

Introduction

The EVB90601 Configuration board is designed to support the MLX90601 based Infrared Thermometer modules. The hardware board acts as an interface between the USB port of a PC and the module's SPI interface. Power for the module and EVB board come from the computer USB port.

OEMs

The EVB90601 is designed to allow OEMs to configure IR sensing for virtually any application quickly. OEMs can quickly experiment with temperature ranges, optics, etc. to find the best IR configuration to meet the application needs. Once the best configuration is established, low volume OEMs can easily configure IR modules for their own use.

For high volume OEMs, Melexis can supply special configured modules, ready to install to customer specifications. Please contact IR Sales at Melexis for quotations.

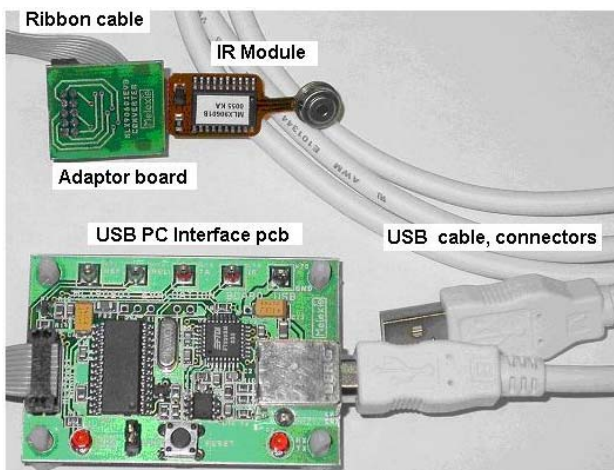
Laboratory/R&D

The EVB90601 allows engineers to custom configure the MLX90601 for very high accuracy IR measurements in an R&D or Laboratory setting.

Getting started

Included in the Kit

- USB configuration pcb board
- ribbon cable
- a USB cable to connect to a PC
- small adaptor board to easily mount a MLX90601 flex pcb module
- samples: MLX90601KZA-CKA and MLX90601KZA-BKA Infrared Modules
- software and documentation



Note that it is advised to check for latest software and documentation updates at www.melexis.com in the section Products: Hardware and Evaluation Boards

System requirements

- Windows 98, Windows NT, Windows 2000, Windows XP

Quick Start

1. Install the SW90601 Configuration Software on your computer **before** connecting the kit to your USB port.

The latest version will always be available on our website here:

<http://www.melexis.com/prodmain.asp?family=SW90601>

Please check periodically for updates.

2. Install a MLX90601 module into the special connector as shown.



3. Connect the ribbon cable to the large pcb and the small pcb

4. Plug in the USB cable to the Melexis pcb and to your computer

5. When the USB cable is connected, the software will direct you to install the USB drivers (see the Read First Melexis USB Software Installation Note included with the MLX90601 Configuration software).

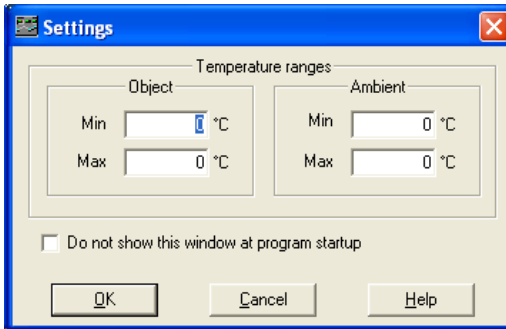
6. Start the MLX90601 Configurator Software on your computer (located in the Program Files).

If everything is correct, you will see the software downloading the data file from the MLX90601.

When you see the software download the EEPROM at startup, the module is communicating correctly with your computer and this Main Toolbar will show ready:

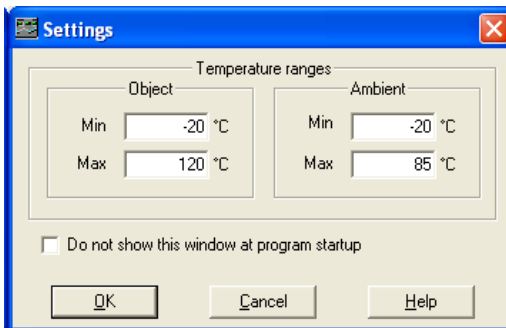


7. Next the software will show you the following screen. You must input the temperature range that your module is configured for.

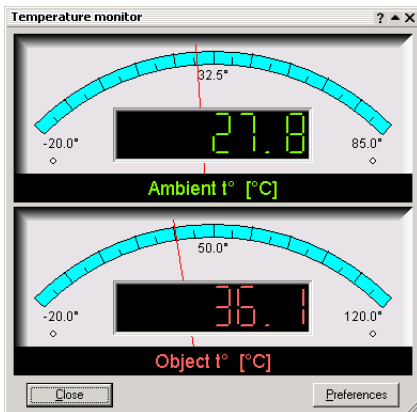


Factory standard MLX90601BKA and MLX90601CKA modules have:

Tobject range of -20 C to 120 C, Tambient range of -20 C to 85 C. So, you must enter the ranges like this:



8. Finally, click on “Windows” on the main menu. Then click on “Monitor”. Your computer should now display the correct To (target temperatures) and Ta (ambient temperatures) as shown here:



(Please note that the Monitor display box can be “enlarged” as any normal MS Windows box by putting your cursor on the edges of the box.)

Done. Wave the module around and you should see the temperature display change accordingly.

Technical Support:

If you experience any problems with the module, Configuration board or Software tools please contact our technical support. When encountering problems with the use of the software, please mention the “program build” info found at the “about” box in the help menu.

Specialized support can be reached by email at: irsales@melexis.com

Following information is described in next pages:

- **Temperature Ranges, Units Changing**
- **Application notes concerning IR-recalibration**
- **Reference Blackbodies**
- **Calibrate “In-place”**
- **Emissivity and Targets**
- **Help Files:** For your convenience, the Help files implemented in the software are good documented, and are describing how to use the evaluation board. The most important help files are presented in next paragraph for easy reference.
- **Application notes concerning FOV (field of view)**
- **Troubleshooting**

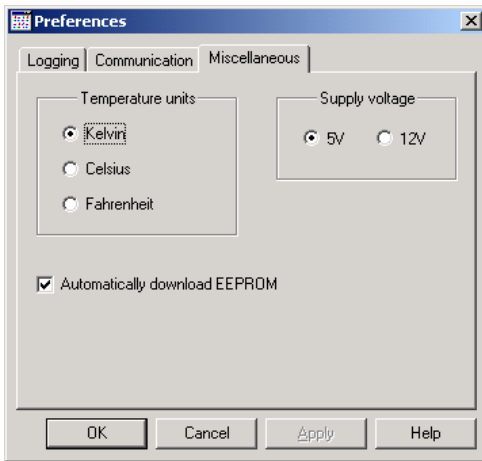
- **PCB Hardware and Firmware Manual**

TEMPERATURE RANGES, UNITS CHANGING:

The temperature ranges that the IR modules are set for, must always be entered manually into the PC software. There is no way at this time for the PC software to know what the configured temperature ranges are inside the module.

This, along with temperature units can be changed manually like this:

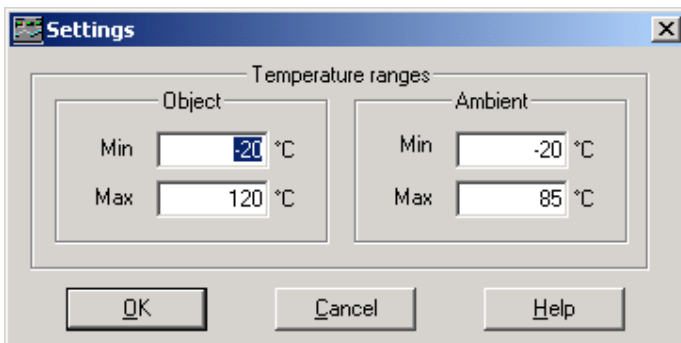
Click on “Configuration”, then “Preferences”, then “Miscellaneous”. Then select “Temperature Units” as shown here:



Select deg F or K (deg C is default).

Click on “Configuration”, then “Settings” on the main menu. Here you have to have to enter the calibrated range of the module you are using.

The screen is shown here:



(You must always make sure you have set the correct “Settings” for the temperature ranges. There is no means for temperature range information to be stored in the MLX90601 module EEPROM. This temperature range information must be inserted manually, external to the module. This means if you change any modules, you must record the temperature ranges that you have set the module to.)

RE-CALIBRATION USING THE EVB90601

Always save the original EEPROM settings of a module before making any EEPROM changes. To do this, click on the main menu "File". Then click "Save as". Give the file a name and save it on your computer.

This will allow you to always return the module to its original settings, calibration, and accuracy. (There is also an internal ID number in EEPROM that cannot be changed. The module serial number is always displayed in the blue bar of the main menu screen when you are connected.)

Up to 7 IR calibration points are available when re-calibrating. However, for many applications only one IR calibration point is needed as the EVB software follows established IR curves for high emissivity objects quite accurately.

Situations where multiple calibration points can be used to increase accuracy are:

To generate the highest level of accuracy for wide temperature ranges. Example: to have the highest accuracy from $T_0 = 0$ to 500 C you can use up to 7 points.

When emissivity is less than 0.9, or unknown, or varies with temperature, using more calibration points can allow you to correct for the variations.

Adding an unusual optical system: lenses, narrow bandpass transmissions, etc. can alter the curve algorithm used in the software. In this situation, using more calibration points will adapt the curve to the application.

In general, using more calibration points can allow you to calibrate out errors that can come from a variety of sources in your intended application.

If you get poor results from your first attempts at re-calibration:

Reload the original EEPROM settings from your test module that you saved on disk back into the module.

Then start the re-calibration tests again.

Always reload the original EEPROM when you wish to re-calibrate the same module.

Additional re-calibration instructions can be found in the "Help" files in the software. Also, the "Help" files are printed in this manual for your reference.

REFERENCE "BLACKBODY"

To perform a calibration, you can use a reference surface temperature "blackbody".

There are numerous commercial blackbodies available. Choose a unit that suits your temperature range and accuracy.

