COEX Solution

NCP File Instruction Manual



Change History

Document Version	Release Date	Description
V1.0.0	2023-06-06	First release

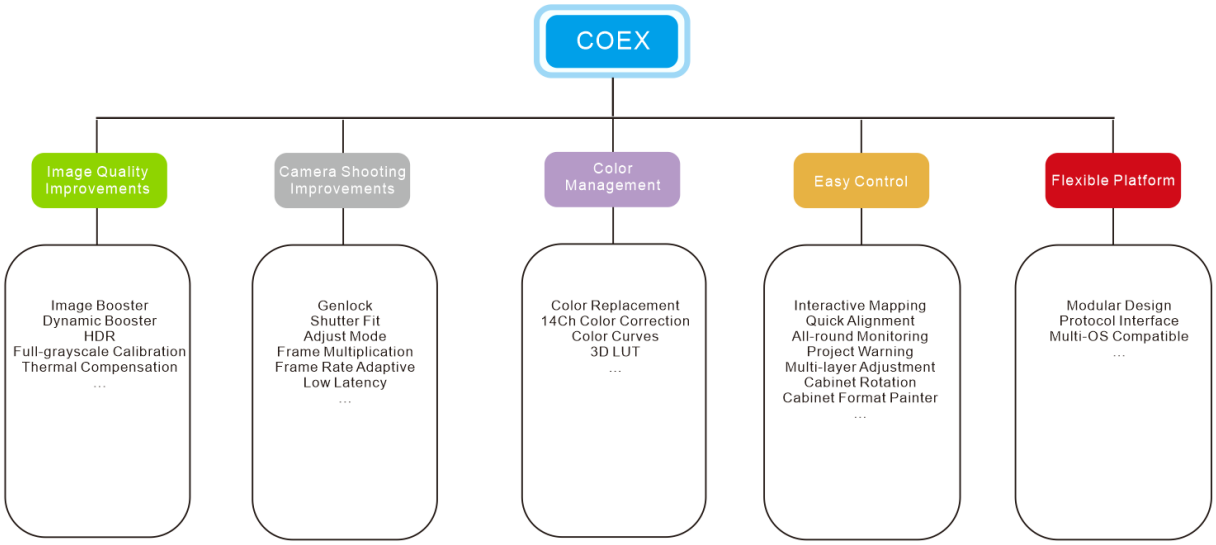
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1 COEX Control System Solution

Xi'an NovaStar Tech Co., Ltd. (hereinafter referred to as "NovaStar") has launched the new COEX Control System Solution, which features an ultra-high video processing capability, as well as innovative image quality enhancement technologies such as full-grayscale calibration, dynamic booster, and thermal compensation. These cutting-edge features ensure that every small detail and color is presented accurately and with greater clarity. Moreover, it provides support for advanced technologies like color correction, shutter fit, phase offset, and frame multiplication, making it ideal for xR virtual shooting scenarios. This will guarantee that every video capture will be seamless and flawless. On top of that, with NovaStar's brand new VMP (Vision Management Platform), the solution combines the quaternity of design, debugging, management, and monitoring into one package. Managing the display system has never been this efficient and convenient.

Figure 1-1 Highlight features of the COEX system



1.1 COEX System Topology

Figure 1-2 COEX - LED Control System Topology

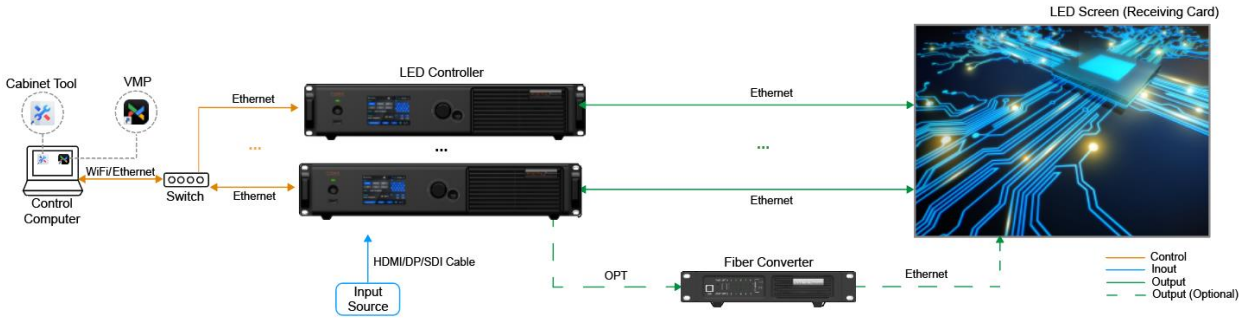


Table 1-1 List of COEX system components

Component	Description
Cabinet Tool	It offers functions such as lighting up modules, configuring cabinets, burning programs, and managing calibration coefficients. Users can import the cabinet library file (.ncp) generated by this tool into VMP to quickly apply the configurations to the control system.
Control Software (VMP)	Designed with a concept of opening platform, VMP offers a seamless, all-around user experience for device management, input source configuration, screen configuration, screen correction, color management, screen adjustment, screen monitoring, preset management, and screen maintenance. Its What You See is What You Get (WYSIWYG) interface provides a highly convenient and responsive experience for users. Currently, VMP is compatible with both Windows and Mac operating systems.

Component	Description
LED Controller	1G: MX40 Pro, MX30, KU20 5G: CX80 Pro, CX40 Pro
Receiving card	1G: Armor series receiving cards such as A10s Pro, A10 Plus-N, A8s-N, A7s Plus, A5s Plus 5G: CA50E, CA50C, XA50
Fiber Converter (Long-distance Transmission)	1G: CVT10 Pro, CVT10 5G: CVT8-5G

Note

The 1G/5G in the table refers to the output bandwidth of a single Ethernet port.

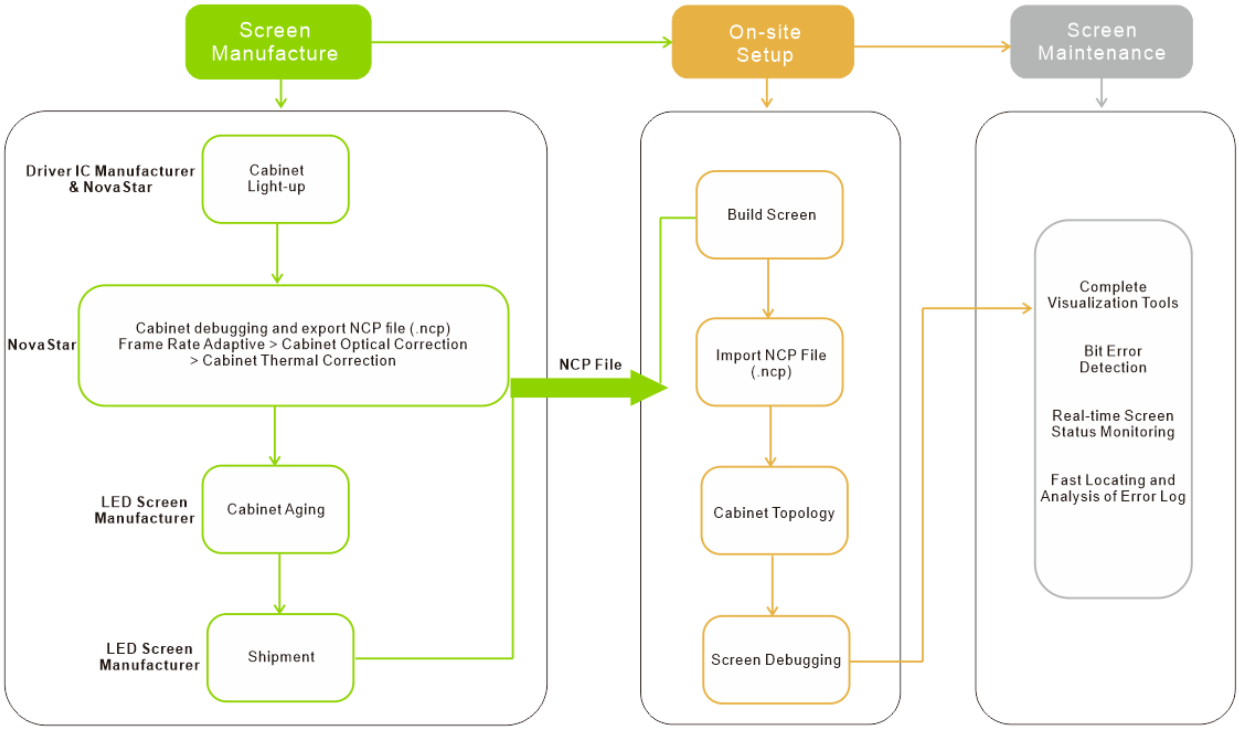
- 1G: a single port loads 659,722 pixels (8bit@60Hz).
- 5G: a single port loads 2,592,000 pixels (8bit@60Hz).

1.2 LED Screen with COEX

The COEX control system solution can cover the entire process from screen manufacture to installation of the screen, and the following illustrates the support provided by COEX in each stage.

- Use the Cabinet Tool to complete the debugging process and generate an NCP file before the screen leaves the factory.
- During the on-site screen configuration, import the NCP file into VMP to configure the screen and adjust the display effects.
- Monitor the display status via VMP when the screen is up and running.

