Txx2672 EVM

USER'S GUIDE ams

Txx2672 PROXIMITY SENSOR EVALUATION SYSTEM

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TSL2672 AND TMD2672

The TSL2672 and TMD2672 devices are packaged differently to support various operational uses, but the software to control the devices is the same. Throughout this document, the devices will be referred to as Txx2672. The screen images in this document use a TSL2672 device, but the program will look and operate the same for a TMD2672. The only difference will be the device name displayed on the screen.

INITIAL HARDWARE SETUP

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

The hardware consists of the Controller EVM v2.1 motherboard, the Txx2672 evaluation daughterboard and a USB interface cable.
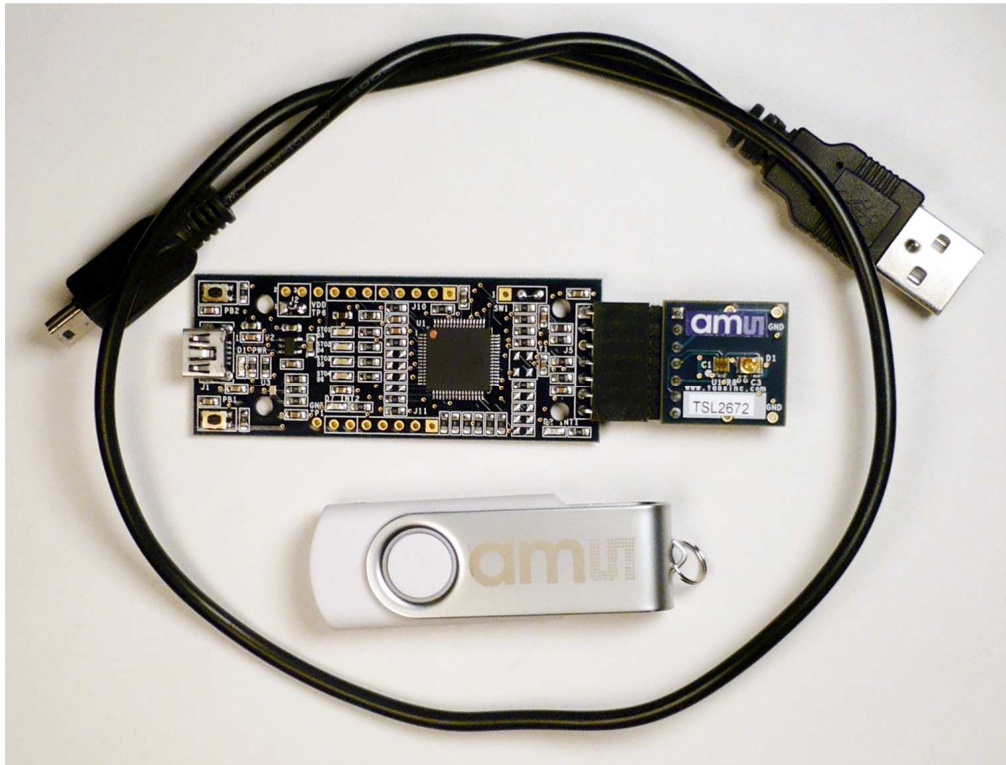
When the USB cable is connected the green LED should light up indicating that power is being received via the USB interface, and the motherboard processor is running. If the green LED does not light up, check the USB cable connections; unplug the USB cable and try again. If the green LED still does not light, check the PC for USB error messages. See the Resources section at the end of this document for additional assistance.

