Test EIZO CG2700X: Graphics professional with UHD resolution

27" 4K graphics monitor offers excellent surface homogeneity and a very high colour gamut for the most demanding image retouching and colour-safe proof simulations

Introduction

We already had the opportunity to convince ourselves of the qualities of the EIZO CG2700S in the summer of last year. The CG2700X was announced at that time, but not yet available on the German market. Just in time for the market launch, we can now put the latest model of the ColorEdge series through its paces. The bar is set high. We are curious to see how the CG2700X compares to its little brother.

Both models have a 27-inch IPS panel, but the resolution of the CG2700X is much finer. 3840 x 2160 pixels not only promise plenty of space on the desktop, but also optimal text and graphics display. Furthermore, the contrast range and stability are significantly improved compared to the majority of IPS variants currently available. EIZO calls this True Black technology. Also pleasing: the comparatively high maximum luminance. This does not yet qualify the CG2700X for colour correction and retouching of HDR material in a professional environment. However, all other users will appreciate the extensive HDR tone curves that are integrated into the hardware calibration.

As usual, the scaler pipeline contains a programmable 3D LUT with 16 bits. It can be further optimised for the specific application via ColorNavigator. The hardware calibration software developed by EIZO has always been a guarantee for extremely precise colour reproduction. Due to the measuring device built into the monitor, there is no need for a separate probe.

However, for use in colour-critical environments, high-performance signal processing is only a necessary, but not sufficient, prerequisite. At least as important is the highest possible colour gamut. The CG2700X should cover Adobe RGB and DCI-P3 RGB almost completely. This means that all common offset printing conditions can be reliably reproduced. The proven "Digital Uniformity Equalizer", an equalisation function to improve area homogeneity, is also on board again.

Via USB-C, a connected notebook can transmit video signals to the monitor and be supplied with data from keyboard and mouse as well as power and network. A second USB interface enables KVM functionality. Only one set of input devices is required for two connected systems.

For detailed information on the features and specifications, please refer to the EIZO CG2700X data sheet.

Scope of delivery

EIZO ships the CG2700X with an HDMI cable, two USB cables (type C and type A to type B) and a power cable. We miss a DisplayPort cable, which is still often used today. Disturbing light influences are reduced via a light shield.

In addition, a report proves the factory calibration. The complete user manual and the ColorNavigator software for hardware calibration can be downloaded from the EIZO homepage.

Optics and mechanics

Externally, the CG2700X and CG2700S are completely similar. This is not unusual for EIZO. Even in the past, the design was only adapted cautiously at best. Our test device presents itself accordingly simple and unagitated. Nevertheless, the attribute "boring" does not do it justice. The no-frills casing made of dark plastic fits well into any work environment. A clear frame surrounds the panel. It thickens in the upper middle area to form a bulge that contains the integrated measuring device. It folds out after activation. However, we miss a flap for dust protection.

The built-in measuring device in the retracted state

The back also presents itself in a tidy manner. Defining design elements are the EIZO logo and a fine metal grid that covers large areas and ensures good heat dissipation.

The EIZO CG2700X with light protection screen

The frame width is about 1.9 cm. In the upper area we measure 3.1 cm. On the desk, the EIZO CG2700X takes up just under 24 cm. Without the stand, there is still about 8 cm.

Stand leg and USB inputs

Material appearance and build quality are good, but not significantly above the class average. The gaps remain small all around.

Lowest position from the front
Lowest position from behind

Highest position from the front
Highest position from behind

The height adjustment range is 15.5 cm. In the lowest setting, the distance from the lower edge of the frame to the table surface is 3.5 cm. In the highest position, we measure 19 cm. The maximum backward tilt is 35 degrees. A tilt in the opposite direction is possible up to about 5 degrees. Alternative mounting systems are connected to the monitor via the VESA 100 screw connection.


Maximum angle of inclination to the rear
Maximum forward tilt angle

The stand allows 180 degree rotation in both directions.


Lateral rotation to the right
Lateral rotation to the left

The EIZO CG2700X can also be operated in portrait orientation via a swivel joint.


Upright alignment (pivot) from the front
Upright alignment (pivot) from behind

The waste heat generated during operation is dissipated via the housing with the extended perforated plate and a few additional ventilation slots. Brightness- or contrast-dependent noise is completely absent.

Rear of the EIZO CG2700X with the perforated plate

The light protection screen leaves an ambivalent impression. It comes in one piece and can be mounted in a flash thanks to integrated magnets. Many competing products are much more complicated to handle.

However, the quality of workmanship and feel are mediocre. Moreover, there is no option to use the diaphragm in portrait mode.

Power consumption

With a luminance of 140 cd/m², we determine an efficiency of only 0.8 cd/W. This makes the EIZO CG2700X no efficiency miracle. Resolution and colour gamut take their toll here. In addition, the white level is reduced due to the area homogeneity enhancement. With the "Brightness" setting, the power consumption is slightly reduced accordingly.

In energy-saving mode, the power consumption drops sufficiently. Thanks to a real power switch, it can finally be reduced to zero.

	Manufacturer	Measured
Operation maximum	225 W	62 W
Operation typical	34 W	-
140 cd/m² (DUE: On)	k. A.	33,4 W
140 cd/m² (DUE: Brightness)	k. A.	35,6 W
Operation minimum	k. A.	27 W
Stand-by mode	0,5 W	0,5 W
Switched off (mains switch)	0 W	0 W

Connections

The EIZO CG2700X accepts video signals via three connections. The user has a DisplayPort, HDMI and USB-C input with DisplayPort implementation at their disposal. A feed in 10 bits per colour channel is possible for each input in RGB and YCbCr without colour subsampling.

The signal inputs of the EIZO CG2700X

The integrated USB hub provides four downstream sockets according to version 3.1 (2 x) and 2.0 (2 x). The interfaces are recessed on the side, while the connection to the computer is made via the rear port array. Here you will find a USB-C interface and a USB-B upstream port. They can be assigned to one of the three signal inputs via the OSD. Switching then takes place automatically. A simple but functional KVM switch.

However, the possible uses of the USB-C interface go far beyond those of a KVM switch. Data from the Ethernet home network is also available here, which reaches the monitor via the RJ-45 socket, which is also present. Connected devices can also be supplied with power up to 94 watts. The EIZO CG2700X thus replaces a USB-C dock. A welcome development that is finding its way into more and more monitors.

Operation

The controls, which are almost completely unlabelled, have been recessed in the lower frame. To facilitate navigation, their current function assignment is displayed. With the exception of the power switch, these are touch-sensitive buttons. Due to the design, there is no haptic feedback. Various actions - including changing the signal input and picture mode - can be carried out directly.

OSD

Despite the comprehensive hardware calibration, EIZO does not do without a very comprehensive OSD. It is divided into seven clearly structured main menu items.

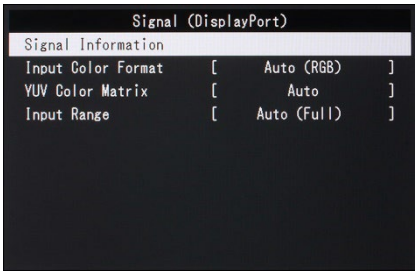
The intensity of the backlight is changed via a brightness control. The desired white point can be adjusted via presets in Kelvin, three RGB gain controls or normative specifications.

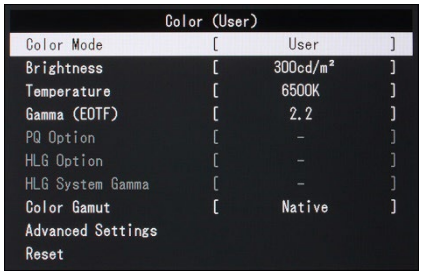
A change of the tone value curve is possible via the gamma controller. Apart from fixed values (1.6 to 2.7), the sRGB characteristic, among others, can also be selected directly. In addition, PQ and HLG gamma curves are available. The gradation characteristic can be adjusted here via further parameters. The colour space emulation is also extensive. In addition to sRGB and Adobe RGB, DCI-P3 RGB and ITU-R BT. 2020 are available. An optional gamut clipping ensures the precise reproduction of in-gamut colours and is particularly interesting for the large colour gamut defined in ITU-R BT. 2020 defined colour gamut. The colour space emulation can be controlled individually via ColorNavigator.

Three scaling settings allow for page-filling, area-filling and unscaled display of incoming signals. Their dynamic range is also taken into account. Under certain conditions (see section "Interpolation"), even simple pixel repetition can be used.

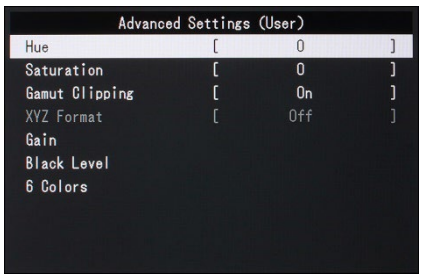
The self-calibration is configured via a separate menu item. The necessary target parameters are determined from a previous calibration with ColorNavigator. However, the settings, for example exact scheduling, can also be completely managed by the user in the software.

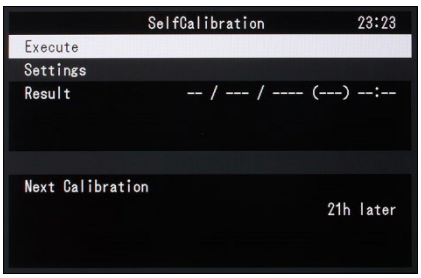
Other functions include selecting the menu language and positioning the OSD.



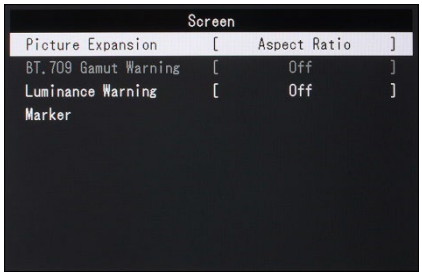


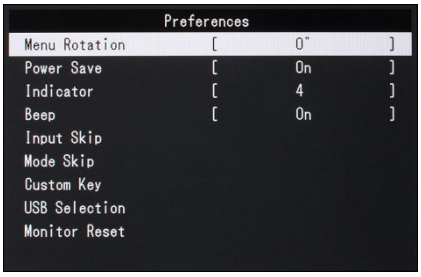
Menu: Signal
Menu: Colour





Menu: Colour -> Advanced
Menu: SelfCalibration



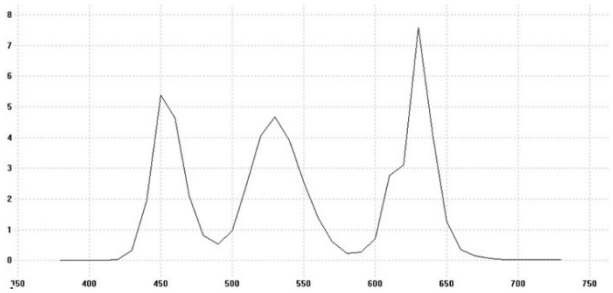


Menu: Screen
Menu: Preferences

Picture quality and signal processing

General

EIZO uses a 27-inch IPS panel with LED backlighting for the CG2700X. No further information can be found in the data sheet. So-called quantum dots could be used to optimise its emission spectrum, i.e. to convert or filter it into the desired, relatively narrow-band range. Compared to the EIZO CG2700S, there are hardly any differences.



