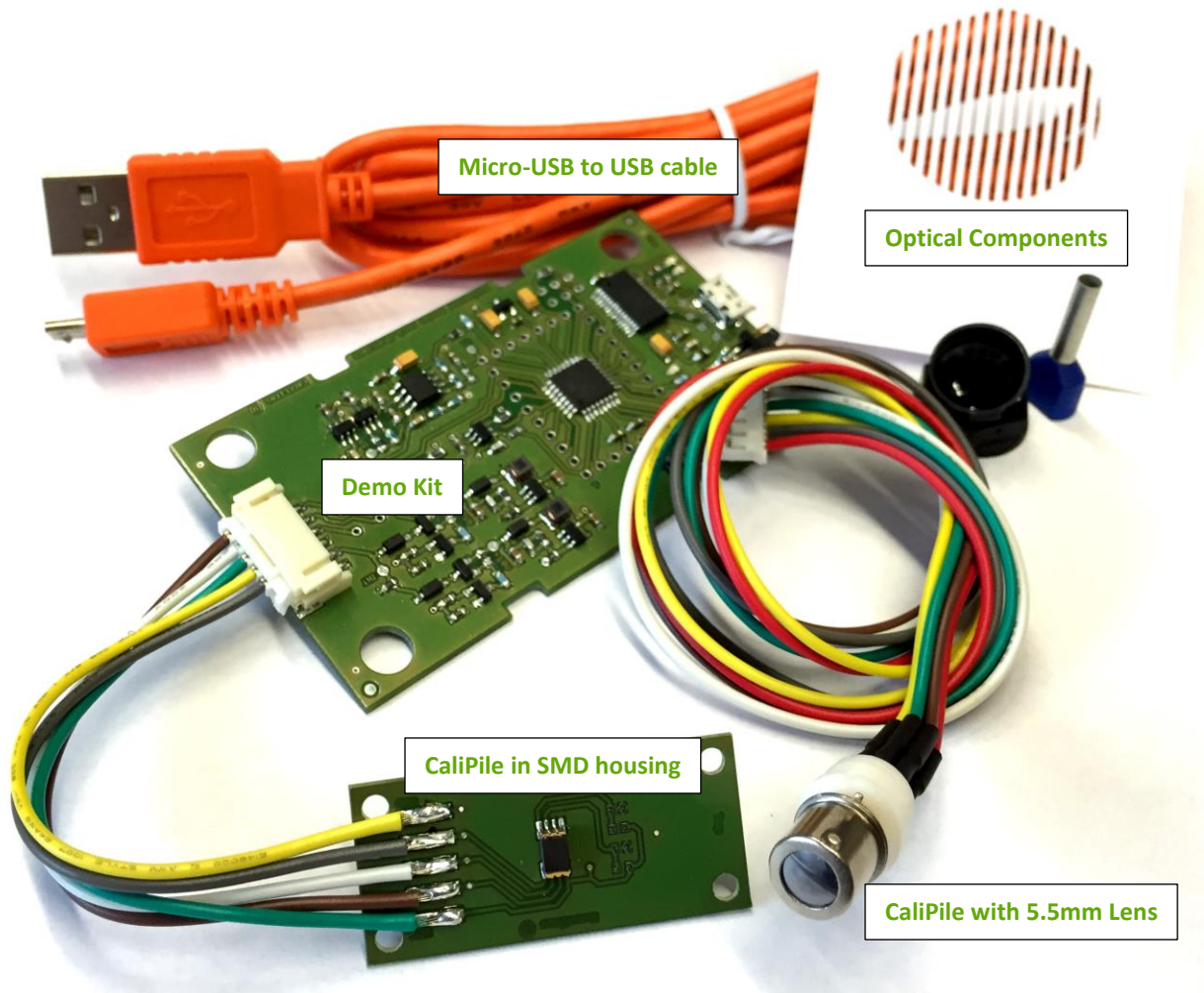




# CaliPile™ Application Software Evaluation Guide

Version 1.8  
For the Excelitas CaliPile™ Family



Not all components shown here are necessarily parts of your shipment

## Introduction

The CaliPile™ Application Software is complementary to the standard Excelitas software package. The approach of this application software is a top-down introduction to the features of the CaliPile™ sensor family based on exemplary applications. It facilitates the first contact to our CaliPile™ sensors and allows exploring the multidimensional parameter range keeping an eye on the resulting behavior. Once having understood the internal structure and signal processing the developer is referred to the standard Excelitas software package, which gives more control on the basic parameters than this software.

## Requirements

In contrast to our very robust standard application software which is based on LabView™, this software is using **Microsoft© .NET 4** which is therefore one prerequisite for running this software. Moreover, if not already installed through the standard software package, VCP drivers are required. Those can be obtained through the office site <http://www.ftdichip.com/Drivers/VCP.htm>. A copy of those is included in the driver folder of our software folder.

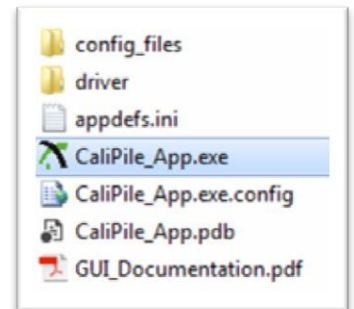
The software was tested to be operational on a Win7 and Win10 system.

## Remarks

The complex user interface functionality may result in performance issues on older workstations and occasionally to unexpected behavior, such as software crashes. Also known are layout issues with different DPI settings, especially when the font is enlarged. We apologize for this inconvenience. Since our software is subjected to constant improvement, please check the availability of an improved version from time to time. Any feedback is much appreciated.

## Startup

- Extract the zip file into a folder of your choice
- In case drivers were not installed yet, execute 'driver\CDMxxxxx\_Setup.exe'
- Connect the sensor with the Demo Kit and the Kit then with the PC using the USB-to-micro-USB cable
- Start the executable

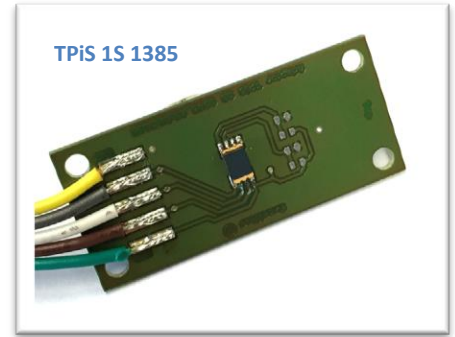


On start-up the software will scan all available COM ports for the existence of an Demo Kit. In case several boxes are connected, the first valid one will be used. Opening several instances of this software is not possible. In case of troubles please try to unplug and connect the Demo Kit again. In case of heavy system load or many existing COM ports the start-up procedure may take longer. Instead of opening another instance of this software, please unplug and reconnect the Demo Kit with the PC again, make sure the software is not running anymore (via task manager) and retry. **Please close the software and unplug the Demo Kit when switching between sensors.** Hot plugging is in principle supported but leads occasionally to unwanted behavior.

## Evaluation Guide

Since the CaliPile™ product family is by far more complex than our other product families this documentation is written in form of a guide through the functionalities. You may jump to the section of your interest but it is recommended to follow this structure step by step.

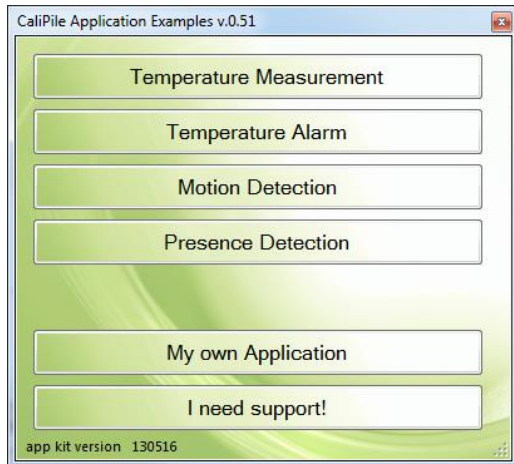
In most of our experiments performed here we were using our TPiS 1S 1385 sensor which is a SMD device with a very high sensitivity. In case you've been sampled with another sensor, results and conclusions will be different but same basic principles apply.



Moreover you may have not received all components depicted in the product pictures here, such as apertures or distance rings. We assume such or similar parts can be easily organized everywhere and give you a better feeling for the complex interplay between the sensor and its integration into your system when setup by yourself.

## Starting Software

On start-up you will be welcomed with a window containing several predefined application examples. The title of the window tells you the software version which you are using. The footer contains the firmware version which is running on the Demo Kit. The applications are in detail:



**Temperature Measurement:** Determine remotely the temperature of an object and the ambient temperature of the sensor.

**Temperature Alarm:** Apply a threshold to the object temperature. In case of over temperature an interrupt signal is send.

