TMF8806

User Guide

TMF8806-EVM

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1 Introduction

The TMF8806 Time-of-Flight (hereafter referred to as ‘ToF’) EVM demonstration kit provides a way to evaluate TMF8806 optical sensors from ams-OSRAM AG. This document is a basic user guide for the setup and operation of the TMF8806 EVM software.

1.1 Kit content

Below is a checklist of what is included in the TMF8806_EVM_DB_DEMO kit.

- TMF8806 sensor EVM enclosure and sample glass (some EVMs come without an enclosure)
- USB type A to micro-USB cable(s)

1.2 Ordering information

Ordering code	Description
TMF8806_EVM_DB_DEMO	Evaluation kit for TMF8806

2 Setting up the EVM

This section describes the setup steps necessary to start using the EVM software.

2.1 Setting up the EVM hardware

The TMF8806 sensor enclosure is already assembled and ready to plug in to a PC. The EVM with the enclosure exposes only one micro-USB connector.

Figure 1: EVM with enclosure

2.2 Install the EVM USB windows driver (only once)

When the EVM is plugged into the PC, Windows should recognize the EVM as a “Removable Disk”. Install this USB driver (right-click and choose “Install” from the context menu):

- ams-raspi-rndis.inf

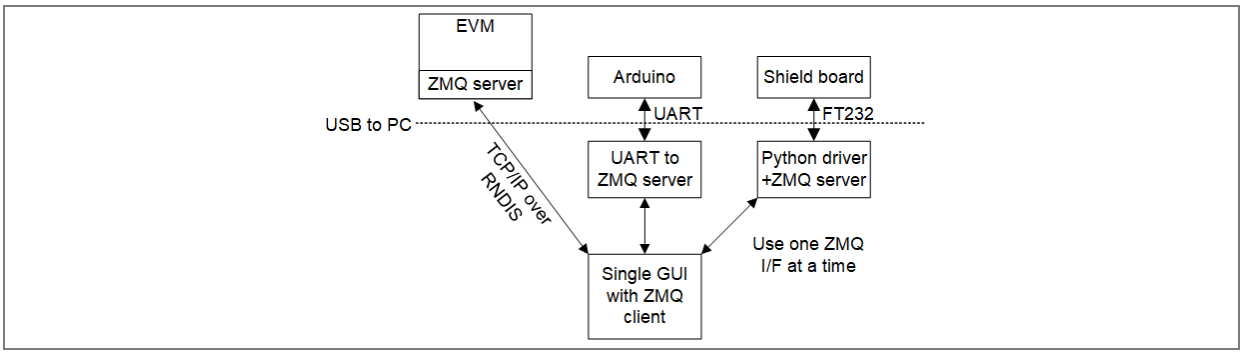
This step is only necessary during first-time setup but will need to be repeated if you’re using the EVM software on a new PC.

2.3 Install the EVM graphical user interface

1. Please download the latest EVM GUI software from the ams OSRAM website: https://ams-osram.com/tmf8806
2. Launch the Windows installer and choose the desired installation options.

2.4 EVM components

Figure 2: EVM components



The abbreviation ZMQ in Figure 2 stands for ZeroMQ. ZeroMQ is used as central communication technology for the EVM software stack.

The ZeroMQ server provides sensor data and offers an interface for sensor configuration. The ZeroMQ client consumes the sensor data and either displays it (EVM GUI) or logs it (active or passive logger).

Information:

Please refer to zeromq.org for more information about ZeroMQ.