ESTABLISHING BASIC FUNCTIONALITY

The software should be started using the desktop icon or by double clicking the DigitalLightSensor.exe file from the installation directory. The default installation directory, depending on the device and the operating system you are using, is:

C:\Program Files\ams\T__2672EVM   Windows 32 bit operating systems
C:\Program Files (x86)\ams\T__2672EVM   Windows 64 bit operating systems

The underscores ("_") in the pathnames will be replaced with "SL" or "MD" as appropriate. A different install path may be selected by the user. When started, two windows will open on the PC. The top window, or Parent Window (PW), is not typically needed and may be placed out of the way. The bottom window, or Child Window (CW), is the main user interface and should be positioned on the screen for easy access.
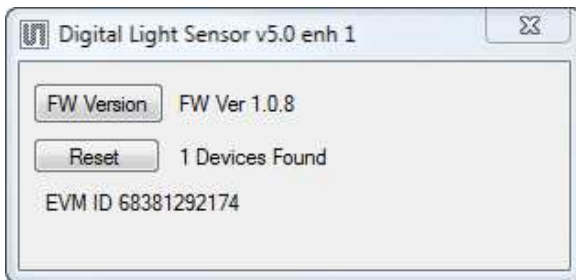
Clicking on the red "X" on the PW will close both windows and terminate the application. Clicking on the red "X" on the CW will close only the CW.

The "Functional" tabs on both the left and right side of the main display (bottom window) will be selected by default. On the right side, numbers should be changing, showing that the ALS and proximity functions are operational. By changing the ambient light source or waving your hand over the sensor at <4 inch (100mm) separation you should see the ALS and proximity readings change correspondingly.
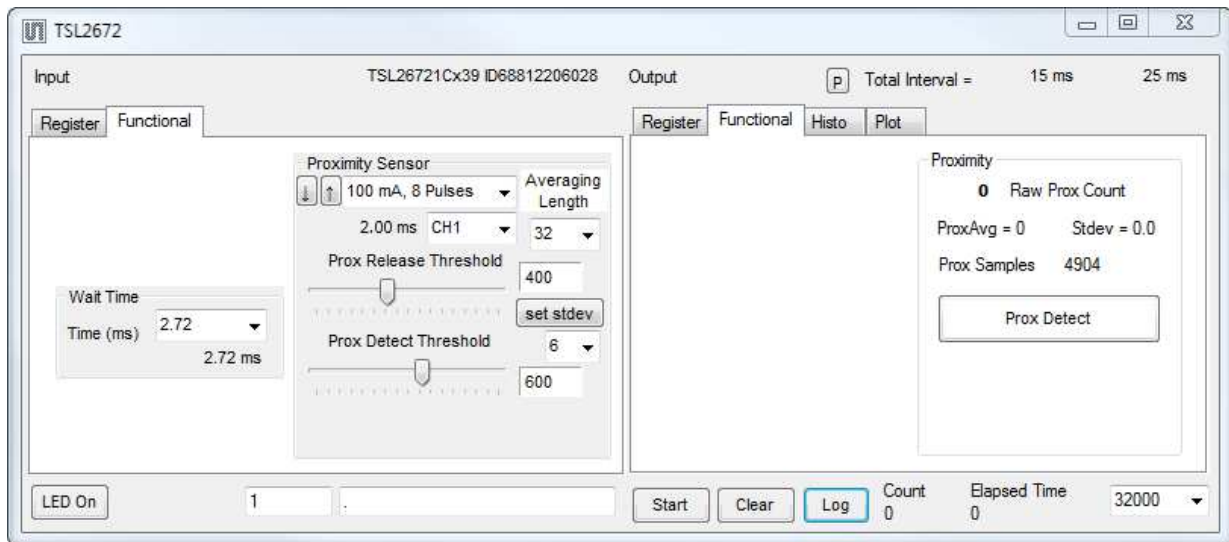
The balance of this document identifies and describes the controls available on the different tabs of the GUI. In combination with the Txx2672 datasheet, the QSG and application notes available on the ams website, www.ams.com, there should be enough information to allow evaluation of the Txx2672 device.

# Txx2672 EVM Graphical User Interface (GUI)

SOFTWARE OVERVIEW

On initialization the software displays two windows – a smaller "Digital Light Sensor" window and a larger window containing controls pertinent to the device connected.

