ams

User Guide

UG000499

TMD3719

TMD3719 EVM

ALS/Color and Proximity Sensor

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Content Guide

1 Introduction

The TMD3719 evaluation kit comes with everything needed to evaluate the TMD3719. The device features proximity detection and digital ambient light sensing (ALS).

1.1 Kit Contents

Figure 1:
Evaluation Kit Contents

No.	Item	Description
1	TMD3719 Daughter Card	PCB with TMD3719 sensor installed
2	EVM Controller Board	Used to communicate USB to I2C
3	USB Cable (A to Mini-B)	Connects EVM controller to PC
4	Flash Drive	Include application installer and documents

1.2 Ordering Information

Ordering Code	Description
TMD3719 EVM	TMD3719 ALS/Color and Proximity Sensor

2 Getting Started

The software should be installed prior to connecting any hardware to the computer. Follow the instructions found in the Quick Start Guide (QSG). This loads the required driver for the USB interface and the device's graphical user interface (GUI).

The balance of this document identifies and describes the controls available on the GUI. In combination with the TMD3719 datasheet, the QSG and application notes available on the **ams** website, www.ams.com, there should be enough information to allow evaluation of the TMD3719 device.

3 Hardware Description

The hardware consists of the EVM Controller, the TMD3719 EVM daughter card, and a USB interface cable. The EVM controller board provides power and I2C communication to the daughter card through a seven-pin connector. When the EVM controller is connected to the PC through USB, a green LED on the board flashes once on power up to indicate the system is getting power.

For schematics, layout and BOM information please see the documents included with the install located in the TMD3719 EVM folder (All Programs -> ams -> TMD3719 EVM -> Documents).

Figure 2:
Evaluation Kit Hardware
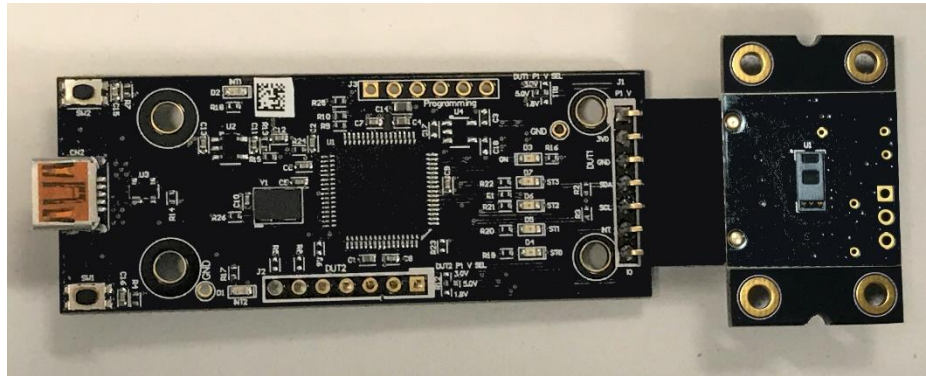
4   Software Description

The main window (Figure 3) contains the system menus, system level controls, device information and logging status. The ALS tab contains controls for the light sensing function. The Prox tab contains settings for the proximity function. The Flicker tab contains controls for flicker detection. The application polls the ALS and proximity raw data as well as flicker data continuously and displays them on the GUI.

Figure 3:
GUI Main Window
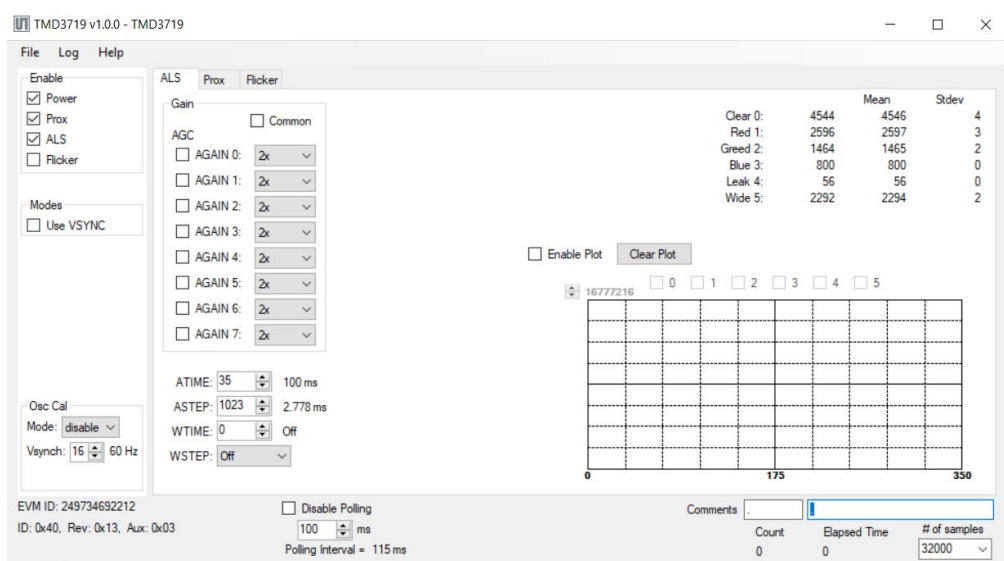
4.1   Connect Software to Hardware

