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Product Management

Hildesheim

15.11.2023

## Release notes

|           |   |
|-----------|---|
| Products: | <b><i>IVA Pro Buildings Pack</i></b><br><b><i>IVA Pro Perimeter Pack</i></b><br><b><i>IVA Pro Traffic Pack</i></b><br><b><i>IVA Pro Intelligent Tracking Pack</i></b><br><b><i>IVA Pro Visual Gun Detection</i></b><br><b><i>Camera Trainer</i></b> |
| Version:  | <b><i>Firmware 9.00 (CPP14),</i></b><br><b><i>Firmware 8.91 (CPP13)</i></b><br><b><i>Configuration Manager 7.71</i></b>   |

### 1. General

Bosch cameras can be clustered by their common product platform (CPP). Newer generations of CPP offer more processing power, and thus also more options for video analytics. Therefore video analytics versions and capabilities differ with the different platforms:

On CPP 13, IVA Pro Buildings and IVA Pro Perimeter are included by default, and IVA Pro Traffic and IVA Pro Intelligent Tracking are available as licensable option.

On CPP 14 cameras of 3100i range, IVA Pro Buildings is included by default.

On CPP 14 camera FLEXIDOME panoramic 5100i, Intelligent Video Analytics is included by default.

On other CPP 14 cameras of 5100i range, IVA Pro Buildings is included by default, and IVA Pro Perimeter, IVA Pro Traffic and IVA Pro Visual Gun Detection are available as licensable options.

On CPP 14 camera FLEXIDOME multi 7000i, IVA Pro Buildings and IVA Pro Perimeter are included by default.

On other CPP 14 cameras of 7100i range, IVA Pro Buildings and IVA Pro Perimeter are included by default, and IVA Pro Traffic and IVA Pro Visual Gun Detection are available as licensable options.

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## 2. New Features

### New features:

#### ► IVA Pro Visual Gun Detection:

Intelligent Video Analytics (IVA) Pro Visual Gun Detection is based on deep learning and is designed for automatic detection and classification of people and brandished firearms. It supports strategies to improve security, for example, of schools or government buildings. In pre-defined conditions\*, the system achieves a 98% true positive rate in detecting guns held by people.

When someone brandishing a gun enters the detection zone, the system is designed to promptly alert personnel who can verify the incident and take proactive measures. This capability may enable quick and appropriate life-saving responses. Since the system is camera-based, security staff can also rely on high-quality video footage for forensics supporting first responders.

The default task for IVA Pro Visual Gun Detection is “Weapon in hand”, alarming on detected weapons but not on detected persons.

Limitations of Visual gun tracking (2D):

- Detection requires the object to be occluded by less than 50%.
- Top-down views (birds eye views) are not supported.
- Objects need to be visible for at least 1 second.
- Not available in corridor mode with 90° image rotation.
- Object color not available.

### Camera support:

#### ► Flexidome multi 7100i:

- Added IVA Pro Buildings
  - Limitation: No polygon object shapes, only object bounding boxes
  - Resolution limited to 640x360 / 640x480
- Intelligent Video Analytics changed over to IVA Pro Perimeter
  - Limitations: No polygon object shapes, only object bounding boxes
  - Limitation: No 3D tracking modes available
  - Resolution limited to 320x180 / 320x240 for double detection distance active, 160x90 / 160x120 else.

### UI Changes for IVA Pro:

- Analysis type now selects IVA Pro Building, IVA Pro Perimeter and IVA Pro Traffic instead of general Intelligent Video Analytics
- “Installed licenses” info has been removed from VCA->Main Operation.

