

How to Calibrate Your Monitor with Free Software

Note: This article refers to SmallHD OS4, please refer to this tutorial for OS3.

Your SmallHD monitor's color is factory calibrated before it ships, however, as with all monitors, colors may begin to shift over time with use.

SmallHD is happy to calibrate your unit for you, but you can also do it yourself using a calibration probe and computer software. This works by connecting your monitor to your computer as a computer display and using calibration software to create a calibration LUT to load into your SmallHD monitor.



We recommend probes that can handle at least 2000 nits of brightness and 1:100000 contrast ratios (depending on your monitor Nit level, your probe should handle more). Common professional calibration probes include the <u>Klein Instruments K-10A</u> and Colorimetry Research CR-100. More budget probes are available on the market, you will get what you pay for in many cases.

SmallHD uses the professional software <u>CalMan</u> with a Klein Probe. Some probes will include their own software and there are free/open-source options on the market (some may or may not utilize a color



probe): <u>DisplayCAL</u>, Calibrize, and Natural Color Pro among a few . We will use DisplayCAL as an example, paired with the K-10A probe.

THINGS YOU NEED:

- Monitor
- Computer
- Software
- SmallHD OS4 or later (in this example)
- SD Card 2,4,8,16 GB properly formatted

WORKFLOW:

First, power on and connect your SmallHD monitor to your computer via HDMI and make sure it's detected as a display and receiving a signal.

Turn on the monitor allow it to warm up at least 45 minutes. You can run video or a test signal during this time.

Enter your monitor's settings page and select Calibration.

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INPUT CONFIG	ш			
COLOR PIPE		Le de la constante de la const	COLOR P	IPE
OUTPUT		Assign ar transform	nd configure color space nations to enable HDR and	and curve d SDR from
		incoming	log-based sources.	
display		() 1 •	Cal. Target - DC	CI P3 🛛
BACKLIGHT			Cal. Taraet - DC	CI P3 🗹
CALIBRATION				c)
APPEARANCE	1		Cal. Target - DC	J P3 🖸
controls		NEW CC	DLOR PIPE	+
VOLUME	=))			
IMAGE ROTATE	J			

Scroll down to reveal additional options and select Create New Calibration. You will enter a calibration wizard with introductory pages to the calibration process.



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feed					
INPUT CONFIG	1.1	L		ATION	
COLOR PIPE			, CALIBR	ATION	
OUTPUT		Calibra Iuminan	tion ensures chromina ice accuracy that can	ance and be relied upon	
		for critic	cal color decisions.		
display					
BACKLIGHT	244	Factory	Calibration		
CALIBRATION	*		WHITE POINT	DCI White	
APPEARANCE	1		COLOR SPACE	DCI P3	
controls			GAMMA	Gamma 2.6	
VOLUME	۹))	$\stackrel{+}{\rightarrow}$	Manual Adjustme	nt 🖸	
IMAGE ROTATE	Ð				

After clicking through the introduction, you will choose your calibration target. For non-HDR monitors, SDR - REC709 will be the recommended calibration. Select your calibration target and in the next screen, select Accept Calibration Target.



		MONITOR SETTING
×	CALIBRATION	
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2	7	
Calibration Tara	SDR - DCI P3 (Recommended)	DCI P3
e la dia	SDR - REC 709	WHITE POINT D65
preset or customize yo	on our Custom	2.6
01	wn.	
0	- Marina and Angeleric and A	SDR calibration target with the DCI P3 color space. Use this preset when
<		working with SDR content requiring more saturation than Rec 709 allows.

In the Profile Display? Page, select Profile Display if a new calibration LUT hasn't already been created.



	MONITOR SETTING
×	CALIBRATION
	Profile Display?
	If you already have a calibration LUT or you wish to skip the full calibration process and tweak the image manually with RGB Gain and Offset, press 'skip' to jump past steps involving a color probe.
	SKIP > Profile display >

Next, you'll be asked to select the Input Range. Select Next and you will have the choice of Auto calibrating by feeding full white and black screens into the monitor or just choose either Legal or Full Range options. (We recommend Full)



			MONITOR	SETTINGS
×	CALIBRATIC	И		
Input Range	Auto (Detect Range)	>		
If you know the data	- Legal Range			
range of your input sianal, select it here or	Full Range			
press Auto if unsure.				

Next you will Calibrate. Select Next and you will be brought to a calibration UI that will display the feed from your computer with no calibration applied, so your probe can start measuring.





Position your probe according to the manufacturer's recommendations.



Follow the DisplayCal instructions, making sure that you have the correct monitor and probe selected. Also make sure that your calibration settings match the calibration target. We are not affiliated with DisplayCal so please refer to the documentation and support from DisplayCal for operating the software.

Be sure to select the correct color space (rec.709 etc) and white point to match what you chose in the menus.

You will have an option to test this calibration to be sure its correct. Cheaper probes will possibly not be accurate so they should be checked, it may take a second or third run to get the unit the way you want it to be. Showing true white.