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 flashes once on power up to indicate the USB cable is connected and providing power to the system.

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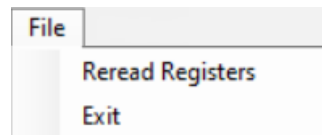
4.2   System Menus

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 re-read all of 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. Any unsaved log data is cleared from memory. The application can also be closed 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
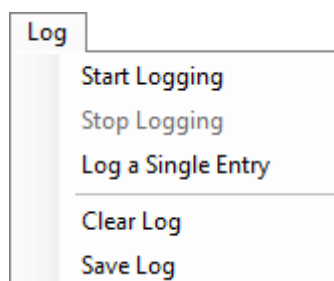
Click **Start Logging** to start the logging function. Each time the program polls the output information from the device, it creates a new log entry showing the raw data values, the values of various control

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 may 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, which has not been saved to disk, this function displays a prompt asking to verify it is OK 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.
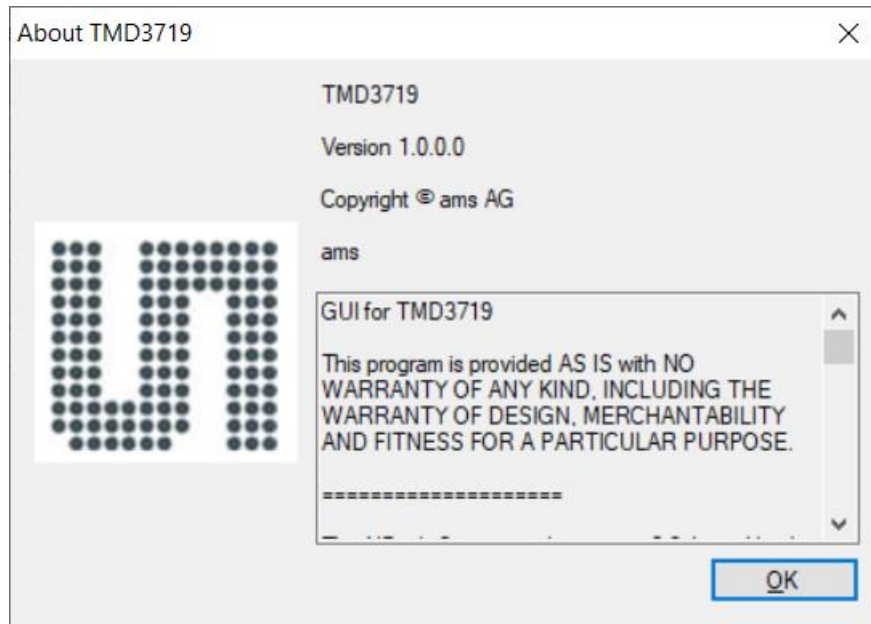
4.2.3   Help Menu

The Help menu contains a single function: About.

Figure 6:
Help Menu
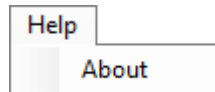
The **About** function displays a dialog box (Figure 7) showing the version and copyright information for the application and library. Click the **OK** button to close this window and continue.

Figure 7:
About Window

4.3   System Level Controls

At the most left side of the main window is the system level controls for the system level functions of the TMD3719 device.