The TMF8806 EVM software stack comprises these components:

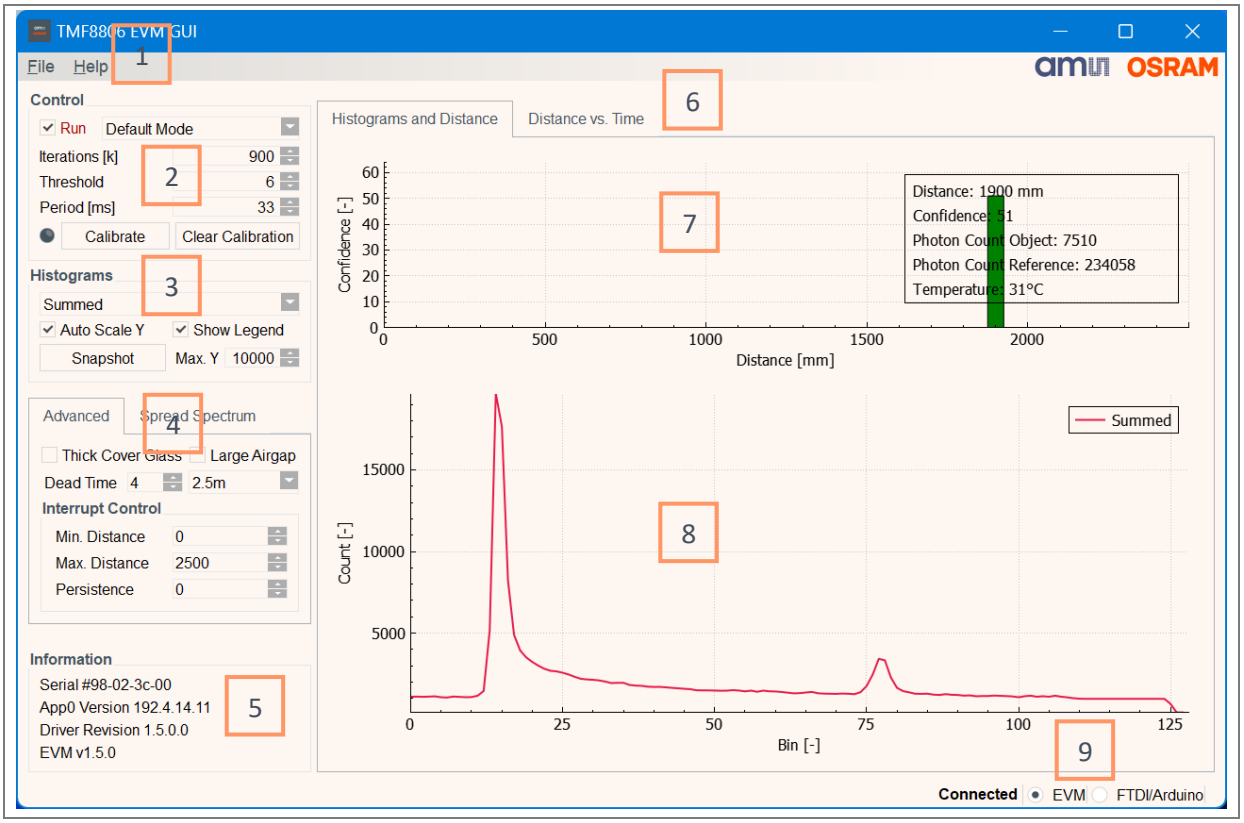
- The EVM hardware with the mobile phone form factor – see Figure 1. It contains the TMF8806 sensor controlled by a Raspberry Pi Zero W. The ZeroMQ server runs directly on the Raspberry Pi.

- Or the TMF8806 sensor on a shield board controlled by an Arduino Uno (or compatible). In this case the ZeroMQ server retrieves sensor data via UART from the Arduino and provides the same interface as the ZeroMQ on the Raspberry Pi. The ZeroMQ server in this case is a program that runs on your Windows computer.
- Or the TMF8806 sensor on a shield board controlled by the integrated FT232 USB to I²C controller. The ZeroMQ server in this case is a program that runs on your Windows computer and directly interacts with the TMF8806 sensor with I²C transfers.
- The TMF8806 EVM GUI that works with all three setups described above.
- The TMF8806 ZeroMQ sensor data loggers that can either run standalone (active logger that also configures the sensor for measurements) or in parallel to the EVM GUI (passive logger that only captures the sensor data, use the GUI for sensor configuration).