Spectral radiation distribution white (colour location ~D65) according to colour filters (i1Pro 2; optical bandpass: 10 nm)

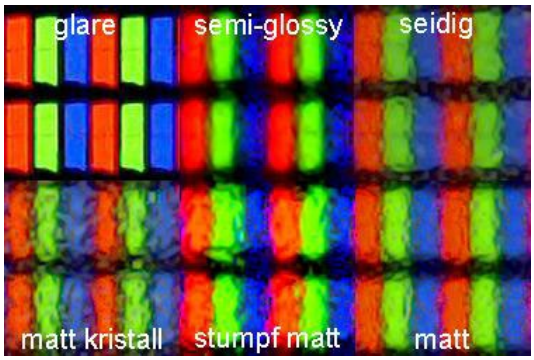
In fact, together with the excellent LC panel, the scaler developed in EIZO's laboratories and cast in an ASIC ensures extremely precise colour reproduction. The programmable 3D LUT is particularly emphasised in the advertising and data sheet, but is ultimately only one component of the extensive signal processing chain. Our expectations are correspondingly high. Nevertheless, the EIZO CG2700X is able to meet them. Its display is always in harmony with the settings made. Visually and metrologically (see the following sections) there are no complaints - even before the hardware calibration via ColorNavigator.

Test image to check grey gradients

In addition to a neutral and homogeneous display, the EIZO CG2700X scores with the very good viewing angle stability of its IPS panel and a comparatively high contrast range. Furthermore, the contrast loss that is otherwise common for IPS technology, which can lead to annoying brightening even when viewed from the front, has been greatly reduced.

Coating

The surface coating of the panel has a great influence on the visual assessment of image sharpness, contrast and sensitivity to ambient light. We examine the coating with the microscope and show the surface of the panel (foremost film) in extreme magnification.



Coating of the EIZO CG2700X
Coating reference image

A microscopic view of the subpixels, focusing on the screen surface: The EIZO CG2700X has a dull matt surface with microscopically visible depressions for diffusion. Grain or glitter effects are completely absent.

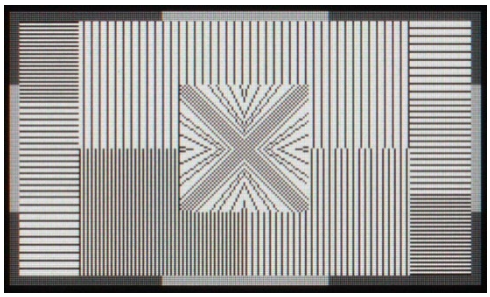
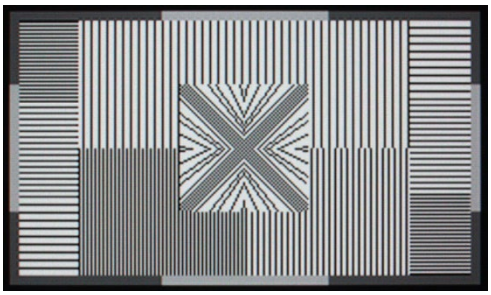
Interpolation

Our test signals are processed well. Scaling by the graphics card does not improve the display. EIZO does without a separate sharpness control, but in most implementations this only achieves questionable improvements anyway.

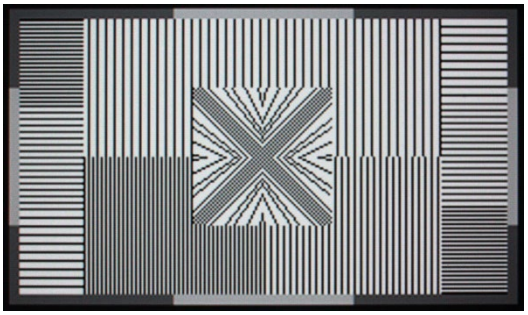
Content with a square pixel aspect ratio can be displayed without distortion. However, the same applies to SD video signals that deviate from this.

Scaling options

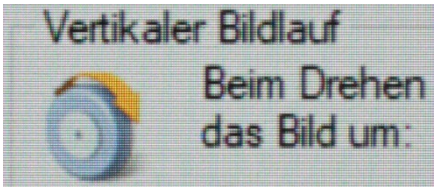
The following pictures give a rough impression of the quality of the scaling. The distance of the camera to the screen is always identical and it is always scaled to full screen according to the page.

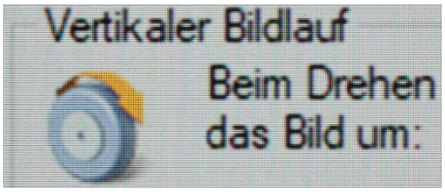



Resolution 3840 x 2160 (native)
Resolution 1920 x 1080

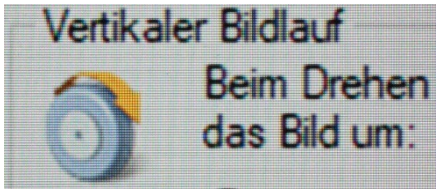


Resolution 1024 x 768



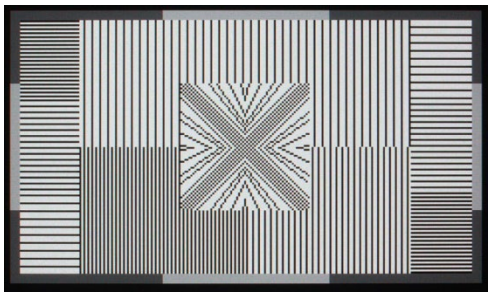


Resolution 3840 x 2160 (native)
Resolution 1920 x 1080



Resolution 1024 x 768

The "Nearest Neighbor" setting scales the signal by means of simple pixel repetition. The option only applies to input resolutions that can be mapped to the full panel resolution with an integer factor. This includes a typical Full HD signal with its 1920 x 1080 pixels. The result is shown below.



Resolution 1920 x 1080 - "Nearest Neighbor" (pixel repetition)

Resolution 1920 x 1080 - "Nearest Neighbor" (pixel repetition)

Juddertest

To test the frequencies and playback characteristics supported by the EIZO CG2700X, we fed in various signals and evaluated the result.

Juddertest on the EIZO CG2700X

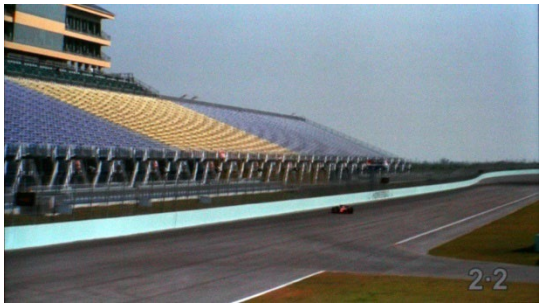
Our test signals ranging from 24 to 75 Hz are supported throughout. The display is judder-free with all refresh rates (24 Hz, 50 Hz, 60 Hz) that are particularly important for video playback.

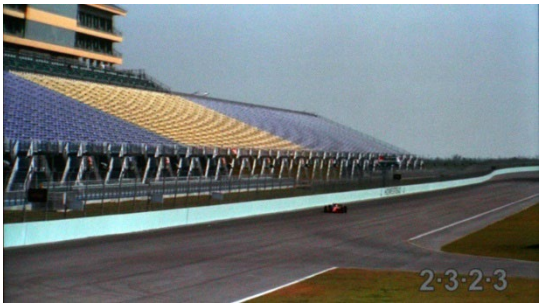
Deinterlacing

Since an LC display is always full-frame (progressive), a built-in deinterlacer must create a full-frame sequence from incoming fields (interlaced).

We check the deinterlacing with field sequences in 3:2 and 2:2 rhythm and then play in real video material with non-contiguous fields. Optimally, the deinterlacer can reconstruct the original full-frame sequence without loss in the first two cases.

The EIZO CG2700X does not recognise the original full images. Resolution losses are the result. However, the deinterlacing works quite well overall. Comb artefacts are absent even with poor material with little in-picture movement.



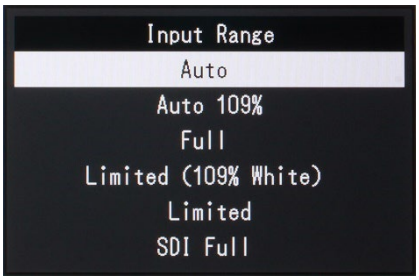


No recognition of 3:2 signals
No recognition of 2:2 signals

Test of the video mode deinterlacing

Signal level and colour model

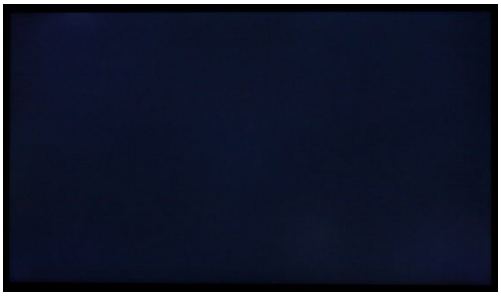
The EIZO CG2700X processes digital RGB and YCbCr signals. The dynamic range can be adjusted via the "Input Range" setting. "Limited" assumes a common video signal without btb and wtw components (tonal value range with 8-bit precision: 16-235). "Limited (109 % White)", on the other hand, preserves possible information in the highlights (tonal range at 8-bit precision: 16-254). "Full" is the correct selection for signals that use the full dynamic range (tonal range at 8 bit precision: 0-255).

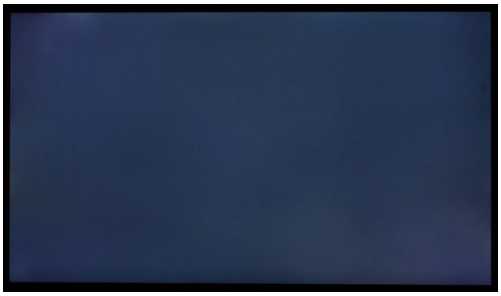


Dynamic range adjustment

Illumination

The illumination of our test device is very good. Even at the edges, there are hardly any irregularities. Even shots with extremely long exposure times reveal only a few artefacts.





Illumination of the monitor with short exposure time
Illumination of the monitor with long exposure time

Image homogeneity

We examine the image homogeneity on the basis of four test images (white, neutral tones with 75 %, 50 %, 25 % brightness), which we measure at 15 points. This results in the averaged brightness deviation in % and the likewise averaged delta C (i.e. the chromaticity difference) in relation to the respective centrally measured value.

+1.52%	-0.34%	+0.13%	+0.36%	+1.14%
+0.1%	-1.14%	0.0%	-0.18%	0.0%
+1.41%	-0.58%	+0.51%	-0.25%	+1.1%

0.9	0.68	0.21	0.34	0.35
0.88	0.34	0.0	0.15	0.41
0.9	0.88	0.57	0.68	0.87

Brightness distribution [%] (DUE: Uniformity)
Colour Uniformity [Delta C] (DUE: Uniformity)

The implementation of the DUE ("Digital Uniformity Equalizer") has always been one of the pronounced strengths of the ColorEdge series. This does not change with the EIZO CG2700X. The display is extremely uniform across the entire panel surface and all mid-tones. Brightness and colour deviations are neither visible to the naked eye nor can they be detected by measurement.

Via the Administrator menu protected with a special key combination (shown in the manual) or ColorNavigator, the interventions of the equalisation function can be reduced (DUE Priority: Brightness). This increases the contrast range.

-7.81%	-8.25%	-7.19%	-8.46%	-9.29%
-6.66%	-3.77%	0.0%	-3.26%	-10.71%
-1.96%	-2.64%	-3.83%	-4.63%	-8.57%

1.0	0.86	0.31	0.25	0.3
1.07	0.5	0.0	0.26	0.44
1.07	0.94	0.64	0.55	0.71

Brightness distribution [%] (DUE: Brightness)
Colour Purity [Delta C] (DUE: Brightness)

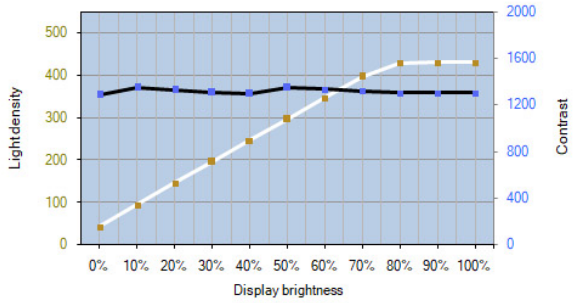
The colour drift is still very low. However, the brightness distribution deteriorates significantly. Starting from a previously almost perfect result, a good rating is nevertheless only just missed.

