

Product Document



Application Note

AN001053

AS7421 Calibration

AS7421 EVK Calibration Procedure with Internal LEDs Using the GUI

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Content Guide

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1 Introduction

The AS7421 is a 64-channel near-infrared sensor for spectral identification and spectral footprint analysis. The spectral response of the sensor is defined in the wavelengths from approximately 750 nm to 1050 nm, and the channels are equally distributed over the mentioned range. In a spectral measurement, all 64 channels are processed automatically by 16 parallel sampling ADCs with four consecutive integration cycles.

The raw data measurements of the sensor are influenced by the LED light source, temperature drift effect of the LED, crosstalk of the filter band, and power distribution effect of the photodiodes in the AS7421 sensor, etc. The calibration reduces these influences and minimizes the drift. It also makes the sensor uniform and increases accuracy based on the application.

This Application Note describes how to implement the AS7421 Sensor Calibration Library. It describes various steps, methods, and various approaches used for calibration.

2 AS7421 Calibration

2.1 Aim of Calibration

In Figure 1, the spike generated comes from the LED used in the board. Similarly, there might be other effects such as temperature drift effect due to LED and power distribution effects caused by the position of the LED to the photodiode array, etc. Several factors may affect the accuracy of the sensor. In a practical application, the user has to consider these factors in their application to improve the accuracy. Calibration aims to minimize the effect caused by these factors and to provide repeatable measurements on a defined target in an application.

Figure 1:
AS7421 Raw Values Measured Without Calibration on Human Skin

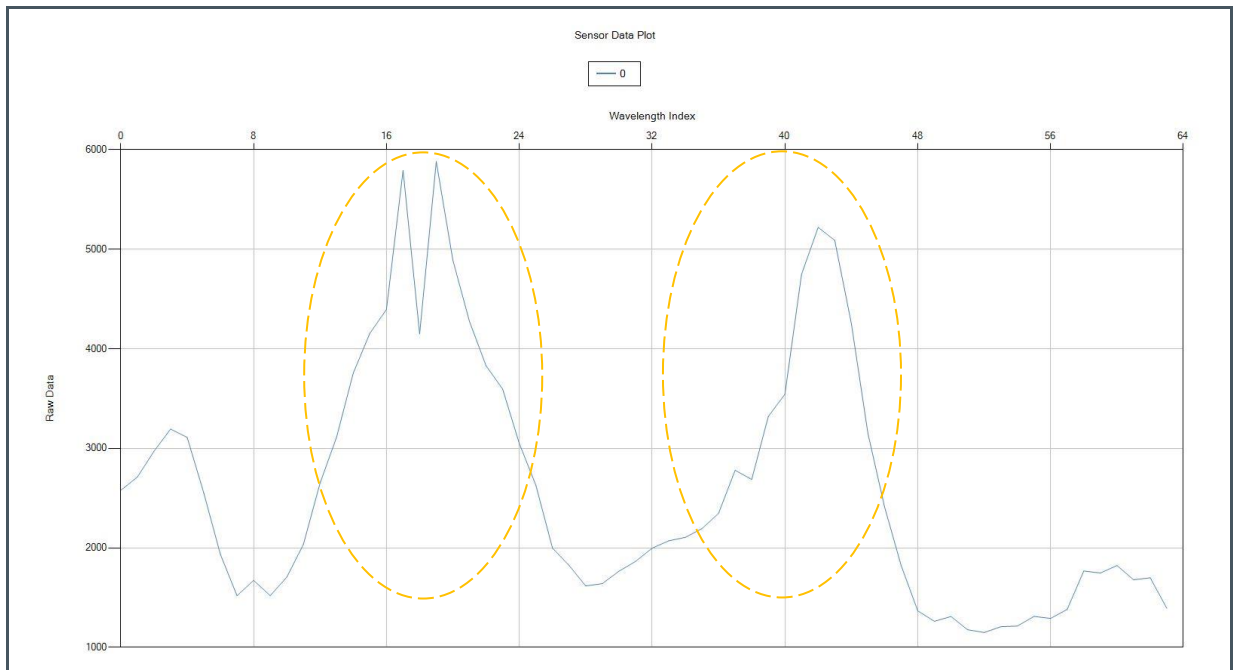
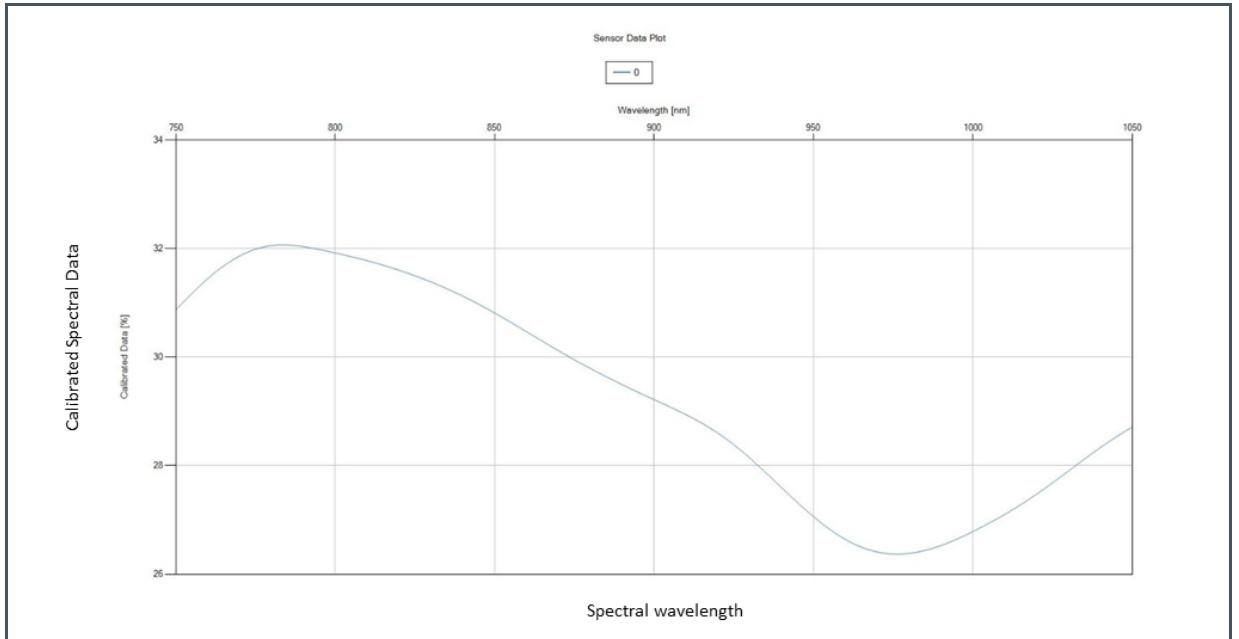