**Motion Detection with presence feature:** An interrupt is send when the object is moving. In case of a narrow field of view the presence of an object can be sensed.

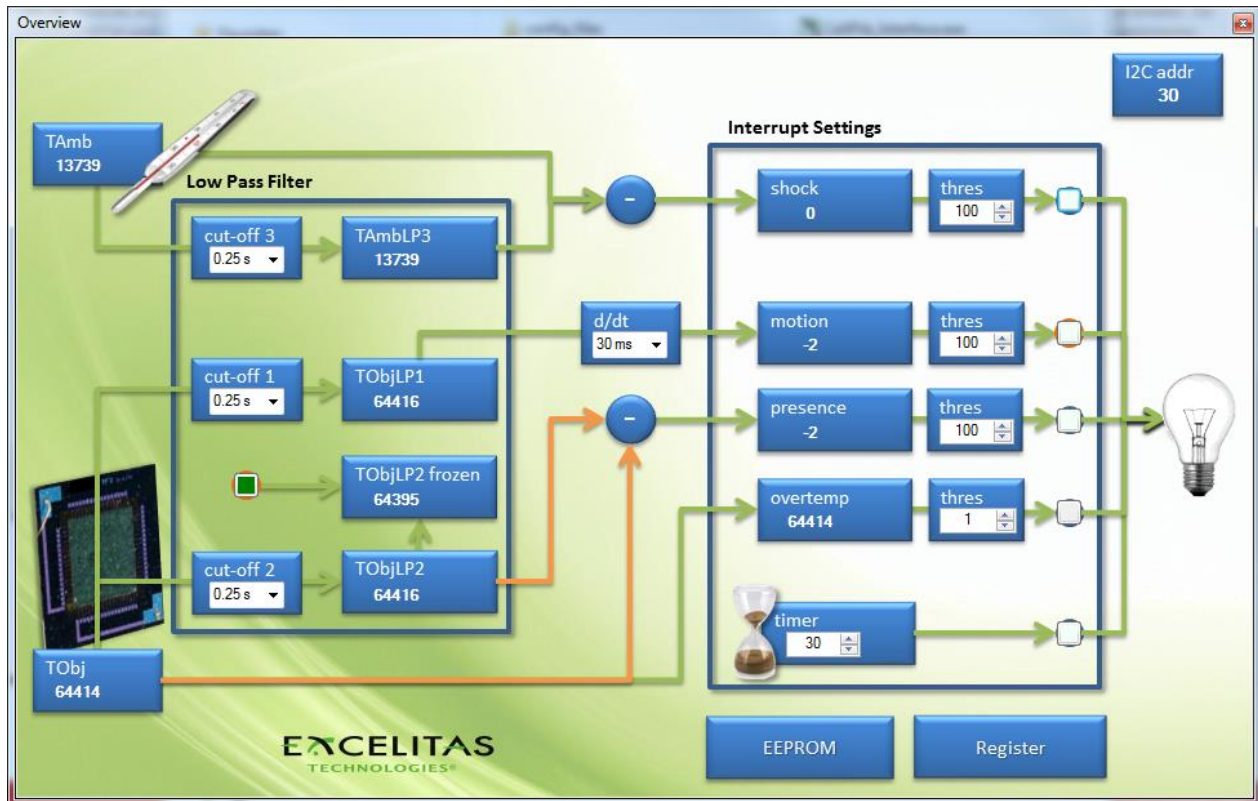
**Presence Detection:** For wide field of views presence of an object can be sensed.

**My own Application:** Having understood the sensor, you can perform your own experiments and adjusting freely all parameters of it.

**I need support:** You will be redirected to the online contact form. Please contact us in case of any questions.

## My own Application

For a short introduction to the basic functionalities of this software please start with 'My own Application'.



A schematic overview of the internal structure of our CaliPile™ ASIC is shown. The application starts a continuous readout of the sensor registers. In case the software should break, the Demo Kit will remain sending data to the computer unless you disconnect the box and plug it back again.

The data in those registers is being decoded and displayed as values in this window. Nearly all values in this window can be clicked with the left mouse button in order to retrieve graphs or set parameters.

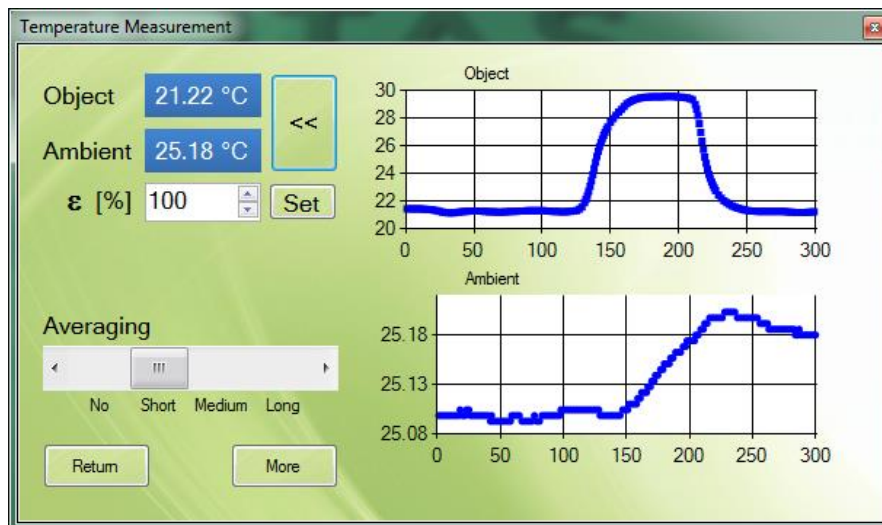
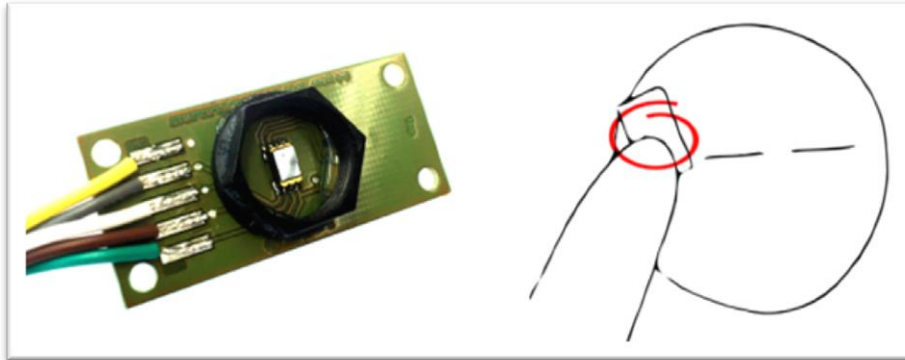
→ Try viewing data, select different cut-off frequencies, en-/disable interrupts, view the content of the EEPROM, change the orange algorithm path for the presence detection by clicking on the '-' symbol.

Some of the basic features of the sensor are displayed here:

- **I2C interface.** The address is shown on the top right corner.
- Ambient temperature sensing. The ADC value of the internal (**proportional to absolute temperature**) PTAT sensor is shown on the top left as TAMB.
- The **thermopile chip** is decoded with a **resolution of 17bit** and displayed as TObj here.
- Signals are processed through **low pass filter** stages. The cut-offs can be selected.
- A **register** gives access to all data at all stages and allows manipulating it.
- An internal **EEPROM** contains non-volatile user specific (calibration) data.
- Fast changes in the sensor temperature can be detected as an **ambient temperature shock**.
- **Motion** is sensed as a slope of the object signal.
- The difference between a slowly varying signal and a fast one is interpreted as a **presence** level.
- The object radiation can be checked for an **over-temperature**.
- An internal **timer** is implemented.
- The processed data can be subjected to thresholds in order to provide an **interrupt** signal to the host system.

The on-chip features can be explored now from the application side. Please close the overview window to return to the applications selection.

## Temperature Measurement



The measurement of an objects temperature is the field of pyrometry which you can explore with this application example.

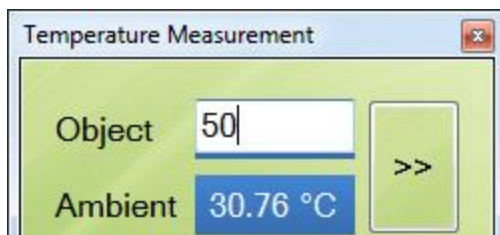
- Try to measure the temperature of different objects. What is the temperature of your tea? What temperature has your cold drink, how does this compare to the bottle temperature containing it?
- If you know the real object temperature, what is the deviation from it?
- Where is the hottest spot on your fore-head? What is the maximum temperature you can read? What is your accuracy (repeatability) of your measurement when measuring several times the same spot? Can you achieve 0.1°C?
- How does the 'temperature' scale with the distance to the object?
- Compare the temperature of a warm blank metal with the temperature of a black sticker attached to it?
- Try to adjust the emissivity to match the reading of a black sticker on the blank metal. What happens with your reading when you increase the temperature of the sensor?
- Wave your hand behind the sensor when facing it to a blank metal, glass, polished wood. What materials do reflect your hand the lowest? Does it make a difference at which angle you are measuring the temperature?
- Try to measure the temperature of your hot tea through glass or other 'transparent' materials. Do you find any materials which are opaque but still you can 'see' the warm object through it?

