

People counting for safer social distancing

A stand-alone solution by Bosch Security Systems and Philips Professional Display Solutions



In partnership with

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1 Overview of the Integration

1.1 Introduction

In many camera systems that have been installed for observation and or security purpose, the Bosch camera is used as information gathering source providing video and I/O facilities for further processing elements.

In this integration application with Philips Professional Display Solutions, the video of the Bosch cameras is used to count people on the move as observed by the camera scene algorithms. Smart Data from these algorithms are sent by the camera to Philips visualization displays whenever people cross virtual “Entry” and “Exit” lines in the video scene of the camera.

The smart displays use dedicated apps to process the information coming in from the camera in order to trigger warnings, safety information and shop rules in accordance with ongoing advertisements.

A PeopleCount installation is a stand-alone product set for a one door counting application, however the flexible design allows the customer to add as many Bosch cameras and as many Philips displays as required to undertake huge counting and monitoring facilities with a total free routing concept, set up for multiple door cameras routing to multiple displays in any imaginable mapping.

You will find the multi-camera / multiple display smart connection principle in the appendix of this application note

1.2 Principle and benefit of the integration

In principle, a Bosch camera embeds onboard Video Analytics algorithms (Essential Video Analytics or Intelligent Video Analytics) that can be used to focus on people either entering or leaving a shop. Crossing a virtual line in the video at the entrance of the shop will trigger a so called “Line crossed” event in the camera. This automatically sends a notification to the Philips display where the app will manage this event. Similarly, an exit line in the same cameras will trigger an exit event when people leave the shop.

In addition to a fully automated people counting facility for a shop, the benefit for the shop owner is that the system can monitor and control an entry allowance of new visitors at any desired moment (peak times) or according to obligatory law regulations.

Selected system information can be presented in the shop owner’s favorite display format, either portrait or landscape.



Example of the portrait visualization on the display

Various content visualization effects can be provided via the display app, for example, showing visitor numbers only, a traffic light controlled entry allowance, any messages of importance and, best of all, the app can mix this format with live advertisements that will be shown simultaneously on a fixed area of the display.



Traffic light indication with visitor advice



Vertically positioned with entrance allowance information



Or combined with sequence of fashion advertisements



Example of content visualization on the display

Last but not least, the display remote control provides instant information consultation of the PeopleCount counted people in the shop by pressing “INFO”. The current number is shown at the bottom center of the screen for several seconds. If this number needs be corrected manually for any reason, then please press the UP or DOWN arrow keys.

Possible reasons for such corrections could be undetectable counts such as:

- ▶ People tailgating or sabotaging
- ▶ Personnel leaving or entering via fire exit etc.
- ▶ Rare false counts because of poor light conditions or reflections etc.
- ▶ Shopping carts being seen as persons

1.3 Building blocks of the PeopleCount integration solution

The integration solution is a ready-to-go packet, comprising of the following elements:

1.3.1 Philips display

- ▶ D-line with Android SoC : BDL4051D / BDL4150D
- ▶ Q-line with Andoird SoC : BDL3050Q
- ▶ H-line with OPS Module : BDL3202H + CRD50

1.3.2 Bosch camera with Video Analytics

All the cameras listed below should have firmware 7.61.0023 or later.

Bosch cameras have Essential Video Analytics or Intelligent Video Analytics built-in as standard:

- ▶ 3000i series (FLEXIDOME, micro or turret)
- ▶ 4000i series (FLEXIDOME or AUTODOME)
- ▶ 5000i series (FLEXIDOME)
- ▶ 6000(i) series (FLEXIDOME or FLEXIDOME panoramic)
- ▶ 7000(i) series (FLEXIDOME, AUTODOME, or FLEXIDOME panoramic)
- ▶ 8000i series (FLEXIDOME)

1.3.3 Power over Ethernet (PoE) router

4 or 8 ports router with DHCP server and wall bracket or stand for the display.

