Considerations

Follow the IEC and ISO recommendations

IEC 80601-2-59:2017 Medical electrical equipment — Part 2-59: Particular requirements for the basic safety and essential performance of screening thermographs for human febrile temperature screening.

ISO/TR 13154:2017 Medical electrical equipment — Deployment, implementation and operational guidelines for identifying febrile humans using a screening thermograph

ISO 80601-2-56:2017 Medical electrical equipment — Part 2-56: Particular requirements for basic safety and essential performance of clinical thermometers for body temperature measurement

FDA Temporal guidelines for the use of Thermographic cameras

The US FDA has declared it will not go after the many companies marketing unapproved fever detection cameras during the coronavirus public health emergency as long as they "do not create an undue risk", even though it does consider these products medical devices, it has announced in new guidance. (1) (source: IPVM)

https://www.fda.gov/media/137079/download

MOBOTIX Statement

- All information provided is intended as a guide.
- This is not a certified medical device.
- Please use as a rapid preliminary screening process to measure elevated temperatures in human.
- Only for indoor applications. Never use outdoors.
- Follow the local government health organization guidance such as FDA, IEC and/or ISO when using this product.

MOBOTIX Thermal Sensors	
Thermal Sensor Type:	Uncooled Microbolometer
Thermal Resolution:	336 x 252
Pixel Pitch:	17 µ m
IR Range:	7.5 to 13.5
Lens Options:	45˚, 25˚, 17˚
Housing Options:	M16 or S16 Series
Power Consumption:	< 10W max

Summary of steps

1. Strategic placement of the camera
2. What factors are affecting the IR temperatures values from a MOBOTIX Thermal Sensor
3. Emissivity
4. Atmospheric transmission
5. Distance
6. Where to measure temperature in humans
   - Examples
7. Factors that might affect the temperature measurement in humans
8. Configuration of the camera: Thermal sensor settings
9. Configuration of the camera: Thermal radiometry events
10. Configuration of the camera: Periodic event
11. Configuration of the camera: Ambient temperature calibration
12. Configuration of the camera: Alarm notification

Strategic placement of the camera

Simply controlling the distance to target is not enough. You must consider other factors that will increase the accuracy of the measurement.

- Don't install the camera near to doors, vents, or anything that can blow hot/cold air to the area surrounding the camera and/or heavily change the relative humidity of the area. Install the camera as further away as possible from such areas.

- Consider (whenever is possible) that a person temperature might be affected by the outdoor environment: Rain, Cold, Hot sunny day, Exercise activity. Measure the temperature as further away as possible from entry points.

What factors are affecting the IR temperatures values from a MOBOTIX Thermal Sensor

- Emissivity
- Ambient temperature & humidity
- Distance

MOBOTIX's products are made in Germany ensuring that we use the best sources to our components and the highest quality control and manufacturing standards, thus ensuring the highest calibration in our thermal sensors.

Emissivity

The MOBOTIX's camera can be calibrated to the emissivity factor of the material of interest

Material	Emissivity
Black body matt	1
Human skin	0.98
Paper	0.93
Wood	0.88 - 0.93
Glass smooth	0.92
Concrete	0.85
Cotton cloth	0.77
Polished copper or steel	0.04
Polished silver	0.02

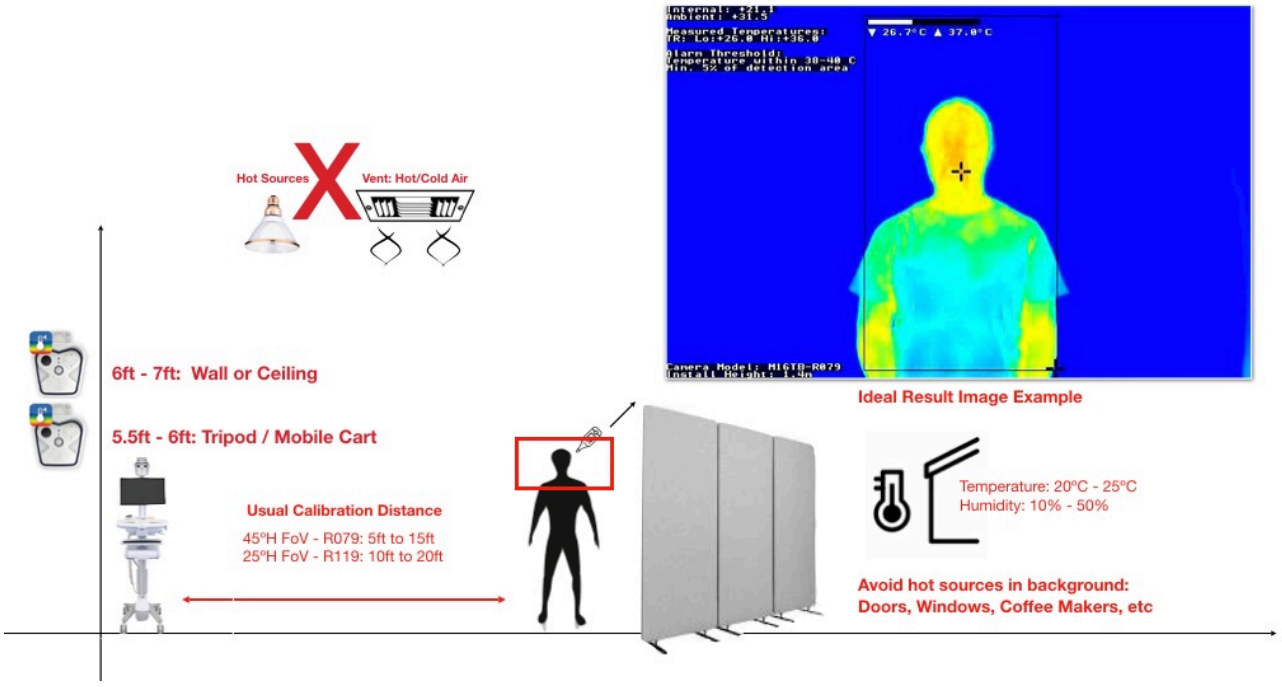
Atmospheric transmission

Further complications come into play when the atmosphere is not completely transmissive for the thermal radiation. One then has some reduction of the thermal radiation getting from the objects to the camera, but at the same time an additional thermal radiation generated in the atmosphere. Those effects could in principle be compensated in the temperature calculation. (3)
(source: MOVITHERM)

Distance

Thermal radiation have a dependence of measurement over the distance. You can only calibrate the camera when the person temperature value measured by the MOBOTIX camera is lower than the the temperature measured by the clinical thermometer. In this figure we see that the performance of the thermal sensor against a baseline fix temperature value would cross-references between 2 to 5 meters in average.

Example of an ideal installation environment

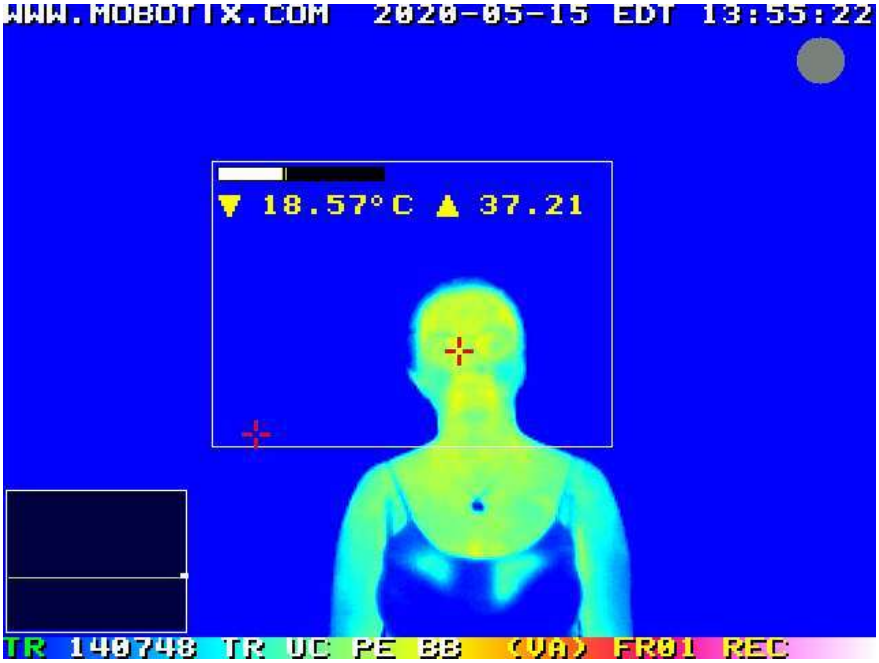


Where to measure temperature in humans with Thermographic cameras

Facial thermography of surface areas other than the region medially adjacent to the inner canthus is unreliable, and may be complicated by perspiration, facial skin flushed from exertion, etc. The current evidence indicates that the region medially adjacent to the inner canthus is the

