

# TCS3410 EVM

## User Guide

Universal ambient light RGB sensor with selective flicker detection

Published by **ams-OSRAM AG**

Tobelbader Strasse 30, 8141 Premstaetten, Austria

Phone +43 3136 500-0

[ams-osram.com](http://ams-osram.com)

© All rights reserved



# Table of contents

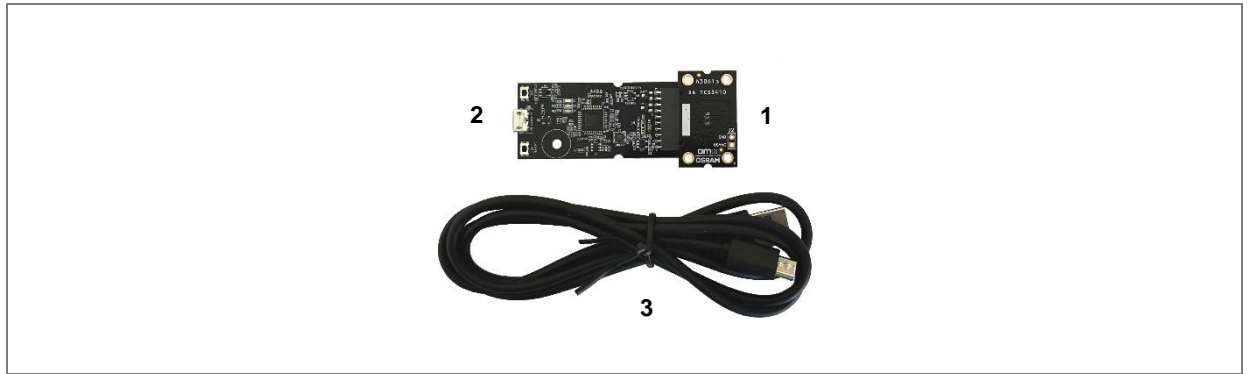
<b>1</b>	<b>Introduction .....</b>	<b>3</b>
1.1	Kit content .....	3
1.2	Ordering information .....	4
<b>2</b>	<b>Getting started .....</b>	<b>4</b>
<b>3</b>	<b>Hardware description .....</b>	<b>4</b>
<b>4</b>	<b>Software description.....</b>	<b>5</b>
4.1	Connect software to hardware .....	6
4.2	System menus .....	7
4.3	System level controls .....	9
4.4	Auto polling .....	10
4.5	Device ID information .....	10
4.6	Log status and control information.....	10
4.7	“Configuration” tab .....	11
4.8	“ALS” tab.....	14
4.9	“SW flicker” tab .....	17
<b>5</b>	<b>Resources.....</b>	<b>18</b>
<b>6</b>	<b>Revision information .....</b>	<b>20</b>
<b>7</b>	<b>Legal information .....</b>	<b>21</b>

# 1 Introduction

The TCS3410 evaluation kit comes with everything needed to evaluate the TCS3410. The device features digital ambient light sensing (ALS) and flicker detection.

## 1.1 Kit content

Figure 1: Evaluation kit content



No.	Item	Description
1	TCS3410 Daughter Board	PCB with TCS3410 sensor installed
2	EVM Controller Board	Used to communicate USB to I <sup>2</sup> C
3	USB Cable (A to Micro-B)	Connects EVM controller to PC

## 1.2 Ordering information

Ordering code	Description
TCS3410_EVM_KT	TCS3410 Evaluation Kit

## 2 Getting started

Install the software before connecting any hardware to the computer. Follow the instructions in the Quick Start Guide (QSG) to install the software, which loads the required driver for the USB interface and the device's graphical user interface (GUI).

This user guide identifies and describes the controls available on the GUI. Combined with the TCS3410 datasheet, the QSG, and application notes available on the ams OSRAM website ([ams-osram.com](https://ams-osram.com)), there should be enough information to evaluate the TCS3410 device.

## 3 Hardware description

The hardware includes the EVM Controller, the TCS3410 EVM daughter board, and a USB interface cable. The EVM controller board provides power and I<sup>2</sup>C communication to the daughter board through a ten-pin connector. When the EVM controller is connected to the PC through USB, a green LED on the board lights to indicate the system is getting power. This LED will be turned off when the GUI program starts so that it does not interfere with light measurements.

