Application note

MLX90397 EVB

Melexis
INSPIRED ENGINEERING

Contents

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1. Scope

This document shows the schematic of the EVB for MLX90397 and how it can be used easily to get started. Note that any of the code is provided as is, and is not guaranteed to be error free. It is only to be used as a demo.
All tools discussed in this document are found on www.melexis.com/EVB90397.

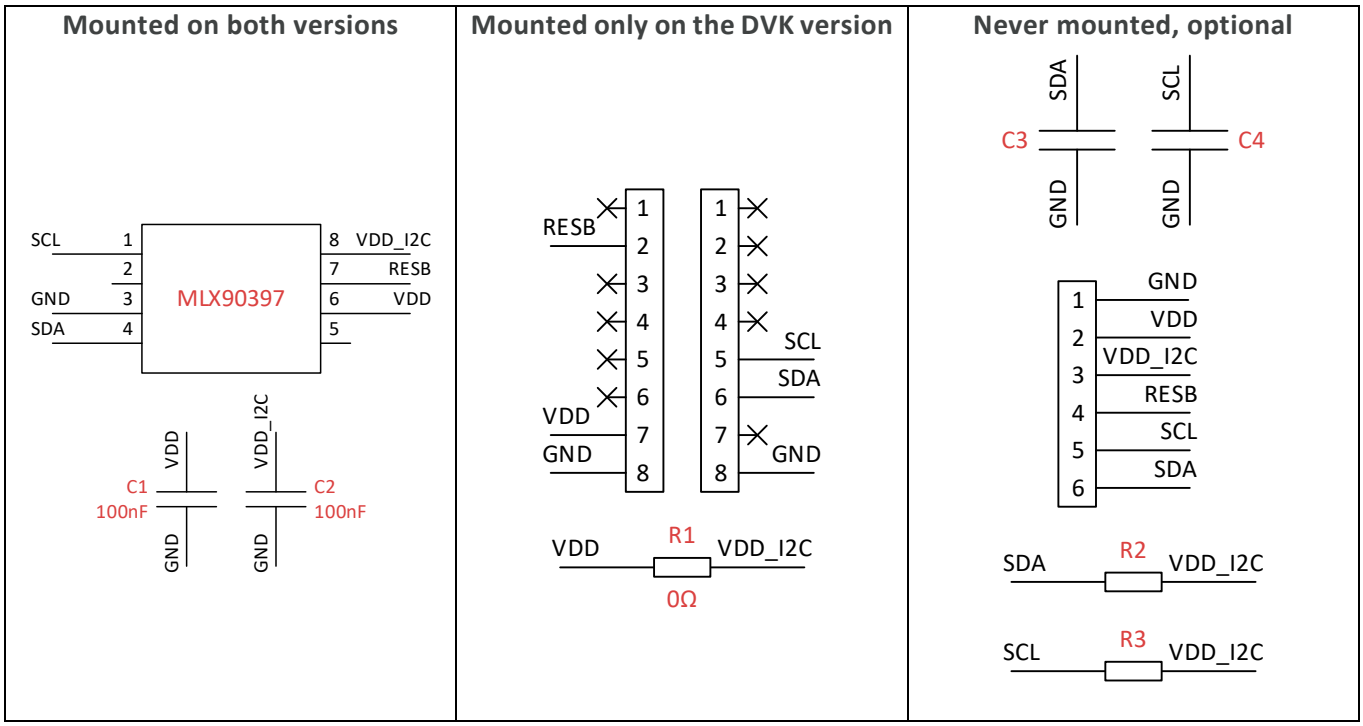
Important is that the IC does not contain a power-on reset circuit, so to ensure a proper reset, follow section 1.4 carefully.

1.1. Different EVB Versions

Important: the MLX90397 operates at 3.3V, which means that when connecting it to a microcontroller one needs to make sure to use a 3.3V microcontroller. Two different versions of the EVB are available:

- **Breakout** version: EVB90397_BK
    - Standard Evaluation Board for MLX90397RLQ-AAA-000. Version without pin header.
    - The IC is mounted, together with two 100nF decoupling capacitors. The six used pins of the IC are directly routed to the 6-pin header footprint.
- **DVK Magnetic** version: EVB90397_DVK
    - Evaluation Board for MLX90397RLQ-AAA-000, fully compatible with the Triaxis DVK magnetic board.
    - The IC is mounted, together with two 100nF decoupling capacitors. The VDD and VDD_I2C are shorted via the 0Ω resistor. The chip is supplied with 3.3V and communication will happen at 3.3V level.