If "No Devices" appears, verify that the daughterboard is connected to the motherboard properly. If "No_HID" appears, verify the USB cable is connected. A green LED on the motherboard indicates that the USB cable is connected and providing power to the system.

The "Reset" button can be pressed, or the software can be restarted, to reinitialize the system.

The larger window contains the user interface with control buttons, fields, selection boxes and output values for the identified device connected. Tabs are used to make control and evaluation of specific device functions easy. For the Txx2672 devices the initial display screen is shown:
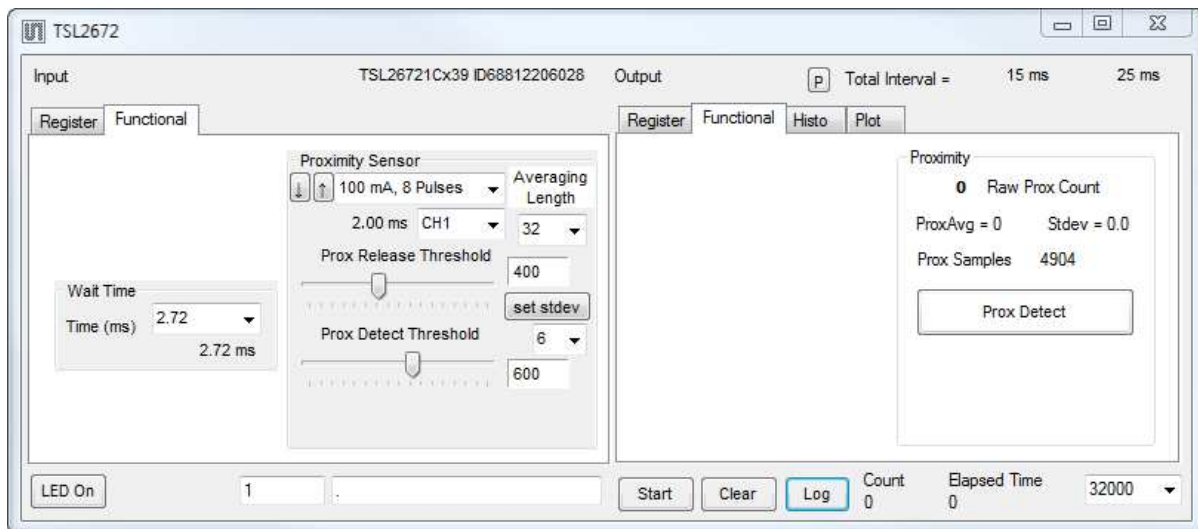
This window has inputs organized on the left, and outputs organized on the right. Values for register variables may be set using multiple techniques. The Functional tab is commonly used to quickly evaluate the device with nominal settings. The Input Register tab allows the register settings to be changed, and the Output Register tab allows registers to be viewed. Other tabs provide additional demonstration and test features for evaluation.

By default the "Functional" tabs have the focus. The values shown in this document will not exactly match a users system but the basic window and controls should be identical. This document will identify the usage and operation of these items in detail.

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Always visible along the bottom are the following controls:
- LED Off – ON/OFF/ON toggle for the green motherboard LED. This LED is a good power-on indicator but can introduce errors in the optical tests. It is recommended for accurate measurements to turn the LED off.
- A section containing logging controls and sampling status information:
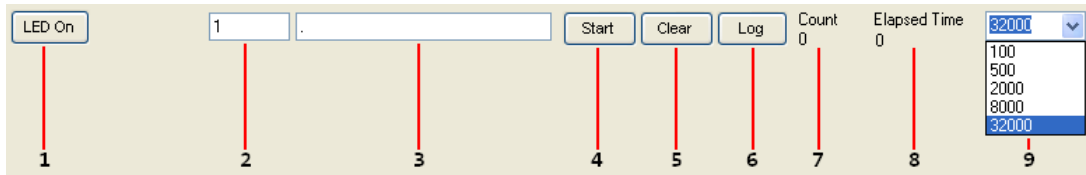
1. Toggles LED on the motherboard.
2. Text entered here is appended to the default file name and stored in the log file. The file name contains the Part Name and address shown in the large "Digital Light Sensor" window, an underscore "_" and the text entered. The default if nothing is entered is a period (".").
3. Secondary comment box. Text entered here is also appended to the log file name and stored in the log. The default if nothing is entered is a period (".").