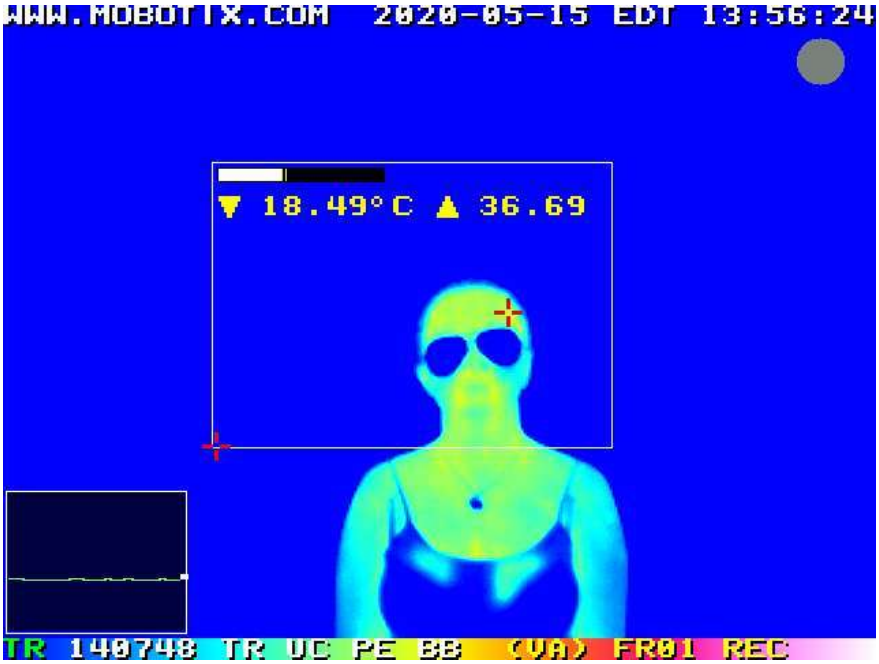
preferred site for fever screening due to the stability of that measurement site. This is because this region is directly over the internal carotid artery.(2) (source: IEC)

Example of full face measurement: Inner Canthus



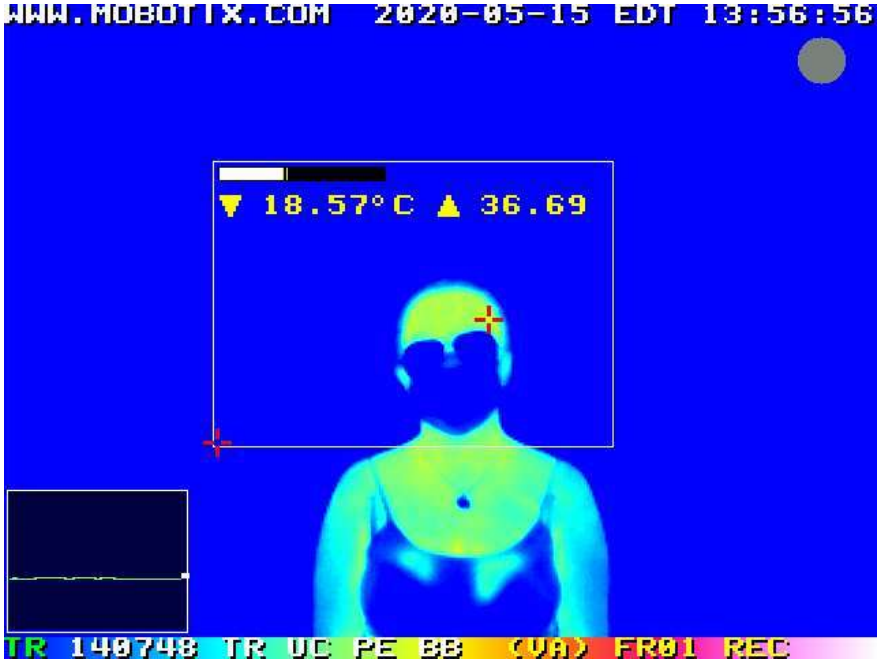
Note: The MOBOTIX Thermographic cameras TR will measure the hottest pixel in the area of measurement

Example of a person wearing goggles, lenses.



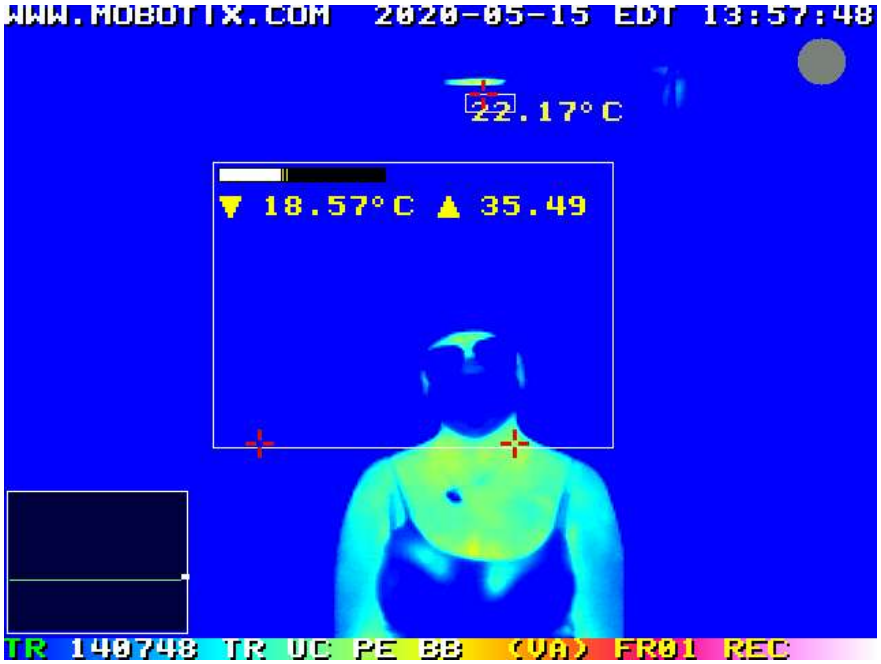
Note: A body temperature difference can be present if a person's face if measured in the forehead versus inner canthus (inner eye area), or versus any other spot in the face.

Example of a person wearing mask and goggles



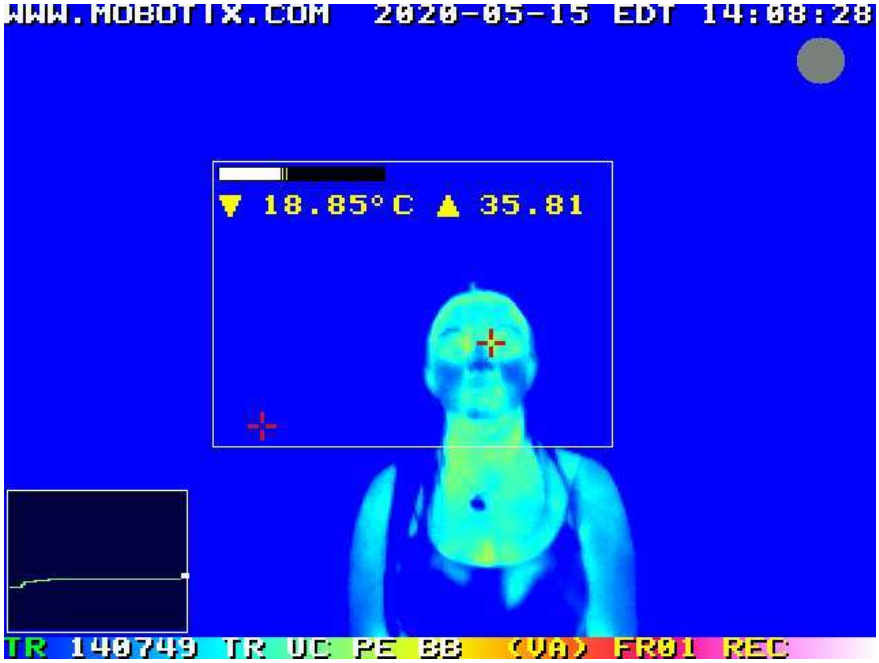
Note: Please note that the temperature measure at the forehead area can be lower versus medial canthus area.

Example of a person wearing full face obstructions



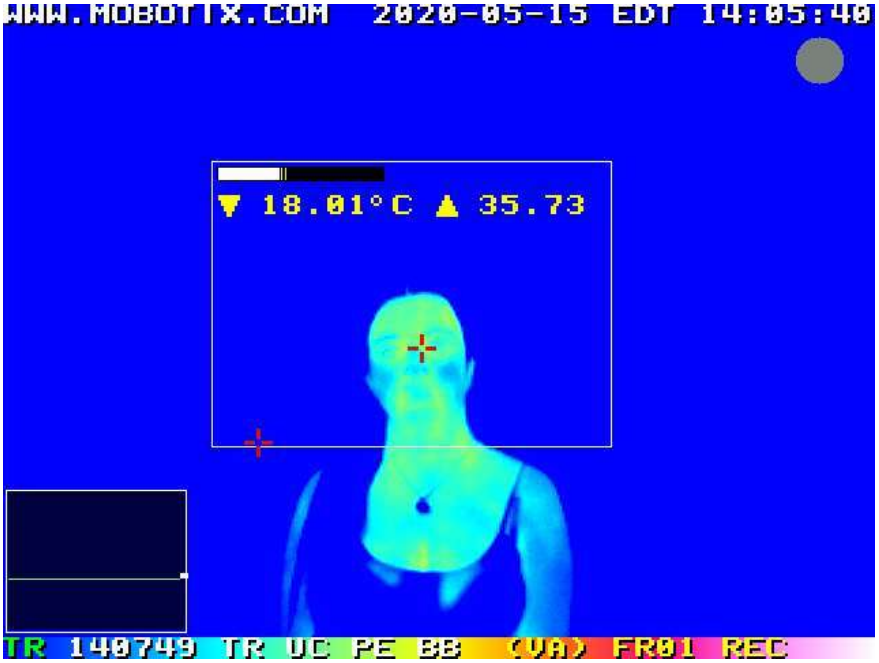
Note: The MOBOTIX Thermographic cameras TR will measure the hottest pixel in the area of measurement. The carotid artery temperature is reflected in the measurement on the neck area.

Example of a measurement with a vent source (room temperature air) blowing air by the person's face



Note: Please note the cheek area gets colder and the temperature measured at the medial canthus area is ~1ºC lower.

Example of a measurement with a vent source (room temperature air) blowing air by the camera lens



Note: Please note how the overall thermal signature is affected by the air being blown by the lens area

Factors that might affect the temperature measurement in humans

The temperatures measured by a screening thermograph can be influenced when the individual being screened is sweating. Sweating thresholds can vary according to a person's fitness level, environment of residence, length of adaptation and the relative humidity. When humidity is controlled, these effects are minimized.

