



From STDN/PRM	Product Management Markus Wierny	Telephone +49 911 93456 0	Nuremberg 07.03.2012
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Release Letter

Product:	<i>IVA Intelligent Video Analysis</i>
Version:	<i>5.5</i>

1. General

Intelligent Video Analysis (IVA) version 5.5 is the successor of IVA 4.5. IVA is a continuously growing product with an additional feature "Counting". In addition we improved the IVA tracking algorithm again to the next stage. An improved calibration method makes it easier to set up highly sophisticated scenarios.

IVA 5.5 again is coming as a free upgrade to IVA 4.5.

IVA 5.5 supports all of the already well known IVA 4.5 features.

For thermal cameras (VOT series) the user interface was adapted. To make things easier and better

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understandable, settings which can only be changed in configuration mode are removed in the replay and search interface.

All installed and running IVA4.5 licenses are upgraded automatically when the BVIP device is upgraded to firmware version 5.50. This means that even new to install licenses of IVA 4.5 are going to transform to IVA 5.5 licenses automatically if the device already has firmware version 5.50.

IVA 5.5 is the latest and most advanced video content analysis algorithm by Bosch available for the following BVIP products:

- VIP X1600 XFM4
- VIPX1 XF
- Dinion 2X IP (IVA Enabled & Ready Versions)
- Dinion IP (IVA Enabled & Ready Versions)
- FlexiDome 2X IP (IVA Enabled & Ready Versions)
- Flexidome IP (IVA Enabled & Ready Versions)
- VG4 AutoDome (H.264) IP series
- Autodome Easy II
- Autodome Easy HD
- VOT 320V
- DinionHD 720p (IVA Enabled & Ready Versions) FlexidomeHD 720p (IVA Enabled & Ready Versions)
- DinionHD 1080p (IVA Enabled Versions)
- FlexidomeHD 1080p (IVA Enabled Versions)

The metadata generated by IVA, transmitted to live video or to storage, are used to display overlay graphics and allow retrospective forensic search using Bosch Video Client (BVC) and Bosch Video Management System (BVMS).

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2. Introduction

IVA is a software algorithm that detects behavior of objects within an environment monitored by a video camera and generates alarm events that can be processed further in a CCTV system.

IVA 5.5 is a licensable option for VIP X1 XF and VIP X1600 XF family devices as well as for Dinion 2X IP and FlexiDome 2X IP cameras, Autodome Easy II, Autodome Easy HD and the VG4 AutoDome (H.264) IP series and runs also on all IVA enabled Bosch IP cameras.

IVA makes it possible to capture and evaluate directional movement of objects, applying configured filter rules, combining these rules, and thereby largely preventing false alarms.

IVA adapts automatically to changing environmental conditions and is therefore non-sensitive to perturbing influences such as rain and small tree movements.

IVA 5.5 provides easy to use, intuitive configuration via graphical user interface as a part of an advanced wizard structure in the IVA Task Manager. Improved with an intuitive configuration option it is now possible to provide the complete property information (size, speed, aspect ratio, direction, color, head...) for an object just by clicking it in the live scene.

IVA 5.5 comes with a filter set including color, now enriched with head detection which allows to filter for whether people are involved in a scene or not.

IVA 5.5 is able to detect idle and removed objects, and also to detect “loitering” objects.

For applications with the camera being installed on non-stable mounts the algorithm provides image stabilization for more reliable object detection and tracking. This feature is only available in the VIPX 1600 XFM4

With the auxiliary function IVA 5.5 Flow the algorithm supports optical flow to detect the direction of objects independent from the structure of the background and the size of the objects.

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3. Features

- Robust motion detection indoor and outdoor
- Enhanced background learning algorithm from Bosch's own research group
- Graphical statistics for more transparency regarding alarm results
- Easy configuration due to the wizard structure of IVA Task Manager
- Now enriched with intuitive "Click-object-in-scene" configuration
- Up to eight independent tasks for alarm generation can be created per channel
- The sensitive area as well as single or multiple detector fields are graphically drawn into the scene of every task for flexible and easy configuration
- Filters for object size, speed, two-way direction, aspect ratio, color and now even head detection are available to create more specific detection rules for every task
- Enhanced camera calibration with a choice of two calibration modes and direct feedback as to the unambiguity of the calibration
- Basic crowd detection based on three predefined "crowd detection areas" based on the reference picture.
- Improved calibration method "Assisted Self Calibration" which provide an easy method to calibrate "normal" rectangular scenes.
- New features which needs calibration:
 - Enhanced tracking, which tracks objects on the ground plane
 - Birds eye view (BEV) people counting which optimizes counting people from above

