CalMAN Setup Guide

Flanders Scientific BoxIO

Rev. 1.1

Introduction

CalMAN takes advantage of the features of the Flanders Scientific BoxIO advanced color management device to calibrate a video display with a 12-bit 1D lookup table (LUT) and/or a 16-bit 33x33x33 3D cube LUT. The BoxIO functions as a reference pattern source for video display LUT calibration.

This *setup* guide assists you in calibrating a video display with the FSI BoxIO and the CalMAN Color Cube workflow.

CalMAN Required Version

- Version 5.7.1 or newer

CalMAN Recommended Workflow

- Color Cube (3D LUT)

Required FSI BoxIO Firmware

- Version 1.45 or newer

FSI BoxIO Control Port

- Ethernet or wireless (Wi-Fi)

FSI BoxIO Computer Connection

Follow one of these methods to connect the BoxIO to your computer:

- **Ethernet Local Network Connection -** Connect BoxIO via Ethernet cable to the same local network as your CalMAN computer.

- **Ethernet Direct Cable Connection -** Connect BoxIO directly to your CalMAN computer via Ethernet cable. Assign a static IP address to your computer that is different from the BoxIO IP address, but in the same subnet (i.e. BoxIO has an IP of 192.168.1.244 and you assign your computer an IP of 192.168.1.5).

    A label on the back of the BoxIO includes the default Ethernet static IP address, the ad hoc wireless network SSID and password, and MAC address information.

Note: A reset button near the BoxIO USB port can be used to reset the unit to the factory network settings found on the label on the back of the BoxIO.

- **Wireless Connection -** From your computer's wireless connection dialog, select the BoxIO you wish to connect to and enter the wireless password from the BoxIO back label.

With the BoxIO connected to your computer, you can now use CalMAN to connect to and control the BoxIO to create and automatically load 1D and/or 3D LUTs, following the instructions below.

BoxIO 3D LUT Display Calibration

The Color Cube workflow in CalMAN is used to create an optimized 3D LUT calibration file and automatically load it into the BoxIO:

1. In CalMAN, load the "Color Cube (3D LUT)" workflow. In the main menu, select *Open Workflow Template / Color Cube (3D LUT)*.

2. Proceed through the instructions on each page of the Color Cube workflow, using the following notes for BoxIO specifics.

Initial Setup section

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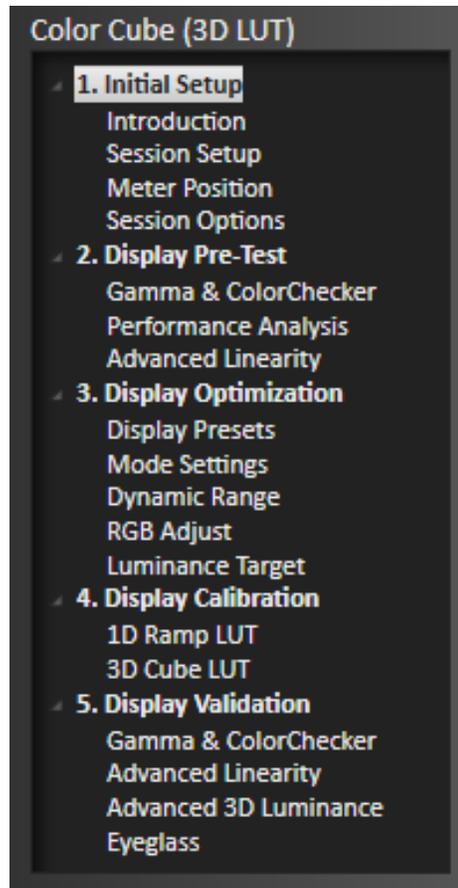

Figure 1. CalMAN Color Cube (3D LUT) workflow outline.

Session Setup - Meter Connect

Connect your color meter to the CalMAN computer.

- On the *Session Setup* page, click the *Find Meter* button to connect your meter.

