User Manual

NovaCLB-Screen Full-Screen Calibration System

V5.1.0 NS140100006

Xi'an NovaStar Tech Co., Ltd.

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1System Overview

1.1 Introduction

Brightness/Color uniformity is of the most important factors that affect the image quality of a full color LED display. Because of the limitations of manufacturing process, including system structure design, LED lights selection, electronic components welting, system cooling, LED brightness decaying and many others, LED displays suffer the brightness/color uniformity loss, which is also the most serious problem of this field.

Facing this fact, Nova pixel level calibration system does not intervene the manufacturing process of a LED display to reduce its brightness/color uniformity. Instead, it performs brightness/color adjustment to the display after it has been completely produced. By adjusting the brightness/color of each LED light according to the software analytical results from the measured brightness/color values of the LED lights, Nova pixel level calibration system can help the LED display acquiring perfect uniformity.

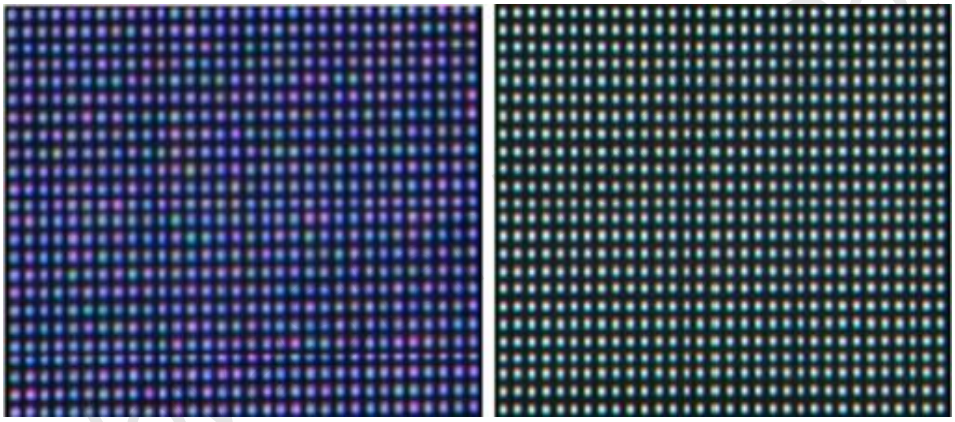

Fig. 1-1 The LED display effects comparison before and after calibration

NovaCLB is applicable for the following two occasions:

- Factory single cabinet pixel level calibration (Factory calibration). Correct each cabinet on the production line to ensure good brightness/color uniformity of the cabinets when produced.
- Field LED display pixel level calibration (Full-screen calibration). Perform calibration for a LED display at where it locates to improve its brightness/color uniformity.

Factory calibration is more efficient and lower in cost than Full-screen calibration. But for cabinets of which the LED lights optical axis directions consistency is not well managed, results of factory calibration will not be as good as that of filed calibration. During factory calibration, the matching NovaCLB-Cabinet is needed.

Full-screen calibration requires engineers to be presence and Full-screen installation of calibration instruments. And what's more, Full-screen calibration can only be performed only at night when it's dark. Despite its complexity and low efficiency (compared with factory calibration), Full-screen calibration can greatly improve the brightness/color uniformity of a LED display and thus results in amazing image quality of the display. During Full-screen calibration, the matching NovaCLB-Screen is needed.

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1.2 Advantages

1) Camera calibration technology enabling accurate brightness/color measurement;
2) performance with brightness variation less than ±1% and color variation less than 0.003;
3) Be capable of eliminating color diversity of LED lights from different manufacturing batches;
4) Be capable of eliminating brightness/color diversity between subareas or cabinets;
5) Arc shape and irregular shape LED display calibration supported;
6) Supporting automatic calibration for the replaced module;
7) Precise calibration coefficients up to 16 bits resulting in outstanding calibration
8) Close loop intelligent calibration resulting in easy and high efficiency calibration. One LED display, one person; 25 minutes, 600K pixels;
9) Adopt RGB to begin the collection mechanism and collection-processing mechanism at the same time during the calibration process so as to improve the efficiency;
10) Support correction to the boundary difference between partitions so as to enable smooth transition between partitions;
11) No extra power supply required.

1.3 System Structure

Fig. 1-2 System structure (NovaLCT)

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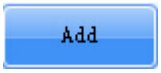
2Authorization Management

NovaCLB-Screen adopts the management methods of encryption lock and authorized file binding authorization; and every dongle corresponds to one authorized file, which is combined with the file authorization.

Insert dongle to the USB port of the computer; click menus "Author" on the main interface; enter to the Authorization manage window, click 

to import the authorized file (in the disk) corresponding to the dongle.

Multiple authorized file can be imported. Thus, dongles can be replaced directly when there are multiple dongles. It is not necessary to reload authorization file every time when replacing dongles. Plug in dongles and it can be used.

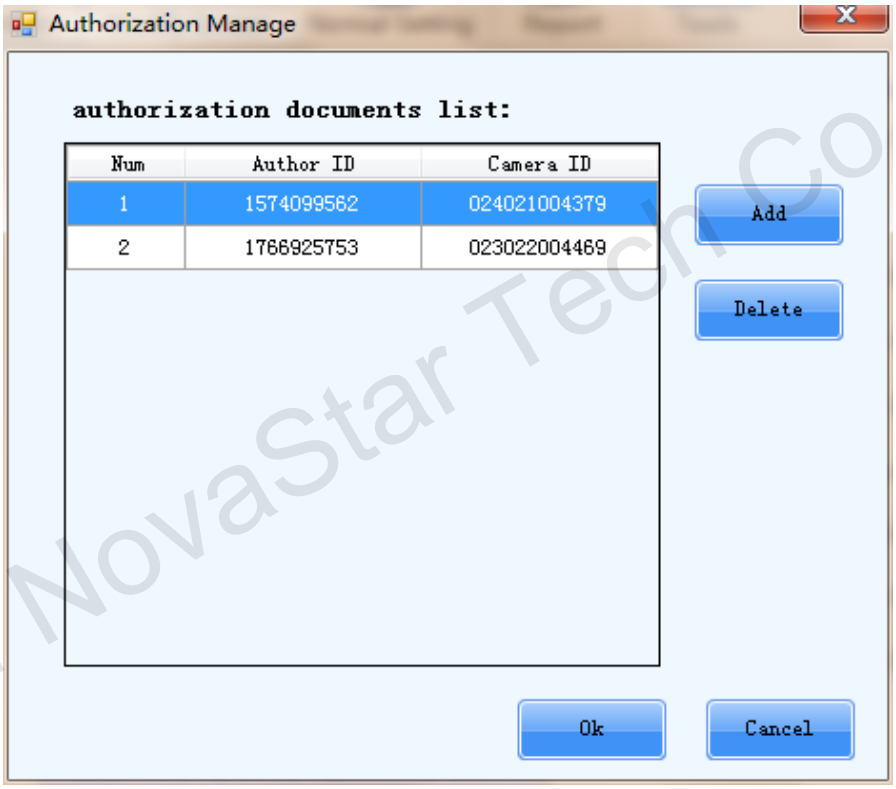


Fig.2-1 Authorization management

3Calibration Modes

According to different requirements, calibration is divided into three modes: **full-screen pixel level calibration**, **seam brightness calibration, new module calibration and evaluation of the uniformity before and after calibration**.

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4Full-Screen Calibration

Procedures of full-screen pixel level calibration:

1) Initialization

Online (online calibration with LCT), create new calibration information files, initializing specifications of modules.

2) Camera Settings

Choose a camera type: digital camera or Caliris camera. Then, click "Connect".

3) Partition Settings

Brightness and chroma of display screen will be collected by camera. The screen need to be partitioned into multiple areas with appropriate size for calibration owing to the limitation of camera resolution.

4) Camera Parameters

Adjust camera parameters.

5) Partitions Calibration

Guide customers to perform pixel level calibration on each LED, which signally improve the display uniformity.

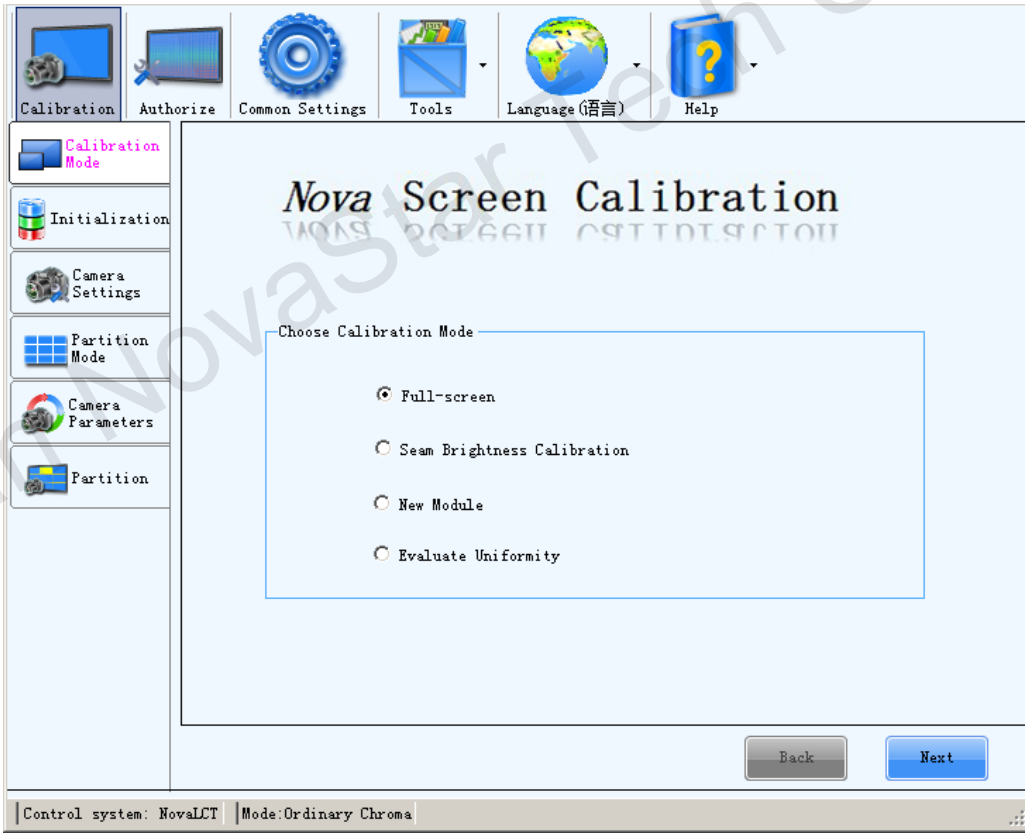

Fig. 4-1Choose calibration mode

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4.1 Initialization

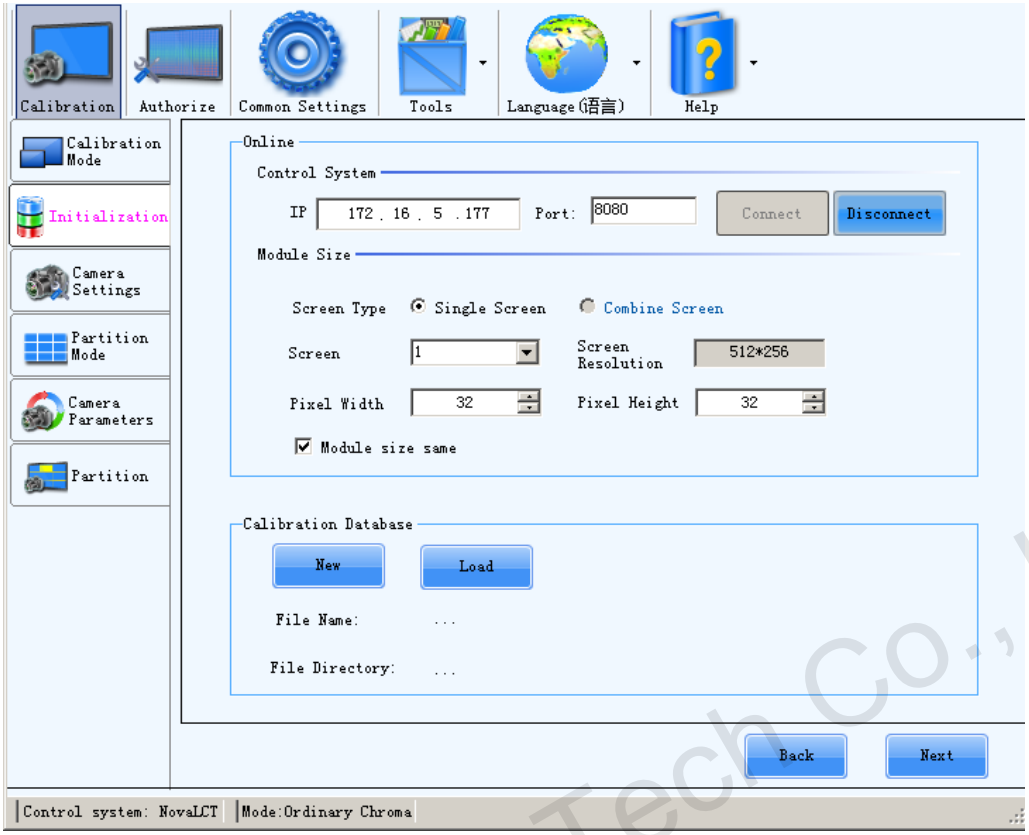

Fig. 4-2Network Settings Interface of Calibration Initialization

1) Control System Connection

Use calibration software together with NovaLCT or connect Nova's video controller NovaPro HD via cable to calibrate display screen.

- NovaLCT Connection

Ensure that the NovaCLB-Screen computer can communicate with the NovaLCT computer well, fill the IP and port (The default is 8080, which can be modified) from NovaLCT in the location of IP and port from NovaCLB-Screen, then click "Connect" button. Fig. 4-3 will pop up and the connection is done.

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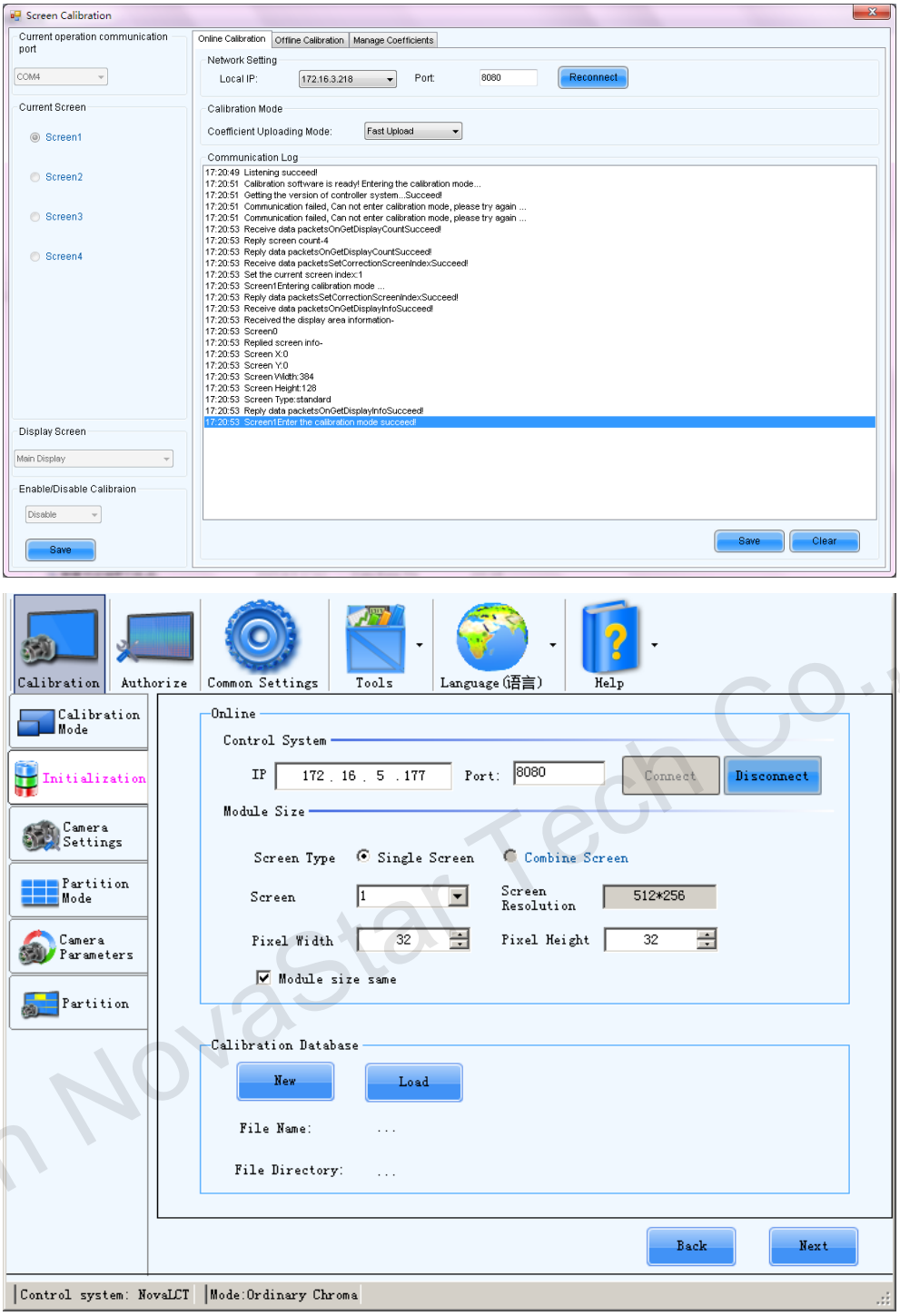

Fig. 4-3 Prompt message from NovaLCT when connection is successful

2) Screen Type

"Single Screen" and "Combine Screen" are supported.

Single screen: Refers to a screen configured on NovaLCT.

Combine screen: Refers to a large screen that combines the screes configured on NovaLCT through "Multiple-screen Management".

3) Screen Resolution

The resolution of display is the width and height in the pixel level.

After NovaCLB-Screen is connected with NovaLCT or NovaPro successfully, the bottom of the interface will show display count and the corresponding resolution of connected NovaLCT or NovaPro. Users

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could choose display number as needed, the default value is the first one.

4) Module Size

Check “Module size same” and set the module width and module height of module if the size of all modules are same. The function of **Seam Brightness Calibration** will not be supported if the size of module is not same.

5) Calibration Database

A new database can be created or an existing database can be loaded to store the information like calibration coefficients, calibration time, screen size, etc. It shall be kept properly.

In combined-screen mode, newly created database contains the database of each single screen (named by the sequence number of the com port and screen), which makes it convenient to maintain in future.

4.2 Settings

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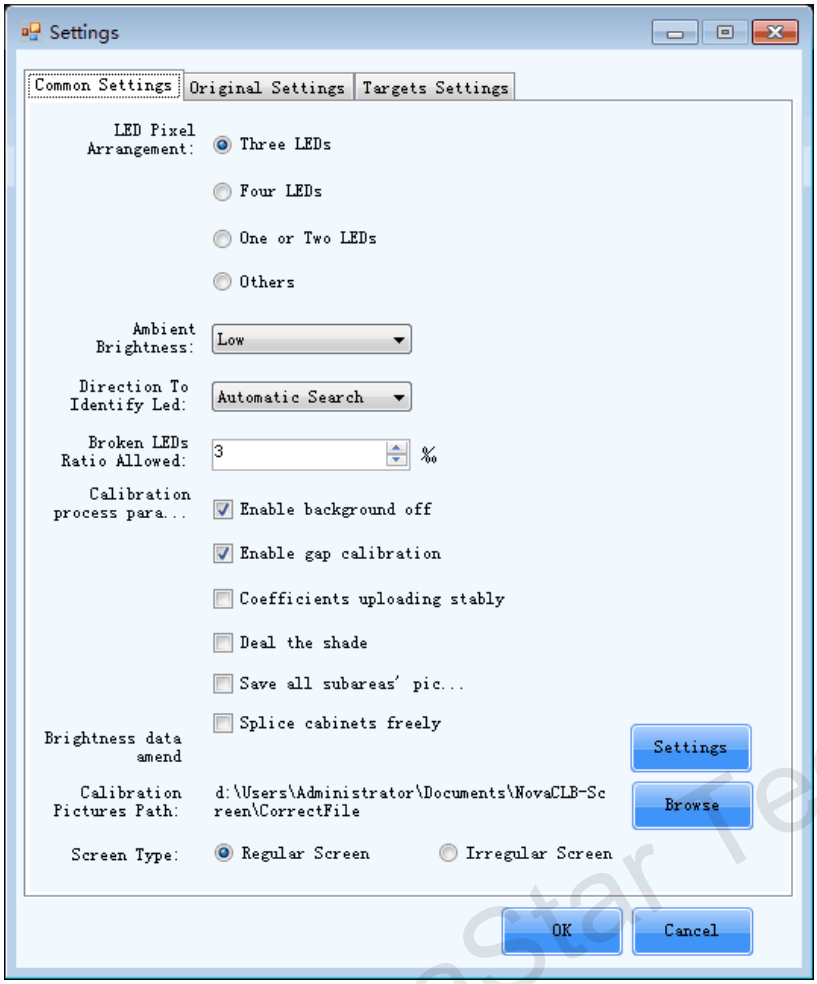
4.2.1 Common Settings



1) LED Pixel Arrangement

Pixel Arrangement is the count of every pixel, the common ones are three LEDs arrangement, Virtual pixel of 3 led, four LEDs arrangement, etc.

2) Ambient Brightness

Ambient Brightness is the brightness of surrounding environment while calibrating. In general, darkroom is "none" and the brightness is "low" at night. It's "High" at nightfall or a cloudy day. It is unsuited to calibrate in sunny day.

3) Direction to Identify LED

The Direction can be divided into four diagonal directions which are from four angles of rectangle. It is used when identify LED and the default direction is automatic search. The software will detect from four directions respectively and select the best result. When the LED of top left angle can't display normally, please change the direction. For example, users try to identify LED from bottom right when the first row or the first column is covered.

4) Broken LEDs Ratio Allowed

If the LEDs which can't be identified in calibrating zone are greater than the ratio. The calibrating flow will stop and some prompt messages will be presented. Please be sure whether the "broken lights are too

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much" or "some LED pixels are covered" is appeared. If the problem can't be solved, users could turn up this ratio to calibrate forcibly.

5) Calibration Process Parameters

- **Enable background off**

Background removal is to remove background light. Generally, calibration is required only to be conducted under relatively dark environment. But if background removal is enabled, calibration can be conducted even if the environment is not dark enough.

After "**Enable background off**" is selected, the interface shown in Fig. 4-5 is displayed when the calibration starts. Users can drag the four vertexes of the quadrangle or adjust the positions of the four vertexes with the mouse or the arrow keys on the keyboard. The area within the quadrangle is the valid calibration area. So, the unwanted light around the screen to be calibrated is removed.

Fig. 4-4Screen Area Determination

- **Enable gap calibration**

This is an option enabled during normal partition calibration. Gap calibration is mainly used for calibration of LED displays with small pixel pitch to solve the bright and dim line caused by cabinet assembly. Note: bright and dim line must be inside Partitions.

Click “Normal setting” on the main menu to pop up the window below, and then check "Enable gap

calibration".

- **Coefficient Uploading Stably**

Coefficient uploading stably means to upload calibration coefficients via serial cable. The speed is slower. Default calibration coefficient uploading method is via video cable. The speed is faster. If there's something wrong with the video cable, serial cable can be used as alternative by selecting coefficient uploading stably.

- **Deal the shade**

Enable this option if some subareas are blocked by leaves, wires, etc. The software will detect the blocked subareas automatically and deal with them.

- **Save all subareas' pictures**

Check "Save all subareas' pictures (Need more space)" to save all pictures of subareas. Don't check to only save the pictures of current subarea.

- **Splice cabinets freely**

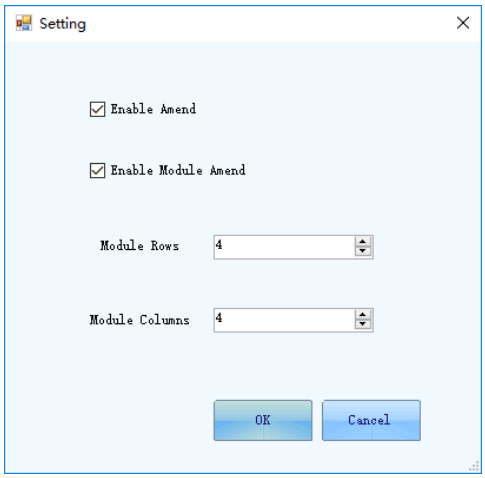
If "**Splice cabinets freely**" is selected, the system will automatically calculate the calibration coefficients of the cabinet edges. After calibration, when the cabinets are used to form a screen next time, each cabinet can be placed at any position in the screen.

Note: If "**Splice cabinets freely**" is selected, it requires that the cabinets in the screen must be from the same batch and there are no obvious dark or brighter blocks between cabinets.

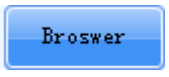
If "**Splice cabinets freely**" is not selected, after calibration, the position of each cabinet cannot be changed. That is to say, when the cabinets are used to form a screen next time, the position of each cabinet must be the same as their position during calibration.

6) Brightness Data Correction

Enable or disable brightness data correction. Module data correction is used when the brightness and chroma have modular difference. Module size is the minimum unit module.



7) Calibration Pictures Path

Click 

to set the position where the collected images are saved during calibration.

8) Screen Type

Set the type of the screen. Screen types include regular screen and irregular screen. Generally, regular screens refer to rectangular screen while irregular screens refer to non-rectangular screens such as round and triangle screens.

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4.2.2 Original Settings

Use colorimeter to measure original values.

Original brightness and chroma is the original brightness and chroma parameters information of the display to be calibrated when calibration is closed.

It's important to set these parameters correctly for the result of calibration.

The colorimeter here means instruments that can measure LED color, like: light gun, color analyzer, Spectral radiation brightness meter, etc.

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4.2.3 Targets Settings

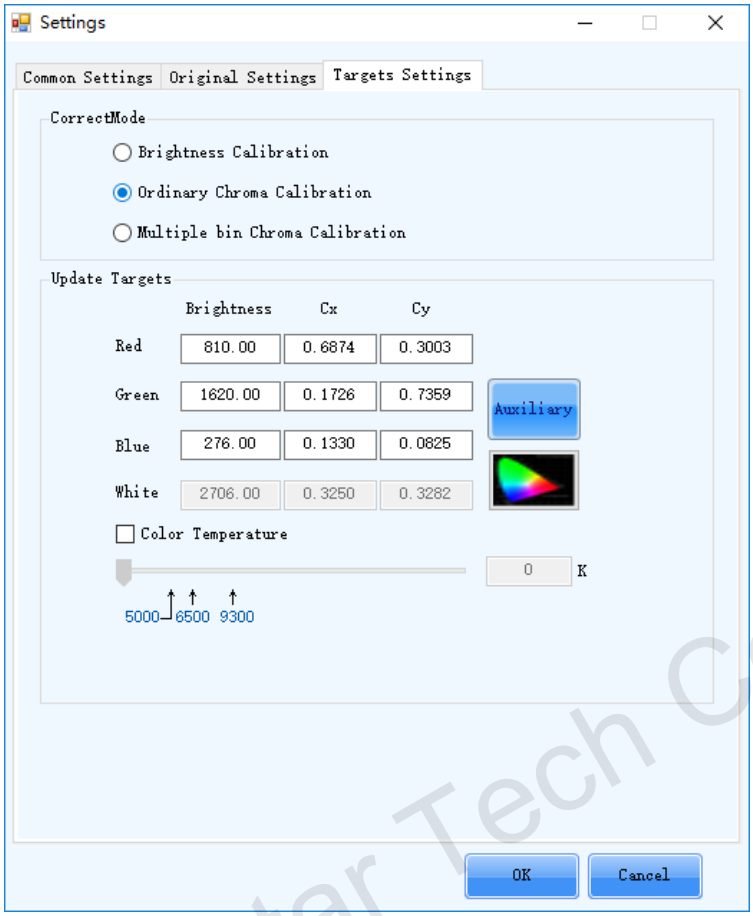

Fig. 4-5 Targets Settings

Brightness Calibration

Brightness calibration can only change the brightness of R, G, B, and it will not attenuate the color gamut. But it can't eliminate the difference in color between LEDs.

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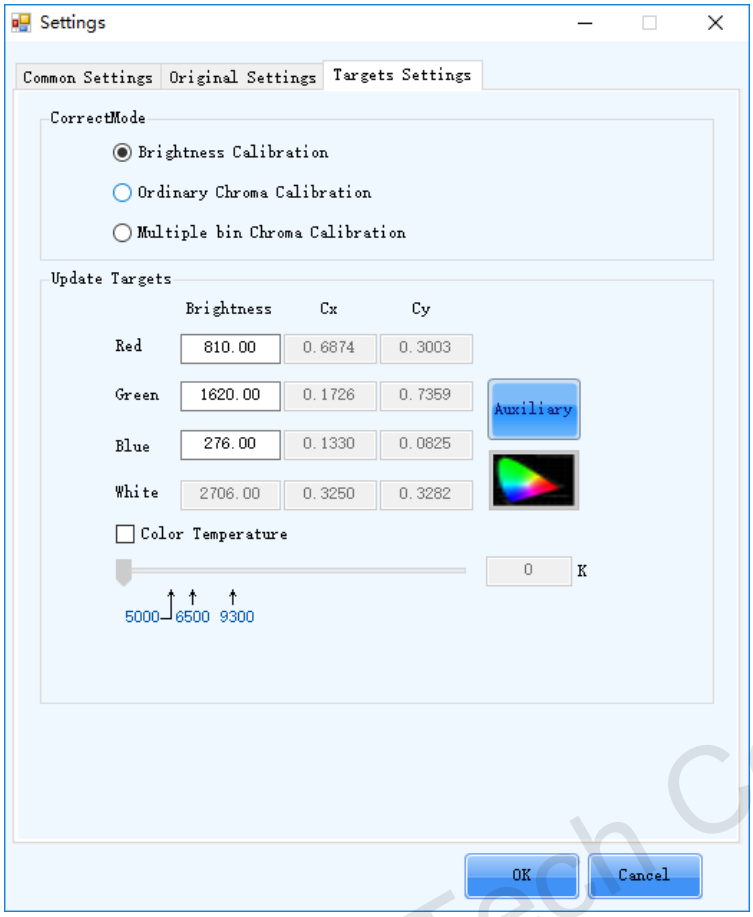
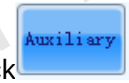


Fig. 4-6 Brightness Calibration

Adjust the RGB brightness in the figure above or click 

to adjust in the figure below.

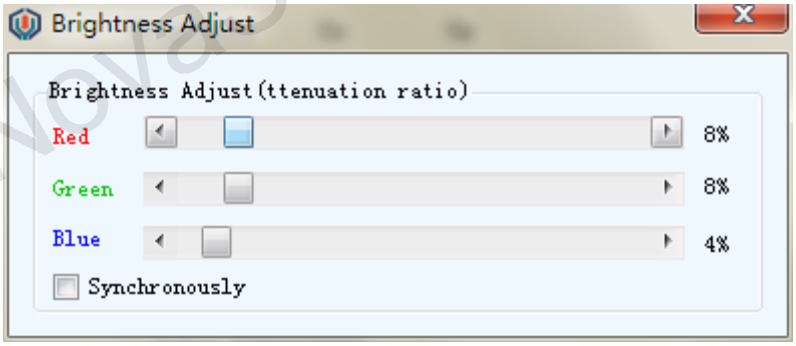


Fig. 4-7 Adjusting brightness by auxiliary tool

Ordinary Chroma Calibration

Brightness and Color calibration can change the brightness of R, G, B, and attenuate the color gamut. But it can uniform brightness and color between LEDs.

Users can adjust target brightness and color value by the

on the right, also users can input values in the textbox directly. Recommend using the first method

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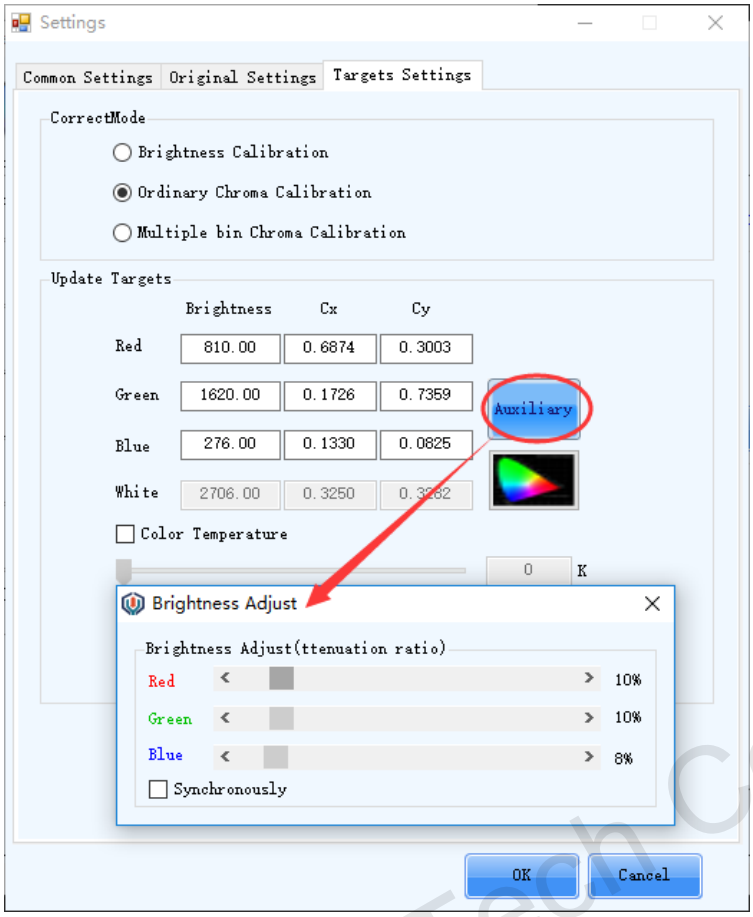

Fig. 4-8 Ordinary Chroma Calibration

After adjustment, click button to look up the current brightness and color value in CIE 1931 Color Diagram.

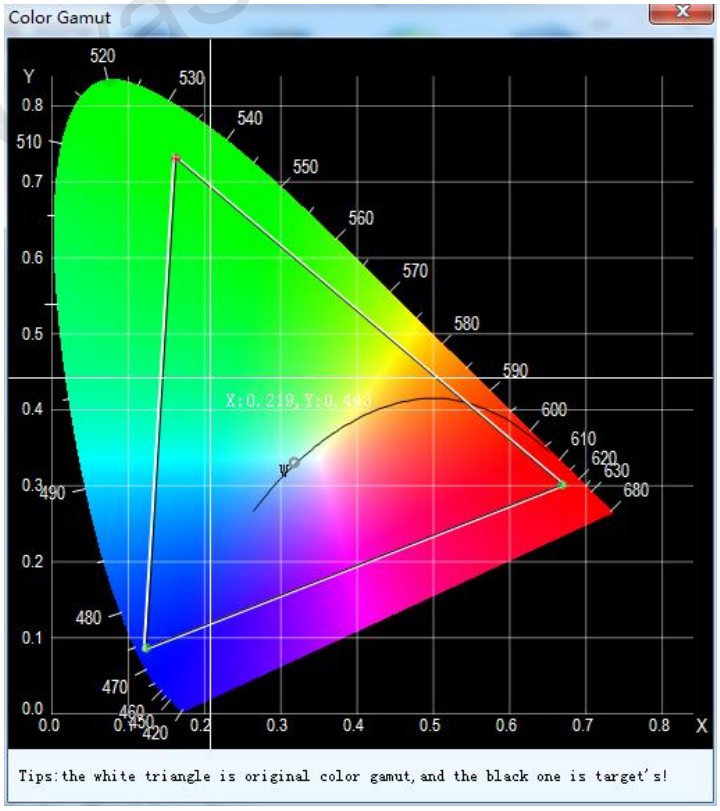

Fig.4-9 Measuring and Target Color Gamut in CIE 1931 Color Diagram

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The white triangle in the image is corresponding to measuring color gamut, the black triangle is corresponding to target color gamut. To realize the uniformity after calibration, the target color gamut should less than measuring color gamut. From the image above, users can get the attenuation of color gamut. Users can also click the right mouse button in Color Diagram to choose to add the color coordinate to "Target Brightness and Color" value.