4.3.1   Enable Group Box

The Enable group box consists the following check boxes:

The **Power On** checkbox controls the PON function of the TMD3719. When this box is checked, the power is on and the device can operate. When this box is unchecked, the power is off and the device does not operate (You can still change the control registers, but the device does not perform ALS and Prox functions).

The **ALS Enable** checkbox controls the AEN function of the TMD3719. When this box is checked, the device collects and report ALS data as programmed. When this box is unchecked, the ALS function does not operate.

The **Prox Enable** checkbox controls the PEN function of the TMD3719. Proximity detection is enabled when this box is checked or disabled when unchecked.

The **Flicker Enable** checkbox controls the FEN function of the TMD3719. Flicker detection is enabled when this box is checked or disabled when unchecked.

4.3.2   Modes Group Box

Modes group box has one check box **Use VSYNC**. When checked, the classical ALS, prox and flicker detection will start with next VSYNC instead of immediately.

4.3.3   Osc Group Box

Osc group box has **Mode** combo box and **VSYNCH** numeric box.

Mode has 3 options: disable, once, and always. It controls how often the internal oscillator is synchronized with the input VSYNCH signal.

VSYNCH sets up VSYNC frequency expected by the device. It controls VSYNC_FREQ function of TMD3719.

4.4   Auto Polling

The application automatically polls the TMD3719 raw data of ALS, Prox and Flicker if enabled. The **Poll Interval** displays the time between reads of the device.
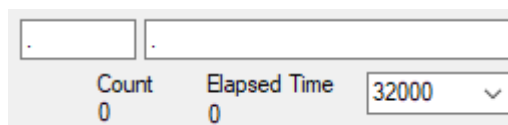
4.5   Device ID Information

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

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 default file name:

TMD3719_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 may be entered in this field is 32000.

4.7   "ALS" Tab

The main portion of the screen contains a tab labeled ALS. The controls in this tab are divided into 3 sections, each performing a separate function.

Figure 9 :
ALS Tab

4.7.1   ALS Controls

The left side of the ALS tab contains controls to set various ALS settings.

The **Gain** group box has controls to set up AGC and gain value for each channel. The most left **AGC** check boxes enable AGC function for each channel when checked. The combo boxes **AGAIN** setup

GAIN values for each channel. When the **Common** check box checked, it will use the setups of the channel 0 for all rest of the channels.

The **ATIME** and the **ASTEP** sets the time of the ALS integration. ALS integration time = (atime+1) *(astep+1) * modclk, where modclk = 2.7126736 µs.

The **AGAIN** control is a pulldown menu which sets the analog gain of the ALS sensor. The values available are 2x, 4x, 8x, 16x, 32x, 64x, 128x, 256x, 512x, 1024x, 2048x, and 4096x when AGC is not enable, and 128x, and 4096x when AGC is enabled.

The **WTIME** control sets how many **WSTEP** time to wait between ALS measurement sequencer steps.

The **WSTEP** control selects Modulator trigger timing step. It defines the repeat rate of ALS measurement. The values are "off", 2.78ms, 50ms, 86.81us, 1.5625ms, and VSYNC.

4.7.2   ALS Output Data

The top right corner of the ALS tab displays the output data. This data is continuously read. The polling interval is shown above the tab.

- **Clear 0:** displays the Channel 0 clear data count.
- **Red 1:** displays the Channel 1 red data count.
- **Green 2:** displays the Channel 2 green data count.
- **Blue 3:** displays the Channel 3 blue data count.
- **Leak 4:** displays the Channel 4 leakage data count.
- **Wide 5:** displays the Channel 5 wideband data count.

4.7.3   ALS Data Plot

The remaining portion of the ALS tab is used to display a running plot of the collected ALS values. 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 **0, 1, 2, 3, 4,** and **5** checkboxes.

