

Product Document



Quick Start Guide

QG001004

AS7331 EVK Logger

AS7331 Evaluation Kit

GUI Version Data Logger

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Content Guide

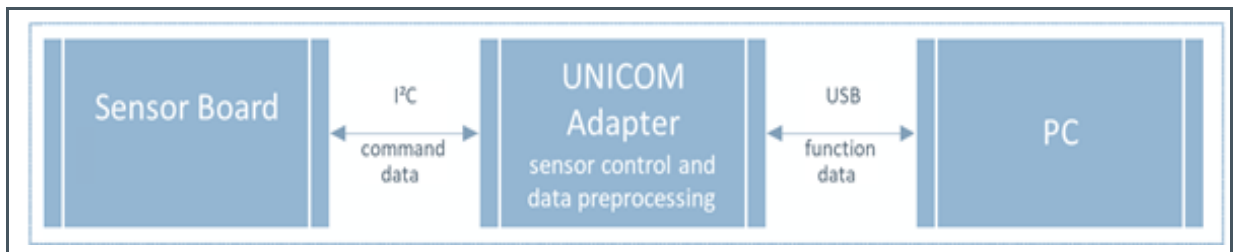
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1 Introduction

The AS7331 EVK Logger allows the testing of the UVA-UVC sensitized photodiodes and the ADC conversion of the photocurrents, as well as a digital I²C interface and temperature sensors on-chip. The IC sensor is described in the datasheet.

This document briefly describes the first setup steps and the start of tests with the AS7331 EVK data logger. For more details, please refer to the user manual [1] for the kit.

Figure 1:
System Solution for the AS7331 EVK Logger



The AS7331 EVK Logger consists of a sensor board with a plugged optical adapter above the sensor and LEDs¹ and an attached interface board. The interface board is connected to the PC via USB, which supplies all the connected hardware with a power supply. The adapter realizes the optical requirements for the used interference filters on the chip, as well as the optical path when using LEDs on the board.

The optical coupling in front of the sensor decides what and under which conditions the sensor sees something. It also considers whether the conversion of the optical signal into digital results is possible with the dynamics of the sensor. Further details are given in the user manual [1].

¹ Generally unassembled and must be soldered customer-specifically.

2 Safety Notifications

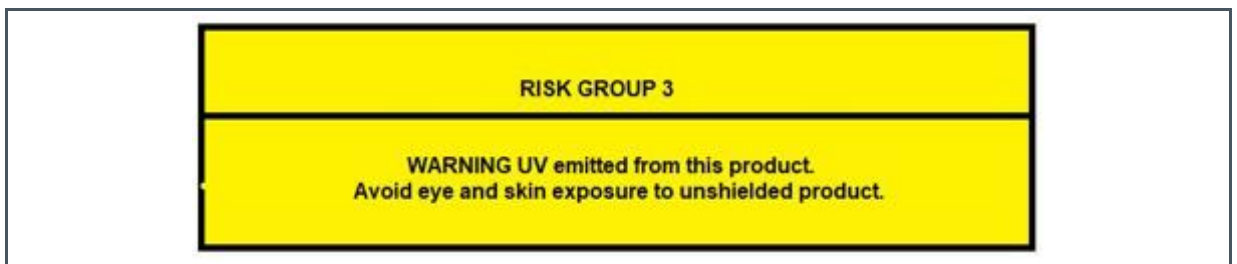


CAUTION

- This product emits UV light in the case of mounted UV LEDs.
- Avoid exposure to the skin and eyes in the case of mounted UV LEDs on the board.



UV – RISC Group 3



There are delivery forms where an EVK on the sensor board can be equipped with UV LEDs of risk group 3. The UV LEDs are partially covered by optical adapters when mounted. The LEDs can be switched on in the EVK software or through firmware and register programming.



CAUTION

For the switched-on state of the UV LEDs, the following safety warnings for the eye and skin apply:

1. UV Radiation hazard.
2. Use only with shielding in place.
3. Protect the eyes and skin from exposure to UV light.

3 What Is In the Box

Figure 2 shows a typical scope of delivery for the AS7331 EVK Logger - with the sensor, interface hardware in a plastic housing with a mounted adapter, and a USB stick. The USB stick contains all the documents for the sensor and hardware, application notes, firmware, the GUI setup, possible libraries, and other details for customers.

