

CalCube MiniLED Screen Calibration

Quick Start Guide



Change History

Document Version	Software Version	Release Date	Description
V2.3.0	V2.3	2022-09-08	First release

I AN NOVASTAR TECH CO.

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1 Introduction

This document introduces how to quickly get started with the common calibration procedure. For all the calibration operations, please refer to *CalCube MiniLED Screen Calibration User Manual*.

Different calibration modes have different calibration procedures. You can click the link below while pressing the **Ctrl** key to jump directly to the corresponding section.

- High-precision calibration & brightness and chroma calibration modes: refer to section 3.2 High-Precision Calibration & Brightness and Chroma Calibration.
- Full-grayscale calibration mode: refer to section 3.3 Full-Grayscale Calibration.
- Low-grayscale calibration mode: refer to section 3.4 Low-Grayscale Calibration.

2 Calibration Preparations

2.1 Calibration Environment

Screen calibration is used for on-site calibration of screens. It requires engineers to bring calibration equipment to the site for pixel level calibration for excellent calibration effect. Screen calibration must be done in the following environment.

Light Requirements	Ensure the following calibration site requirements are met:
	 There is no external light interference and no obvious light around the screen during the calibration process.
	 There is no infrared light emitting equipment (such as infrared light-sensing camera) at the camera alignment position.
Calibration Distance	Make sure the LED partition image is in the center of the camera preview area and takes only 4/5 of the preview area.
	For example, to calibrate a COB screen with a pixel pitch of P0.9, the best distance for a 4K screen is 7 m to 8 m, and the best distance for a 2K screen is 3 m to 4 m.
Calibration Computer	CPU: 3.0 GHz or greater
	• RAM: 16 G or greater
	 Network adapter: Intel(R) Ethernet Connection network adapter
(Operating system: Windows 10 (64-bit)

Figure 2-1 Illustration of calibration environment



2.2 Software Installation

- Install CalCube MiniLED in the same way as an ordinary application. Please install it by following the setup wizard. After installation, the computer needs to be restarted.
- Insert the dongle into the USB port on the calibration computer and the dongle indicator will turn on.
- In the Authorization File area on the navigation page, click so real to import the corresponding authorization file of the dongle. The software will search for and find all the authorization files in a folder containing five subdirectories at most, and read and import them to the software.

2.3 System Deployment



There are three methods to connect the calibration computer and control computer in a local area network (LAN).

- For short-distance calibration: Connect the two computers with Ethernet cable and set their IP addresses on the same network segment.
- If not convenient to extend the Ethernet cable: Connect the calibration computer to the router wirelessly and connect the control computer to the LAN port of the router with Ethernet cable.
- For long-distance calibration: Connect the two computers to a wireless point-to-point remote communication device.

Note:

- Before calibration, make sure that the calibration computer and graphics card have the same resolution and the scale is set to 100%. In addition, scaling must be disabled on the controller.
- When you connect the control systen, the CalCube MiniLED software automatically checks whether the controller supports the Super Resolution Imaging function. If it is supported, it will be enabled by defualt. In addition, the low-grayscale calibration mode requires that the Super Resolution Imaging function must be enabled.

Controllers that support that function include CX series, MX series, and MCTRL4K.

2.4 Set NovaLCT Monitoring

If the CalCube MiniLED software works with the NovaLCT control system, monitoring settings are required. If the Coex control system is used, skip this section.



- Step 1 Open NovaLCT, choose User > Advanced Synchronous System User Login, enter the password ("admin"), and click Login. Then, click Calibration to open the calibration page.
- Step 2 If a message saying **Enable network monitoring successfully** is displayed, the monitoring settings are done in NovaLCT. If a message indicating that monitoring failed is displayed, change the port number and try again.