1.3.4 Software Bosch and Philips

- ▶ Android app: APK for PeopleCount app installation
- ▶ Bosch Configuration Manager (free download via [Bosch Download Area](#))
- ▶ Bosch camera VCAScript and AlarmTask script

1.4 Software on USB stick

The USB stick is not part of the product and should be added locally. Use the links provided by Philips to download the software. The PeopleCount app (for instance “PeCo 50-50.apk”) should be installed on the display via its remote control but does not necessarily need to be on the USB stick later. To ensure that the app boots autonomously when the display is switched on, the display boot order must be set to start from the USB. (see **appendix A**)

However, runtime customer text or advertisements JPG’s can be stored on the USB root directory for sequencing display purposes.

An example:

app	30/04/2020 21:48	File folder	
1920x1080.jpg	30/04/2020 21:51	IrfanView JPG File	235 KB
1920x1080-2.jpg	30/04/2020 21:51	IrfanView JPG File	311 KB
1920x1080-3.jpg	30/04/2020 21:53	IrfanView JPG File	249 KB
settings.json	30/04/2020 21:23	JSON File	1 KB

The PeopleCount app runtime configuration details are stored in the file “settings.json” and are loaded at display startup. In this “settings.json” file you can set the parameters i.e. maximum number of people allowed in the shop before the “Stop” notification appears.

Example .JSON content:

```
{
  "red" : 3,
  "green-image" : "app/green.jpg",
  "red-image" : "app/red.png"
}
```

The number **3** is the max. number of people who are allowed in the shop, which can be changed easily.

“app/green.jpg” is referring to the USB folder named “app”. This folder contains the so called “Notification content” (i.e. traffic light or warning pictures) which, in this case, are Green.jpg and Red.png. Both JPG and PNG pictures are possible.

1.5 A single camera, single display stand-alone installation example

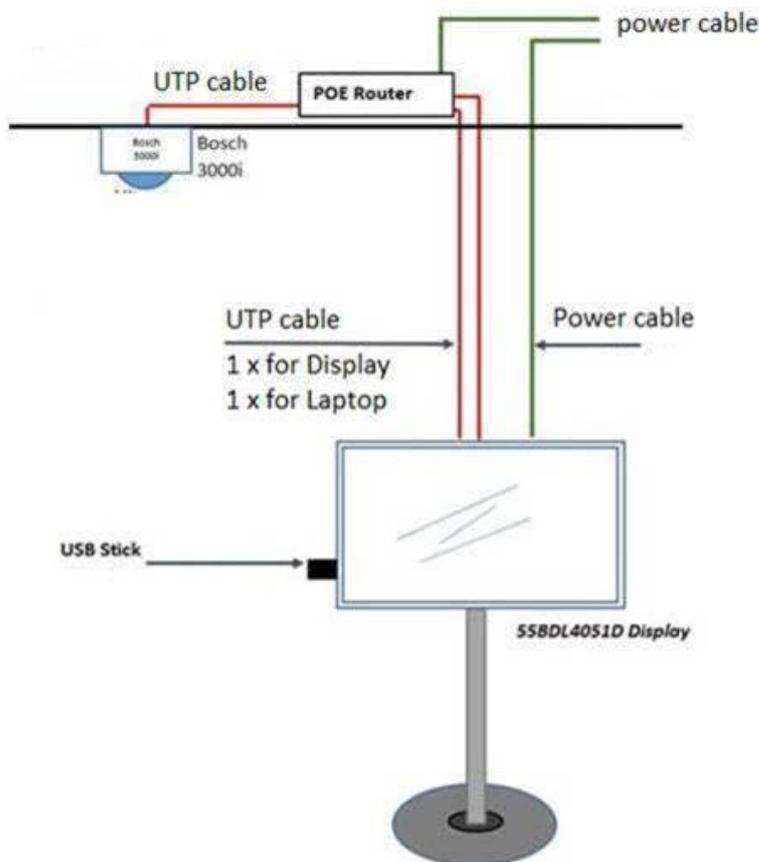
Note 1:

For other variant scenarios with multiple cameras / multiple displays, please consult **appendix B** for further details. The information below for single camera / single display is the basis for creating these variants and is used to gain knowledge to create the other variant as explained in **appendix B**.