- *How much does the temperature change when you walk near the sensor? How does it scale with the distance to it?*
- *How is the object temperature affected when you put your warm finger at the back side of the sensor? What happens when you blow warm/cold air on the sensor?*
- *Try to reduce the field of view with an aperture. Adjust the emissivity such that the temperature gives the correct reading. What happens when you touch this aperture with your fingers without being in the field of view?*
- *What is the difference in the temperature when 1 person sits in front of the sensor? What is the difference with 2 persons?*
- *How much does the temperature vary without any people in the room? What happens when you open a door or a window?*

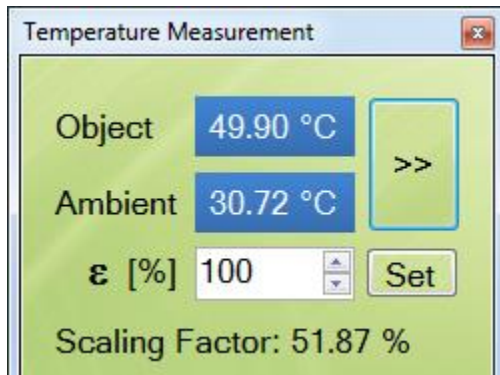
It was demonstrated that TPiS 1S 1385 can achieve an accuracy (deviation from the true object temperature) of better than 0.3°C in a ambient temperature range between 10°C and 50°C when facing a black body at 37°C. The precision (repeatability of a measurement) is at least 5 times better. However this was a laboratory measurement. In your application many factors will affect your accuracy and precision.

For the best experience your object should cover the full field of view of the sensor (which is for an SMD based device ~120°!). Effects which you will observe are:

- **Distance dependence:** A measurement can be always calibrated for a fixed distance. If you change the distance you will get varying results. Devices with lenses or internal reflecting mirrors have much smaller distance dependence due to the smaller field of view. When attempting to use the device for body temperature measurements, please consider to implement a cavity for the sensor. The sensor must not be touched for sanitary and temperature flux reasons.
- **Change in the ambient temperature.** The signal of the thermopile has to be compensated for the ambient temperature. A change in the ambient temperature is nearly always connected to a temperature gradient along the device which in turn changes the thermal balance and therefore the precision. If the ambient temperature is changing too rapidly you will see it influencing your measured object temperature even when all other effects are under control.
- **Stray light.** Objects outside of the field of view can be internally reflected and give an additional error on the signal.
- **Emissivity.** No object is a perfect black body. A shiny metal for example is emitting only a small fraction of its own temperature but reflecting the ambient with the largest portion. You can theoretically correct for the emissivity of the object but in practice you will not be happy with the results. You should apply dark paint or similar to the object which you want to measure.
- **Transmission.** You should know that the opacity of several materials is significantly different in the infrared region. We are in most cases measuring from 5.5µm towards long wavelengths. In this region **glass is opaque but silicon has a high transmittance.** Never trust your eyes here!



In case you know your object's temperature you can set it in the application as a new calibration point. Double click on the temperature of the object, enter the real value and confirm by pressing the "Enter" key. With the "Esc" key you exit this feature. To reload the factory calibration you must return to the main window and start this application over.



Temperature Measurement

Object 49.90 °C >>

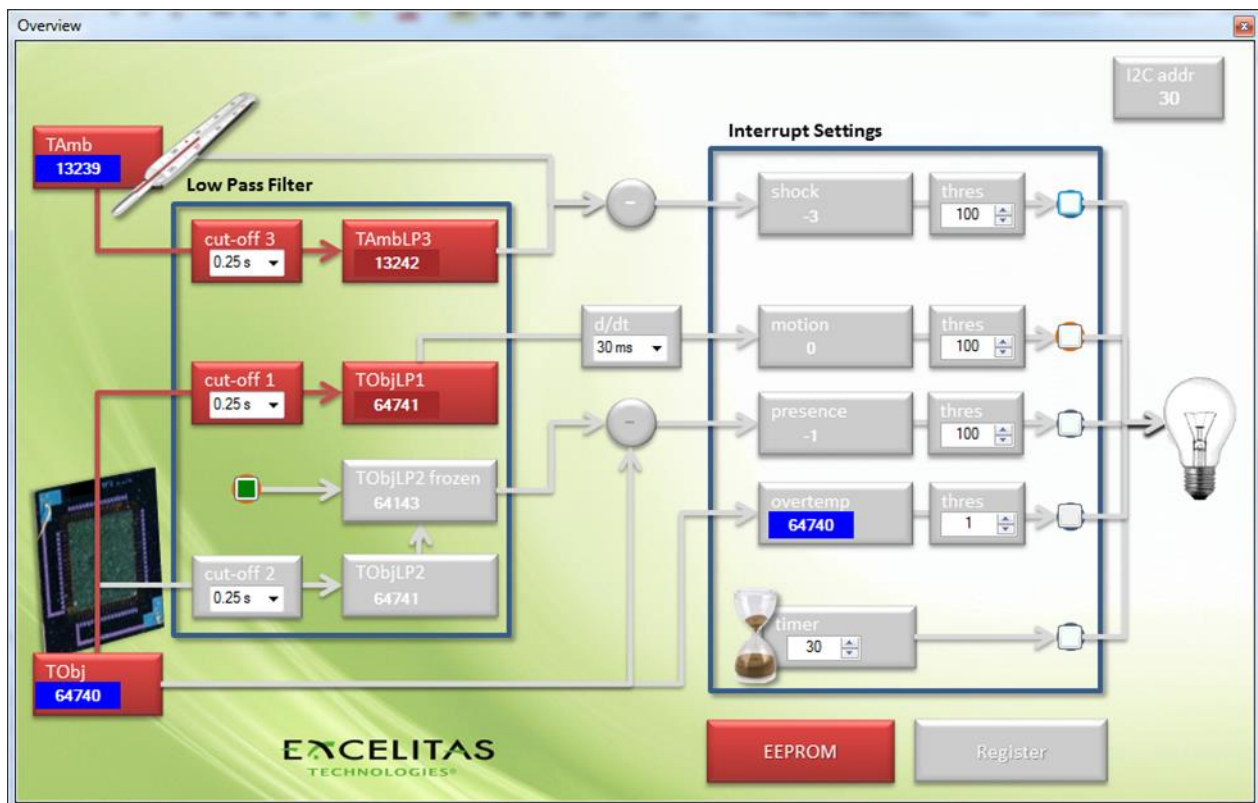
Ambient 30.72 °C >>

$\epsilon$  [%] 100 Set

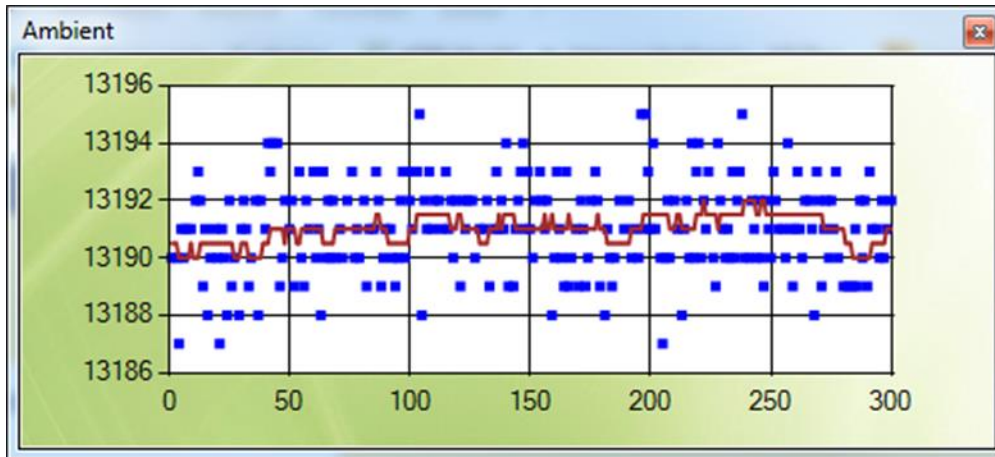
Scaling Factor: 51.87 %

As a result you will see a scaling factor which has to be applied. In order to evaluate if you can transfer our factory calibration to your application by applying this scaling factor, write down this factor and enter it as an emissivity factor to all other sensor samples which you test in your application. Generally speaking the scaling factor should be close to 100% to achieve good results. In case you see a very small scaling value, any influence from the ambient temperature will affect the measurement drastically. Very large scaling factors are likely to be difficult to be applied to other factory calibrated sensors. As a result large systematic variations between sensors have to be expected.