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Brightness Screer	Control M	er Login	-	a fact for	x	pring		
ocal System Informat	on							
Control System	0	Passw	ord			of Device		
		1 4001						
Ionitor Information		Loc	in	Cancel				
					J			
	NO J	,	ICK HCT		iguruu	on		
ervice Status: Service	version:3.1.1							
ervice Status: Service	version:3.1.1							
ervice Status: Service System(S) Setting	version:3.1.1 s (C) Tools(T)	Plug-in (P)	User(U)	Language(L)	Help(H)			
ervice Status: Service System(S) Setting	version:3.1.1 s (C) Tools(T)	Plug-in (P)	User(U)	Language(L)	Help(H)			
ervice Status: Service System(S) Setting Quick Configuration	version:3.1.1 s (C) Tools(T)	Plug-in (P)	User(U)	Language(L)	Help(H)	Monitoring	Multi-function	Card
ervice Status: Service System(S) Setting Quick Configuration Local System Information	version:3.1.1 s (C) Tools(T)	Plug-in (P)	User(U)	Language(L) Libration	Help(H)	Monitoring	Multi-function	Card
ervice Status: Service System(S) Setting Quick Configuration .ocal System Information	version:3.1.1 s (C) Tools(T) Screen Configur ion	Plug-in (P) ation Bright	User(U) ness	Language(L)	Help(H)	Monitoring	Multi-function	Card
ervice Status: Service System(S) Setting Quick Configuration Local System Informat Control System	version:3.1.1 s (C) Tools(T) Screen Configur ion 1	Plug-in (P) ation Bright Other Device	User(U) ness Cal	Language(L) Language(L) Libration Scree Unknown	Help(H) en Control View Detai	Monitoring	Multi-function	Card
ervice Status: Service System(S) Setting Quick Configuration Local System Informat Control System	version:3.1.1 s (C) Tools(T) Screen Configur ion 1	Plug-in (P) ation Bright Other Devic	User(U) ness Cal	Language(L) Language(L) libration Scree Unknown	Help(H) en Control View Detai	Monitoring	Multi-function	Card
ervice Status: Service System(S) Setting Quick Configuration Local System Informat Control System Monitor Information	version:3.1.1 s (C) Tools(T) Screen Configur ion 1	Plug-in (P) ration Bright Other Devic	User(U) ness Ca e	Language(L) Libration Scree Unknown	Help(H) en Control View Detai	Monitoring (s of Device	Multi-function	Card E
ervice Status: Service System(S) Setting Quick Configuration Local System Informat Control System Monitor Information	version:3.1.1 s (C) Tools(T) Screen Configur ion 1	Plug-in (P) ation Bright Other Devic	User(U) ness Cal e	Language(L) Libration Scree Unknown	Help(H)	Monitoring	Multi-function	Card

3 Screen Calibration Procedure

3.1 Create a Project and Select Calibration Mode

Click the **New** button to open the project page, set the project name, module size, and select the calibration mode. Different calibration modes have different calibration procedures.

- High-Precision Calibration: It is suitable for calibration of common COB screens.
- Brightness and Chroma Calibration: It is suitable for calibration of common SMD screens.
- **Full-Grayscale Calibration**: Select this mode if you want to ensure good calibration effect at medium grayscale and low grayscale, and if the calibration site has the supporting equipment that supports full grayscale calibration.
- Low-Grayscale Calibration: It is suitable for calibration of screens that use special driver ICs and have bad low-grayscale effect.

Figure 3-1	Selecting calibration mode
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Project		×
1. Project Nam	e	
Name	New_Screen_20220907074826	
Path	C:/Users/Nova001157/Desktop	
Image Save Path	C:/Users/Nova001157/Documents/NovaCLB/Screen	
2. Module Size		
🗸 Sa	me Module Size	
Width	 (4~512) Height (4~512) 	
3. Calibration M	Node	
🔵 High	-Precision Calibration 🛛 🔵 Brightness and Chroma Calibr	ration
🔵 Full-	Grayscale Calibration O Low-Grayscale Calibration	
	OK	cel

3.2 High-Precision Calibration & Brightness and Chroma Calibration



3.2.1 Connect Devices



Step 1 Connect the control system.

- Coex: Click Refresh and the Coex control system will be automatically connected.
- NovaLCT: On the Screen Calibration page in NovaLCT, obtain the IP address and port number. On the Device page in CalCube MiniLED, enter the obtained information in the IP and Port boxes in the Control System area, and click Connect.
- Step 2 Connect the camera.

Connect the camera to a power supply and to the calibration computer with USB cable. After the camera indicator turns green, click **Connect** in the **Camera area** in CalCube MiniLED.

When you connect the C3200 camera for the first time for calibration, click the **Advanced** button and click **Initialize Camera** to adjust the collection efficiency of the C3200 to the best.

