

Scope

The MLX90129 from Melexis is a sensor IC with an integrated 13.56 MHz high frequency (HF) interface that allows sensor data to be read with a HF radio frequency identification (RFID) reader. The DVK90129 is a development kit designed to assist developers explore the features of the MLX90129.

This user manual provides guidelines for use of the DVK90129 development kit. It also provides guidelines for the EVB90129 datalogger / sensor tag based on the Melexis 90129 sensor IC and the Proxima RF USB HF RFID Desktop reader. The DVK90129 development kit along with user friendly evaluation software will decrease sensor IC evaluation time to improve your development cycle and time to market. The dedicated Application Programming Interface (API) provides a quick start for developing custom applications.

Related Melexis Products

Part No.	Comments
MLX90129	Sensor tag / RFID datalogger IC
EVB90129	Evaluation Board for MLX90129
DVK90129	Development kit for MLX90129



Introduction

The DVK90129 development kit has been developed by Melexis in partnership with Proxima RF. It provides a unique platform to evaluate and develop applications based on the MLX90129 sensor IC. By following the guidelines provided in this manual, the sensor tag and datalogging application can be implemented very quickly. The plug and play Proxima RF™ USB HF RFID reader and application oriented user interface are customized for the EVB90129 evaluation board. Pre-programmed settings for the EVB90129 sensors along with external memory help developers discover and apply features found in the MLX90129 sensor IC. The XML based configuration file and export tools allow users to characterize the sensors and fine tune the MLX90129 settings and share these settings with other users. This documentation gives instructions for software and USB reader installation plus guidance on features found in the evaluation software to help developers practice with the tools. Finally, step-by-step instructions are given for two examples so developers can walkthrough trial applications. The first example is based on a sensor tag application and the second example is based on a datalogging application.

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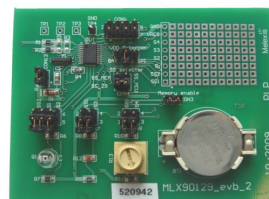
1.Kit contents

The DVK90129 is composed of:

Proxima RF™ Desktop reader



EVB90129



Documentation, drivers, software and API are available with log in on the www.proximarf.com website.

2. Software and hardware installation

The following paragraphs describe how to download and install the user interface software and hardware.

2.1. Download

In order to download the software you must first create an account with Proxima RF. Please go to <http://www.proximarf.com/support> and find the New Customer tab on the page. Once you go to the New Customer page, see the picture of the serial number on the backplate of the reader. Note the serial number on your reader, fill in that number and click on 'Sign Up' to proceed with account creation. Complete account creation by providing the necessary contact information as requested. This information is necessary for product support and to contact you about updates. Once you have created an account, you can access the support page. The DVK90129 software will be available for download in the 'Downloads' section. Be sure to select the correct software for your operating system.

2.2. Software installation

After downloading the software, simply run the installer and follow the on-screen instructions. The installer will install both the software and required drivers.

2.3. Hardware installation

2.3.1. Connect the Proxima RF Desktop

Once the software and drivers are installed you can connect the Proxima RF Desktop reader to your computer using the enclosed USB cable. After connecting the USB Cable, please wait while Windows completes the hardware installation. A pop up screen will advise 'Your new hardware is installed and ready to use' to indicate that the Proxima RF Desktop unit is properly installed.

2.3.2. Check the assigned Virtual COM Port

IMPORTANT:

Make sure that Windows has assigned a virtual com port between COM0 and COM9 to the Proxima RF Desktop by following these steps:

- Navigate to 'Start->Control Panel->System'.
- Select the 'Hardware' tab and click on 'Device Manager'.
- Find the 'Ports' entry in the list of hardware and expand it by clicking on the '+'.
- Find the 'USB Serial Port (COMX)' entry where X is the assigned number.

If this number is not between 0 and 9 you can change this by following these steps: (NOTE: you must have administrative access on your computer to complete the next steps.)

- Double click on the 'USB Serial Port (COMX)' entry
- Select the 'Port Settings' tab.
- Click on 'Advanced'
- Select a new COM Port between COM0 and COM9 from the 'COM Port Number' list.
- Click on 'OK'

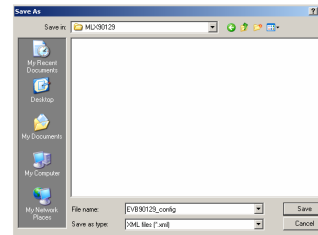
3. Getting Started

3.1. Open the software

Once the software is installed and the reader is connected, the DVK90129 User Interface can be started by navigating to Start->All Programs->Proxima RF->DVK90129

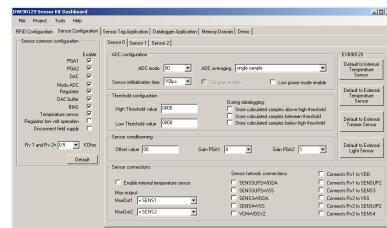
3.2. New Project

Start a new MLX90129 project by selecting “New” in the “File” menu. The project file contains the complete MLX90129 configuration in XML format. This configuration can be loaded in the software and in the MLX90129 memory. Save the project by selecting “Save” or “Save As” in the “File” menu.