Figure 1-3 Build and manage LED screen with COEX



Note

To fully use the functionalities of the NovaStar COEX control system, contact NovaStar technical engineers before the screen leaves the factory to complete the debugging process and generate a cabinet library file (.ncp). The debugging process includes driver IC light-up test, frame rate adaptive configuration, cabinet optical correction (image booster), and cabinet thermal correction (thermal compensation).

1.3 COEX Solution Build

Based on different LED controllers, the COEX Solution supports different receiving cards, which are listed below:

Table 1-2 COEX system build

Solution	Control Software	LED Controller	Receiving Card	Manage Screen With
1G solution	VMP	MX40 Pro, MX30, KU20	Armor series receiving card such as A10s Pro, A10 Plus-N, A8s-N, A7s Plus, A5s Plus	A10s Pro: Only cabinet library file (.ncp) is supported. Other Armor series receiving cards: both cabinet library file (.ncp) and cabinet configuration file (.rcfgx) are supported.
5G solution	VMP	CX80 Pro, CX40 Pro	CA50E, CA50C, XA50	Only cabinet library file (.ncp) is supported.

Note

For COEX system, users can only import cabinet library files (.ncp) and cabinet configuration files (.rcfgx) to VMP. The files cannot be edited.

- Should you need to edit the cabinet library file (.ncp), please contact your LED screen manufacturer and NovaStar technical engineers will make the changes in Cabinet Tool.
- Should you need to edit the cabinet configuration file (.rcfgx), please connect to a non-COEX control system and make the changes in NovaLCT.

2 NCP File Introduction

2.1 About NCP File

Background

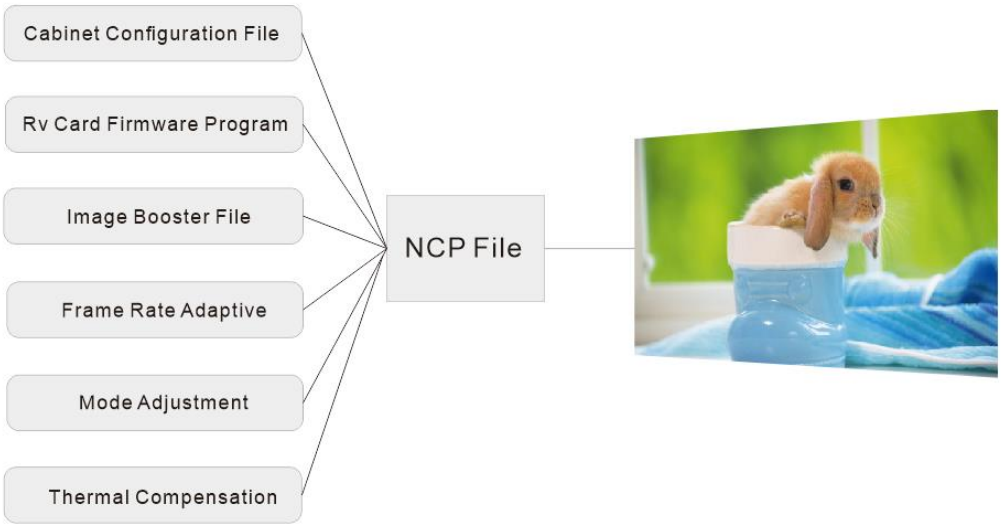
In the past, to ensure the normal function of the screen, it was common practice to use a cabinet configuration file (.rcfgx) to light up the display, use an image quality file (.nrf/.vglcx) to improve the display effect, and use firmware program (.zip) to update the screen functionalities. Moreover, all these files need to be coordinated so they comply with each other. This can be somewhat cumbersome for the on-site staff as how to obtain these files and how to properly store them would not be an easy task. However, now with the brand new COEX control system, users can complete the entire cabinet debugging process with a single NCP file.

Introduction

Six in one, the NCP file combines the cabinet configuration file, receiving card firmware program, image booster (cabinet optical correction), frame rate adaptive parameters, mode adjustment parameters, and thermal compensation (cabinet thermal correction) into one file. By uploading the NCP file from a computer or pre-loading the file in the control system, users can utilize the NCP file at any time to light up the screen with a few clicks and achieve optimal display effects.

To generate the NCP file from the Cabinet Tool, please contact NovaStar technical engineers before the screen leaves the factory.

Figure 2-1 NCP file content



2.2 NCP Features

Compared to the old-fashioned cabinet configuration file (.rcfgx), the cabinet library file (.ncp) enables users to light up the screen with just a few clicks. On top of that, the display effect configurations stored in the file are made by NovaStar technical engineers to ensure better display effects.

Table 2-1 Comparison between (.ncp) file and (.rcfgx) file

Comparison	Cabinet Configuration File (.rcfgx)	Cabinet Library File (.ncp)
Content	Only includes cabinet configuration	Includes the cabinet configuration file, receiving card firmware program, image booster (cabinet optical correction), frame rate adaptive parameters, mode adjustment parameters, and thermal compensation (cabinet thermal correction).
Functionality	Only for lighting up the screen	On top of lighting up the screen, it also comes with functions such as image booster, frame rate adaptive, mode adjustment, and thermal compensation.
Generated by	LED screen manufacturer or NovaStar	NovaStar technical support engineers

Comparison	Cabinet Configuration File (.rcfgx)	Cabinet Library File (.ncp)
	technical support engineers	
How to obtain	LED screen manufacturer	LED screen manufacturer
Generated from	NovaLCT	Cabinet Tool

2.3 NCP File and Receiving Card Compatibility

NCP files can only be used on specific receiving cards. Please refer to 7 Specifications of Receiving Cards Supported by COEX Controllers for the specifications of supported receiving cards.

In addition, to generate the NCP file from the Cabinet Tool, please contact NovaStar technical engineers before the screen leaves the factory.

Table 2-2 List of supported receiving cards

Solution	Supported receiving cards
1G solution	Armor series receiving card such as A10s Pro, A10 Plus-N, A8s-N, A7s Plus, A5s Plus
5G solution	CA50E, CA50C, XA50

2.4 NCP File and Driver IC Compatibility

NCP files can only be generated for supported module driver ICs. When the end user switches to the COEX control system, or when the LED screen manufacturer designs a new cabinet, to use the NCP file, it is recommended to first check whether the driver IC is supported and then submit a request to NovaStar technical support engineers.

- If the driver IC is supported, NovaStar technical support engineers will perform the debugging process and generate an NCP file as soon as possible.
- If the driver IC is not supported, NovaStar technical support engineers will escalate the request to NovaStar dev team. Once the dev team is finished and the driver IC is supported, support engineers will then complete the debugging process and generate an NCP file.

2.4.1 Supported Driver ICs

NCP files can only be used on specific driver ICs and the frame rate adaptive function is only supported by some driver ICs. Supported driver ICs are listed in Table 2-3.

Table 2-3 List of supported driver ICs

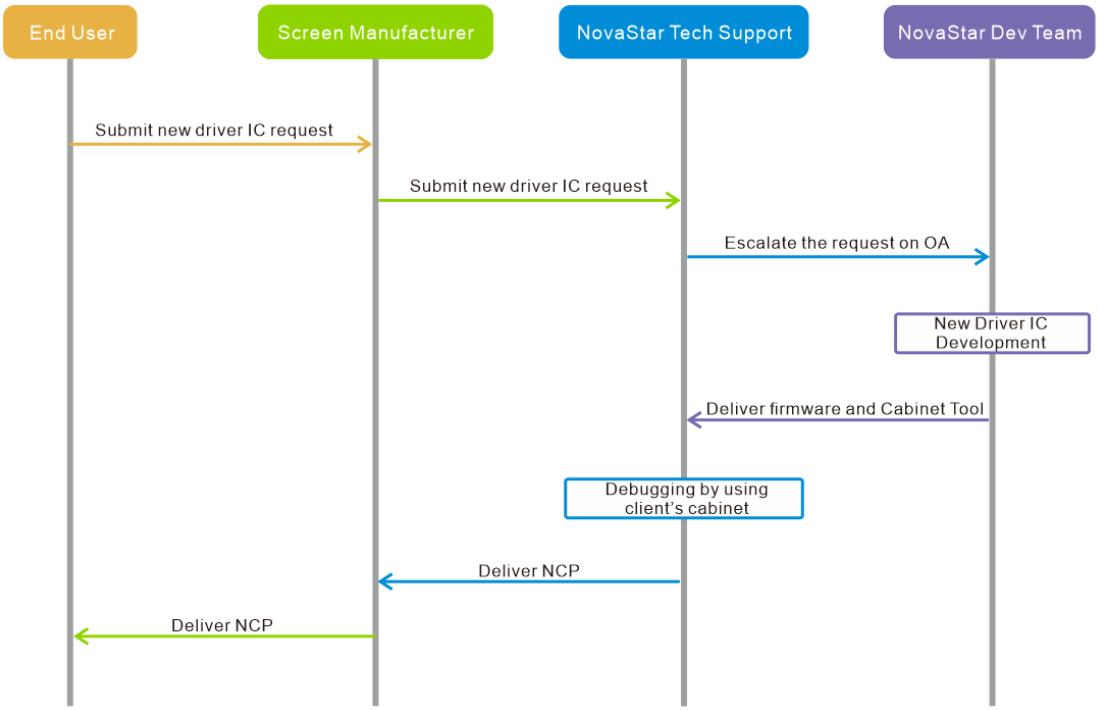
Solution	Supported Driver ICs	
1G solution	Supports frame rate adaptive	ICND2055, ICND2065, ICND2069, MBI5253A, MBI5253B, MBI5754B, MBI5264, CFD555
	Does not support frame rate adaptive	ICND2053P, ICND2153, ICND2153P, ICND2055S, ICND3065 MBI5051B, MBI5153, MBI5251, MBI5252, MBI5252B, MBI5353B, MBI5754B, MBI5759 XM10480, XM11202G, SM16259, SM16389, SM16389SF, MY9748, MY9758 SCL8081, DP3264, NT27002S, TBS3268
5G solution	Supports frame rate adaptive	ICND2055, ICND2065, ICND2069, MBI5264
	Does not support frame rate adaptive	MBI5759, MBI5850, MY9748, MY9758, XM11202, XM11480

2.4.2 New Driver IC Support Request

When the user needs an NCP file but the driver IC is not supported, they can submit a request to NovaStar technical support engineers to seek support for the new driver IC.