"TEMPERATURE BATH" as a "Blackbody" A standard laboratory temperature bath is a near "ideal blackbody". The emissivity of water, and nearly all liquids, is around 0.985. That is as good as many of the highest quality commercial blackbodies. Here are some simple rules in using a temperature bath for a blackbody:

1. It must be a "stirred" temperature bath so that the top layer is constantly being controlled correctly.
2. If you wish to measure above approx. 40 C, you should remove the water in the bath and replace it with a non-evaporating fluid. (Reason for this is that evaporating water will condense on the IR module sensor window. Condensation on the IR sensor window distorts its ability to see heat.) A good working fluid could be automotive antifreeze or equivalent. Such fluids are excellent as they

- have high evaporation points, and low freezing points. Using such a fluid, you can have a very high accuracy blackbody from -40 C to 100 C.
3. For temperatures below 10 C, a temperature bath with such a fluid is better than conventional blackbodies. On conventional blackbodies, low temperatures can cause condensation on the face of the blackbody. This will distort its readings. A temperature bath with low working temp fluid has no such problem because it is "stirred", and the stirring motion prevents water forming a condensing layer on top.

CALIBRATE "IN PLACE"

The most accurate IR calibration for OEMs is to calibrate the module on the actual target that you wish to measure, under the conditions that you wish to measure it.

Example: to achieve the highest accuracy with a fusing roll in a copier, set up a calibration station using an actual fusing roll and heater with a reference temperature sensor actually mounted on the fuser roll. Bring the fuser roll to the temperature(s) you want highest accuracy, and then perform the calibration(s) to match the known surface temperature(s) desired. Then the IR module can be installed on a production unit.

EMISSIVITY and TARGETS

Non-metals normally have a very high emissivity, greater than 0.9, and can be measured very well using IR.

Metals (uncoated metals) are normally not good targets for IR temperature measurements as they are normally very low emissivity (less than 0.2). This means that more than 80% ($1.0 - 0.2 = 0.80$) of the signal the IR sensor will see is ambient reflection. If the ambient reflection changes by even small amounts, errors will be introduced. Metals should be coated with a non-metal for best measurements.

The only exception is this: Uncoated metals can be measured with reasonable accuracy at high temperatures (normally above 500 C). The reason for this is that changes in ambient reflections are small IR signals compared to the amount of IR radiation coming from a hot metal. In other words, the IR signal is dominated by the metal even when emissivity is low if the temperature is high enough.

Biological materials are very good targets with emissivities better than 0.98, nearly blackbody (no reflection).

Plastics, nearly all plastics are very good targets for IR. The only exceptions are thin polypropylene and thin polyethylene, which allow IR to pass right through, depending on the thickness. Most plastic IR lenses are made of those material precisely because of those properties.

There are numerous Emissivity Tables available on the internet for general reference.

Help Files

For your convenience, the Help files in the software are presented for easy reference.

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[Disclaimer](#)

Copyright

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Author

Alexander Savov
phone: (+359 2) 9174 823
e-mail: als@melexis.com
Melexis web site: <http://www.melexis.com>

Menu Commands

[File menu](#)

[Module menu](#)

[Configuration menu](#)

[Windows menu](#)

[Help menu](#)

File Menu

The File menu offers the following commands:

Open	Loads internal EEPROM cache with the contents of the selected file.
Save as...	Stores the contents of the module's EEPROM in the specified file.
Download	Updates the internal EEPROM cache from the connected module's EEPROM.
Upload	Updates the connected module's EEPROM from the internal EEPROM cache.
Exit	Exits MLX90601 Configurator.

Module Menu

The Module menu offers the following commands:

Calibration	Opens the Calibration settings dialog .
Configure output	Opens the Module output configuration dialog .
Rescale object range	Opens the Rescale object temperature range dialog .
Rescale ambient range	Opens the Rescale ambient temperature range dialog .
Control measurements	Opens the Control measurements dialog .
Reset	Resets the connection with the module.

Configuration Menu

The Configuration menu offers the following commands:

Settings	Opens the Settings dialog .
Preferences	Opens the Preferences dialog .

Windows Menu

The Windows menu offers the following commands:

Monitor	Toggles display of the Monitor window .
EEPROM Table	Toggles display of the EEPROM window .
Registers Table	Toggles display of the Registers window .
Log Window	Toggles display of the Log window .
Lock	Lock all the child windows to the main, so they can all be moved at once.

Help Menu

The Help menu offers the following commands, which provide you assistance with this application:

Table of contents	Display the Help Contents
About MLX90601 Configurator	Displays the version number and copyright information of MLX90601 Configurator.

MLX90601 Configurator Windows

[Main window](#)

[Monitor window](#)

[EEPROM Table window](#)

[Registers Table window](#)

[Log window](#)

See also:

[Window menu](#)

MLX90601 Configurator Main Window


















This is the application's main window. It features the following settings:

Application's main menu

For a complete list of the MLX90601 Configurator menu commands see [Menus](#).

Application's toolbar

The toolbar buttons duplicate some of the mostly used menu commands:

Click	To execute
	The Open command.
	The Save as command.
	The Calibration command.
	The Configure output command.
	The Rescale object range command.
	The Rescale ambient range command.
	The Control measurements command.
	The Reset command.
	The Settings command.
	The Preferences command.
	The Monitor command.
	The EEPROM Table command.
	The Registers Table command.
	The Log Window command.
	The Lock command.
	The Exit command.
	The About MLX90601 Configurator command.

Supply Voltage

Provides means for controlling the power supply for the connected module. Note that the program is not functional as long as the module is turned off. The red display at the right end shows the actual value of the module's supply voltage. See also [Supply Voltage](#) section of [Miscellaneous Page](#).

Multifunctional status bar

The MLX90601 Configurator's status bar is divided into 4 areas. The first area is used to display status messages. The other 3 extra areas are provided for user convenience. The following is the meaning of each extra area:

- **Progress area** - displays the progress of prolonged operations such as EEPROM downloads or uploads.
- **Logging area** - displays the logging status of the program. Double-clicking with the left mouse button on this area toggles the logging on and off in the same way as the [Enable logging](#) checkbox of the [Logging Page](#) does.
- **Status area** - displays the status of the connection with the module.

Note: closing the Main window makes the application to terminate.

See also:

[MLX90601 Configurator Windows](#)

Monitor Window

This window displays the ambient and object temperatures measured from the module. Incorrect values may be shown if either the module is not calibrated properly or the temperature settings do not match the module's calibrated ranges (see [Settings dialog](#) for more information). Double-click with the left mouse button on any of the indicators activates the Settings dialog.

An "Err" text appears on both displays if the communication with the module is not functional. An "OFF" text appears on both displays if the module is turned off (see [Main window](#) for information how to control the power supply for connected module). A dash "-" appears on each display if the corresponding channel is not configured properly.

The Monitor window allows resizing to achieve better visual comfort. Simply move the mouse cursor over any of the window's borders. The shape of the cursor must change to a "stretch" cursor. Now you can press left mouse button and drag the border to resize the window.

Close button

Closes the Monitor window.

Preferences button

Opens the [Monitor preferences dialog](#), which allows modification of the settings for temperature monitoring.

See also:

[MLX90601 Configurator Windows](#), [Monitor command](#)

EEPROM Table Window

This window dumps the contents of the program's internal EEPROM cache. Each line of the table displays the value of one EEPROM cell in MLX90601. The cells are classified into 4 groups according to their use, for better navigation from one cell to another:

- **Registers group** - these cells keep the contents of some of the module's internal registers.
- **Linearization group** - these cells keep the constants used by the temperature linearization block.
- **Other data group** - these cells keep miscellaneous information which is important for the module's proper operation.
- **User data group** - these cells do not keep any information which is used by the module's circuits. However, all of them are reserved from the manufacturer for storing of identification data.

Four columns are used to display a particular EEPROM cell:

- **Address** - shows the address of the cell in the EEPROM. MLX90601 is equipped with 128 EEPROM cells which occupy addresses from 0 to 0x7F (127).
- **Register** - shows the name of the cell. This is a convenient alias for the address.
- **Hex value** - shows the full contents of the cell, which resides in the EEPROM, including the Hamming code bits.
- **Source value** - shows the useful information kept by the cell, excluding the Hamming code bits.

The *Range rescaling* and *Calibrating* operate with and alter the contents of the module's EEPROM. However, they do not update the program's cache. In this case, some of the displayed cells are colored in blue, which means that they differ from the corresponding cells in the module's EEPROM. This is useful if you want to review the changes made by last operation. In this case, an [upload](#) operation transmits the program's cache to the module's EEPROM and undoes the changes.

The same coloring will occur after [loading](#) a file in the cache.

The EEPROM Table window allows resizing. Simply move the mouse cursor over any of the window's borders. The shape of the cursor must change to a "stretch" cursor. Now you can press left mouse button and drag the border to resize the window.

Note: the whole internal cache is invalidated if either the connection with the module cannot be established or the module is turned off.

Note: do not try to update the cache regularly with the *Download* button as the program keeps its consistency whenever it is needed.

Close button

Closes the EEPROM Table window.

Download button

Initiates an update of the internal EEPROM cache from the connected module's EEPROM. This functionality is duplicated by [Download](#) menu command.

See also:

[MLX90601 Configurator Windows](#), [EEPROM Table command](#), [Registers Table window](#)

Registers Table Window

This window dumps the contents of the module's internal registers. Each line of the table displays the value of one register in MLX90601. Three columns are used to display a particular item:

- **Address** - shows the address of the register.
- **Name** - shows the name of the internal register. This is a convenient alias for the address.
- **Value** - shows the value of the register. Can be either a decimal or a hexadecimal number according to the selection below the table. Some of the internal registers keep values which are altered dynamically in the module.

The Registers Table window allows resizing. Simply move the mouse cursor over any of the window's borders. The shape of the cursor must change to a "stretch" cursor. Now you can press left mouse button and drag the border to resize the window.

Note: not all of the MLX90601 internal registers are accessible for read.

Close button

Closes the Registers Table window.

Download button

Updates the display, retrieving the last values of the registers.

See also:

[MLX90601 Configurator Windows](#), [Registers Table command](#), [EEPROM Table window](#)

Log Window

This window dumps the logging output of the program. MLX90601 Configurator logs the *Range rescaling*, *Calibrating* and *Control measurements* operations. The same information can be output to a file too.

The Log window allows resizing. Simply move the mouse cursor over any of the window's borders. The shape of the cursor must change to a "stretch" cursor. Now you can press left mouse button and drag the border to resize the window.

Note: the Log window supports up to 2000 lines. In case of overflow, the information is lost in FIFO order.

Clear button

Deletes the contents of the window.

Close button

Closes the Log window.

See also:

[MLX90601 Configurator Windows](#), [Log command](#), [Logging page](#)

Dialog Boxes

[Preferences Dialog](#)

[Logging Page](#)

[Communication Page](#)

[Miscellaneous Page](#)

[Ambient rescale dialog](#)

[Object rescale dialog](#)

[Calibration settings dialog](#)

[Calibration dialog](#)

[Module output configuration dialog](#)

[Settings dialog](#)

[Monitor preferences dialog](#)



Preferences dialog

This dialog allows you to customize a variety of MLX90601 Configurator settings. The dialog features three configuration pages:

[Logging Page](#) This page allows you to edit the logging behavior of the program.