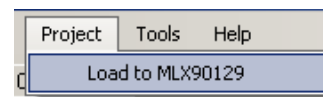
3.3. MLX90129 memory configuration

Several tabs allow you to modify the configuration of the MLX90129 for both the datalogger and sensor tag. More information is provided in the following paragraphs. You can make as many modifications and changes as you like – they are only loaded in the software and will not be loaded to the device until you select “load configuration” – as follows.



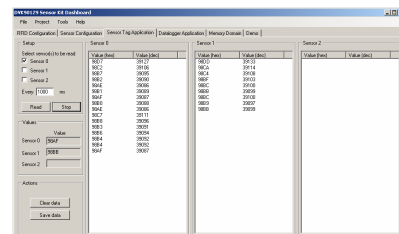
3.4. Load configuration

Once you have finalized the configuration of the MLX90129, it can be loaded onto the EVB90129 by RFID. Loading the configuration will modify the existing EEPROM and internal device configuration of the EVB90129. In order to proceed, the EVB90129 has to be placed on the top of the reader and click on the command “Load to MLX90129” in the Project menu.



3.5. Run Application

The sensor values collected from either the sensor tag or datalogging application can be seen through the “Sensor Tag Application” and “Datalogger Application” tabs. Data can be saved in CSV format.



4. Tabs description

The following paragraphs describe the features of each tab.

4.1. RFID configuration

You can select ISO15693 communications modes via the “RFID Configuration” tab. This tab also allows you to send ISO15693 RFID commands and custom MLX90129 commands. For more information about ISO15693 modes and commands, please refer to the MLX90129 datasheet and to the ISO web site www.iso.org.

! WARNING: Only an experienced MLX90129 user should be allowed to send ISO15693 and MLX90129 commands . Incorrect manipulation or bad parameters could result in locking the MLX90129 chip.

The screenshot displays the 'DVK90129 Sensor Kit Dashboard' with the 'RFID Configuration' tab selected. The interface is divided into several sections:

- RFID option:** Contains subcarrier settings (Single/Dual subcarrier, Modulation: 10%) and communication mode options (Not addressed, Addressed with UID). A 'Default' button is present.
- ISO15693 commands:** Features a 'Command' dropdown (set to 'Inventory'), 'Data' input fields (Iso15 2701 and 00), and an 'Append CRC automatically' checkbox (checked). A 'Send' button is located below. A 'Dialogue box' shows the command and reply: 'Command: Iso15 270100 crc', 'Reply: TAG Resp 0000413743A560A01FE03C33 CRC OK'.
- MLX90129 custom commands:** Features a 'Command' dropdown (set to 'Write register file'), 'Data' input fields (Iso15 03A11F and 113412), and an 'Append CRC automatically' checkbox (checked). A 'Send' button is located below. A 'Dialogue box' shows the command and reply: 'Command: Iso15 03A11F113412 crc', 'Reply: TAG Resp 0078F0 CRC OK'.

Callouts with arrows point to the following elements:

- 'ISO15693 modes (RFID reader settings)' points to the 'RFID option' section.
- 'Sends ISO15693 commands' points to the 'Send' button in the ISO15693 commands section.
- 'Sends MLX90129 custom RFID commands' points to the 'Send' button in the MLX90129 custom commands section.
- 'RFID commands parameters (to be filled if necessary)' points to the 'Data' input fields in the MLX90129 custom commands section.

4.2. Sensor configuration

The “Sensor Configuration” tab allows you to configure up to three sensors differently. The “Sensor common configuration” contains settings which are applied to all the sensors. Examples of changes you can make are: the value of the internal resistor can be selected or the MLX90129 low volt supply can be enabled. NOTE: The “regulator low volt operation” option is linked to bit 3 of the internal device #04 and the “Disconnect field supply” impacts bit 15 of the internal device #03.