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- ▶ Tracking mode has been moved from VCA->Metadata Generation->Tracking to VCA->Main Operation. Only the tracking modes of the selected IVA Pro will be available.
- ▶ Removed scenario defaults as the IVA Pro packs effectively replace them.
- ▶ Changed visualization of object properties in the video:
  - Moved class and stationary information to new object info box below object
  - Added object speed
  - Added object size. 3D size (length x width x height) will be used if available, 2D size (width x height) otherwise
  - By selecting an object, only the info box of this object will be shown
  - Select which information to show via the right-click video menu
- ▶ In the video menu (right click on video), "Items" has been renamed to "Task elements"
- ▶ Metadata Generation has been renamed to Metadata.
- ▶ Metadata sub-tabs have been dissolved and merged into a single tab
  - Camera Trainer enable was moved to Camera Trainer tab
  - New grouping "General" includes
    - Enable (available always, default on, can be deactivated if only Camera Trainer should run).
    - Color (available on on non-thermal cameras, default on, can be deactivated for lower metadata size).
    - Polygon (available always, default on, can be deactivated for lower metadata size)
    - Flexible shape (Perimeter / People tracking (3D) only, active by default)
    - Sensitivity (Perimeter Pack only)
    - Noise suppression (Perimeter Pack only)
    - Min object area (available always)
  - New grouping "Stationary" includes
    - Stationary timeout (formerly "Stopped object debounce time", available always)
    - Stationary vehicle (Buildings Pack / Traffic Pack, active by default, can be deactivated to no longer show non-moving vehicles.)
    - Stationary person (Buildings Pack / Traffic Pack, active by default, can be deactivated to no longer show non-moving persons. Recommended when false alarms on short poles and traffic lights occur.)
    - Started / stopped event (available always, off by default)
  - New grouping "Placed / taken" (Perimeter Pack only) includes
    - Placed / taken event (off by default)
    - Placed / taken timeout
    - Object Size
  - New grouping for VCA Masks

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## Introduction

IVA Pro are software algorithms that detect behavior of objects within an environment monitored by a video camera and generate alarm events that can be processed further in a CCTV system. They make it possible to capture and evaluate directional movement of objects, apply configured filter rules and to combine these rules, thereby largely preventing false alarms. All algorithms adapt automatically to changing environmental conditions and are therefore non-sensitive to perturbing influences such as rain and small tree movements.

While IVA Pro Perimeter reacts to moving objects of any kind, IVA Pro Buildings, IVA Pro Traffic, IVA Pro Intelligent Tracking and IVA Pro Visual Gun Detection are AI-based and focused solely on upright persons and vehicles, both moving and stationary. Thus, they are inherently even more robust to headlights, shadows, shaking camera and background motion.

Intuitive configuration via graphical user interface is a part of an advanced wizard structure in the Task Manager. Improved with an intuitive configuration option it is possible to provide the complete property information (object type, size, speed, aspect ratio, direction, color) for an object just by clicking it in the live scene.

Camera Trainer is an extension of IVA Pro Perimeter Pack. Based on examples of target objects and non-target objects, the Camera Trainer uses machine learning to allow the user to define objects of interest and generate detectors for them. In contrast to the moving objects detected in general by IVA Pro, Camera Trainer allows detection of both moving and non-moving objects, separates and immediately classifies them. Training can be done both on live video as well as on recordings available through the respective camera. The resulting detectors can be down- and uploaded for distribution to other cameras.

The generated metadata, transmitted to live video or to storage, is used to display overlay graphics and allow retrospective forensic search. Configuration Manager and Bosch Video Management System (BVMS) support forensic search for optimization of the configuration. The camera web page, the Video Security Client (VSC) and the Video Security Apps support a limited forensic search called smart search.

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### 3. Features

#### General

- ▶ Robust object detection and tracking for indoor and outdoor usage in sparsely populated scenes.
- ▶ People tracking and counting in well-populated scenes.
- ▶ Built-in tamper monitoring detects camera hooding/masking, blinding, defocusing, and repositioning. An indication is shown if the reference image check works and when the alarm will be triggered.
- ▶ Two different VCA configurations (profiles) per DINION / FLEXIDOME allow for different settings of different conditions (like day and night)
- ▶ 16 different VCA configurations (profiles) for AUTODOME / MIC permit to combine a dome scene position with a certain VCA configuration (profile)
- ▶ Camera Trainer is an extension of Intelligent Video Analytics. Based on examples of target objects and non-target objects, the Camera Trainer uses machine learning to allow the user to define objects of interest and generate detectors for them. In contrast to the moving objects detected in general by IVA, Camera Trainer allows detection of both moving and non-moving objects, separates and immediately classifies them. Training can be done both on live video as well as on recordings available through the respective camera. The resulting detectors can be down- and uploaded for distribution to other cameras.

