



## User Guide

UG000414

# TMD3702VC

## Narrow ALS, Color and Proximity Sensor Evaluation Kit

TMD3702VC-EVM

v1-00 • 2019-Jan-09

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# Content Guide

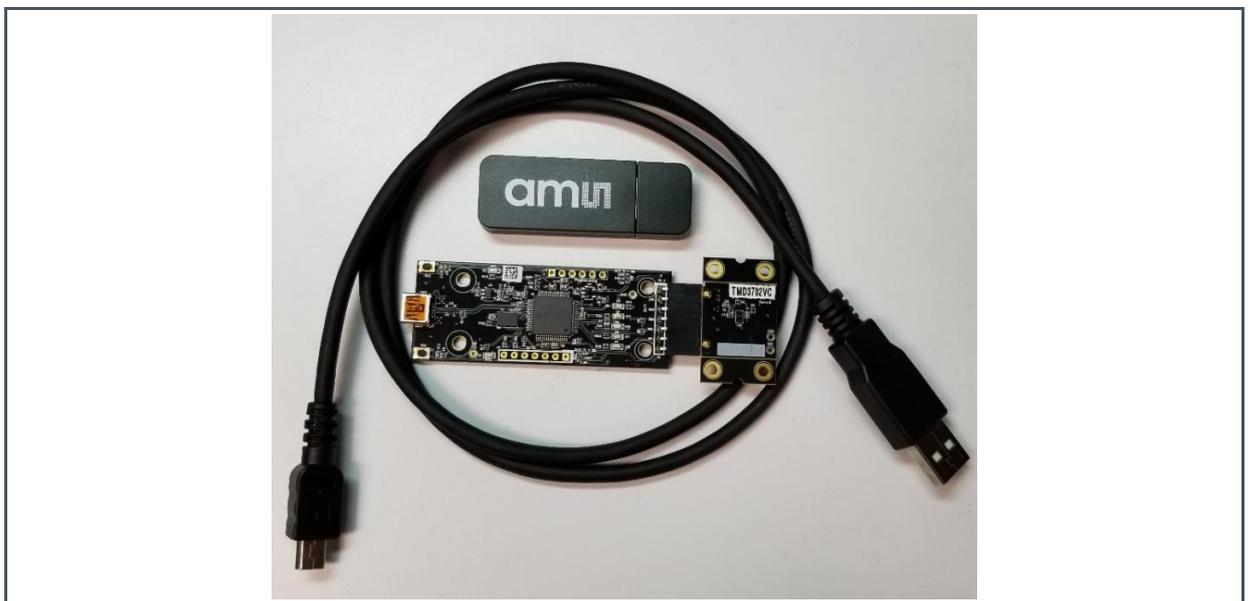
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# 1 Introduction

The TMD3702VC evaluation kit comes with everything needed to evaluate the TMD3702VC. The device features proximity detection, color sense (RGBC+IR), and digital ambient light sensing (ALS).

## 1.1 Kit Contents

**Figure 1:**  
Evaluation Kit Contents



No.	Item	Description
1	TMD3702VC Daughter Card	PCB with TMD3702VC 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
TMD3702VC-EVM	TMD3702VC Narrow ALS, Color and Proximity Sensor Evaluation Kit

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## 2 Getting Started

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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 also the device's graphical user interface (GUI).

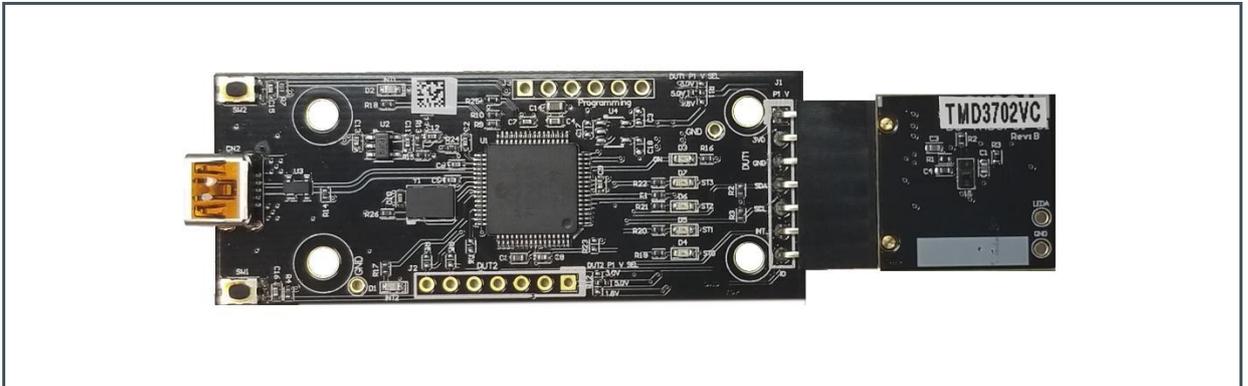
The balance of this document identifies and describes the controls available on the GUI. In combination with the TMD3702VC datasheet, the QSG and application notes available on the **ams** website, [www.ams.com](http://www.ams.com), there should be enough information to allow evaluation of the TMD3702VC device.