The configuration for sensor 0, sensor 1 or sensor 2 includes ADC, acquisition chain, thresholds and connections settings. Threshold value and offset are to be filled with hexadecimal data. Detailed information is provided in the datasheet. The preprogrammed configurations of the following EVB90129 sensors are available by clicking on the dedicated buttons:

- Internal temperature sensor
- External temperature sensor
- External trimmer sensor
- External light sensor

The screenshot shows the 'Sensor Configuration' tab of the 'DVK90129 Sensor Kit Dashboard'. The interface is divided into several sections:

- Sensor common configuration:** A list of options to be enabled for all sensors, including PGA1, PGA2, DAC, Modu ADC, Regulator, DAC buffer, BIAS, Temperature sensor, Regulator low volt operation, and Disconnect field supply. A resistor value 'Rv1 and Rv2=' is set to 0.5 KOhm.
- Sensor 0 configuration:** A dashed box highlights the configuration for Sensor 0, which is identical to Sensor 1 and Sensor 2.
- Sensor 1 and Sensor 2 configuration:** A dashed box highlights the configuration for Sensor 1 and Sensor 2.
- ADC configuration:** Includes ADC mode (11), ADC averaging (single sample), Sensor initialization time (150µs), and options for Chopper enable and Low power mode enable.
- Threshold configuration:** Includes High and Low Threshold values (both 0000) and options for storing calculated samples during datalogging.
- Sensor conditioning:** Includes Offset value (00), Gain PGA1 (8), and Gain PGA2 (1).
- Sensor connections:** Includes 'Enable internal temperature sensor' (checked), Mux output settings, and 'Sensor network connections' (SENSSUP2=VDDA, SENSSUP2=VSS, SENS3=VDDA, SENS4=VSS, VCM=VDD/2).
- EVB90129 Preprogrammed configurations:** A dashed box highlights four buttons: 'Default to Internal Temperature Sensor', 'Default to External Temperature Sensor', 'Default to External Trimmer Sensor', and 'Default to External Light Sensor'.

Callouts from the text above point to these sections: 'Configuration identical for sensor 0,1 and 2' points to the Sensor 0 configuration box; 'Sensor 0 configuration' points to the Sensor 0 tab; 'Sensor 1 and Sensor 2 configuration' points to the Sensor 1 and 2 tabs; and 'Preprogrammed configuration for EVB90129 sensors' points to the EVB90129 buttons.

4.3. Sensor Tag Application

The “Sensor Tag Application” tab allows reading of the MLX90129 sensor IC values with HF RFID. Setup allows you to select which sensor(s) are to be read and the time between two consecutive measurements. Data for each sensor are shown in the dedicated windows. Data can be saved in CSV format.

Select sensor(s) to be read and timing between measurements

Sensor 0 measured values

Sensor 1 measured values

Sensor 2 measured values

Last sensor(s) value(s)

Clears old sensor values. Saves data to a .csv file

The following picture shows the format of the .csv file. The file can be opened with Microsoft Excel.

	A	B	C	D	E	F	G	H
1	UID	0634000000641FE0						
2								
3	Sensor 0			Sensor 1			Sensor 2	
4	(hex)	(dec)		(hex)	(dec)		(hex)	(dec)
5	B53A	46394		DC45	56389		1AD4	6868
6	B53A	46394		DC46	56390		1AD4	6868
7	B53C	46396		DC45	56389		1AD4	6868
8	B538	46392		DC4A	56394		1AD5	6869
9	B539	46393		DC4E	56398		1AD6	6870
10	B53B	46395		DC50	56400		1AD4	6868
11	B53B	46395		DC51	56401		1AD4	6868
12	B53B	46395		DD42	56642		1AD4	6868

4.4. Datalogger Application

The “Datalogger Application” tab is comprised of two sub tabs which allow configuration of datalogger parameters and provides a read-out of datalogging results.

4.4.1. Datalogger configuration

The configuration tab defines all the parameters for a datalogging application. First, select the data to be saved (sensor 0, sensor 1, sensor 2 and timestamp).

For each sensor used during the datalogging, take care to note the threshold parameters available in the tab “Sensor configuration”. If no threshold conditions are used, the three conditions have to be ticked as shown in the following picture:

Threshold configuration

High Threshold value

Low Threshold value

During datalogging:

- Store calculated samples above high threshold
- Store calculated samples between threshold
- Store calculated samples below high threshold

The destination of the data (sensors, values and timestamp) can be either to the MLX90129 internal memory or to optional SPI external memory. In both cases, the start address (hexadecimal value), the number of data (decimal value) and the period of measurement must be provided. The required memory area is calculated and provided (hexadecimal value).

When using the internal memory, the start address is 0x29 in order to prevent overwriting the configuration data. Choose the clock source for the period, either the MLX90129 embedded oscillator (LFO) or the external oscillator (XLFO).

When using the external memory, fill in the communication parameters in “External Memory Configuration” or click on the “EVB90129 External memory” button to apply the recommended settings for the external memory of the EVB90129.