[Communication Page](#) This page allows setting up the connection with the module.

[Miscellaneous Page](#) This page provides some other options.

OK button

Closes the dialog and saves the preferences.

Cancel button

Closes the dialog discarding any changes you have made.

Apply button

Saves the preferences without closing the dialog.

Help button

Opens this help window.

See also:

[Preferences command](#), [Settings dialog](#)


Logging Page (Preferences Dialog)

This configuration page allows you to edit the logging settings:

Enable logging checkbox

Globally enables / disables the generation of log information.

Log To File group

If it is checked, MLX90601 Configurator stores its logging output in a disk file. You can specify the desired file name either by typing it manually or by choosing it through a standard Open dialog, pressing the **Browse** button .

Cumulative log checkbox

If it is not checked, MLX90601 Configurator truncates to zero length its log file while opening it. Otherwise, the log information accumulates and the log file grows up.

See also:

[Preferences Dialog](#), [Log Window](#)

Communication Page (Preferences Dialog)

This configuration page allows you to setup some of the parameters of the communication with the module:

Serial port group

You can choose the serial port (COM1 to COM4) which is connected with the SPI controller (Evaluation board). In addition, you can choose from three available baud rates - 38400 bps, 19200 bps or 9600 bps.

Note: default settings are **COM1** and **38400** bps.

SPI controller group

Here you can specify the ID number of the SPI controller you are using.

Note: Melexis MLX90601 Evaluation Board SPI controller responds with "07" to the command "ID". Change this setting only if instructed to do so, or the controller may not be recognized by the program.

See also:

[Preferences Dialog](#), [Reset command](#)

Miscellaneous Page (Preferences Dialog)

This configuration page allows you to edit miscellaneous options:

Temperature Units group

Here you can choose the preferred unit for the temperature displays.

Supply Voltage group

Here you can specify the voltage of the module's power supply.

Note: default value is **5V**. Choose **12V** only if you are sure this is the proper supply voltage for the module or else it may be damaged.

Automatically download EEPROM checkbox

If it is checked, the program updates its internal EEPROM cache when one of the following occurs:

- A successful connection with the module has been established. The [Reset](#) command reinitializes the communication. On success, this command downloads the EEPROM. The same procedure is executed during program startup.
- The module has been turned on successfully. See [Supply Voltage](#) section of the [Main Window](#) for more information.

Note: the whole internal cache is invalidated if either the connection with the module cannot be established or the module is turned off.

See also:

[Preferences Dialog](#), [EEPROM Table Window](#)



Ambient rescale dialog

This dialog allows you to rescale the range of the ambient temperature. The limits of the range cannot be exceeded, i.e. the lower limit may only be raised and the upper limit may only be lowered. This is a convenient substitution of the calibration process. Note that ambient range rescaling is automatically followed by an object range rescaling.

Rescaling operation reduces the precision of the module due to the rounding of the linearization constants, stored in EEPROM. Thus, avoid applying it multiple times on a single module.

The dialog features the following settings:

Current °t range group

Displays currently calibrated range of the ambient temperature. Ensure that these values match the module's currently calibrated ambient range, before starting any rescaling or else

New °t range group

Here you can specify new limits for the range of the ambient temperature. Note that the lower limit can only be raised and the upper limit can only be lowered.

Update global settings checkbox

If it is checked, global limits of the range of ambient temperature are updated with the values you have entered for this module. See [Settings dialog](#) for more information.

OK button

Validates the values and performs ambient rescaling. Then, if successful, closes the dialog. Otherwise the dialog remains active.

Note: actually, rescaling is performed only if you have altered any of the of limits. Otherwise, the dialog is just closed.

Cancel button

Closes the dialog, discarding any changes you have made.

Help button

Opens this help window.

See also:

[Rescale ambient range command](#), [Object rescale dialog](#)



Object rescale dialog

This dialog allows you to rescale the range of the object temperature. The limits of the range cannot be exceeded, i.e. the lower limit may only be raised and the upper limit may only be lowered. This is a convenient substitution of the calibration process.

Rescaling operation reduces the precision of the module due to the rounding of the linearization constants, stored in EEPROM. Thus, avoid applying it multiple times on a single module.

The dialog features the following settings:

Current °t range group

Displays currently calibrated range of the object temperature.

New °t range group

Here you can specify new limits for the range of the object temperature. Note that the lower limit can only be raised and the upper limit can only be lowered.

Update global settings checkbox

If it is checked, global limits of the range of object temperature are updated with the values you have entered for this module. See [Settings dialog](#) for more information.

Emissivity correction group

Here you can specify a real number to rescale the linearization constants. This can be useful if the emissivity of your object differs from the emissivity of the black body used for object calibration. A value of 1.0 means that emissivity should not be corrected.

OK button

Validates the values and performs object rescaling. Then, if successful, closes the dialog. Otherwise the dialog remains active.

Note: actually, rescaling is performed only if you have altered any of the of limits or the emissivity coefficient. Otherwise, the dialog is just closed.

Cancel button

Closes the dialog, discarding any changes you have made.

Help button

Opens this help window.

See also:

[Rescale object range command](#), [Ambient rescale dialog](#)



Calibration settings dialog

This dialog allows you to setup the object (also called IR) channel calibration. An [output configuration](#) should be performed before proceeding with calibration, to ensure proper results of the calculations. The dialog features the following settings:

To range, Ta range folders

The global ranges of the object and ambient temperature are listed here. These values will be used for calibration unless you change them. In this case you may check **Update settings** to update the global ranges when the dialog is closed. See [Settings dialog](#) for more information. Note that the ambient channel cannot be recalibrated, thus the *Ta range* folder must contain currently calibrated Tamin and Tamax.

Preferred ranges folder

Special preferred temperature intervals can be specified, where the best accuracy should be expected. This is at the cost of eventual decreasing of the accuracy for the rest part of the ranges. The corresponding folders must be unchecked if such intervals should not be used.

Calibration points folder

Here you can specify the temperatures of the black bodies to be used. A maximum of 7 calibration points can be used. They all must specify different temperatures. The order of the points is not important, as the program will always use them in decreasing temperature order, starting with the greatest one and finishing with the smallest one.

Other settings folder

MLX90601 Configurator is able to perform several measurements of each reference temperature and get the average values for better accuracy. The desired number of measurements per temperature has to be entered in the **Readings per meas** field.

Usually, the real *IR channel calibration* is preceded by an *IR gain calculation and configuration* step. MLX90601 Configurator performs some additional measurements and sets the optimal gain for the IR channel amplifier chain, according to the desired object temperature range. Note that the optimal gain depends on that range and has to be recalculated each time the range is changed. Therefore, **Automatic** IR gain configuration is recommended for using in most cases. The **Separate Step** IR gain configuration does the same with the difference that the gain configuration and the first reference temperature measurement are performed in separate steps. **Skip** IR gain configuration only if the gain has been previously set to the proper value, or else the module may not work correctly. The IR gain configuration is performed on the first reference temperature, thus it does not require an additional reference temperature.

MLX90601 has two multifunctional outputs - *IROUT* for the IR channel and *TOUT* for the ambient channel. They can be configured to bring out the corresponding temperature in the form of an analog voltage between 0V and an user specified value from 2V to 4.5V. Check any of the options in the *Analog output* section if you want to use these features for the associated output, then select the desired maximum output voltage. Uncheck both options if analog outputs will not be used.

Note: analog output features are not available if IR gain configuration is skipped.

Note: MLX90601 Configurator will not configure an output for an analog operation if it has been previously set to a PWM configuration.

The calibration process is maintained by the [Calibration dialog](#). Checking the *Hide this window* option hides the *Calibration settings dialog* as long as the *Calibration dialog* is active, thereby uncovering the [Log window](#).

Close button

Closes the dialog and updates the *global settings* if necessary.

Start calibration button

Opens the [Calibration dialog](#).

Help button

Opens this help window.

See also:

[Calibration command](#)

Calibration dialog

This dialog maintains the calibration process. A limited set of the [logging](#) messages is displayed in a window during calibration. The dialog features the following settings:

Step X: ... group

It is associated with the corresponding calibration step. The reference temperature of the step is displayed. It must be applied to the module for the step to be completed properly. The **Start** button executes the step. The red LED indicates that the step is in progress if it is lighted up. A blinking LED means that the program has determined this is the next step to be executed. See *Check module button* for more information.

Note: After the last calibration step has finished successfully, the IR channel of the module is calibrated and ready for work.

Check module / Turn off module button

Check module state of the button: if pressed, turns on the power for the connected module and reads the EEPROM, trying to determine which is the next calibration step to be executed. If successful, the red LED of the appropriate step starts blinking. Using this button is not necessary, if you are sure which step is to be the next.

Note: During the calibration, MLX90601 Configurator stores some verifying information in the module's EEPROM, where IR linearization constants are kept normally. This makes the IR channel not functional until the end of the calibration process.

Turn off module state of the button: if pressed, turns off the power for the connected module and darkens the blinking LED.

Close button

Closes the dialog and returns control to the [Calibration settings dialog](#).

See also:

[Calibration command](#)



Module output configuration dialog

This dialog provides an access to the output settings of the connected module. It features the following settings:

IRout Function group

Select an appropriate mode for the **IROUT** pin of the module:

- *Non-linearized analog output* - the pin is connected to the analog amplified IR sensor signal (analog output)
- *Linearized analog output* - pin's voltage is proportional to the linearized object temperature (analog output)
- *Comparator1 setpoint input* - this configuration configures **IROUT** as an input for an external potentiometer, which provides a reference voltage for Comparator1 (analog input)
- *PWM output* - the pin transmits current linearized object temperature in PWM format (digital output)

Note: MLX90601 Configurator will not allow switching from PWM to linearized analog output and vice versa.

Tempout Function group

Select an appropriate mode for the **TEMPOUT** pin of the module:

- *Non-linearized analog output* - the pin is connected to the analog amplified temperature sensor signal (analog output)
- *Linearized analog output* - pin's voltage is proportional to the linearized ambient temperature (analog output)
- *Comparator2 output* - the pin is connected to the output of Comparator2 (digital output)
- *PWM output* - the pin transmits current linearized ambient temperature in PWM format (digital output)

Note: MLX90601 Configurator will not allow switching from PWM to linearized analog output and vice versa.

Comparator1 Setup (Rel pin) group

Configures Comparator1 function.

Comparator2 Setup group

Configures Comparator2 function.