The former method is recommended. Users can also check “Color Temperature” and directly enter an appropriate color temperature value，or drag the bar to set color temperature value, or click to use the recommended color temperature value, where three commonly used color temperature values are provided: 5000K, 6500K, 9300K.

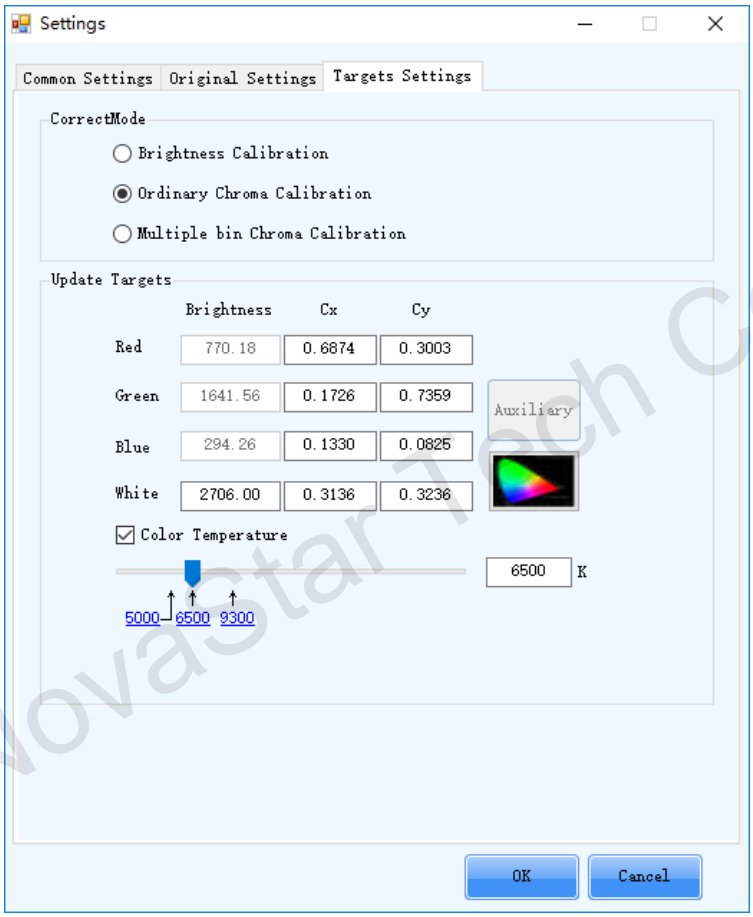

Fig. 4-10 Expected Color Temperature

Multiple bin Chroma Calibration

Multiple bin chrome calibration is mainly used for adjusting the brightness difference after multi-batch of lamps or lamp panels have been mixed.

The operation steps of **multiple bin Chroma Calibration** is basically the same as **“Ordinary Chroma Calibration”** pattern.

4.3 Camera Settings

During calibration, camera must be connected computer correctly, aimed at the partition and be able to take photos normally. It is required to choose camera type before connecting camera. Digital camera refers to Canon camera and industrial camera is HS1000. After the camera is connected, camera status

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is as the figure below. Click “Next” to move on to partition mode to do the relevant camera settings. See details in 13.4 Camera operating skills.

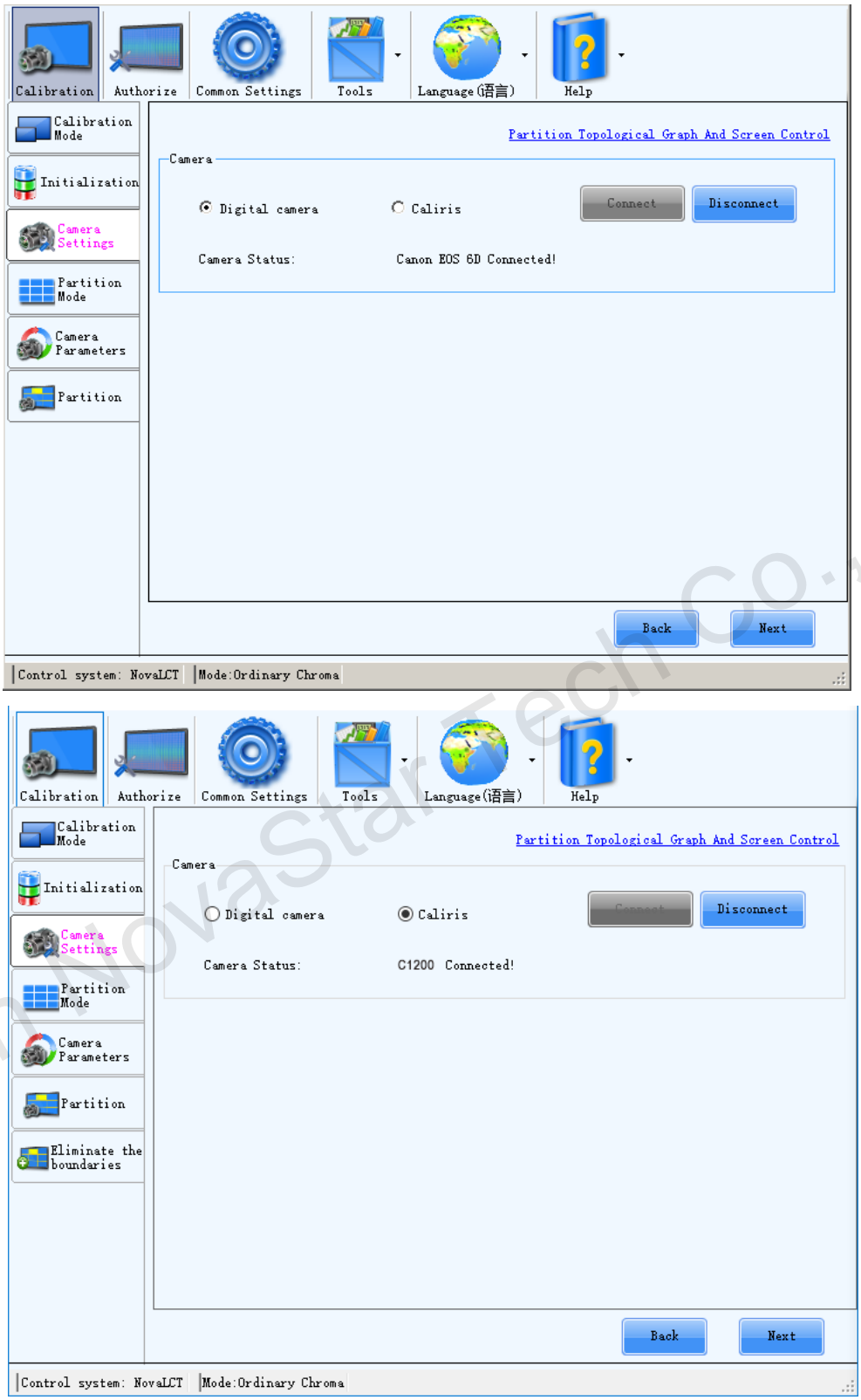

Fig. 4-11 Connect Camera to LCT

4.4 Partition Mode

Due to the limitation of the camera's resolution, the screen needs to be divided into several proper

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subareas to be calibrated.

Partition calibration can achieve the specific process of display calibration after the setting of calibration parameters is completed.

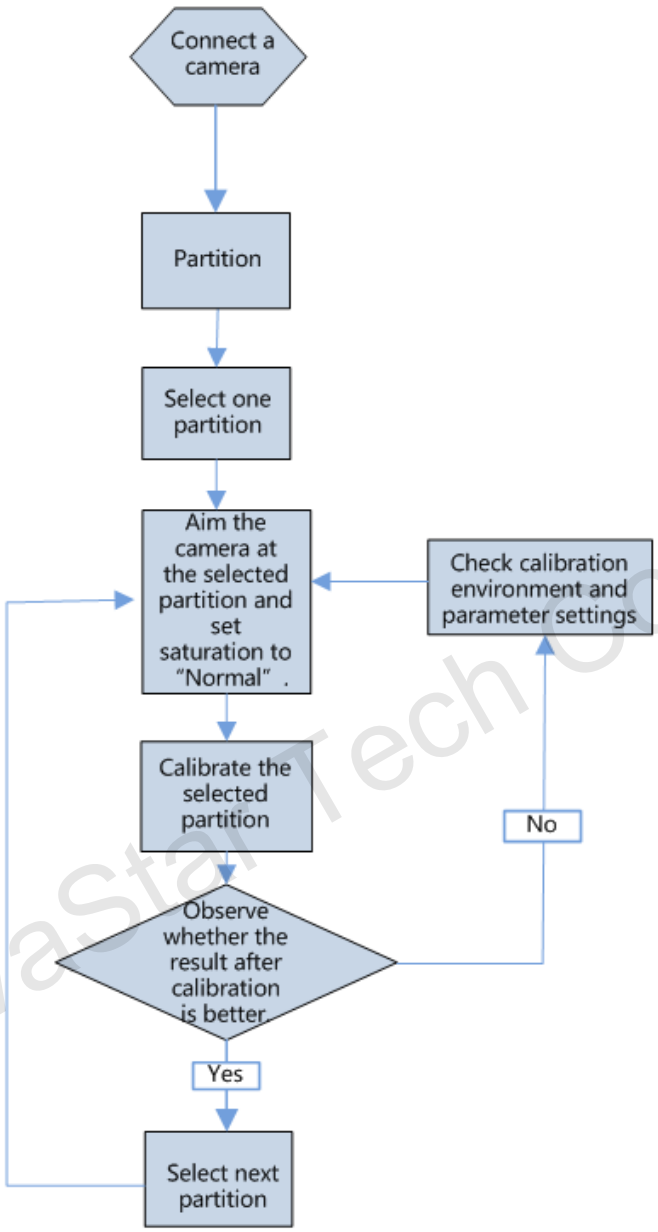

Fig. 4-12Partition calibration Flow Diagram

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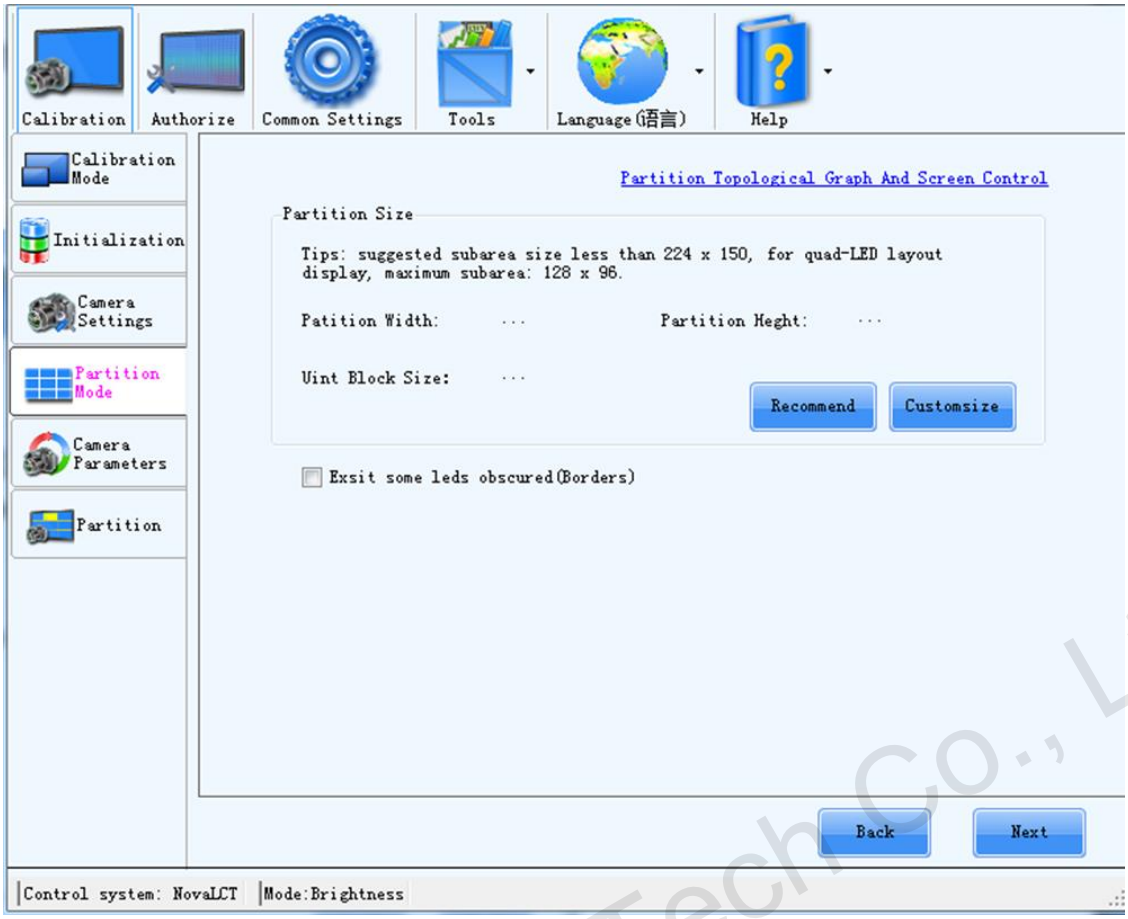
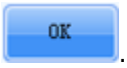


Fig. 4-13 Partition Mode

Click

, thus the software will calibrate the proper pixel size of a single partition according to the display size and conduct auto-partition.

Click

to set the unit size when adopting customized partition, where columns and rows collected by the camera cannot exceed the default value "224×150", while Caliris is "256×192". and the partition size (unit columns and rows ×columns and rows collected by the camera) is displayed at the bottom of the interface. After setting is finished, click 

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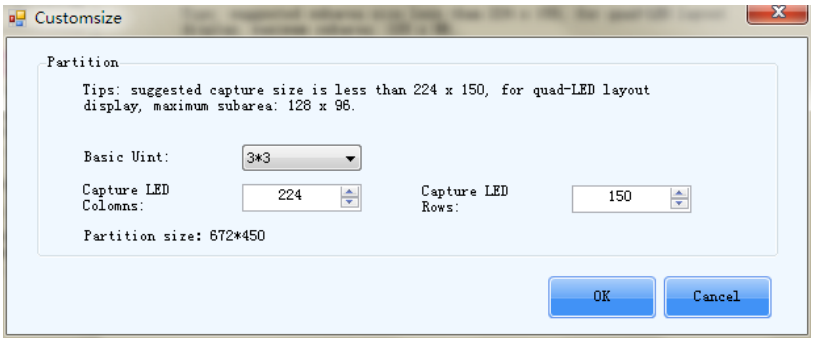

When finished, you can see the result as shown in Fig 4-15.

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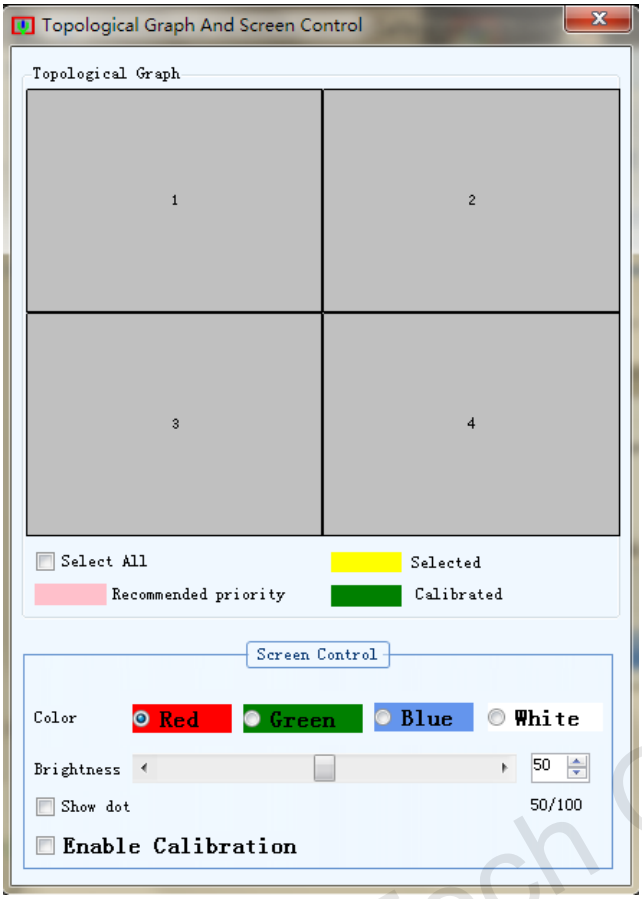

Fig. 4-14 Topography Graph And Screen Control Window

Topography Graph

It is composed of divided subareas. Number these subareas from left to right, from top to bottom.

Screen Control

It is used to realize the control of screen color, brightness and division switch.

The right window can move together with the main window, and can shut down if unnecessary. Click "**Partition Topological Graph And Screen Control**" on the right page, it will popup.

If there is binding around the display, it is necessary to check "**Exsit some leds obscured**" and input the columns and rows of borders and then click to view the screen. The operation is successful when see the fist rows or columns have on it .

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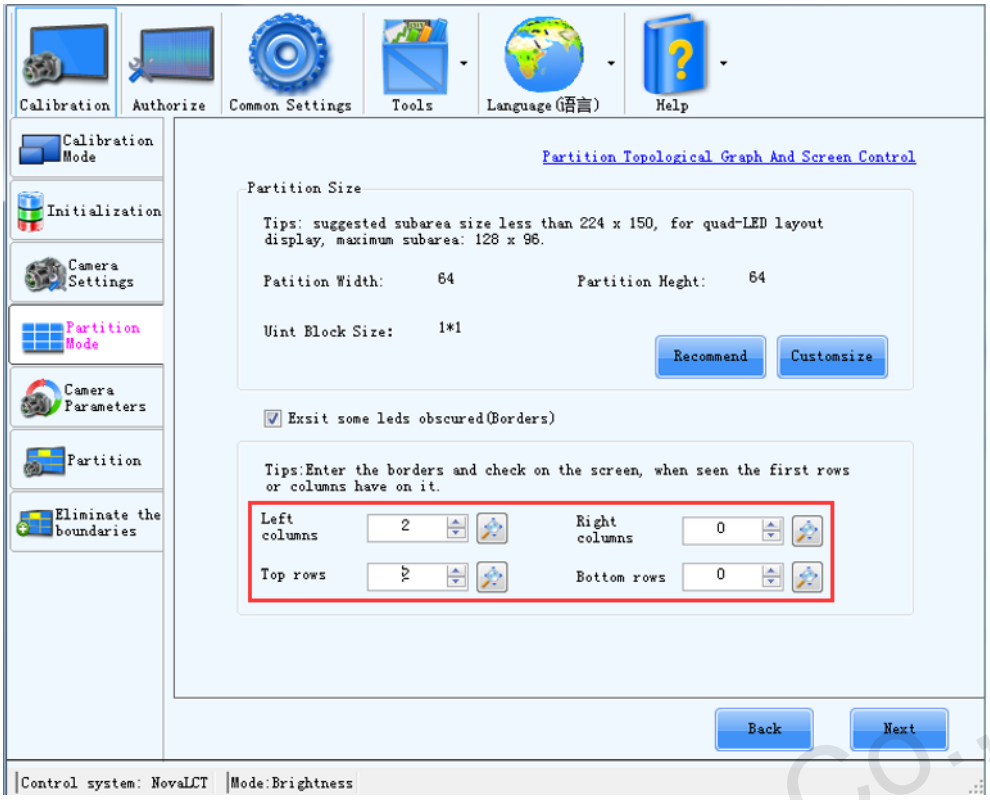
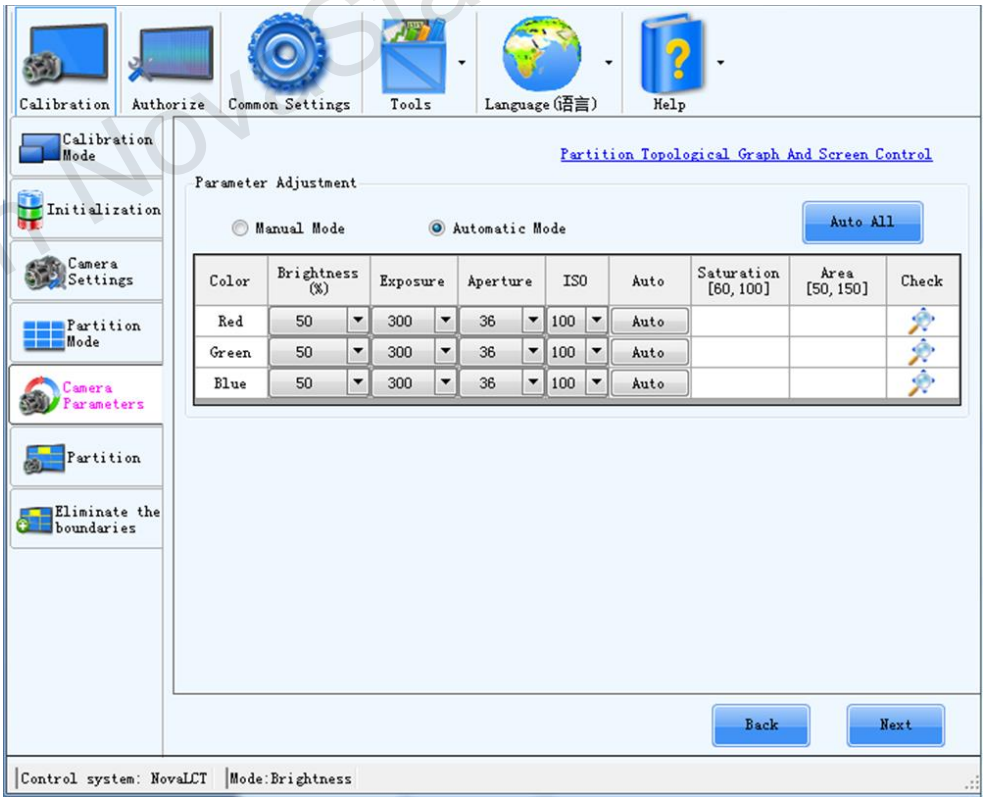


Fig. 4-15 Setting the number of rows and columns of borders

After division, click "Next", enter into "Camera Parameters".

4.5 Camera Parameters



The figure above is the interface after successfully connecting the camera. The Caliris camera do not

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have the preview window. Click on

to open **Quick Start Guide** and view the operating skills of camera.

No matter manual mode or automatic mode is adopted, adjust the saturation till the result reaches "**Normal**", and adjust the image size to "**Fit**". During this process, make sure that the camera faces to the partition.

Notice: If the image area is relatively small when the saturation is normal, the micro focus ring can be adjusted to blur the image. After zooming the camera window, the image seen in camera window is different from the actual image. User can solve the problem by clicking the LED light spot in the image prompted by magnifying glass to separate them.

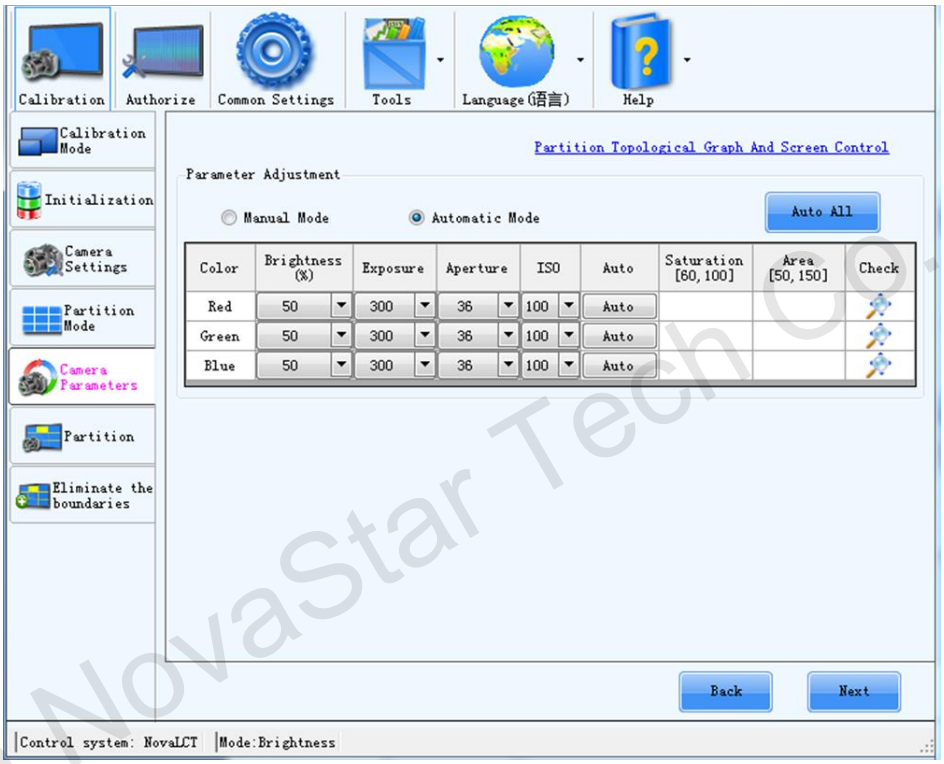

Fig. 4-16 Camera Settings

Automatic Mode

This mode is the default mode. Under this mode, users just need to click on

button, then the software will automatically analyze and adjust the saturation and finally achieves "normal". If failed, please check the calibration environment and parameters, then try again.

Manual Mode

Under this mode, users should adjust calibrate brightness, exposure time and aperture size. When adjusting, give priority to "aperture", followed by "exposure", and finally "brightness".

Note: The default brightness 50. Automatic analysis is advisable. Manual adjustment can be carried out if experienced. Next step can be taken only if the analysis result is normal. Saturation between 60 and 100 is normal. It is proper to adjust the image size to 50~150.

You can click
to view the image obtained after saturation adjustment, in order to help finding problems. When red, green, blue analyses are all completed, click "next" to enter into the page

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"**Partition**".

4.6 Partition

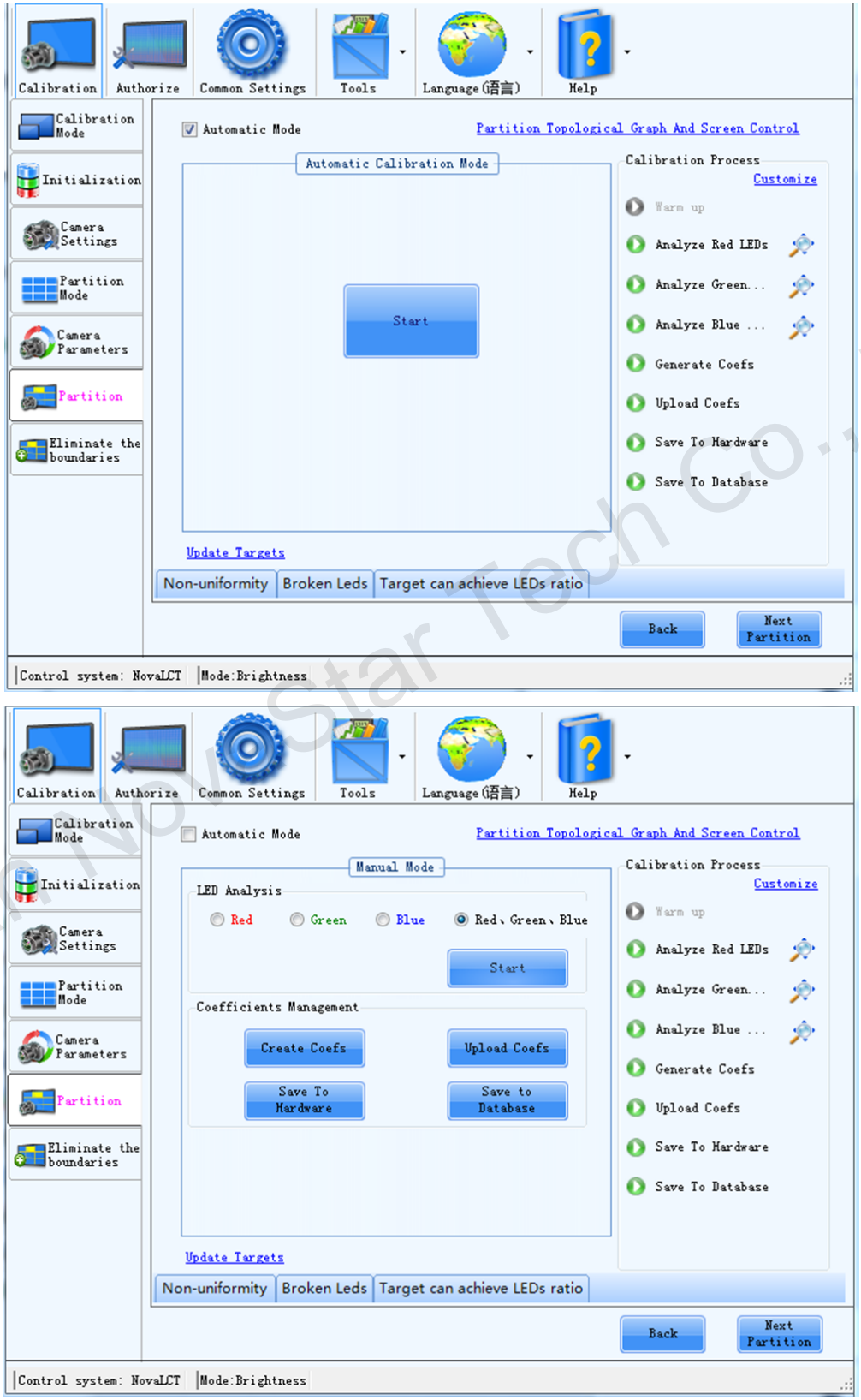

Fig. 4-17 Partition

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1) Automatic calibration Mode

Users just need to click "Start" button, the software can do the following things automatically: analyze red, green and blue led, generate coefficients, upload coefficients, save to hardware and to database. It will make calibration more convenient and efficient. Users may also manage this flow according to their own requirements. Click "Customize", you can see fig. 4-20.

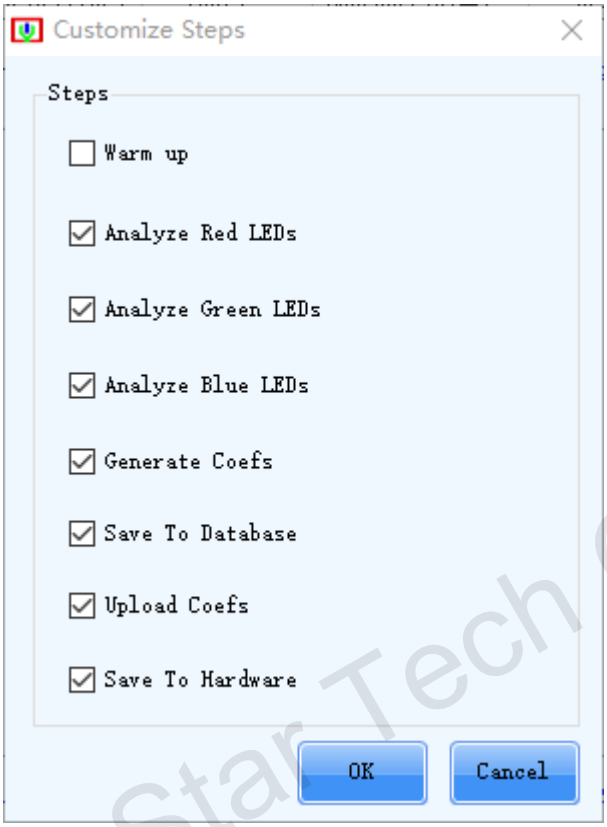

Fig. 4-18 Customize Window

2) Manual Calibration Mode

Users can separately operate every step of the calibration process.

For the partition is completed, users can test whether the calibration effect is good through "pictures control" on the right side of this window.

3) Upload calibration coefficients

Upload calibration coefficients to screen.

Coefficients of area without accessing video data could not be uploaded if the subareas are across two or more screens during calibration. Select multiple subareas from topological graph after calibration is completed and right click to upload the coefficients. Please note that only the subareas loaded by the sending device connected to the control computer with a video cable can be selected and the selected subareas need to form a rectangle.

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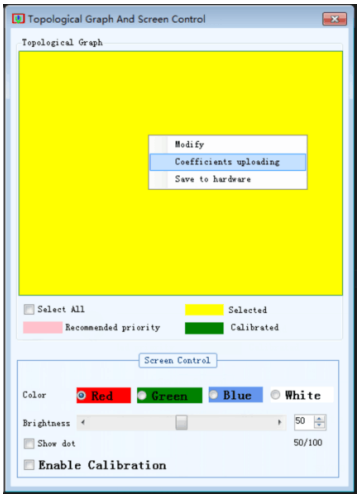
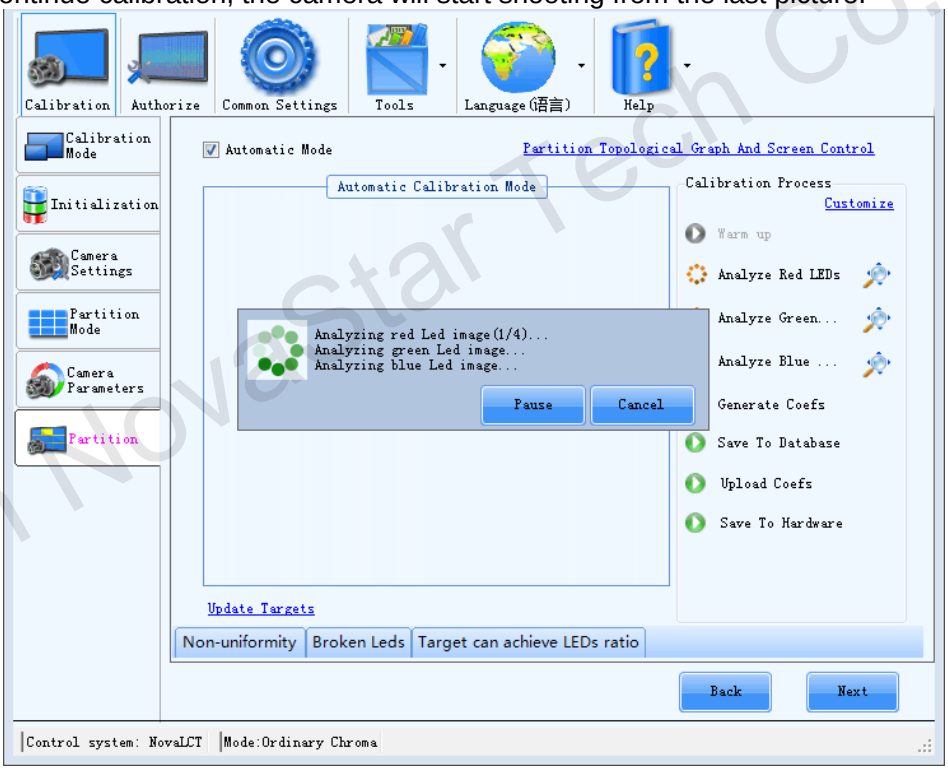


Fig. 4-19 Uploading calibration coefficients via topological graph

4) Pause Calibration

Some emergency situations may happen during the calibration process, such as sudden appearance of obstruction. User can click Pause to stop calibration under such condition. When user clicks Continue to continue calibration, the camera will start shooting from the last picture.



