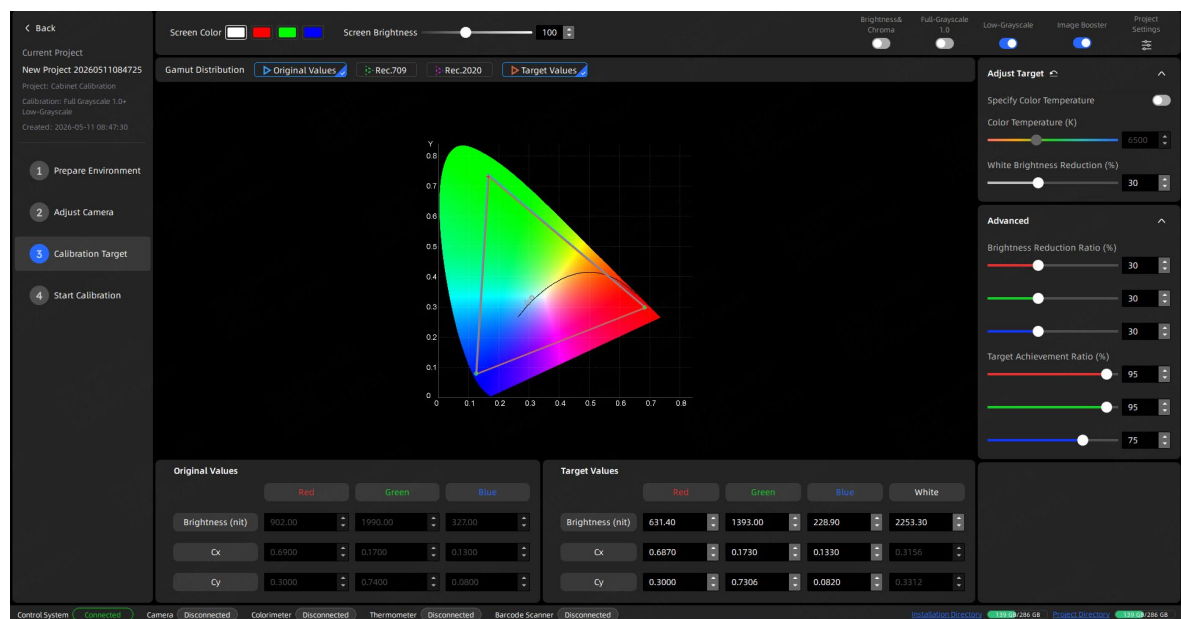
Note

After the smart analysis is completed, if any parameters of the camera are modified, you must perform aperture selection, area positioning and smart analysis again; otherwise the calibration effect will be affected.

7.6.3 Calibration Target

Obtain the original values of the cabinet brightness and chroma, and set the target values to complete the calibration target settings.

Figure 7-91 Calibration target



7.6.3.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the cabinet to be calibrated. They are used to calculate the calibration target values.

The full-grayscale 1.0 + low-grayscale calibration plan does not need to capture original values. The original values will be captured during the feature learning process and automatically refreshed after feature learning is completed.

7.6.3.2 Set Target Values

Prerequisites

Before calibration, adjust the color temperature value in the receiving card configuration file or NCP file to match or closely align with the screen's shipment color temperature requirements.

Procedure

Based on the obtained original values, adjust the brightness reduction or color temperature to obtain the target values that meet the requirement.

Step 1 On the project home screen, select the **Calibration Target** tab.

Step 2 Set the target values in any of the following ways:

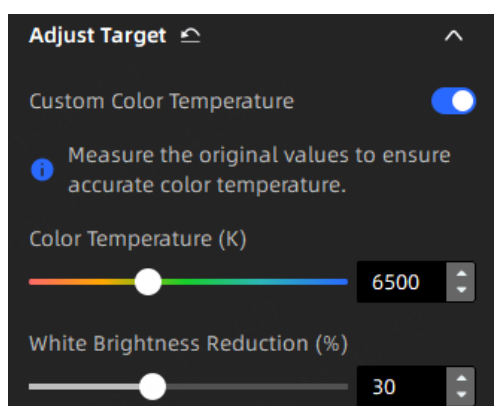
Note

To balance white brightness reduction with color temperature, first disable **Custom Color Temperature**. Adjust the white brightness reduction as needed, then enable **Custom Color Temperature** and set it to the desired value.

- Set the target color temperature

1. In the Adjust Target area on the right, turn on **Custom Color Temperature**.

Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.

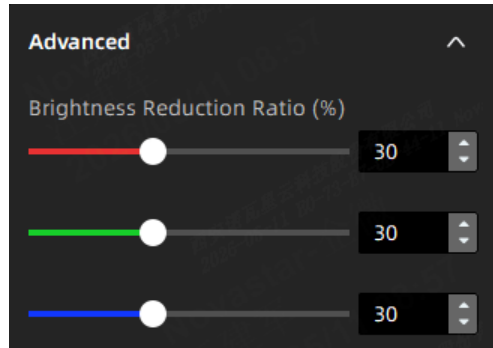


2. Drag the Color Temperature slider, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

Click  next to **Adjust Target** to restore both the original and target values to their default values. This will also turn on **Custom Color Temperature**.

- Advanced editing
 - Manually adjust brightness reduction ratio

- a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
- b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.

- Set the target values in the color gamut distribution chart

In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

7.6.3.3 Color Gamut Distribution Chart

Check the chroma range of the original and target values, visually view the chroma distribution information of the LEDs, and change the target values.

Figure 7-92 Color gamut distribution chart



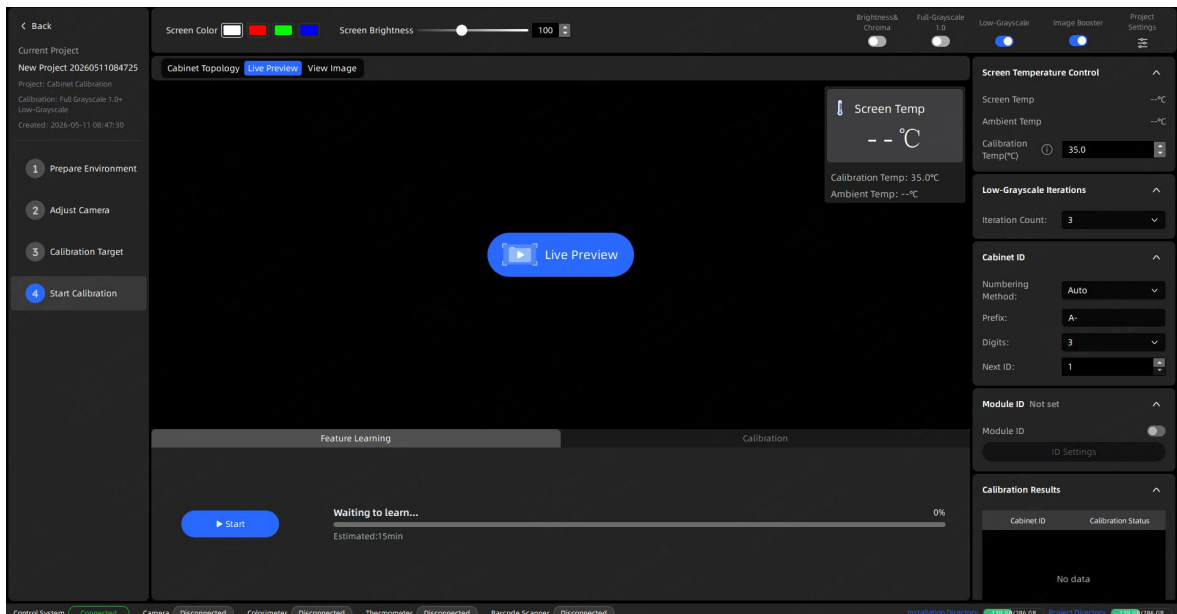
Related Operations

- Click the **Original Values**, **Rec.709**, **Rec.2020**, and **Target Values** buttons above the color gamut chart to show or hide the corresponding color gamut ranges on the color gamut distribution chart. They are shown by default.
- In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values. Before adjusting the target values, you need to enable **Advanced** editing.

7.6.4 Start Calibration

Perform sample cabinet feature learning, configure the calibration parameters and procedure, start calibration and curved surface correction, view calibration results and export calibration coefficients.

Figure 7-93 Start Calibration



- Click the **Live Preview** button to view the image captured by the camera in real time.
- Also, click the **View Image** button in the upper left corner to view the captured images.

7.6.4.1 Control Screen Temperature

Before feature learning, you need to set the screen temperature during calibration.

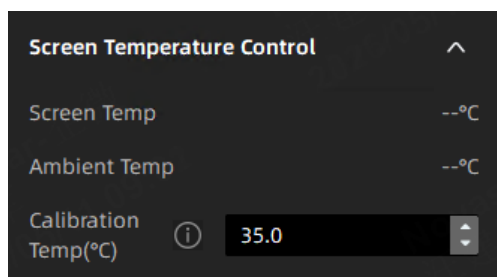
Prerequisites

- The thermometer is connected.
- The cabinets to be calibrated are placed in the darkroom. For specific requirements of the darkroom environment, please refer to [5.1.1 Darkroom Requirements](#).

Procedure

Select a normal cabinet, power it on, use the highest grayscale to display a white image on a cold screen for 90s, and set the resulting temperature as the calibration temperature.

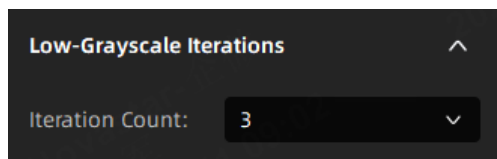
Figure 7-94 Controlling screen temperature



7.6.4.2 Set Low-Grayscale Iterations

Enter the number of times to perform low-grayscale calibration. This can be set based on the uniformity of the display and calibration experience, with a default of 3 times.

Figure 7-95 Setting low-grayscale iterations



7.6.4.3 Feature Learning

Learn the public characteristics of cabinets in the same batch to ensure that the calibration speed and effect can be effectively improved in the subsequent batch calibration process.

Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the feature learning process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

- Step 1 Select sample cabinets for feature learning and ensure the brightness difference of the samples should be within 7%.
- Step 2 On the **Start Calibration** screen, click the **Feature Learning** tab to access the feature learning screen.

Step 3 Click **Start** and the system will automatically capture the feature data of the current cabinet.

There are strict requirements for the cabinet temperature during feature learning.

- If the current cabinet temperature is 0.3°C higher than the set calibration temperature, the system will prompt you to power off the cabinet to cool it down.
- If the current cabinet temperature is 0.3°C lower than the set calibration temperature, the system will automatically heat the cabinet to the calibration temperature.

Step 4 When CC3 automatically reaches the colorimeter measurement step, it will pop up the colorimeter configuration information.

Figure 7-96 Configuring colorimeter

If the colorimeter connection has been completed during environment preparation, **Connected** will be displayed on the right side of **Model**. If the colorimeter is not connected, select the currently used colorimeter next to **Model** and click **Connect** to complete the connection.

A white capture area of **Side Length** size will be displayed on the cabinet. In **Start Coordinates**, you can set the position of the colorimeter capture area. Once done, align the capture head of the colorimeter with the white color block on the cabinet.

Note

- When configuring the capture area, please refer to the instructions on the colorimeter configuration screen, otherwise it will affect the feature learning effect.
- Capture areas cannot span across modules and it is recommended that the capture area be 2 pixels larger than the diameter of the colorimeter's measurement aperture. During the capture process, keep the colorimeter facing the capture area without moving.

Step 5 Click **OK**, and CC3 will capture chroma through the colorimeter.

After the chroma capture is completed, CC3 will pop up instructions to remove the colorimeter. You need to remove the colorimeter first, and then click **OK**.

Step 6 When the progress bar turns green and prompts "Learning successful", feature learning is completed.

Figure 7-97 Feature learning completed



7.6.4.4 Confirm Target Values

After feature learning, new target values will be automatically generated based on the captured original brightness and chroma values of the sample cabinets, as well as your settings for white brightness reduction and color temperature.

At this time, you need to return to the **Calibration Target** screen to confirm the target values.