Figure 2 shows the spectral value after calibration. The calibrated spectral value reduces the various effects discussed and filters out the LED spectrum.

Figure 2:
AS7421 Calibrated Value Measured on Human Skin



3 Calibration of the AS7421 EVK with the GUI

After the successful installation of the AS7421 Demo GUI, connecting the AS7421 evaluation kit measurement is possible only after selecting the calibration file. There are two types of calibration files: Sensor (stage 1) and Custom (stage 2) calibration files. Any one of these types of calibration files must be selected to carry out the measurement.

The Sensor (stage 1) calibration files provided by ams OSRAM are created during the production of the final test. This calibration file only contains certain configuration settings for the calibration (such as the spectral response of the channels, LED light source wavelength, auto-zero parameters, power distribution parameters, etc.) and does not include data related to calibration. Therefore, calibration data calculation with the Sensor (stage 1) calibration files is not possible. Instead, this file is selected for raw measurement without any calibration.

Alternatively, Custom (stage 2) files contain the reference data for the calibration and the compensation of the optical path of the final system. During the Custom (stage 2) calibration, the power distribution effect, LED effects, crosstalk effect, characteristics of the diffuser and cover glass used in the system, etc, are considered. When using the Custom (stage 2) file, it calculates the calibration and generates the necessary spectral data - first and second derivative data.

3.1 Selecting the Calibration Stage Files

When connecting to the AS7421 EVK for the first time, the software asks for an appropriate calibration file. The calibration file can be found on the USB stick under “stage 1” or “stage 2”. Select the calibration file that includes the unique ID of the sensor board in its name.



Information

If no matching calibration file is present, please contact ams OSRAM and provide the corresponding unique ID number.

