HEIMANN Sensor

HEIMANN SENSOR GMBH

*Operating Manual for Heimann Sensor*

# *ArraySoft*

*Rev.5 04.08.2016*

# Content

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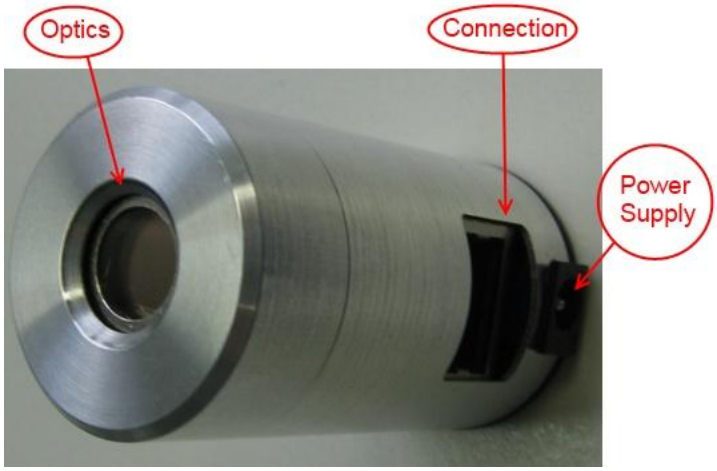
# 1 Accessories of the HTPA device




## 1.1 Optics

For the best optical performance of the HTPA device it is necessary to keep the lens clean. Be aware that every cleaning carries a risk of damaging the lens or the coating of the lens. Scratches occur when something harder than the optical coating is rubbed over the lens. Lens cleaning tissues (lint-free) and fluids are recommended for cleaning. Dust and other particles can scratch the lens when rubbing them off. Therefore, first remove the dust on the optical surface. This can be done by using compressed gas, a soft brush or a bellow. Organic dirt, such as fingerprints can be easily removed with special tissues and fluids. There are special fluids available on the market, but it is also possible to use a tissue with a few drops of ethanol or isopropyl alcohol.

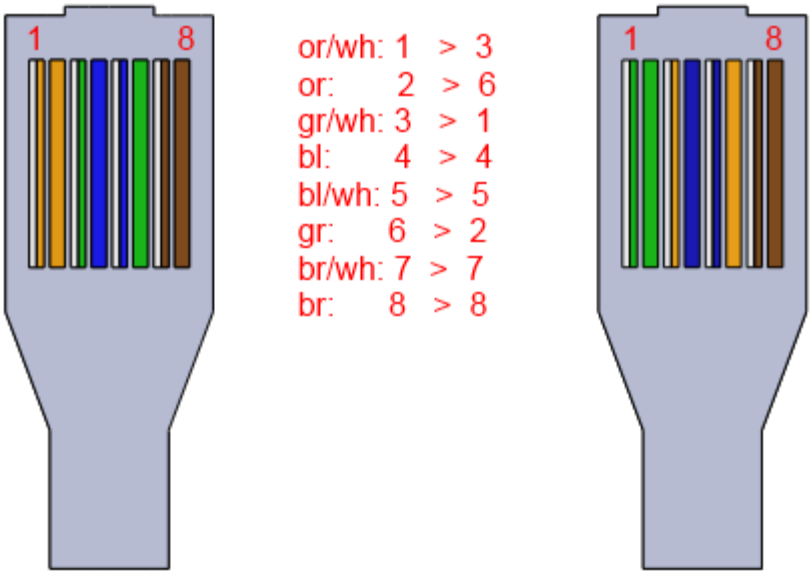
**Avoid intense rubbing** on the lens! If fluids are used, they shouldn't be applied directly on the surface of the lens. Always use a tissue additionally, which is only used once.

## 1.2 Connections

For a detailed description which cable should be used, see "3.2 Connect HTPA device".

- Ethernet:
  - Standard ethernet cable


  - Crossed ethernet cable



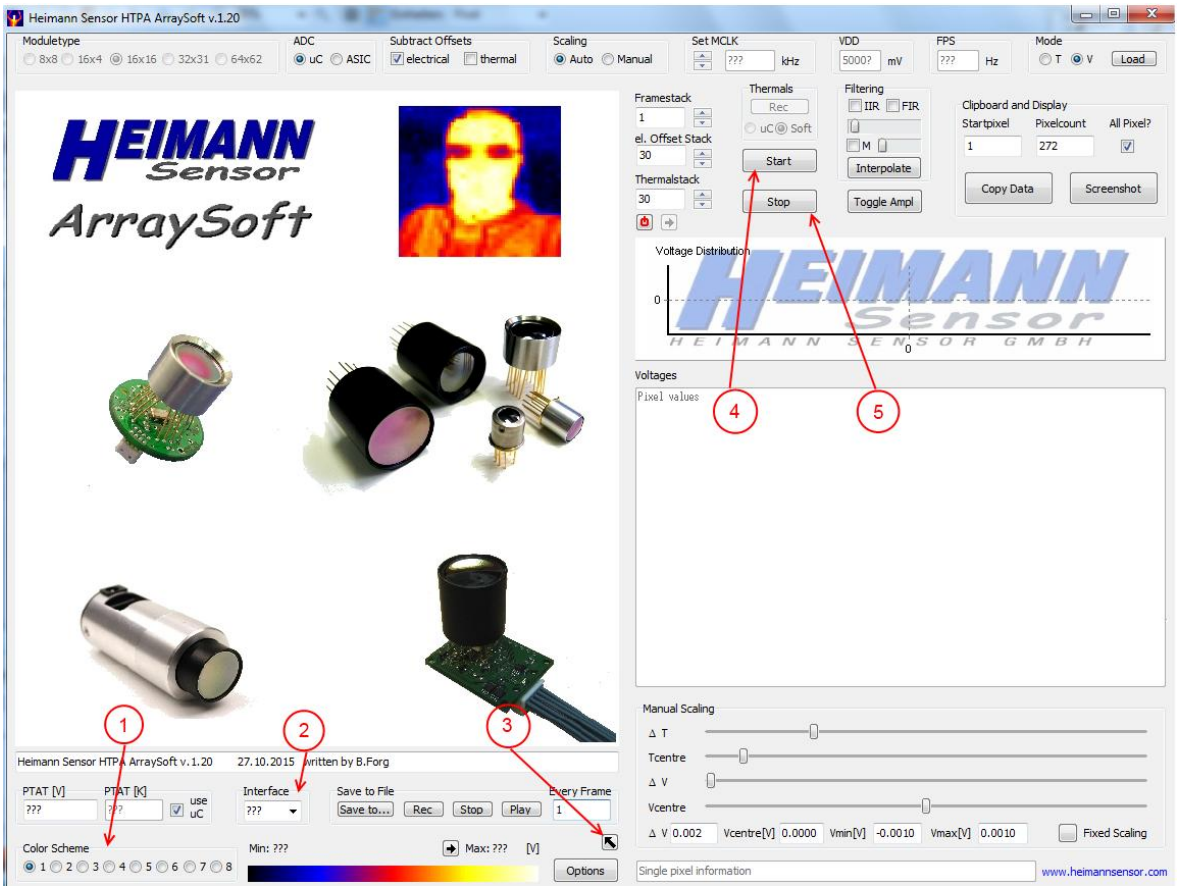

- Power supply : 3.3 VDC +/- 5%, 300mA

  VSS (-) GND

  VDD (+) Supply (+3.3V DC)

# 2 ArraySoft Program Features

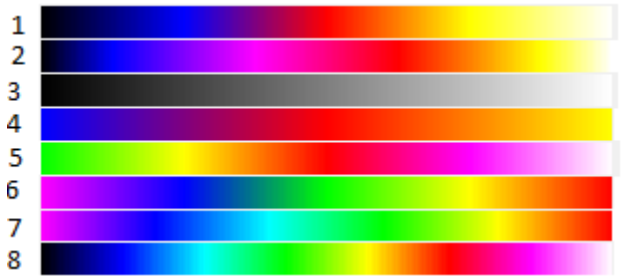
## 2.1 Basic Control Elements




**2-1: Basic Control Elements**

### (1) Color Scheme

There are eight different color schemes available:




**2-2: Color Schemes**

**(2) Interface**

It can be chosen between UDP (LAN) and COMx (Serial Port, only UART devices). By choosing UDP automatically a broadcast is sent, which searches for devices. All responding HTPA devices are bound to the IP of the local machine, on which the GUI is running on.