- Under the *Target Display Type* drop down, select the backlight/pixel technology for the display that is being calibrated.

Session Setup - Source Connect

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

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

- On the *Find Source* dialog (Figure 2), under *Manufacturer*, select "Flanders Scientific."

- Under *Model*, select "FSI-BoxIO." (Or, you can elect to use an external pattern source.)
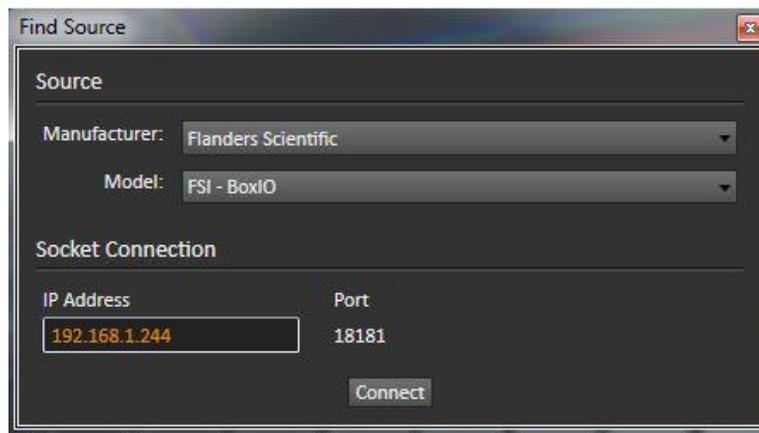
- Click *Connect*.

Figure 2. CalMAN Find Source dialog for connecting to the BoxIO as a test pattern source.

If you have difficulty connecting to the BoxIO with CalMAN, you may want to use the BoxIO Utility to try to connect to the BoxIO, to confirm the network setup. If the BoxIO Utility doesn't connect to the BoxIO, then CalMAN won't connect either. The BoxIO Utility is available as a free download from: http://flandersscientific.com/ip-remote/

Session Setup - Source Settings (Figure 3)

Window Size

On some displays, it is best to use the smallest window size practical. Window 10% is a good first choice.

Delay

This sets a measurement delay time to allow a display to stabilize with a newly selected pattern. If measurements are unstable on a particular display, click the *Optimize* button to optimize this delay.

Pattern 1D LUT, Pattern 3D LUT

The 1D LUTs and 3D LUTs that CalMAN writes to the BoxIO are always active for the display output signal, but they can be enabled or disabled for the internal pattern generator. Until you have created a 1D or 3D LUT and are ready to validate its performance, do not enable the pattern LUTs here on the Source Settings tab. The Validation section at the end of this document guides you in this process.

<u>Note</u>: When CalMAN creates a 1D LUT for the BoxIO, it automatically writes the LUT to both the display output and the pattern output and enables the LUT on both outputs.

Output Format

Here, you can select the desired *Output Format* of the BoxIO test pattern generator.