The procedure of the driver IC support request is illustrated in Figure 2-2. Based on the user's requirements, such as whether to support frame rate adaptive, NovaStar dev team will evaluate the development time and work out an agreeable timeline.

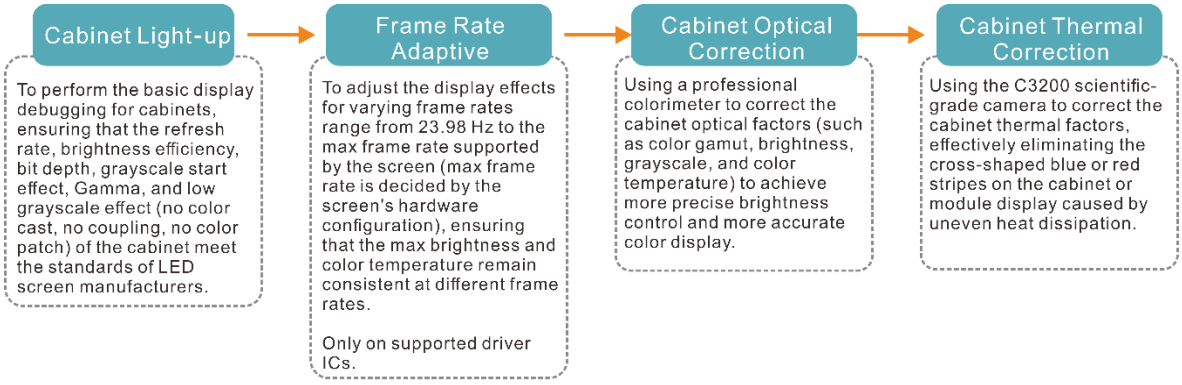
Figure 2-2 New Driver IC Support Request



3 NCP File Key Configuration

The Cabinet Tool is used to configure and generate NCP files. The key configurations of an NCP file include cabinet light-up, frame rate adaptive, cabinet optical correction, and cabinet thermal correction. Among them, cabinet light-up is a required configuration, and cabinet optical correction is another required configuration for receiving cards that support the image booster.

Figure 3-1 NCP File Key Configuration



3.1 Cabinet Light-up

Overview

To perform the basic display debugging for cabinets, ensuring that the refresh rate, brightness efficiency, bit depth, grayscale start effect, Gamma, and low grayscale effect (no color cast, no coupling, no color patch) of the cabinet meet the standards of LED screen manufacturers.

Cabinet light-up requires the cooperation of NovaStar technical support engineers and driver IC manufacturers.

Prerequisites

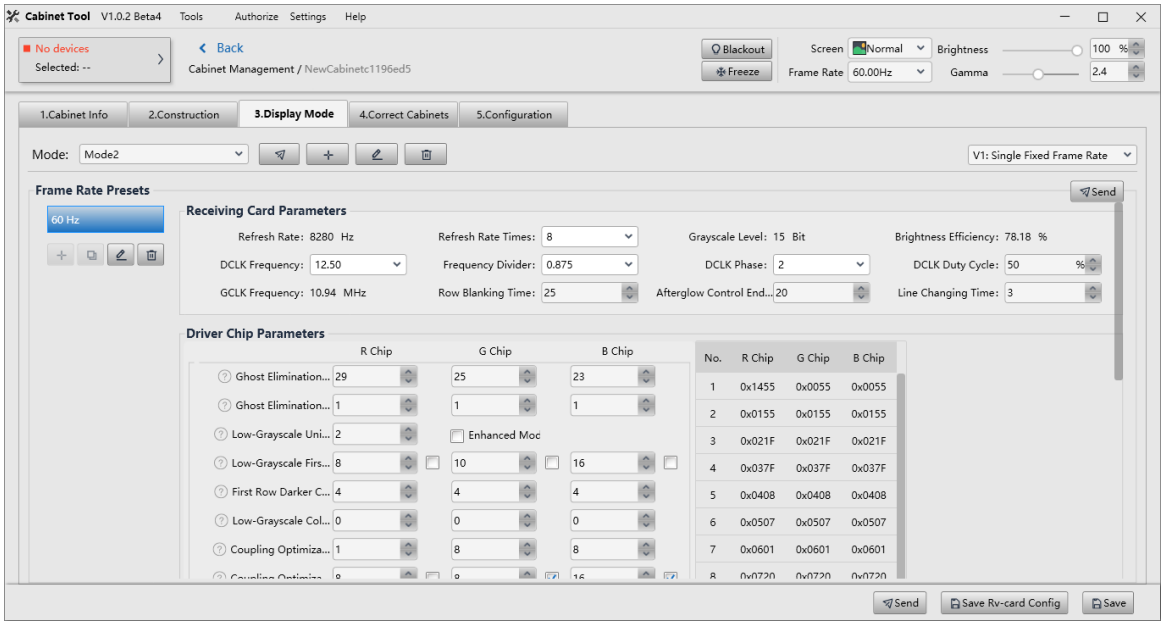
Obtain the cabinet specifications from the LED screen manufacturer (must include the max frame rate of the cabinet).

How to Configure

On the homepage of the Cabinet Tool, click **Cabinet** to display the **Cabinet Files** screen.

Click **Add Cabinet** and then complete the configurations under the **1. Cabinet Info**, **2. Construction**, and **3. Display Mode** tabs.

Figure 3-2 Display mode



3.2 Frame Rate Adaptive

Overview

To adjust the display effects for varying frame rates range from 23.98 Hz to the max frame rate supported by the screen (max frame rate is decided by the screen's hardware configuration), ensuring that the max brightness and color temperature remain consistent at different frame rates. It is suitable for scenarios that need to change the frame rate, such as using different types of video sources with different frame rates, and achieving perfect playback of high frame rate videos.

Figure 3-3 Frame Rate Adaptive



Prerequisites

- The receiving card supports frame rate adaptive.

  Currently all 5G receiving cards support frame rate adaptive. As for 1G receiving cards, only A10s Pro supports this feature.
- The driver IC supports frame rate adaptive.

  Frame rate adaptive is supported on the following driver ICs:

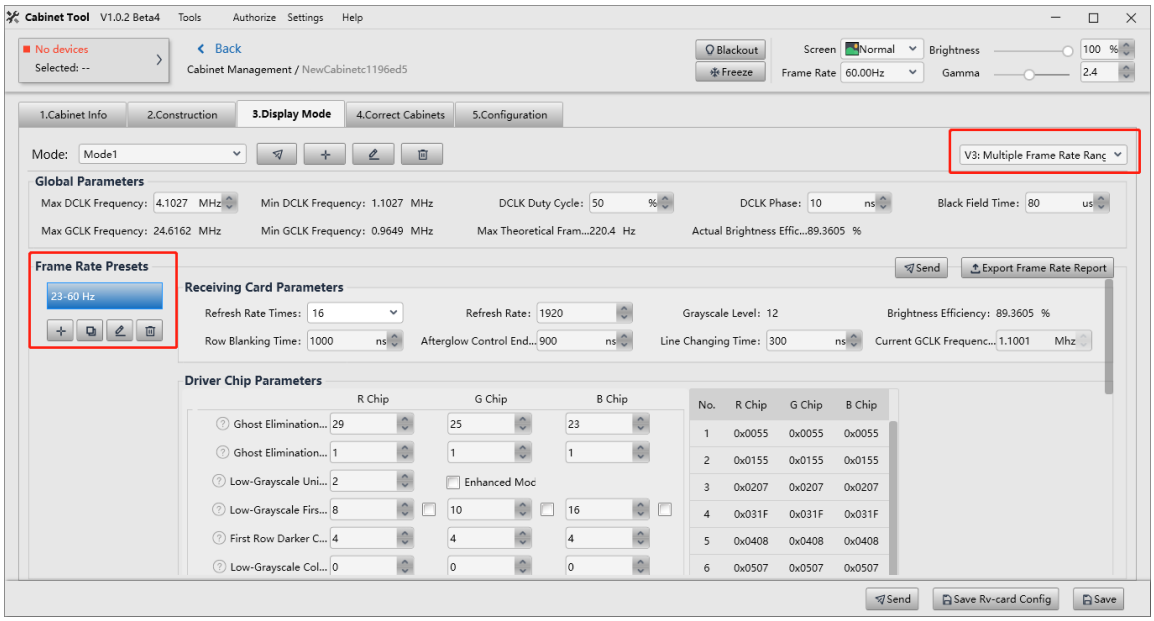
  - COEX 1G solution: ICND2065, ICND2055, MBI5253A, MBI5253B, MBI5754B, MBI5264, CFD555.
  - COEX 5G solution: ICND2065, ICND2055, ICND2076, MBI5264, XM11202, XM11480.