Advanced	×
Camera IP Configuration	
Local IP 169 254 241 139	
Configure IP automatically	
Configure IP manually	
Camera IP	
Subnet Mask 255 255	
Other Settings	
Initialize Camera F	Restart Camera
ок	Cancel
15 Ohio - 25	

Step 3 Connect the colorimeter.

Install the colorimeter driver program on the calibration computer, and select **Colorimeter connected** in CalCube MiniLED. Select the model of the connected colorimeter and COM port number.

3.2.2 Set Target Values

• If you have uniformity requirements only, use the system's default target values.



• If you have requirements for chromaticity diagram and color temperature of the screen before it leaves the factory, you need to use a colorimeter to obtain the original values and set the target values. The value of each target value parameter cannot exceed the value of each original value parameter.

3.2.3 Analyze Camera Parameters

- Step 1 Set partition information. Click the **Partition** button. The system will automatically calculate the partition according to the screen resolution and the resolution of the image collected by the camera
- Step 2 Adjust camera settings. Click How to Adjust a Camera and follow the instructions to set the camera.

CalCube MinILED V2.3	Device	Target		Camera	Calibration	
Partition Topology	Live	Preview	2	Image	 Display Control Screen Brightness Area to Be Calibrated Bezel Information Partition Information Custom Partition 	80 :
Brightness Calibration1 Manual mode Automatic mod Color Brightness 10 10 10	de Live Preview Auto Adjust Stropsure Time Analyze 310 Auto Adjust 1120 Auto Adjust	Calibration2 ^[Al] <u>How to Adjust a Cam</u> Peak Brightness(40~70) 46 65	Brightness Back Percentage(50~85)% 47(too small) 62	Calibration3 Next View Image View Image View Image	Max Columns Collected Once 2300 : Max Rows Collected Once 1600 : Single Partition Size 1280/1440 Actual Columns Collected 1280 Actual Rows Collected 1440	,
10 Control System: Not connected	2220 Auto Adjust Camera: Not connected Co	60 lorimeter: Not connected	53	View Image		

How to Adjust a Camera - When the Super Resolution Imaging function is enabled/disabled



You can enable or disable the Super Resolution Imaging function on the **More Params** tab page. After changing the function switch status, camera parameter reanalysis is needed.

- Step 3 Analyze camera parameters.
 - 1. Select the Auto Adjust method to adjust the settings for green.

After you click AutoAdjust, the software will automatically analyze and adjust the **Peak Brightness** and **Percentage** values to be within the appropriate range. If these values still do not meet the requirements, adjust the focus ring and aperture. After adjustment, click **Auto Adjust** again.

2. Eliminate the ambient light.

During adjustment, when the page below is displayed, drag the four vertexes to make them close to the image edges. The purpose is to adjust the effective calibration area and eliminate the interference light around the screen.



- 3. Select the Auto Adjust All method to adjust the settings for red and blue.
- 4. Check the statuses of the Peak Brightness and Percentage values of all calibration procedures.
 - If all the values are in white, they are normal. Go to substep 6.
 - If a value is in red or a value cell has a red border, the value is abnormal. Go to substep 5.
- 5. Switch to the Manual mode and adjust the abnormal values.
 - For red values, adjust the Exposure Time value or turn the focus ring to adjust the focus.

Based on the difference between the actual values of **Peak Brightness** and **Percentage** and the standard value range, adjust the exposure time and focus ring properly, and click the **Manually Adjust** button.

- > If the **Peak Brightness** value is below the appropriate range, increase the exposure time.
- > If the **Peak Brightness** value is above the appropriate range, decrease the exposure time.
- If the **Percentage** value is below the appropriate range, turn the focus ring to let the image become blurry.
- If the **Percentage** value is above the appropriate range, turn the focus ring to let the image become clear.

For red borders, click **Advanced Adjustment** in the **Manual mode** to adjust the filters that has a red value.

Adv	anced Adjustment							×
	Color	Brightness	Exposure Time	Analyze	Peak LED Brightn	LED Percentage(View Image	
	Green filter	160	100	Manually Adjust			View Image	
	Red filter	160	100	Manually Adjust			View Image	
	Blue filter	160	100	Manually Adjust			View Image	
	Green filter	160	150	Manually Adjust			View Image	
	Red filter	160	150	Manually Adjust			View Image	
	Blue filter	160	150	Manually Adjust			View Image	
	Green filter	160	1000	Manually Adjust			View Image	
	Red filter	160	1000	Manually Adjust			View Image	
	Blue filter	160	1000	Manually Adjust			View Image	
							ок	

The adjustment method is the same as the above method.