    Sample:
    TMD26721Cx39_A-B-C_1-2-3_Log.csv

    ──── From DigitalLightSensor.exe
    ──── From User Input

4. The start button tells the program to start logging. The fields entered in #2 and #3 will be used as field names in the output. If you change the values in #2 or #3, the corresponding field names will change in the output beginning at the time of the change. The default log file name be based on the values in #2 and #3 at the time the log file is written.
5. Clear –The Clear button will flush the previous optical sample readings and reset the elapsed time indicator (see #7).
6. Log – Creates a comma-separated values file containing the log data. The name will be assigned as explained in #3. This will cause the system to write out any data currently in the log buffer.
7. Count of samples in the log buffer. When that number reaches the limit selected in #9, the system will show a file dialog to save the log in a named file.
8. The elapsed time since the beginning of logging data.
9. The number of log samples collected before log entry is written to the log file.

INPUT SIDE, "FUNCTIONAL" TAB

Simple commonly used controls exist for the proximity detection functionality, the wait time between samples, and the proximity threshold level.

WAIT TIME

When the software initializes, a default wait period of 2.7mS is inserted between each Prox execution. This duration can be adjusted in 2.72mS steps from 0 to 696mS. A wait multiplier (WLONG=1) may also be used to multiply the wait period by 12x. Using these controls the duration of the wait may be adjusted from none (WEN=0) to 8.3 seconds (WEN=1, WLONG=1, WTIME=0x00).

The Wait Time list box provides a quick mechanism for setting preselected wait periods from 2.72mS to 696mS. The wait period is completely disabled by setting WEN=0 (Enable Register (0x00, bit3)).

PROXIMITY SENSOR / PROX THRESHOLD

The control fields to vary the proximity sensor settings are found in this section. Two drop-down controls allow adjustment of the sink current and number of LED pulses, and selection of which photodiodes are used to detect the reflected energy. Two slider controls are provided for selection of proximity release and proximity detection thresholds.
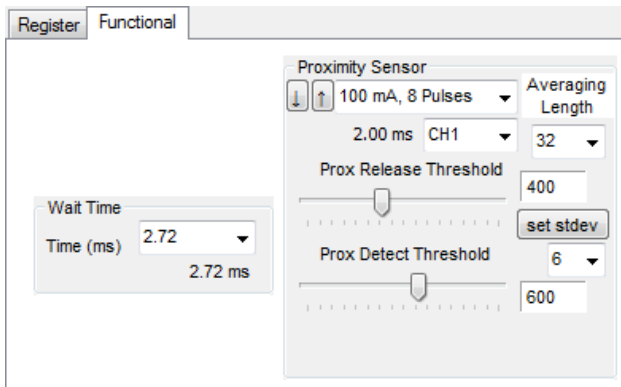
The first list box allows rapid selection of LED sink current and the number of LED pulses. Clicking the down arrow brings up a list box with several predefined combinations:

- Individual settings for the sink current and/or number of pulses can also be made using the device registers as documented later in this manual.
- The photodiodes receiving the reflected optical energy are chosen in the second line. The list box shows options for Neither, Ch 0, Ch 1 or Both.