There are several options for datalogging:

- The setting “enable stand by mode once ended” allows the unit to go into stand by mode (lowest power consumption) after completion of the datalogging cycle.
- The option “enable data logging loop” automatically restarts the data logging cycle, overwriting the previous data.
- The “disable automatic loading” option is linked to bit 7 of the internal device #03 (cf datasheet).

There are two options to start data acquisition:

- The option “As soon as the MLX90129 is powered” means bit 2 of the EEPROM#10 “automatic logging mode enable” is set to ‘1’. This means that as soon as the MLX90129 is powered, the configuration is loaded into the register file and the datalogging application starts.
- The option “By RFID command” means bit 2 of the EEPROM#10 “automatic logging mode enabled” is set to ‘0’. This means that even if the MLX90129 is powered, the datalogging application does not start. To start it, it is necessary to set this bit to 1 in the Register File #10. This command is sent by pressing the button “start datalogging” in the “Application” tab.

The screenshot shows the 'DVK90129 Sensor Kit Dashboard' configuration window. It features several tabs: 'RFID Configuration', 'Sensor Configuration', 'Sensor Tag Application', 'Datalogger Application', 'Memory Domain', and 'Demo'. The 'Datalogger Application' tab is active, showing a 'Configuration' section with the following settings:

- Data to be logged:** Includes Sensor 0, Sensor 1, and Timestamp.
- DMA parameters:** Select data destination: External memory; Start address: 0029; Log data every: 10 s; Log data: 720 times; Required memory: 0870; Clock source: LFO.
- Datalogging options:**
 - Enable data logging loop
 - Enable stand by mode once ended
 - Do not copy the MSByte of the first word in the datalogging sequence in the external EEPROM
 - Do not copy the LSByte of the last word in the datalogging sequence in the external EEPROM
 - Disable automatic loading
- Start options:**
 - As soon as the MLX90129 is powered
 - By RFID command
- External memory SPI communication settings:**
 - Address mode: 16-bit address is used; Enable burst mode
 - Command code "Write enabled": 06; to be send: before every write operation; write write delay: 7 ms
 - Command code "Read": 03
 - Command code "Write": 02

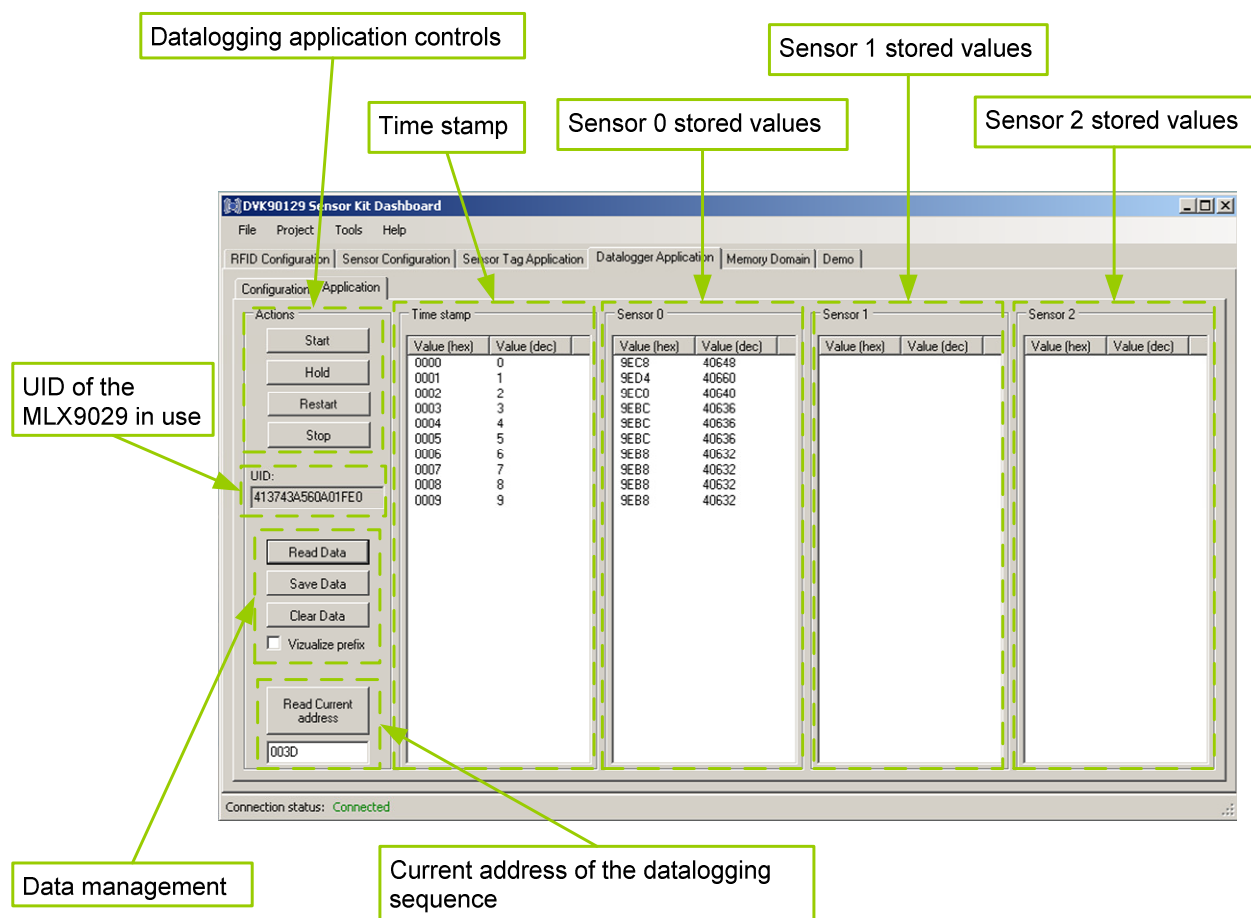
At the bottom right, there is a button labeled 'EVB90129 External Memory Default'. The connection status at the bottom left is 'Connected'.