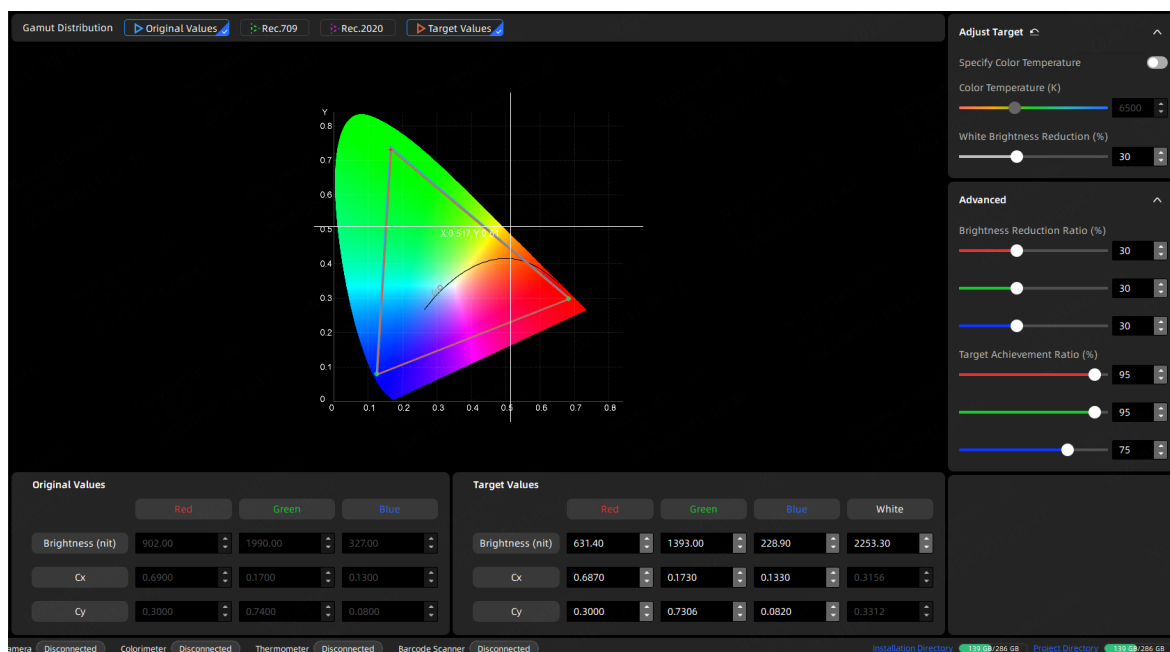
1. Check whether the target values generated by feature learning meet the shipping standards.

It is recommended to use the target values generated by feature learning to ensure optimal calibration results. If there are strict shipping standards, you may also fine-tune the existing parameters.

2. Adjust the target values as needed.

When adjusting the generated target values, ensure that the adjusted values do not turn red (indicating they are out of range). If necessary, adjust them to fall within the appropriate range.

Figure 7-98 Confirming target values



7.6.4.5 Set Cabinet ID and Module ID

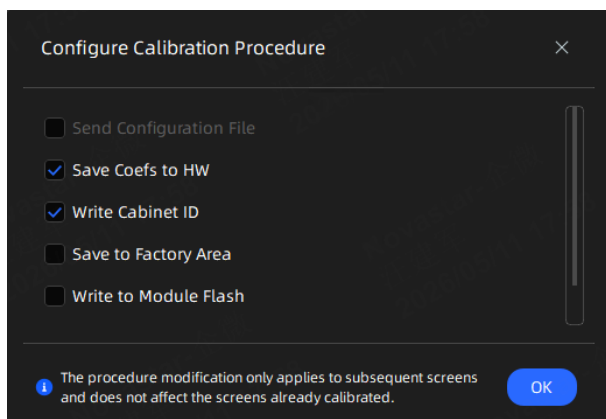
The cabinet and module IDs can be set. The procedure is the same as for brightness and chroma calibration. See [7.2.4.3 Set Cabinet ID](#) and [7.2.4.4 Set Module ID](#).

7.6.4.6 Configure Calibration Procedure

You have the option to customize the calibration procedure based on the condition of the cabinet to be calibrated.

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab, and then click **Configure Procedure** in the lower right corner to open the **Configure Procedure** window.
- Step 2 Check the relevant calibration steps as needed.

Figure 7-99 Configuring procedure



- Send Configuration File

Send the configuration file to the receiving card. If the configuration file used in the cabinet to be calibrated is an NCP file, CC3 does not support sending the configuration file.

- Save Coefs to HW

The parameters after calibration will be automatically saved into the receiving card of the cabinet.

- Write Cabinet ID

Write the cabinet ID to the receiving card.

- Save to Factory Area

Save the calibration coefficients to the factory area of the receiving card. After the coefficients are adjusted or lost, you can apply the factory area coefficients to the application area and the coefficients will be restored to the original data.

- Write to Module Flash

Write the calibration coefficients to the module flash memory for backup.

- Save Rv Card Parameters

Save the receiving card configuration file to hardware to prevent the loss of the file after the screen is powered off and on again. If the configuration file used in the cabinet to be calibrated is an NCP file, there is no need to send or save the configuration file.

- Step 3 After the procedure is configured, click **OK** below.

7.6.4.7 Calibrate Sample Cabinets

Calibrate the sample cabinets that have undergone feature learning and assemble them into a screen (3x3 cabinets at least recommended) to verify the calibration effect.

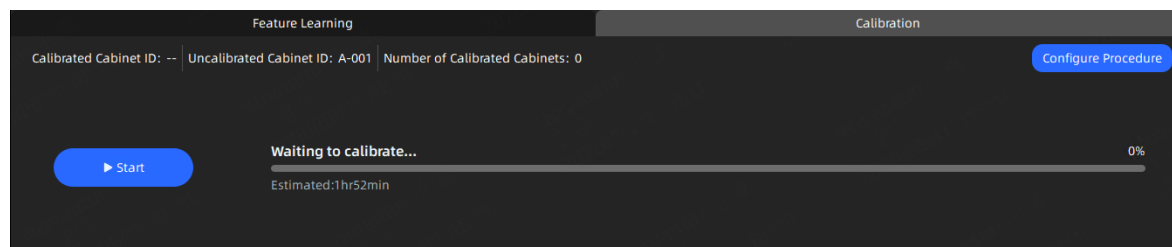
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- Target values are confirmed.
- The calibration procedure is configured, and cabinet ID settings are completed.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Procedure

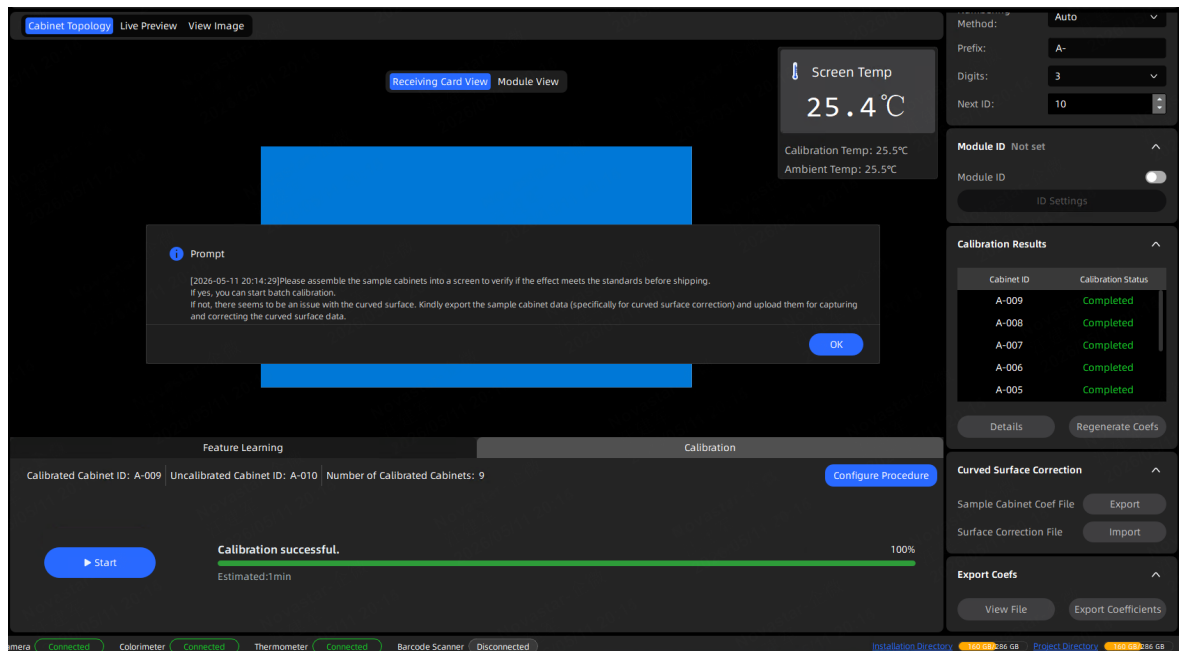
- Step 1 On the **Calibration** tab page in the lower part of the **Start Calibration** screen, click **Start** in the lower left corner, and the calibration software will automatically execute each step according to the configured calibration procedure.

Figure 7-100 Calibrating sample cabinets



- Step 2 Recalibrate at least 9 sample cabinets, assemble the calibrated sample cabinets into a screen to verify the calibration effect.
- Step 3 Evaluate the full-screen calibration results to determine if there are any curved surface transition issues.

Figure 7-101 Confirming calibration effect



- If the calibration results are satisfactory, refer to [7.6.4.9 Batch Calibration](#) to complete the batch calibration of cabinets.
- If the calibration results do not meet expectations, first refer to [7.6.4.8 Curved Surface Correction](#) to complete curved surface correction before proceeding with batch calibration.

Note

- When checking the calibration effect after calibration, use the CC3 software to display the test pattern and adjust the brightness.
- After completing the sample cabinet calibration, the camera parameters, camera position, and sample cabinet position must remain unchanged to ensure the results of the batch calibration.

7.6.4.8 Curved Surface Correction

If curved surface issues are present after sample cabinet calibration, refer to this section to implement the curved surface correction procedure. This will enhance the overall visual effect of the batch of cabinets when assembled, ensuring smooth curved surface transitions and achieving higher display quality.

Related Information

If the customer expects uniform display performance at higher screen temperatures, capture the data after the screen has been preheated. Otherwise, proceed with data capture on a cold screen.

Note

When performing curved surface correction, do not move or adjust the calibration environment used during sample cabinet calibration.

Procedure

In the **Curved Surface Correction** area on the right, click **Export** to save the coefficient files of sample cabinets to your local computer.

Please refer to the operating steps in [7.7 Curved Surface Correction](#) to perform the correction.

7.6.4.9 Batch Calibration

Full-grayscale 1.0 + low-grayscale calibration can be done automatically or manually.

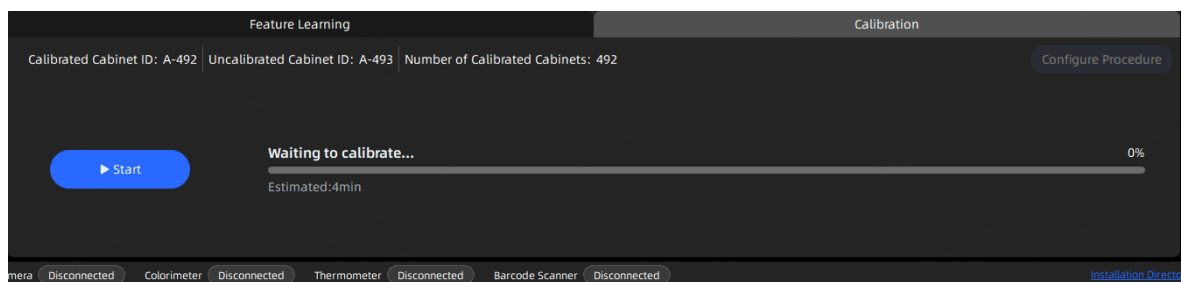
Prerequisites

- All the devices are connected normally and the Image Booster effect is enabled for the current batch of cabinets.
- The curved surface effect of the sample cabinet correction meets the expected results.
- The configuration files for the current batch of cabinets are sent and saved in the control software (VMP/NovaLCT), and the receiving card firmware versions for the cabinets are consistent.
- During the calibration process, ensure that the camera is positioned directly facing the cabinet and cannot be moved. Each time you replace the cabinet, try to maintain the same position as before.

Start Calibration

- Step 1 On the **Start Calibration** screen, select the **Calibration** tab to access the calibration screen.
- Step 2 Click **Start** in the lower left corner, and the calibration software will automatically execute cabinet calibration.

Figure 7-102 Cabinet calibration



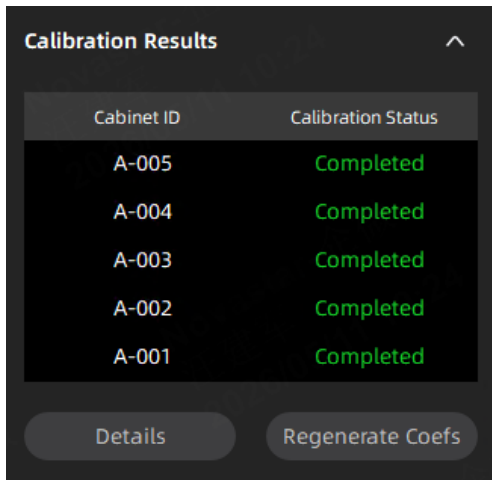
- Step 3 View the calibration progress and the status.

During calibration, the execution progress, status and other information of each calibration step will be displayed. You can cancel, pause and end calibration based on the actual situation.

- If the execution is successful, the progress bar will be green and the progress will display 100%.
- If the execution fails, an "Error" message, the failed step name, and the failure reason will be displayed above the progress bar. Troubleshoot the issue based on the provided reason. After troubleshooting is complete, click the step name again.

Step 4 In the **Calibration Results** area on the right, view the calibration result.