#### IVA Pro Buildings Pack:

Tracking modes:

- ▶ Base tracking (2D)

Object classes:

- ▶ Person
- ▶ Vehicle

Tasks:

- ▶ Detect persons/vehicles within, entering, or leaving single or multiple (up to three) areas in a specified order
- ▶ Detect multiple line crossing from single line up to three lines combined in a specified order
- ▶ Detect persons/vehicles traversing a route
- ▶ Detect loitering in an area related to radius and time
- ▶ Detect persons/vehicles which are idle for a predefined time span
- ▶ Detect persons/vehicles that started moving
- ▶ Detect persons/vehicles who's properties such as size, speed, direction, and aspect ratio change within a configured time span according to specification (for example something falling down)
- ▶ Count persons/vehicles crossing a virtual line
- ▶ Count persons/vehicles within an area and alarm if a predefined limit is reached.

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### Object Filters:

- ▶ Object class
- ▶ Object width
- ▶ Object height
- ▶ Object size
- ▶ Object direction (two different directions can be defined)
- ▶ Object aspect ratio
- ▶ Object color

### IVA Pro Perimeter Pack:

#### Tracking modes:

- ▶ Perimeter tracking (2D)
- ▶ Perimeter tracking(3D)
- ▶ People tracking (3D)
- ▶ Museum mode (2D)
- ▶ Ship tracking (2D)

#### Object classes:

- ▶ Perimeter tracking(3D): Person, bike, car, truck
- ▶ People tracking (3D): Person

#### Tasks:

- ▶ Detect objects within, entering, or leaving single or multiple (up to three) areas in a specified order
- ▶ Detect multiple line crossing from single line up to three lines combined in a specified order
- ▶ Detect objects traversing a route
- ▶ Detect loitering in an area related to radius and time
- ▶ Detect objects which are idle for a predefined time span
- ▶ Detect removed objects
- ▶ Detect objects who's properties such as size, speed, direction, and aspect ratio change within a configured time span according to specification (for example something falling down)
- ▶ Count objects crossing a virtual line
- ▶ Count objects within an area and alarm if a predefined limit is reached.
- ▶ Detect a certain crowd level in a predefined field

#### Object Filters:

- ▶ Object class
- ▶ Object width

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- ▶ Object height
- ▶ Object size
- ▶ Object speed
- ▶ Object direction (two different directions can be defined)
- ▶ Object aspect ratio
- ▶ Object color

### IVA Pro Traffic Pack:

Tracking modes:

- ▶ Traffic tracking (2D)
- ▶ Traffic tracking (3D)

Object classes:

- ▶ Person
- ▶ Vehicle
  - Bike
    - Bicycle
    - Motorbike
  - Car
  - Truck
    - Bus

Object classes are hierarchical. That means e.g. a bicycle is also a bike is also a vehicle, and a bus is also a truck is also a vehicle. Object class filters fully support this hierarchy, while visual class labels will only show the deepest level of classification, that is they will show person, bicycle, motorbike, car, truck, and bus labels. Bikes seen from the front can be confused with persons as they look very similar. Also, bus and trucks may be confused.

Tasks:

- ▶ Detect persons/vehicles within, entering, or leaving single or multiple (up to three) areas in a specified order
- ▶ Detect multiple line crossing from single line up to three lines combined in a specified order
- ▶ Detect persons/vehicles traversing a route
- ▶ Detect loitering in an area related to radius and time
- ▶ Detect persons/vehicles which are idle for a predefined time span
- ▶ Detect persons/vehicles that started moving
- ▶ Detect persons/vehicles who's properties such as size, speed, direction, and aspect ratio change within a configured time span according to specification (for example something falling down)
- ▶ Count persons/vehicles crossing a virtual line
- ▶ Count persons/vehicles within an area and alarm if a predefined limit is reached.



