Xovis Technical Documentation

PC-Series

User Manual

Document History

Version	Date	Author	Comment
2.0	25.08.2017	TL	New layout and update for FW 3.5 and PC2R
2.0.1	18.09.2017	CG	Clean-up between PC manual and API documentation.
2.0.2	19.09.2017	CG	Updates browser compatibility list
2.1	12.12.2017	TL	Removed parts with own manual, update for FW 3.6
2.1.1	12.07.2018	DJ	Adapted for new user settings

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1 Overview

1.1 Content Declaration

This manual is intended for administrators and users of the PC-Series sensor and is applicable for software version 3.3.0 and later. It includes instructions for using and managing the sensor on your network. Basic knowledge of network configuration and the specific network in which the sensor is operated are required when using this product.

1.2 PC-Series hardware concept

The housing of a PC-Series sensor is designed to be mounted directly on the ceiling, containing two holes for sensor positioning and fixation with an ethernet connector on the backside. Please refer to the accessory overview and the mounting instructions for all mounting options.

PC-Series sensors are as well available as outdoor sensors. Those sensors are meeting the IP65 requirement with an increased temperature range.

2nd generation sensors (PC2S / PC2R) are equipped with a hardware RESET button on the back. Pressing this button for 3 seconds restores the sensor to factory default.

Figure 1: PC2 / PC2S / PC2R (left) and PC3 (right) 3D sensor

1.3 PC-Series 3D sensors

Sensor	Material	Height
PC2 / PC2S / PC2R	Aluminum and Plastic (Cover)	Up to 6m
PC2R-O	Aluminum	Up to 6m
PC3	Aluminum and Plastic (Cover)	Up to 20m
PC3-O	Aluminum	Up to 20m

2 Installation Fundamentals

2.1 Network requirements

The device needs to be connected to the network by a shielded Cat 5 RJ45 Cable. The plug and the sensor need to be free from any mechanical pressure. The sensor supports Ethernet 10/100Mb Full/Half/Auto negotiation based on the IEEE 802.3 standard. It is highly recommended to set the switch port to auto negotiation.

2.2 Power over Ethernet

PoE Class 0, compliant to IEEE 802.3af, powers the sensor. As defined by the standard, the network switch port needs to provide 15 Watts at 48 V.

2.3 Sensor LED

The PC-Series sensor provides a multifunctional LED on the front side. The red arrow on the next picture indicate the LED on the PC2 / PC2S / PC2R and PC3 models.

Figure 2: PC2 / PC2S / PC2R LED (left) and PC3 LED (right)

The LED indicates the following states:

Green: Device is powered by PoE

Orange/Green blinking: Device is up and running

The LED state can be useful during installation. When using the optional housing, the LED will be covered after successful mounting.

3 Configuration & Usage

3.1 Person tracking

The Xovis PC-Series sensor tracks persons. A few things must be considered to understand how the detection and the person tracking works:

3.1.1 Person generation

The PC-Series sensor generates a person first when the person is completely within the visible scene (see Figure 3).

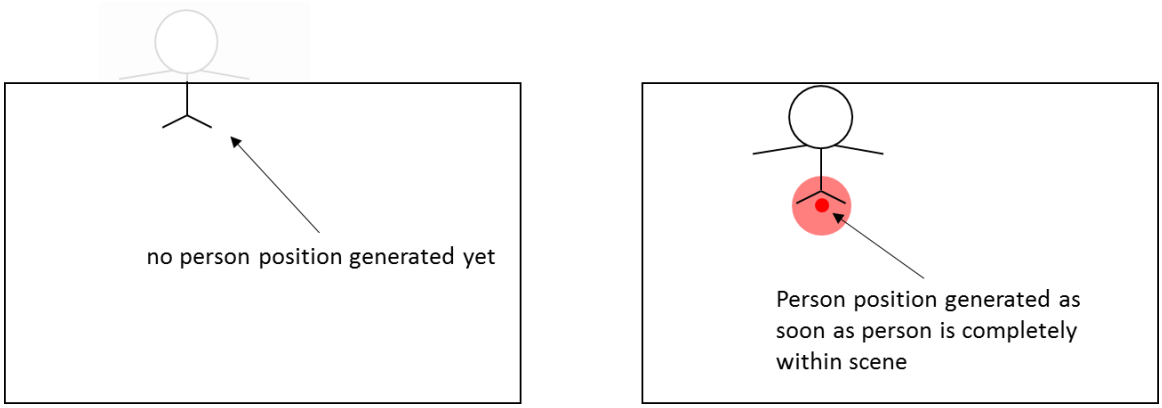


Figure 3: Person generation

When a person track once was generated, the person stays tracked until it leaves the scene again and its head is touching the visible scene border. Tracking/counting at border is therefore not supported for persons only partially within the scene.

The following situation illustrates the person generation capability:

Figure 4: Demonstration of person generation with coordinate mode "head"

The situation shows that a person is first detected by the sensor when its head is completely visible i.e. within the scene.

3.1.2 Person position / coordinate mode

The PC-Series sensor uses one specific position per person to evaluate the counting on lines and zones. This position is either located at the head of a person or at its feet. Figure 5 illustrates the two possible positions.

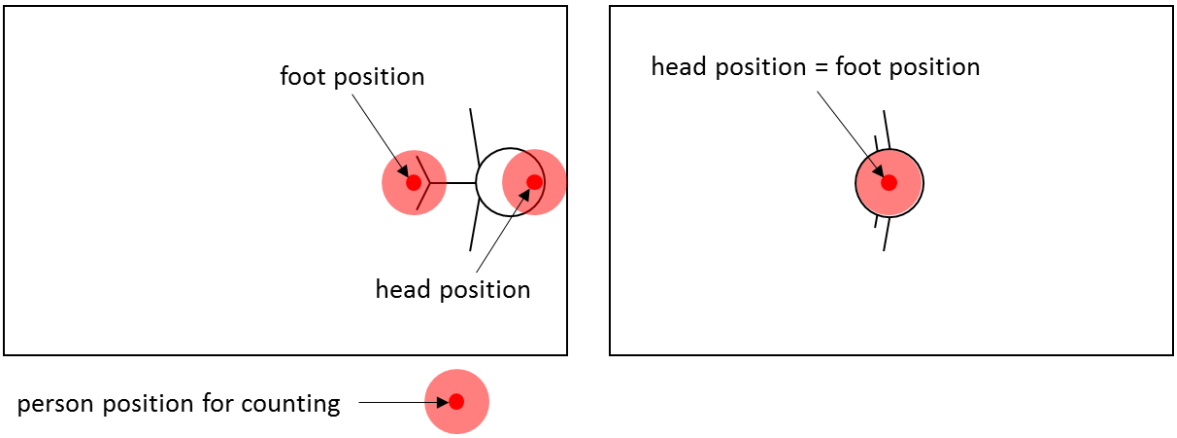


Figure 5: Person position

Due to the visual perspective of the overhead mounted sensor, the head and foot positions are congruent directly underneath (in the plump) of the sensor but at different positions at the scene borders. The user can choose which position shall be used on the sensor by defining the coordinate mode. This coordinate mode, which can either be "foot" or "head", then defines where to show the tracking of a person.

The displaying of the person tracks (paths) on the other hand influences the definition of the counting elements: When choosing foot coordinates, the person paths will first be displayed after an offset from the border, as persons only get detected by the sensor as the head is seen by the sensor. Due to the visual perspective, the feet of a person will be seen by the sensor long before the head of the same person is seen. In other words, when a persons head is seen by the sensor, its feet will be located within the sceen with a certain distance to the border / to the head of the person. The following situation demonstrates this fact:

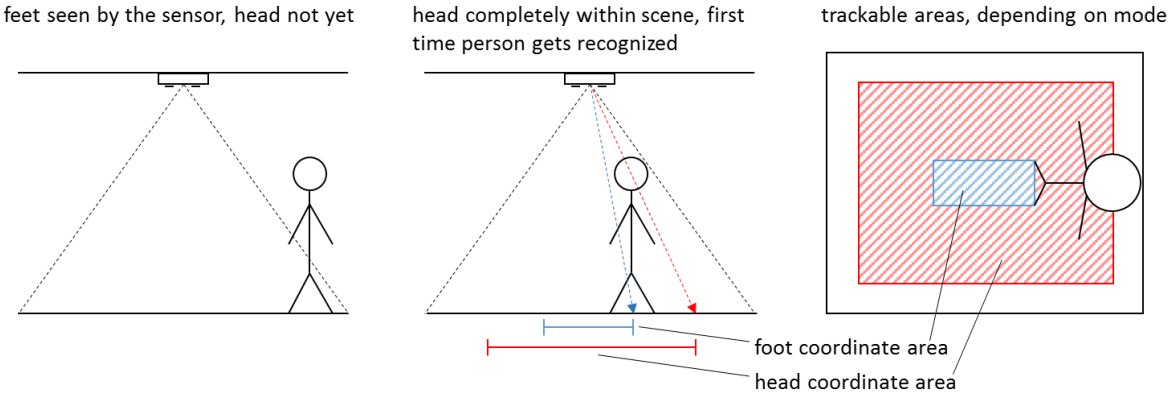


Figure 6: Different tracking areas depending on the coordinate mode

Theoretically the foot coordinates will always be the easier way to use, as all counting items (e.g. count line) can just be oriented on the scenes floor (all possible locations of a persons

feet are given by considering the floor of the scene). But due to the visual perspecitive, feet positions will not be displayed within the complete visible floor which can complicate the proper drawing of counting items, especially on lower mounting heights where the difference between the trackable areas of both coordinate modes is quite big (see Figure 6). Therefore, in some situations, head coordinates can be the preferred choice.

The following situation illustrates the two different coordinate positions:

Figure 7: Demonstration of coordinate modes

On the left, foot coordinates are in use and on the right, head coordinates. The situation shows that the first possible position of person "bubbles" is clearly closer at the border when head positions are used.

3.2 Setting up a sensor

3.2.1 Introduction

This chapter describes the recommended procedure how to set up a new PC-Series sensor.

3.2.2 Setting up the sensor in the network

The sensor is setup for use in a DHCP environment by default. If a sensor is attached to a network, it is expecting an IP address assignment by a DHCP server in the network. This is the simplest way to install a new sensor.

If no DHCP server is present, a static IP setting needs to be applied to the sensor. For this purpose, a Windows PC attached to the same physical subnet as the sensor is required. The static network settings can then be applied with the Xovis Sensor Explorer tool.

3.2.3 Login to the sensor

The arrival page of the website shows a log-in dialog. Choose between the "Administrator" and "Viewer" profile in the dropdown menu. The default password is "pass" (without the "" quotation signs). **Important:** Please replace the default password after completing the initial setup wizard for security reasons (see how in chapter **3.2.8.4.4**).

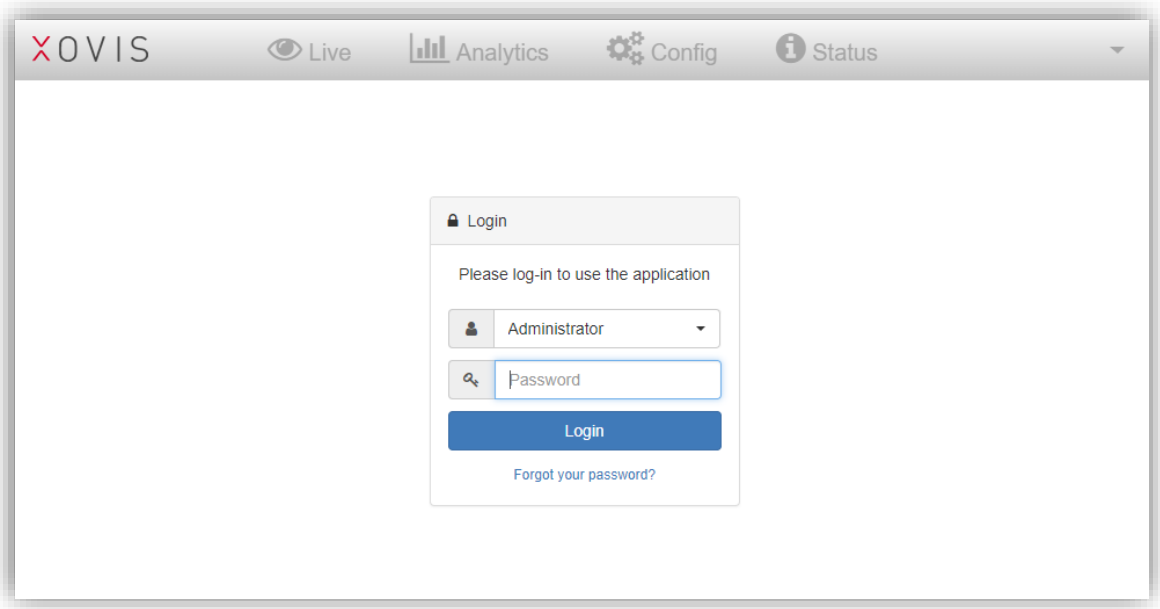
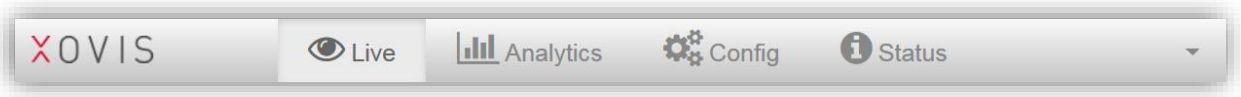


Figure 8: Login screen

The login screen holds a "Forgot your password" link. This allows to reset the sensor using the Sensor Master Key (SMK). The reset procedure is described in chapter 3.2.8.4.5.

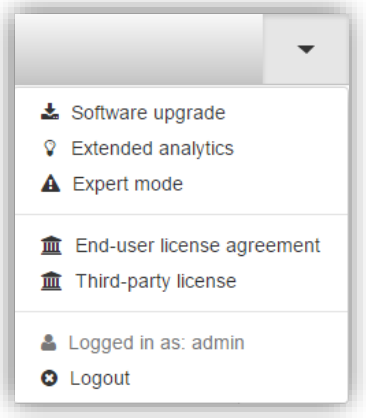
3.2.4 Navigation



The navigation bar is located at the top of the web GUI. It basically holds three sections: The logo, the menu buttons, and a context menu.

The menu buttons allow the user to switch between the four main views "Live", "Analytics", "Config" and "Status". The purpose of these views is described in their respective chapters **3.2.6** to **3.2.9**. These buttons are disabled when logged out and in the setup wizard mode (see next chapter).

The context menu holds additional functionalities for maintaining the sensor and to logout the current user:



The "Software Upgrade" procedure will be explained in chapter **3.2.10**. "Extended Analytics" is covered in chapter **3.2.11**. The "Expert Mode" is not documented in this manual as it is reserved for expert use only.

Xovis strongly recommends to NOT USE the expert mode at all as changes made with the expert mode can cause the sensor to become unresponsive.

The two entries for EULA and third-party licenses display the respective licenses.

The "Logout" button ends the session of the currently logged in user and returns to the login page. The currently logged in user is displayed directly above the "Logout" button.

3.2.4.1 Plugins

The PC2 sensor can be enriched with various plugins. The plugin installation procedure is described in chapter **3.2.8.4.3**. Plugins which offer a frontend component will also be listed in the navigation bar. Figure 9 shows an example with the "Wrong Way Detection" plugin:

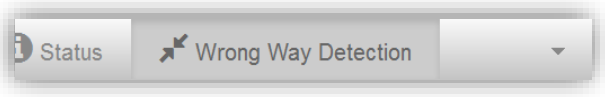


Figure 9: Plugin button in the navigation bar

A plugins functionality and usage is documented in the documentation of the specific plugin.

3.2.5 Setup Wizard

If the sensor is not configured, the setup wizard will be shown directly after logging-in.

It is strongly recommended to use the setup wizard for setting up the sensor as the wizard ensures to gather all information needed for a proper usage of the sensor.

3.2.5.1 Welcome screen

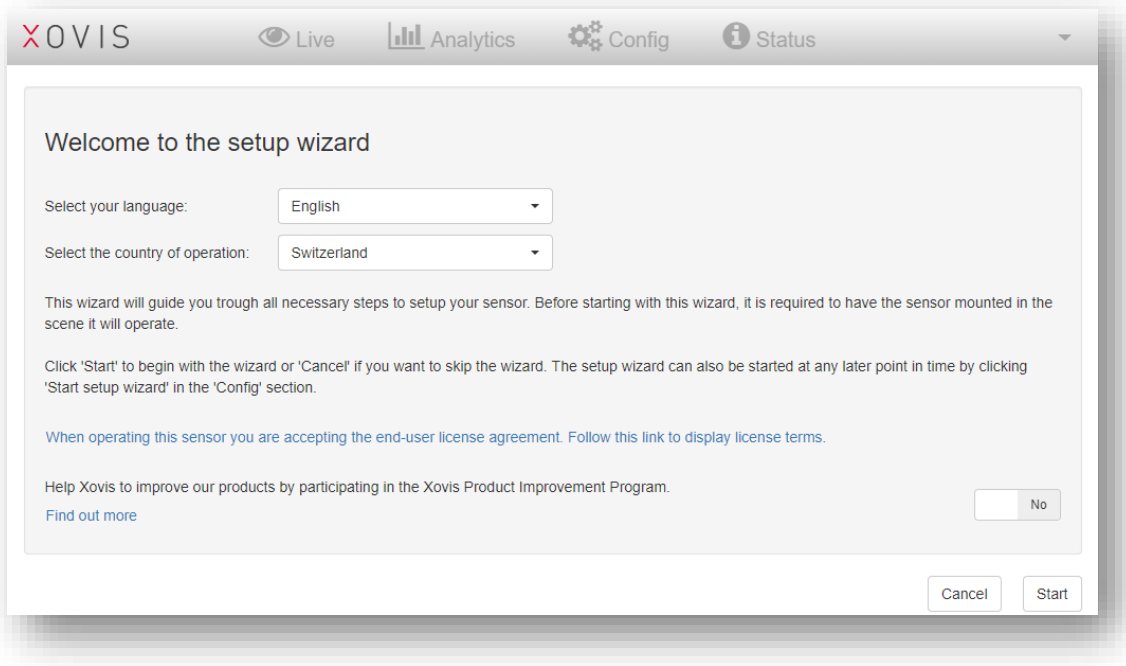


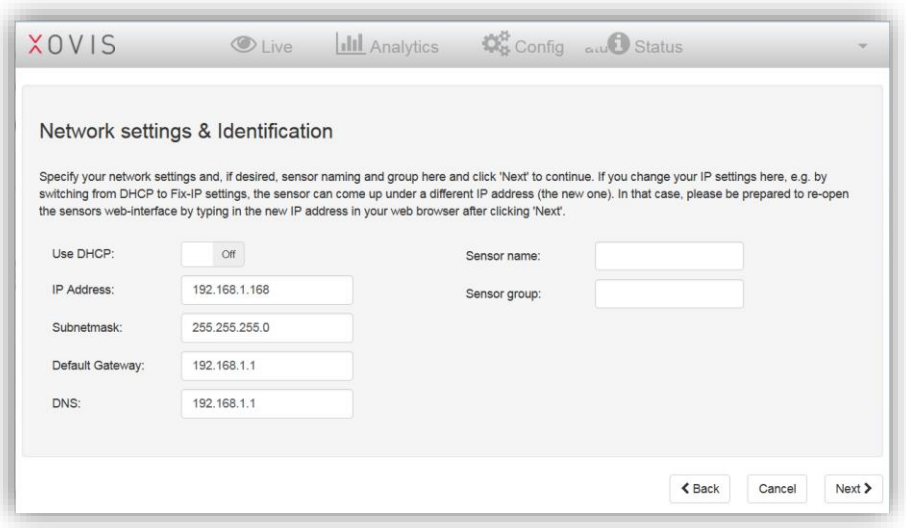
Figure 10: Setup wizard

The welcome screen of the wizard gives a quick description of the intent of the wizard and allows the user to choose the desired GUI language as well as the country of operation (sensor installation).

The toggle on the bottom left corner allows to participate at the product improvement program (PIP) and helps Xovis to constantly improve their products. Find out more will open a modal window with more information.

The wizard can be started by clicking “Start”. At any step of the wizard, it can be ended by clicking “Cancel”. The setup wizard can be re-started anytime in the config view (see chapter 3.2.8.1.3).

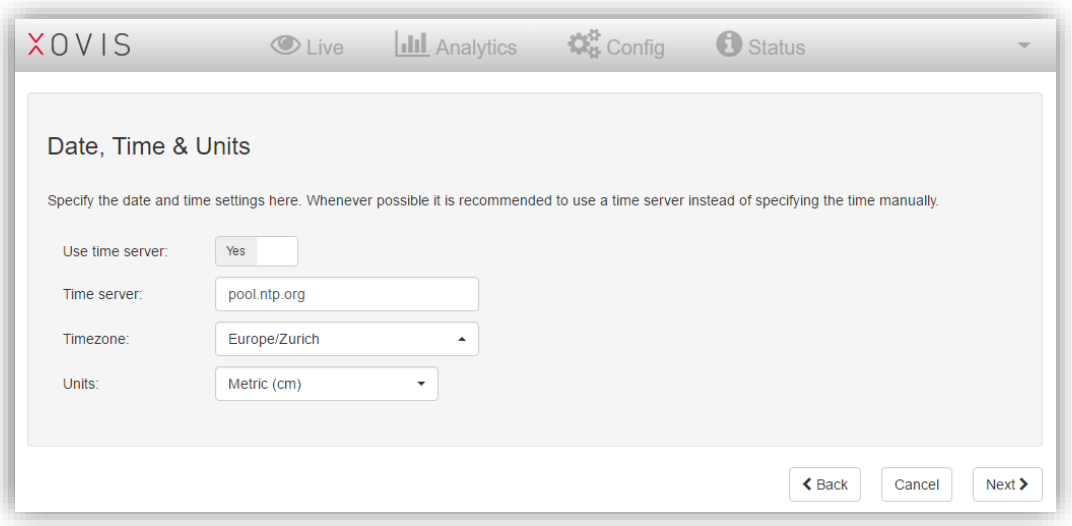
3.2.5.2 Network settings & identification



As a first step, the wizard is asking for the network settings and identification naming. The sensor can be run with DHCP or a fixed IP address. If not using DHCP and the IP settings have been applied already by using the Xovis Sensor Explorer, it is recommended to double check the network settings here. Optionally, a name and group can be specified for the sensor. By clicking “Next”, the network settings are applied to the sensor.

If the IP address of the sensor is changed here, the sensor will instantaneously come up under the new address after pressing “Save”. In that case, the new IP address needs to be entered in the web browser after saving.

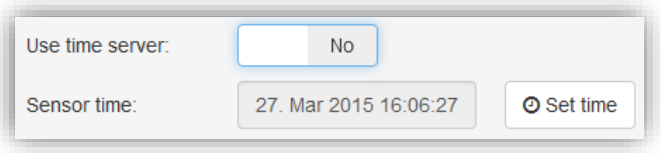
3.2.5.3 Date & Time



In the next screen, the wizard is asking for setting the sensors date, time, and units.

Whenever possible it is recommended to use a timeserver, as a correct time can be crucial for stored counting data statistics.

When not using a time server, the sensor time can be set manually by switching the "Use time server" toggle to "No" and then clicking on "Set time":

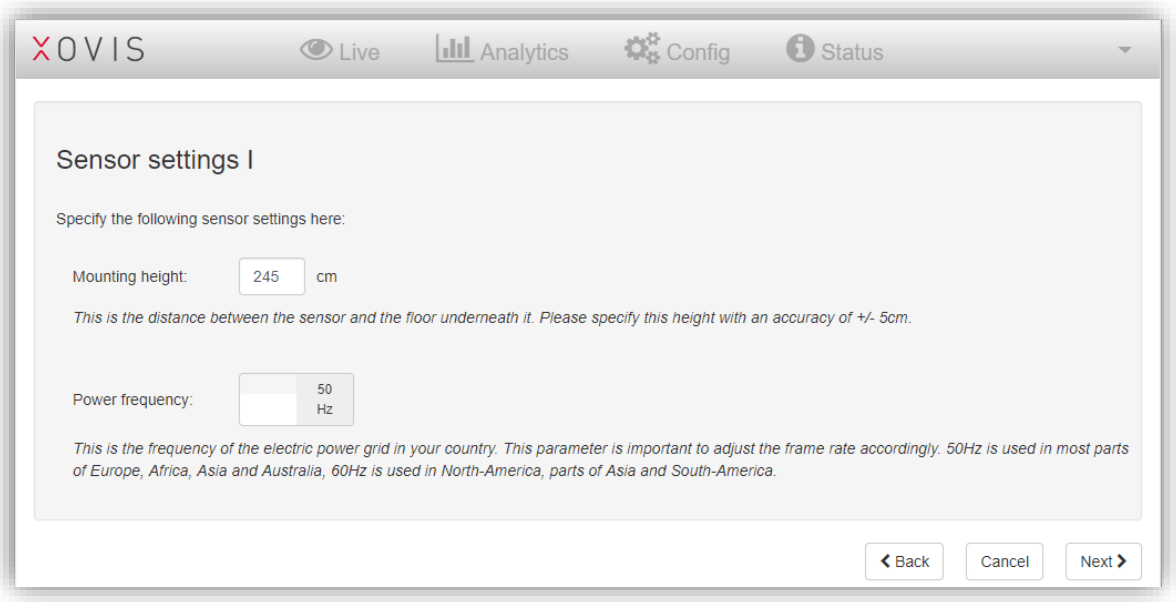


The time zone dropdown is ordered by continents / geographic regions and cities. The time zone should be set according to the sensors location.

The "Units" dropdown allows to choose between Metric (cm) and Imperial (feet/inch) units.

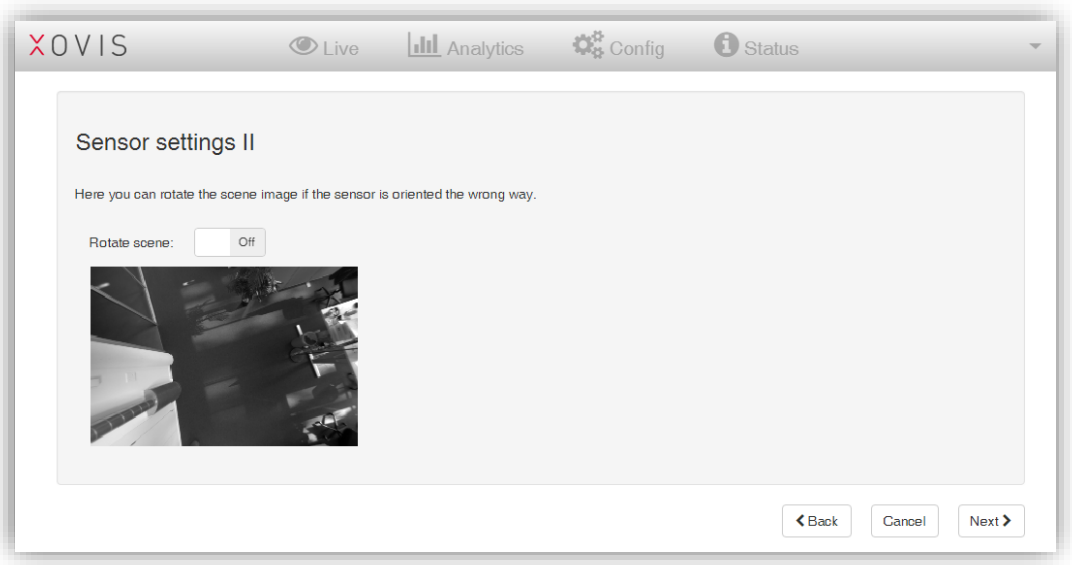
By clicking "Next", the date and time settings are applied to the sensor.

3.2.5.4 Sensor settings I



In the next screen, some base settings for the sensor operation need to be specified. First, the mounting height needs to be set as accurate as possible. Second, the user is asked to specify the power frequency of the country of operation. This is needed to adjust the sensors frame rate to the illumination frequency. By clicking “Next”, these settings are applied to the sensor.

3.2.5.5 Sensor settings II



In the succeeding screen, the scene image can be rotated by 180 degrees if desired. This can be of use if the user's sense of the scene view differs from the orientation of the mounted sensor. The orientation is applied by clicking "Next".

3.2.5.6 Mark the scene floor

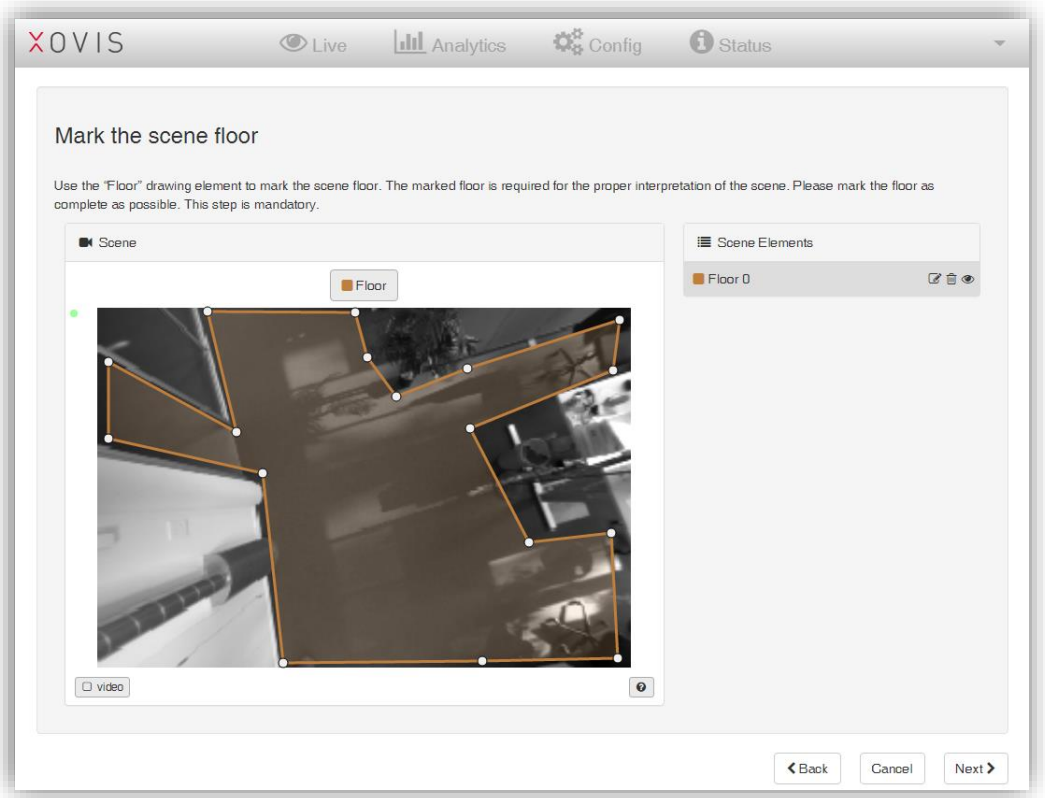
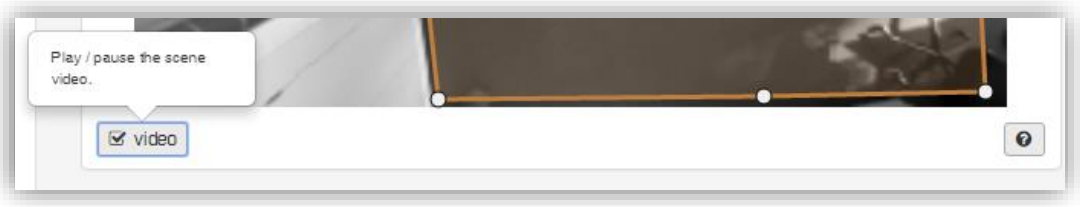


Figure 11: Drawn scene floor

In the next screen, the user is asked to mark the scene floor. The displayed scene image by default is a still image as this usually simplifies the analysis of the scene environment. However, if a video stream is preferred or maybe to just recapture a new still image, the live stream can be displayed by clicking on the play button located below the scene image. The help button beside the play button also offers a short explanation when hovering over it with the mouse:



The floor is masked by selecting the drawing tool "Floor" and directly drawing the whole floor as a polygon in the scene (see Figure 11). With the "Floor" tool activated, one can simply click in the scene image to draw corners of a floor area. A floor area is finished by clicking on the first corner again, by double-clicking to create the last corner, by disabling the "Floor" tool or by pressing [Esc] on the keyboard. After finishing a floor area, one is asked to name it (see Figure 12). A default name is proposed.

