

SpectraCal ColorBox

Image Calibration Processor

CalMAN Setup Guide

CalMAN takes advantage of the SpectraCal ColorBox processor features to calibrate a video display with a 10-bit 64x64x64 3D cube lookup table (LUT) for SMPTE video level signals. (NOTE: The ColorBox is not suitable for creating a 3D LUT at full range/PC levels.) The ColorBox provides six different 3D cube LUTs, selectable on the front panel LED display. This setup guide assists you in calibrating the ColorBox with the CalMAN Color Cube workflow.

Recommended CalMAN Workflows:

- Color Cube or CalMAN Studio to optimize panel or projector picture controls and to calibrate the ColorBox grayscale 3D LUT.

Required ColorBox Firmware:

- All current firmware

ColorBox Control Connection:

- USB A to USB B (printer) cable
- USB driver contained in SpectraCal Device Driver Kit

Calibration LUT Creation

When creating 3D calibration LUTs in ColorBox, it is important that the desired LUT is selected on the ColorBox processor before connecting to the ColorBox through CalMAN. The ColorBox processor, once connected in the CalMAN software, cannot change its selected LUT. To create multiple LUTs, the ColorBox needs to be disconnected from the software, and then reconnected after selecting a new LUT on the ColorBox.

ColorBox Control Connection

The ColorBox is connected to a computer via a USB A to B cable. The ColorBox uses the FTDI USB driver, which is available in the CalMAN Device Driver Kit, available for download on the SpectraCal website.

To connect a ColorBox for 3D LUT calibration:

1. On the ColorBox, select the desired lookup table (LUT), using the C1 through C6 buttons on the ColorBox remote. Confirm that the selected number appears on the ColorBox LED.
2. Connect the ColorBox to the CalMAN computer with the specified USB cable.

To change the ColorBox LUT setting:

1. In the CalMAN *Display Control* panel, *Disconnect* the ColorBox.
2. Select the desired LUT on the ColorBox.
3. In the CalMAN *Display Control* panel, click *Find Display* to reconnect the ColorBox.

To reset a ColorBox LUT:

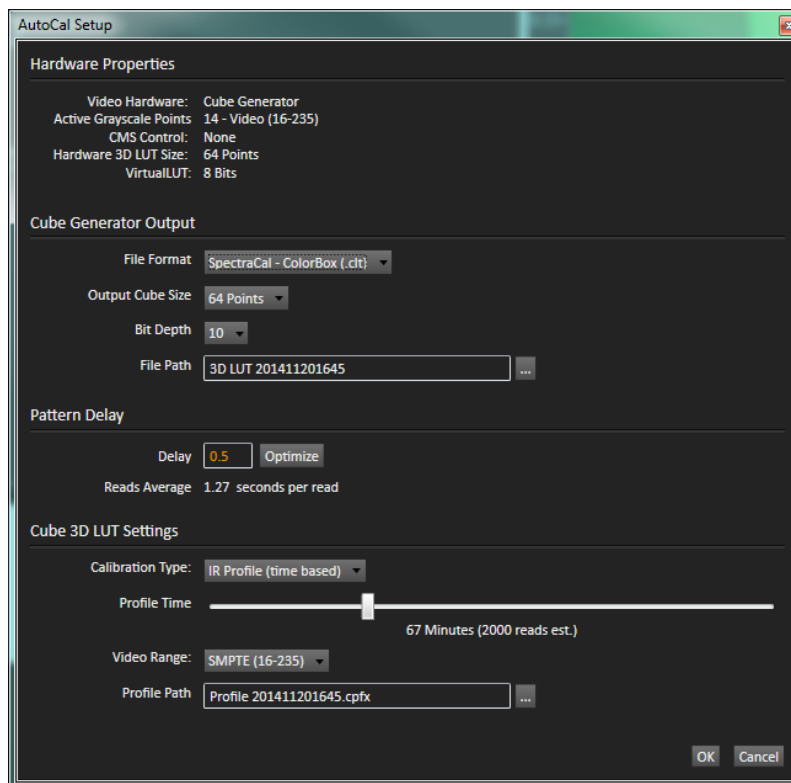
1. In the CalMAN *Display Control* panel, select the ColorBox LUT that you wish to reset.
2. At the bottom of the CalMAN *Display Control* panel, press the *Full DDC Reset* button.

NOTE: If the ColorBox LED reads "0," it indicates a problem with HDMI handshaking between the source device, the ColorBox, and the display device. The ColorBox will not produce desired results when this condition exists. Power cycling the ColorBox usually resets normal handshaking among all devices and resolves the issue.