Specialty Patterns

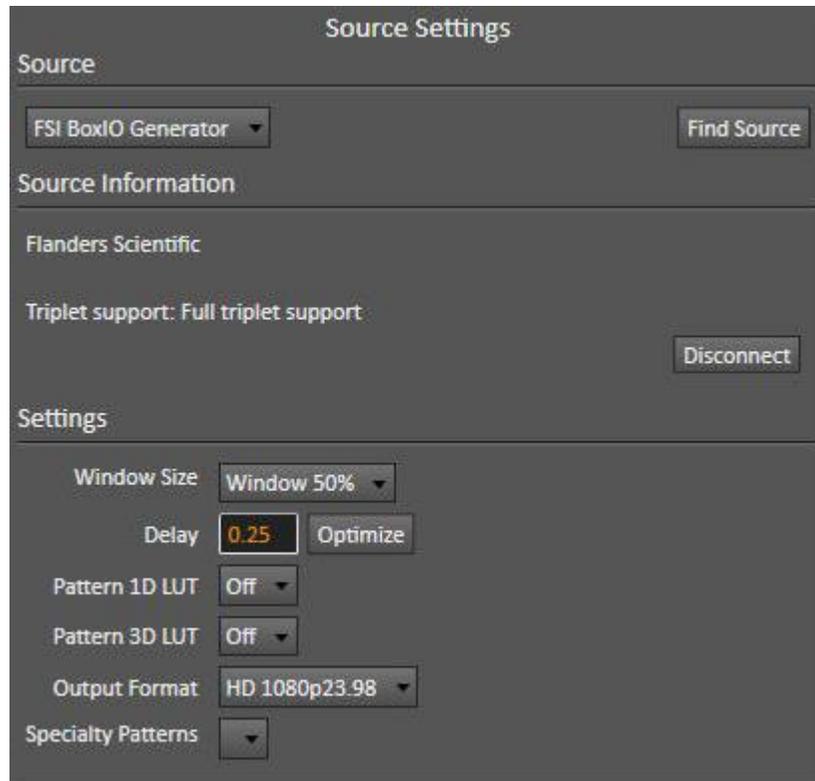*Here*, you can select a test pattern for visual display evaluation (not for measurement).

Figure 3. CalMAN Source Settings dialog for configuring the BoxIO test pattern output.

Session Setup - LUT Device Connect

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

- On the Find *Display* dialog (Figure 4), under *Manufacturer*, select "Flanders Scientific."

- Under *Model*, select "FSI-BoxIO."
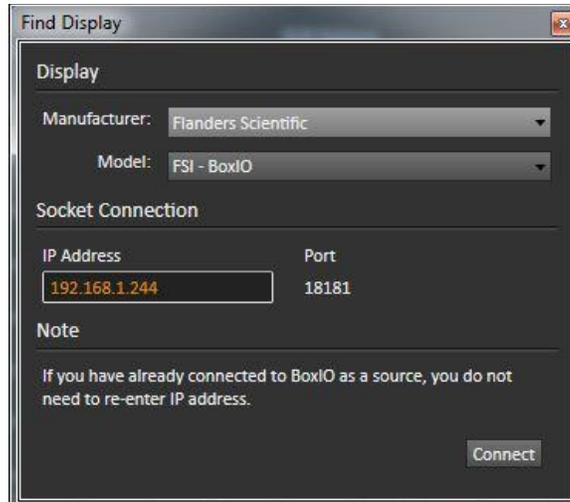
- Click *Connect*.

Figure 4 CalMAN Find Display dialog, for connecting to the BoxIO for LUT creation and loading.

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 and on the *Advanced Linearity* page.

If the *Performance Analysis* page indicates any red lights for display performance, you may wish to optimize the display's picture controls before creating a 3D calibration LUT. Click the *Display Optimization* button to proceed to that workflow section.

Otherwise, click the *Calibrate Cube LUT* button to proceed directly to the *Display Calibration* section.

Display Optimization section

To optimize the display's picture controls before creating a 1D or 3D calibration LUT, advance through the adjustment pages in the *Display Optimization* section of the workflow.

Display Calibration section

In *the Display Calibration* section of the Color Cube workflow, there are provisions for calibrating with both a 1D Ramp LUT (*1D Ramp LUT* page) and a 3D cube LUT (*3D Cube LUT* page).

