



White Paper

Accuracy and Advantages of the ColorEdge CG245W's Built-In Calibration Sensor

CONTENTS

1. Overview	2
2. Self calibration	3
3. Accuracy of built-in calibration sensor	6
4. Operation of self-calibration	9

No.10-009 Revision B

August 2010

EIZO NANA O CORPORATION

1. Overview

The CG245W, announced by EIZO in February 2010, is the first of the ColorEdge series to come with a built-in calibration sensor. The built-in sensor is housed within the monitor's top bezel and it swings down over the center top of the screen at the start of calibration.

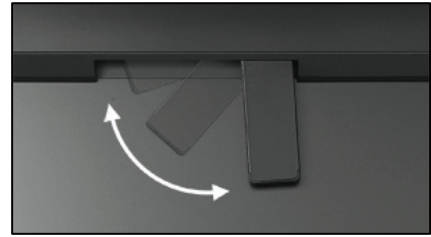
This document outlines the functions, performance and effects of the CG245W built-in calibration sensor.

2. Self calibration

2-1. Built-in swing sensor

The CG245W has a calibration sensor unique to EIZO within the monitor's top bezel. The built-in calibration sensor is approximately only 5 mm in thickness so that it can be housed in the monitor's bezel.

EIZO has designed a built-in calibration sensor that can swing down when measuring, and is stored in the bezel, so that it does not obstruct operation when the monitor is displaying. This built-in sensor eliminates the need for users to apply and remove third-party calibration sensors to and from the monitor for calibration. The swing mechanism enables the CG245W to calibrate monitors automatically and in line with a user's schedule. Users do not need to secure storage space for the calibration device and do not need to worry about misplacing or dropping it.

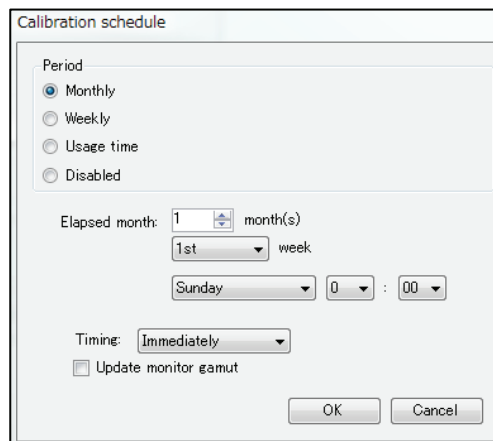
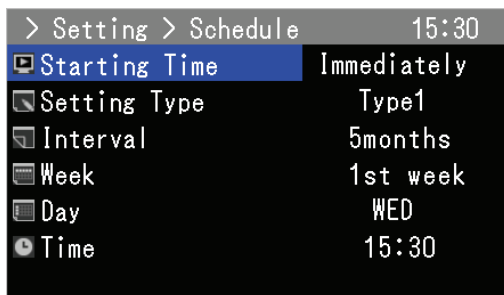


2-2. Self-calibration function

It is necessary to calibrate monitors at regular intervals so that they maintain correct image display at all times.

Using either the OSD menu or the bundled ColorNavigator software, you can schedule the ColorEdge CG245W to self-calibrate at a specific time and at specific intervals. You can even schedule calibration to be done outside of work hours when your computer is turned off and you are away. The self-calibration function reduces the time and effort required for calibration, cuts operation and maintenance costs, and increases operation efficiency. Scheduling can also be done in the OSD menu.

Since the PC itself is not necessary for self-calibration, the ability to calibrate the monitor is not dependent upon using an operating system that supports the ColorNavigator software. Therefore, a calibrated ColorEdge CG245W can be used with Linux even though ColorNavigator is currently not compatible with this OS.



2-3. Self-calibration function

[Built-in EIZO special sensor]

The built-in sensor adheres to EIZO's strict quality standards, and is designed especially for EIZO. The sensor is housed in a part of the monitor that is only 5mm thick, but it has a wide light-receiving area, and thus measures the monitor's screen highly accurately and quickly. The built-in calibration sensor is a particularly important optical device, and is produced under strictly-controlled temperature and humidity conditions. Moreover, due to its highly enclosed structure, the sensor is highly degradation-resistant and remains stable over long periods.