Threshold / Hysteresis fields (both comparators)

Here you can specify an active temperature range for each comparator. Both values are in temperature degrees, not EEPROM LSBs - MLX90601 Configurator does the calculations for you. The value of the hysteresis represents the half of the interval.

Example:

We have **threshold = 30 °C** and **hysteresis = 5 °C**. Hence the comparator will turn its state at **25 °C** and **35 °C** respectively.

Note: the whole temperature interval [Thr - Hyst; Thr + Hyst] must lie within the corresponding

temperature range. Current calibrated temperature ranges have to be specified in [Settings dialog](#) before opening Module configuration dialog.

Note: navigate to [Miscellaneous page](#) to specify your preferable temperature units before opening Module configuration dialog.

Low pass filters group

Select the desired number of averaged points for measurement and averaged offset measurements for each channel.

OK button

Updates the module's EEPROM and closes the dialog. If an error occurs, an error message will be displayed and the dialog will be closed.

Cancel button

Closes the dialog and discards any changes you have made.

Help button

Opens this help window.

See also:

[Configure output command](#)

Control measurements dialog

This dialog allows measuring with the module. In fact, MLX90601 Configurator initiates internal module measurements and reads a subset of the module's internal registers. The results can be stored in a separate file as well as sent to the standard logging output of the program.

The dialog features the following controls:

Collect group

Here you can specify the data of interest. Six of the module's registers can be observed directly. In addition, current T_o and / or T_a will be calculated if you collect the values of IROUT and / or TOUT registers respectively. Global temperature ranges should be adjusted before starting of the measurements, on order to obtain the correct temperature values from these registers. Time stamps can be included in the results too. These values represent the time, in milliseconds, that has elapsed since the beginning of the first measurement.

Repetitive measurements group

Check this group to perform a set of measurements. Specify the number of the measurements as well as the period between two measurements, which can be a real number. If the period is zero, then each measurement follows immediately after the previous one.

Note: currently a full measurement cycle (all registers) takes approximately 1.5s, so specifying a less period is equivalent to a zero period.

Output group

Here you can specify where the results should be sent:

- To the program's standard logging output if *Standard logging* is checked. See [Logging page](#) for more information.
- To a separate file. This is not the file used for standard logging.

Therefore the program allows the results of the measurements to be sent to three destinations at the same time - the [Log window](#), the log file and a separate file.

Measure group

Use the *Start* button to begin measuring. It can be canceled at any time by pressing the *Stop* button.

Close button

Closes the dialog.

Help button

Opens this help window.

See also:

[Control measurements command](#)



Settings dialog

This dialog allows editing of the object and ambient temperature ranges. This information is used by [Monitor window](#), [Ambient rescale dialog](#), [Object rescale dialog](#) and [Output configuration dialog](#). The ranges can be updated automatically by [Ambient rescale dialog](#), [Object rescale dialog](#) and [Calibration settings dialog](#).

The dialog features the following controls:

Object group

Allows changing the range of the object (IR channel) temperature. You can specify convenient temperature units in [Miscellaneous page](#) of the [Preferences dialog](#).

Ambient group

Allows changing the range of the ambient temperature. You can specify convenient temperature units in *Miscellaneous page* of the *Preferences dialog*.

OK button

Closes the dialog and saves the settings.

Cancel button

Closes the dialog and discards any changes you have made.

Help button

Opens this help window.

See also:

[Settings command](#)



Monitor preferences dialog

This dialog allows setting up of the [Temperature monitor window](#). It features the following settings:

Filter lengths group

Specify the length of the monitoring filter (1 to 128) for each channel.

Reading rate (readings / second) group

Specify the desired frequency (1 to 10) for polling the module's temperatures. Applies to both channels.

Rounding group

Choose an appropriate rounding for the temperatures:

- **1 unit** - rounds the value to the nearest whole number
- **0.5 units** - rounds the value to the nearest whole number or half of a number
- **0.1 units** - rounds the value to nearest tenth of a number

Applies to both channels.

OK button

Closes the dialog and saves the preferences.

Cancel button

Closes the dialog and discards any changes you have made.

Apply button

Saves the preferences without closing the dialog.

Help button

Opens this help window.

How to calibrate the object (IR) channel

Warning

It is recommended to save the module's EEPROM in file when inserting it for the first time. This is an useful backup if you wish to return to the factory calibrated settings. Open **File** menu, then select [Save as...](#) option and specify the desired file name when prompted. The *Save as...* command has a shortcut - **F3**.

Note: each EEPROM saving requires a separate file, thus if you select the same file multiple times, the previous information will be lost.

Perform an IR channel calibration

1. Open *Module menu*, then select [Calibration](#) option. The [Calibration settings](#) dialog appears.
2. Specify the desired object temperature range in *To range* folder.
3. Specify currently calibrated range of the ambient channel in *Ta range* folder.
3. Specify temperature intervals where the best accuracy is needed in *Preferred ranges* folder. The program will try to calculate the linearization constants in a way that ensures better accuracy for temperatures inside the preferred ranges. Uncheck the corresponding group if the preferred range should not be specified.
5. Specify the temperatures of the black bodies in *Calibration points* folder. A maximum of 7 calibration points can be used. The order of the points is not important, as the program will always use them in decreasing temperature order.
6. Ensure that an *Automatic* IR gain configuration is selected.
7. Setup the analog outputs - select the pins and the maximum voltage. The output voltage for analog output is always scaled to *To* max. For example, we have calibrated a module with *To* range from -20 °C to 120 °C and an analog output of 4.5V. We will have then 4.5V on *IRout* pin if *To* is 120 °C and 0V if *To* is -20 °C. Uncheck both pins if analog outputs will not be used.
8. Fill in *Readings per meas* field with a number greater than 1 and usually less than 20. The greater number is specified, the better accuracy is achieved, but calibration time increases.
9. Press *Start calibration* button. The [Calibration](#) dialog appears.
10. Begin execution of the calibration steps. Apply the required object temperature (put the sensor in front of the corresponding black body) before pressing the *Start* button. If you want to calibrate more than one module, you should apply the appropriate step on all the modules before proceeding with the next step. **Note: replace modules only if the power supply is turned off.** The program turns off the power supply automatically when the calibration step completes (the red LED darkens).
11. A module is fully calibrated and ready for work if it has passed successfully all the calibration steps.
12. Close the *Calibration* dialog by pressing the *Close* button.
13. Ensure that *Update settings* option of the *Calibration settings* dialog is checked.
14. Close the *Calibration settings* dialog by pressing the *Close* button.
15. Now you can verify the results of the calibration. **Note: replace modules only if the power supply is turned off.** Use [Supply voltage](#) panel of the program's main window to manipulate the power for the connected module.

How to change object temperature range

Two situations are possible:

1. The desired new temp range lies entirely in current temp range **and** the module has a calibrated IR channel. You should perform an [Object temperature range rescaling](#), which is faster and easier than [IR channel calibration](#), but leads to a little decreasing of the module's precision. So, do not apply multiple range rescalings on a single module.
2. The above conditions are not met. Only [IR channel calibration](#) can be performed in this case.

How to change ambient temperature range

You can only raise the lower limit of the range and/or lower the upper limit of the range by performing an [Ambient temperature range rescaling](#). It leads to a little decreasing of the module's precision, similarly to the [Object temperature range rescaling](#). So, do not apply multiple range rescalings on a single module.

How to rescale object temperature range

Warning

It is recommended to save the module's EEPROM in file when inserting it for the first time. This is an useful backup if you wish to return to the factory calibrated settings. Open **File** menu, then select [Save as...](#) option and specify the desired file name when prompted. The Save as... command has a shortcut - **F3**.

Note: each EEPROM saving requires a separate file, thus if you select the same file multiple times, the previous information will be lost.

Ensure that Global settings contain current calibrated module's ranges

Open *Configuration menu*, then select [Settings](#) option. The [Settings](#) dialog appears, allowing you to edit the ranges if it is necessary.

Perform object rescaling

Open *Module menu*, then select [Rescale object range](#) option. The [Rescale object temperature range](#) dialog appears. Specify the desired new limits of the object temperature. Ensure that [Update global settings](#) option is checked if you are not planning to rescale more modules of the same type. Specify an emissivity correction coefficient if necessary, otherwise leave the default value of 1. Press OK and wait for the function to be completed. On success, the dialog will be closed with no further messages, otherwise an error message will be displayed and the dialog will remain active.

See also:

[How to rescale ambient temperature range](#), [How to change the emissivity](#)

How to rescale ambient temperature range

Warning

It is recommended to save the module's EEPROM in file when inserting it for the first time. This is an useful backup if you wish to return to the factory calibrated settings. Open **File** menu, then select [Save as...](#) option and specify the desired file name when prompted. The Save as... command has a shortcut - **F3**.

Note: each EEPROM saving requires a separate file, thus if you select the same file multiple times, the previous information will be lost.

Ensure that Global settings contain current calibrated module's ranges

Open *Configuration menu*, then select [Settings](#) option. The [Settings](#) dialog appears, allowing you to edit the ranges if it is necessary.

Perform ambient rescaling

Open *Module menu*, then select [Rescale ambient range](#) option. The [Rescale ambient temperature range](#) dialog appears. Specify the desired new limits of the ambient temperature. Ensure that [Update global settings](#) option is checked if you are not planning to rescale more modules of the same type. Press OK and wait for the function to be completed. On success, the dialog will be closed with no further messages, otherwise an error message will be displayed and the dialog will remain active.

See also:

[How to rescale object temperature range](#)

How to change the emissivity

Warning

It is recommended to save the module's EEPROM in file when inserting it for the first time. This is an useful backup if you wish to return to the factory calibrated settings. Open **File** menu, then select [Save as...](#) option and specify the desired file name when prompted. The Save as... command has a shortcut - **F3**.

Note: each EEPROM saving requires a separate file, thus if you select the same file multiple times, the previous information will be lost.

Ensure that Global settings contain current calibrated module's ranges

Open *Configuration menu*, then select [Settings](#) option. The [Settings](#) dialog appears, allowing you to edit the ranges if it is necessary.

Before you start

If you are planning also to change the limits of object temperature range, please refer to [How to rescale object temperature range](#) topic.

Perform object rescaling

Open *Module menu*, then select [Rescale object range](#) option. The [Rescale object temperature range](#) dialog appears. Do not alter any of the new t° range fields. Specify the emissivity correction coefficient. Press OK and wait for the function to be completed. On success, the dialog will be closed with no further messages, otherwise an error message will be displayed and the dialog will remain active.

How to change output configuration

Warning

It is recommended to save the module's EEPROM in file when inserting it for the first time. This is an useful backup if you wish to return to the factory calibrated settings. Open **File** menu, then select [Save as...](#) option and specify the desired file name when prompted. The Save as... command has a shortcut - **F3**.

