



**Flanders
Scientific
Inc.**

Colorimeter Matrix Creation Instructions

Matrix creation using FSI ColorMatrix Application

Flanders Scientific, Inc.
6215 Shiloh Crossing
Suite G
Alpharetta, GA 30005
Phone: +1.678.835.4934
Fax: +1.678.804.1882
E-Mail: Support@FlandersScientific.com
www.FlandersScientific.com

This guide will walk you through creating a display specific matrix on a i1D3DS OEM, CR100, or Klein K10A/K80 colorimeter with a reference spectroradiometer using the FSI ColorMatrix Application. When completed the matrix will be stored directly on the probe and will be accessible by FSI's GaiaColor AutoCal. Matrices stored on a CR100 or Klein K10A/K80 can be accessed within 3rd party calibration applications like LightIllusion's ColourSpace and Portrait Display's Calman. Instructions on accessing i1D3DS OEM matrices within 3rd party calibration applications are included in the i1D3DS OEM section. *Note, this guide is intended for users that own their own spectroradiometer and want to create their own matrices. If you instead purchased a colorimeter from FSI with matrices pre-loaded you do NOT need to use these instructions as your matrices will already be saved on your device.*

Initial Monitor Setup

Begin by setting your FSI monitor to its default profile:

On DM Series: Menu > System > Load Profile > Default. When prompted, confirm by selecting Yes.

On XMP and XMP C Series: Menu > Profile Load > Default.

Next, you will put the monitor in its panel native gamut setting.

On DM Series: Bypass the 3D LUT in the monitor's Color Management menu by selecting Color Management > LUT Bypass > 3D LUT. *Remember to set LUT Bypass back to None when you have finished creating your matrix.*

Achieving Panel Native Gamut on DM



Achieving Panel Native Gamut on XMP



Note: The following instructions were written using a Colorimetry Research spectroradiometer and a Blackmagic Design output card. Additional test pattern generation and spectroradiometer options can be found in the Tips and Troubleshooting section at the end of this guide.

i1D3DS OEM Matrix Creation

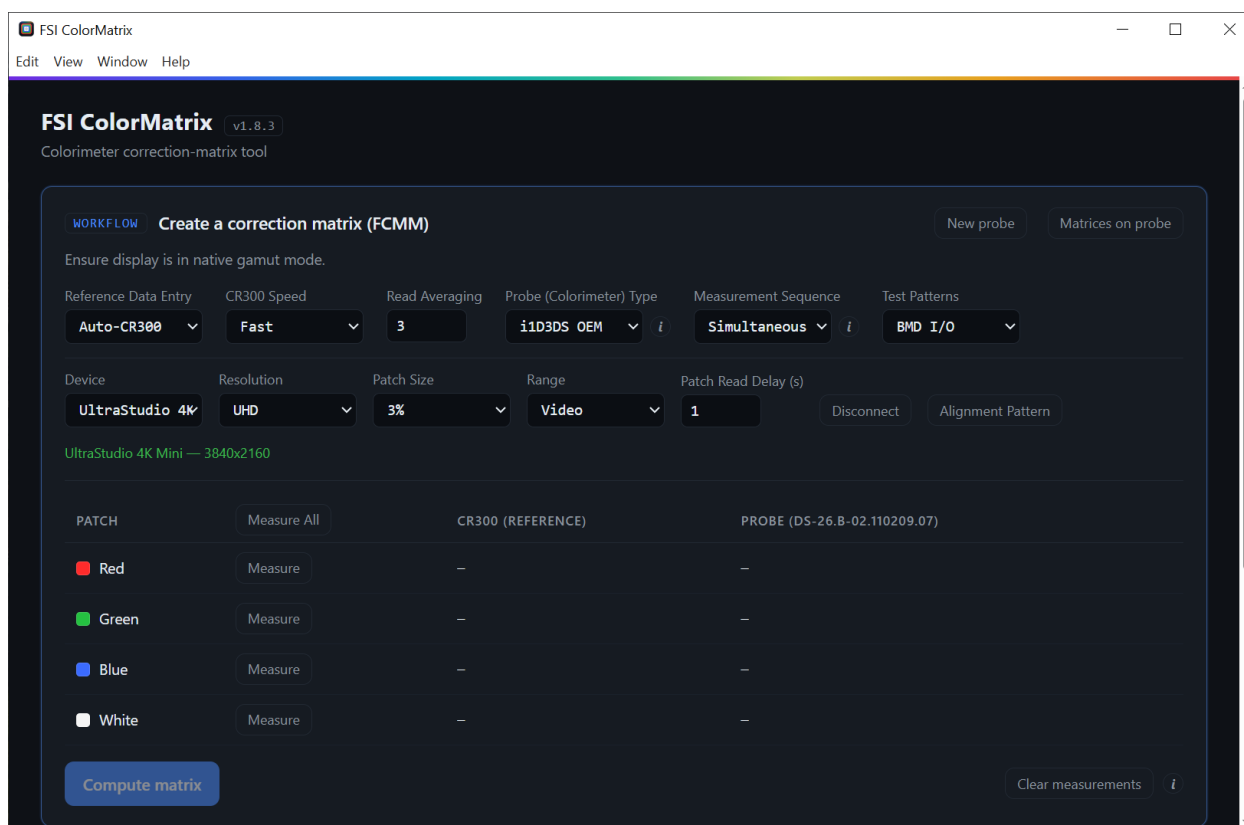
Connect the CRI spectroradiometer and i1D3DS OEM to your computer.