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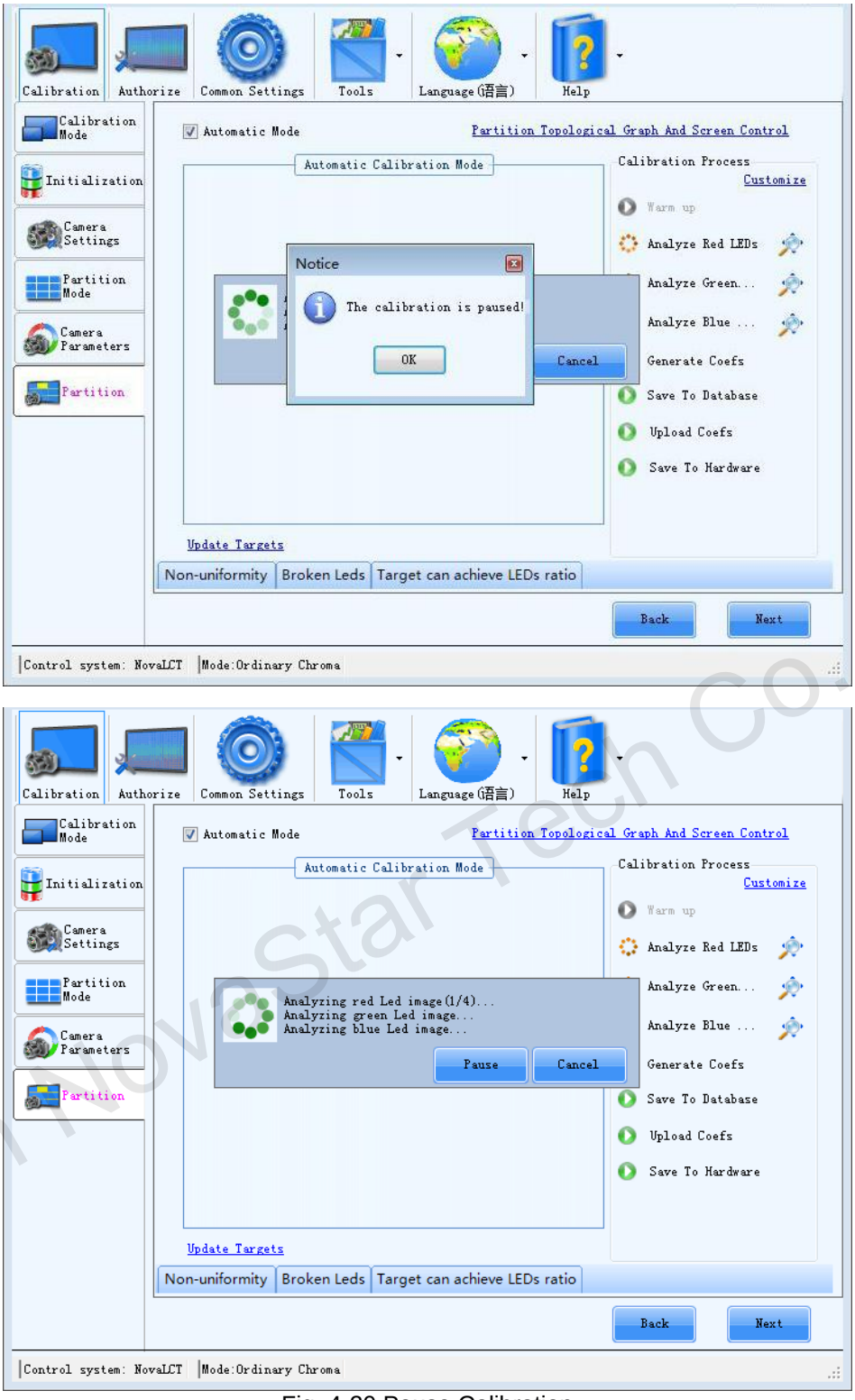

Fig. 4-20 Pause Calibration

5) Change the target value

The user can click Update Targets to change the target value in target calibration interface if the calibration result is not satisfying after partition calibration. Brightness calibration, ordinary chroma calibration and multiple bin chroma are all supported. Multiple bin chroma calibration supports blue calibration which is mainly used for optimizing blue effect.

The user can input the value manually or modify the target value with auxiliary tools. Click to

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view gamut distribution diagram after modification.

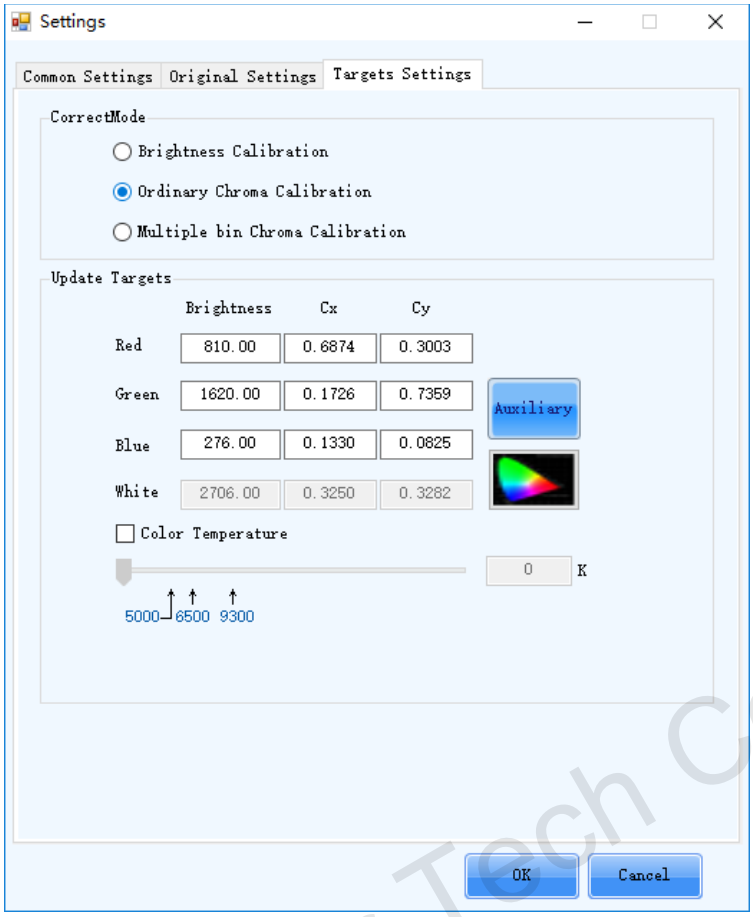


Fig. 4-21 Change the target value

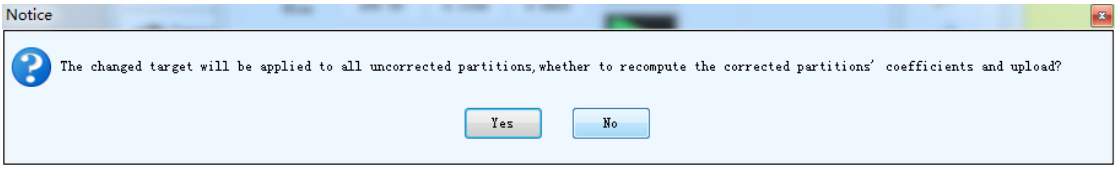
Restore: Restore the calibration mode and target value to the value shown when the interface is opened just.

Preview: View the effect on the display after the target value has been modified.

Enable correction: this option to view the effect of the latest correction coefficient on the display.

Click

if the corrected target value is satisfying, and thus the system will prompts “Whether apply the corrected target value into all partitions?” Check ‘Yes’, and thus the system will recalculate the corrected correction coefficient of partition and load the new one. Click “No”, and thus the target value will only be applied into the partition needs correction.



When the calibration of a partition is done, click "Next Partition" to calibrate the next partition. If the Caliris camera is used for calibration, change the partition and click "Image Preview" to view whether the camera faces the partition.

If there are still differences among these partitions after all partitions are calibrated, select "Eliminate the boundaries" to eliminate the differences.

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4.7 Eliminate Boundaries

- Skip this step if no border exists between partitions;
- If borders are found between partitions, click "**Eliminate Borders**", "**Upload Coefficients**", "**Save to Hardware**" and "**Save to Database**".

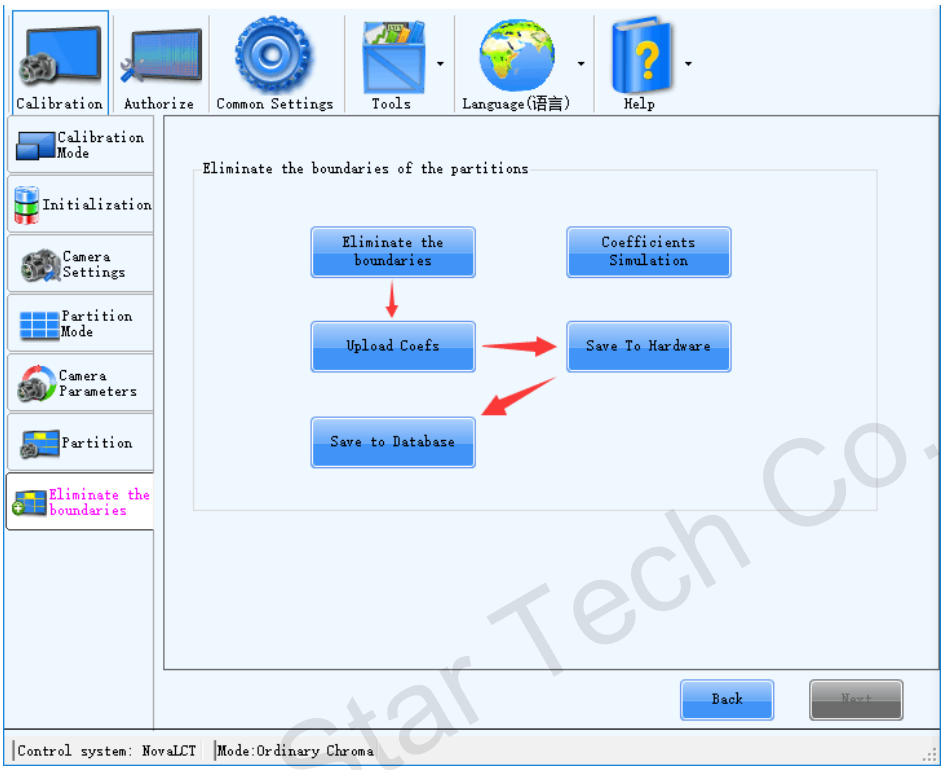

Fig. 4-22 Eliminate Partition Borders

If there are many sending cards and the combined screen is configured, click "Upload Coefficients" and then select the sub-screen with the normal DVI signal on the pup-up screen selection page (as shown in Figure 4-23). Please select the sub-screen that properly connects to the video cable. When the calibration coefficients of all sub-screens are required to be uploaded, switch the video cable and upload all the sub-screens respectively (You can also select stable uploading method with significantly low uploading speed in **Settings**.).

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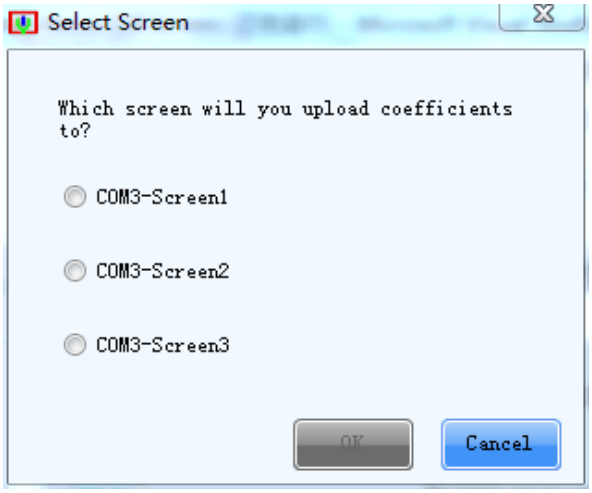

Fig. 4-23 Sub-Screen Coefficients Uploading of Eliminating Borders

In the combined screen mode, you are advised to use LCT to upload coefficients. Below are the operating procedures:

1) Click "Eliminate Boarders" and then "Save to Database".
2) Copy the database to the control computer, and then open NovaLCT.
3) Log into NovaLCT and choose "Calibration" > "Coefficients Management".
4) Click "Single Screen", and select a current operating communication port from the drop-down list and a current display screen.

(Due to the limit of transmission capacity of the video cable, only one screen can be connected. Therefore, select a single screen loaded by the sending card that is connected to the video cable. After the coefficients are uploaded, connect the video cable to another sending card to upload coefficients respectively.)

5) Import the copied database.
6) Upload coefficients.

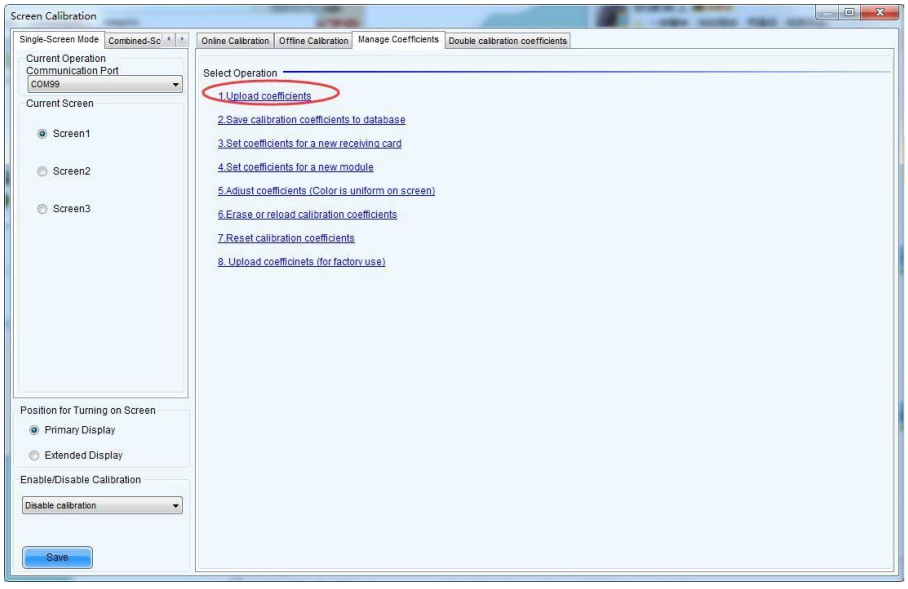

Fig. 4-24 Sub-Screen Coefficients Uploading

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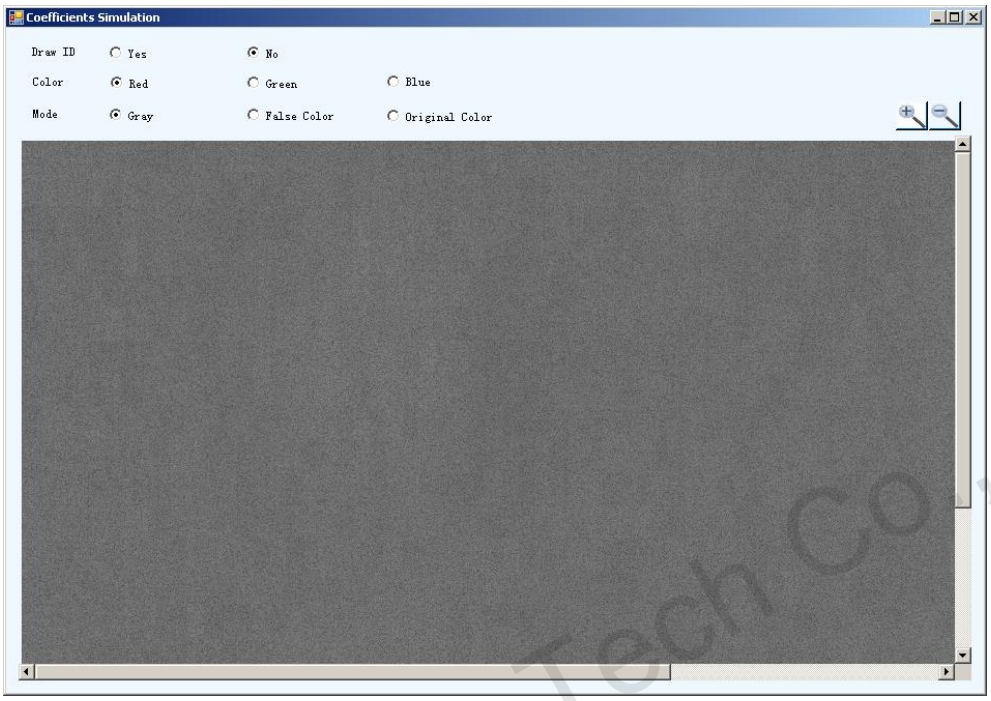
➢ Coefficient simulation

Calibration engineers can see the simulation effects (before calibration) on the simulation image. If the measured brightness data have problems, the display defects can be observed on the simulation image. Click "Coefficient Simulation" to enter the coefficient simulation page, as shown in the figure below.



- **Draw ID**: Paint partition ID on the simulation image.
- **Color**: Displayed color of the simulation screen.
- **Mode**: The simulation image has three modes: original color, gray and false color. Simulation image is a colored image. Primary color is the color of the simulation image. Primary color mode means that the color of the simulation image is the same as the primary color. Gray mode means that the color of the simulation image is always grayscale image no matter what the color of the simulation image is. False color mode means that the simulation image appears like a colored image and so it is called false color image because the RGB values of each pixel on the simulation image are assigned according to different calibration coefficients.

  If the LED display is evenly blurred before calibration, the calibration coefficients are distributed very evenly and the simulation image also looks very even. If a partition on the simulation image appears brighter or darker, the calibration result of this partition is abnormal.

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5Seam Brightness Calibration

The bright/dark line on the display can be adjusted by the function of **Seam Brightness Calibration** when it is located at the splice between lamp panels or cabinets. The effect can be very remarkable if the operation is proper.

Select“**Seam Brightness Calibration**”as calibration mode.

Fig. 5-1 The mode of Modify dark or bright lines

5.1 Initialization

Setting of Initialization is the same as pixel level calibration. Please refer to 4.1 Initialization.

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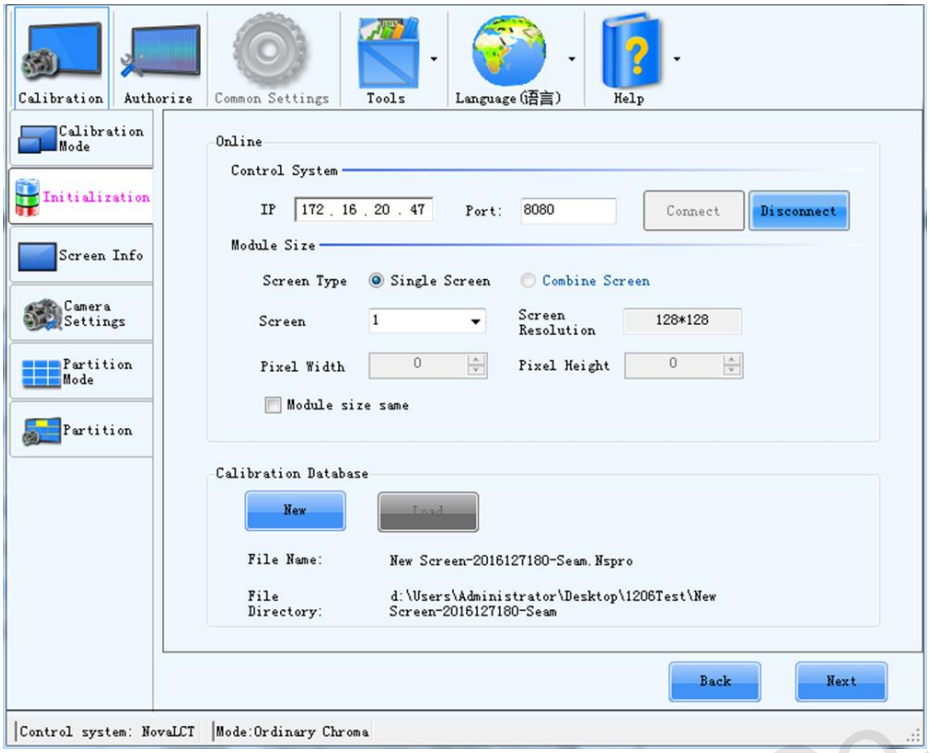

Fig. 5-2 Choose Calibration Mode

5.2 Screen Info

The operation process varies with the calibration of display and can be divided into without calibration, Screen calibration and Cabinet calibration. The user need to load database and pay attention to the following items in the latter two situations:

1) Screen Calibration, The full-screen calibration must be conducted with NovaCLB-Screen V4.0 or higher version; moreover, the size of module must be identical.
2) Cabinet calibration, the cabinet database must be converted to full-screen database at first.

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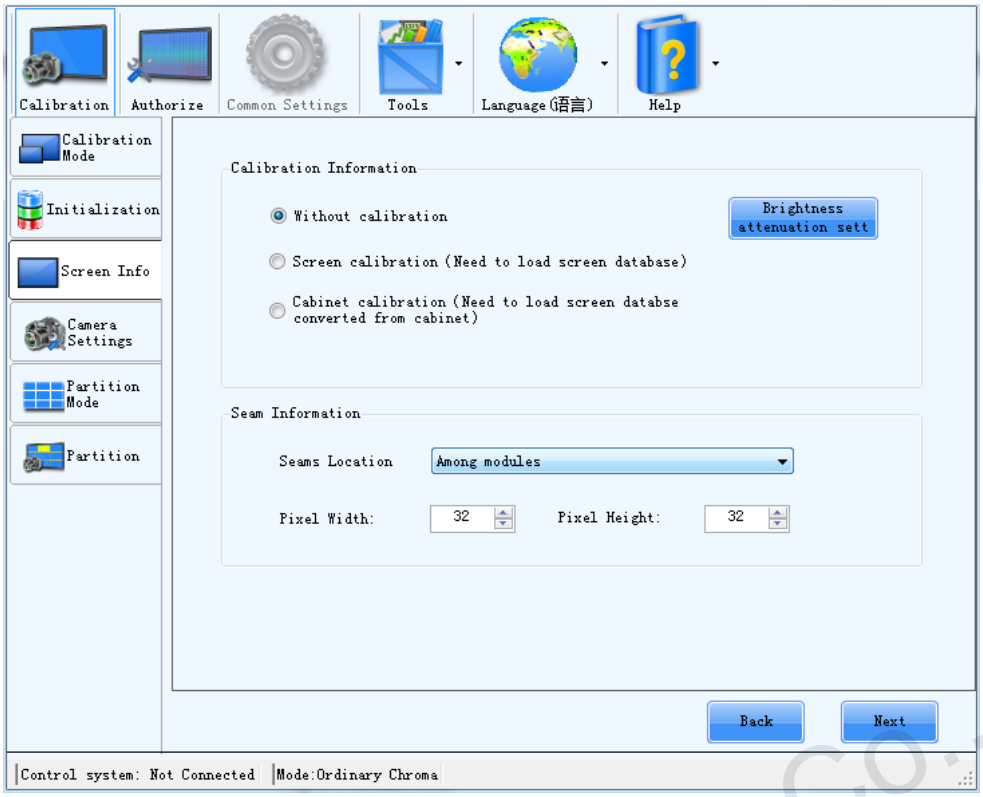

Fig. 5-3 Screen Info

Seam Information

- Select the position of seams among two types: between cabinets or between modules (it is located between cabinets generally).
- Fill in the number of columns and rows of each module.

Click

after setting to enter the Partition Mode.

5.3 Camera Settings

Camera need to connect normally to computer, face directly toward the subarea and take pictures normally. Camera status is shown in the figure below. Click “Next” to start partition.

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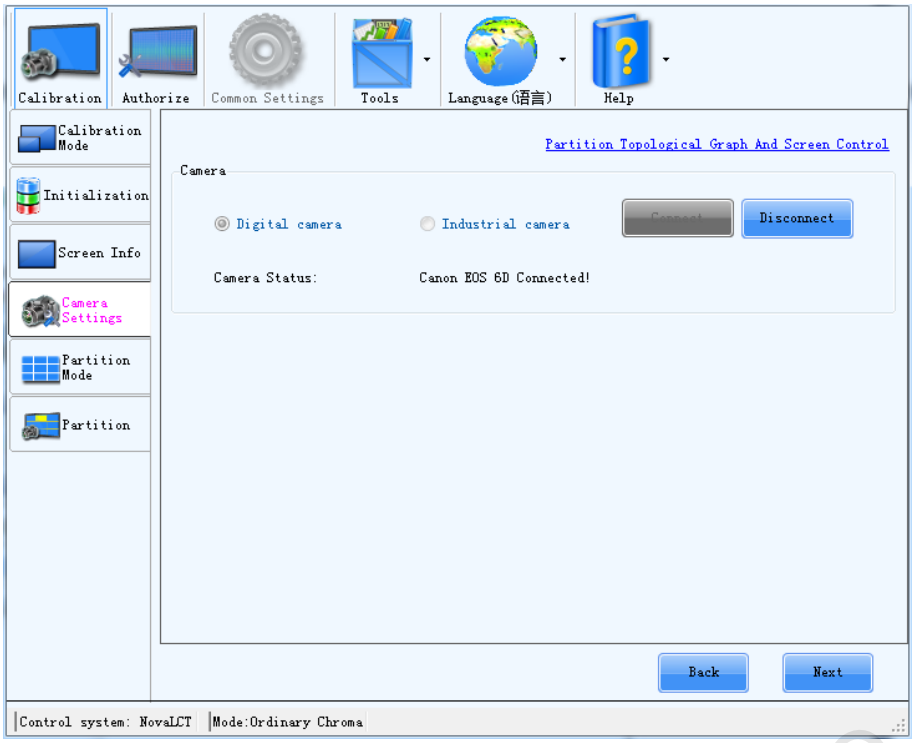

Fig. 5-4 Camera Settings

5.4 Partition Mode

Start to modify bright and dark lines when the initialization of calibration is completed. The screen need to be divided into multiple areas with appropriate size for calibration due to the limitation of camera resolution.

Please refer to 4.3 Partition Mode for the setting of partition.

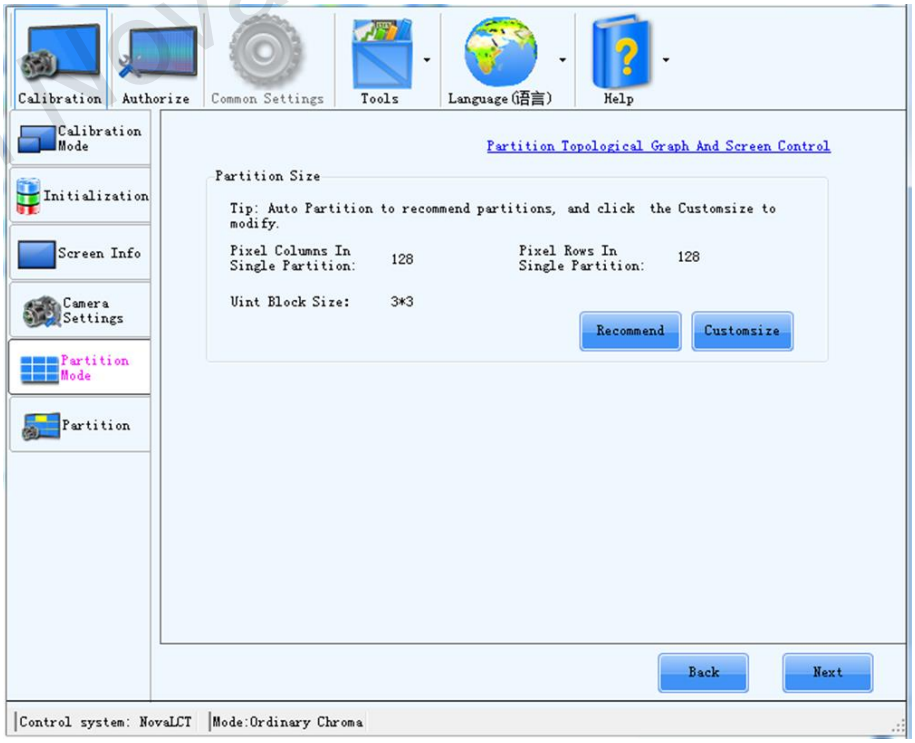

Fig. 5-5 Partition Mode

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5.5 Partition

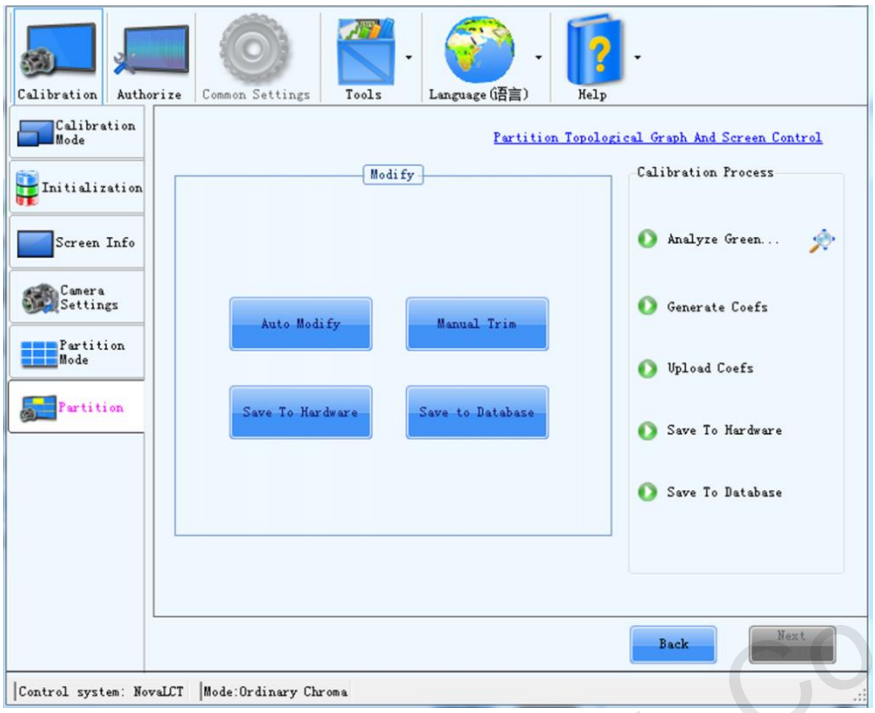

Fig. 5-6 Modifying bright and dark lines

1) Preparation

Before enabling auto modification, point the camera to the partition and adjust the focal length and focus ring of the camera to makes sure that the entire partition is within the viewfinder of the camera and each partition is separate. Click image preview to adjust the aperture size while using a Caliris camera.

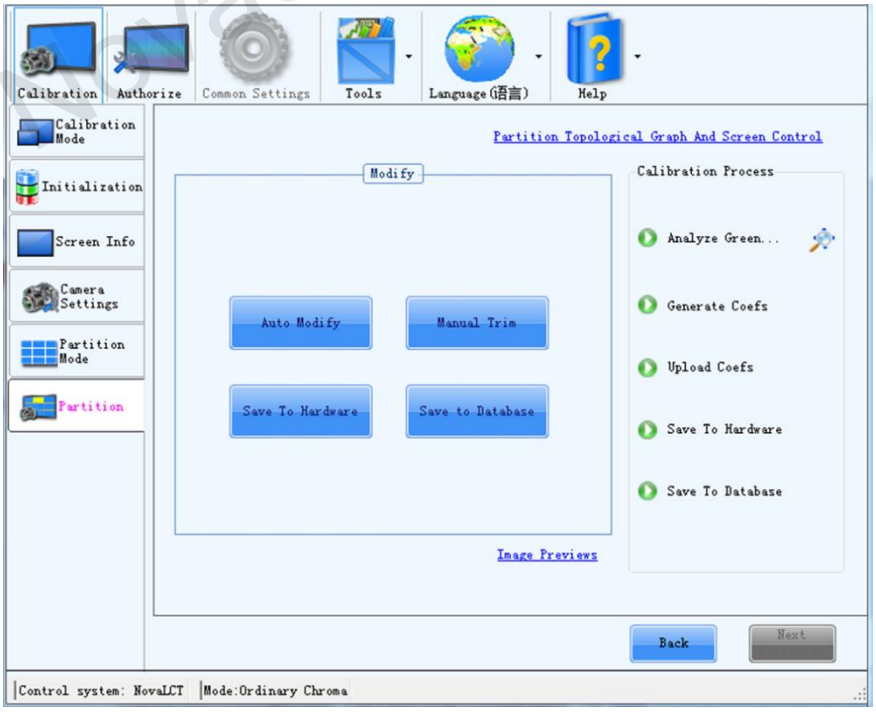

Fig. 5-7 Common Settings

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2) Auto Modify

Click

and the interface shown in Fig. 5-8 will be displayed when start modify. Users can use the mouse to drag the four vertexes of the quadrangle to select the valid area to be calibrated. The unwanted light around the screen to be calibrated is removed.

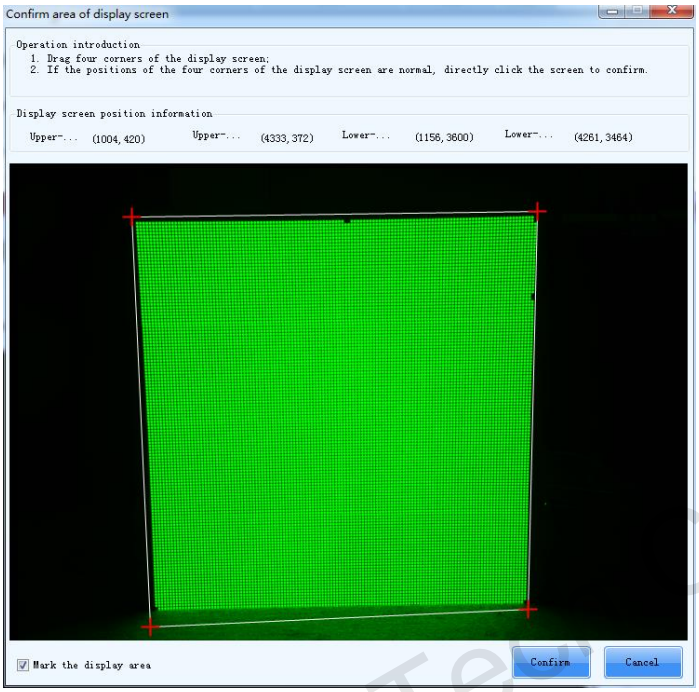
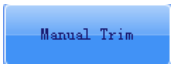


Fig. 5-8 Confirm area of display screen

3) Manual fine adjustment

The user can conduct manual trim if the modification result is not satisfying after auto-modification.

Click 

to enter the fine Manual Trim interface of system as shown below:

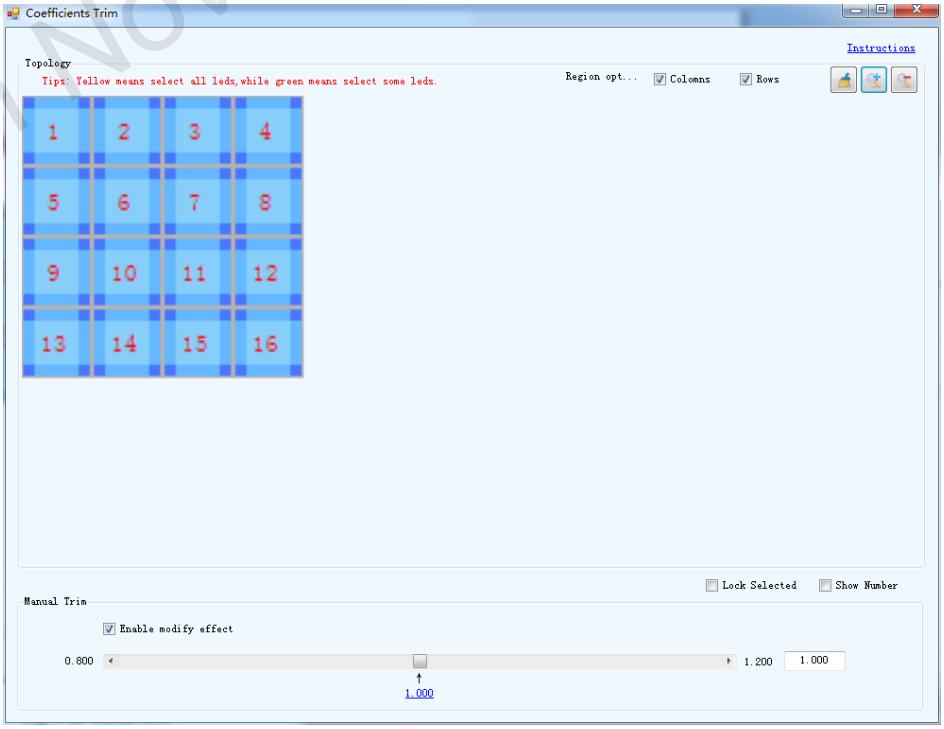


Fig. 5-9 Manual trim

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Operation steps of manual fine adjustment:

a) Users can select the edge or point requiring fine adjustment by dragging mouse window or clicking the mouse. Yellow means that the whole edge is selected; green means that partial LEDs are selected.