6. Click the Chroma Calibration tab and repeat the steps above to finish the analysis and adjustment.

For the **Brightness and Chroma Calibration** mode, there is one calibration procedure only, as described above. After that procedure is finished, you can view the image directly.

3.2.4 Implement Calibration

Step 1 Set more parameters. Generally, you can use the default settings. For details, please refer to CalCube MiniLED Screen Calibration User Manual.

CalCube MiniLED V2.3	Device	Contract Target	Camera	Calibration	
Partition Topology	Live Preview	Vie	w Image	Display Co Brightness Target	Procedure More Para
		-	Selected	Pixel Positioning Parameters	
			Preferred Done	Calibration Parameters	
			Target Values Changed	Screen Information	
				Uniformity Optimization Param	eters
				Wider Wavelength and Brightn	ess Range LED Calibration
Partition Calibration		Border Correction		Uniformity Compensation	
Manual Calibration		🖉 Warm Up			
		 Upload Initial Coefs Area Positioning Collect Red LEDs 		Super Resolution Imaging	
		- Collect Green LEDs			
Control System: Not connected Camera: 1	Not connected Colorimeter: Not	connected			

Parameter	Description
Pixel Positioning Parameters	Set the allowed dead LED ratio. The default value is 3‰.
Calibration Parameters	Set the calibration process parameters.
Screen Information	Confirm the module size and screen type again. Please fill in the information according to the on-site situation, otherwise the effect of correcting seam brightness caused by splicing will be compromised.
Uniformity Optimization Parameters	It is used to set the direction of the realizing the target values. You can set the parameters as needed.
Wider Wavelength and Brightness Range LED Calibration	With the reasonable calibration coefficients that match different ranges of precisely collected wavelength and brightness of LEDs, the display effects of different batches of LEDs can be significantly improved. This function is enabled by default.
Uniformity Compensation	It is suitable for screens with poor display effects before calibration. It can effectively improve the display uniformity. This function is enabled by default.
Eliminate Seam Stripes	It is used to remove the diagonal stripes around the seams caused by high- resolution partitions after calibration.
Super Resolution Imaging	It is used to greatly increase the calibration speed with a latest algorithm. This function is enabled by default.

- Step 2 Click **Auto Calibration**, and the software will start the calibration procedure automatically, including collecting data, analyzing data, and generating, uploading and saving coefficients.
- Step 3 On the **Display Control** tab page, control the LED display status and check the effect before and after calibration.
- Step 4 Do border correction.
 - Observe whether there are border lines between the partitions. If no, skip this step.
 - If there are border lines, click the Border Correction > Upload Coefs > Save Coefs > Save Coefs to HW buttons in order.



Partition Topology	Live Preview	View Image	✤ Display Co	Brightness	Target	Proced	ure More Para
				Brightn			
		Selected		631.40			
		Preferred					
		Done					
		Target Values Changed	Driabl		reactore		
			Bright	ness Decay Pe	rcentage		
							10 ÷ %
							10 : %
							10 : %
			Svn	chronous Deca	N		
			Kee	p Color Tempe	rature		
Partition Calibration		Border Correction					
				4700 6500	9300		
			Tarc	et Value Applic	ation		
Control System: Not connected Camera	Not connected Colorimeter: Not connected						

 Coef Simulation: The software uses the calibration coefficients to restore the display effect of the LED screen before calibration. The restored image is simulation image.



3.3 Full-Grayscale Calibration



Note:

Before full-grayscale calibration, make sure you have finished the Precise Grayscale operation of Image Booster for the screen in NovaLCT. For details, please refer to *NovaLCT LED Configuration Tool for Synchronous Control System User Manual*.

3.3.1 Connect Devices and Set Target Values

The operations are the same as those in the above calibration modes. Please refer to sections 3.2.1 Connect Devices and 3.2.2 Set Target Values.

3.3.2 Analyze Camera Parameters

- Step 1 Set partition information. Click the **Partition** button. The system will automatically calculate the partition according to the screen resolution and the resolution of the image collected by the camera
- Step 2 Set grayscale levels.