To produce consistent and reliable results of the temperature screening process, it is imperative that the screening thermograph be situated in a reserved stable indoor environment with a temperature range of 20 °C to 24 °C and relative humidity range from 10 % to 50 %. (1) (source: IPVM) These conditions can best be achieved by creating a local, controlled environment. For example a walk-through booth.

Toilets should not be proximal to the screening thermograph area. This is to both inhibit potential cross-infection and to prevent facial washing (alteration of the thermal profile) immediately prior to entering the screening thermograph area.

The individuals to be screened are channelled into single line and caused to stop or pause so that the screening thermograph can capture the region medially adjacent to the inner canthus temperature distribution one individual at a time. Measuring individuals one at a time facilitates the capture of a reliable thermogram and allows the determination of potentially febrile individuals requiring secondary screening.

To minimize disruption in high volume situations, the response time and throughput of the screening thermograph should be capable of operating in near real time for rapid and effective screening. This can necessitate that the screening thermograph be highly automated.(1) (source: ISO/IEC)

The measurement time of a person should be for at least 1 second, 2 seconds will be event better.

There area many more factors such as what the person was doing before entering to the screening area. Here we name a few others,

- Excessive makeup
- Physiological Stress
- High or low blood pressure, fitness.
- Long exposure to hot/cold/humid weather.
- Subject motion (Super fast walking, running). Normal walking pace is OK.

A cold down time is recommended for persons who has been exposed for long periods to hot/cold/humid weather.

A secondary screening area should be at a tangent to the screening thermograph area, but removed from the general traffic flow. Screening near the entrance of the facility prevents commingling. The secondary screening area is a care area that should equipped with a clinical thermometer and accessories that comply with ISO 80601-2-56 and should be

staffed by qualified medical personnel.

Setting up the MOBOTIX Camera

You will need a computer with full administrative rights Windows or Mac, a PoE switch or injector IEEE802.3af/at, network patch cable Cat6a shielded.

More details in the MOBOTIX Camera Manual,
https://www.mobotix.com/sites/default/files/2018-07/mx_ML_M16_en_20180717.pdf

Make sure you have the latest firmware in the camera,

https://www.mobotix.com/en/software-downloads

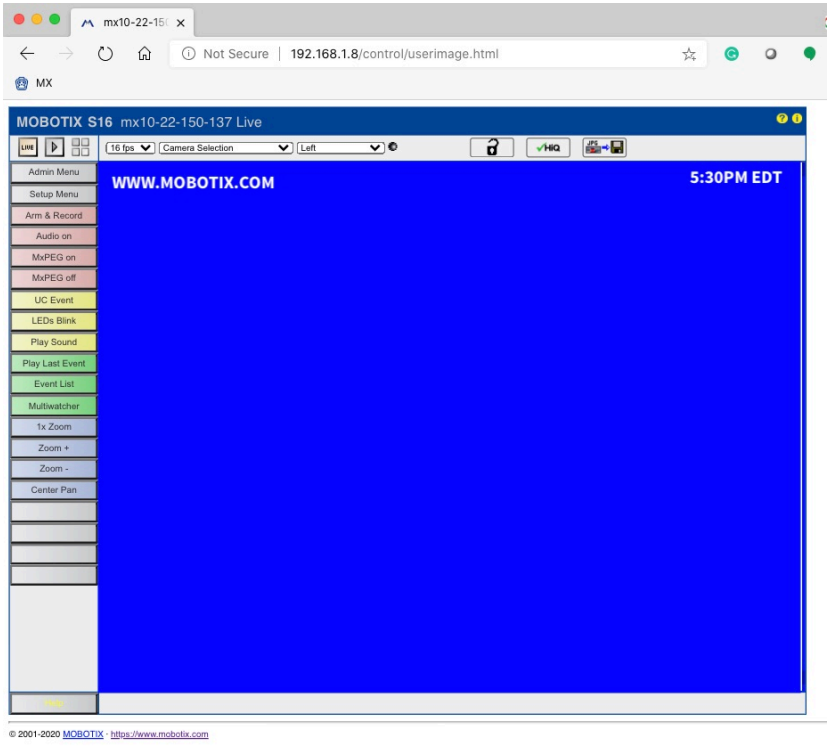
Download the MOBOTIX Management Center

https://www.mobotix.com/en/software-downloads

MOBOTIX Management Center System Requirements
https://www.mobotix.com/sites/default/files/2020-06/MxMC2.3.1_release-notes_en.html

Camera configuration

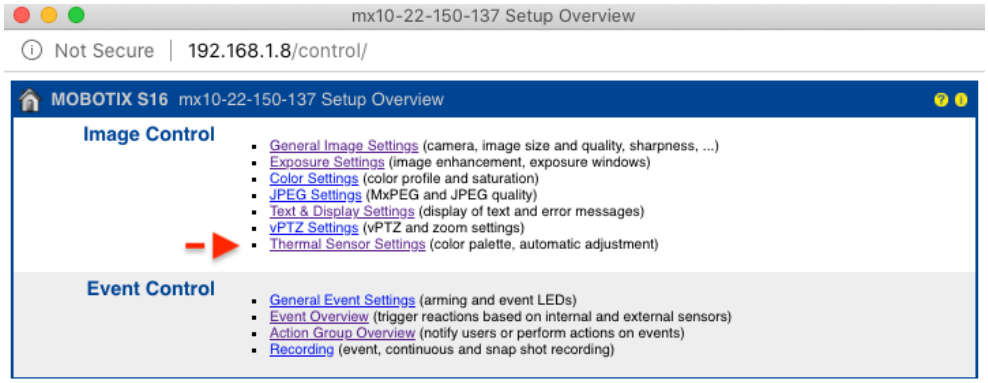
Open up your web the camera in your web browser (Chrome, Safari, Firefox, Edge, etc)



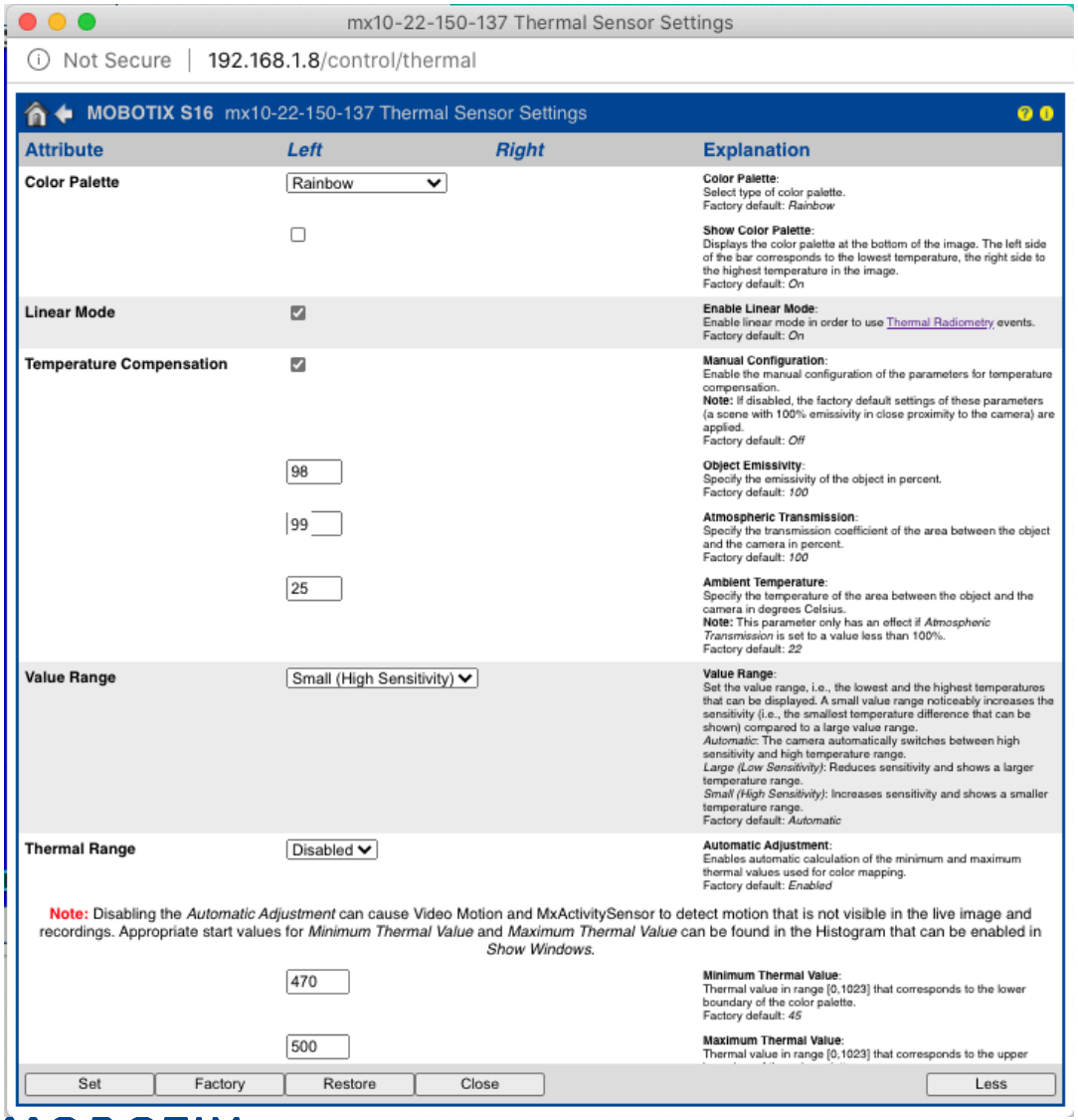
Configuration of the camera: Thermal sensor settings

Thermal sensor settings is the area where you can calibrate the camera to perform a specific type of thermal measurement. The steps here below are for measuring temperature on persons.