1D Ramp LUT page

1. On the *1D Ramp LUT* page, if you wish to create a 1D LUT, click the *AutoCal* button (rotating arrows) at the right end of the meter action buttons. The *AutoCal Setup* dialog then appears (Figure 5).
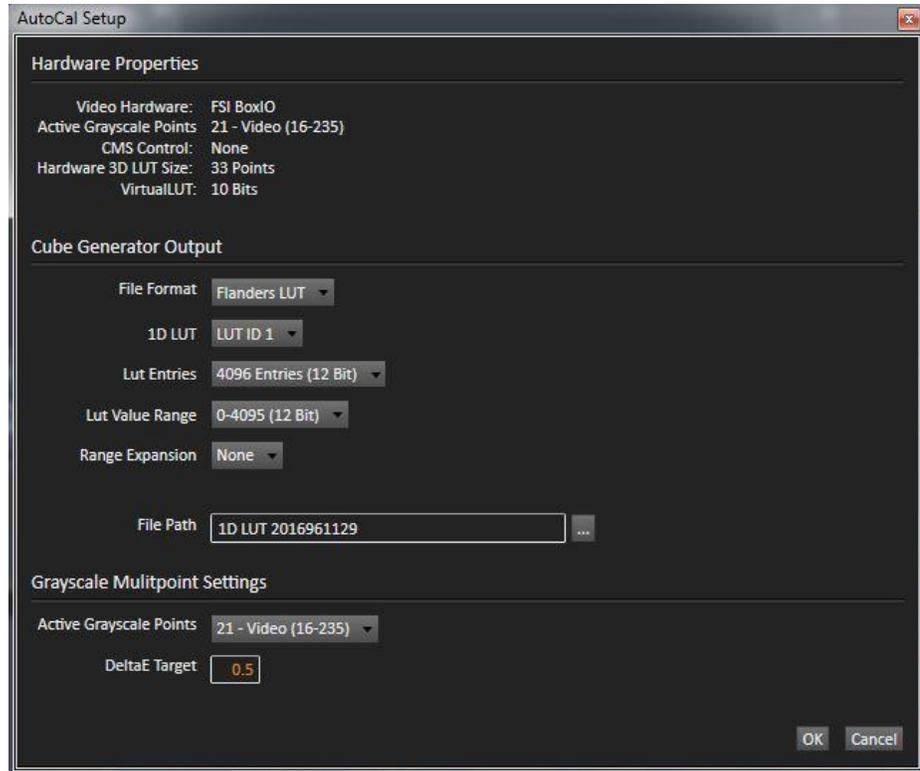
Figure 5. CalMAN AutoCal Setup dialog, for selecting options for 3D LUT creation.

2. Under *File Format*, select "Flanders LUT."

3. Under *1D LUT*, select your desired LUT ID in the BoxIO.

Note: If you are going to create both a 1D LUT and a 3D LUT, they should both be in the same LUT ID.

4. Under *LUT Entries*, select your desired bit depth for the 1D LUT.

5. Under *LUT Value Range*, select the full value range for your selected bit depth (0-xxx).

6. Under *Range Expansion*, select "None."

✷   *Caution: Selecting any signal state other than full range, with no Range Expansion, will cause the BoxIO to clip signal levels.*

7. Under *File Path*, select the desired directory path and provide a name for the backup LUT file that CalMAN will create and save. (e.g. monitor ID and date).

8. Under *Active Grayscale Points*, select the number of grayscale points you wish to measure on the display to create the 1D LUT.

9. Click *OK*.

When the AutoCal 1D Ramp LUT calibration completes, CalMAN automatically writes the optimized 1D LUT calibration data to the selected

BoxIO LUT ID and enables the LUT on both the display output and the internal pattern output.

🕱 *Caution: CalMAN takes some time to write the LUT data to the BoxIO display output and then write the LUT data to the BoxIO internal pattern output. The write process will fail if you attempt CalMAN operations before the LUT write process complete dialog appears.*