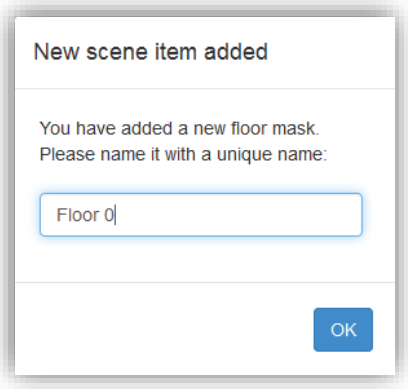


Figure 12: Name a scene item

As for all scene elements, this name must be unique among all other scene elements like count lines and count zones. But at this point, the floor item will be the first scene item added. After specifying a name, the floor is automatically added to the scene element list on the right. There can also be more than one floor area (element) in the scene, e.g. for two corridors covered by one sensor or just to simplify the drawing procedure for the user (see Figure 13 b).

The floor mask defines the area in which persons should be detected by the sensor and refers to the feet positions of a person. Usually the whole floor contained in a scene should be covered by the floor mask. For special situations, it can be desired to limit the floor mask to a part of the actual floor only, e.g. when persons passing in a neighboring zone should be ignored (see Figure 13 c).

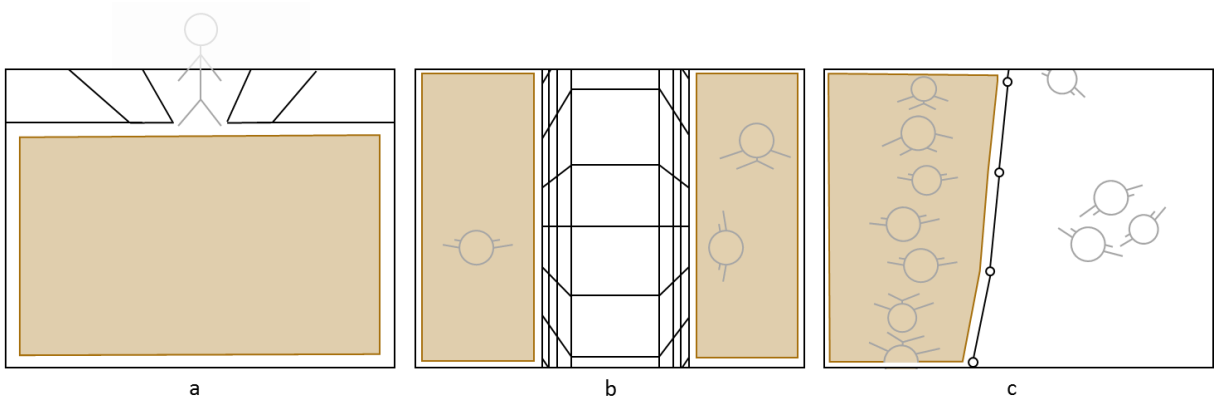


Figure 13: Floor mask in different scene situations

As Figure 13 shows, it is a good practice to keep a small distance between the floor mask and limiting objects like walls, doors or shelves. As mentioned already, it is also possible to use more than one floor masks if the situation is demanding this.

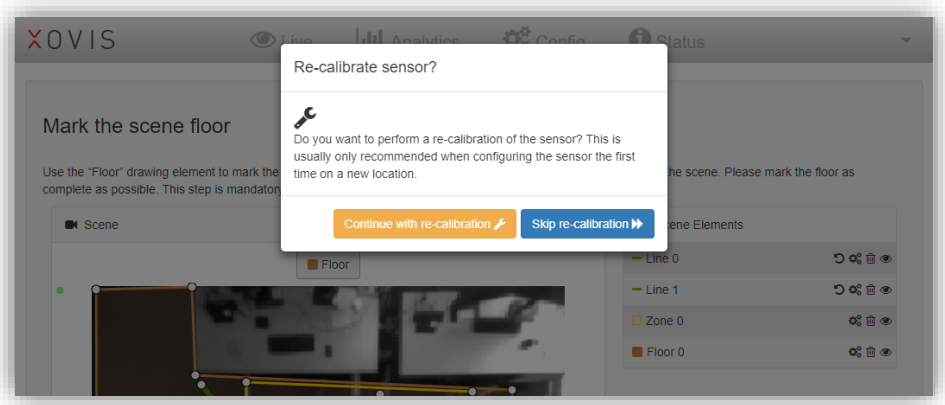
To modify a floor, mask the polygon points can simply be moved with the mouse. Double-clicking on a polygon point will delete it, double-clicking on the polygon line will add an additional point to the polygon. The whole polygon can be moved by clicking and holding the mouse within the floor mask area and moving it to the desired location (drag-and-drop).

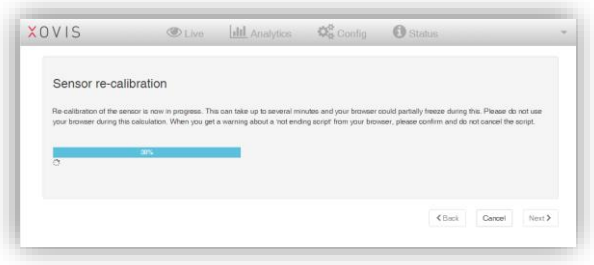
The wizard requires the user to add at least one floor mask before continuing. However, after finishing the wizard, the floor mask can theoretically be removed again. In that case, if no floor mask is used, the whole scene is considered as floor and therefore enabled for person detection.

The floor mask is applied when clicking “Next”.

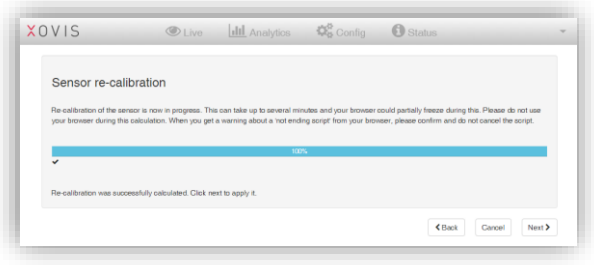
3.2.5.7 Re-calibrate Sensor

The wizard will now ask if a re-calibration should be applied. It is recommended to re-calibrate the sensor when installing it for the first time in a new location. If this step is skipped the sensor cannot be used in a Multisensor.



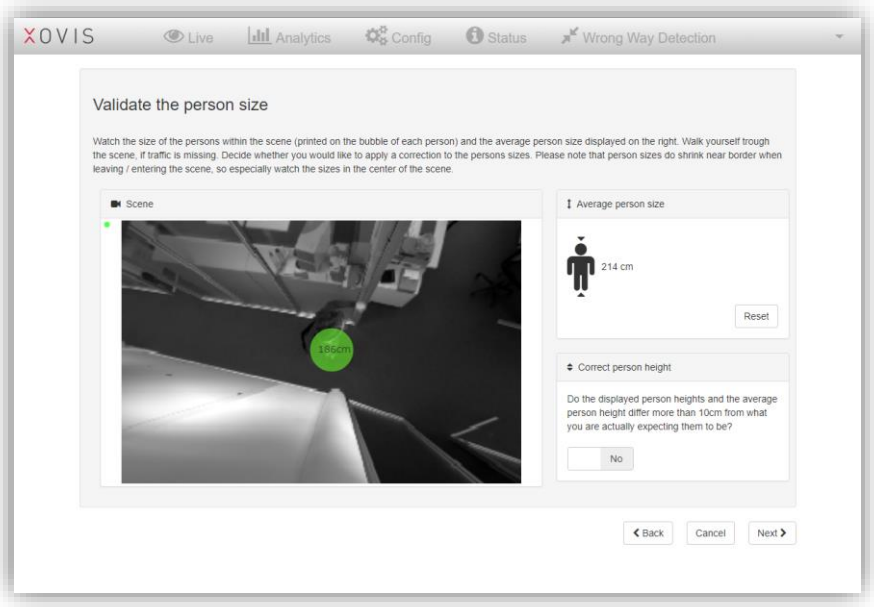


The recalibration requires a data exchange between the sensor and the web browser. If performed by remote, the connection bandwidth will impact the duration and can take several minutes. In such case, we suggest a connection with at least 200kbytes/s.



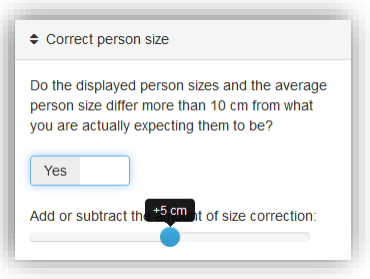
When the re-calibration is done, it is applying to the sensors by clicking on “Next”.

3.2.5.8 Validate the person size



In the succeeding screen, the user is asked to verify the person size. This is important to validate the distance measurement of the sensor. In most cases, especially on mounting heights below 3.5 meters, the person sizes will be quite exact without an additional correction (precision is better than +/- 10 cm). But in several situations, the sensor might not be able to correctly measure the scene and therefore measures the person sizes incorrectly.

If the average person size or the sizes printed on the bubbles within the scene seem to be unrealistic, a correction can be applied. For this, the toggle switch in the “Correct person size” box on the right must be set to “Yes”. Now, using the slider, a size correction can be applied (the resolution is 5 centimeters based as this is the accuracy range the sensor is operating).

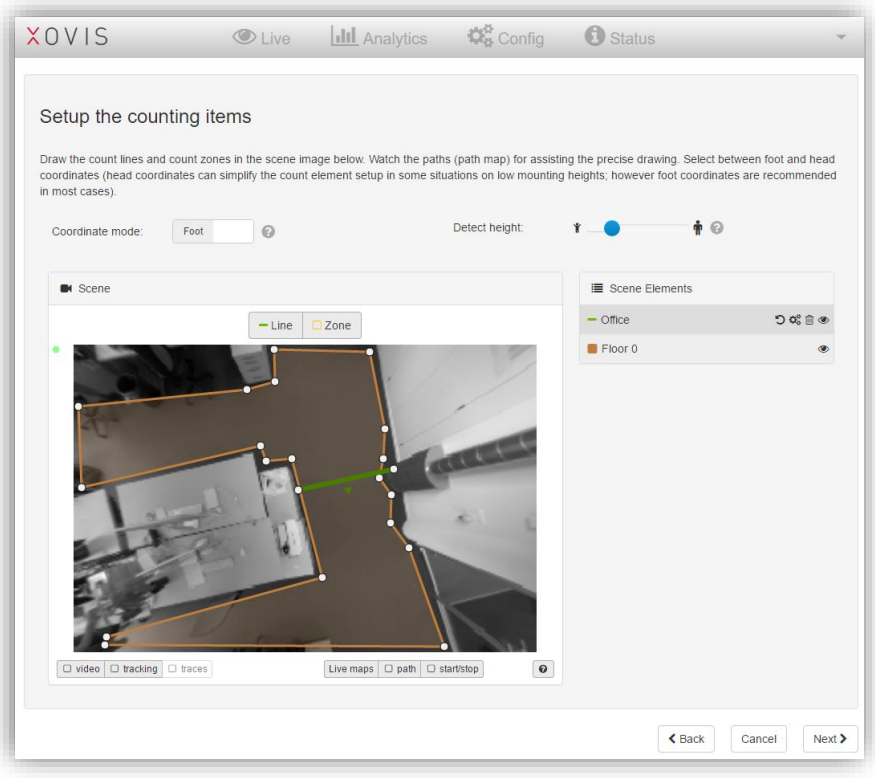


When modifying the slider, the correction is automatically applied to the scene, so the effect can be observed immediately. Also, the average person size is reset every time the slider is moved.

Please note that person sizes do shrink near border when leaving / entering the scene, so especially watch the sizes in the center of the scene. The average person size uses the maximum height of each person detected within the scene, so it is more representative.

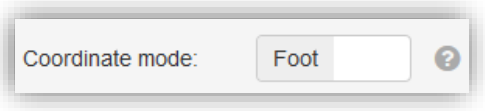
After verifying the person sizes, any correction is applied to the sensor after clicking “Next”.

3.2.5.9 Setup the counting items



In the next screen, the counting setup can be performed. In the upper part of the screen, the coordinate mode and the detect height can be set.

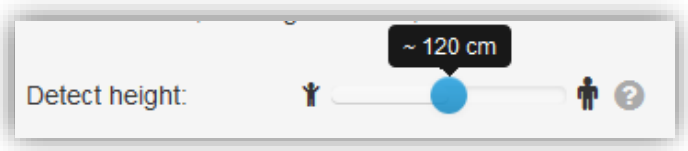
3.2.5.9.1. Coordinate mode



The coordinate mode defines where to show the tracking of a person, either at its head or at its feet. The purpose of the coordinate mode and the difference between "head" and "foot" is explained in detail in chapter **3.1.2**.

When toggling between the two coordinate modes, the sensor will automatically apply the changed mode and switch the displaying of the person positions accordingly.

3.2.5.9.2. Detect height



The detect height defines the height from floor, at which a person gets detected and analyzed by the sensor. This parameter influences the detection of small persons (children) and can be reduced to 80 cm at least. With this parameter, the exclusion from persons below a specific size can be realized, i.e. to ignore children from being counted. The detect height can be parameterized between 80 cm and 160 cm. Figure 14 visualizes the detect height.

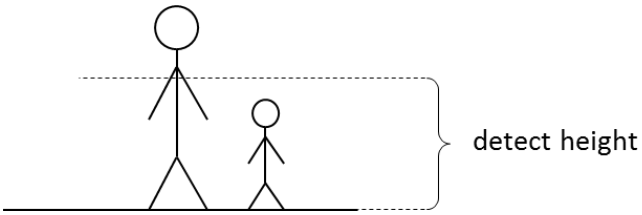


Figure 14: Detect height

When changing the detect height with the slider, the changes will automatically be applied to the sensor so they can immediately be verified in the scene view.

3.2.5.9.3. Scene view controls

The scene view offers several controls which can be helpful when setting up the counting elements.

The first control, the video checkbox, allows to activate or de-activate the live video.

The "tracking" checkbox controls whether to show a bubble on every tracked person. This bubble will be located either on the person's head or feet, depending on the chosen coordinate mode (see chapter 3.2.5.9.1).

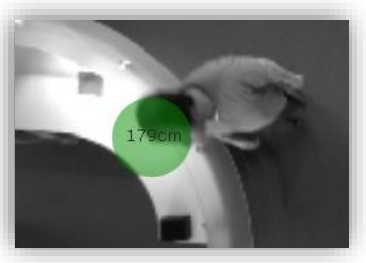


Figure 15: Bubble displayed on tracked person

The "traces" checkbox is only activated when the "tracking" checkbox is selected. If "traces" is selected, the most recent part of the track of every person within the scene is visualized:

Figure 16: Displayed path of tracked person

The "Live maps" section allows to show/hide several types of visualization maps: If the "path" checkbox is selected, the whole tracks of all persons are kept and visualized in the scene image. This path map can be of great use while drawing the counting elements properly as the displayed paths help the user to identify the areas where tracking occurs:

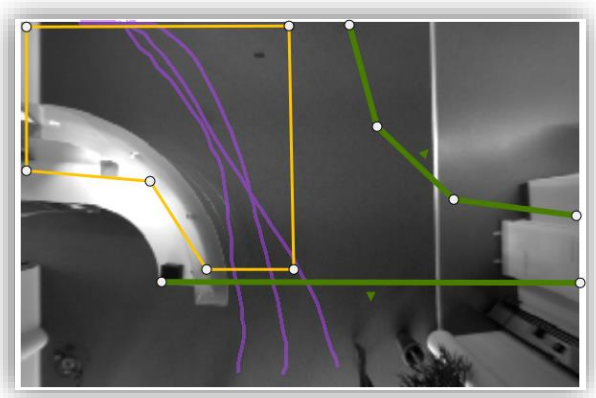


Figure 17: Pathmap helps to identify the actual tracking while setting up the counting elements

Note: When the "path" checkbox gets unchecked, the tracks will disappear from the scene view and be reset (when re-selecting the path live map checkbox, the old paths will not be included again).

If the "start/stop" checkbox is selected, generation and deletion points of all persons will be displayed as green and red dots. This allows to analyze, where people actually start to get tracked and where they disappear again. Using this point map, a count line can be easily adjusted properly to ensure to not miss any person.

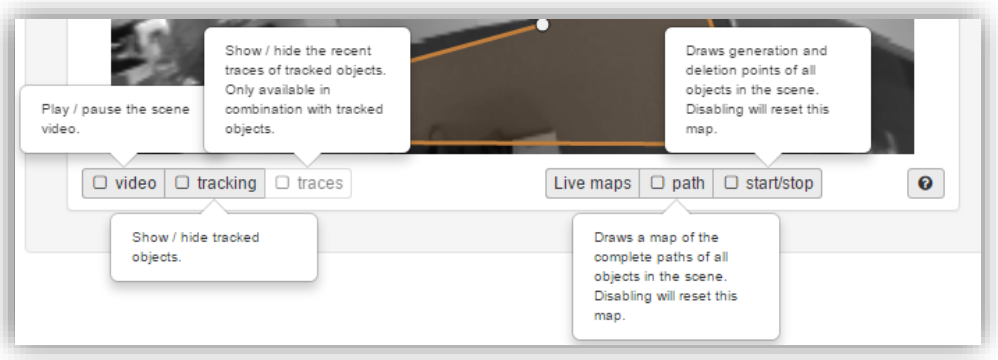
Figure 18: Start/stop map visualizes generation and deletion points of persons

As with the path live map, when the "start/stop" checkbox gets unchecked, the points will disappear from the scene and be reset.

Please note that all live visualizations are influenced by network bandwidth. As the visualization are drawn by the client (web-browser) here, it is likely that some frames are missed when low bandwidth is given. This leads to a visualization not showing the actual truth, as, for example, start points will be drawn later as they occurred (location will be more towards the inside of the scene)

Whenever using the maps for proper analytics, and especially with low bandwidth, it is highly recommended to use the "visualization maps" instead, as they are based on persisted, sensor-stored data. See chapter 3.2.7.2 for more details.

The help button offers quick explanations for all the control elements mentioned so far. Hovering over it with the mouse will pop-up the help information:



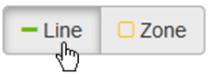
3.2.5.9.4. Count lines

The count line is the first of the two counting and observation tools available with a PC-Series sensor. A count line measures the number of persons crossing a defined line. Forward and backward crossings are counted separately. A line therefore has a directional property, i.e. an orientation. This orientation is indicated with a centered arrow pointing in the direction of forward crossing (see Figure 19).

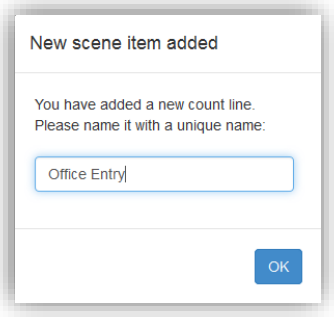
Figure 19: Orientation of a count line

A count line offers several ways to analyze person crossings for its counts. These strategies are explained in section “Example Situations” in chapter 3.2.5.9.7 “Count line configuration”.

Drawing a count line



A line can be drawn by selecting the drawing tool “Line” and directly drawing the corners of the line in the scene image. A line is finished with a second click on the last corner, by a double click to create the last corner, by disabling the drawing tool “Line” or by pressing [Esc] on the keyboard. After finishing a line, the user is asked to name it.



As with the floor masks, this name must be unique among all other scene elements. After naming the line it is automatically added to the scene element list.

In the examples shown above, a line always has two corners / points. However, a line can have multiple points (corners) to fit all situations. Such a multi-point line can be created by just going ahead drawing corner points in the scene. Figure 20 shows an example:

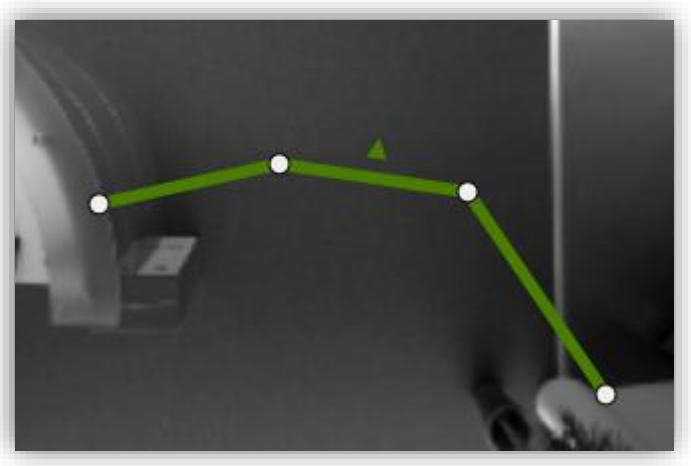


Figure 20: A multi-point line

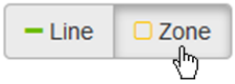
An existing line can be modified by moving its corners or by dragging the whole line by clicking-and-holding on a line edge.

The sensor supports up to 99 count lines. When the 99th line is drawn, the line drawing tool gets disabled. One or more lines then need to be deleted to re-enable the line drawing tool.

3.2.5.9.5. Count zone

The count zone is the second counting and observation tool available with the PC2. A count zone measures the occupancy of a defined zone. Every count zone provides a count level which indicates the number of persons currently situated within the zone.

Drawing a count zone



A count zone can be drawn similar to the floor mask. By selecting the drawing tool “Zone” one can simply draw the corner points of the zone polygon in the scene image. A count zone can be finished by clicking on the first corner again, by double-clicking to create the last corner, by disabling the “Zone” tool or by pressing [Esc] on the keyboard. As with the count lines, after finishing, the user is asked to name the count zone before it gets automatically added to the scene element list.

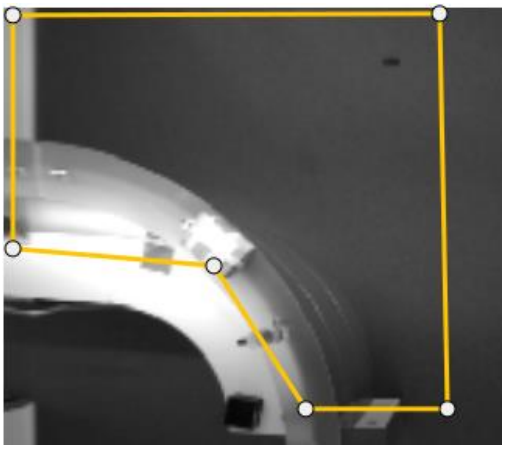


Figure 21: A count zone

Editing a count zone is the same as with the floor masks.

The sensor supports up to 99 count zones. When the 99th zone is drawn, the zone drawing tool gets disabled. One or more count zones then need to be deleted to re-enable the zone drawing tool.

3.2.5.9.6. Scene elements

All the scene elements described so far (floor masks, count lines, count zones) are listed in the scene elements box:

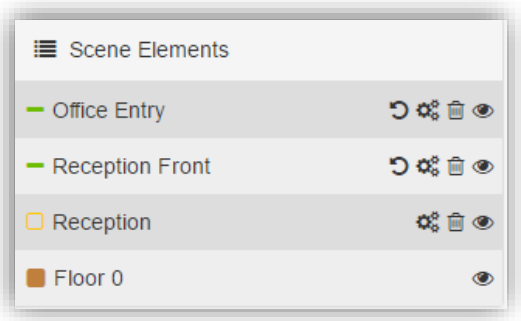


Figure 22: Scene elements

When hovering over the elements within the list, the element gets hightlighted both within the list and within the scene. When clicking on a specific element, it gets marked red both within the list and within the scene. At the same time the selected element is brought to the front of the scene view, allowing to modify it even if it was actually lying behind another element (e.g. count line behind a count zone). Clicking again on the element or selecting another element will unmark it again. The vice-versa procedure is also supprted, i.e. hovering and selecting the scene elements within the scene view. Figure 23 shows an example:

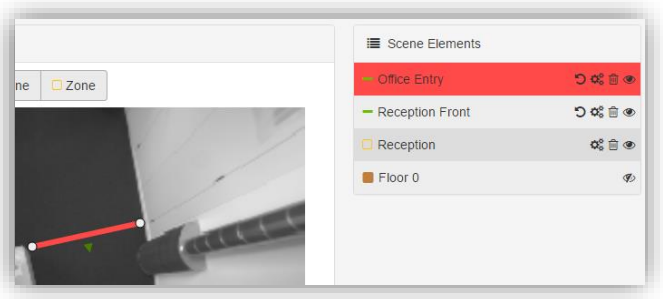


Figure 23: Highlighted scene element

Every scene element offers a series of icons on the right side of the list entry:

Show / hide a scene element

The eye icon allows to hide and show any scene element. This can be of use especially when dealing with a certain amount of scene elements. As the floor mask usually covers a big part of the scene image, it can be helpful to hide it when modifying other scene elements.

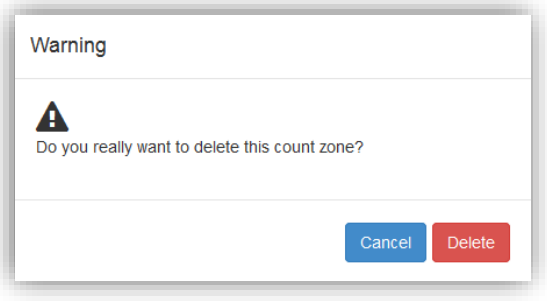
Figure 24: Hide / show a scene element

Delete a scene element

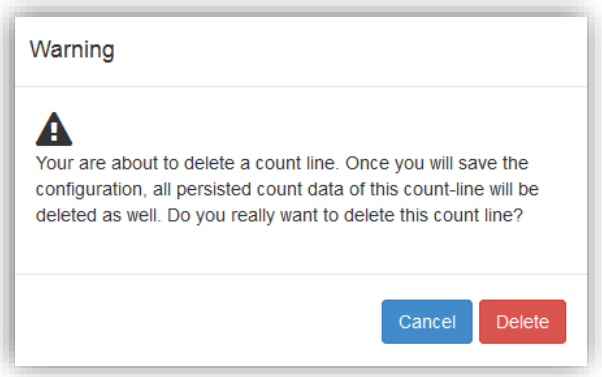
The trash bin icon allows to delete any scene element. During the wizard, the floor mask, once set, cannot be deleted as it is mandatory. However, after finishing the wizard, even the floor masks can be deleted the same way as any other scene element.

Figure 25: Delete a scene element

When clicking on the trash bin icon, the user is asked to confirm the deletion of the specific scene element:

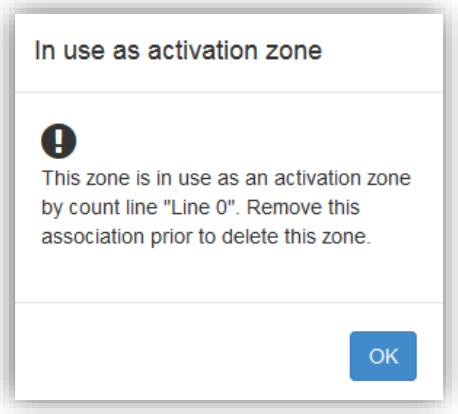


When deleting a count line, a special warning will inform the user that all persisted count data belonging to this count line will be deleted as well:



Attention: When deleting a count line, all persisted count data of this count line will also be deleted!

When trying to delete a count zone which is in use as an activation or deactivation zone (more on this later), a special warning will inform the user that the association has to be removed prior to be able to delete the count zone:



Switch count line orientation

The count lines offer an additional icon within the scene element list, the rotate icon:

Figure 26: Switch count line orientation

When clicking on this icon, the specific count line switches its orientation. Thereby the arrow indicating the lines forward direction will appear on the other side of the line, indicating that the counting direction changed:

Count item configuration

The count lines and count zones offer an additional icon within the scene element list, the gear-wheel icon:

Figure 27: Open count item configuration

When clicking on this icon, a dialog is displayed allowing the user to control a series of parameters associated with this count item. These parameters are explained in the following two chapters, Count line configuration and Count zone configuration.

3.2.5.9.7. Count line configuration

The count line configuration displays the following dialog:

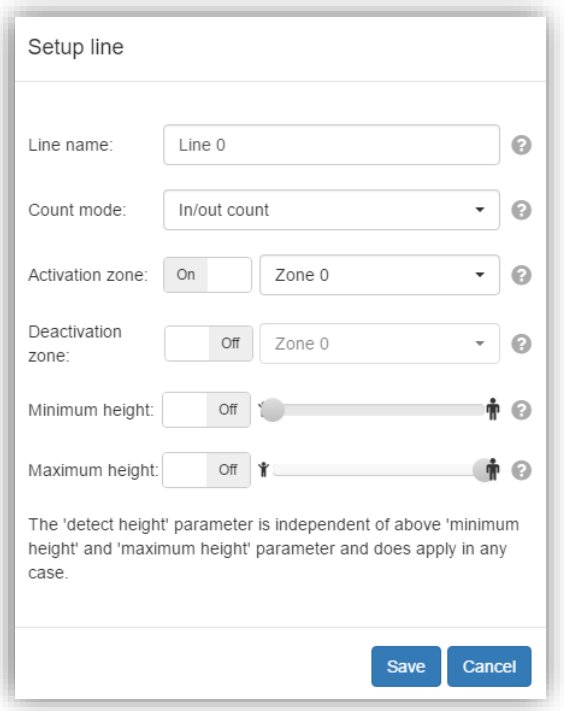


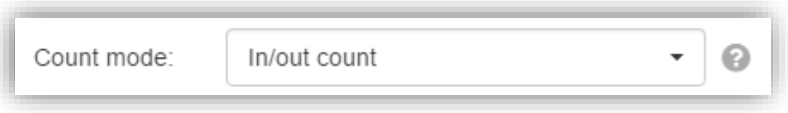
Figure 28: Count line configuration

Line name

The first text field allows to change the name of the count line:

Count Mode

The dropdown menu located just below, allows to specify the count mode of this count line:



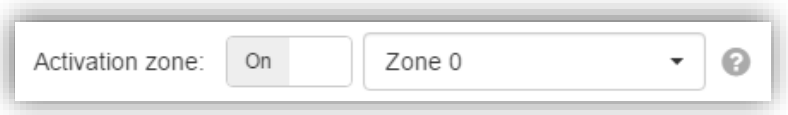
The count mode defines the strategy how line crossings of a person shall be processed. Two different count modes are available:

In/out count: The first crossing of a person is updated immediately. When the person exits where entered, this count will be updated as well as soon the person gets deleted. This mode is activated by default.