Figure 2:
Kit Contents of the AS7331 EVK Logger



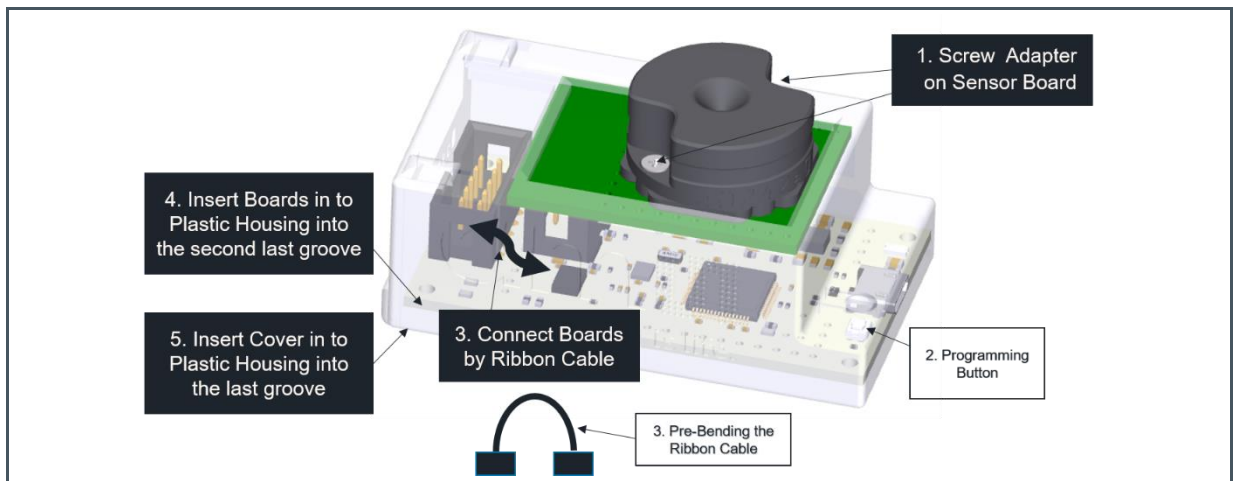
Item No.	Item	Comment
1	990601135	AS7331 EVK Logger ⁽¹⁾
2	USB Stick	Documents, software, firmware, and drivers ⁽²⁾

- (1) This can be delivered as individual components (sensor board, interface board, ribbon cable, optical adapter, housing base, and cover). The screws, nuts, and cable can be omitted. Please use a standard USB cable in this case. The sensor and interface board can also be delivered as single variants with a ribbon cable and an alternative or without an optical adapter.
- (2) The version of the documents may be old. Therefore, we always recommend downloading the latest USB stick as a ZIP variant from the ams website.

4 Device Assembly

If the hardware is supplied as individual modules, please assemble them completely before commissioning.

Figure 3:
Hardware Assembly



To assemble the hardware, follow the instructions below:

1. Screw the adapter onto the sensor board. Note the different holes for the screws and the guide of the adapter on the sensor board. Afterward, tighten the screws.
2. Instructions for programming the interface board (if necessary)² are stated in the user manual of the EVK [1]. Uploading the firmware can only be done via the hardware outside the plastic packaging, as the card can be put into programming mode by pressing a button on the card during the USB connection.
3. Then, connect the sensor board to the Unicom interface board with the ribbon cable. Bend the cable slightly forward like a sling to relieve pressure from the sockets when sliding the connected boards into the case.
4. Afterward, insert the Unicom (USB connector to the front) and sensor board into the penultimate groove of the plastic housing.
5. Then, insert the cover of the housing into the last groove of the housing and snap the housing into place.
6. Finally, connect the completed EVK via USB to the PC and start the software. More details are given in the EVK manual [1].

² Usually, the Unicom contains the necessary firmware upon delivery. If that is not the case, or a new firmware version is to be flashed, please refer to [1].