EIZO's proprietary algorithm allows measurements to be taken in bright indoor conditions with a non-contact type sensor with the same accuracy as with a contact-type one, and accuracy is further increased by taking into account and compensating for the characteristics of the liquid crystals.

* If calibrating the CG245W in a bright room, please be sure neither the lighting conditions nor ambient light changes during calibration.

[Individual factory adjustment of built-in sensors]

To ensure that each built-in sensor is as accurate as possible, EIZO uses high-precision professional spectroradiometers (Konica Minolta Sensing, Inc. Spectroradiometer CS-1000A) to calibrate built-in sensors for brightness and color chromaticity.

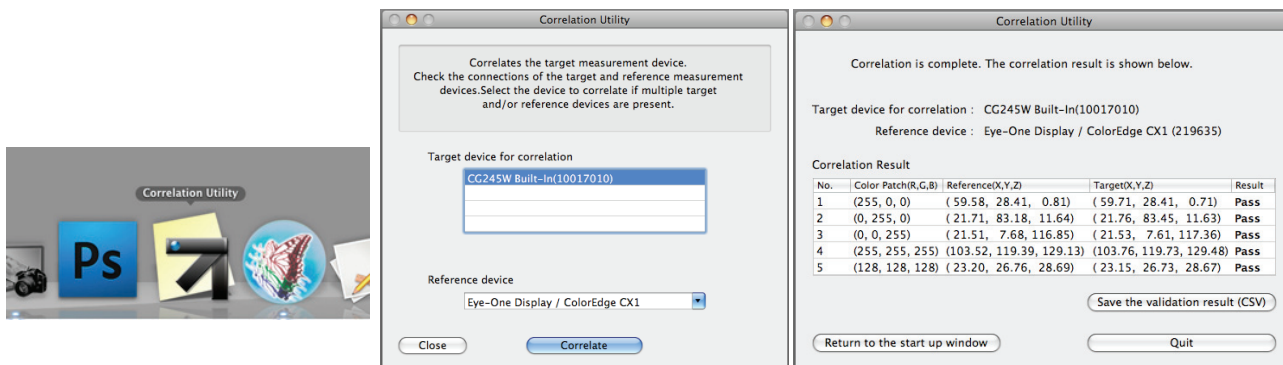
The variability of LCD panels and sensors generally affects measurement accuracy. EIZO adjusts all built-in sensors individually at the time of shipping from the factory in order to correlate the variability of LCD panels and sensors. By absorbing the variability of each sensor and correcting it to the characteristics of each LCD panel, accuracy is improved

Since the built-in sensor is housed in the top edge of the monitor and measures the top area of the screen, there is a concern that different measurement values will be obtained between the top and other parts of the screen. EIZO takes the following steps to deal with this concern.

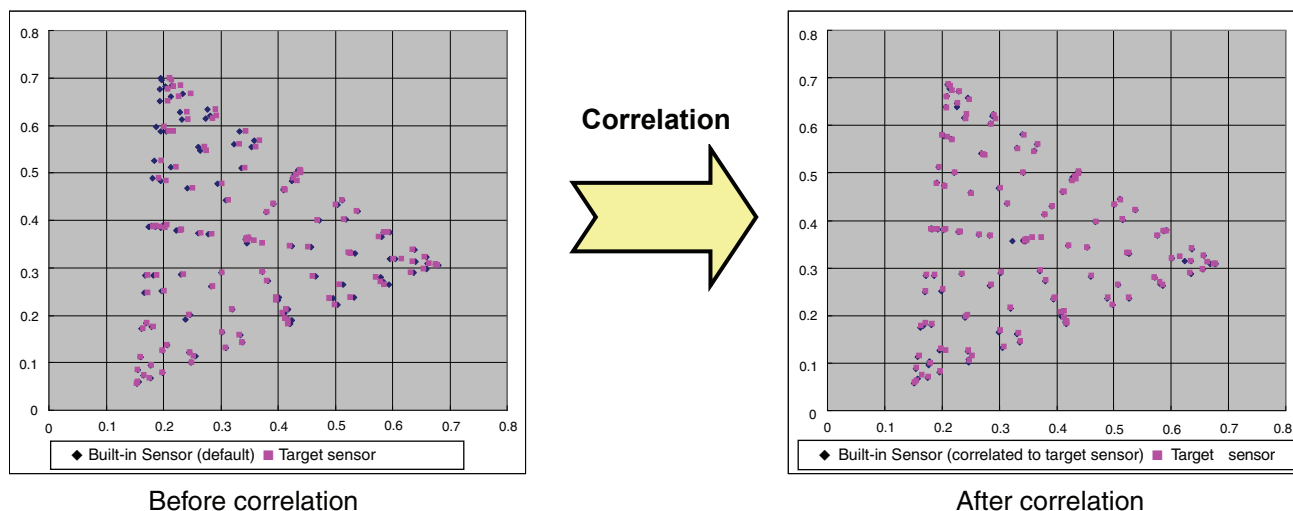
- The CG245W has a DUE (Digital Uniformity Equalizer) function which significantly improves uniformity characteristics relative to existing models.
- In order to reduce the effect of the edges of the sensor upon the measurement, the edges of the sensor are not used in the measurement when it swings down by 90 degrees.
- To further increase accuracy, the sensor has a function that takes the correlation between the measured part and the central part of the screen, and corrects the uniformity difference at each tone level.

