



madVR Envy

3D LUT Calibration for Calman

Rev. 4.0

Introduction

Calman Display Calibration Software interfaces directly with the madVR Envy to produce the required test patterns (patches) as Calman measures the display.

Calman controls the Envy as it creates an optimized calibration LUT file. Calman then automatically loads the calibration LUT file into the Envy to apply calibration correction to the display. Envy alters its output signal, according to the LUT data, to correct the display performance to very accurately comply with the selected video standard (e.g. Rec709, DCIP3, Rec2020, etc.).

Calman Required Software Version

- **Please use the latest version of Calman 2020.** Some earlier versions of Calman had a bug that would result in an all-white screen whenever the LUT is enabled. |

Calman Required Workflow

- Color Cube (3D LUT)

madVR Envy Requirements

- Envy Pro or Envy Extreme
- Wired Ethernet connection of the Envy to your local network
- Calman running on a laptop or desktop connected to the same network.
CAUTION: Please be sure to run Calman on a laptop/computer with a WIRED internet connection. Due to a Calman bug, if you use Wifi, there's a good chance your calibration will be interrupted at some point (possibly just before it finishes a long calibration run) and you'll have to restart from scratch. If your laptop doesn't have an Ethernet port, we recommend this adapter or one like it:
<https://www.amazon.com/gp/product/B00BBD7NFU>

Prepare your Display

Follow this procedure to make sure your Display is set up for properly and receiving the type of source content you wish to calibrate for.

Preparing your display for calibration, before connecting Calman

1. Before telling Calman to connect to the Envy and show its patterns, put on a movie for the gamut and frame rate you want to calibrate for and pause it indefinitely (for the duration of your calibration session). For instance, when calibrating for 4K 24 HDR, play a 4K 24 HDR movie and then hit pause. Make sure the pause will last indefinitely and not timeout with a screen saver function etc, so that there is no HDMI resync if the pause function should end (some players pause indefinitely, others you must configure them to do so). Otherwise your calibration may be interrupted.
2. Set the gamma of your display as follows. If you always plan to use the Envy with the 3D LUT enabled, set the gamma in your display to 2.2. As you will see in this guide later, you **MUST** therefore choose a target gamma in Calman of 2.2 as well. This does *not* mean your content will be displayed with a 2.2 gamma! Envy's tone mapping uses a dynamic gamma, so this 2.2 target in the display and in Calman serves only as an important reference that Envy relies on during calibration only for proper accuracy. If, however, there are times you may want to run the Envy with the calibration disabled, then set the Set the gamma of the display to the gamma you'd want it to use in that situation. For example, 2.4. In the end, it does not matter much, because Calman achieve a 2.2 gamma either way. But if you do not intend to use the Envy without a calibration, setting your display's gamma to 2.2 will enable the calibration to achieve the desired gamma without "pushing" the controls as hard.

Display Calibration

Follow this procedure to:

1. Create a display calibration 3D LUT file for a video display that is driven from the Envy and automatically load the 3D LUT file into the Envy.
2. Validate the calibrated display performance.

Open Calman Color Cube workflow

3. Open Calman.
4. Load the *Color Cube* workflow - in the Calman main menu, select “Open Workflow Template,” then select “Color Cube (3D LUT).”

Create Display Calibration 3D LUT

Proceed through each step of the Color Cube workflow in the normal fashion, using the following notes for the Envy specifics.

Initial Setup section

In the *Initial Setup* section of the Color Cube workflow (Figure 1), step through the following pages:

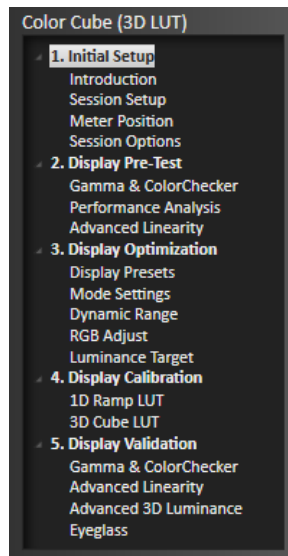


Figure 1. Calman Color Cube (3D LUT) workflow outline.