Figure 7-103 Calibration results



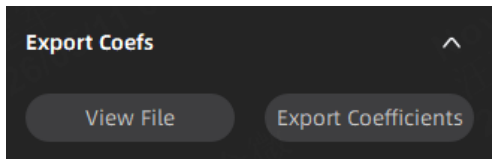
Cabinet ID	Calibration Status
A-005	Completed
A-004	Completed
A-003	Completed
A-002	Completed
A-001	Completed

Details Regenerate Coefs

7.6.4.10 View and Export Calibration File

After calibration is complete, you can view or export the calibration coefficients in the **Export Coefs** area at the bottom right of the **Start Calibration** screen.

Figure 7-104 Viewing calibration coefficient file



View Calibration Coefficients

Click **View File**, and the software will automatically open the folder where the coefficients are stored.

Export Coefficients

Step 1 Click **Export Coefficients** to open the coefficient export screen.

Figure 7-105 Exporting coefficients

Export

Coefficient Type

☒ Cabinet coef ☐ Module coef

Number of Target Databases

☒ Single ☐ Multiple

File Name

New Project 20260511092738

Save Path

C:/Users/Administrator/Desktop Browse

Cancel OK

Step 2 Configure the coefficient type for calibration coefficient export. Currently, only **Cabinet Coef** can be selected.

Step 3 Select to save as a single database or multiple databases.

- Single: Export the coefficients of all currently calibrated cabinets to a single database file.
- Multiple: Export coefficients for all currently calibrated cabinets by cabinet ID. The name of the exported database file is "*Cabinet ID + Export Time*".

Step 4 Under **File Name** or **Folder Name**, set the name of the file or folder where the exported coefficients are located

Step 5 Under **Save Path**, set the save path for the exported coefficients.

Step 6 Click **OK**, and the system will automatically export coefficients.

Step 7 After the export is complete, click **OK** to finish coefficient export.

7.7 Curved Surface Correction

If curved surface issues are present after sample cabinet calibration, refer to this section to implement the curved surface correction procedure. This will enhance the overall visual effect of the batch of cabinets when assembled, ensuring smooth curved surface transitions and achieving higher display quality.

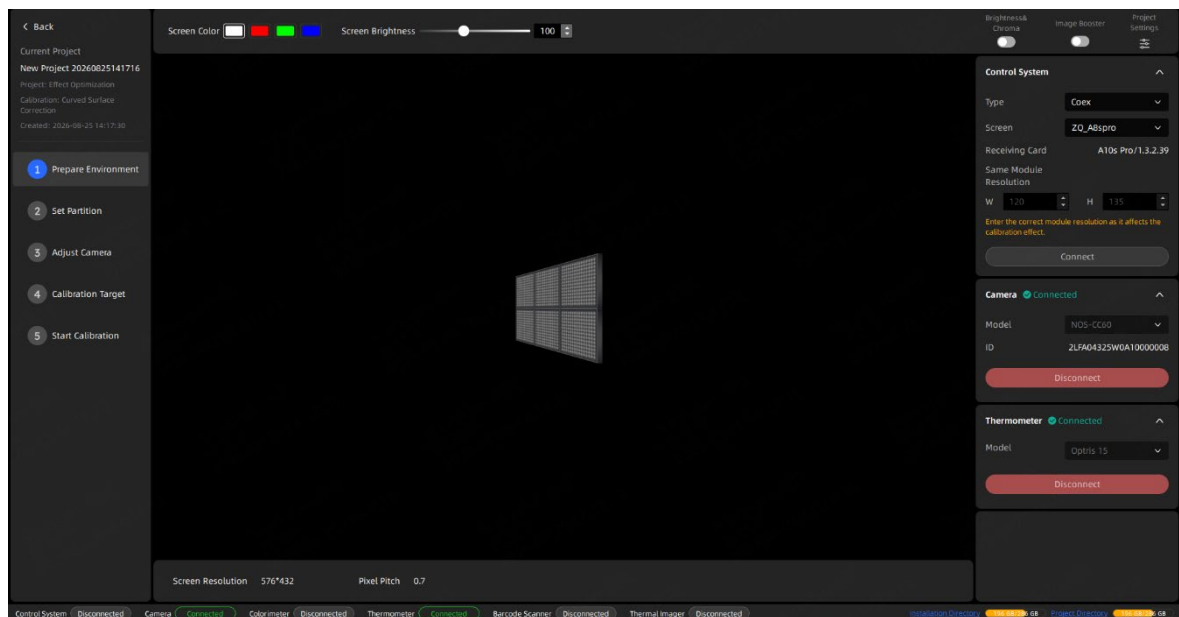
Prerequisites

- After cabinet calibration, go to the **Start Calibration** screen and select **Curved Surface Correction > Export** to export the current cabinets' calibration coefficients.
- Assemble all fully calibrated cabinets into a large screen.

Procedure

- Step 1 On the startup screen, click **New Project** to access the **New Project** page.
- Step 2 Under Project Type, select Effect Optimization.
- Step 3 Under Calibration Plan, select Curved Surface Correction.
- Step 4 Under **Import Curved Surface Correction File**, click **Browse** and select the exported cabinet calibration file.
- Step 5 Click **OK** to complete creating the project. The software automatically opens the project and enters the project home screen.

Figure 7-106 Curved surface correction



7.7.1 Prepare Environment

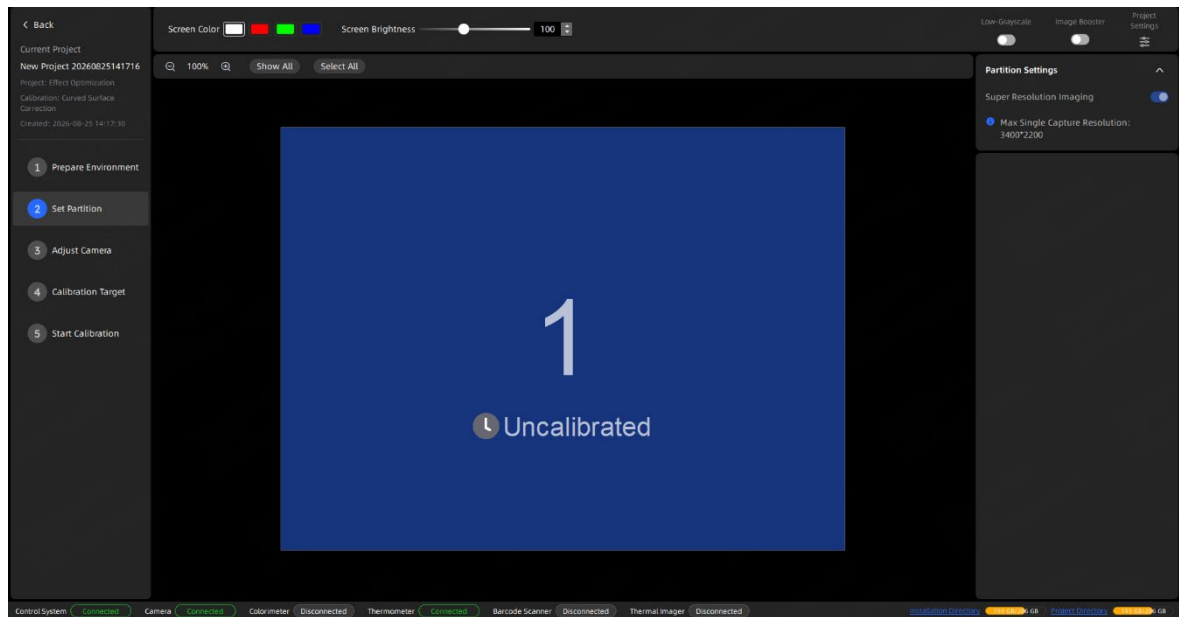
In the calibration software, connect a control system and import the receiving card configuration file, set the module resolution and partition, and connect a camera, thermometer and barcode scanner. The preparation steps are the same as those for the brightness and chroma calibration. For details, see [7.2.1 Prepare Environment](#).

Only the NOS-CC60 imaging colorimeter or C3200 industrial camera is supported. Digital cameras are not supported.

7.7.2 Set Partition

Check the current screen splicing layout, and view the max single capture resolution of the camera under **Super Resolution Imaging**.

Figure 7-107 Setting partition



Max single capture resolution of the camera when Super Resolution Imaging is enabled:

- NOS-CC60: 3400×2200.
- C3200: 2300×1600.

7.7.3 Adjust Camera

Preview the images captured by the camera, set the calibration grayscale, camera parameters, and area positioning, and analyze the camera parameters to ensure the parameter analysis results meet the calibration requirements.

7.7.3.1 Set Calibration Grayscale

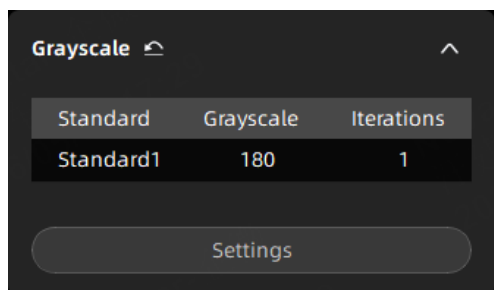
Set grayscale values for functions such as live preview, smart analysis and calibration.

Step 1 Go to the project home screen and select the **Adjust Camera** tab.

Step 2 In the **Grayscale** area on the right, view and set the calibration grayscale information.

Click  next to **Grayscale** to restore the grayscale values to the default values.

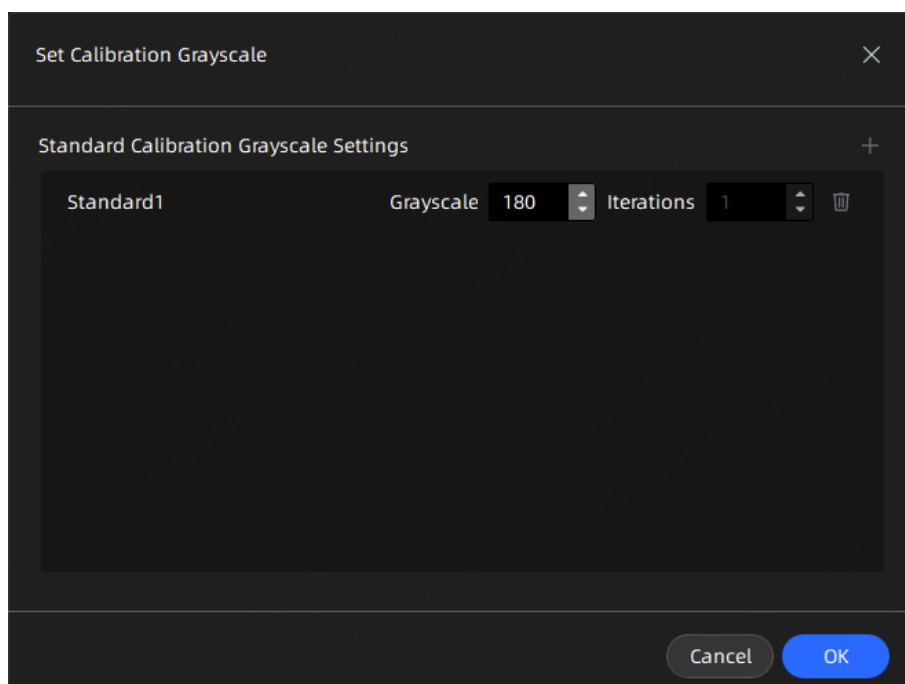
Figure 7-108 Calibration grayscale



Step 3 Click **Settings** in the **Grayscale** area to complete settings in the pop-up window.

- Grayscale: The default value is 180, and the value range is 0 to 255. Only one layer of calibration grayscale is supported.
- Iterations: It defaults to 1, and can be set between 1 and 10. Higher iteration counts will increase processing time. It can be adjusted on-site according to the actual situation of the screen, or you can contact NovaStar engineers for assistance.