### 3 Hardware Description

The hardware consists of the EVM Controller, the TMD3702VC 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 TMD3702VC EVM folder (All Programs -> ams -> TMD3702VC EVM -> Documents).

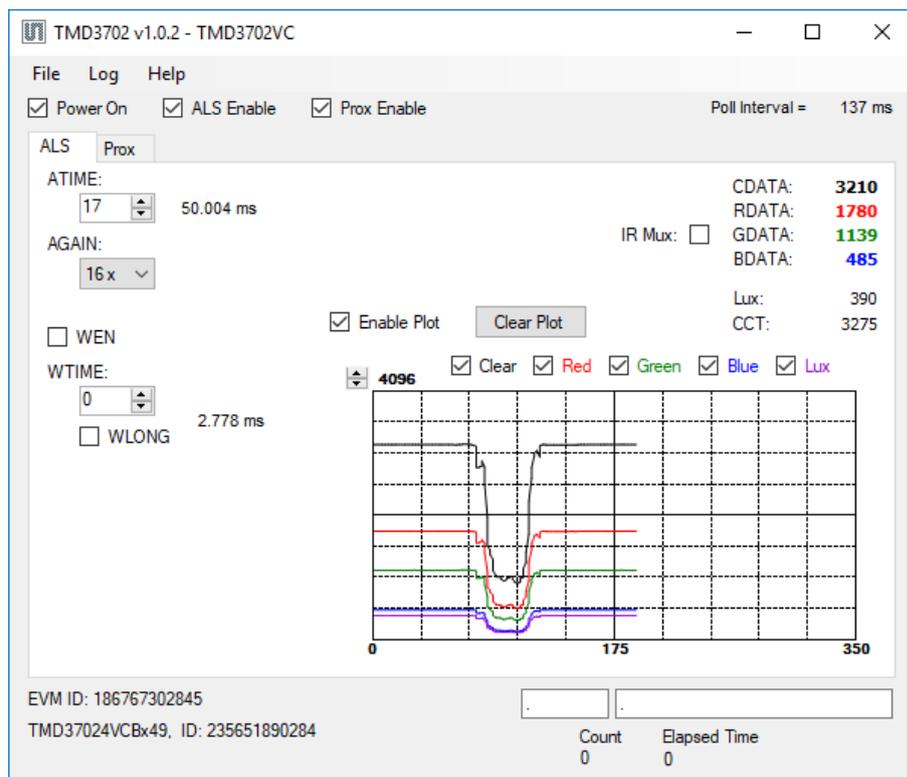
**Figure 2:**  
Evaluation Kit Hardware



## 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 and the Prox tab contains settings for the proximity function. The application polls the ALS and proximity raw data continuously and calculates the Lux, CCT, and prox standard deviation values.

Figure 3 :  
Software 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 is disconnected 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.

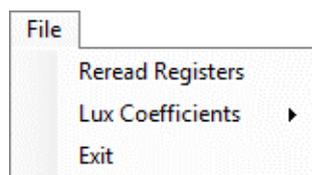
## 4.2 System Menus

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 is used to control 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 those registers are continually read while the program is running.

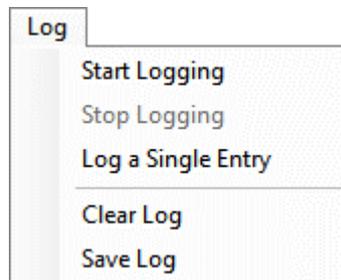
The **Lux Coefficients** menu allows the user to Display, Load or Save the lux coefficients used to calculate lux. See ALS Lux Coefficients section for more details.

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 close by clicking the red “X” in the upper right hand corner.