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### Object Filters:

- ▶ Object class
- ▶ Object width
- ▶ Object height
- ▶ Object size
- ▶ Object speed
- ▶ Object direction (two different directions can be defined)
- ▶ Object aspect ratio
- ▶ Object color

### IVA Pro Visual Gun Detection

#### Tracking modes:

- ▶ Visual Gun Tracking (2D)

#### Object classes:

- ▶ Person
- ▶ Belongings
  - Weapon

Object classes are hierarchical. That means e.g. a weapon is also a belongings. Object class filters fully support this hierarchy, while visual class labels will only show the deepest level of classification.

#### Tasks:

- ▶ Detect persons or weapons within, entering, or leaving single or multiple (up to three) areas in a specified order
- ▶ Detect multiple line crossing from single line up to three lines combined in a specified order
- ▶ Detect persons or weapons traversing a route
- ▶ Detect loitering in an area related to radius and time
- ▶ Detect persons or weapons which are idle for a predefined time span
- ▶ Detect persons or weapons that started moving
- ▶ Detect persons or weapons who's properties such as size, speed, direction, and aspect ratio change within a configured time span according to specification (for example something falling down)
- ▶ Count persons or weapons crossing a virtual line
- ▶ Count persons or weapons within an area and alarm if a predefined limit is reached.

#### Object Filters:

- ▶ Object class
- ▶ Object width
- ▶ Object height

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- ▶ Object size
- ▶ Object direction (two different directions can be defined)
- ▶ Object aspect ratio

### Easy configuration:

- ▶ Wizard structure of task manager guides through the setup
- ▶ Broad range of predefined detection tasks available
- ▶ Up to 16 independent tasks for alarm generation can be created per channel
- ▶ Filters for object type, size, speed, two-way direction, aspect ratio and color are available to create more specific detection rules for every task
- ▶ All spatial information like detector lines, detector fields, sensitive area, configured object size, object aspect ratio, object direction and more are graphically drawn into the scene and can be manipulated there for flexible and easy configuration
- ▶ Enriched with intuitive “Click-object-in-scene” configuration of object filters
- ▶ Graphical statistics for more transparency regarding alarm results
- ▶ Guided camera calibration with direct feedback
- ▶ Task scripting offers the possibility to combine tasks and thus hugely extend the predefined tasks

### Features which need calibration:

All 3D tracking modes, which track objects on the ground plane. These enable:

- ▶ Object filter for size and speed in metric or imperial system
- ▶ Geolocation, the output of the positions of tracked objects in relation to the camera position.
- ▶ Object filter by type “upright person, bike, car, truck via 3D tracking in Intelligent / Essential Video Analytics and via Perimeter tracking (3D) in IVA Pro Perimeter Pack
- ▶ Double detection distance for Intelligent Video Analytics and IVA Pro Perimeter Pack.

Any 2D tracking mode will not make use of calibration at all.

**Forensic Search** allows to define any task / object filter computation as well as the task combinations available via the task script language.

### Smart Search supports the following search tasks:

- ▶ Any object
- ▶ Line crossing
- ▶ Object in field

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## 4. Specific Explanations and Limitations

### General

- ▶ IVA Pro consist of two parts: The generation of metadata describing the detected objects, which will be stored together with the video, and live alarming or forensic search based on this metadata. In the configuration, all options in the tab “metadata generation” change the generated metadata. Therefore these options are not available for forensic search later on. All alarming as defined in “Tasks” as well as the inspection of metadata can be done both for live alarming and during forensic search.
- ▶ Only if IVA Pro is active can it create metadata for live viewing, alarming and for storage. Forensic search therefore just can deliver results in a retrospective search for moving objects in the database for cameras that have had one of these algorithms enabled for the recording.
- ▶ The forensic search function for the feature “crowd detection” is only working on the crowd fields you defined before in the camera or in the encoder. Metadata for crowd will only be generated in this crowd fields and cannot be changed for a different crowd fields in Forensic Search.