**(3) GUI size**

This Button scales the GUI size smaller or larger. This is useful if the display resolution is smaller than 1280x1024.

**(4) Start**

Starts the data streaming.

**(5) Stop**

Stops the data streaming.

## 2.2 Advanced Control Elements


**2-3: Advanced Control Elements**

### (6) Moduletype

Shows the module type of the current HTPA device (e.g. 16x4, 32x31…).

### (7) ADC

This allows choosing the analogue digital converter (ADC) of the µC or of the ASIC if the HTPA sensor supports this feature.

### (8) Subtract Offsets

It is possible to subtract electrical and/or thermal offsets. The checkbox “thermal” subtracts only the thermal offsets. The checkbox “electrical” subtracts the operating point of the amplifiers.

**(9) Scaling**

**Auto:** This function searches for the minimum and maximum voltage / temperature value in each frame and sets these values as the limits of the false color scale. Therefore, in this mode the min and max values are dynamic and allow a maximum contrast of the selected color scheme.

**Manual:** In this mode it is possible to fix the min and max values of the false color scale to any temperature or voltage value. It is also useful to set the range manually to eliminate ambient noise. For further information about manual scaling see ***(32).***

**(10) Set MCLK**

The clock for the ASIC is delivered by the microcontroller and can be decreased or increased by pushing the up or down button. The frame rate of the device is proportional to the MCLK value. In temperature mode the HTPA device will read the MCLK-calibration value from EEPROM and set it. Therefore, MCLK changes take only effect in voltage mode.

**(11) Clipboard and Display**

The button "Screenshot" copies a JPG of the current infrared image into the clipboard of the PC. Pasting this JPG e.g. into another application by pressing CTRL and V is useful for evaluating.

The button "Copy Data" copies the pixel values into the clipboard of the PC as ASCII data. So it is possible to analyze the pixel values in another software. Additionally the number of copied pixels can be chosen. All Pixel data is copied into the clipboard if "All Pixel?" is checked. For copying another amout of pixel data the "All Pixel?" checkbox must be unchecked and a "Startpixel" and a "Pixelcount" must be typed in. For example if "Startpixel" is set as 5 and the "Pixelcount" is set to 4, the data of pixel 5, 6, 7 and 8 are copied in to the clipboard.

**(12) Mode**

The default output data type is voltage (checkbox is set to "V"). This mode shows the voltage values of the pixels. In voltage mode recording of thermals ***(15)*** is available.

If the checkbox is set to "T" the temperature mode is selected. It is recommended to stop data capturing before changing the mode. Temperature mode is only available with the calibration setup of the device.

In temperature mode it is possible to change from absolute temperature scale to degree celsius temperature scale by typing "celsius" in the Message line ***(26)***, or using the Options

***(14)*** dialogue. Shifting back to absolute scale works the same way. The "Load" button loads the calibration data of the sensor module into the ArraySoft, wich can be used if one of the Temperature Calculation→by GUI features is used. This feature is only available for some devices and will become obsolete in future.

### (13) Save to File

The data stream can be saved in a binary-, text- or .avi file. For analysing the **text files** are easier to handle. Clicking "Save to…" and entering a file name, file type and destination generates an corresponded file. By generating a text file, it is necessary to enter the starting-pixel and, after that, the amount of pixels to be stored. For example, entering 5 and 3 means that the pixelvalues 5, 6, 7 will be stored. This option does not exist for binary files.

Data capturing starts by clicking "Rec" in the Save to File-Box. The button is highlighted red, as long as data capturing proceeds. By pressing "Stop" in the Save to File box the record stops. For playing the stored stream (.bds) with your ArraySoft, "Play" must be clicked. A new window appears. By pressing "Open stream…" and opening the desired file, the stream is replayed. The frame rate in Hz*10 must be typed in and confirmed.

It is also possible to reduce the size of the file by setting the figure in the "Every Frame"-field to a different amount. When "Every Frame" is set to 6, for example, then only each sixth frame is recorded. This value is also used, when a recorded data stream is replayed.

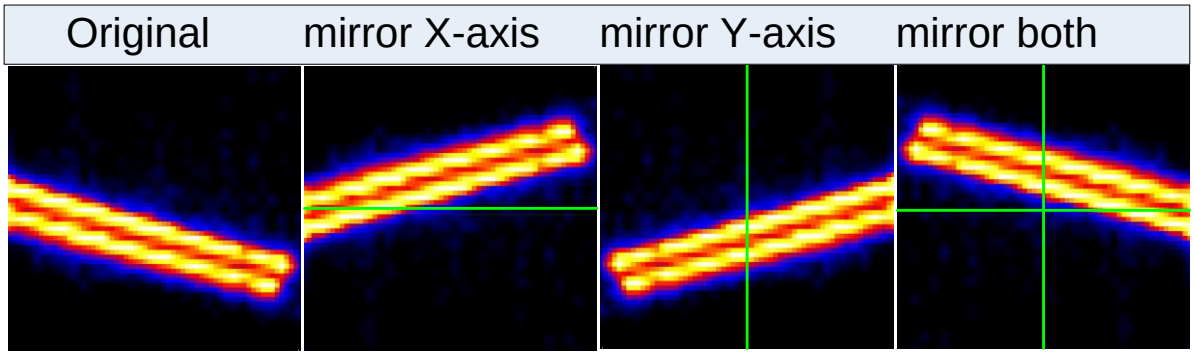
By choosing an .avi file and pressing "Rec" several codecs may be available for selection. This depends on the codecs which are installed on your machine, the GUI comes without codecs. The compression causes less storage consumption of the the .avi file, but will come with the disadvantage of less quality. These files can be replayed e.g. with Windows Media Player or comparable programs.

### (14) Options

**"Temperatures in"** allows an easy change from absolute temperatures to degree celsius if temperature mode is selected.

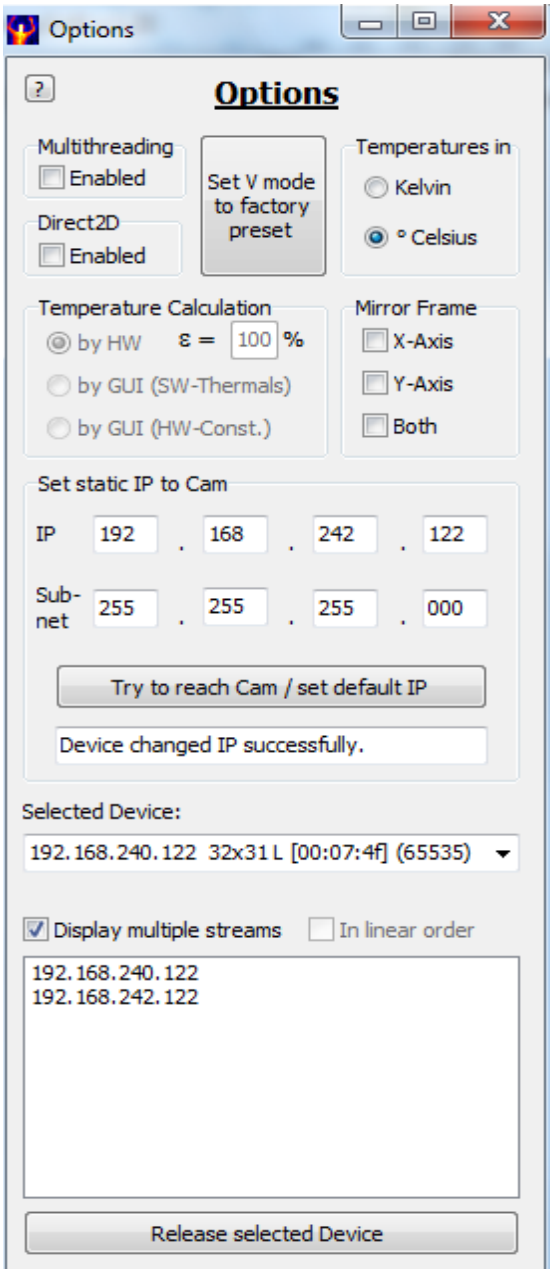
**"Temperature Calculation"** changes the temperature calculation. For users, only "by HW" (by Hardware) and "by GUI (SW-Thermals)" is useful. "By HW" is the default setting.