5 Software

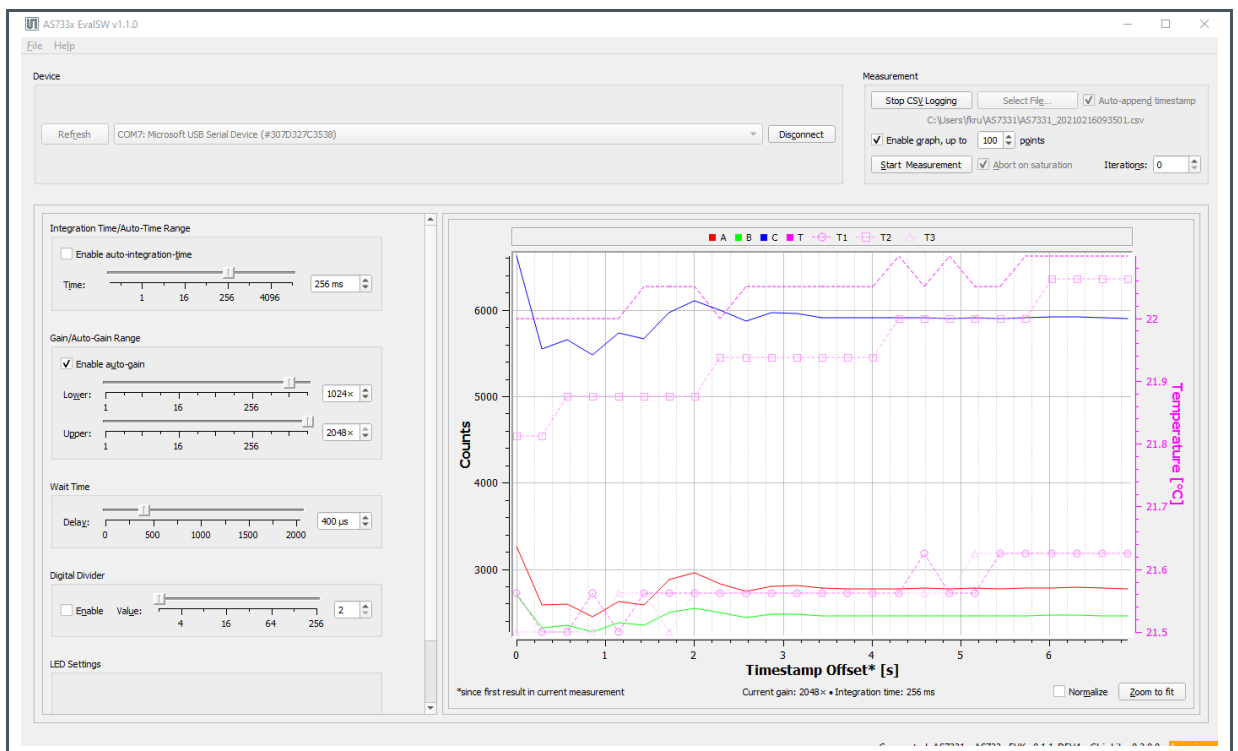
ams OSRAM provides a GUI application for the AS7331 EVK Logger called “AS7331 Evaluation Software”. This software is available as a Windows installer and a Linux (amd64) AppImage.

To install the application on a Windows system³, run the installer “AS7331_EvalSW-1.0.0-win64.exe” from the USB stick with administrator privileges, and follow the instructions. This will create the application in your start menu, where it can be launched.

For Linux systems, the included AppImage should be compatible with most modern distributions. Simply run the “.AppImage” file.

Launching the application will give you a user interface like the one shown in Figure 4. This window allows the user to connect to an attached device, configure, run a measurement, and output the results on a chart and/or to a CSV log file.