Click **Advanced** and on the displayed page, you can set the layers of grayscale level (4 layers by default) and position of grayscale level collection flexibly based on the screen characteristics. If the screen uniformity is not too bad, you can decrease the layer quantity appropriately to shorten the calibration time.



Step 3 Adjust camera settings. On the **High-Brightness** tab page, click **How to Adjust a Camera** and follow the instructions to set the camera.

CalCube M V2.3		Device		C Target		Camera	Calibration	
Partit	ion Topology		Live Preview			View Image	→ Display Control	
							Screen Brightness —	80 \$
							▶ Area to Be Calibrated	
							Bezel Information	
							✓ Select Grayscale Levels	
							Selected grayscale levels	Advanced
								255
High-Brightr	ness Hig	h-Brightness Parame	eter Record	Low-Brightnes	s Low	r-Brightness Parameter Record	1 0 32 04	
Manual mode	Automatic mode							
Color	Brightness Ex	posure Time	Analyze Peak	Brightness(40~70)	Percentage(50~85)	% View Image	 Partition Information 	
			uto Adjust			View Image	Custom Partition	
			uto Adjust			View Image	_ Loit Cito	
		1000 A	uto Adjust			View Image	Unit Size	

How to Adjust a Camera - When the Super Resolution Imaging function is enabled/disabled

How to Adjust a Camera 🗙 🗙	How to Adjust a Camera					×
1. Set the camera aperture to a value not greater than 18. You are advised to adjust the focus ring from $\mathbf{x}_{\rm c}$	 Set a display brightnes green and blue) and turn Set a camera aperture 	s value for green (100 on the live preview fur value and a proper ex	-230 recommen Iction. posure (refer to t	ded and ti he table b	ne same foi below).	r red,
2. Turn on the live preview and make the camera face the area to be collected. Ensure the	Partition Size		2K-4K		48	
entire view. Adjust the focus ring to let the images of green LEDs become overlapped.	Recommended Aperture	11-16 🕧		0	8-11	. ()
3. Analyze the peak brightness and percentages of green, red and blue LEDs.	3. Analyze the peak bright ring to let the images of g Ensure the image borders a definition of the image borders a definit of the image borders a definition of the image borde	ness and percentageer reen LEDs become ch re outside the red box	s of green, red an ear and not over	nd blue LE	Ds. Adjust	the focus
ок						

You can enable or disable the Super Resolution Imaging function on the **More Params** tab page. After changing the function switch status, camera parameter reanalysis is needed.

Step 4 Analyze camera parameters.

1. Select the Auto Adjust method to adjust the settings for green.

After you click AutoAdjust, the software will automatically analyze and adjust the **Peak Brightness** and **Percentage** values to be within the appropriate range. If these values still do not meet the requirements, adjust the focus ring and aperture. After adjustment, click **Auto Adjust** again.

2. Eliminate the ambient light.

During adjustment, when the page below is displayed, confirm the locating box. If the display area is abnormal, drag the vertexes to select the effective calibration area.



- 3. Select the Auto Adjust All method to adjust the settings for red and blue.
- 4. Check the statuses of the Peak Brightness and Percentage values of all calibration procedures.
 - If all the values are in white, they are normal. Go to substep 6.
 - If a value is in red or a value cell has a red border, the value is abnormal. Go to substep 5.
- 5. Switch to the Manual mode and adjust the abnormal values.
 - For red values, adjust the Exposure Time value or turn the focus ring to adjust the focus.

Based on the difference between the actual values of **Peak Brightness** and **Percentage** and the standard value range, adjust the exposure time and focus ring properly, and click the **Manually Adjust** button.

> If the **Peak Brightness** value is below the appropriate range, increase the exposure time.

- > If the **Peak Brightness** value is above the appropriate range, decrease the exposure time.
- If the **Percentage** value is below the appropriate range, turn the focus ring to let the image become blurry.
- > If the **Percentage** value is above the appropriate range, turn the focus ring to let the image become clear.
- For red borders, click **Advanced Adjustment** in the **Manual mode** to adjust the filters that has a red value.