Go to: Setup menu / Thermal Sensor Settings



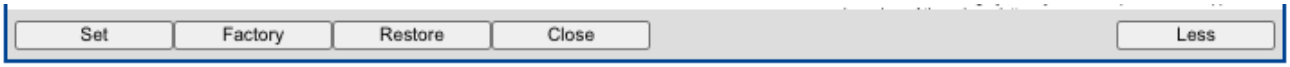
Configure starting parameters as indicated in the picture



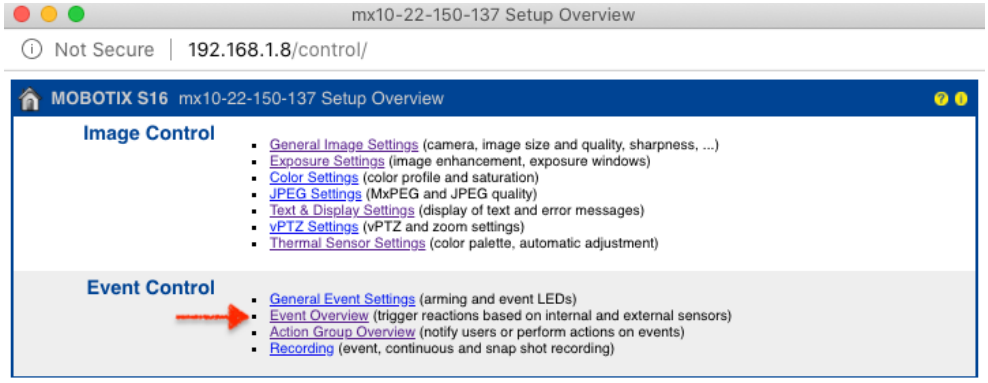
The most important parameters are:

- **Object emissivity:** 98
- **Atmospheric Transmission:** 99
- **Ambient Temperature**: 25 (Set to current ambient temperature at the room, the MOBOTIX camera requieres this value in Celsius).

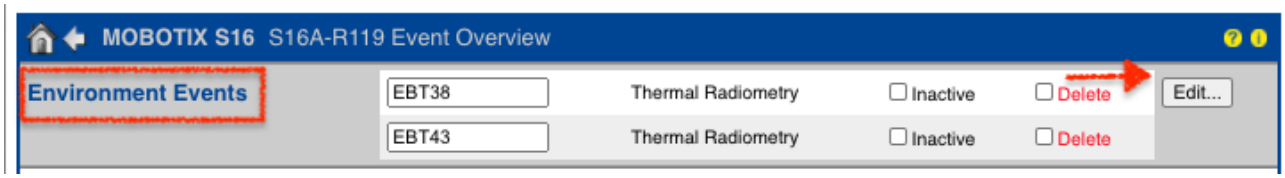
Always click SET before leaving exiting any menu to temporarily save and enable your changes



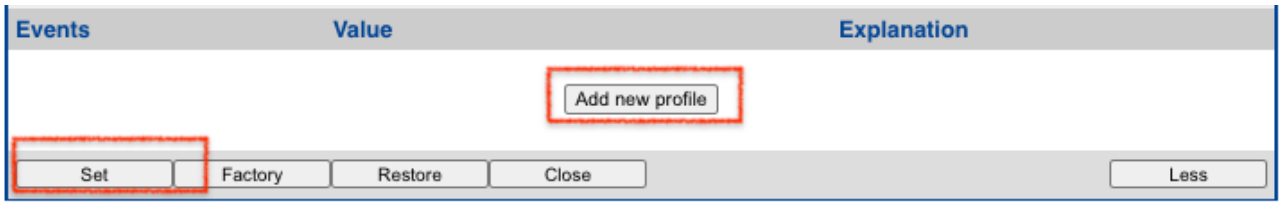
Configuration of the camera: Thermal radiometry events



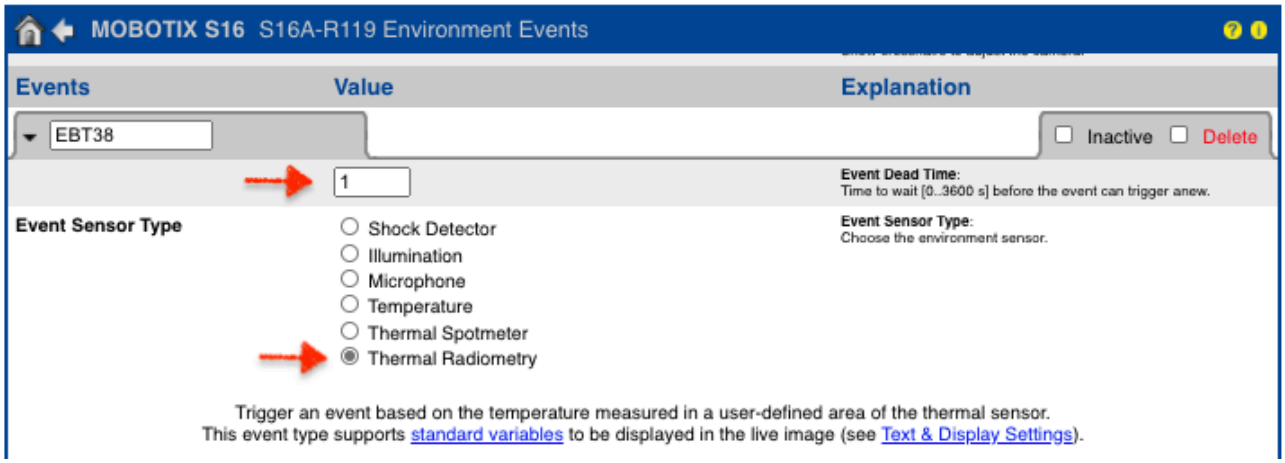
Go to Setup menu / Event Overview



Environment Events: Click on <Edit…>



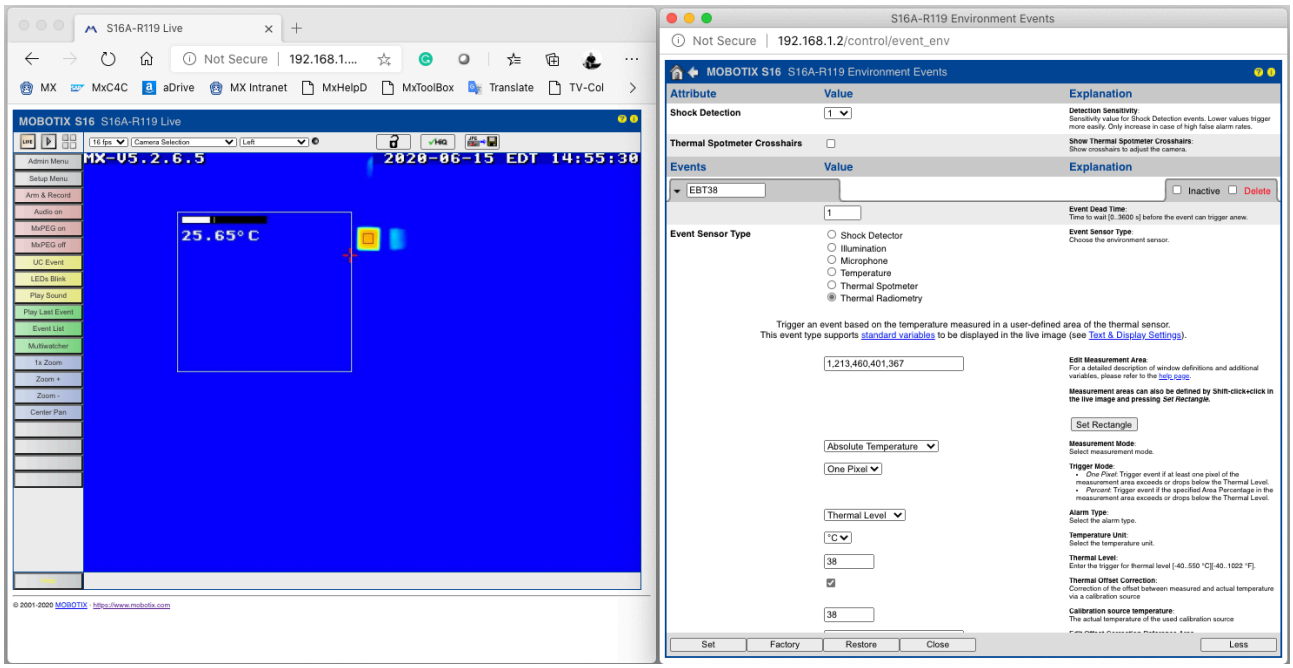
Click <Add new profile>



- **Assign a name to the profile.** Example: EBT38 (Elevated Body Temperature 38 Celsius)
- **Event Dead Time** : 1 second
- **Event Sensor Type:** Thermal Radiometry