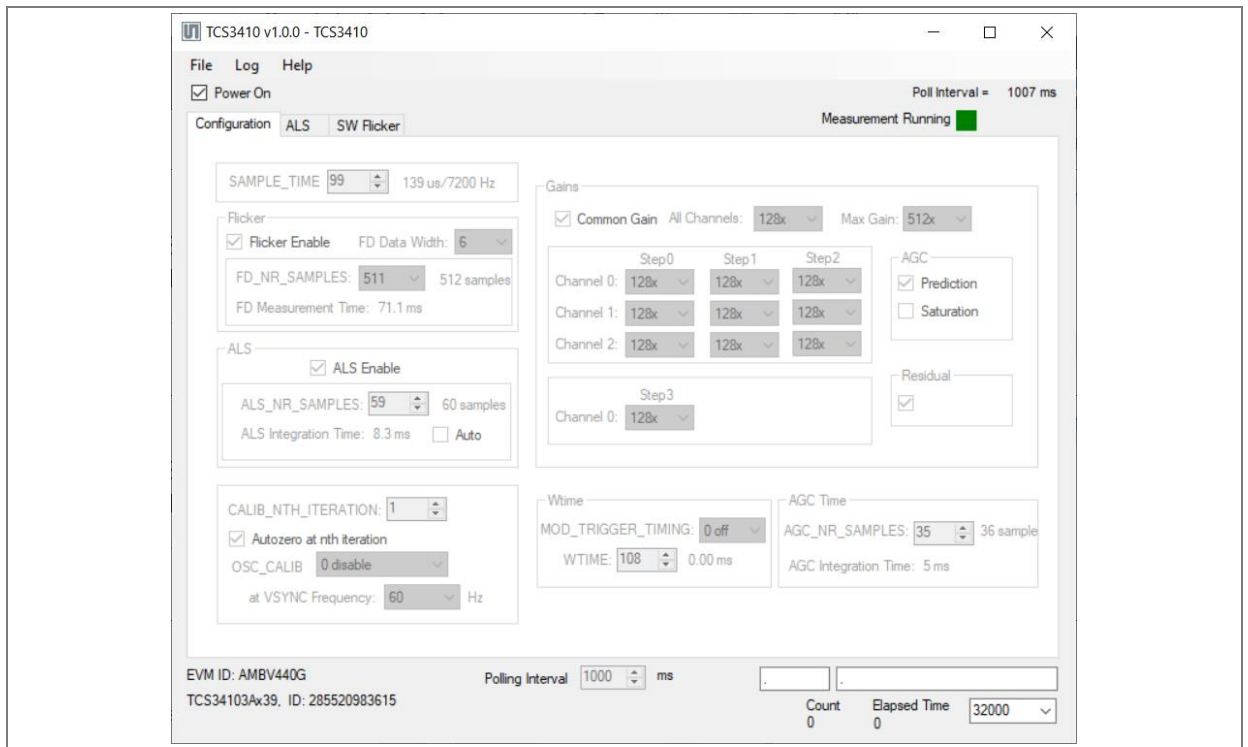
Figure 2: Evaluation kit hardware



## 4 Software description

The main window (Figure 3) contains the system menus, system-level controls, device information, and logging status. The Configuration tab contains controls to set up both ALS and Flicker detection parameters. The ALS tab and SW Flicker tab display ALS data, Flicker data, and Mod Gain data. The ALS tab contains a plotting area in which raw ALS data is drawn. The SW Flicker tab contains a plotting area in which the flicker raw data and flicker frequency after FFT calculation are drawn. The application polls the ALS and flicker raw data continuously, and calculates flicker frequency values.

Figure 3: GUI main window



## 4.1 Software to hardware connection

On startup, the software automatically connects to the hardware. On successful initialization, the software displays a main window, containing controls pertinent to the connected device. If the software detects an error, an error window appears. If “Device not found or is unsupported” appears, verify the correct daughterboard is properly connected to the EVM controller board. If “Cannot connect to EVM board” appears, verify the USB cable is connected. When the EVM controller board is connected to the USB, a green LED on the board lights indicating the USB cable is connected and supplying power to the system.

If the EVM board disconnects from the USB bus while the program is running, the program displays an error message and then terminates. Reconnect the EVM board and restart the program.

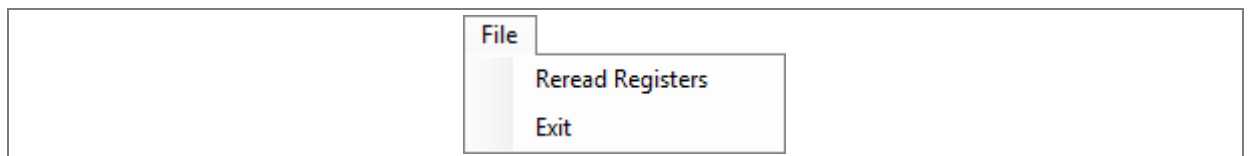
## 4.2 System menus

At the top of the window there are pull-down menus labeled “File”, “Log”, and “Help”. The **File** menu provides basic application-level control. The **Log** menu controls the logging function, and the **Help** menu provides version and copyright information for the application.