Note: each EEPROM saving requires a separate file, thus if you select the same file multiple times, the previous information will be lost.

Choose the desired output (PWM, Analog, ...)

Open the [Module output configuration](#) dialog (*Module menu -> Configure output*). Choose the desired output type in *IRout* (or *Tout* respectively) *Function* group. Press OK and wait for the function to be completed. On success, the dialog will be closed with no further messages, otherwise an error message will be displayed before the dialog disappears.

Note: MLX90601 Configurator will not allow switching from PWM to linearized analog output and vice versa.

Comparators setup

Both comparators work independently from one another, even they both can use the same source - object or ambient temperature. In the *Threshold* field you must specify a value which is the middle point of the comparator's hysteresis temperature interval and the half of this interval is entered in the *Hysteresis* field.

For example:

We have entered a **threshold = 70 °C** and a **hysteresis = 2 °C**. Hence the comparator will turn its state at **68 °C** and **72 °C** respectively.

Note: the whole temperature interval [*Thr - Hyst*; *Thr + Hyst*] must lie within the corresponding temperature range. Current calibrated temperature ranges have to be specified in [Settings dialog](#) before opening Module configuration dialog.

Note: navigate to [Miscellaneous page](#) to specify your preferable temperature units before opening Module configuration dialog.

Low pass filters setup

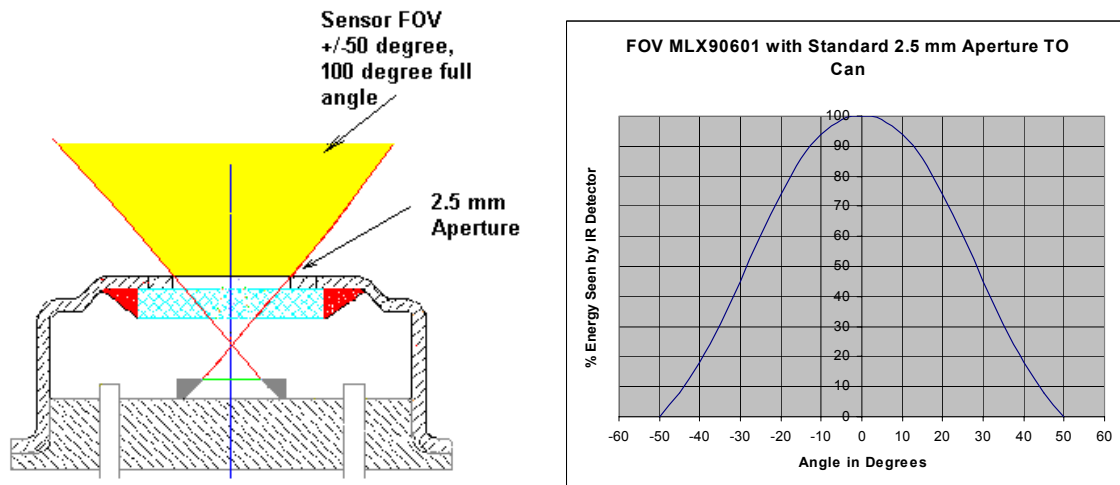
Specify the desired number of averaged points for IR and Temp measurement. There are 5 choices from 64 to 1024.

Select the desired number of averaged offset measurements for IR and Temp chain. There are 2 choices - 512 or 1024.

Changing the “FIELD OF VIEW” OF THE MLX90601

Standard FOV (field of view)

The standard FOV (field of view) of the MLX90601 IR module is as shown here:



What this means is that if you want the highest possible accuracy, you need to make sure your target fills the +/-50 deg angle seen by the sensor.

Minimum Resolution (approx.): 0.025 deg C at 25 C target temperature

(Minimum Resolution is achieved with the “low pass filter” inside the MLX90601 processor set at maximum filtering. This is the standard factory setting. This results in approximately 600 ms response time. The resolution can be further improved by additional filtering by an external processor if the MLX90601 is connected by SPI bus to a low cost micro-controller. Of course, the response time increases when this technique is used. The filter setting is accessible by using the EVB90601 kit.)

CHANGING THE FOV OF THE MLX90601 USING SIMPLE APERTURES

(Note: The Melexis part # EVB90601 is necessary when adding an aperture to a standard MLX90601.

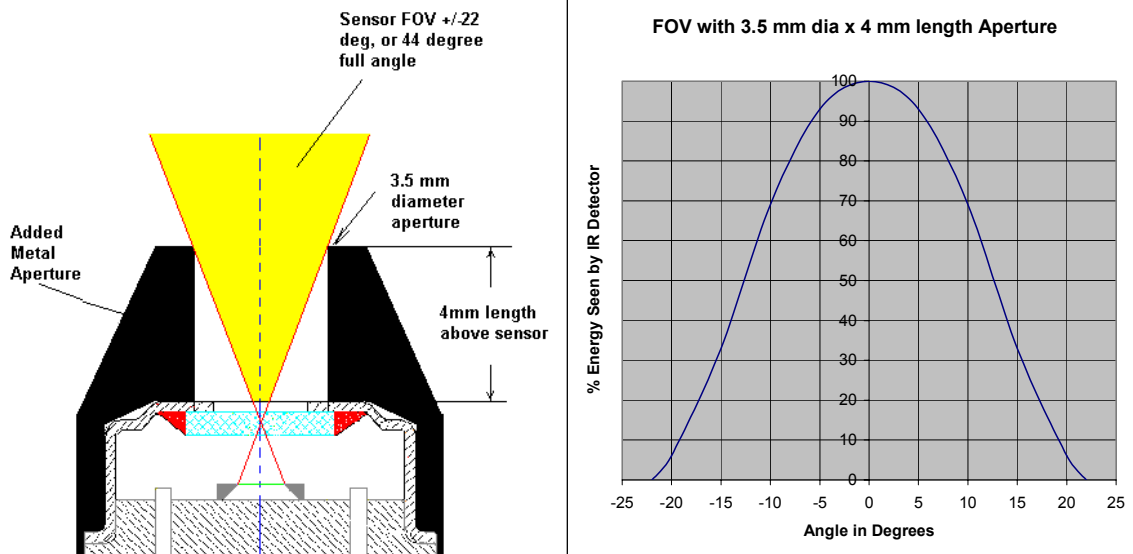
Normally, a one point IR re-calibration must be performed to adapt the aperture.)

The digital signal processing of the MLX90601 allows for easy modifications to customize the module for many applications at minimal engineering and manufacturing cost.

- The aperture must be mounted directly onto the thermopile sensor of the MLX90601, and epoxied into place.
- They must be thermally connected, with the assembly staying isothermal under your desired operating conditions.
- The aperture must be a high thermal conductance metal.
- The internal aperture must be blackened, or coated to eliminate internal reflections.
- The internal aperture can be threaded to further eliminate reflections.
- Black anodized aluminum with internal sharp threads makes a very good aperture assembly.
- Reducing the FOV of the sensor reduces the base level temperature resolution of the module. (When an aperture is added, the amount of energy seen by the detector is reduced. As a result, the basic voltage output of the detector is reduced.)

Example 1: Adding 3.5 mm x 4 mm Aperture

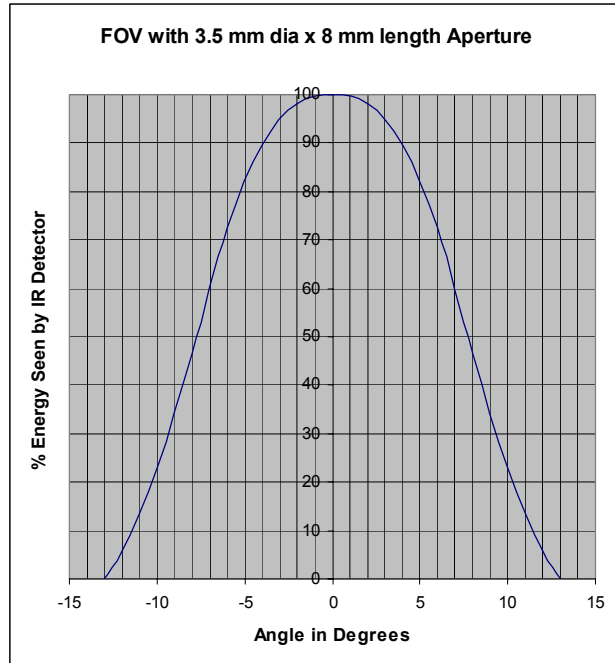
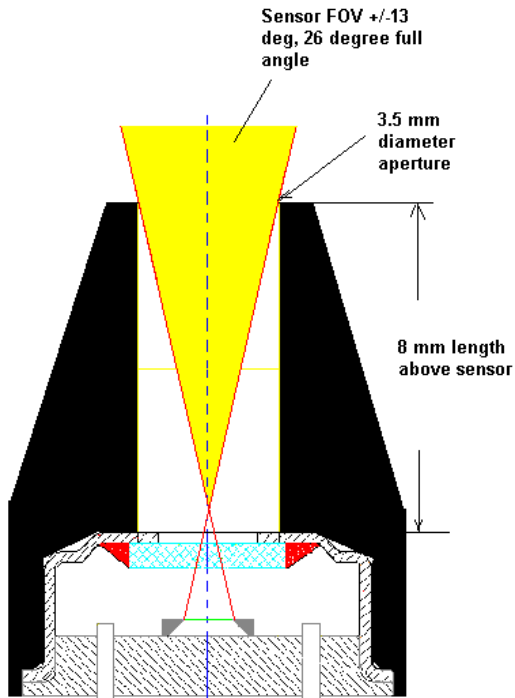
The following shows the optical effect of adding an aperture device with a 3.5 mm diameter hole, by 4 mm length above the top of the sensor.



As you can see, this simple aperture has reduced the FOV quite considerably.