Figure 10:
ALS Data Plot
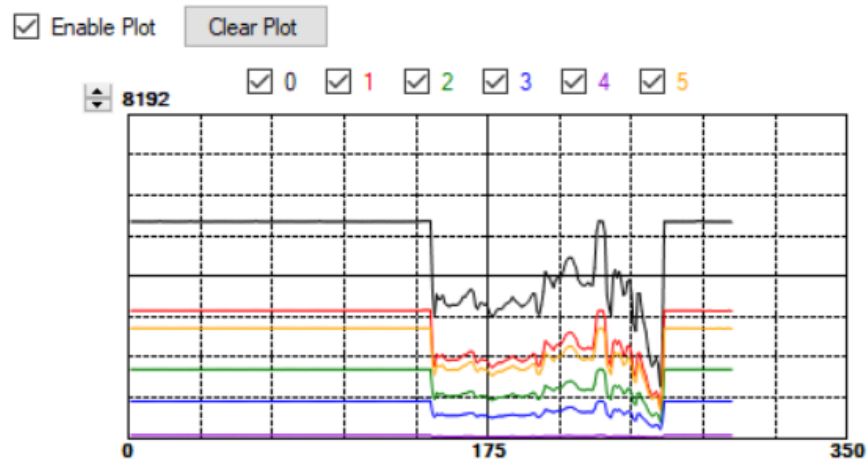
The scale of the Y-axis of the plot can be adjusted by clicking on the small up and down arrows at the top left corner of the plot. The scale can be set to any power of 2 from 64 through 65536.

Click the **Clear Plot** button to discard the current data and continue plotting the new data. Note 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.

4.8   "Prox" Tab

The main portion of the screen contains a tab labeled Prox. The controls in this tab are divided into 3 sections, each performing a separate function.

Figure 11 :
Prox Tab
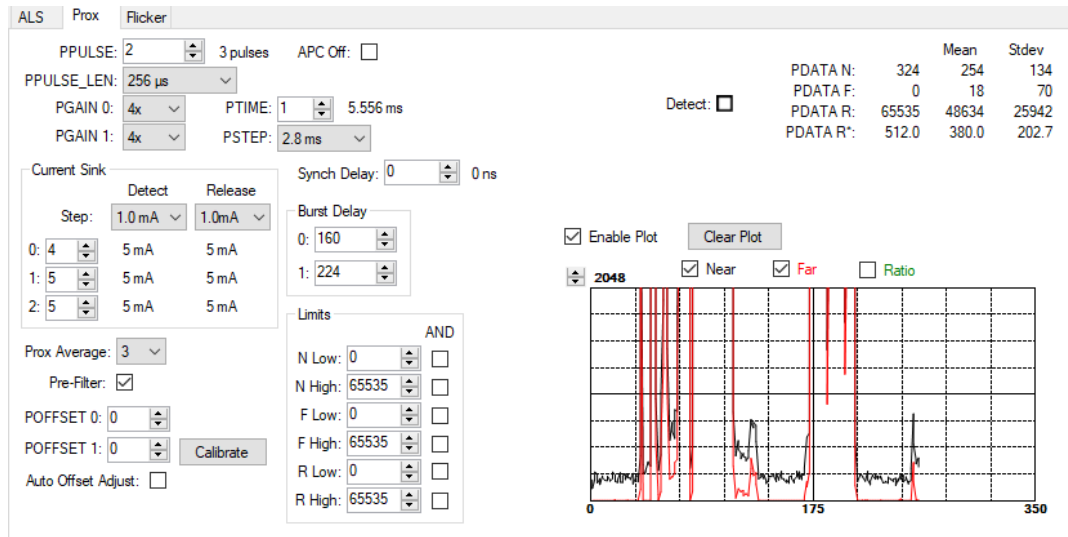
4.8.1   Prox Controls

The left side of the Prox tab contains controls to set various Prox settings.

The **PPULSE** controls the number of pulses used for each prox cycle. The number of pulses is one more than the PPULSE value and is displayed immediately to the right of the box. The pulse count can be set between 1 and 256 pulses.

The **PPULSE_LEN** control sets the width of all IR LED pulses within the proximity cycle. Longer pulses result in increased proximity range and typically result in less electrical noise generated in the analog front end. Pulse Length can be set to any power of two, from 4 µs to 512 µs.

The **PGAIN0** and **PGAIN1** controls is are pulldown combo box that lets you control the two gain stages of the proximity IR sensor. The PGAIN0 values are 1x, 2x, 4x and 8x. The PGAIN1 values are 1x, 2x, 4x and 8x.