Figure 4:
Screenshot of the Application’s Main Window



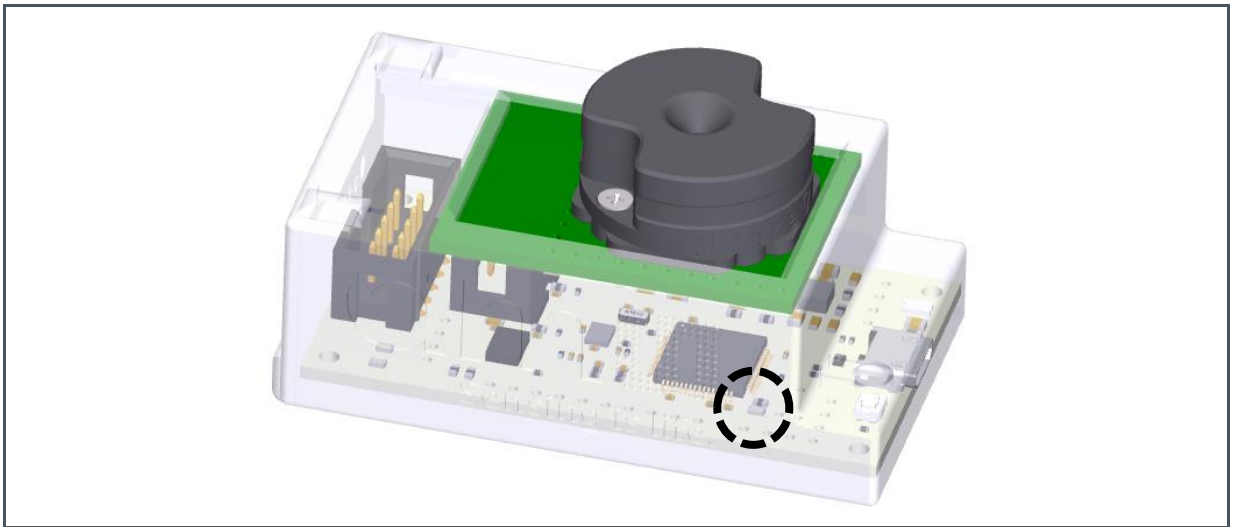
³ Windows 10 and higher.

5.1 Connecting to a Device

To connect an AS7331 EVK Logger device, connect it via USB to your computer running the application.

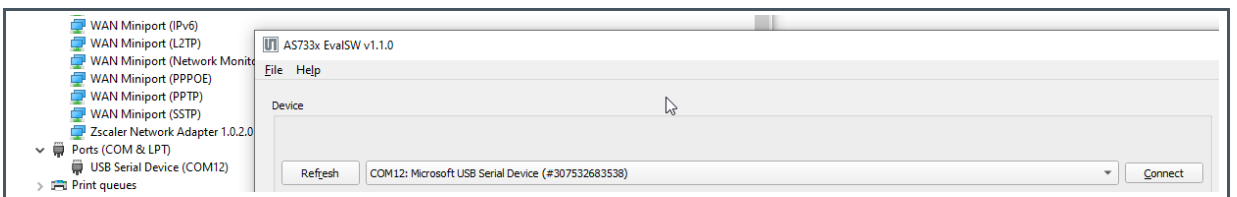
A green LED on the Unicom board will be switched on after connecting the EVK to the PC via USB.

Figure 5:
LED (marked in the figure) Should Switch on After USB Connection of the EVK to a PC



In the case of a connection error to the kit, check the status of the active COM ports (with and without the USB connection of the kit to the PC) in the device manager, and check the cable and USB connector in the case of an error.

Figure 6:
COM Port in Device Manager Displayed in the List of Available Devices



When it starts, the device should automatically appear in the drop-down list at the top left. Otherwise, you may need to refresh the list of available devices using the “Refresh” button on the left-hand side of the box.

Once you have selected a device, press the “Connect” button. This should establish a connection to that device, and the button should turn into a “Disconnect” button - which allows you to end the connection if you wish. If the connection fails for any reason, an error dialog will be displayed.

When the connection is established, the status on the right-hand side of the lower status bar will be updated, and it will be possible to configure and perform measurements or terminate the connection by disconnecting the hardware.

Figure 7:
Connections in the Main Tab of the GUI for Connecting/Disconnecting



5.2 Configuring a Measurement

To configure measurements, a connected device is needed. On the left-hand-side of the diagram are several parameters that can be changed to set up measurements. Most parameters are displayed as horizontal sliders and synchronized incrementable/decrementable numeric fields. In addition to the mouse, the sliders can be moved with the left/right arrow keys when selected, and the values of the numeric fields can be changed with the up/down arrow keys. Entering numbers is not supported.