As both directions in the window option are considered as checked in default setting, the edges in the rows and columns can be selected. If only “columns” is checked in the window option, user can only check the edge in the columns of the window.

Fig. 5-10 Region option 1

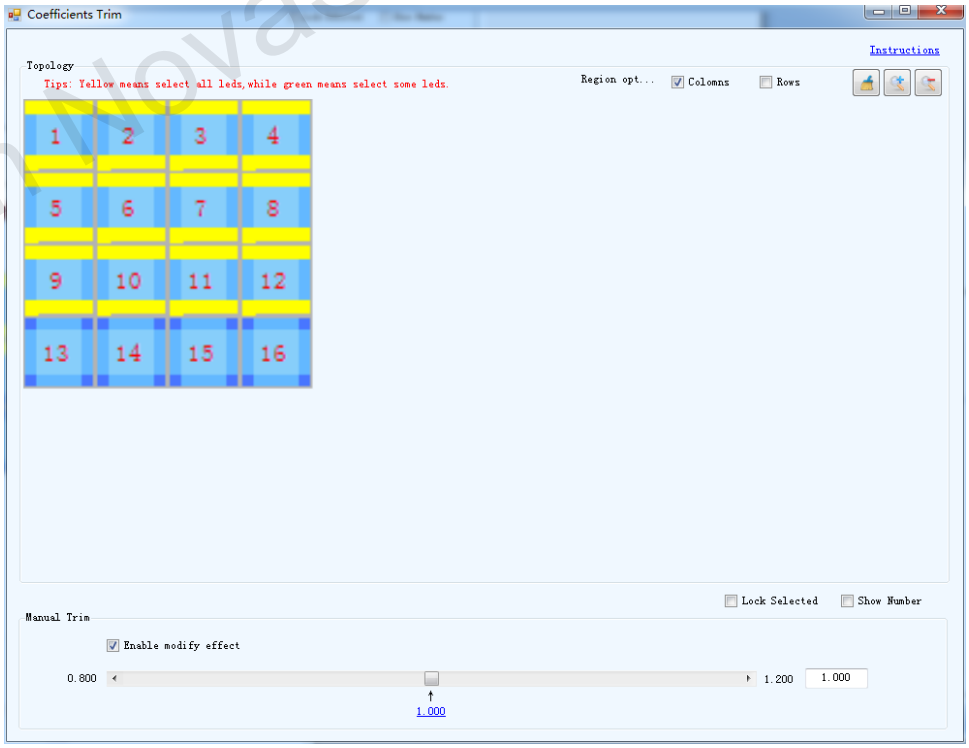

Fig. 5-11 Region option 2

The edge need trimming can be selected with a single click of the mouse.

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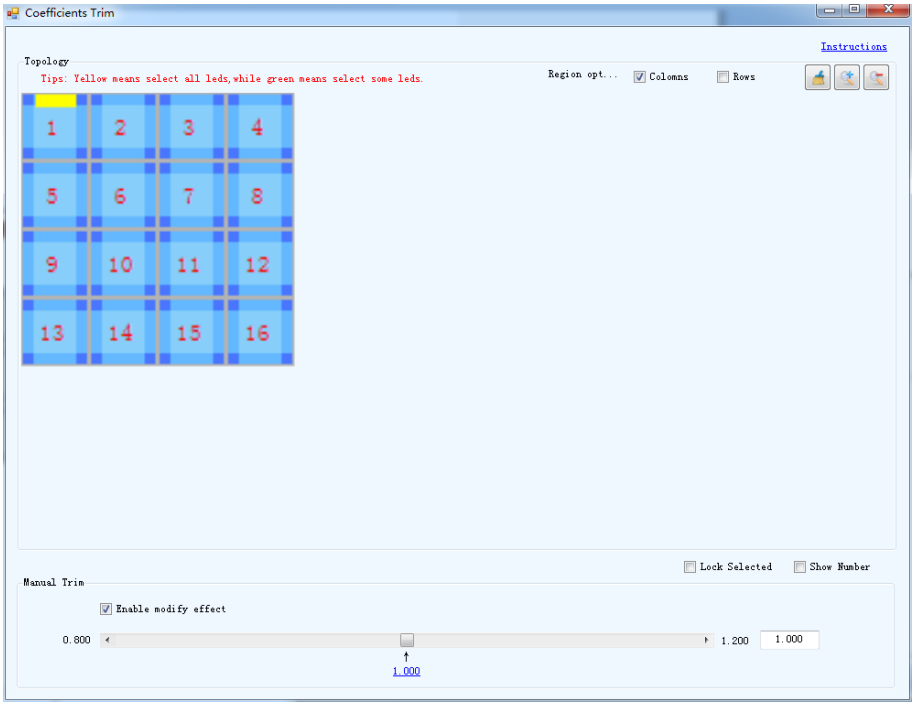

Fig. 5-12 Clicking the mouse to select the edge to be adjusted

Double-click the edge to pop up the following screen, you can click or select the light spot to be trimmed. Hold Ctrl or shift key to click the mouse to select multiple spots.

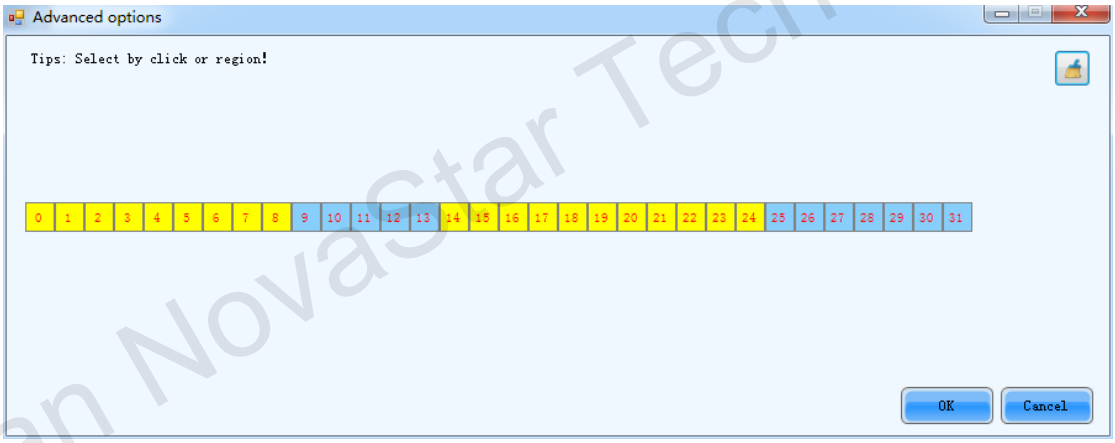

Fig. 5-13 Select the light spots to be trimmed

After selecting the light spots, green indicates the light spots that have been selected, as shown below.

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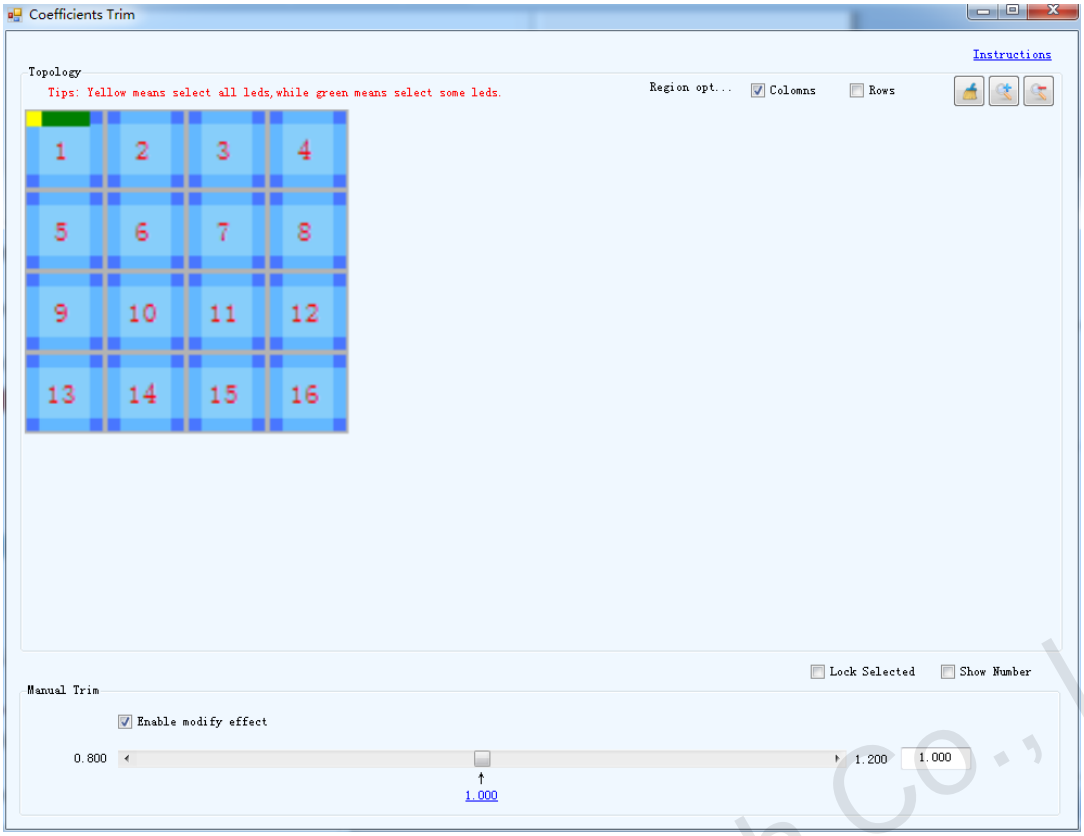

Fig. 5-14 After selecting the light spots

Lock Selected: Lock the selected edge or spot.

Show number: When checked, number will be displayed on the screen.

b) Drag the lever to fine adjust the coefficient. When checking “Enable modify effect”, it indicates that trimming is conducted based on the previous correction. When not checking, it indicates that trimming is conducted based on automatic correction.

4) If the Modify effect is satisfactory, click

to save the coefficient to hardware. And then click

to save the correction coefficient to database.

6New Module

Connect control system (NovaLCT or NovaPro) to start on-line calibration.

Select “**New Module**” as calibration mode and click “Next” to enter the interface of initialization.

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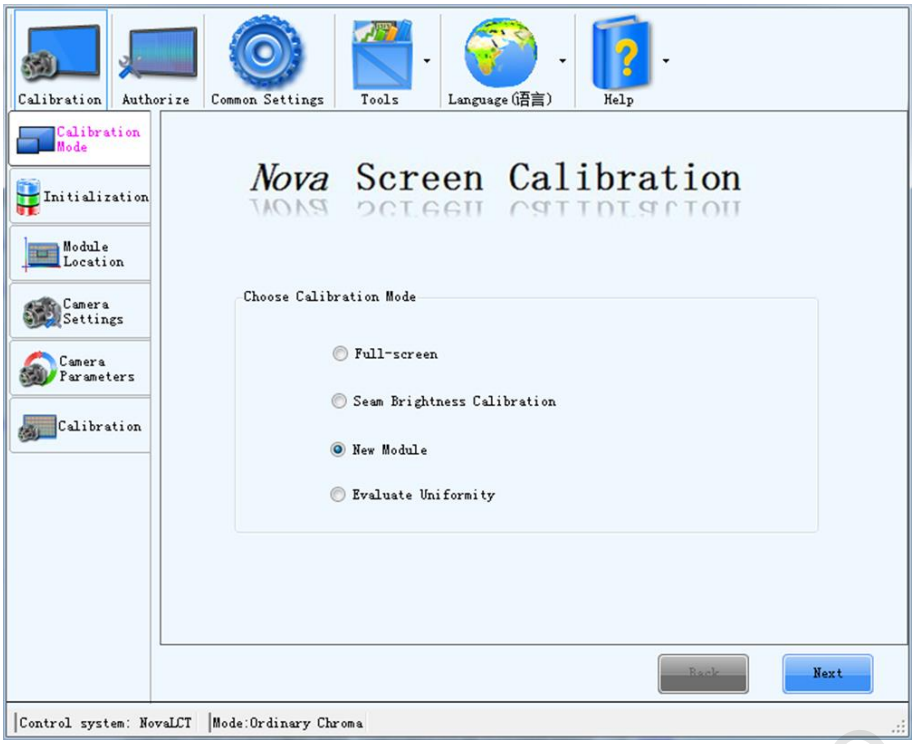

Fig. 6-1 New Module

6.1 Initialization

Setting of Initialization is the same as pixel level calibration. Please refer to 4.1 Initialization.

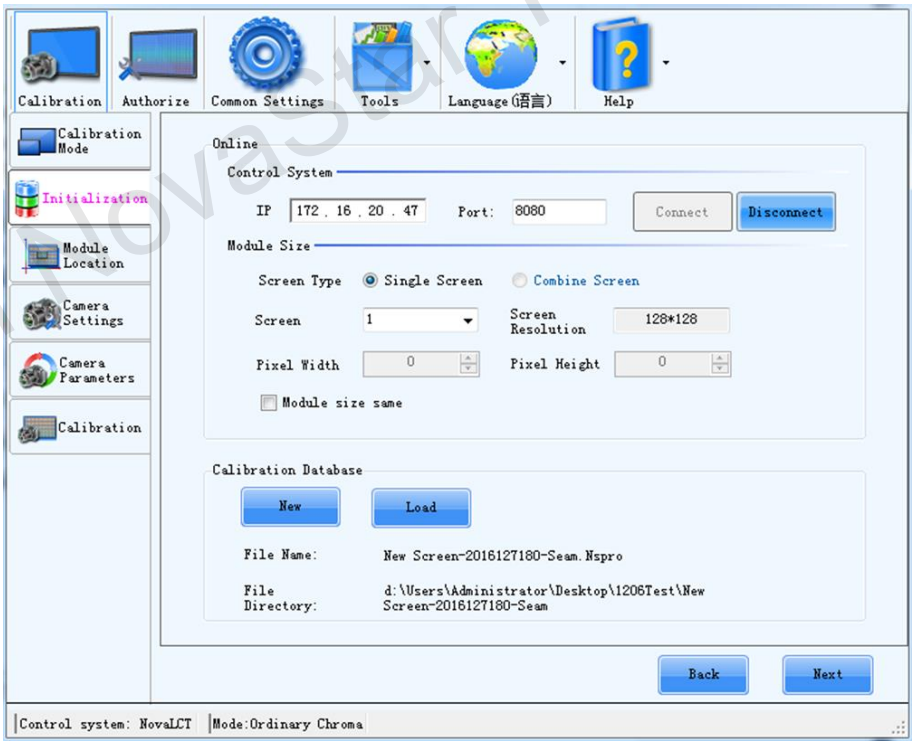

Fig. 6-2 Initialization

6.2 Module Location

The position of the new module shall be located accurately so as to perform accurate calibration for the

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new module.

1) Manual setting

If the calibration personnel knows clearly about the coordinate position of the new module, manual setting can be used to quickly set the coordinate and the module size, and click "Next" to connect to the camera.

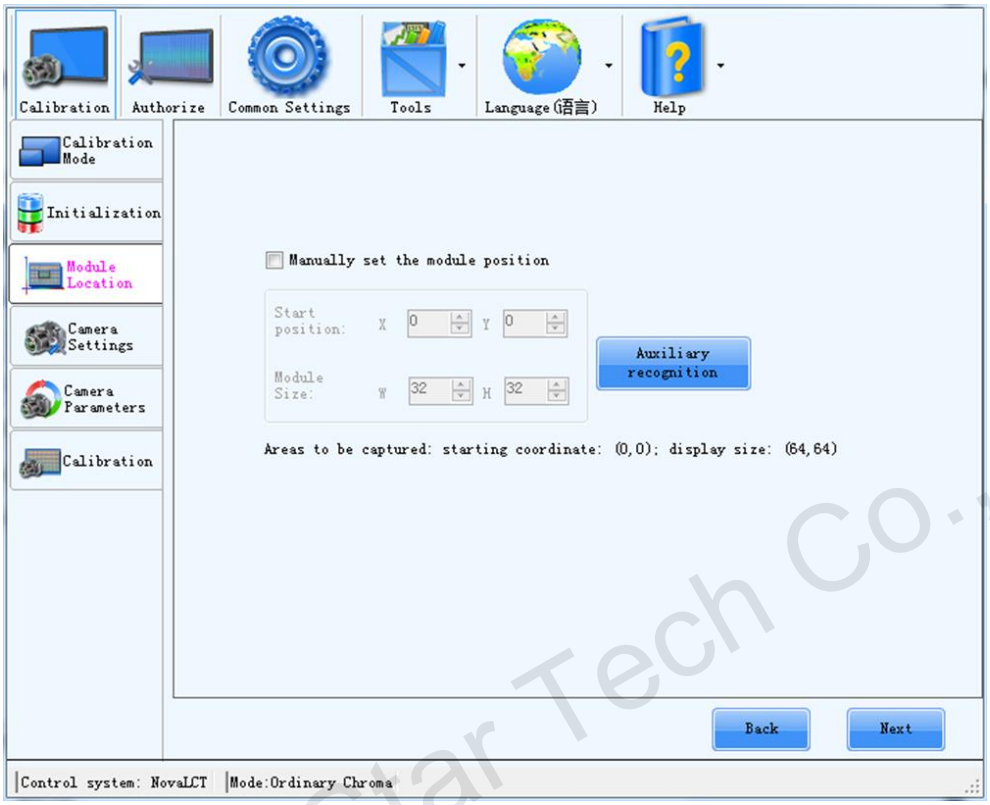
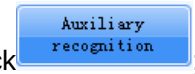


Fig. 6-3 Manually set the module position

2) Auxiliary recognition

If the position of the new module cannot be located accurately, click 

; and the following steps are as follows:

NovaPro does not support Auxiliary recognition, please check "**Manually set the module position**" to input the start position and size of Module.

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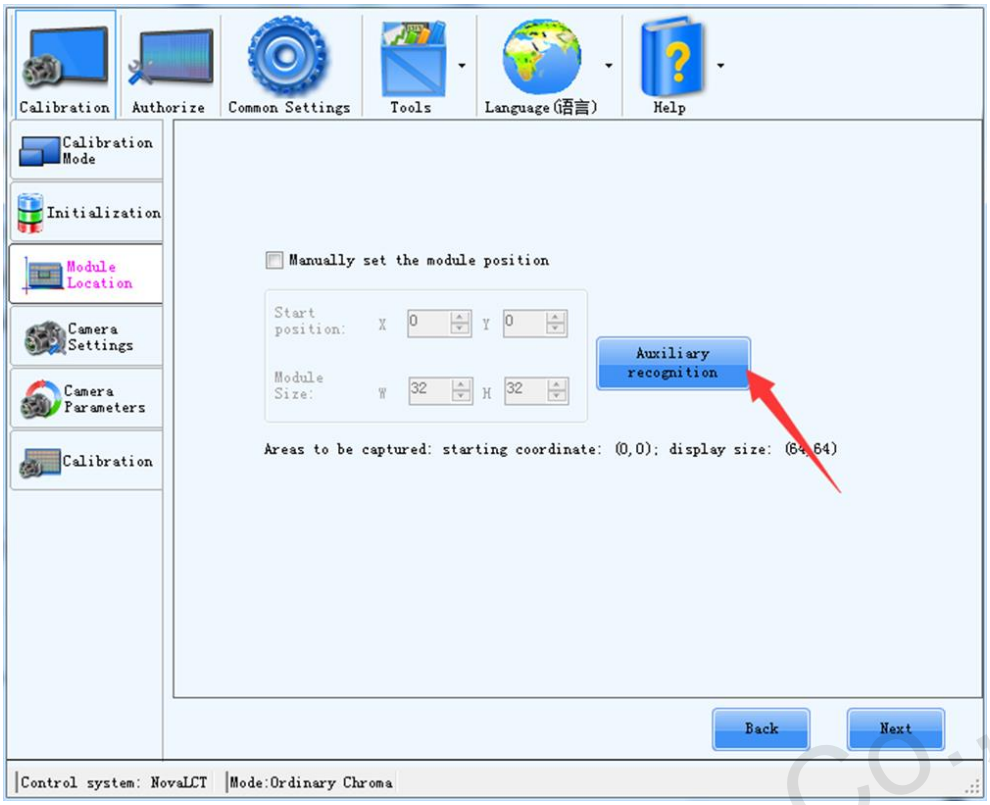

Fig. 6-4 Auxiliary recognition

a) Set the module size, click "Next", and it can be seen that the screen is divided into multiple partitions with numbers (the software defaults to conduct partition as every partition has 4×4 modules).

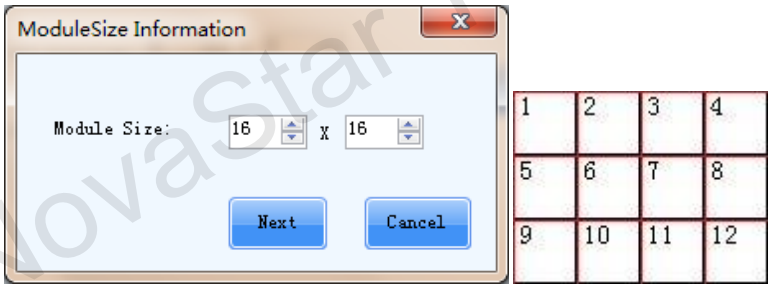

Fig. 6-5 Module Size information

b) Select number of the area where the new module is, then click "Next", and the screen displays the partition separately as well as the module number.

User can click "Reset the area size" to reset the amount of the module in every area, as shown in the following figure; after setting, click "Reposition", and click "OK", and the screen will display the area division after repositioning.

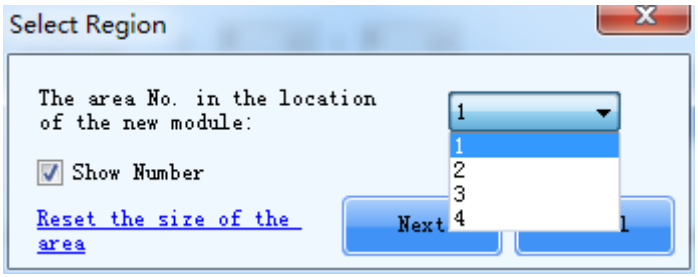

Fig. 6-6 Select Region

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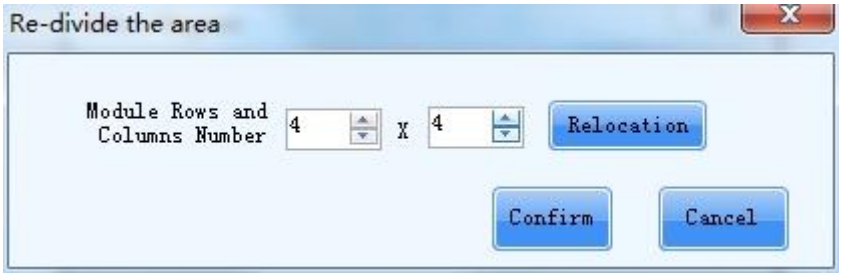

Fig. 6-7 Re-divide the area

c) Confirm the number of the new module, and click "OK".

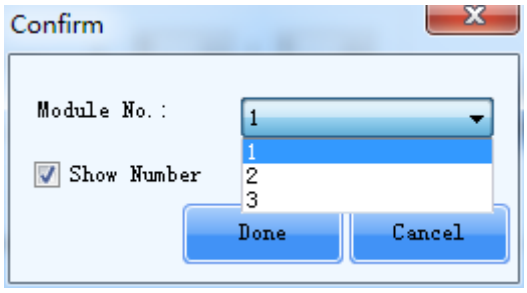

Fig. 6-8 Confirm Module location

6.3 Camera Settings

Camera need to connect normally to computer, face directly toward the subarea and take pictures normally. After successfully connecting camera, adjust its parameters.

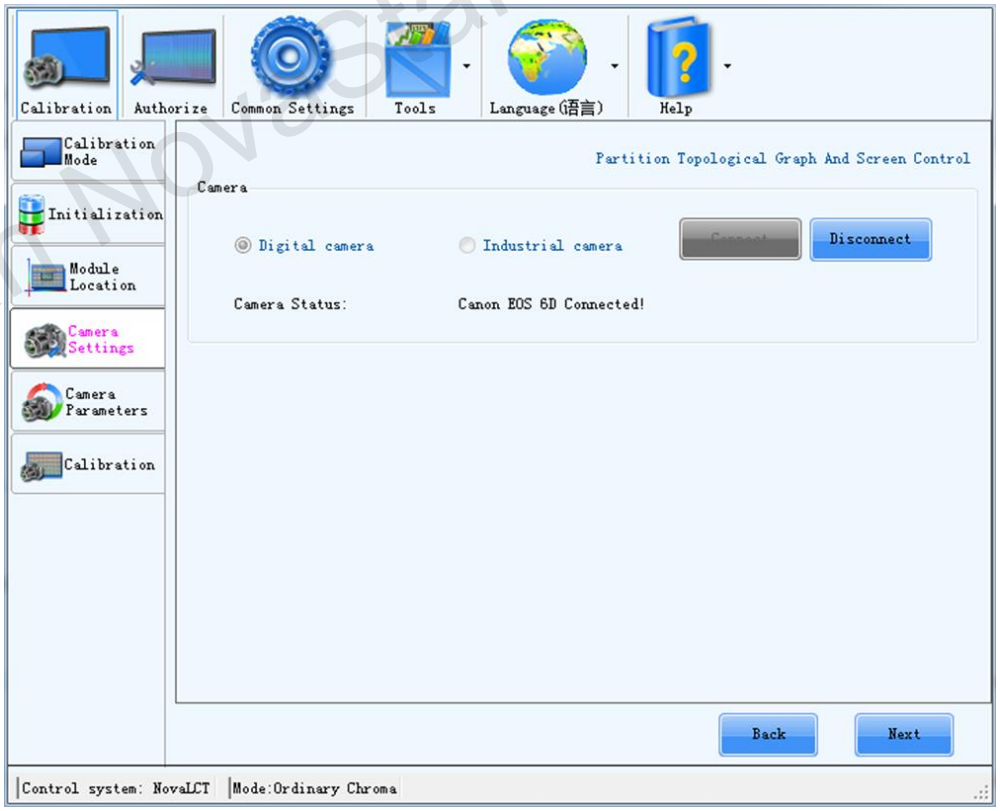

Fig. 6-9 Camera Connection

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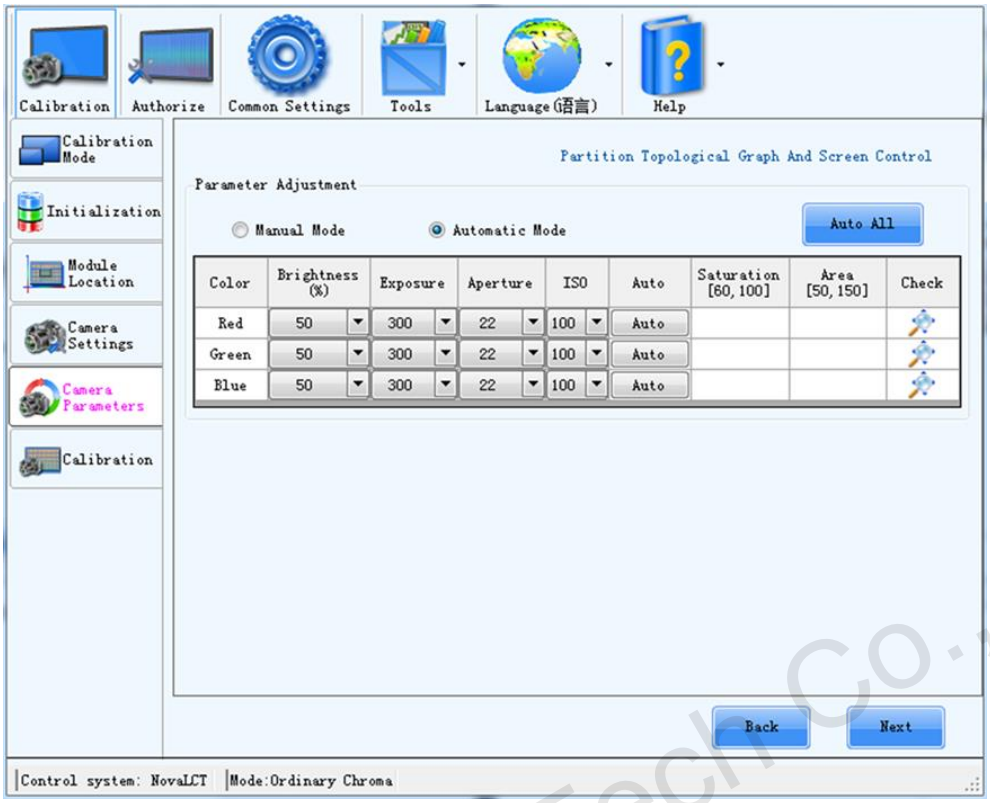
6.4 Camera Parameters



No matter manual mode or automatic mode is adopted, adjust the saturation till the result reaches "**Normal**", and adjust the image size to "**Fit**".

Please refer to 4.3 Camera Settings for detailed description.

After completing setting, click "Next".

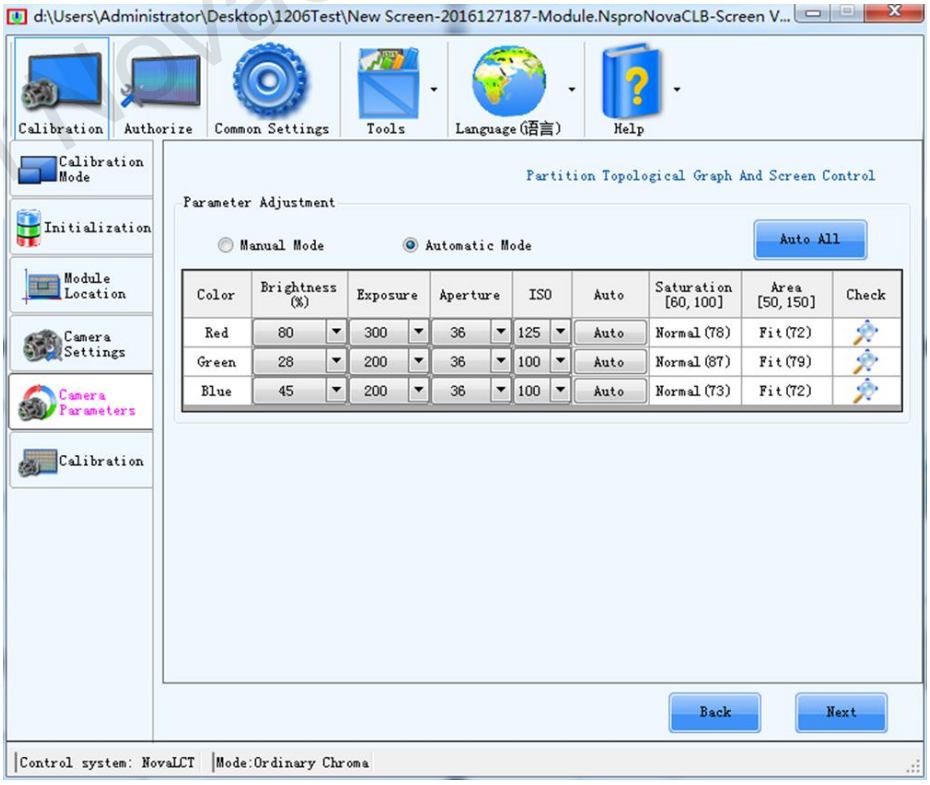


Fig. 6-10 Camera Settings

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6.5 Module Calibration

The software defaults to check "Automatic mode" and click "Start", and the software will finish the calibration to the module automatically.

User can cancel checking "Automatic mode", and manually complete the module calibration according to the calibration procedures on the right.

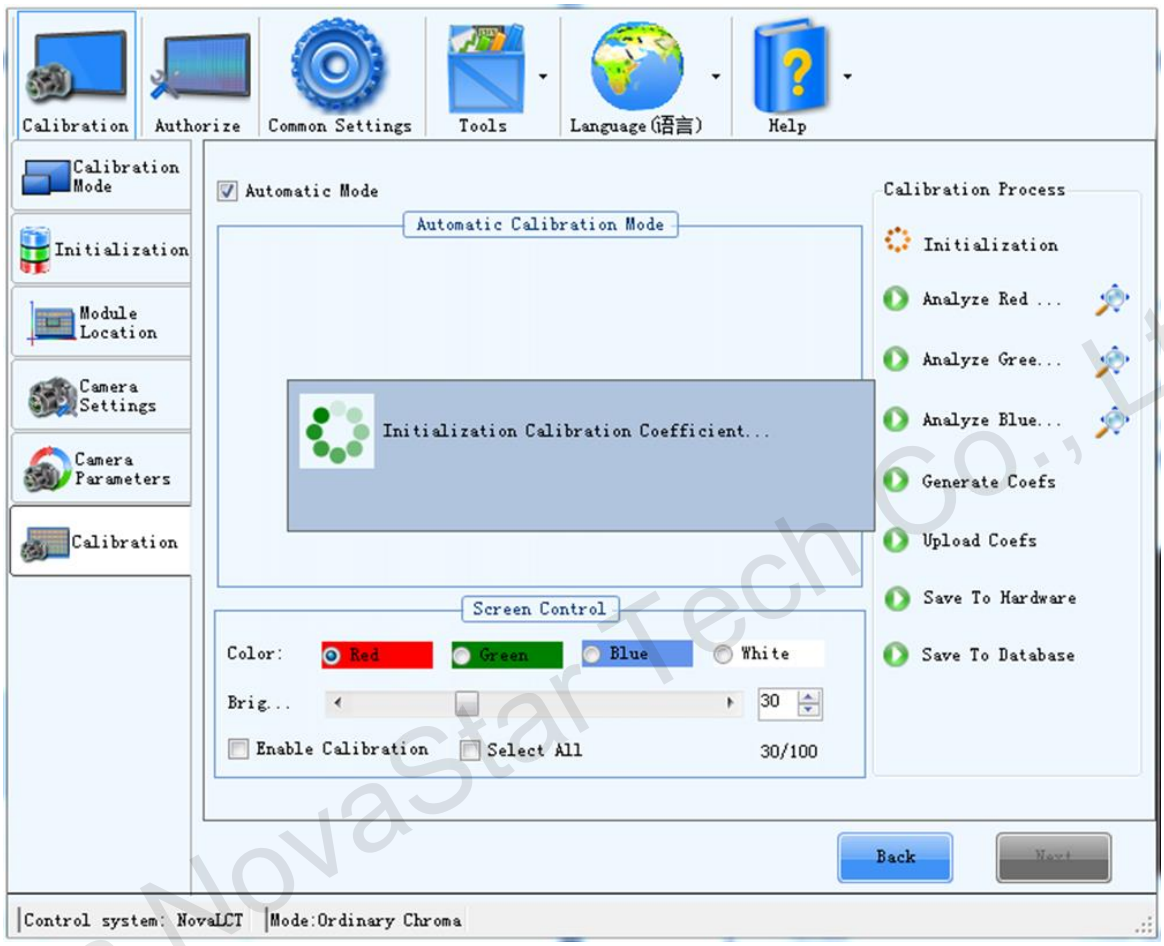

Fig. 6-11Module calibration

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7 Calibration Interruption (Searching LED position failed)

No matter full-screen calibration or module calibration, after the calibration is enabled, various problems at the site may cause led position failed leading to calibration interruption, such as screen binding, dead LED or interference light. Generally, artificial location is adopted to help solve these problems, and this section will introduce solutions for several common situation.

1) Normal binding

Normal binding means that the whole columns or rows at the edge of the screen is wrapped regularly,

and the error of search appears as not enough detected columns and rows, as shown in the following figure:

Solution:

a) Check "There exists some wrapped LED light", and click "Next".

b) The software detects four sides of the screen respectively, and the software defaults "Auto switch". User needs to pay attention to the state of the software (namely at which row or column) while observing the lights lighting up at which stage of the screen, then record which state so as to select state at the "result" and click "Next".

c) After the four sides of the screen are detected, the software continues for calibration.