- The "Prox Release Threshold" and "Prox Detect Threshold" sliders allow a threshold (with hysteresis) to be selected to determine when a proximity detection occurs. The thresholds can be set to any value from 1 to 1022. The numeric values selected by the sliders are shown near the right-hand end of the sliders.
- To provide a convenient method for setting the slider values, a button and a pull down list are provided immediately to the right of the sliders. When the "set stdev" button is pressed, it will calculate the standard deviation of a number of the most recent proximity values and set the release and detect thresholds to a range that is N standard deviations above and below the average value. The drop-down list below the "set stdev" button can be used to choose the number of standard deviations used (N), from 1 through 6. In the top right corner of the tab is another drop-down list that allows you to choose the number of points used when calculating the average and standard deviation values. The list allows powers of 2 from 2 through 512.

INPUT SIDE, "REGISTER" TAB
"Control" Sub Tab

The Register tab provides for direct control of the registers of the device.

The Control sub-tab allows enabling and disabling functionality in the Txx2672 and also controls the wait time multiplier (WLONG).

Additionally, a list box provides options for turning ON all parts (All On) of the device or turning OFF all parts (All Off) of the device simultaneously.

- Enable Register (0x00) – Provides the ON/OFF control of the device.
- Check boxes are provided to allow selection of specific functions on the device:
    1. PON – Power on. Activates internal oscillator. When =0 device is in standby.
    2. PEN – Proximity Enable. Writing a one (1) enables the proximity detection.
    3. WEN – Wait Enable. Writing a one (1) activates the wait timer.
    4. PIEN – Proximity Interrupt Enable. Writing a one (1) enables the Proximity interrupt.
    5. SAI – Stop After Interrupt. Writing a one (1) causes the device to power down at the end of the Prox cycle when an interrupt has been generated.
- WTIME (0x03) – Controls the wait time in 2.72ms increments, unless the WLONG bit is set, in which case the wait time is multiplied by 12. The number to the right is the computed WTIME. Computing the base wait time, in milliseconds, is based on WTIME and WLONG:
    1. When WLONG is 0: Wait Time = (256 – WTIME) * 2.72
    2. When WLONG is 1: Wait Time = (256 – WTIME) * 2.72 * 12
- Config Register (0x0D) – Controls the wait time multiplication factor of x12.
    1. WLONG – Wait Long. When checked (=1) enables the wait multiplier.

"Proximity" Sub Tab

The Proximity tab shows editable registers associated with proximity sensing control. Register values in hex are shown on the left, the middle section contains preset controls for quick configurations, and the column on the right displays the actual values in use.

Note: Values entered via the registers and list boxes do not automatically update each other, so the values displayed may not match. The computed values on the right are always correct and show the values currently in use.

- PTIME (0x02) – Sets the integration time of the proximity ADC in 2.72mS increments. The actual time is:

     (256-PTIME) * 2.72 ms

- PPULSE (0x0E) - This control allows the user to select the number of LED pulses for proximity detection. The pulses have a frequency of 125kHz and a 50% duty cycle.
- PDRIVE – sets the sink current through the IR LED.
- PDIODE – Chooses the active photodiode(s) for proximity sensing.
- PGAIN – Sets the gain of the Proximity sensors.
- POFFSET – shifts the proximity data positive or negative, depending on the proximity offset polarity bit. The actual amount of the shift depends on the proximity gain (PGAIN), proximity LED drive strength (PDRIVE), and the number of proximity pulses (PPULSE).
- PDL – Setting this bit to one (1) causes the actual IR LED sink current value to be 1/8 of the selected PDRIVE value.
- Offset Positive Polarity – Setting this bit to one (1) causes the POFFSET to shift the proximity data in a positive direction.

"Prox Interrupt" Sub Tab
This tab contains the settings for controlling the generation of Prox interrupts to a control processor.

The PILT and PIHT values are 16 bit thresholds for the upper and lower trigger points. Each is set using two 8-bit registers. Another control (PPERS) establishes the required persistence of the interrupt signal.