Next open the FSI ColorMatrix application. The i1D3DS OEM serial number should be shown in the Workflow section. It is recommended to use the default settings for the spectroradiometer which should be the following: Reference Data Entry set to Auto-CR300, Speed set to Fast, and Read Averaging set to 3. Also set Measurement Sequence to Simultaneous and Test Patterns to BMD I/O.

Your BMD device should be shown in the Device box. Press Connect and then set the output to recommended settings for each series and then click connect.

For DM Series: HD Resolution, 10% Patch Size, Video Range, and 1 second Patch Read Delay

For XMP and XMP C Series: UHD Resolution, 3% Patch Size, Video Range, 1 second Patch Read Delay

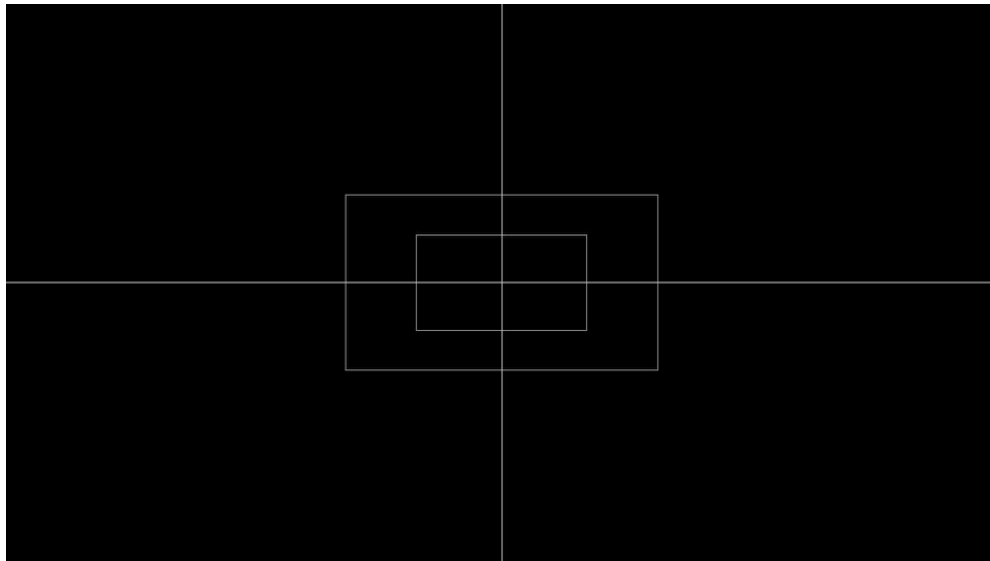


The screenshot shows the FSI ColorMatrix application window. The title bar reads 'FSI ColorMatrix' with standard window controls. The menu bar includes 'Edit', 'View', 'Window', and 'Help'. The main header displays 'FSI ColorMatrix v1.8.3' and 'Colorimeter correction-matrix tool'. The workflow section is titled 'Create a correction matrix (FCMM)' and includes buttons for 'New probe' and 'Matrices on probe'. A note states 'Ensure display is in native gamut mode.' Below this, several settings are configured: Reference Data Entry is 'Auto-CR300', CR300 Speed is 'Fast', Read Averaging is '3', Probe (Colorimeter) Type is 'i1D3DS OEM', Measurement Sequence is 'Simultaneous', and Test Patterns is 'BMD I/O'. The Device section shows 'UltraStudio 4K' with a 'Connect' button and 'Disconnect' and 'Alignment Pattern' buttons. Below the device name is the text 'UltraStudio 4K Mini — 3840x2160'. A table for patch measurements is displayed with columns for 'PATCH', 'Measure All', 'CR300 (REFERENCE)', and 'PROBE (DS-26.B-02.110209.07)'. The table lists four patches: Red, Green, Blue, and White, each with a 'Measure' button. At the bottom, there is a 'Compute matrix' button and a 'Clear measurements' button with an information icon.