Advance	ed Adjustment							×
	Color	Brightness	Exposure Time	Analyze	Peak LED Brightn	LED Percentage(View Image	
	Green filter	160	100	Manually Adjust			View Image	
	Red filter	160	100	Manually Adjust			View Image	
	Blue filter	160	100	Manually Adjust			View Image	
	Green filter	160	150	Manually Adjust			View Image	
	Red filter	160	150	Manually Adjust			View Image	
	Blue filter	160	150	Manually Adjust			View Image	
	Green filter	160	1000	Manually Adjust			View Image	
	Red filter	160	1000	Manually Adjust			View Image	
	Blue filter	160	1000	Manually Adjust			View Image	
							ок	

The adjustment method is the same as the above method.

6. Click Next. On the High-Brightness Parameter Record tab page, record the aperture and focus values.

High-Brightness	High-Brightness Parameter Record	Low-Brightness	Low-Brightness Parameter Record
	Aperture 0.00 :	Focus 0.00 ÷	Back Next
Control System: Coex Carr	nera: Canon 6D Colorimeter: Not co	onnected	

7. Click **Next**. On the **Low-Brightness** tab page, repeat the steps above to adjust the low-brightness parameter and record the corresponding aperture and focus values.

Note:

If an aperture can meet the requirements for camera parameter analysis at all grayscale levels, there is no need to record the high-brightness or low-brightness parameter value during the process.

3.3.3 Implement Calibration

Step 1 Set more parameters. Generally, you can use the default settings. For details, please refer to CalCube MiniLED Screen Calibration User Manual.

CalCube MiniLED V2.3	Device	C Target	Camera	Calibration	₹ _ ¤ X
Partition Topology	Live Preview	vi	ew Image	✤ Display Co Brightness Target	Procedure More Para
		_	Selected	Pixel Positioning Parameters	
			Preferred	 Calibration Parameters 	
			Target Values Changed	 Screen Information 	
				 Uniformity Optimization Paramet 	ers
				Wider Wavelength and Brightnes	ss Range LED Calibration
Partition Calibration		Border Correction		 Uniformity Compensation 	
Manual Calibration		🖉 Warm Up			
		 Upload Initial Coefs Area Positioning Collect Red LEDs Collect Green LEDs 		Super Resolution Imaging	
Control System: Not connected Camera: 1	Not connected Colorimeter: No	t connected			

Parameter	Description
Pixel Positioning Parameters	Set the allowed dead LED ratio. The default value is 3‰.
Calibration Parameters	Set the calibration process parameters.
Screen Information	Confirm the module size and screen type again. Please fill in the information according to the on-site situation, otherwise the effect of correcting seam brightness caused by splicing will be compromised.
Uniformity Optimization Parameters	It is used to set the direction of the realizing the target values. You can set the parameters as needed.
Wider Wavelength and Brightness Range LED Calibration	With the reasonable calibration coefficients that match different ranges of precisely collected wavelength and brightness of LEDs, the display effects of different batches of LEDs can be significantly improved. This function is enabled by default.
Uniformity Compensation	It is suitable for screens with poor display effects before calibration. It can effectively improve the display uniformity. This function is enabled by default.
Eliminate Seam Stripes	It is used to remove the diagonal stripes around the seams caused by high- resolution partitions after calibration.
Super Resolution Imaging	It is used to greatly increase the calibration speed with a latest algorithm. This function is enabled by default.

Step 2 Click **Auto Calibration**, and the software will start the calibration procedure automatically, including collecting data, analyzing data, and generating, uploading and saving coefficients.

During the calibration process, the following window will be displayed. Please adjust the camera aperture and focus to the values displayed in the window.



Note:

If an aperture can meet the requirements for camera parameter analysis at all grayscale levels, there is no need to adjust the aperture or focus. You can click **OK** directly.

Step 3 On the **Display Control** tab page, control the LED display status and check the effect before and after calibration.

To enable the full-grayscale calibration effect, you need to check both Enable Calibration and Full-Grayscale.

- Step 4 Do border correction.
 - Observe whether there are border lines between the partitions. If no, skip this step.
 - If there are border lines, click the Border Correction > Upload Coefs > Save Coefs > Save Coefs to HW buttons in order.

Partition Topology	Live Preview	View Image	Display Co	Brightness	Target	Procedu	ire More Para
				Brightn			
		Selected		631.40		0.3000	
		Preferred					
		Done				0.0820	
		Torget Values Changed					
		Target values Changed	Bright	ness Decav Pe	rcentage		
			, in the second s			3	1 * %
						31	J = %
			B L			31	0:%
			Syn	chronous Deca			
			Kee	p Color Tempe	rature		
Partition Calibration		Border Correction					
Border Correction Coef Simu		ve Coefs Save Coefs to HW	▶ Targ	et Value Applic	ation		
Control System: Not connected Camera: I	Not connected Colorimeter: Not connected						

 Coef Simulation: The software uses the calibration coefficients to restore the display effect of the LED screen before calibration. The restored image is simulation image.