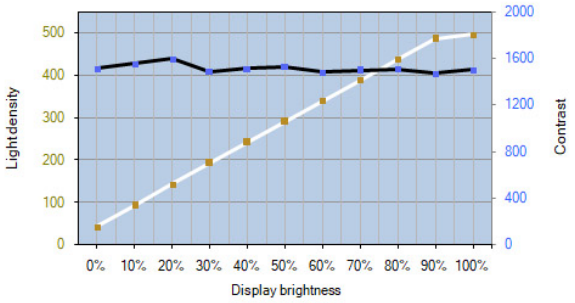
At this point we would like to point out that the position of our measurements are shifted towards the edges compared to the requirements in ISO 12646.

Brightness, black level, contrast

Measurements are taken after calibration to D65 as the white point. If possible, all dynamic controls (including local dimming) are deactivated. Due to the necessary adjustments, the results are lower than when performing the test series with native white point.

The measurement window is not surrounded by a black border. The values can therefore be compared more with ANSI contrast and reflect real-world situations much better than measurements of flat white and black images.





Brightness and contrast curve of the EIZO CG2700X - D65 (DUE: Uniformity)
Brightness and contrast curve of the EIZO CG2700X - D65 (DUE: Brightness)

Luminance White (DUE: Uniformity):

Brightness	Native	D65	5800 K	D50
100 %	446.1 cd/m²	430.2 cd/m²	433.3 cd/m²	439 cd/m²
50 %	-	297.2 cd/m²	-	-
0 %	-	42.5 cd/m²	-	-

Luminance Black (DUE: Uniformity):

Brightness	Native	D65	5800 K	D50
100 %	0.33 cd/m²	0.33 cd/m²	0.33 cd/m²	0.33 cd/m²
50 %	-	0.22 cd/m²	-	-
0 %	-	0.03 cd/m²	-	-

Luminance White (DUE: Brightness):

Brightness	Native	D65	5800 K	D50
100 %	513.8 cd/m²	495.8 cd/m²	499.8 cd/m²	505.6 cd/m²
50 %	-	290.9 cd/m²	-	-
0 %	-	42.4 cd/m²	-	-

Luminance Black (DUE: Brightness):

Brightness	Native	D65	5800 K	D50
100 %	0,33	0.33 cd/m²	0.33 cd/m²	0.33 cd/m²
50 %	-	0.19 cd/m²	-	-
0 %	-	0.03 cd/m²	-	-

With an almost native white point, we achieve a maximum luminance of over 510 cd/m². So the factory specification does not promise too much here. This means there is sufficient margin for almost all SDR application areas. We even come close to the 640 cd/m² required for sampling according to ISO 3664 P1. This high value is necessary because of the illuminance of 2000 lx required there (for example for live proofing in the press room).

A contrast ratio of a very decent 1500:1 is maintained across the entire range of brightness settings. After switching to DUE mode (Priority: Uniformity), the contrast ratio drops to a still good 1350:1. The maximum luminance is now around 450 cd/m².

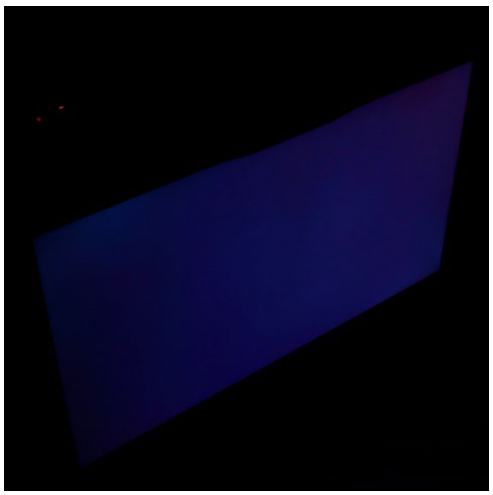
Viewpoint

The factory specification for the maximum viewing angle is 178 degrees horizontally and vertically. The figures are based on a residual contrast of 10:1, which is typical for modern IPS and VA panels. However, further colourimetric changes are not or only insufficiently included in the specification.

Viewing angle of the EIZO CG2700X

The IPS panel of the EIZO CG2700X convinces with its high viewing angle stability. Hue and gradation changes are significantly reduced compared to screens with VA panels. These properties allow large-area display of colour-critical content.

Precautions have also been taken to reduce brightening effects caused by the viewing angle. As a result, this improves the subjective black level even when viewed from the front, as the image remains more homogeneous towards the edges even at close viewing distances.



Reduced brightening when viewed from the side

Colorimetric tests

Colour space comparison in CIELAB (D50)

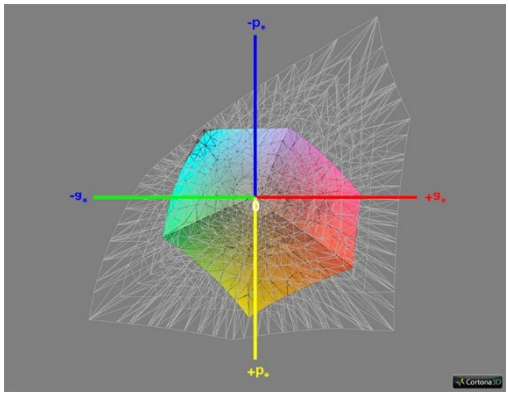
The following illustrations are based on the colourimetric data after a calibration to D65 as white point. The reference white for the preparation in CIELAB is D50 (adapted with Bradford).

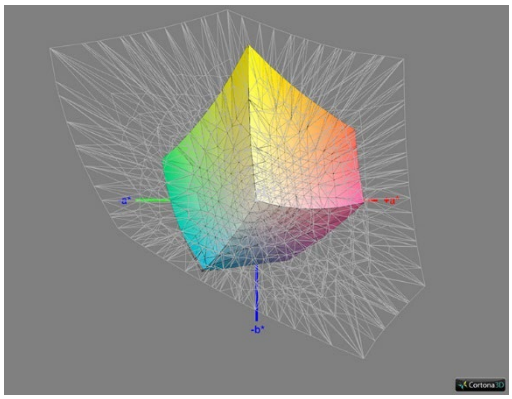
White volume: screen colour space
Black volume: reference
colour space Coloured volume: intersection
Comparison targets: sRGB, Adobe RGB, ECI-RGB v2, ISO Coated v2 (ECI), DCI-P3 RGB

Colour space	Cover
ISO Coated v2	99 %
sRGB	100 %
Adobe RGB	99 %
ECI-RGB v2	92 %
DCI-P3 RGB	97 %

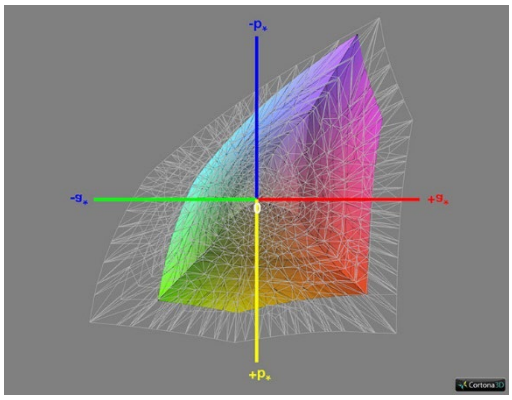
sRGB and Adobe RGB are fully covered. The offset printing condition described by the FOGRA39 characterisation data can also be reproduced precisely. This makes meaningful proof simulations possible. The comparatively high coverage of ECI-RGB v2, which is often used in media-neutral workflows, is also pleasing.

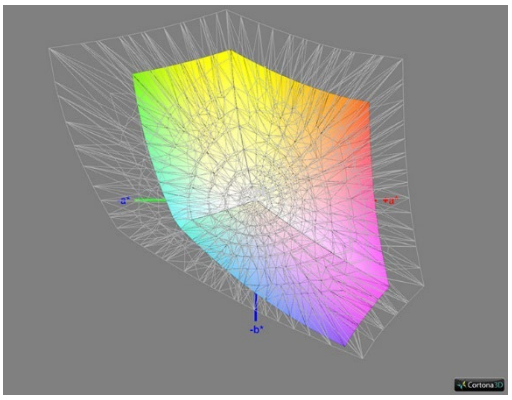
For use in HDR video workflows, the coverage of DCI-P3 RGB plays a major role. Here, the EIZO CG2700X is also convincing.



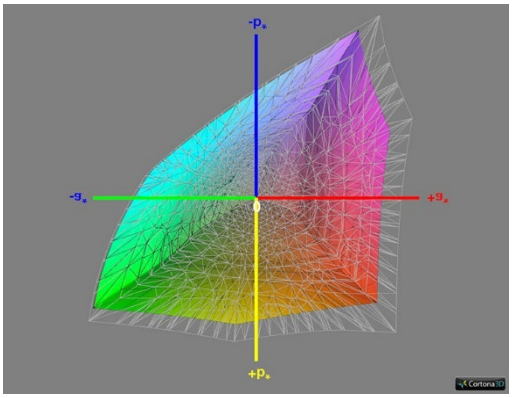


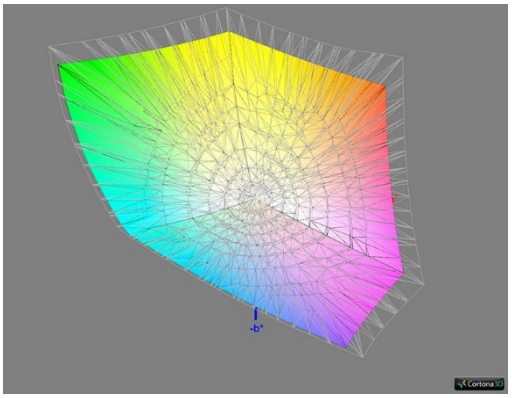
Cover ISO Coated v2, 3D cut 1
Cover ISO Coated v2 , 3D cut 2



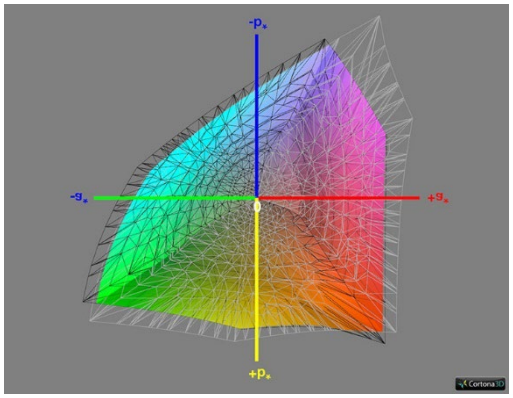


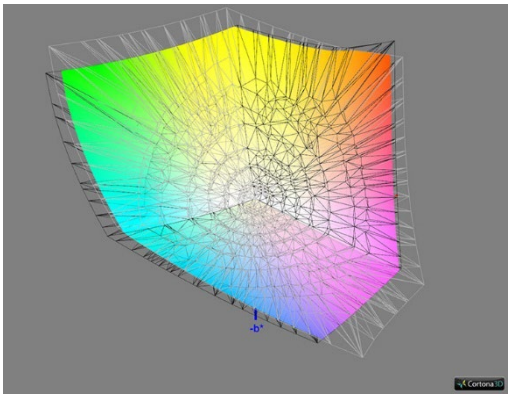
Coverage sRGB, 3D cut 1
Coverage sRGB, 3D cut 2