3 Using the EVM software

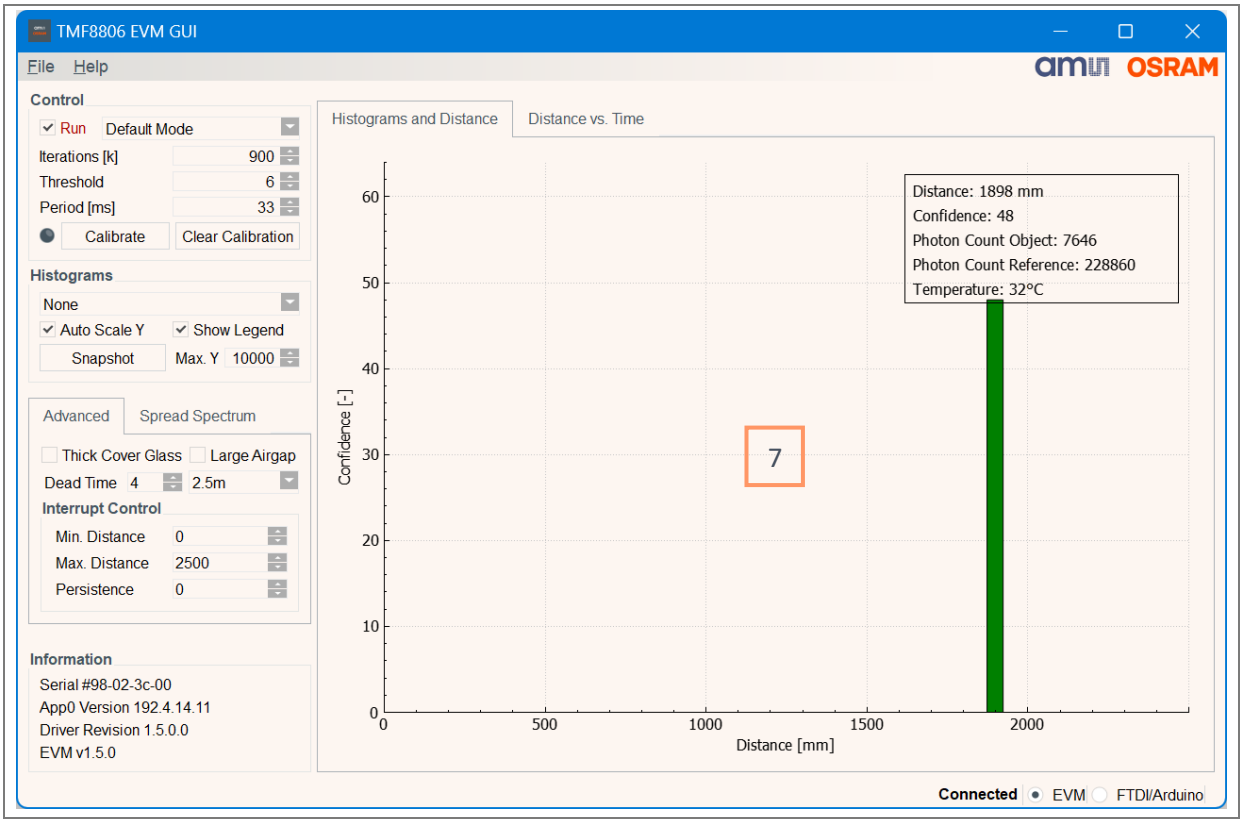
This section describes the operation and capabilities of the EVM Graphical User Interface (EVM GUI).

Figure 3: EVM GUI overview, histogram selected, distance graph



The “Histogram graph” (8) shows time-to-distance-converter (TDC) histogram information. The X-axis indicates the “time buckets” in multiples of 100 picosecond increments (200ps in 2.5m mode, 400ps in 5m mode, 800ps in 10m mode). The Y-axis indicates the number of photonic triggers / hits at the given time interval.