4.4.2. Datalogger application

The datalogger application tab allows you to collect, display and save data logged from the MLX90129. Start the datalogging application by sending the command “Start Datalogging”. At any time the measurement sequence can be put on hold by pressing the button “Hold datalogging”. Finally, the application can be stopped by pressing the button “stop datalogging”.

Data from sensors can be read and parsed in the three windows corresponding to sensor 0, 1 or 2. Values can be exported in a CSV file. The option “Visualize prefix” shows data as they are stored in memory, i.e. with a prefix.

At any time during the sequence, you can read the current destination address which corresponds to internal device #05.



4.5. Memory Domain

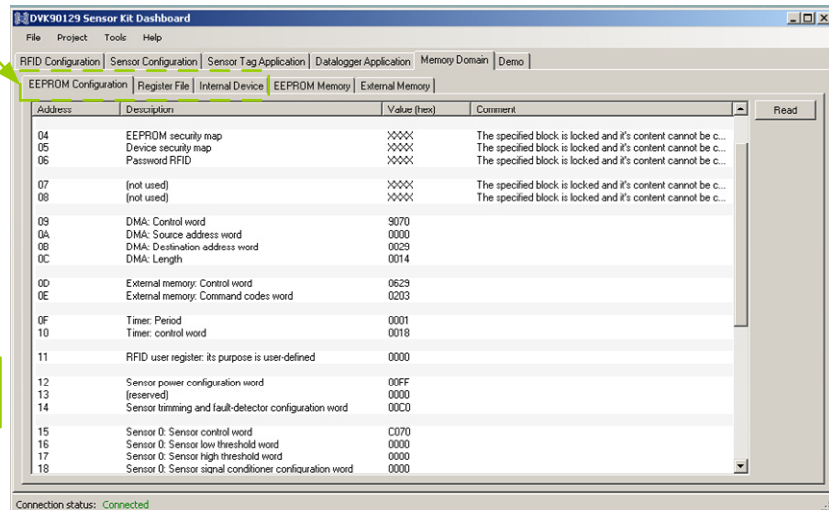
The “Memory Domain” tab is comprised of several sub tabs which correspond to the memory domain available in the MLX90129. The memory domain is for displaying device configuration (MLX90129 EEPROM / Register file / Internal device) and data storage (MLX90129 Internal EEPROM / External Memory).

Modifications made in the configuration tabs (Sensor / Datalogger) automatically update the corresponding bits in the EEPROM or in the register file. The bit level impact of modifying the settings is displayed in this tab.

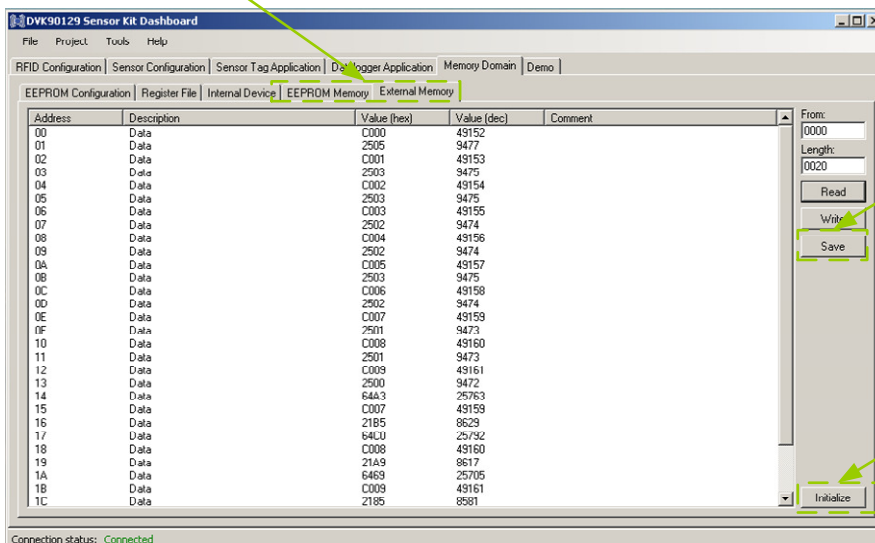
Only the Register File is accessible for write operation to avoid any bad manipulation in the EEPROM. (Register files are cleared after resetting the MLX90129). Storage memories can be read. The “initialize” button will write 0xFFFF values to the EEPROM or External Memory..

