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Intelligent Insights Object positions

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1 Introduction

This technical note describes how Intelligent Insights visualizes geolocation data from Bosch Video Analytics cameras in the object positions widget. Best practices on how to configure Intelligent Insights and the cameras are shown. Geolocation is the identification of the real world geographic location of an object. For Bosch IP cameras, geolocation means the position of the Bosch IP camera as well as the objects detected and tracked by Intelligent Video Analytics, Essential Video Analytics or Intelligent Tracking in this camera, either in the global positioning system (GPS) or in a local map coordinate system.

1.1 Applications

Object positions displays the position of Bosch IP cameras and objects detected and tracked by Intelligent Video Analytics or Essential Video Analytics on an overview map. It provides location awareness and reduces the need to look at single camera views.

1.2 Limitations

- Only possible on planar ground planes.
- Geolocation of the camera must be set accurately.
- Calibration of the camera must be set accurately.
- Video analytics tracking mode must be standard tracking, 3D tracking, 3D people tracking or ship tracking.
- Geolocation for Intelligent Tracking is only available on CPP7.3.
- Accuracy of the position decreases with distance.
- Due to lens distortion, the geolocation of objects at the borders of the video will be less accurate.
- Geolocation of partly occluded objects may be displaced. If the lower part of objects is occluded, the foot position on the ground plane can not be determined accurately.

2 Camera configuration

The configuration consists of three major steps:

1. Configure where the camera is located on the map (geolocation)
2. Configure the perspective in the camera's field of view (calibration).
3. Set the video analytics to a tracking mode that is supporting geolocation.

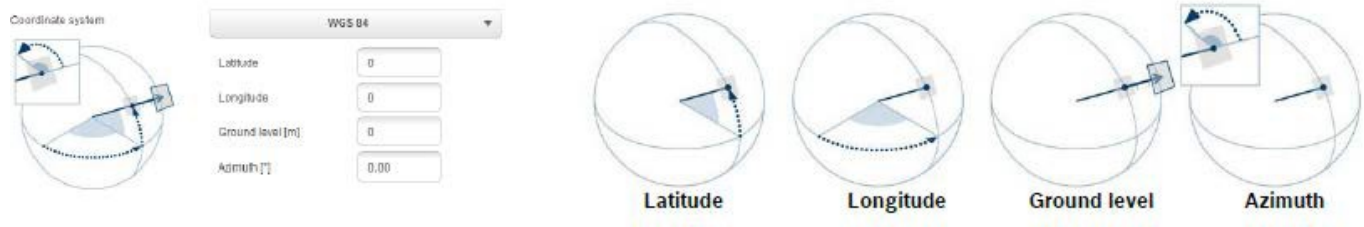
2.1 Geolocation

Configure where the camera is located on either a global world map or a local map. This can be done at:

- Device web page: Configuration > Camera > Installer Menu > Positioning
- Configuration Manager: General > Positioning

First, choose a coordinate system. There are two options:

1. WGS 84, the most used GPS coordinate system. It describes the position of the camera on the earth in the spherical latitude and longitude coordinates. In addition, the ground level above sea level can be set.



2. Cartesian, allowing a simple description of local 2D / 3D maps. The Cartesian coordinate system describes the local space with rectangular X, Y and Z coordinates, where X and Y describe the ground plane and Z the height.

For both coordinate systems, the direction of the camera is described by the azimuth angle. The azimuth is defined as zero in the east or along the X-axis. A positive azimuth angle means that the camera is turned counter-clockwise when viewed from above, resulting in north at 90° or along the Y-axis, west at 180° and south at 270°.

2.2 Camera calibration

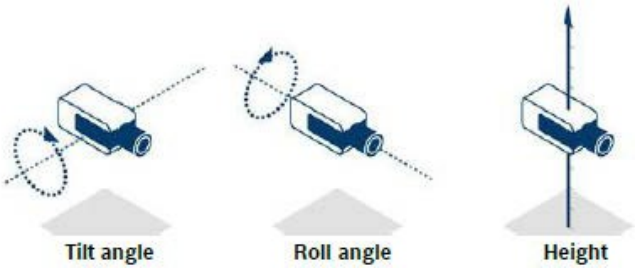
To calibrate the camera's field of view and perspective. This can be done at:

- Device web page: Configuration > Camera > Installer Menu > Positioning
- Configuration Manager: General > Positioning

Calibration is determined by the following values:

- **Tilt angle**: The angle between the horizontal plane and the camera. A tilt angle of 0° means that the camera is mounted parallel to the ground. A tilt angle of 90° means that the camera is mounted top-down in a bird's eye view perspective. The flatter the tilt angle is set, the less accurate the geolocation of the tracked objects will be. Estimates are no longer possible when you have reached 0°.
- **Roll angle**: The angle between the roll axis and the horizontal plane. The setting can deviate from the horizontal by up to 45°.
- **Height**: The vertical distance from the camera to the ground plane of the captured image.

