Application note

Changing the refresh rate of the MLX90632

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1. Scope

The MLX90632 is a non-contact infrared temperature sensor in a small SMD SFN package. The device is factory calibrated with calibration constants stored in the EEPROM memory. The ambient and object temperature can be calculated externally based on these calibration constants and the measurement data.

The MLX90632 is available in two different versions: standard and medical accuracy.
Both versions are calibrated in the ambient temperature range from -20 to 85˚C.
The difference between both versions is visible in accuracy and the object temperature range.
The medical version is factory calibrated with an accuracy of ±0.2˚C within the narrow object temperature range from 35 to 42˚C for medical applications. The object temperature range is limited from -20 to 100˚C.
On the other hand, the standard version covers an object temperature range from -20 to 200˚C but offers an accuracy of ±1˚C.

This application note explains how the refresh rate or sampling time can be changed in the memory of the MLX90632 sensor and is applicable for all MLX90632 versions (standard and medical version).

Changing the refresh rate will change the measurement speed.
The factory calibrated refresh rate is set to 2Hz or 0.5s.

It is important to know that the noise performance will change as well when the refresh rate is changed.

2. Applications

- High precision non-contact temperature measurements
- Body temperature measurement
- Non-contact thermometer for mobile and IoT application
- Temperature sensing element for residential, commercial and industrial building air conditioning
- Industrial temperature control of moving parts
- Home appliances with temperature control
- Healthcare
- Livestock monitoring

3. Related Melexis Products

- MLX90632SLD-BCB-000
- MLX90632SLD-DCB-000
- MLX90632SLD-DCB-100

4. Other Components Needed

To change the refresh rate, the user needs access to the memory of the MLX90632.
The easiest way is to use the EVB90632, which can be purchased at your local distributor.
A second method is to use a microcontroller in combination with the official driver on GitHub.

5. Guidelines

The MLX90632 requires a set of 2 measurements to calculate ambient and object temperature:

- Measurement 1: RAM_4, RAM_5, RAM_6;

- Measurement 2: RAM_7, RAM_8, RAM_9

An important note is that the resulting TA and TO cannot be obtained without knowing all parameters.
(RAM_4 and RAM_5) or (RAM_7 and RAM_8) are needed for a TO calculation.
The determination which set to use is dependent of the cycle_pos bit (see example below).

The formula for TA and TO calculation shows that RAM_6 and RAM_9 are always needed.

Both variables are unknown after POR (time = 0s.)
RAM_6 is known when the first measurement is executed (time = 0.5s.)
RAM_9 is known after the second measurement (time = 1s.)
Both variables are known and TA and TO can be calculated from this point in time.
For the next measurement (3), RAM_6 will be updated (time = 1.5s.)
TA and TO can be calculated with RAM_6 from measurement 3 and RAM_9 from the previous measurement
must be used. RAM_4 and RAM_5 are the most recent updated and should be used.
For measurement 4, RAM_9 will be updated (time = 2s.) and RAM_6 from measurement 3 will be used. RAM_7
and RAM_8 are the most recent updated and should be used.

In this way the refresh rate of 0.5s can be achieved.

Example:

t0:   Measurement 1   =>   no calculation of TA or TO possible
        (cycle_pos = 1)   because not all parameters are known

t1:   Measurement 2   =>   calculate TA (RAM_6, RAM_9)
        (cycle_pos = 2)   calculate TO (RAM_7, RAM_8, RAM_6, RAM_9)   =>   1s.

t2:   Measurement 3 (= 1)   =>   calculate TA (RAM_6, RAM_9)
        (cycle_pos = 1)   calculate TO (RAM_4, RAM_5, RAM_6, RAM_9)   =>   0.5s.

t3:   Measurement 4 (= 2)   =>   calculate TA (RAM_6, RAM_9)
        (cycle_pos = 2)   calculate TO (RAM_7, RAM_8, RAM_6, RAM_9)   =>   1.5s.

t4:   …

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The available refresh rates are shown in the table below:

Refresh rate [Hz]	Time [ms]
0.5	2000
1	1000
2	**500**
4	250
8	125
16	62.5
32	31.25
64	15.625

Figure 1: Available refresh rates

Important note

The desired refresh rate setting should be the same for both measurements.