Late count: Every person's line crossings are first evaluated and counted when he leaves the scene. Forward and backward counts of a single person on the same line thereby cancel out each other. That way, multiple counting of one and the same person which moves continuously forward and backward in the region of the count line is ignored. This is the preferred mode to get exact counting per person with the limitation of possible delayed counter updates due to the fact that the counters are first updated when a person leaves the scene.

Activation zone

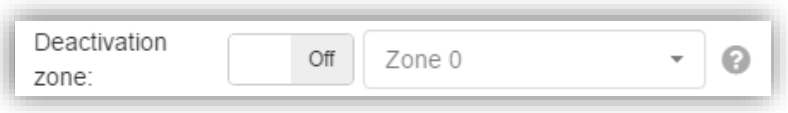
The activation zone toggle allows to enable the use of any zone as an activation zone for this count line:



If toggled to "On", the dropdown allows to define any of the configured count zones as an "activation zone". Whenever an activation zone is associated to a count line, person crossings are only counted on this count line when the person is either generated or deleted within the activation zone.

Deactivation zone

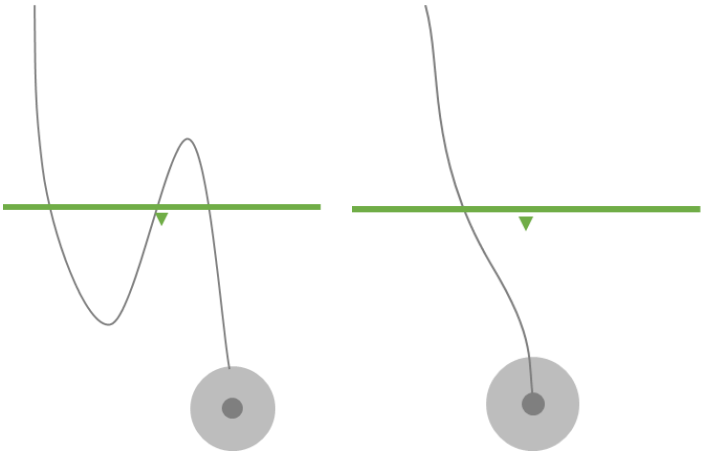
The deactivation zone toggle allows to enable the use of any zone as a deactivation zone for this count line:



The deactivation is the opposite to an activation zone. If toggled to “On”, the dropdown allows to define any of the configured count zones as a “deactivation zone”. Whenever a deactivation zone is associated to a count line, person crossings are only counted on this count line when the person is neither generated nor deleted within the deactivation zone.

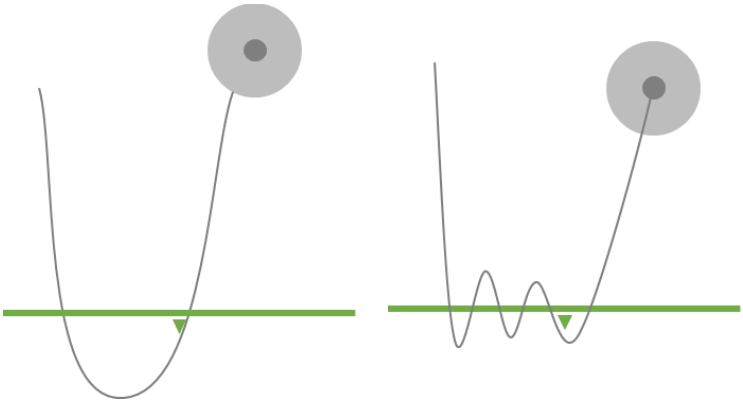
Example situations

In the following, several examples demonstrate the difference between the two count modes and the effect of an associated activation/deactivation zone:



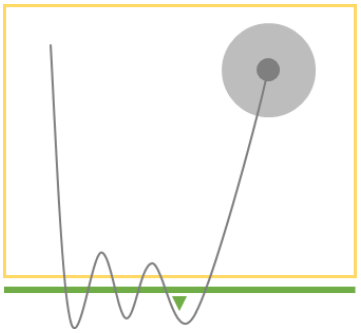
Counts	In/out	Late
Forward	1	1
Backward	0	0

Figure 29: Count mode example 1



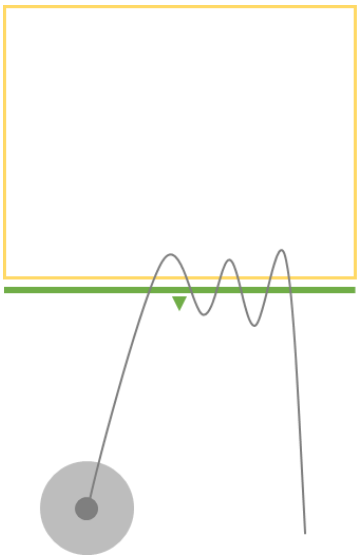
Counts	In/out	Late
Forward	1	0
Backward	1	0

Figure 30: Count mode example 2



Counts	In/out	Late	In/out	Late
	Activation Zone		Deactivation Zone	
Forward	1	0	0	0
Backward	1	0	0	0

Figure 31: Count mode example 3



Counts	In/out	Late	In/out	Late
	Activation Zone		Deactivation Zone	
Forward	0	0	1	0
Backward	0	0	1	0

Figure 32: Count mode example 4

The examples show that the chosen counting mode as well as the use of an activation/deactivation zone can be crucial to the desired behavior. “In/out count” is recommended count mode as it combines instantaneous update of the first crossing plus filtering of person wobbling on the line.

Minimum height

The minimum height toggle allows to enable a specific minimal height of persons considered for counting:

All persons showing a height smaller than this defined minimum height will not lead to a count on this count line. This can for example be of use for excluding children to be counted.

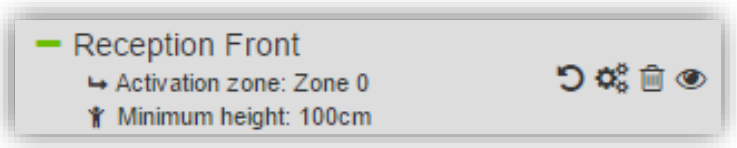
Maximum height

The maximum height toggle allows to enable a specific maximal height of persons considered for counting:

All persons showing a height taller than this defined maximum height will not lead to a count on this count line. This can for example be of use for only counting children on this count line.

For counting children and adults separately at the same location, two individual count lines can be drawn, one with a minimum height rule applied, the other with a maximum height rule applied.

Specific settings of a count line are directly displayed in the scene item list. The example below indicates that "Zone 0" is set as activation zone and that persons below 100 cm height are not considered for counting for this count line:



Please be aware, that some of the above count line settings require a delayed evaluation of person tracks. Counts can therefore first show up after the deletion of a person, independent of the count mode. For example, when specifying a minimum height on a count line, the average height of all crossings of a person is used for evaluating the criterion. Therefore, the counting can fist be done when a person gets deleted.

3.2.5.9.8. Count zone configuration

The count zone configuration displays the following dialog:

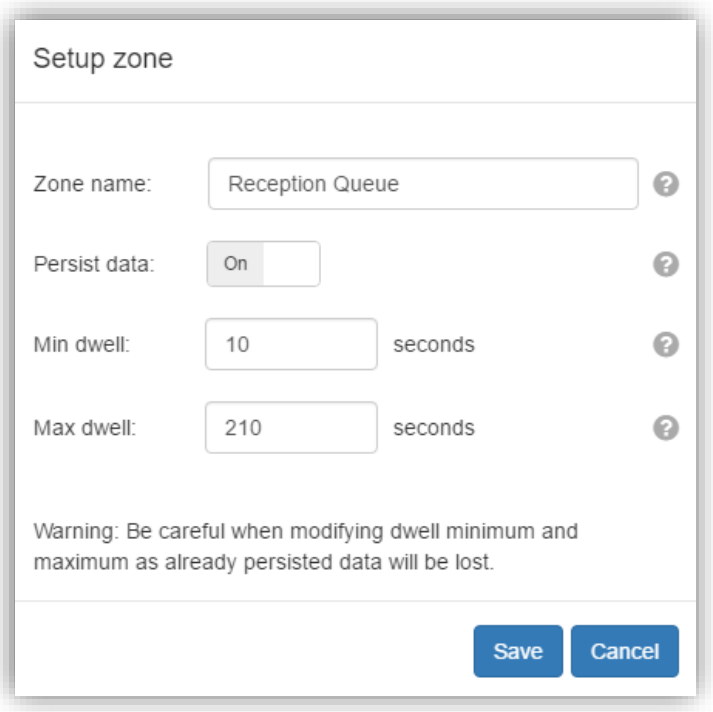
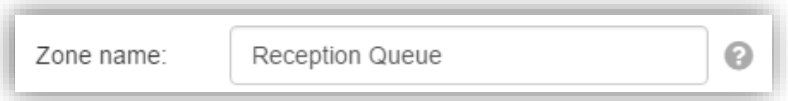


Figure 33: Count zone configuration

Zone name

The first text field allows to change the name of the count zone:



Zone data persistence & dwell time

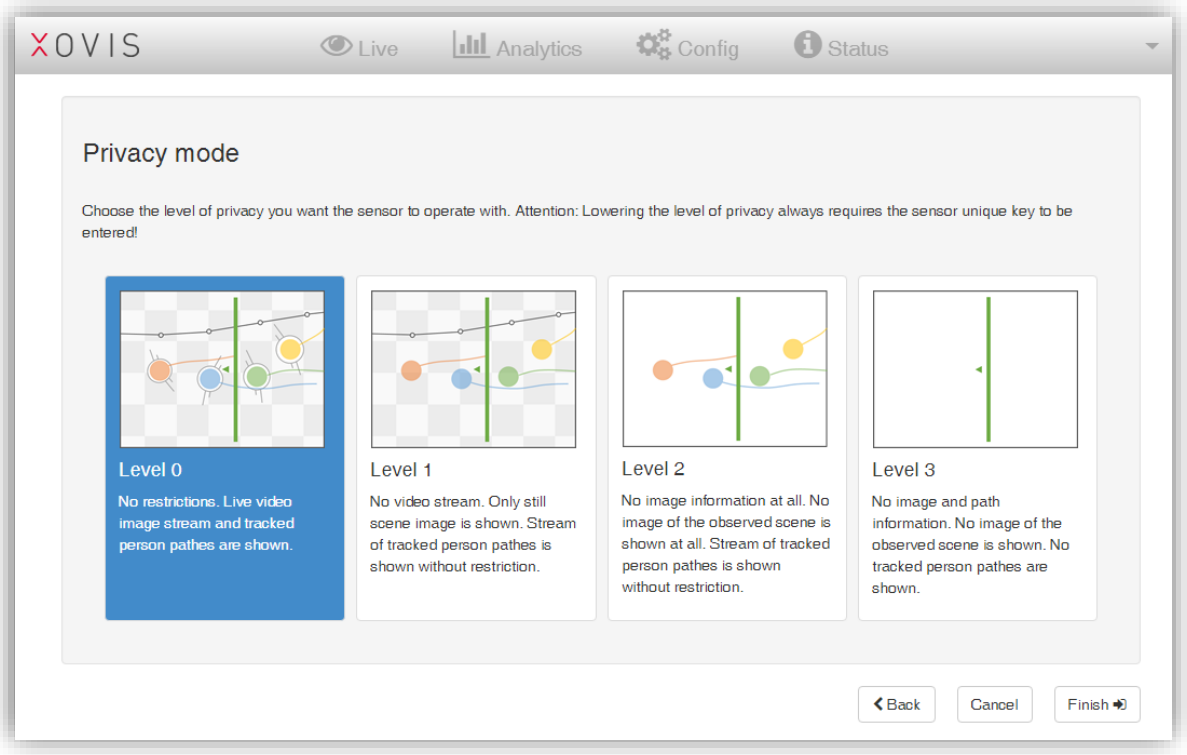
If toggled to "On", fill level and dwell time statistics are stored on the sensor:

When set to "On", a minimum and a maximum dwell time have to be specified. Persons dwelling for a shorter time than the minimum dwell time set here are not considered for dwell time statistics. Same with the maximum dwell time.

The time span between the minimum and maximum dwell time is divided into 10 bins of equal size for dwell time distribution. See also chapter 3.2.7.1.1 “Count zone charts” for more details on this.

For meaningful dwell time statistics, it is important to place the zone correctly inside the sensor actual tracking area. Only tracks started and ended outside the zone are considered for dwell time calculation. Please refer to chapter 4.3 “Placement of dwell zones” for more information on this.

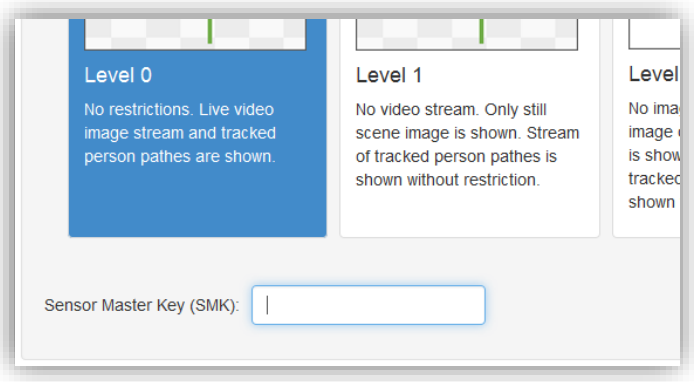
3.2.5.10 Privacy mode



After setting up the counting items, the next screen allows to define the privacy mode. The sensor offers 4 level of privacy:

Level	
0	No restrictions. A live video of the scene as well as person tracking is shown without any restrictions in the WebUI.
1	Only a still image of the scene is shown, no video stream. This still image can be refreshed on request. Tracking is shown without restrictions.
2	No image information is shown at all. The scene background is just displayed as a white area. Tracking is shown without restrictions.
3	No image information and no tracking information is shown. Only the counting values are updated.

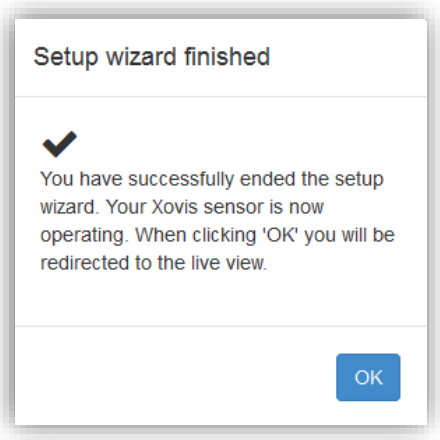
The level of the privacy mode can be increased at any time and is not additionally protected. An additional key (the Sensor Master Key SMK) protects the decreasing.



The Sensor Master Key is unique for every sensor and is provided together with the corresponding order invoice. Alternatively send a request to support@xovis.com

3.2.5.11 Finishing the wizard

When the privacy mode is set, the wizard will be finished by clicking on "Finish". After applying all settings to the sensor, the wizard will end with the following message:



After clicking “OK”, the wizard will be closed, and the user is redirected to the live view.

3.2.6 Live View

The live view is the default landing page after logging in to the sensor or after finishing the setup wizard.

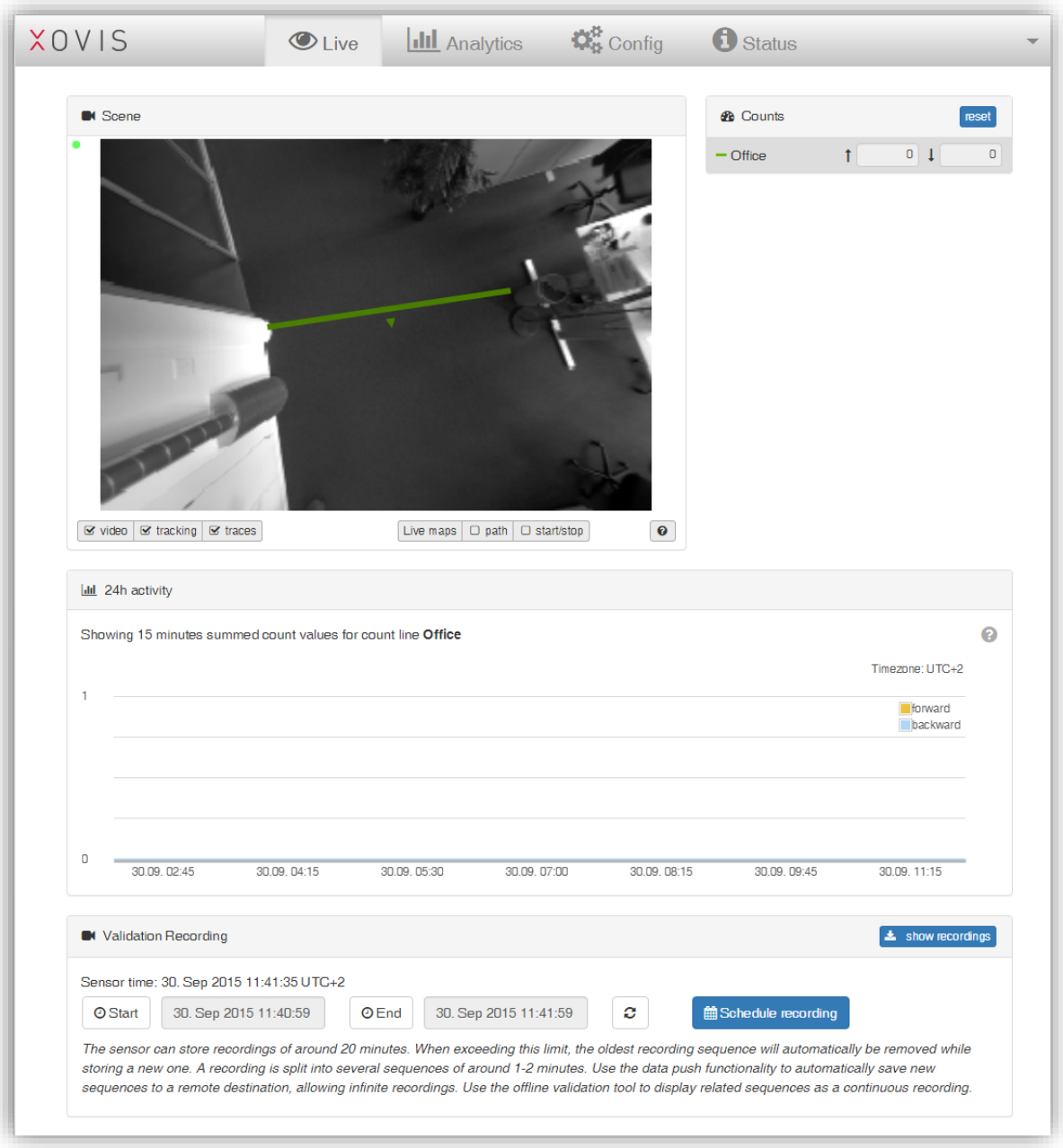


Figure 34: Live view

The live view holds four main parts:

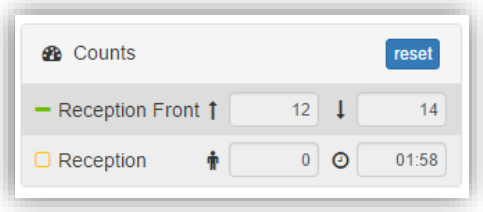
3.2.6.1 Scene live view

The "Scene" box holds the live view of the sensors scene. Configured count lines and count zones are overlaid in the scene image. The monitoring can be controlled by the scene view controls described in chapter 3.2.5.9.3.

When hovering over the count elements within the scene, the element gets hightlighted both within the scene and within the "counts" list (mentioned in the next chapter). When clicking on a specific element, it gets marked red both within the scene and within the "counts" list.

The blinking small green dot displayed in the upper left corner of the "Scene" box indicates an intact connection to the sensor.

3.2.6.2 Live count states



The "Counts" box lists all configured count elements on the sensor, i.e. count lines and count zones. For each count line, the current values of their forward and backward counts are displayed beside the count line name. For every count zone, the current person occupancy i.e. the number of persons currently located within the zone as well as the average dwelling time of the last 15 minutes is shown. The displayed values are updated every 3 seconds.

If no valid dwell times of a zone have been measured in the past 15 minutes, the dwell time of a count zone will be displayed as "n/a" (not available).

When hovering over the count elements within the list, the element gets hightlighted both within the list and within the scene. When clicking on a specific element, it gets marked red both within the list and within the scene.

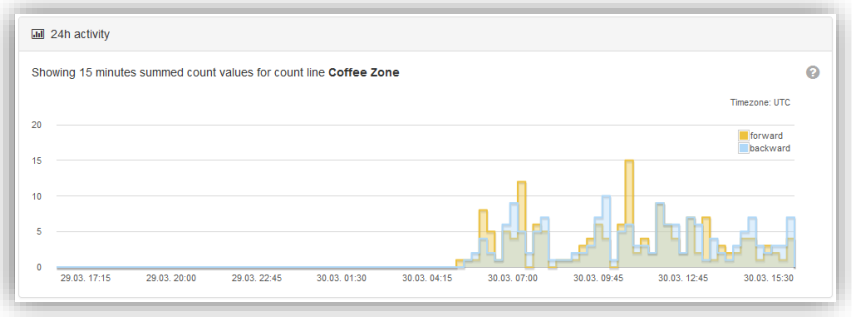
The count values of the count lines can be reset to 0 by clicking on the small blue "reset" button located in the header of the "Counts" box. Resetting the count values can be of use to do a measurement starting at a specific point in time.

Resetting the count values can influence additional software that depends on the sensors count data. However, as the sensor stores the count line values every minute, the stored statistics will only be influenced for the last single minute.

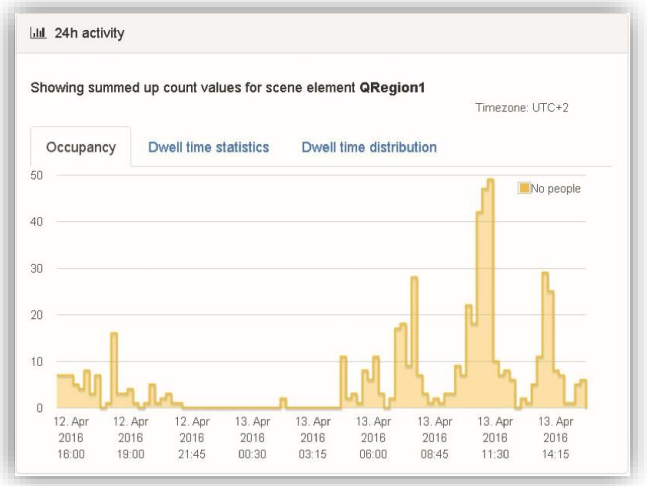
3.2.6.3 24h live statistics

The 24h activity shows measurements of a specific count item of the past day. Per default, the chart shows data for the top most count item (if at least one if defined). When clicking on a count item, be it a line or a zone, the chart will display the corresponding data.

For count lines, both, the forward and the backward counts are displayed within the chart. The values are summed up to 15-minute bins.



For count zones, in case the data persistence feature has been activated (see 3.2.5.9.8), the occupancy as well as dwell times are available. The individual charts for occupancy, dwell time statistics and dwell time distribution are accessible by selecting the respective tab:

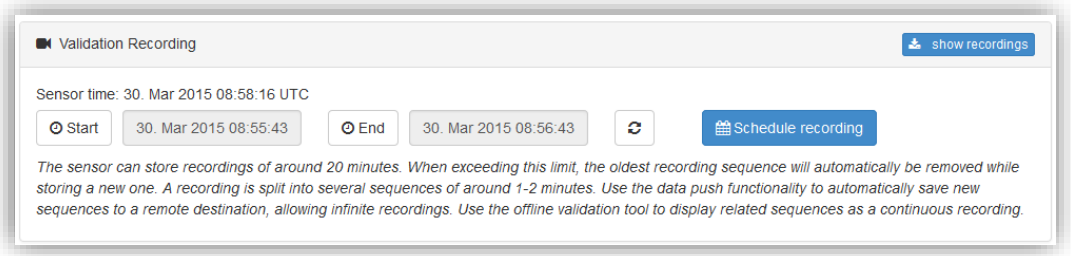


Occupancy and dwell time statistics represent the values in 15-minute bins. Dwell time distribution shows a histogram of 10 bins with equal size, holding the values of the past 24 hours.

Refer to chapter 3.2.7.1.1 “Count zone charts” for more information on the persisted zone data.

The chart is automatically updated every minute.

3.2.6.4 Validation Recording



The “Validation Recording” box allows to manage validation recordings of the sensor. A validation recording contains the scene video, the person tracks, the count item configuration and all line counting and crossing events. With these information, the sensors functionality can easily be validated. Xovis provides the “Xovis Validation Viewer” tool to analyze validation recordings offline.

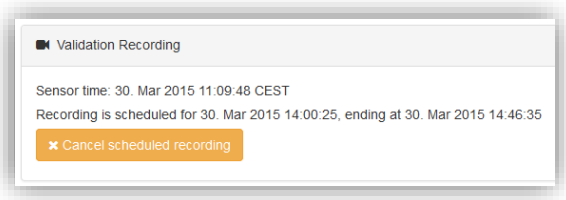
The recordings are split into several sequences of 5MB. Use the Xovis Validation Viewer to visualize the sequences belonging together (it can be downloaded from the Xovis Customer Portal).

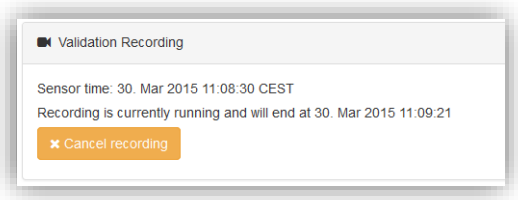
3.2.6.4.1. Schedule a recording

With the two date fields “Start” and “End”, a validation recording can be scheduled to a specific period, starting now or in the future. When clicking “Schedule recording”, the scheduling is stored. As soon the start time of the scheduling is reached, the sensor will start to record the validation data. The recording is automatically stopped when reaching the end time.

As the scheduling is always based on the sensors time which does not need to be the same as the local time of the user’s computer currently configuring the sensor, the sensors time is shown directly above the schedule items and is automatically refreshed periodically. By clicking the “refresh”-icon (arrows in a circle) the scheduling start time is immediately updated to the latest sensor time and the end time will hold the start time value plus 1 minute. This can be helpful to quickly start a short validation recording, i.e. if an interesting situation seems to happen right that moment.

Whenever a recording is scheduled or running, the state is presented accordingly:



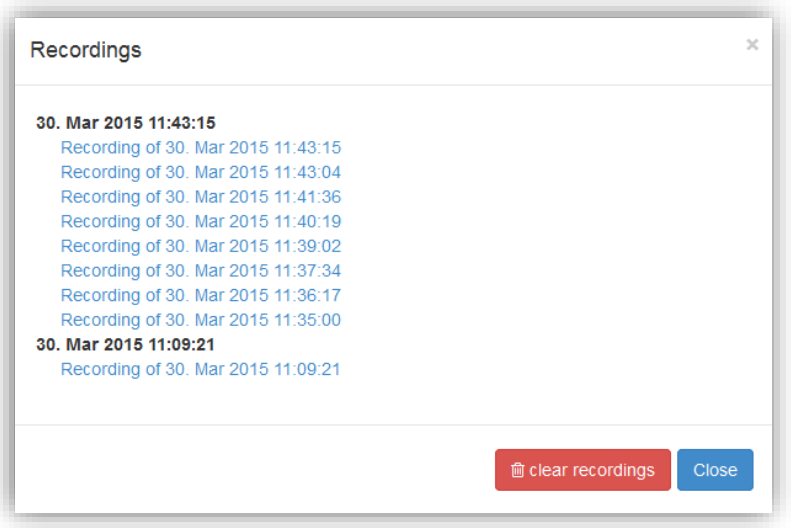


The sensor can store recordings of around 40 minutes. When exceeding this limit, the oldest recording sequence will automatically be removed while storing a new one. A recording is split into several sequences of 5MB. Using the data push functionality, recorded sequences can be stored on a remote destination (FTP) allowing recordings of any length.

A configuration change of any count line will not stop a pre-scheduled validation recording, even though it is already ongoing. By saving a new configuration the sensor stops a currently running recording and starts a new one immediately after completion of the saving process.

3.2.6.4.2. Manage recordings

By clicking on "show recordings", all recorded sequences stored on the sensors are displayed:

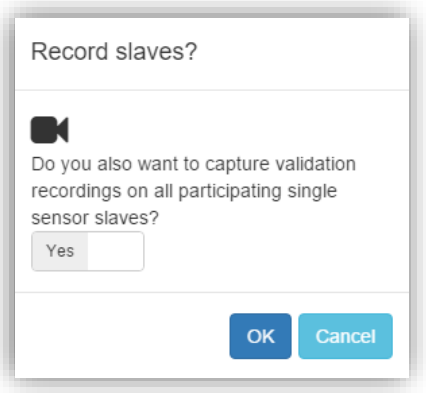


All sequences are grouped into their corresponding recording, displayed with the date of the latest sequence of every recording. A single sequence file can be downloaded by clicking on it. To analyze a complete recording, all sequence files should be downloaded in one directory. The Xovis Validation Viewer can then interpret all these single sequence files as one recording and display the recording accordingly.

The button "clear recordings" allows to remove all sequence files from the sensor.