Session Setup - Meter Connect

1. Connect your color meter to the Calman computer.
2. On the *Session Setup* page, click the *Find Meter* button.
3. If your meter is listed on the *Find Meters* dialog, select it, then click *Search*. If your meter is not listed on the dialog, just click *Search*.
4. Position the meter on the target display.

Session Setup - Source Connect

1. On the Calman *Session Setup* page, click the *Find Source* button.

2. On the *Source* dialog (Figure 2), under *Manufacturer*, select “madVR”.
3. Under *Model*, select “madVR – madVR Test Pattern Generator.”
4. Enter the IP address of the Envy, as obtained from your router software or from the Envy Info Menu.
5. Click *Connect*.

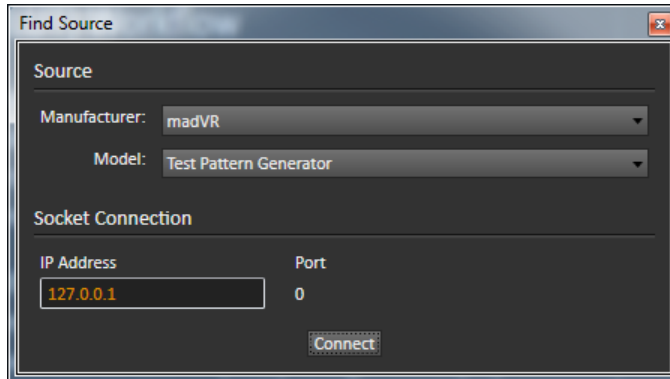


Figure 2. Calman Find Source dialog, for connecting to the Envy.

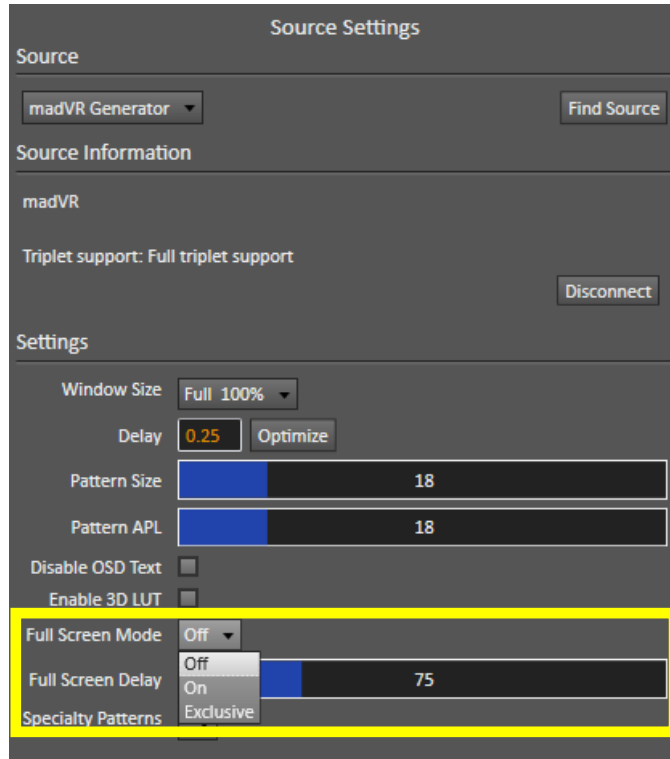


Figure 3. Calman Source Setting tab, for selecting test pattern options.

Session Setup - LUT Device Setup

On the Calman *Session Setup* page, click the *Find 3D LUT Device* button.

1. On the *Find Display* dialog (Figure 4), under *Manufacturer*, select “madVR”.
2. Under *Model*, select “3D LUT Generator.”
3. Enter the same IP address of the Envy used in the prior step when connecting the Envy as a pattern generator.
4. Click *Connect*.