⚠ WARNING: The external memory can only be read if the correct memory settings are programmed in the “Datalogger Application” tab

Read MLX90129 configuration from EEPROM, Register File and Internal Device



Read data from internal EEPROM and external SPI memory



Data can be exported as a CSV file

Initialize the memory with the data 0xFFFF

4.6. Demo

The “Demo” tab allows for easy demonstration of EVB90129 sensing features. It is important to note that the sensors are for demonstration only and are not calibrated or set for granular measurement. Sensor configurations are preprogrammed and available by dragging and dropping the sensor icon on the free sensor area. There are configurations available for:

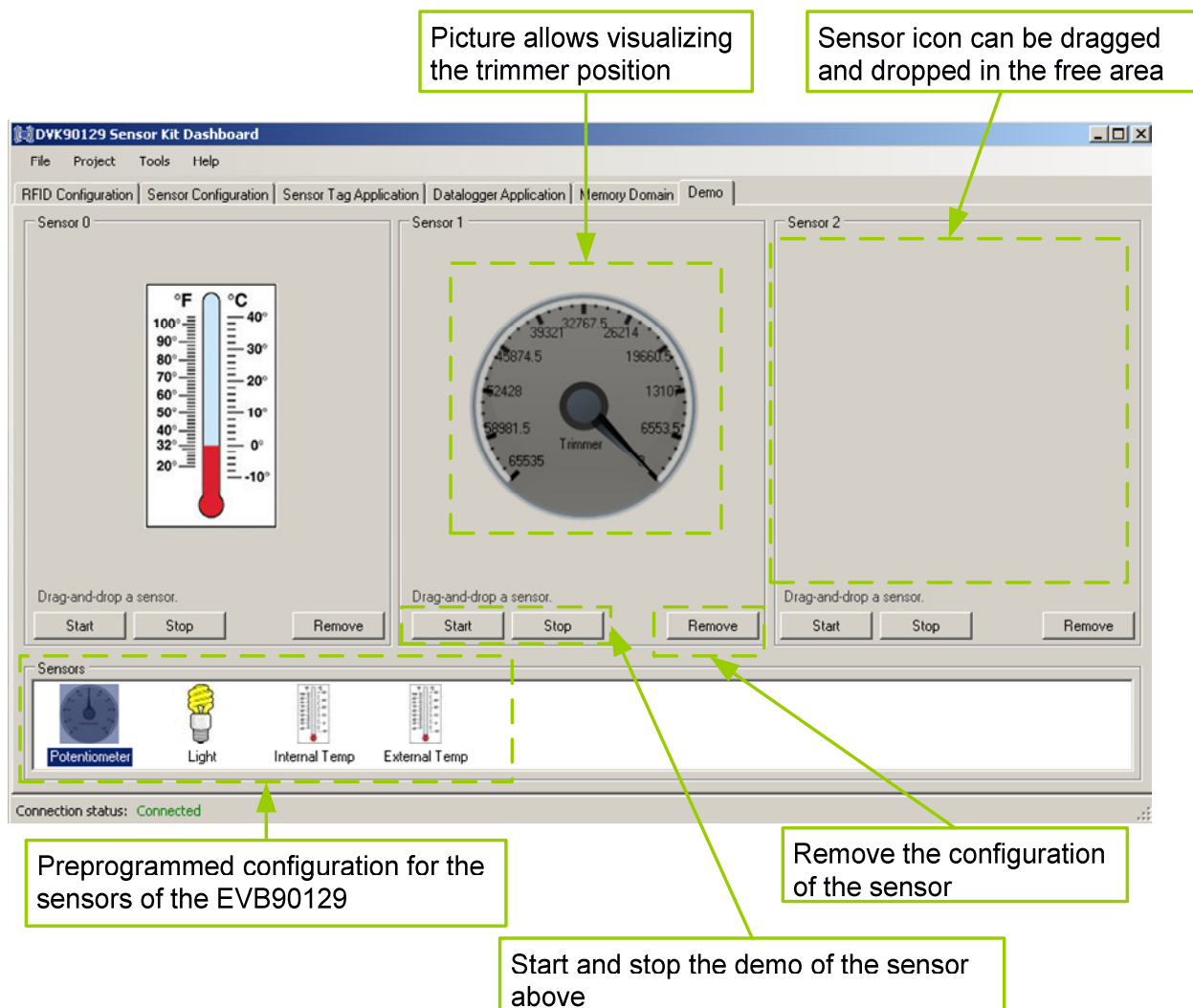
- MLX90129 Internal temperature sensor (thermometer)
- External temperature sensor (thermometer)
- External trimmer sensor (gauge)
- External light sensor (bulb)