- **Focal length**: The focal length is determined by the lens. The shorter the focal length, the wider is the field of view. The longer the focal length, the narrower is the field of view and the higher the magnification. For Bosch IP cameras with an inbuilt lens this value is determined internally by the camera and does not need to be entered.



2.2.1 To calibrate the cameras:

- **DINION / FLEXIDOME**: Calibration is done once for the camera, independent of any VCA profiles. Use **AutoSet** to automatically set all values known by the camera itself, or to update these values after a change in camera positioning. For all cameras with inbuilt lenses, the focal length is set, and for all CPP7 and CPP7.3 cameras, the tilt and roll angles are automatically determined as well. In most cases only the camera height above ground needs to be entered manually. Additionally, a calibration tool measuring vertical and ground lines as well as ground angles, is available to sketch the perspective and let the camera deduce fitting values for unknown tilt, roll, height and focal length values on demand. Similar measuring elements are also available to verify the calibration. Note that vertical lines can also be used to measure the height of standing persons. Best practice is to distribute the measuring elements well in the image. For example one element in the front, one in the rear and one at the side.
- **FLEXIDOME IP panoramic**: The FLEXIDOME IP panoramic automatically sets the focal length information as the lens is inbuilt. It has no internal sensors for measuring angles, and due to the fisheye perspective, sketching of lines will not work either. For most scenarios, the FLEXIDOME IP camera is either ceiling mounted or wall mounted, which can be directly selected in the calibration. Only the height of the camera above ground needs to be configured.

- **AUTODOME / MIC:** Calibration can be done once for the camera by choosing **Standard** mounting position and entering the height of the camera above ground. The assumption is that the AUTODOME / MICs are mounted perfectly straight. Any deviation from that can not be modeled in the global calibration. For all pan-tilt-zoom positions of the camera, the correct calibration and field of view is deduced automatically. In case of prepositions with video analytics, the calibration can be fully adjusted to compensate for field of views on different ground planes, non-horizontal ground planes or inaccuracies for large zoom factors by the sketch tool. These calibrations are only active if a preposition is activated, but not when the camera just sweeps across the preposition while on a non-preposition tour or manual steering.

2.2.2 To verify the calibration:

- Press **Verify** (available in Configuration Manager only).
  You can now draw measuring elements along further ground lines, vertical lines, persons or ground angles in the scene, and verify their length / height / angle.

Or

- Set the video analytics tracking mode temporarily to **3D people tracking** and have someone walk through the scene. If the artificial 3D person shape fits well around the person in all areas of the scene, the calibration is good. If the artificial 3D person shape is too small or too large, the calibration needs to be adjusted.

Or

- Check whether the location of objects in the scene fits to where they appear on the map.

Note that calibration handling has changed with FW 6.40, and the instructions above on how to calibrate are not fully valid for older FW versions.