Figure 4: EVM GUI overview, no histogram selected, distance graph

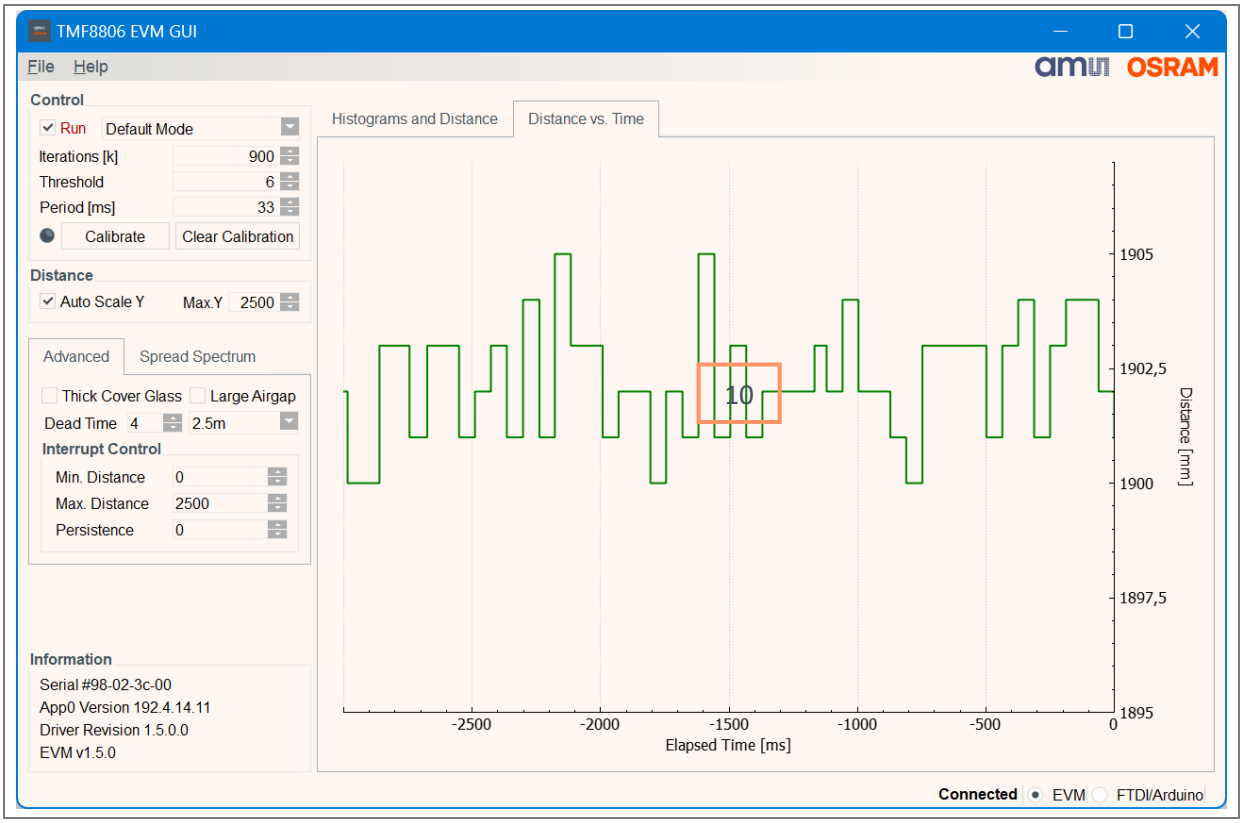


The “Distance graph with confidence” (7) is a plot of the detected object’s distance vs. the confidence value (range 0 – 63) of the given detection. The X-axis indicates the distance in millimeters and the Y-axis indicates the confidence value.

The information box shows:

- The current object distance
- The current object detection confidence value
- The amount of light reflected by the target object (Photon Count Object)
- The amount of light reflected within the sensor package to the reference channel (Photon Count Reference)
- The current sensor temperature

Figure 5: EVM GUI overview, distance vs. time



The “Distance vs. Time graph” (10) replaces the “Distance graph with confidence” and histogram graph with a single display of the object data reported over the previous three seconds.