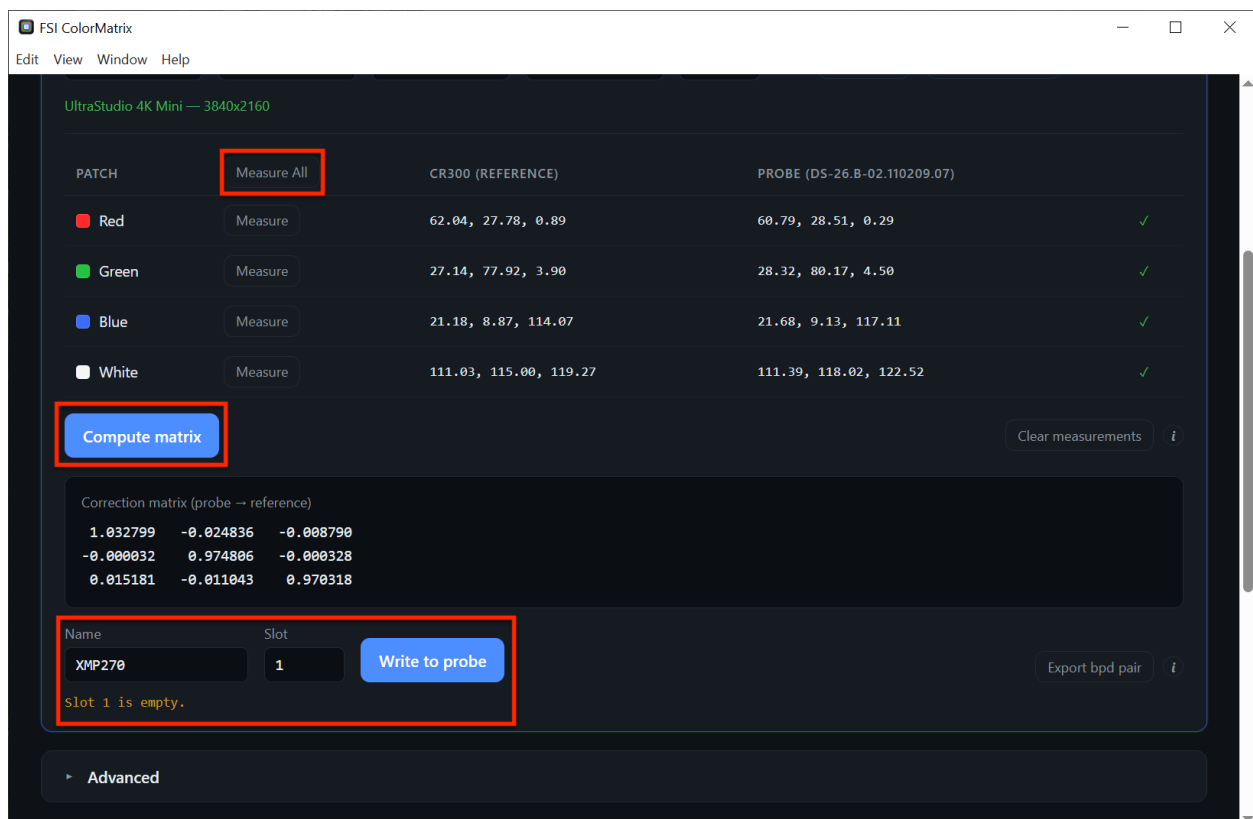
PATCH	Measure All	CR300 (REFERENCE)	PROBE (DS-26.B-02.110209.07)
Red	Measure	—	—
Green	Measure	—	—
Blue	Measure	—	—
White	Measure	—	—

Colorimeter Matrix Creation Using FSI ColorMatrix

Next, position both probes near the center of the screen. You can use the Alignment Pattern option to display a guide directly on the monitor to assist in probe placement. The smaller box is a 3% window and the larger box is a 10% window.



Now select Measure All. The application will take measurements with both probes on red, green, blue, and white. Once complete select Compute Matrix. You may need to scroll down to see the Correction Matrix data and Write to Probe options. Enter the model name for the matrix Name and select an available slot and then Write to Probe.



Colorimeter Matrix Creation Using FSI ColorMatrix

Please note that GaiaColor AutoCal will select the first available matching matrix name stored on the probe. If storing a matrix with a name already stored then either overwrite the previously matching matrix slot or delete the previous matrix from the Matrices on Probe selection at the top of the workflow section.

With the matrix created, select Advanced to open the Verify section. Select the matrix slot that was just created and then select Measure All. Once complete ensure that the Reference and Probe+Matrix measurements for red, green, blue and white are a close match. Once verified, matrix creation is complete and the probe can now be used for GaiaColor AutoCal.

Ideal targets for an accurate matrix are $\Delta x, \Delta y$ 0.001 or lower and 5% or lower for ΔY .

Advanced

VERIFY Test Saved Matrix Reload matrices

Checks a matrix already on the probe against a reference instrument.
Readings are compared as x, y and Y rather than XYZ, with dE2000 for the overall difference.

Matrix on probe
1: XMP270

Reference Data Entry: Auto-CR300
CR300 Speed: Fast
Read Averaging: 3
Measurement Sequence: Simultaneous
Test Patterns: BMD I/O

Using UltraStudio 4K Mini — UHD, 3% patch, Video range, 1s read delay. Change these in the matrix workflow above.

PATCH		REFERENCE x, y, Y	PROBE + MATRIX x, y, Y	Δx	Δy	ΔY	dE2000
Red	Measure	0.6838, 0.3063, 27.783	0.6840, 0.3062, 27.811	0.0002	0.0001	0.1%	0.04 ✓
Green	Measure	0.2492, 0.7153, 78.067	0.2493, 0.7150, 78.251	0.0001	0.0002	0.2%	0.05 ✓
Blue	Measure	0.1469, 0.0616, 8.880	0.1468, 0.0616, 8.874	0.0001	0.0000	0.1%	0.02 ✓
White	Measure	0.3215, 0.3328, 115.000	0.3216, 0.3329, 115.069	0.0000	0.0000	0.1%	0.02 ✓

4 patch(es): average dE2000 0.04, worst 0.05 Clear results

3rd Party Calibration Software Matrices for i1D3DS OEM

If needing Calman matrices select the Matrices on Probe option. Then select the Export ccfx option and save to a location of your choosing. This will generate a ccfx file of all matrices currently stored on the probe as well as instructions on how to use that file with Calman.