  More driver ICs will be supported for frame rate adaptive in the future. If you have any questions, please contact NovaStar.
- Perform display debugging to ensure that the basic display effects of the screen meet the standard.

How to Configure

Users can add, copy, edit, or delete frame rate, and export Frame Rate Report from the left side of the **3. Display Mode** tab under the **Frame Rate Presets** section.

Figure 3-4 Frame rate adaptive parameters



Note

Flickering may occur when the selected frame rate exceeds the maximum supported by the screen.

For example, if the maximum frame rate is 196 Hz and a frame rate of 240 Hz is selected, flickering will occur since it exceeds the screen's hardware capability.

3.3 Cabinet Optical Correction

Overview

Using a professional colorimeter to correct the cabinet's optical factors (such as color gamut, brightness, grayscale, and color temperature) to achieve precise brightness control and accurate color display.

When adjusting the effect parameters, it includes the color management, precise grayscale, and 22bit+ functions of the image booster:

- Color Management

  With the help of NovaStar's unique color management algorithm, the image booster will realign the LED screen's color gamut to approximate the standard color gamut of BT.709, BT.2020, and DCI-P3, and eventually, the color gamut is adjusted to be consistent with the video source, eliminating color deviation and reproducing natural colors.

Figure 3-5 Before and after color management

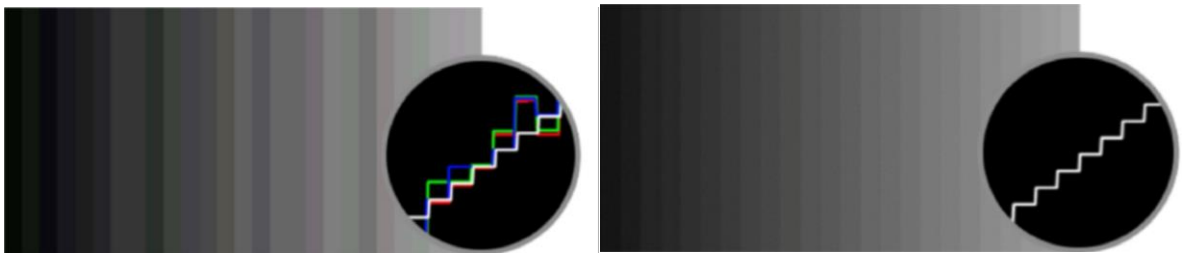


- Precise Grayscale

  With the help of professional optical instruments, individually correct the 65,536 levels of grayscale of the driver IC to fix the display problems at low grayscale conditions, such as brightness spikes, brightness dips, color cast

and mottling. This will achieve pinpoint accuracy in grayscale control, allowing for a significant improvement in the quality of LED display images.

Figure 3-6 Before and after precise grayscale adjustment



- 22bit+

  Harnessing the power of image quality algorithms, the bit depth of low shades of grayscales on the screen is elevated, resulting in an incredible 64-fold surge in dynamic contrast. This process effectively addresses common issues such as grayscale loss and contour lines that arise in case of insufficient grayscale on the screen, allowing for richer grayscale shading and intricate detail presentation for on-screen images.

Figure 3-7 Before and after 22bit+ is enabled



Prerequisites

For auto or custom collection, a CA410-VP427, CA410-VP427, or CA410-P427H (when brightness is over 3,000 nits) colorimeter must be connected to the Cabinet Tool.

How to Configure

Navigate to the **4. Correct Cabinets** tab and select a mode and frame rate (the debugging process is normally conducted at 60 Hz, 120 Hz, and 240 Hz). Then, fill in the settings for synchronization, collection method, and collection indicators.

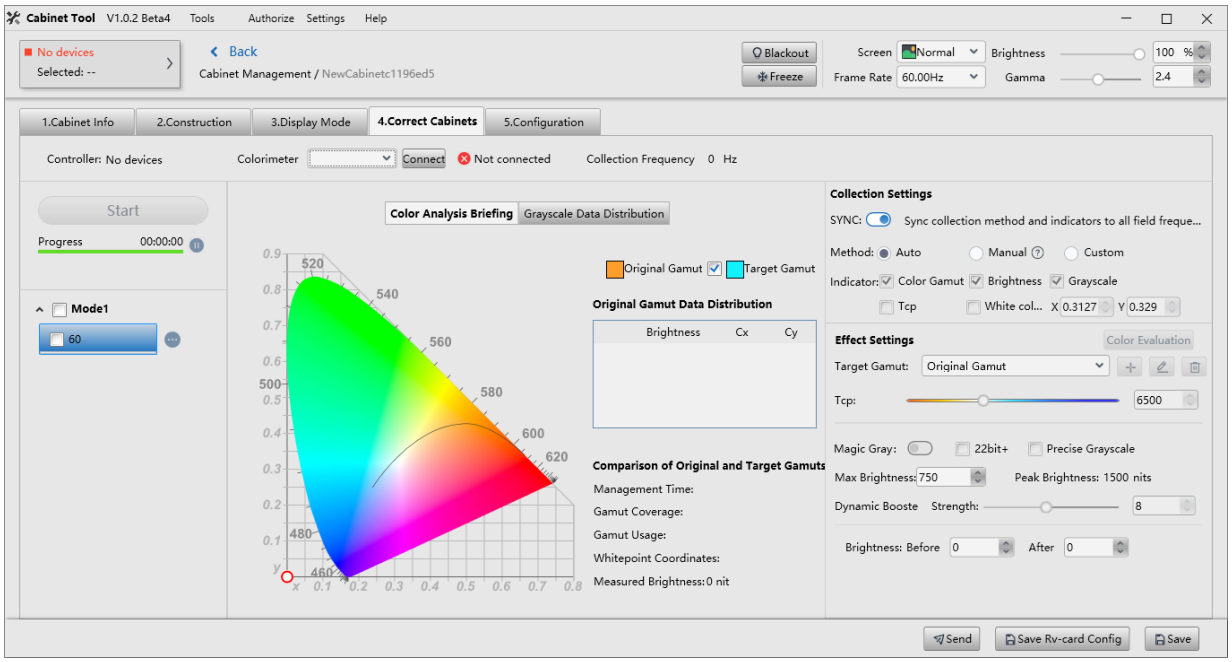
- When auto or custom collection is selected, the colorimeter will automatically collect screen data after clicking **Start**.
- When manual collection is selected, users can measure and fill in the screen data manually.

Once the screen data collection is completed, users can adjust the parameters and view the display effects under the **Effect Settings** section.

Note

If you already have an image quality file (.nrf/.vglcx), you can simply import it and then adjust the parameters.

Figure 3-8 Correct Cabinets



3.4 Cabinet Thermal Correction

Overview

Using the C3200 scientific-grade camera to correct the cabinet thermal factors, effectively eliminates the cross-shaped blue or red stripes on the cabinet or module display caused by uneven heat dissipation.