Figure 7-109 Setting calibration grayscale



Note

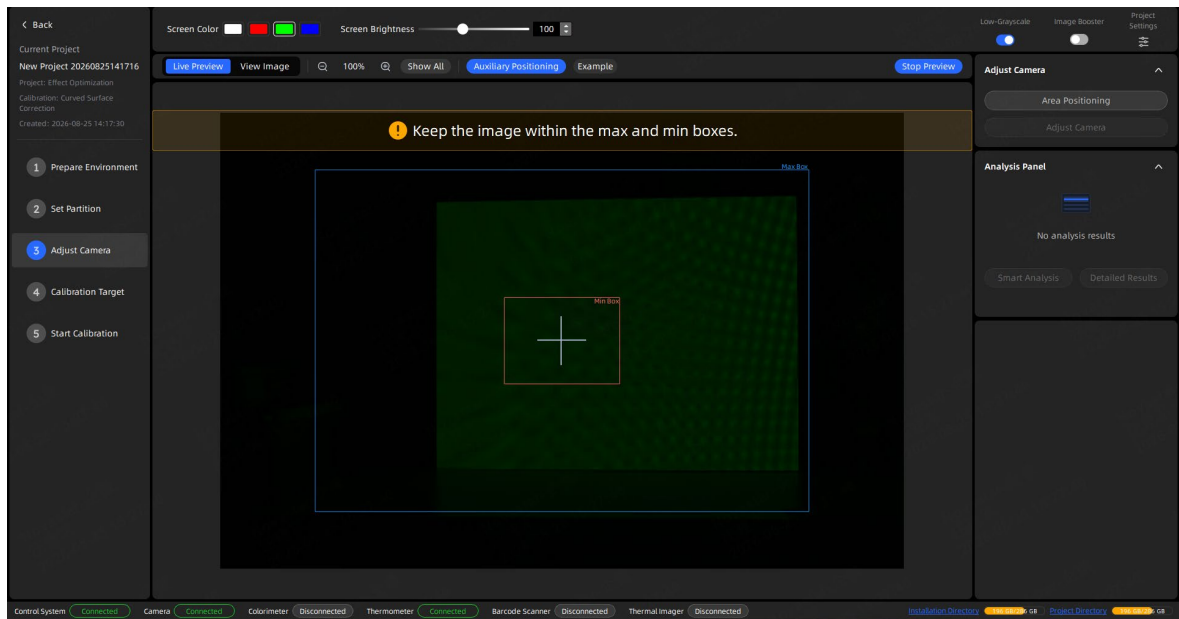
Grayscale settings are not required for curved surface correction after low-grayscale calibration.

7.7.3.2 Live Preview

Preview the images captured by the camera in real time to quickly adjust the camera position, focus ring, and aperture.

- Step 1 Click **Live Preview** in the center of the screen to enter the preview screen.
- Step 2 Use the tools at the top left of the center area or the right-click menu to assist in adjusting the live preview image and facilitate quick area positioning.

Figure 7-110 Live preview



- 20% : Click or to zoom out or in the preview image. You can also adjust the image zoom ratio through the mouse scroll wheel.
- Show All: Click this button to select it to center all the images captured by the camera in the preview box.
- Auxiliary Positioning: Click this button to assist in adjusting the distance between the camera and the screen. It is recommended that the camera image fall between the maximum and minimum boxes.
- Example: Click this button, and a reference image window will be displayed at the bottom right of the screen, which can provide a reference for users to adjust the live preview image.

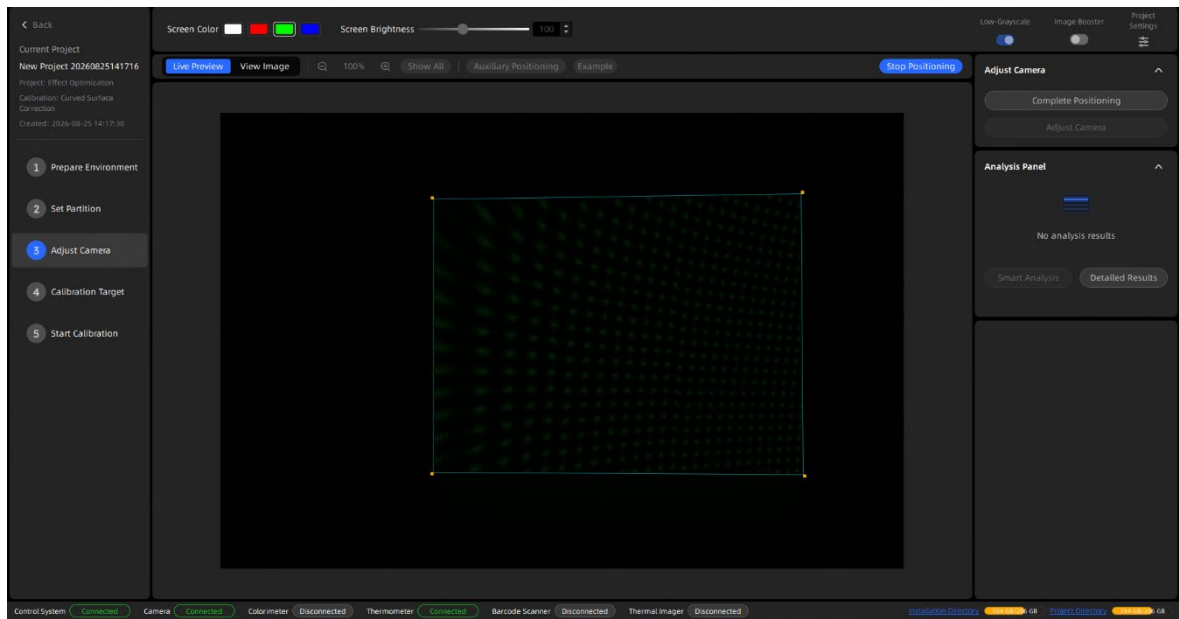
Step 3 (Optional) Click **Stop Preview** at the top right to exit live preview.

7.7.3.3 Area Positioning

Position the area to be calibrated to improve the efficiency of smart analysis and calibration.

- Step 1 On the **Adjust Camera** screen, click **Area Positioning** in the **Adjust Camera** area on the right. An area positioning box with draggable corner points appears.

Figure 7-111 Area positioning



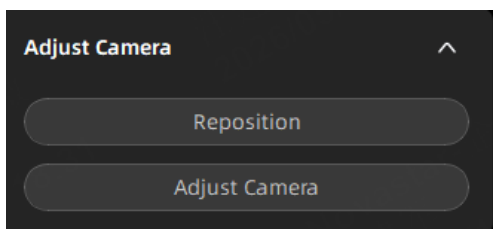
- Step 2 If the positioning box is abnormal, click and drag its four corner points to position the area by changing the position and size of the positioning box.
- During the adjustment, pay attention that the boundary lines of the positioning box cannot cover the LEDs. To cancel positioning, you can click **Stop Positioning** in the upper right corner, and the live preview screen will appear.
- Step 3 After the area positioning is completed, click **Complete Positioning** on the right.
- After clicking, the live preview screen will appear. You can click **Reposition** to enter the area positioning screen again to perform positioning.

7.7.3.4 Adjust Camera

The purpose of camera adjustment is to enable the camera to capture LED information that meets the requirements for subsequent calibration procedure.

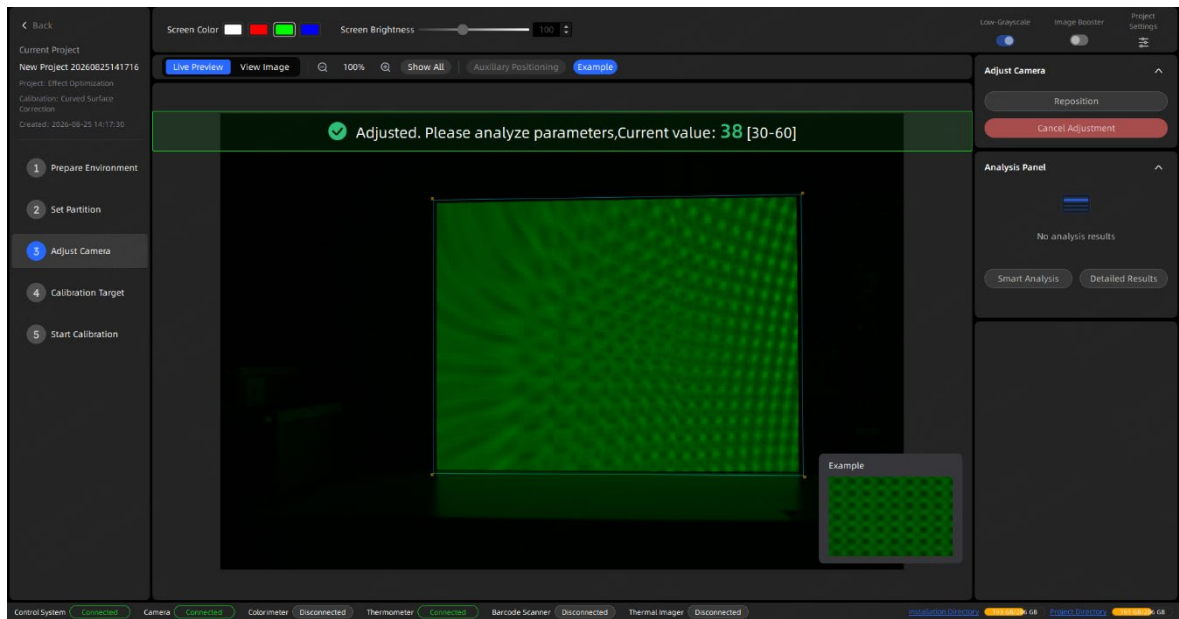
- Step 1 On the **Adjust Camera** screen, click the **Adjust Camera** button in the **Adjust Camera** area on the right.

Figure 7-112 Adjusting camera



- Step 2 Adjust the camera hardware parameters according to the prompts on the screen.
- The software will automatically calculate the appropriate exposure time based on the captured images and display the exposure values on the screen. You can switch colors to check whether the image for each color falls within the acceptable range.

Figure 7-113 Adjusting camera



Step 3 After the adjustment is completed, click **Cancel Adjustment** in the **Adjust Camera** area to return to the live preview screen.

7.7.3.5 Smart Analysis

Analyze the parameters of all colors with one click to obtain complete and qualified camera parameters for subsequent calibration procedure.

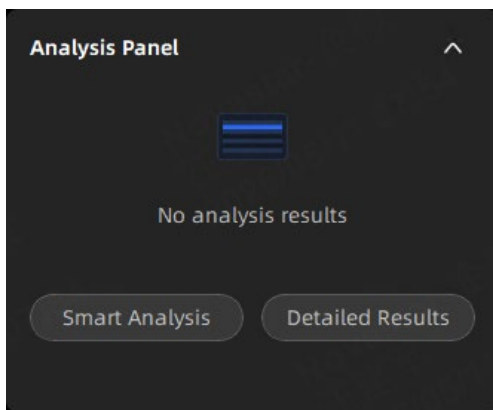
Prerequisites

- Make sure both the camera and control system are in a "connected" state.
- Area positioning is completed.
- The camera adjustment results are normal.

Procedure

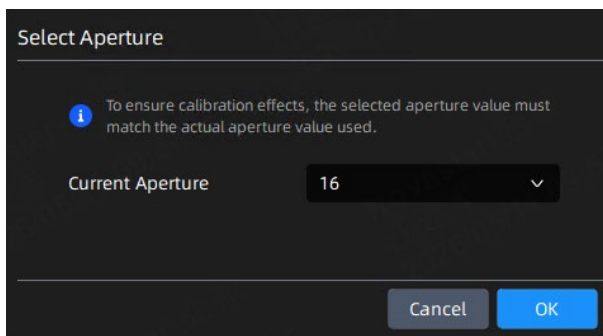
Step 1 On the **Adjust Camera** screen, click **Smart Analysis** in the **Analysis Panel** area on the right to start camera parameter analysis.

Figure 7-114 Smart analysis



Step 2 (Optional) When using the NOS-CC60 for calibration, after you click **Smart Analysis**, a **Select Aperture** dialog box will appear. Please click the drop-down menu and select the aperture that matches the actual aperture value.

Figure 7-115 Aperture settings



Step 3 After analysis, check the statuses of **Peak Brightness** and **Image Size** values of each color.

- If a white value is displayed next to the color, the value is normal and the smart analysis is completed.
- If a white value with a yellow exclamation mark icon is displayed next to the color, the value is abnormal. Go to [Step 4](#).

Step 4 Adjust the abnormal values by adjusting the camera-related parameters.

- If the peak brightness is less than 40, increase the aperture size or exposure time.
- If the peak brightness is greater than 60, decrease the aperture size or exposure time.
- If the image size is less than 20%, turn the focus ring to let the image become blurry.
- If the image size is greater than 70%, turn the focus ring to let the image become clearer.

Step 5 (Optional) Click **Detailed Results**. In the pop-up window, you can view the real-time analysis of the XYZ filters for each color at each captured grayscale level, along with the exposure time and gain.

Note

After the smart analysis is completed, if any parameters of the camera are modified, you must perform area positioning and smart analysis again; otherwise the calibration effect will be affected.