### 4.2.1 File menu

The File menu contains the following functions:

Figure 4: File menu



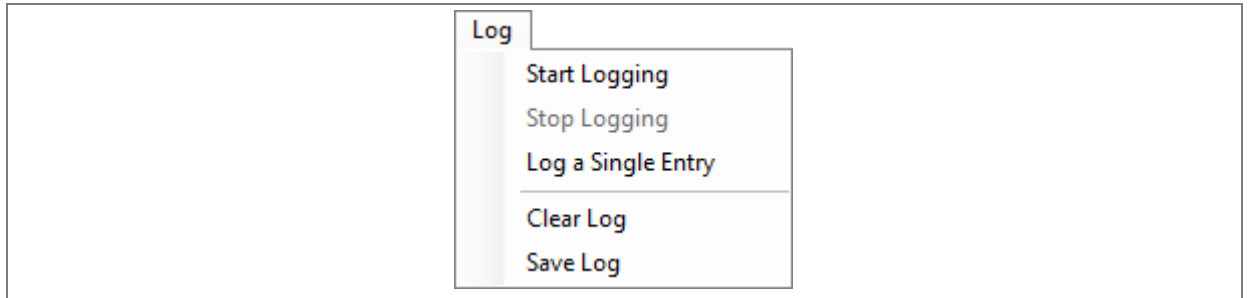
The **Reread Registers** function forces the program to reread all the control registers from the device and display them on the screen. This does not read the output data, because the program reads those registers continually while it is running.

Click on the **Exit** command to close the main window and terminate the application. This clears any unsaved log data is cleared from memory. The application can also be close by clicking the red “X” in the upper right-hand corner.

## 4.2.2 Log menu

The Log menu controls the logging function and saves the log data to a file. Log data accumulates in memory until discarded or written to a data file.

Figure 5: Log menu



Click **Start Logging** to start the logging function. Each time the program polls the output information from the device, it creates a new log entry showing the raw data values, the values of various control registers, and the values entered by the user into the text fields near the bottom right corner of the window.

Click **Stop Logging** to stop the logging function. Once logging stops, the user can store the data in a file, or continue collecting additional data by clicking **Start Logging** again.

The **Log a Single Entry** command causes logging to start, collect one single entry, and immediately stop again. This function is not available when logging is already running.

Click **Clear Log** to discard any previously collected data. If there is data in memory, that has not been saved to the disk, this function displays a prompt asking for verification to discard the data. If the log is active when this function executes, the log continues running after the existing data is discarded.

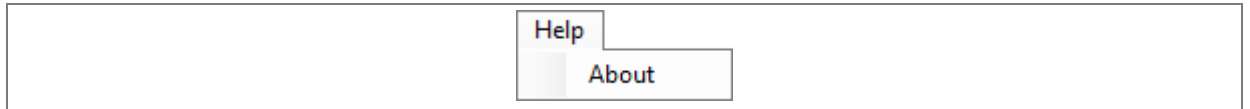
Click **Save Log** to save the collected log data to a CSV file. This stops the logging function, if it is active, and displays a file dialog box to specify where to store the logged data. The Log status and control Information section below describes the default file name, but you may change the file name if desired.



### 4.2.3 Help menu

The Help menu contains a single function: About.

Figure 6: Help menu



The **About** function displays a dialog box (Figure 7) showing the version and copyright information for the application and library. Click the **OK** button to close this window and continue.

Figure 7: About window



## 4.3 System level controls

Immediately below the top menu bar are checkboxes used to control the system-level functions of the TCS3410 device.

The **Power On** checkbox controls the PON function of the TCS3410. When this box is checked, the power is on, and the device runs measurements according to the settings in the

Configuration tab. The Configuration tab is disabled to prevent users from changing the settings while the measurement is ongoing. When this **Power On** checkbox is unchecked, the power is off, and the device does not operate. The Configuration tab is then enabled, and the user can change the controls to set up the parameters for the next run.

#### 4.4 Auto polling

The application automatically polls the TCS3410 raw data of ALS and Flicker if enabled. The **Poll Interval**, at the upper right corner of the form, displays the actual time between the reads of the device. The control "**Poll Interval**" in the middle bottom of the form lets the user set the desired polling interval.

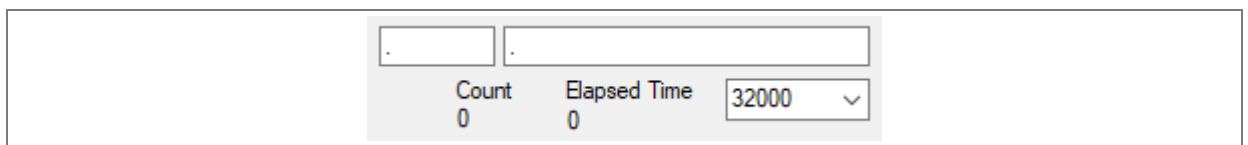
#### 4.5 Device ID information

The lower left corner of the window displays the ID number of the EVM Controller board, identifies the device being used, and displays the ID of the device.