Figure 3:
Calibration Tab in the AS7421 Demo GUI Software

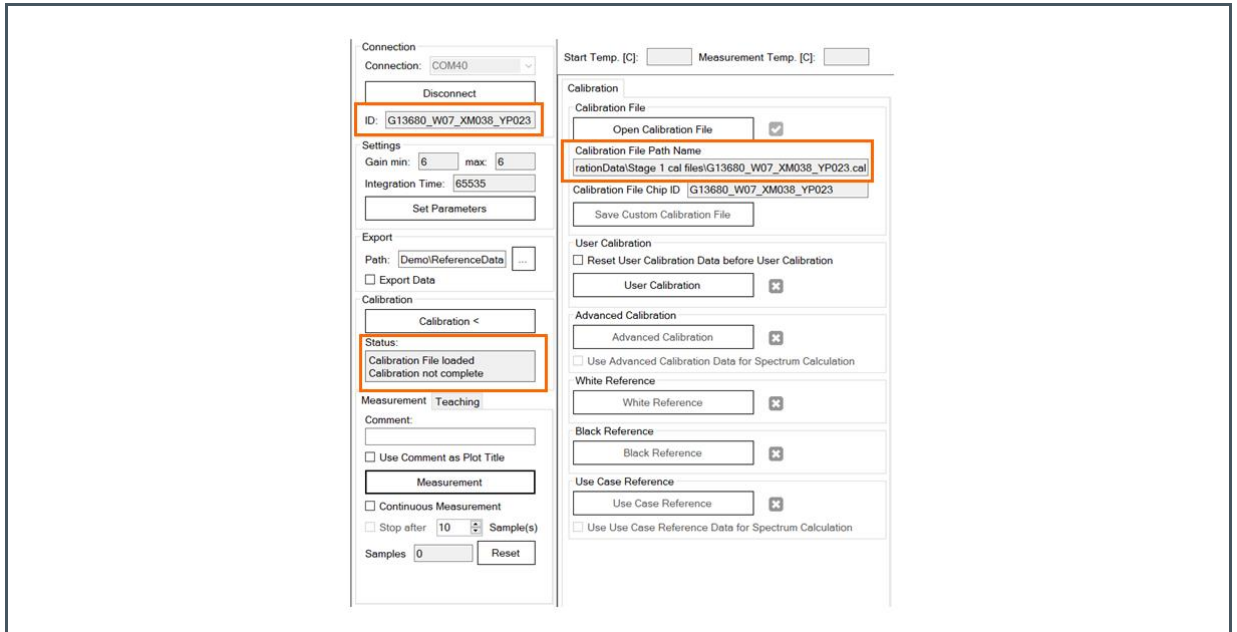
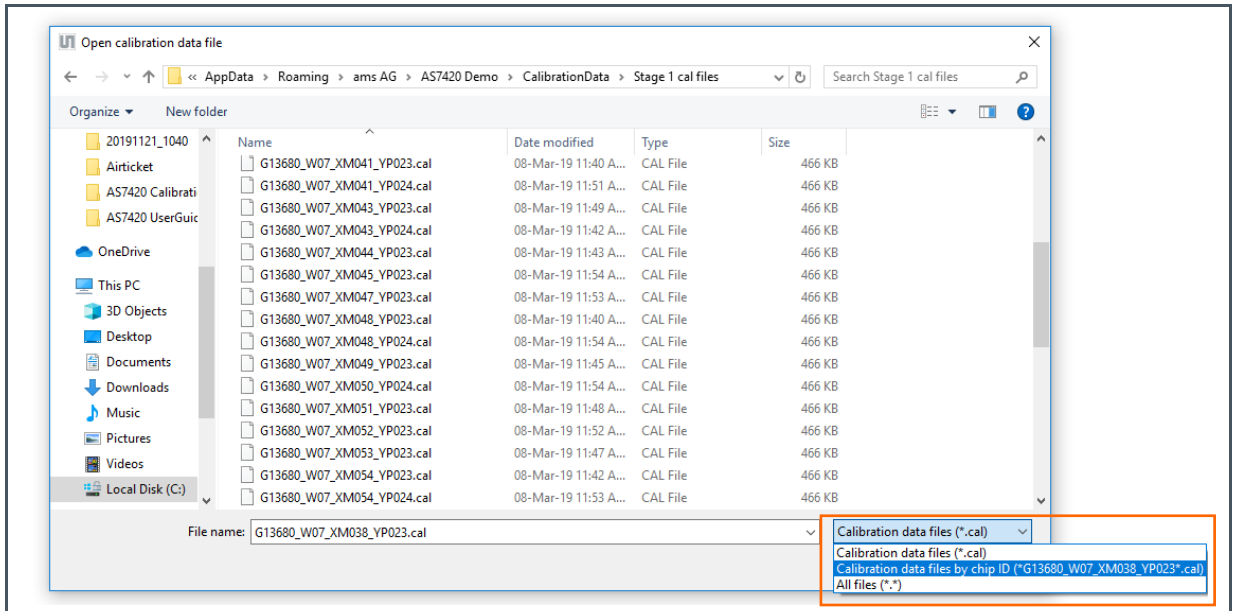