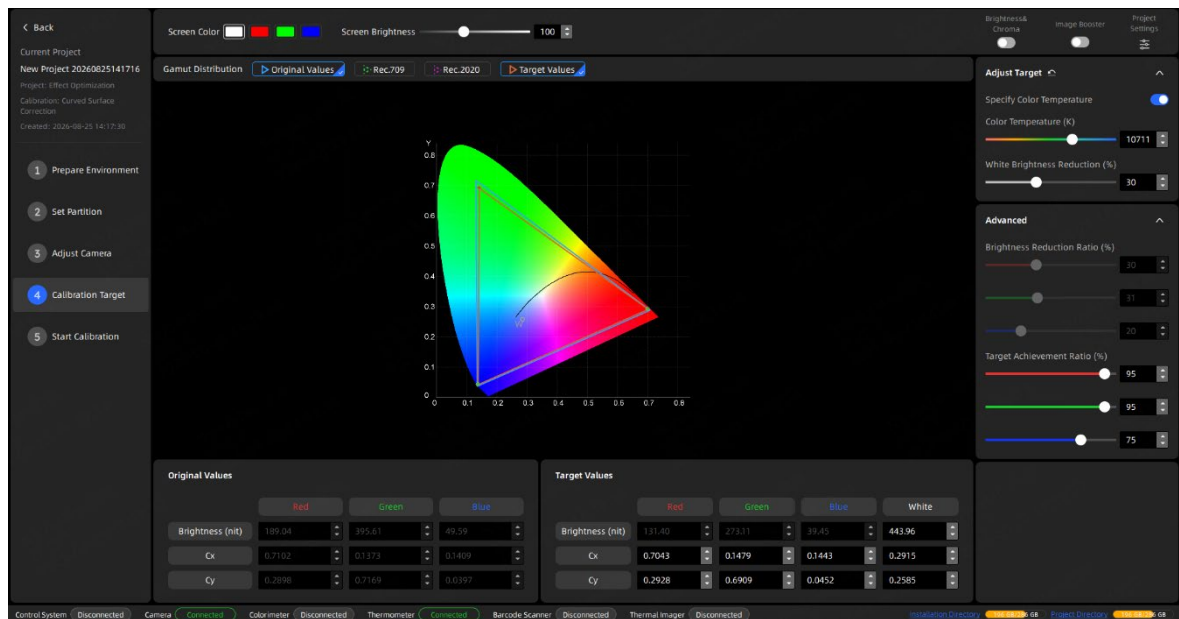
7.7.4 Calibration Target

Obtain the original values of the cabinet brightness and chroma, and set the target values to complete the calibration target settings.

Note

The calibration target settings are not required for curved surface correction after low-grayscale calibration.

Figure 7-116 Calibration target



7.7.4.1 Obtain Original Values

The original values refer to the original brightness and chroma information of the cabinet to be calibrated. They are used to calculate the calibration target values.

The curved surface correction plan does not need to capture original values, as the original value collection and refresh have already been completed during the feature learning of cabinet calibration.

7.7.4.2 Set Target Values

Prerequisites

Before calibration, adjust the color temperature value in the receiving card configuration file or NCP file to match or closely align with the screen's shipment color temperature requirements.

Procedure

Adjust the white brightness reduction or color temperature based on the user's desired shipping standards.

- Step 1 On the project home screen, select the **Calibration Target** tab.
- Step 2 Set the target values using one or a combination of the following methods.

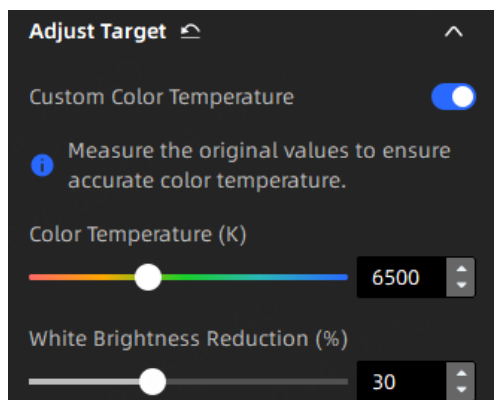


Note

To balance white brightness reduction with color temperature, first disable **Custom Color Temperature**. Adjust the white brightness reduction as needed, then enable **Custom Color Temperature** and set it to the desired value.

- Enable **Custom Color Temperature**.

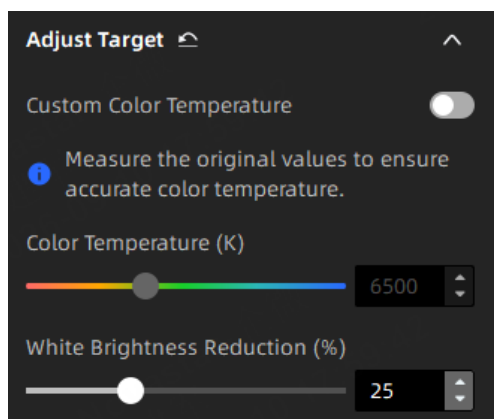
Set the target values through **Custom Color Temperature**. When **Custom Color Temperature** is enabled, **Color Temperature** becomes adjustable.



Drag the **Color Temperature** slider, click the ▲ and ▼ buttons, or directly enter a value to set the color temperature.

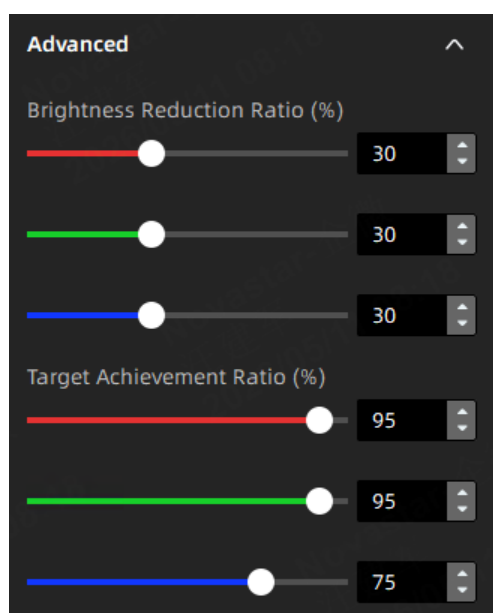
- Disable **Custom Color Temperature**.

After it is disabled, **Color Temperature** becomes disabled, and **White Brightness Reduction** becomes adjustable.



Drag the **White Brightness Reduction** slider, click the ▲ and ▼ buttons, or directly enter a value to set the white brightness reduction.

- Advanced editing
 - Manually adjust brightness reduction ratio
 - a. In the **Adjust Target** area on the right, turn off **Custom Color Temperature**.
 - b. In the **Advanced** area on the right, drag the **Brightness Reduction Ratio** and **Target Achievement Ratio** sliders, click the ▲ and ▼ buttons, or directly enter a value to set the target values.



- Manually edit the target brightness and chroma values

In the target value table, click the ▲ and ▼ buttons, or directly enter a value to set the values.
- Set the target values in the color gamut distribution chart

In the color gamut distribution chart, drag the corner of the target color gamut to change the coordinates of the target values.

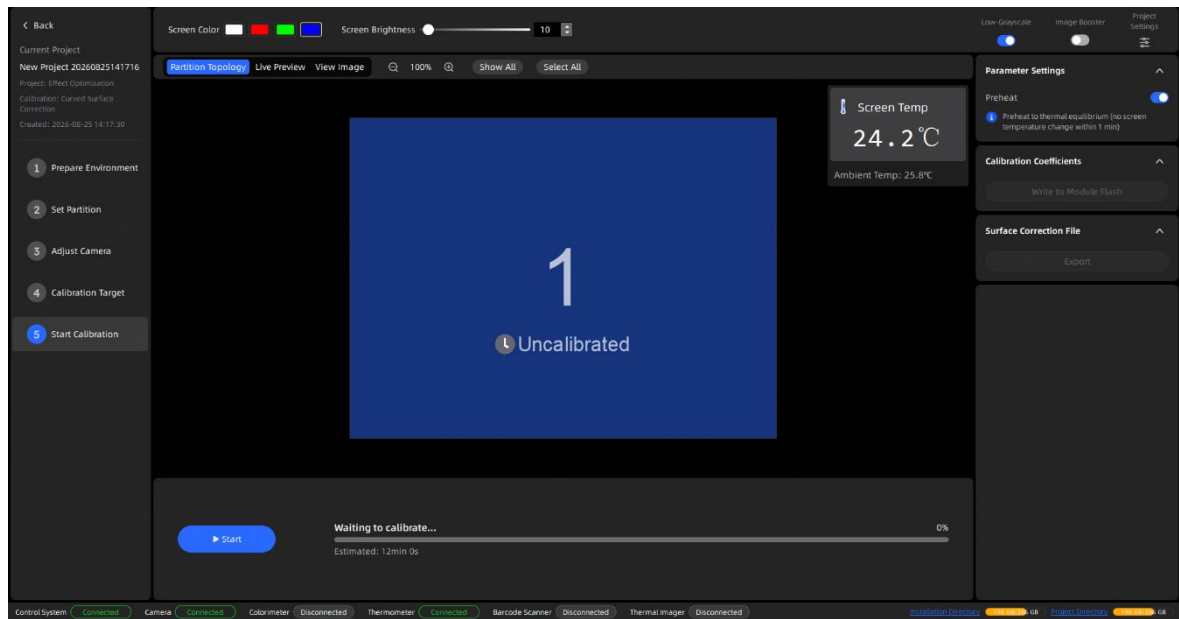
- Click ↺ next to **Adjust Target** to restore both original and target values to the default values.

7.7.5 Start Calibration

Set the calibration process parameters and procedure, start calibration, view calibration results, and export calibration coefficients.

Step 1 Click **Start Calibration** on the left to enter the corresponding screen.

Figure 7-117 Start Calibration



- Step 2 Preheat the screen by enabling **Preheat** in the parameter settings area in the top-right corner.
- After it is enabled, wait for the screen to preheat automatically. The preheating is complete when the screen temperature displayed by the thermometer remains unchanged for one minute.
- Step 3 Click **Start**, and the system will automatically perform the curved surface correction according to the workflow.
- Step 4 After the curved surface correction is complete, click **Write to Module Flash** on the right to save the corrected coefficients to the receiving card Flash.
- Step 5 (Optional) Under **Surface Correction File**, click **Export** to export the corrected coefficients to a local directory.
- Step 6 After exporting the curved surface correction coefficients, open the corresponding cabinet calibration project, go to **Start Calibration > Curved Surface Correction**, click **Import** to import the corrected coefficients into the cabinet, and then perform batch cabinet calibration until the process is complete.

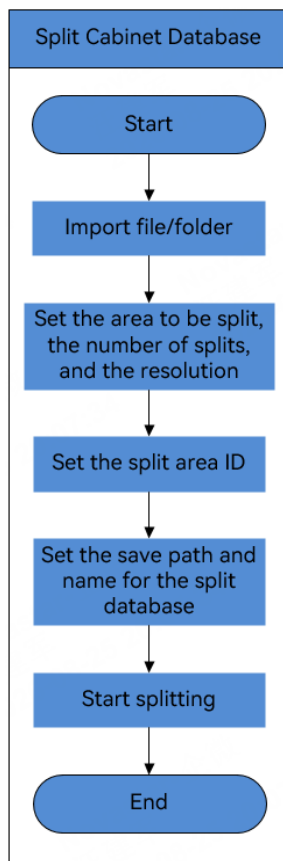
8 Calibration Coefficient Management

8.1 Split Coefficients

The Coefficient Splitting Tool allows you to divide the screen database into cabinet or module database based on the actual screen resolution and number of cabinet rows/columns. Depending on different needs, a screen database can be converted into a single or multiple databases.

Since an LED screen is typically composed of multiple cabinets, if a user needs to obtain calibration coefficients for individual cabinets after calibrating the entire screen, the screen calibration coefficients can be split into calibration coefficients for each individual cabinet.

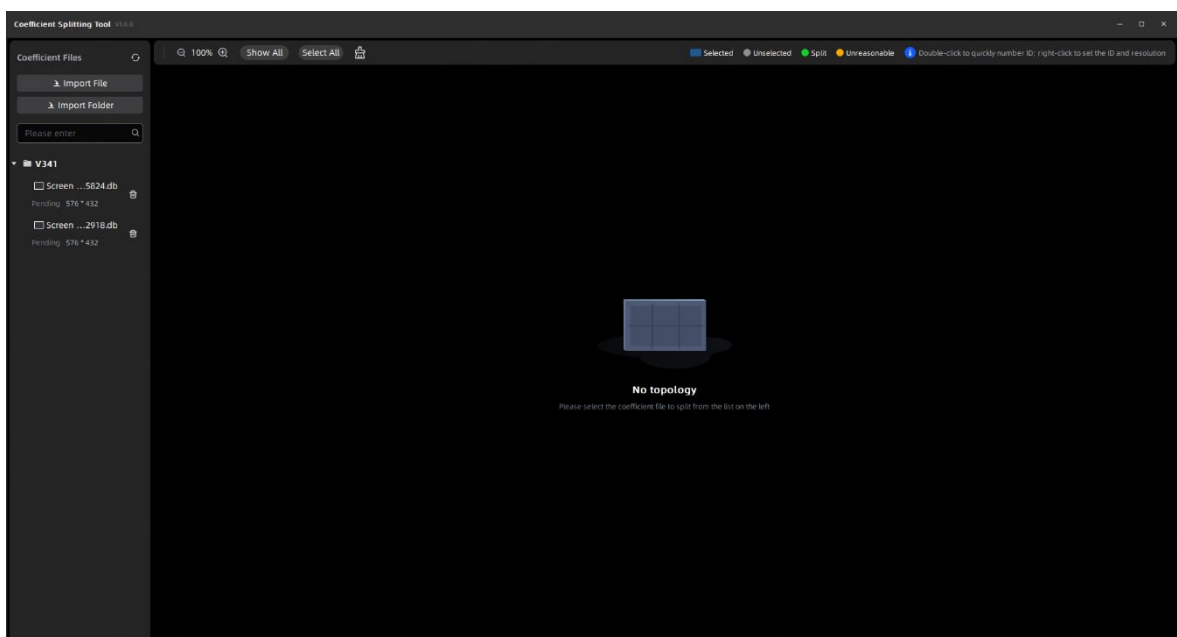
Figure 8-1 Procedure of splitting screen database



8.1.1 Import/Select Screen Database

- Step 1 From the top menu bar, choose **Tools > Coefficient Splitting Tool**.
- Step 2 Select a local project, or click **Import File** or **Import Folder** to import an existing project.