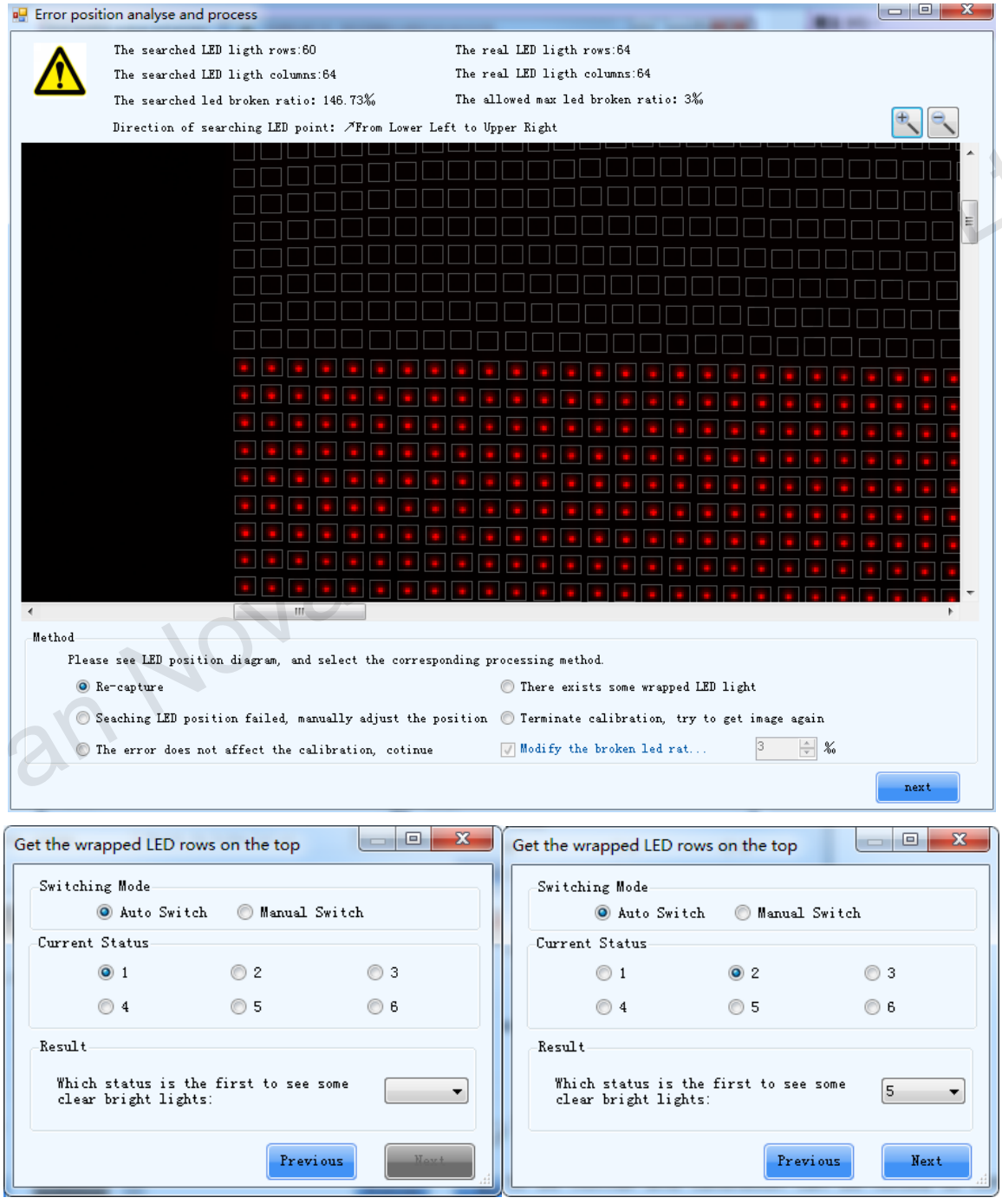

Fig. 7-1 Solution for Normal binding

2) User considers the binding to be normal and calibration can be forced to continue. Sometimes, user

considers the binding to have a little effect, then checks "The error does not affect the calibration, continue", then click "Next" to continue calibration.

3) Dead LED is reasonable, continue calibration

The number and location of the Dead LED detected match the actual situation, which means that the screen actually has these Dead LEDs at these positions, and this situation is called normal Dead LED.

Solutions:

i. Check "The error does not affect the calibration, continue" and click "Next" to continue calibrating

ii. Check "Modify the broken led ratio" and turn up the allowable dead light rate.

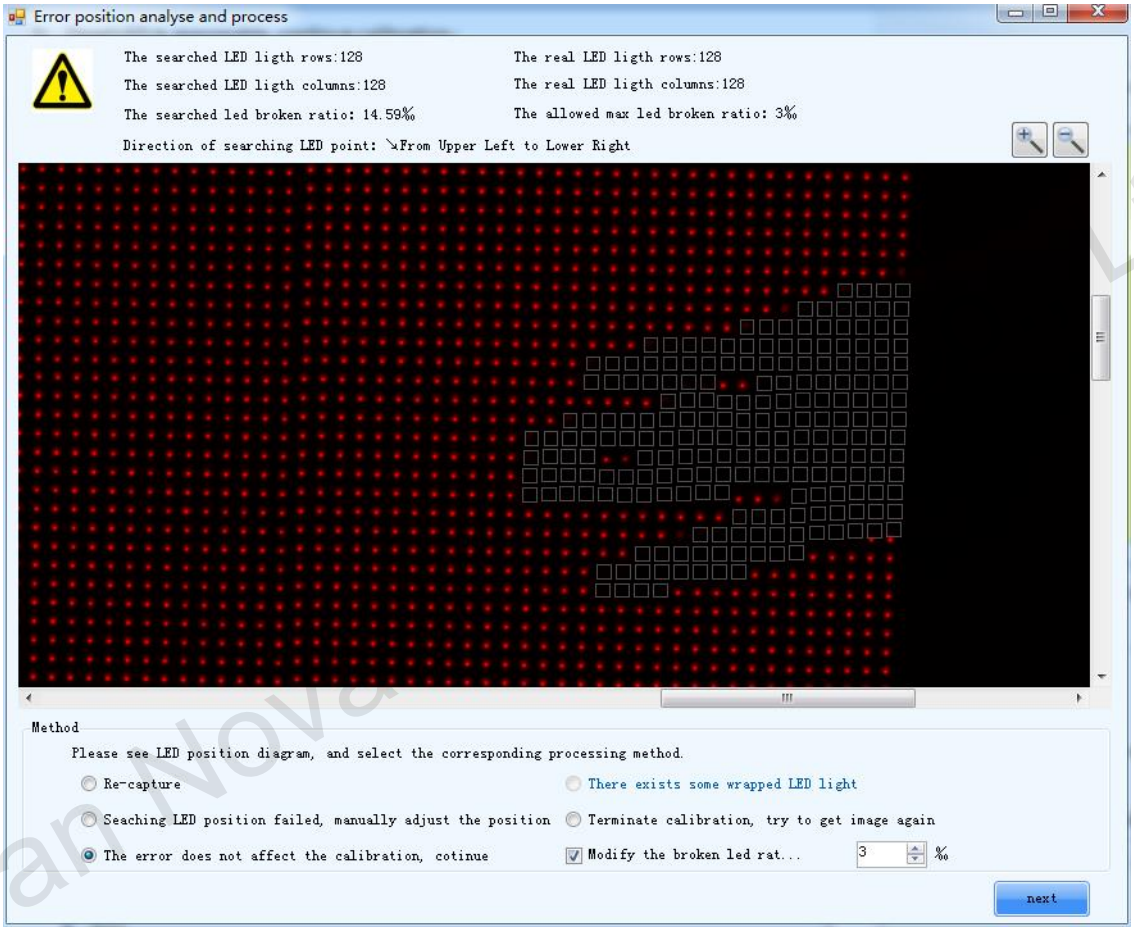

Fig. 7-2 Dead LED is reasonable

4) Dead LED increased by failure of searching

It is the failure of point location that leads to the increasing number of dead LEDs or the offset of point location.

Solution:

a) Check "Searching LED position failed, manually adjust the position", and click "Next";

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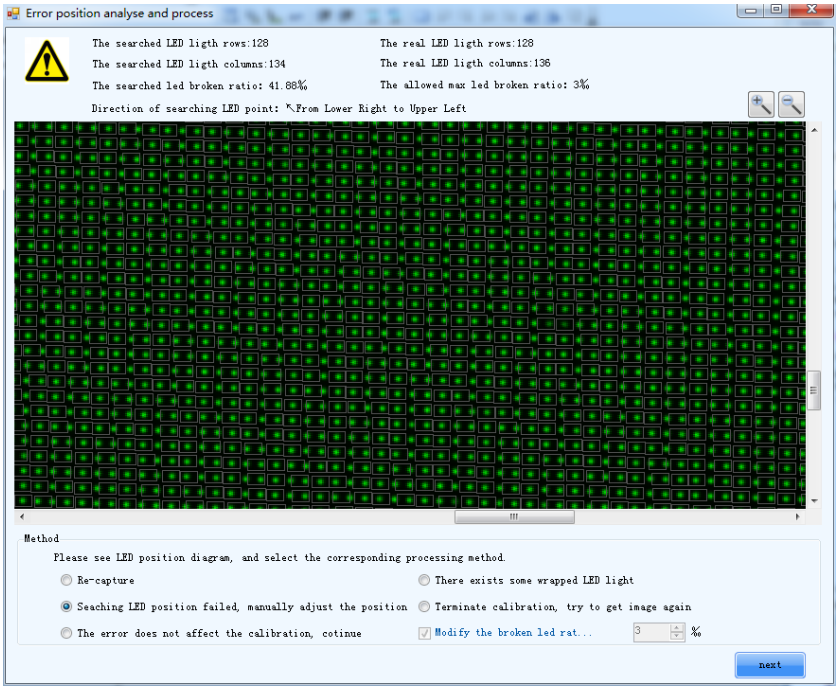

Fig. 7-3 Death light rate is more than the normal range

b) Adjust the first wrong LED point on the searching direction to right position, then click "search again".

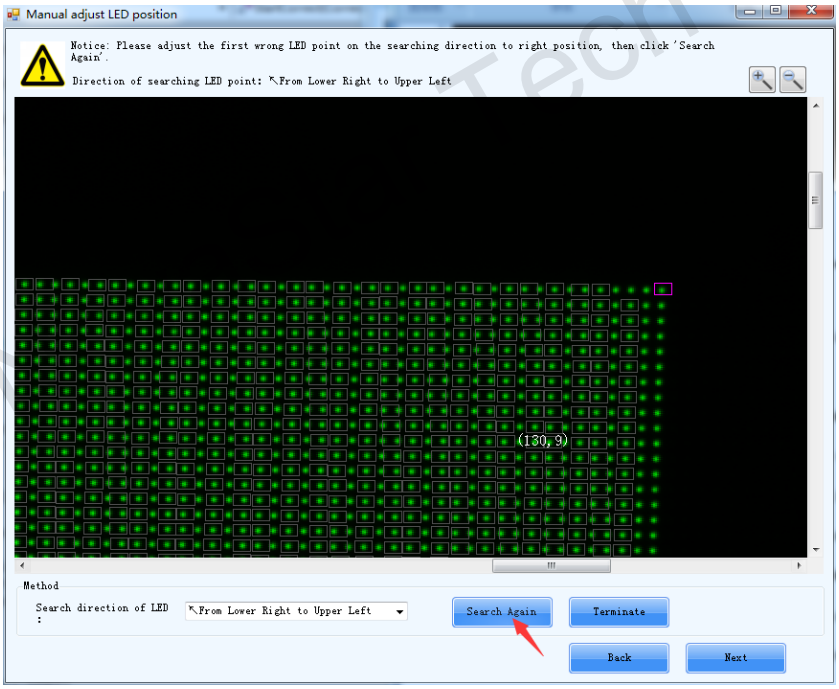

Fig. 7-4 Search again

Search again: Conduct search again according to the current location direction and initial point;

c) After the searching is successful, continue calibration.

5) Search result differs a lot from actual situations, calibration abandoned

If the result of search differs a lot from the actual situation, for example, searching result is that there are Dead LEDs at the up side and down side of the screen, but actually, there are Dead LEDs at left and right sides, under this situation, it is suggested to abandon calibration.

6) The number of rows and columns increases in the detection result

The result of search failed is that the number of rows or columns is greater than actual situation.

Solution: This result is caused by two possibilities: one is interference light which is eliminated as the solution; the other is that the resolution of sending card is inconsistent with that of graphics card, then the resolution of the sending card shall be set on LCT.

8 Evaluate Uniformity

After the calibration is completed, evaluate the uniformity before and after calibration and you can find the uniformity changes obviously.

Fig. 8-1 Choose calibration mode

8.1 Initialization

It is required to connect control system and set evaluation area during initialization. The maximum evaluation area can be up to 224X150.

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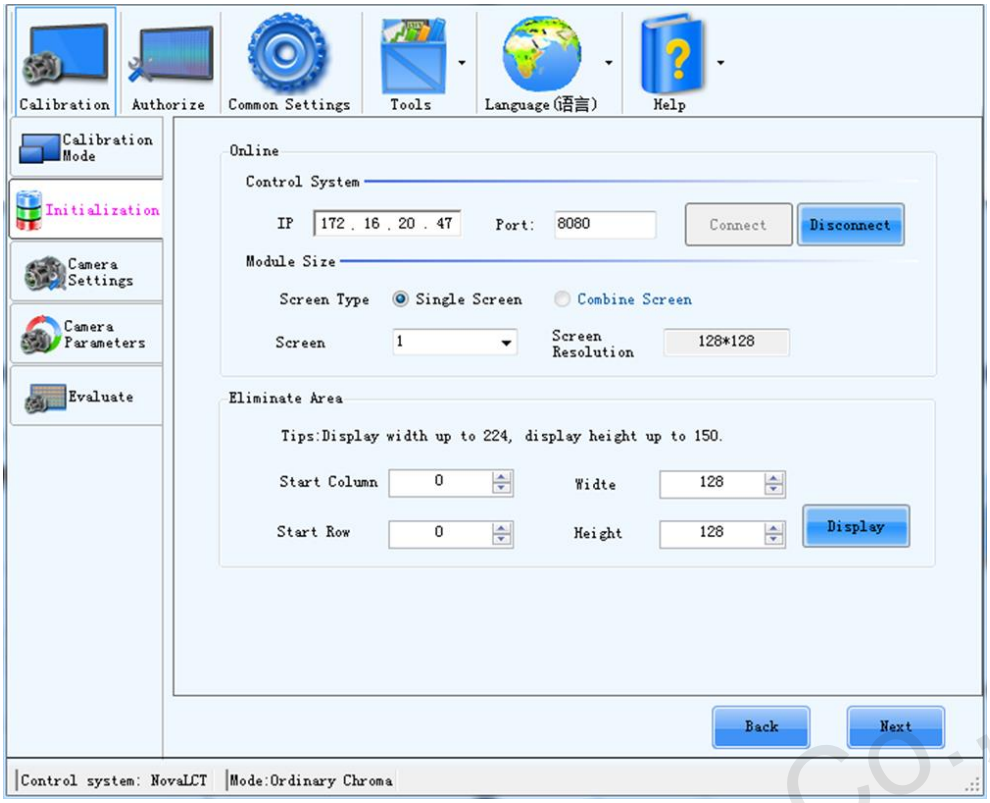
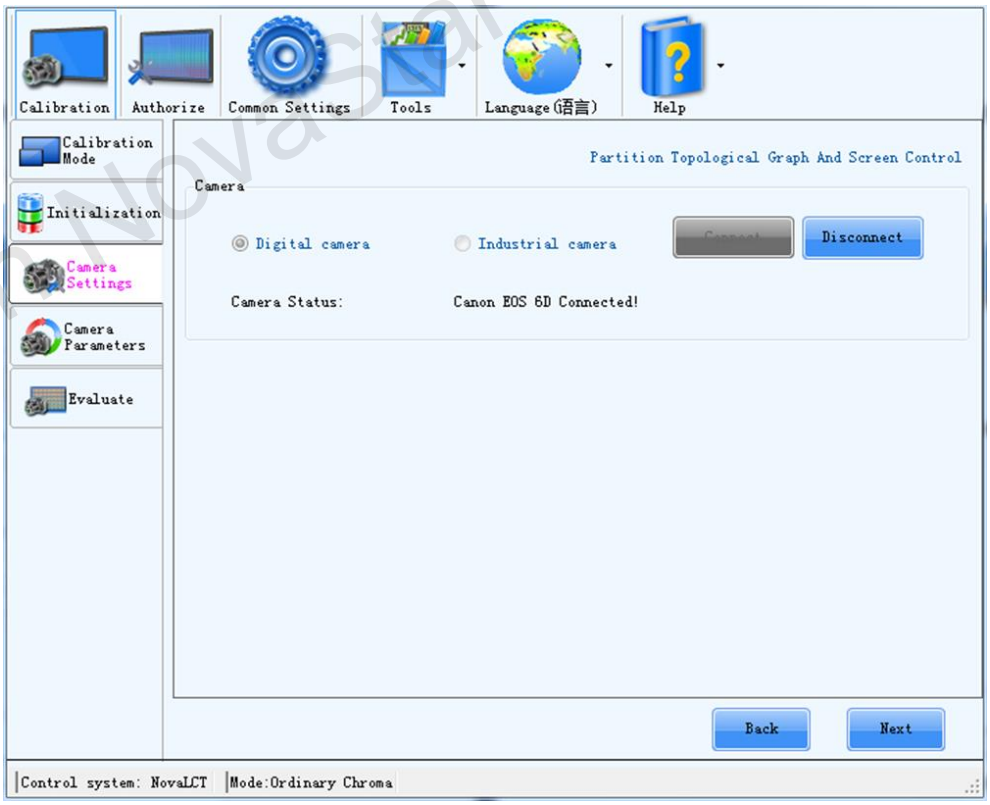


Fig. 8-2 Initialization

8.2 Camera Settings



During calibration, camera must be connected computer correctly, aimed at the partition and be able to take photos normally. It is required to choose camera type before connecting camera. Digital camera refers to Canon camera and industrial camera is HS1000. After the camera is connected, camera status

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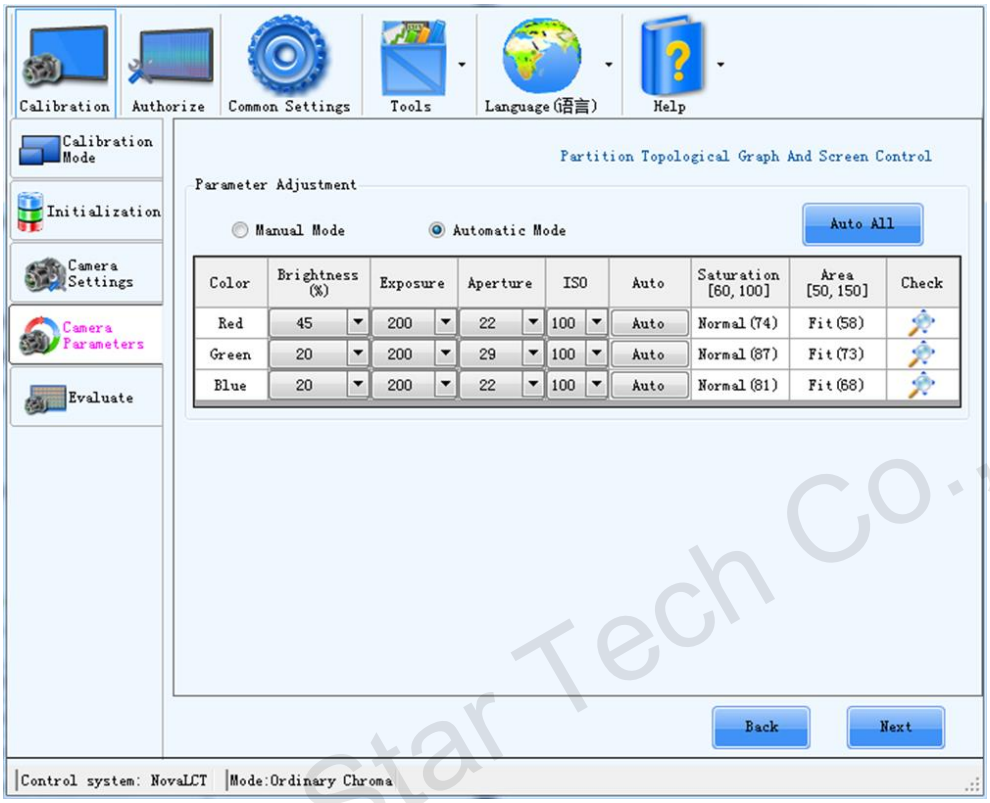
is as the figure below. Click “Next” to move on to partition mode to do the relevant camera settings. See details in 13.4 Camera operating skills.

8.3 Camera Parameters



No matter manual mode or automatic mode is adopted, adjust the saturation till the result reaches "**Normal**", and adjust the image size to "**Fit**".

Please refer to 4.3 Camera Settings for detailed description.

After completing setting, click "Next".

8.4 Uniformity Evaluation

After evaluation, you can see the parameters and visual image change obviously.

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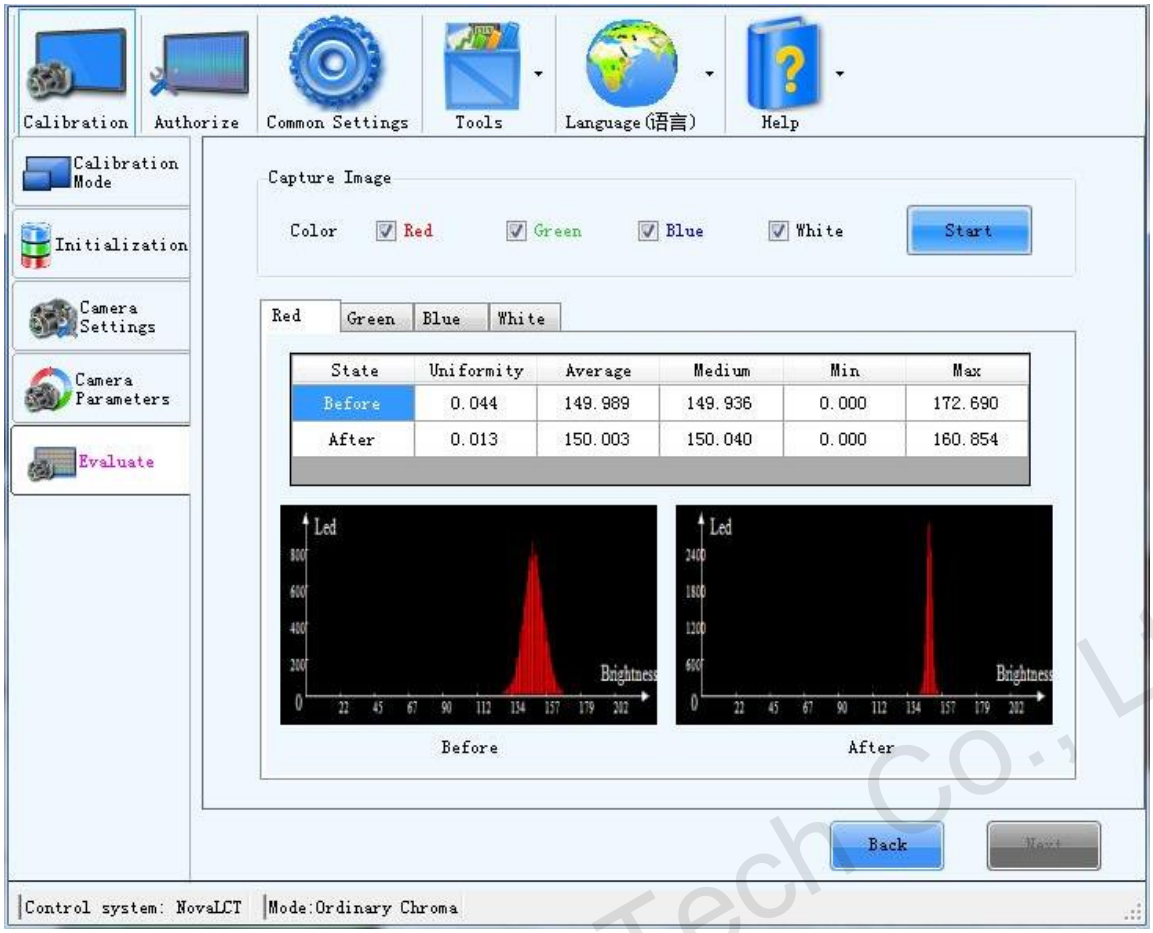

Fig. 8-3 Evaluate calibration

The closer the uniformity is to 0, the better the uniformity is. The narrower the wave peak of brightness distribution figure is, the better the uniformity is.

9 Screen Data Merging

Spot calibration often encounters such situation: a large screen is applied with multiple sending cards for loading, and a video processor and a video stitching device are used between the graphics card and the sending card to connect the frames; at this moment, the display and the large screen are not in point-to-point display, and during calibration, the video process equipment needs to be skipped, and the large screen shall be divided into multiple split screen for respective calibration; and after calibration, unsmooth transition may appear at the adjacent area of the split screens, which is commonly known as layering. The full screen date merging tool is for solving this problem.

At the main interface of the software, click "Tools" → "Full screen data merging"; after opening the tool, assume that the full screen has been divided into four regions for calibration, set 2 rows and 2 columns of split screen.

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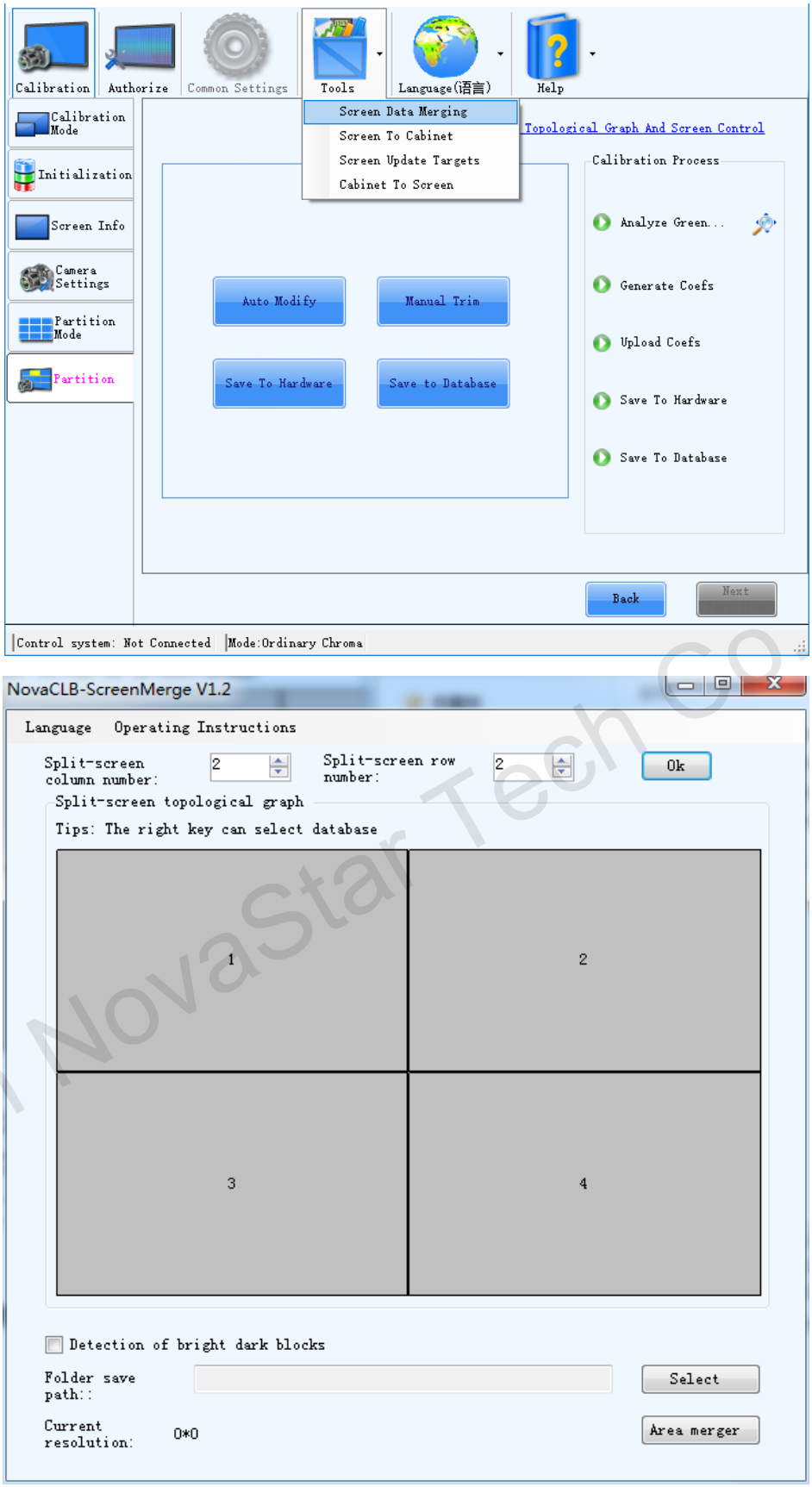

Fig. 9-1 Full screen region data merging

Select one of the regions, click right button of the mouse → "Select database", load the corresponding full screen database; After loading successfully, see the information related to the database; and load the full screen database corresponding to all regions according to the same procedures, as shown in the figure below.

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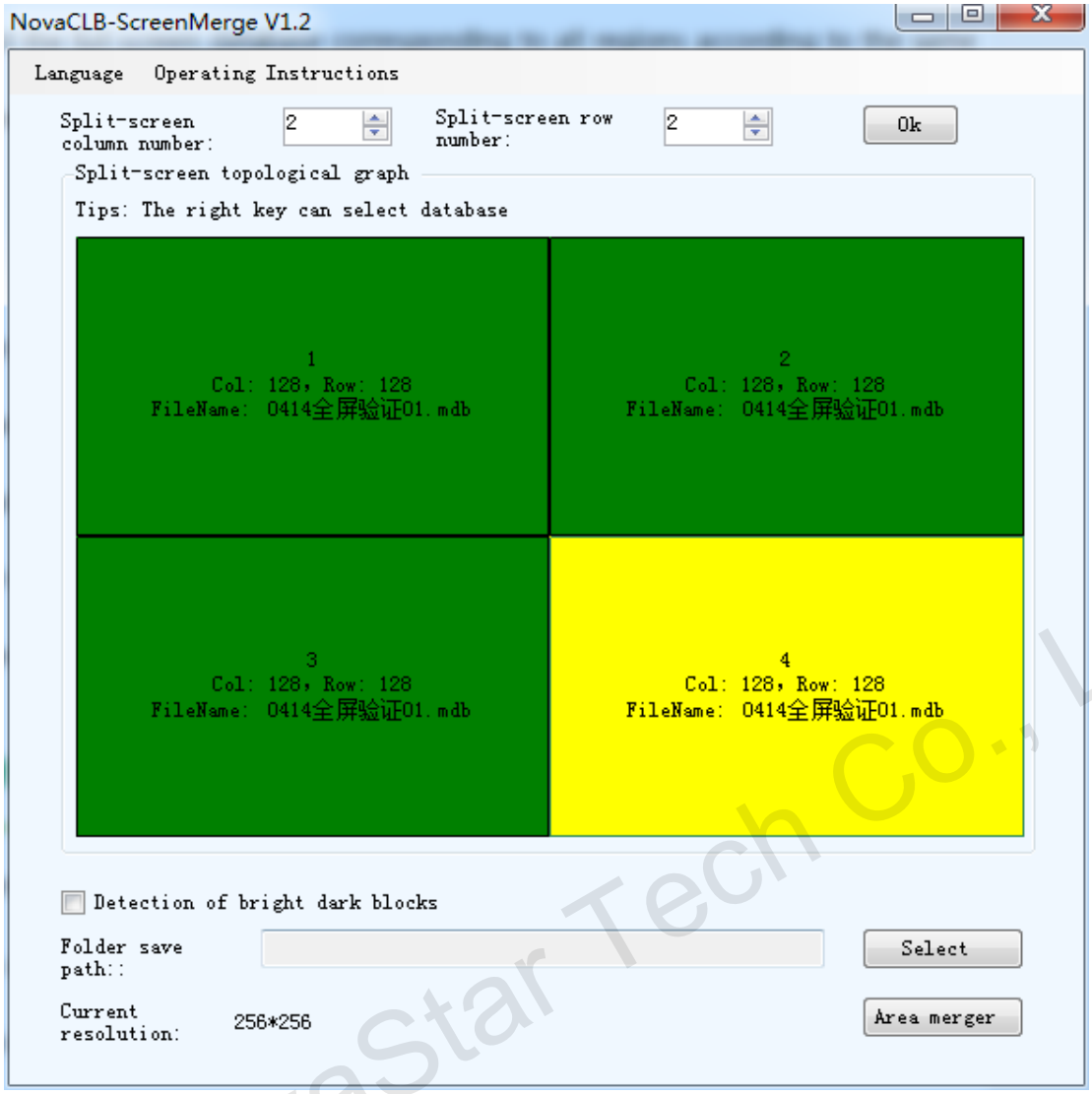

Fig. 9-2 Loading the database

Click "Select" to set the storage directory for the database generated after merging.

Pay attention to whether current resolution ratio of all regions are matched to the full screen resolution or not; after confirming they are matched, click "Area merger".

If the option "Split-screen databases" is checked, four databases after merging will be generated; if the option "Entire-screen databases" is checked, one database will be generated after merging.

10 Screen to Cabinet

Full-screen converting cabinet software can switch the full-screen database into cabinet or module database according to a certain resolution. It can be switched to single database or multiple databases based on different needs.

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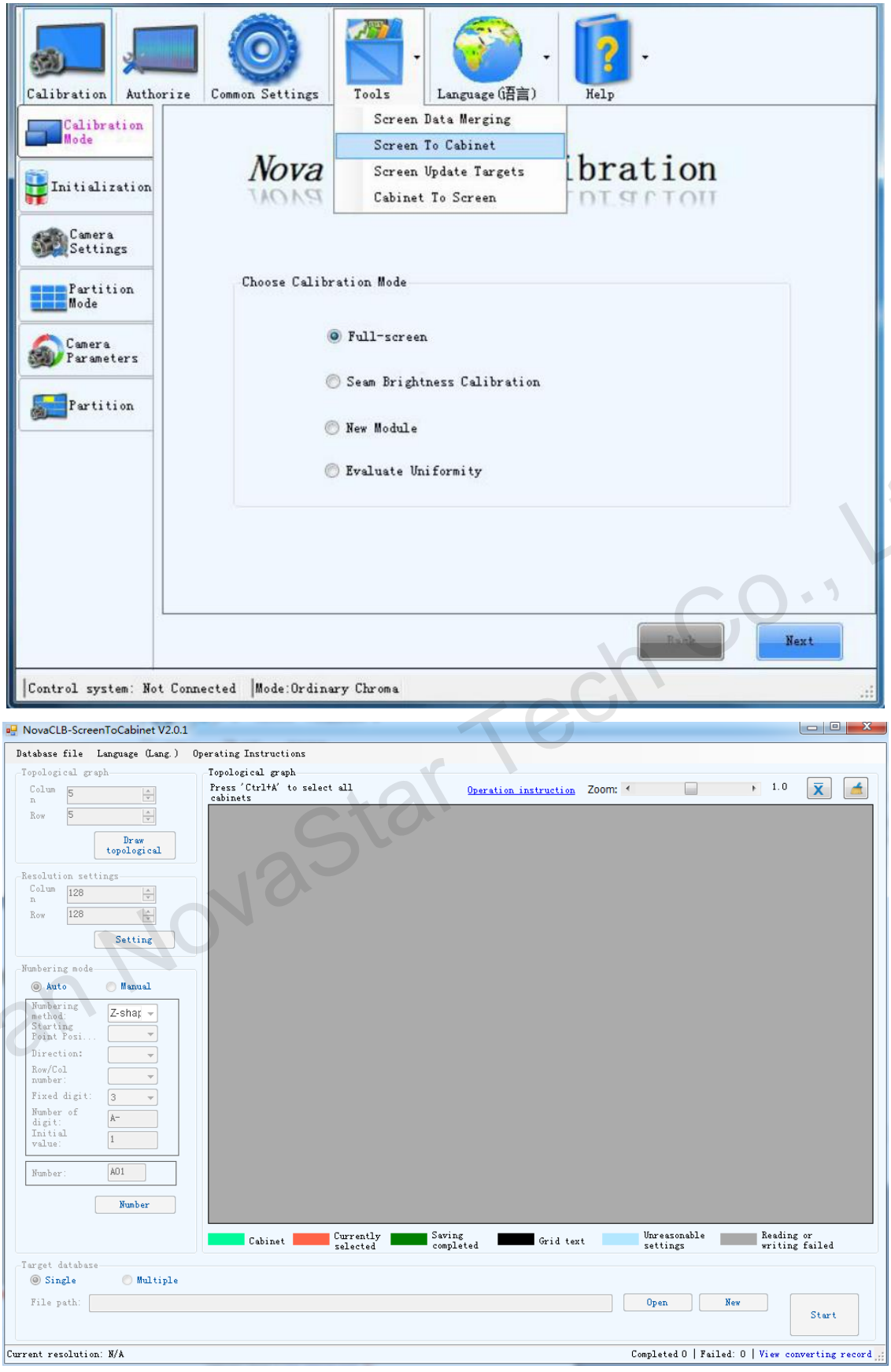

Fig. 10-1 Screen to cabinet

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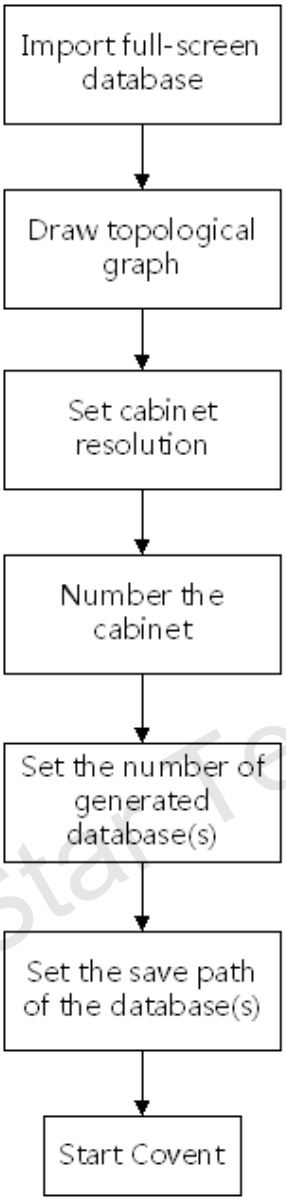
10.1 Operation procedure



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10.2 Operation instruction

This chapter will illustrate operation steps of all procedures for users in detail.