3D Cube LUT page

1. On the *3D Cube LUT* page, click the *AutoCal* button (rotating arrows) at the right end of the meter action buttons. The *AutoCal Setup* dialog then appears (Figure 6).
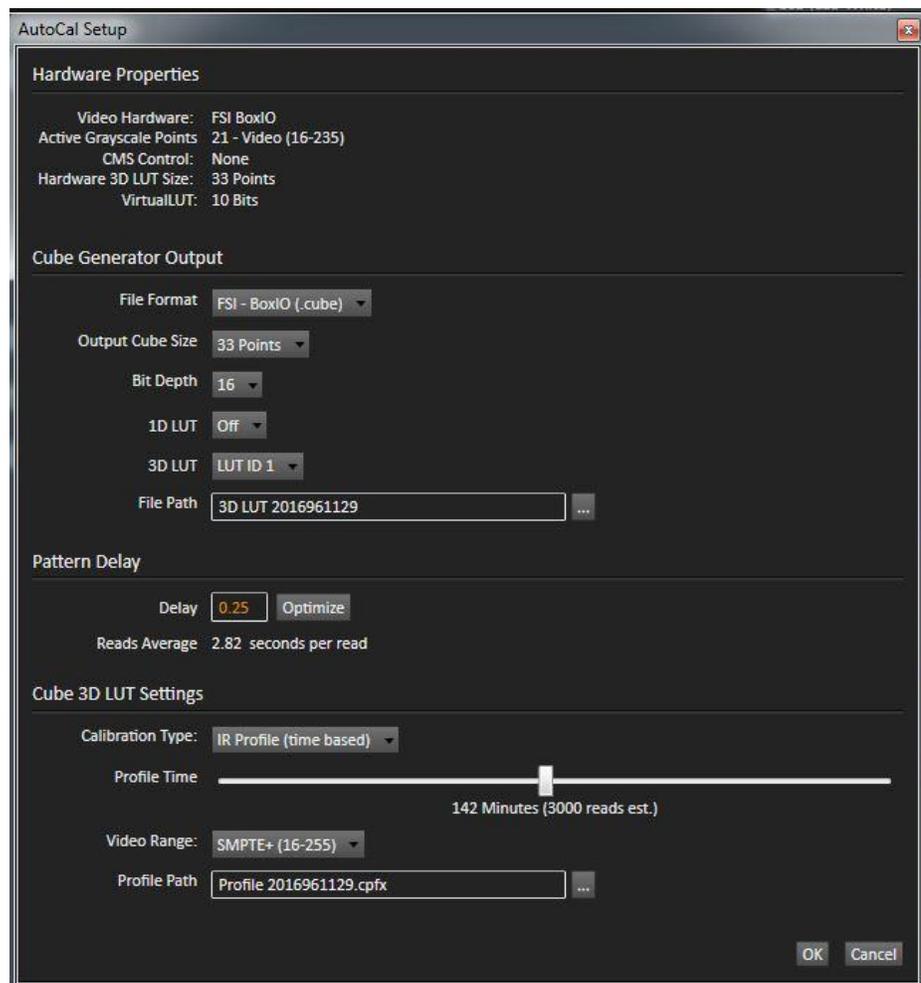

Figure 6. CalMAN AutoCal Setup dialog, for selecting options for 3D LUT creation.

2. Under *File Format*, select "FSI - BoxIO (.cube)."

3. Under *Output Cube Size*, select "33 Points."

4. Under *Bit Depth*, select "16."

5. Under *1D LUT*, if you are creating only a 3D LUT and have not already created a 1D LUT, select "Off". If you have already created a 1D LUT, select the LUT ID into which you loaded the 1D LUT.

Note: When CalMAN creates a 1D LUT for the BoxIO, it automatically writes the LUT to both the display output and the pattern output and enables the LUT on both outputs.

6. Under *3D LUT*, select your desired LUT ID. If you have already created a 1D LUT, select the same LUT ID as the 1D LUT.

7. Under *File Path*, select the desired directory path and provide a name for the backup LUT file that CalMAN will create and save (e.g. monitor ID and date).

8. 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.

9. Under *Video Range*, select "Full (0-255)."

✹ *Caution: Video Range selections other than "Full" will cause the BoxIO to clip its input signal.*

10. Click *OK*.

When the AutoCal 3D LUT calibration completes, CalMAN automatically writes the optimized 33x33x33 LUT calibration data to the selected BoxIO LUT ID.