1.2. EVB Schematic



C3 and C4 are decoupling capacitors for the SDA and SCL lines, optional.

R2 and R3 are pull-up resistors for the SDA and SCL lines, optional.

1.3. Microcontroller and GUI Setup

Firmware is written for the below microcontroller.

- Compatible Arduino®: https://www.arduino.cc/
    - An example code (.ino) is made implementing all the functions, executing them based on serial commands and returning the replies to the PC.[1]
    - Install the software from the website to have also the drivers and to be able to upload the code to the board.
    - Make sure to use a 3.3V version! (or use a level shifter)

As GUI, an executable is available on www.melexis.com/EVB90397 which implements the commands from section 3 of this document and visualizes the reply from the IC. As the GUI is written in LabVIEW™ software, make sure to install the runtime engine (2019, 32-bit) in order to run it, which can be downloaded free of charge.

1.4. Power-on Reset

Since there is no power-on reset circuit inside the IC, to ensure proper reset of the IC the user has to make sure to provide the IC with the reset pulse according the datasheet.

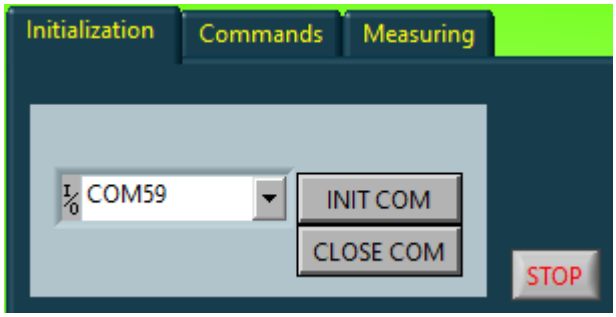
On the DVK this can be achieved by pressing the “Reset” button on the compatible 3.3V main board, if connected.

[1] Due to the implementation of the I²C library, the “Read Direct” function does not detect Nacks. As from Rev2.0 of the demo code this has been fixed.

2. GUI

In the demo (V1.0), three tabs are present. All of them are shown in the following chapters.

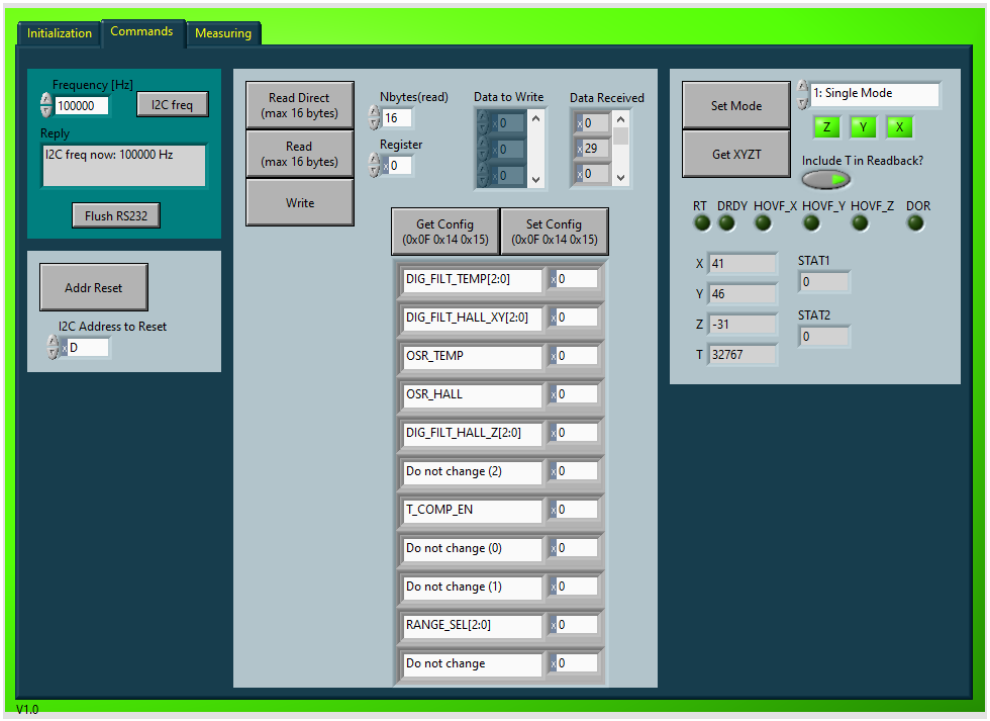
2.1. Initialization



Button	Action/Usage
INIT COM	Select the COM port in the drop down list and click this button to connect to the device.
CLOSE COM	To close to COM port, click this button.
STOP	This button stops the UI, there is no need to use this normally.