### 4.2.2 Log Menu

The Log menu is used to control the logging function and to save the log data to a file. Log data is accumulated in memory until it is 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 is stopped, the data can be written to a file, or the user can 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 data that has already been collected. 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 running when this function is clicked, 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 default file name is described in the Log Status and Control Information section, but the file name may be changed if desired.

### 4.2.3 Help Menu

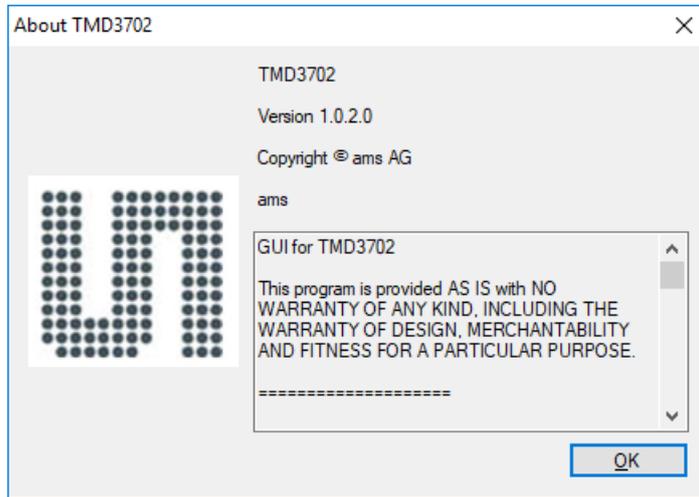
The Help menu contains a single function: About.

**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 there are checkboxes used to control the system level functions of the TMD3702VC device.

The **Power On** checkbox controls the PON function of the TMD3702VC. 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 (The control registers can still be written, but the device does not function).

The **ALS Enable** checkbox controls the AEN function of the TMD3702VC. When this box is checked, the device collects and report ALS data as programmed. When this box is unchecked, the ALS functions do not operate.

The **Prox Enable** checkbox controls the PEN function of the TMD3702VC. Proximity detection is enabled when this box is checked or disabled when unchecked.

## 4.4 Auto Polling

The application automatically polls the TMD3702VC raw data of ALS and Prox if enabled. The **Poll Interval** displays the time between reads of the device.

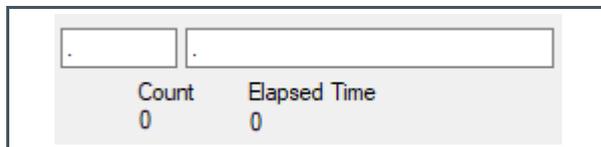
## 4.5 Device ID Information

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 log 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:**

TMD3702VC\_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 was started.

## 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 **ATIME** control sets the time of the ALS integration. ATIME can be adjusted in 2.778ms steps.

The **AGAIN** control is a pulldown menu which sets the analog gain of the ALS sensor. The values available are 1x, 4x, 16x, 64x, 128x, 256x and 512x.

The **WEN** checkbox controls the ALS Wait feature. When this box is checked, the values for WTIME and WLONG are used to determine the time between ALS cycles. When this box is unchecked, there is no wait period between ALS cycles and the values of WTIME and WLONG are ignored.

The **WTIME** control sets the time to wait between ALS cycles. WTIME can be adjusted in 2.778ms steps.

The **WLONG** checkbox controls sets the WTIME factor. When this box is checked, the wait time between ALS cycles is extended by a factor of 12x.

The **IR Mux** checkbox sets the GDATA channel to be the IR channel. The Lux and CCT values are invalid when IR Mux is checked.

## 4.7.2 ALS Lux Coefficients

The TMD3702VC supplies information that is used to calculate Lux (unit of illumination). The Lux equation for the TMD3702VC uses a combination of data from the sensor and various coefficients to calculate the Lux value. The software is pre-configured with coefficients for an open-air configuration. When the sensor is placed behind glass, different coefficients should be loaded into the software to update the Lux equation. The coefficients can be loaded or saved to an XML file using the File menu. To ensure the proper XML format first save the current coefficients using **File > Lux Coefficients > Save**. Once the file is saved locate the XML file created and edit with a text editor such as notepad to change the coefficients. Then go to **File > Lux Coefficients > Load** and select the XML file that was updated.

The software can also automatically load new coefficients upon starting the GUI. To do this save the XML file as **TMD3702VC\_luxeq.xml** in the system documents directory (**%USERPROFILE%\Documents**, also known as **My Documents**). Then restart the GUI and see a dialog appear with the new coefficients displayed.