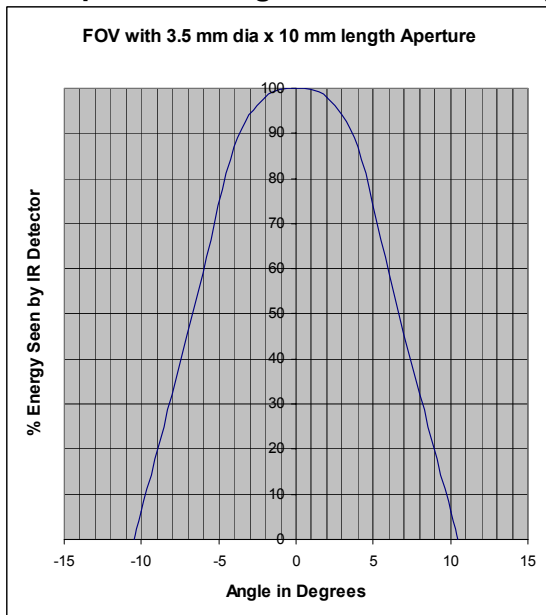
Minimum Resolution (approx.): 0.04 deg C at 25 C target temperature

Example 2: Adding 3.5 mm x 8 mm Aperture



Minimum Resolution (approx.): 0.13 deg C at 25 C target temperature

Example 3: Adding 3.5 mm x 10 mm Aperture

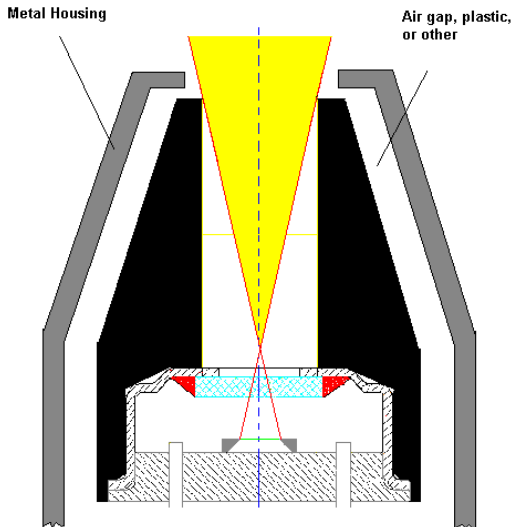


Minimum Resolution (approx.): 0.18 deg C at 25 C target temperature

Additional Suggestions:

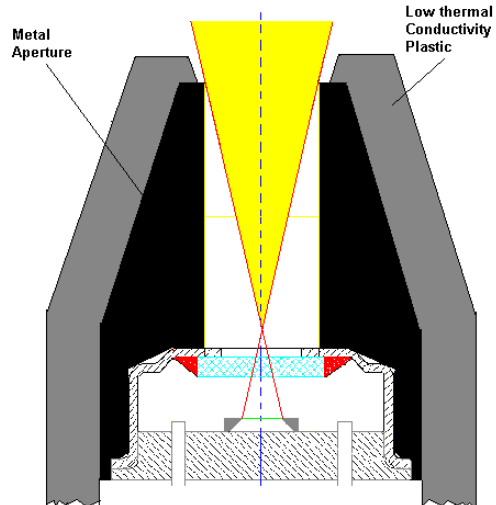
Using a Metal Housing

If you need an external metal housing for your application, it is absolutely necessary to have an insulation layer between your outer housing and the internal aperture device. The internal aperture must remain isothermal under all your operating conditions. If not, errors will be induced.

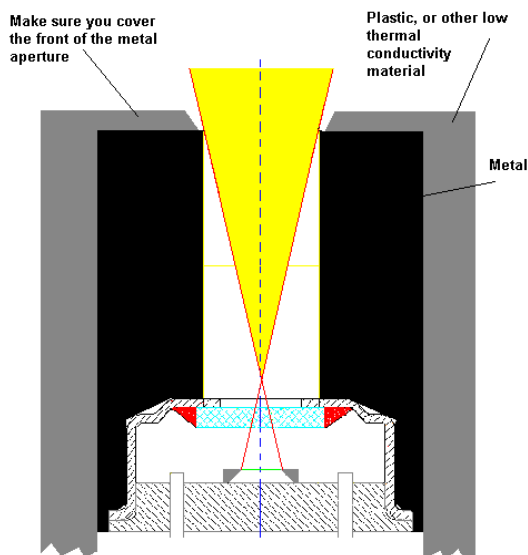


Plastic Housing With Aperture

For applications where a plastic housing is acceptable, please choose a "low thermal conductivity" plastic. Select enough thickness so that any expected temperature shocks applied to the outside of the assembly will not disturb the isothermal state of the inner metal aperture assembly.



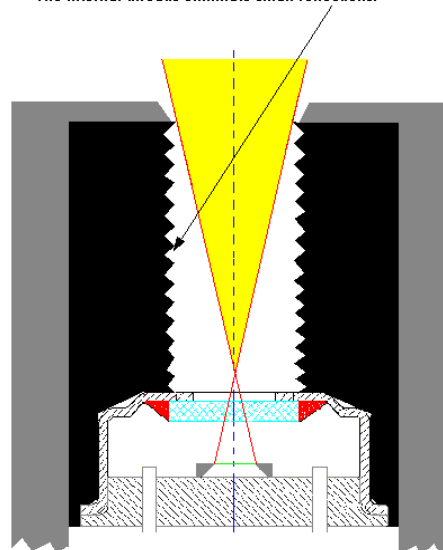
If you use a low cost straight cylinder optic scheme....



For best results, use sharp threads inside the aperture combined with a blackening.

Black anodized Aluminum with threads is a good choice

The internal threads eliminate small reflections.



For high volume OEMs (minimum 50K/year units), Melexis can supply the MLX90601 with OEM specified apertures or optical systems installed and calibrated. Please contact Melexis for a quotation.

For lower volume OEMs, Melexis can provide assistance for customer installation and configuration of optical assemblies.

Notes:

1. Please note that the “Minimum Resolution” of the MLX90601 is affected as the FOV is made narrow by apertures. This is due to the reduced amount of energy entering the detector with the limits of the amplifiers inside the MLX90313 chip. The resolution can be improved for narrow FOVs by adding “focusing” optical assemblies. Please contact Melexis for OEM design assistance on this topic. Focusing optics should be used only when aperture optics are truly inadequate for a desired application. Focusing optics add complexity, and additional engineering and parts costs.
2. For high temperature applications, the FOV can be made very narrow using only apertures. High temperature targets emit substantial IR energy. The relative high amount of IR energy supplies plenty of energy to drive the thermopile detector. For example, just using apertures to make a FOV of 2.9 degrees full angle, on a 500 C target can deliver approx. 0.5 deg C resolution with the MLX90601. An FOV of 2.9 degrees full angle is a 20:1 Distance to Spot size ratio (distance of 1 meter, spot size of 5 cm). That is a fairly sharp FOV. Please contact Melexis for further OEM design assistance, if necessary.
3. Aperture, and thus FOV, spot geometry does not have to be “round”. The target spot area can be made square, rectangular, wide, thin, etc. Much of this can be done with simple apertures to achieve design goals. Please contact Melexis for assistance in this area.
4. The engineering trick, in adding any optical assembly, is to make sure that the entire optical assembly remains isothermal (one temperature, no gradients from front to back) in the application that is intended. In applications where the ambient can change quickly, or an operator can touch the assembly, it is best to insulate the metal heat sink sufficiently to overcome any normal potential thermal upsets. Please contact Melexis IR Sales for assistance if needed.

Appendix A: Troubleshooting guide

Problem	Possible solutions
The software won't install from the internet.	The file can get corrupted during download from the internet. Try saving the install file to your local hard drive before opening it. Use the option 'save file to disk' when clicking the file using a browser.
The software does not complete installation when upgrading or reinstalling the software.	Always delete a prior version of the software before installing the newest version. Manually delete the program folder where a previous installation is located. By default this will be in C:\Program Files\Melexis\90313 Configurator\. Then try again installing the new software. Call the Technical support.
The Monitor window gives random results.	The module is not connected properly to the Configuration Board. Connect the module. Check the flat cable between the module and the board.
By accident, I have overwritten the module eeprom. Can I restore the original contents ?	No, unless you have made a backup copy of your original EEPROM data. If you don't have a copy, you should contact the technical support.

Appendix B: Hardware and Firmware Manual

Hardware User's Manual

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Revision 1.0

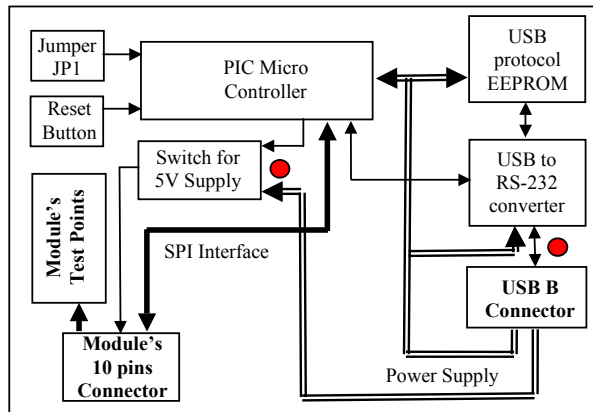
05-NOV-2003

Overview

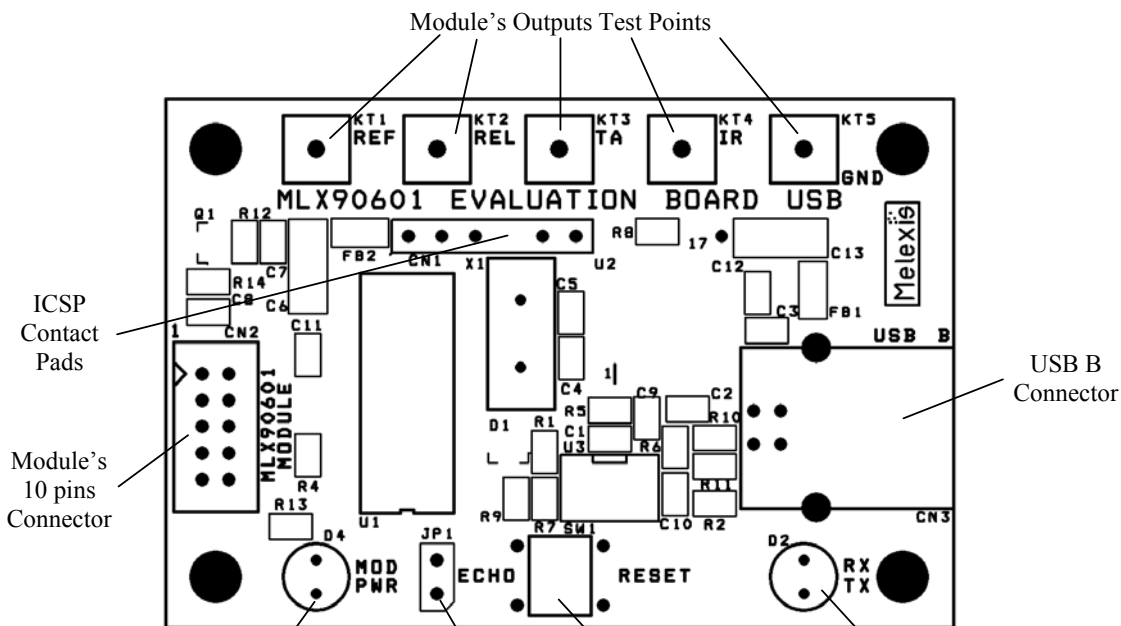
The MLX90601 USB evaluation board (EVB) provides virtual serial communication interface between a PC and a single MLX90601 module. Physically, the EVB is connected to the PC's USB connector and uses the PC's built-in USB interface. The PC application software can access the MLX90601 module as a virtual RS-232 serial device by using of the Virtual COM Port Drivers for the respective operating system (see the Appendix B).