Also on this screen is a button that will automatically generate the register values to provide threshold settings 3 standard deviations higher and lower than the Proximity Data Register value.

- Proximity Interrupt Low Threshold (0x04, 0x05) – Low threshold for proximity interrupt.
    1. PILTL (0x08) – The lower 8 bits of the 16 bit low threshold value.
    2. PILTH (0x09) – The upper 8 bits of the 16 bit low threshold value.
- Proximity Interrupt High Threshold (0x06, 0x07) – High threshold for proximity interrupt.
    1. PIHTL (0x0A) – The lower 8 bits of the 16 bit high threshold value.
    2. PIHTH (0x0B) – The upper 8 bits of the 16 bit high threshold value.
- PERS (0x0C) – The PPERS field (bits 7:4) allows the number of times the Prox interrupt threshold (PILT, PIHT) is exceeded before the interrupt is generated to be controlled. Setting a zero means an interrupt is generated on every proximity reading.
- The +/-3 Stdev maintains a running average of the most recent Proximity Data Register values and automatically computes new values for the PILT and PIHT, each with a 3 standard deviation wider latitude.

OUTPUT SIDE, "REGISTER" TAB

The value of internal registers is displayed on this tab. Register values cannot be set here. To set registers use the Register tab on the input side of the screen.

A button is provided for clearing the Proximity interrupt (PINT). The current interrupt status is also shown.

The PDATA value is the proximity detection value. It is read via two 8-bit registers.

- ID (0x12) – The ID register provides the value for the part number.
- Status (0x13) – Internal status. Interrupts active (2 bits) and ALS valid bits are here. The contents of the register is decoded as follows:
    1. The status block will display "Prox OK" or "Prox Not OK depending on the PVALID bit.
    2. "Prox Saturated" or "Prox Not Saturated" will be displayed based on the PSAT bit.
    3. Interrupts
        - "PINT True" or "PINT False" is displayed to indicate whether the Prox Interrupt bit is set. Clicking on this Clear button will clear the PINT interrupt. Note that if the proper conditions exist, the interrupt will be raised again immediately.
        - Clicking on the Clear button will clear the Prox interrupt. Note that if the proper conditions exist, the interrupt will be raised again immediately.
- PDATA (0x18, 0x19):
    1. PDATAL (0x18) – The lower 8 bits of the proximity value.
    2. PDATAH (0x19) – The upper 8 bits of the proximity value.
    3. The full 16-bit value is displayed next to the PDATA fields.
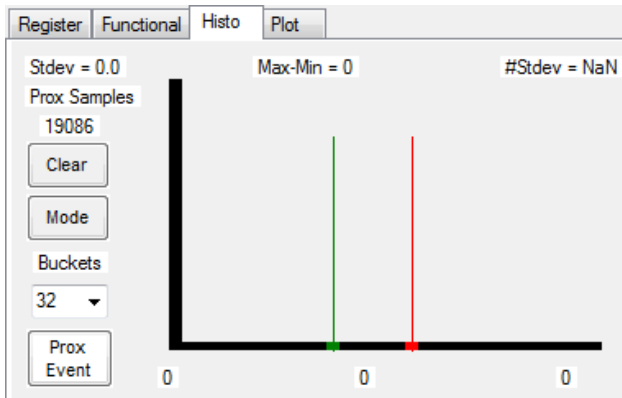
OUTPUT SIDE, "FUNCTIONAL" TAB
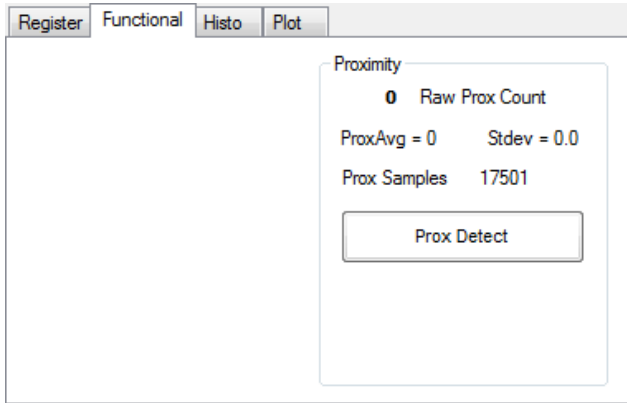
The Proximity indication shows the current reading (Raw Prox Count), a rolling average (ProxAvg), and the standard deviation of the rolling samples. The number of samples is specified on the Input Side, "Functional" tab.