3.1 GUI elements overview

1. Main Menu
2. Basic controls for measurements
3. Graph dependent controls, differs between histogram graph and distance vs. time graph
4. Advanced controls for measurements and spread spectrum settings
5. Sensor and controller information box
6. Main tab selector, switch graph
7. Distance graph with confidence and target information info box

8. Histogram graph, only visible if a histogram is selected
9. EVM controller selector
10. Distance vs. time graph

3.2 GUI element description

3.2.1 Main menu

The main menu contains these entries:

3.2.1.1 “File” menu

- “Load Configuration” – loads all EVM GUI settings (control values).
- “Save Configuration” – save all EVM GUI settings (control values).
- “Show Log Window” – display the communication protocol log window.
- “Update Target Controller” – update driver and server software on the EVM controller (Raspberry Pi).
- “Exit” – leave the EVM GUI.

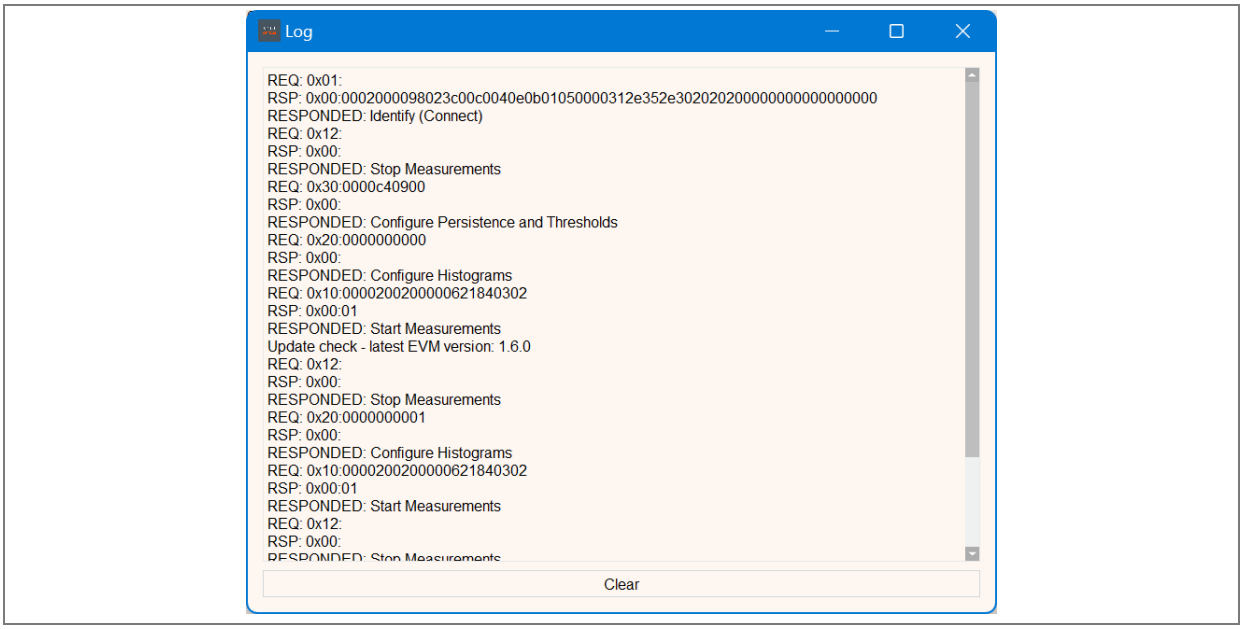
3.2.1.2 “Help” menu

- “About” – shows version information and copyright notices.

3.2.1.3 Log window

The log window lists the ZeroMQ protocol messages exchanged between the EVM GUI and the host controller. Please read the ZeroMQ protocol description to decode the messages. Also refer to chapter 3.3, describing the loggers, please.