#### 4.6 Log status and control Information

The lower right corner of the window contains status information and controls for the logging function:

Figure 8: Logging status



The screenshot shows a control panel for logging status. It features two text input fields at the top, each containing a period (.). Below these fields, the text "Count" is displayed above the value "0". To the right, the text "Elapsed Time" is displayed above the value "0". Further right is a dropdown menu with the value "32000" and a downward arrow.

This section contains text boxes that are stored in the log file data and used to build the file name for the log file. If the data in these fields are changed, the new values are stored with any new data logged. The default file name is based on these values at the time the log file is written. If nothing is entered in these boxes, they default to a period (".").

**Sample of a default file name:**

TCS3410\_1-2-3\_Log\_HH\_MM\_SS.csv

- From Application
- From User Input

The **Count** value displayed is a count of the number of samples currently in the log buffer.

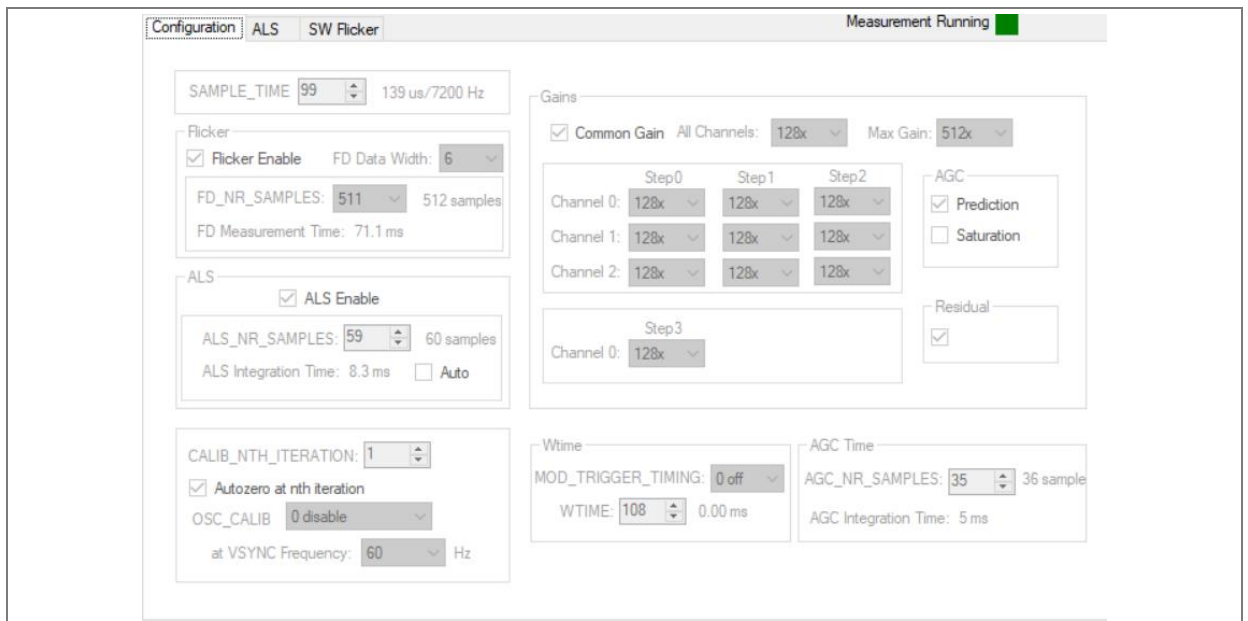
The **Elapsed Time** value indicates the elapsed time since data logging started.

The numeric box in the bottom right-hand corner sets a limit to the size of the collected dataset. You may select a value from the pull-down list or enter a value manually. When the number of entries in the log reaches this value, the program will automatically stop logging and display a file dialog box to specify where to store the logged data. You may change the file name if desired. The maximum value that can be entered in this field is 32000.

## 4.7 “Configuration” tab

The main portion of the screen contains a tab labeled Configuration.

Figure 9: Configuration tab



### 4.7.1 Configuration controls

The **SAMPLE TIME** control sets the time of one flicker measurement. It also defines the measurement time of the step for ALS measurements.

The **Flicker** group box contains controls relating to flicker detection:

- **Flicker Enable** control enables the flicker detection if checked.
- **FD Data Width** control sets the width of the compressed flicker data in the FIFO. The values are from 1 to 15.
- **FD\_NR\_SAMPLES** control defines the number of samples for one flicker measurement.
- **FD Measurement Time** control displays the integration time for one flicker measurement.