Figure 3-9 Before and after thermal compensation



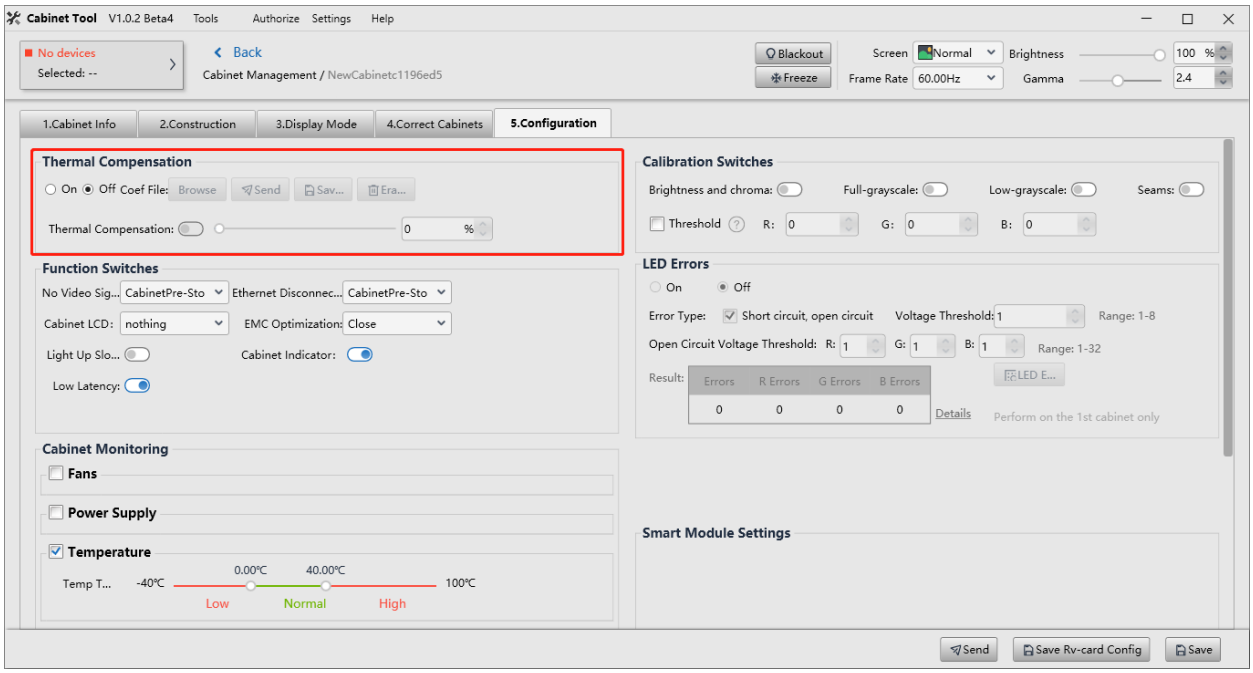
Prerequisites

Performing the thermal factor collection with the help of NovaStar high-precision calibration system and C3200 scientific-grade camera and generating a thermal coefficients file.

How to Configure

Navigate to the **5. Configuration** tab, select **On**, click **Browse,** and select a coefficient file on the pop-up window. Then, click **Send** and **Save Rv-card Config** and adjust the strength of thermal compensation.

Figure 3-10 Configuration

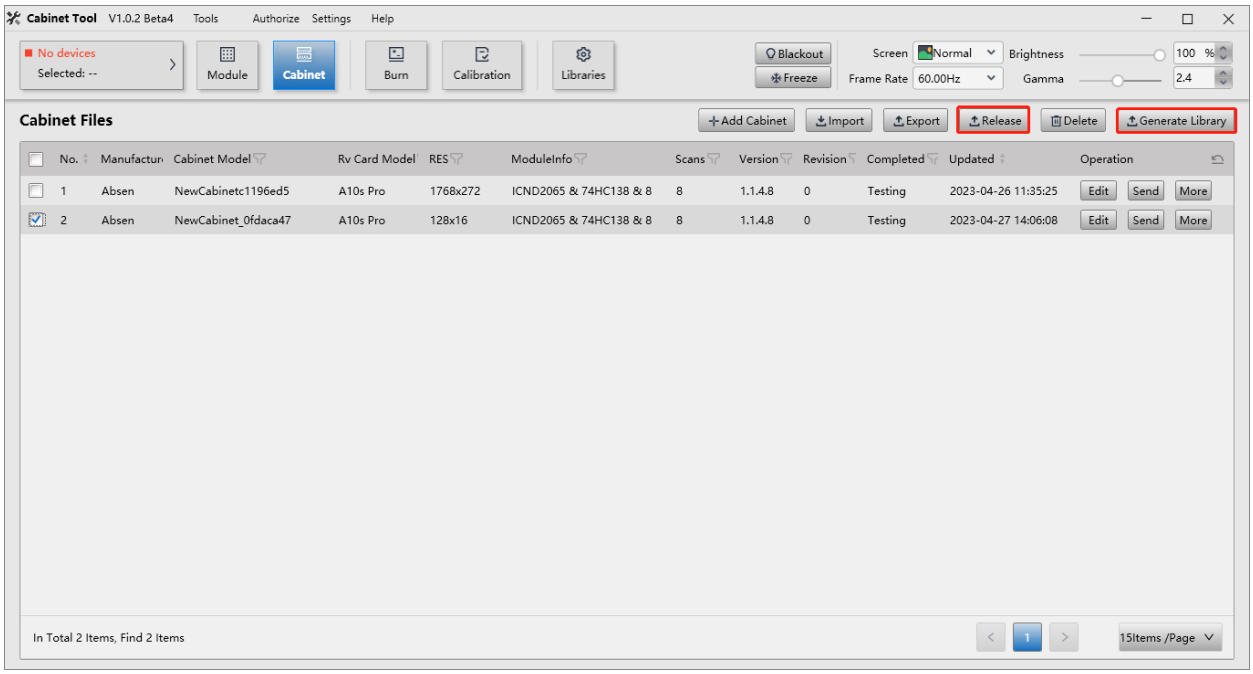


3.5 Generate NCP file

On the **Cabinet Files** screen, click **Release** to start the cabinet file releasing process. Verify the file version and status and click **Generate Library**.

The generated NCP file will be delivered to the LED screen manufacturer by NovaStar technical support engineers and then delivered to end users.

Figure 3-11 Generate NCP file



4 NCP File Quality Assurance

Once an NCP file is generated, both NovaStar and the LED screen manufacturer will conduct quality assurance to ensure the NCP file can drive the cabinet properly and achieve optimal display.

Figure 4-1 QA process



- NovaStar Quality Assurance

  NovaStar will conduct quality assurance on the NCP file. For example, the xR virtual shooting QA checklist is listed in Table 4-1. NovaStar will deliver the NCP file to the LED screen manufacturer once it passes the QA process.

- LED Screen Manufacturer Quality Assurance

  The LED screen manufacturer will conduct quality assurance based on the application scenario of the cabinet.

- On-site Quality Assurance

  The end-user may also conduct on-site quality assurance on the NCP file.

Table 4-1 QA checklist

Test Type	Test Item
Single cabinet test	Basic tests (such as cabinet information, brightness, refresh rate, max frame rate, and low latency)
	Image booster
	Grayscale curve
	Adjust mode
	HDR-PQ curve
	Frame rate adaptive (100% brightness)
	Frame rate adaptive (10% brightness)
	Camera shooting test
	Stability test
Small screen test (minimum cabinet size of 3×3)	Upload NCP file for the entire screen
	Thermal compensation
	Full-grayscale calibration
	Camera shooting test
Big screen test	Upload NCP file for the entire screen
	Calibration coefficient management
	Stability test

5 How to Apply NCP File

NCP files can be applied both on VMP and Cabinet Tool. It is recommended to use VMP. The supported actions are listed in Table 5-1.

Table 5-1 Supported actions

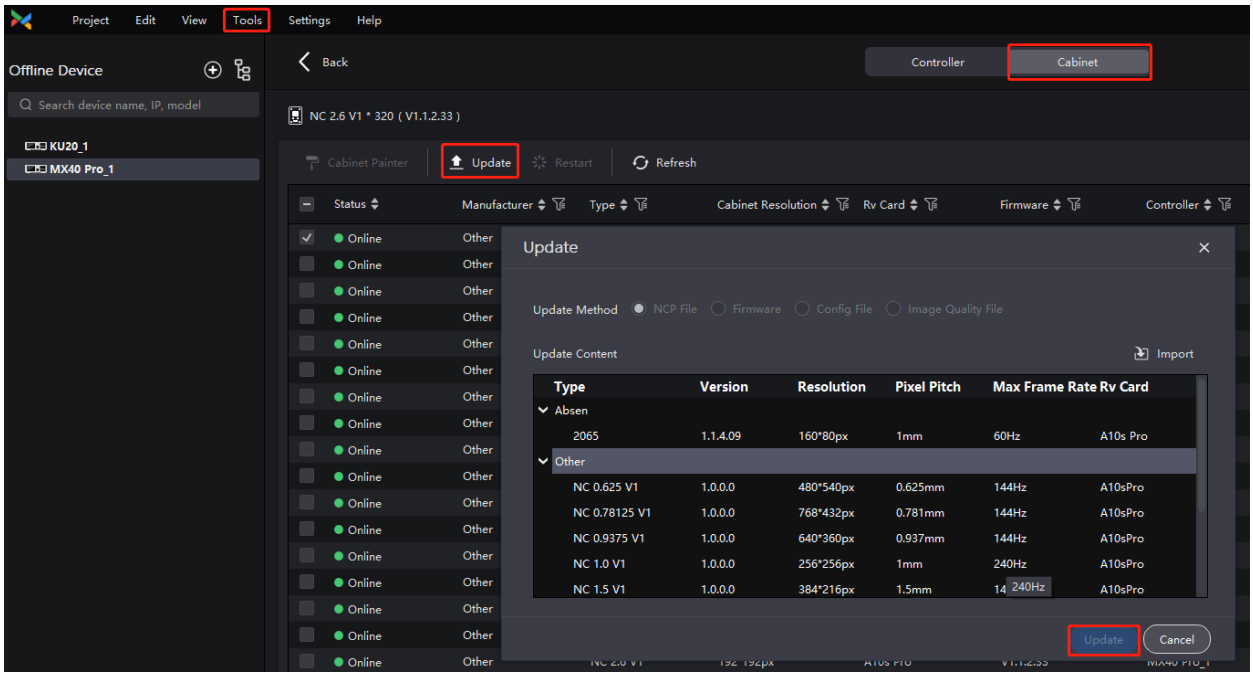
NCP Actions	Description	Supported actions	
		VMP (V1.2.1 and later)	Cabinet Tool (V1.0.2 and later)
Edit	Edit NCP file content.		√
Generate	Generate NCP file.		√
Import	Import NCP file into the software.	√	√
Export	Export NCP file from the software.	√	
Sync	Sync NCP file between the device and the local computer, or sync NCP file between devices.	√	
View	View the cabinet information of an NCP file.	√	
Update	Update the configuration file and firmware program contained in the NCP file to the receiving card.	√	√

5.1 VMP Actions

5.1.1 Import and Update NCP File

Open VMP and select **Tools** > **Maintain** from the toolbar. Under the **Cabinet** tab, select the cabinet that needs to be updated, click **Update**, and then import and update the NCP file on the pop-up window.