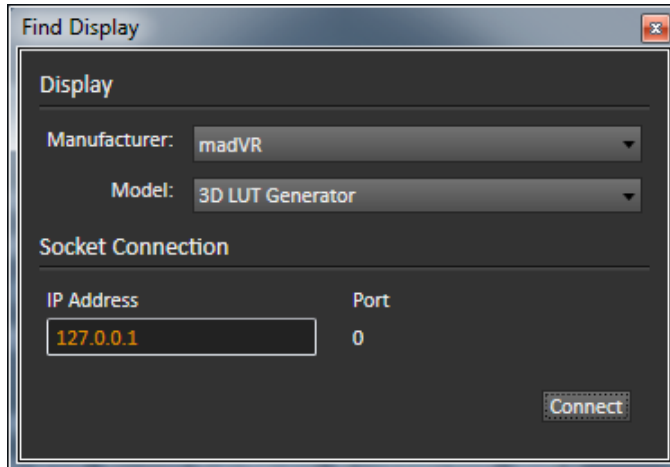


Figure 4. Calman Find Display dialog, for connecting to the Envy for loading 3D LUT.

5. **In some cases, your display could accidentally go into HDR mode when you connect it to the Envy. If you proceed like this, your calibration will be completely invalid.** Therefore, you should check your display’s menu to ensure that its HDR menu is not active after you connect Envy to it through Calman. If it is, find the Calman “HDR” checkbox and it will be unchecked. Click this box so that it is now checked. Then click it one again so that it is back to unchecked. This action should revert your display out of HDR mode – check the display’s menu to confirm it is no longer in HDR. It is good practice to check this HDR status to make sure it is Off, prior to any pre or post measurements.
6. On the Calman Session Setup workflow page, select the Envy gamut memory that you wish to calibrate (Figure 5).

IMPORTANT: *It is recommended that you only pick a gamut that your display can reach. If the native gamut of your display is not wide enough for the target gamut you choose (the native gamut is undersaturated in comparison), the 3D LUT will likely result in posterization, particularly near the edges of the gamut. For example, if the display only reaches DCI-P3 (most projectors fall into this category), do not use a BT2020 LUT. In that case, only create a Rec709 and DCI-P3 3D LUT, and madVR will automatically and flawlessly map BT2020 content to fit the DCI-P3 gamut of your display.*

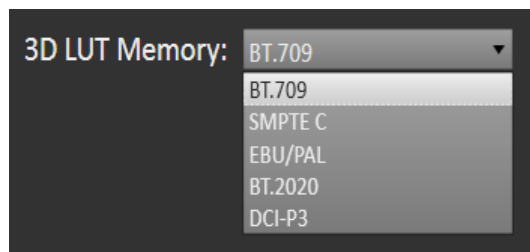


Figure 5. Memory selection on Calman Session Setup page, for selecting which Envy gamut memory to calibrate.

Session Options page

On the Calman Session Options page, select the *Input Signal Levels of PC Levels (0-255)*, regardless of whether you use Video or PC levels, until the Calman LUT engine is updated in the future. Otherwise, if you select Video (16-235), you are likely to notice hard clipping occasionally in some content, especially with bright reds or greens.