2.2. Commands

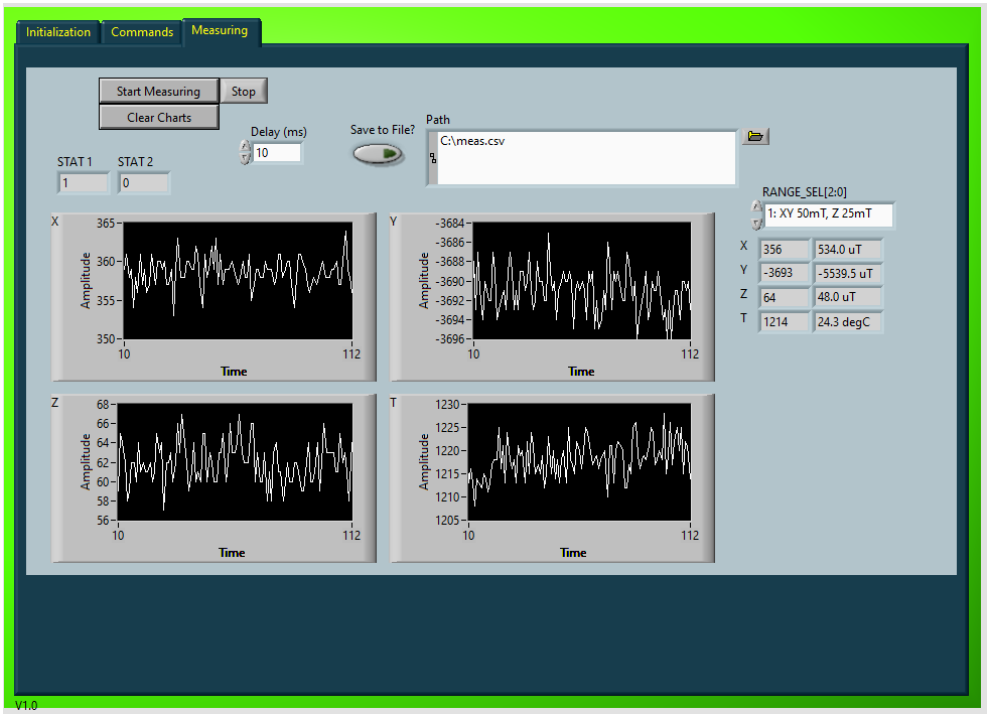
If a Nack is detected, the green border will turn red.(1)



Button	Action/Usage
I2C freq	Change the I²C frequency. By default, the I²C frequency is set to 100kHz.
Flush RS232	Flush the RS232 buffers, click a couple of times in case of corrupted data.
Addr Reset	Send a reset command to the device with I²C address as in the “I2C Address to Reset” input box.
Read Direct	Read a number of registers (specified by input box “Nbytes(read)”, starting from register 0x00. Answer shown in the “Data Received” output box.
Read	Read a number of registers (specified by input box “Nbytes(read)”, starting from the register specified by the input box “Register”. Answer shown in the “Data Received” output box.
Write	Write the content in the input box “Data to Write” to the IC, starting from the register specified by the input box “Register”.
Get Config	Reads registers 0x14 and 0x15 and decodes them in the section below.
Set Config	Writes registers 0x14 and 0x15 with the content of the section below.
Set Mode	Select a mode in the enumeration list next to it and click to set the IC in that mode.
Get XYZT	Get the magnetic measurement and status (and decoded status) from the IC, and show the result in the below output boxes. Temperature can also be read out if “Include T in Readback?” is set.

2.3. Measuring

If a Nack is detected, the green border will turn red. A conversion to µT and degC using typical sensitivity can be done. Selection of the correct version is needed.



Button	Action/Usage
Start Measuring	Starts sending in a loop single measurement commands to the IC, and asks after a delay specified by “Delay (ms)” the measurement results from the IC. The data is displayed in the graphs below. Enabling the option “Save to File?” allows for the data to be stored in a csv format. Specify the path first.
Stop	Stop the measurement loop, it allows for the last loop to be completed.
Clear Charts	Clears the graphs below.
RANGE_SEL[2:0]	Set to the programmed code to use the correct sensitivity for the conversion LSB to µT.