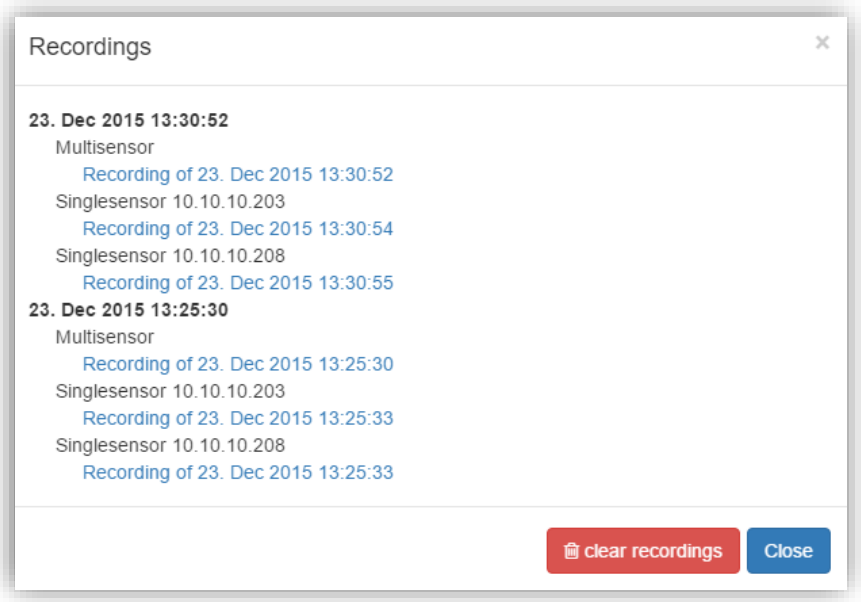
3.2.6.4.3. Multisensor Validation Recording

The Multisensor supports validation recordings as well. The operation and management of recordings is equal to the behavior on single sensor. The only difference is, that, when scheduling a validation recording, the user gets asked to also schedule validation recordings on all participating slave sensors:



This is highly recommended for a ground-truth analysis of a Multisensor. The Xovis Validation Viewer supports Multisensor validation including belonging single sensor slave recordings.

Belonging single sensor recordings will also be listed in the "show recordings" modal in the Multisensor view and can directly be downloaded here:



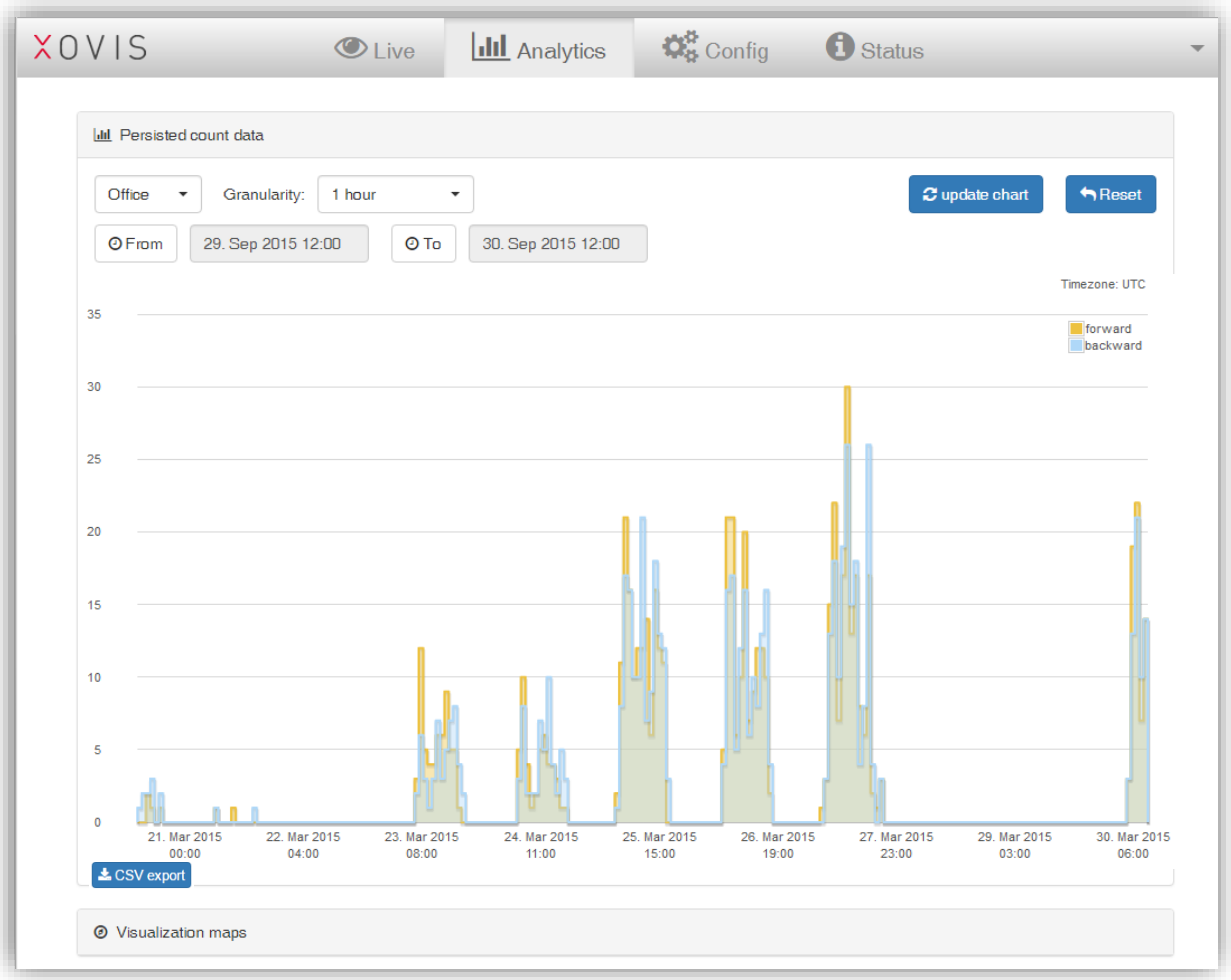
Please note, that when using the Validation Recording data push (see chapter 3.2.8.4.2) on the Multisensor master sensor, only the recording files from the master device will be pushed. All participating single sensor slaves need to also have data push configured if common provisioning of these files is desired on the remote side.

Please see the Xovis Validation Viewer manual to learn how to evaluate validation recordings offline.

3.2.7 Analytics View

The analytics view contains two boxes named “Persisted count data” and “Visualization maps”. With the persisted count data box, it’s possible to display custom charts of the persisted count data. The visualization maps box allows to display the start/stop, height and heat map based on persisted data on the sensor.

3.2.7.1 Persisted count data



To display the count data based on a specific time frame, start by selecting the count item of interest in the first drop-down menu. Both, count lines as well as count zones with activated data persistence are listed.

The second drop-down menu allows the user to choose a granularity. The following granularities are available: 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 6 hours, 12 hours, 1 day.

With the “From” and “To” buttons, the time range can be specified on a minute basis.

After selecting the properties, the chart can be updated by clicking on the “update chart” button.

To reset the properties to the default values and display the chart accordingly, the “reset” button can be clicked.

The chart in the statistics view can only display 400 data points in a meaningful manner. When choosing a granularity and period which would lead to more than 400 data points, a warning message will be displayed, and the granularity will automatically be reduced to the next coarse value that will lead to 400 values at maximum (see Figure 35).

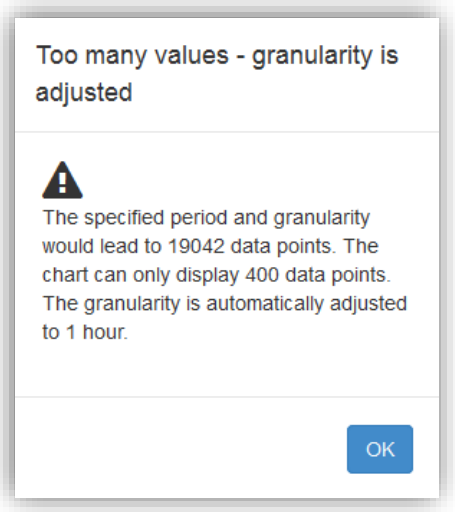
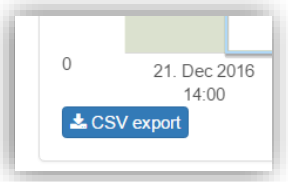


Figure 35: Warning of too many data points

Persisted count line data can be exported to a CSV file by clicking on the “CSV export” button located all on the bottom of the dialog:



All settings are also applied to the CSV export, e.g. the chosen granularity and period.

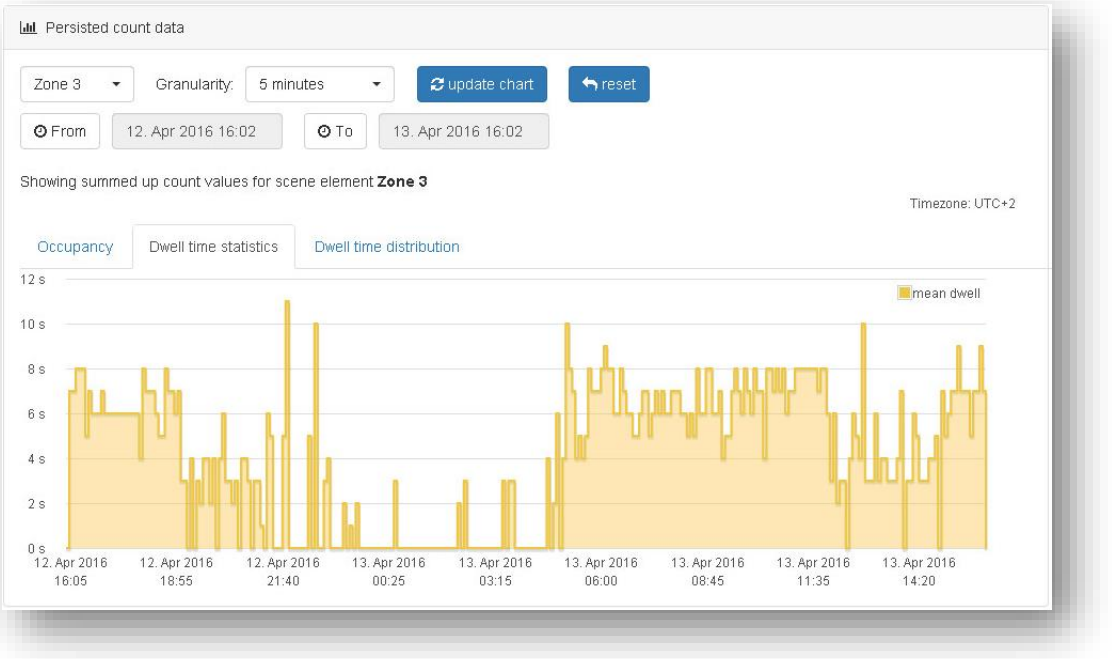
3.2.7.1.1. Count zone charts

When displaying the persisted data of a count zone, a tab navigation offers three types of charts:

Occupancy

The occupancy shows the number of persons that have been measured within the zone at the end of each time-bin. When changing the granularity to rougher granularities than “1 minute”, the new time bins will contain the occupancies of their last included minute bin. For example, when selecting a “5 minutes” granularity, the bin from 9:00 to 9:05 will contain the occupancy level of the persisted value from 9:04 to 9:05.

Dwell time statistics



The dwell time statistics value shows the average dwell time during every time bin. When choosing rougher granularities than “1 minute” the data from the stored 1-minute values are combined. For correct statistical combination of these dwell times, the sensor internally stores the number of persons for each 1-minute value and uses a weighted average.

Dwell time distribution

The Dwell time distribution shows a histogram of all dwell times during the selected time period. The values are shown in 10 equally distributed bins between the minimal dwell time and the maximal dwell time.

The information text below the histogram shows a list of dwell times which are not considered in the histogram:

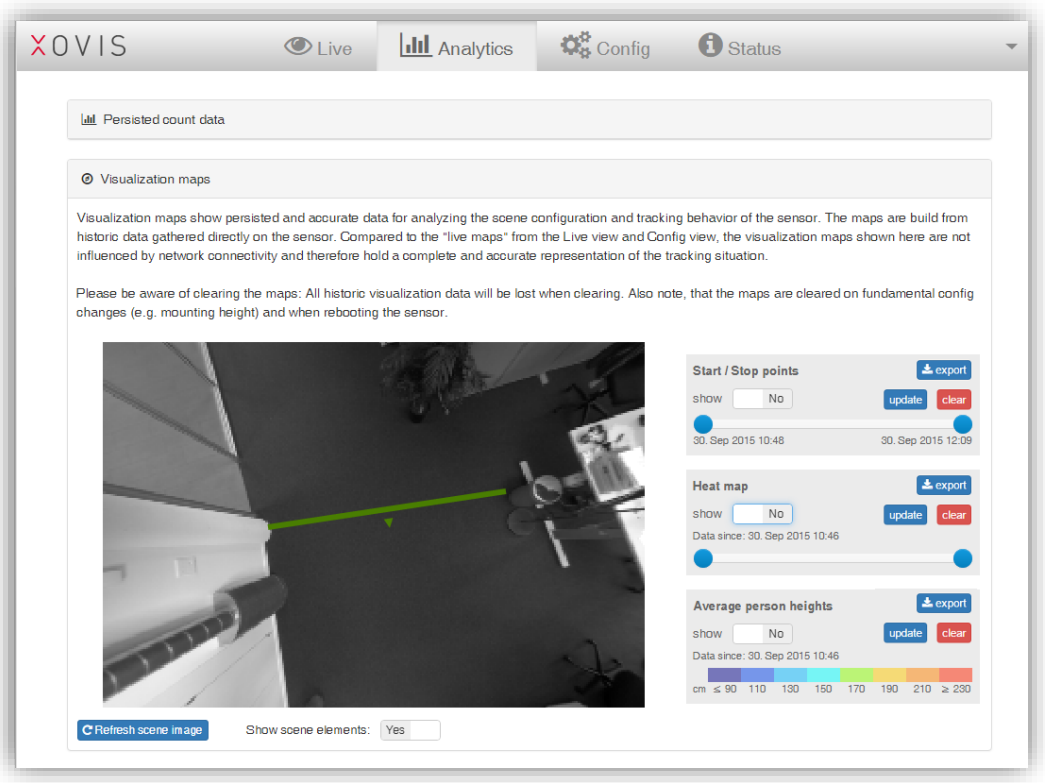
Too short dwell times: Shows the number of tracks with dwell times, shorter than the minimal dwell time

Too long dwell times: Shows the number of tracks with dwell times, longer than the maximal dwell time

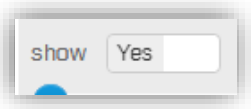
Invalid tracks: Shows the number of tracks which have not been created and deleted outside the dwell zone (for further information see the chapter “4.3 dwell zone placement”)

3.2.7.2 Visualization maps

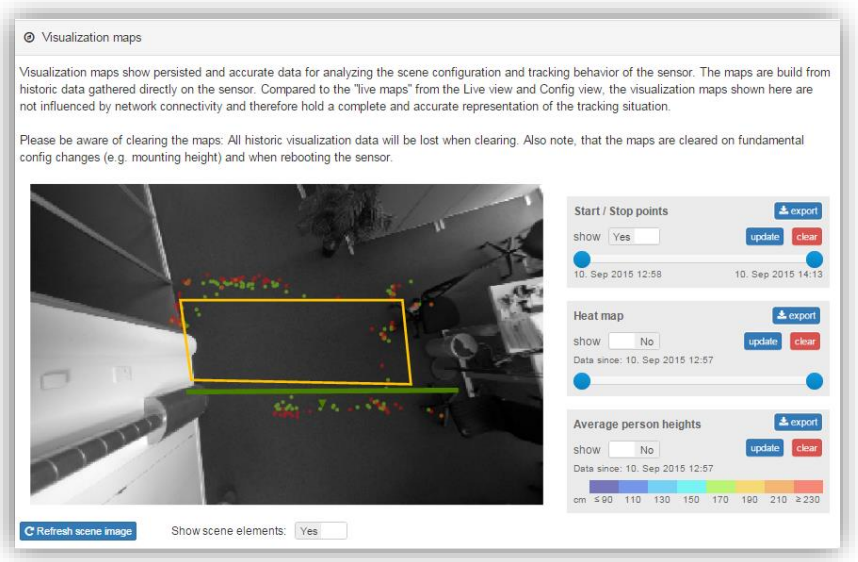
The “Visualization maps” box shows persisted and accurate map data for analyzing the scene configuration and tracking behavior of the sensor. The maps are built from historic data gathered directly on the sensor. Compared to the "live maps" from the Live view and Config view, the visualization maps shown here are not influenced by network connectivity and therefore hold a complete and accurate representation of the tracking situation.



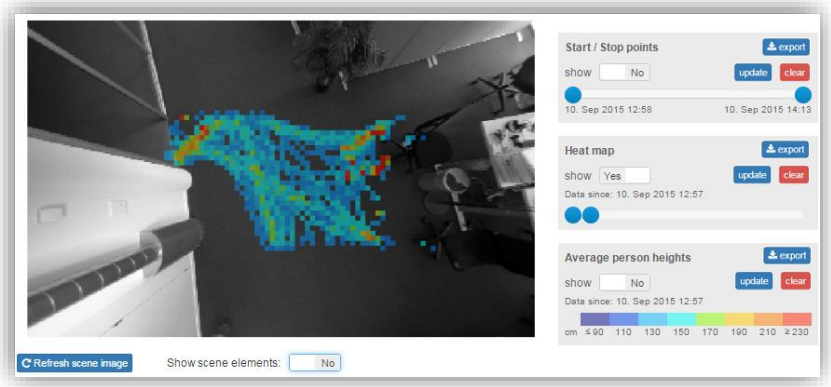
Each single map type can be overlaid on the scene by just toggling the dedicated “show”-toggle.



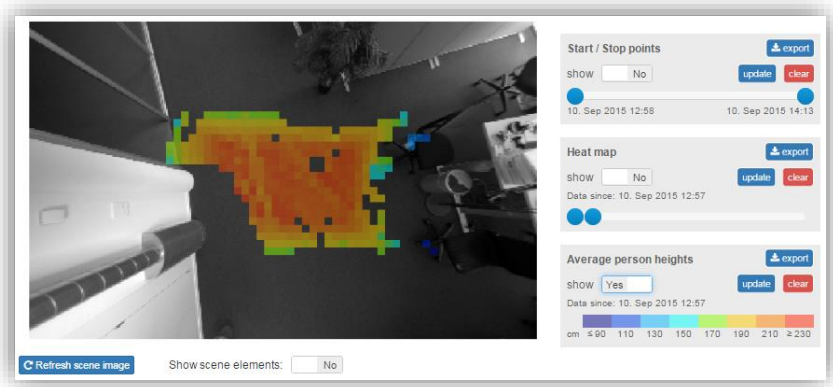
In the next example, the Start / Stop points are shown on the scene. The slide bar allows to navigate through the monitored time period and to visualize the start / stop points depending on it. Based on this it is now possible to see how the start / stop points have been generated over the time. The sensor holds the past 10’000 points and will replace the oldest point with a new one when the limit is reached.



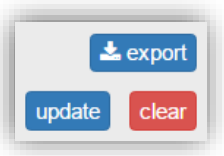
The heat map shows a dwell-time based coloring of the scene traffic. With the slide bar, it is possible to adjust the saturation. Using it allows to also highlight paths with less traffic.



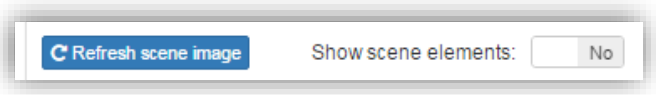
The Height map displays the average person heights within the scene. This averaged map can help to if a sensor was moved after configuration. The averaged map will then show a clear slope. It also helps to validate a proper calibration of the sensor (heights differ too much from excepted value). The colors are explained in the legend on the side.



All three maps can be exported to a PNG image. The chosen settings like the time period for start/stop points or the saturation for the heat map are also applied to the exported images. All maps can be reset by clicking on "clear". The user is the asked to confirm the reset. As these maps are not updated live, for refreshing them the button "update" must be clicked.

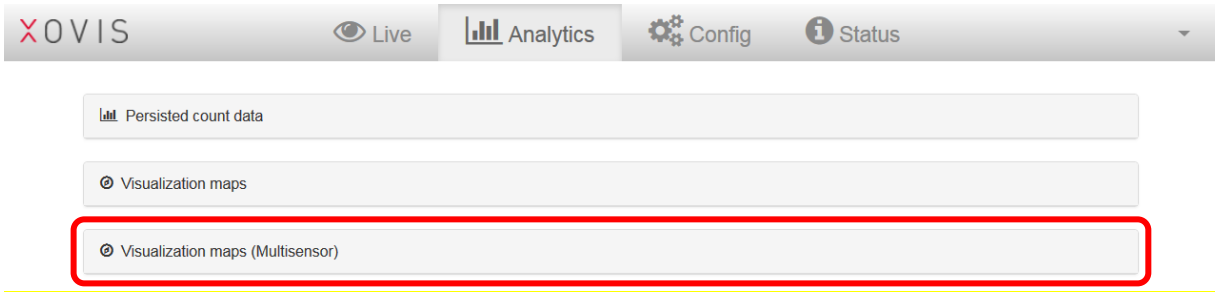


All below the map view, the button "Refresh scene image" allows to re-capture the displayed scene image. Toggling the switch "Show scene elements" allows to overlay or hide count lines and count zones. This is very helpful to verify proper drawing of the count items, e.g. when looking at the start/stop points.



3.2.7.3 Multisensor visualization maps

After configuring a Multisensor according chapter "3.2.8.4.7 Multisensor" a third analytics bar appears:

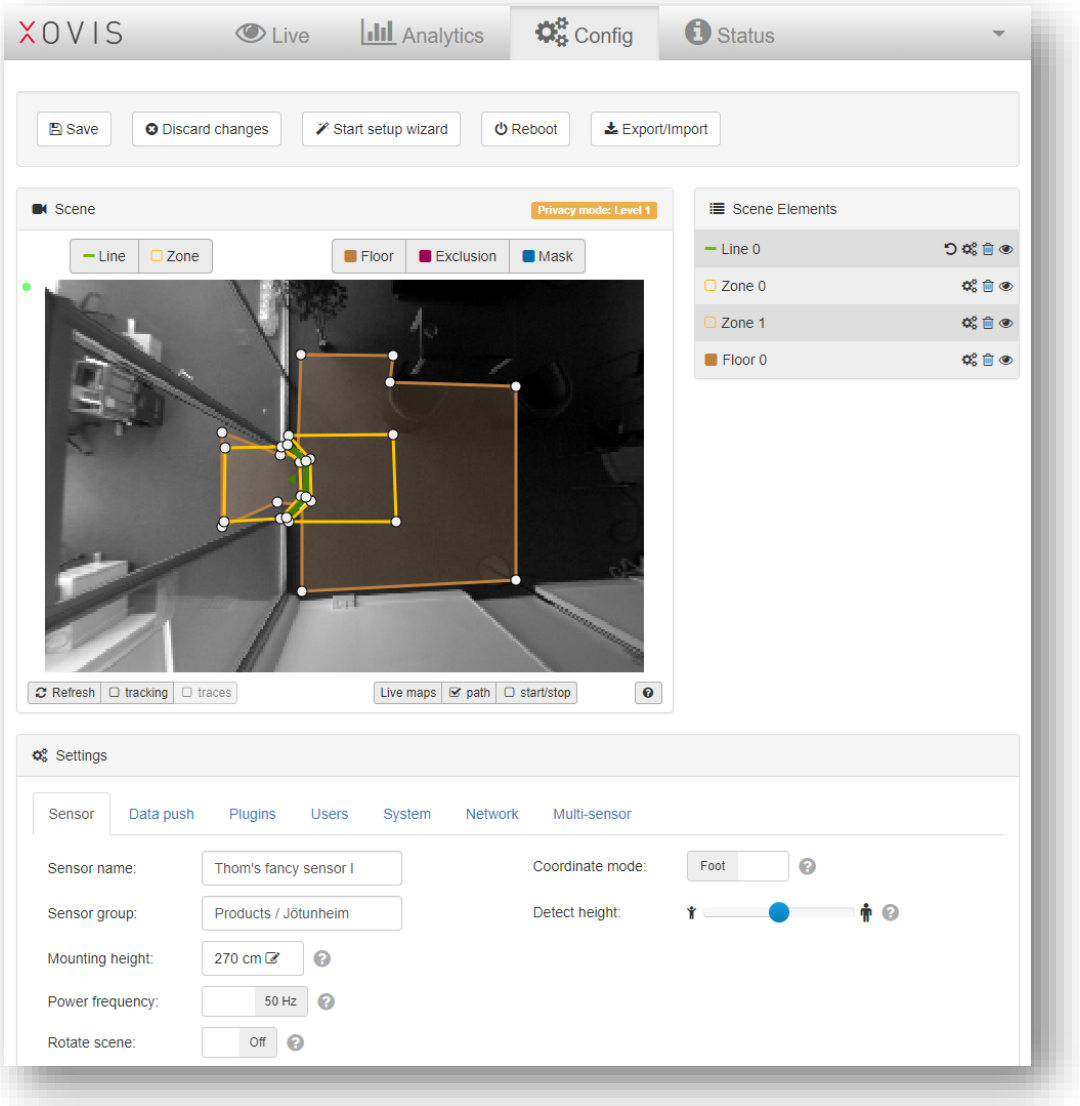


There are the same features accessible as for a single sensor:

- Start / Stop points
- Heat map
- Average person heights

Please note that the map controlling elements are located on the bottom of the background image here, other than with the single sensor "visualization maps".

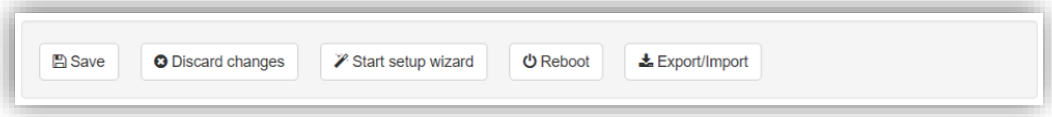
3.2.8 Config View



The config view allows the complete configuration of the sensor. However, it is usually recommended to configure the sensor using the setup wizard (explained in chapter **3.2.5**).

The config view is divided into four parts:

3.2.8.1 Control buttons



3.2.8.1.1. Save

The "Save" button applies all settings to the sensor. Depending on the changes made, the re-initializing of the sensor after configuration changes can take up to 20 seconds.

While applying the settings and re-initializing the sensor, the web GUI is blocked with the following indicator:

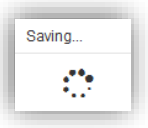
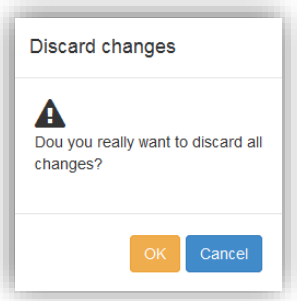


Figure 36: Configuration save indicator

Important: All changes made in the config view will first be applied to the sensor when pressing the "Save" button.

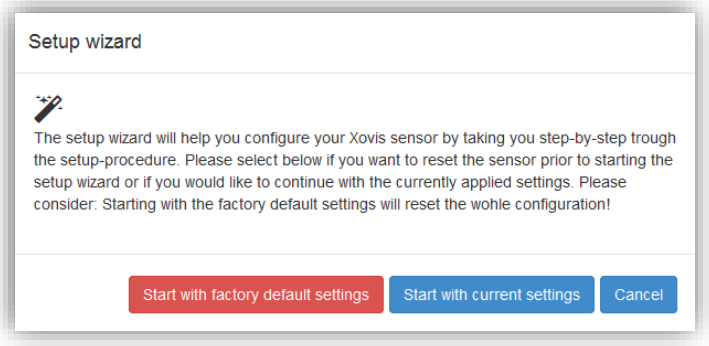
3.2.8.1.2. Discard changes

The „Discard changes" button discards all changes made since saving the last time. Discarding the changes will prompt for a confirmation:



3.2.8.1.3. Start setup wizard

The "start setup wizard" button allows to re-start the setup wizard at any time. When clicking this button, the user gets asked to choose to either start the wizard with the currently applied settings or by first resetting the sensor to the factory-default configuration:



"Start with current settings" is recommended when the user just wants to use the wizard for updating some parts of the sensor configuration, e.g. the coordinate mode or the count elements.

"Start with factory default settings" is recommended when the user wants to start the configuration completely from the beginning with a fresh, un-configured device as it gets delivered right out of the factory. All settings will then be reset to their origin state expect the network configuration. This ensures that the sensor will still be reachable under the same IP address after applying the factory default settings.

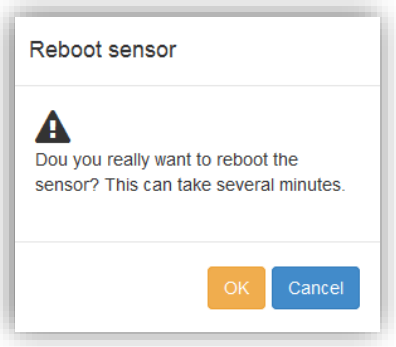
Attention: Applying the factory default settings will delete all custom-made settings, including all count elements. All stored count data will be removed irreversibly!

After choosing to start the wizard with or without resetting the settings, the start page of the wizard will be displayed.

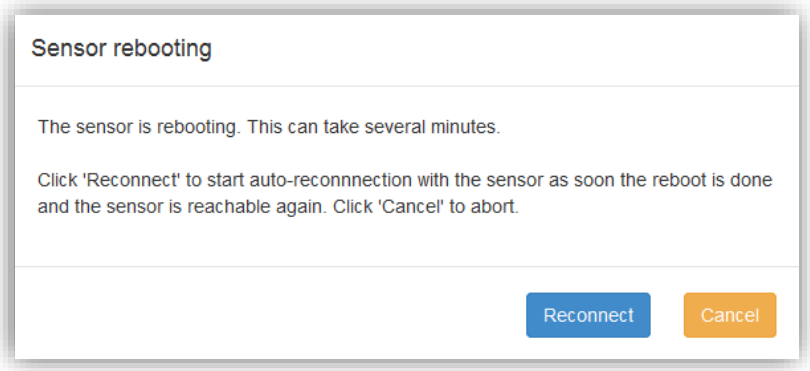
3.2.8.1.4. Reboot

The "Reboot" button allows the user to reboot the sensor. This can be necessary for example when configuration changes are made on a DHCP based network and the network clients need to reassign their leases anticipated.

After pressing this button, the user is asked to confirm the requested reboot.



When clicking "OK", the sensor will reboot which usually takes about 2 minutes. The following dialog will be displayed:



By clicking "Reconnect", the web GUI will automatically poll the sensor to observe when it is back online and will then automatically reconnecting the web GUI. While waiting for the sensor to be online again, the "Reconnect" button will indicate the reconnection with a rotating spinner icon as shown in Figure 37:

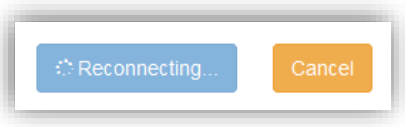


Figure 37: Reconnecting to the web GUI while rebooting

Reconnection will fail if the sensor is assigned to a different IP address by the DHCP server after rebooting.

3.2.8.1.5. Export/Import

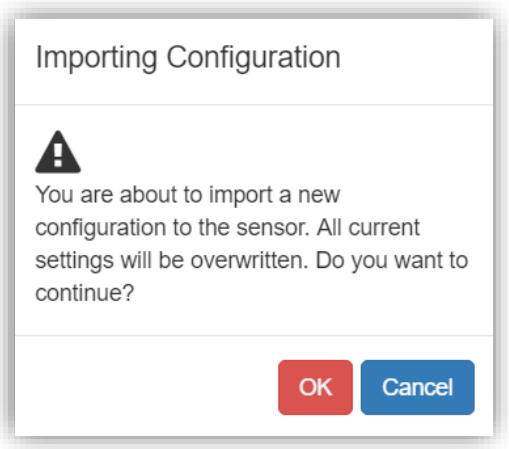
The "Export/Import" button offers a convenient way to save the whole sensor configuration to a file or to import and apply a configuration from such a file.