Pressing the button 'more' tells you more about the internal signal processing. You will see a signal diagram of the CaliPile™ ASIC. Only the parts relevant for this application are highlighted in red. Other parts will be discussed in later sections.



On the top left the ADC output of the internal PTAT temperature sensor is displayed. The PTAT is a signal which is linear and proportional to the absolute temperature. The standard calibration is a one point temperature calibration. Optional for higher precision a two point calibration can be discussed with us. This signal is further processed by a digital low pass filter with a selectable cut-off frequency.



Clicking on the TAmb and TAmbLP3 labels a window with a graph will appear. Here you can see the data as a function of time. The axis is the number of retrieved data points. The standard time base in this software is 30ms but can be as low as 5ms in your' application. 300 measurements correspond to a timespan of 9 seconds.

→ *Place the sensor in a paper box. Wait for the temperature to stabilize. How much is the noise? Compare it with the data sheet.*

It should be noticed that the resolution of the filtered data is higher than the one of the raw data. Internally it is represented with a larger bit quantity.

On the bottom left of the overview window the ADC output of the TP chip is shown. Also this signal can be passed through an on-chip selectable low pass stage to reduce noise further. Using the 'averaging' slider at the application window actually changes the filter settings. When 'no averaging' is selected, the raw signal is being processed.

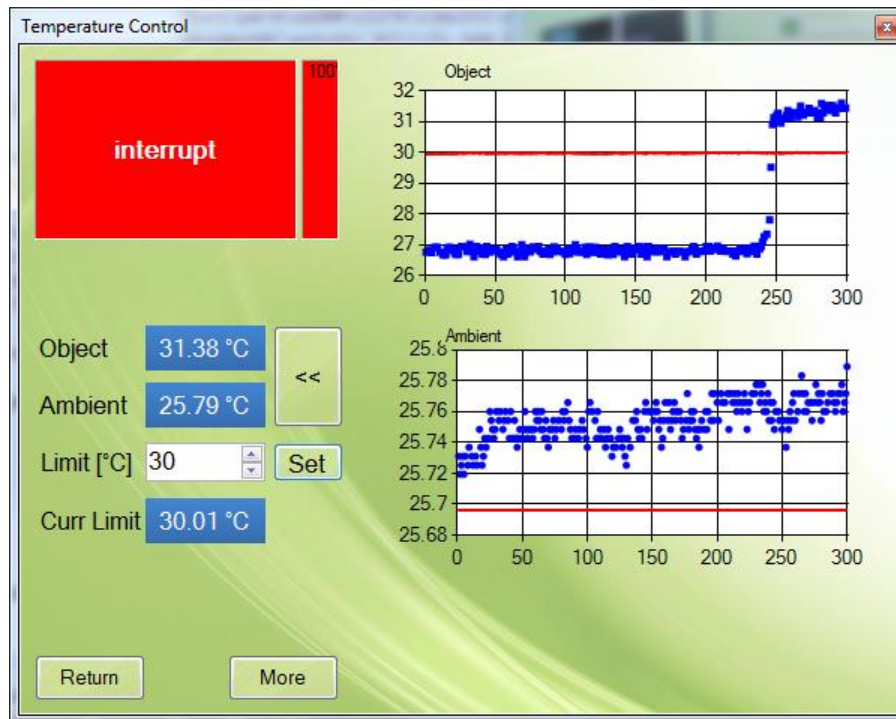
→ *Face a sensor to an object of fixed temperature. Heat the sensor (for example by touching it from the back). What happens with the TObj signal, when the TAmb signal is rising or falling?*

But both signals are meaningless without the calibration data and the mandatory ambient temperature compensation. The calibration data of the sensor is actually stored on the sensor chip's EEPROM. The calibration data there can be viewed by clicking at the EEPROM label. Usually not all 32 bytes of the EEPROM are reserved for calibration data. Optional calibration parameters can be discussed with you. **The temperature calculation must be performed on the host system.** Even small  $\mu$ Cs can be used for this task. We do provide the instructions as well as the support for the implementation.

**Please contact Excelitas in case your application is temperature measurement for further advice and fruitful discussions!**



## Temperature Alarm



TPIS 1S 0186 L5.5



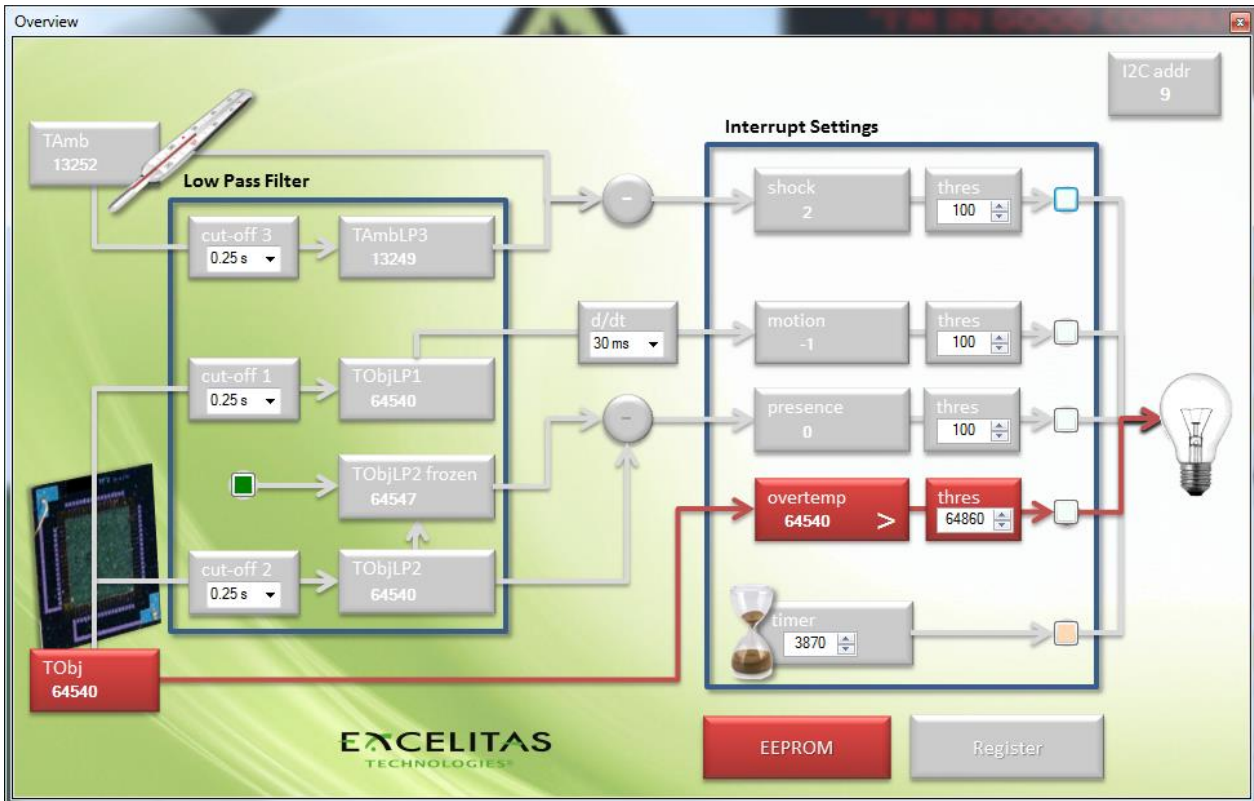
Thermopiles are very fast as compared to thermistors which moreover need to be attached the object. Thus objects which can potentially quickly overheat can be protected through the interrupt feature of the CaliPile™. Typical applications are fuser rolls, flow heater and power electronics.

The measurement of the object temperature is discussed in the previous section and same principles apply to this application. For typical applications we recommend TO-can-detectors with a focusing lens for a restricted field of view. This allows much easier to cover the full field of view with the object of interest.

The EEPROM provides all necessary data to calculate the temperature from the raw TP ADC value and the PTAT ADC value. The calculated data can be viewed over time by pressing the '>>' button. A limit for an over-temperature can be set.

→ *Set a limit above the ambient temperature. Face the sensor to a hot object and watch the interrupt when crossing the limits.*

→ Increase or decrease the ambient temperature and observe the 'current limit'.