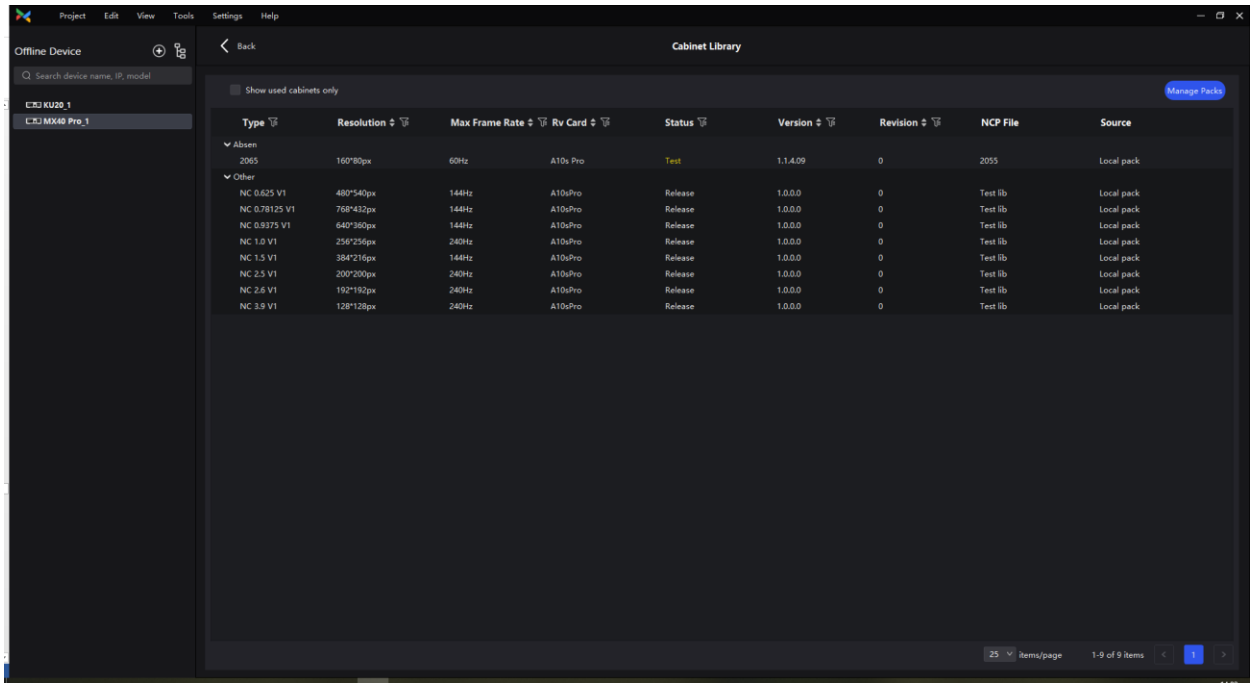
Figure 5-2 Import and Update NCP File



5.1.2 Manage NCP File

Open VMP and select **Settings** > **Cabinet Library** from the toolbar. Then, click **Manage Packs** to manage cabinet library files.

Figure 5-3 Cabinet Library

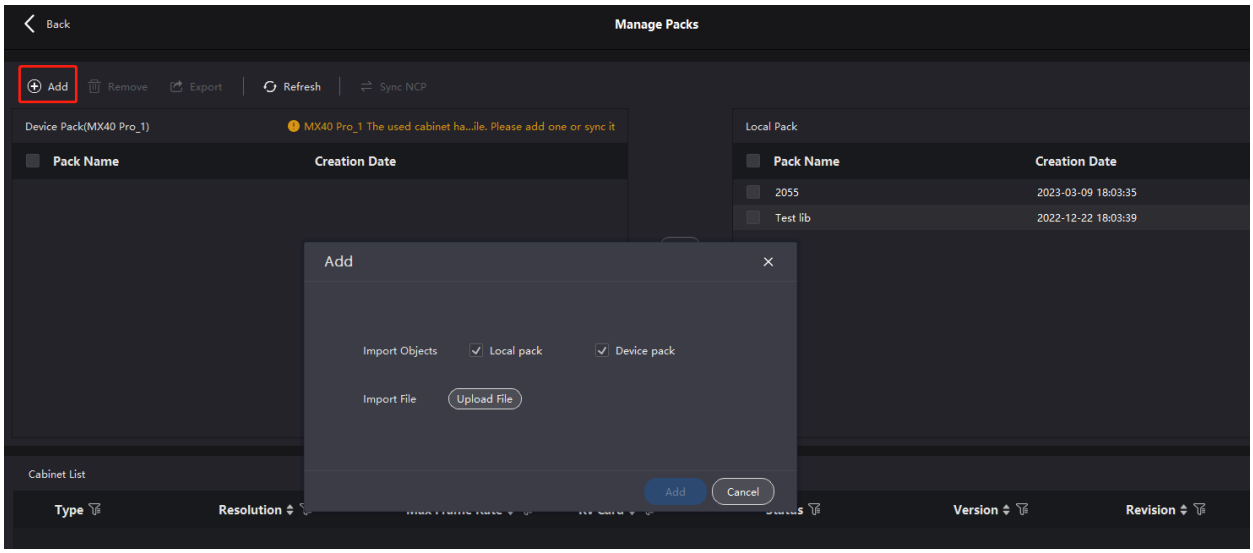


Import NCP File

Click **Add** and then click **Upload File** on the pop-up window to import one or more files. Finally, click the **Add** button on the pop-up window to finish importing the selected NCP file.

- When **Local pack** is selected, the imported NCP file will be saved under the VMP installation directory.
- When **Device pack** is selected, the imported NCP file will be saved in the LED controller's storage space.

Figure 5-4 Import NCP File



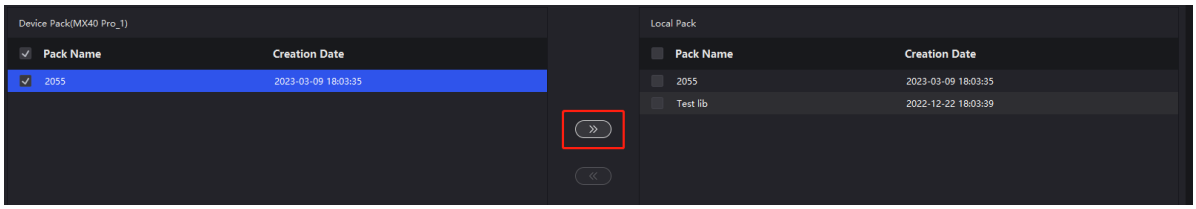
Export NCP File

Select one or more files on the **Manage Packs** screen and then click **Export**. When exporting multiple files at once, they will be packaged into a compressed file (.zip).

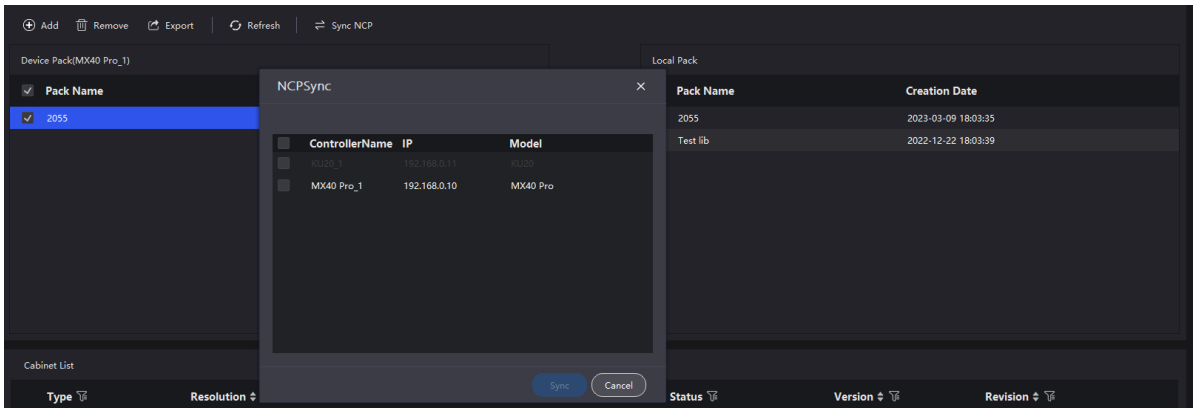
Sync NCP File

- Sync between the device and the local computer

  Select one or more files to be synced on the **Manage Packs** screen and then click .