The settable parameters are (also see Figure 4):

- Integration Time:** This determines the conversion time for the ADC, i.e., the time the sensor is exposed, in milliseconds. Internally, this adjusts the CREG1:TIME and CREG3:CCLK registers, specifying a multiple and the duration of the internal clock periods, respectively. Optionally, an auto-integration-time mode can be enabled via the “Enable auto-integration-time” checkbox, and the lower and upper limits are set. The sliders follow an exponential scale. If the lower and upper limits are set to the same value, the auto-gain mechanism is disabled. The same can be achieved by disabling the checkbox and adjusting the single slider/numerical input. The actual integration time value, applicable to a set of measured values, will be logged along with the data if CSV logging is enabled.

- **Gain/Auto-Gain Range** specifies either a fixed gain or lower and upper thresholds of an auto-gain mechanism in the device’s firmware. Internally, this mechanism adjusts the CREG1:GAIN register, aiming for an optimal operating point. The gain value and the user-specified thresholds follow an exponential scale. If the lower and upper thresholds are set to the same value, the auto-gain mechanism is disabled. The same can be achieved by disabling the “**Enable auto-gain**” checkbox and adjusting the single slider/numerical input. The actual gain value, applicable to a set of measured values, will be logged along with the data if CSV logging is enabled.
- **Wait Time:** This determines the wait time between measurements in microseconds. Internally, this operates on the BREAK register. A value of zero will still incur a wait of three clocks (CREG3:CCLK).
- **Digital Divider⁴:** This enables an optional digital division of measured count values by a value on an exponential scale. The checkbox enables or disables the divider, and the slider and numerical field adjust their value. Internally, this corresponds with the CREG2:EN_DIV and CREG2:DIV registers.
- **LED Settings:** This allows for each of the up to eight external LEDs to be configured. The exact number varies with the type of sensor board used. A group of radio buttons at the top of the group box allows each of the LEDs to be selected in turn. The checkbox and slider/numerical field below, allow for it to be toggled and for its brightness to be changed on a scale of 0 to 1000. Not all available LEDs may support a brightness setting; please refer to the documentation of the sensor board. To view which LEDs are enabled, their state will be shown by the radio buttons, and the radio button labels of the enabled LEDs will be bold with a white background.

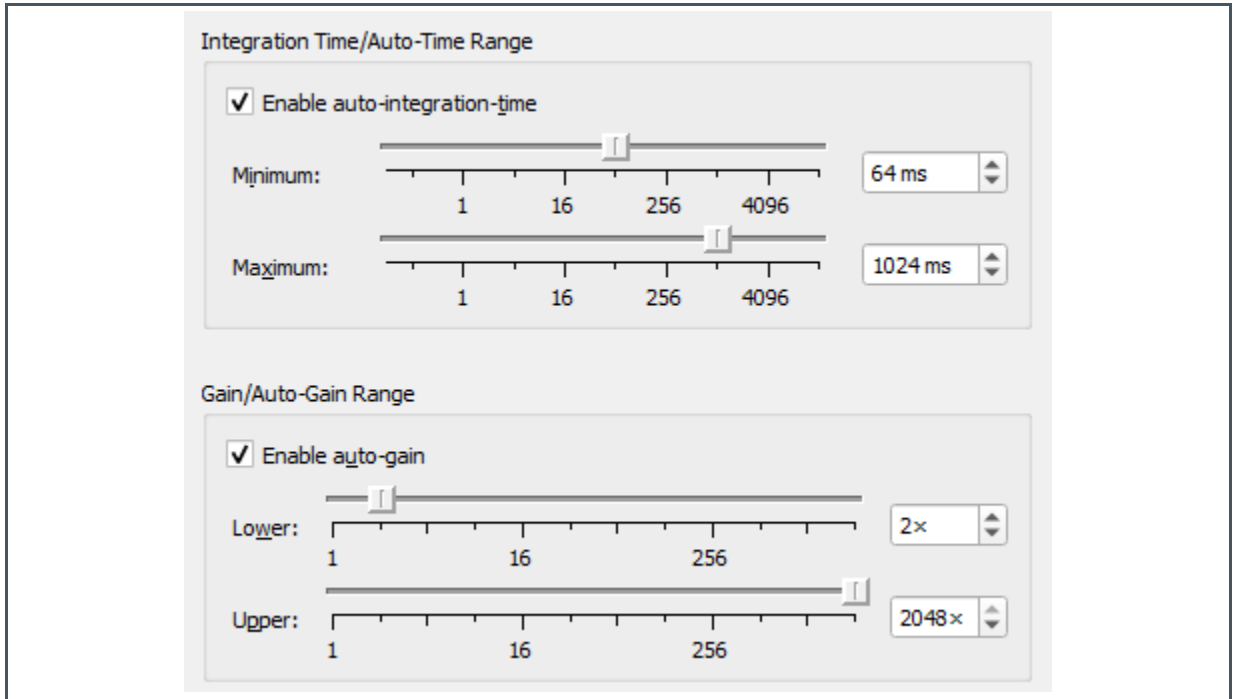
In contrast to the other settings, changing LED settings will take effect immediately.