This EVB does not require any external power supply because it is entirely supplied by the USB bus. The board itself provides the necessary power supply to the attached MLX90601 module.

The block diagram of the MLX90601 USB evaluation board is provided below:

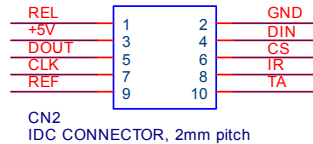


The external view of the EVB is the following:



Connectors

The MLX90601 is connected to the EVB's 10-pin IDC connector (CN2):

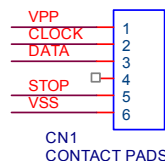


The DIN, DOUT, CLK and CS signals form the communication SPI interface of the module's ASIC. These signals can be used for reading from and writing to the ASIC's internal registers and its built-in configuration EEPROM.

The IR, TA, REL and REF signals are the module's output signals which can have different meaning depending on the actual configuration. These signals could be easily accessed on the EVB, at the respective test points (KT1÷KT5).

The +5V is the module's supply voltage, which is not permanently applied to the module. The supply ON and OFF states are controlled by the software and are indicated by the LED D4.

The connector CN1 is an optional In-Circuit Serial Programming (ICSP) connector for (re)programming of the microcontroller's firmware. The connector does not exist as a physical component. However, the pinout of the contact pads is the following:



During the optional in-circuit serial (re)programming the STOP signal must be connected to the VSS signal.

The USB B Connector (CN3) is with a standard pinout, so it is compatible with the general-purpose USB A to USB B computer cables that can be found in any PC store.

Jumpers Settings

The jumper JP1 (ECHO) determines the ECHO mode – NO ECHO (open) or ECHO (closed).

Principle of Operation

The MLX90601 evaluation board acts as an interface between a MLX90601 module and the PC. It allows performing of all basic read/write operation with the module's internal registers or EEPROM. It also provides several test points with the important module's output signals.

The microcontroller (U1) PIC18F252 (Microchip) is used to convert the PC application software commands to the module's SPI commands and to return the module's replies back to the PC software. The microcontroller uses its built-in UART port for communication with the PC.

The USB to UART conversion is accomplished by the FT232BM (FTDI Chip) IC (U2). From the PC application software point of view the USB to UART converter IC remain invisible; the EVB is accessed as a standard RS-232 device, while the physical media is the USB interface.

The corresponding Virtual COM Port Drivers provided by FTDI Chip (available for most of the existing operating systems) must be previously installed (see the Appendix B).

The data written in the external EEPROM 93C46 (U3) is used to customize the USB VID, PID, Serial Number, Product Description String and Power Descriptor value of the FT232BM. This data during the USB link establishment and it is not used by the EVB's microcontroller.

The LED D2 indicates the data transfer (receive and transmit) via USB.

User interface

Initially, the symbols sent to the EVB via the virtual RS-232 are echoed if the jumper JP1 ('ECHO') is shorted and NOT echoed if the jumper JP1 is open. Further, during the normal operation the echoing could be enabled or disabled by the software.

The ECHO mode is convenient for manual operations, when a standard terminal emulation program is used to type different commands to the evaluation board. If the EVB is to be used with dedicated PC application software to configure, calibrate or recalibrate the module, then the NO ECHO mode could be preferred.

The settings of the PC virtual serial RS-232 port must be the following:

Baud rate: 115200

Data bits: 8

Parity: None

Stop bit: 1

Flow control: None

All the commands supplied from the PC to the EVB are text (ASCII) statements ending with a carriage return symbol (CR). The syntax is the following (1 command and up to 4 arguments):

```
command [argument1] [argument2] [argument3] [argument4] <CR>
```


The commands are 2-character alphanumeric strings. The arguments are 1-byte (0-255), alphanumeric strings in HEX radix. Additional special symbols such as space intervals, commas, dots, etc. can be placed between the command and arguments in order to make the statements more readable and understandable. The only restriction is one statement to be not longer than 30 bytes (characters). The commands and arguments are 2 characters long. The leading zeros of arguments are also required. For example the argument '0x0B', should be written as '0B'. If the zero is missed and it is entered as 'B', the firmware will accept it as 'B0'. All missing arguments are accepted as '00'. For example the command 'rd 00 00' can be shortened to 'rd'. But the command 'wr 00 0A 0B' CANNOT be entered as 'wr 0A 0B', because, in this case, it will be recognized as 'wr 0A 0B 00'.

If the arguments passed to some command are not sufficient (for example the command needs 3 arguments, but only 2 are supplied), 0x00 replaces the missing arguments. If the arguments passed to some command are more than required, only the necessary arguments are considered. The rest of them are just skipped.

The interface is NOT case sensitive! The entered commands and arguments could be either lower or upper case.

If the commands are typed manually (using any standard terminal emulation program) and a typing mistake is encountered, the entire command statement can be removed by pressing the ESC button. The last typed symbols could be removed also by pressing the BACKSPACE button.

The commands are passed for processing after sending of the <CR> symbol (ENTER button).

All the returned values by the EVB are also in text format (ASCII symbols) and can be read by any standard terminal emulation program. The numbers returned are in HEX radix.

Commands List

The EVB recognizes the following commands:

1. Reading the micro-controller registers. This also includes the special purpose registers and micro-controller ports. The microcontroller PIC18F252 uses 12 bits to address its data memory and special function registers

Syntax:

rd *address MS byte* *address LS byte*
command argument 1, HEX byte argument 2, HEX byte argument 3, HEX byte argument 4, HEX byte

Return Value:

One HEX byte (2 chars) with the contents of the specified register<CR>.

Example:

rd 0FF5

2. Writing to the micro-controller registers. This also includes the special purpose registers and micro-controller ports. The microcontroller PIC18F252 uses 12 bits to address its data memory and special function registers

Syntax:

wr	<i>address MS byte</i>	<i>address LS byte</i>	<i>value</i>	
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

None.

Example:

wr 0FF5 14

3. PCB identification. The ID number of MLX90601 USB Evaluation Board is 0x0C. But to keep the compatibility with any older application software, when the id command is issued without arguments (i.e. all of them are 0x00) the MLX90601 USB EVB will return an ID 0x07 as the previous version EVB. When a non-zero first argument is sent, then the EVB will reply with 0x0C.

Syntax:

id	<i>extended</i>			
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

in compatible mode:

07 <CR> (default, when *extended* is equal to 0x00)

or

0c <CR> (if the *extended* is different than 0x00)

Example:

id

or

id 01

4. Software reset. This command resets entirely the EVB's microcontroller, and re-initializes its memory and registers. It is equal to the hardware reset, performed by the reset button.

Syntax:

rs
command *argument 1, HEX byte* *argument 2, HEX byte* *argument 3, HEX byte* *argument 4, HEX byte*

Return Value:

None.

Example:

rs

5. Welcome message. Returns a text description of the PCB function, firmware version and release date.

Syntax:

wl
command *argument 1, HEX byte* *argument 2, HEX byte* *argument 3, HEX byte* *argument 4, HEX byte*

Return Value:

<CR>
90601 MLX Evaluation Board USB <CR>
Version 1.07, 21-OCT-2003<CR>
Melexis BG<CR>

Example:

wl

6. Modules' supply voltage. Depending on the 'source' value, this command switches the power supply ON or OFF:

- Source = 0x01 or Source = 0x02 – Connects +5V supply to the module
- Source ≠ 0x01 and Source ≠ 0x02 – Disconnects the supply from the module.

Syntax:

sv *source*
command *argument 1, HEX byte* *argument 2, HEX byte* *argument 3, HEX byte* *argument 4, HEX byte*

Return Value:

None.

Example:

```
sv 01
```

7. Reading the contents of module's ASIC EEPROM. The supplied address is 8 bits. The result is 16 bits.

Syntax:

```
m1      address
command  argument 1, HEX byte    argument 2, HEX byte    argument 3, HEX byte    argument 4, HEX byte
```

OR

```
re      address
command  argument 1, HEX byte    argument 2, HEX byte    argument 3, HEX byte    argument 4, HEX byte
```

Return Value:

Two HEX bytes (4 chars) with the contents of the specified EEPROM address<CR>.

Example:

```
m1 00
```

8. Reading the contents of module's ASIC internal registers. The supplied address is 8 bits. The result is 16 bits.

Syntax:

```
m2      address
command  argument 1, HEX byte    argument 2, HEX byte    argument 3, HEX byte    argument 4, HEX byte
```

OR

```
rr      address
command  argument 1, HEX byte    argument 2, HEX byte    argument 3, HEX byte    argument 4, HEX byte
```

Return Value:

Two HEX bytes (4chars) with the contents of the specified internal register address<CR>.

Example:

```
m2 00
```

9. Writing to the module's ASIC internal registers at the specified address. The supplied address is 8 bits. The data is 16 bits.

Syntax:

m3	<i>address</i>	<i>data MS byte</i>	<i>data LS byte</i>	
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

OR

rw	<i>address</i>	<i>data MS byte</i>	<i>data LS byte</i>	
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

None.

Example:

m3 10 B2 00

10. Writing to the module's ASIC EEPROM at the specified address. The supplied address is 8 bits. The data is 16 bits.

Note! The ASIC's EEPROM is normally locked. To unlock it, two additional commands should be issued, after applying the power supply and before attempting to write into the EEPROM:

- 1.) m3 10 B2 00 – to enter the test mode
- 2.) m3 18 00 65 – to remove the EEPROM write protect.

Note! The ASIC's EEPROM should be erased before writing. To do this, one of the following commands should be performed after unlocking the EEPROM and before the writing process:

- m6 *address* – to erase the EEPROM at the specified address, or
- m7 – to erase the entire EEPROM.

Syntax:

m4	<i>address</i>	<i>data MS byte</i>	<i>data LS byte</i>	
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

OR

we	<i>address</i>	<i>data MS byte</i>	<i>data LS byte</i>	
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

None.

Example:

m4 00 02 C3

11. Block writing to the ASIC's EEPROM. The address is not required because this command fills the entire EEPROM with the provided data (16 bits).