2.3 Video Analytics configuration

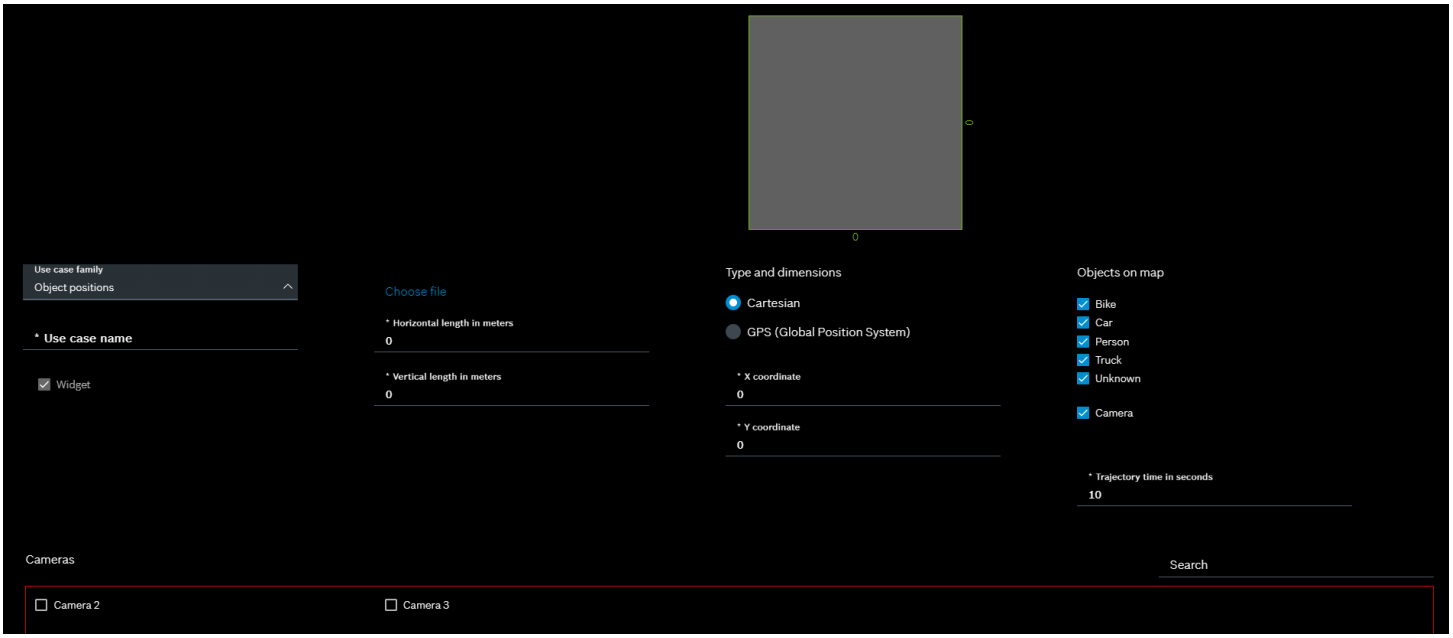
2.3.1 Set Intelligent / Essential Video Analytics to 3D tracking

As soon as the camera is calibrated, both video analytics will output the geolocation of objects in both standard tracking and ship tracking. However, performance increases if 3D tracking is selected, as the tracking is then done directly on the ground plane and position and speed are more accurate. If you only expect upright persons in the scene, you can use 3D people tracking. The only tracking mode that can not be used at all is the museum mode, as no geolocation of tracked objects is generated there.

Note:

A camera cannot be added to an Intelligent Insights system, if the VCA Operating mode is configured to "Silent VCA".

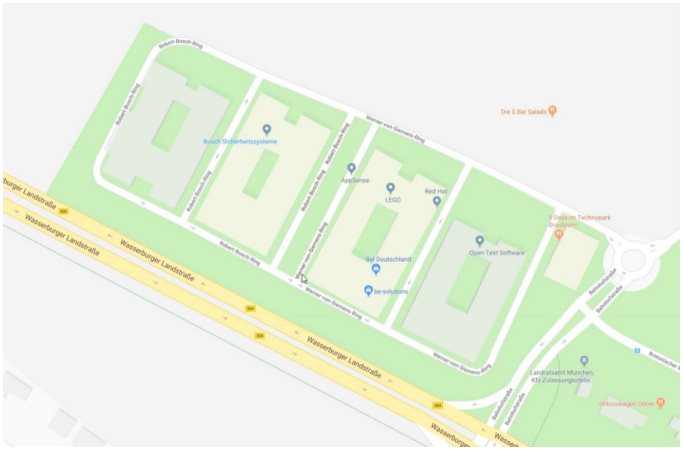
3 Intelligent Insights configuration



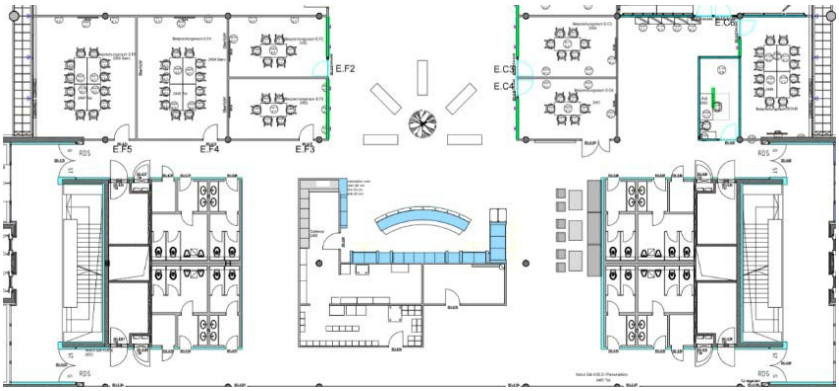
3.1 Map file

To visualize cameras and objects detected by cameras in Intelligent Insights, you have to upload a map or a floor plan of the appropriate area to the system. The uploaded map is used as background. The camera positions and the objects detected by the cameras are displayed as overlays on the map.