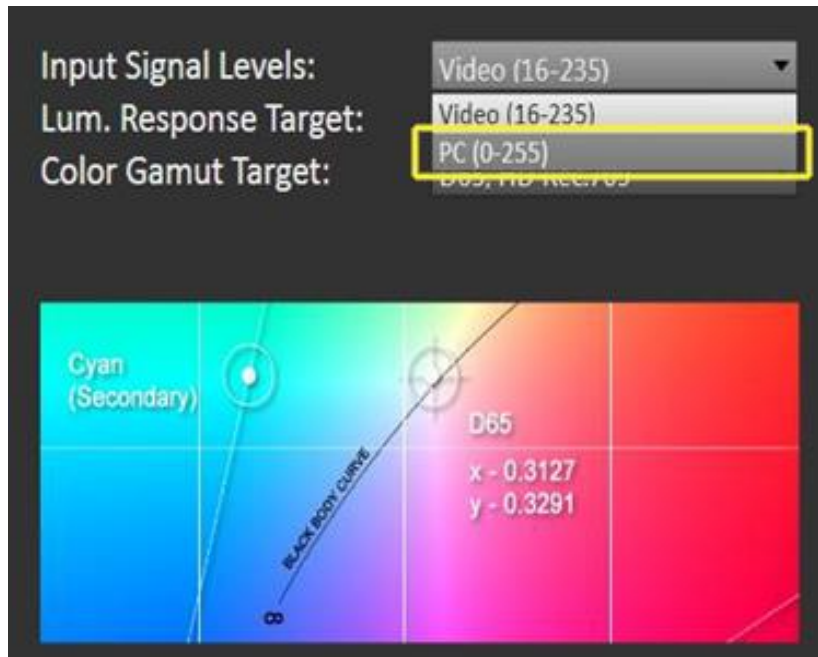


Figure 7. Always select PC (0-255) for the Input Signal Level.

Ensure a power gamma 2.2 is applied and that your display is also set to a 2.2 gamma.

- In the Calman Session Options page, select Power Gamma and specify a value of 2.2.

IMPORTANT: The tone mapping applied by Envy requires that the 3D LUT calibration is created using the power gamma function set at 2.2. Note: This does not mean that the output will be equivalent to a 2.2 gamma!

Display Pre-Test section

In the *Display Pre-Test* section of the Color Cube workflow, you can measure the performance of a display before you calibrate it, on the *Gamma & ColorChecker* page.

CAUTION:

While Calman is running, it disables any existing 3D LUT in the Envy, by default.

If there is already a 3D LUT loaded in the Envy and you wish to first measure the performance of the display with that 3D LUT, you must enable the LUT during your display Pre-Characterization steps.

To enable an existing Envy 3D LUT:

- On the Calman Source Settings tab, check the box for “Enable 3D LUT.”

On the *Performance Analysis* page, the display measurements from the *Gamma & ColorChecker* page are evaluated in a series of pass/fail performance parameters.

- If the display fails any of the parameters on the *Performance Analysis* page, you should consider using the following *Display Optimization* section of the workflow to optimize control adjustments on the display itself.
- If the display passes all of the parameters on the *Performance Analysis* page, you can skip the *Display Optimization* section and go immediately to the *Display Calibration* section of the workflow.

Display Optimization section

In the *Display Optimization* section of the Color Cube workflow, you are guided to optimize any controls the display may have for picture mode, color gamut, color temp, gamma, dynamic range, white point balance, or white point luminance.

CAUTION: *Before you make any adjustments to optimize the display controls or perform 3D LUT calibration, be sure to disable any existing Envy 3D LUT.*

Failure to disable an existing Envy 3D LUT before making any adjustments or creating a new LUT will result in an inaccurate display calibration.

To disable an existing Envy 3D LUT:

- On the Calman Source Settings tab, uncheck the box for “Enable 3D LUT.”

On the *RGB Adjust* page, if the display has RGB Gain controls, under the *RGB Adjust Levels* selection, select “2 Point 30, 100%.” Click *Read Continuous* and adjust the display’s RGB Gain controls for RGB balance at 100%. Accurate RGB balance at 100% is beneficial as a foundation for 3D LUT calibration.

Display Calibration section

In the *Display Calibration* section of the Color Cube workflow, skip the 1D Ramp LUT page and use only the *3D Cube LUT* page.

1D Ramp LUT page - Skip this.

3D Cube LUT page

1. Make sure that any current 3D LUT is disabled before continuing. See the bottom of page 8 for information on disabling any active 3D LUT.
2. On the *3D Cube LUT* page, click the *AutoCal* (rotating arrows) button at the right end of the meter action buttons. The *AutoCal Setup* dialog then appears (Figure 8).