[Correlation with other sensors]

The ColorEdge CG245W can correlate with the measurement results of external calibration sensors. Correlation is carried out with a new Correlation Utility, included with the bundled ColorNavigator software.



Due to the individual characteristics of each sensor, the Correlation Utility correlates the differences in the measured values of their RGB primary color gamut, white point, and gray balance. The graph below on the left shows the differential of the built-in sensor and a targeted sensor before correlation, and the graph below on the right shows the post-correlation characteristics of the built-in sensor correlated to those of the targeted sensor. This is a convenient function for situations where the ColorEdge CG245W is used in an environment with other ColorEdge monitors. In such a case, a single measurement device must be used as a standard for all monitors.



[Auto-aging function]

To ensure correct calibration, the CG245W measures the aging condition of the monitor. It has a function that initiates self-calibration following auto-aging and after brightness and colors have stabilized. During aging, the OSD indicates the aging status on the screen.



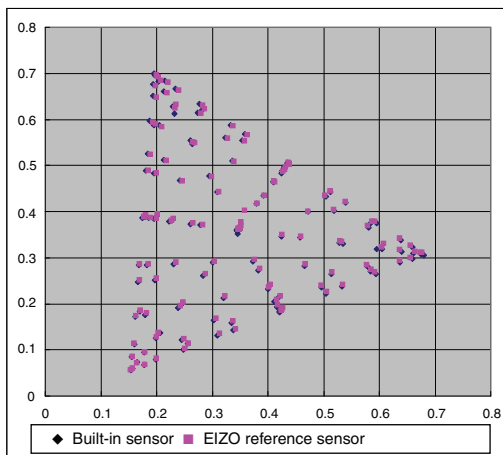
3. Accuracy of the built-in calibration sensor

3-1. Comparison with third party sensors (accuracy)

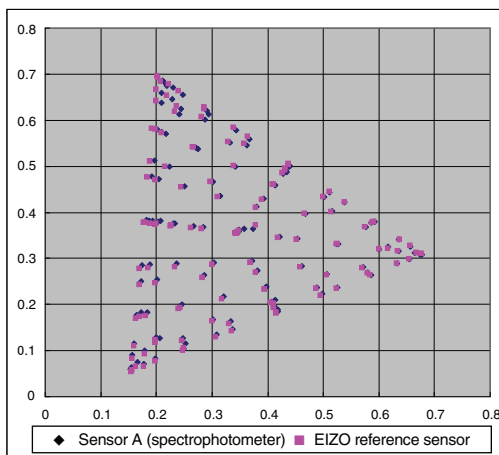
The table below shows the difference in accuracy between the built-in sensor and external third party sensors compared with the EIZO reference measurement sensor (Konica Minolta Sensing, Inc. Spectroradiometer CS-1000A). It indicates that the built-in calibration sensor is more accurate than external third-party sensors.