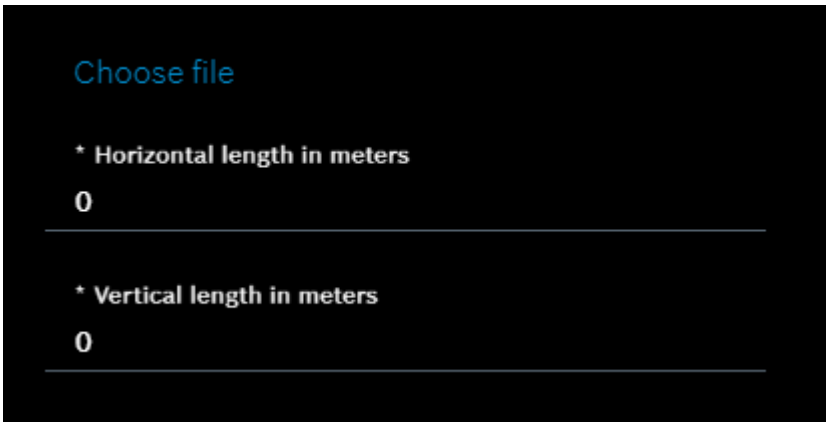
- To visualize objects moving in outdoor areas, you can create a screenshot from Google Maps, for example:



- To visualize objects moving inside of a building, you can use floorplans, for example:



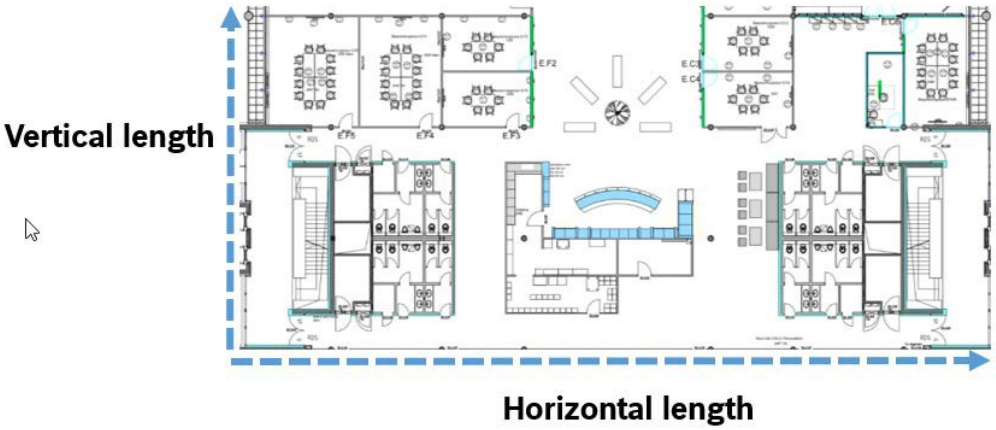
- To upload a file, click **Choose file**.

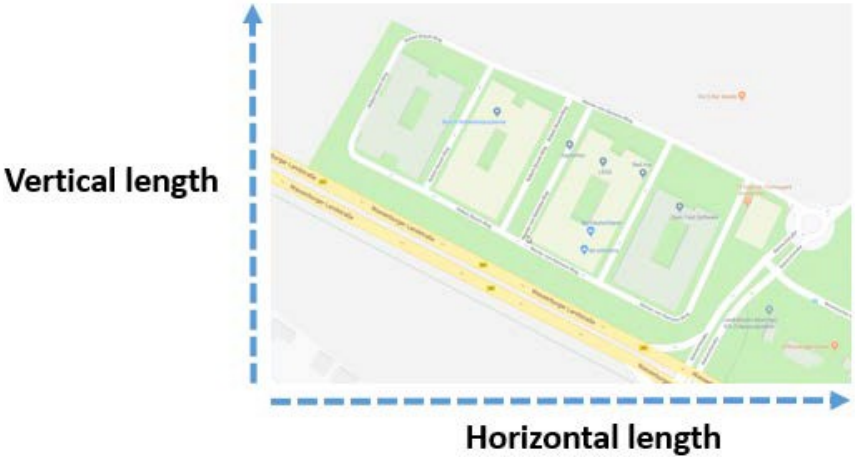


The following image file formats are supported: jpeg, svgz, gif, jpg, ico, png, svg, tif, xbm, bmp, jfif, pjpeg, pjp, tiff, dib.