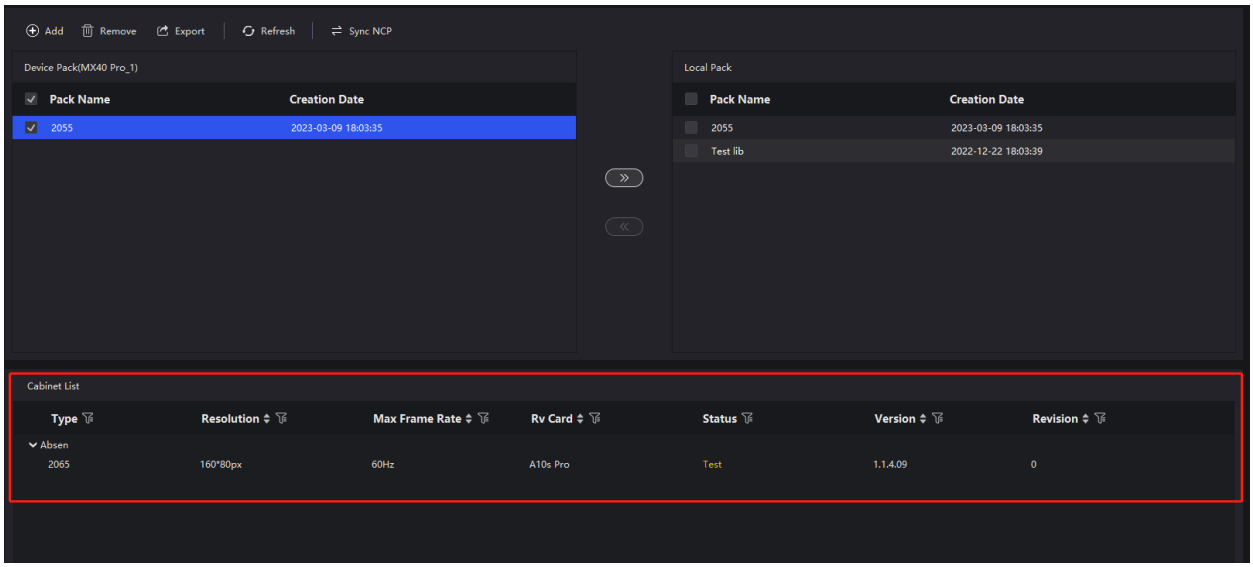


- Sync between devices
  a. Select one or more files to be synced on the **Manage Packs** screen and then click **Sync NCP**.
  b. Select one or more devices you want to sync the files.
  c. Click **Sync.**



View NCP File Information

Select an NCP file, and you can view the cabinet information such as cabinet model, resolution, max frame rate, receiving card model, status, version, and revision under the **Cabinet List** section.

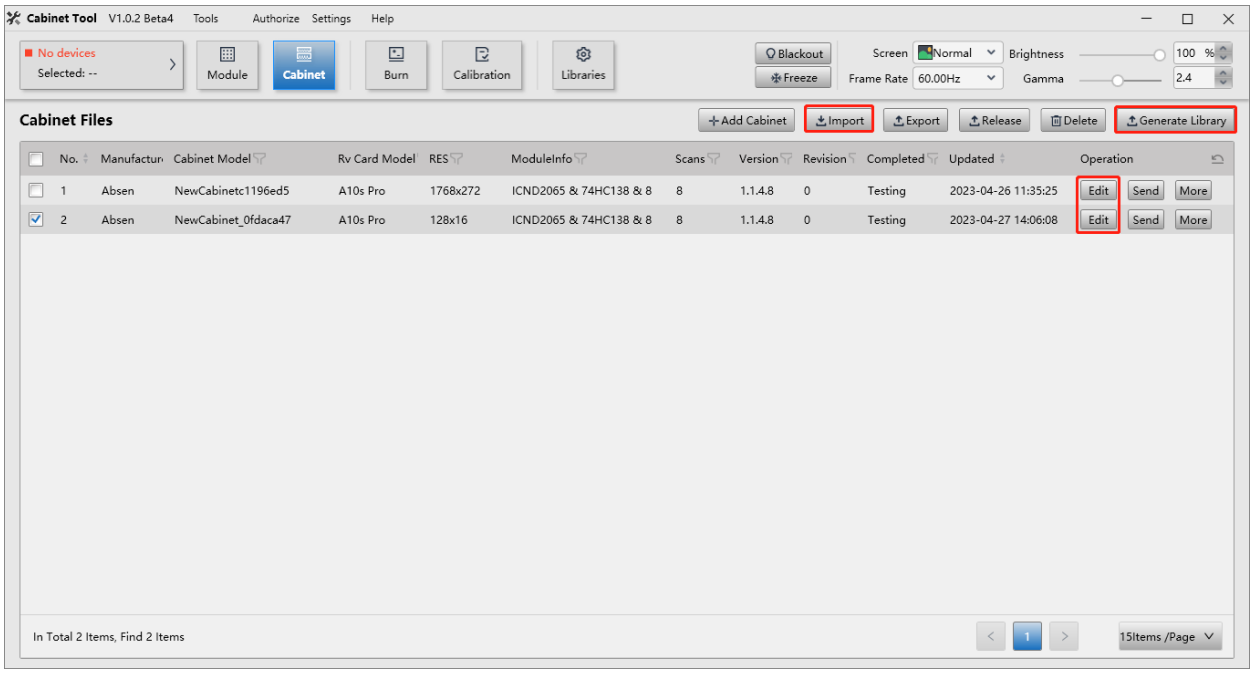


5.2 Cabinet Tool Actions

Edit, Generate, and Import NCP File

To import, edit, or generate NCP files, click **Cabinet** on the homepage of the Cabinet Tool to navigate to the **Cabinet Files** screen.

Figure 5-5 Edit, Generate, and Import NCP File



Note

The **Export** button on the **Cabinet Files** screen is to export project files (.project). It cannot be used to export NCP files.

Use NCP File to Update Cabinet

On the homepage of the Cabinet Tool, click **Burn**. On the **Single Burn** and **Batch Burn** screens, use the NCP file to update the cabinet.

Figure 5-6 Single Burn

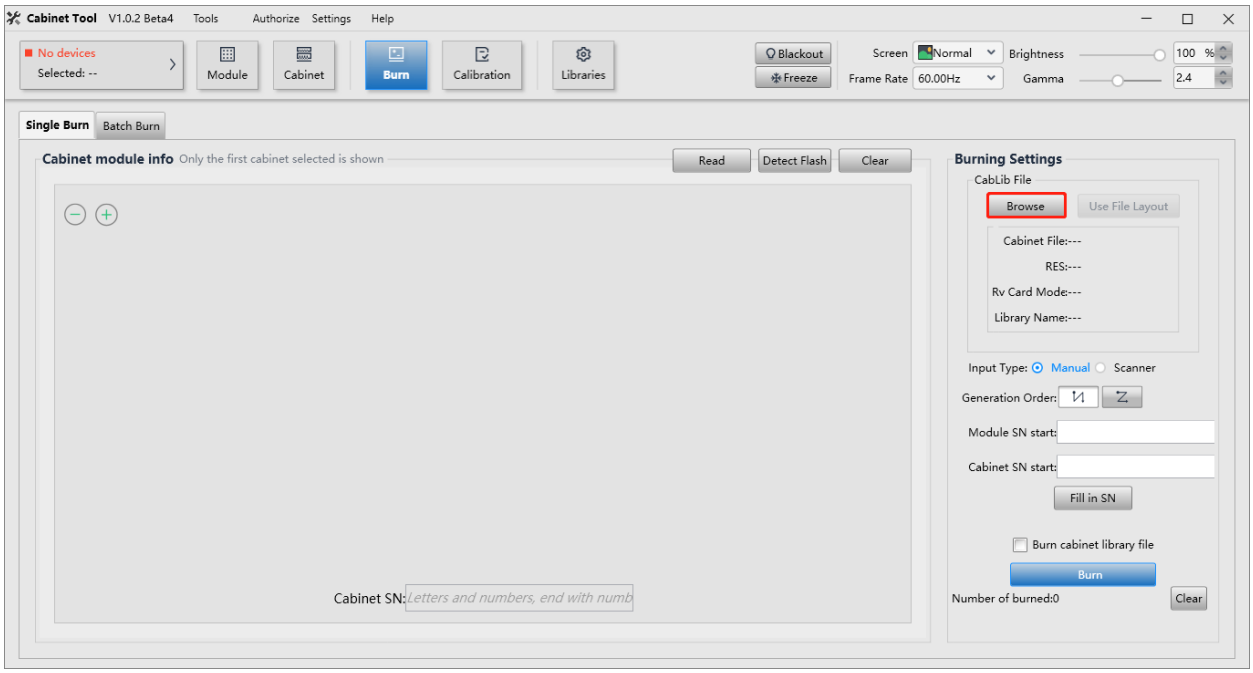
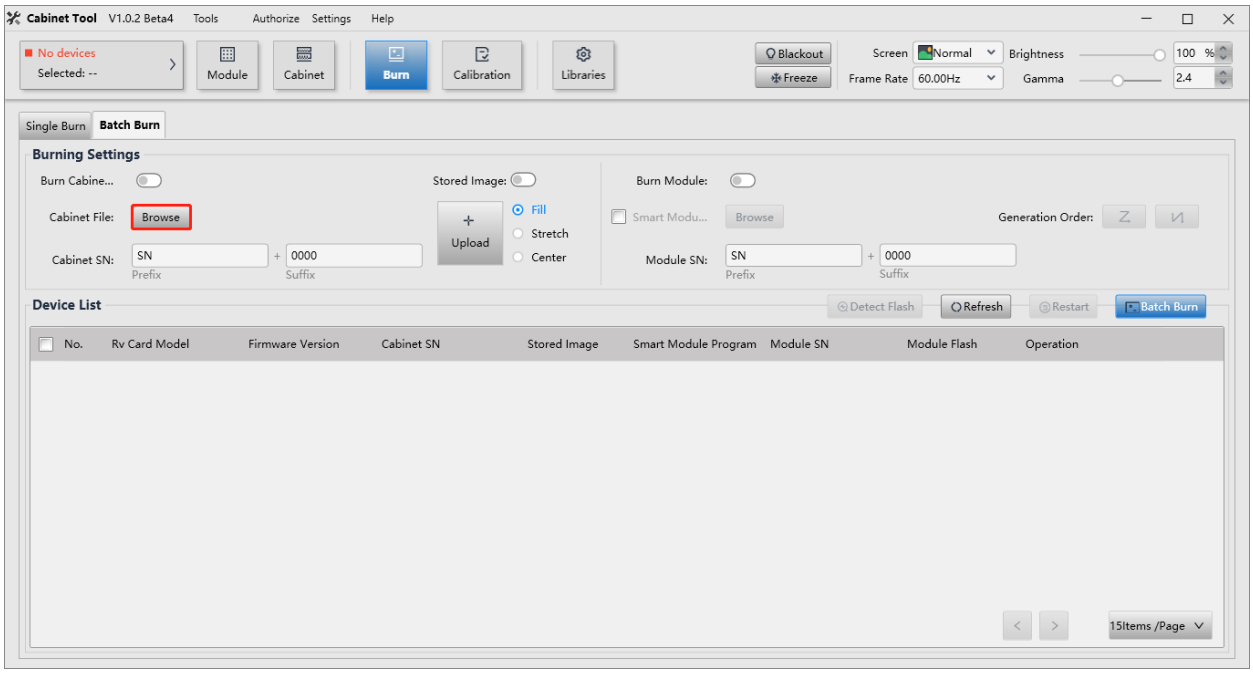