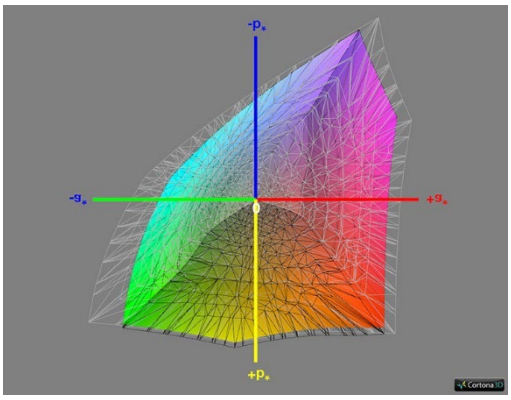


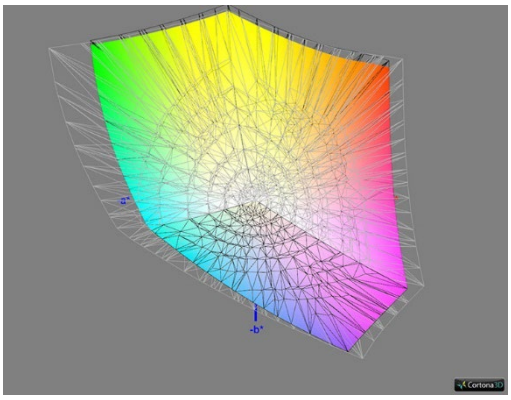
Coverage Adobe RGB, 3D cut 1
Cover Adobe RGB, 3D cut 2





Coverage ECI-RGB v2, 3D cut 1
Coverage ECI-RGB v2, 3D cut 2





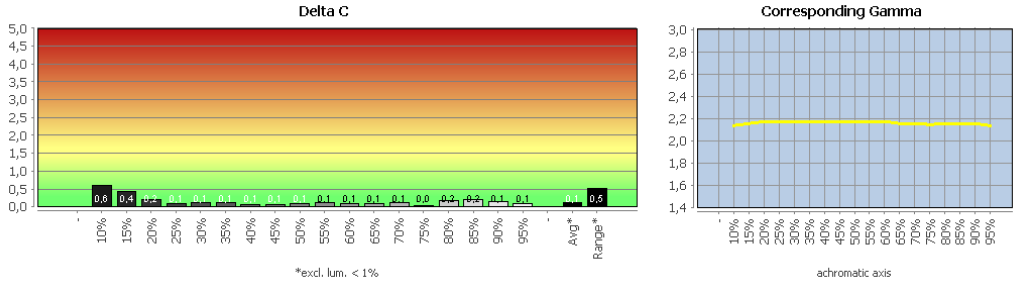
Cover DCI-P3 RGB, 3D cut 1
Cover DCI-P3 RGB, 3D cut 2

Measurements before calibration and profiling

Dynamic controls are deactivated, if possible, before the subsequent tests.

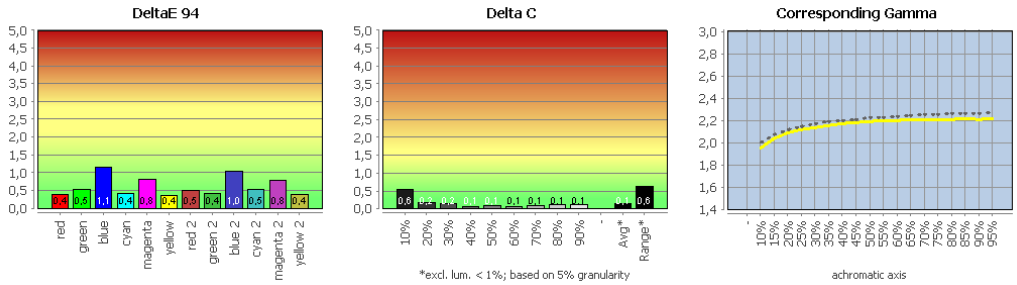
Factory setting (colour mode: User)

The factory setting of the EIZO CG2700X is without fault. All the parameters we recorded match the current OSD setting almost perfectly. The grey balance is excellent.



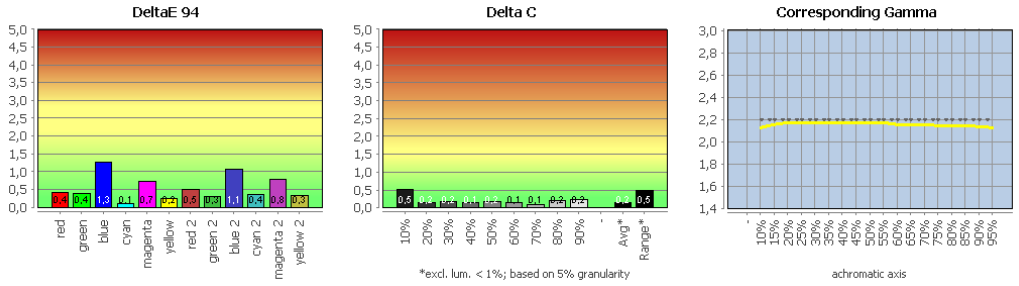
The detailed test results can be downloaded as a PDF file.

Colour mode sRGB compared with sRGB



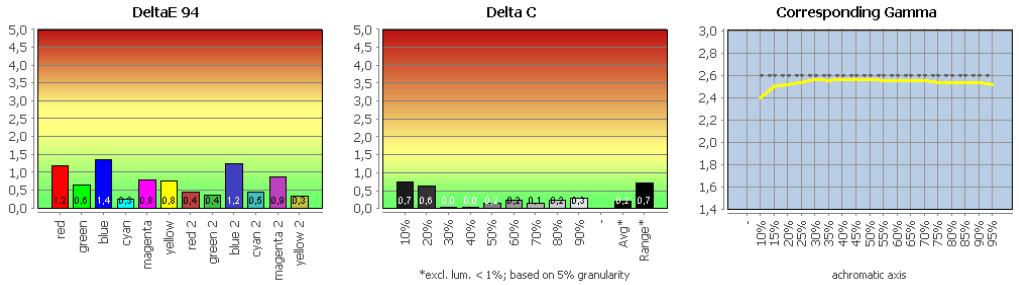
The detailed test results can be downloaded as a PDF file.

Adobe RGB colour mode compared with Adobe RGB



The detailed test results can be downloaded as a PDF file.

Colour mode DCI-P3 RGB compared with DCI-P3 RGB



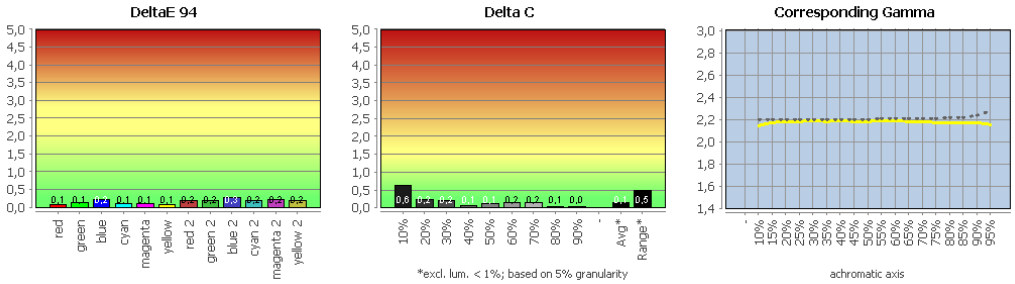
The detailed test results can be downloaded as a PDF file.

The already very positive picture at the beginning continues in the picture modes we measured. The deviations in the bright colours are very small. The grey balance is also convincing. Appropriate content can thus be reproduced very attractively without further measures, even in applications that are not colour management-capable.

Measurements after calibration and profiling

For the following measurements, the EIZO CG2700X was hardware calibrated and profiled from within ColorNavigator with Priority set to "Standard" (more on this setting in the "ColorNavigator" section). The target brightness was 140 cd/m². D65 was selected as the white point. Neither of these is a generally valid recommendation. This also applies to the choice of tone curve, especially since the current characteristic is taken into account anyway within the framework of colour management.

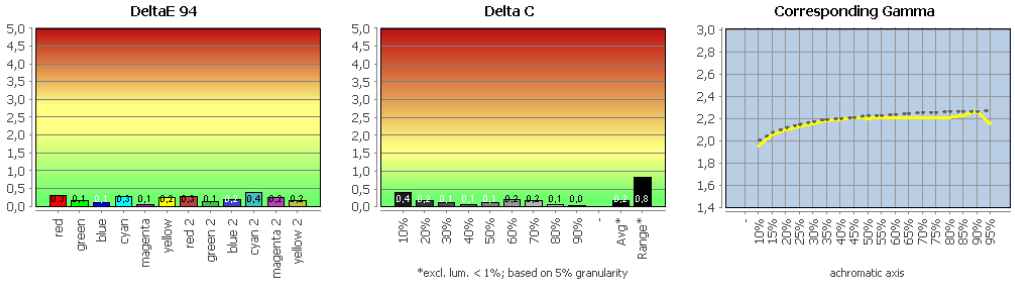
Profile validation (Priority: Standard)



The detailed test results can be downloaded as a PDF file

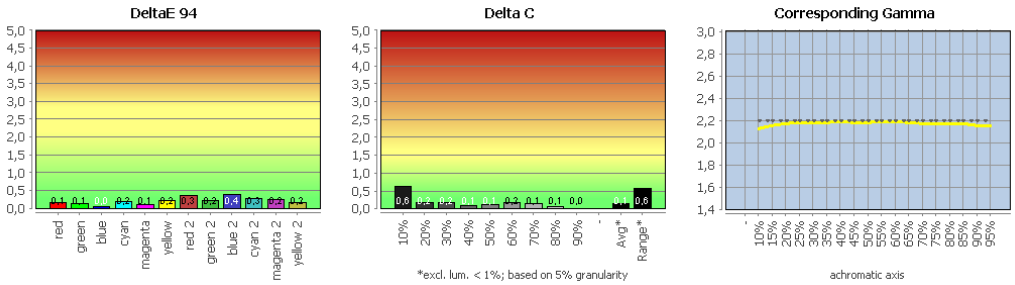
The EIZO CG2700X shows no noticeable drifts or unsightly non-linearities. The shaper/matrix profile describes its condition extremely accurately. A repeat of the profile validation after 24 hours showed no significantly increased deviations. All calibration targets were achieved. The grey balance is perfect.

Comparison with sRGB (colour transformed)



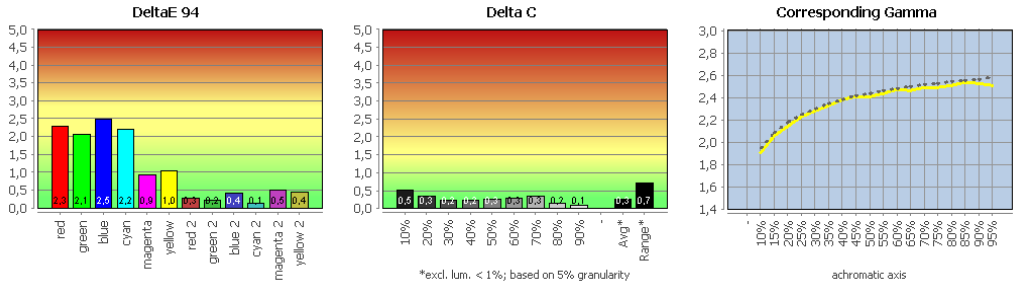
The detailed test results can be downloaded as a PDF file

Comparison with Adobe RGB (colour transformed)



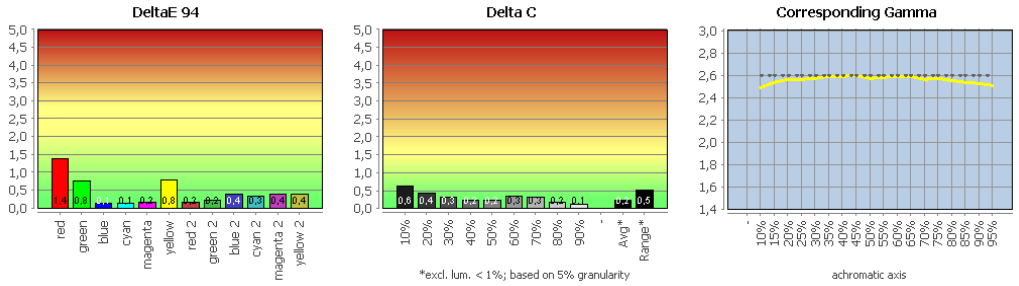
The detailed test results can be downloaded as a PDF file

Comparison with ECI-RGB v2 (colour transformed)



The detailed test results can be downloaded as a PDF file.