Once the icon has been dragged and dropped in the sensor area, the demo can be started by pressing “Start” button and stopped by pressing the “Stop” button.

The demo reads sensor values continuously and provides a graphical display of the value with an animated picture. The sensor configuration can be removed by pressing the “Remove” button.

⚠ NOTE: The given temperature is a rough estimation because the sensors are not calibrated.

⚠ NOTE: The bulb will only light if a direct light is applied very close to the sensor.

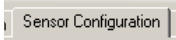
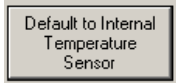
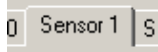
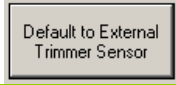

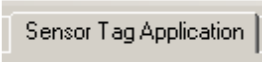
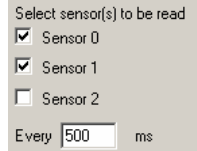

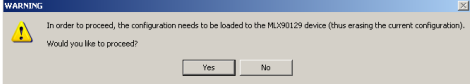
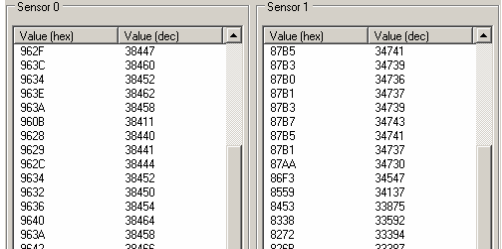




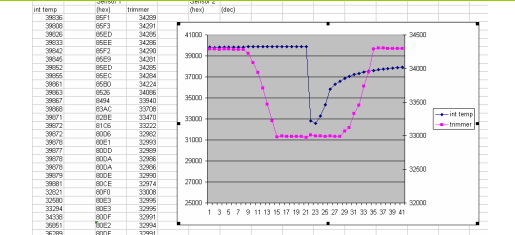
5. Step by step examples

In the following examples, step by step instructions provide simple instructions to experience the sensor tag and datalogging features of the EVB90129. Start by clicking on the RFID configuration tab after ensuring the reader is connected.

5.7. Sensor tag

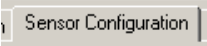

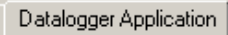
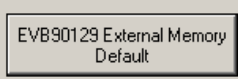
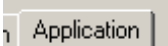
This example application selects the internal temperature sensor for sensor 0 and the trimmer for sensor 1, then reads sensor values by RFID at a single point in time.

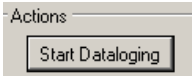
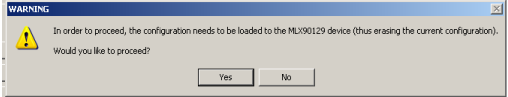
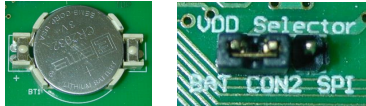
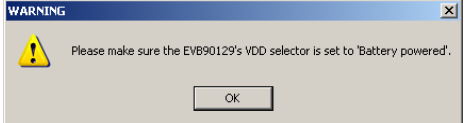
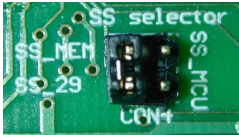
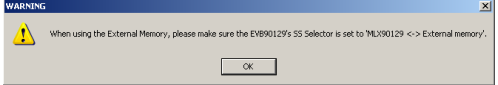
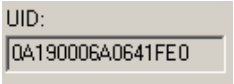
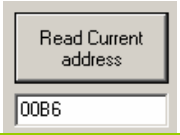
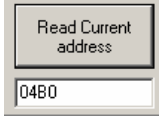