If needing ColourSpace matrices you can select the Export bpd pair after selecting Compute Matrix and then store the files in a location of your choosing. You can also export bpd files of all previously created matrices stored on the probe by selecting Export synthetic bpd's from the Matrices on Probe window. This will generate a bpd file pair for all matrices stored on the probe.

Matrices saved on the probe			×
SLOT	NAME		
1	XMP270	rename	view delete
2	— empty —		
3	— empty —		
4	— empty —		
5	— empty —		
6	— empty —		
7	— empty —		
8	— empty —		
9	— empty —		
10	— empty —		

CR100 Matrix Creation

Connect the CRI spectroradiometer and CR100 to your computer.

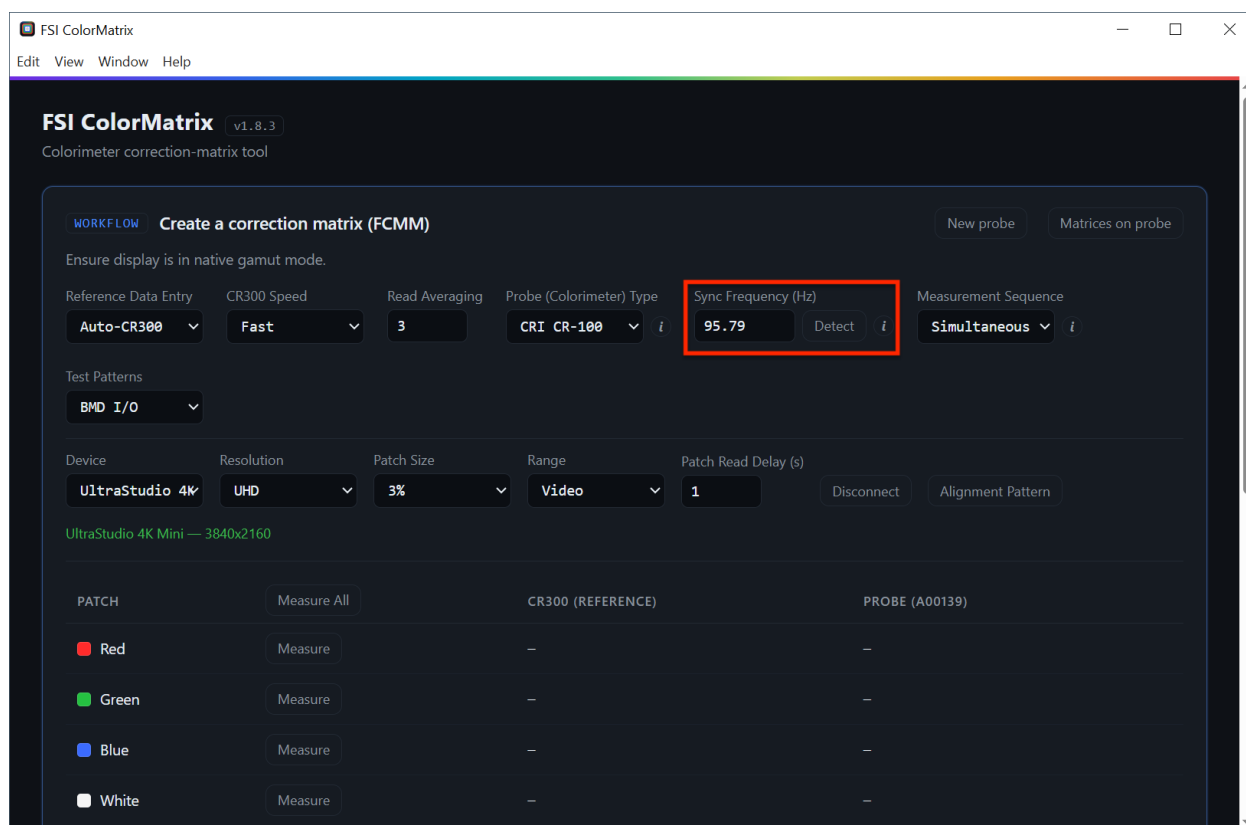
Next open the FSI ColorMatrix application. Select CRI CR100 in the Probe (Colorimeter) type drop down. The CR-100 serial number should be shown in the Workflow section. It is recommended to use the default settings for the spectroradiometer which should be the following: Reference Data Entry set to Auto-CR300, Speed set to Fast, and Read Averaging set to 3. Also set Measurement Sequence to Simultaneous and Test Pattern to BMD I/O.

Your BMD device should be shown in the Device box. Press Connect and then set the output to recommended settings for each series and then click connect.