The **ALS** group box contains controls relating to flicker detection:

- **ALS Enable** control enables the ALS detection if checked.
- **ALS\_NR\_SAMPLES** control defines the number of samples for one ALS measurement.
- **ALS Integration Time** control displays the integration time for one ALS measurement.

The **Calibration** group box contains the following controls:

- **CALIB\_NTH\_ITERATION** control sets the repeat rate of the calibration execution in the measurement sequencer rounds. The values are from 0 to 255.
- **Autozero at nth iteration** checkbox enables auto zero calibration during the nth iteration calibration if checked.
- **OSC\_CALIB** control defines the calibration mode. The available options are “0 disabled”, “1 after pon”, and “2 always on”.
- **At VSYNC Frequency** sets VSYNC frequency. The available values are 60Hz, 90Hz and 120Hz.

The **Gains** group box contains controls to set up all the gains:

- **Common Gain** checkbox, if checked, will set all the channels to the same gain.
- **All Channels** dropdown combo box sets the gain for all the channels if the **Common Gain** checkbox is checked. The choices are 1/2x, 1x, 2x, 4x, 8x, 16x, 32x, 64x, 128x, 256x, 512x, 1024x, 2048x, 4096x and 8192x.
- **Max Gain** dropdown combo box sets the max gain for all the channels if the **Common Gain** checkbox is checked. The choices are 1/2x, 1x, 2x, 4x, 8x, 16x, 32x, 64x, 128x, 256x, 512x, 1024x, 2048x, 4096x and 8192x.
- **Gain at Channel 0/1/2 and Step 0/1/2** dropdown combo box sets the gain for channel 0/1/2 at step 0/1/2 if the **Common Gain** checkbox is unchecked. The choices are 1/2x, 1x, 2x, 4x, 8x, 16x, 32x, 64x, 128x, 256x, 512x, 1024x, 2048x, 4096x and 8192x.

- **Gain at Channel 0 and step 3** sets the gain for channel 0 at step 3, which is for flicker detection.
- **AGC** group box has two checkboxes. One is the **Prediction** checkbox for enabling the prediction of the AGC function for all steps of the sequence if checked. The second is the **Saturation** checkbox which enables AGC analog saturation if checked.
- **Residual** checkbox enables a residual measurement on modulator 0 if checked.

The **WTime** group box contains controls relating to the wait function:

- **MOD\_TRIGGER\_TIMMING** defines the repeat rate of modulator/sequencer measurements. The available selections are “0 off”, “1 normal = 2.84 ms”, “2 long = 45.51 ms”, “3 fast = 88.89  $\mu$ s”, “4 fastlong = 1.42 ms”, “5 vsync”, “6 reserved0” and “7 reserved1”.
- **WTIME** specifies the time to wait between measurement steps. The values are from 0 to 255.

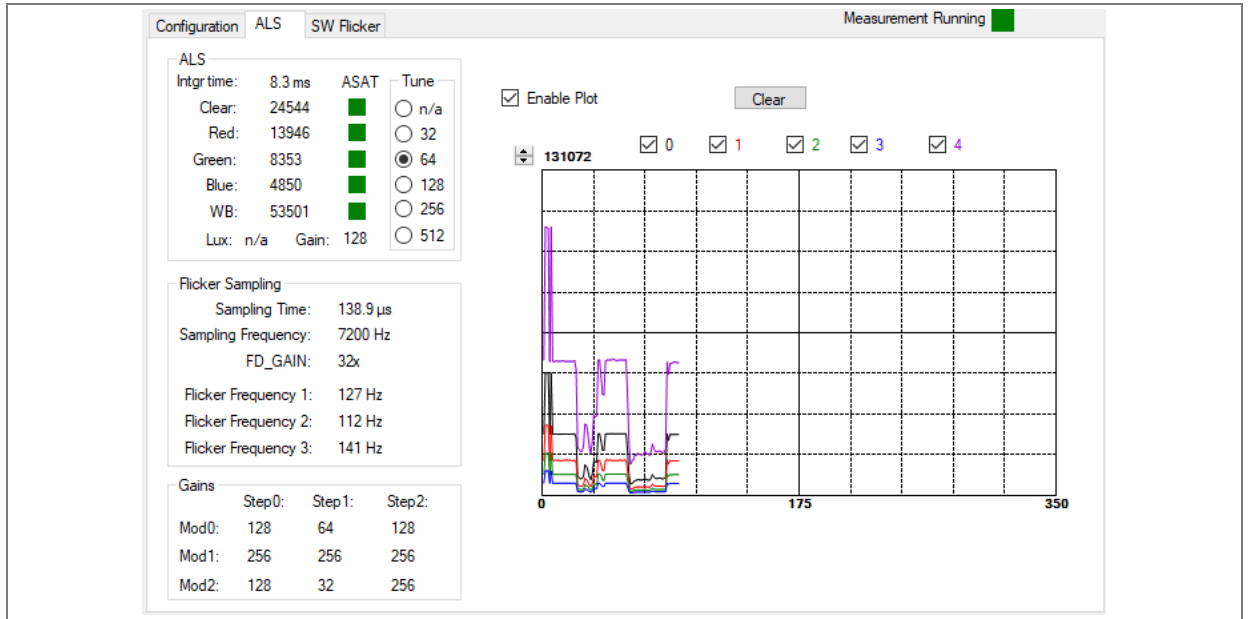
The **AGC Time** group box contains controls to set up the AGC time:

- **AGC\_NR\_SAMPLES** defines the number of samples for every AGC measurement. The values are from 0 to 65535.
- **AGC Integration Time** displays the AGC integration time.

## 4.8 “ALS” tab

The main portion of the screen contains a tab labeled ALS. It displays measurement data.

Figure 10: ALS tab



### 4.8.1 ALS group box

The lefthand side of the ALS tab displays the ALS measurement data with the following items:

- The ALS **Integration time**.
- **Clear** data counts.
- **Red** data counts.
- **Green** data counts.
- **Blue** data counts.
- **Wide band** data counts.
- **Clear data saturation status**: A green color means no saturation happened. A red color means otherwise.
- **Red data saturation status**: A green color means no saturation happened. A red color means otherwise.

- **Green data saturation status:** A green color means no saturation happened. A red color means otherwise.
- **Blue data saturation status:** A green color means no saturation happened. A red color means otherwise.
- **Wide band data saturation status:** A green color means no saturation happened. A red color otherwise.
- **Lux:** Lux calculation is not implemented in the GUI.
- **Gain:** Normalized Gain value. This is the gain value of channel 0 in step 0 for clear data detection.
- **The Tune radio buttons:** This set of radio buttons prevents the plotting graph values from jumping dramatically due to the AGC effect of different normalized gain values applied when measuring. The displayed data is the measurement data ratio when normalized gain has the selected value (of the radio button).

#### 4.8.2 Flicker sampling group box

The following items display in the Flicker Sampling group box:

- **Sampling Time**
- **Sampling Frequency**
- **FD\_GAIN**
- **Flicker Frequency1**, which has the biggest FFT value.
- **Flicker Frequency2**, which has the second biggest FFT value.
- **Flicker Frequency3**, which has the third biggest FFT value.

#### 4.8.3 Gains group box

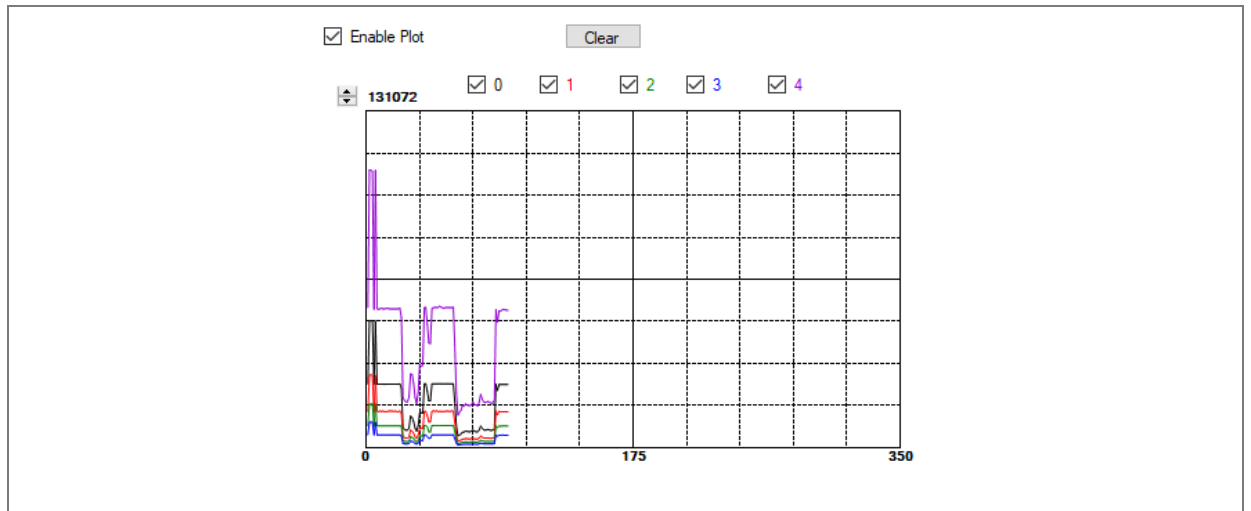
In this group box, there is the nine gain value matrix for modulator 0/1/2 and step0/1/2.