10.2.1 Import database

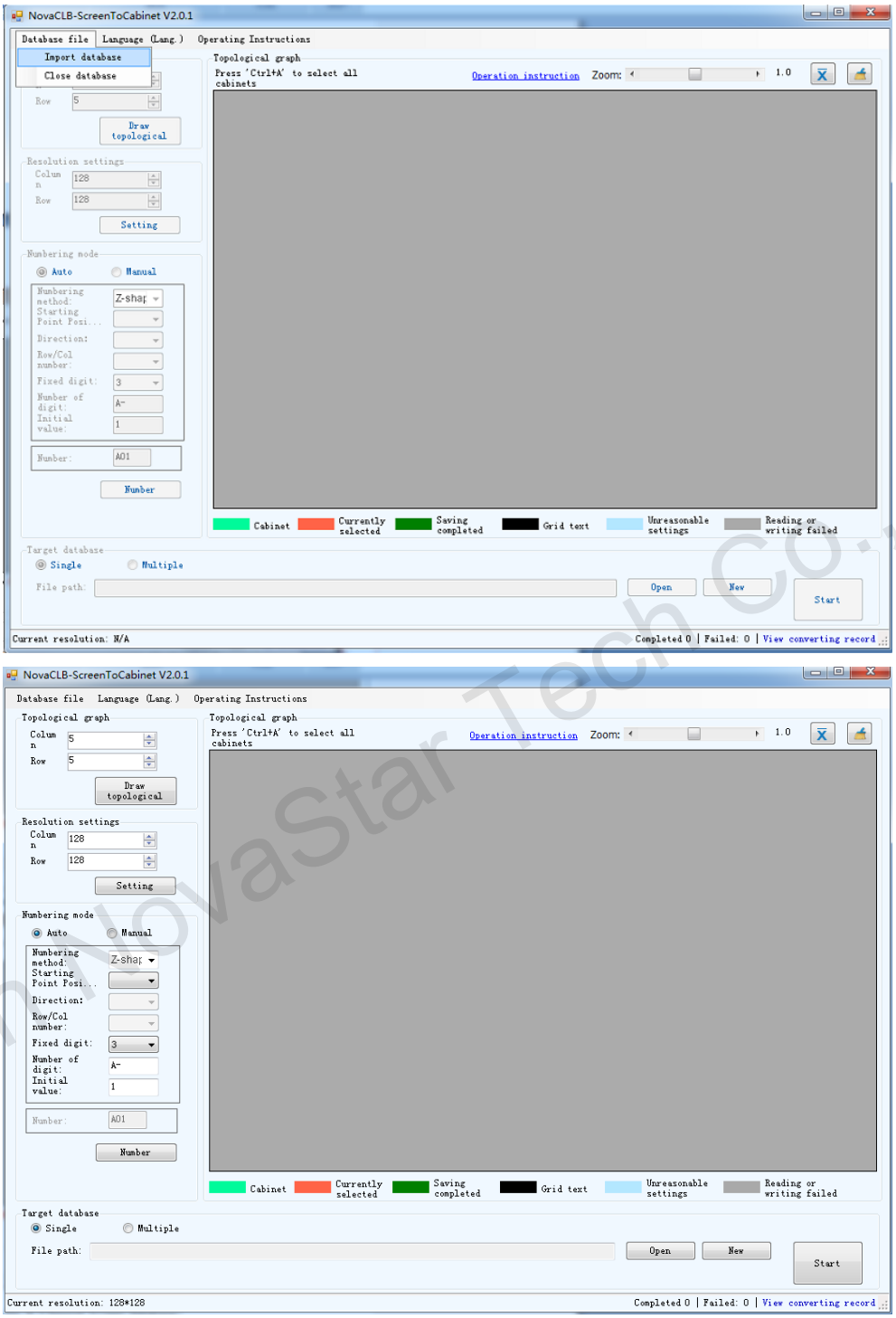

Fig. 10-2 Import Screen database

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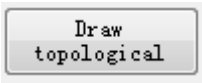
10.2.2 Draw topological graph

Set the number of rows and columns of the cabinet, and then click 

to generate a topological graph in the right window of the software.

Note that the sum of the resolution of all rows and all columns of the cabinet shall be equal to the resolution of the screen. Therefore, under the premise that resolution of each cabinet is known, number of rows and columns of the cabinet shall be calculated accurately.

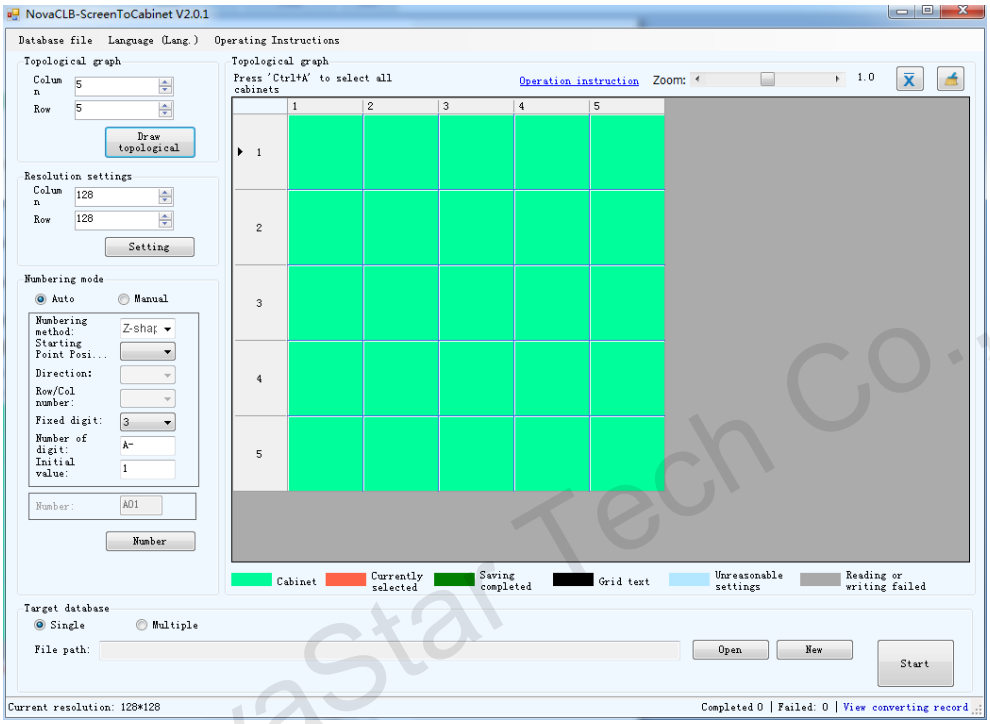


Fig. 10-3 Draw topological

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10.2.3 Set resolution of each cabinet

First, select the cabinet which will be set in certain resolution, then set the resolution, and click Setting.

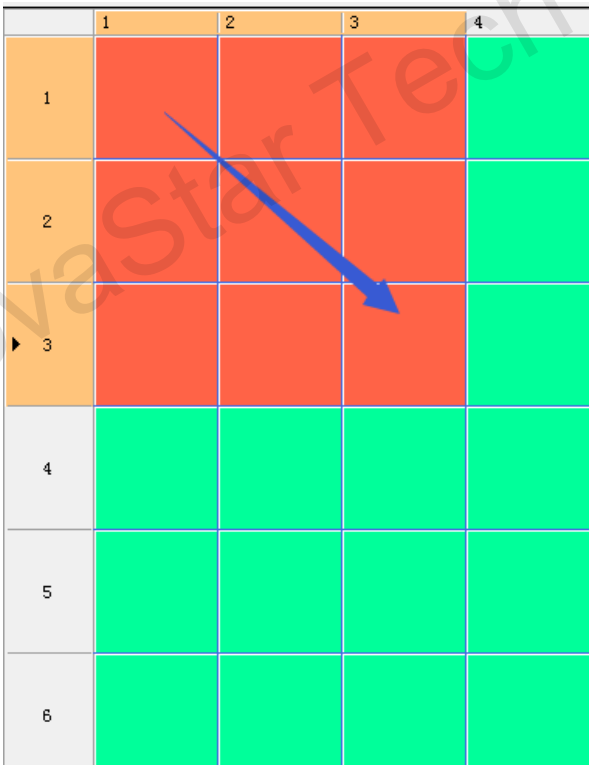
The cabinets can have different resolution; however, for cabinets on the same row, rows of the resolution shall be the same, and for cabinets on the same column, columns of the resolution shall be the same; when the resolution setting is irrational, the color will appear; the sum of the resolution of all rows and all columns of the cabinet shall be equal to the resolution of the screen.

Instruction of the right-click menu of the cabinet:

Right-click on the topological graph will show two options in the right-click menu, "Partition averagely" and "Clear settings". "Partition averagely": partition the resolution of the display averagely on the drawn topological graph of the cabinet with resolution of each cabinet being the same. "Clear settings": clear the resolution and cabinet name set on the topological graph.

The following methods can be used to select the cabinet:

a) Select the first cabinet, hold down the mouse and drag according to the direction of arrow in the figure; the result is as follows:



b) Press the "Ctrl" key to conduct multiple selections; the result is as follows:

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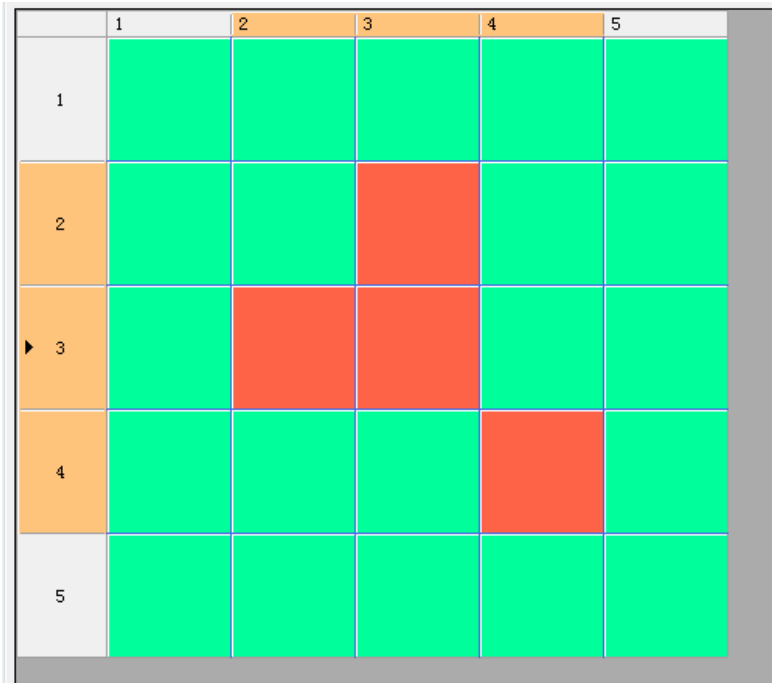

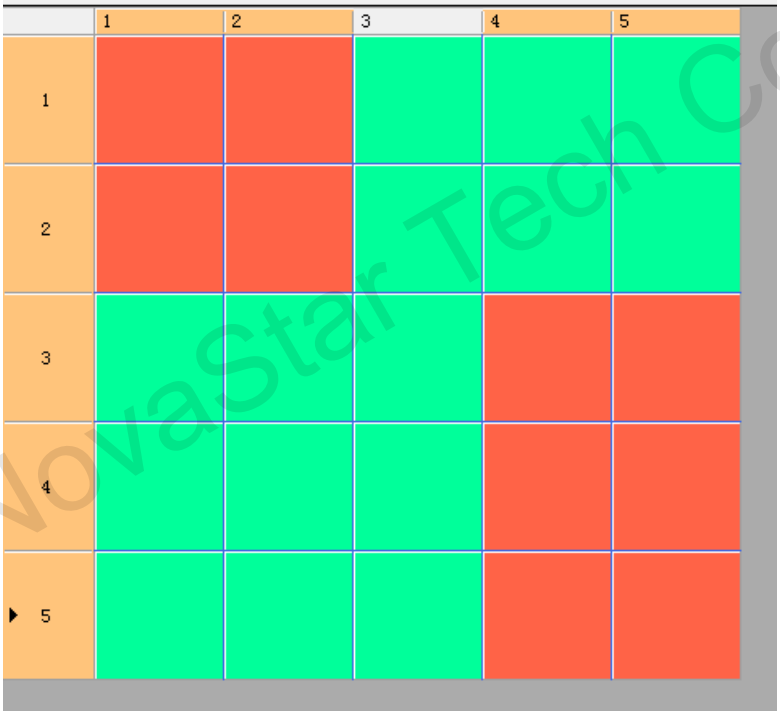

c) Select one cabinet as the start, press the "Shift" key, and then select another cabinet as the end.In this way, the rectangular area from the start cabinet to the end cabinet can be selected; the result is as follows:

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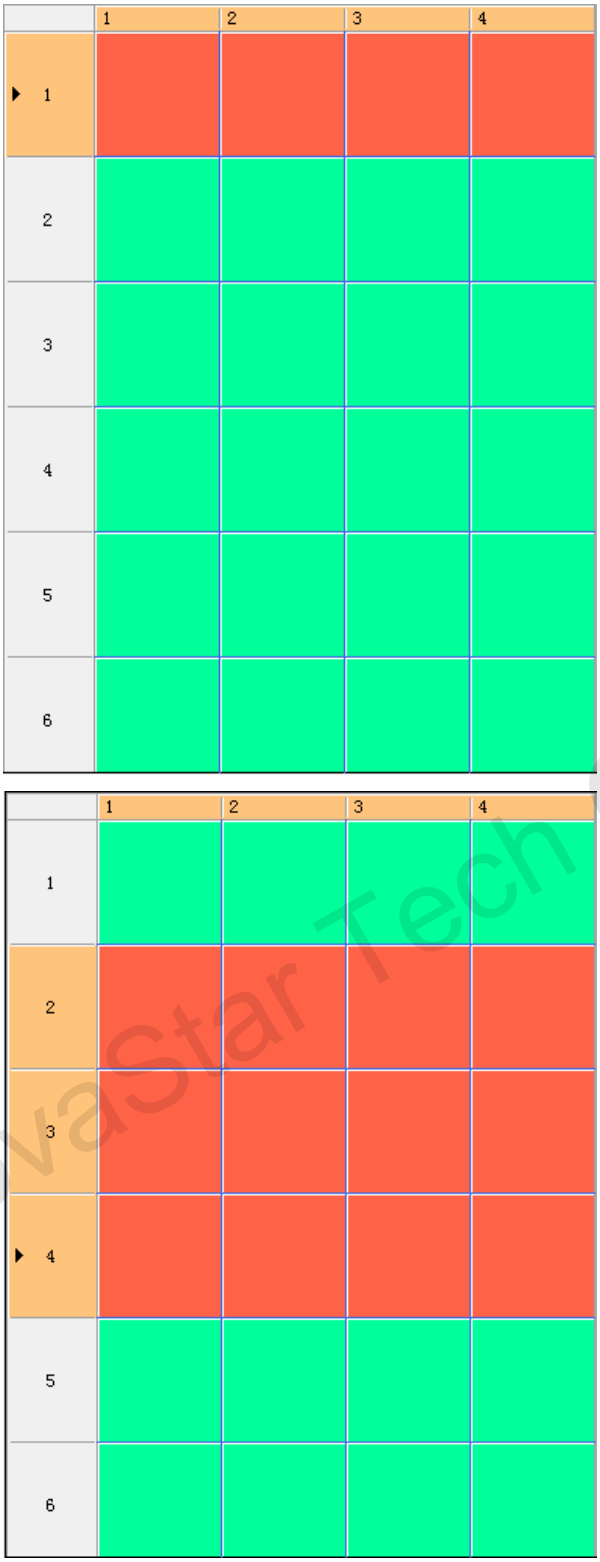

d) Press "Ctrl+A" to select all cabinets and the result is as follows:

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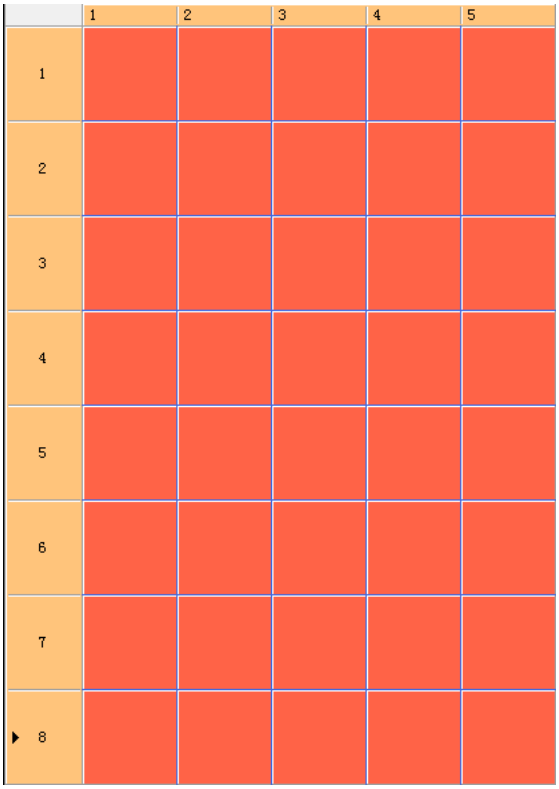

The topological graph with set resolution is shown as follows:

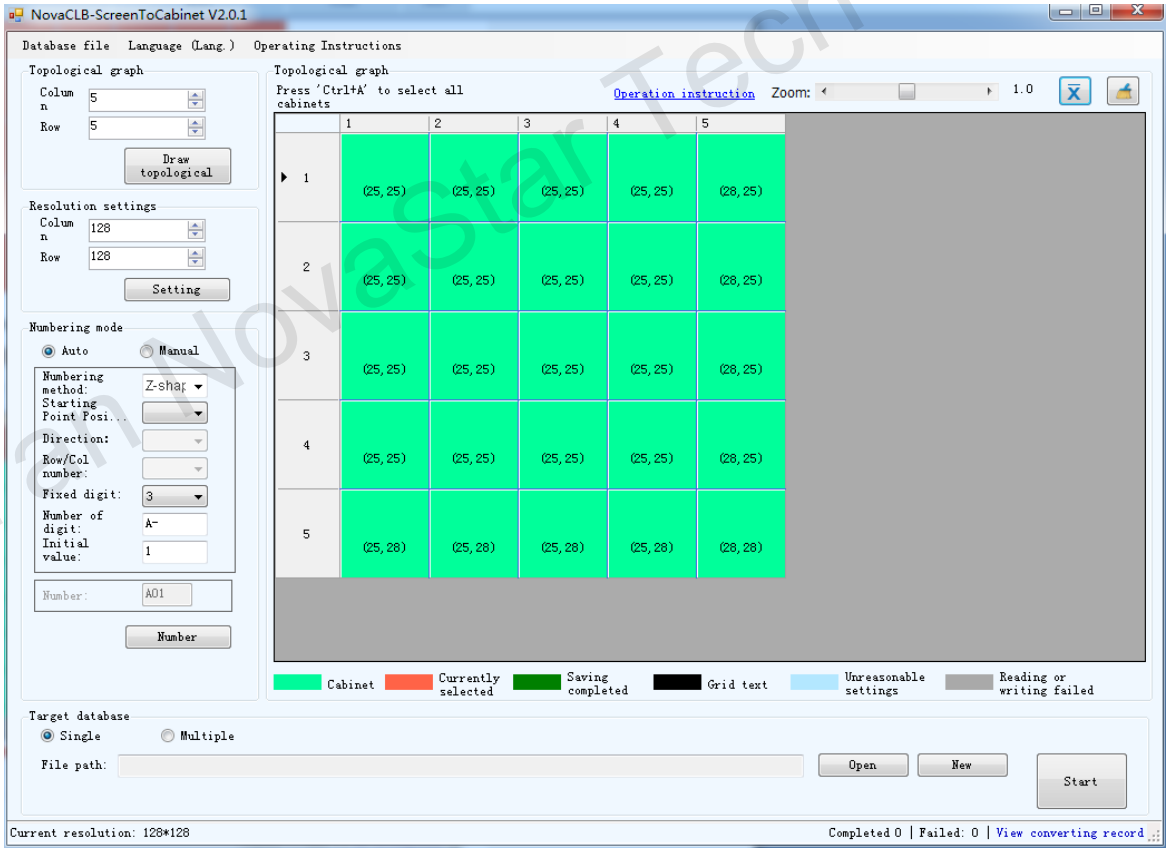

Fig. 10-4 Resolution setting

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10.2.4 Number the cabinet

Numbering can be automatic or manual.

1) Automatic numbering

Check "Auto", select numbering method, row/column number, number of digit, and set fixed digit and initial value, and then click

.

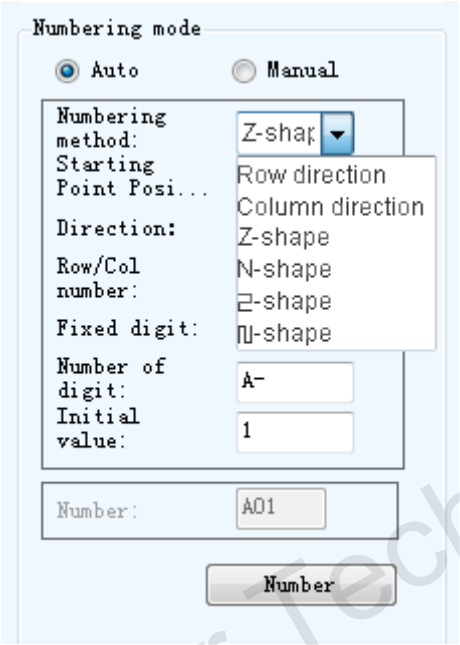

Fig. 10-5 Select Numbering mode

Numbering method: column direction, row direction, Z-shaped, ∽-shaped, Ƨ-shaped, N-shaped.

Row/column number: When selecting column direction and row direction, it needs to select the first row/column, the second row/column, the third row/column…, the nth row/column, and number them respectively. The following figure is the topological graph after being numbered.

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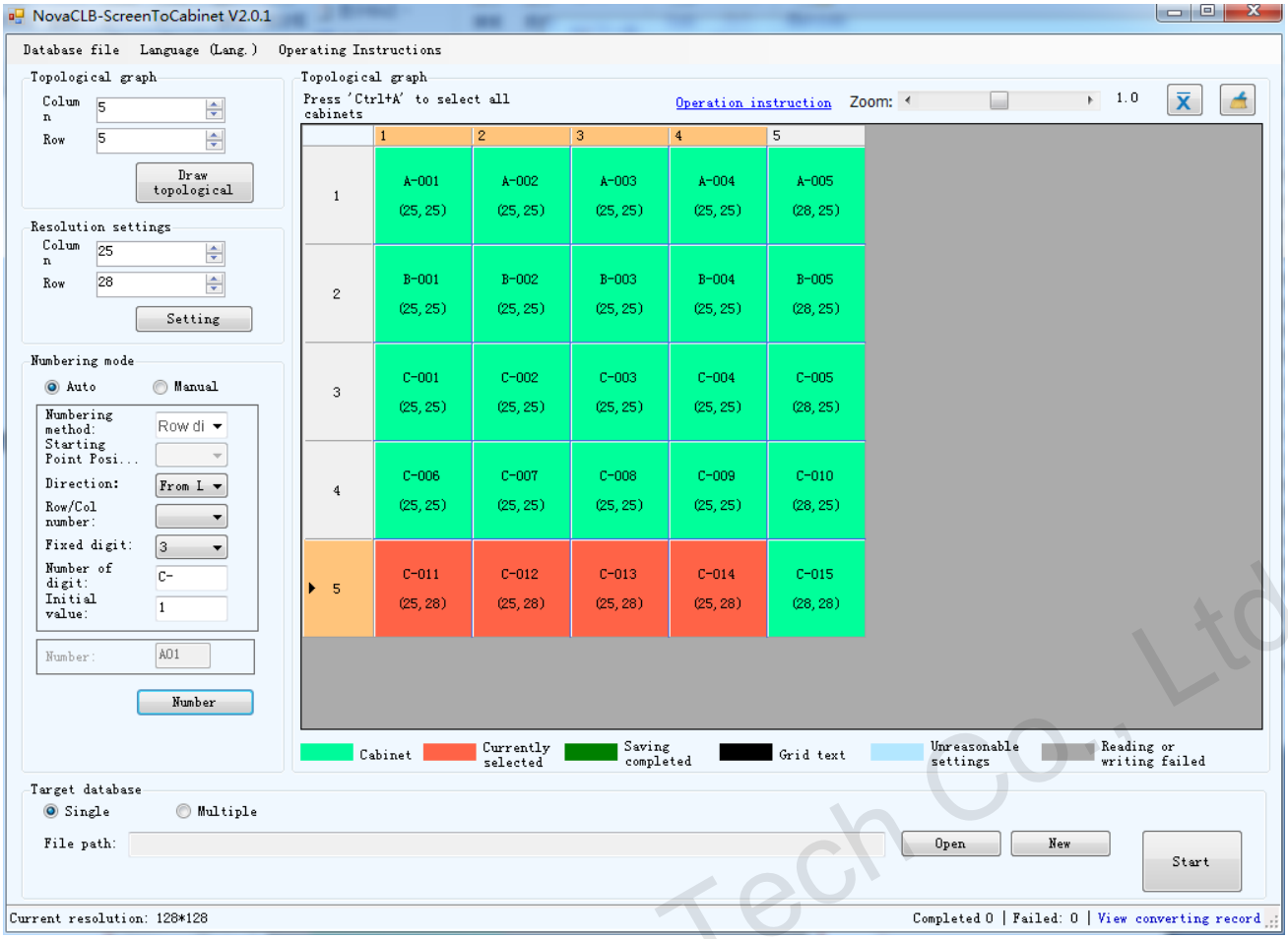

Fig. 10-6 Numbering according to row, column

If Z-shaped, ∽-shaped, 己-shaped, N-shaped is selected, there is no need to select row/column number every time. The software will number all the cabinets according to the Z-shaped, as shown in the following figure:

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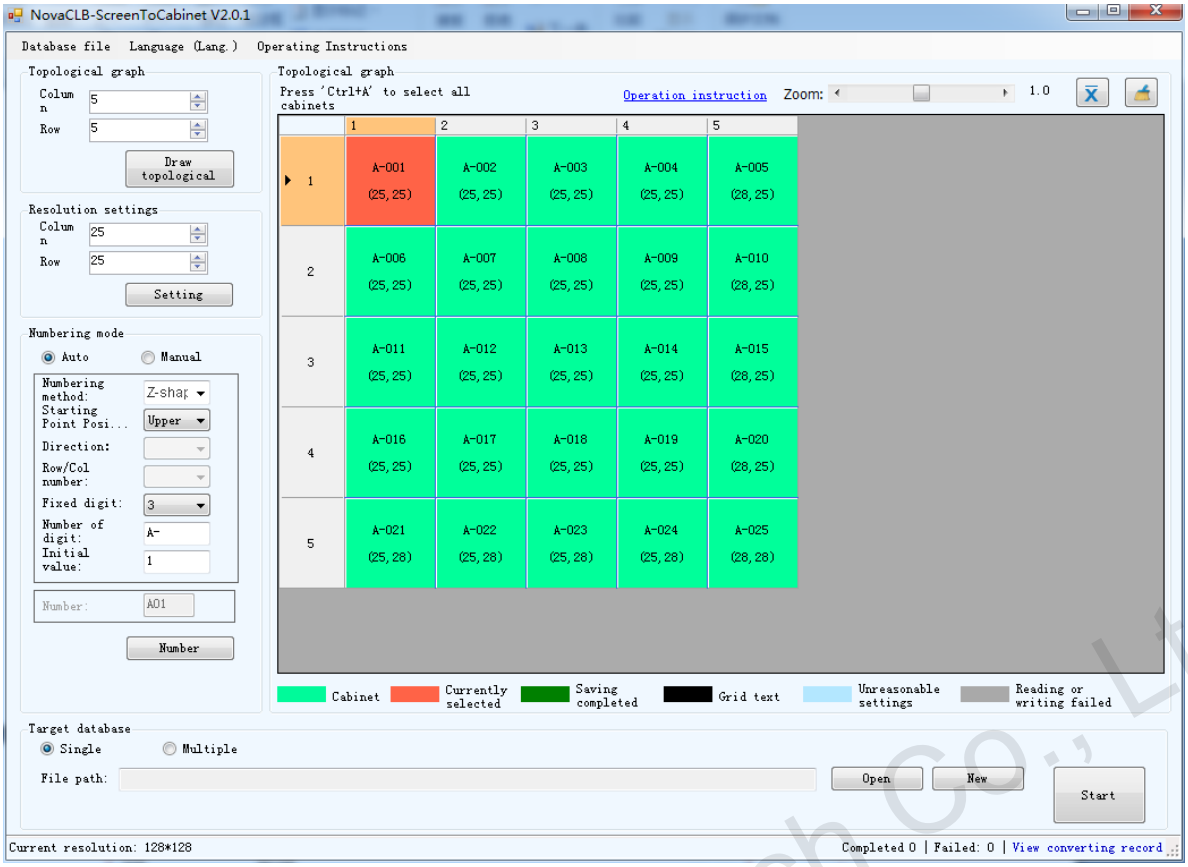

Fig. 10-7 Z-shaped Numbering

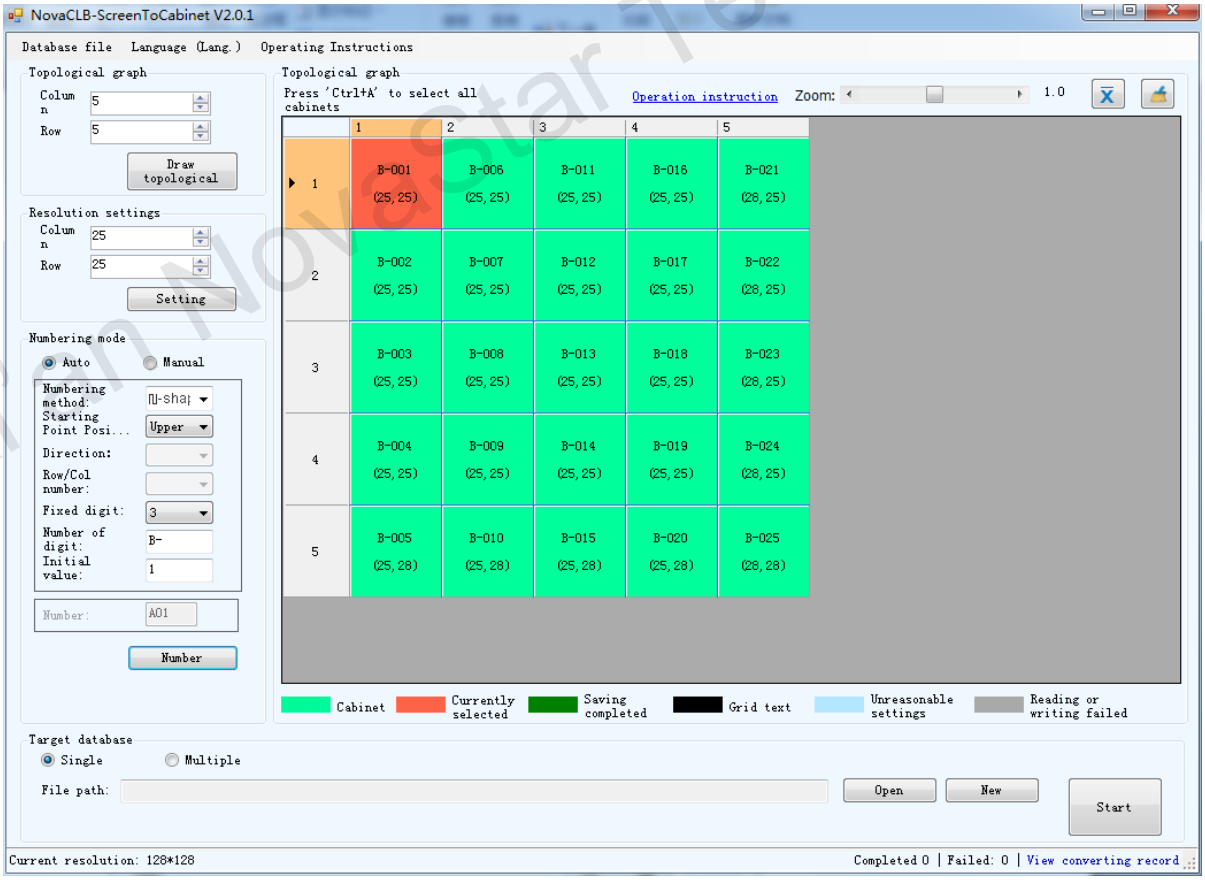

Fig. 10-8 ∽-shaped Numbering

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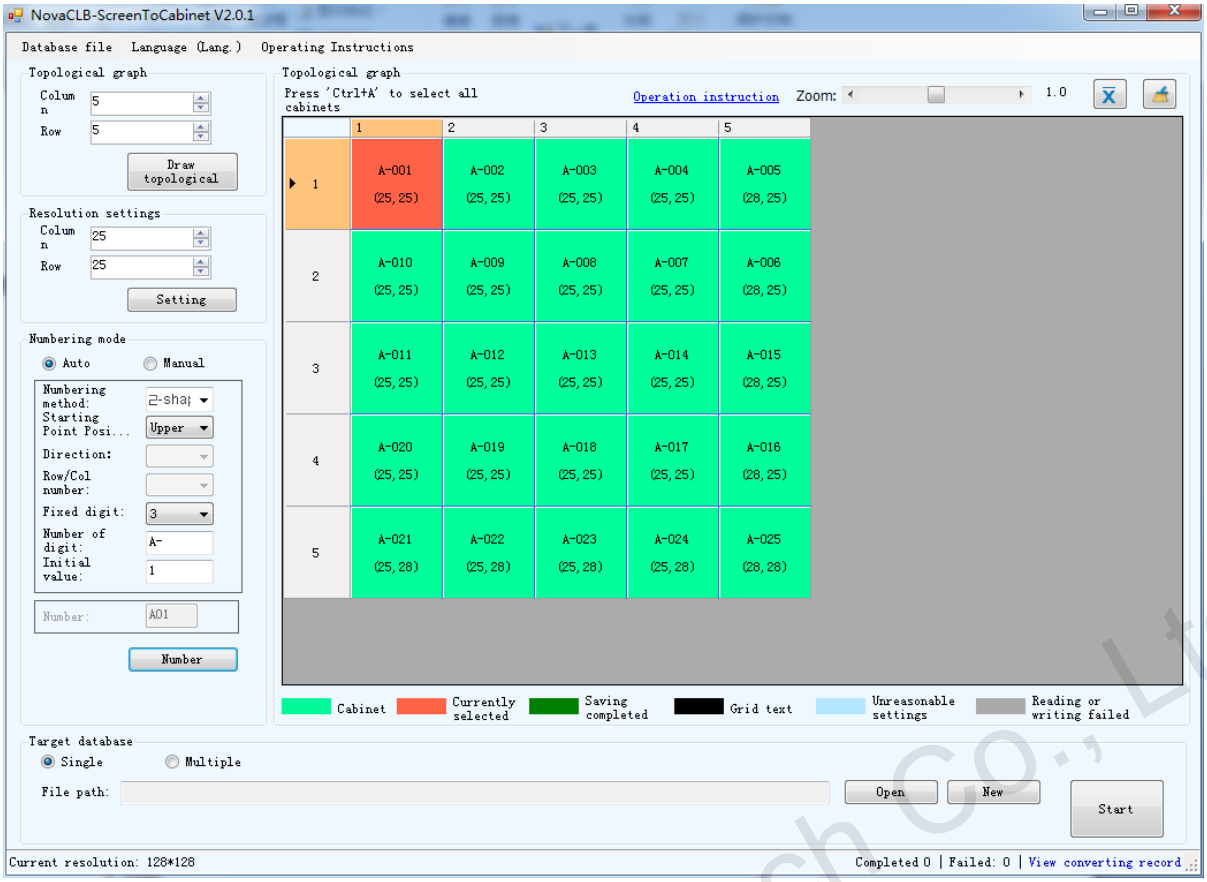