Figure 8-2 Importing screen database



8.1.2 Configure Splitting Settings

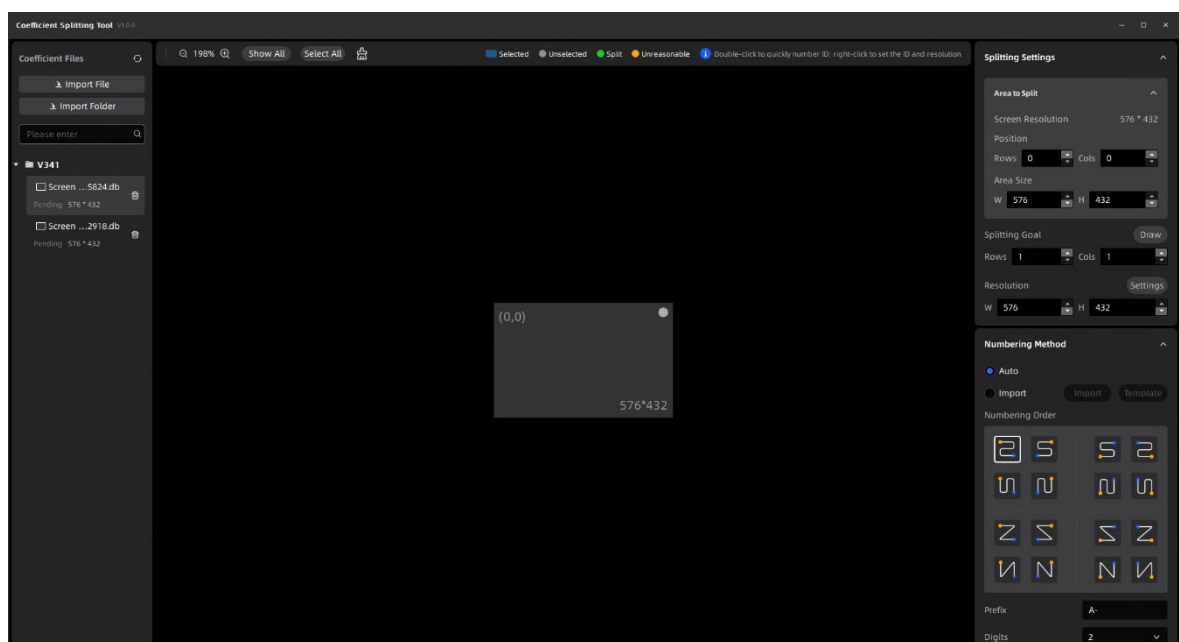
Step 1 Click an imported screen database on the left.

Step 2 In the **Splitting Settings** area on the right, set the position and area size for the area to split based on the splitting range.

- Under **Position**, set the starting row and column of the area to split.
- Under **Area Size**, set the width and height of the area to split in pixels.

The default area to split is the entire screen. You can modify it as needed, but the area to split you set must not exceed the size of the entire screen.

Figure 8-3 Splitting settings



Step 3 Set **Splitting Goal** based on the size of the desired area size.

Enter the values of rows and columns. They range from 1 to the screen width/height.

Step 4 Click **Draw** to generate the split topology.

Click 100% to zoom the topology in or out, or restore the topology size to 1:1. You can also press **Ctrl** and roll the mouse wheel at the same time to zoom the topology.

Step 5 Under **Resolution**, enter the cabinet resolution and click **Settings**.

Right-click a cabinet and select **Set Resolution**. In the dialog box that appears, set the width and height. You can simultaneously set the height for the entire row where the selected cabinet is located.

Hold down the **Ctrl** key and click to select multiple target cabinets.

Note

Cabinets can have different resolutions, but they must follow the rules below. If the resolution settings are invalid, the topology will turn yellow.

- The sum of the row resolutions of all cabinets must equal the row resolution of the full screen, and the sum of the column resolutions of all cabinets must equal the column resolution of the full screen.

- Cabinets in the same row must have the same row resolution, and cabinets in the same column must have the same column resolution.

8.1.3 Set Cabinet ID

Cabinet IDs can be assigned automatically, manually, or by importing.

Auto IDs

- Step 1 Select **Auto** under **Numbering Method**.
- Step 2 Set **Numbering Order**, **Prefix**, **Digits**, and **Start Value**.
- Step 3 Click **ID Settings**.

Figure 8-4 Automatic numbering

The screenshot shows a dark-themed dialog box titled "Numbering Method". At the top, there are three radio buttons: "Auto" (selected), "Import", and "Template". Below these are two buttons: "Import" and "Template". Under the "Numbering Order" section, there is a grid of 16 icons representing different numbering paths: Z-shape, N-shape, ㄱ-shape, and ~-shape. Below the grid, there are four input fields: "Prefix" (set to "A-"), "Digits" (set to "2"), "Start Value" (set to "1"), and "Example" (showing "A-01"). At the bottom, there is a button labeled "ID Settings".

- Numbering Order: Includes Z Shape, N Shape, ㄱ Shape, and ~ Shape.
The software will number all the cabinets according to the selected shape.
- Prefix: The prefix does not change with the cabinet ID. It is just a mark.

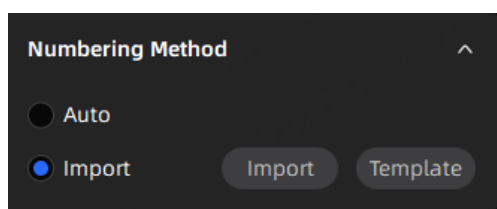
- **Digits:** Set the length of numeric codes in the ID, which defaults to 3.
 - If the actual number of digits exceeds the selected value, all digits are displayed.
 - If the actual number of digits is less than the selected value, leading zeros are added.
- **Start Value:** Set the starting sequence number for the cabinet to be calibrated.

For example, if you set **Prefix** to "A-", **Digits** to "2", and **Start Value** to "1", the cabinet ID during calibration will be "A-01".

Import IDs

You can set the cabinet ID by importing a table.

Figure 8-5 Importing IDs



- Click **Import** to import a table containing IDs previously read back and exported using the NovaLCT control software.
- Click **Template**, download and fill out the template, and then import it.



Note

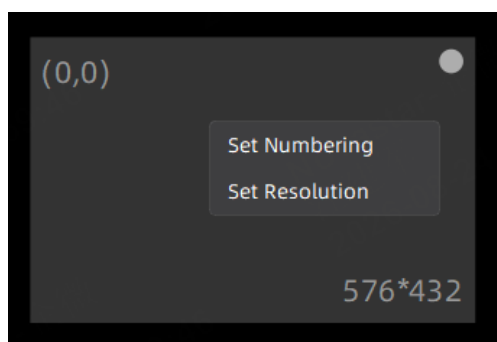
Before importing, you need to draw the topology diagram, and the imported IDs must be unique, with no duplicates allowed.

Manual IDs

Right-click on a cabinet in the topology diagram to select it and assign an ID to it.

For example, select the first cabinet, right-click on it, choose **Set Numbering**, and enter "A-01" to assign it to the first cabinet. Repeat this process to complete the numbering of all cabinets.

Figure 8-6 Manually numbering cabinets

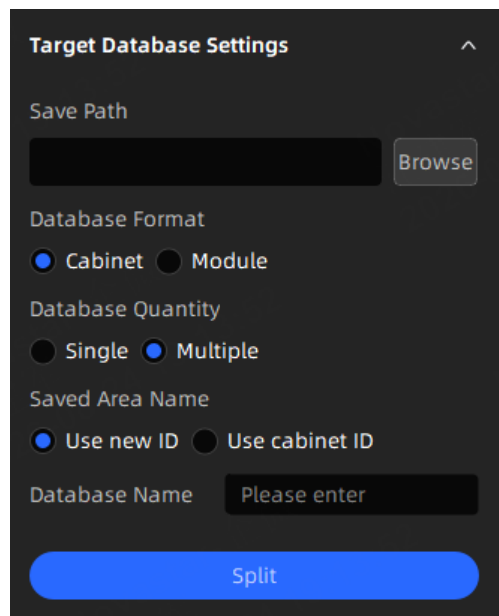


You can also double-click a cabinet to automatically assign a numeric ID to it.

8.1.4 Set Target Databases

Step 1 Under **Save Path**, select a save path for the target database.

Figure 8-7 Setting save path

The screenshot shows a 'Target Database Settings' dialog box with a dark background. It contains several settings: 'Save Path' with a text input field and a 'Browse' button; 'Database Format' with radio buttons for 'Cabinet' (selected) and 'Module'; 'Database Quantity' with radio buttons for 'Single' and 'Multiple' (selected); 'Saved Area Name' with radio buttons for 'Use new ID' (selected) and 'Use cabinet ID'; and 'Database Name' with a text input field containing 'Please enter'. At the bottom is a large blue 'Split' button.

Step 2 Set the database save format to **Cabinet** or **Module**.

Step 3 Set the number of target databases to **Single** or **Multiple**.

- Single: Save the data of all the cabinets or modules into one database, resulting in a single database.
- Multiple: Save the data of each cabinet or module as a separate database, resulting in multiple databases, each named according to the cabinet or module ID.

Step 4 Configure the saved area name type. Options include **Use new ID** and **Use cabinet ID**.

This parameter is available only when the database save format is set to **Cabinet** and the database save quantity is set to **Multiple**.

- Use new ID: Uses the cabinet IDs configured in [8.1.3 Set Cabinet ID](#) as the names for each target database.
- Use cabinet ID: Uses the original cabinet IDs from the screen's database as the names for each target database. This option is available when the imported data contains data for multiple cabinets.

Step 5 Next to **Database Name**, enter a name for the target database or the folder name for multiple target databases.

Step 6 Click **Split** to split the database.

Note

- The new database name cannot be the same as the original database name.
- Once the data is successfully split, you cannot modify the parameters to split it again.

8.2 Simulate Coefficients

The pre-calibration display effect of an LED screen can be restored using calibration coefficients. The restored image is a simulation image, which calibration engineers can compare with the actual pre-calibration effect to determine if the calibration is correct.

Note

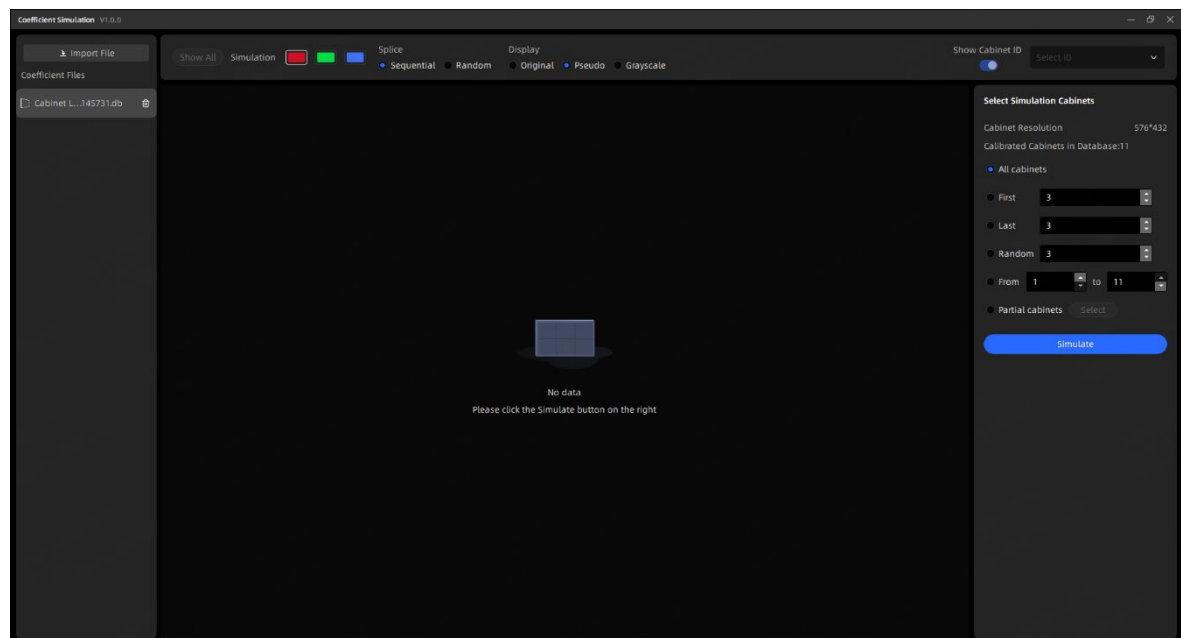
Coefficient simulation is not supported for “modules” after coefficient splitting.

8.2.1 Import/Select Cabinet Database

Step 1 From the top menu bar, choose **Tools > Coefficient Simulation Tool**.