3.4 Low-Grayscale Calibration

Note:

For screens that use special ICs, after the low-grayscale calibration procedure is finished, do a full-grayscale calibration procedure to ensure a good calibration effect.

3.4.1 Connect Devices and Set Low-Grayscale Parameters

	CalCube MiniLED V2.3	Device	C Target	Camera	Calibration	₹ _ ¤ ×
		Control System	Camera		Low-Grayscale Parameters	
	System Version IP Port	NovaLCT Coex <u>172 , 18 , 12 , 50 </u> <u>8080</u> Connect	Туре С3200		Number of Calibration 3 : Max Coef 255 : Initial Coefs Red 6 : Croen 6 :	
	Screen Mode Screen Resolution	Single Screen Combined Screen V			Blue 6 :	
Control Sy	ystem: Not connected	Camera: Not connected Colo	primeter: Not connected			

Step 1 Connect the control system.

- Coex: Click **Refresh** and the Coex control system will be automatically connected.
- NovaLCT: On the Screen Calibration page in NovaLCT, obtain the IP address and port number. On the Device page in CalCube MiniLED, enter the obtained information in the IP and Port boxes in the Control System area, and click Connect.
- Step 2 Connect the camera.

Connect the camera to a power supply and to the calibration computer with USB cable. After the camera indicator turns green, click **Connect** in the **Camera area** in CalCube MiniLED.



When you connect the C3200 camera for the first time for calibration, click the **Advanced** button and click **Initialize Camera** to adjust the collection efficiency of the C3200 to the best.

Advanced					×
Camera	IP Configuration				
Lo	cal IP 169 25				
	Configure IP aut	omaticall	у		
	Configure IP ma	nually			
Other S	ettings				
STREET, STREET, ST	nitialize Camera		Re	start Came	
)K	Can	

Step 3 Set the low-grayscale parameters.

- Number of Calibration: The number of low-grayscale calibration. It defaults to 3. You can set it based on the screen uniformity situation and your calibration experience.
- Max Coef: Enter the maximum calibration coefficient value based on the receiving card chip type (please ask the chip supplier).
- Initial Coefs: Set the initial coef values for the red, green and blue before calibration for the camera. The follow-up calibration coefs will be based on these values.

3.4.2 Analyze Camera Parameters

- Step 1 Set partition information. Click the **Partition** button. The system will automatically calculate the partition according to the screen resolution and the resolution of the image collected by the camera.
- Step 2 Adjust camera settings. On the **Brightness Calibration1** tab page, follow the **How to Adjust a Camera** instructions to adjust the camera settings.





- Step 3 Analyze camera parameters.
 - 1. Select the Auto Adjust method to adjust the settings for green.

After you click Auto Adjust, the software will automatically analyze and adjust the **Peak Brightness** and **Percentage** values to be within the appropriate range. If these values still do not meet the requirements, adjust the focus ring and aperture. After adjustment, click **Auto Adjust** again.

2. Eliminate the ambient light.

During adjustment, when the page below is displayed, confirm the locating box. If the display area is abnormal, drag the vertexes to select the effective calibration area.

Confirm Background Elimi	nation Area	×
Description		
1. If the display ar	ea is normal, please click OK.	
2. You can drag ar	nd move the four vertexes with your mouse to modify the display area.	
	•	
	ОК Са	

3. Select the Auto Adjust All method to adjust the settings for red and blue.

In this mode, you only need to click AutoAdjustAll, and the software will automatically analyze and adjust the **Peak Brightness** and **Percentage** values to be within the appropriate range.

- 4. Check the statuses of the Peak Brightness and Percentage values of all calibration procedures.
 - If all the values are in white, they are normal. Go to substep 6.
 - If a value is in red, the value is abnormal. Go to substep 5.
- 5. Switch to the **Manual mode** and adjust the abnormal values. You can adjust the **Exposure Time** value or turn the focus ring to adjust the focus.