### Limitations of IVA Pro Perimeter Pack:

- ▶ Due to reflections, objects or motion might not be reliably detected or too many objects or motions might be detected. False alarms might occur due to:
  - reflective background
  - glass (glazed building frontages)
  - water as a background
  - cones of light moving in the dark
- ▶ Sudden appearance of spotlights, moving headlights or torch cones etc. are lightening up an area that might be detected as an “object”.
- ▶ Large areas of reflected light can also cause spurious motion detection. However, light reflections caused by falling raindrops, for example, are small enough to be ignored for statistical purposes and owing to the uniform nature of their motion.
- ▶ Motion of vegetation due to wind is covered for slow, continuous and uniform wind. If this movement overlaps with objects, false as well as missed detections are possible. To avoid this, adjusting the camera position.
- ▶ Strong wind, storms and heavy peak blasts from different directions, especially in the foreground of a scene, might trigger false alarms.
- ▶ Suddenly appearing sharp shadows of clouds, trees and buildings can be mistake as objects. Soft shadows are covered by the algorithm.
- ▶ An object in strong sunlight with crisp shadow may therefore be registered within its outlines including this shadow. This has to be taken into account for aspect ratio and object size configuration. Soft shadows are covered by the algorithm.
- ▶ A constant background is necessary in order to detect motion reliably and to assign that motion to a certain object. The more the background moves, the harder it is to distinguish moving objects from it. For instance, a person walking in front of a hedge that is moving heavily in the wind will very probably not be detected properly.

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- ▶ Merging effects (outline bubble over more than one object) might occur with objects overlapping or passing-by close to each other. This means the occurrence of a new (bigger) object in the scene and the loss of the former already detected and tracked object IDs with all the consequences to the selected detection tasks. The same applies when these object separate again. To avoid this, please check your scene and camera position to the best and take it into account when setting up the configuration
- ▶ If the image consists to a certain extent of nothing but moving objects – in other words if objects cannot be distinguished from each other or from the background – the motion of an individual object cannot be detected (e.g. individuals in a large crowd, idle object in a large crowd).
- ▶ The detection and analysis of objects entering the image will be delayed until significant size and motion have been observed. To avoid this, center all evaluations in the image. With Intelligent Video Analytics, the sensitivity parameter allows you to additionally choose a trade-off between fast object detection and less false alerts due to insignificant motion.
- ▶ “Click-object-in-scene” configuration: The quality of the metric results provided (size, speed, aspect ratio) is very much depending on the correct calibration. Furthermore it has to be mentioned that the color filter used in the “click-object-in-scene” function is of course related to the outlined area of an object. In most of the cases this outlines include additional surroundings like background (e.g.: asphalt). To concentrate on the real object specification, it is recommended to delete these unwanted colors from the histogram using the “Clear” button.

#### Minimal object size & differences in processing resolution & frame rate

IVA Pro typically use less resolution than available, and different processing resolutions on different devices and for different image aspect ratios. If not stated differently, the video analytics runs with a framerate of 15 fps if the camera has 30/60 fps base rates, and 12,5 fps for 25 fps base rate. Here the processing resolutions for different video aspect ratios

- ▶ IVA Pro Perimeter Pack, 3D tracking on, noise suppression OFF / MEDIUM, for moving / started / stopped objects, video base rate 25/30 fps
  - 4:3 - 512x384
  - 16:9 - 640x360
- ▶ IVA Pro Perimeter Pack, 3D tracking off or noise suppression STRONG or placed/taken objects, video base rate 25/30 fps
  - 4:3 - 256x144
  - 16:9 - 320x180
- ▶ IVA Pro Perimeter Pack, 3D tracking on, noise suppression OFF / MEDIUM, for moving / started / stopped objects, video base rate 50/60 fps
  - 16:9 - 512x288
- ▶ IVA Pro Perimeter Pack, 3D tracking off or noise suppression STRONG or placed/taken objects, video base rate 50/60 fps
  - 16:9 - 256x144

In corridor mode, the height and width are switched. IVA Pro Perimeter Pack can reliably detect objects that have at least 20 square pixel in this internal resolution, e.g. 3x8 pixel for an upright person.