Note! The ASIC's EEPROM is normally locked. To unlock it, two additional commands should be performed, after applying the power supply and before attempting to write into the EEPROM:

- 1.) m3 10 B2 00 – to enter the test mode
- 2.) m3 18 00 65 – to remove the EEPROM write protect.

Note! The ASIC's EEPROM should be erased before writing. To do this, one of the following commands should be performed after unlocking the EEPROM and before the writing process:

- m6 *address* – to erase the EEPROM at the specified address (this command should be cycled over the all addresses), or
- m7 – to erase the entire EEPROM.

Syntax:

```
m5      data MS byte  data LS byte
command      argument 1, HEX byte  argument 2, HEX byte  argument 3, HEX byte  argument 4, HEX byte
```

OR

```
bw      data MS byte  data LS byte
command      argument 1, HEX byte  argument 2, HEX byte  argument 3, HEX byte  argument 4, HEX byte
```

Return Value:

None.

Example:

```
m5 02 C3
```

12. Erasing to the ASIC's EEPROM at the specified address. The supplied address is 8 bits. No data is required.

Note! The ASIC's EEPROM is normally locked. To unlock it, two additional commands should be performed, after applying the power supply and before attempting to write into the EEPROM:

- 1.) m3 10 B2 00 – to enter the test mode
- 2.) m3 18 00 65 – to remove the EEPROM write protect.

Syntax:

```
m6      address
```

<i>command</i>	<i>argument 1, HEX byte</i>	<i>argument 2, HEX byte</i>	<i>argument 3, HEX byte</i>	<i>argument 4, HEX byte</i>
or				
ee	<i>address</i>			
<i>command</i>	<i>argument 1, HEX byte</i>	<i>argument 2, HEX byte</i>	<i>argument 3, HEX byte</i>	<i>argument 4, HEX byte</i>

Return Value:

None.

Example:

m6 00

13. Block erasing to the ASIC's EEPROM. The address and data are not required because this command erases the entire ASIC's EEPROM.

Note! The ASIC's EEPROM is normally locked. To unlock it, two additional commands should be performed, after applying the power supply and before attempting to write into the EEPROM:

- 1.) m3 10 B2 00 – to enter the test mode
- 2.) m3 18 00 65 – to remove the EEPROM write protect.

Syntax:

m7				
<i>command</i>	<i>argument 1, HEX byte</i>	<i>argument 2, HEX byte</i>	<i>argument 3, HEX byte</i>	<i>argument 4, HEX byte</i>
or				
be	<i>address</i>			
<i>command</i>	<i>argument 1, HEX byte</i>	<i>argument 2, HEX byte</i>	<i>argument 3, HEX byte</i>	<i>argument 4, HEX byte</i>

Return Value:

None.

Example:

m7

14. Reading the contents of microcontroller's EEPROM address. The supplied address is 8 bits. The result is 8 bits.

Syntax:

er	<i>address</i>			
<i>command</i>	<i>argument 1, HEX byte</i>	<i>argument 2, HEX byte</i>	<i>argument 3, HEX byte</i>	<i>argument 4, HEX byte</i>

Return Value:

One HEX byte (2 chars) with the contents of the specified EEPROM address<CR>.

Example:

```
er 02
```

15. Writing to the microcontroller's EEPROM at the specified address. The supplied address is 8 bits. The data is 8 bits.

Syntax:

ew	<i>address</i>	<i>data</i>		
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

None.

Example:

```
ew 02 C3
```

Note! The microcontroller's EEPROM address 0xFF is reserved! Changing the EEPROM value written to this address may cause the EVB to stop responding!

16. Wait Time. The EVB provides a 150 bytes input circular buffer. One or more commands may be sent to the PCB without any pausing between them. They will be processed consecutively and the respective return values will be sent out (if the respective commands return any results). If the execution of the sent commands should be separated in time, the respective wait time interval may be introduced in the commands sequence (up to 255ms).

This command does nothing else but wait the specified amount of time (in milliseconds).

Syntax:

wt	<i>waittime</i>			
<small>command</small>	<small>argument 1, HEX byte</small>	<small>argument 2, HEX byte</small>	<small>argument 3, HEX byte</small>	<small>argument 4, HEX byte</small>

Return Value:

None.

Example:

```
wt 0A
```

17. Echo. At startup the echo mode depends on the presence of the jumper JP1. However the echo mode could also be changed by the software. If the *echo* argument is zero then the echo is turned OFF, if the *echo* argument is not zero – the echo is turned ON.

Syntax:

ec *echo*
command *argument 1, HEX byte* *argument 2, HEX byte* *argument 3, HEX byte* *argument 4, HEX byte*

Return Value:

None.

Example:

ec 01

Error messages

The MLX90601 USB EVB may generate the following error messages:

!c1	The supplied command is not valid.
!c2	NON-HEX symbols provided as arguments
!c3	Input queue full – in this case the last sent command is lost.

Appendix A – MLX90601 USB Evaluation Board Commands List

<i>Command</i>	<i>argument1</i>	<i>argument2</i>	<i>argument3</i>	Brief Description
rd	<i>address MS byte</i>	<i>address LS byte</i>		Read the PIC memory/registers
wr	<i>address MS byte</i>	<i>address LS byte</i>	<i>value</i>	Write to PIC memory/registers
id				PCB Identification
rs				Software reset
wl				Welcome message
sv	<i>source</i>			Switch ON /OFF the module's supply voltage
re, m1	<i>address</i>			Read the module's EEPROM
rr, m2	<i>address</i>			Read the module's internal registers
rw, m3	<i>address</i>	<i>data MS</i>	<i>data LS</i>	Write to module's internal registers
we, m4	<i>address</i>	<i>data MS</i>	<i>data LS</i>	Write to module's EEPROM
bw, m5	<i>data MS</i>	<i>data LS</i>		Block write to module's EEPROM
ee, m6	<i>address</i>			Erase module's EEPROM
be, m7				Block erase module's EEPROM
er	<i>address</i>			Read the microcontroller's user EEPROM
ew	<i>address</i>	<i>data</i>		Write to microcontroller's user EEPROM
wt	<i>waittime</i>			Introduce wait time
ec	<i>echo</i>			Enable / disable ECHO

Appendix B – FTDI Chip Drivers for Virtual COM Port

The MLX90601 USB Evaluation Board requires the installation of the Virtual COM Port (VCP) Drivers for the FT232BM USB to UART converter. Please download the latest version for your operating system from the following addresses:

The FTDI Chip Drivers page is:

<http://www.ftdichip.com/FTDriver.htm>

The VCP Drivers for Windows 98 / ME / 2000 / XP (with enhanced BM series support):

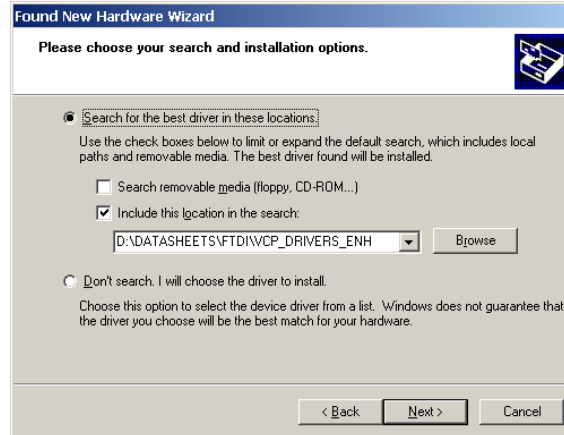
<http://www.ftdichip.com/FTWinDriver.htm> (select the Enhanced BM series support)

Appendix C – Installation of the VCP drivers under Windows XP

1. Unzip the downloaded VCP drivers if you have saved them as a .ZIP file.
2. Plug the MLX90601 USB Evaluation Board to one of the PC USB connectors. The pop-up message “Found new hardware MLX90601 Evaluation Board” should appear.
3. After that the Found New Hardware Wizard will automatically display, proposing to install the software for MLX90601 Evaluation Board:

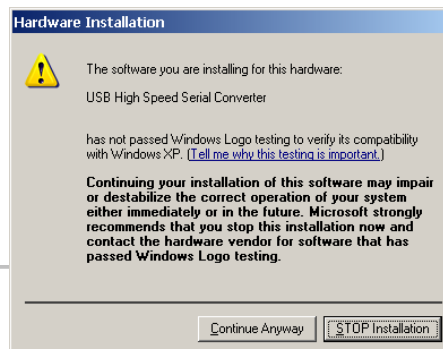


4. Select “Install from a list of specific location (Advanced)” and press “Next”.



Select “Search for the best driver in these locations” and check only the box “Include the location in the search”. Point the directory where you have downloaded and unzipped the FTDI drivers. Press “Next” button to continue.

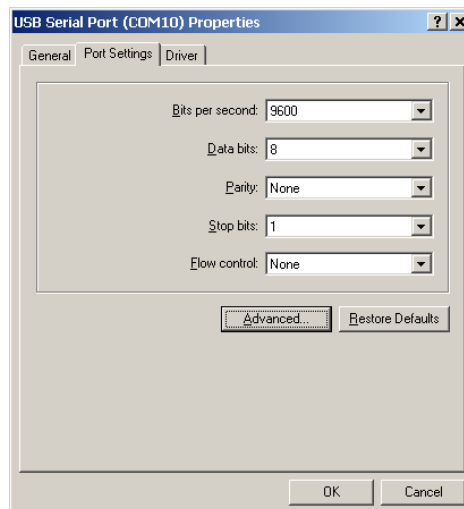
If the following window appears, choose “Continue Anyway”.



5. Press “Finish” to complete this step from installation.



6. The Windows XP will display the following pop-up message: “Found New Hardware - USB Serial Port” and after a while the Found New Hardware Wizard will automatically display, proposing to install the software for USB Serial Port. Repeat the steps 3 to 5. Finally a pop-up message “Found New Hardware – Your new hardware is installed and ready for use” should appear.
7. The application software may access the MLX90601 USB Evaluation Board as a standard RS-232 COM Port “USB Serial Port (COMxx)”, where xx denotes the actual used COM Port number. To see the actual settings select “Settings – Control Panel – System”. From the opened window select “Hardware” and then “Device Manager”. After that select “Ports (COM & LPT)” and look for “USB serial port...”. If the displayed value is larger than 9, some softwares may have problems opening the port. You can change the number of the used COM port in the following way: Double clicking over the “USB Serial Port (COMxx)”. The following window “USB Serial Port (COMxx) Properties” will appear.



Select “Advanced...” and from the opened dialog window select some smaller number COM port. Usually all the numbers below 10 are marked as “in use” although not all of them are really in use. You can select any number which was not displayed in the “Device Manager” window.