Based on the difference between the actual values of **Peak Brightness** and **Percentage** and the standard value range, adjust the exposure time and focus ring properly, and click the **Manually Adjust** button.

- If the **Peak Brightness** value is below the appropriate range, increase the exposure time.
- If the Peak Brightness value is above the appropriate range, decrease the exposure time.



- If the **Percentage** value is below the appropriate range, turn the focus ring to let the image become blurry.
- If the Percentage value is above the appropriate range, turn the focus ring to let the image become clear.
- 6. After procedure 1 analysis is complete, the software will automatically calculate and generate the camera parameter values of the rest procedures.
- 7. After adjustment, click View Image to view the images collected by camera during analysis.

3.4.3 Implement Calibration

Step 1 Set more parameters. Generally, you can use the default settings. For details, please refer to CalCube MiniLED Screen Calibration User Manual.

CalCube MiniLED V2.3	Device	C Target	Camera	Cali	bration		
Partition Topology	Live Preview	Viev	v Image	✤ Display Co	Brightness Target	Procedure	More Para.
			Selected	▼ Pixe	Positioning Parameters		
			Preferred	Allo	wed Dead LED Ratio 3	\$ %	
			Done				
			Target Values Changed	👻 Calil	bration Parameters		
				$\sim \setminus \mathbf{Z}$	Ambient Light Elimination		
					Blocked Area Brightness P	rocessing	
				V	Stable Coefficient Uploadin	Ig	
					Save Images of All Partitior	IS	
				V	Save Images of All Procedu	ires	
Partition Calibration		Border Correction			Image Save Path ocument	s/NovaCLB/Scre	
Manual Calibration		🖉 Warm Up					
		Upload Initial Coefs Area Positioning		▼ Scre	en Information		
Live Preview arameter Calculatio	Auto Calibration	💿 Collect Red LEDs			Same Module Size		
Parameters not calc	ulated	💮 Collect Green LEDs					
Control System: Not connected Camera: I	Not connected Colorimeter: Not	connected					

Parameter	Description
Pixel Positioning Parameters	Set the allowed dead LED ratio. The default value is 3‰.
Calibration Parameters	Set the calibration process parameters.
Screen Information	Confirm the module size and screen type again. Please fill in the information according to the on-site situation, otherwise the effect of correcting seam brightness caused by splicing will be compromised.
Super Resolution Imaging	It is used to greatly increase the calibration speed with a latest algorithm. In low-grayscale calibration mode, this function is enabled by default and cannot be disabled.



Partition Calibration		Border Correction				
Manual Calibration		 Warm Up Upload Initial Coefs 				
Live Preview	arameter Calculatio Auto Cali	ation Collect Red LEDs				
	Parameters not calculated	Collect Green LEDs				
Control System: Not conn	ected Camera: Not connected	Colorimeter: Not connected				

Step 3 Click **Auto Calibration**, and the software will start the calibration procedure automatically, including collecting data, analyzing data, and generating, uploading and saving coefficients.

Step 4 Do border correction.

- Observe whether there are border lines between the partitions. If no, skip this step.
- If there are border lines, click the Border Correction > Upload Coefs > Save Coefs > Save Coefs to HW buttons in order.

Partition Topology	Live Preview	View Image	✤ Display Co	Brightness	Target	Procedu	e More Para
				Brightn			
		Selected		631.40		0.3000	
		Preferred					
		Done					
	Brinhtness Decay Percentane						
			Dirgin		licentage	20	• •
			к			- 30	- %
						30	\$ %
						30	
			Syne	chronous Deca			
	Keep Color Temperature						
Partition Calibration	Border Correction						
			Taro	et Value Annlic:	ation		
Border Correction Coef Sim				or release plane.			
Control System: Not connected Camera:	Not connected Colorimeter: Not connected						

Step 5 On the **Display Control** tab page, control the LED display status and check the effect before and after calibration.

At the calibration grayscale level, check whether the screen uniformity is as expected. If not, consider increasing the number of low-grayscale calibration.

- Step 6 Finish the Precise Grayscale operation of Image Booster for the screen in NovaLCT. For details, please refer to NovaLCT LED Configuration Tool for Synchronous Control System User Manual.
- Step 7 Go back to the navigation page of CalCube MiniLED, create a new full-grayscale calibration project and finish the calibration by following section 3.3 Full-Grayscale Calibration.

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