Step 2 Click **Import File** to import a data file containing completed cabinet calibration data.

Figure 8-8 Importing a cabinet database



8.2.2 Select Simulation Cabinets

Step 1 In the **Select Simulation Cabinets** area, select the range of cabinets to be simulated.

- Options include all cabinets, the first n cabinets, the last n cabinets, n random cabinets, or n consecutive cabinets.

Figure 8-9 Selecting simulation cabinets

Select Simulation Cabinets

Cabinet Resolution 576*432

Calibrated Cabinets in Database:11

☒ All cabinets

☐ First 3

☐ Last 3

☐ Random 3

☐ From 1 to 11

☒ Partial cabinets Select

Simulate

- When **Partial cabinets** is selected, click **Select**, check the boxes for the desired cabinets, and click **OK**.

Figure 8-10 Selecting partial cabinets

Select Simulation Cabinets

Cabinet Resolution 576*432

Calibrated Cabinets in Database:11

☐ All cabinets

☐ First 3

☐ Last 3

☐ Random 3

☐ From 1 to 11

☒ Partial cabinets Select

Total:11 Cabinets, Selected:0 Cabinets

Simulate

Select

☐ Select All Total:11 Cabinets, Selected:0 Cabinets

☐ A-001	☐ A-002	☐ A-003	☐ A-004
☐ A-005	☐ A-006	☐ A-007	☐ A-008
☐ A-009	☐ A-010	☐ A-011	

Cancel OK

Step 2 Click **Simulate** and check the coefficient simulation effects.

8.2.3 Check Simulation Effects

Step 1 In the **Splice** area at the top, set how the cabinets are spliced together. The options are as follows:

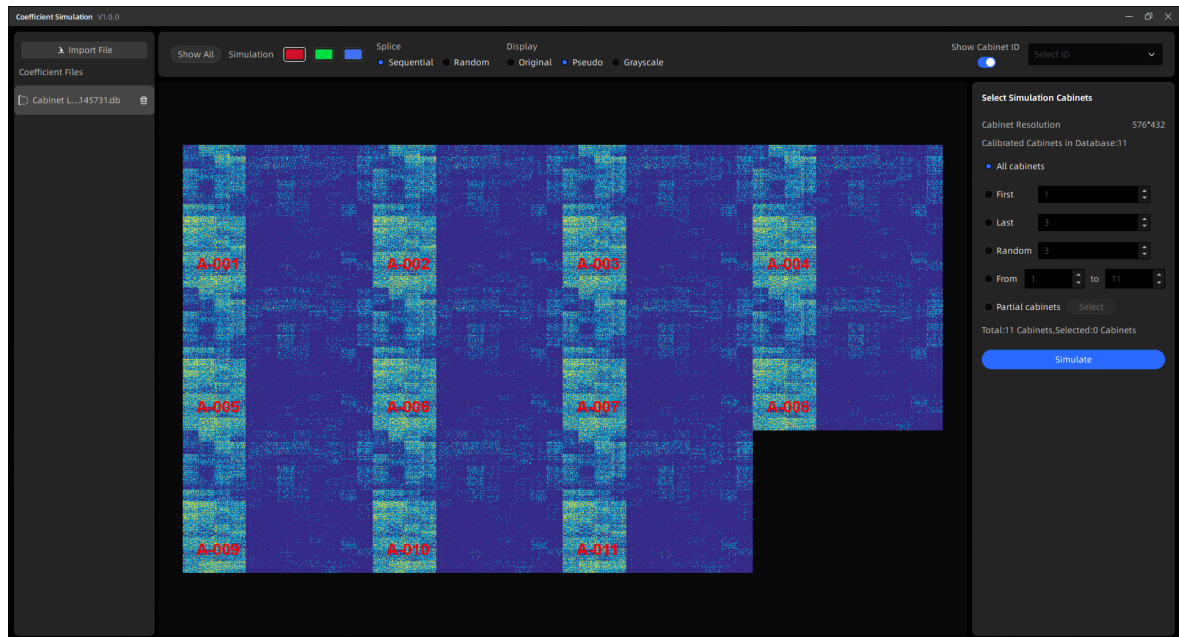
- Sequential: Cabinets are spliced by ID from left to right and top to bottom.
- Random: Cabinets are spliced automatically in a random order.

Step 2 Select the display color for the simulated screen. Options are red, green, and blue.

Step 3 Set the display mode for the simulation image. Three modes are supported:

- Original: Displays the simulation image using the actual selected color.
- Grayscale: Converts the brightness of the selected color into a grayscale image.
- Pseudo: Uses different colors to represent different brightness levels.

Figure 8-11 Coefficient simulation effect



Click **Show Cabinet ID** in the upper-right corner to toggle the display of cabinet IDs on the simulation screen. Once enabled, you can select a specific cabinet from the drop-down list on the right to locate and view its individual simulation effect.

9 FAQ

9.1 How to connect an imaging colorimeter or a camera?

The CC3 calibration software supports the NOS-CC60 imaging colorimeter, C3200 industrial camera and Canon EOS 90D\80D\70D\R7 digital cameras. When connecting the camera, it is necessary to complete the required camera settings.

Imaging Colorimeter/Industrial Camera

Step 1 Plug in the camera and connect it to the calibration computer.

- NOS-CC60: Use a USB cable to connect it to the calibration computer.

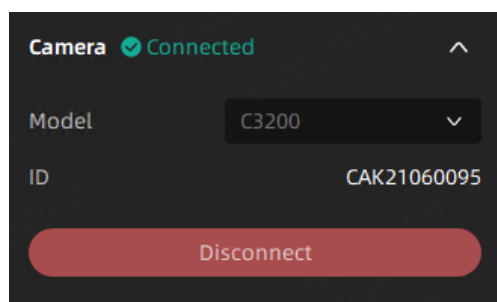
- C3200: Use an Ethernet cable to connect it to the calibration computer.

Step 2 Go to the project home screen and select the **Prepare Environment** tab.

Step 3 In the **Camera** area on the right, select the model of the connected camera.

Step 4 Click **Connect** to connect the camera to the calibration software.

Figure 9-1 Connecting camera



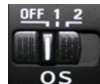
Note

Due to compatibility issues between the C3200 camera and some computers, the camera connection may fail. In such cases, you can try disabling the network adapter connected to the C3200 and then enabling it again. The camera can be managed by using the tool that is installed together with the calibration software. See [9.2 How to use the auxiliary tool for C3200 camera?](#)

Digital Camera

Step 1 Use a USB cable to connect the camera to the calibration computer and turn the camera switch to **ON**.

Step 2 Rotate the mode dial  to **M** (manual) and set the focus mode to **MF** (manual focus) . If

the lens has anti-shake function (Sigma: OS, or optical stabilizer), turn it off .

Step 3 In the camera menu, enable **Live View Shoot** and press  to turn on LCD viewfinder shooting. The real-time image captured by the camera will be displayed on the LCD screen.

Step 4 In the camera menu, turn off the **Auto power off** function.

Step 5 Go to the project home screen and select the **Prepare Environment** tab.

Step 6 In the **Camera** area on the right, select the model of the connected camera.

Step 7 Click **Connect** to connect the camera to the calibration software.

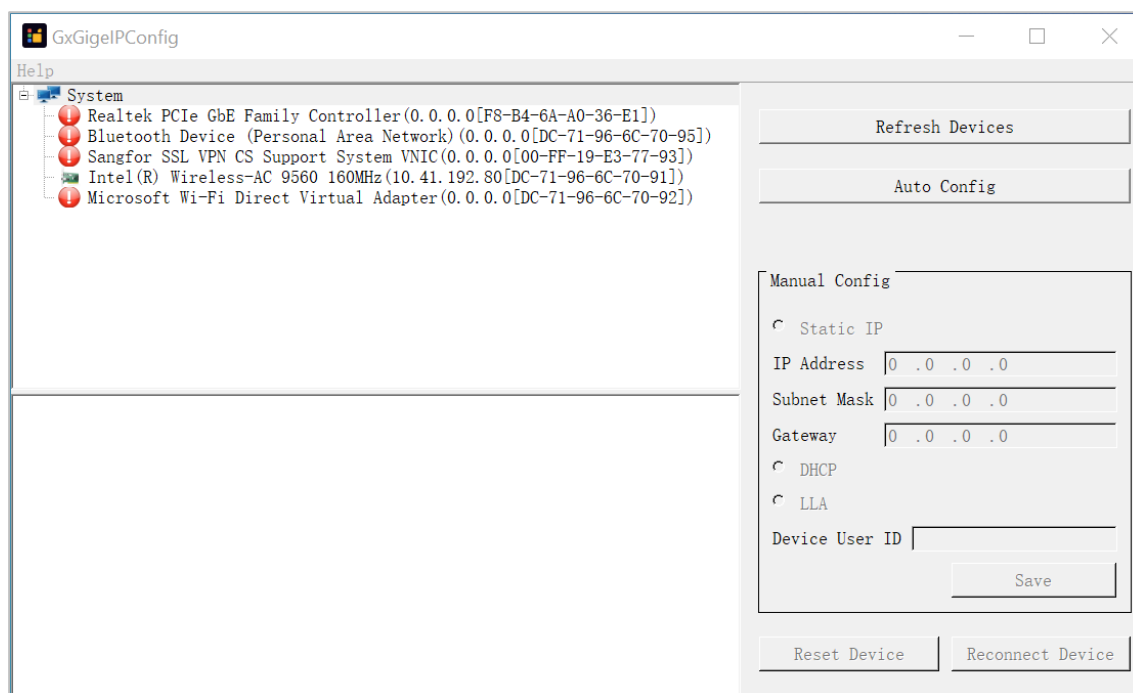
Note

- In LCD viewfinder shooting mode, press the zoom in button of  to show the image in the original size, or zoom in the image by 5 times or 10 times.
- If the digital camera connection fails, check [Step 1](#) to [Step 4](#) and check whether the digital camera and dongle match.

9.2 How to use the auxiliary tool for C3200 camera?

You can use the IP configuration tool that is installed together with the calibration software to manage the camera.

In the **System** list in the upper-left corner, you can see all the network adapters of the computer directly connected to the C3200 and which adapter the C3200 is connected to.



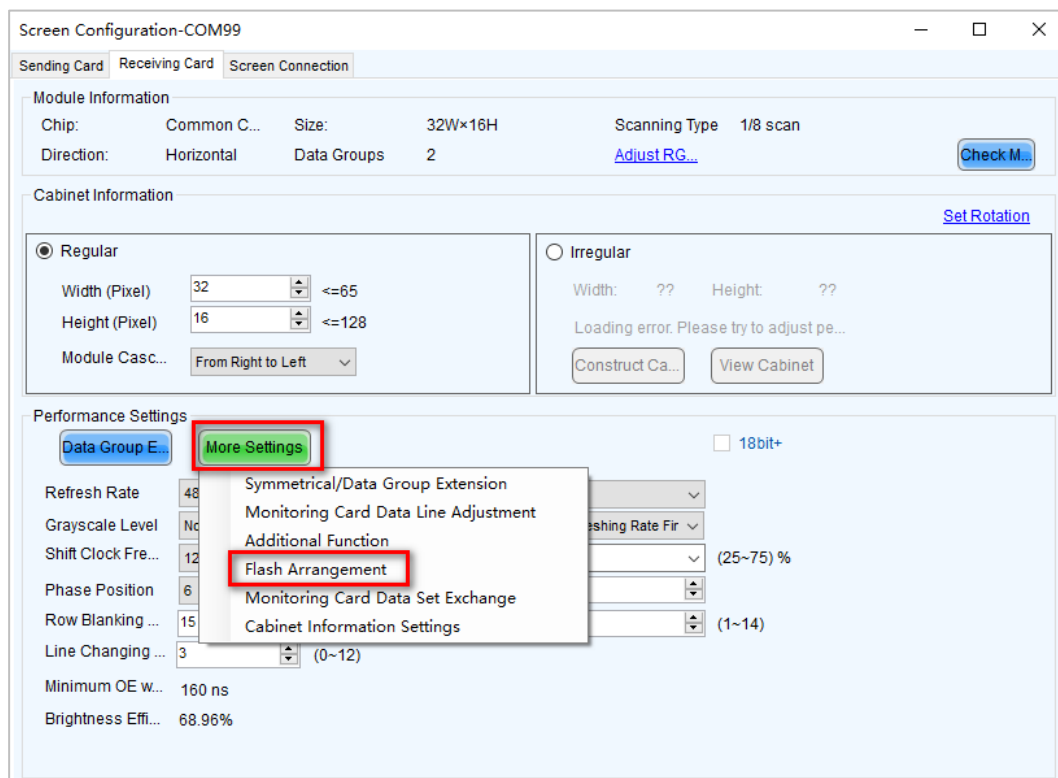
- Refresh Devices: Click to view the latest connection status of the devices.
- Reset Device: Click to power off the C3200 and restart it.
- Reconnect Device: Click to disconnect and reconnect the C3200.