**"Mirror Frame"** mirrors the pixel screen according to the following axes:




**2-5: Mirror Frame**

With **"Set static IP to Cam"** it is possible to set the default IP of the device. IP and subnet should by typed into the boxes and confirmed by clicking "Try to reach Cam". Only the device, which IP should be changed, must be powered and connected. Otherwise, all devices which receive the message will change their IP to the requested value. Multiple devices with the same IP in the same subnet will cause packet collisions. The given IP will be used in the active session. Nevertheless, selecting "UDP" in the Interface-Box is necessary again. When a reset occurs (for example by a power event) the device tries to get an IP via DHCP. If no DHCP is present, the given default IP will be used. If multiple devices were found it is possible to select the appropriate device with the combo box "Selected Device".

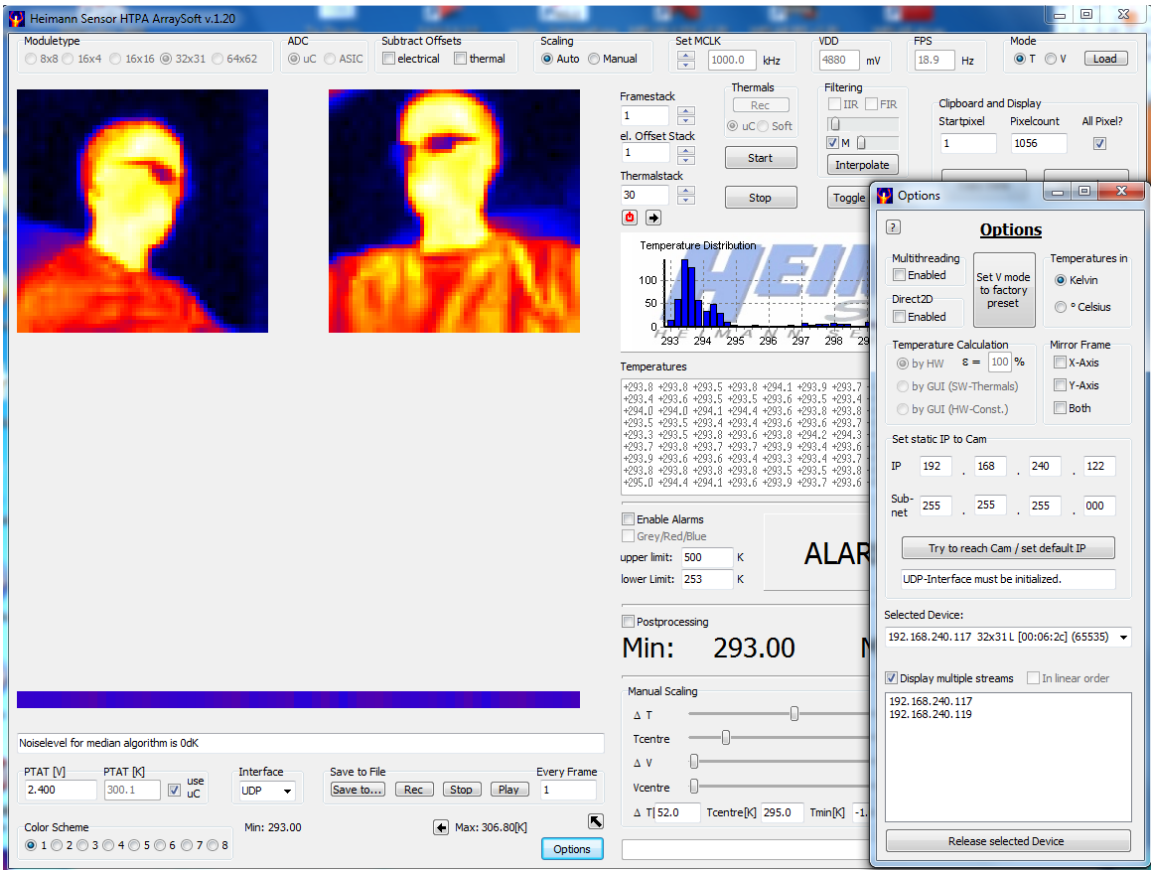



**2-4: Options**

**"Selected Device"** allows to change the connected device if more than one device is present on the LAN.

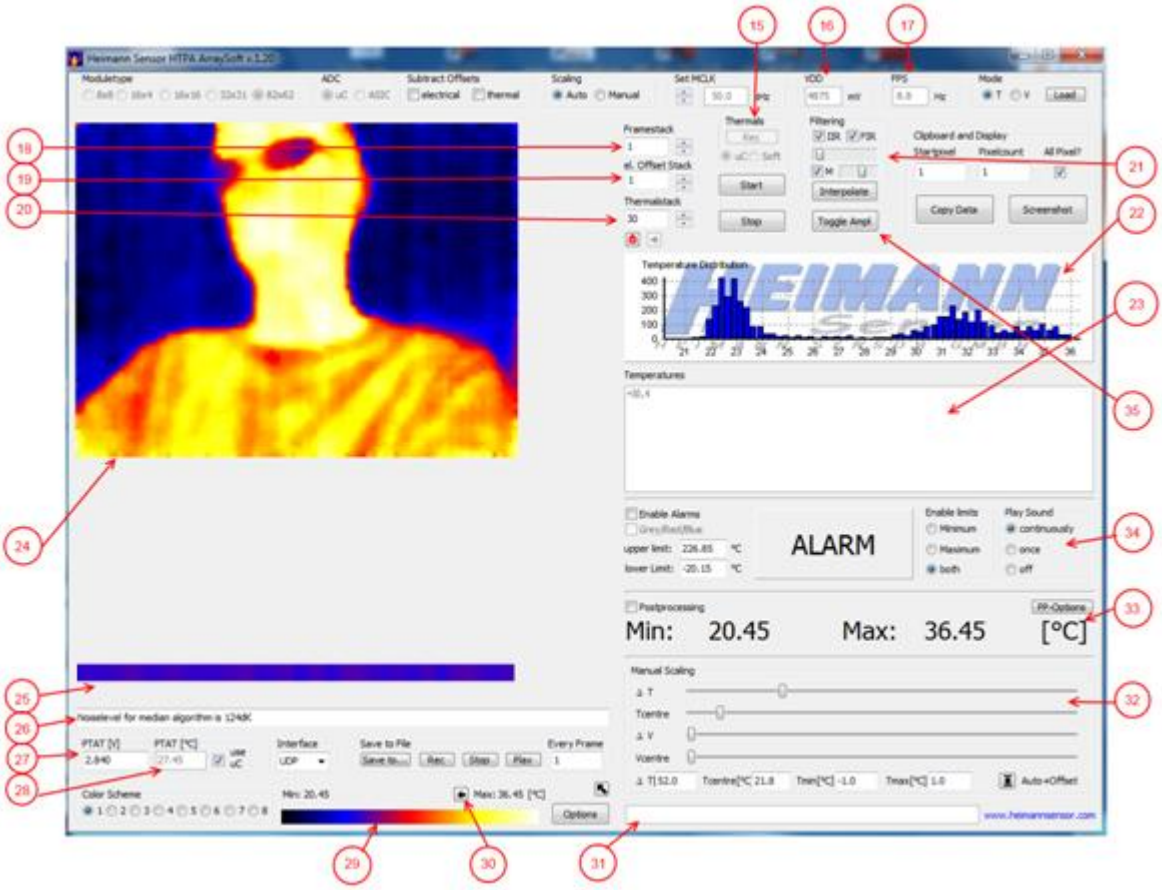
If multiple clients were found by selecting "UDP" in the "Interface" combobox, it is possible to "**Display multiple streams"**, if the devices are from the same type (e.g. 16x16). To display multiple streams, the box