Set measurement area

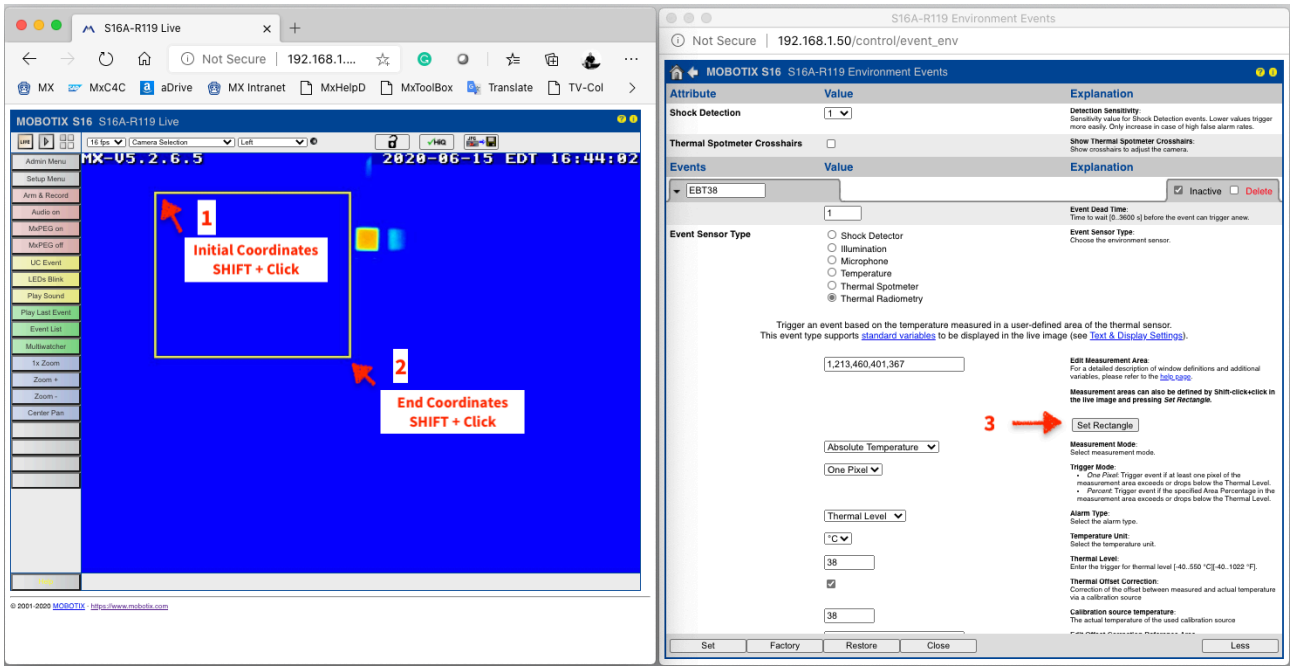
Pro-Tip: Set the image resolution of the camera to VGA mode and maintain Live image and Setup menu side to side in your screen while configuring.



Creating the measurement area

On the live image do as follow,

- **Initial coordinates:** Click [Shit] Key + Click
- **Final coordinates:** Click



Then Click SET at the bottom right corner of the page.

Setting up the Thermal Radiometry triggering parameters when not using a Black Body Radiator

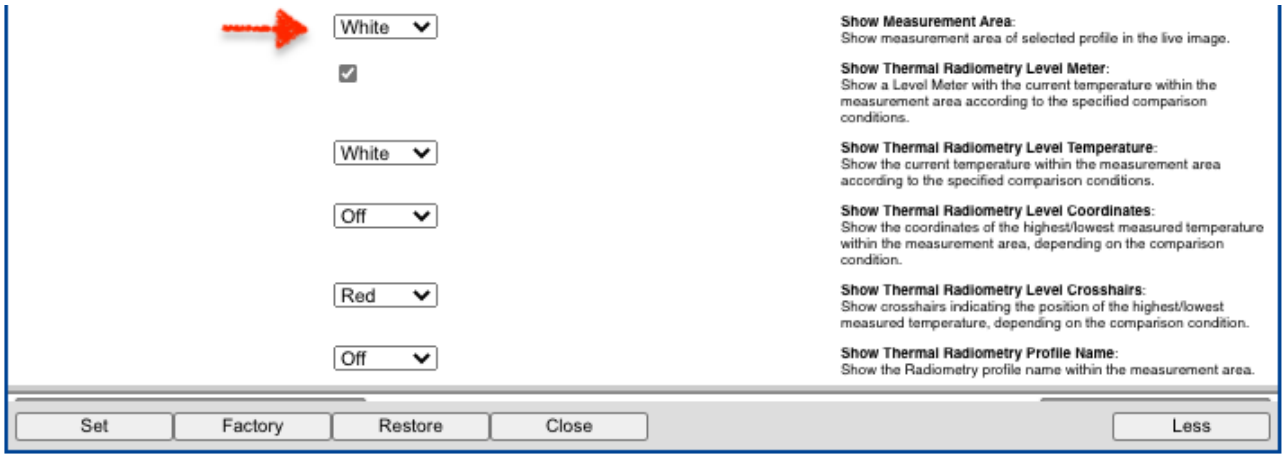
- **Measurement mode:** Absolute Temperature
- **Trigger mode:** One Pixel
- **Alarm type:** Thermal Level
- **Temperature unit:** °C
- **Thermal Level:** 37.6°C (This value must be in accordance to the local health department guidelines).

Type of reading	0–2 years	3–10 years	11–65 years	Over 65 years
Oral	95.9–99.5°F (35.5–37.5°C)	95.9–99.5°F (35.5–37.5°C)	97.6–99.6°F (36.4–37.6°C)	96.4–98.5°F (35.8–36.9°C)
Rectal	97.9–100.4°F (36.6–38°C)	97.9–100.4°F (36.6–38°C)	98.6–100.6°F (37.0–38.1°C)	97.1–99.2°F (36.2–37.3°C)
Armpit	94.5–99.1°F (34.7–37.3°C)	96.6–98.0°F (35.9–36.7°C)	95.3–98.4°F (35.2–36.9°C)	96.0–97.4°F (35.6–36.3°C)
Ear	97.5–100.4°F (36.4–38°C)	97.0–100.0°F (36.1–37.8°C)	96.6–99.7°F (35.9–37.6°C)	96.4–99.5°F (35.8–37.5°C)

Source: https://www.welchallyn.com/

- **Thermal offset correction:** Leave blank / uncheck
- **Comparison:** Higher than
- **Action type:** Every

Displaying the values on the image



- **Show Measurement area:** White
- **Show thermal radiometry level meter:** Check or Uncheck (as you wish)
- **Show thermal radiometry level coordinates:** Off
- **Show thermal radiometry level crosshair:** Red
- **Show thermal radiometry profile name:** Off

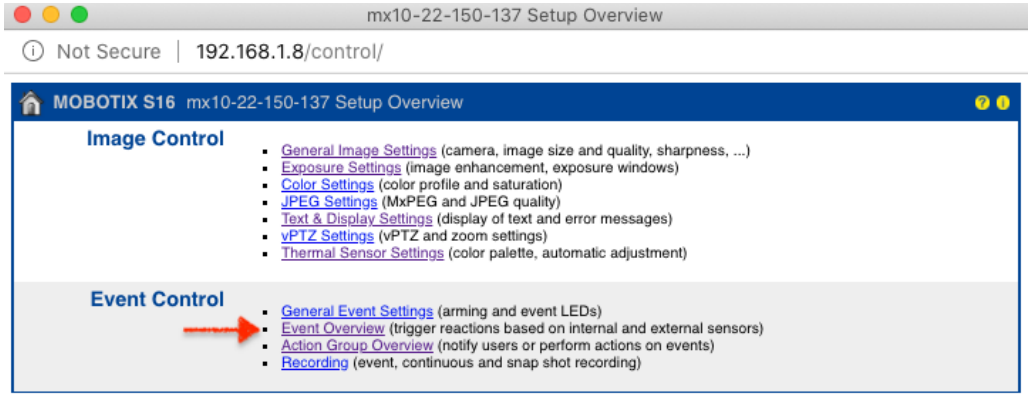
Click [SET] and then [CLOSE] at the bottom left corner of the menu.

Configuration of the camera: Periodic event

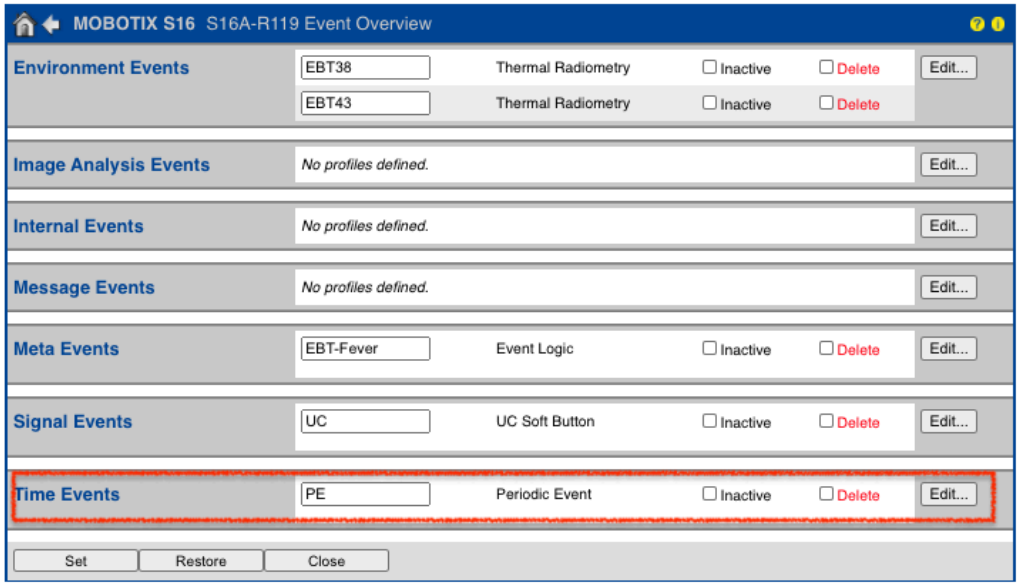
The MOBOTIX's camera can calibrate itself against the ambient temperature for this we recommend the use of MOBOTIX's accessories such as ExtIO and GPS-Box. The M16 camera also have a built-in Ambient Temperature Sensor.

We configure a Periodic Event to let the camera know every 5 minutes the ambient temperature changes.