	White			Red		Green		Blue		Black	Temp.
	x	y	Y	x	y	x	y	x	y	Y	T[K]
Built-in sensor	-0.001	-0.001	2.1	0.003	0.000	-0.003	0.003	-0.001	-0.003	-0.06	36
Sensor A (Spectrophotometer)	-0.001	0.004	-3.4	0.000	0.001	0.008	-0.007	0.000	0.005	0.02	51
Sensor B (Filter)	0.006	0.004	9.1	0.006	-0.005	0.006	-0.003	0.001	0.001	0.03	-243

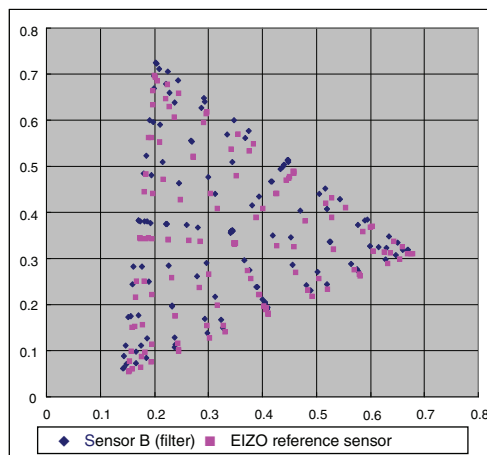
Additionally, the graphs below show the actual differences in values measured for each displayed patch color with each sensor following calibration, and compared with the EIZO reference measurement sensor. The graphs indicate that the CG245W's built-in sensor is the most accurate among these sensors. The CG245W calibrated with its built-in sensor reproduces a higher level of accuracy than when calibrated using other sensors.



CG245W built-in sensor



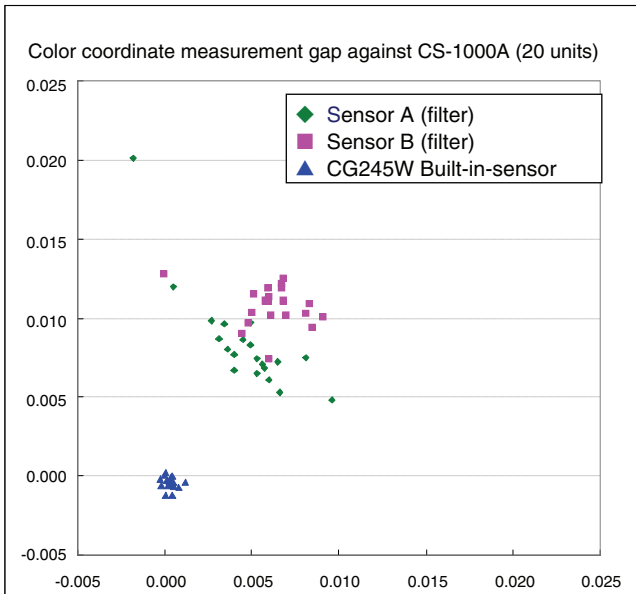
Sensor A (Spectrophotometer)



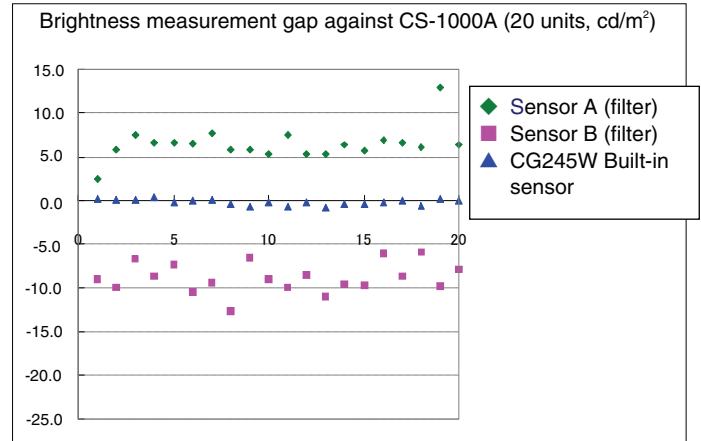
Sensor B (Filter type)

3-2. Comparison with other third party sensors (individual variability)

The graphs below show the individual variability of the built-in sensor and external third party sensors. They indicate that the built-in sensor is the most stable in terms of brightness and color chromaticity.