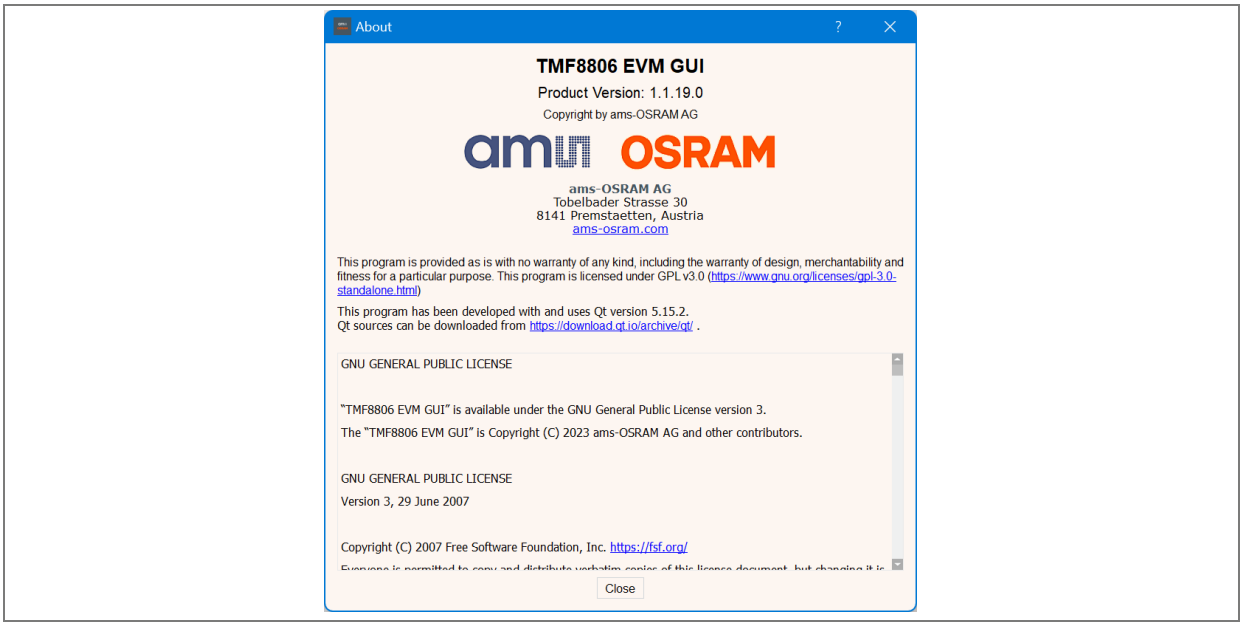
Figure 6: Log window



3.2.1.4 About dialog

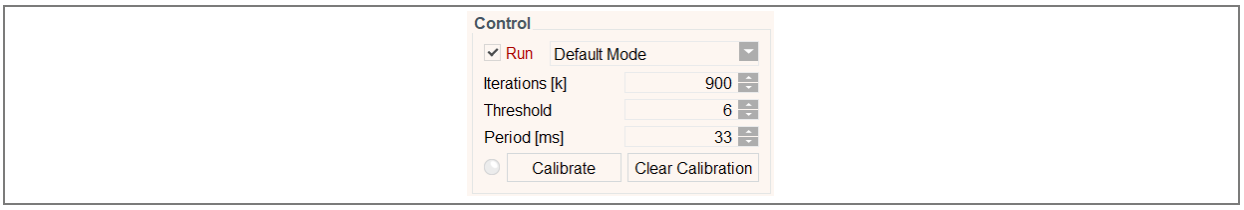
Open the “About” dialog to read the EVM GUI license text and to check the version of the program.

Figure 7: About dialog



3.2.2 Basic controls for measurements

Figure 8: Basic controls



The basic controls set the most fundamental measurement settings:

- The number of measurement iterations – the higher the number the better the sensor performance. But more iterations also increase the measurement time.

- The object detection threshold. This setting helps to filter false positive object detections. The higher this number the higher the required signal (reflected light from object) to noise (ambient light) ratio. The default value of “6” should work for the most scenarios.
- The measurement period (time between two measurements). The sensor firmware will try to match the measurement period. If the number of iterations is too high to finish within the period, the sensor will deliver results as possible (best effort).
- Deselect the “Run” checkbox to stop updates of the graphs (distance and histogram graphs).
- The dropdown list offers three preselected configurations:
  – Default mode for a good balance between sensor performance and measurement time
  – Low power mode to optimize for current consumption
  – High performance mode to optimize for sensor performance and measurement distance

To calibrate the system, click the “Calibrate” button.