The "Prox Detect" box is a visual indicator of proximity detection, based on the Release and Detect sliders on the Input Side "Functional" tab. When the average exceeds the prox detect threshold, the box will turn red. When the average gets lower than the release threshold, the box will turn white again.

The Ch 0 and Ch 1 photodiodes output values are shown, and their ratio is shown below.

OUTPUT SIDE, "PROXHISTO" TAB

This tab contains a histogram of the recent prox evaluations. It is displayed as a rolling histogram spanning the number of readings specified on the Input Side, "Functional" tab.

Stdev – standard deviation of the displayed data

Max-Min – difference between the maximum reading and the minimum reading

#Stdev – the number of standard deviations represented by the Max-Min value.

The three numbers below the Horizontal axis show the minimum value, maximum value, and mean of the displayed samples. The red and green vertical lines show the proximity detection and release thresholds (respectively), as set by the sliders on the input side of the GUI.

"Prox Event" – a visual indicator of proximity detection, based on the Release and Detect sliders on the Input Side "Functional" tab. When the average exceeds the prox detect threshold, the box will turn red. When the average gets lower than the release threshold, the box will turn white again.

"Buckets" – allows selection of the granularity of the histogram plot. You may choose 32, 64, 128, or 256 buckets or bins to be displayed on the graph. Changing this field does not affect the calculation of the average or standard deviation values, only the width of each bin on the display.

"Mode" – toggles the method used to display the data. In one mode, only the current samples (as selected on the Input Side, "Functional" tab) are displayed. In the other mode, values are not cleared

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from the histogram. This mode allows you to see the effects of rapid data changes that might be difficult to see before they are cleared.

"Clear" – removes all of the data from the current chart, regardless of the current mode, and starts graphing the samples collected after that point.

"Prox Samples" – a simple count of all the prox samples collected since the control form was opened.

OUTPUT SIDE, "PLOT" TAB

The prox reading displayed vs. time on the graph.
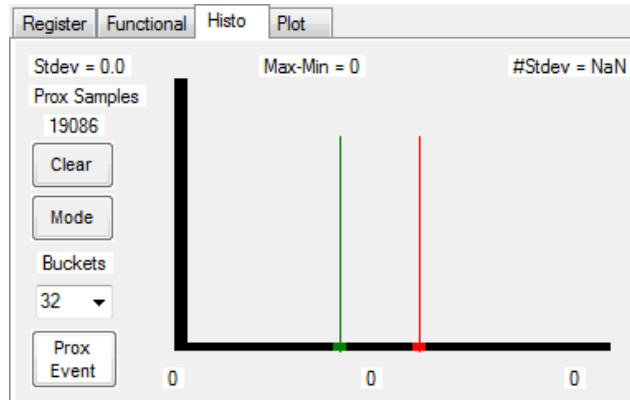
The plot shows proximity events occurring. Multipliers (selected from the list boxes) may be used to scale the display accordingly. Plot data is collected and displayed only when the log function is running (See the description of the logging function in the Software Summary above).

RESOURCES
TSL2672 datasheet
TMD2672 datasheet
Quick Start Guide (QSG)
Designer's Notebooks

For additional information regarding the TSL2672 or TMD2672, please refer to the respective datasheet. For information regarding the installation of the TSL2672 or TMD2672 EVM host application please refer to the 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](www.ams.com)

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