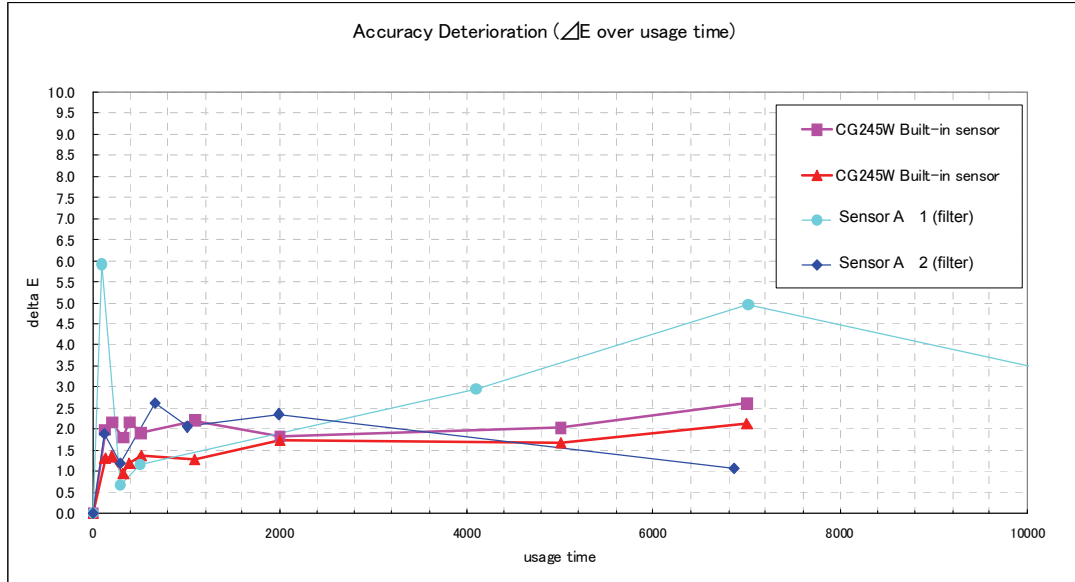
Individual variability of each sensor (CIE xy)



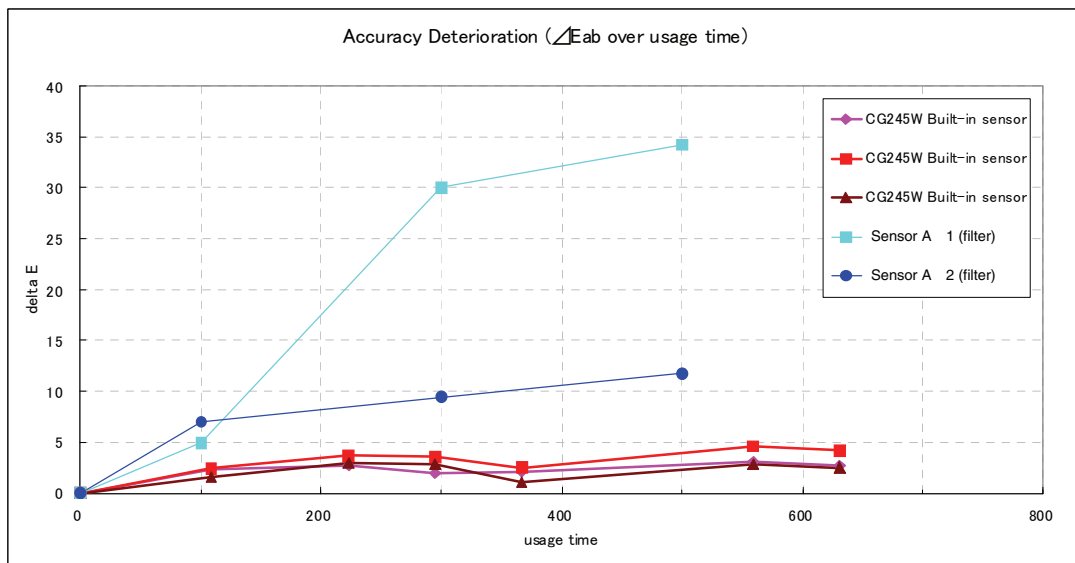
Individual variability of each sensor

3-3. Comparison with third-party sensors (long-term life accuracy)