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The following tasks can be selected for IVA 5.5:

- Detecting objects entering or leaving an area or just being within it (detector field)
- Detecting loitering in an area related to radius and time
- Detecting idle objects
- Detecting removed objects
- Detecting trajectories/routes of objects passing by in the scene
- Detecting line crossings from single line up to three lines combined in a logical row
- Detecting condition changes for properties like size, speed, direction and/or aspect ratio within a specified time span
- Crowd detection (if device supports reference image)
- Counter and people counter from above

The following tasks can be selected for IVA 5.5 Flow:

- Detecting flows in a certain area and if needed filter for the main direction speed and activity of the moving objects:
 - The user may define up to two flow directions
 - In counter flow mode the user does not have to define a main flow direction. Instead, the algorithm automatically detects the direction of the main flow and triggers an alarm if objects move against this direction
- Crowd detection (if device supports reference image)

Additional features:

- Two different VCA configurations (profiles) per encoder/IP camera allow for different settings

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for different conditions (like day and night)

- Ten different VCA configurations (profiles) for the AutoDome series permit to combine a dome preset position with a certain VCA configuration (profile)
- Alarm Task Scripting offers the possibility to even combine tasks logically

General features:

- Image stabilization for more reliable object detection and tracking in applications with cameras installed on non-stable mounts
- 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.

4. Specific Explanations and Limitations

- Video content analysis is running on a separate hardware accelerator (FPGA) which means IVA is running totally independent from the H.264 encoding or other functions.
- You have to choose between IVA 5.50 and IVA 5.50 Flow. It is not possible to run both functions at the same time.
- 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:
 - a reflective metal background
 - glass (glazed building frontages)
 - water as a background

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- 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. Objects that always move uniformly (such as clouds) do not impair the detection of other objects and do not trigger false alarms.
- Tree movement is covered with slow continuously and uniform wind. If tree movement and another object might overlap nearby, it might come to false detections. Please avoid this by adjusting the camera position.
- Hard wind and fast storms as well as heavy peak blasts from different directions, especially in the foreground of a scene, might trigger false alarms.
- Crisp sharp shadows of clouds/trees/buildings that appear suddenly and crisp to the scene due to moving clouds and strong sun may also be detected as objects. Soft shadows are covered by the algorithm.
- An object in strong sun 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.
- Image stabilization can cost significant CPU load, so use it only in case needed otherwise

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switch it off. It can cover camera vibrations which may result in pixel variations over the whole picture/scene. A total shifting by up to 2% of the camera image/scene between two frames is possible. This feature is only available in the VIPX 1600 XFM4.

- Minimum object size to be reliably detected by IVA needs to be bigger than 3% of the whole scene.
- Minimum object size for a reliable detection in IVA 5.50 Flow must be at least eight blocks, each with a size of 8 x 8 (QCIF-pixel).
- Objects too fast which cross the camera view in less than two seconds, might not be detected by IVA 5.5 Flow.
- Only if a channel has activated a valid IVA license, it can 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 IVA enabled for the recording.
- 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).
- “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

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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.

- Precision slider for color configuration: Please be aware that 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.
- 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 IVA starts with 25% as for the main color to guarantee realistic search results.
- Again it has to be mentioned that an object is always detected within its outlines that could cover additional background. That is to be taken into account with metric and of course color as well.
- With the slider precision you define the accuracy of the color match in alarm detection. Be aware that this “selected range of accuracy” can be used for only one color or shared between 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.