By clicking the button, the following dialog offers these two options to the user:

Clicking on "Export" leads to a download of the sensor configuration file. Depending on the browser settings, the file is automatically downloaded to a default folder or the user gets asked where to save the file.

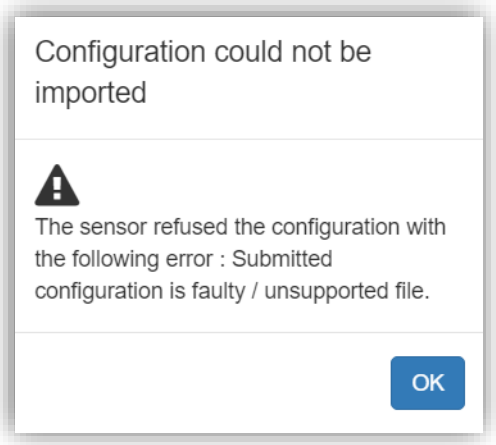
For importing a sensor configuration from a configuration file stored locally on the user's computer, the user simply can browse for the file by clicking on "Browse...". After selecting the desired file, the import is started by clicking on "Import".

The user then is asked to confirm the import process of the configuration.

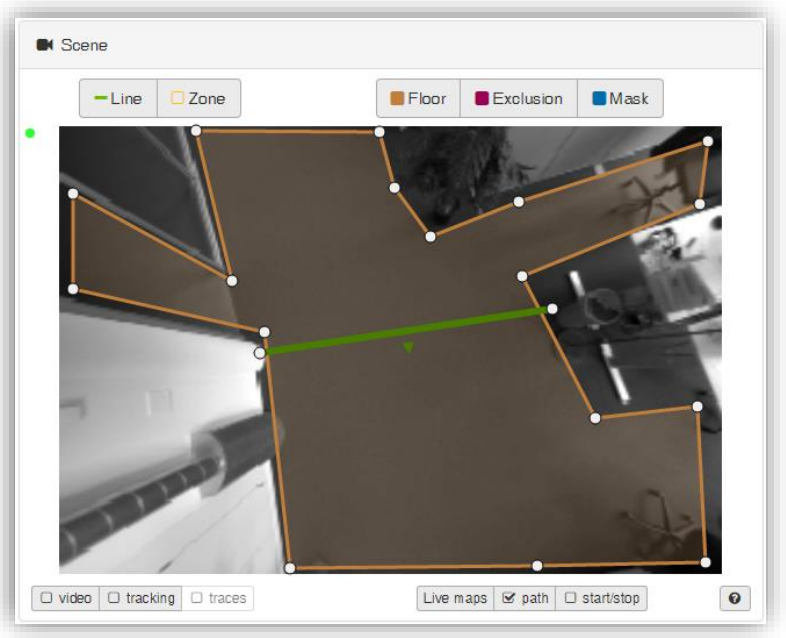


Please be aware, that the configuration currently applied to the sensor will be completely overwritten by the imported configuration.

If the file trying to import is not a valid Xovis PC-sensor configuration file or the configuration is not applicable to the sensor, the user gets notified by a respective message dialog:

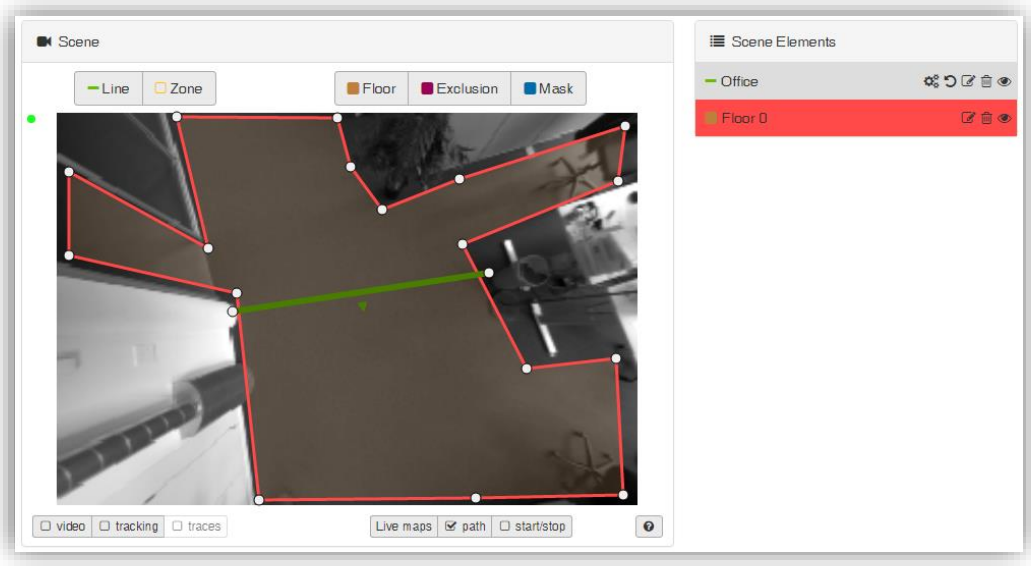


3.2.8.2 Scene view

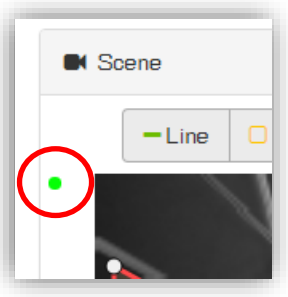


Like the "Scene live view" in the live view (see chapter 3.2.6.1) the "Scene" box holds the live view of the sensors scene. All configured scene elements are overlaid in the scene image. The monitoring can be controlled by the scene view controls described in chapter 3.2.5.9.3.

When hovering over the count elements within the scene, the element gets hightlighted both within the scene and within the "counts" list (mentioned in the next chapter). When clicking on a specific element, it gets marked red both within the scene and within the "counts" list.



The blinking small green dot displayed in the upper left corner of the "Scene" box indicates an intact connection to the sensor.



In addition, the “Scene” box now holds a series of drawing buttons located over the scene image:

These buttons allow the user to add new scene elements like count lines and zones but also floor, exclusion, and taboo masks.

The drawing procedure and functionality of count lines, count zones and floor masks are described in chapters 3.2.5.6, 3.2.5.9.4 and 3.2.5.9.5. Please refer to these chapters to learn about the functionality and purpose of the scene elements. The exclusion and taboo masks (violet and blue icon) are used rarely and only for troubleshooting. The drawing procedure is the same as for floor masks. The meaning and usage of exclusion and taboo masks will be explained in the troubleshooting section in chapter 4.2.

The currently active drawing tool is indicated as a pressed button as shown in Figure 38:

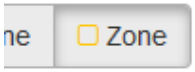
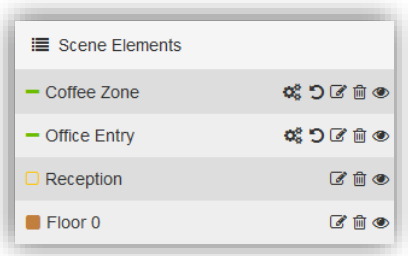


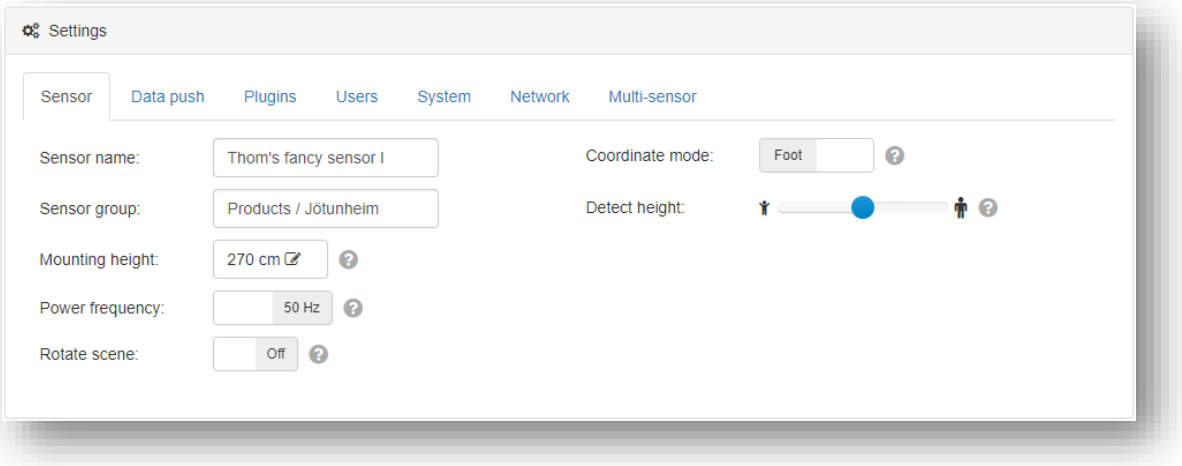
Figure 38: Active drawing tool

3.2.8.3 Scene elements

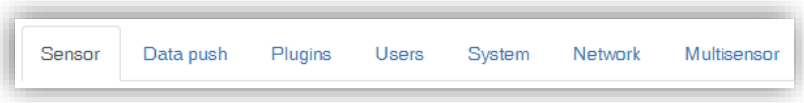


The “Scene elements” box has already been explained in chapter 3.2.5.9.6. The functionality and purpose in the config view is the same. Other than during the setup wizard, the floor masks can now be deleted also. Please refer to the mentioned chapter to learn more about the “Scene elements” box.

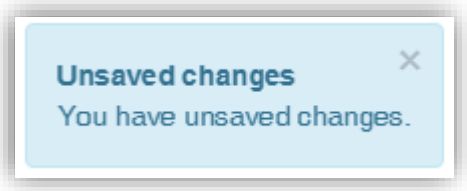
3.2.8.4 Settings



The "Settings" box holds elements for all settings of the sensor. Most of these settings are part of the setup wizard and it is strongly recommended to setup a PC-Series sensor by using the wizard (see chapter **3.2.5Fehler! Verweisquelle konnte nicht gefunden werden.**). However, users' familiar with all the settings can change them here. Beside those basic settings, the "Settings" box also allows to manage users, plugins and data push configuration. The settings are divided into 7 sections which can be displayed using the tab navigation:



Important: All changes made in the config view will first be applied to the sensor when pressing the "Save" button (see chapter 3.2.8.1.1). An "unsaved changes" reminder pops-up as soon as any changes will be performed. It will disappear only after clicking on the save button, by undoing any changes or by clicking the cross symbol on the upper right side of the blue reminder box.



3.2.8.4.1. Sensor

The "Sensor" section holds all parameters relevant to the counting / tracking functionality of the sensor as well as the sensor identification fields "Sensor name" and "Sensor group". All these settings have already been described in chapter Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden..

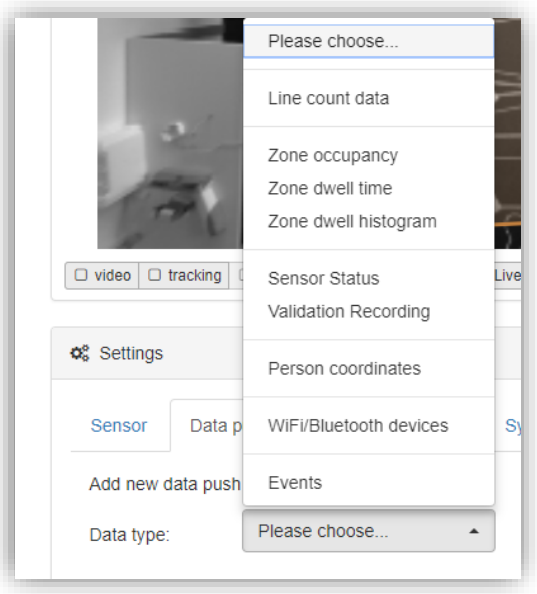
3.2.8.4.2. Data Push

This section allows to manage the data push capability of the sensor. Using data push, the sensor can automatically inform a remote point about count data, person coordinates, sensor status or validation recordings. These data can be pushed using HTTP(S) and (S)FTP.

The built-in webserver fully supports HTTP 1.1. Both, the WebUI and the API can therefore be addressed using HTTP 1.1.

Please refer to the API documentation to learn more about the data push mechanism including formats and requirements to the remote destination.

To add a new data push agent, first the data type must be selected:



As soon the data type is set, all remaining fields will appear and let the user select:

- The interval: How often the data shall be pushed.
- The Granularity (for line & zone data and person coordinates only): Which granularity to apply to the count data or person coordinates. See chapter 3.2.7.1 “Persisted count data” to learn more about granularity for count data.
- The protocol: Which method to use for pushing the data (HTTP(S), FTP or SFTP/SSH, validation recording uses FTP/SFTP only).
- Data push format (for line & zone data only): Which data format to use for the pushed data (XML v2 or JSON). For legacy reason, line count data offer XML v1 as well.
- All parameters required for the chosen protocol.

For pushing with FTP and SFTP/SSH a custom port can be specified by just declaring it after the host (IP or domain) separated by a colon (“:”).

When pushing using HTTP(S), only the URL needs to be specified. The URL requires declaring the protocol which can be http:// or https://. Please refer to the RFC 3986

declaration to learn more about URL format. Figure 39 shows an example of count data push configuration using HTTP(S):

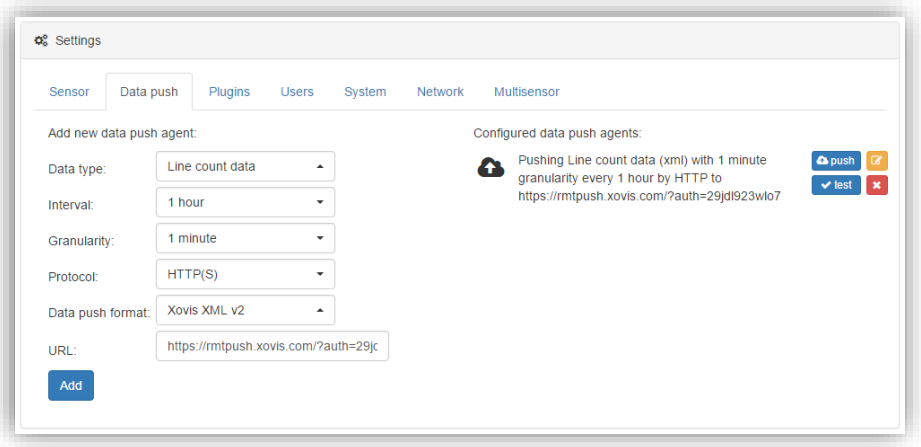
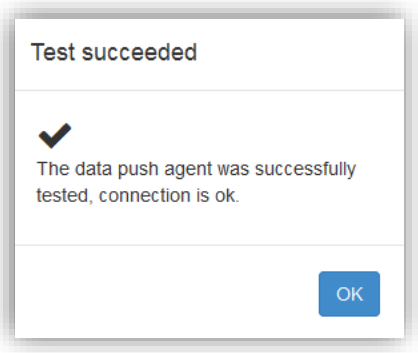


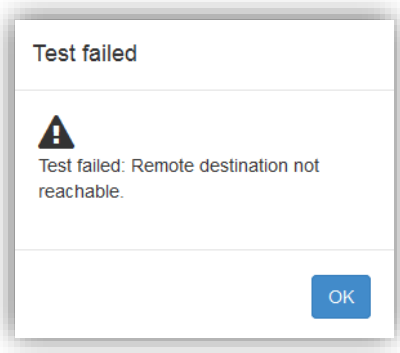
Figure 39: Example configuration for pushing count data to remote destination

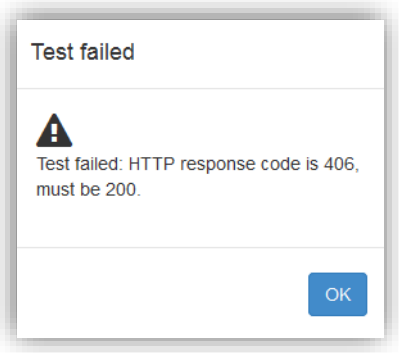
This setup will push count data of 1-minute granularity every hour to rmtpush.xovis.com with a custom URL parameter "auth".

The "test" button allows to instantaneously test the connectivity to the remote destination. When clicking on it, the sensor tries to send a sample message to the specified destination. The status is the shown to the user in the Web GUI:



If testing fails, the error is added to the status message to support the debugging procedure:





When pushing using FTP or SFTP/SSH, the server and login credentials need to be provided. Optionally a directory can be specified. The following figure shows an example of validation recording push configuration (only FTP/SFTP is supported for validation recording):

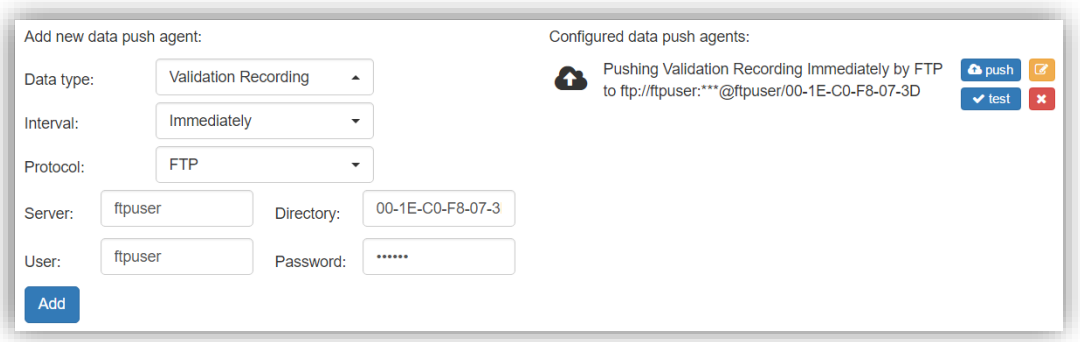
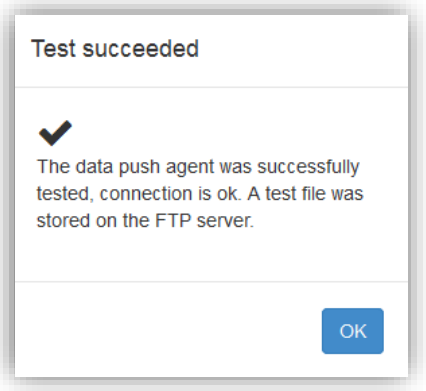


Figure 40: Example configuration for pushing validation recordings to remote destination

This setup will push validation recording sequences immediately, i.e. directly after a sequence file is stored, to the FTP server with IP 10.10.10.88 using user "ftpuser" with a specified password. The recordings will be stored in the directory /sensor/00-1E-C0-DF-65-D9/rec.

The password will never be displayed and will also be stored in an encrypted format on the sensor. Once set, a password therefore cannot be looked up in plaintext anymore.

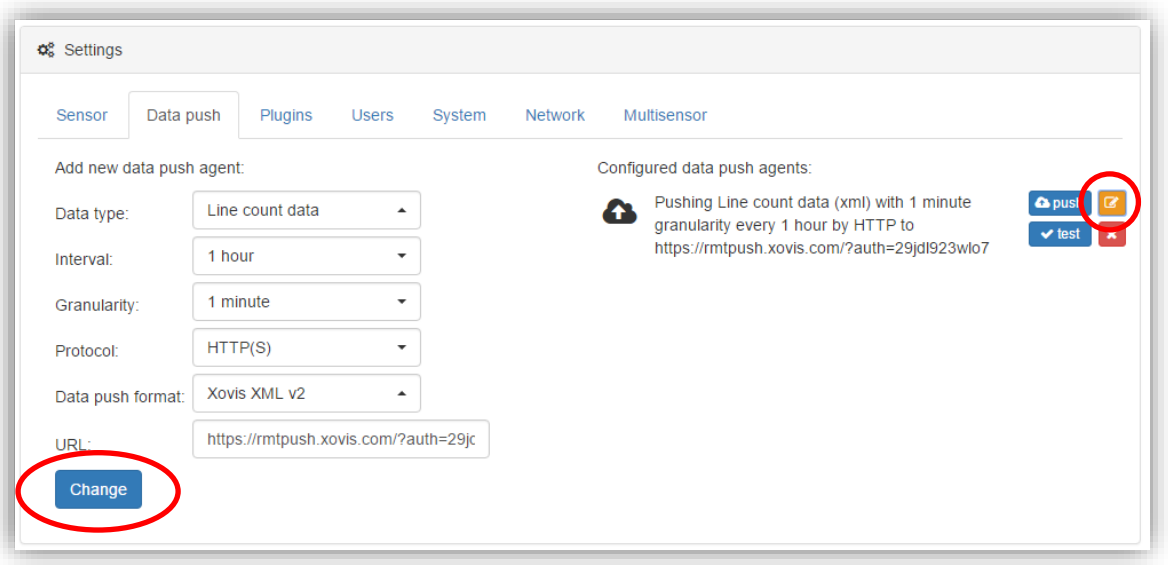
As with the count data push agent, connectivity can also be tested using the "test" button. If the connection succeeds, a file with sample content will be stored on the FTP server. The status message informs about this:



The sensor supports up to 8 data push agents. A configured data push agent can be removed by clicking on the "remove" button on the right side of every agent.

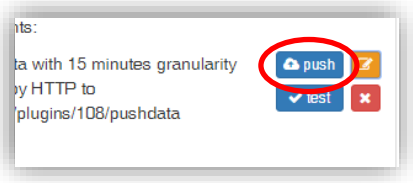
As with the whole config section, changes to the data push configuration are first applied when pressing the "Save" button.

Any already configured push agent can be modified by just clicking on the orange icon highlighted on the next picture. To confirm any setting changes just click on the button "Change" and afterwards "Save" again.

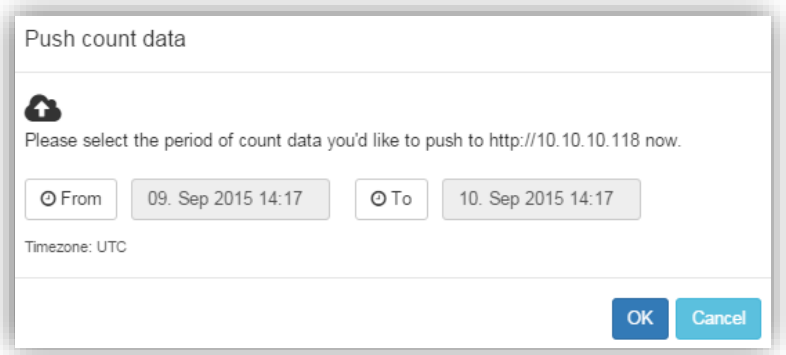


The button "push" allows to immediately push count data, sensor status or a validation recording sequence to the selected destination at any time.

This can be useful for example when a sensor was installed two weeks ago but outgoing network connectivity was first possible after these two weeks. Using the "manual data push" functionality now, the count data of these past two weeks can now be pushed to the remote side manually.



Manually pushing count data allows the user to specify the desired period to push:



Manually pushing validation recording will transfer all currently stored recordings to the remote destination and manually pushing the sensor status will push the current sensor status.

Person coordinates

Person coordinates represent all person positions tracked by the sensor in a defined period whereby the granularity of the push agent sets this period. With other words, the granularity defines the resolution of person tracks. As finer the granularity, as higher the temporal resolution of the pushed coordinates.

Person coordinate push can be compared to the Object Stream functionality (refer to the respective documentation to learn more about the Object Stream) with the difference, that the client asking for person tracks does not have to initiate a session and therefore does not need direct access to the sensor. Using person coordinate push, the sensor can be set to send person tracks to a remote site even if the sensor is located behind a firewall.

The finest/highest granularity available here is 0.25 seconds, the lowest one is 2.5 seconds. The interval defines how often the person coordinates shall be transmitted to the remote site.

Due to the possibly high amount of data, person coordinates are not persisted on the sensor but only cached. Not all combinations of interval vs. granularity are supported. For example, when using the largest interval of 1 hour, the finest granularity supported is 2.5 seconds. On the other hand, when demanding for the finest possible granularity of 0.25 seconds, the maximum interval period is 30 seconds. The following table shows which granularities are available at which interval:

	Interval						
Granularity		**5 s**	**30 s**	**1 min**	**5 min**	**15 min**	**1 h**
	0.25 s	X	X				
	0.5 s	X	X				
	1 s	X	X	X	X		
	2.5 s	X	X	X	X	X	X

Person coordinates do not support manual push as these data are not persisted on the sensor.

Please refer to the API documentation to learn how to receive and parse person push data.

Events

With Events, sensor events can automatically be pushed to a remote destination using Data Push. All events known from the Event Stream are also supported by “Events”, which are:

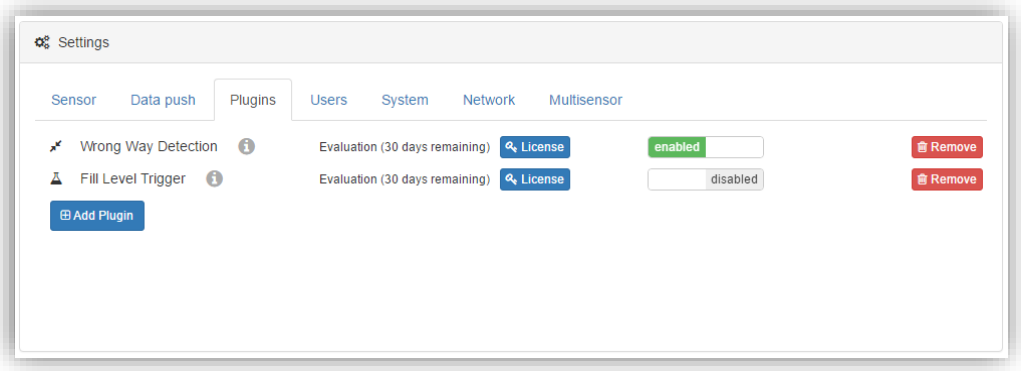
CREATE, DELETE, ZONEENTRY, ZONEEXIT, LINECROSSFW, LINECROSSBW, LINECOUNTFW, LINECOUNTBW, ZONEDWELLTIME.

Events do not support manual push as these data are not persisted on the sensor.

Please refer to the API documentation to learn how to receive and parse event push data.

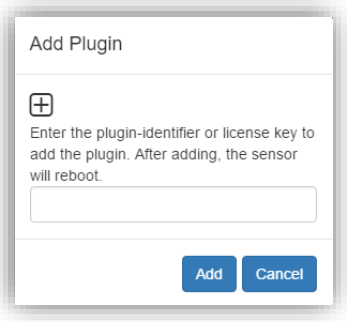
3.2.8.4.3. Plugins

The "Plugins" sections shows an overview of all plugins currently activated on the sensor:



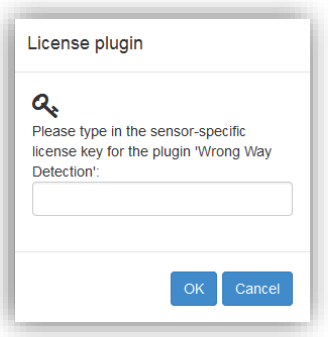
By default, the sensor comes with four plugins pre-activated, the "Object Stream" and the "Event Stream" both, for single-sensor and multi-sensor. These four plugins cannot be removed. The "Event Stream" plugin is included and free to use, the other plugins can be evaluated for 30 days (only counting when enabled) and needs to be licensed afterwards. Please refer to the separate plugin manuals to learn more about these default plugins.

Additional plugins can be added by clicking on the "Add Plugin" button. In the subsequently dialog, the plugin identifier can be entered. After adding the plugin, the sensor will reboot.

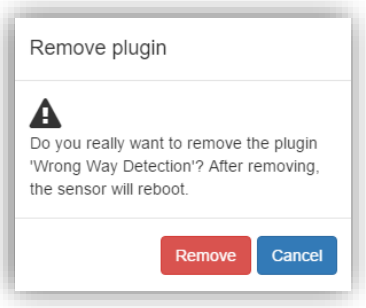


Please contact Xovis to learn more about all available plugins and the respective plugin identifier, if you are interested in evaluation.

Plugins can be disabled and enabled again by toggling the "enable/disable" switch accordingly. To license a plugin, the blue "License" button needs to be pressed. In the following dialog, the license key needs to be entered:



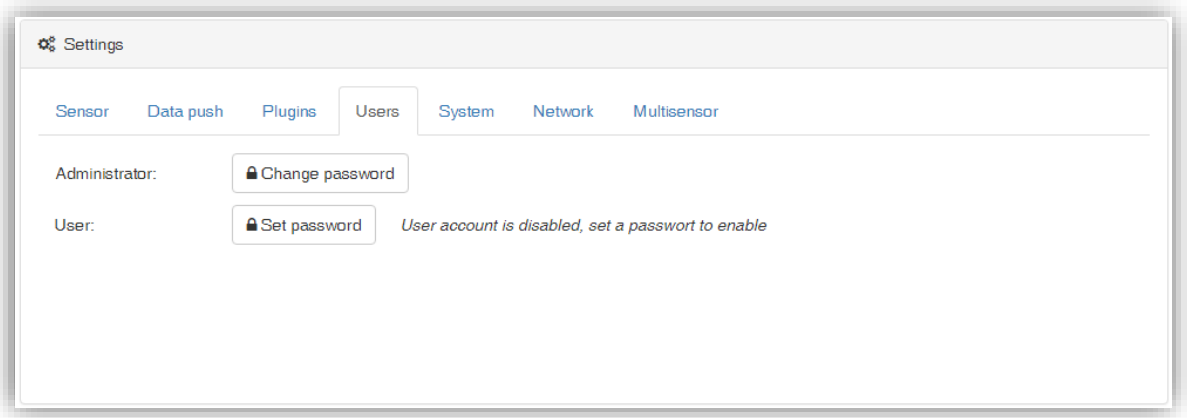
Any non-default plugin can also be removed from the sensor. To do so, the red "Remove" button needs to be pressed. Before the plugin is removed, the user must confirm a warning dialog:



After confirming, the plugin will be removed, and the sensor will reboot.

3.2.8.4.4. Users

The "Users" section allows to manage the users:



The PC Series sensors offer an "Administrator" and a "Viewer" account. The "Viewer" account is disabled by default and can be enabled by setting a password for this user. If the "Viewer" account is enabled, choose the according entry in the dropdown menu on the login screen.