“Display multiple streams” in the options dialogue must be checked and the devices should be added to the list by selecting them in the combobox “Selected Device”. It is possible to add up to four devices to the list. The device can be deleted for multistreaming by doubleclicking it. When multiple streams are shown, all figure data (except FPS) which is shown on the GUI is from the current selected device. The FPS data is generated out of the sum of all devices. Changing the current selected device can be done by clicking somewhere in the frame of the appropriate device. The frames are sorted in order of their IP. The frame in the upper left corner is the device with lowest, the frame in the lower right corner is the device with the highest IP.




**2-6: Multiple streams**

## 2.3 Image Processing




**2-7: Image Processing**

### (15) Thermals

In voltage mode it is possible to capture thermal offsets. For this it is necessary to cover the lens with an homogenous tempered object with a high absorption coefficient during the process (until the button is highlighted red). For the thermal offsets there is an arbitrary stack too. In voltage mode it is recommended to record the thermals. The voltages of each pixel in relation to the tempered object is set to zero.

Normally, in temperature mode the thermals are calculated and subtracted by hardware, but it is possible to use the recorded thermals in temperature mode for some devices. At first a connection of a module to the GUI is necessary and by selecting UDP in "Interface" ***(2)*** and pressing "Load" ***(12)***, the calibrations constants will be loaded. After that, opening the "Options" ***(14)*** dialogue and selecting "Temperature Calculation" by GUI (SW thermals) make a software calculation of temperatures possible. A message box will appear, which will guide the user if the thermals have to be recorded weather the "Subtract Offsets" checkbox "electrical" is checked or not. Selecting voltage mode ***(12)*** starts the device.

With covering the lens and then pressing “Rec Thermals” the thermals will be recorded and subtracted. When the red mark disappears, the device can be stopped and “T” for the temperature mode can be selected. After restarting the GUI shows temperature values. The recorded thermal offsets will be used as long as the checkbox “by GUI (SW Thermals)” in “Options” ***(20)*** is activated. It is useful to measure thermals by software for compensation of temperature drifts of the system. But be aware, that readings might be incorrect, if the object, which has covered the lens, was not exact at the same temperature as the ASIC. Therefore, use this option with care.

**(16) VDD**

Shows the VDD of the current HTPA device in mV.

**(17) FPS**

Shows the frame rate of the current HTPA device in Hz.

**(18) Framestack**

The “Framestack” allows a moving average over multiple pictures for better SNR since the larger bandwidth will decrease noise. The frame stack can get a size between 1 and 300. It can be changed by typing the desired value directly into the field or by using the buttons.

**(19) El. Offset Stack**

The “Electrical Offset Stack” builds an average value from multiple frames for each amplifiers operating point. The value determines how many frames are used for averaging. The stack size can be changed between 1 and 300 by typing the number directly into the field or by using the buttons. The microcontroller electrical offset buffer is static at the size of 64 or 32 (device dependent) and starts working after it is filled up.

**(20) Thermalstack**

This stack builds an average frame, which can be subtracted by checking “thermals”. The value determinates how much frames are recorded for an averaging. The thermal software stack size can be changed between 1 and 300 by typing the number directly into the field or by using the buttons.

**(21) Filtering**

**IIR/FIR:** The infinite impulse response filter and finite impulse response filter are both $2^{nd}$ order low-pass Bessel filters and work in voltage- and temperature mode to reduce noise. They have a cut-off frequency of 3 Hz. The delay of the FIR filter is 300 ms and of the IIR filter is between 60 ms and 130 ms.

**Adaptive Average Filter:** The scrollbar below the IIR/FIR filter sets a noise reducing adaptive average filter. It is only available in temperature mode. Is the temperature difference of the correspondend pixel to the last value greater than the defined threshold, the filter has no effect. If it is smaller, then the value of the pixel is calculated as an average of the last 4 pictures. So, noise of static scenery can be reduced. If the threshold is set to high image artifacts can occure.

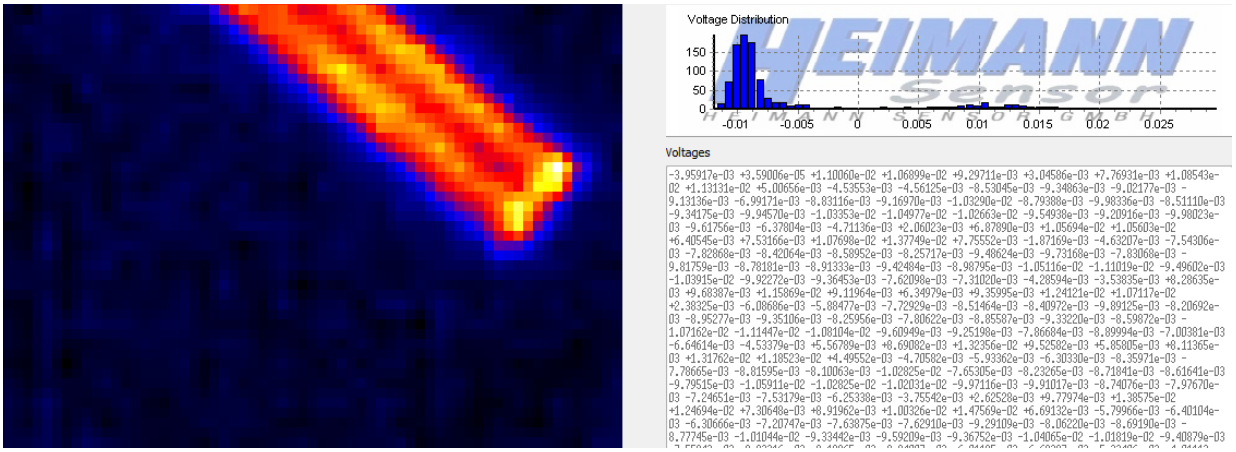
**Median Filter:** This filter helps to reduce noise in order to get a homogeneous image. It sorts the voltage- or temperature values of each neighbor pixel and writes the median value of this group of pixels.