Fig. 10-9 ㄹ-shaped Numbering

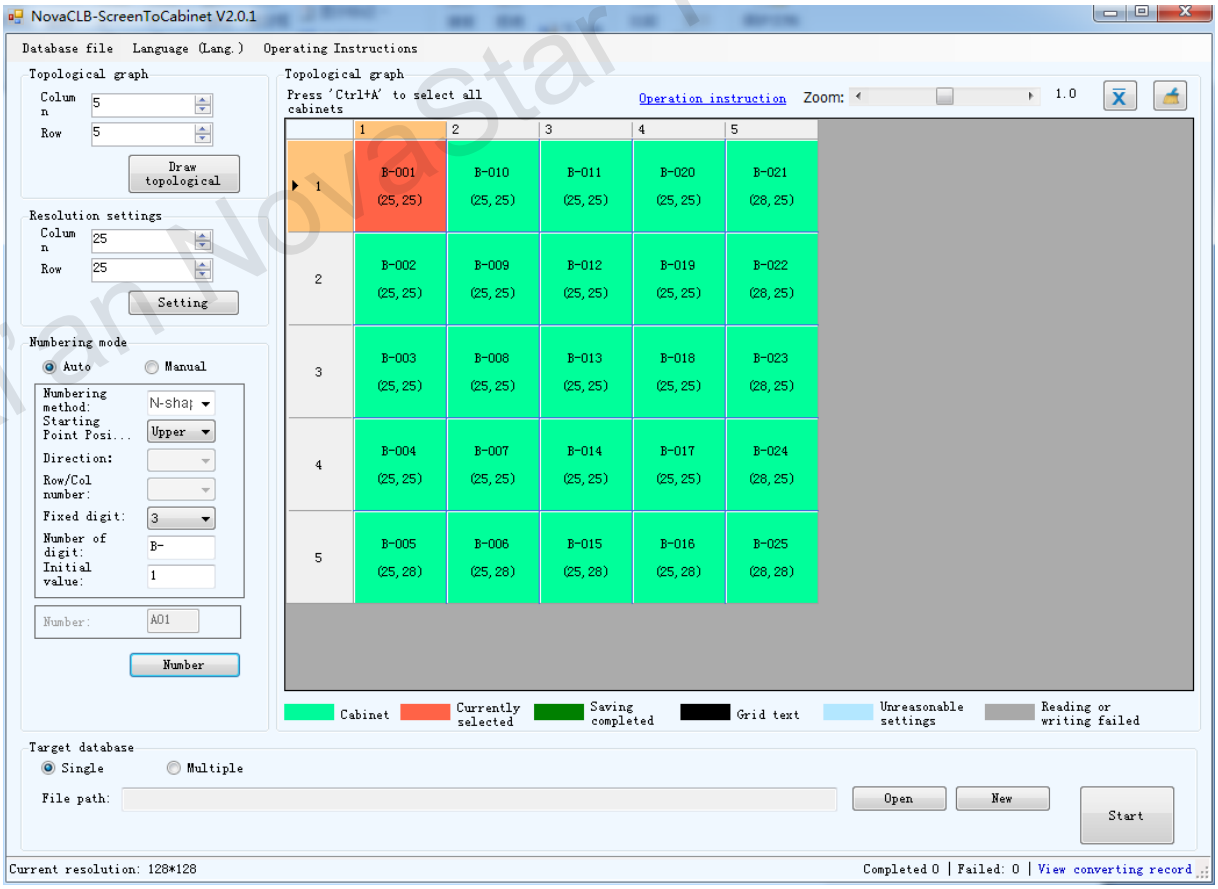

Fig. 10-10 N-shaped Numbering

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Fixed digit: fixed numbering character at the beginning of the number which can be set by the user; it can be any character, for example, A-, B-, number-, etc.

Number of digit: number of digit for the number, 1-4 digits; as shown in the following figure, the numbers of the first and second column have 2 digits; the number of the second column has one digit; the fourth column has 4 digits; and the fifth column has 3 digits.

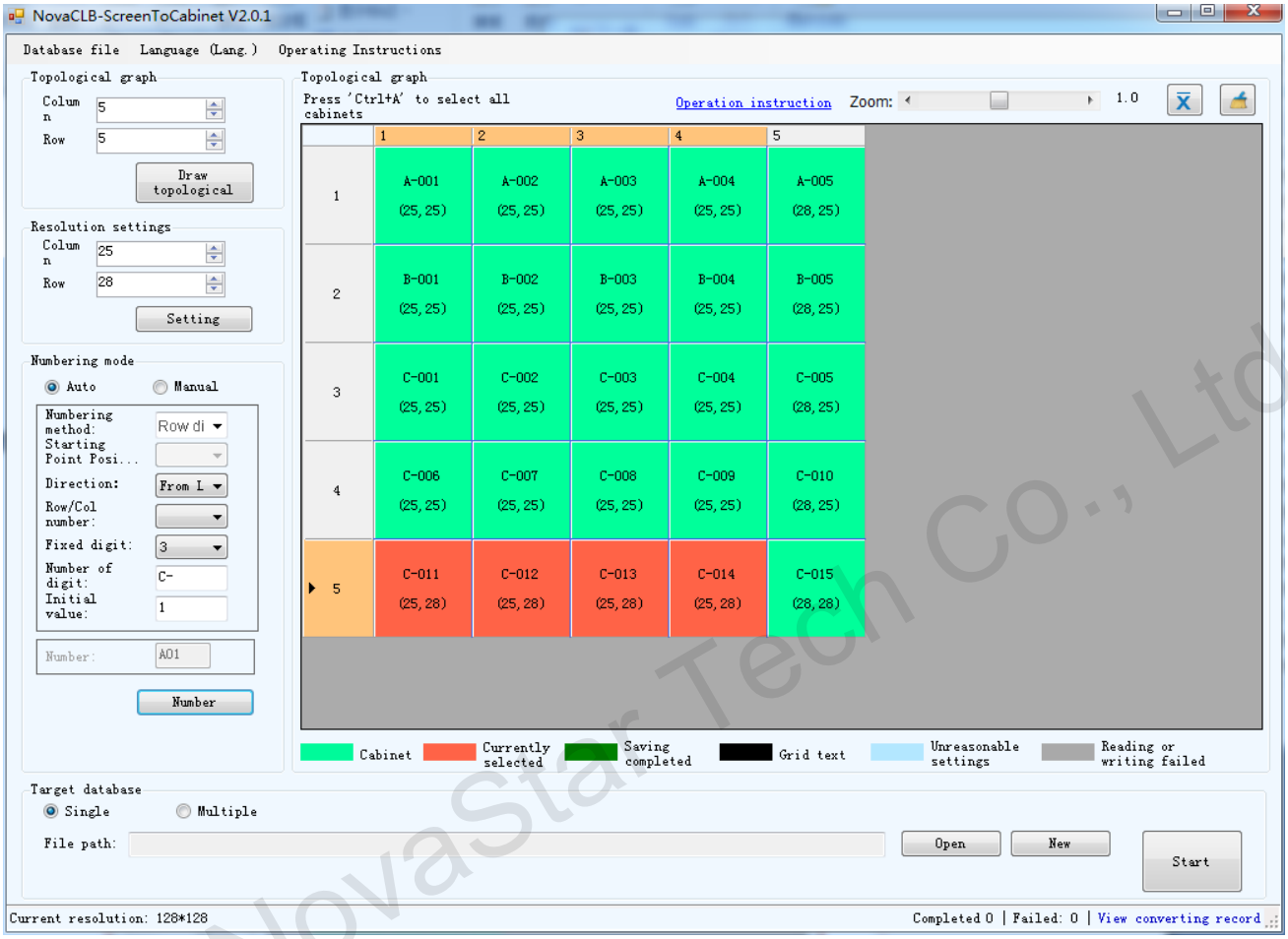

Fig. 10-11 Set the number of digit

Initial value: it means the initial value of the digit position in a single numbering process; for example, A-01 to A-08 can be used for the first column, and the initial value of the second column can be set as 9.

2) Manual numbering

Each time, number shall be entered manually; for example, enter the number A01, select the first cabinet, and then click

to finish the numbering of the first cabinet; then enter A02, select the second cabinet, and then click

to finish the numbering of the second cabinet; and the following can be done in a similar way to finish numbering of all cabinets.

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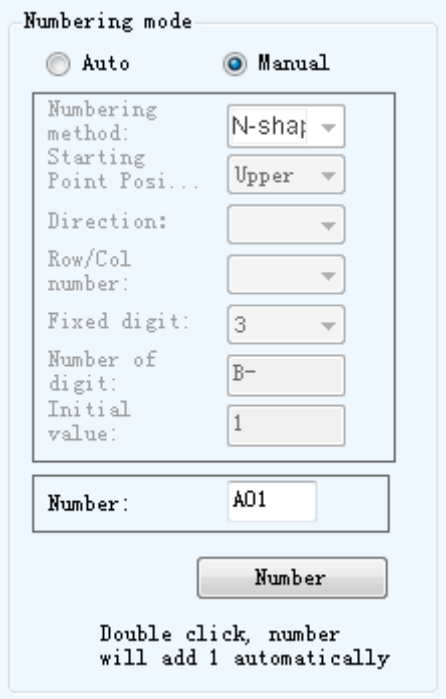

Fig. 10-12 Select Manual numbering mode

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10.2.5 Set target database

There can be single target database or multiple target databases. For single target database, all cabinets or modules will be saved to one database and one database will be generated. For multiple target databases, single cabinet or module will be saved as one database, and multiple databases will be generated which are named after the number of each cabinet or module.

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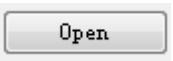
10.2.6 File path

In the case of saving as one single database, there are two situations. One is to save the cabinet data to the existing database which requires clicking 

to open the existing database. The other is to save the cabinet data to a new database, which requires clicking

to create a new database on some path of the computer.

In the case of saving as multiple databases, click

to select the saving path of the cabinet database.

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10.2.7 Switch

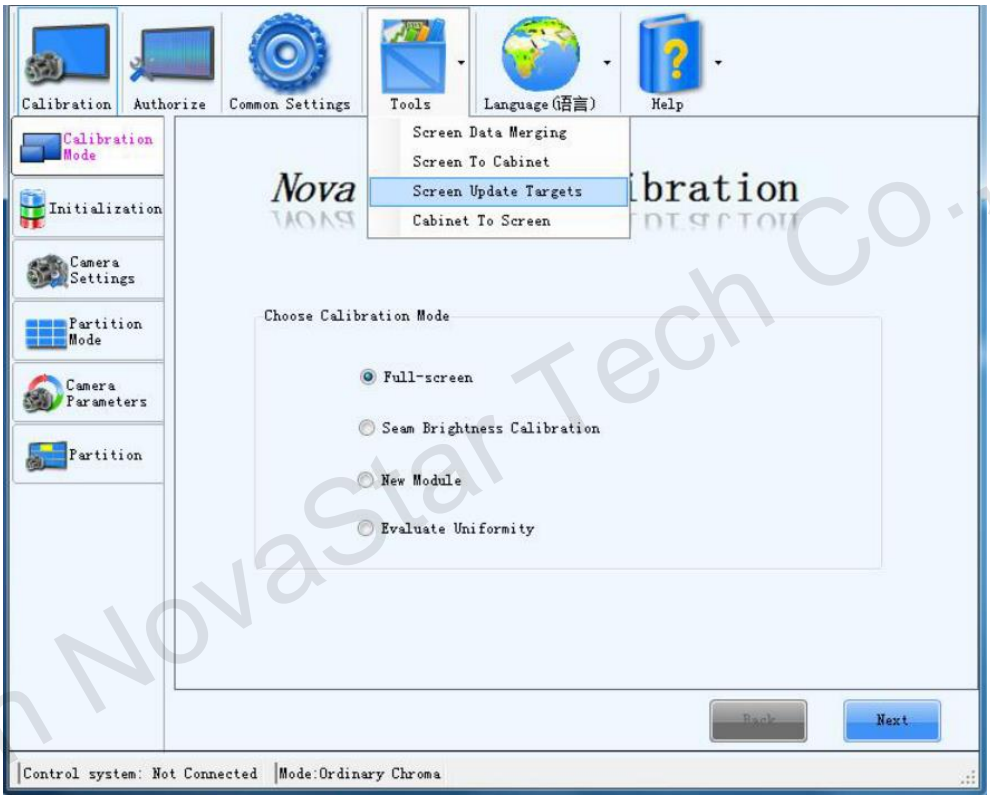
After completion of settings of all the options above, click

.

11 Screen Update Targets

If the brightness and chroma of the full screen is not satisfactory after the calibration is completed, the full-screen target value can be modified through this function.

The operation is as follows:



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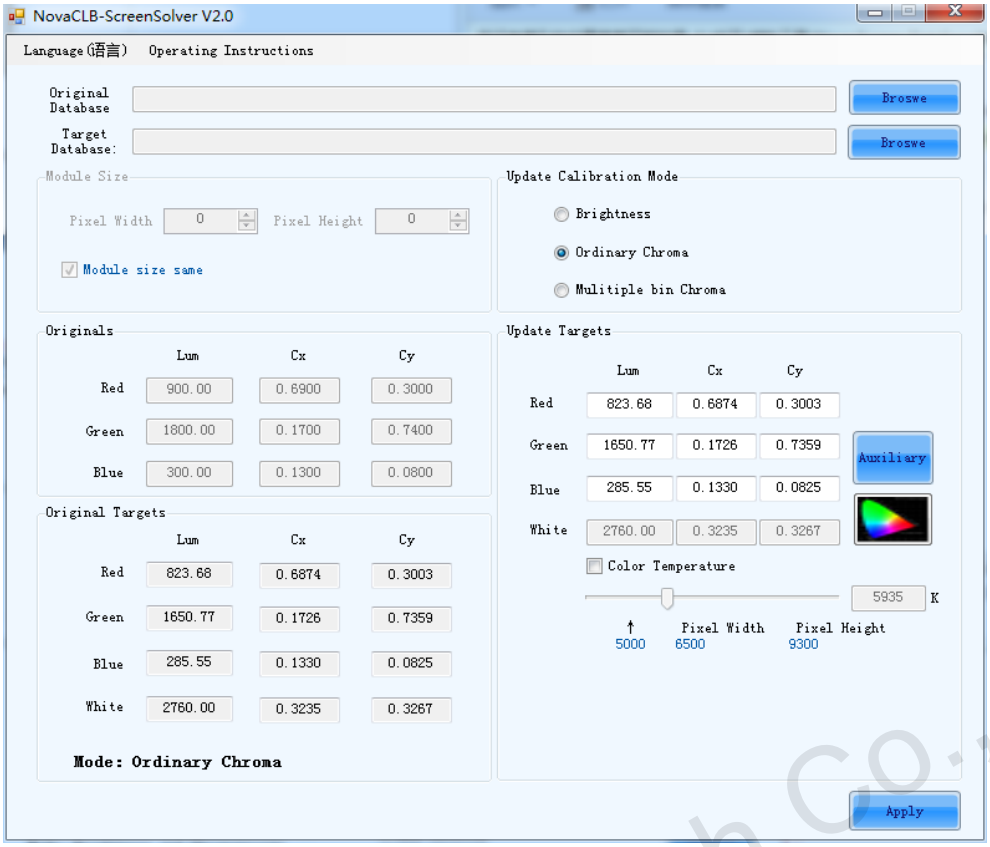

Fig. 11-1 Screen update targets

Click the first

to import the original database, and click the second

to set the route of the target database.

Operations of target value modification are the same as 4.2.3 Target Settings.

After the modification is completed, click

to save and apply the target value.

Click the first

and it can be individually loaded into the database or project. After being individually loaded into the database, the colorimetric correction mode cannot be changed. After being loaded into project, the correction modes can be changed freely. The information of modules also can be modified. Then click the second

to set the path of the target database.

The target value can be changed in the same way as the setting of "expected brightness and chroma".

After the change, click

to save the target value and apply.

12 Cabinet to Screen

To upload cabinet database, upload one cabinet at a time. For a screen that is composed of many cabinets, it takes a lot of time to upload databases of all cabinets. Now, use the cabinet-to-screen tool NovaCLB-Cabinet-To-Screen to change cabinet database into a screen database, and database uploading can be completed once.

The specific operation is as follows:

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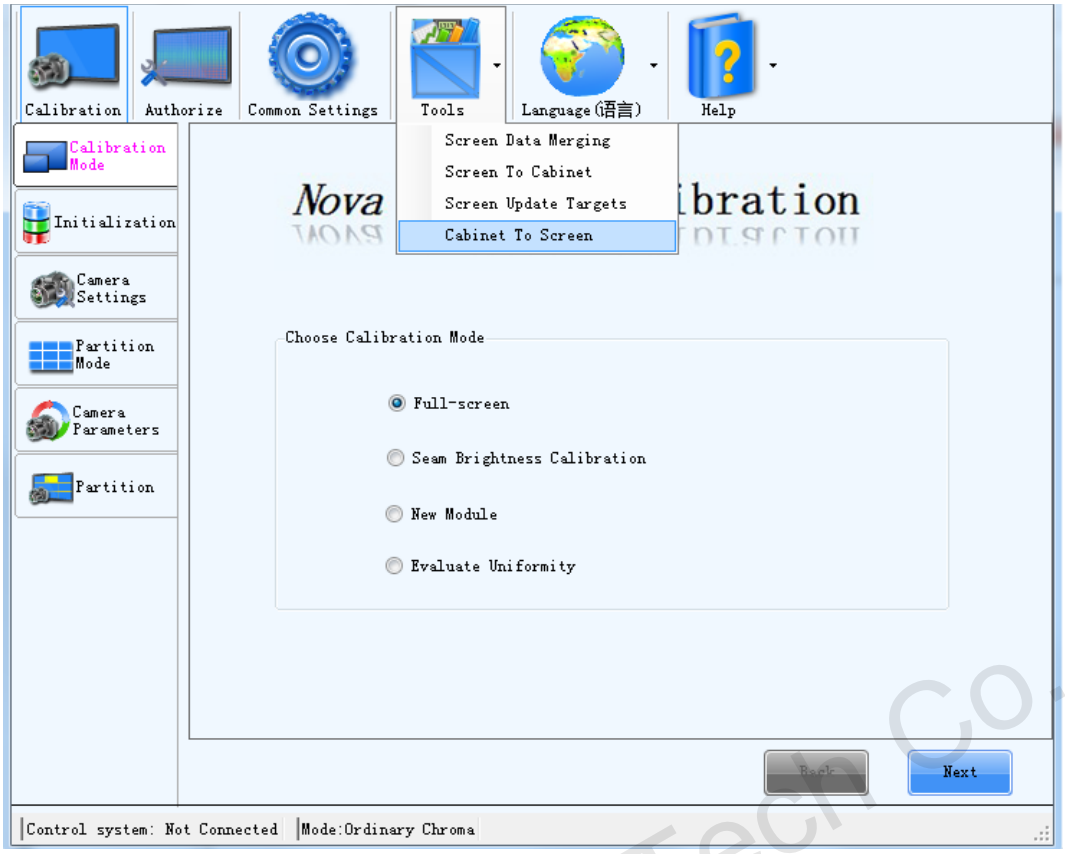
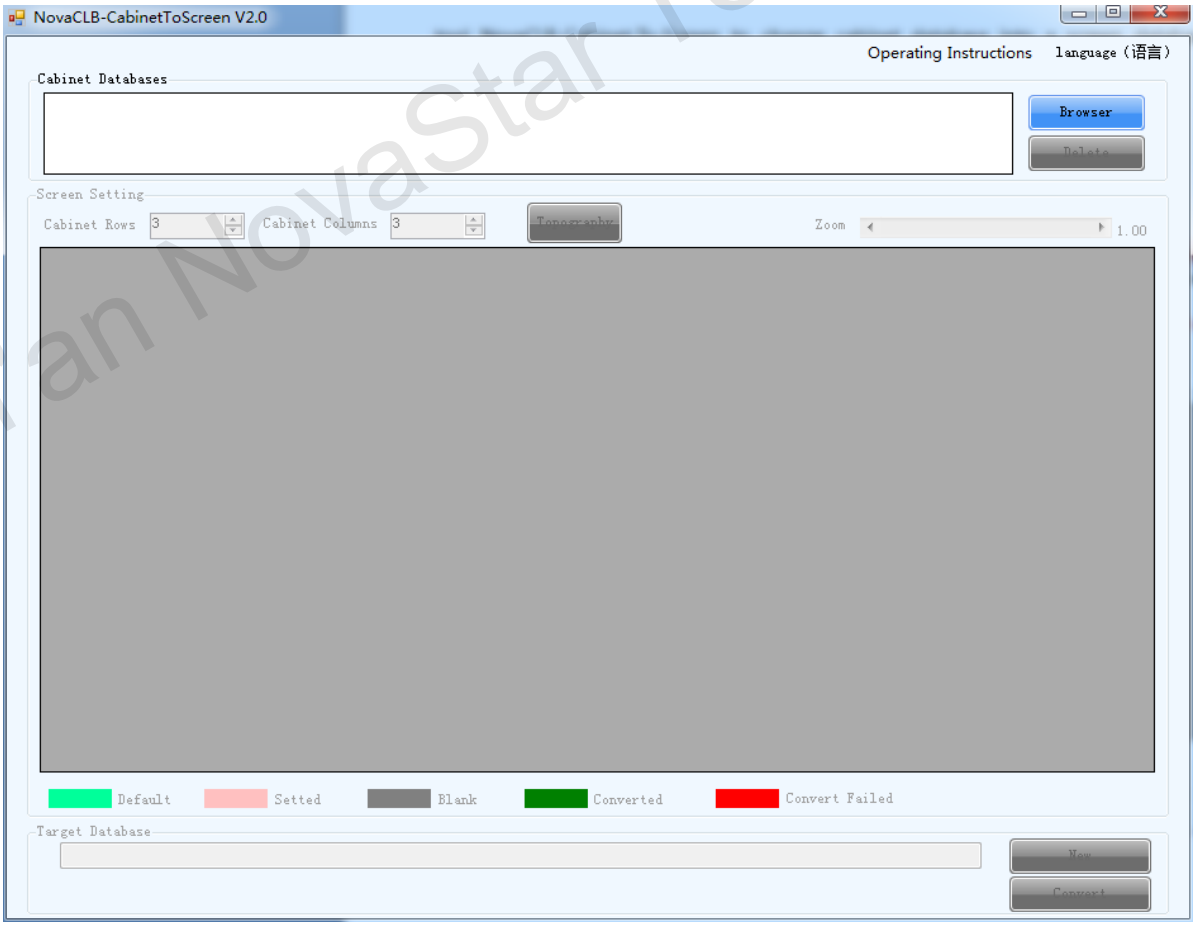
1) Load cabinet databases





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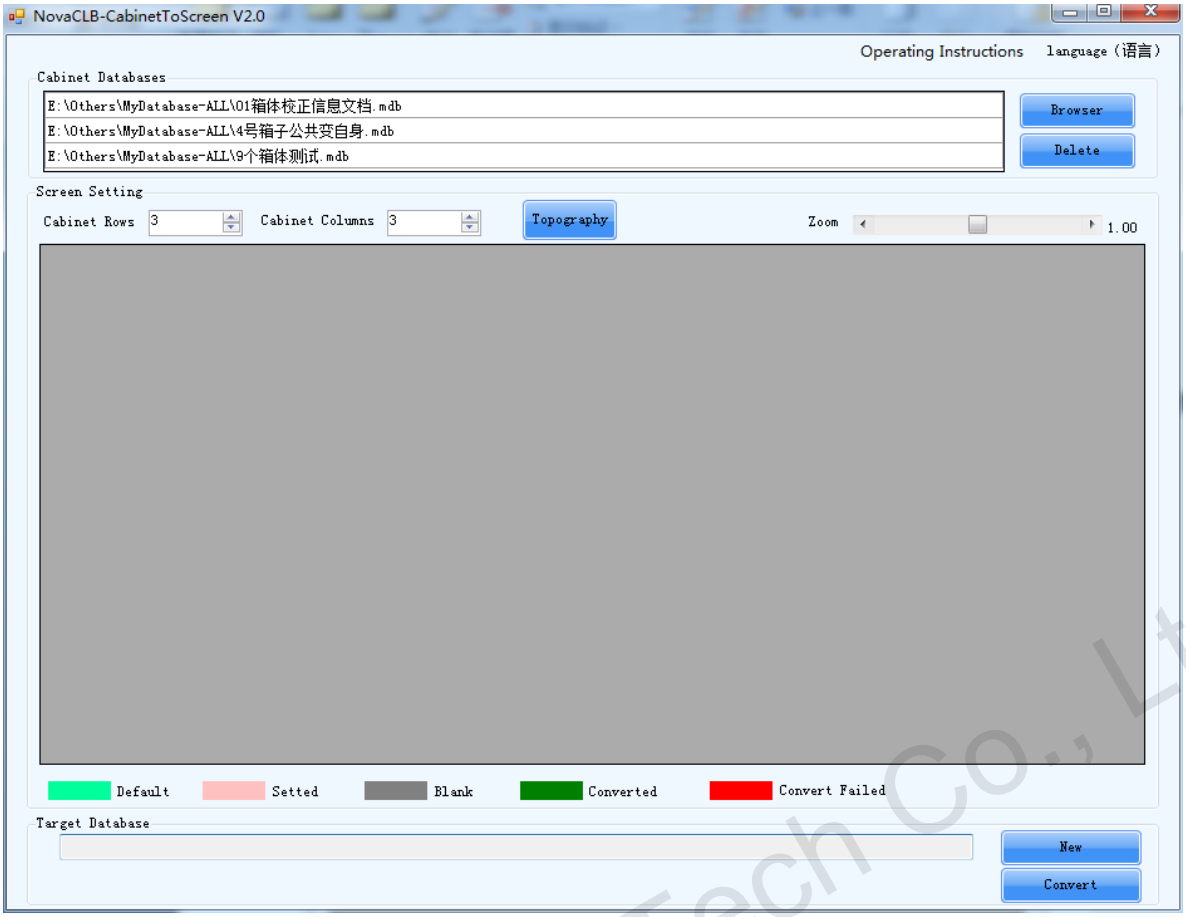

Fig. 12-1 Load Cabinet Databases

2) Topography

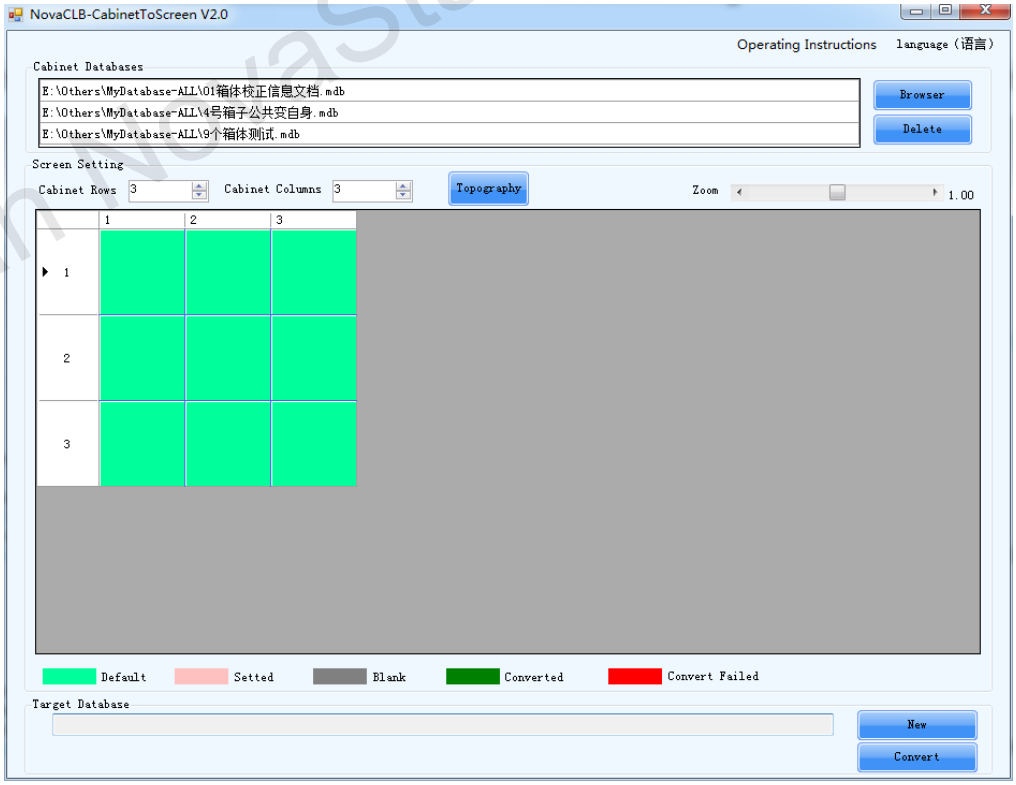

Fig. 12-2 Topography

3) Setting Cabinet ID

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Double click a cabinet on the topology and enter its ID (for viewing onsite). Cabinet ID should be manually entered.

To set a position of the screen black, double-click this position, check “set black”, and enter the pixel row and column number.

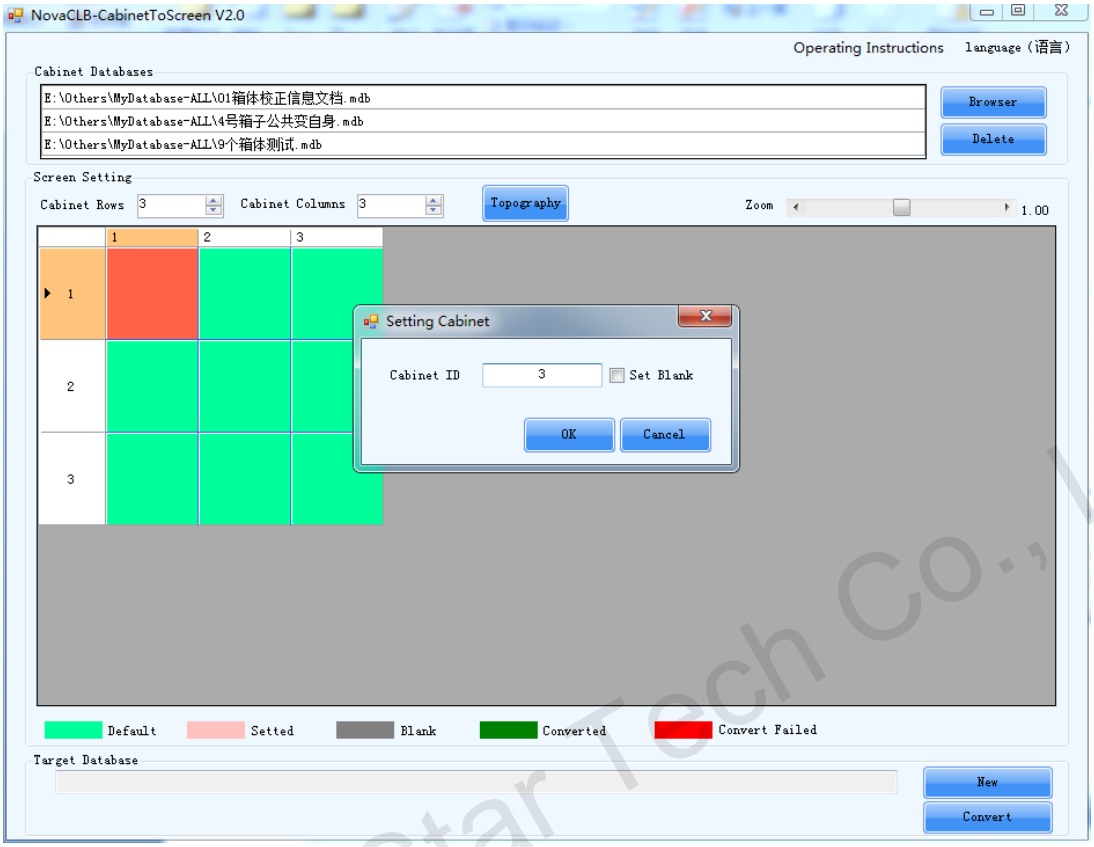

Fig. 12-3 Setting Cabinet

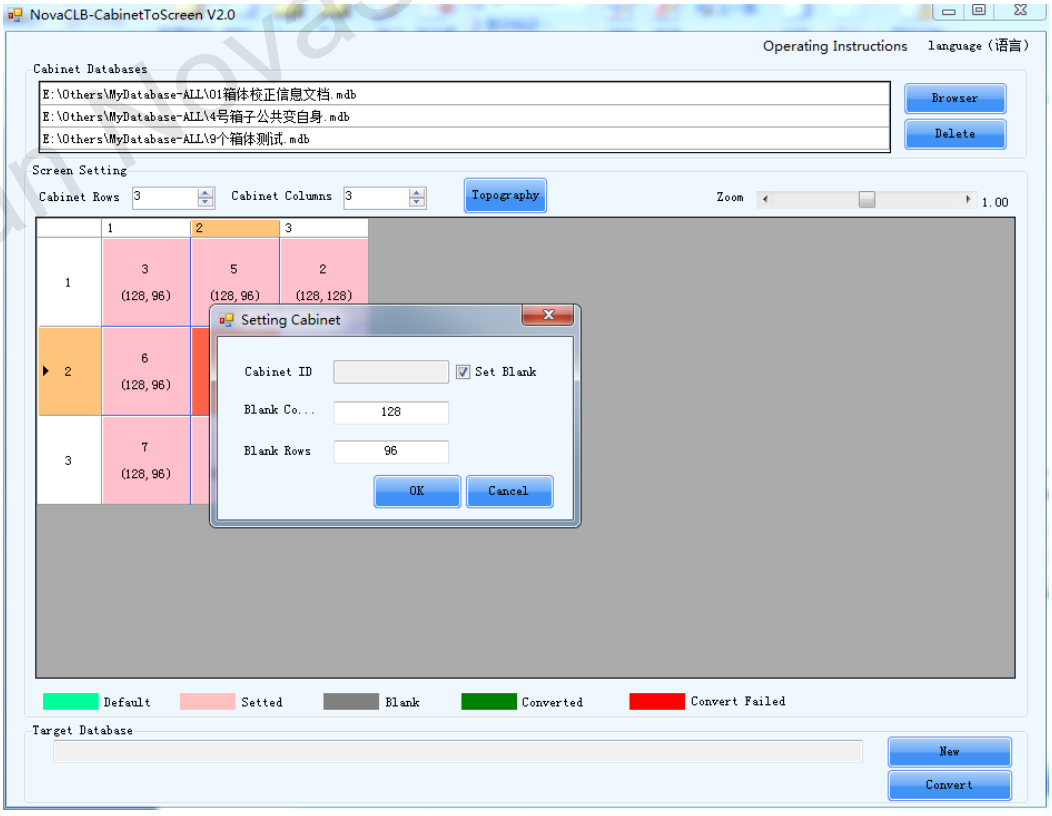

Fig. 12-4 Set Black

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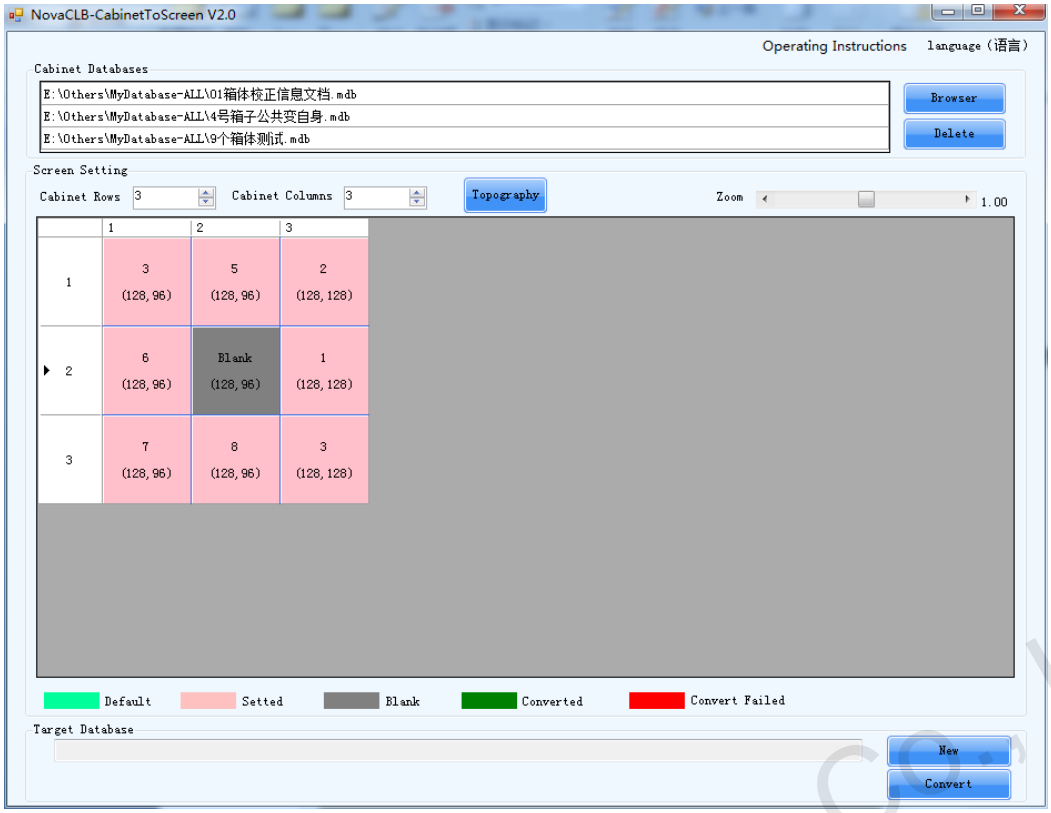

Fig. 12-5 Setting back is over

4) Create a target database, that is, a full-screen database.