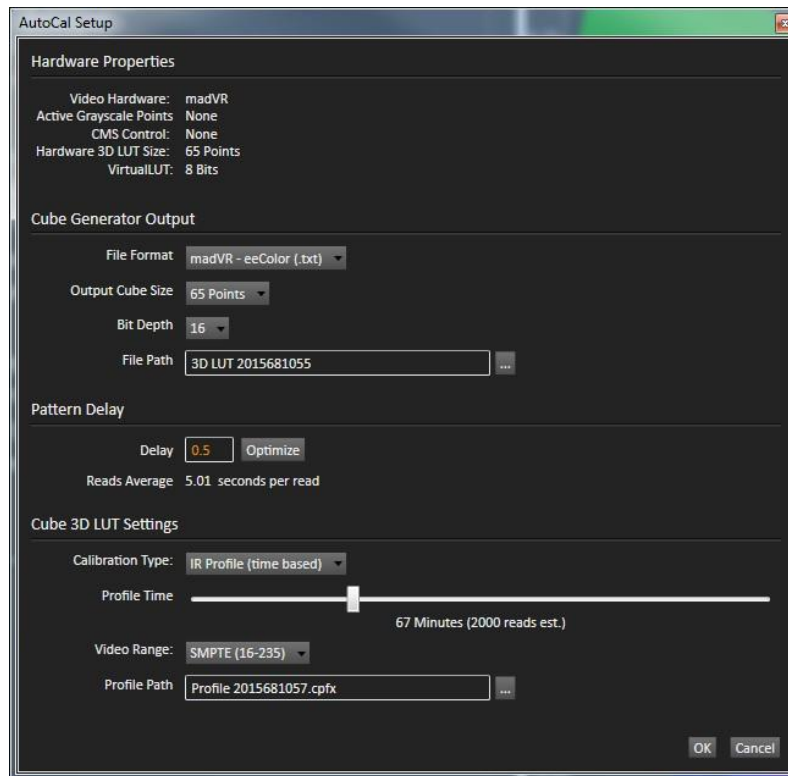


Figure 8. Calman AutoCal Setup dialog, for selecting options for 3D LUT creation.

3. Under *File Path*, select the desired directory path and provide a name for the LUT file that Calman will create (e.g. monitor ID, color space, and date).
4. Under *Calibration Type*, select the desired type of 3D LUT calibration process.
 - **IR Profile (time based)**: Creates the best quality display calibration 3D LUT possible in the selected period of time. You select how much display quality you have time for, from 30 minutes to maximum display quality (6,000 points max). Uses Intelligent Resolution Profiling to search out the most nonlinear color space areas and correct those first.
 - **IR Profile (point based)**: Creates the best quality display calibration 3D LUT possible with the selected number of measurement points (1,000 - 10,000 points). Uses Intelligent Resolution Profiling to search out the most nonlinear color space areas and correct those first.
 - **Lightning LUT**: Creates a display calibration 3D LUT in five minutes or less. Produces a very high-quality result on professional displays with moderate linearity. Displays with significant nonlinearity may produce marginal results.
5. Under *Video Range*, select “SMPTE (16-235)” if you are calibrating a video display that clips or compresses signals above reference white, as tested on the Calman *Dynamic Range* page.
6. Click *OK*.

As the last step in the AutoCal process completes, Calman automatically loads the calibration LUT file into the Envy based on the target gamut memory you previously selected (see Figure 5 on Page 7).

You may store one 3D LUT per gamut target, and the Envy will automatically select the proper 3D LUT based on the content’s gamut. For instance, when the source is playing BT2020 content, Envy will automatically use the BT2020 3D LUT, or if there is no BT2020 3D LUT, but there is a DCI-P3 one, Envy will automatically map the BT2020 content to DCI-P3 and apply that 3D LUT.