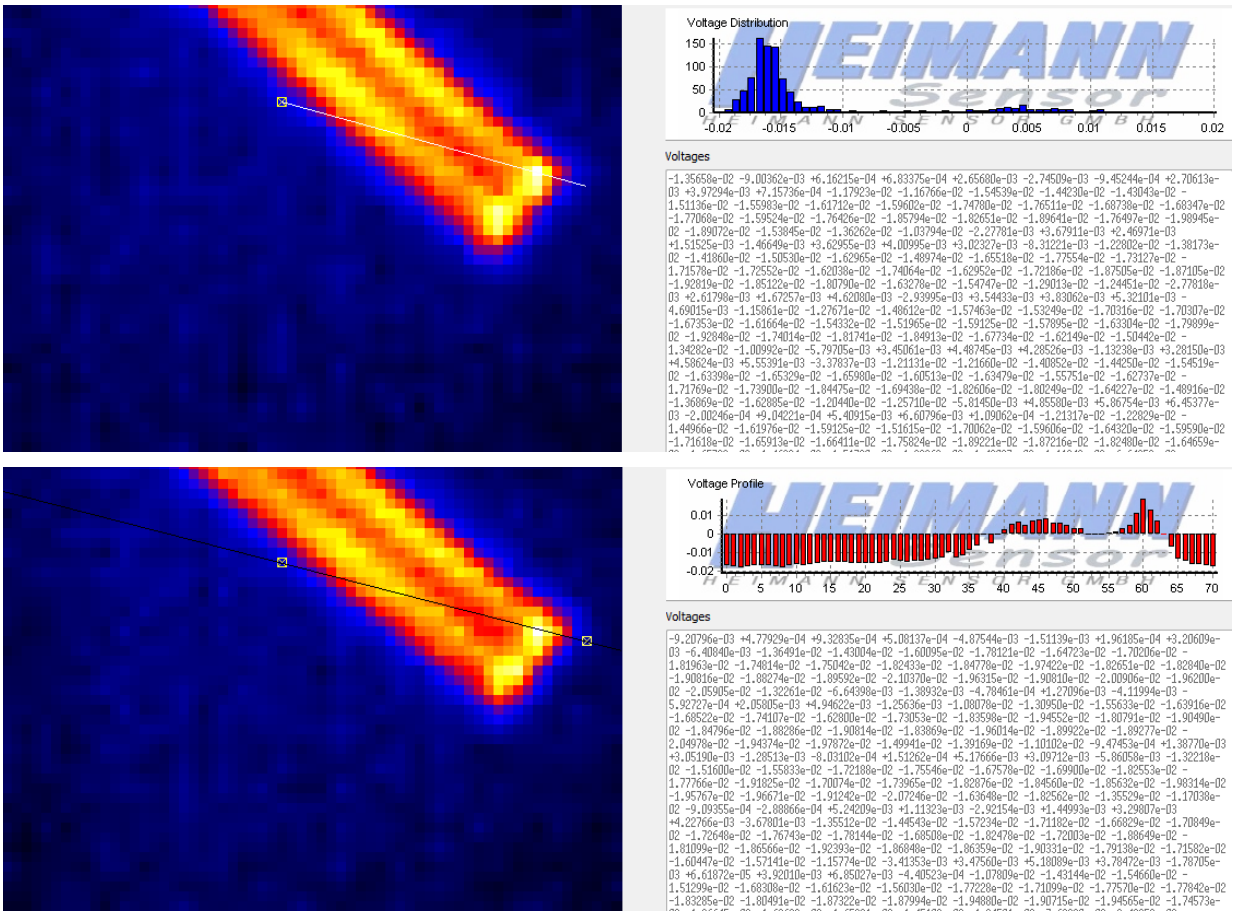
The threshold, which can be set by the scrollbar, defines at which quotient (in voltage mode) or difference (in temperature mode) the filter has no effect. This is useful to exclude edges of the image of the median filter function.

**Interpolate:** This function allows a simulation of a higher resolution with a factor of 2*n-1, where n is the number of pixels per line or column. For example will a 32x31 array have 63x61 interpolated pixels.

## (22) Histogram / Temperature and Voltage-Profile

The Histogram shows the distribution of the voltage / temperature. Normally the Histogram shows the amount of pixels with a given value in dependency of voltage or temperature. This distribution is calculated for all sensitive pixels. It is possible to draw a profile line with the mouse into the image, which shows the pixel value in dependency of the pixel coordinate. Therefore, you can draw a line on the “Pixel screen” and every pixel which subtends the line will be shown in the Histogram. The selected cutting edge is shown in the pixel screen and the Histogram shows the temperature / voltage in dependency of the position.






**2-8: Profile line in histogram**

### (23) Voltages

Shows the voltage / temperature values of the pixels.

### (24) Pixel screen

The Pixel screen shows a false color image for the temperature / voltage frames which are transmitted from the HTPA device. The color scheme can be chosen easily ***(1)***.

### (25) PTAT and electrical offset

Shows the PTAT and electrical offset of the pre amplifiers as a false color image, scaled between 0 and VDD with the same colors as the Pixel screen.

### (26) Message line

Shows information like amplification, current IP-Address of the connected HTPA device and several other messages, transmitted by the HTPA device.

### (27) PTAT [V]

Shows the PTAT value in V.

**(28) PTAT [K]**

This value is only shown in temperature mode and represents the ambient temperature of the chip.

**(29) False color scale**

The false color scale shows the chosen color scheme with the current minimum and maximum values of the temperature or voltage frame.

**(30) Min/Max enable arrow**

This button activates the Alarm screen ***(34)*** and the postprocessing screen ***(33)***. Deactivating this button enlarges the voltages screen ***(23)***.

**(31) Single pixel information**

Single pixel information shows several information of the selected pixel (coordinates, pixel number, el. offset of the pixel and amplified TP-Voltage) in the pixel screen ***(24)***. The pixel can be selected by simply clicking on it in the pixel screen.

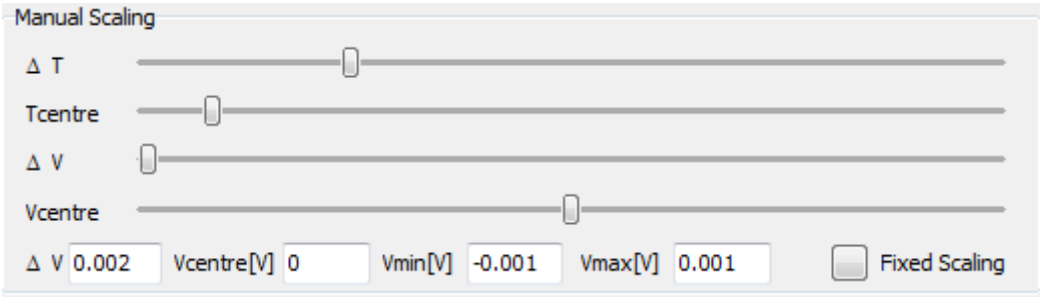
**(32) Manual Scaling**

This field is active if the scaling ***(9)*** mode is set to "manual". The values can be changed by direct typing or by using the sliders. It is possible to increase the accuracy of the slider by factor 2, 4 or 8 by pressing SHIFT, ALT or SHIFT+ALT during sliding. There are six different manual scaling modes. You can switch between these modes with the button in the lower right corner of the "Manual Scaling" box.

**Mode 1 (Fixed Scaling)**

This is the standard manual scaling mode which can fix the absolute "min" and "max" values of the false color scale.

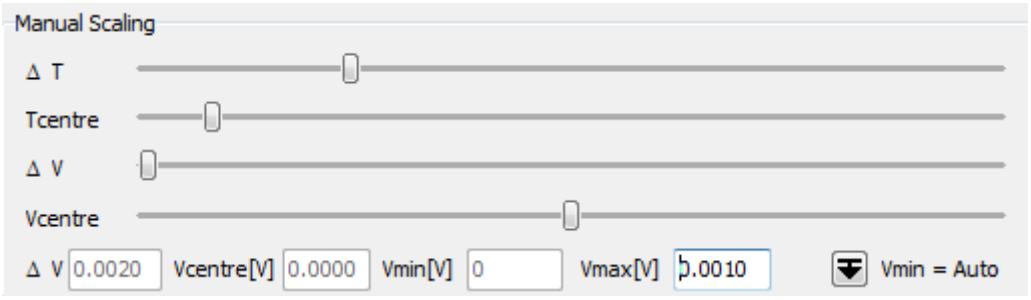
To set the desired range changing of ΔV, Vcentre, or -Vmin and Vmax is possible. ΔV is the difference between Vmax and Vmin, Vcentre is the middle of ΔV.