3.2 Dimension of the area

For a correct visualization of detected objects on the map or floorplan, some data of the area is necessary. You have to provide the horizontal and vertical length of the area, which is visualized in the map.

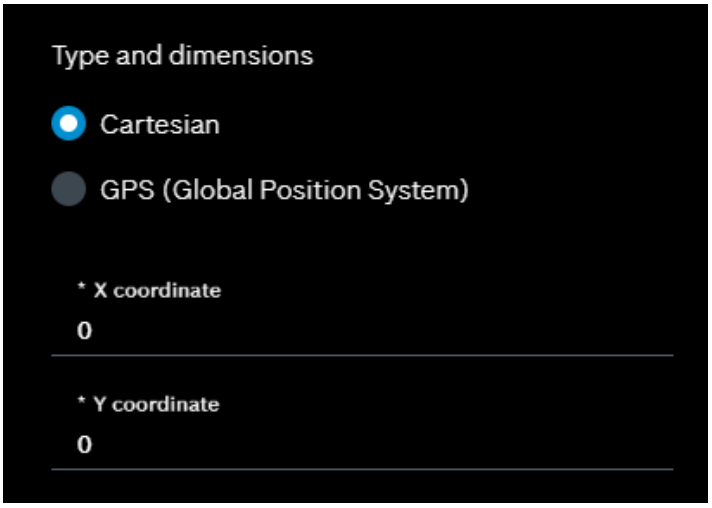




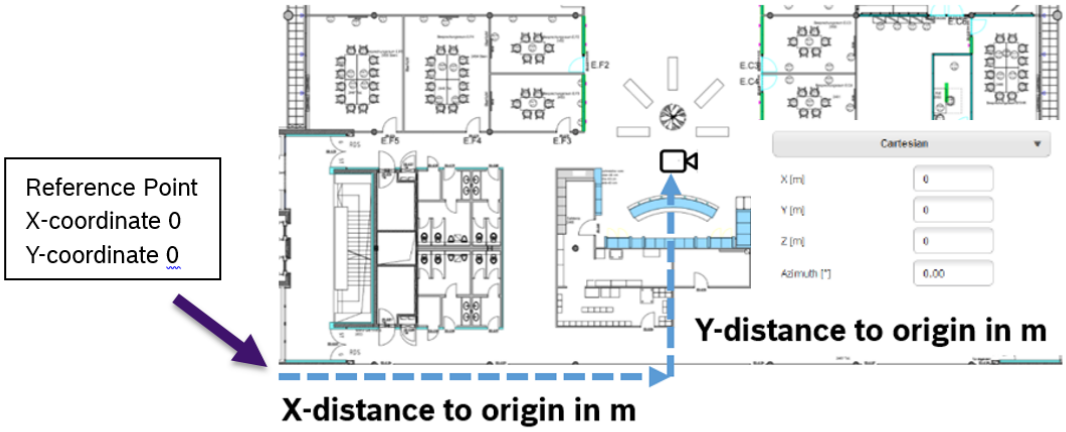
3.3 Origin or reference coordinates of the map

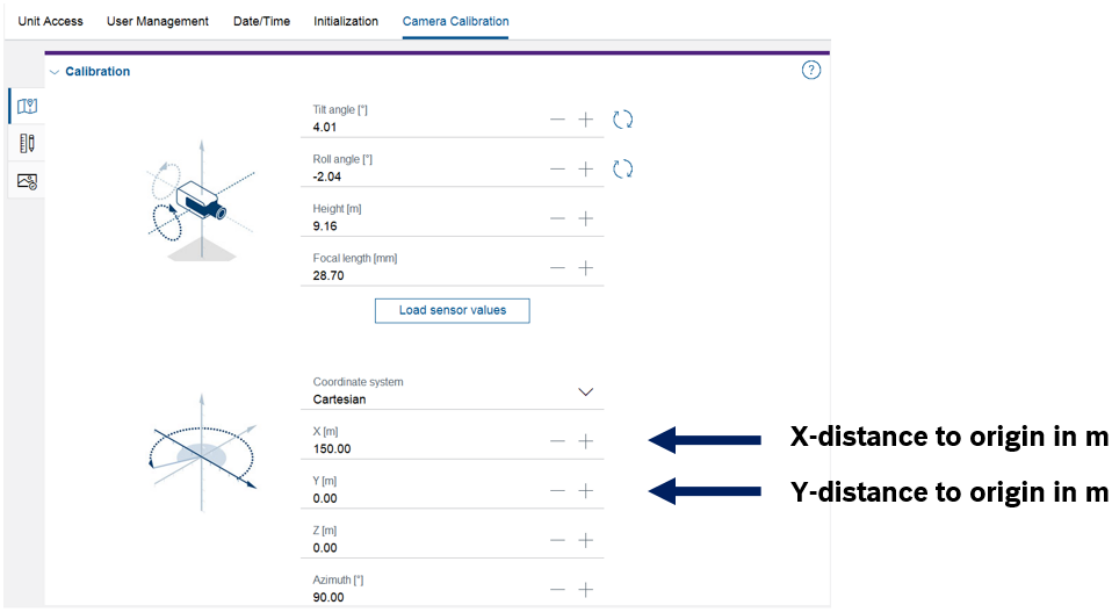
The origin or reference coordinates in the map are used to calculate the positions of detected objects on the map. The reference point is in both coordinates systems the lower left corner of the map or floorplan.