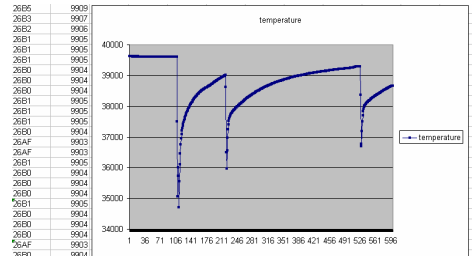
Actions	Pictures
Select "Sensor Configuration" tab	
Apply the default configuration for the Internal temperature sensor for sensor 0	
Select sensor 1	
Apply the default configuration for the external trimmer sensor for sensor 1	
On the EVB90129, connect the trimmer sensor to the MLX90129 by setting the correct jumpers	
Select "Sensor Tag Application" tab	
Select "Sensor 0" and "Sensor 1" boxes and write 500 ms for the sensing period	
Press "Read"	
Select "Yes" for the question "Would you like to proceed?" in order to load configuration into the MLX90129	
Ensure the application is running. If not – go back to the first step.	

Press "Stop" to stop the application	
Select save data	
Name and save the file	File name: <input type="text" value="sensor_tag"/> Save Save as type: <input type="text" value="CSV files (*.csv)"/> Cancel
Open the saved data file (in Excel, for example) and create a graph	

5.8. Datalogging

This example of the datalogging application selects the internal temperature sensor for sensor 0 and configures the MLX90129 as a datalogger to save temperature data every second for a period of 10 minutes. Data are saved with a timestamp in the external memory.

Actions	Pictures
Select "Sensor Configuration" tab	
Apply the default configuration for the Internal temperature sensor for sensor 0	
Select "Datalogger Application" tab	
Select Sensor 0 and Timestamp	<input type="checkbox"/> Include: <input checked="" type="checkbox"/> Sensor 0 <input type="checkbox"/> Sensor 1 <input type="checkbox"/> Sensor 2 <input checked="" type="checkbox"/> Timestamp
Select External Memory for the data destination	Select data destination <input type="text" value="External memory"/>
Press the button "EVB90129 External Memory Default" in the External memory configuration area.	
Select "s" to log data every second	Log data every <input type="text" value="1"/> <input type="text" value="s"/>
Data will be saved 600 times (every second for ten minutes). Type in the number 600 in the Log data field	Log data <input type="text" value="600"/> times Required memory <input type="text" value="04B0"/> Clock source <input type="text" value="LFO"/>
Select the sub tab " Application"	

<p>Press the “Start Datalogging” button</p>	
<p>Select “Yes” for the question “Would you like to proceed?” in order to load configuration into the MLX90129</p>	
<p>As requested by the warning message, the battery has to be plugged on the EVB90129 and the “VDD Selector” jumper has to be set on BAT.</p>	 
<p>As requested by the warning message, the “SS Selector” jumper has to be set between SS_29 and SS_MEM.</p>	 
<p>Ensure the application is running</p>	
<p>Click the “Read Current Address” button to display the progress of the operation.</p>	
<p>After 10 minutes, click the “Read Current Address” button to make sure the datalogging has ended (the number is no longer increasing).</p>	
<p>Click the “Read Data” button to load the logged sensor values from the external memory.</p>	
<p>Data can be saved by pressing the button “Save Data”</p>	
<p>Name and save the file.</p>	
<p>Open the saved data (in Excel, for example) and create a graph</p>	

6. Trouble shooting notes

Troubleshooting Checklist.

A warning message indicates the reader is not connected:

- Are the drivers correctly installed? => Check the Windows pop up after the reader has been plugged in.
- Confirm the COM port number is between 0 and 9. => If not, modify the COM port number by following the procedure described in Chapter 2 of this document
- Is there other software using this COM port? (for example, if you already have the Proxima RF reader demo running, the COM port is already in use) => If yes, close the other application.

EVB90129 does not answer or a warning indicates, "No Tag Response":

- Is the correct MLX90129 device selected? => Check Menu Tools/ Device
- Is the MLX90129 correctly powered? => Check to see if you have clicked the "Disconnect field supply" option on the Sensor configuration tab. If so a battery has to be used to power the MLX90129.

Sensor tag application is not reading data:

- Is the correct MLX90129 device selected? => Check Menu Tools/ Device
- Is the MLX90129 configured with correct settings? => Load settings through Menu Project/ Load to MLX90129.
- Are the settings correct? => Try the application with default settings provided.
- Are the external sensor connections enabled? => Check the EVB90129 jumpers (refer to page 4 of the EVB90129 user manual)

No data is being logged

- Are the threshold settings correctly set? => Check the tab "Sensor Configuration" tab.
- Is the external memory enabled and connected? => Check the EVB90129 jumpers. (refer to page 4 of the EVB90129 user manual)

7. Contact Information

Further information can be found in the MLX90129 datasheet. If further documentation is required please refer to the Melexis website, www.melexis.com. For additional information contact:

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