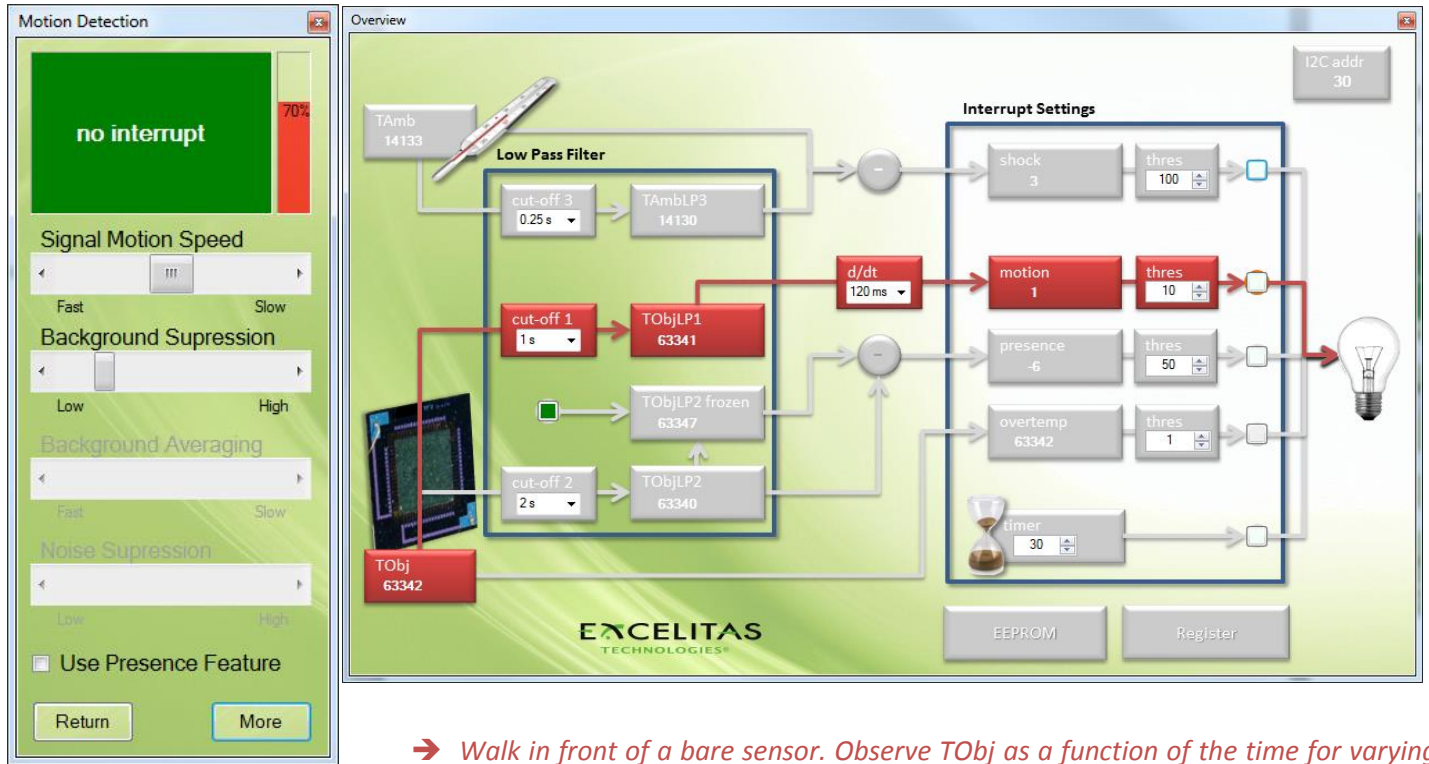


The real limit for the interrupt depends on the ambient temperature. This can be explained when looking on the overview by pressing the 'More' button. In fact the thermopile ADC value is directly compared with an absolute threshold. The TP output depends on the ambient temperature and is not compensated in the ASIC. Thus it is recommended to adjust the threshold in case the ambient temperature is changing significantly.

Depending on the application an interrupt can be generated for a transition from below to above (over-temperature) or for a transition from above to below (under-temperature). This can be selected in this window by pressing the '>' sign in the 'overtemp' field.

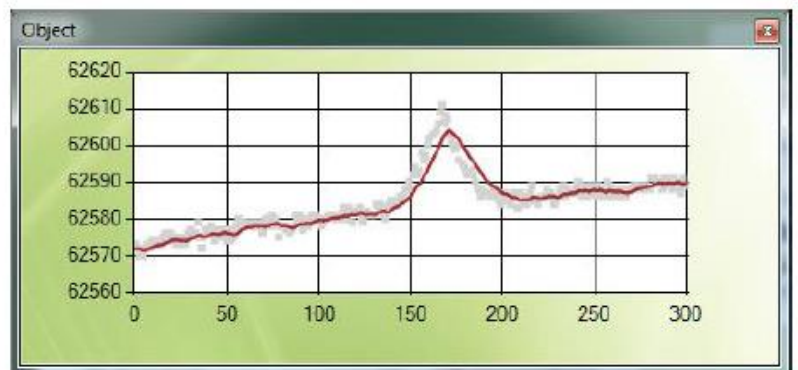
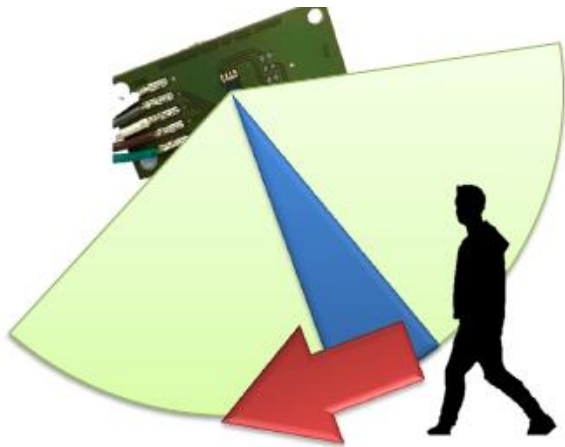
## Motion Detection

Selecting the application ‘Motion Detection’ in the main window of the software will open a window which displays the interrupt status of the sensor. Press ‘More’ in order to retrieve the values used for the motion detection.



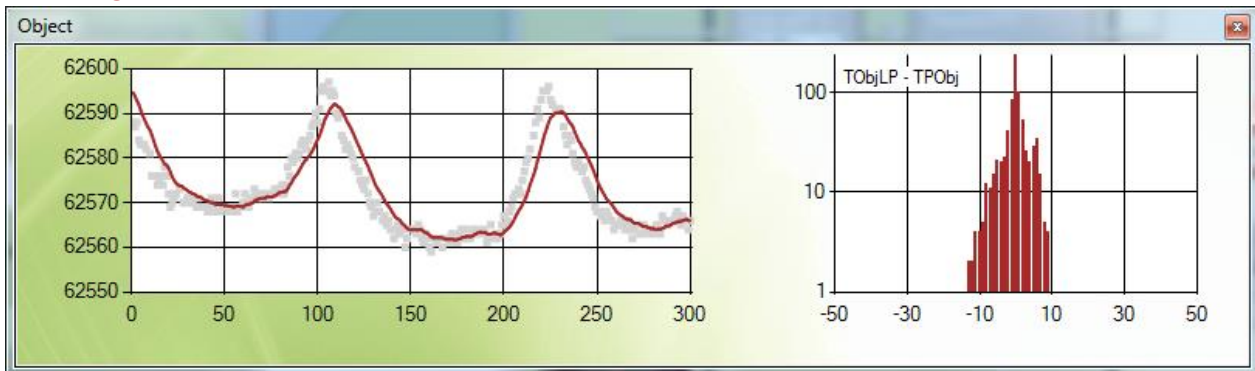
➔ Walk in front of a bare sensor. Observe TObj as a function of the time for varying distances to the sensor. At which distance do you barely see any change in the signal amplitude?

➔ Apply a grid (min 1 mm spacing), slit, aperture or multifocal Fresnel lens in front of the sensor. Can you optimize the optical parameters such that you will see a large variation in the motion signal?



In fact you will barely notice a person moving in front of the bare smd sensor when looking at the object signal. No wonder since the field of view (depicted in green in the figure above) is in general very wide as long as no lens or other optical modifications are being used. Only when you reduce the field of view (depicted in blue above) or divide it into ‘zones’ as it is done with multifocal Fresnel lenses, you will be able to detect motion. In the example above a **15mm long aluminum tube with a diameter of 2mm** was used to reduce the field of view to about 60 degree. Signal Motion Speed was set to ‘Fast’ (cut-off 1 at 0.25s, d/dt 60ms).

- Left click on the Object Graph and record several movements in the field of view in the histogram. What are good 'Signal Motion Speed' settings (cut-off values) for the filtered signal TObjLP1 so that the distribution is remaining narrow?