For more details on the parameters and register-level information, please refer to the datasheet of the respective chip.

> **NOTE:** If no signals can be seen in the diagram after starting measurements, the setup for the ADC may be wrong, and the sensor measures only noise. Then, increase gain and integration time or select automatic for gain and integration time. At this point, it is important to set the limits for both parameters correctly – as a suggestion, see Figure 8.

⁴ Must also be considered in calculations for the sensor results – use them as a factor for multiplication with the ADC counts.

Figure 8:
Suggested ADC-Parameter for the First Tests



5.3 Performing Measurements

After setting up all the useful parameters, measurements can be performed using the controls on the upper right-hand side of the main window. Gain and integration time are the most important parameters to affect the counts or digits as sensor results. If these parameters are set to low, then the sensor measures noise; if they are too high, the sensor goes into saturation. Both of these conditions are wrong and will not give proper and acceptable sensor results.

Pressing the "Start" button begins the measurement. This turns the button into a "Stop" button - so that a continuous measurement process can be stopped.

► **NOTE:** It may happen that a certain combination of parameter settings, which are subject to complex conditions at the device level, is not permissible. In this case, starting a measurement will fail with an error message indicating this.

To perform a certain number of measurements, a value greater than zero is selected in the "n =" input field on the right of the "Start" button, and the measurement is started. After the specified number of measurements has been performed, the process is automatically stopped. To perform an indefinite number of measurements in CONT means to set the value "n =" to zero.

By default, the graphical output is enabled via the "Enable graph" checkbox, which will display the measurements as a graph and line diagram for the sensor outputs' UV and temperature. The graph will display up to the last n measurements, specified via the "up to" input box on the right-hand side of the checkbox. This limitation is done for performance reasons, as a large number of points plotted during an ongoing measurement process, with a short integration time, can lead to performance problems. Depending on the system, performance can also suffer from short integration times. As a result, a warning message is displayed when starting a measurement, with graph plotting enabled in such cases. In case of very short integration times, it is recommended to deactivate the graph and only output to a CSV log. The graph can be switched on and off, as desired, during a running measurement process. Starting a new measurement process deletes the graph (but not the log file).

The measurement data can be logged to a CSV file. This is disabled by default and can be enabled via the "Log CSV to" checkbox. By default, a file is preset to be located in a subdirectory, named after the device in your home directory, and has a name that includes both the device type and a wall clock timestamp. The file can be changed via the "File..." button. This will open a file selection dialog box that defaults to the same directory and has a file name matching the default name but containing a current timestamp. In the case of write errors to the log file during a running measurement, an error box is displayed, and the measurement stops.

The checkbox "Abort at saturation" causes a running measurement to be aborted if saturation is reached for one of the channels of the sensor.

5.4 Graphical Output

If enabled, a graph of an ongoing measurement is rendered in real-time in the right-hand area of the main window.

The graph shows four series:

- Three, for the three sensor channels, labeled A, B and C relating to the left y-axis, with a unit of counts.
- One for the internal temperature sensor, labeled T, relating to the right y-axis, with a unit of °C.

Depending on the device, there may be up to eight additional series for **external temperature sensors**, labeled **T0** through **T7**, corresponding to the respective sensor index, and relating to the right y-axis, and with a unit of °C. These have their points marked by a distinctive symbol per series, in addition to a color gradient across the set of series.