The **PSTEP** control selects the timing of the timing steps that define the repeat rate of proximity measurements. The PSTEP values are "Always", 2.8 ms, 50 ms, 86.81 µs, 1.5625 ms, and VSYNC. The term "Always" implies that the proximity measurement is always triggered, meaning that the next measurement begins immediately. VSYNC uses the VSYNC input for each trigger step.

The **PTIME** control sets the repeat rate of proximity measurements by selecting how many PSTEPs occur between the start of each measurement. Note that the actual number of steps taken is PSTEP + 1.

The **SYNCH DELAY** control sets the delay of the synch input in multiples of the modulator clocks (2.7126736 µs).

The **CURRENT SINK** group of controls sets the current used by each of the IR VCSELs

- The **Detect** and **Release** controls the scaler values used when the device is in Detect or Release mode. These modes are defined by the setting of the Limits controls. Each of these controls can be set to 0.5 mA, 1.0 mA, 1.5 mA, or 2.0 mA.
- The **0, 1,** and **2** controls set the actual sink current for VCSEL 0, 1, and 2 respectively, in multiples of the Detect and Release step size. Sink 0 is the Master VCSEL. The current for this VCSEL is the value in the 0 control + 1 times the Detect/Release step. For VCSELs 1 and 2, the sink current is the value in the associated control times the Detect/Release step. This means that the Master VCSEL current sink cannot be set to 0 mA, but that the other two can).
- The actual sink current for each of the VCSELs in each of the modes is shown directly to the right of each VCSEL control and below the Detect and Release controls.

The **Burst Delay** controls the delay of 2 sets of proximity pulses when the VSYNC signal is being used to trigger proximity measurement. Units are specified as $1/256^{th}$ of the VSYNC period.

The **Prox Average** control sets how many ADC samples averaged for the proximity values. The control can be set to "Off" or to 2, 3, 4, 5, 6, 7, or 8 samples. The prox data will be updated every cycle with a running average of the last N samples.

The **Pre-Filter** checkbox causes the prox data to be a sum of two consecutive prox measurements. When selected, the sum of the two samples is used for pdata and interrupt generation. This also affects the Prox Average function.

The **POFFSET0/1** controls shift PDATA0/1 to remove crosstalk from the proximity data. The values range from -255 to 255. This value can be set manually, or it can be set by the Proximity offset calibration.

The **Calibrate** button triggers the sensor's proximity offset calibration sequence. This function automatically selects a POFFSET to remove crosstalk from PDATA.

The **Auto Offset Adjust** checkbox enables a function that automatically decrements the POFFSET value any time the PDATA value is 0. When this function is active, manual changes to the POFFSET control are disabled, and the program will read and update the POFFSET value each time it reads the PDATA value.

The **APC Off** checkbox disables the Automatic Pulse Control function. This feature is used for hardware configurations with high crosstalk.

The **Limits** group box has controls to set up threshold values as following.

- **N Low/F Low/R Low** is near/far/ratio proximity ADC channel low threshold to generate interrupt. The value range is from 0 to 65535.
- **N High/F High/R High** is near/far/ration proximity ADC channel high threshold to generate interrupt. The value range is from 0 to 65535.
- **AND** check boxes set the relative threshold data to be seen as AND for pint calculation if checked, or set the relative threshold data to be seen as OR if not checked.

Exceeding the high values of the limit conditions causes the system to be in Detect mode. Falling below the low values of the limit conditions causes the system to be in Release mode.

4.8.2   Prox Output Data

The top right corner of the Prox tab displays the output data. This data is continuously read. The polling interval is shown above the tab.

- **PDATA N/PDATA F/PDATA R** displays the data counts of the Proximity ADC channels of Near/Far/Ratio. The displayed ratio, calculated by the TMD3719 device is 128 times Near/Far. The GUI adds an additional line, PDATA R*, which displays this value divided by 128 as a floating-point value.
- **Mean** displays the calculated average of the last 32 PDATA samples displayed on the screen.
- **StDev** displays the calculated standard deviation of the last 32 PDATA samples displayed on the screen.

4.8.3   Prox Data Plot

The remaining portion of the Prox tab is used to display a running plot of the collected PDATA values. 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.