Currently the baseline calibration is not selected automatically in the display by Envy. Therefore, the user must manually select the correct calibration in the display if not using the same baseline for all colorspace. Currently, you need a HD Fury device (Vertex, Diva, Maestro) to do this for JVC projectors as they are not able to select more than two calibrations automatically (one for HDR10 and one for SDR).

Verify Calman 3D LUT in the Envy

After Calman completes the 3D LUT calibration, a “Calibration On/Off” option will appear in the Envy Display Configuration Menu and it will be set to On. To disable the 3D LUT applied by the Envy at any time you may simply turn it Off (and back on) at any time.

With the 3D LUT calibration now completed, you are ready to verify the accuracy of the resulting display calibration (see below).

Display Validation section

In the *Display Validation* section of the Color Cube workflow, you can validate the accuracy of the resulting display calibration.

CRITICAL:

By default, while Calman is running the Envy 3D LUT is disabled and not applied to any test patterns displayed.

In order to verify the 3D LUT stored in the Envy, you must first tell Calman to apply the Envy 3D LUT. Otherwise your measurements will read exactly as any pre-calibration measurements, since the Envy 3D LUT you just created would not be applied otherwise.

To enable the Envy 3D LUT so it is applied to the test patterns:

- On the Calman Source Settings tab, check the box for “Enable 3D LUT.”

To validate the 3D LUT display calibration:

1. On the Calman Source Settings tab, check the box for “Enable 3D LUT.”
2. On the Calman *Gamma & ColorChecker* page, click the *Read Series* button to make a complete series of display validation measurements.
3. Observe the calibrated Max and Avg performance data.
4. On the *Gamma & ColorChecker* page, click the *Save* button to save the measurement and 3D LUT data.

Retarget Profile to Other LUT Memories

After you have profiled a display with Calman and created a 3D LUT, you can create additional 3D LUTs targeted to the other 3D LUT memories in the Envy.

If you use the same calibration baseline for all colorspace, you can retarget the existing profile to a new 3D LUT. This takes just minutes and does not require additional display measurements. For instance, if you have low nits (brightness) and want to keep your display always in DCI-P3, even for BT709 content, you can do so by retargeting your DCI-P3 calibration to BT709. Then any time you play BT709 content, Envy will automatically map it to display accurately even though your display is set to DCI-P3.

Otherwise you have to select the correct baseline depending on whether you are profiling your display for SDR or HDR, and reprofile the display for the new baseline.

To retarget a Calman profile to another Envy memory:

1. On the *Display Control* tab, select the new 3D LUT memory that you wish to create.
2. On the *Display Control* tab, click the “Retarget LUT From Profile” button.
3. On the file *Open* dialog, select the Calman profile file from the original calibration.
4. On the *Import 3D LUT* dialog, select the *Colorspace Target and Gamma Formula* that matches the Envy LUT memory that you selected in step 1, above.
5. Click *OK*.
6. Repeat for any other 3D LUT memories that you wish to create.

Close Calman to disconnect from the Envy.

NOTE: The Envy is not a SpectraCal product, and SpectraCal does not provide technical support for the Envy. For Envy support, please contact your madVR Envy dealer.

About / Contact

About madVR Labs

madVR Labs manufactures extreme video hardware and software products to meet the demands of the most discerning and critical video enthusiasts. Our products are the result of over ten years of extensive R & D, with hundreds of thousands of madVR users world-wide. We are a funded startup, launched in 2019, that serves the commercial cinema, post-production, and high-end home theater markets.

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About Portrait Displays

Portrait Displays, Inc., since 1993, is a leading application software provider (ASP) for PC, smartphone, and tablet displays. The Portrait Displays team now includes **SpectraCal**, the world's leading provider of video display calibration software. The combined companies offer value-added, feature-rich solutions to both OEM display manufacturers and end users seeking improved accuracy and manageability of their displays.

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