► **NOTE:** Due to technical limitations, if there are more than four external temperature sensors available, values will only be received and plotted for the first four values. Regardless, the legend will show all the available sensors.

Intervals during which **saturation** has occurred for any of the channels will be **highlighted in red**.

The time axis reflects the timestamps of the measurements as obtained from the device. For comprehensibility, the scale shows them as an offset to the first measurement in the currently-running (or last-run) measurement process in seconds.

Hovering on the chart will show the channel and time values at the crosshair's location. Drag, using the left mouse button, and zoom in on a rectangular region. Right-clicking or pressing the "Zoom to fit" button will reset the zoom to show the entire series.

The "Normalize" checkbox will toggle normalized basic counts obtained from the raw counts by normalizing to:

- An integration time of 1 ms.
- A gain of 1.
- A divider value of 1 (i.e., no divider).

This does not affect the data logged to a CSV file.

Below the chart, the current effective gain will be shown if a measurement process runs with the graph enabled.

5.5 CSV Output

If enabled, measurement data can be logged to a CSV file. Logging can be toggled via the "**Start CSV Logging**" button (which subsequently turns into "**Stop CSV Logging**").

A default file with a path and name, depending on the device type, will be initially set. This can be changed via the “**Select File...**” button, which will open a file selection dialog. The current log file path is displayed below the buttons.

When selecting a new file, a preexisting file of the same name will be overwritten (you will be prompted for confirmation). Running multiple measurement processes with the same file set will append to that file. Changing measurement settings intermittently will ask for confirmation of whether you want to log data obtained with different settings to the same file.

To the right of the file selection button, there is a checkbox labeled “**Auto-append timestamp**” (checked by default). With this checked, the selected file will automatically get a textual timestamp appended to its name, immediately after a measurement is started with logging enabled. Stopping and starting logging without selecting a new file will generate and use a new timestamp.

When logging is active, and any data has been written to the current file, a “**Logging**” marker will be shown on the right-hand side of the status bar.

Figure 9:
Example of a CSV Log File with Timestamp, Sensor Results, and Setup

	A	B	C	D	E	F	G	H	I	R	S	T	U
1	Timestamp	A	B	C	Temperat	Integratio	Gain	Divider	LED 0	ExtTemp 1	ExtTemp 2	ExtTemp 3	Error
2	0	3258	2688	6623	22	256	2048	1		21.562	21.812	21.562	0
3	286689	2582	2316	5545	22	256	2048	1		21.562	21.812	21.562	0
4	573409	2594	2352	5651	22	256	2048	1		21.562	21.875	21.562	0
5	860009	2445	2272	5476	22	256	2048	1		21.562	21.875	21.562	0
6	1146641	2624	2380	5729	22	256	2048	1		21.562	21.875	21.562	0

The CSV includes a header row and consists of the following columns, in this order:

- (device) Timestamp (in microseconds).
- Raw counts.
- Internal temperature (in °C).
- Integration time (in milliseconds).
- (effective) Gain value.
- Divider value ('1' if disabled).
- Error value (see below).
- State of external LEDs 0 through 7, with an empty value, if not present. Otherwise, the brightness value or 0 if disabled.

The error field logs any error that may have occurred. These values correspond to error values as used internally with the host and chip libraries; please refer to the corresponding documentation for the meaning of the values. Value 34 indicates the saturation of any channel. The occurrence of an error aborts the measurement; only value 34 may be logged continuously along with the data.

5.6 Further UI Elements

The application also features a menu bar containing two menus:

- The “File” menu only contains an option to quit the application.
- The “Help” menu contains an “About...” option - showing a dialog with information about the application version, used open-source software, etc. Another option shows a dialog of application log messages, otherwise printed to the console if run via a terminal.

At the bottom of the main window, a status bar gives notifications about events as they happen on the left-hand side. It shows persistent status information on the right-hand side, including the connection and measuring states, whether saturation has occurred during the current or last measurement process.

6 Additional Documents

The following list includes a selection of available documents with more technical details for the AS7331 EVK and demos. This list is not fixed and it is constantly changing. Ask ams OSRAM for new details.



For further information, please refer to the following documents:

1. ams-OSRAM AG, *AS7331 EVK Logger (UG001037)*, User Manual.
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