Figure 4:
Dialog Window to Select the Calibration File

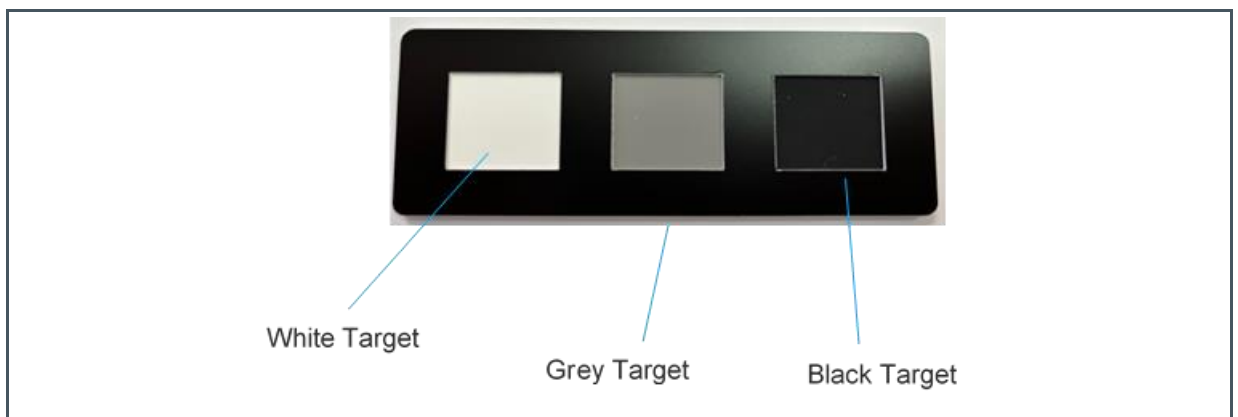


After selecting the Sensor (Stage 1) or Custom (stage 2) file, the GUI is ready to measure with the sensor. As discussed earlier, the Sensor (stage 1) calibration file will only measure raw data (64 channels) and the Custom (stage 2) calibration file does the calibration to generate the calibrated data (301 values from 750 nm to 1050 nm with 1 nm interval) along with raw data.

3.2 Generating Your Calibration File Using the GUI

It is recommended for a user to generate their Custom (stage 2) calibration file based on a given measurement setup, ambient temperature, and other conditions. The user can generate their custom (Stage 2) calibration file based on the application by using the GUI, reference target, and the reference target spectral data (provided on the USB stick with the AS7421 EVK kit). This chapter describes a calibration using the Grey, White, and Black reference targets provided with the AS7421 EVK. It is possible to use different reference targets if they are characterized in the lab with a Spectrometer for reference spectral data.