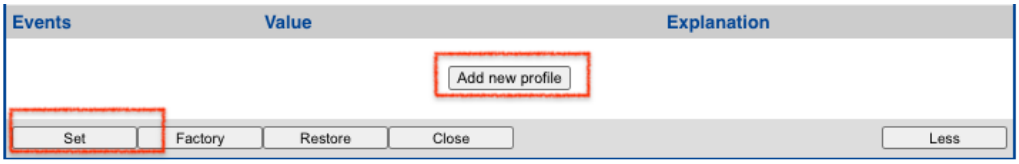
Go to Setup Menu / Event Control / Event Overview

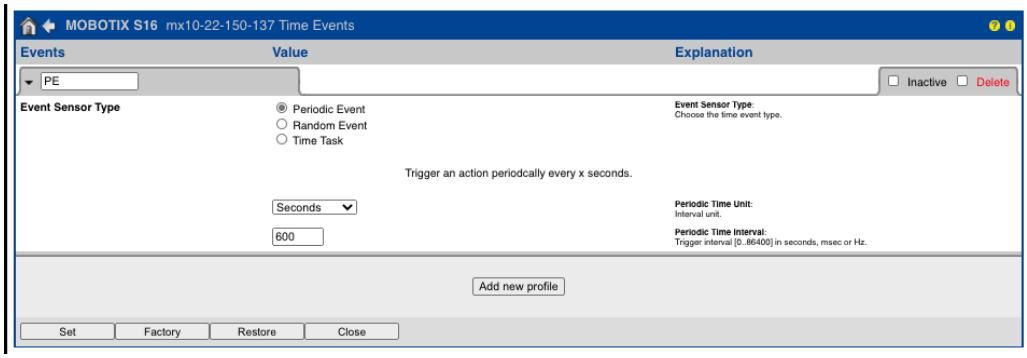


Go to Time Events / Click [Edit]



Add new profile





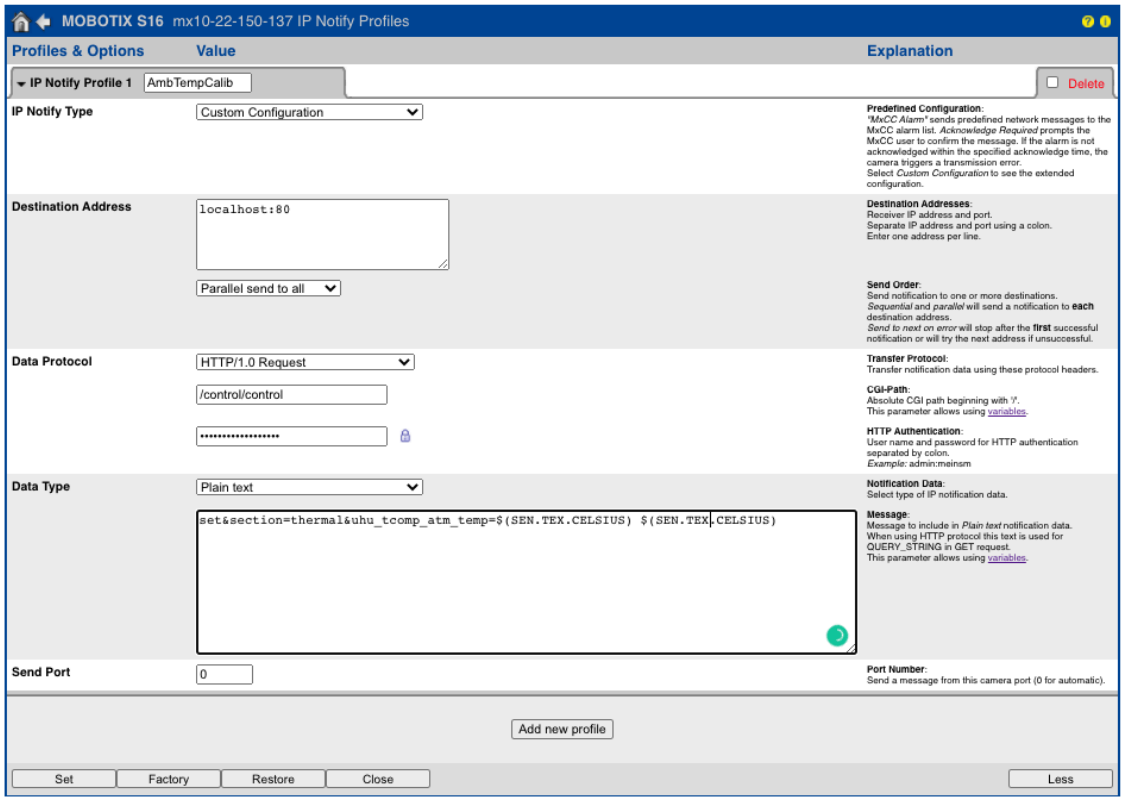
- **Name:** PE
- **Event sensor type:** Periodic Event
- **Periodic time unit:** Seconds
- **Periodic time interval:** 300 (5 minutes), 600 (10 minutes) - Your choice

Click [SET] and [CLOSE]

Creating the IP notifications: Ambient temperature calibration

Go to Admin Menu / Transfer Profiles / IP Notify

Pro-Tip: You can use IP Notification Profile # 5 as a example.



- **Name:** AmbTempCalib
- **Destination Address:** localhost:80
- **Send order:** Parallel send to all
- **Transfer protocol:** HTTP/1.0 Request
- **CGI-Path:** /control/control
- **HTTP Authentication:** <user-name>:<password> (enter the user name of the camera separated from the password with colon ":")
- **Notification Data:** Plain text
- **Message:** set&section=thermal&uhu_tcomp_atm_temp=$(SEN.TEX.Celsius) $(SEN.TEX.Celsius)

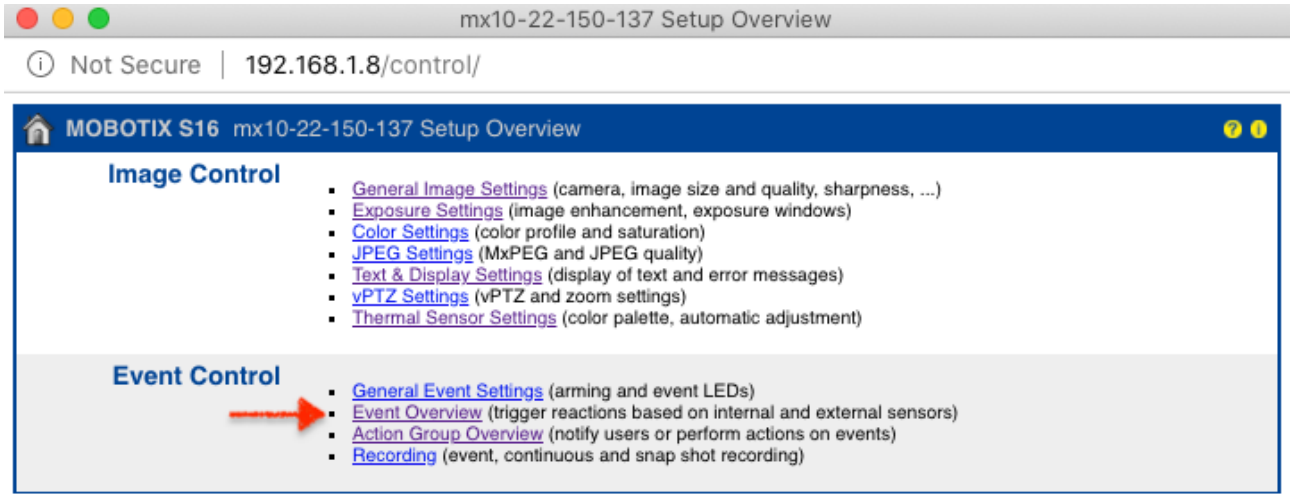
NOTE

- **$(SEN.TEX.Celsius)** is the placeholder variable for “Camera Internal Thermometer” and we are using it this as an example only.
- If you are using one of the recommended MOBOTIX accessories **you need to replace** the variable placeholder for the corresponding value.

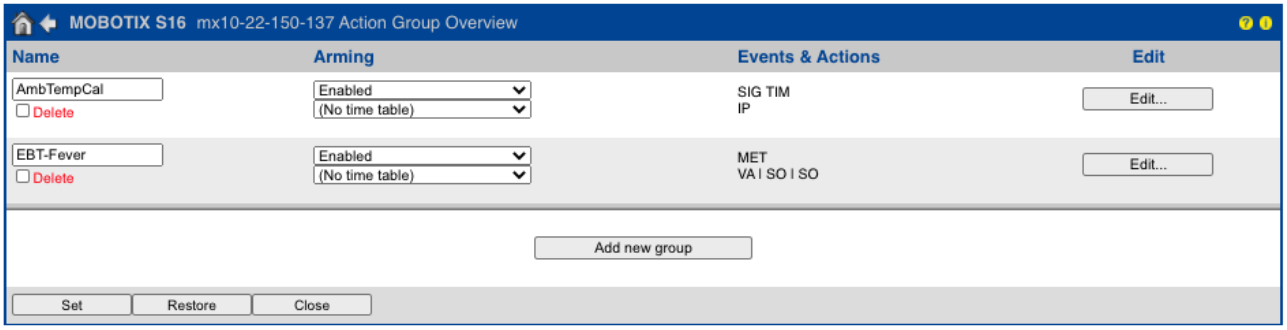
`$(SEN.TEX.CELSIUS)`, `$(SEN.TEX.FAHRENHEIT)`	***Only with ExtIO!*** Temperature of the ExtIO in degrees Celsius or degrees Fahrenheit	°C °F
`$(SEN.TGP.CELSIUS)`, `$(SEN.TGP.FAHRENHEIT)`	***Only with MX-GPS-Box!*** Temperature of the MX-GPS-Box in degrees Celsius or degrees Fahrenheit	°C °F