The "Viewer" account offers read-only privileges. When logged in with the User account, the complete "Config" view is disabled and no operation which could influence the sensors state can be performed. Figure 41 shows the navigation when logged in with the "Viewer" account:

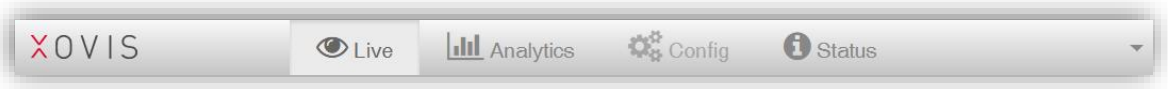


Figure 41: Disabled Config view when logged in with User account

When logged in as an "Administrator" and the "Viewer" account is enabled, the "Users" section presents a "Disable account" button to disable the "Viewer" account (see Figure 42). Clicking on it will instantaneously disable this user account.

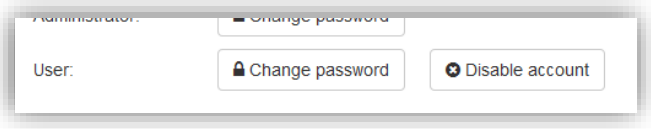
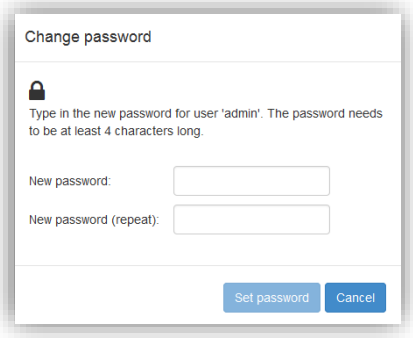


Figure 42: "Viewer" account enabled

Whenever changing or setting a password, the following dialog appears:



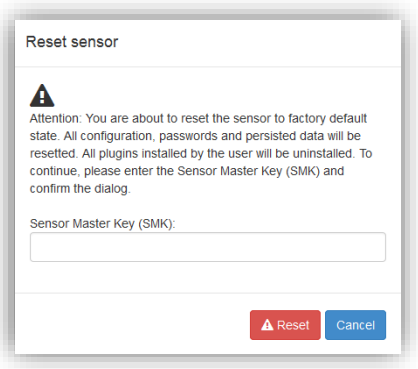
To change the password, the user is asked to enter the new password twice for the chosen user. It needs to be at least 4 characters long. The new password is set by clicking on "Set password". After applying the new password to the sensor, the web GUI will automatically logout and return to the login screen (see chapter **3.2.3**).

3.2.8.4.5. System

The "System" section allows to manage the time zone and the time server or to apply a time manually, to setup the user interface language, the country of origin, if the sensor uses the metric or imperial system, to define the privacy mode level, to perform a complete sensor reset and the possibility to subscribe or unsubscribe to the product improvement program (Find out more will open a modal window with more information).

For time zone, sensor time, UI language and privacy mode, please refer to the corresponding chapters in the wizard section, see chapter **3.2.5 Setup Wizard**.

The sensor reset allows to complete reset the sensor to its factory state. Other than with the factory default settings which can be applied when starting the setup wizard (see chapter 3.2.8.1.3), this reset will not only apply the default configuration but will also reset all passwords, reset all plugins, and remove any custom added plugins, remove any validation recordings, reset the privacy mode to level 0 and enable HTTP again if configuration disabled it. The sensor reset requires the Sensor Master Key (SMK) to be entered:

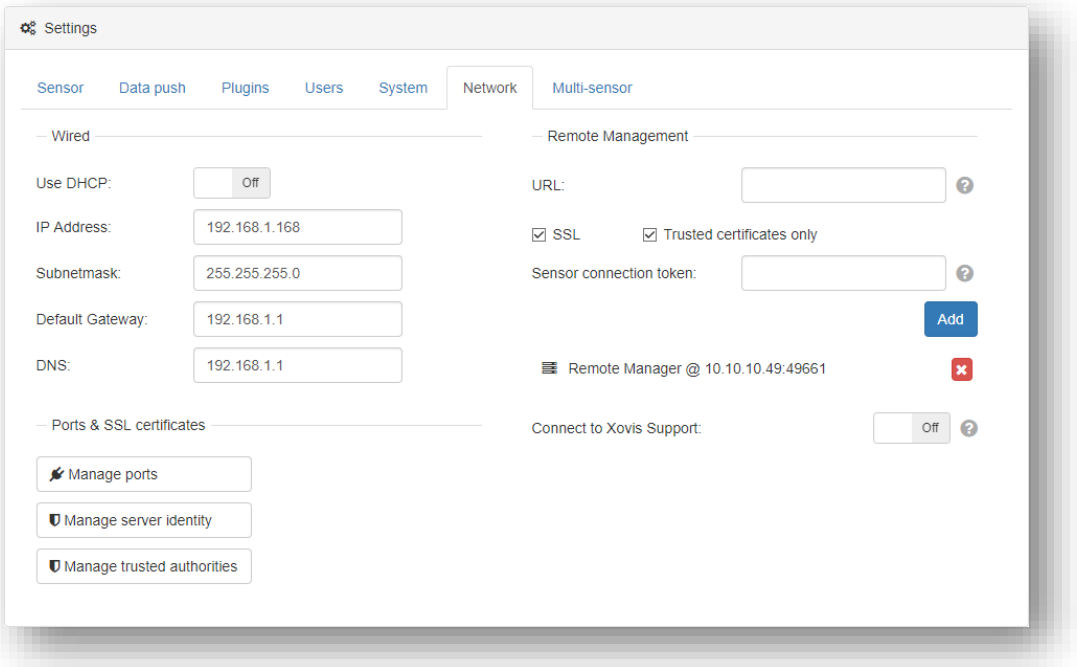


Please refer to chapter 3.2.5.10 to learn more about the Sensor Master Key (SMK).

Attention: Resetting the sensor will erase any configuration and data and set back the sensor to the factory default state.

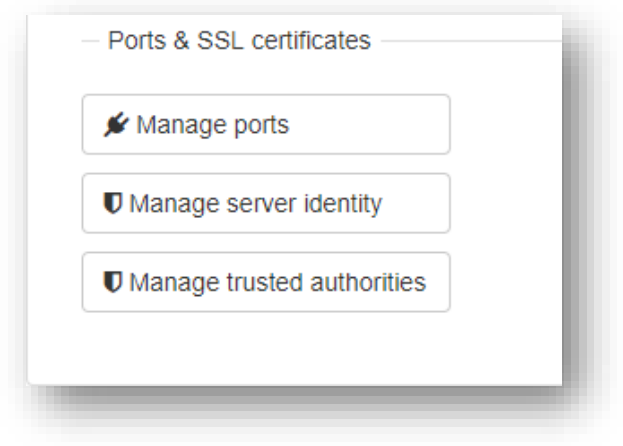
3.2.8.4.6. Network

The "Network" section holds the network parameters like the corresponding step in the setup wizard (see chapter **3.2.5**). In addition, it contains the Ports & SLL certificates settings , the Remote Management Server settings, and the toggle for the Xovis support connection.



Port & SSL certificates

The user can fully control all network ports, use their own server identity (SSL key and certificate) and manage trusted authorities. The configuration modal is in the "Network" section of the Config page:



Manage Ports

The «Manage Ports» dialog allows to change the port of every service and allows to disable most of the services. Only HTTPS cannot be disabled as otherwise the user can completely lock himself out of the WebUI and API.

Any changes made here are first applied after saving the configuration.

Please note, that changing and/or disabling any network service port can cause the sensor to become unresponsive! Only use this dialog when you know, what you are doing.

Changing or disabling/enabling the Rescue Daemon and/or the SSH port will only be applied after rebooting the sensor. After saving the configuration, use the "Reboot" button located in the Config page to reboot the sensor:

HTTP can be disabled permanently here. This way, any non-encrypted access to the sensor API and WebGUI is prevented. When toggling this switch to disabled, a popup will inform the user about the deactivation of the http-WebGUI.

Attention: When disabling HTTP here, the WebGUI will not be reachable anymore under http://... after saving the configuration.

Manage Server Identity

The "Manage Server Identity" dialog allows to upload and apply a custom SSL key/certificate to the sensor. It will then override the Xovis default key/certificate, which can be restored at any time by deleting the custom key/certificate again.

Accepted format for uploading is a PKCS#12. Simply choose the file (.p12, .pfx) and enter the keystore's password, then click "Upload & Apply".

If more than one key/certificate is contained in the keystore, only the first one will be applied.

For deleting the custom server identity and restoring the Xovis default server identity, simply press "Reset to default".

An already applied server identity will automatically be overridden when uploading a new one.

Manage Trusted Authorities

The "Manage Trusted Authorities" dialog allows users to trust their own authorities. Certificates can simply be uploaded and will automatically be applied. Any uploaded certificate can be removed at any time. The Xovis default CA can be enabled and disabled.

Supported formats are PEM or DER (.der, .pem, .crt).

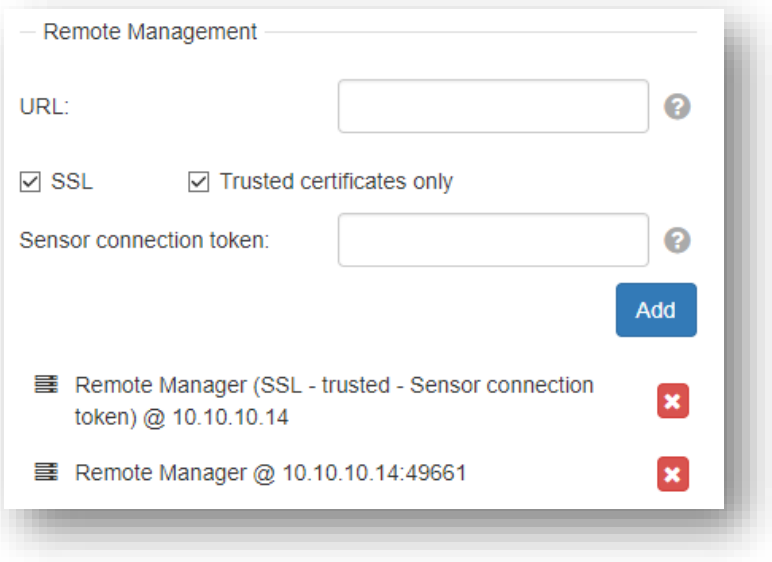
Additional Security Restrictions

TLS 1.0/1.1 is disabled by default (can be enabled using the Expert Mode by adding the following node to the "network" node: <enablelegacytls>true</enablelegacytls>)

SSL 3.0 is disabled as well as RC4 based ciphers.

Remote Management

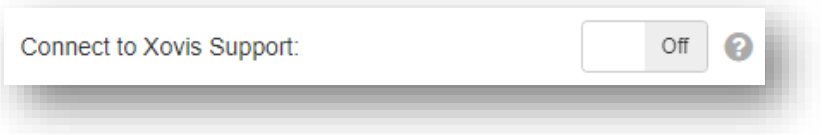
To allow the communication with up to four Remote Management Server just enter its URL/IP address. Two different connection types are provided, either the legacy or the SLL connection. To use the SLL connection the authentication token must be known from the IBEX device control instance. The connection can be restricted for trusted certificates only. To establish trusted connections the used certificate from the IBEX device control instance must be installed on the server the sensor should connect to.



For any further details about the Remote Management Server please refer to the dedicated documentation.

Connect to Xovis Support

With sensor FW 3.6 and higher a direct connection to the Xovis support remote manager can be established, while persisting the configured remote connections.

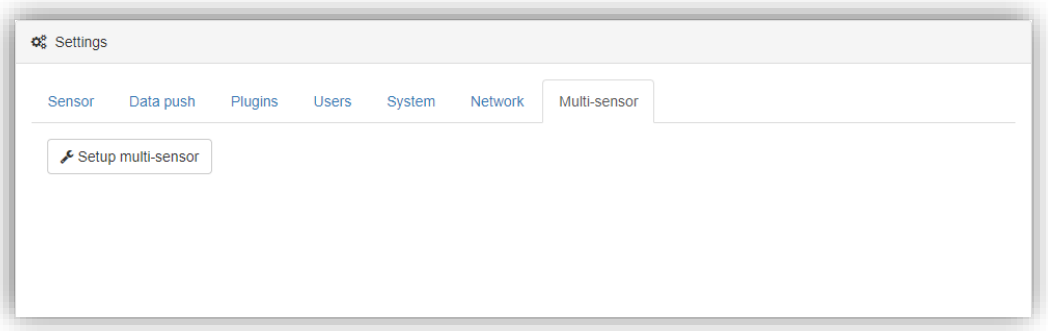


Attention: An outgoing internet connection is needed to connect to the Xovis support remote manager

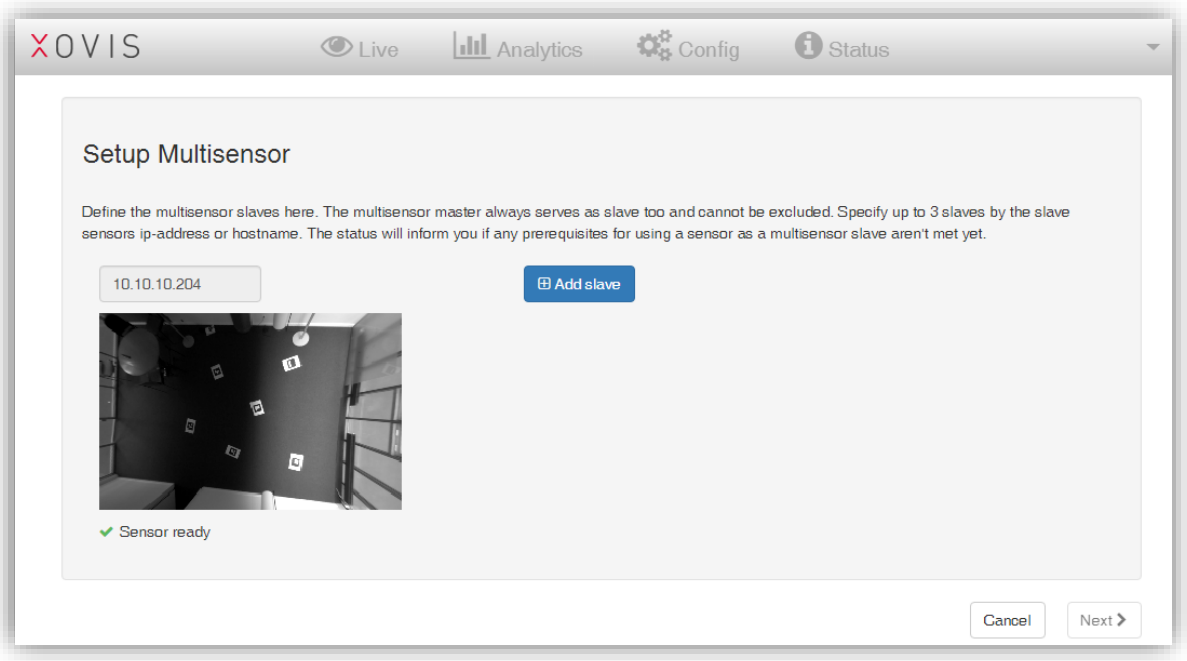
3.2.8.4.7. Multisensor

This section allows to configure the Multisensor feature. A Multisensor today can consist of up to 9 sensors.

Attention: Make sure that before starting the Multisensor configuration each involved sensor is already configured as single sensor.



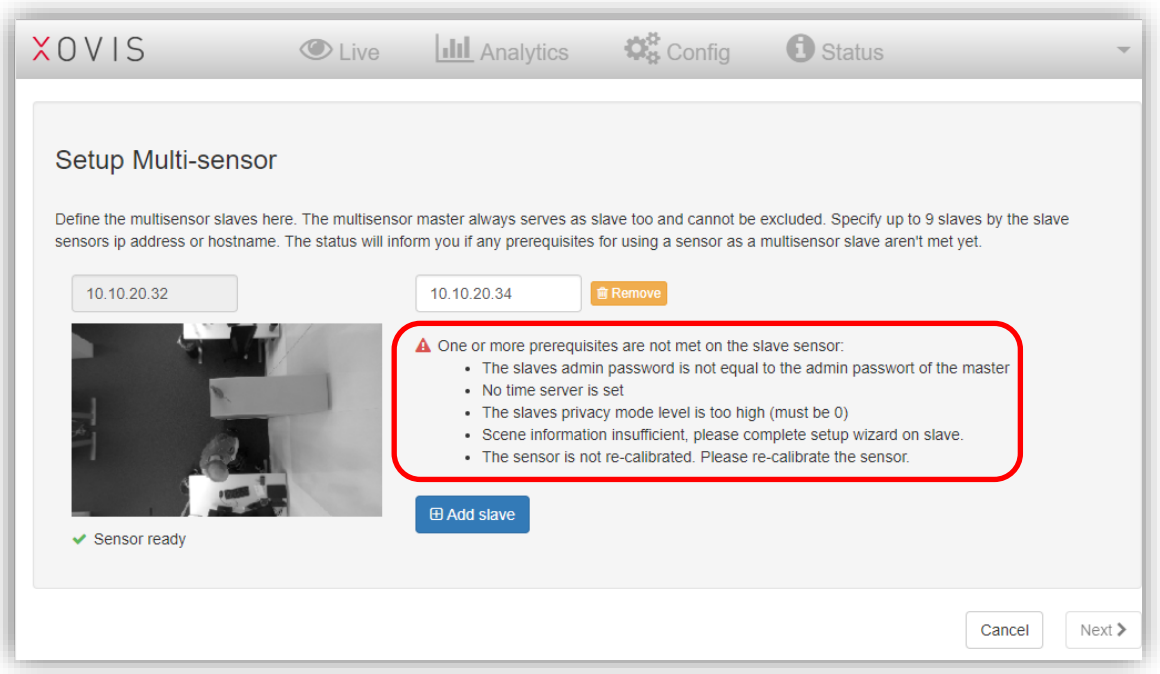
With a click on the "Setup Multisensor" button the dedicated configuration wizard will start. In the first screen, all involved single sensors can now be added to the Multisensor. The device the Multisensor master is running on will always be included here.



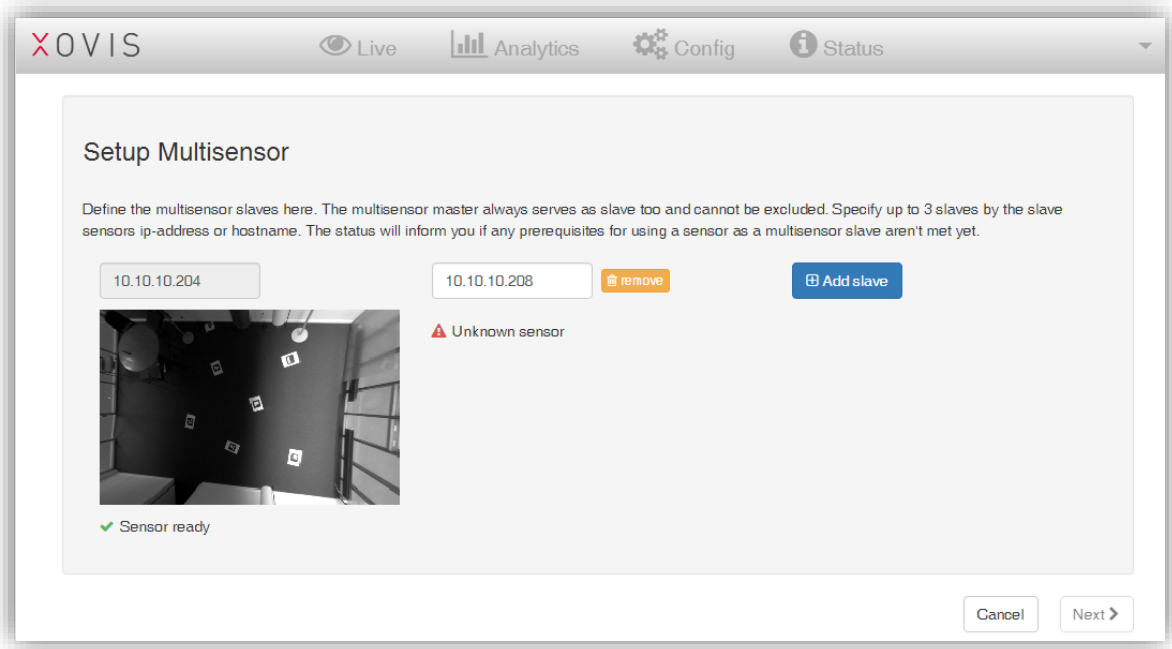
Add a sensor by clicking “Add slave” and specify its IP. By leaving the IP field or pressing “Enter”, the wizard will try to connect to the slave sensor and check, if the slave is ready to become part of a Multisensor.

The following conditions must be fulfilled:

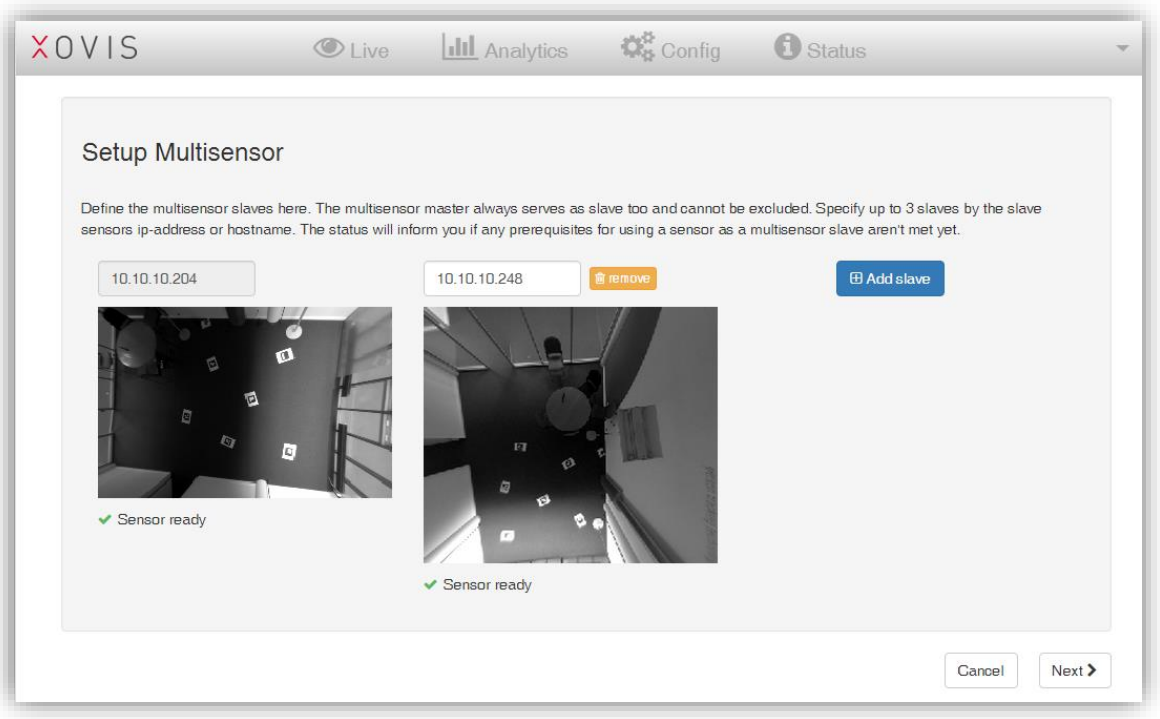
- The admin passwords are matching
- The time server is set up
- Privacy Mode is set to 0
- The sensor is configured by the wizard
- The sensor is recalibrated



If one of those conditions is not met, an error message will inform the user about the reason.

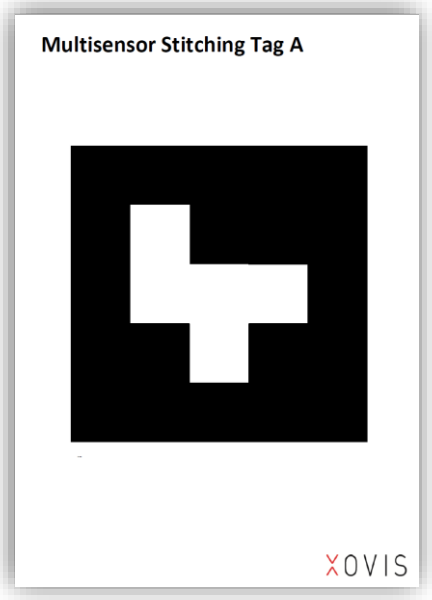


In this example, the IP was wrong and after retrying the sensor availability was confirmed.



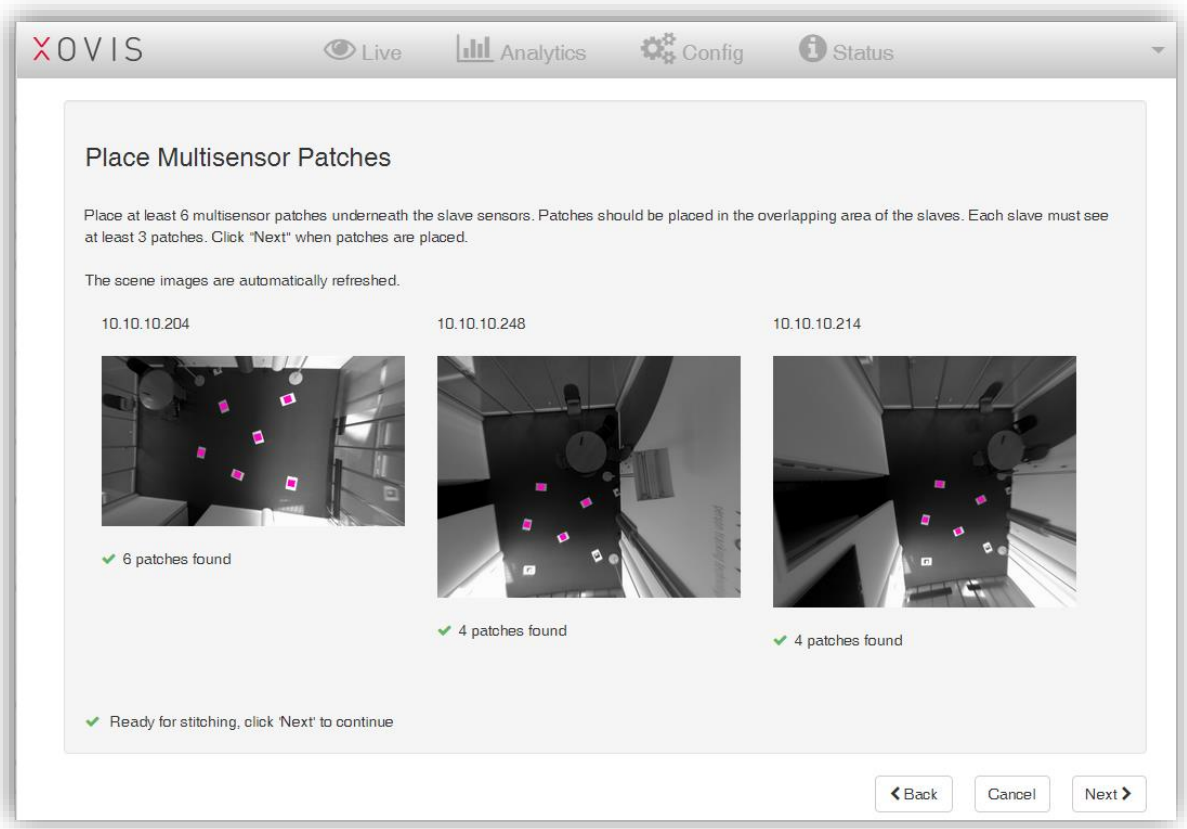
Note: The use of different PC-Series models like for example a PC2 with a PC2-UL or a PC3 is supported. In the above example, there is a PC2 on the left and a PC2-UL on the center.

When all slaves are added, clicking "Next" will bring up the stitching page. The automated stitching is based on tags which must be placed underneath the involved sensors with a distance between each other of minimum 1 meter. Xovis provides a PDF-file (Xovis_multisensor_stitching_tags_v2.pdf) containing a set of 30 predefined tags, each one to be printed on an A3-sized paper sheet.

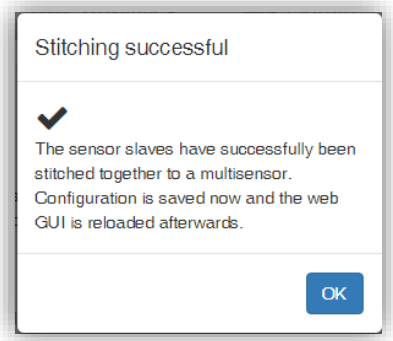


On the stitching screen the wizard indicates the number of tags recognized through each sensor. The accepted tags will be highlighted in purple color. If there are enough visible tags (at least 3 per sensor), the notification "Ready for stitching" appears on the bottom left side.

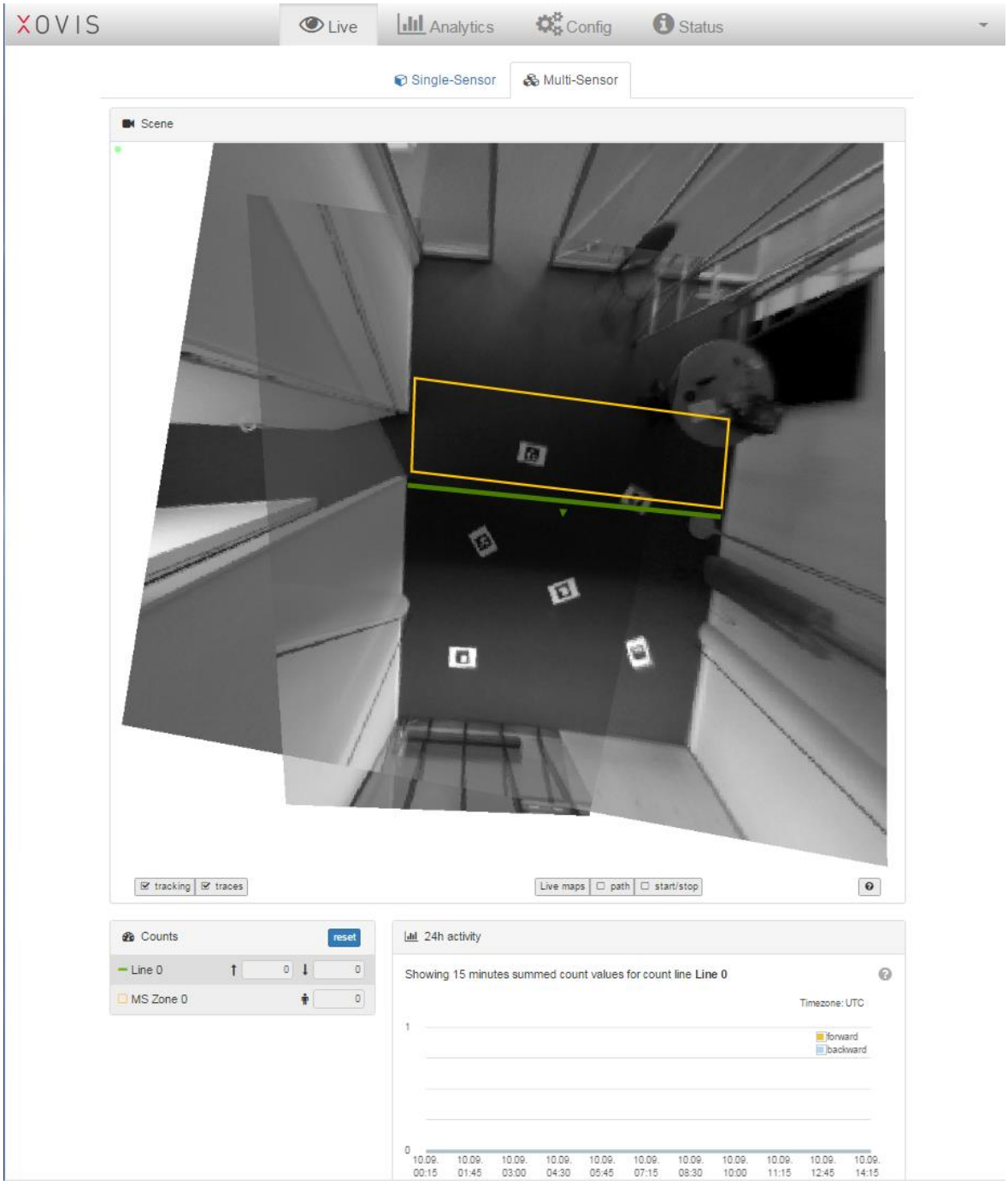
Attention: Make sure to never use a specific tag (e.g. 'A') more than once in a Multisensor stitching process.