For DM Series: HD Resolution, 10% Patch Size, Video Range, and 1 second Patch Read Delay

For XMP and XMP C Series: UHD Resolution, 3% Patch Size, Video Range, 1 second Patch Read Delay

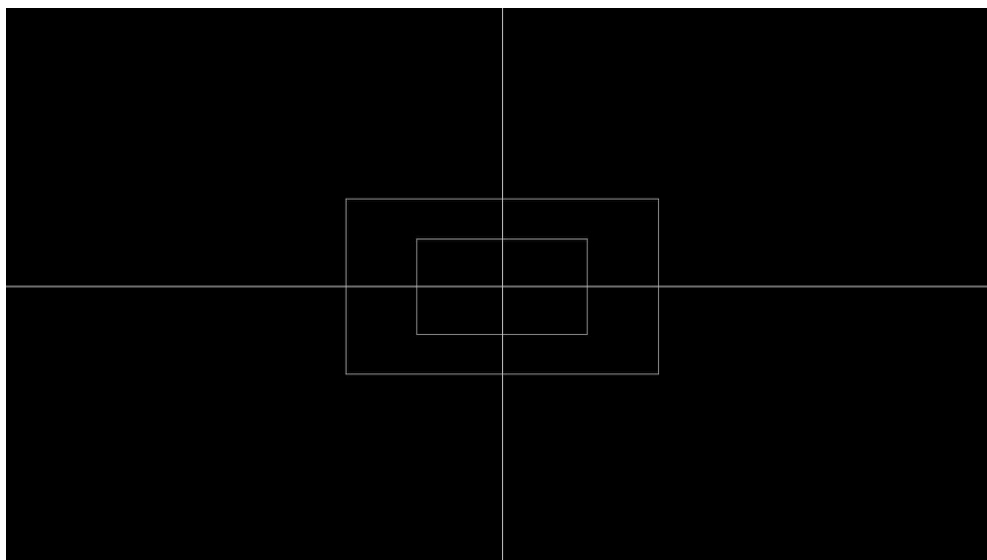
Position the CR100 near the center of the screen and select Detect under Sync Frequency (Hz).



Colorimeter Matrix Creation Using FSI ColorMatrix

Connect the CRI spectroradiometer and CR100 to your computer.

With sync detected, position both probes near the center of the screen. You can use the Alignment Pattern option to display a guide directly on the monitor to assist in probe placement. The smaller box is a 3% window and the larger box is a 10% window.



Now select Measure All. The application will take measurements with both probes on red, green, blue, and white. Once complete select Compute Matrix. You may need to scroll down to see the Correction Matrix data and Write to Probe options. Enter the model name for the matrix Name and select an available slot and then Write to Probe.

FSI ColorMatrix

Edit View Window Help

Device: UltraStudio 4K Resolution: UHD Patch Size: 3% Range: Video Patch Read Delay (s): 1 Disconnect Alignment Pattern

UltraStudio 4K Mini — 3840x2160

PATCH	Measure All	CR300 (REFERENCE)	PROBE (A00139)
Red	Measure	64.29, 28.92, 0.97	65.20, 27.71, 0.96 ✓
Green	Measure	27.38, 81.06, 5.39	27.61, 82.69, 4.92 ✓
Blue	Measure	20.55, 7.47, 113.13	20.69, 8.27, 110.90 ✓
White	Measure	113.93, 118.60, 121.43	114.90, 119.40, 117.93 ✓

Compute matrix Clear measurements i

Correction matrix (probe → reference)

0.985944	0.003186	0.002272
0.029865	0.974957	-0.010525
-0.002370	0.005235	1.026687

Name: XMP310 Slot: 12 Write to probe

Slot 12 is empty — adds a new matrix.

Colorimeter Matrix Creation Using FSI ColorMatrix

Please note that GaiaColor AutoCal will select the first available matching matrix name stored on the probe. If storing a matrix with a name already stored then please overwrite the previously matching matrix slot.

With the matrix created, select Advanced to open the Verify section. Select the matrix slot that was just created and then select Measure All. Once complete ensure that the Reference and Probe+Matrix measurements for red, green, blue and white are a close match. Once verified, matrix creation is complete and the probe can now be used for GaiaColor AutoCal and/or within 3rd party calibration software.

Ideal targets for an accurate matrix are $\Delta x, \Delta y$ 0.001 or lower and 5% or lower for ΔY .

FSI ColorMatrix
Edit View Window Help

Advanced

VERIFY Test Saved Matrix Reload matrices

Checks a matrix already on the probe against a reference instrument.
Readings are compared as x, y and Y rather than XYZ, with dE2000 for the overall difference.

Matrix on probe
12: XMP310 *i*

Reference Data Entry: **Auto-CR300** CR300 Speed: **Fast** Read Averaging: **3** Measurement Sequence: **Simultaneous** Test Patterns: **BMD I/O**

Using UltraStudio 4K Mini — UHD, 3% patch, Video range, 1s read delay. Change these in the matrix workflow above.