#### 4.8.4 ALS data plot

The remaining portion of the ALS tab is used to display a running plot of the collected ALS values and calculated Lux. The last 350 values are collected and plotted on the graph. As additional values are added, the old values will be deleted from the left side of the graph. To

start the plotting function, check the **Enable Plot** checkbox and select the **ALS**, **IR**, or **Lux** checkboxes.

Figure 11: ALS data plot



The scale of the Y-axis of the plot can be adjusted by clicking on the small up and down arrows at the top left corner of the plot. The scale can be set to any power of 2 from 64 through 65536.

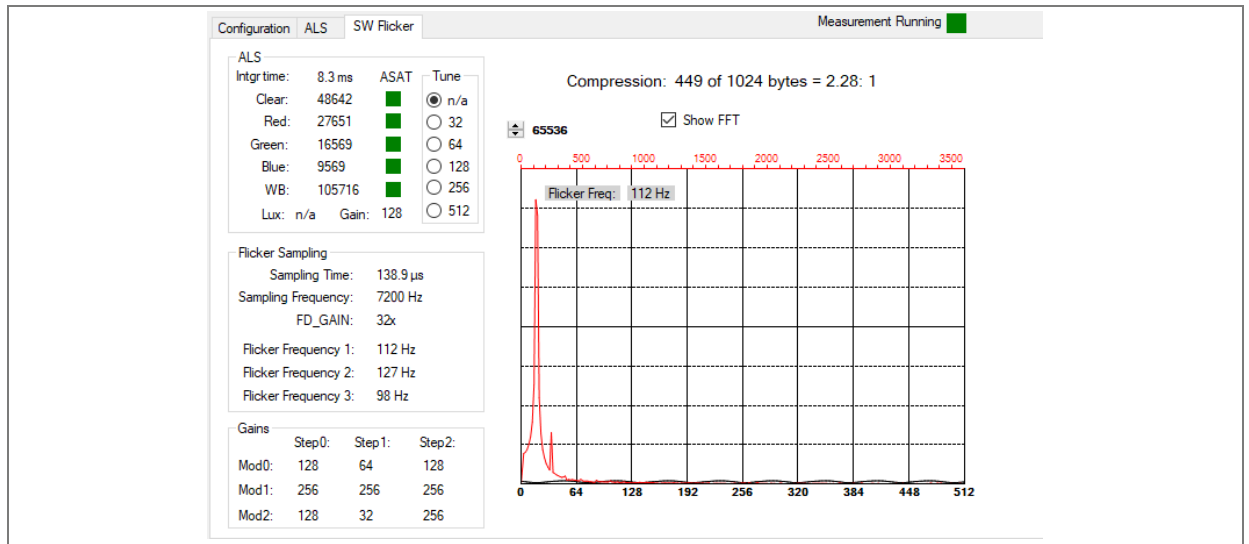
Click the **Clear Plot** button to discard the current data and continue plotting the new data. Note that if the Clear Plot button is clicked while the plot is disabled, the data is discarded, but the actual plot will not be updated until the plot function is re-enabled.



## 4.9 “SW flicker” tab

The main portion of the screen contains a tab labeled SW Flicker.