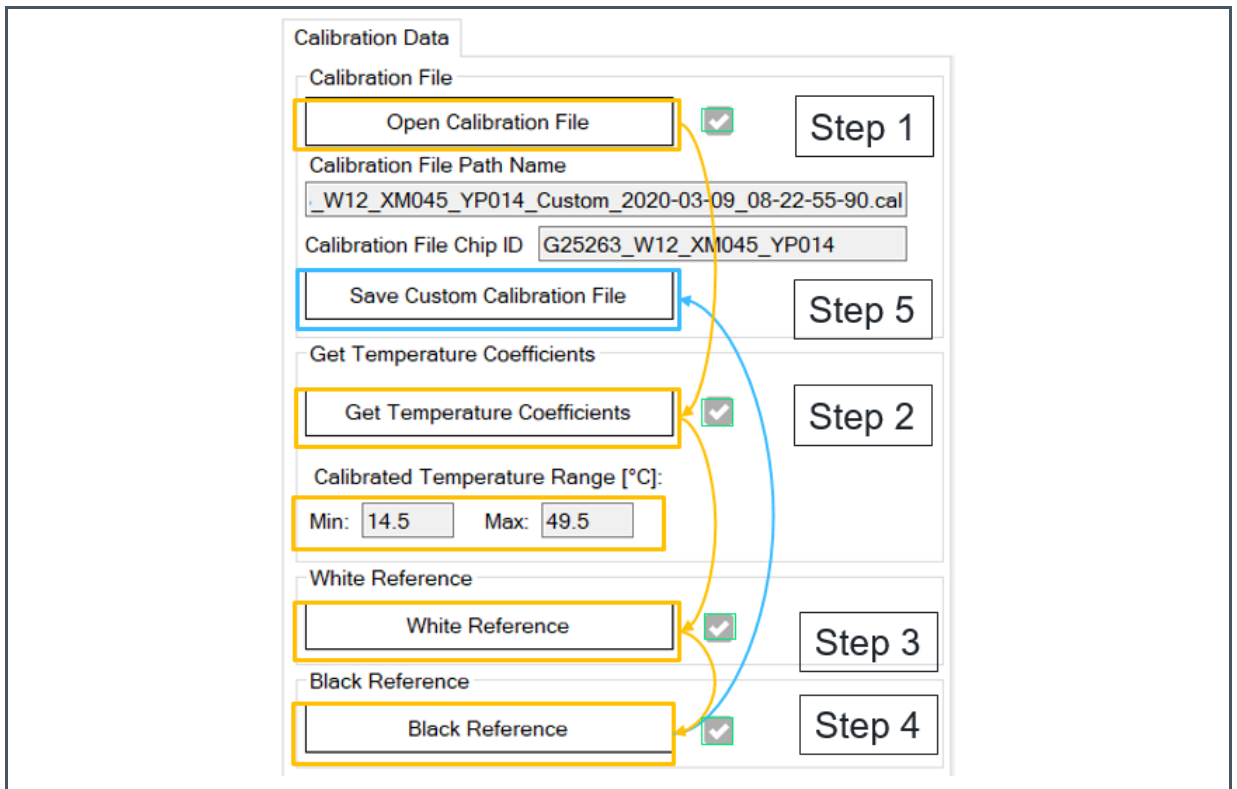
Figure 5:
Example of a Calibration with Grey, White, and Black Target Reference



To perform a custom calibration, follow the steps below:

1. Open the sensor calibration file from the stored location on the computer or USB Stick.
2. Afterward, click on the “Get Temperature coefficient” button after placing the grey target on the sensor. Wait until the measurement is done and the bottom status bar displays “Ready”. The box next to the “Get Temperature coefficient” will change to a tick mark. The calibrated temperature range is displayed in the corresponding textbox.
3. Then, place the White target on the sensor, click on the “White Reference” button and start the measurement. Wait for the end of the measurement and tick marks to appear on the side of the “White Reference” button.
4. Change the target to Black and repeat the procedure until tick marks appear on the side of the “Black Reference” button.
5. Finally, click on “Save Custom calibration file” to save the Custom file in the given location.
6. After these, calibration is finished and measurements can now be performed.

Figure 6:
Custom Calibration Steps in the GUI



Information

This document covers the calibration procedure for the AS7421 sensor when used with internal LEDs. For use with an external LED, please refer to the document [1].

4 Additional Documents

The following list includes a selection of available documents with more technical details for the AS7421 Sensor and its test kits. This list is not fixed and it is constantly changing. Ask us for new details.



For further information, please refer to the following documents:

1. ams-OSRAM AG, *AS7421 External LED Synchronization* (AN001026), Application Note.
 2. ams-OSRAM AG, *AS7421 64-Channel Hyperspectral NIR Sensor* (DS000667), Datasheet.
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5 Revision Information

| Changes from previous version to current revision v1-00 | Page |
|---|------|
| Initial version | all |

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

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