If you are experiencing trouble loading new coefficients, this may indicate a problem with the file format. The XML file must contain all the required Lux equation elements to be loaded. The format of the file follows the standard XML format and is as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<!-- Device:TMD3702VC Saved:11/27/2018 9:41:28 AM -->
<luxeq>
  <eq_values>
    <coef name="DGF" value="833" />
    <coef name="C_Coef" value="0.11" />
    <coef name="R_Coef" value="-0.1" />
    <coef name="G_Coef" value="0.29" />
    <coef name="B_Coef" value="-0.27" />
    <coef name="CT_Coef" value="7245" />
    <coef name="CT_Offset" value="1605" />
  </eq_values>
</luxeq>
```

## 4.7.3 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.

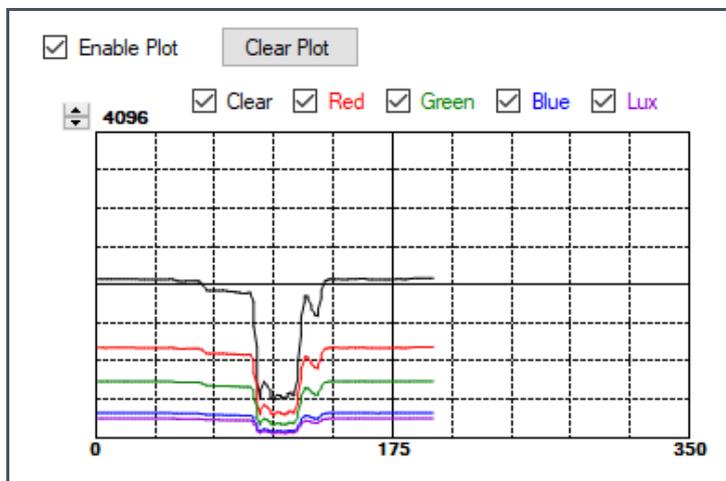
- **CDATA** displays the Clear Channel data count.
- **RDATA** displays the Red Channel data count.
- **GDATA** displays the Green Channel data count or the IR Channel counts if **IR Mux** is checked.
- **BDATA** displays the Blue Channel data count.
- **Lux** displays the calculated lux.
- **CCT** displays the calculated correlated color temperature.

**Note:** If **IR Mux** is checked the Lux and CCT values are invalid.

#### 4.7.4 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 **Clear**, **Red**, **Green**, **Blue**, or **Lux** checkbox.

**Figure 10:**  
ALS Data Plot



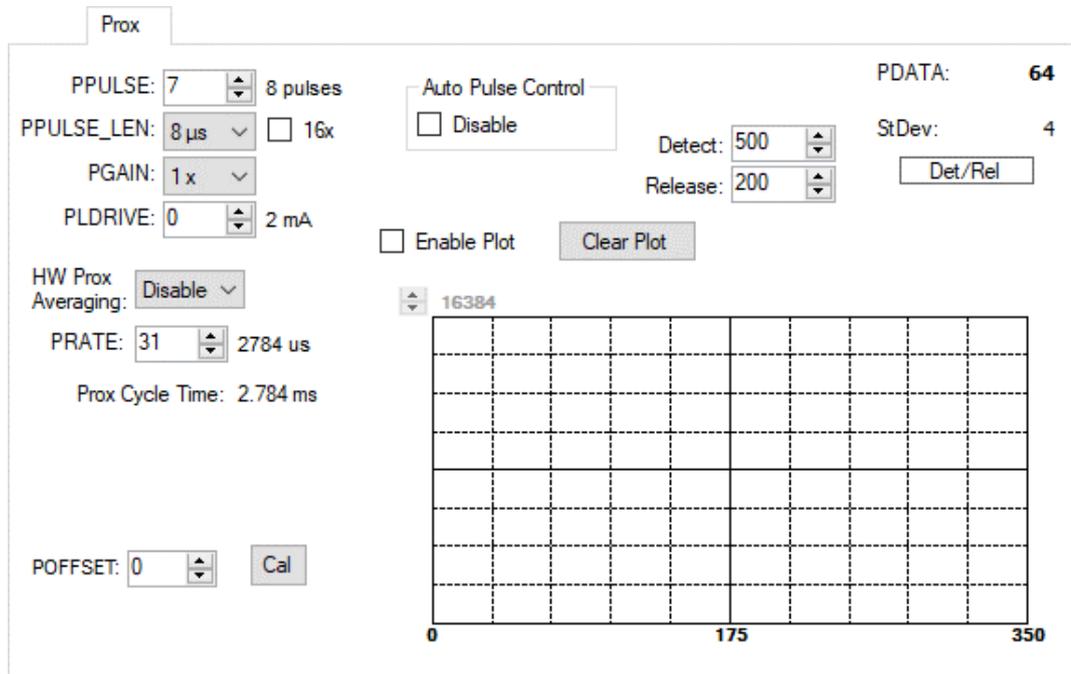
The scale of the Y-axis of the plot can be adjusted by clicking on the small up and down arrows at the top left corner of the plot. The scale can be set to any power of 2 from 64 through 65536.

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 **PULSE** controls the number of pulses used for each prox cycle. The number of pulses is the PULSE value plus 1 and is displayed immediately to the right of the box.

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.

The **16x** checkbox sets the PPULSE\_LEN factor. When this box is checked, the pulse length is extended by a factor of 16x.

The **PGAIN** control is a pulldown menu that lets you select the analog gain of the proximity IR sensor. The values that can be chosen are 1x, 2x, 4x and 8x.

The **PLDRIVE** control sets the drive strength of the IR LED current. The values range 2mA to 19mA.