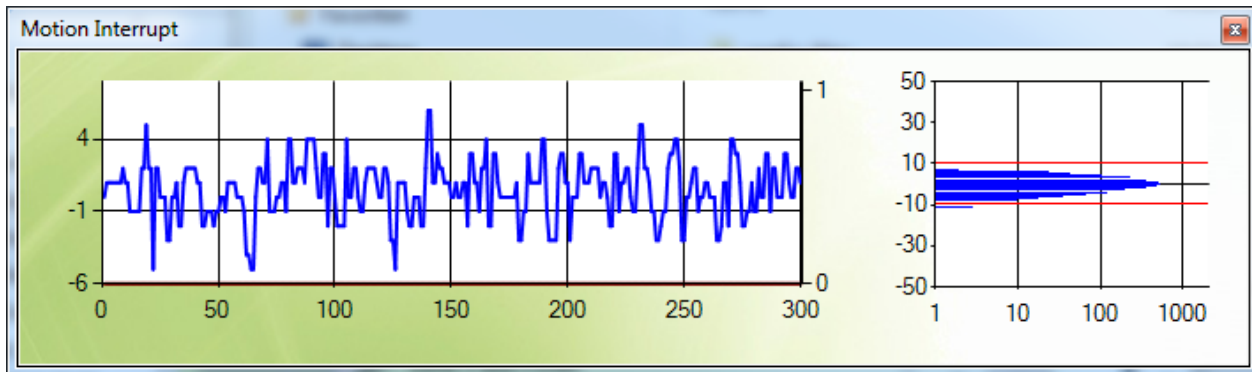


Of course the fastest filter settings will give you the narrowest distributions, but those filter settings give you the opportunity to filter unwanted fast signals. Thus you should choose a setting at which your typical signal variation is also clearly visible in the filtered data.

- Open the motion graph by left clicking the 'motion' value. Observe 'motion' for various 'd/dt' settings. When is the amplitude for motion maximized?

Generally speaking signals after the low pass filter will appear to have a smaller amplitude and longer. When you increase the differentiation time, you may be able to compensate the amplitude in the motion value. But the differentiation time should not be longer than the slope of your filtered signal is lasting.

- Move out of the field of view to measure your back ground. By left clicking into the 'motion' graph a histogram will appear to record your noise distribution. Observe the red level bar (in the Motion Detection window) and reduce the 'Background Suppression' (motion threshold) such that the level will be close to 100% but is staying below which will be also visible in the histogram which should be within the 2 red bars. By left clicking into the histogram you can toggle through different axis limits (zoom).



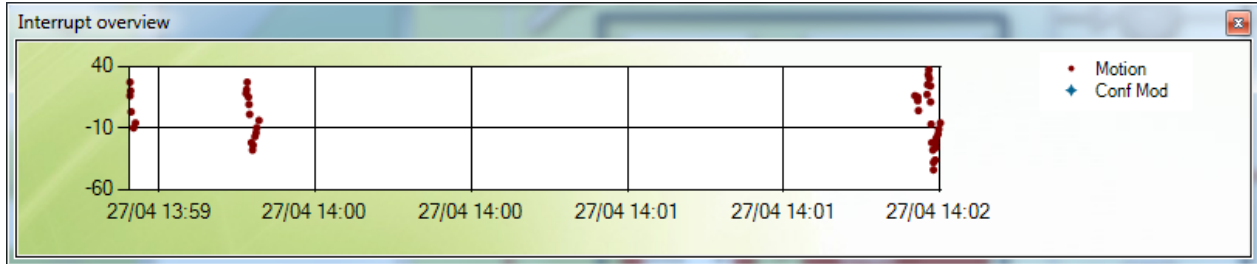
The histogram will show you where to set the optimal threshold just above the noise floor or back-ground contribution to the signal.

- What is the sensing distance which you can achieve?

Applying a tube as mentioned previously a distance of 3-4 m is achievable (**0.5s cut-off, d/dt 120 ms, threshold 11 counts**). Tests with the Excelitas D37 multifocal Fresnel lens showed a similar performance but of course a wider field of view. To elongate the distance larger lenses must be used to collect more IR-light. Using the TPiS 1T 1286 L 5.5 showed a good performance up to 8 m.



- Observe the percentage bar when blowing cold/warm air on the sensor, opening windows, turning heaters on etc. Observe the amount of false triggers over a longer period of time by enabling the motion interrupt (left click on the color changing buttons after the threshold) and left clicking the bulb for the interrupt overview graph. What cut-off values and thresholds give the best trade-off between sensitivity and background robustness?



The Interrupt overview graph shows you when which interrupt was send. To record the corresponding value (such as shock/motion/presence etc.) during its interrupt condition, the interrupt must be enabled before. Then the corresponding graph label will appear. Moreover each change in the configuration is also stored in the graph.

For a general understanding for the severity of any sources of temperature fluctuations is the measurement of the object temperature when moving in the field-of-view by the sensor. You can explore with the 'Temperature Measurement' application the very high sensitivity of the sensor which sees temperature changes of way below 0.1°C! You will notice raw signal changes even at large distances, but other heat sources might be dominating such as

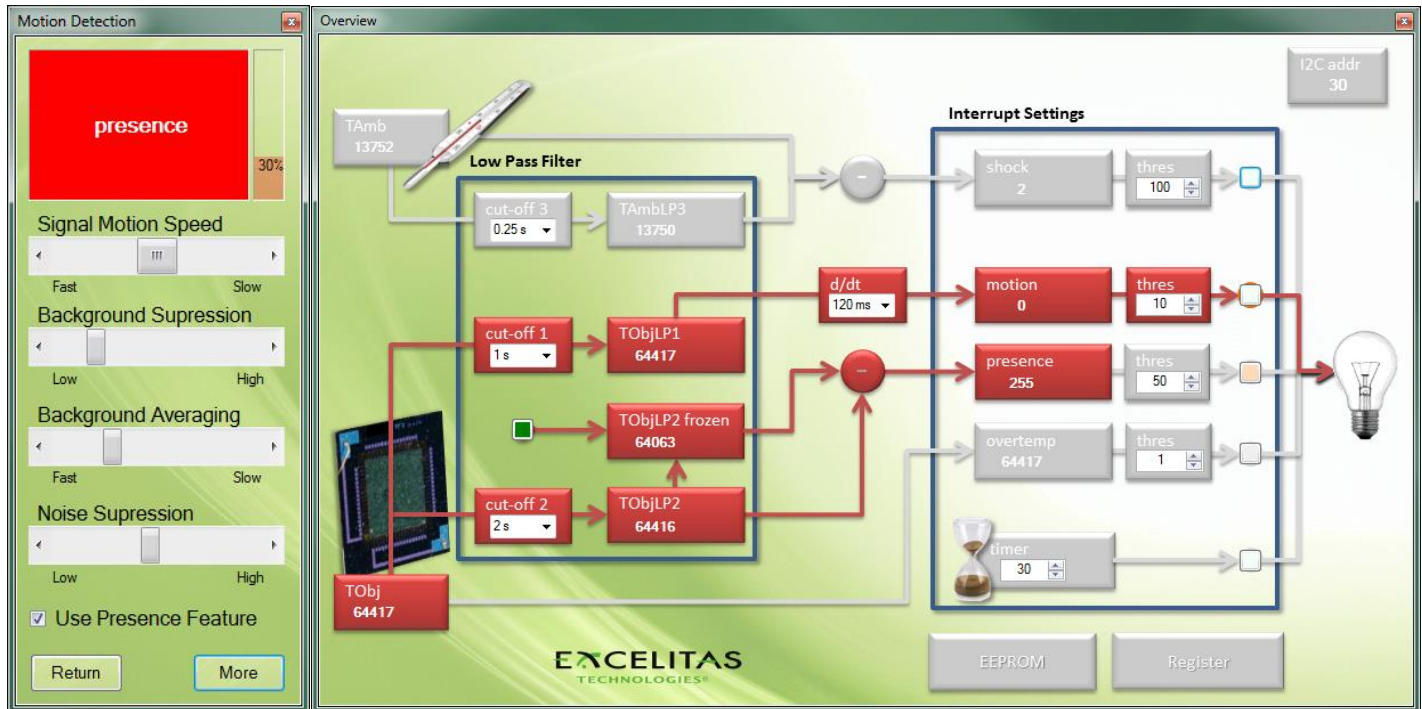
**Air flux:** Air conditioning, open windows even blowing at the sensor will change the temperature of the sensor package and in turn influence the total signal.

**Heating:** Radiators, hot coffee mugs, ovens etc. will be dominating the signal when not having a stable temperature.

Generally speaking such sources are rather slowly changing the signal and can be filtered with the optimal settings. Of course the motion detection feature alone is not a strong argument for the CaliPile™ product family as compared to traditional pyroelectric sensors. The additional benefit comes from the possibility for presence sensing.