PATCH	Measure All	REFERENCE x, y, Y	PROBE + MATRIX x, y, Y	Δx	Δy	ΔY	dE2000	
Red	Measure	0.6827, 0.3071, 28.920	0.6826, 0.3071, 28.883	0.0001	0.0000	0.1%	0.04	✓
Green	Measure	0.2406, 0.7122, 81.073	0.2406, 0.7120, 81.267	0.0000	0.0002	0.2%	0.05	✓
Blue	Measure	0.1456, 0.0529, 7.473	0.1455, 0.0529, 7.415	0.0002	0.0001	0.8%	0.10	✓
White	Measure	0.3219, 0.3351, 118.633	0.3219, 0.3351, 118.467	0.0001	0.0001	0.1%	0.05	✓

4 patch(es): average dE2000 0.06, worst 0.10 Clear results

Klein K10A/K80 Matrix Creation

Connect the CRI spectroradiometer and Klein K10A or Klein K80 to your computer.

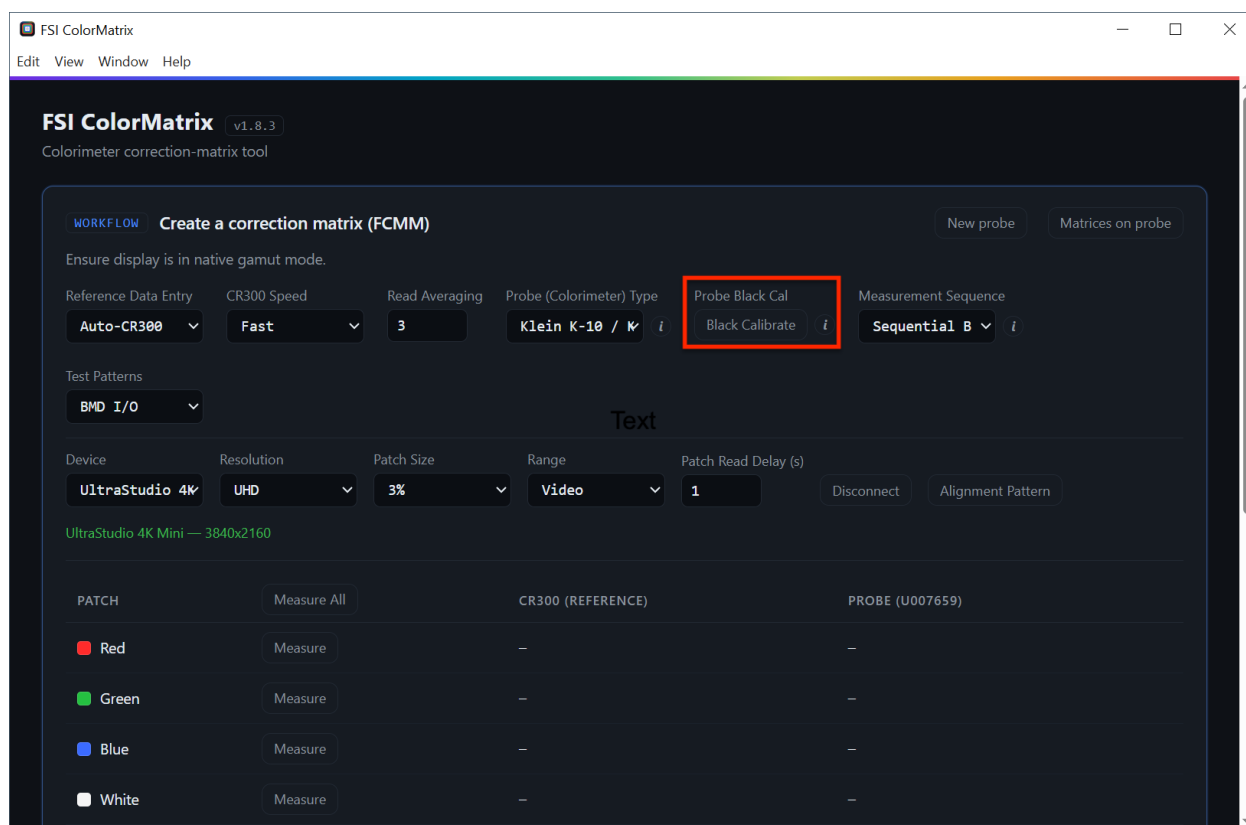
Next open the FSI ColorMatrix application. Select the Klein K10A/K80 option in the Probe (Colorimeter) type drop down. The Klein serial number should be shown in the Workflow section. It is recommended to use the default settings for the spectroradiometer which should be the following: Reference Data Entry set to Auto-CR300 (or Auto-CR250), Speed set to Fast, and Read Averaging set to 3. Also set Measurement Sequence to Sequential B and Test Pattern to BMD I/O.

Your BMD device should be shown in the Device box. Press Connect and then set the output to recommended settings for each series and then click connect.