3. Serial Commands

The commands are send on the serial bus with following settings:

Setting	Value
Baud rate	9600
# Data bits	8
# Stop bits	1
Parity	None
Flow control	No
End character (PC->microcontroller)	None needed (if ending is sent, execution starts before ending is received and ending is discarded)
End character (microcontroller->PC)	0x0A ("\n" or "Line Feed")

If more than one information is returned, each data section is ended by a ";" to allow for splitting, this includes the last section. In case of a single information, the data is not ended by a ";".

3.1. Read N Bytes

To read N bytes starting from a specified register, send to the microcontroller the following sequence. Note that setting Nbytes to 0 will equal 16 bytes to be read out.

Char #	Message to send	Example: Read 2 bytes, starting from register 0x14
1	**A** as character	A
2	**R[7:4]** as hex character	1
3	**R[3:0]** as hex character	4
4	**Nbytes** as hex character	2

Data #	Data received	Example: Read 2 bytes, starting from register 0x14
1	**Nack;** >0 if I^2C NACK are observed	0;
2	**R_1[7:0];** in decimal value	225;
3	**R_2[7:0];** in decimal value	
…	**…**	
N+1	**R_N[7:0];** in decimal value	181;
N+2	**"\n"**	\n

3.2. Read Direct N Bytes

To read N bytes starting from register 0x00, send to the microcontroller the following sequence. Note that setting Nbytes to 0 will equal 16 bytes to be read out.(1)

Char #	Message to send	Example: Read Direct 16 bytes
1	**B** as character	B
2	**Nbytes** as hex character	0

Data #	Data received	Example: Read Direct 16 bytes
1	**Nack;** >0 if I²C NACK are observed	0;
2	**R_1[7:0];** in decimal value	0;
3	**R_2[7:0];** in decimal value	0;
…	**…**	0;0;0;0;0;0;0;0;152;186;0;0;0;
17	**R_N[7:0];** in decimal value	0;
18	**"\n"**	\n

3.3. Addressed Reset

To send an addressed reset on the bus, send to the microcontroller the following sequence.

Char #	Message to send	Example: Addressed Reset, 7-bit I²C address 0x0C
1	**D** as character	D
2	**I2CAddr[6:4]** as hex char, pad MSB "0"	0
3	**I2CAddr[3:0]** as hex character	C

Data #	Data received	Example: Addressed Reset, 7-bit I²C address 0x0C
1	**Nack** >0 if I²C NACK are observed	0
2	**"\n"**	\n

3.4. Write N Bytes

To write N bytes starting from a specified register, send to the microcontroller the following sequence.

Char #	Message to send	Example: Write 0xE1 0xB5, starting from register 0x14
1	**E**, as character	E
2	**R[7:4]** as hex character	1
3	**R[3:0]** as hex character	4
4	**D1[7:4]** as hex character	E
5	**D1[3:0]** as hex character	1
6	**D2[7:4]** as hex character	B
7	**D2[3:0]** as hex character	5
…	**…**	-
2*N+3	**DN[7:4]** as hex character	-
2*N+4	**DN[3:0]** as hex character	-
2*N+5	**T** as character (terminate transmission)	T

Data #	Data received	Example: Write 0xE1 0xB5, starting from register 0x14
1	**Nack** >0 if I^2C NACK are observed	0
2	**"\n"**	\n

3.5. Change I²C Frequency

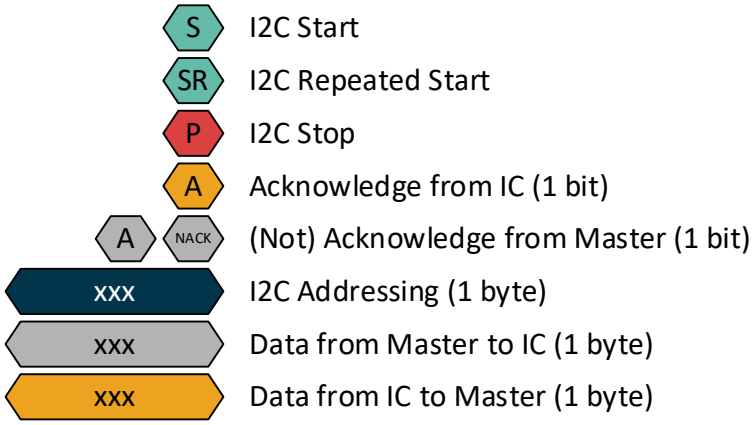
To change the I²C frequency, this command has to be sent. The length of the frequency value (in Hz) is fixed to 7 decimals, so padding with "0" is required for frequencies smaller than 1MHz. The default I²C frequency is 100kHz.