Comparison with DCI-P3 RGB (colour transformed)



The detailed test results can be downloaded as a PDF file.

Our CMM takes into account the working colour space and monitor profile and performs the necessary colour space transformations with colourimetric rendering intent on this basis. This works perfectly for the EIZO CG2700X.

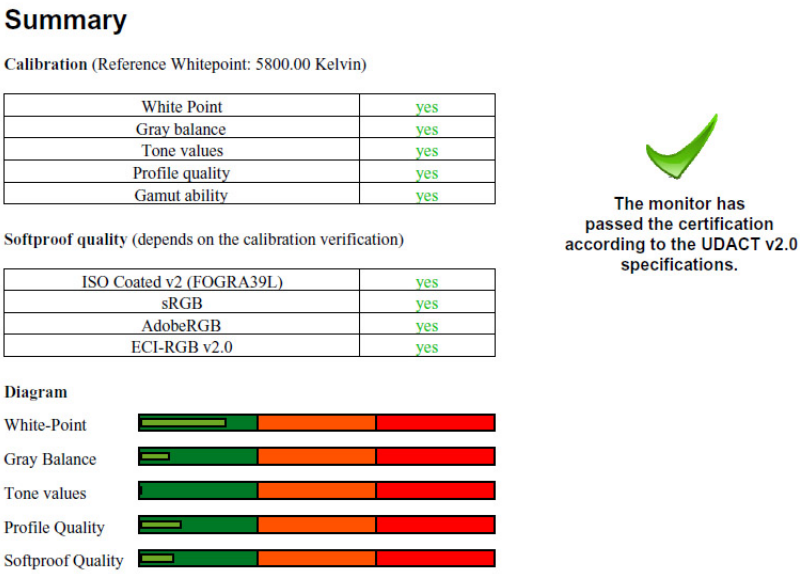
In sRGB, Adobe RGB and DCI-P3 RGB, no or at most few out-of-gamut colours occur due to its large colour gamut. Even in ECI-RGB v2, which is often used in media-neutral workflows, the results are decent. Only some strongly saturated tonal values can only be reproduced approximately by mapping to the colour space boundary. Compared to many other monitors with an extended colour space, the risk of tonal value breaks is thus reduced once again.

UDACT ("UGRA test")

Before the test, we calibrated the screen to the following target values, which correspond to UGRA's recommendations for soft proofing tasks (alternatively: L* gradation):

Destination	Brightness	White point (CCT)	White point (XYZ, norm.)	Gradation
	160 cd/m²	5800 K	95.37 100.00 97.39	Gamma 1.8

As part of the certification process, the Ugra/Fogra media wedge CMYK is measured on the basis of the selected printing condition. Here we define the offset printing condition described by the FOGRA39 characterisation data (glossy or matt coated image printing paper). The EIZO CG2700X masters this test without any problems.



Summary

Calibration (Reference Whitepoint: 5800.00 Kelvin)

White Point	yes
Gray balance	yes
Tone values	yes
Profile quality	yes
Gamut ability	yes

Softproof quality (depends on the calibration verification)

ISO Coated v2 (FOGRA39L)	yes
sRGB	yes
AdobeRGB	yes
ECI-RGB v2.0	yes

Diagram

White-Point
Gray Balance
Tone values
Profile Quality
Softproof Quality

The monitor has passed the certification according to the UDACT v2.0 specifications.

The detailed test results of the UGRA-UDACT can be downloaded as a PDF file.

ColorNavigator 7

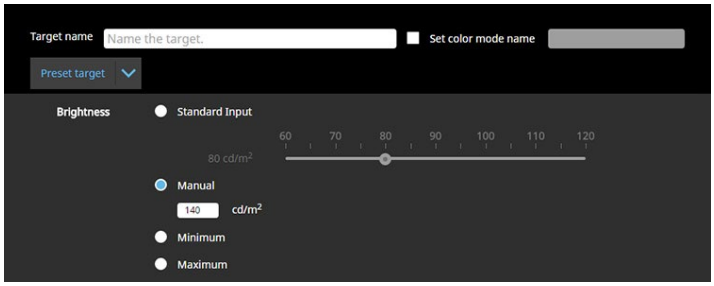
Hardware calibration

The EIZO CG2700X can be calibrated using the supplied ColorNavigator software. Since the scaler or its LUTs are accessed directly, this is a so-called hardware calibration. Numerous measuring devices are supported. The most popular models in the prosumer sector are probably i1Pro (1-3), i1Display Pro and Pro Plus from X-Rite as well as Spyder 4, 5 and X from Datacolor. At the other end of the (price) scale is, for example, the Minolta CS-2000, which is also supported.

The user first defines a target and then triggers the calibration. It is possible to switch between already calibrated targets later with a simple mouse click. The flexible colour space emulation is fully integrated into this process.

In the following, we briefly describe the procedure for creating a new destination with manual data entry. Alternatively, various other methods can be used: These include modifying existing targets, reading colourimetric data from ICC profiles, live measurement of another screen or tuning the white point with regard to ambient light or the paper white under standard light.

1. Brightness: The low slider range (60-120 cd/m²) can be overridden by manual input. This means that the full luminance is also available during hardware calibration.

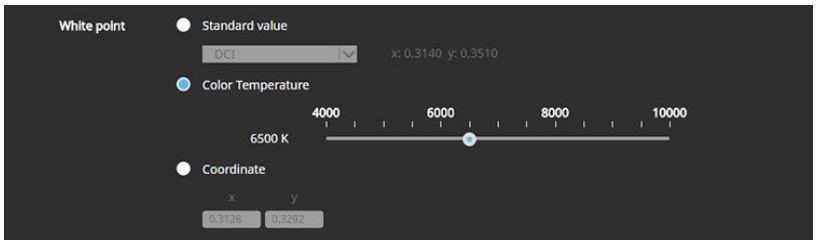


Brightness

2. Black level: The black level can be raised in a defined way if desired.

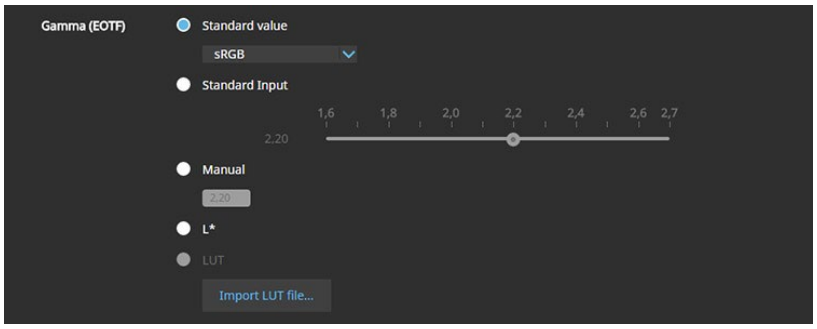
Black level

3. White point: The user can choose between different presets in Kelvin (reference: daylight spotlight, illuminant D) and the individual definition in xy standard colour value components.



White point

4. Gamma (EOTF): Initially, gamma tone value curves (1.0-2.6) and L* as well as sRGB characteristics are available for calibration. However, individual tone value curves can be defined by specifying a suitable colour profile or by loading a text file (CSV) with corresponding assignments. In addition, PQ and HLG gamma curves can be selected and parameterised. More on this in the section "HDR".

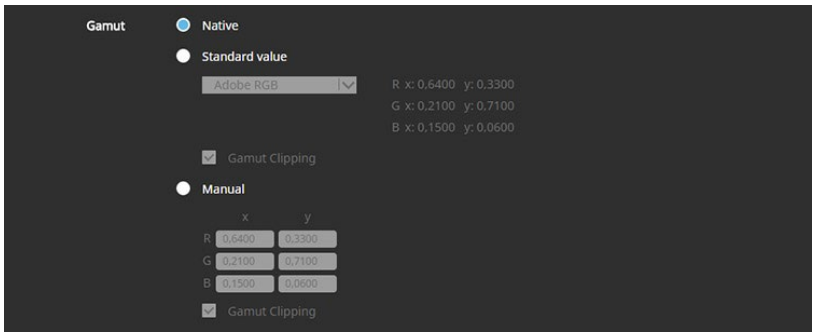


Gamma (EOTF)

5. Priority: The choices under "Priority" control the calibration process. With the "Fixed Gamma" setting, only the white point is adjusted on the basis of concrete measured values. Necessary corrections in the mid-tones are calculated by the scaler. "Standard" optimises the grey balance and tone curve, but does not raise the black level. By choosing "Gray balance", the maximum possible neutrality is achieved. This requires raising the black level to avoid colour casts even in the absolute depths. However, we can no longer see any improvement here in the already impeccable result.

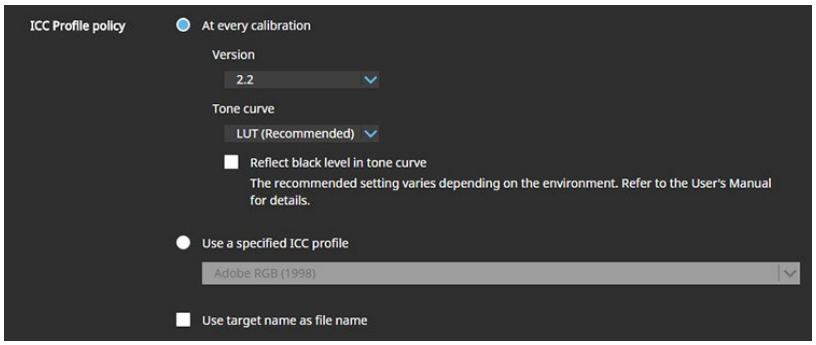
Priority

6. Gamut: In a colour management-enabled workflow, you will mostly want to work on the basis of the native monitor colour space. This maximises flexibility. Alternatively, the colorimetric data of the primary colours can be determined from an ICC profile or by specifying the xy standard chromaticity coordinates. We explain the option "Gamut Clipping" in the section "Colour Space Emulation".



Gamut

7. ICC Profile policy: Finally, the colour profile to be created is specified. It can be saved as v2 or v4 type. CLUT profiles are not generated (only shaper/matrix). In view of the excellent linearity, this is acceptable, especially since the characterisation optionally reflects the actual black level of the monitor.



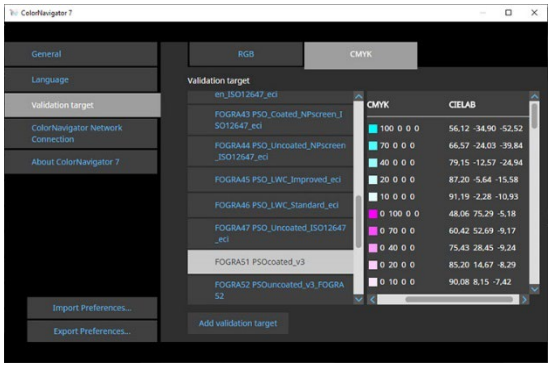
The target is now calibrated with one of the available measuring instruments. This is followed by the profiling. Initially, one memory location is available, but any number of targets can be assigned to it. Each of these must be recalibrated. However, each of the predefined image modes can also record individual calibration data (under any new name if required). Switching is then possible with a mouse click in the task bar. The colour profile in the Windows system folder is also updated.