For DM Series: HD Resolution, 10% Patch Size, Video Range, and 1 second Patch Read Delay

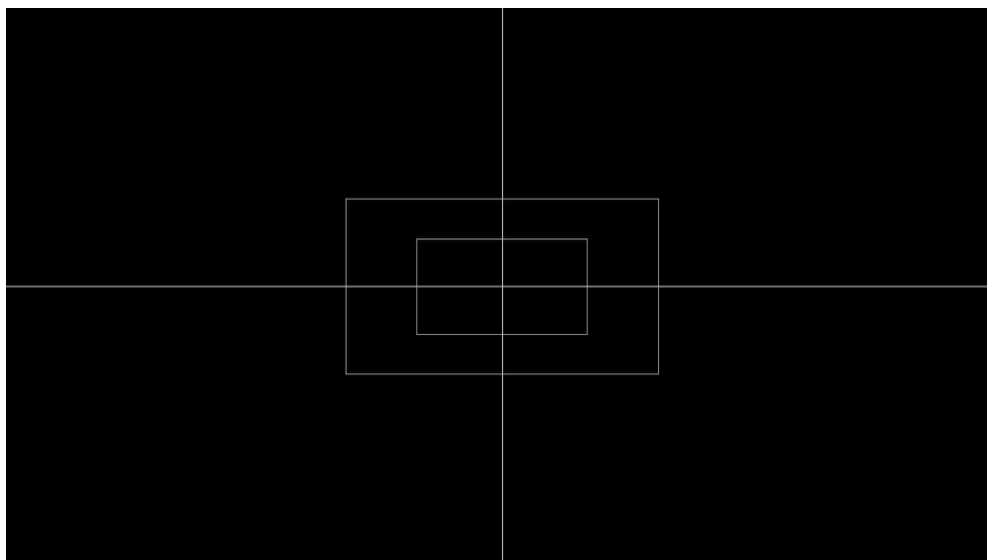
For XMP and XMP C Series: UHD Resolution, 3% Patch Size, Video Range, 1 second Patch Read Delay

With the lens cap still on the Klein, select Black Calibrate underneath Probe Black Cal. In the new window click Continue and then click Done once complete. Remove the lens cap for matrix creation.

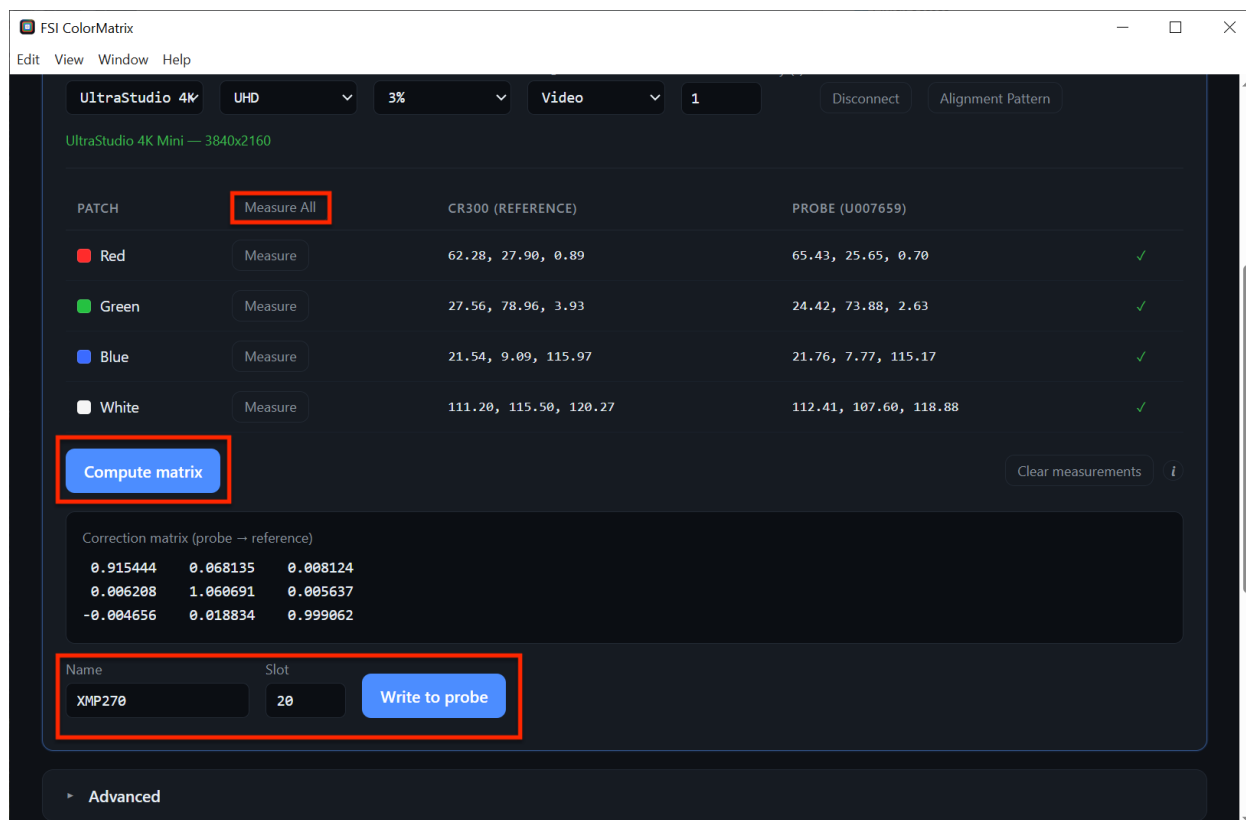


Colorimeter Matrix Creation Using FSI ColorMatrix

Next, position the spectroradiometer in the center of the screen. You can use the Alignment Pattern option to display a guide directly on the monitor to assist with probe placement.