- You can clear a previous calibration with the “Clear Calibration” button.
- The circular calibration indicator is black during calibrated operation and grey otherwise.
- If calibration fails, the indicator will remain grey after clicking the “Calibrate” button.

Information:

Spin-boxes (e.g. for Iterations) do not track every single value change during editing. If you enter a new number in a spin box, please press the ENTER key to send the updated configuration value to the sensor.

Information:

Low ambient light and no target within 40cm in front of the sensor are mandatory for calibration. Please see the TMF8806 datasheet for details.

3.2.3 Graph dependent controls

Figure 9: Histogram controls

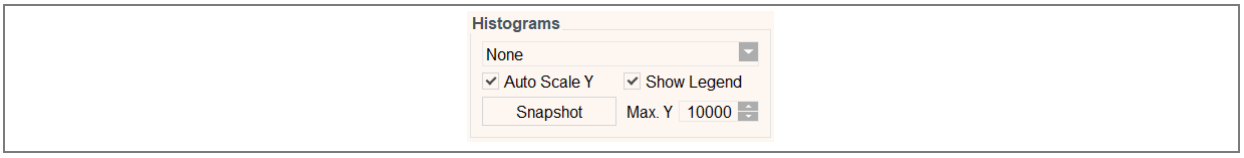


Figure 10: Distance vs. time controls

The histogram graph and the distance vs. time graph auto scale the Y axis to optimize readability. If you want to define the maximum of the Y axis yourself uncheck the “Auto Scale Y” checkbox and change the value in “Max. Y”.

The histogram graph controls also let the user hide the legend (uncheck “Show Legend”) and to “freeze” the current data (button “Snapshot”) to compare to measurement setups, e.g.:

- Position target at 50cm.
- Check “Snapshot”.
- Position target at 100cm.

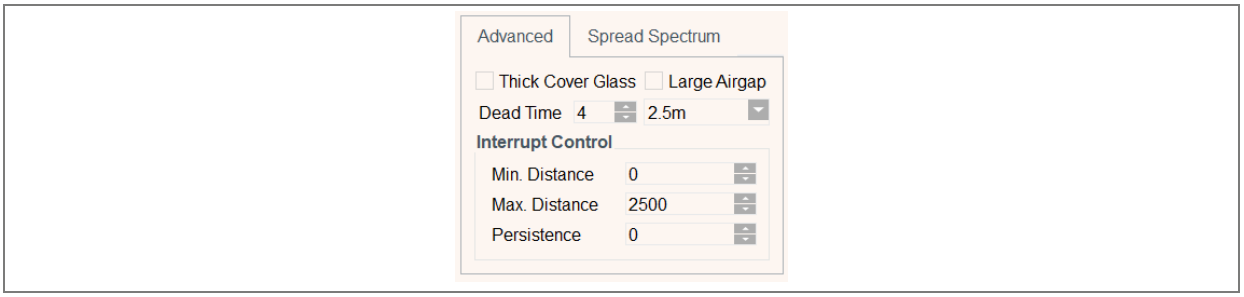
To see the histograms together with the distance bar chart select one of these in the dropdown list:

- Summed histogram
- Short range histogram (without reference channel)
- Short range histogram (with reference channel)
- Long range histogram (without reference channel)
- Long range histogram (with reference channel)

The reference channel measures in-package crosstalk independent of a target in front of the sensor.

3.2.4 Advanced controls

Figure 11: Advanced controls



There are two tabs with controls in this part of the GUI. One tab with advanced settings that influence the sensor measurement and one tab with controls for EMC performance enhancements.

The check box “Large Airgap” optimizes the SPAD selection for the short-range measurements and an optical stack with increased air gap size. The check box “Thick Cover Glass” provides another optimized setting for a matching optical stack. These two settings are mutually exclusive.

Select the maximum measurement distance with the matching entry in the dropdown list. Usually there are here three options – 2.5m, 5m and 10m. If the sensor works with the App0 ROM firmware 192.4.14.0 (no firmware patch loaded) the 10m option will not be available.