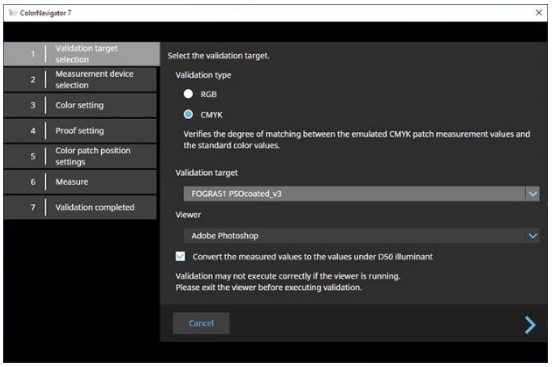
Testing tools

After calibration and profiling are completed, a quality control can be carried out. In the course of profile validation, any RGB test shapes can be created. EIZO also offers two presets, one of which implements the requirements defined in ISO 12646. The colourimetric data of the displayed colour patches are then compared with the measurement figures resulting from corresponding transformations based on the monitor profile. This target/actual comparison shows how well the calibration target was achieved and how precisely the current characteristic was captured in the profile.

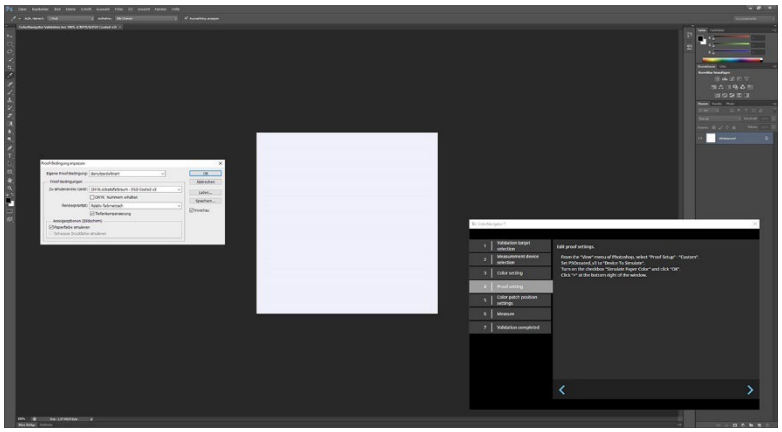
With the EIZO CG2700X, however, CMYK targets can also be measured at this point. External software is used to display the colour patches. Therefore, Adobe Photoshop (from CS1) or Adobe Acrobat (from version 7) must be installed. The actual measurement takes place fully automatically after manual presettings by the user. A softproof display with paper colour simulation is always used. The measured values can thus be compared directly with the target values after a white point adaptation.

Attention: Unless D50 has been calibrated as the white point, a check box for the corresponding adaptation must be explicitly activated.





CMYK validation: target definition
CMYK validation: target definition



CMYK validation: Proof simulation and automatic measurement in Adobe Photoshop

Colour space emulation

To configure the colour space emulation, the desired colour gamut is defined via the xy standard colour value components of the primary colours (see section "Hardware calibration"). Alternatively, the data can be read from an ICC profile. In this way, the intended tone value curve is also adopted. Please note that ColorNavigator recalculates the data adapted to D50 in the profile if a "chromaticAdaptationTag" is available.

The setting "Gamut Clipping" forces a colourimetric transformation. Out-of-gamut colours are then shifted to the colour space boundary. In-gamut colours are reproduced precisely. Without gamut clipping, the calibration target is internally adjusted to be fully covered by the colour gamut of the monitor. This avoids tonal clipping, but reduces the precision of the reproduction of in-gamut colours - under the premise that a target has been defined that extends beyond the native colour gamut of the monitor.

In order to guarantee the most correct representation possible even in colour management-capable applications - here, however, one will usually calibrate without monitor-internal colour space emulation - the ICC profile with activated "gamut clipping" reflects the emulation target even if the actual monitor colour space is smaller.

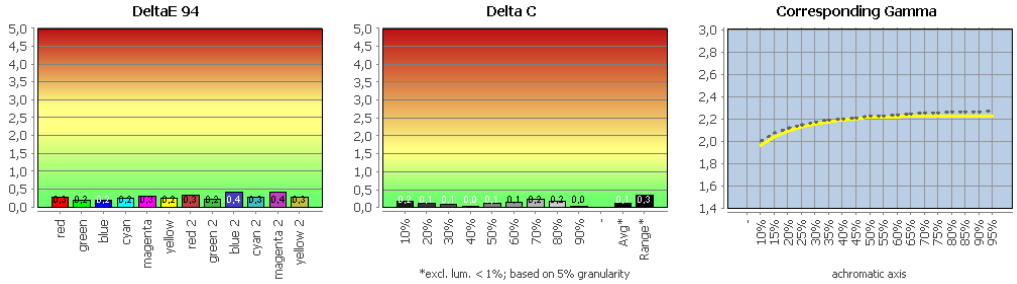
However, the colour space transformations can also be precalculated via a CMM and automatically written into the LUT pipeline of the monitor. For this purpose, the user selects the desired emulation target in the form of an ICC profile and assigns it to a calibration target. As long as its characterisation information is correct, the conversions are performed very accurately and with specified rendering intent (if supported by the profile). Depth compensation is not available. If the monitor profile generated by ColorNavigator reflects the real black level, slight tonal value breaks may therefore occur in the depths. In this case, the corresponding preset ("Reflect black level in tone curve") should be waived in advance of the selected calibration.

Important: The active monitor profile naturally still contains the colourimetric data of the parent target. In colour management-capable applications, this leads to an incorrect display.

A third variant is particularly interesting for professional users in the video sector. Behind the inconspicuous emulation function "LogView LUT Emulation" is a possibility to load ready-made transformations into the 3D LUT of the monitor. If only generic CLUTs are available (for example, according to Rec. 709), they are assigned to a corresponding emulation target.

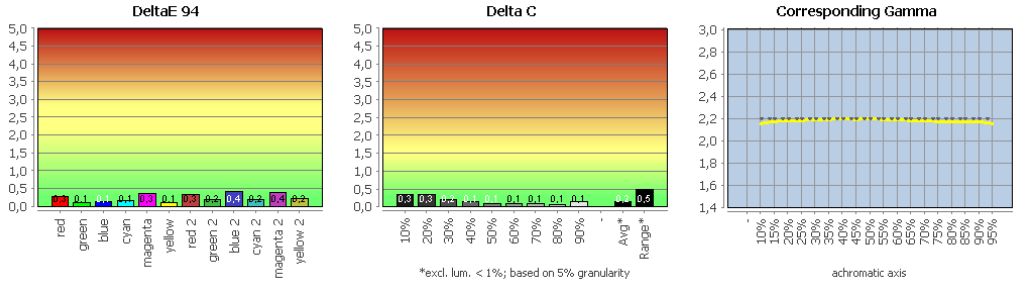
In the following we have used the colour space emulation from within ColorNavigator to simulate sRGB, Adobe RGB, DCI-P3 RGB and ECI-RGB v2 with "Gamut Clipping" activated. The measurements against the respective working colour space are carried out without colour management. A CMM is therefore not used.

Comparison of sRGB emulation with sRGB



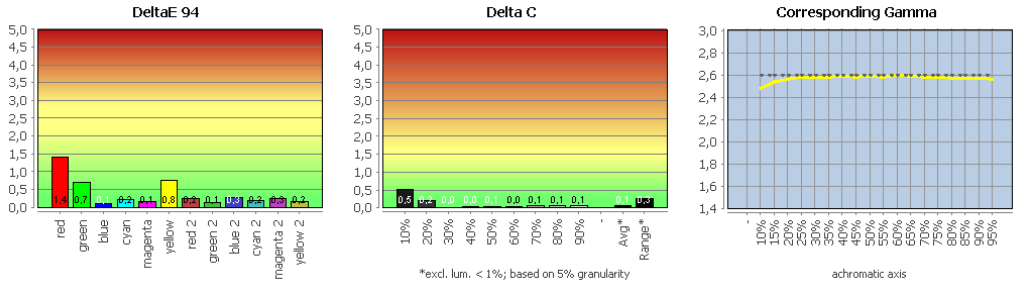
The detailed test results can be downloaded as a PDF file.

Comparison of Adobe RGB emulation with Adobe RGB



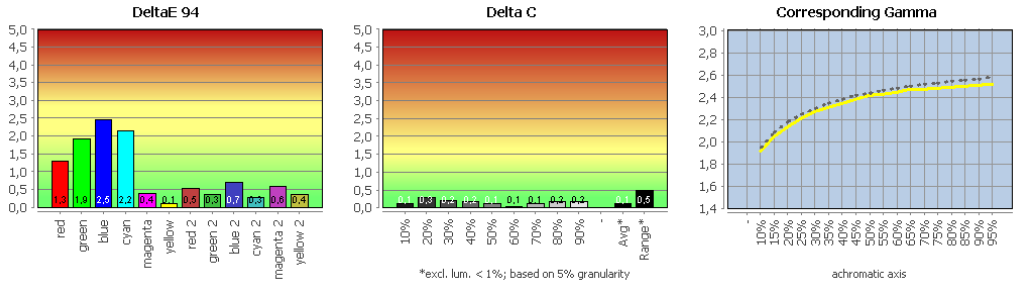
The detailed test results can be downloaded as a PDF file.

Comparison of DCI-P3 emulation with DCI-P3 RGB



The detailed test results can be downloaded as a PDF file.

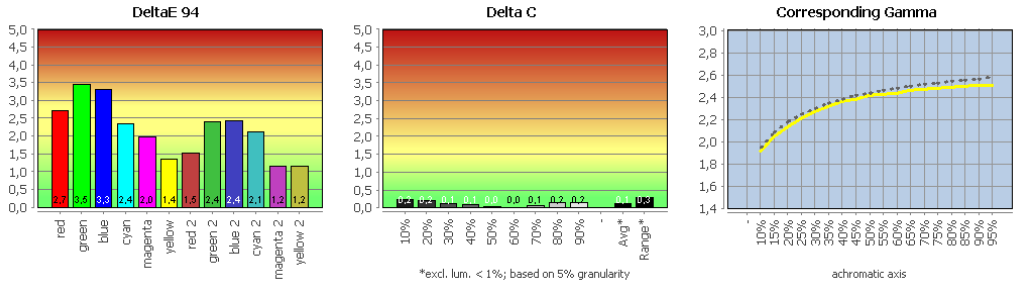
Comparison of ECI-RGB v2 emulation with ECI-RGB v2



The detailed test results can be downloaded as a PDF file.

The colour space transformations are implemented precisely. This enables a defined representation even outside the ICC workflow. The emulation of ECI-RGB v2 shows the relatively colourimetric rendering intent in the result: tonal values within the monitor colour space are ideally converted. All other tonal values end up on the colour space boundary.

For comparison, we have simulated ECI-RGB v2 again with "Gamut Clipping" deactivated. This inevitably leads to increased deviations even in areas that lie within the monitor colour space. On the other hand, the full tonal range of the input signal is preserved.

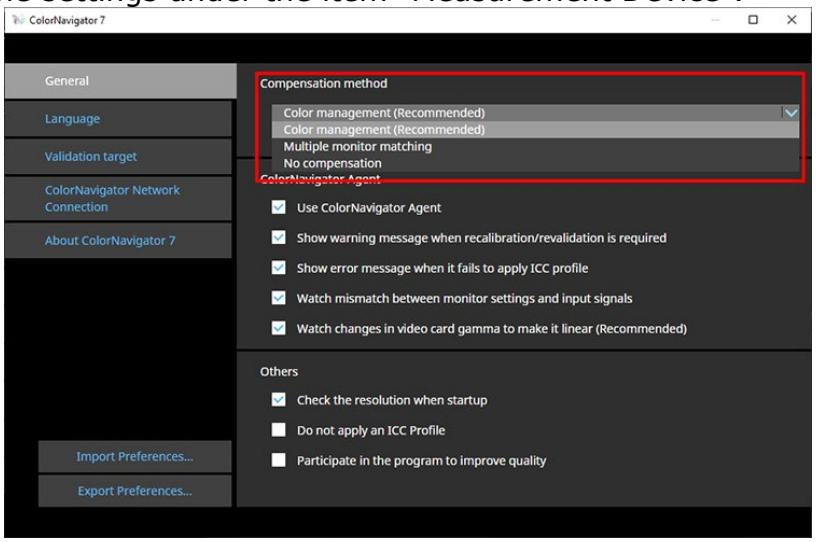


The detailed test results can be downloaded as a PDF file.