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IVA Pro Buildings Pack, IVA Pro Traffic Pack & IVA Pro Visual Gun Detection (if available):

- ▶ CPP 13:
  - 16:9 - 640x360
- ▶ CPP 14 3100i range or FLEXIDOME multi 7100i
  - 16:9 - 640x360
  - 4:3 – 640x480
- ▶ CPP 14 & 25/30fps base rate:
  - 16:9 - 1280x720
  - 4:3 - 1024x768
- ▶ CPP 14 & 50/60fps base rate:
  - 16:9 - 1024x576

IVA Pro Buildings and IVA Pro Traffic need a minimum object size of 256 square pixels, e.g. 16x16 pixel. IVA Pro Visual Gun Detection needs a minimum object size of 1024 square pixel, e.g. 32x32 pixel.

No IVA Pro Buildings or IVA Pro Traffic available on CPP13 in corridor mode. IVA Pro Visual Gun Detection not available on CPP14 in corridor mode.

#### Limitations of automatic calibration:

- ▶ Calibration can only be done for a single, flat, horizontal ground plane.
- ▶ For MIC and AUTODOMES, a proper vertical mount is assumed, otherwise the global calibration will not work.
- ▶ The more horizontally the camera is looking, the more accurate calibration needs to be, and automatic calibration may not be accurate enough.
- ▶ The larger the focal length and covered distance, the more accurate calibration needs to be, and automatic calibration may not be accurate enough.

#### Limitations of automatic classification of object type in Perimeter tracking (3D), People tracking (3D):

- ▶ Camera must be calibrated and 3D tracking must be active
- ▶ No differentiation of crawling or rolling persons from animals. Only upright walking or standing persons are classified as persons.
- ▶ Persons and bikes seen from the front are easily confused. A bike from the front will only be classified as such if it is fast enough, otherwise it will be classified as a person.
- ▶ No differentiation between bicycle and motorbike.
- ▶ Small objects with only a few pixel can be confused (for example, objects far away from the camera).
- ▶ Object class may change over time.
- ▶ All objects start as an unknown object. They are only classified over the time if the object class can be determined sufficiently reliable.

#### Limitations of color configuration:

- ▶ An object is almost never displayed in a consistent color in the image data. Pixels on the outer edge of a detected object in particular often contain the color information of the background and not the object. Objects

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such as automobiles comprise a variety of parts (body, windows, tires). Each individual part of the object is displayed in a different color, for example the mudguards in red and the tires in black.

- ▶ The color properties of an object depend upon the lighting conditions. If the lighting conditions in a captured image changes, then the captured color of the object also changes. Objects on a street appear in different hues depending on the time of day and weather conditions.
- ▶ An object that changes its position or direction of motion may then appear with different color properties. For example, automobiles are often marked on the side in color but not on the back. When people are seen from the front, the hue of the face determines the color impression; however, if the person turns around, the color properties are then defined by the hair or headdress.
- ▶ Having a lot of different colors of the spectrum selected and low precision set nearly the entire color spectrum is selected to be detected. This means nearly all colors might trigger unwanted alarms. It is suggested to be more selective and/or precise in these cases.
- ▶ To define a specific color nuance, use the slider for saturation to select from more colors out of the spectrum. Up to five colors can be selected for one object. The importance of the colors in the search is from left to right: 25%; 20%; 15%; 10%; 5%. The reason to start with 25% is that objects normally consist of several colors, e.g. a car out of windshields (white or mirror effect), tires (black or dark grey), bumpers (black or dark grey) and finally the car paint we are actually looking for. The pure car paint might cover just 25% of the object therefore the algorithm starts with 25% as for the main color to guarantee realistic search results.
- ▶ With the slider precision you define the accuracy of the color match in alarm detection. With the slider being at the far left side (meaning "0") the selected color is not detected at all. With the slider at the far right ("full"), the color has to match exactly to be detected. Be aware that this "selected range of accuracy" is shared across all several selected colors. This means: one color could take all range of accuracy for itself and the other colors hence have to match exactly or all of the colors share less accuracy for each of them.