**2-9: Fixed scaling**

### Mode 2 (Vmin = Auto)

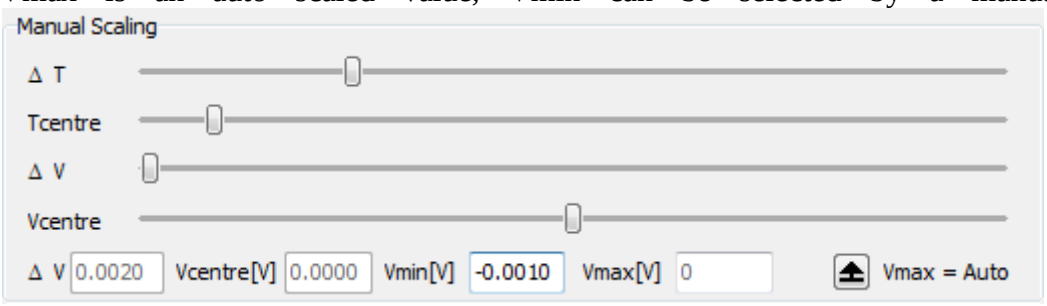
Vmin is an auto scaled value, Vmax can be selected by a manual value.




**2-10: Vmin=Auto**

### Mode 3 (Vmax = Auto)

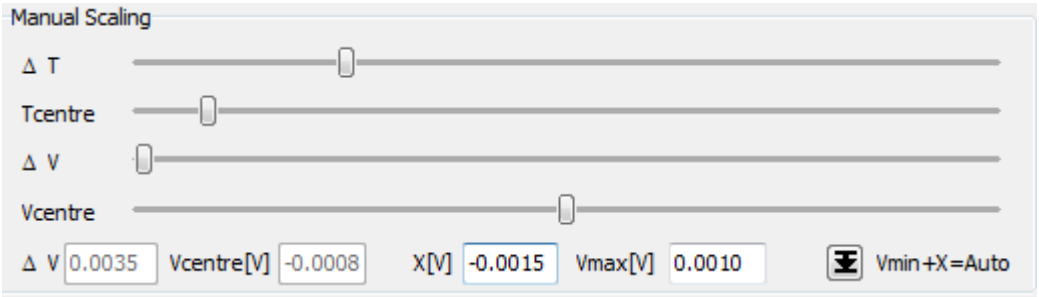
Vmax is an auto scaled value, Vmin can be selected by a manual value.




**2-11: Vmax=Auto**

### Mode 4 (Vmin+X = Auto)

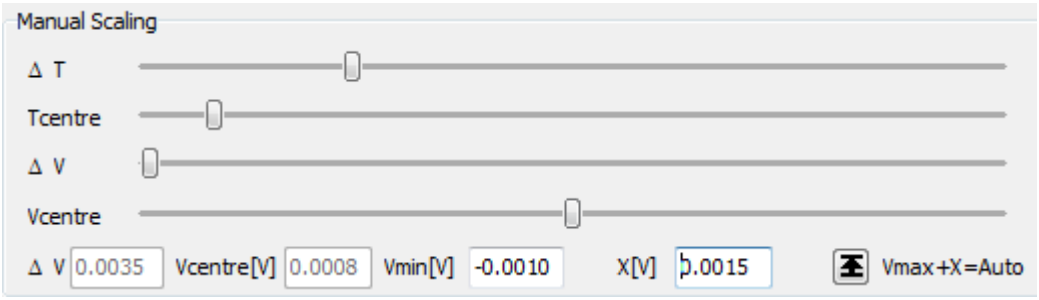
In this mode changing the Vmax value and adding an offset to Vmin (which is auto scaled), called X, is possible.




**2-12Vmin+X=Auto**

### Mode 5 (Vmax+X = Auto)

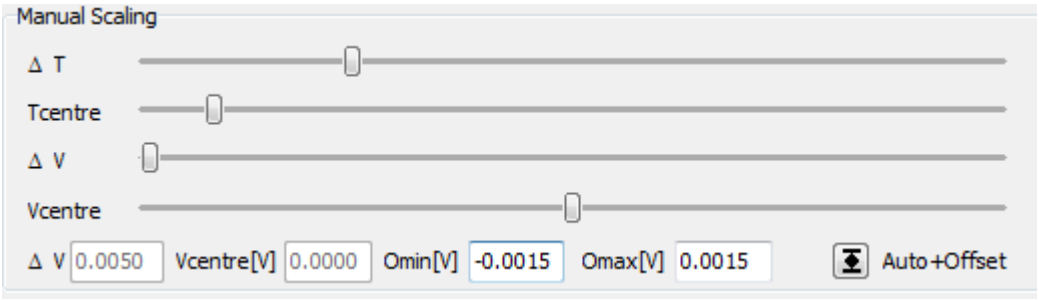
Vmin is changeable and an offset, called X, can be added to Vmax (which is auto scaled).




**2-13Vmax+X=Auto**

### Mode 6 (Vmin+Omin = Auto and Vmax+Omax = Auto)

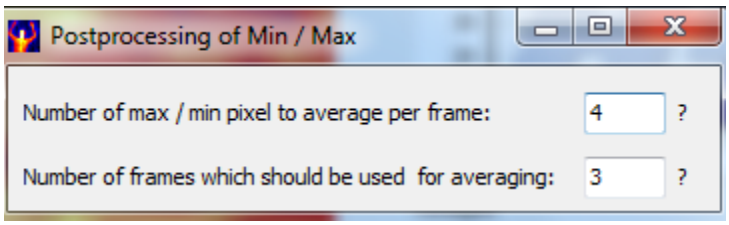
In this mode are Vmin and Vmax values auto scaled and additionally the offsets Omin to the Vmin and Omax to the Vmax can be added.




**2-14Vmin+Omin=Auto and Vmax+Omax=Auto**

### (33) Min/Max/Postprocessing

After clicking the "Enlarge Min/Max" button ***(30)*** an additional large min/max display is shown. In default settings the minimum and maximum value either in Volt or in Kelvin/°C is printed.




**2-15: Postprocessing of Min/Max options**

By hitting the "PP-Options" button, a definition of how many pixels the program should use to average the min and max values and how many frames should be taken to average

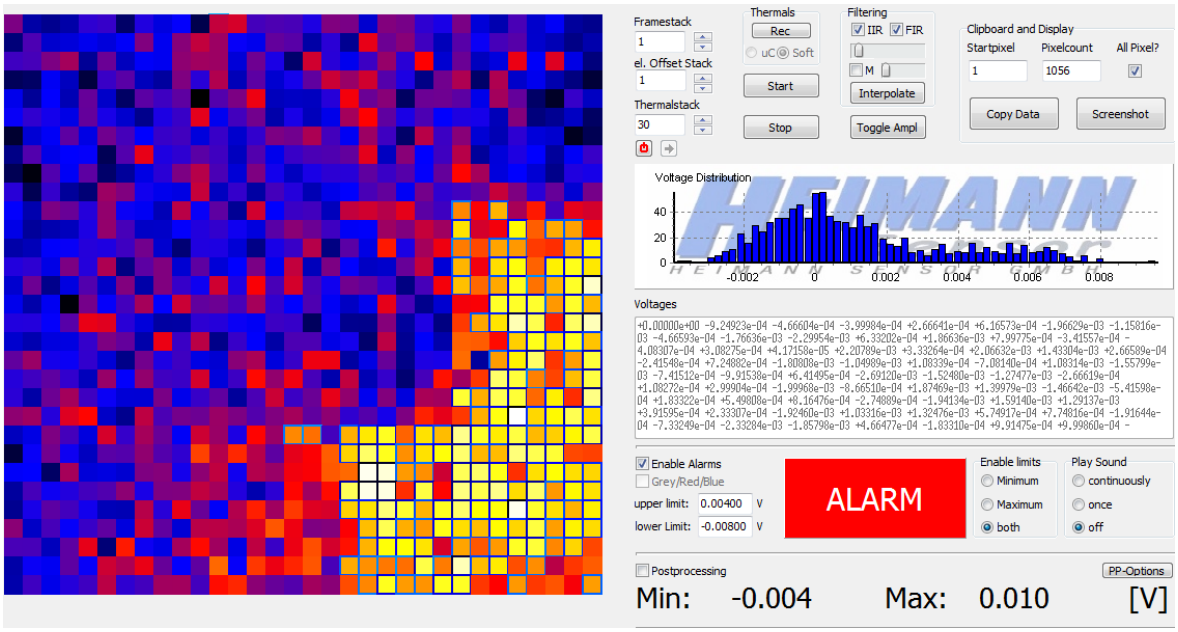
these values can be set. To activate this postprocessing the “Postprocessing” checkbox above the displayed min value must be checked. The result is a more stable min/max value.