3.3.1 Cartesian Coordinates System

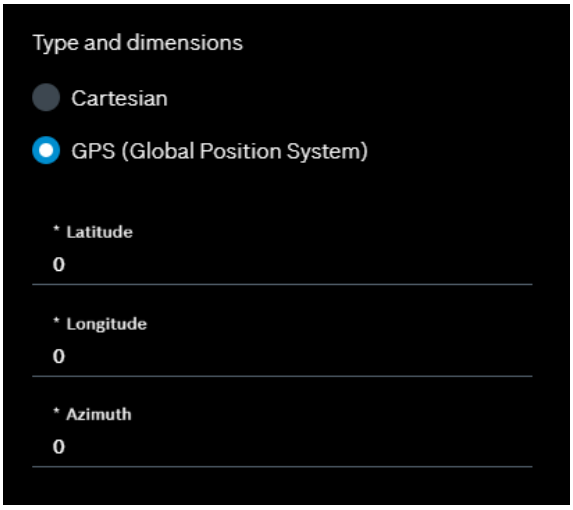


When using the cartesian coordinates system, the camera positions have to be defined based on the reference point. Measure the distance from the camera to the reference point and enter the values in the camera positioning settings. With changing the X- and Y-coordinates in the Intelligent Insights configuration, the reference point in the map or floorplan can be adjusted.





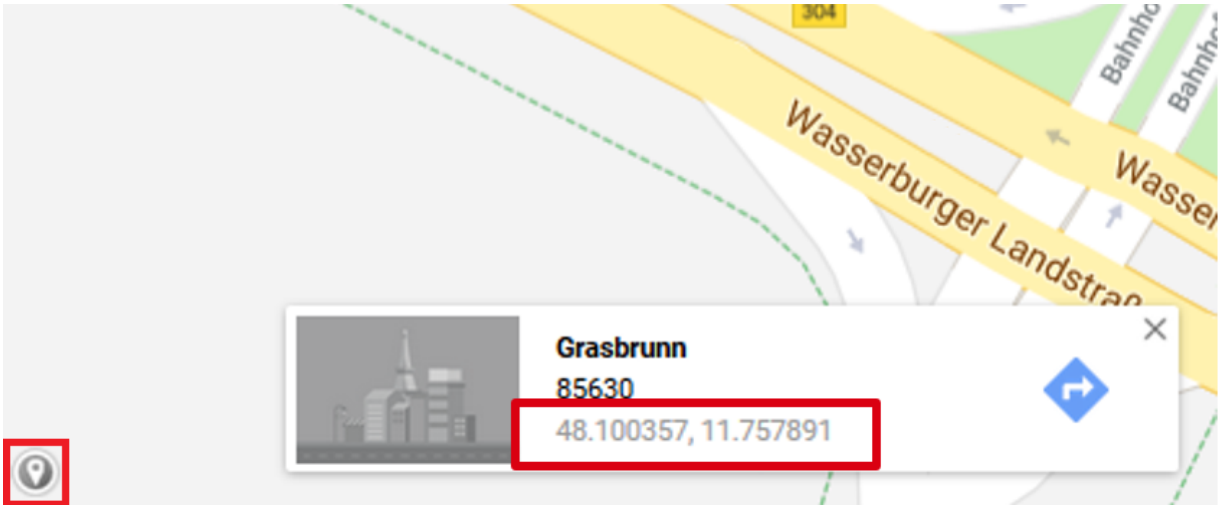
3.3.2 GPS coordinate system

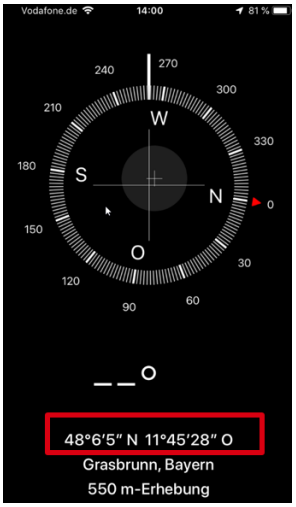


If the GPS coordinate system is used, the longitude and latitude of the lower left corner, and the azimuth of the map must be specified.