9.3 How to set module flash memory arrangement?

9.3.1 Mars Control System

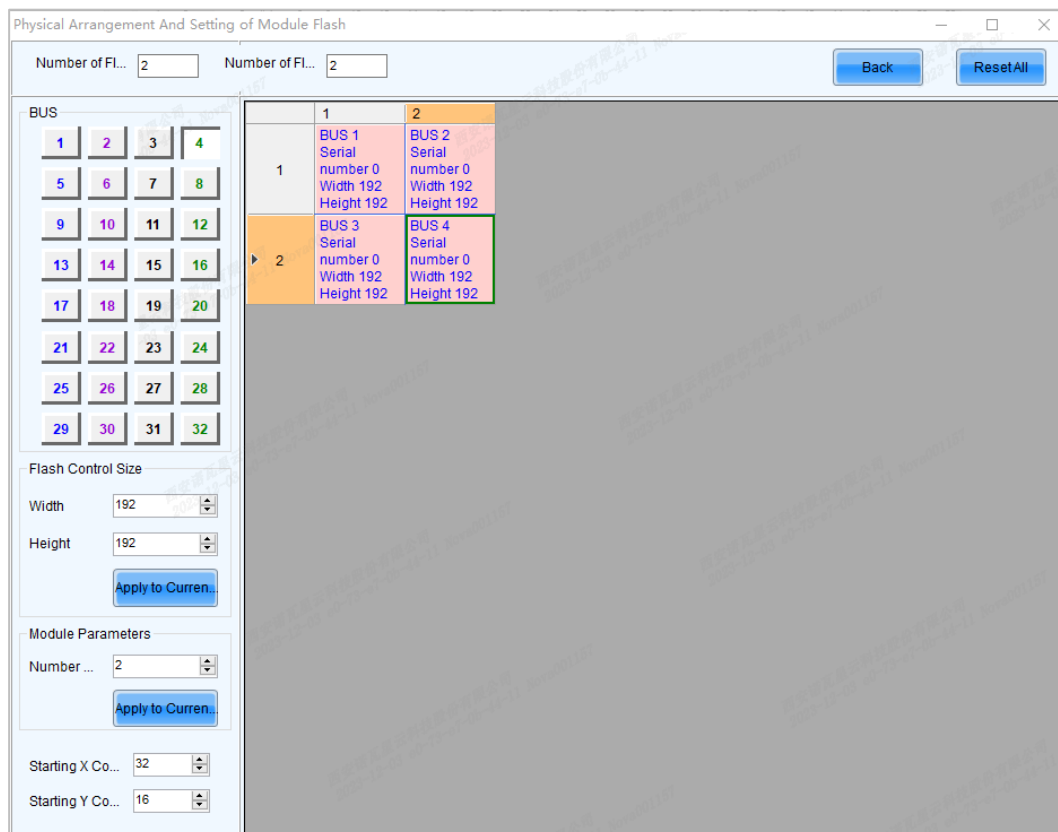
- Step 1 On the **Screen Configuration** page in NovalCT, click the **Receiving Card** tab.
- Step 2 Click the **Load from PC** or **Read from Receiving Card** button to load the receiving card configuration file, or read back the receiving card configuration file from the cabinet that displays images normally.
- Step 3 In the Performance Settings area, choose More Settings > Flash Arrangement.

Figure 9-2 Module flash memory arrangement



Step 4 In the pop-up window, set the flash memory arrangement according to the actual flash memory hardware layout.

Figure 9-3 Setting flash memory arrangement



Step 5 After setting, click **OK** in the bottom right corner.

Step 6 On the **Receiving Card** tab, click **Send to Receiving Card** in the bottom right corner to send the flash memory arrangement to the receiving card and then click **Save**.

Figure 9-4 Sending and saving flash memory arrangement

Screen Configuration-COM99

Sending Card Receiving Card Screen Connection

Module Information

Chip: Common C... Size: 32Wx16H Scanning Type 1/8 scan
 Direction: Horizontal Data Groups 2 [Adjust RG...](#) [Check M...](#)

Cabinet Information [Set Rotation](#)

☒ Regular ☐ Irregular

Width (Pixel) 32 <=65 Height (Pixel) 16 <=128
 Module Casc... From Right to Left

Performance Settings

[Data Group E...](#) [More Settings](#) ☐ 18bit+

Refresh Rate 480 Hz Refresh Rate Ti... 4
 Grayscale Level Normal 4096 Grayscale Mode Refreshing Rate Fir
 Shift Clock Fre... 12.5 MHz Duty Cycle 50 (25~75) %
 Phase Position 6 Low Grayscale C... 0
 Row Blanking ... 15 (=1.20us) Ghost Control En... 13 (1~14)
 Line Changing ... 3 (0~12)
 Minimum OE w... 160 ns
 Brightness Effi... 68.96%

[Smart Settings](#) [Receiving Car...](#) [Load from...](#) [Save to File](#) [Read from Re...](#) [Send to Receiving Card](#) [Restore Facto...](#)

Current Receiving ... mo... Version:

[Export Screen M...](#) [Save System Co...](#) [Save](#) [Close](#)

9.3.2 Coex Control System

Step 1 Open Cabinet Tool and load the cabinet file (.ncp).

1. On the homepage, click **Burning**.
2. On the **Single Burn** tab, click **Read** to read back and display the cabinet information.

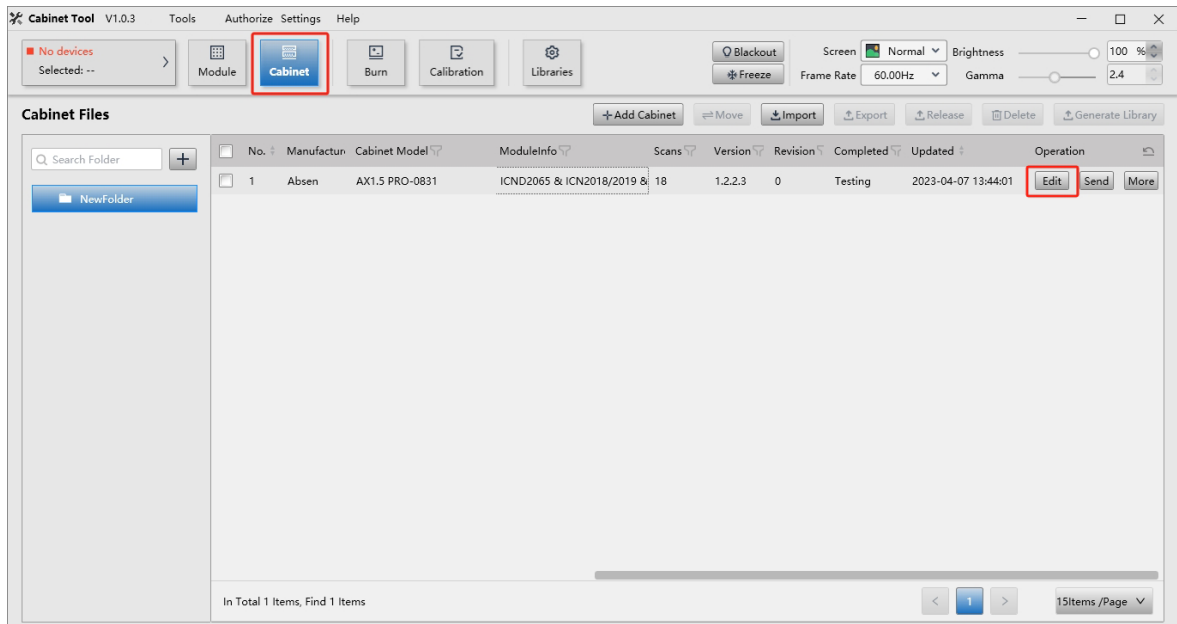
Figure 9-5 Single Burn



3. Click **Browse**.
4. On the pop-up window, click **Import**, select a cabinet file (.ncp), and then click **Open**.
5. Click **OK** to close the prompt once the file is imported.

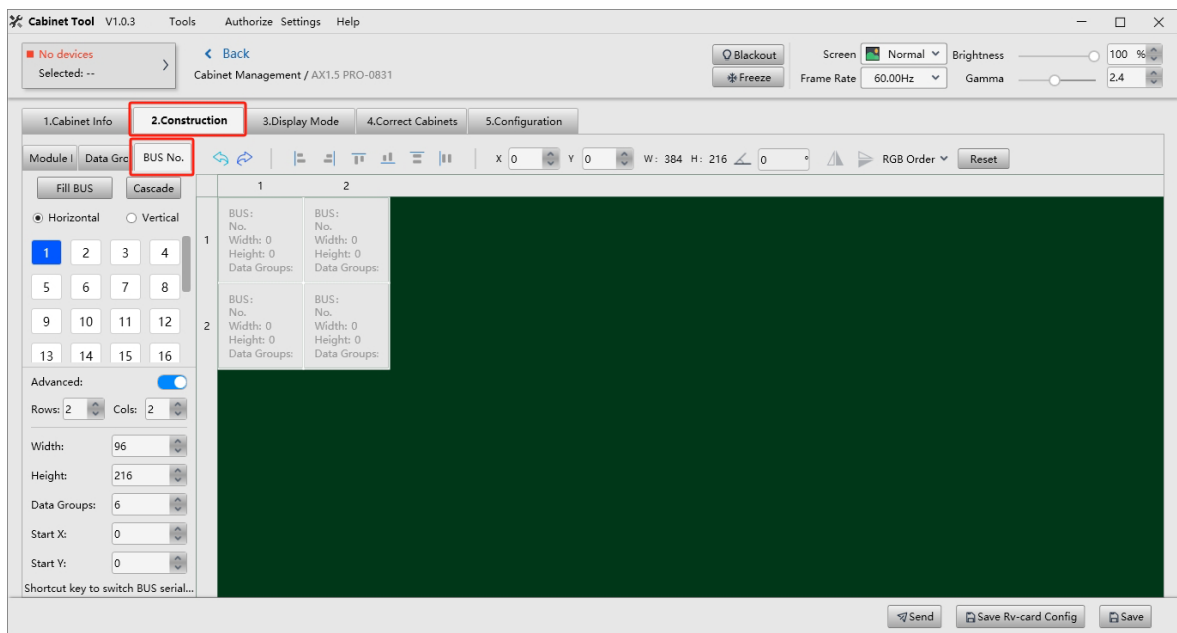
Step 2 Go back to the homepage of Cabinet Tool, click **Cabinet** and then click **Edit** on the information row of the target cabinet.

Figure 9-6 Cabinet design



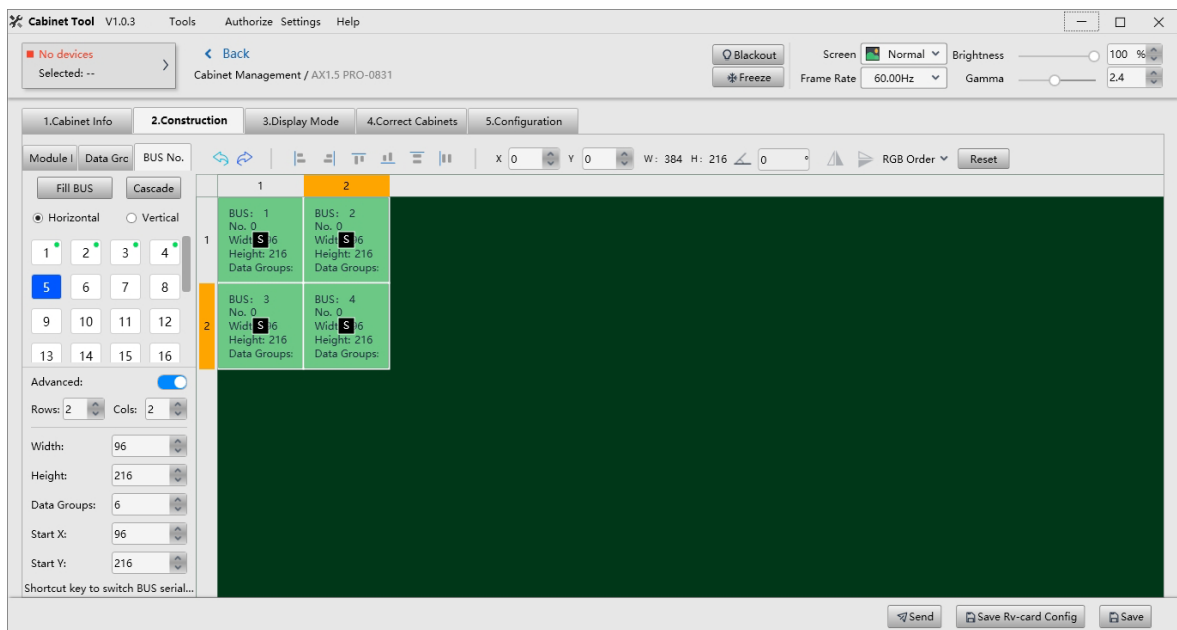
Step 3 Choose Construction > BUS No..

Figure 9-7 Construction



Step 4 Set the flash memory arrangement according to the actual flash memory hardware layout.

Figure 9-8 Setting flash memory arrangement



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