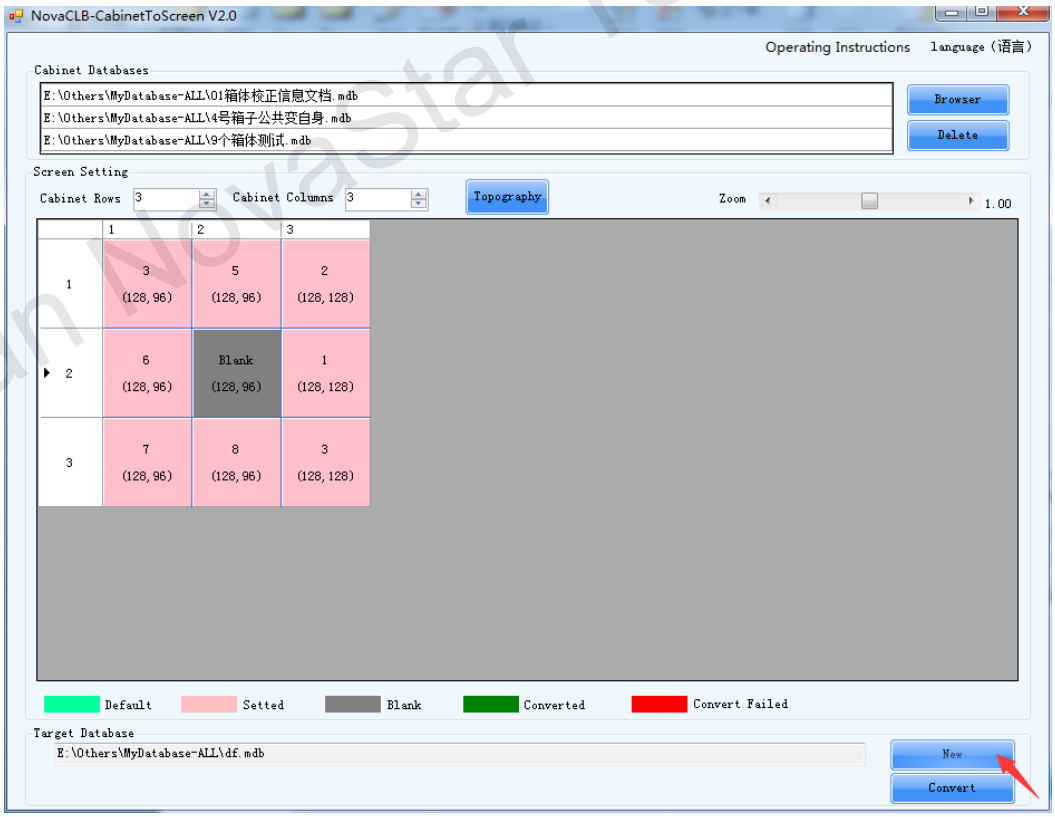

Fig. 12-6 Create a target database

5) Click “Convert” to convert the cabinet database into a full-screen database.

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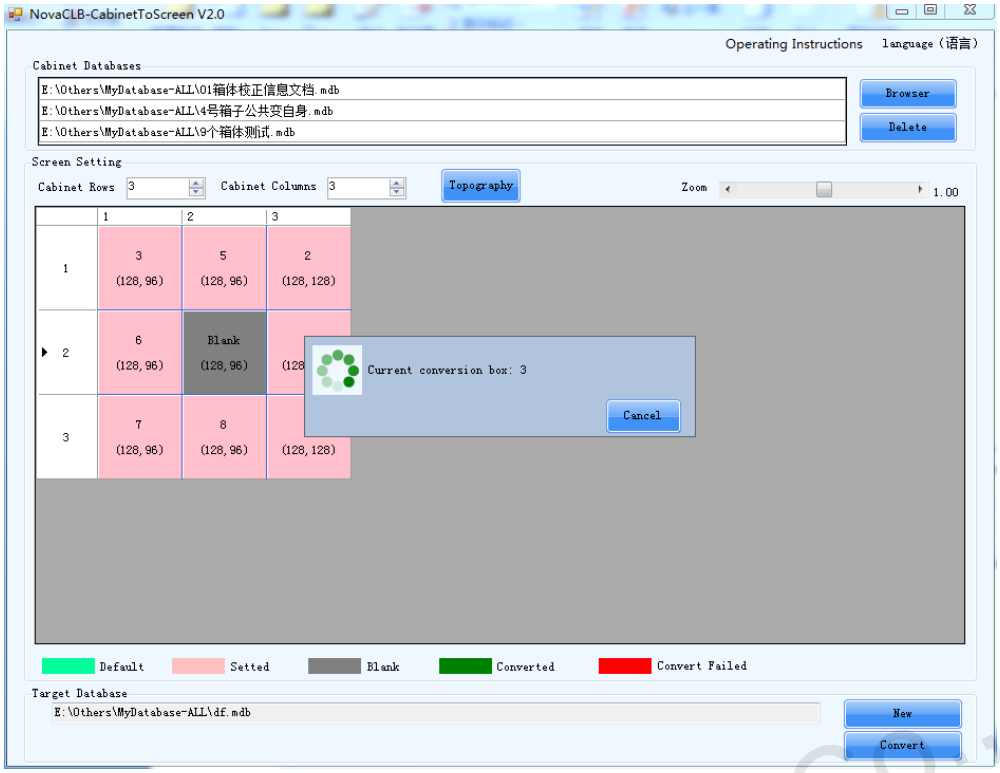

Fig. 12-7Conversion process

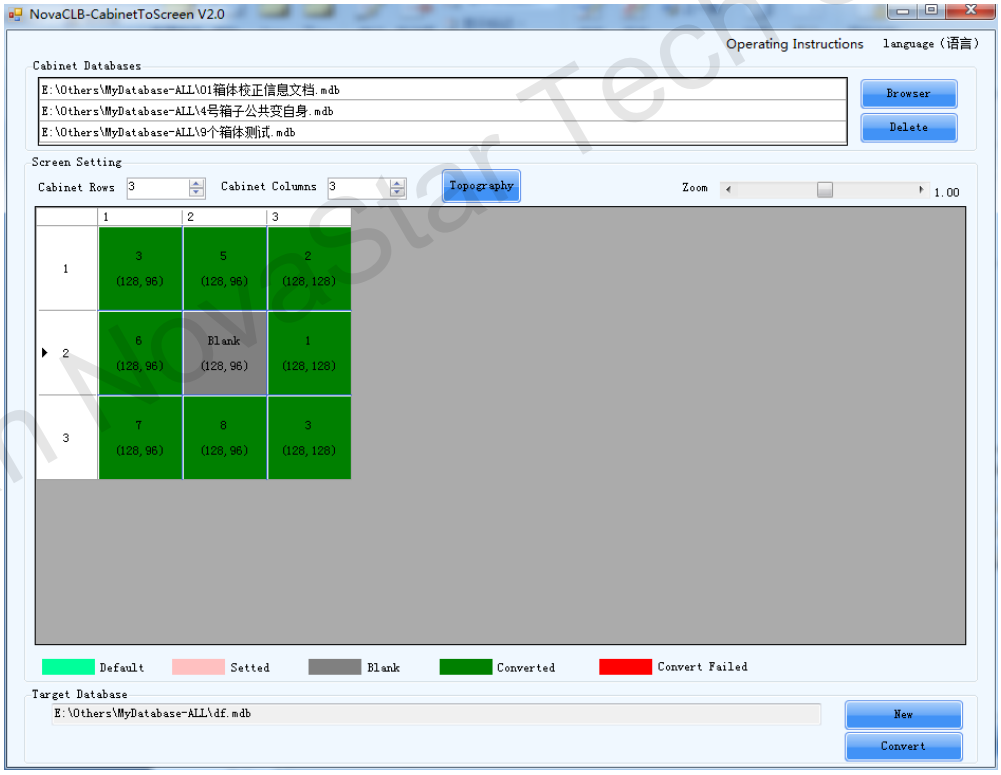

Fig. 12-8 Conversion is over

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13 NovaCLB-Screen Help

13.1 Network Settings

If the distance between the calibration computer and the NovaLCT or NovaPro control computer is within 100m when performing calibration, Ethernet cables can be used to connect the two computers. Otherwise, wireless routers should be used.

Here TP-LINK WR941N will be taken as an example for illustrating how to configure a wireless router for calibration application:

Fig. 13-1 The Wireless router TP-LINK WR941N

1) Connect the wireless router to the control computer through network cable into the yellow interface.

Fig. 13-2 Ports for Connection

2) Enable the wireless networking capabilities of calibration computer to connect to wireless router.

Note: whether using network cable or wireless router, you need to set the IP of the two computers and the default IP of wireless while calibrating with NovaLCT. And you need to set the IP of calibration computer，NovaPro , and the default IP of wireless when calibrating with NovaPro.

You need to set the IP of the two computers and the default IP of wireless router to be within the network segment.

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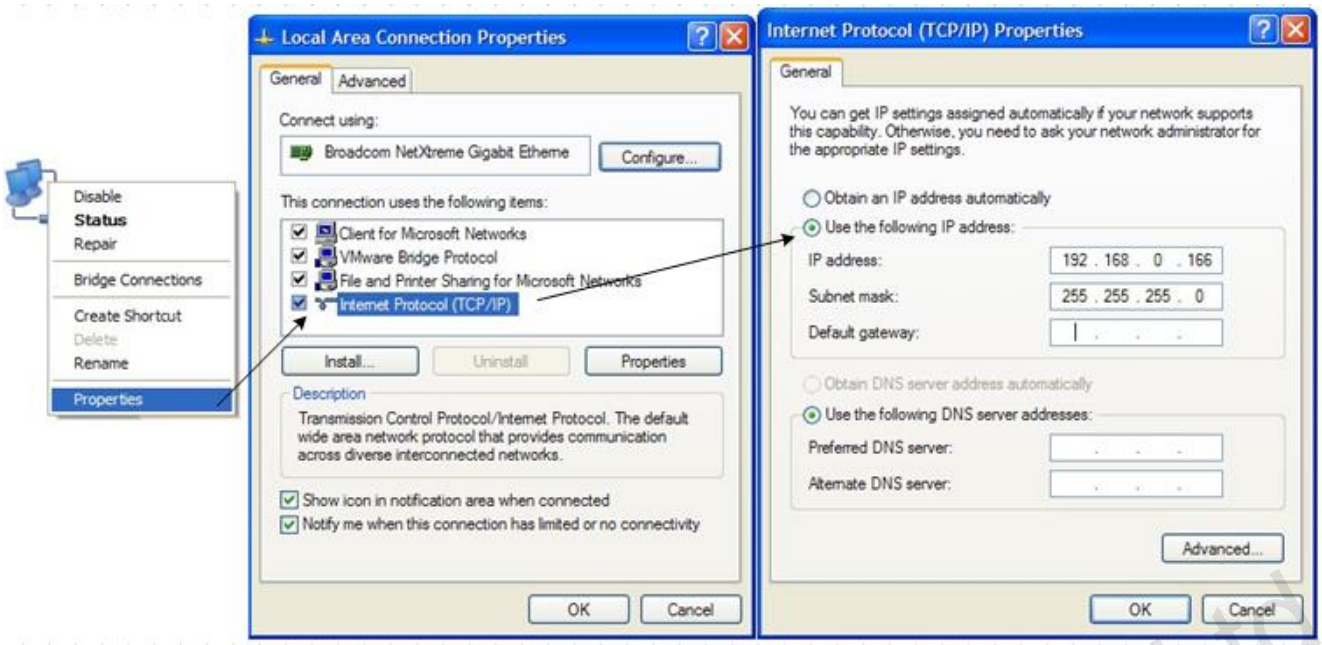

Fig. 13-3 IP Configurations

13.2 LCT Monitor Settings

Ensure that network is normal. Then users need to open NovaLCT-Mars, and choose advanced users. The password is **admin**, as shown in fig. 13-4

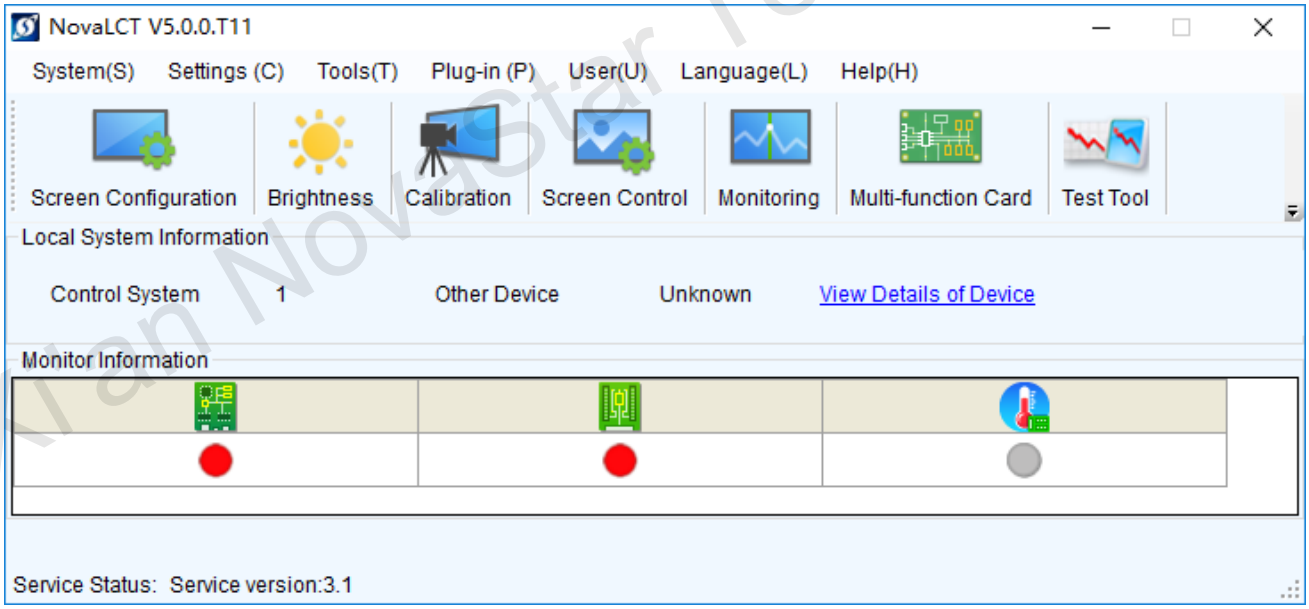

Fig. 13-4 LCT Main Interface

After loading by advanced user, calibration options will appearon NovaLCT-Mars toolbar.Click into the calibration page.

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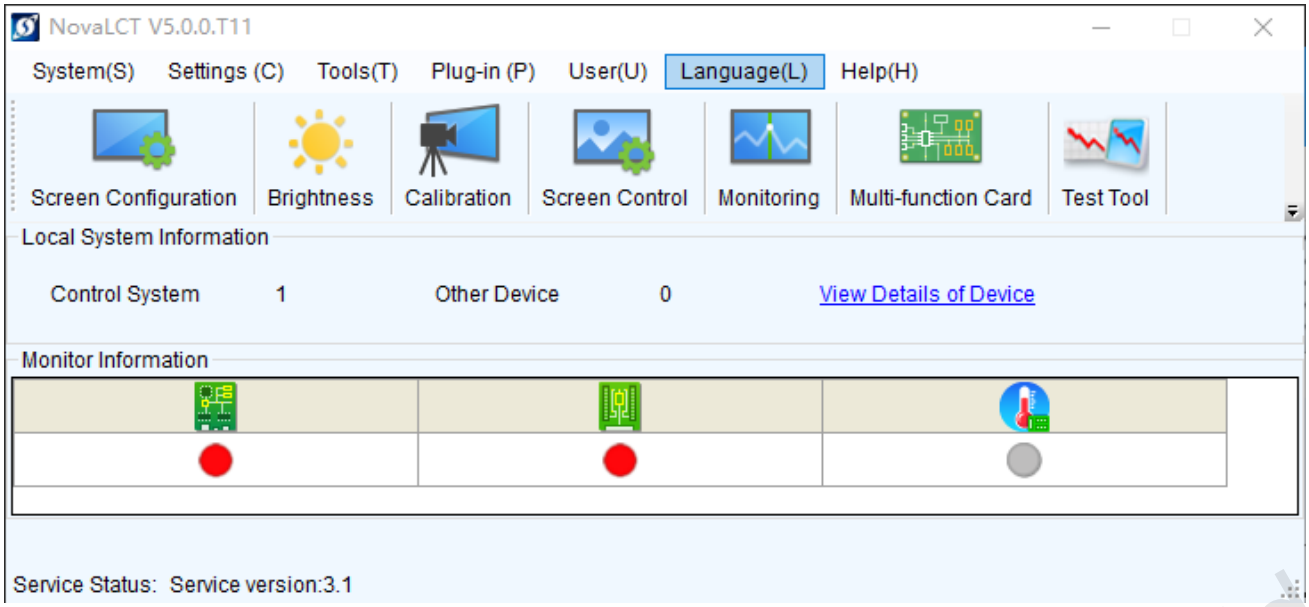

Fig. 13-5 Calibration Page

After getting into the calibration page, please check the network settings to make sure network is normal and then click "Reconnect". The message of "Listening succeed" shown in the following message window indicates that calibration service has been activated. If not, please check the network.

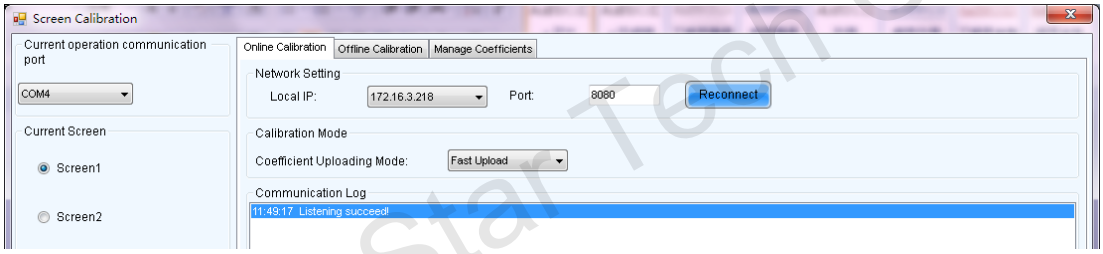

Fig. 13-6 Enter into Calibration Mode

13.3 Principle of Brightness and Color Calibration

Generally speaking, it is recommended that users select brightness and color calibration mode. Higher uniformity can be obtained. For some customers demanding more colorful and brighter, they can choose brightness calibration only.

Brightness calibration: Brightness calibration is to adjust the brightness of LED lights to improve the brightness uniformity. In the brightness calibration, brightness of most lights will be properly lowered. Fig. 13-7 shows an example of brightness adjustment of green LED lights, in which there are two brightness distribution curves corresponding to before and after calibration (adjustment) respectively. Before calibration, the brightness values of green LED lights are scattered between 2400 – 3300 cd/m^2, but after calibration those are concentrated almost at 2500 cd/m^2, representing high brightness uniformity.

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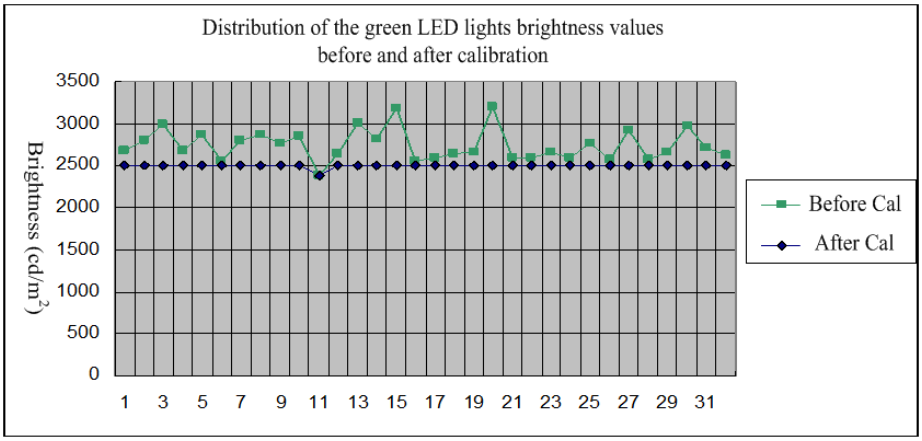

Fig. 13-7Brightness Values Distribution Before and After Calibration

Brightness and color calibration: Brightness and color calibration is based on the theory of RGB color match. It adjusts the coordinates of LED lights in the RGB color coordinate system to reduce the color diversity. As shown in Fig. 13-8, the large triangle is the gamut of a LED display before calibration , while the small one is the gamut of same LED display after calibration. The R, G and B color coordinates of LED lights scatter in relative large areas when before corrected while those after calibration are concentrated, which represents high color uniformity.

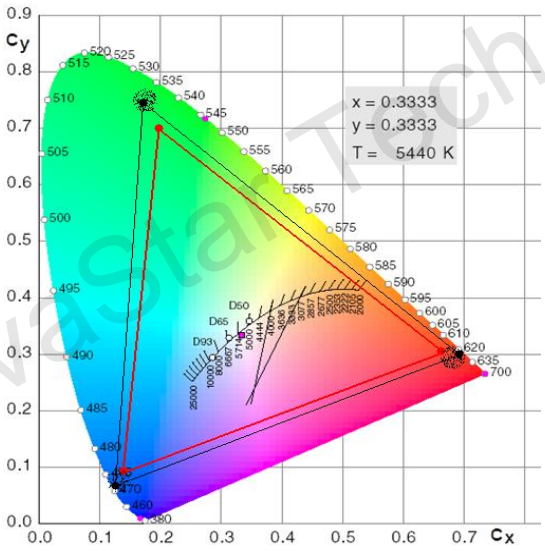

Fig. 13-8 Gamut of A LED Display Before and After Calibration

Note: When performing the brightness and color calibration, proper coordinates for R, G and B should be chosen in order to avoid color distortion.

13.4 Camera Operating Skills

Digital Camera:

a) Connect the camera to the computer through USB. Set the camera to "ON". Click "Connect to camera." After "Connected" is displayed, the camera will be automatically controlled by the software.

b) Set the mode dial to "M" (manually) and lens focus to "MF" (manual focus). If the lens supports the anti-shake function ("OS" on Sigma cameras), set to "OFF."

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c) Switch between the viewfinder and LCD: Enable "Live view shoot" in the "MENU" of the camera and press to switch between the viewfinder and LCD.

Tip: When LCD framing is enabled, users can press to switch among original size, five times of the original size, and ten times of the original size for images.

Caliris Camera:

a) Connect the camera to the power supply and use a USB cable to connect the camera to the computer. Please make sure that the indicator on the camera turns green.

b) Click "Image Preview" on the software to view the image collected by the camera in real time.

c) Adjust the focal length and focus ring to make the image larger than the red box in the image preview window. If the image is too bright, adjust the aperture to decrease its size.

Adjustment of the Camera Saturation:

Click "Analyze." The software automatically calculates the saturation. Adjust the aperture size, time of exposure and calibration brightness value to enable the saturation to be normal. The saturation value ranging from 60 to 100 is normal, and the area value ranging from 50 to 150 is fit. The adjustment principle is as follows: the adjustment must be conducted in the following order: aperture size > time of exposure > calibration brightness value. Generally, the aperture value is inversely proportional to the saturation, and the time of exposure and brightness are directly proportional to the saturation.

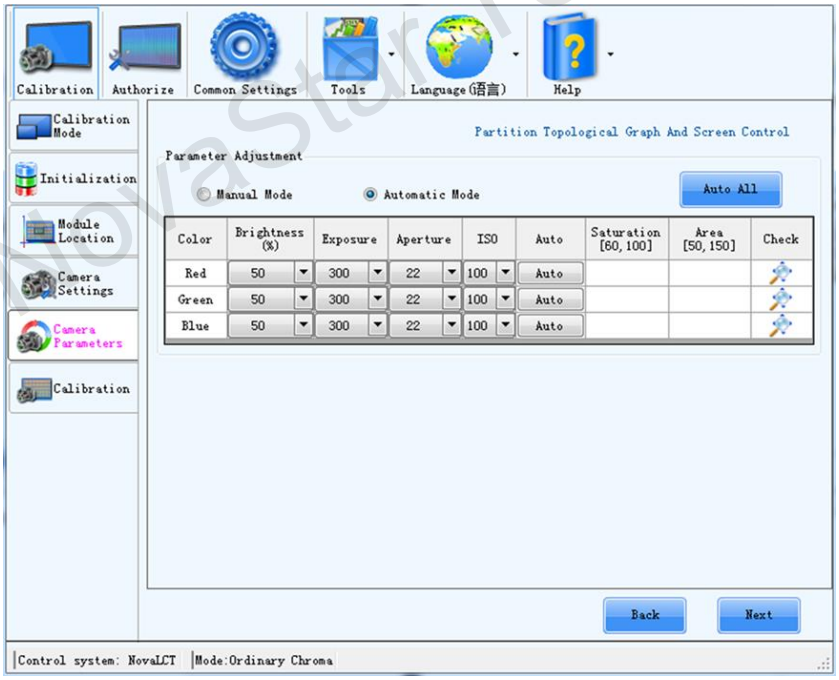

Fig. 13-9 Camera Parameters Adjustment

13.5 Subarea Imaging Operating Skills

During the calibration for large screens, point the camera toward the partition to be calibrated and adjust the focal length to make sure the partition is in the viewfinder. You can view the partition through the LCD while using a digital camera, or through the image preview function while using a Caliris camera.

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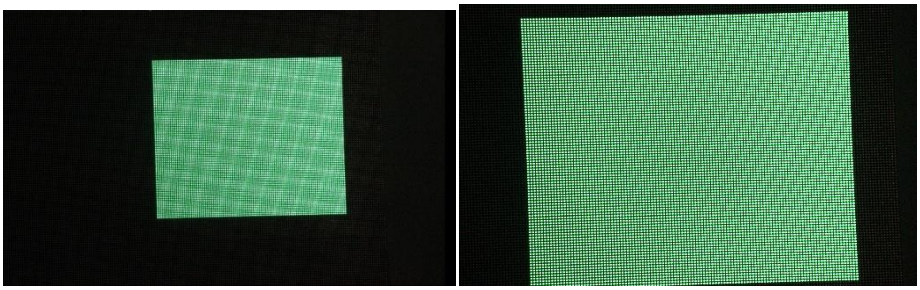
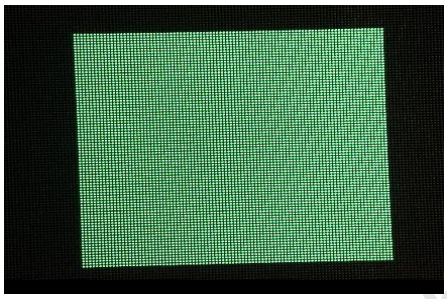
Because of the outer part of the lens decreases in imaging quality, the direction of the camera should be adjusted to ensure the subarea image is at the central part of the whole image. And the size of the subarea image should be about 4/5 of the whole image size. That is to leave 1/10 of the whole image at sides, as shown in Fig 13-10.



(a) Subarea Image Too Small (b) Subarea Image Too Large



(b) Suitable Subarea Image Size

Fig. 13-10 Imaging of A Subarea

For factory calibration, it is not recommended to use the maximum lens focus length. Because the pixel size is less than the supported maximum subarea size, the suitable focus length is that makes the cabinet view center is at the center of the whole view. Length and width are half of the length and width of imaging of a subarea, i.e., reserve 1/5 for top, bottom, left and right respectively.

13.6 Steps to Check Calibration Effects

It may occur unsatisfactory calibration effects in some areas of screen after calibration, then troubleshoot according to calibration effect is needed. Before checking, users should know how to check "Camera Image Collection".

Click magnifying glass icon in Partition calibration page, then measurement image page appears. First, observe the image resolution and integrity, second, observe whether all led points have been selected. As shown in Fig. 13-11:

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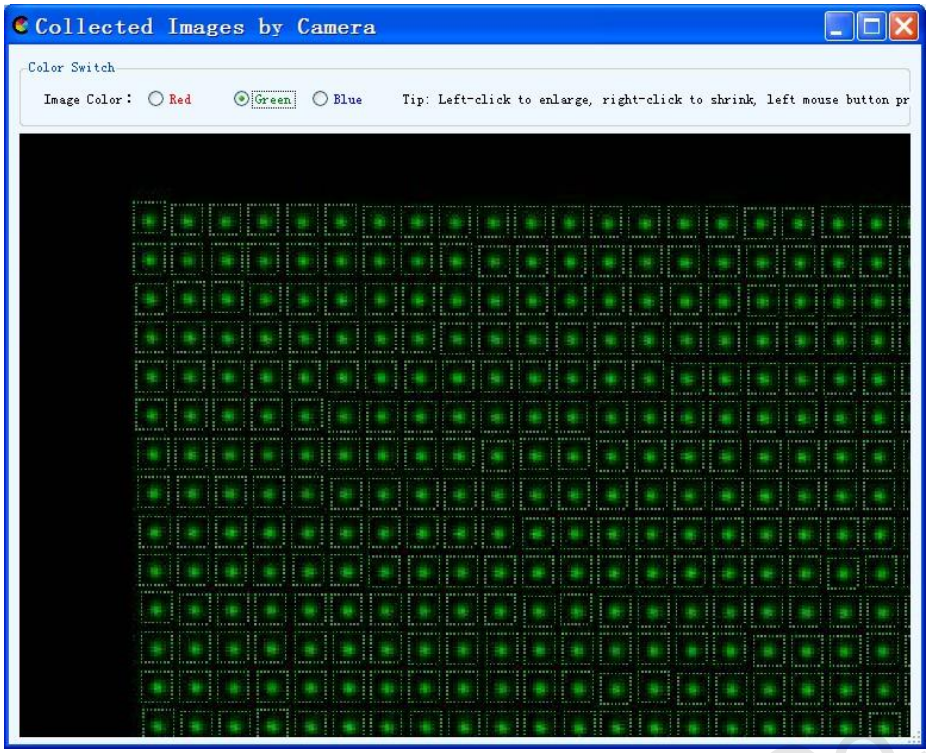

Fig. 13-11View of Collection Images

Screen fuzzy phenomenon 1: there appears some bright or dark lines in vertical direction between subareas.

Analysis: Generally speaking, it is because of poor quality of imaging, users may check whether LED image clear or not on "Camera Image Collection". Generally both Oversize resolution when partition setting and not clear focus when the imaging may lead poor quality of imaging.

Screen fuzzy phenomenon 2: there appears water ripples in subareas

Analysis: Generally speaking, it is because of inadequate sampling. Show red, green and blue image on LED screen after calibration to find out undesirables color. Slightly adjust the focus or re-focus, then repeat the calibration of the color, you can solve the problem.

Moreover, some scene reasons may also lead unsatisfactory, for example, outside light interference, lens jitter by site windy and imaging fuzzy by rain and snow. In order to reach the most ideal effect, engineers need to avoid these influences of external environment.

13.7 Water Ripple in Full-Screen Calibration

Full-screen calibration may appear full screen of a color rendering water ripple, blue share the highest frequency. This is due to that the display resolution is too large, and the relative lack of camera resolution leads the low sampling frequency. It is known as moiré patterns phenomenon in optical imaging.

Try below resolutions to solve this problem, and then collect R/G/B again.

1) Change camera angle. Rotate camera lightly to change its angle to eliminate or reduce the existing moiré patterns.
2) Change camera position. Move camera up or down or left or right to reduce moiré patterns.
3) Change camera focusing. Too clear focus and details may cause moiré patterns, please adjust camera aperture to reduce camera focus Clarity, furthermore to reduce moiré patterns.

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4) Change camera lens. Try different focus length to reduce or eliminate moiré patterns.
5) Try to divide the full screen into several parts to perform calibration when performing full screen correction. The reduction of imaging points can help eliminate Moiré Effect.

14 Release Notes

Document Version	Release Date	Software Version
V1.0.0	2012-09-25	First Release
V2.0.0	2012-12-19	NovaCLB-Screen V1.9.0
V2.2.0	2013-09-06	NovaCLB-Screen V2.0.0
V3.1.0	2014-03-07	NovaCLB-Screen V3.1.0
V3.2.0	2014-04-08	NovaCLB-Screen V3.2.0
V3.3.1	2015-01-26	NovaCLB-Screen V3.3.1
V3.4.0	2015-04-21	NovaCLB-Screen V3.4.0
V4.0.0	2015-09-22	NovaCLB-Screen V4.0.0
V5.0.0	2016-12-14	NovaCLB-Screen V5.0.0
V5.1.0	2018-04-20	NovaCLB-Screen V5.0.0

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