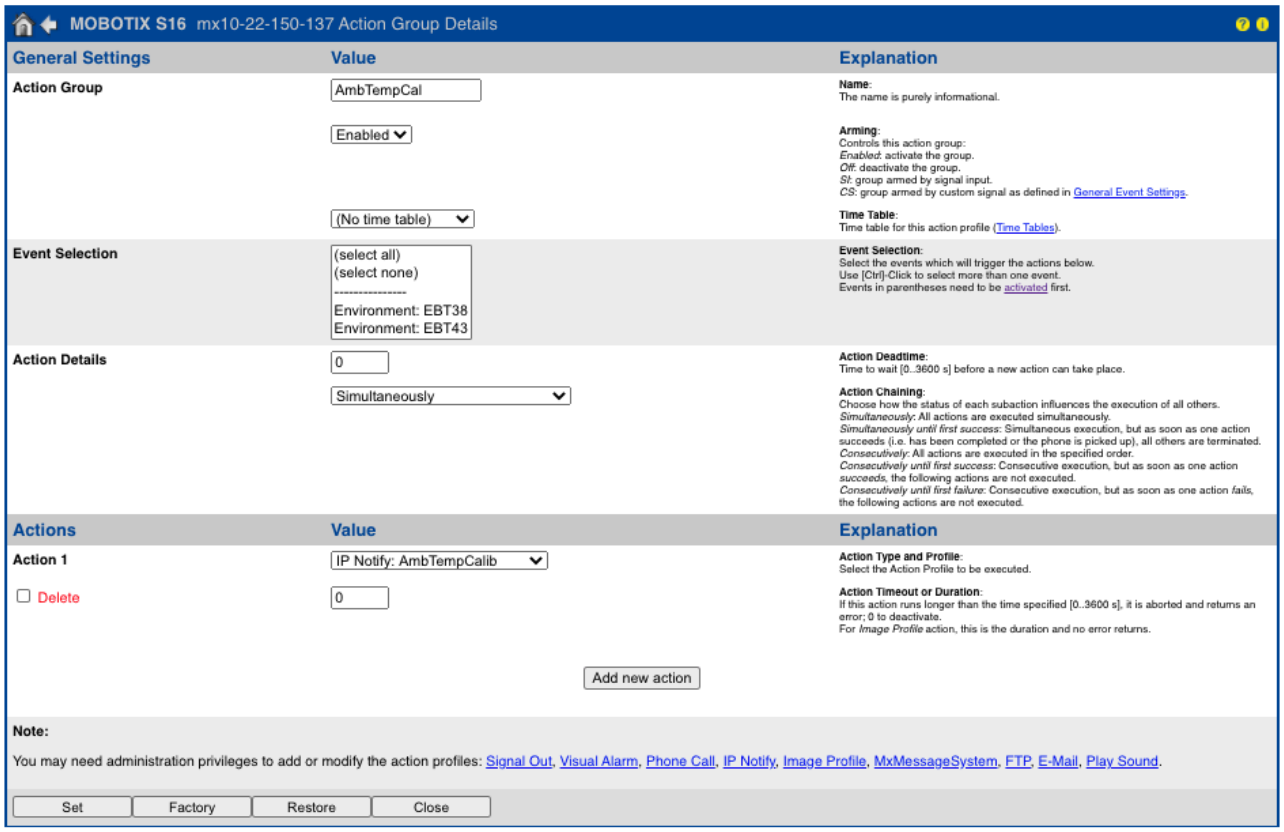
Triggering the Ambient Temperature Calibration to the camera

Go to Setup Menu / Action Group Overview



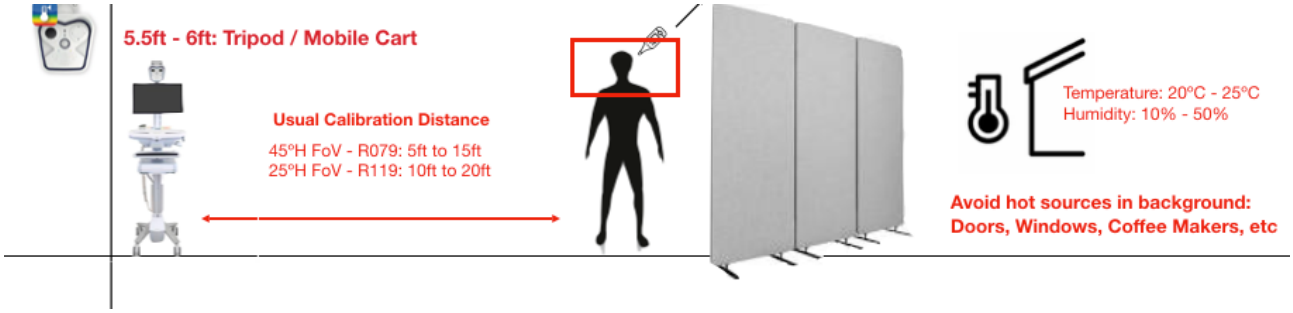
Click [Add new group]





- **Name:** AmbTempCalib
- **Arming:** Enabled
- **Time Table:** No Time Table
- **Event Selection: Time:** PE
- **Action Dead Time:** 0
- **Action chaining:** Simultaneously
- **Action 1: IP Notify:** AmbTempCalib
- **Action timeout or duration:** 0

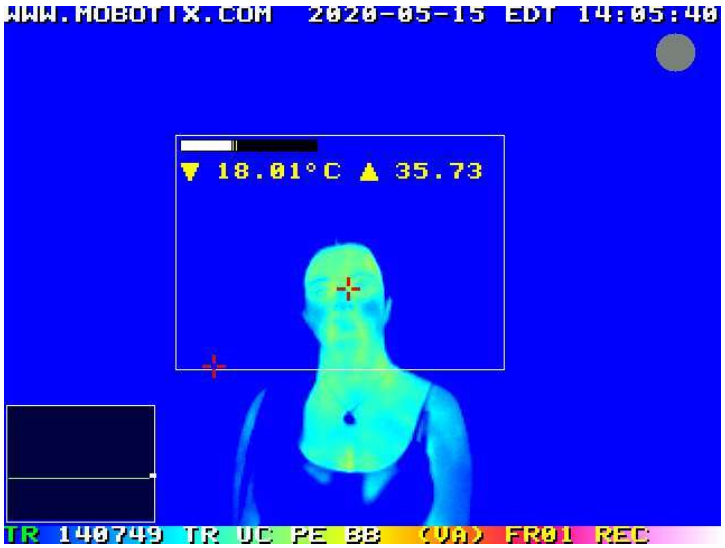
Fine tuning of the temperature measurement



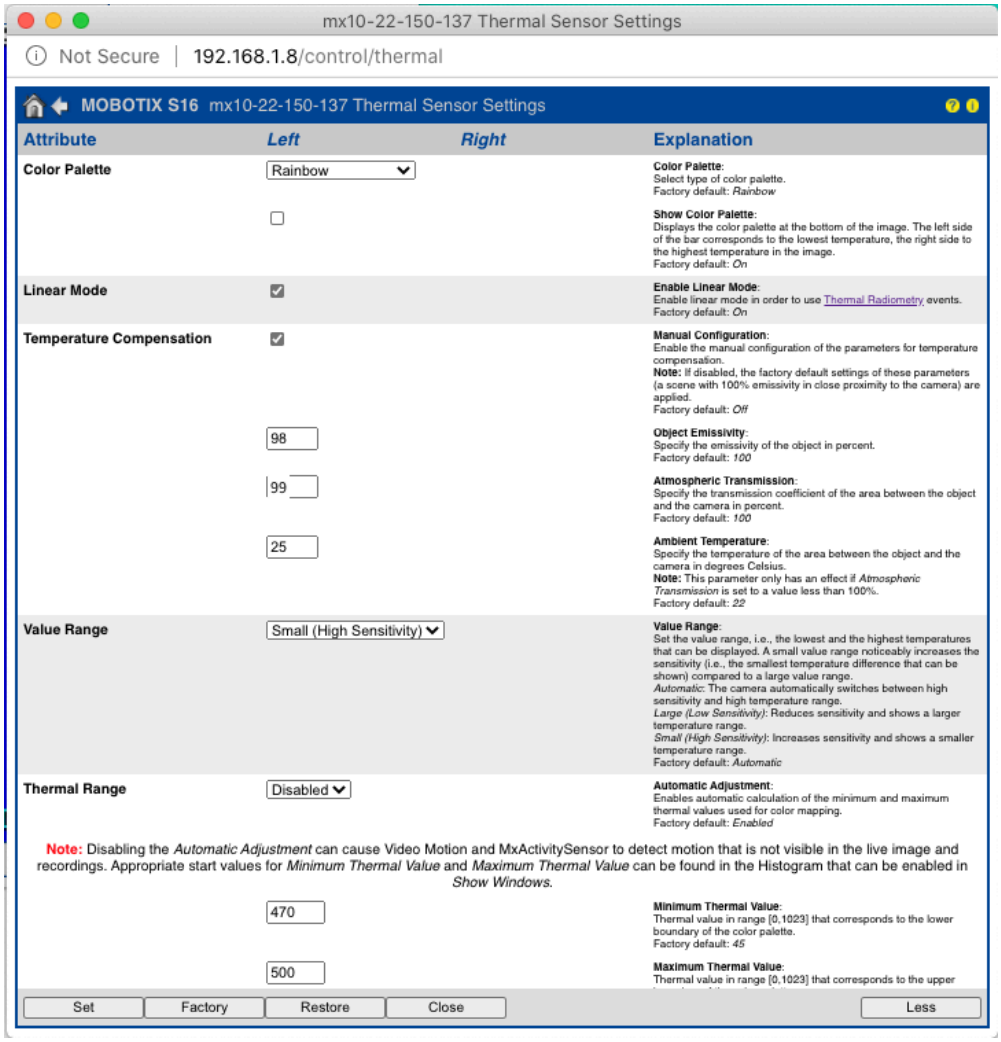
Pro-Tip: You need two persons to complete this task and FDA approve Non-Contact Clinical Thermometer