Now select Measure All. The application will take measurements with the spectroradiometer on red, green, blue and white. When prompted, position the Klein in the center of the screen and click continue. Once complete select Compute Matrix. You may need to scroll down to see the Correction Matrix data and Write to Probe options. Enter the model name for the matrix Name and select an available slot and then Write to Probe..



Colorimeter Matrix Creation Using FSI ColorMatrix

Please note that GaiaColor AutoCal will select the first available matching matrix name stored on the probe. If storing a matrix with a name already stored then either overwrite the previously matching matrix slot or delete the previous matrix from the Matrices on Probe selection at the top of the workflow section.

With the matrix created, select Advanced to open the Verify section. Select the matrix slot that was just created and then select Measure All. Once complete ensure that the Reference and Probe+Matrix measurements for red, green, blue and white are a close match. Once verified, matrix creation is complete and the probe can now be used for GaiaColor AutoCal and/or within 3rd party calibration software.

Ideal targets for an accurate matrix are $\Delta x, \Delta y$ 0.001 or lower and 5% or lower for ΔY .

FSI ColorMatrix
Edit View Window Help

Advanced

VERIFY Test Saved Matrix Reload matrices

Checks a matrix already on the probe against a reference instrument.
Readings are compared as x, y and Y rather than XYZ, with dE2000 for the overall difference.

Matrix on probe
20: XMP270 *i*

Reference Data Entry: **Auto-CR300**
CR300 Speed: **Fast**
Read Averaging: **3**
Measurement Sequence: **Sequential B**
Test Patterns: **BMD I/O**

Using UltraStudio 4K Mini — UHD, 3% patch, Video range, 1s read delay. Change these in the matrix workflow above.

PATCH	Measure All	REFERENCE x, y, Y	PROBE + MATRIX x, y, Y	Δx	Δy	ΔY	dE2000
Red Red	Measure	0.6837, 0.3063, 27.900	0.6838, 0.3065, 27.929	0.0001	0.0002	0.1%	0.14 ✓
Green Green	Measure	0.2496, 0.7149, 78.923	0.2496, 0.7148, 79.171	0.0000	0.0001	0.3%	0.07 ✓
Blue Blue	Measure	0.1470, 0.0620, 9.056	0.1470, 0.0621, 9.104	0.0000	0.0001	0.5%	0.08 ✓
White White	Measure	0.3205, 0.3328, 115.433	0.3208, 0.3331, 116.599	0.0003	0.0003	1.0%	0.28 ✓

4 patch(es): average dE2000 0.14, worst 0.28 Clear results

Tips and Troubleshooting

Using test pattern generator other than Blackmagic device	Ensure that the monitor and output settings match as outlined in the Initial Monitor Setup and Matrix Creation sections of this guide. If you do not have a % based window size please use L18 or L20 in place 3% and L30 or L32 in place of 10% window sizes. We do not recommend using Measure All if using an external test pattern generator source. Instead, generate the correct color patch from the test pattern generator and then select Measure next to the corresponding color. The application will then take a measurement of that test patch only. Do the same for the all other patches before selecting Compute Matrix.
Using spectroradiometer other than CR300/CR250 for manual entry of reference data	Ensure that the monitor and output settings match as outlined in the Initial Monitor Setup and Matrix Creation sections of this guide. Then take measurements of red, green, blue and white with the spectroradiometer taking note of the X, Y, Z data as measured by the reference device. Once complete center the colorimeter in the center of the screen and set Measurement Sequence to Simultaneous. Select Measure next to red and enter the X, Y, Z data from the reference device and then click Ok. The FSI ColorMatrix application will then measure your red test patch with the colorimeter. Now do the same for green, blue and white before selecting Compute Matrix.
Matrix delta targets not met when verifying	Ensure that the monitor and output settings match as outlined in the Initial Monitor Setup and Matrix Creation sections of this guide. If using manual entry, ensure that all measurement data was properly entered as measured by the spectroradiometer. Ensure that the diffuser on the i1d3DS OEM is not covering the lens, the lens cap of the Klein K10A is removed and ensure that the probe is fully within the test patch window.
Probe not found or connecting	Ensure that the probe is not connected in another software (e.g. Calman) Use the Scan for Probe option in the Advanced section in the FSI ColorMatrix application. • If probe is found then select New Probe in the Workflow section to force a reconnect. • If probe is not found then disconnect and reconnect the probe to your computer before selecting the New Probe option.
Blackmagic device not connecting	Ensure that the Blackmagic output device is not connected in another application (e.g. DaVinci Resolve). Ensure that the computer is recognizing the output device by going to the Blackmagic Desktop Video application.
BMD I/O output not detected by display	Ensure that display is capable of accepting 444 RGB signals. The ColorMatrix application only outputs 444, not 422. If using an HD monitor ensure that output is set to HD.