The refresh rate can be changed in the measurement settings in EEPROM.
The first measurement can be configured at address 0x24E1 (EE_MEAS_1), the second one is configurable at address 0x24E2 (EE_MEAS_2).

3 bits will change refresh rate setting and are shown in the figure below:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Refresh rate			Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved	Melexis reserved

The desired refresh rate and corresponding values that should be written in EEPROM are summarized below:

| EE_MEAS_1[10:8] EE_MEAS_2[10:8]	Refresh rate [Hz]	Time [ms]	EE_MEAS_1 (0x24E1)	EE_MEAS_2 (0x24E2)
0	0.5	2000	0x800D	0x801D
1	1	1000	0x810D	0x811D
2	**2**	**500**	**0x820D**	**0x821D**
3	4	250	0x830D	0x831D
4	8	125	0x840D	0x841D
5	16	62.5	0x850D	0x851D
6	32	31.25	0x860D	0x861D
7	64	15.625	0x870D	0x871D

6. Noise performance

Changing the refresh rate will have an impact on the sensor noise performance.
The NETD (Net Equivalent Temperature Difference) in function of refresh rate setting is shown in the graph below.
Measurement conditions for the noise performance are To = Ta = 25°C.

Note:
Due to the nature of thermal infrared radiation, it is normal that the noise will decrease for high temperature and increase for lower temperatures.
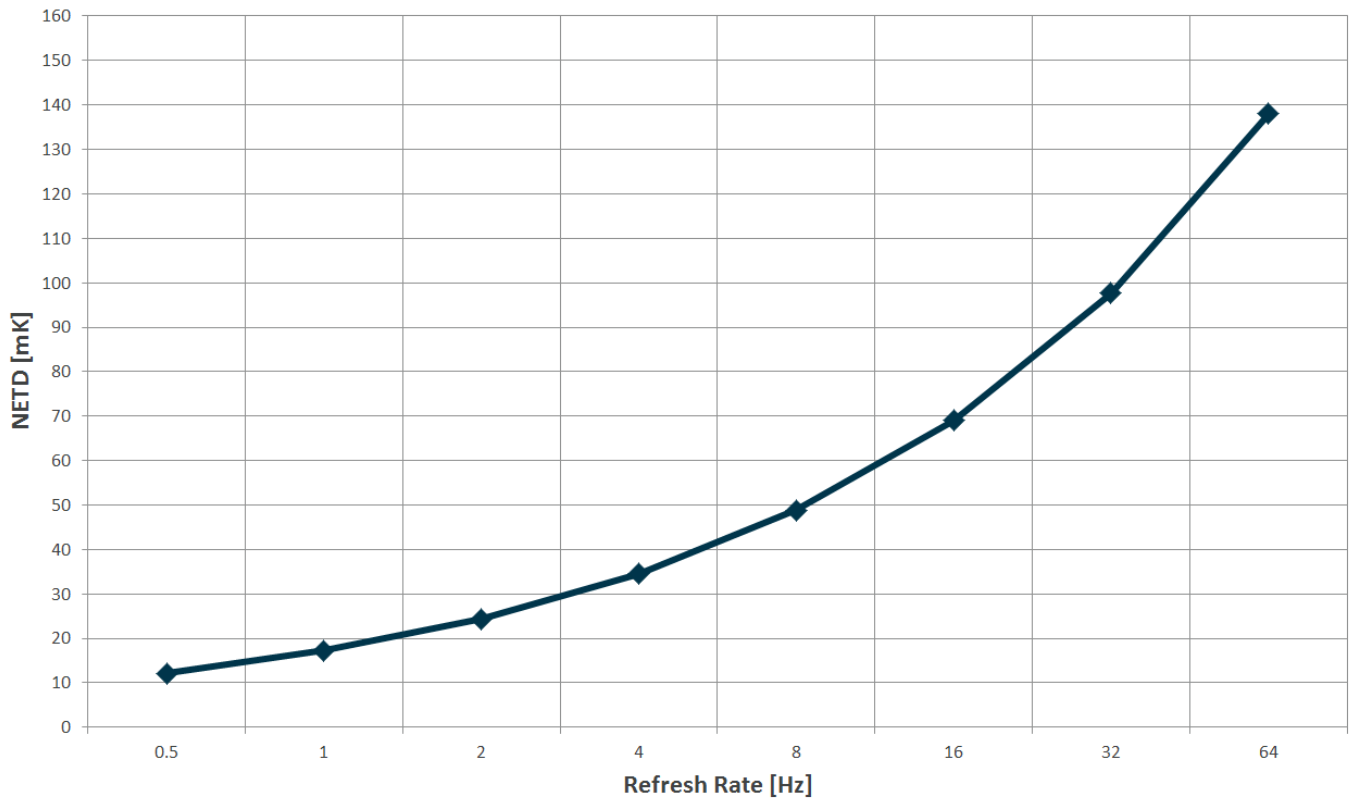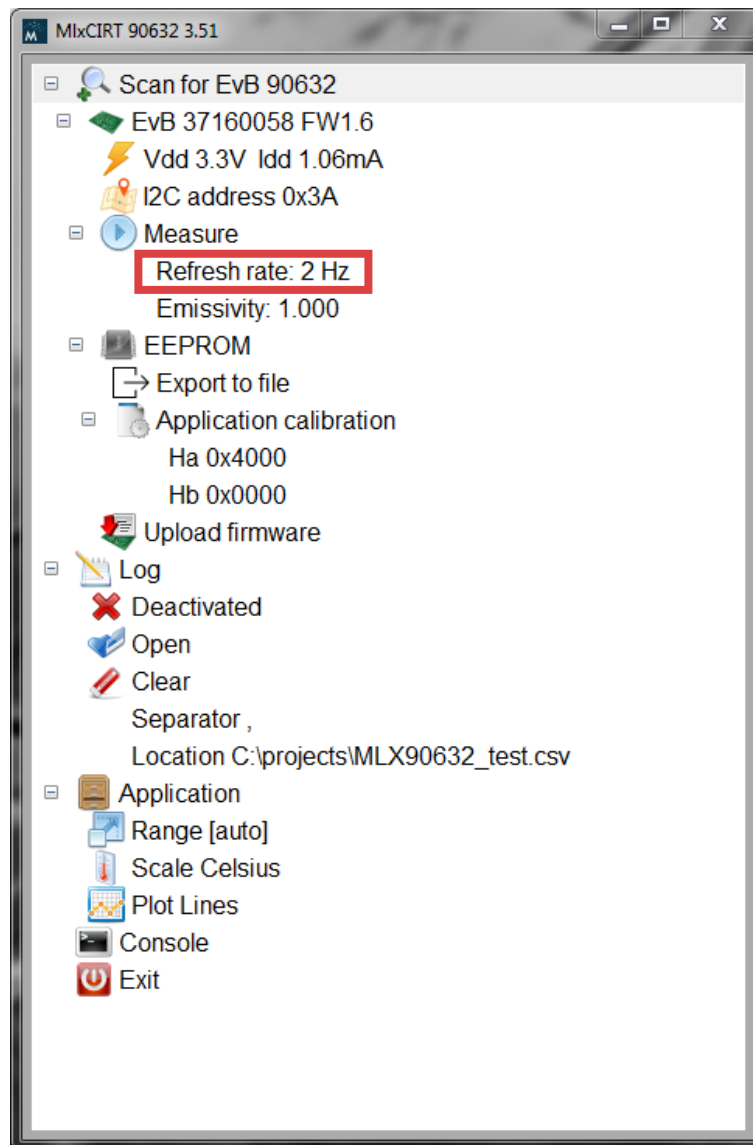
7. Changing the refresh rate with the EVB software

Connect the EVB + sensor to the PC using the EVB connection.

Open MlxCIRT90632.exe.

When the scanning for EVB 90632 is complete the following menu is available in the application.

The refresh rate can be changed under the "Measure" menu.

Double click "Refresh rate" to change both measurements settings to the desired refresh rate.