Figure 12:
Prox Data Plot
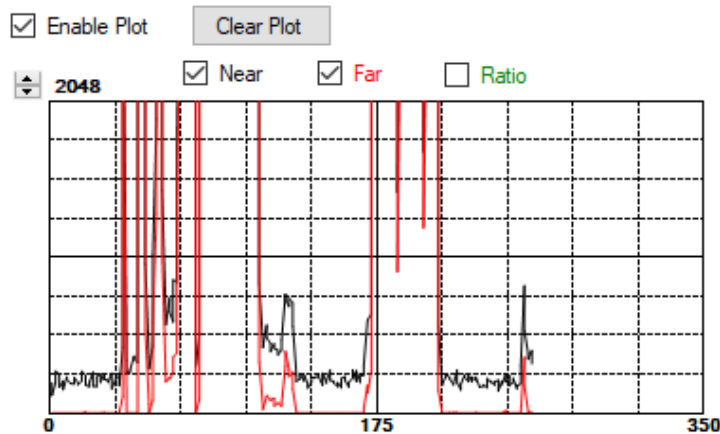
The scale of the Y-axis of the plot can be adjusted by clicking on the small up and down arrows at the top left corner of the plot. The scale can be set to any power of 2 from 16 to 16384.

Click the **Clear Plot** button to discard the current data and continue plotting the new data. Note 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 "Flicker" Tab

The main portion of the screen contains a tab labeled Flicker, which configures the settings for flicker detection and display the results of the flicker detection.

Figure 13 :
Flicker Tab
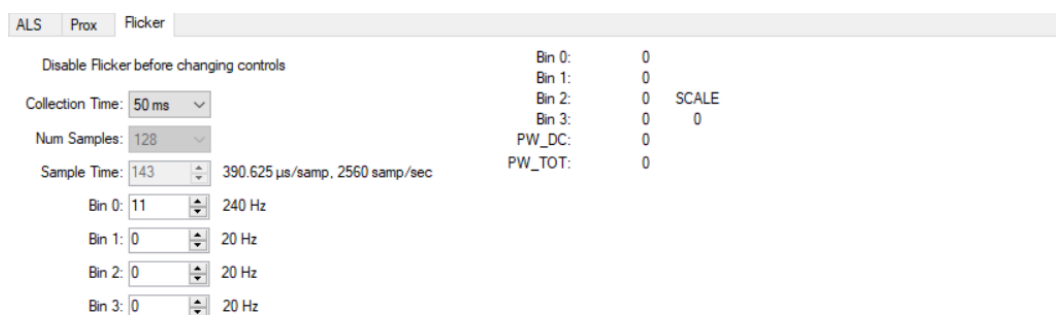
4.9.1 Flicker Controls

The controls on this tab may only be changed when the Flicker Enable checkbox is unchecked. When Flicker Detection is running, these controls may not be changed.

The **Collection Time** control sets the total time to measure flicker. It has 4 values of 50ms, 100ms, 200ms and User defined. When one of the numeric values is chosen, the Num Samples and Sample Time controls are locked and set to pre-defined values. When "User" is selected the user may change those controls.

The **Num Samples** control sets the number of samples used to measure for flicker detection. It can be set to values of 128, 256, 512, or 1024.

The **Sample Time** control sets the sample frequency of the Flicker data collection. The overall collection time for each flicker detection is (Num Samples) * (Sample Time + 1) * modclk.

The **Bin 0/1/2/3** controls specify the bin number for up to four frequencies to check for Flicker. The size of each bin is determined by the sample frequency and number of samples collected. The actual

frequency is displayed immediately to the right of each control. The values entered for each of these controls can range from 0 to 31.

On the right-hand column, **Bin 0/1/2/3** values display the amount of energy detected at each of the selected frequency bins. The actual values are scaled by a value of two raised to the SCALE value displayed to the right of these values.

The **PW_DC** is the DC power of the light received.

The **PW_TOT** is the total power of the light received.

5   Resources

For additional information regarding the TMD3719, please refer to the datasheet. For information regarding the installation of the TMD3719 EVM host application software please refer to the TMD3719 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** website www.ams.com.

For further information, please refer to the following documents:

- TMD3719 Datasheet
- TMD3719 EVM Quick Start Guide (QSG)
- TMD3719 EVM User's Guide (this document)
- TMD3719 EVM Schematic Layout

6   Revision Information

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

- 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

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