Colorimeter correction

The measuring principle on which a colourimeter is based is borrowed from the human eye. The spectral sensitivity of the CIE standard observer is simulated by photoelectric receivers with upstream filters. The design and tuning of the filters (at least three, but often more) are of decisive importance for the achievable measurement accuracy. Due to remaining differences, corrective measures are necessary, which in each case refer to specific reference monitors with characteristic emission spectra.

The correction for the supported colourimeters stored by EIZO in ColorNavigator is hidden in the settings under the item "Measurement Device".



Correction for colorimeter

The deviations between the i1Pro 2 we use as a reference and the i1Display Pro Plus as a colourimeter are negligible both with and without explicit compensation setting(s). At the maximum, they are at a Delta E (76) of 1.5, not reverting to X-Rite's generic characterisation even with compensation disabled. Of course, the i1Pro, no matter in which version, is not an ideal reference. However, the results show that EIZO also pays attention to this problem and does not use an off-the-shelf solution.

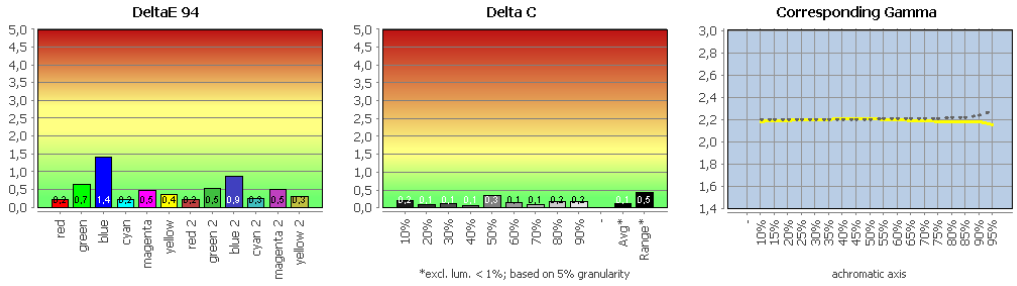
Built-in measuring device

The built-in measuring device can be selected as a separate probe in ColorNavigator. It allows you to completely dispense with your own measuring equipment and automatically extends in the upper middle range after activation.

The built-in measuring device in action

For testing purposes, we carried out calibration and profiling with the built-in measuring device and then validated the profile with the X-Rite i1Pro 2.

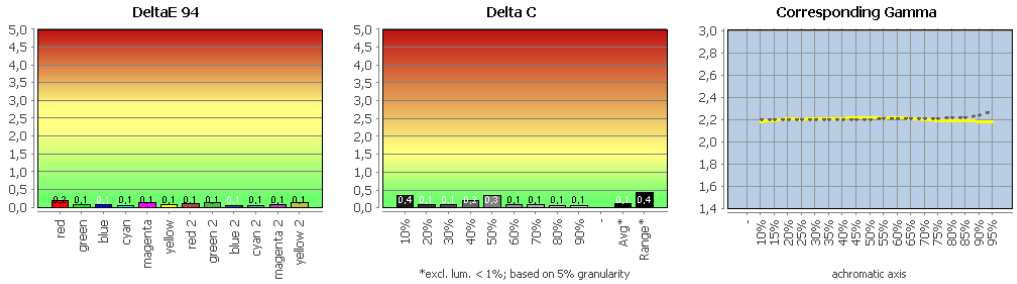
Profile validation (built-in measuring device uncorrelated => i1Pro 2)



The detailed test results can be downloaded as a PDF file.

The result is once again convincing. All deviations are at a low level. If you want to adjust the measurements to an existing probe, you can do this easily using the correction function. For this purpose, the same series of measurements (RGBW) is run through by the internal and external probes. The results form the basis for a correction that is automatically applied in the form of a simple 3x3 matrix.

Profile validation (built-in measuring device correlated => i1Pro 2)



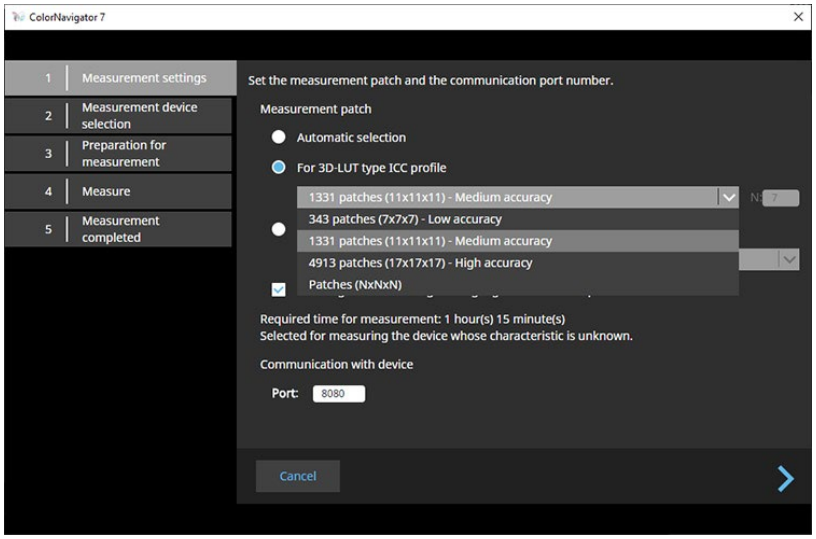
The detailed test results can be downloaded as a PDF file.

Using the built-in measuring device, the EIZO CG2700X can be recalibrated on a regular basis. This increases the precision between complete calibration and profiling runs via ColorNavigator, which also need to be carried out less frequently.

The configuration is simple. If one has already calibrated the screen, the necessary parameters are directly noted. The user only has to set the desired time interval.

Profiling of other display devices (e.g. tablets, smartphones)

Another interesting function is the profiling of external screen devices such as tablets or smartphones. The test fields are displayed fully automatically on the target device via internet browser. The necessary network port is specified by the user during configuration. The results can be saved as a matrix or LUT profile and of course also used for colour space emulation.



Profiling of further display units

HDR

EIZO did not have the CG2700X specified according to VESA DisplayHDR. Nevertheless, our test device also scores in the area of HDR reproduction. Technically comparable competitor models with DisplayHDR-400 specifications are even clearly outperformed. Although this is not yet enough for professional HDR colour correction and retouching, EIZO makes full use of the panel and makes it possible to reproduce demanding HDR material.

The VESA specifications provide for the HDR10 format as the transmission standard. The signal to be processed has the following properties at its core:

- 10 bits per channel.
- Absolute tone curve according to SMPTE ST 2084.
- Colour gamut according to ITU-R BT. 2020.
- Processing of static metadata defined in SMPTE ST2086.

The absolute tone value curve is based on a basic concept that has long been known from the medical field (DICOM). The objective is maximum coding efficiency even under unfavourable conditions (an eye that is always brightness-adapted to assess a minimum difference). There is plenty of room for improvement for the maximum brightness. The same applies to the colour gamut, which could only be achieved with monochromatic primary colours. The VESA takes this into account and defines DCI-P3 RGB as the reference colour space.

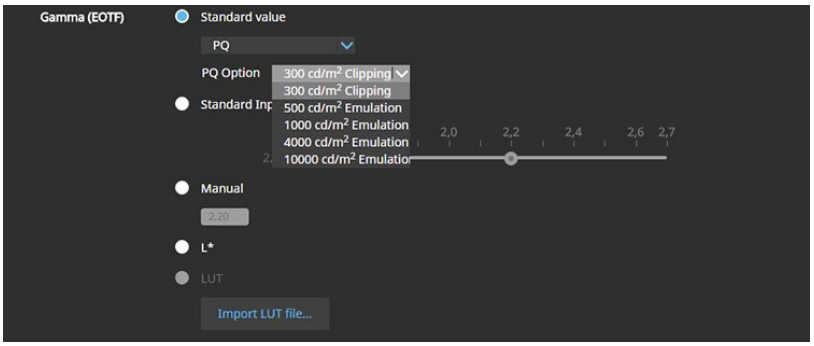
The display technology is a good deal behind this transmission standard. However, metadata relating to the specific mastering characterises the material in a rudimentary way. The monitor's scaler can then make an adjustment. In the following, we will concentrate primarily on HDR10 reproduction.

OSD and ColorNavigator make the PQ transfer function available. The settings include:

- 300 cd/m² clipping
- 500 cd/m² emulation
- 1000 cd/m² emulation
- 4000 cd/m² emulation
- 10 000 cd/m² emulation

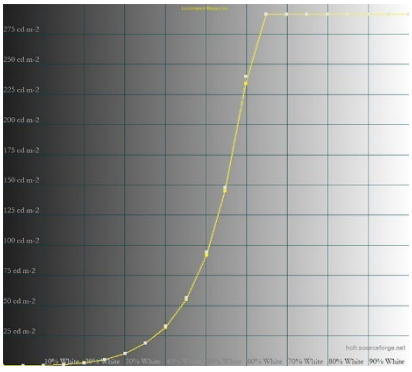
The implementation promises accurate reproduction up to 300 cd/m² for the single clipping setting. Beyond that, of course, differentiation is no longer possible. The emulation settings differentiate up to the eponymous threshold value. Naturally, the precision decreases with increasingly higher values. An interesting feature is the colour highlighting of areas that exceed the threshold values listed above.

The APL for the subsequent measurements was always below 50 % due to the selected measurement field size. However, the EIZO CG2700X reaches its maximum luminance even with a full-surface display.



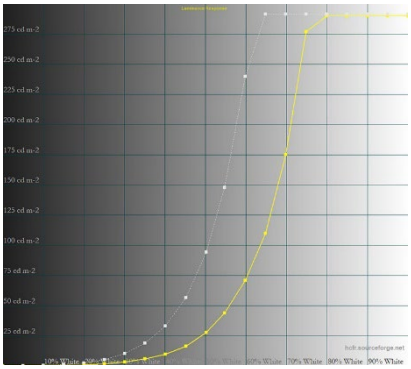
Configuration PQ transfer function in ColorNavigator

PQ 300 cd/m² clipping



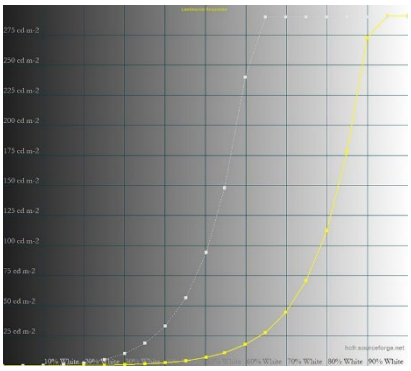
PQ 300 cd/m² clipping

PQ 1000 cd/m² emulation



PQ 1000 cd/m² emulation

PQ 4000 cd/m² emulation



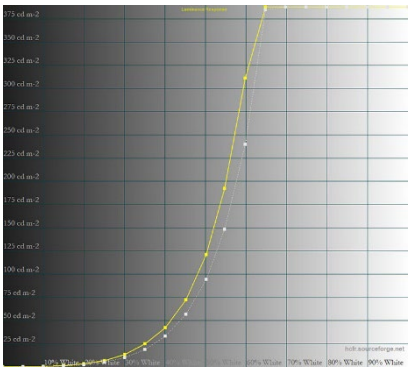
PQ 4000 cd/m² emulation

In the graphics, the target characteristic is deposited as a light grey curve. It is based on the measured maximum brightness and from there follows the PQ transfer function (according to SMPTE ST 2084). This results in a more or less large clipping range for all real monitors, as the maximum 10 000 cd/m² are not reached.