## Motion Detection with Presence Feature

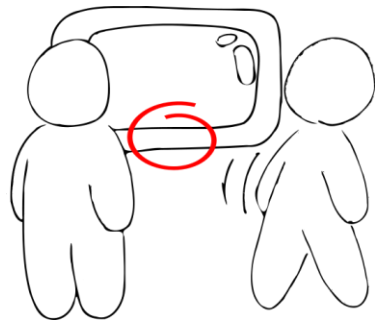
The big advantage over pyroelectric sensors is the DC signal, sensitive to a constant radiation. If you followed the section before, please enable the 'presence detection feature' in the 'Motion Detection' application window. Otherwise please set in addition optimal values to detect your motion when entering the field-of-view of the sensor.



- ➔ Reduce the field of view of the sensor by application of an aperture such as a simple tube. Observe the TObj signal. Adjust 'Signal Motion Speed' and 'Background Suppression' such that a motion interrupt will be given when you enter the field of view and exit it parallel to the sensor plane, but not when you are moving in the field of view. When does the TObjLP2frozen value change?
- ➔ Move out of the field of view. Adjust 'Background Averaging' such that TObjLP2 is slow enough to suppress people passing the field of view by but fast enough to recognize a person staying still for a moment. How does the 'presence' signal behave for different situations? What is the sign of it, when the person is in the field of view, what if the person is out of the field of view?
- ➔ How does the application react on persons moving perpendicular to the sensor plane?

This application example works best with a very narrow field of view which can be achieved by application of an aperture such as a simple tube. However to enlarge the range significantly, it is recommended to use a lens type CaliPile, such as the **TPiS 1T 1286 L5.5**. With the latter a good presence detection performance of up to 5 m distance was achieved using the following settings: **cut-off 1: 1s; cut-off 2: 2s; motion threshold: 50 counts; presence threshold 50 counts.**



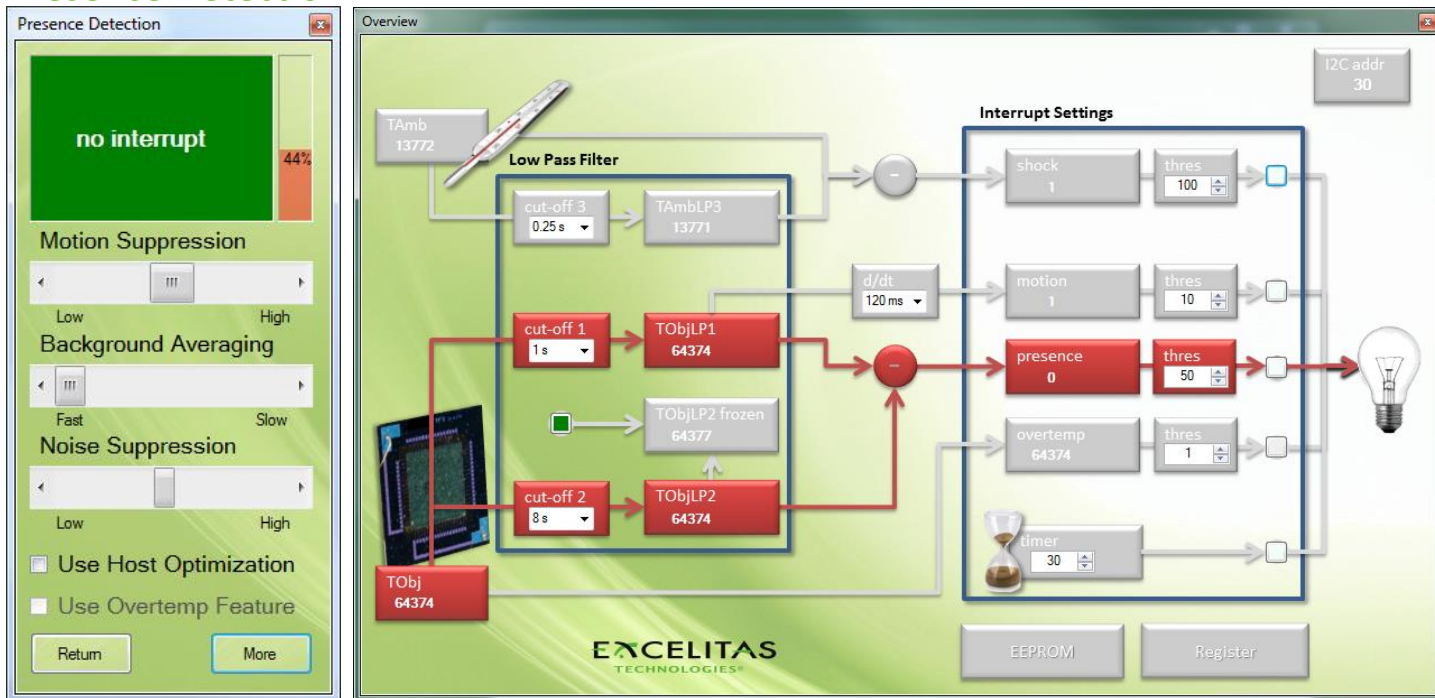


A typical application would be a monitor, robot or similar which has to react on people which are not passing by but standing in front of the device. Motion triggers the sensor to 'remember' the value of the low pass 2 branch. The difference between the stored value and the actual value gives a sign in the 'presence' value which can be used to determine if a person entered the field of view or left it.

The direction of motion should be restricted to be parallel to the sensor plane in order to sense motion prior to measuring the presence of a person.

In case the application requires a wide field of view but provides strong object signals the following application example 'Presence Detection' might be a better option to be evaluated.

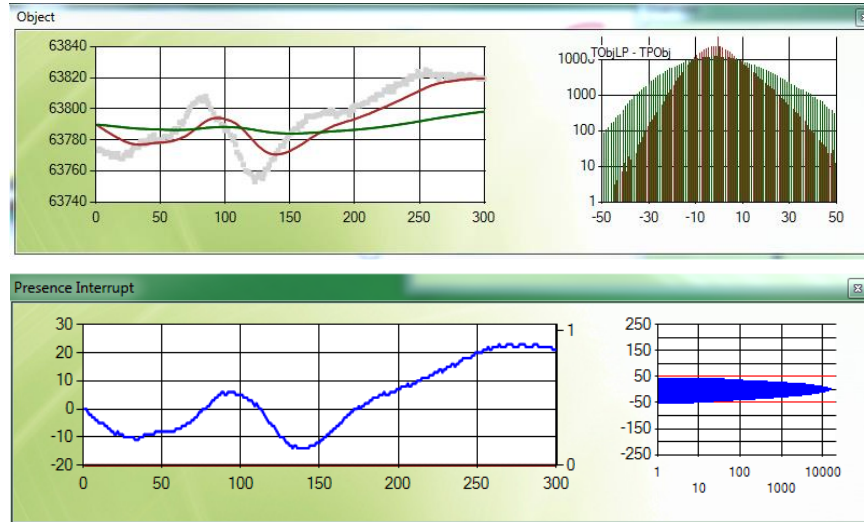
## Presence Detection



Please select the 'Presence Detection' application example. Open also the 'overview' by pressing the 'More' Button.

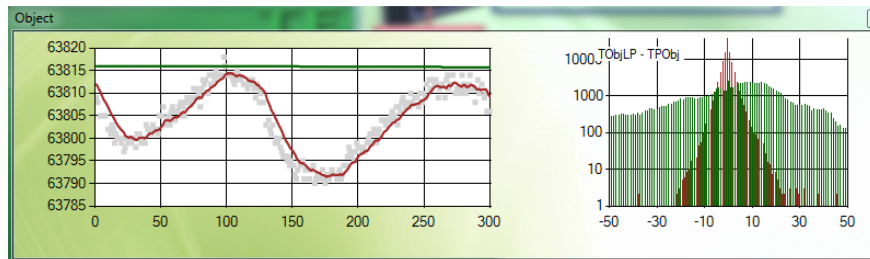
- ➔ *Try a bare sensor with a full field of view where motion sensing was not possible. Observe TObj, TObjLP1 and TObjLP2 when entering the field of view and exiting it. Observe the signals without any person to be detected. How much does the Object value vary when you are moving at long distance, how much at short distance?*
- ➔ *Change the 'Background Averaging' (cut-off 2). Can you 'model' the 'background' when nobody is in the field of view such that TObjLP2 is fast enough to follow the TObj signal? Try to make the 'Background Averaging' as slow as possible.*

Two settings were tested over several hours. The first setting with a **cut-off 1 at 1s and cut-off 2 at 8s** features narrow distributions for both low-pass values.