Ø DisplayCAL 3.8.9.3 File Options Tools Language ?	- O X
DisplayCAL ³ Display calibration and characterization pow	rered by ArgyllCMS
Settings Video (D65, Rec. 1886)	
Display & instrument	Calibration Profiling 🗱 3D LUT 📿 Verification
Display	Instrument
1303Bright @ -2880, 0, 2880x1620	✓ C K-10 ✓ Mode Factory Default ✓
White level drift compensation	Black level drift compensation
Override minimum display update delay	20 📥 ms
Override display settle time multiplier 1.00	00000
Output levels) TV RGB 16-235
Correction Auto (None)	~ 0 1 0 +
 Disable any and all dynamic picture settings contrast, dimming, automatic brightness and sin Make sure light does not shine directly onto the lf your display is an QLED or Place TV or other 	the display during that time as well. of your display if applicable. This can include functions such as dynamic milar features. e screen of your display. er type with variable light output depending on picture content, enable
white level drift compensation.	er type with variable light output depending on picture content, enable
If your instrument is a spectrometer and you u to enable instrument black level drift comper	se it in contact mode on a display with stable black level, you may want 1sation .
If your instrument is a colorimeter , you should display technology type. Note that some instrur already tuned for specific display types.	use a measurement mode or correction suitable for your display or ments (e.g. K-10, Spyder4/5/X) may offer a selection of measurement modes
Show information about common display te	chnologies
	Calibrate & profile

After calibration is complete, create a calibration LUT from the 3D LUT tab. Load this LUT onto an SD card and insert it into your monitor.



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File Options Tools Lang	juage ?	
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Settings <mark>Vi</mark>	deo (D65, Rec. 1886) V 🗖 🗖 🔤	▼
	Display & instrument 🜔 Calibration Profiling 🗱 3D LUT 🚫 Verification	
3D LUT settings		^
Create 3D LUT after p	profiling	
Source colorspace	Rec709 ITU-R BT.709 ~	
Tone curve	Rec. 1886 ~ Gamma 2.4 ~ Absolute ~	
	Black output offset	
	Apply calibration (vcgt)	
Gamut mapping mode	Inverse device-to-PCS	
	○ PCS-to-device	
Rendering intent	Relative colorimetric ~	
3D LUT file format	IRIDAS (.cube)	
Input encoding	Full range RGB 0-255	
Output encoding	Full range RGB 0-255	
3D LUT resolution	16x16x16 ~	
A 3D LUT (LUT	= Look Up Table) or ICC device link profile can be used by 3D LUT or ICC device link capable applications	
for full display of	color correction.	
Creating severa	al (additional) 3D LUTs from an existing profile	
With the desired	profile selected under "Settings", uncheck the "Create 3D LUT after profiling" checkbox.	
Choosing the r	ight source colorspace and tone response curve	
For 3D LUTs and become a fixed	d ICC device link profiles, the source colorspace and tone response curve need to be set in advance and part of the overall color transformation (unlike ICC device profiles which are linked dynamically on-the-	
fly). As an exam	ple, HD video material is usually mastered according to the Rec. 709 standard with either a pure power	
gamma of arou	nd 2.2-2.4 (relative with black output offset of 100%) or Rec. 1886 tone response curve (absolute with	¥
	Create 3D LUT	

On your monitor, which should still be in the calibration screen, select Done and in the following page, select Next then Browse for LUT





Select the LUT file you created and select Select. In the confirmation window, you can see your applied LUT affecting the screen. Our new calibration is more natural compared to the blue shifted old calibration. Select Keep to continue.









Next you will be prompted to select your HDR Range option. You can use your probe to measure the monitor's dynamic range and enter the values, or select Skip to apply factory measurements. We will skip in this example.



		MONITOR SETTINGS
×	CALIBRATION	
		10,000 White level
HDR Range	Measure Dynamic Range >	
Use an external probe to measure the panel's dynamic range/	Skip (apply factory measurement)	
contrast ratio.		

You will be presented with a Calibration Summary screen. Here you can use Manual Adjustment to tweak the calibration, as well as compare a before and after with A/B Compare. Select Save Calibration to save your settings.



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Calibration Summary At this stage you can adjust your new calibration and test against a non-calibrated image. ✓ ✓ Image: Image: <th></th> <th>[♥] COLOR SPACE</th> <th>REC 709</th> <th></th>		[♥] COLOR SPACE	REC 709	
Calibration Summary At this stage you can adjust your new calibration and test against a non-calibrated image. Save Calibration			D65	
At this stage you can adjust your new calibration and test against a non-calibrated image.	Calibration Summary	CURVE	Gamma 2.4	
calibration and test against a non-calibrated image. ✓ Save Calibration ✓	At this stage you can	Manual Adjustment		
against a non-calibrated image.	calibration and test	^ ₽ A / B Compare		
image. < Save Calibration ✓	against a non-calibrated			
	image. <			Save Calibration \checkmark

Your calibration will show up as Custom Calibration in the Calibration settings. You can toggle between Custom Calibration and Factory Calibration at any time.



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Custo	om Calibration				
	WHITE POINT	D65			
	COLOR SPACE	REC 709			
	GAMMA	Gamma 2.4			
++	Manual Adjustment	ď			
Facto	ory Calibration				