All settings live up to their name. However, with the 4000 cd/m² emulation at the latest, the tone value curve is inevitably lowered to such an extent that even halfway sensible sampling is no longer possible under the given parameters.

The brightness setting should definitely be 300 cd/m². Deviating values lead to a loss of precision because the calculations are always based on this maximum brightness. Unfortunately, this also applies to hardware calibration.

PQ 300 cd/m² clipping - luminance: 400 cd/m²

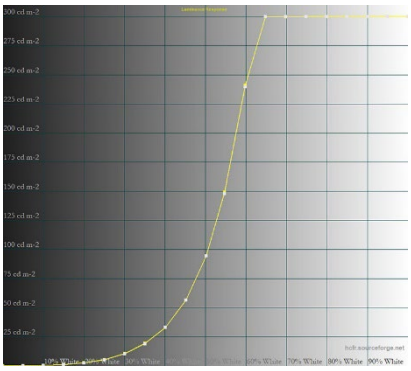


PQ 300 cd/m² clipping with 400 cd/m² luminance

The tone value curve now no longer follows the target characteristic, but is always slightly above it.

In the following, we have prepared the results for the setting "300 cd/m² clipping" after the hardware calibration.

PQ 300 cd/m² clipping - hardware calibration



PQ 300 cd/m² clipping after hardware calibration

The result after the HDR hardware calibration is also fully convincing. The desired characteristic is achieved extremely precisely - and with almost perfect grey balance.

Based on the colour space emulation, we finally carried out a more extensive series of measurements. For this purpose, in ColorNavigator the PQ transfer function with the setting "300 cd/m² clipping" and a colour gamut according to ITU-R BT. 2020 with "Gamut Clipping" was selected (HDR10-compliant). Since the colour gamut of the material generally does not exceed DCI-P3 RGB, no additional tonal value breaks are to be expected despite the extensive gamut clipping. Corresponding out-of-gamut colours are simply not included.

Unfortunately, EIZO does not offer a corresponding predefined picture mode here. The "PQ_DCI-P3" mode offered in the OSD uses a DCI-P3 RGB emulation and implements the PQ transfer function in the 1000 cd/m² clipping setting.

Hardware calibration: PQ 300-cd/m² clipping, ITU-R BT. 2020 ("Gamut Clipping")

	Red	Green	Blue	Cyan	Magenta	Yellow
dE 94	2,3	0,8	0,4	0,3	0,2	1,0

	Red2	Green2	Blue2	Cyan2	Magenta2	Yellow2
dE 94	0,5	0,7	0,8	0,8	0,4	0,8

	Gray35	Gray50	Gray80	White
dE 94	0,6	0,9	0,6	0,0

Colour deviations PQ 300 cd/m² clipping and ITU-R-BT.2020 emulation ("gamut clipping") after hardware calibration

In contrast to SDR measurements, the reference point for the evaluation is not the white point at maximum brightness, but an area white with only around 100 cd/m². Here we assume a complete visual adaptation (adjustments via Bradford). Only colour patches are used that are within the colour gamut of DCI-P3 RGB but are encoded in ITU-R BT. 2020 are encoded.

Once again, the EIZO CG2700X can live up to all expectations. Its colour reproduction shows no weaknesses. This again applies almost unreservedly to the results without prior calibration.

In addition to the PQ transfer function, the EIZO CG2700X also supports the HLG characteristic ("Hybrid Log Gamma"). This is a relative tone value curve. HDR material encoded accordingly has the advantage of still being reproduced reasonably acceptably on an SDR reproduction device with characteristic gamma 2.4 (2.2) (the peak highlights are strongly compressed at the "upper stop"). The metadata-free HLG is therefore mainly used for TV broadcasts.

Reaction behaviour

We tested the EIZO CG2700X in native resolution at 60 Hz on the DisplayPort connection. The monitor was reset to factory settings for the measurement.

Image build-up time and acceleration behaviour

We determine the image build-up time for the black to white change and the best grey to grey change. In addition, we give the average value for our 15 measuring points.

The data sheet specifies a response time of 13 ms (GtG). The EIZO CG2700X does not implement an overdrive function.

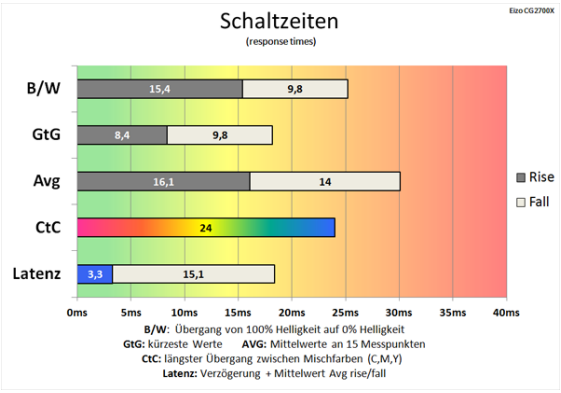
The switching time diagram shows, among other things, how different brightness jumps add up, how fast the monitor reacts in the factory setting in the best case and what average reaction time can be assumed.

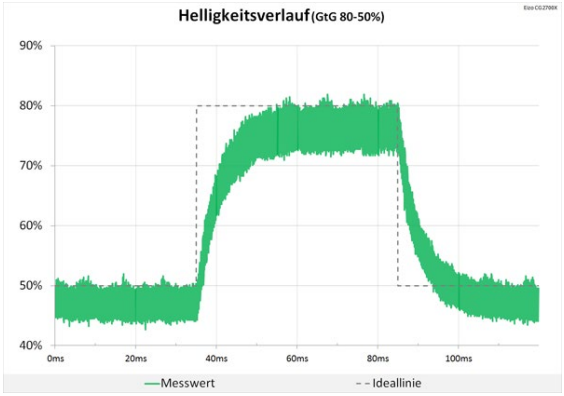
The measurement Color to Color (CtC) goes beyond the conventional measurements of single-colour brightness jumps, after all, one usually sees a coloured image on the screen. This measurement therefore measures the longest period of time that the monitor needs to change from one mixed colour to the other and stabilise its brightness.

The mixed colours cyan, magenta and yellow are used - each with 50 % signal brightness. With the CtC colour change, not all three subpixels of a pixel switch in the same way, but different rise and fall times are combined.

Switching times

We determine the black/white change with a very leisurely 25.2 ms and the fastest grey change with 18.2 ms. The average value for all our 15 measuring points is 30.1 ms. The CtC value is slow at 24 ms. The brightness curve (GtG 80-50 %) is of course completely neutral.

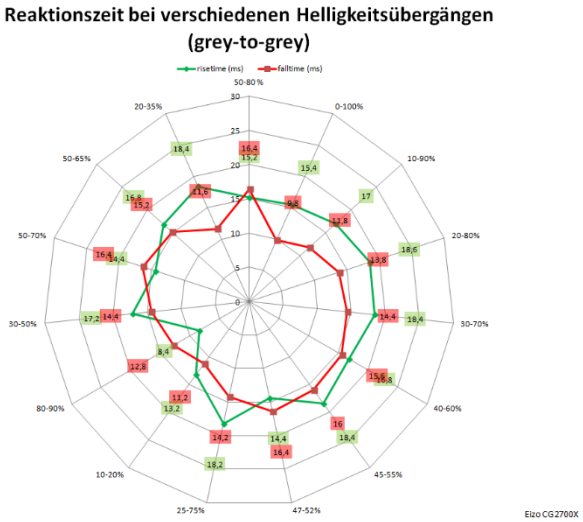




Slow switching times
Completely neutral tuning

Network diagram

In the following network diagram you can see an overview of all the measured values for the different brightness jumps of our measurements. Ideally, the green and red lines are close to the centre. Each axis represents a brightness jump of the monitor defined in level and dynamics, measured via light sensor and oscilloscope.



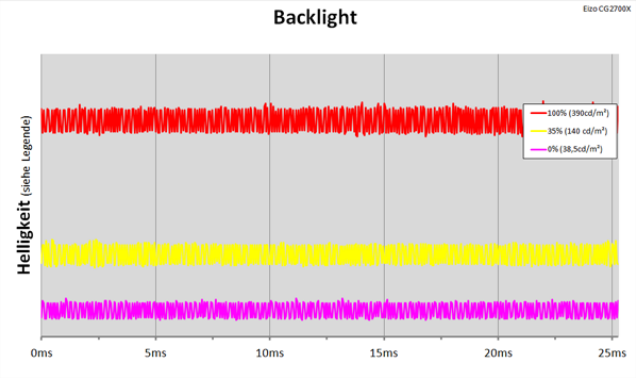
Network diagram

Latency

The latency or signal delay time is an important value for gamers, as low values guarantee direct feedback. The signal delay at 60 Hz is very short at only 3.3 ms. The total latency is a leisurely 18.4 ms.

Backlight

The backlight of the EIZO CG2700X is not regulated by pulse width modulation (PWM). There are no interruptions in the luminous flux in any operating state, which could be perceived as flickering at low frequency. This makes the monitor suitable for longer working sessions even for sensitive eyes.



LED backlight without PWM brightness control

Evaluation

Housing processing and mechanics:	5
Ergonomics:	5
Operation/OSD:	5
Energy consumption:	2
Noise generation:	5
Subjective image impression:	5
Viewing angle dependence:	5
Contrast:	5
Illumination (black image):	4
Image homogeneity (brightness distribution Uniformity Comp.: On; Off):	5; 5
Image Homogeneity (Colour Uniformity Comp.: On; Off):	5; 5
Colour space volume (ISO Coated v2; sRGB; Adobe RGB; ECI-RGB v2, DCI-P3 RGB):	5; 5; 5; 4; 5
Before calibration:	5
Before calibration (sRGB):	5
After calibration (sRGB):	5
After calibration (profile validation):	5
Interpolated image:	4
Suitable for casual players:	3
Suitable for hardcore players:	1
Suitable for DVD/Video (PC):	5
Suitable for DVD/video (external feed):	5
Price-performance ratio:	4
Price [incl. VAT in Euro]:	from €3,200
Overall ranking:	4.5 (VERY GOOD)

Conclusion

The EIZO CG2700X is a real enrichment of the renowned ColorEdge product line. Thanks to its UHD resolution, it also opens up to user groups for whom the pixel density of the CG2700S was previously not sufficient. Moreover, both models are easily comparable with each other. You have to look for real weaknesses with a magnifying glass. The most likely place to find them is in the response time. No, games are not the profession of the graphics professional from Japan. The inconspicuous monitor is all the more convincing in almost all other areas.

The high-resolution, viewing-angle stable and comparatively high-contrast IPS panel forms an ideal basis on which EIZO can build with its development know-how. Thanks to DUE, its surface homogeneity is excellent, while its high colour gamut enables the most demanding image retouching and colour-safe proof simulations. Of central importance is also the in-house developed scaler, which processes the input signal loss-free and with high precision. With ColorNavigator, a software for controlling the hardware calibration is available that leaves hardly anything to be desired after a short training period. The integration of a colour

space emulation into the calibration process ensures maximum colour reliability even in applications that are not colour management-capable.

The built-in, well-tuned measuring device makes a separate probe superfluous in most cases. Self-calibration ensures compliance with calibration targets over time and can meanwhile even be started during operation.

Although the CG2700X is not aimed at demanding HDR workflows, we like the parameterizable PQ and HLG transfer functions. Simple control tasks are thus quite possible. A small downer is the limitation to a luminance of 300 cd/m² for maximum precision. The panel has considerably more reserves.

With an RRP of around 3,000 euros, the EIZO CG2700X is in the upper price segment. A lot of performance for a lot - but not too much - money. In a professional environment, this investment will quickly pay for itself.

Note: PRAD received the CG2700X on loan from EIZO for testing purposes. The manufacturer had no influence on the test report, no obligation to publish it and no confidentiality agreement.

Link to the original test report:
https://www.prad.de/testberichte/test-eizo-cg2700x-grafik-profi-mit-uhd-aufloesung/