#### Limitations of any 3D tracking modes:

- ▶ To activate any 3D tracking, a calibration of the scene is required. If the scene is not well calibrated the tracking may deliver wrong or no results. Both tracking modes assume that all objects move on a single flat ground plane. Multiple floors, staircases, vertical object motion etc. may lead to wrong results.
- ▶ 3D tracking requires a camera height of more than 2.5 meter (above 3 meter recommended) to work robustly. By using more elaborate algorithms and prior real-world knowledge, the 3D tracking mode can improve the object tracking robustness.
- ▶ In 3D tracking modes, objects that are located entirely above the horizon (e.g. flying objects) are not detected, since object motion here is restricted to the ground plane.

#### Limitations of People tracking (3D):

- ▶ For a top-down perspective: Heights of the camera more than 3 meter (recommended 4 meter). Lens to be chosen that head diameter of heads of persons is optimally between 7% and 14% of the screen width and 8% and 16% of the screen heights.
- ▶ Calibration of the scene is required, and tracking should be set to "3D people tracking".
- ▶ Other moving objects, reflections on the ground, blinking lights, changing light conditions, shadows, trolleys or persons carrying bags or umbrellas can lead to wrong counting results.
- ▶ Children close to other persons may not be detected.

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- ▶ The algorithm is not suitable to count persons in crowded areas, or to count persons that stand still for a very long time.
- ▶ The amount of people that can be tracked in real time is ~20
- ▶ If more than this amount of people is in the scene, there will occur more and more frames without metadata. The tracking will continue correctly nonetheless as long as possible.
- ▶ Line counting at the edge of the field of view may not work.
- ▶ It will not work in low lighting conditions.

### Limitations of counting:

- ▶ In addition to the limitations of 3D people tracking, partly concealed objects, objects which cannot be tracked well, e.g. because of speed, background conditions or size will lead to wrong counting results.
- ▶ The counter can be reset by reloading the configuration or via a RCP+ command.

### Limitations of Ship tracking (2D):

- ▶ Only available in IVA Pro Perimeter.
- ▶ The tracking mode “water vehicle tracking” needs to be enabled.
- ▶ This tracking mode should not be used to track people at a shore.
- ▶ Applications like a lock where water rushes in white foam into the lock once the doors are opened are not supported.
- ▶ False alerts may occur due to high waves.
- ▶ Two boats following each other closely will be detected as one boat only, as the wave of the first boat and thus the second boat as well will be suppressed.

### Limitations of Base tracking (2D), Traffic tracking (2D), Traffic tracking (3D):

- ▶ Detection requires the object to be occluded by less than 50%.
- ▶ Top-down views (birds eye views) are not supported.
- ▶ Traffic tracking (3D) requires calibration in order to be activated. It corrects object detections based on size and location, providing more stable tracking, speed and geolocation.
- ▶ Bikes seen from the front can be confused with persons as they look very similar. Also, bus and trucks may be confused.
- ▶ Rolling, crawling and camouflaged persons will not be detected.
- ▶ Not available on CPP13 in corridor mode 90° / 270° image rotation.

### Limitations of Visual gun tracking (2D):

- ▶ Detection requires the object to be occluded by less than 50%.
- ▶ Top-down views (birds eye views) are not supported.
- ▶ Objects need to be visible for at least 1 second.
- ▶ Not available in corridor mode with 90° image rotation.
- ▶ Object color not available.