✹ *Caution: CalMAN takes some time to write the LUT data to the BoxIO display output and then write the LUT data to the BoxIO internal pattern output. The write process will fail if you attempt CalMAN operations before the LUT Write Process Complete dialog appears.*

Display Validation section

Before you validate a 1D LUT and/or 3D LUT, you need to enable the corresponding Pattern LUT on the Source Settings tab (Figure 7).

- If you have created a 1D LUT, on the Source Settings tab, under Pattern 1D LUT, select the appropriate LUT ID in which you created the 1D LUT.

- If you have created a 3D LUT, on the Source Settings tab, under Pattern 3D LUT, select the appropriate LUT ID in which you created the 3D LUT. (If you have created both a 1D LUT and a 3D LUT, they should both be in the same LUT ID.)
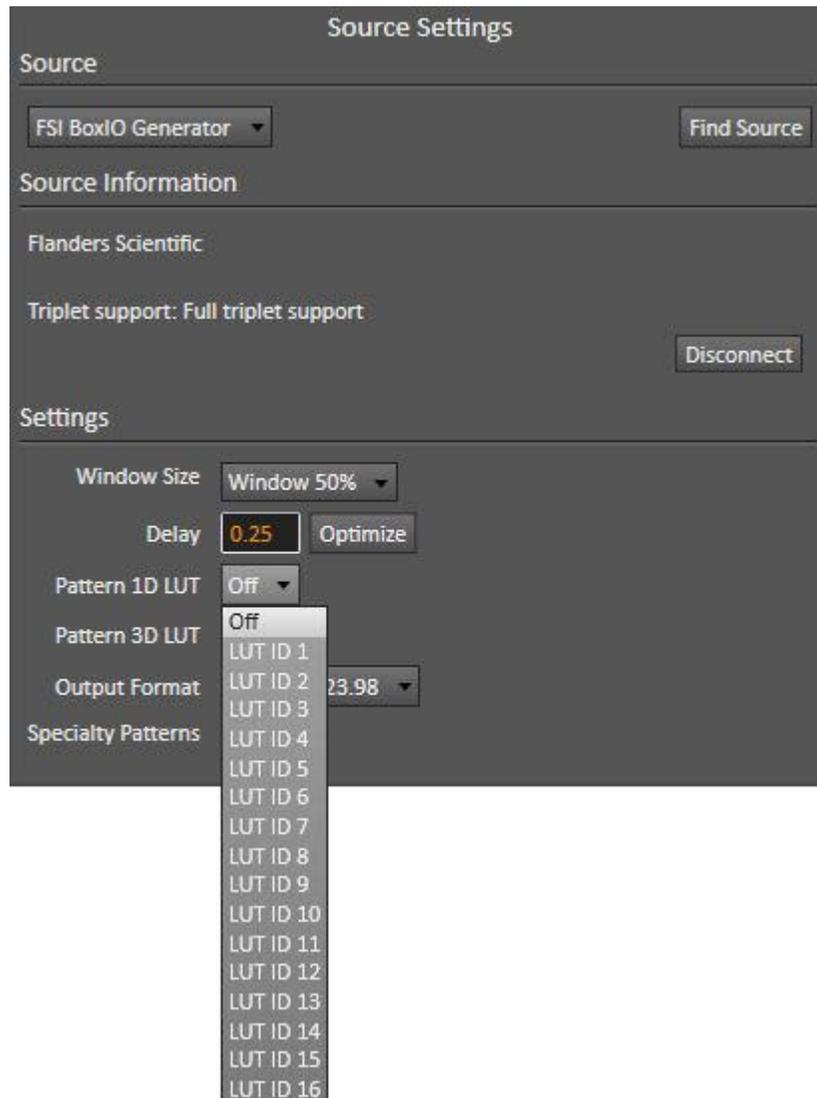

Figure 7. CalMAN Source Settings tab, to enable the 1D LUT and/or 3D LUT(s) in the BoxIO.

On the Display Validation page, click the Read Series button to validate the display calibration with the 1D LUT and/or 3D LUT that you have created in the BoxIO.

DONE! - Display calibration and validation with the FSI BoxIO is complete.

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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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