The graphs below show the changes in accuracy of the built-in sensor and sensor A (filter type) in a long-term life test. The built-in sensor deteriorates less than sensor A (filter type). In particular, the lower graph shows that the deterioration of sensor A (filter type) is greater than that of the built-in sensor. Therefore, the CG245W built-in sensor is superior in terms of long-term lift accuracy to other sensors.



Long-term life test (normal humidity)



Long-term life test (high humidity)

4. Self-calibration operation

4-1. Correlation period

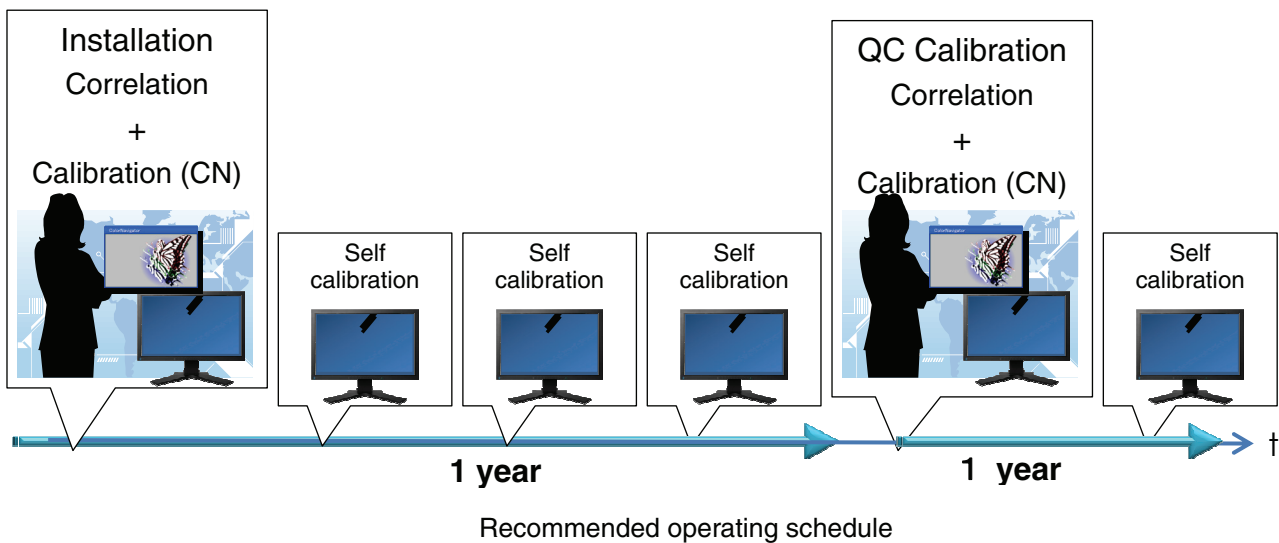
The results shown in Section 3-3 indicate that the accuracy of the built-in sensor in the CG245W is stable within ΔE three (3) or less for several thousand hours at normal temperature. Therefore, EIZO recommends carrying out correlation of the built-in sensor every year with a corrected reference sensor, in order to maintain a given level of monitor quality in terms of brightness, colors, and tones.

4-2. Recommended operation

The figure below shows an example schedule combining calibration, self-calibration and correlation operations using ColorNavigator.

- (1) When installing the CG245W, carry out correlation with a reference sensor and perform the initial calibration
- (2) Set a schedule to carry out self-calibration every one to two months
 - ✓ Set the self-calibration to be performed during the night, or when the monitor will not be used.
- (3) Carry out correlation and normal calibration using ColorNavigator every year

This recommended operating schedule maintains monitor quality while effectively reducing the actual time a person has to spend calibrating the monitor..



All company and product names are trademarks or registered trademarks of their respective companies. Copyright©2010 EIZO NANAOCOOPERATION. All rights reserved.