### (34) Alarms

After clicking the “Enlarge Min/Max” button ***(30)*** the alarm display is shown, too.

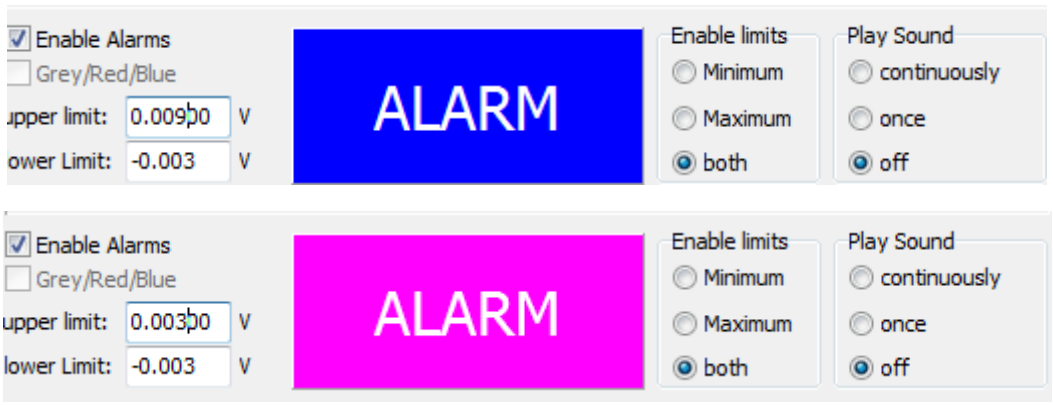

**2-16: Alarm display**

By activating the alarms using the „Enable Alarms“ checkbox, pixels in the image can be highlighted. This can be done by changing the values of “upper limit” and “lower limit”. The alarm occurs if the minimum or maximum or both values are exceeded. Besides this it is possible to get a sound alarm. This can be a continuously alarm or an alarm which only occurs once.




**2-17: Enabled alarm**

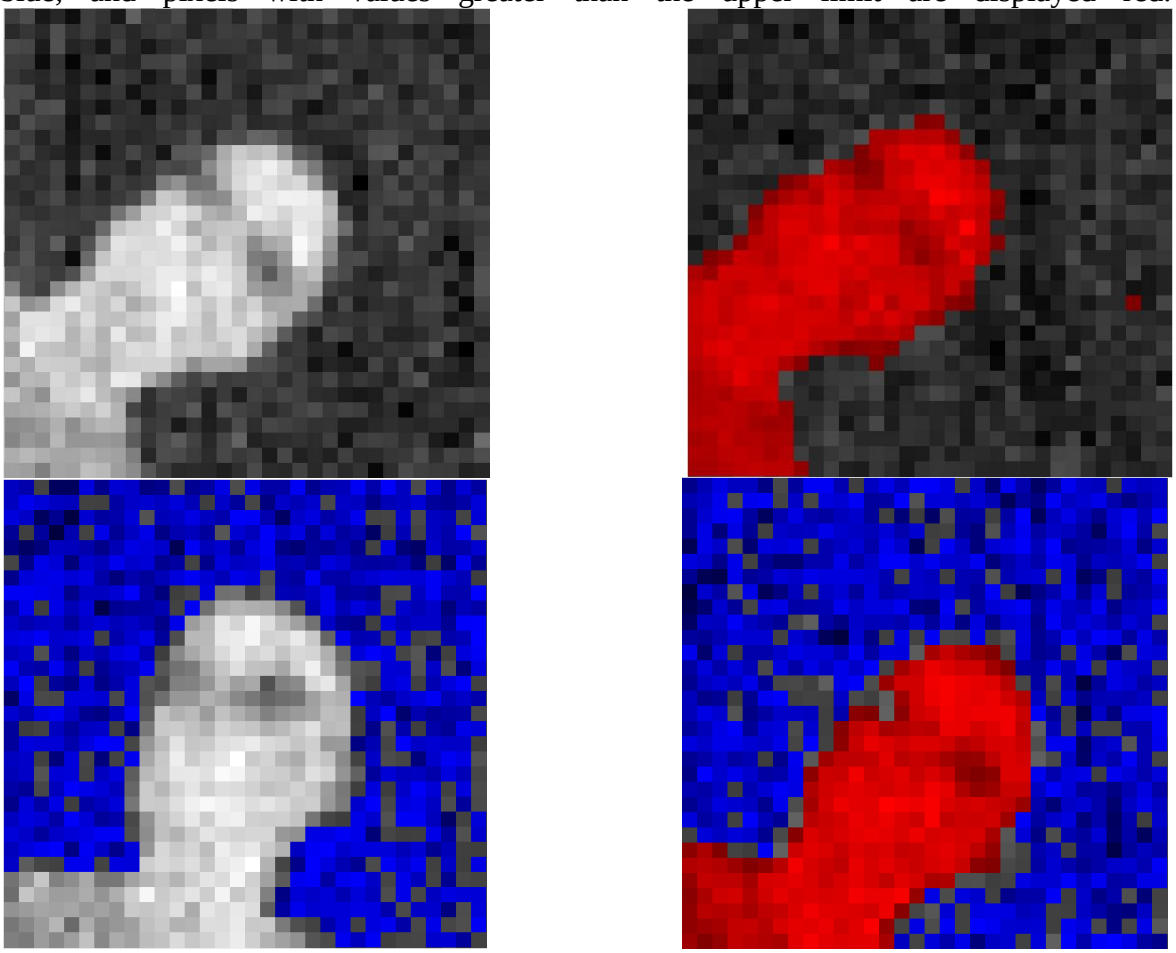
Figure 2-17 shows how pixels are highlighted if alarm is enabled. Also the “ALARM” box is highlighted red if a maximum alarm occurres. If a minimum alarm occurs this field will be displayed blue. If both occur, then the ALARM is highlighted purple.




**2-18: Colored alarm identification**

The alarm is available in voltage and temperature mode. In temperature mode the limits can be changed by typing values in Kelvin.

Another feature is only available with the grey scaled color scheme. Here it is possible to check “Grey/Red/Blue” where pixels with values smaller than the lower limit are displayed blue, and pixels with values greater than the upper limit are displayed red.



**2-19: Grey/Red/Blue alarm presentation**

### (35) Toggle Ampl

This button switches between high and low amplification. The current amplification is shown in the message line ***(26)*** after the “Toggle Ampl” button is pushed, or in the options dialogue->Selected device. If the last letter in the combo box is “L” the amplification is low, if it is “H”, the amplification is high.

The values both for high and low are sensor dependent and can be gathered by the corresponding datasheet of the sensor.

Be aware that an use of “Toggle Ampl” in Temperature Mode is not possible, because the device always reads its calibration value.