1. Measure the temperature of the person by the Eye' medial canthus, Forehead, between nose and lips area.
2. Write down all measurements
3. Start placing the person at 10 feet away from the camera
4. Look straight to the camera standing still
5. Avoid any face obstructions
6. The person at the computer must adjust the camera Atmospheric Transmission value
7. In order to be able to perform any calibration the temperature value measured by the MOBOTIX cameras must be lower than the temperature measure by the clinical thermometer

Example
The subject in the picture measure temperature by the NC Clinical Thermometer is 37°C, but at the 10 feet away the camera measure the person at 35.73°C



Go to Setup Menu / Thermal Sensor Settings

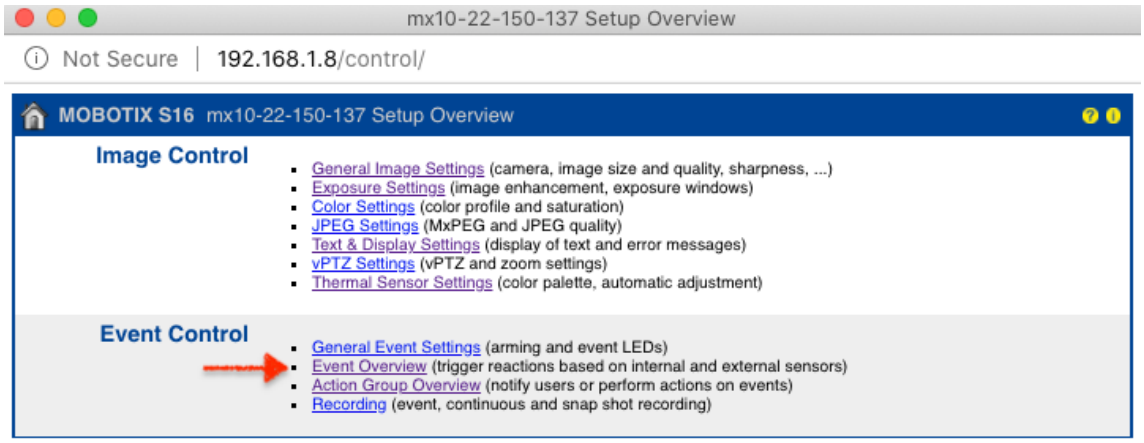


Adjust the Atmospheric transmission down from 99 in decrements of 5 points, 3 points, etc until you match ±0.3C to ±0.5C of the temperature measure by the clinical thermometer

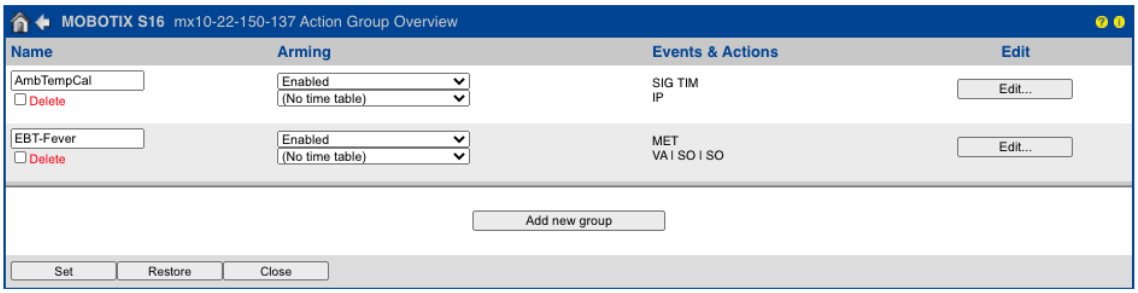
Always click [SET] to enable changes after changing the value. You can also adjust the Object emissivity if needed to 97, or to 99.

Configuration of the camera: Alarm notification for elevated body temperature alerts

Go to Setup Menu / Action Group Overview



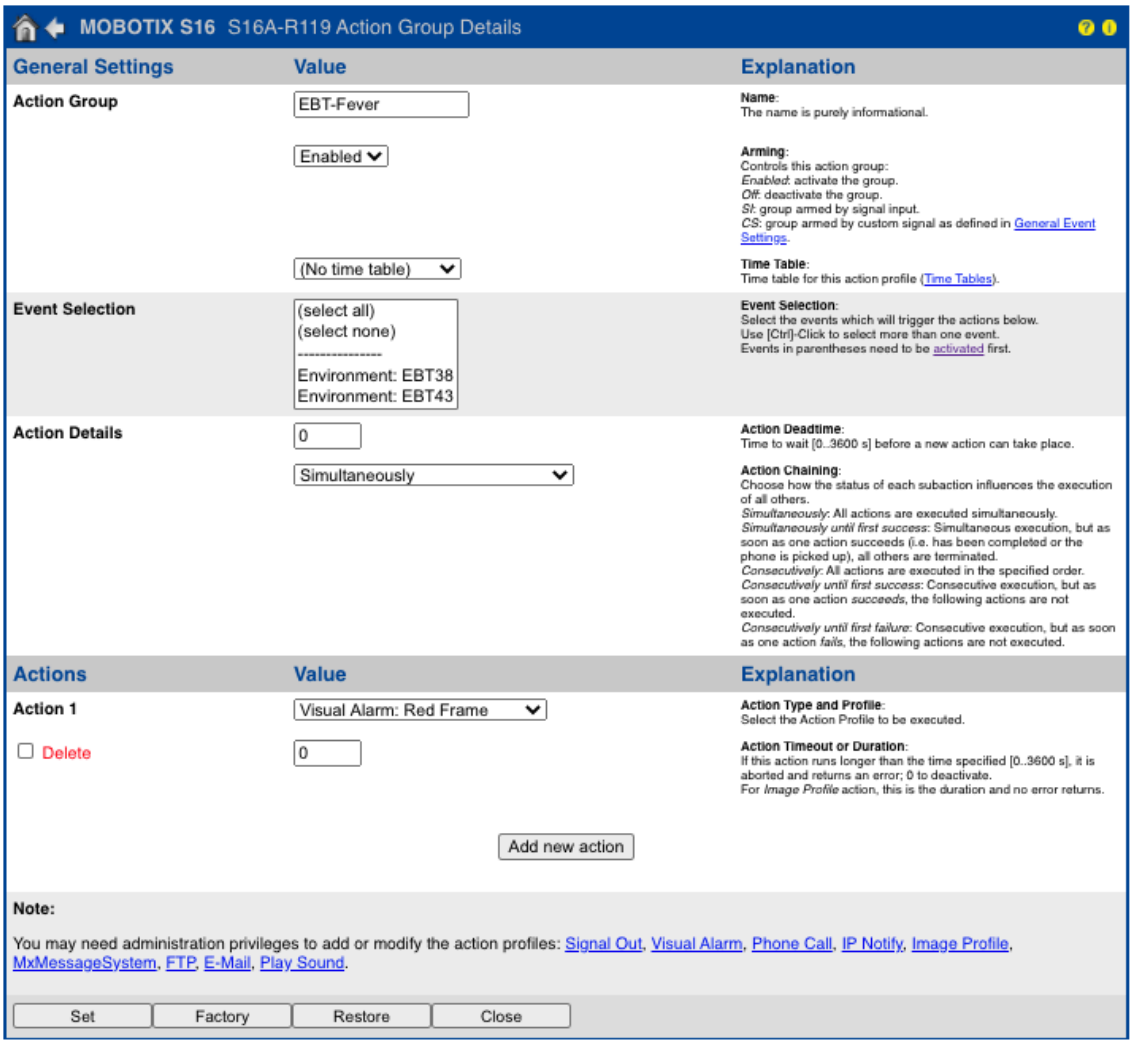
Click [Add new group]



- **Name:** EBT-Alarm
- **Arming:** Enabled
- **Time Table:** No Time Table
- **Event Selection: Time:** EBT38
- **Action Dead Time:** 0
- **Action chaining:** Simultaneously
- **Action 1: IP Notify:** Visual Alarm: Red Frame
- **Action timeout or duration:** 0

You can also configure the camera for,

- Signal Output Alarm
- Visual Alarm
- Phone Call: SIP-VoIP Alarm
- IP Notify Alarm
- FTP, Email
- Custom Sound Alarm


MOBOTIX S16 S16A-R119 Action Group Details
General Settings
Value
Explanation
Action Group
EBT-Fever
Name:
The name is purely informational.
Enabled
Arming:
Controls this action group:
Enabled: activate the group.
Off: deactivate the group.
SI: group armed by signal input.
CS: group armed by custom signal as defined in General Event Settings.
(No time table)
Time Table:
Time table for this action profile (Time Tables).
Event Selection
(select all)
(select none)
Environment: EBT38
Environment: EBT43
Event Selection:
Select the events which will trigger the actions below.
Use [Ctrl]-Click to select more than one event.
Events in parentheses need to be activated first.
Action Details
0
Action Deadtime:
Time to wait [0..3600 s] before a new action can take place.
Simultaneously
Action Chaining:
Choose how the status of each subaction influences the execution of all others.
Simultaneously: All actions are executed simultaneously.
Simultaneously until first success: Simultaneous execution, but as soon as one action succeeds (i.e. has been completed or the phone is picked up), all others are terminated.
Consecutively: All actions are executed in the specified order.
Consecutively until first success: Consecutive execution, but as soon as one action succeeds, the following actions are not executed.
Consecutively until first failure: Consecutive execution, but as soon as one action fails, the following actions are not executed.
Actions
Value
Explanation
Action 1
Visual Alarm: Red Frame
Action Type and Profile:
Select the Action Profile to be executed.
Delete
0
Action Timeout or Duration:
If this action runs longer than the time specified [0..3600 s], it is aborted and returns an error; 0 to deactivate.
For Image Profile action, this is the duration and no error returns.
Add new action
Note:
You may need administration privileges to add or modify the action profiles: Signal Out, Visual Alarm, Phone Call, IP Notify, Image Profile, MxMessageSystem, FTP, E-Mail, Play Sound.
Set
Factory
Restore
Close