The geolocation information of the lower left corner can be determined with the help of a GPS receiver, such as a smart phone, by placing the device to the reference point and reading the displayed values. Alternatively, the geolocation information of the reference point can be determined by marking the point in Google Maps and reading the values.

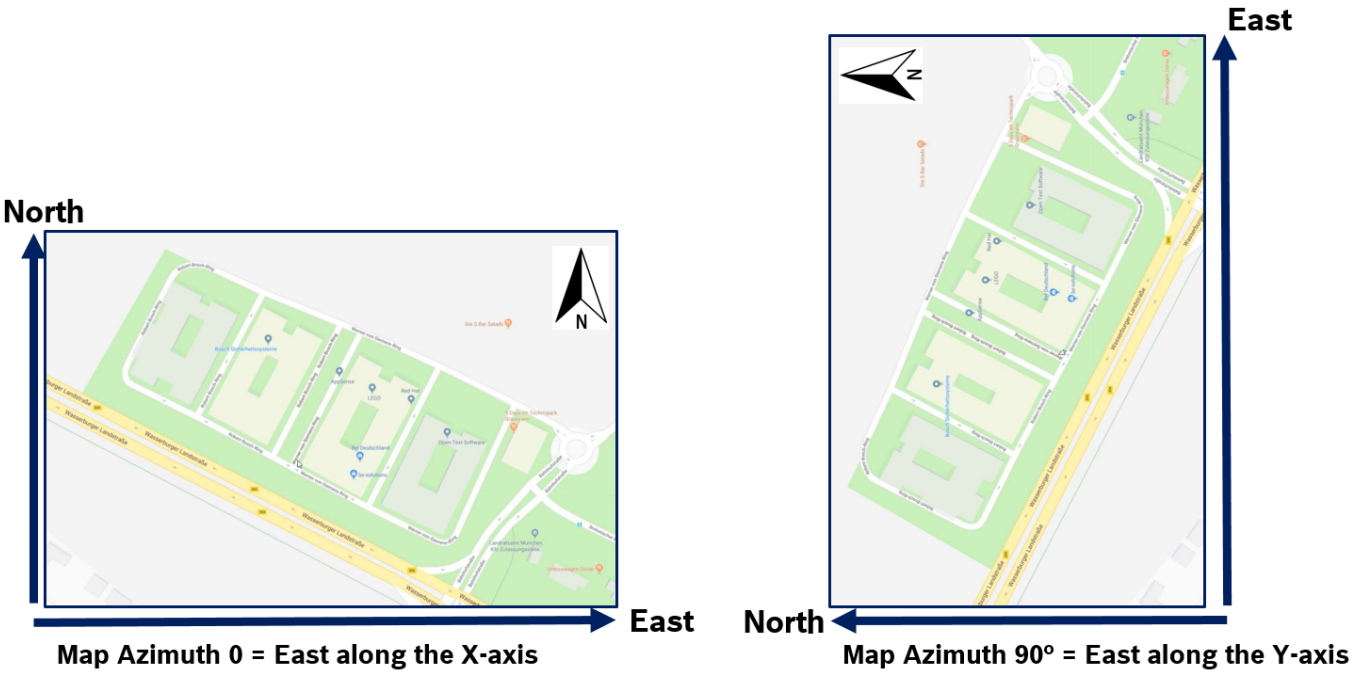
The GPS coordinates are specified in the decimal degree format, for example 40.446° N 79.982° W.





The azimuth value defines the direction of the map to the north. An azimuth value of 0 means the maps north direction is showing along the Y-axis. An azimuth value of +90° means the map is showing along the X-axis to the north.