# 3 Getting started

## 3.1 Install software

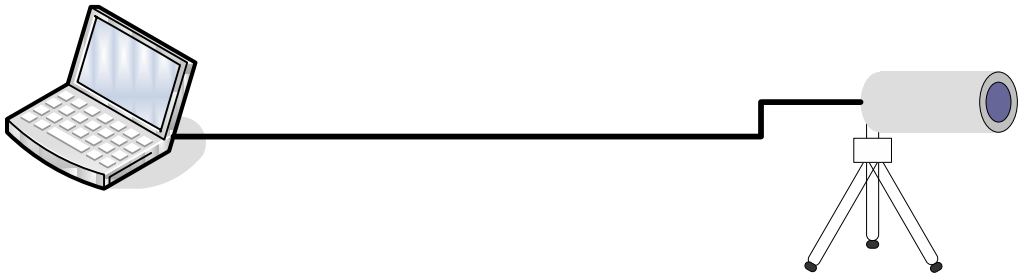
The Software for the HTPA device is on a CD which is generally included in Application sets.

Install the Arraysoft by copying the files Cam.exe and HTPA_Unwise.bat into any directory of the HDD. If a previous version of ArraySoft was installed it is necessary to start HTPA_Unwise.bat for once first.

## 3.2 Connect HTPA device

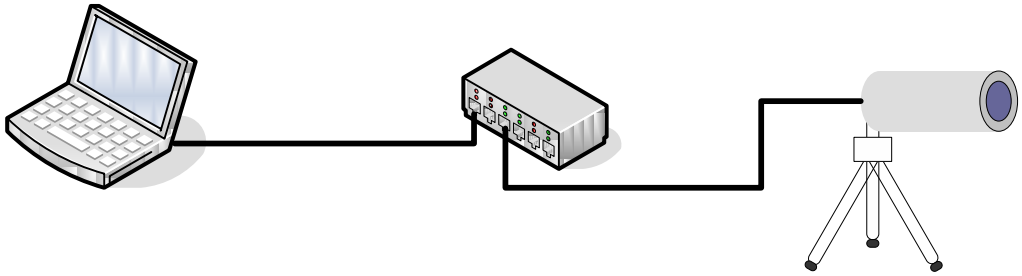
- Communication
  - Direct connection (crossed connection) to PC:

    For this type of connection a crossed ethernet cable is needed (A crossed ethernet cable is generally included in application sets).



  - Connection via Switch/Hub

    This Connection needs a normal/standard ethernet cable.



- Power supply

  The analog HTPA devices should only be used with a 3.3V DC power supply, otherwise the HTPA device might be damaged. The digital HTPA devices should be powered via USB (5V DC).

Events on power up:

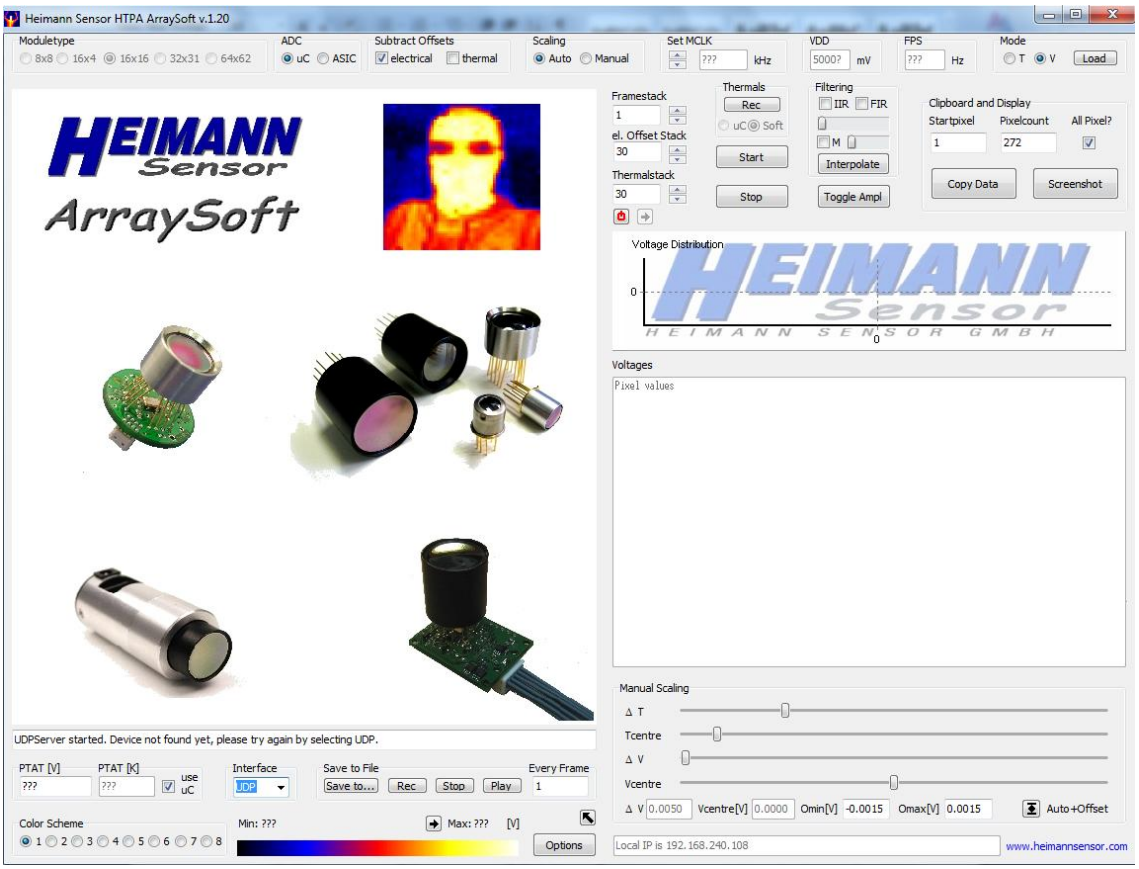
If a DHCP is present in the network, the device will get his IP via the DHCP. In this case no further steps are required. If no DHCP is present (usually when the device is directly connected to a computer or Laptop) the device tries 10 seconds to reach the DHCP. If this time expires, the device tries to recover an IP and subnet mask, which was set in a previous session by user. If no IP was set by user the device uses the **default IP 192.168.240.122.** The subnet mask is in this case 255.255.255.000.

## 3.3 Execute ArraySoft (Cam.exe)

Select "UDP" in the Interface-Combo-Box.

If a DHCP is present, the GUI will show in the message line: *"Client found at XXX.XXX.XXX.XXX. Ready to operate."* The X-values represent the given IP-Address of the device. In the single pixel information line of the GUI ***(31)*** the IP of your local machine is shown. If the device was not found, the dialogue *"UDPServer started. Device not found yet, please try again by selecting UDP."* will be shown in the message line. Be aware that the **device usually needs about 10-30 seconds to start up completely** (depending on device type). If the GUI found a device, but could not operate it properly, check the IP's of the system and the HTPA device. The standard subnet mask is 255.255.255.000. The reason might be that the search for devices, which is done via broadcast, could reach the recipient, but the control packets are not forwarded to the device. In this case, the IP of the device can be changed by a click on the options button ***(14)***. In the options dialogue subnet mask and IP can be set and by pressing *"Try to reach Cam"* they are sent. Be aware, that only one device is online, otherwise all of the devices will change their IP to the given values too! If the device changed its IP successfully, a message box will appear. In some cases it might be necessary that the IP of the PC, on which the GUI is running, is changed to the same subnet, as the default IP of the device signifies. This might be only necessary, when the user IP wasn't set. If the user IP is set and no DHCP is found the device will operate with the user IP. Therefore the user IP should be changed into the same subnet, as the PC, on which the GUI is usually running.

If you still experience connectivity problems, please have also a look into the FAQ, which are supplied on the same CD as this manual.




**3-1: ArraySoft (Cam.exe)**