After clicking on the button "Next" the master sensor performs the stitching and confirms it with the following popup:



After clicking "OK", the GUI is reloaded. The "Live" and the "Config" tab now contain a "Multi-Sensor" and a "Single-Sensor"-View.



The Multisensor page on the "Live"-view contains the same four sections as known from the single sensor page:

Scene

The "Scene" view shows the stitched still image of the Multisensor. It is possible to activate the tracking (shows the bubbles), the traces and the live maps "path" and "start/stop".

Counts

The section "Counts" will show the counts of the count lines and zones of the Multisensor.

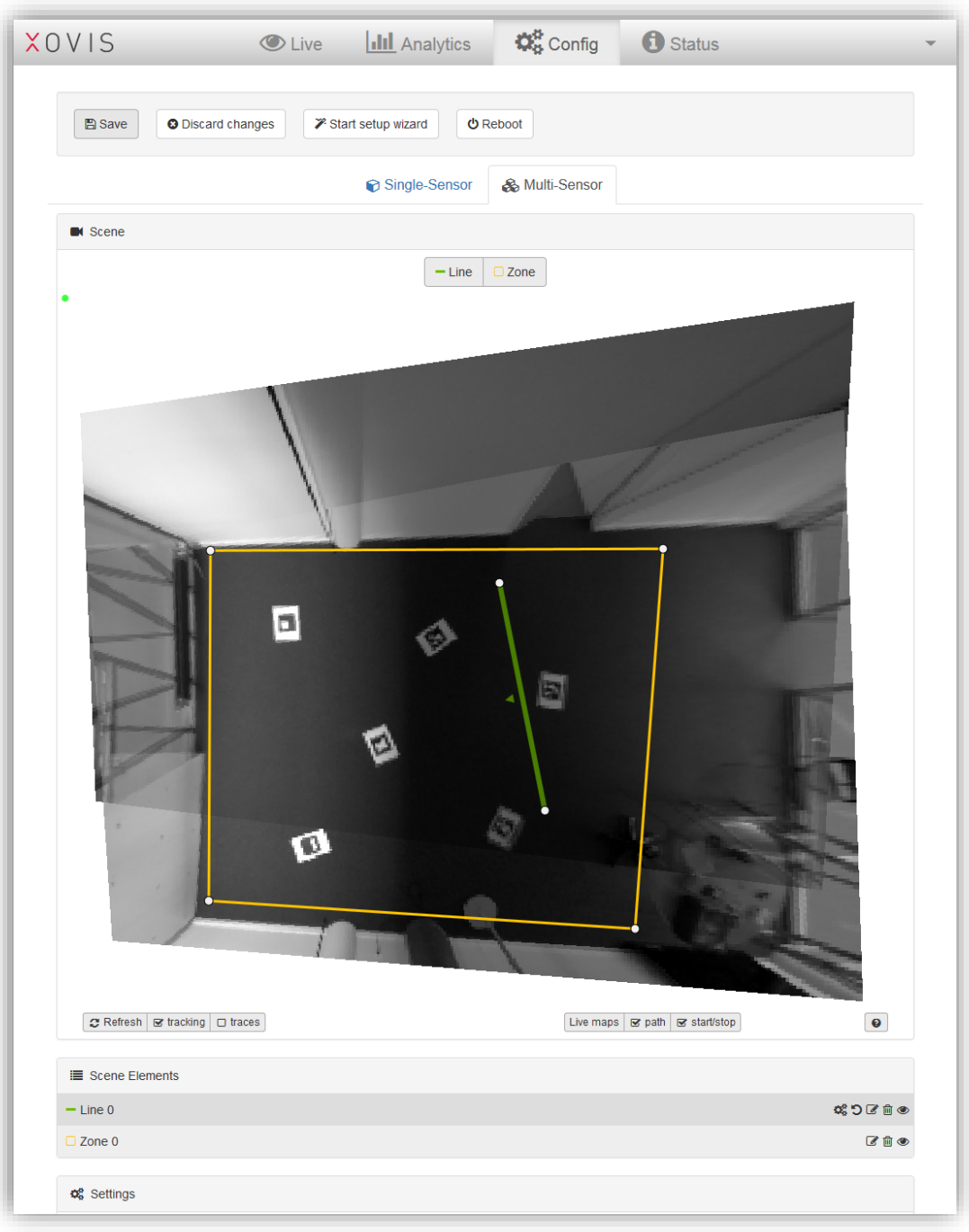
24h activity

The section "24h activity" will show the activities of the last 24 hours with 15-minute granularity.

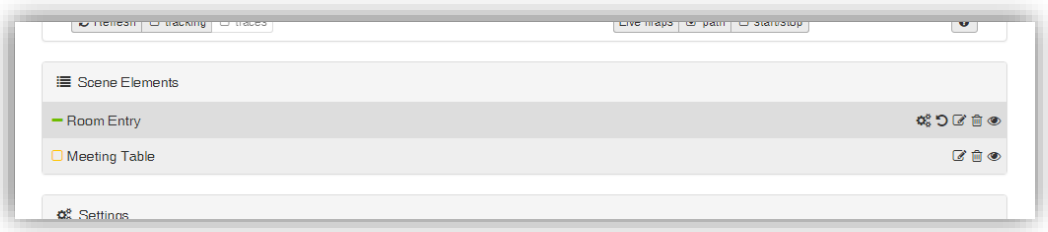
Validation Recording

Schedule and manage Multisensor validation recordings.

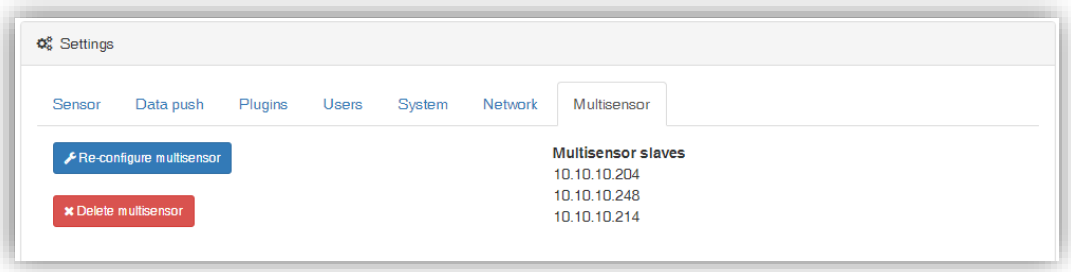
The Multisensor view in the "Config" tab allows to setup count lines and zones for the Multisensor:



Likewise, when configuring a Single-Sensor, a Multisensor allows to draw up to 99 count lines and zones by using the same drawing method. The drawn Multisensor element will be shown in the section “Scene Elements”.

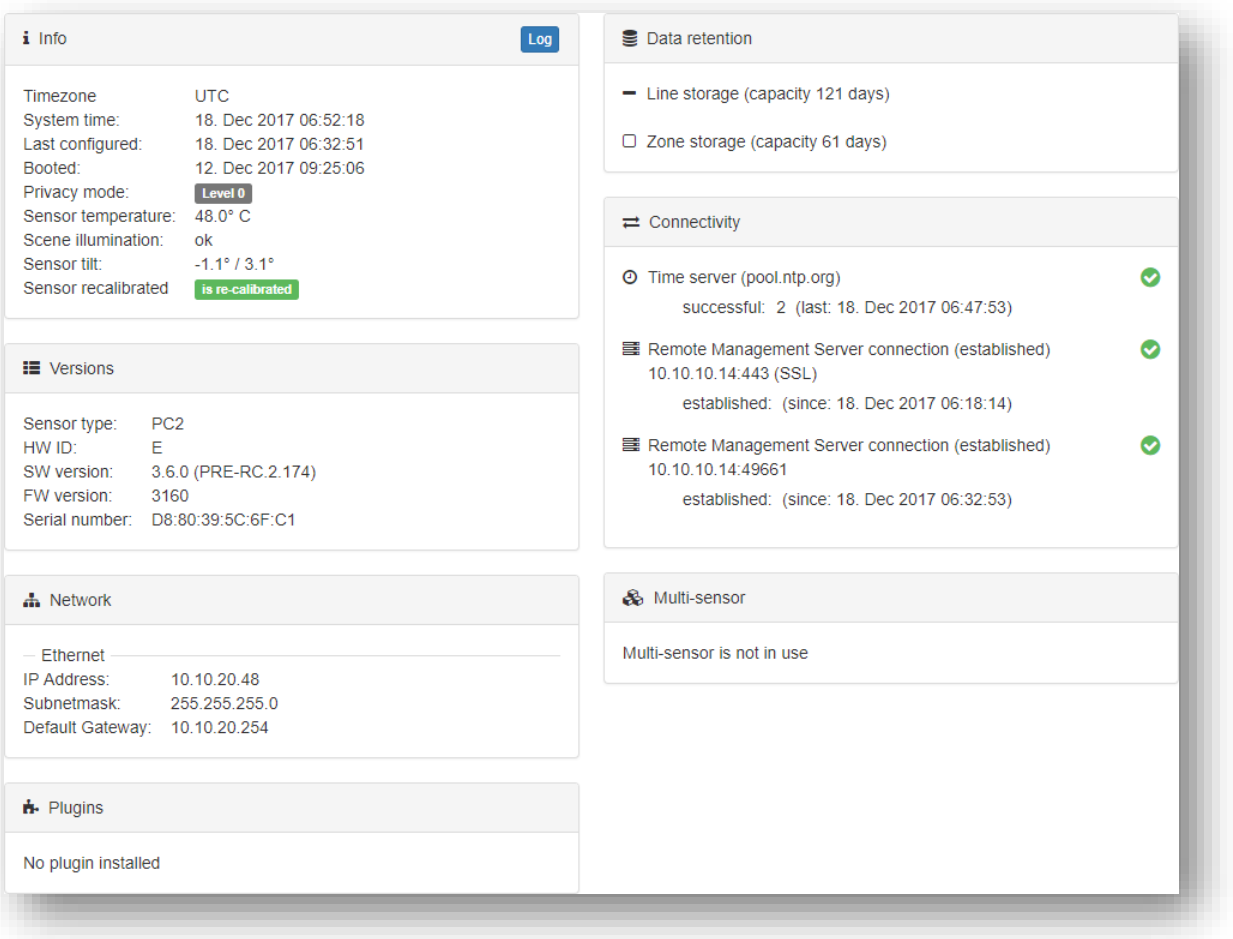


The sections “Settings” → “Multisensor” contains a list of all involved sensors with their IP address. Furthermore, the Multisensor stitching wizard can be restarted here and the Multisensor can be deleted permanently.



3.2.9 Status View

The status view provides various information about the sensor:

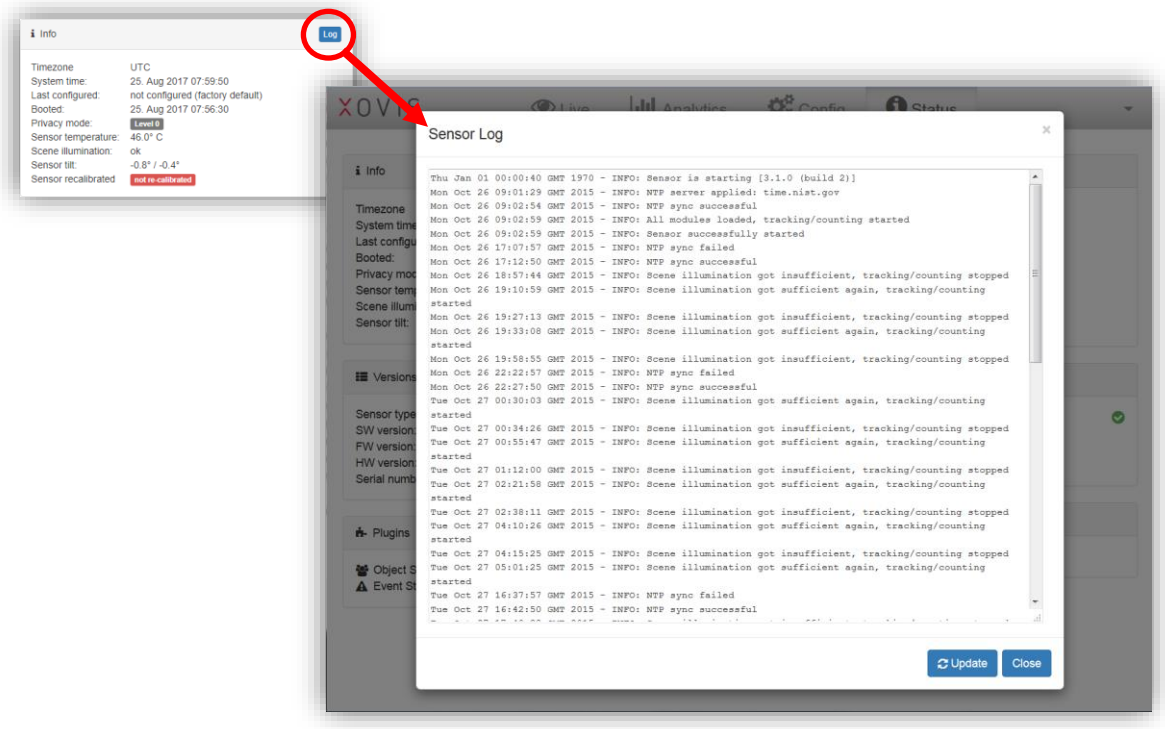


3.2.9.1 Info

The "Info" box holds a series of status information of the sensor:

Item	Description
Timezone	The configured time zone, displayed as actual offset from UTC
System time	The sensors internal time/date
Last configured	The time of last configuration change, or "not configured (factory default)" when the sensor was not yet configured
Booted	The last boot time
Privacy mode	The configured level of privacy (Level 0 – Level 3)
Sensor temperature	The sensors temperature in degrees Celsius
Scene illumination	The illumination status of the scene in which the sensor is operating, can be "ok" or "insufficient"
Sensor tilt	The current tilt of the sensor
Sensor recalibrated	Status about recalibration either "is re-calibrated" or "not re-calibrated"

The "log"-button on the upper right corner of the Info box opens the detailed log view:



The log holds details about:

- Boot process
- NTP connectivity
- Push agent connectivity
- Scene illumination
- Configuration change
- Sensor reset
- Software upgrade

The log file size is limited to 200 KB. When reaching this limit, the log is automatically rotated, i.e. the oldest entries are removed when new ones are added.

3.2.9.2 Data retention

The "Data retention" box informs about the amount of days that are stored on the sensor. The sensor can store up to 122 full days for count lines and up to 61 full days for count zones. This number of days is shared between the configured count items of each type (lines, zones). For example, when using just one count line, the count values of this line will be stored for 122 days. When using 2 count lines, both line values are stored for 61 days and so on. The date stated after "since" represents the oldest data available on the sensor for this count item.

3.2.9.3 Version

The "Version" box holds a series of version information of the sensor:

Item	Description
Sensor type	The device type, e.g. PC2
HW ID	The hardware version
SW version	The version of the software currently running on the sensor
FW version	The firmware version
Serial number	Serial number/Ethernet MAC of the sensor

3.2.9.4 Connectivity

The "Connectivity" box shows the state of outgoing connections (NTP server, all configured data push agents, and the remote management servers, if set). The icon on the right of each connection indicates, if the connection is still established or not (green check if established, red alert if not).

3.2.9.5 Network

The "Network" box holds a series of ethernet connection information:

Item	Description
IP Address	The configured IP address of the sensor
Subnetmask	The configured subnet mask
Default Gateway	The configured default gateway
DNS	The configured DNS

3.2.9.6 Multisensor

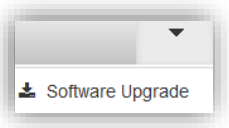
The "Multisensor" box shows the status of the Multisensor and the status of each single sensor with its IP address connected in the Multisensor array.

3.2.9.7 Plugins

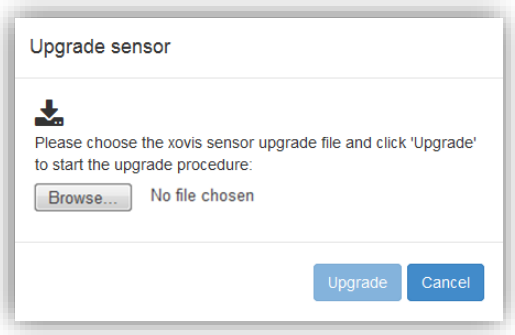
In the "Plugins" box, all plugins currently activated on the sensor are listed. The license state as well as the running state (enabled / disabled) are shown.

3.2.10Firmware upgrade

The sensor allows to easily upgrade its software / firmware. The installation of firmware upgrades can be done by clicking on the "Software Upgrade" menu entry in the context menu (see chapter **3.2.4**):

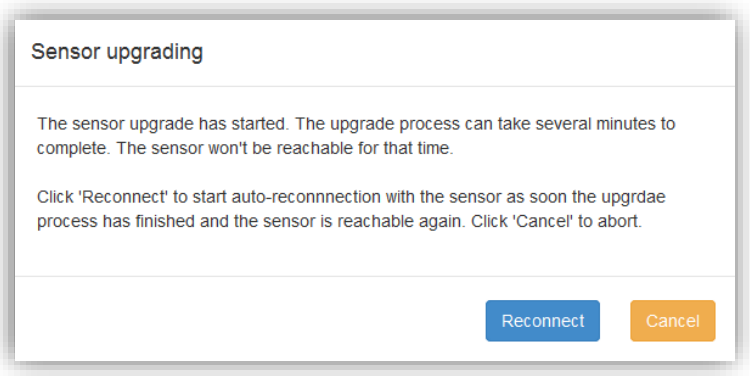


The following dialog appears:



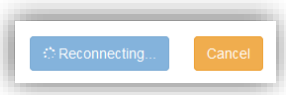
By clicking on the "Browse..." button, the firmware upgrade file can be chosen on the local file system. The only supported file extensions are. Xfw and Xcb. When a valid file is chosen,

the “Upgrade” button will get enabled. Clicking on it will start the upgrade / installation procedure. The following dialog will be displayed:



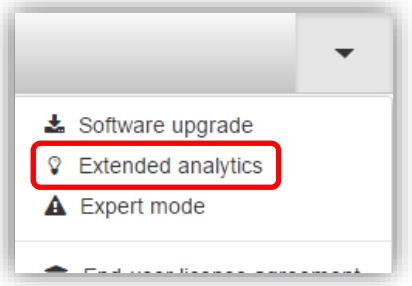
By clicking “Reconnect”, the web GUI will automatically poll the sensor to observe when it is back online and will then automatically reconnecting the web GUI.

While waiting for the sensor to be online again, the “Reconnect” button will indicate the reconnection with a rotating spinner icon as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**:

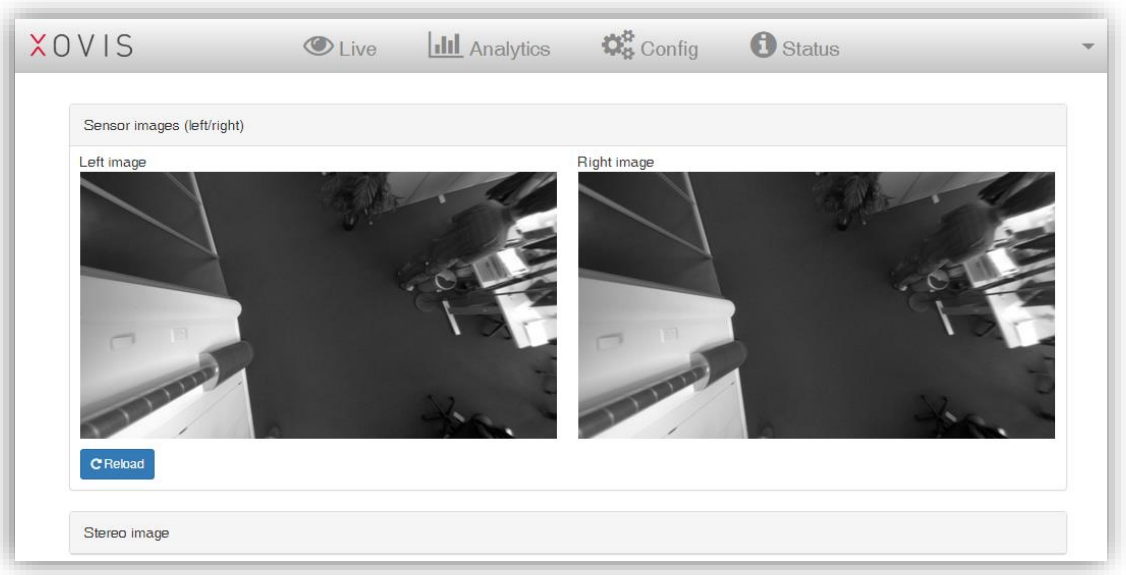


3.2.11Extended analytics

The extended analytics offers two additional views helping in case of trouble shooting.

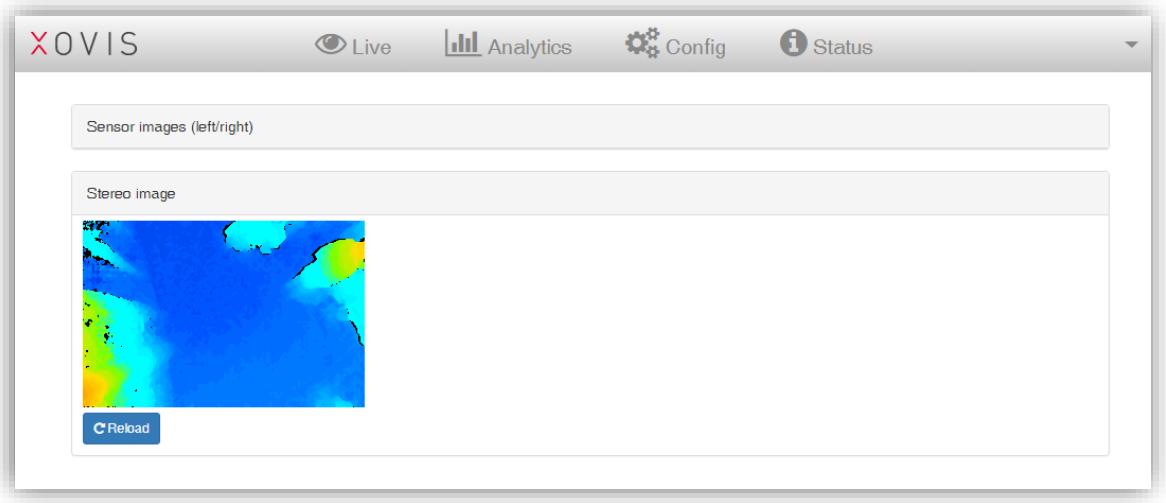


“Sensor images (left/right)” shows the grayscale image of both lenses. This can help to identify dirt and scratches on the lenses. Furthermore, it also helps identifying obstacles hanging from the ceiling which demand for a mask. Clicking on “Reload” gathers new images.



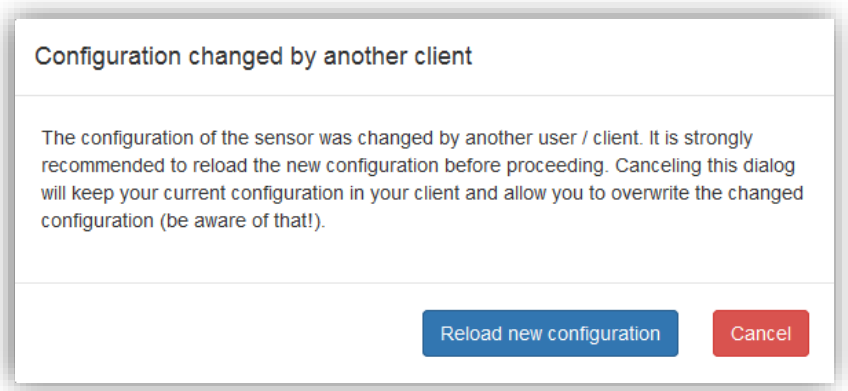
The "Stereo image" box shows the processed depths image of the sensor. This can help to verify the scene-calibration: If the floor is not colored blueish or shows a slope in coloring, this indicates a false calibration.

It is then recommended to perform a recalibration of the sensor (either re-start the setup wizard or use the "shortcut" by clicking on the "mounting height" in the "Settings" part of the "Config" view).



3.2.12 Configuration changes from another client

Whenever another client changes the sensors configuration, i.e. when more than one user is working on the sensor configuration at the same time, the web GUI will inform the user about changes made by another client with the following dialog:



It is recommended to reload the new configuration to be up to date with the latest sensor configuration. This can be done by just clicking on "Reload new configuration" in the dialog.

3.2.13 Connection warning

Whenever the network connection between the client and the sensor gets slow or broken, the web GUI will inform the user with the following popup, appearing on the bottom right:

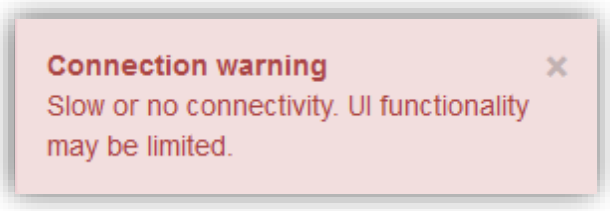


Figure 43: Connection warning

A connection break can be caused by multiple reasons, e.g. by a rebooting sensor, a running firmware upgrade or just a communication issue in the local network (e.g. very low bandwidth).

Whenever this message appears, working with the UI could get limited. With low connectivity, image stream and count value updates can get delayed, for example. When the connection is completely broken, the UI will not be updated at all. However, switching between the tabs (Live, Statistics, Config, Status) and changes to the configuration can still be made. However, saving the configuration changes will not succeed until the connection is established again.

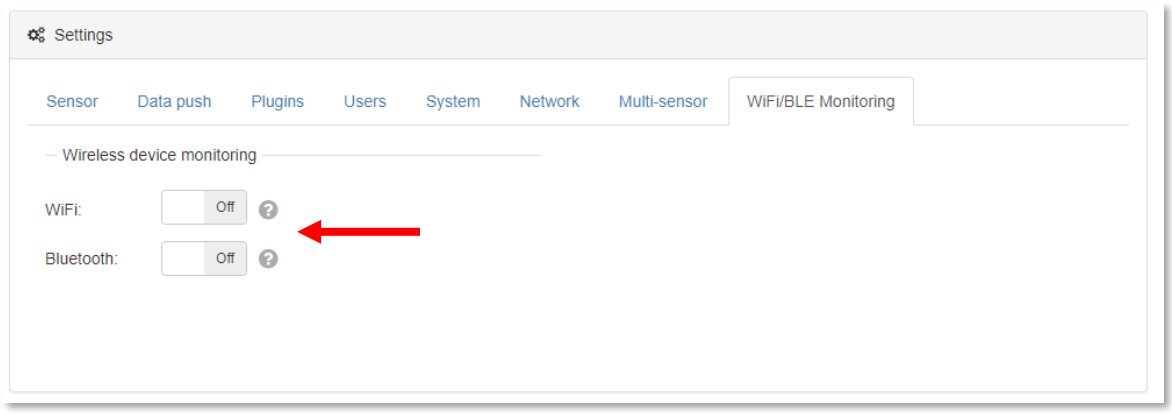
3.3 PC2R

The following section covers features exclusively available on the PC2R sensor.

3.3.1 Bluetooth / WiFi Data Acquisition (Monitoring)

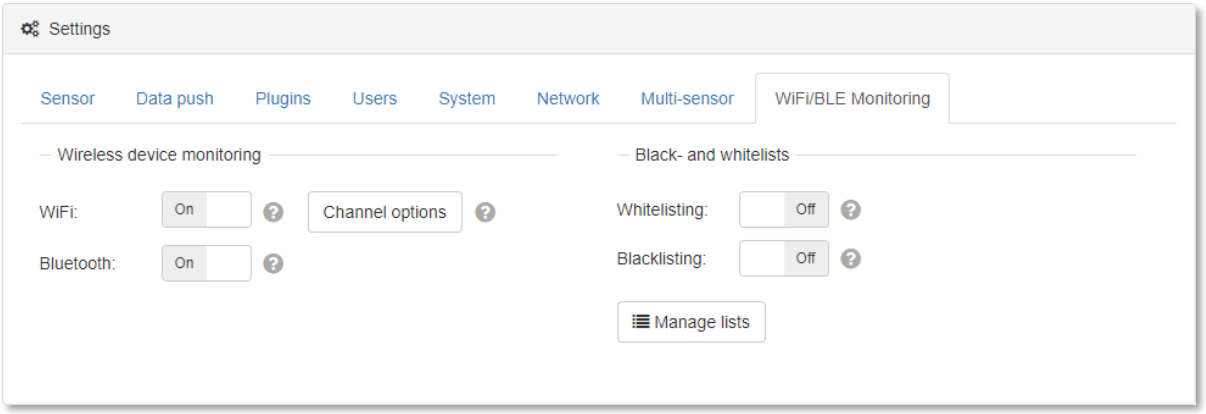
The PC2R offers wireless data acquisition. The sensor can listen for WiFi and Bluetooth devices nearby and send that information continuously using Data Push for external analysis. This way, customer applications like "Recurring Customers" or "Staff Exclusion" can be targeted.

Wireless data acquisition can be controlled in the "WiFi/BLE Monitoring" section of the Config page:



WiFi data acquisition and Bluetooth data acquisition can be enabled/disabled individually.