Figure 12: SW flicker tab



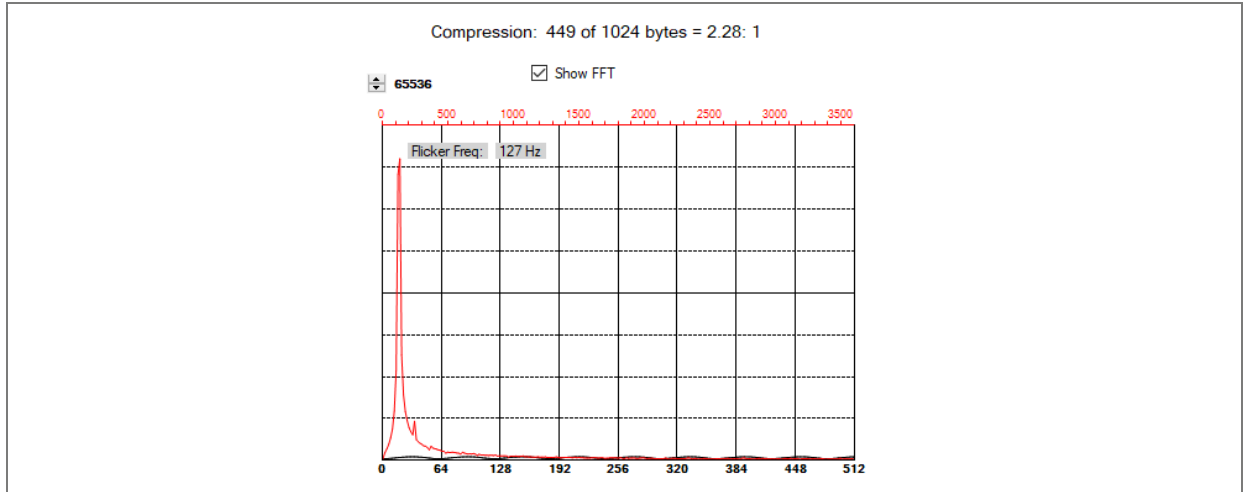
### 4.9.1 Flicker information

The left side of the SW Flicker tab displays the same ALS and Flicker information as in the ALS tab. See chapter 4.8 for detailed information.

### 4.9.2 Flicker output data

The top right-hand section of the SW Flicker tab displays a plot of the original flicker data and the data after FFT. Besides, the peak Flicker Frequency, the compression rate are also displayed there.

Figure 13: SW flicker data plot



The scale of the Y-axis of the plot can be adjusted by clicking on the small up and down arrows at the top left corner of the plot. The scale can be set to any power of 2 from 16 to 16384.

Click the **Clear Plot** button to discard the current data and continue plotting the new data. Note that if the Clear Plot button is clicked while the plot is disabled, the data is discarded, but the actual plot will not be updated until the plot function is re-enabled.

## 5 Resources

For additional information regarding the TCS3410, please refer to the datasheet. For information regarding the installation of the TCS3410 EVM host application software, please refer to the TCS3410 EVM Quick Start Guide.

Designer's Notebooks dealing with various aspects of optical measurement and optical measurement applications are available. All content is available on the ams OSRAM website [ams-osram.com](https://ams-osram.com).



**Reference documents:**

- TCS3410 Datasheet, DS000752
  - TCS3410 EVM Quick Start Guide (QSG), QG000168
  - TCS3410 EVM User's Guide (this document), UG000504
-

## 6 Revision information

### Definitions

#### Draft / Preliminary:

The draft / preliminary status of a document indicates that the content is still under internal review and subject to change without notice. ams-OSRAM AG does not give any warranties as to the accuracy or completeness of information included in a draft / preliminary version of a document and shall have no liability for the consequences of use of such information.

Changes from previous released version to current revision v2-00	Page
Document contents were transferred to latest ams OSRAM template	
Updated Figure 1, Figure 2 and Figure 4	3, 4, 7
Updated Ordering code	4

- 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.

## 7 Legal information

### Copyright & disclaimer

Copyright ams-OSRAM AG, Tobelbader Strasse 30, 8141 Premstaetten, Austria-Europe. Trademarks Registered. All rights reserved. The material herein may not be reproduced, adapted, merged, translated, stored, or used without the prior written consent of the copyright owner.

Demo Kits, Evaluation Kits and Reference Designs are provided to recipient on an "as is" basis for demonstration and evaluation purposes only and are not considered to be finished end-products intended and fit for general consumer use, commercial applications and applications with special requirements such as but not limited to medical equipment or automotive applications. Demo Kits, Evaluation Kits and Reference Designs have not been tested for compliance with electromagnetic compatibility (EMC) standards and directives, unless otherwise specified. Demo Kits, Evaluation Kits and Reference Designs shall be used by qualified personnel only.

ams-OSRAM AG reserves the right to change functionality and price of Demo Kits, Evaluation Kits and Reference Designs at any time and without notice.

Any express or implied warranties, including, but not limited to the implied warranties of merchantability and fitness for a particular purpose are disclaimed. Any claims and demands and any direct, indirect, incidental, special, exemplary or consequential damages arising from the inadequacy of the provided Demo Kits, Evaluation Kits and Reference Designs or incurred losses of any kind (e.g. loss of use, data or profits or business interruption however caused) as a consequence of their use are excluded.

ams-OSRAM AG shall not be liable to recipient or any third party for any damages, including but not limited to personal injury, property damage, loss of profits, loss of use, interruption of business or indirect, special, incidental or consequential damages, of any kind, in connection with or arising out of the furnishing, performance or use of the technical data herein. No obligation or liability to recipient or any third party shall arise or flow out of ams-OSRAM AG rendering of technical or other services.

### Headquarters

ams-OSRAM AG

Tobelbader Strasse 30

8141 Premstaetten

Austria, Europe

Tel: +43 (0) 3136 500 0

Please visit our website at [ams-osram.com](https://ams-osram.com)

For information about our products go to [Products](#)

For technical support use our [Technical Support Form](#)

For feedback about this document use [Document Feedback](#)

For sales offices and branches go to [Sales Offices / Branches](#)

For distributors and sales representatives go to [Channel Partners](#)