Char #	Message to send	Example: Set I²C frequency to 100kHz
1	**W**, as character	W
2	**F6** as hex character	0
3	**F5** as hex character	1
4	**F4** as hex character	0
5	**F3** as hex character	0
6	**F2** as hex character	0
7	**F1** as hex character	0
8	**F0** as hex character	0

Data #	Data received	Example: Set I²C frequency to 100kHz
1	**"I2C freq now: xxxxx Hz\n"**	I2C freq now: 100000 Hz\n

4. Examples

In the examples, the I²C communication is shown using the legend below:



4.1. Changing Filter Settings

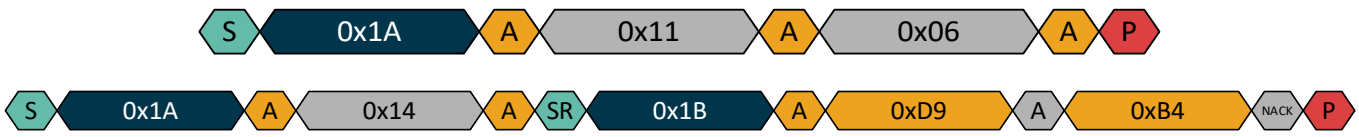
7-bit I²C address is 0x0D, this gives for reading 0x1A and for writing 0x1B as byte to send on the I²C bus. The digital filters (one for XY and one for Z) for the magnetic measurements will be both set to zero.

A first step is to read the registers where the filters are stored, in order to know what the content is of the other bits in the registers. The filters are stored at register 0x14 (XY) and at register 0x15 (Z). Both will be read out with an addressed memory read command:

Setting 0x14[5:3] and 0x15[2:0] to 0 gives 0xC1 and 0xB0 as new content for registers 0x14 and 0x15 respectively:

An addressed memory read is performed again to verify that the content is written:

Note that it is not written in non-volatile memory! Issuing a reset command will set the content back to the factory defaults:

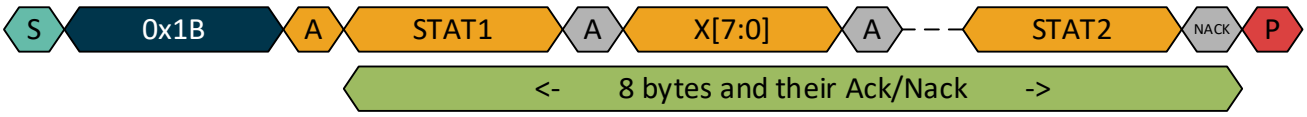


4.2. Performing a Single Measurement (XYZ)

7-bit I²C address is 0x0D, this gives for reading 0x1A and for writing 0x1B as byte to send on the I²C bus.

First the mode '1', with needs to be written into register 0x0E, together with X_EN, Y_EN, and Z_EN set (giving 0x71 as code):

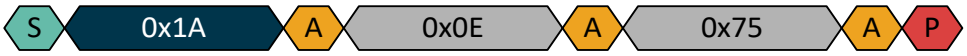
From register 0x00, the measurement data and status bytes can be read out after the measurement came to completion. A Read Direct is used here:



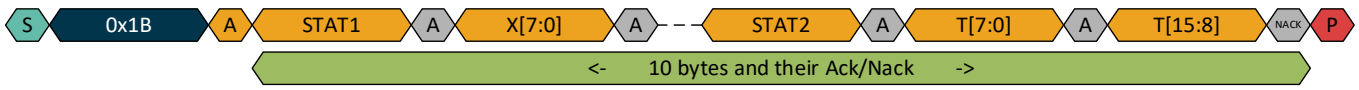
4.3. Performing a Continuous Measurement (XYZT, 100Hz), and Returning to Idle Mode

7-bit I²C address is 0x0D, this gives for reading 0x1A and for writing 0x1B as byte to send on the I²C bus.

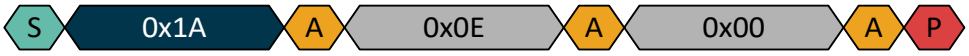
First the mode '5' needs to be written into register 0x0E, together with X_EN, Y_EN, and Z_EN set (giving 0x75 as code):



From register 0x00, the measurement data and status bytes can be read out after the measurement came to completion. A Read Direct is used here. This can be done repeatedly to get new data.



To go back to idle, set the mode back to '0':



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6. Revision History

Revision	Changes
001, Feb 2022	Creation
002, May 2022	Released version

For the latest revision of this document, visit www.melexis.com/EVB90397

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