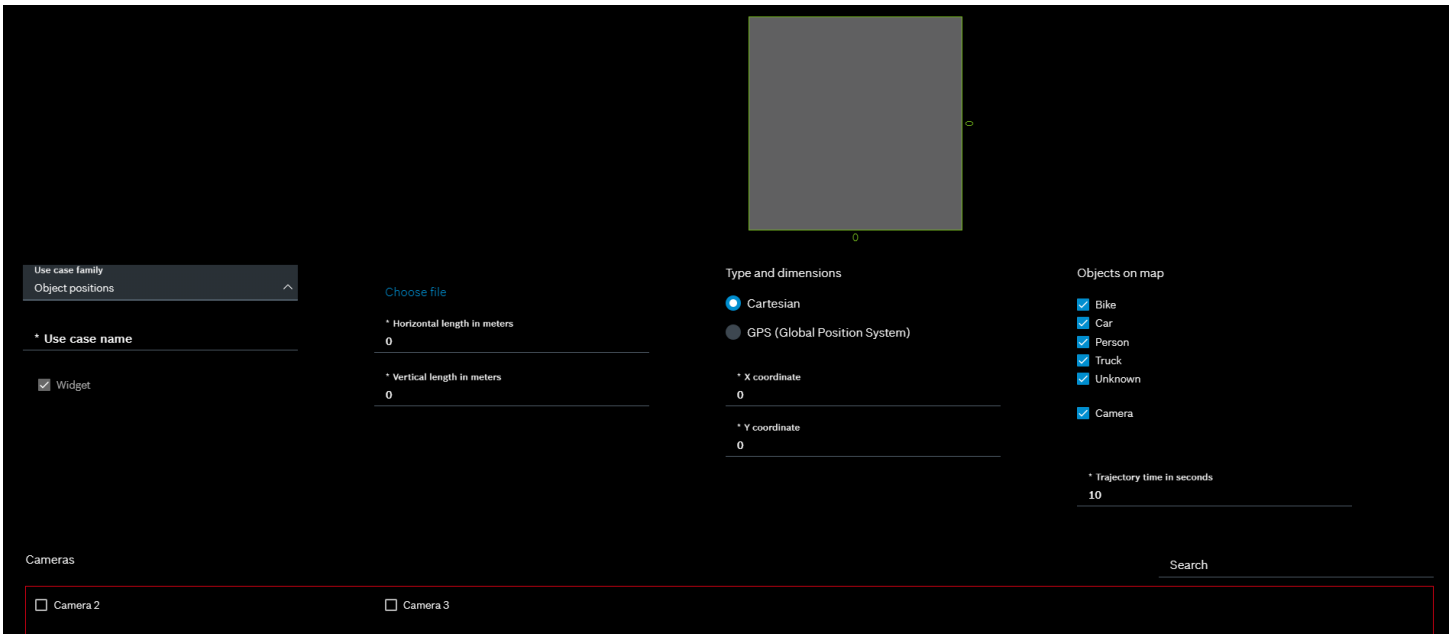
The azimuth value can be any number between 0 and 360. The formula for Map Azimuth = Counter Clock wise angle From Y Axis to True North.



3.3.3 Note:

In the cameras configuration the azimuth is defined as zero in the east or along the X-axis. In Intelligent Insights the azimuth is defined as zero to the north along the Y-Axis.

3.4 Define object on map, trajectory time and visible cameras



3.4.1 Objects on map

Object classification evaluates geometric and speed properties of an object detected and tracked by either Essential Video Analytics or Intelligent Video Analytics. It decides whether the object is an upright person, a bike, a car or a truck. In Intelligent Insights you can filter which objects are shown on the map or floor plan. In addition you can select if the camera position is shown on the map or floor plan.

3.4.2 Trajectory lines in seconds

This setting defines how long the trajectory lines are visible on the map or floor plan if the objects are moving on the map. This helps the operator to understand the route of the object.

3.4.3 Visible cameras

In the cameras section you can define which cameras visualize objects on the map. Deselect the cameras that should not visualize data on the map.

3.4.4 Limitations

- Maximum 16 cameras are supported per Object position widget
- Visualization of more than 50 objects for a longer period may lead to a high memory consumption on the client and low responsiveness of the dashboards
- Objects with a higher speed than 100 km/h are not detected by cameras
- Depending on the number of objects to be displayed, the refresh rate of the widget is automatically adjusted. In high load situations, the refresh rate might be increased up to 5 seconds
- Bosch recommends to use the Chrome web browser for highest performance.
- In case more than 50 objects are displayed in a widget and multiple object position widgets are displayed in a dashboard, system performance can no longer be guaranteed.
- When using the Microsoft Edge browser in high load situations and minimizing the browser, the browser may crash