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### Limitations on panoramic cameras:

- ▶ The algorithms run on the warped image only, though the results can be transformed into de-warped image views.
- ▶ The calibration wizards are not available as they are based on straight lines not available in the warped image.

### Limitations of geolocation:

- ▶ The camera needs to be calibrated and given a geolocation itself. Tracking is only possible on a single ground plane.
- ▶ Performance will be better if 3D tracking mode is enabled.
- ▶ A viewer to show the geolocations on a map is needed.

### Limitations of idle/removed object detection in IVA Pro Perimeter:

- ▶ Placed / taken object detection is most robust if the object placed or taken is much smaller than the object which handles it.
- ▶ If a person places or removes a bike, the bike can be detected as placed / taken or as started / stopped as the bike is similar in size to the person. Therefore check for all idle / removed objects if this is of interest.
- ▶ Cars should always be detected as started / stopped objects as they are much larger than persons entering or leaving them.
- ▶ In regions with much background movement only stopped objects will be detected. Activation of the detection all other idle / removed object types in these regions is only possible by deactivating the noise suppression.

### Limitations of Camera Trainer:

- ▶ Training is only possible via the Configuration Manager. Minimum Configuration Manager version: 6.20
- ▶ Training samples are stored in the Configuration Manager. When needing to configure the Camera Trainer detectors from another computer, the samples need to be transferred by hand by saving the VCA configuration under VCA -> Main Operation on the computer with the samples, and loading the VCA configuration from the other computer. The Configuration Manager adds the samples to the VCA configuration and recovers them from there.
- ▶ Target objects must have distinct edge patterns which are different to anything else in the scene.
- ▶ Objects that are too similar to each other in their edge patterns cannot be separated. This includes not being able to distinguish different car models, person identification, wearing helmets or safety vests.
- ▶ Target objects in the image must have a similar size in pixels, similar perspective from the camera to them, similar pose and similar background.
- ▶ The object color filter is not available nor used for Camera Trainer objects.
- ▶ No 3D evaluation including geolocation or speed for Camera Trainer objects.
- ▶ Not usable for intrusion detection
- ▶ Minimum FW version: 7.10

### Limitations of Autocalibration

The Autocalibration uses AI technology to detect and analyze cars in the scene in order to determine calibration



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parameters. It cannot work if there are no cars in the scene  
The following cameras are supported:

► FLEXIDOME 5100i (IR):

- NDV-5702-A
- NDV-5702-AL
- NDV-5703-A
- NDV-5703-AL
- NDV-5704-A
- NDV-5704-AL
- NDE-5702-A
- NDE-5702-AL
- NDE-5703-A
- NDE-5703-AL
- NDE-5704-A
- NDE-5704-AL

► DINION 7100i IR:

- NBE-7702-ALX
- NBE-7703-ALX
- NBE-7704-AL

### Limitations of auto-distortion handling in the calibration

The following cameras are supported:

► FLEXIDOME 5100i (IR):

- NDV-5702-A
- NDV-5702-AL
- NDV-5703-A
- NDV-5703-AL
- NDV-5704-A
- NDV-5704-AL
- NDE-5702-A
- NDE-5702-AL
- NDE-5703-A
- NDE-5703-AL
- NDE-5704-A
- NDE-5704-AL

► DINION 7100i IR:

- NBE-7702-ALX

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- NBE-7703-ALX
- NBE-7704-AL

## 5. System Requirements

- ▶ Configuration Manager 7.71 or newer

Additional information:

- ▶ The software functionality is part of the firmware release 8.90 / 9.00 and higher, for the products listed to support it.
- ▶ Set-up of IVA Pro, Intelligent Video Analytics and Essential Video Analytics is achieved using Configuration Manager 7.71, which is available for download via the Bosch Website.
- ▶ IVA Pro consumes CPU power – please check chapter 4 (Specific Explanations and Limitations) for details.
- ▶ Forensic Search is a system feature of Bosch Video Management System (BVMS) and BVMS Viewer.