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- IVA 5.50 Flow is only capable to detect objects that have an almost constant velocity and linear movement.
- Heavy camera movement like camera pans and camera vibration can cause false alarms and lead to objects not being detected with IVA 5.50 Flow.
- The higher the sensitivity value, the more tolerant is IVA 5.50 Flow in detecting objects that are temporarily covered.
- The range of the main flow must at least have 45° to detect even objects that move slowly.
- For 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.
- To activate “Enhanced tracking” or “BEV people counting” 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.
- “Enhanced 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 “enhanced tracking” mode can improve the object tracking robustness.
- In “Enhanced tracking” mode, 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 BEV people counting
 - 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

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- 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.
- The algorithm is not suitable to count persons standing in a queue or in crowded areas (more than 10 people in the field of view).
- Line counting at the edge of the field of view may not work.
- People counting will not work in low lighting conditions.
- BEV on the VIPX1600 XF works only reliable if you use every other input.
- Limitations of counting
 - In addition to the limitations of BEV people counting, 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 BEV counter or the normal counter can be reseted either by reloading the IVA configuration or via a RCP+ command.
- Limitation on thermal cameras e.g. VOT
 - Thermal cameras do not support tamper detection.
 - The following Tasks are not supported: "Tampering", "Crowd detection", "BEV People Counter", Idle und Removed object detection.
 - Features as Head Detection and Color based detection are also not available.

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- IVA/Flow 5.50 is only working on the pure BVIP H.264 products. Please see the following table:

Device Type	Firmware	IVA version
VIP X1	2.5x	IVMD 1.0
VIP X2	2.5x	IVMD 1.0
VIP X1 XF	<= Arm_4.10	IVA 4.0
VIP X1 XF	<= Arm_4.5x	IVA 4.5
VIP X1 XF	>= Arm_5.5x	IVA 5.5
VOT 320	<= Arm_4.10	IVA 4.0
VOT 320	<= Arm_4.5x	IVA 4.5
VOT 320	>= Arm_5.5x	IVA 5.5
VIP X 1600 M4S	<= TI_4.10	IVA 4.0
VIP X 1600 XFM4	<= TI_4.10	IVA 4.0
VIP X 1600 XFM4	<= TI_4.2x	IVA 4.5
VIP X 1600 XFM4	>= TI_5.5x	IVA 5.5
VJ X10/20/40 (SN)	<= TI_4.10	IVA 4.0
Dinion/Flexidome IP (TI-based)	<= TI_4.10	IVA 4.0
Dinion/Flexidome IP (Ambarella-based)	<= Arm_4.10	IVA 4.0
Dinion/Flexidome IP (Ambarella-based)	<= Arm_4.5x	IVA 4.5
Dinion/Flexidome IP (Ambarella-based)	>= Arm_5.5x	IVA 4.5
Autodome G4 IP (TI based)	<= TI_4.10	IVA 4.0
Autodome G4 IP (Ambarella based)	<= Arm_4.10	IVA 4.0
Autodome G4 IP (Ambarella based)	<= Arm_4.5x	IVA 4.5

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Autodome G4 IP (Ambarella based)	>= Arm_5.5x	IVA 5.5
Autodome Easy II	<= Arm_4.10	IVA 4.0
Autodome Easy II	>= Arm_4.5x	IVA 4.5
Autodome Easy II	>= Arm_5.5x	IVA 5.5
Autodome Easy HD	<= Arm_4.5x	IVA 4.5
Autodome Easy HD	>= Arm_5.5x	IVA 5.5

5. System Requirements

- Microsoft Internet Explorer 8.0 or higher
- Oracle Java Virtual Machine version 1.6.0_26
- Bosch Video Client (BVC) 1.3 with VideoSDK 5.20 B25
- Configuration Manager 4.30.0042 with VideoSDK 5.20 B25

Additional information:

- The software functionality IVA 5.50 is already part of the firmware release 5.5X (VIPX 1600 XFM4 and ARM based H.264 products) and higher, for the products listed to support IVA 5.50. It only needs to be licensed to make it operational.
- All installed IVA 4.50 licenses are upgraded automatically when the BVIP device running IVA 4.50 is upgraded to firmware version 5.5X (VIPX 1600 XFMA and ARM based H.264 products) — as far as the product is listed to be able to support IVA 5.50.
- Set-up of IVA 5.50 is achieved using Bosch Video Client (BVC) 1.3 or newer that is included on the product's CD. It is also available for download via the Bosch Website. Configuration



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Manager can be installed as often as required on any PC that shall be used for configuration of IVA 5.50 and the devices themselves.

- Bosch VideoSDK 5.20 B25 or newer is necessary to run IVA 5.50.
- IVA consumes CPU power – please check chapter 4 (Specific Explanations and Limitations) for details.
- Forensic Search is a system feature of Bosch Video Client BVC 1.3.