The **HW Prox Averaging** control is a pulldown menu that defines the number of ADC samples collected and averaged during a cycle. The values range from 0 (Disabled) to 7 (128 samples) where each value is the exponent of 2 ( $2^{\text{value}}$ ).

The **PRATE** controls sets the duration of a single prox sample. The time is equal to  $(PRATE + 1) * 87\mu s$ , with a range from  $PRATE = 0$  ( $87\mu s$ ) to  $PRATE = 255$  ( $22.272ms$ ). If HW Prox Averaging is set then the total prox cycle time is multiplied by the number of samples to average.

The **POFFSET** controls shift PDATA to remove crosstalk from the proximity data. The values range from -255 to 255.

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

The **Auto Pulse Control Disable** checkbox disables the automatic pulse control (APC) function.

The **Detect** and **Release** controls are threshold software values used for the Det/Rel status indicator. Detect is the PDATA value that indicates an object has been detected. Release is the PDATA value to indicate the object is no longer present.

## 4.8.2 Prox Output Data

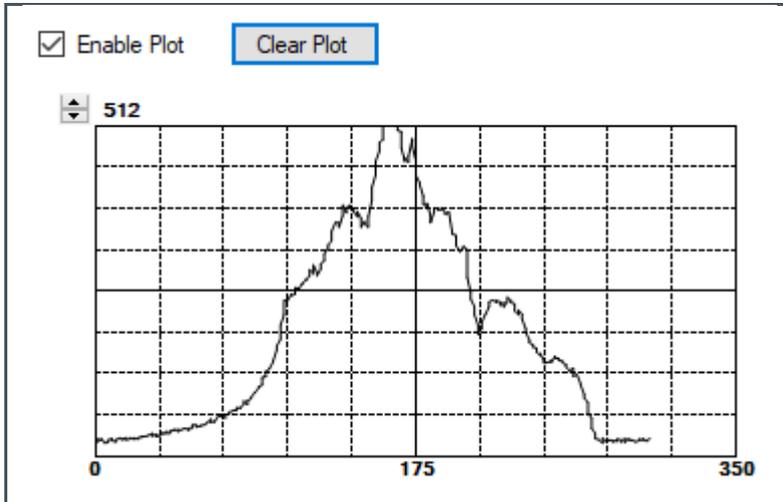
The top right corner of the Prox tab displays the output data. This data is continuously read. The polling interval is shown above the tab.

- **PDATA** displays the Proximity ADC channel data counts
- **StDev** displays the calculated prox standard deviation based on the last 32 PDATA samples
- **Det/Rel** shows the status of the detect and release thresholds. When PDATA goes above the detect threshold the icon turns red and stays red until PDATA goes below the release threshold.

## 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.

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## 5 Resources

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For additional information regarding the TMD3702VC, please refer to the datasheet. For information regarding the installation of the TMD3702VC EVM host application software please refer to the TMD3702VC 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](http://www.ams.com).



**For further information, please refer to the following documents:**

- TMD3702VC Datasheet
  - TMD3702VC EVM Quick Start Guide (QSG)
  - TMD3702VC EVM User's Guide (this document)
  - TMD3702VC EVM Schematic Layout
  - TMD3702VC Optical Design Guide
  - TMD3702VC Proximity Design Guide
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# 6 Revision Information

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