Figure 5-7 Batch Burn



6 FAQ

6.1 Switching to COEX System

6.1.1 Can I keep using my current screen after switching to a COEX controller?

You can switch to a COEX controller and keep using your current screen.

If you experience a display issue after the switch, you may follow the instructions listed below depending on whether you have an NCP file:

- I have an NCP file
  - Import NCP file: Select **Tools** > **Maintain** from the VMP toolbar and then import the NCP file on the **Cabinet** screen.
  - Edit NCP file: If the current NCP file does not meet your requirements, please contact your LED screen manufacturer and NovaStar technical support engineers will modify and provide an updated NCP file.
- I don't have an NCP file
  - Import .rcfgx file: Select **Tools** > **Maintain** from the VMP toolbar and then import the .rcfgx file on the **Cabinet** screen.
  - Edit .rcfgx file: If the current .rcfgx file does not meet your requirements, please switch back to your previous controller and modify the file using NovaLCT. Unfortunately, VMP does not support modifications to .rcfgx file.
  - Obtain an NCP file: If you'd like to use the frame rate adaptive (only on supported driver ICs), image booster, or thermal compensation, please contact your LED screen manufacturer and NovaStar technical support engineers will provide an NCP file based on your requirements.

If the screen is experiencing abnormal calibration effects after the switch, you may follow the instructions listed below depending on whether there are calibration coefficients in the receiving card flash:

- There are calibration coefficients in the receiving card flash

  You may read back the coefficients using VMP and apply them to the active screen.
- There are no calibration coefficients in the receiving card flash

  You may recalibrate the screen with the help of NovaStar high-precision calibration system and C3200 scientific-grade camera. After that, you can upload, save, adjust, and read the coefficients on the **Coefficient Management** screen of VMP.

6.1.2 Can I keep using my current screen after switching to the A10s Pro receiving card?

You can switch to the A10s Pro receiving card and keep using your current screen. You will gain access to many functions such as dynamic booster, full-grayscale calibration, shutter fit, thermal compensation, frame rate adaptive, adjust mode, and 90° image rotation after the switch.

If you experience a display issue, you may follow the instructions listed below depending on whether your controller is a COEX controller:

- Non-COEX Controller
  - If you have an .rcfgx file for the cabinet, you may import the .rcfgx file using NovaLCT to update the cabinet.
  - If you have an NCP file, please refer to the following instructions. NCP file contains configurations for frame rate adaptive (only on supported driver ICs), image booster, and thermal compensation to enable the screen to deliver more satisfying display effects.

    Method 1: Select **Tools** > **More** > **Send NCP** from the NovaLCT toolbar to update the cabinet. The cabinet light-up and frame rate adaptive configurations will take effect after this. For mode adjustment, image booster, and thermal compensation, please connect to a COEX controller and enable these functions on the **Screen Settings** of VMP under the **Image Quality** tab.

    Method 2: Connect to a COEX controller and select **Tools** > **Maintain** from the VMP toolbar and then import the NCP file on the **Cabinet** screen.
- COEX Controller

  You may import the .rcfgx file using VMP to update the cabinet. But VMP does not support modifications to the .rcfgx file. For better display effects and more efficient configuration file management, please contact your LED screen manufacturer and have NovaStar technical support engineers provide an NCP file.

- Import NCP file: Select **Tools** > **Maintain** from the VMP toolbar and then import the NCP file on the **Cabinet** screen.
- Edit NCP file: If the current NCP file does not meet your requirements, please contact your LED screen manufacturer, and NovaStar technical support engineers will modify and provide an updated NCP file.

6.1.3 Can I use NovaLCT to send NCP files to receiving cards?

You can use NovaLCT to send NCP files to receiving cards of all models.

The operations are as follows: To send the NCP file and update the cabinet, you may select **Tools** > **More** > **Send NCP** from the NovaLCT toolbar.

If you frequently use both a COEX controller and a non-COEX controller, it is recommended to contact your LED screen manufacturer for an NCP file. You can send NCP files both on NovaLCT and VMP, greatly reducing the hassles of managing configuration files.

Once you have sent the NCP file using NovaLCT, the Armor series receiving cards will support the following functions:

- A10s Pro

  Cabinet light-up and frame rate adaptive configurations will take effect. For mode adjustment, image booster, and thermal compensation, please connect to a COEX controller and enable these functions on the **Screen Settings** of VMP under the **Image Quality** tab.

- Receiving cards other than A10s Pro

  Cabinet light-up configurations will take effect. You may also enable the image booster on the **Image Booster** screen of NovaLCT.

6.2 While Using COEX System

6.2.1 What should I do if the cabinet does not come with an NCP file?

If the screen is experiencing an abnormal display, you may follow the instructions listed below depending on the receiving card model.

- Armor Series Receiving Cards
  - Import .rcfgx file: Select **Tools** > **Maintain** from the VMP toolbar and then import the .rcfgx file on the **Cabinet** screen.
  - Edit .rcfgx file: If the current .rcfgx file does not meet your requirements, please connect to a non-COEX controller and modify the file using NovaLCT. Unfortunately, VMP does not support modifications to .rcfgx file.
  - Obtain an NCP file: If you'd like to use the frame rate adaptive (only on supported driver ICs), image booster, or thermal compensation, please contact your LED screen manufacturer and NovaStar technical support engineers will provide an NCP file based on your requirements.
- CA50E Receiving Card

  Please contact your LED screen manufacturer and NovaStar technical support engineers will provide an NCP file based on your requirements.

6.2.2 Can I mix 1G devices with 5G devices?

1G and 5G devices cannot be mixed due to different bandwidths. It is recommended to use 1G controllers with 1G receiving cards and 5G controllers with 5G receiving cards.

7 Specifications of Receiving Cards Supported by COEX Controllers

Table 7-1 Specifications of Receiving Cards Supported by COEX Controllers

Product model	A5s Plus	A7s Plus	A8s-N	A10s Plus-N	A10s Pro	CA50E
Load capacity	512×384	512×512	512×384	512×512	512×512	768×512
Parallel RGB data groups	32	32	32	32	32	32
Serial data groups	64	64	64	64	64	64
Dynamic booster					√	√
Full-grayscale calibration					√	√
18bit+	√	√	√	√	√	√
22bit+			√	√	√	√
Precise grayscale			√	√	√	√
Color management	√	√	√	√	√	√
Shutter fit					√	√
HDR			√	√	√	√
Mapping function	√	√	√	√	√	√
Temperature & voltage monitoring	√	√	√	√	√	√
Bite error detection	√	√	√	√	√	√
Pixel level brightness and chroma calibration	√	√	√	√	√	√
Thermal compensation					√	√
Frame rate adaptive					√	√
Adjust mode					√	√
90° image rotation					√	√

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