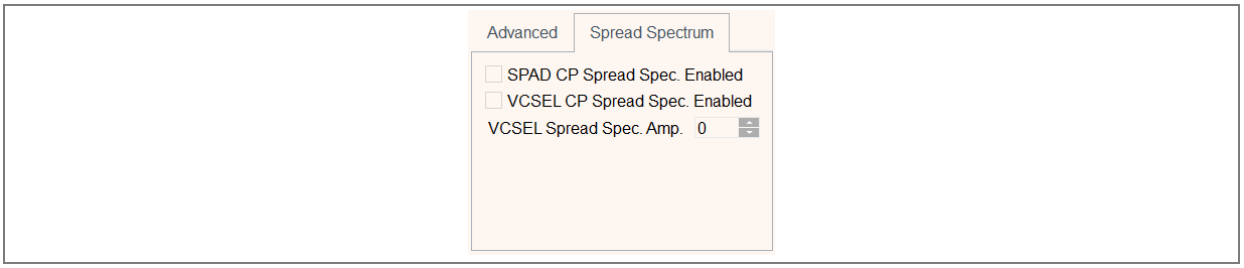
The spin box “Dead Time” controls the SPAD dead time. Shorter SPAD dead times (higher selected number) improve sunlight performance but degrade short range accuracy.

Please refer to the datasheet for more information.

The group box “Interrupt Control” contains controls for interrupt filtering.

- Set the minimum and maximum distance for object detection with the corresponding spin boxes.
- Use the "Persistence" control to set the required minimum number of sequential object detections: E.g. only trigger a result interrupt if an object is detected three times in a row.
- Setting “Persistence” to 0 disables filtering.

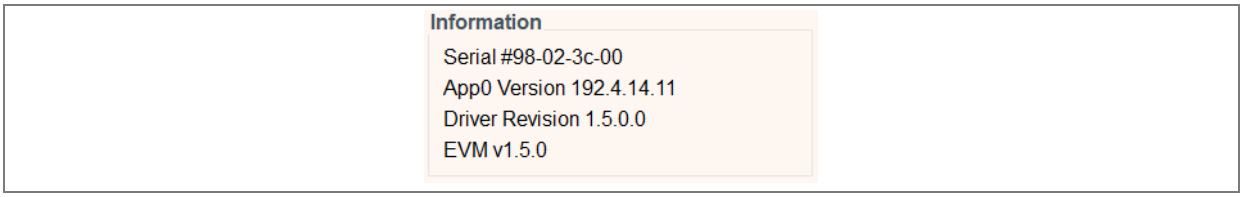
Figure 12: Spread spectrum controls



These controls enhance the EMC performance of the sensor. There's one control for each hardware block. The GUI selects the recommended configuration for these blocks. Please refer to the datasheet for more details.

3.2.5 Sensor and controller information box

Figure 13: Information box



Here you can find:

- The serial number of the TMF8806 sensor in your setup
- The firmware revision running on your TMF8806 sensor
- The revision of the sensor driver (e.g. the Linux driver version of your EVM kit)
- And the ZeroMQ server version for your setup

3.2.6 EVM controller selector

Figure 14: EVM controller selector

Select the correct controller for the TMF8806 sensor here. Choose EVM for the EVM kit with mobile phone form factor. Choose “FTDI/Arduino” for setups that use the TMF8806 shield board.

3.3 ZeroMQ loggers

Please download the latest logger release from the ams OSRAM website. It contains examples for a passive and an active logger (please refer to section 2.4).

You’re free to modify the existing examples or to implement a custom logger with the provided python classes.

4 Online resources

Please look for the most recent software and documentation on the ams OSRAM website https://ams-osram.com/tmf8806

You can find source code and executable programs also on the ams OSRAM github page: https://github.com/ams-OSRAM

E.g. for the ZeroMQ loggers:

https://github.com/ams-OSRAM/tmf8806_zmq_data_logger

5 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 v3-00	Page
Updated screenshots	all
Describe 10m mode selection	15

- 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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