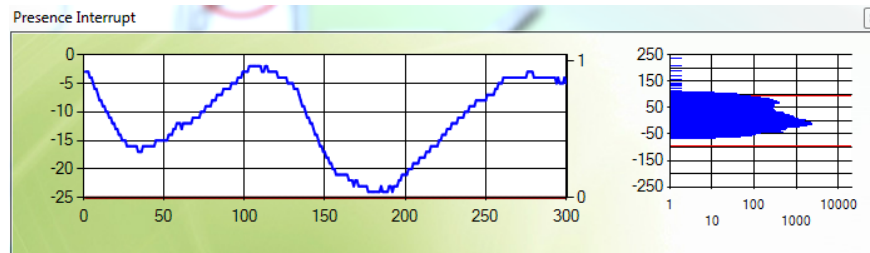


The recorded background in the presence-graph and its histogram suggests a threshold of 50 counts for an operation without false triggers.

The second setting is a very aggressive setting which reacts very fast to presence and senses even a slow entrance in the field of view.



With a cut-off 1 at 0.25s and cut-off 2 at 512s a very slow response to signal changes can be observed.



Even at stable conditions a higher threshold of 100 counts must be selected in order to suppress false triggers. The draw back here is a slow response to a rapidly changing environment. Both settings give a similar performance of 2-3m in sensing range.

- ➔ *Move in the field of view. Observe the 'presence' value. What happens to presence when you remain for a longer period of time in the field of view?*
- ➔ *Wait until presence is around 0. Adjust 'Motion Suppression' (cut-off 1) and 'Noise Suppression' (presence threshold) such that TObjLP1 is fast enough to sense you entering/exiting the field of view, but slow enough to suppress typical motion patterns in the field of view. Can you optimize both sliders such that 'presence' is at a maximum value for a long period of time?*

The aggressive setting with the very long cut-off 2 value has the advantage of a very long 'presence' detection and very high robustness against movement in the field of view. However it should be noticed that the smaller the difference between both cut-off results becomes with time, the less sensitive the measurement of absence becomes. Thus the



aggressive setting is only recommended for cases where the person is remaining for a relatively short time (several minutes) in the field of view and long pauses between entrances to the field of view.

## Integration behind a protecting window

The CaliPile™ is equipped with a silicon lens which can be easily exposed to the environment. To clean the sensor it is recommended to use alcohol and on a soft material. But of course it is possible to “hide” and protect the detector behind IR-transparent covers such as PE or PP. However due to the IR absorption in the material (about 50% of the signal for typical thicknesses of about 500µm) the signal amplitude is significantly reduced and the detectable distance becomes shorter. Fortunately simultaneously background is usually also dampened, which allows more aggressive settings. A TPiS 1S 1385 was tested behind 680µm thick transparent PP. The setting with a **cut-off 1 at 0.25s, cut-off 2 at 8s at a presence threshold of only 10 counts** allowed a detection range of about 2m.

## Host Optimization: Your contribution to make your product great

Sensing the presence of a human with only one channel is a very cost effective but also tricky task. We apply a model to the background with the assumption that what we do not want to sense by adjusting filter settings to large cut-offs. Simultaneously the object is assumed to be significantly faster changing the average temperature, thus being suppressed with lower cut-off values. The difference between both is defined then as ‘presence’. When the person is remaining the field of view for a longer period of time, at some point he will become ‘background’ and cannot be sensed anymore. Thus the host must assume that the person is still there. Thus ‘presence’ should be rather regarded as a motion detection feature which works without any additional lenses or other scrambling optics. To enhance the performance, some more logic can be implemented on the host system.

- *Enable ‘Use Host Optimization’. Observe the red percentage level in the ‘Presence Detection’ window. This is the difference between the ‘presence’ and the ‘threshold’. When ‘presence’ is around 0, optimize ‘Motion Suppression’ and ‘Noise Suppression’ such that your motion in the field of view does not reach 100%.*
- *Move away from the sensor. What does the host do with the cut-off 2 in order to come faster to a state where entrance to the field of view is again triggering the presence interrupt?*
- *Enter the field of view and wait until ‘presence’ is again around 0. Hold your hand in front of the sensor and wait again until ‘presence’ is again around 0. Remove the hand then. Are you now present or absent?*

This is a simple algorithm for the host in order to overcome the complication that at long terms a person must become by definition background. The person cannot be distinguished from a heater, air-conditioning or day-night fluctuations. Still it can be assumed that the person is moving significantly faster in and out of the field of view. But to ‘reset’ the TObjLP2 value back to the value of the real background during absence, the response must be increased by lowering the cut-off. Once TObjLP1 and TObjLP2 are at a similar level the previous filter setting can be restored (TObjLP1 > TObjLP2 when TObjLP1 is not dropping anymore) and the host can be put to sleep mode in order to be waked up by the interrupt only.

Issues here are for the case where more than one person is entering the field of view or the person is moving towards the sensors and going back. The algorithm can only distinguish between approach and stepping back. In case you have a quite stable environment over time, you may consider using the overtemperature feature.

- *Enable ‘Use Overtemp Feature’. Leave the scene and come back. Move in front of the sensor. Check at which distance you are actually leaving the scene.*

Enabling the overtemperature feature does 2 things: It remembers once you are entering the FOV the TObjLP2 value and sets it as a limit for the overtemperature. Even when you approach the sensor even more and step back again, the

sensor will only react once the signal falls below the limit. The disadvantage here is that you must assume that the background does not change significantly nor the sensor temperature does. The assumption of a “constant” background can work for many indoor applications.

Of course more elaborate filter operations can be developed, depending on the distance to the sensor, motion patterns, background behavior etc. The smart treatment of our parameters is the big opportunity for you and your company to make your application unique and better than other applications. Therefore we hope this small guide through the motion and presence features of our CaliPile™ product-family was encouraging enough to start developing your own ideas.

**Enjoy developing as much as we do supporting you in your development!**

## Copyright

This software is proprietary to Excelitas and dedicated for use in combination with the *Multisensor Demo Kit* for product evaluation purposes only and without licensing agreement.

This document and the product to which it relates are protected by copyright law from unauthorized reproduction.

Notice to U.S. Government End Users

The Software and Documentation are "Commercial Items," as that term is defined at 48 C.F.R. 2.101, consisting of "Commercial Computer Software" and "Commercial Computer Software Documentation," as such terms are used in 48 C.F.R. 12.212 or 48 C.F.R. 227.7202, as applicable. Consistent with 48 C.F.R. 12.212 or 48 C.F.R. 227.7202-1 through 227.7202-4, as applicable, the Commercial Computer Software and Commercial Computer Software Documentation are being licensed to the U.S. Government end users (a) only as Commercial Items and (b) with only those rights as are granted to all other end users pursuant to the terms and conditions herein. Unpublished rights reserved under the copyright laws of the United States.

## 1 More information

For additional information on Excelitas products: <http://www.excelitas.com/>

## 2 Third party resources

Microsoft© .NET® runtime engine: [www.microsoft.com/net](http://www.microsoft.com/net)

FTDI® USB drivers: <http://www.ftdichip.com/FTDrivers.htm>

## 3 Liability policy

Excelitas endeavours to provide a quality product and takes full responsibility for the correct function of the application kit with its own sensors. Excelitas is not responsible for any misuse of the application kit, or for the performance with any sensor other than with Excelitas sensors. Excelitas also takes no responsibility for any hardware or software failures caused by installing and using this software on a third-party computer system. The software is solely intended to operate the *TPiX Application Kit Version 2.0* for product evaluation purposes. Excelitas is not liable for property damage, physical injury, or data corruption.

Excelitas reserves the right to make changes or modifications to this product without notice.

Excelitas Inc. shall not be liable for direct, indirect, incidental, or consequential damages, including, but not limited to, loss of use, revenue, or prospective profits resulting from the use of this document or the product to which it relates. All warranties, express or implied, including, but not limited to, warranties of merchant ability and fitness for a particular purpose are hereby disclaimed.

**Excelitas Technologies**  
22001 Dumberry Road  
Vaudreuil-Dorion, Quebec  
Canada J7V 8P7  
Telephone: (+1) 450.424.3300  
Toll-free: (+1) 800.775.6786  
Fax: (+1) 450.424.3345  
detection@excelitas.com

**European Headquarters**  
**Excelitas Technologies**  
**GmbH & Co. KG**  
Wenzel-Jaksch-Str. 31  
D-65199 Wiesbaden  
Germany  
Telephone: (+49) 611 492 430  
Fax: (+49) 611 492 165  
detection.europe@excelitas.com

**Asia Headquarters**  
**Excelitas Technologies**  
8 Tractor Road  
Singapore 627969  
Telephone: (+65) 6775-2022  
Fax: (+65) 6778-1752

---

For a complete listing of our global offices, visit [www.excelitas.com/ContactUs](http://www.excelitas.com/ContactUs)

© 2011 Excelitas Technologies Corp. All rights reserved. The Excelitas logo and design are registered trademarks of Excelitas Technologies Corp. All other trademarks not owned by Excelitas Technologies or its subsidiaries that are depicted herein are the property of their respective owners. Excelitas reserves the right to change this document at any time without notice and disclaims liability for editorial, pictorial or typographical errors.