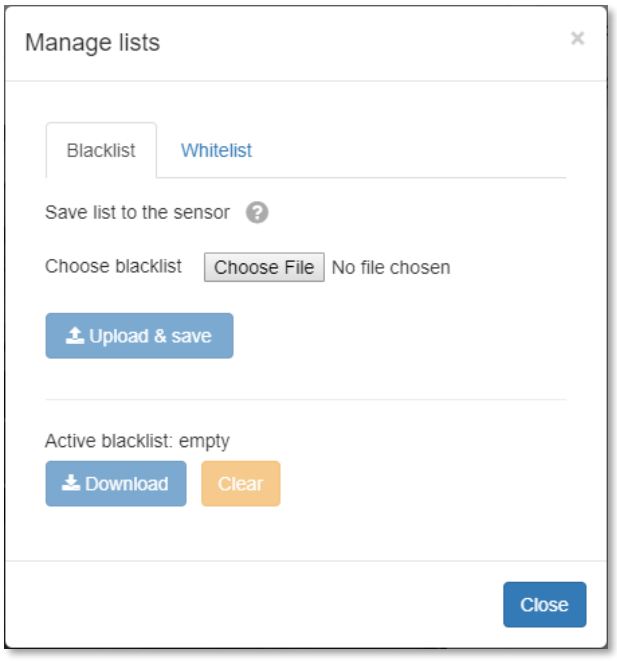
For enabling data acquisition, simply toggle one or both toggle switches to "On":



3.3.1.1 Whitelisting / Blacklisting

Wireless devices can be whitelisted and blacklisted. With a whitelist in use, only devices specified in the whitelist will be monitored by the sensor and their ID will not be anonymized. Devices specified in a blacklist will never be monitored by the sensor.

By clicking on "Configure lists", individual lists can be managed:



The tabs on top controls which list to manage, i.e. the whitelist or the blacklist. For each list, a CSV file can be uploaded. An applied list can also be downloaded here. The CSV file can contain MAC addresses and UUIDs separated by commas or new-lines. The file is limited by 1000 entries. When uploading a list, a previously applied list will be overridden.

Examples:

The MAC addresses and/or UUIDs in the CSV file must be comma separated or on new lines as in below examples.

AA:BB:CC:DD:EE:FF, AA:BB:CC:DD:EE:FF, AA:BB:CC:DD:EE:FF

or

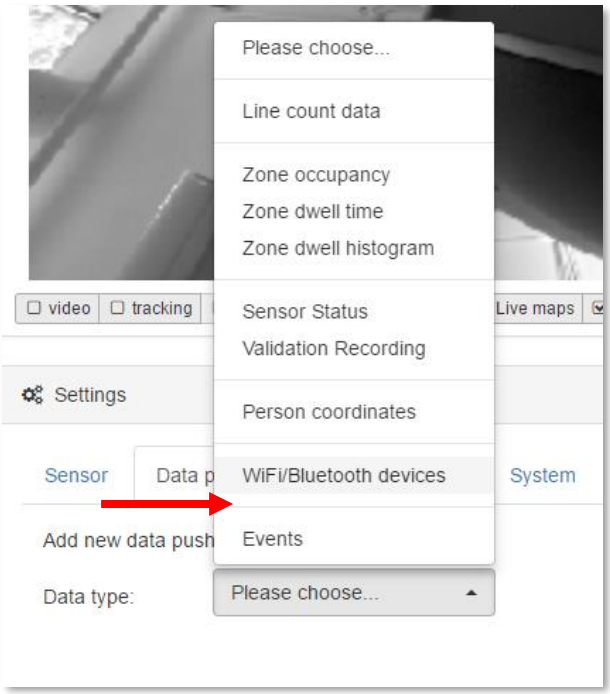
AA:BB:CC:DD:EE:FF

AA:BB:CC:DD:EE:FF

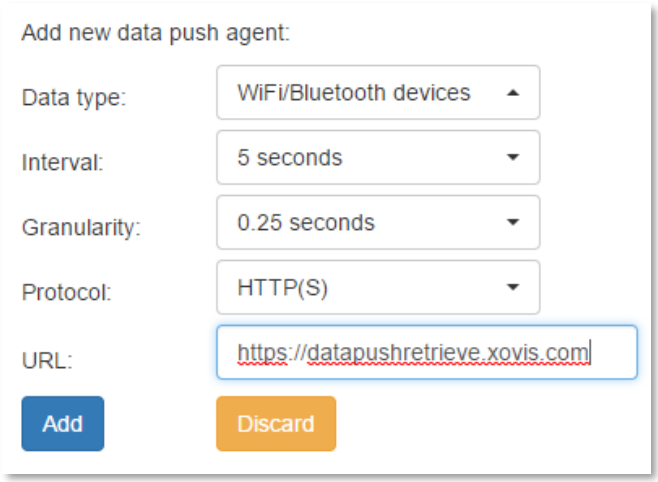
AA:BB:CC:DD:EE:FF

3.3.1.2 Wireless Devices Data Push

For retrieving the monitored wireless devices, the PC2R offers a new Data Push type called “WiFi/Bluetooth devices”:



As with any other Data Push type, the interval and the granularity can be chosen as well as the type of transmission (HTTP(S), FTP, SSH/SFTP).



The specified server (URL) will now retrieve all monitored WiFi devices in the defined interval. Each "Device" contains its device ID (MAC), the signal strength in dB, the corresponding device type (Bluetooth, Bluetooth low energy, WiFi) and in case of a Bluetooth device also it's UUID.

Wireless devices data push does not support manual push as these data are not persisted on the sensor.

Please refer to the API documentation to learn how to receive and parse wireless device push data.

4 Troubleshooting

4.1 False behavior

Under some special conditions, the sensor can show an unwanted behavior. Examples for such behavior are wrongly detected/generated persons or bubbles of a tracked person which jumps to an object, e.g. a pillar.

Such issues occur rarely and are caused by a scene situation which disturbs the sensors algorithm and leads to a false detection. Even if it is unlikely that such false behavior would influence the counting accuracy of a sensor, it can be desirable to reduce such issues.

4.2 Masks

Depending on the actual disturbance, two types of masks can be used: Exclusion and taboo masks.

As the sensor is robust against disturbances in most situations, masks will only be necessary in few situations. Proactively drawing masks is therefore not required.

4.2.1 Exclusion masks

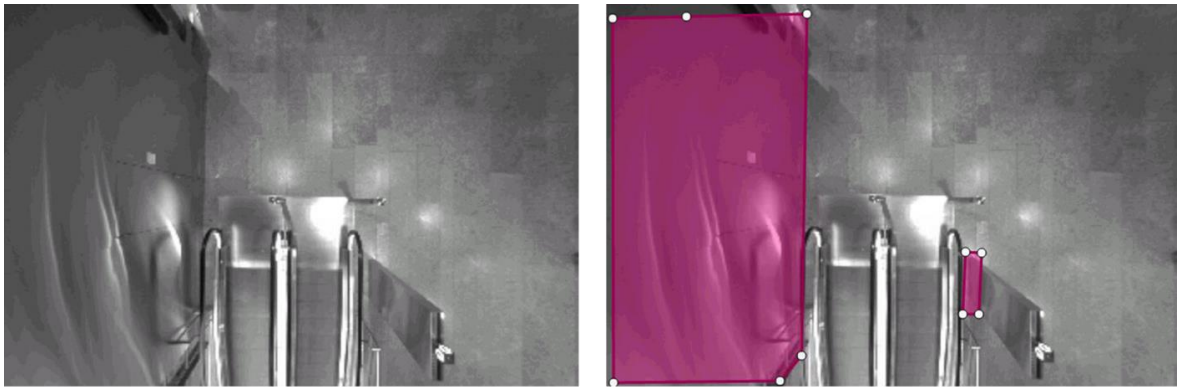
Exclusion masks define a zone as invalid for tracking. Same as with the floor mask, the exclusion mask is oriented on the floor. As soon a person enters an exclusion mask, it will be deleted immediately. A new person which is in an exclusion mask won't be generated until it leaves the mask. The location thereby is always referenced to a persons' foot position.

The exclusion mask can help to hinder false detections or bubbles sticking on objects like pillars, walls or lamps. To identify situations where this mask could be used, it is recommended to switch the sensor to foot coordinates. That way bubbles are projected to the floor and potential problematic objects/regions can be identified easily. Refer to chapters 3.2.5.9.1 and 3.2.8.4 to learn how to change the coordinate mode.

A mirroring wall (metal or glass wall) is a common example where exclusion masks can be used. When a sensor shows problems with bubbles occurring or jumping to the region on the mirroring wall, the whole wall can simply be covered by an exclusion mask.

Another example for using an exclusion mask could be an information column in the peoples' pass way. Especially when located close to the border, the bubbles of persons leaving the scene could jump to the column and stick there for a short period. To hinder this, a simple exclusion mask covering the footprint of this column can be drawn.

Figure 44 shows an example for both situations. The left image (a) shows a scene with a big mirroring wall on the left and an information column on the right bottom. The right image (b) shows the same scene with exclusion masks applied.



a b

Figure 44: Exclusion mask on mirroring wall and information column

The drawing procedure is the same as with the floor mask (see chapter 3.2.5.6). Exclusion masks are also added to the scene element list as soon as the initial drawing is finished.

4.2.2 Taboo masks

Taboo masks define areas completely excluded from the sensor's processing. They can be understood like black holes, i.e. areas where no image information at all is kept. In addition, taboo masks act as artificial scene boundaries. The sensors algorithms benefit from the information of such scene boundaries, e.g. for proper handling people leaving the scene. Therefore, scene boundaries which differ from the actual sensors view boundaries should be marked by using taboo masks for everything behind that scene boundary.

Figure 45 shows an example situation where a taboo mask masks the doorway, to guarantee fast deletion of persons leaving through the door:

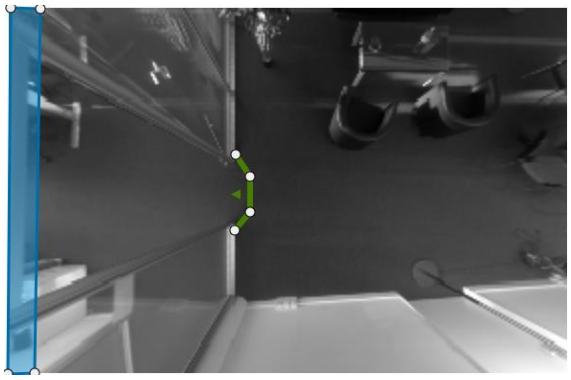


Figure 45: Taboo mask for marking the scene boundary

Furthermore, taboo masks can be important to eliminate disturbing influence caused by scene situations not processable by the sensors stereo vision algorithm. Such influences can for example be caused by:

- Signboards or monitors mounted within the sensors view
- Unstructured or mirroring walls
- Dark regions in strongly inhomogeneous illumination situations

For better identifying objects influencing the internal processing, it is best to switch the sensor to head coordinates. Refer to chapters 3.2.5.9.1 and 3.2.8.4 to learn how to change the coordinate mode. Now, with coordinate mode set to “head”, false detections are shown where they really appear.

Figure 46 shows a situation combining two reasons for using taboo masks in the same scene: First, a significant part of the scene is covered by the wall which reaches towards the sensor. This can cause disturbing artefacts which can influence the sensors vision algorithms. Second, the situation shows two doors in the inner area of the scene, i.e. not at the scene border, same as already in Figure 45. Telling the sensor about this artificial scene boundary helps for proper person deletion when leaving through the doors. Masking out the area appropriate eliminates such possible misbehavior:

Figure 46: Taboo mask on unstructured white wall and marking the scene boundary over two doors

Figure 47 shows a situation with a big sign located within the sensors view. As this sign is very close to the sensor, the stereo vision processing could be disturbed. And, again as with the situations in Figure 45 and Figure 46, it is important to tell the sensor about this scene boundary. Otherwise person bubbles could stick at the sign when the person walks underneath it. Masking out the sign appropriate eliminates such possible misbehavior.

Figure 47: Taboo mask on a sign within the sensor view

Note that, other than with floor masks, taboo masks usually cover slightly more than necessary. This is important due to the fact, that disturbing artefacts which are masked out by taboo masks show inexact dimensions and can slightly slop over their actual region.

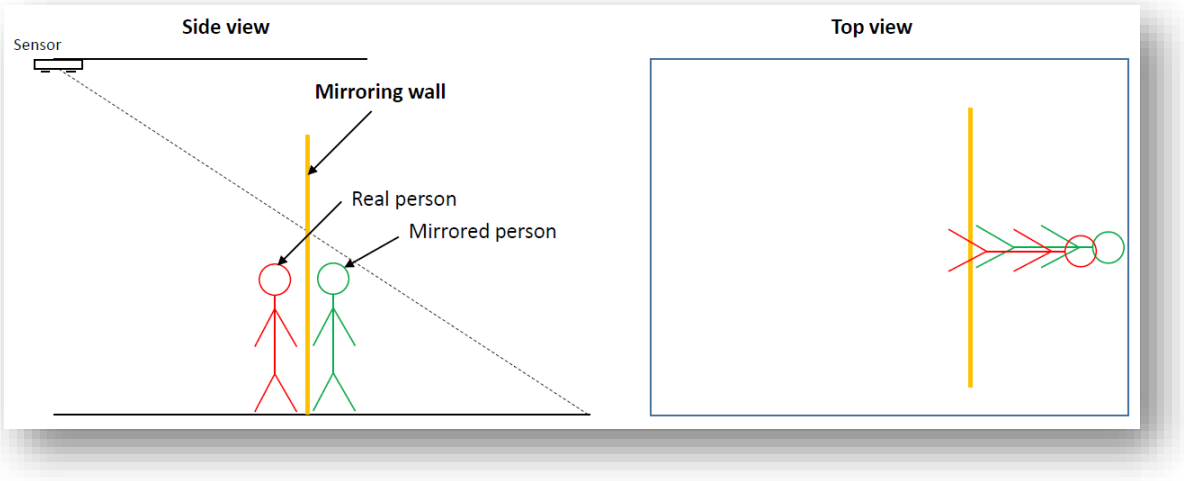
Taboo masks should cover slightly more than necessary to ensure robustness against a slightly slopping over of disturbing artefacts.

The drawing procedure is the same as with the floor mask (see chapter 3.2.5.6). Taboo masks are also added to the scene element list as soon as the initial drawing is finished.

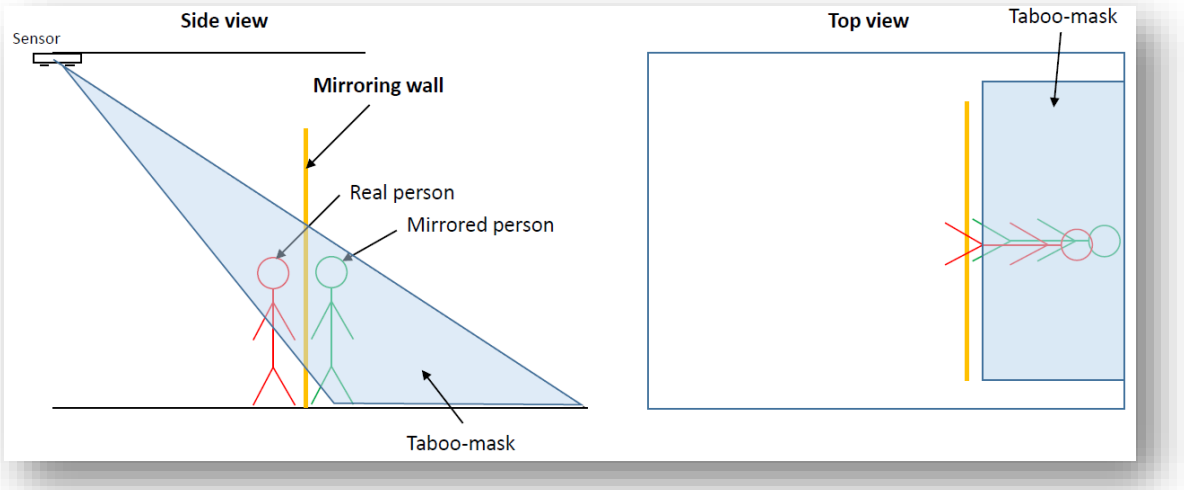
4.2.3 Example for mask differentiation

The following example gives a better understanding on how the two masks work.

The following image illustrates a person walking close to a mirror (red) and the reflection of the person (green).



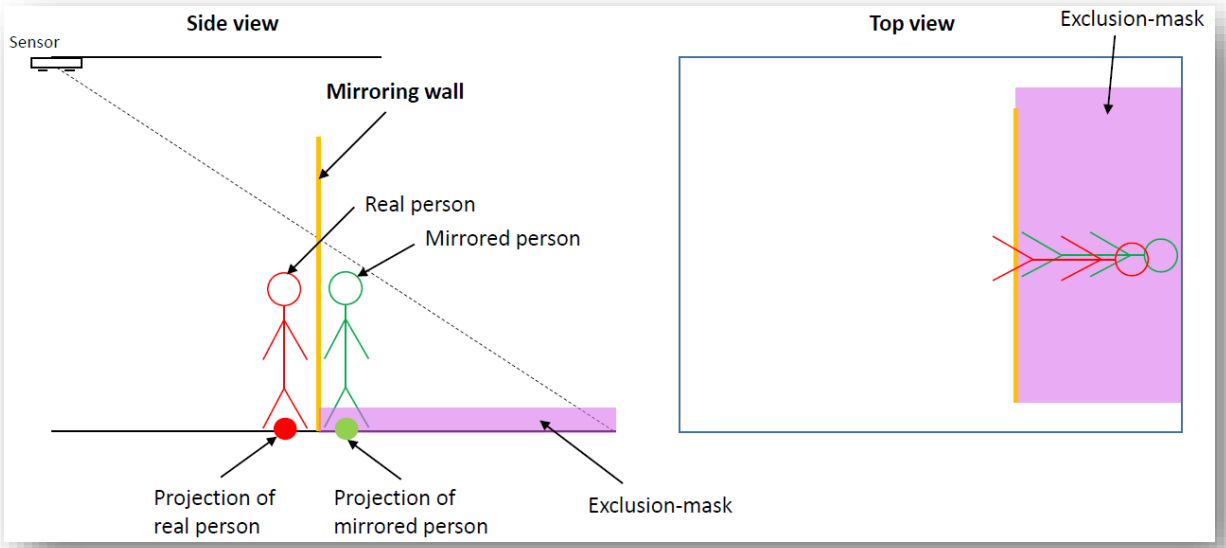
As the green mirrored person shows valid criteria to the sensor for being a real person as well, the sensor will track both. This is unwanted and can be addressed by using a mask.



When using a blue mask, the complete area covered by this mask is cleared, i.e. shows no information anymore. The sensor is blind in this area. This leads to the fact, that not only the

green (unwanted) person gets deleted but also big parts of the red one (it will be cut by the blue mask). This will therefore also eliminate the track of the red person, which is unwanted.

Other with a purple mask. As the sensor scene is still completely processed, also in the area covered by the purple mask, internally both persons will be tracked. But an additional check will now lead to the deletion of the green person: As soon the foot position of a person is located within the purple mask, it will get deleted immediately. For the sample situation, this is exactly what the user was looking for.



4.3 Placement of dwell zones

The dwell time analysis uses a regular zone which is configured in the Config View. When placing the zone, special care should be taken that the dwell zone correctly lies within the sensor's tracking area.

The dwell time analysis only considers tracks which enter the zone across the zone's border and leave the zone across the zone's border. Tracks that are created or deleted within the zone are not considered by the dwell time analysis.

The below image shows three tracks A, B, and C:

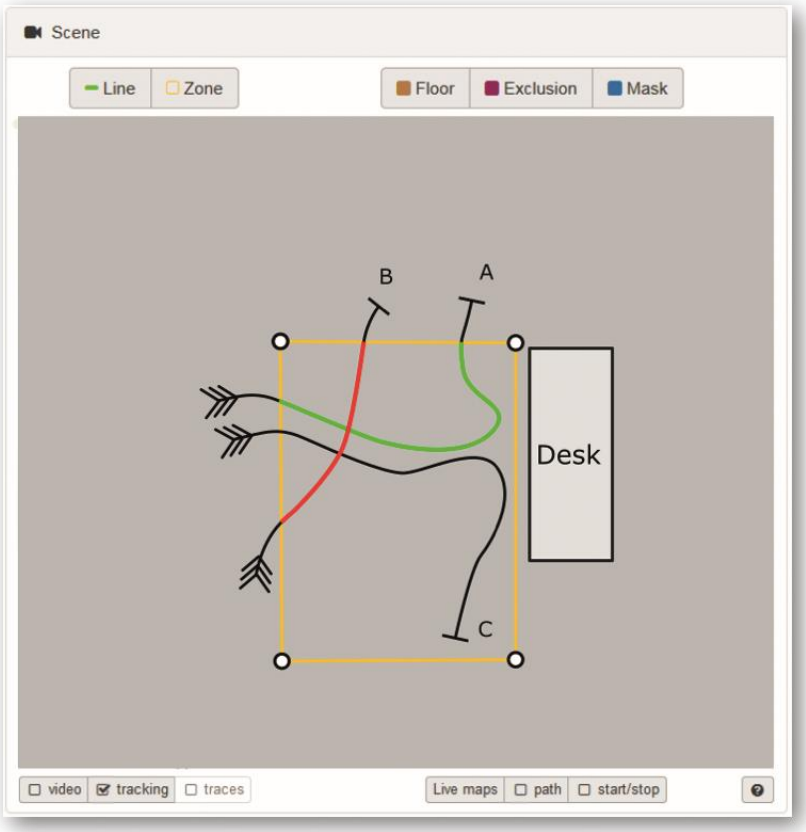


Figure 48: Illustration of different tracks and their influence on dwell time calculation

- Track A enters the dwell zone from the left, walks to the desk (where it is waiting during the desk process) and then leaves the sensor's tracking area towards the top. The track is created AND deleted outside the dwell zone. Its dwell time is calculated (time between the zone entry and the zone exit, green) and is then used in the statistical dwell time analysis.
- Track B enters the dwell zone from the left, doesn't go to the desk, but quickly moves on and leaves towards the top. As its track is correctly created AND deleted outside the dwell zone, the dwell time is calculated (time between the zone entry and the zone exit, red). But as its dwell time was shorter than the minimal dwell time its dwell time value will not be considered for further statistical dwell time analysis.
- Track C enters the dwell zone from the left, walks to the desk and leaves the sensor towards the bottom. Unfortunately, the sensor's tracking area is not large enough and the track is deleted before the track leaves the dwell zone. The dwell time of this track is not calculated, because its deletion point is inside the dwell zone.

The example of track C shows that special care should be taken when placing the dwell zone in order assure correct dwell time analysis, otherwise it could lead to a rather high amount of not calculated dwell times

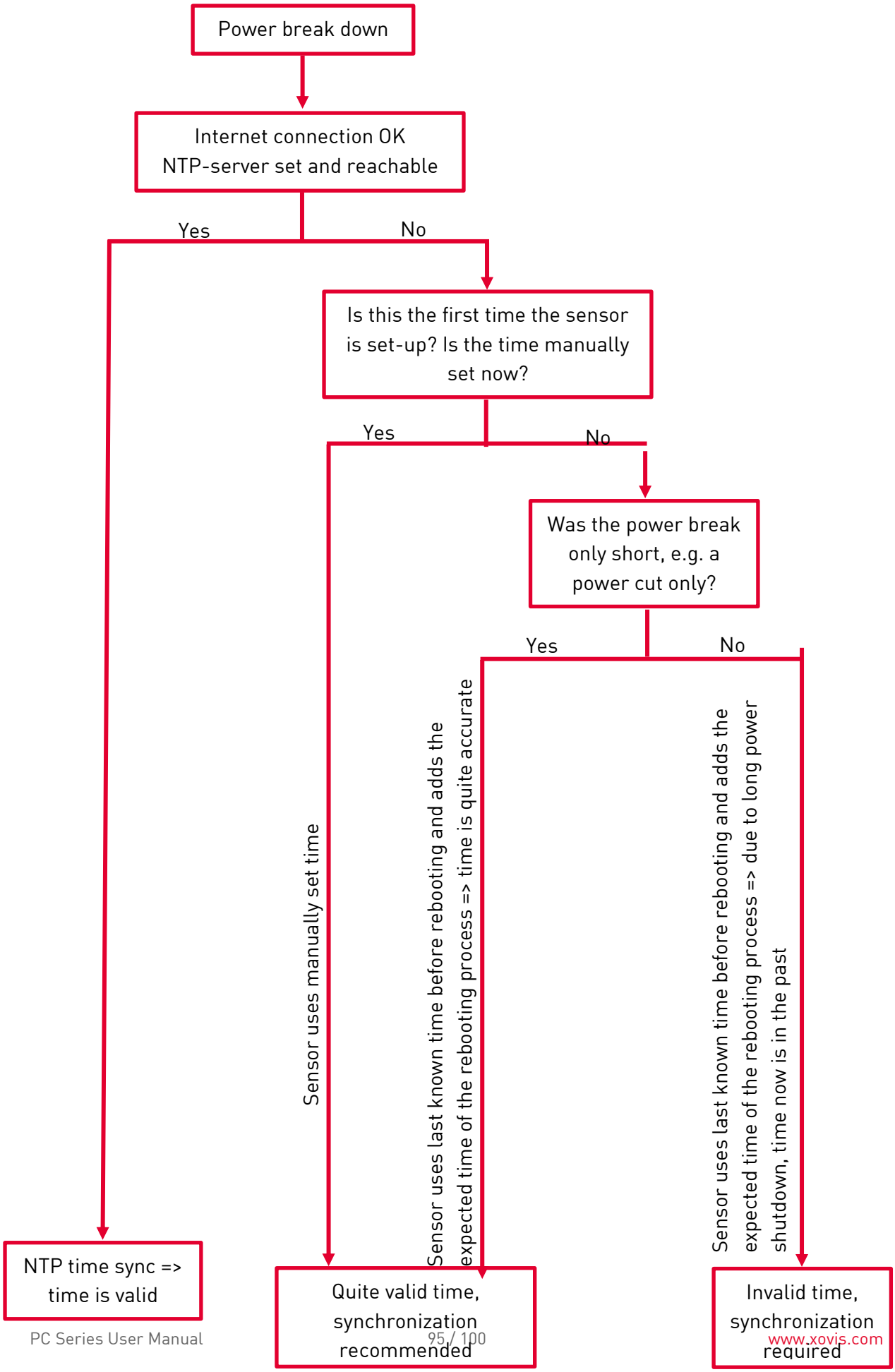
As shown in the figures below, the activation of start/stop points can be useful to optimize the dwell zone placement.

Figure 49: Start/stop points help identifying actual tracking area

The start/stop points (indicated as red and green points) show the limits of the sensor's tracking area. For optimal dwell time analysis, the dwell zone must be placed inside the sensor's tracking area.

4.4 Time synchronization mechanism

The below flow diagram describes the time synchronization behavior depending on power or internet connection loss.


Power break down
Internet connection OK
NTP-server set and reachable
Yes
No
Is this the first time the sensor is set-up? Is the time manually set now?
Yes
No
Was the power break only short, e.g. a power cut only?
Yes
No
NTP time sync => time is valid
Sensor uses manually set time
Sensor uses last known time before rebooting and adds the expected time of the rebooting process => time is quite accurate
Sensor uses last known time before rebooting and adds the expected time of the rebooting process => due to long power shutdown, time now is in the past
Quite valid time, synchronization recommended
Invalid time, synchronization required

5 Technical data

General

Temperature	0 – 45°C -25 – 40°C (only PC2R-O and PC3-O)
Humidity	20 – 80%
Size	PC2 / PC2S / PC2R: 130mm x 94mm x 30mm (LxWxH) PC2R-O: 154mm x 103mm x 83mm (LxWxH) PC3: 345mm x 67mm x 37mm (LxWxH) PC3-O: 385mm x 90mm x 86mm (LxWxH)
Weight	PC2: 350g (with plastic cover) PC2S / PC2R: 250g (with plastic cover) PC2R-O: 1100g PC3: 600g PC3-O: 1500g
Power	max. 6W
Connection	RJ-45 Ethernet, Power over Ethernet (IEEE 802.3af), Class 0
Mounting height	PC2 / PC2S / PC2R / PC2R-O: 2.2 – 6.0m PC3 / PC3-O: 6.0 – 20.0m
Data bandwidth	Ideal bandwidth: >200 KB/s (4 frames per second delivered in live view) Min. bandwidth: 100 KB/s (Configuration, live view provides limited fps) Data transmission: <20KB/s (no Web UI usage) **Note:** Actual needed bandwidth depends on how many Data Push Agents, Object Streams etc. are in use.

Analytics

99 Multipoint count lines for counting in forward and backward direction

99 Multipoint count zones for measuring number of persons within the zone (occupancy)

“In/out” and “Late” count mode

Activation zones

Data retention of 122 days in total, divided by the amount of count lines in use

Plugin architecture

The sensors functionality can be extended by various plugins which run directly on the sensor. Xovis offers a list of all available plugins.

6 Certificates / Tests

First Generation (PC2 / PC3)

Emission – Requirements
IEC/CISPR 22:2005 +A1:2005; EN 55022:2006 A1:2007

Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement

Immunity – Requirements
IEC/CISPR 24:1997 +A1:2001 + A2:2002; EN 55024:1998 A1:2001 +A2:2003

Information technology equipment - Immunity characteristics - Limits and methods of measurements

Safety – Requirements
IEC 60950-1:2005 (Second Edition) +Am 1: 2009 + Am 2: 2013

Safety of information technology equipment

Second Generation (PC2R / PC4)

Electromagnetic Compatibility (EMC)
CISPR 32:2015; EN 55032:2015

Electromagnetic compatibility of multimedia equipment – Emission requirements

CISPR 35:2016

Electromagnetic compatibility of multimedia equipment – Immunity requirements

EN 301 489-17 V3.1.1

Electromagnetic compatibility and Radio Spectrum Matters (ERM); EMC standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems

CFR 47 Part 15 – B:2016

Code of Federal Regulations – Title 47 – Telecommunication, Part 15, Subpart B: "Unintentional Radiators"

GOST 30805.22-2013

Information technology equipment. Radio disturbance. Limits and methods of measurements: Class B

GOST CISPR 24:2013

Information technology equipment. Immunity to electromagnetic disturbances. Requirements and test methods

Immunity – Requirements
CISPR 24:2010/AMD1:2015; EN 55024:2010 + A1

Information technology equipment - Immunity characteristics - Limits and methods of measurements

Safety – Requirements
IEC 62368-1:2014 (Second Edition)

Audio/video, information, and communication technology equipment – Part 1: Safety requirements

All Generations

FCC

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in an installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

7 Custom Integration

7.1 API

Xovis offers the possibility to access raw sensor data directly by a platform independent API and thereby provides an easy way to integrate Xovis sensors into third-party applications.

Detailed information on the sensor interface and custom integration can be found in the API documentation.

7.2 Plugin Architecture

The plugin architecture provided by the PC-Series software can be used for custom based plugins, which can be run directly on the sensor. Xovis offers the development of custom based plugins for certain use cases. Interested integrators can contact Xovis for more information.