CalMAN 3D LUT Display Calibration – Hardware LUT Load

CalMAN can calibrate the 3D LUT in the ColorBox with a direct USB control connection. To produce an optimized 3D LUT calibration file and automatically load it into the ColorBox:

1. In CalMAN, load the "Color Cube (3D LUT)" workflow.
2. On the CalMAN Settings tab (gear icon), under Workflow Basic Options, select either *Video (16-235)* [SMPTE legal] or *PC (0-255)* [Full] to match the intended signal levels to be sent to the display.
3. Proceed through each step of the workflow in the normal fashion, using the following notes for guidance on the indicated workflow pages.
4. On the *Session Setup* page:
 - a. Click the *Find 3D LUT Device* button, then select "SpectraCal – ColorBox, eeColor 3D Cube (USB)."
 - b. Under *3D LUT Memory*, select the same LUT that you selected on the ColorBox (very important).
5. On the *Dynamic Range* page, adjust the display's black level/Brightness control to the black level of the signal content that will be processed through the ColorBox (16 for video or 0 for PC/full range).
6. On the *RGB Adjust* page, 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%. Adjust the display's RGB Offset/Bias controls (if provided) for RGB balance at 30%.
7. Skip the *1D Ramp LUT* page (a 1D LUT does not need to be created).
8. 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 (see below).



9. Under *File Path*, select the desired directory path and provide a name for the LUT file that CalMAN will create (e.g. monitor ID and date).
10. 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.
11. 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.
12. Click *OK*.

Upon completion of the AutoCal 3D hardware LUT calibration process, CalMAN automatically loads the optimized 64x64x64 LUT calibration data into the ColorBox Image Calibration Processor.

DONE – ColorBox 3D LUT calibration and setup is complete.

CalMAN 3D LUT Display Calibration File Creation for ColorBox

CalMAN can also create a 3D LUT display calibration file for the ColorBox without immediately loading the file into the ColorBox. The ColorBox does not need to be available during this display calibration and file creation process. The file created will be a .3dl file with the proper ColorBox data format for later loading into the ColorBox with CalMAN (as detailed below).

To create a 3D LUT display calibration file for the ColorBox with CalMAN:

1. In the CalMAN main menu, select *Open Workflow Template*, then select the 'Color Cube (3D LUT)' workflow.
2. On the CalMAN Display Control tab, connect to the SpectraCal Cube Generator as a Display Control device.
3. On the Display Control tab, under 'File Format,' select '3DL – common .3dl formats.'
4. On the Display Control tab, under 'File Path,' select your desired destination for the .3dl LUT file.
5. On the CalMAN Source Settings tab, select your desired test pattern source for display calibration.
6. Follow the display calibration instructions in the 'CalMAN 3D LUT Display Calibration' section above.
7. On the *AutoCal Setup* popup dialog, under 'Output Cube Size,' select 64 Points. Under 'Bit Depth,' select 10.

Done: Upon completion of the AutoCal 3D LUT calibration process, CalMAN automatically writes a .3dl file, containing color cube display calibration data, to your selected file destination. This display calibration file can be later loaded to a ColorBox, using the procedure in the 'CalMAN 3D LUT Load to ColorBox' section below.

CalMAN 3D LUT Load to ColorBox

CalMAN can load a properly formatted 3D LUT file into the ColorBox. The LUT needs to be a .3dl LUT file with a bit depth of 10 bits and 64x64x64 data points, with the data points at the following bit levels: 0,16,32,48,64,80,96,112,128,144,160,176,192,208,224,240,256,272,288,304,320,336,352,368,384,400, 416,432,448,464,480,496,512,528,544,560,576,592,608,624,640,656,672,688,704,720,736,752,768,784, 800,816,832,848,864,880,896,912,928,944,960,976,992,1008.

This .3dl LUT file can be a display calibration LUT created with the CalMAN Cube Generator function (as detailed above). Or, it can be a creative (look) LUT created by any other application (with the proper data points). During the load process, CalMAN converts the .3dl file into the file format required by the ColorBox.

To load a 3D LUT file into a ColorBox:

1. In CalMAN, on the Display Control tab, connect to the ColorBox as a Display Control device.
2. On the Display Control tab, click the 'Open DDC Window' button.
3. On the DDC Controls dialog, scroll to the '3D LUT Controls' page.
4. Click the 'Load LUT File' button.
5. In the resulting file navigation window, select the .3dl LUT file that has been created for the ColorBox.

Done: The selected 3D LUT file is now contained in the ColorBox.