Note 2:

To get the best people counting abilities, the camera should be mounted **top-down**. (birds eye-view)

A single camera with a single display providing people counting via single entry / exit door could be set up like this:



Example installation scheme

In the example above, the camera is mounted on a ceiling and the PoE router (see appendix C.1) is placed above the ceiling.

Two UTP cables go from the PoE router to the display. One will be connected to the display, the other is used to connect your laptop for camera calibration and service (firmware updates to the display or camera).

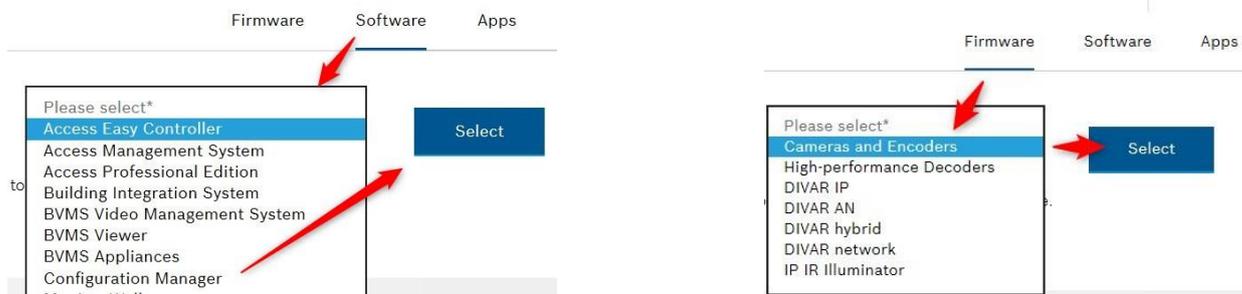
The Video Analytics algorithm in the camera aimed at the door will detect persons crossing virtual lines in the video picture.

2 Technical details and setup of the Integration

2.1 Bosch camera setup for 1 camera to 1 display counting entry & exit events

The Bosch cameras can be set up via free Bosch Configuration Manager software.

The Configuration Manager as well as latest camera firmware can be downloaded from the Bosch download site [here](#).



All camera programming can be done easily with the Bosch Configuration Manager software.

There are a few steps to setup the Bosch camera for the PeopleCount solution:

1. Identifying the Bosch camera IP address and adding an initial password
2. Adding your camera to system to access settings
3. Setting the camera installation values like height, tilt angle etc. of the camera
4. Copying the file “Bosch camera AlarmTaskScript.txt“ to the camera
5. Copying the file “Bosch camera VCAScript.txt“ to the camera
6. Adjusting the camera entry and camera exit lines on the local shop floor

2.1.1 Identifying the Bosch camera IP address and adding an initial password

Note:

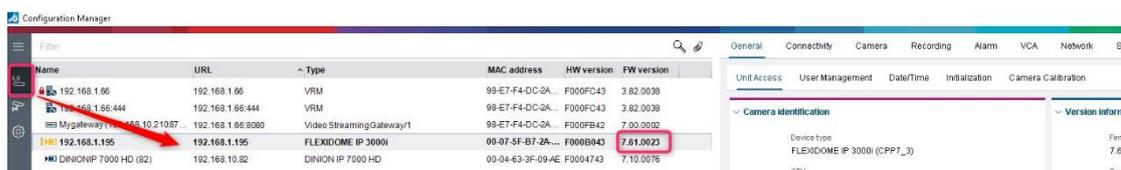
The entire description below is based on a “factory default” startup status of the camera (as found when delivered out of the box). You can go to this status at any time later by pressing the hardware reset button in the camera, located opposite the network connector (3000i series).

Press this button until the green led turns flashing red to go to factory default again.

The DHCP server in the PoE router in the network will try to provide an IP address for the Bosch camera as well as your laptop. So make sure your PC is in DHCP mode. See also appendix C.1 for router info.

The next step is to launch the Configuration Manager. (You may password protect the use of this program at start-up if you want). When your network is scanned by the software, your camera IP address will pop up in the left list automatically.

First check the listed Firmware version of your camera (expand the column until FW version is visible)

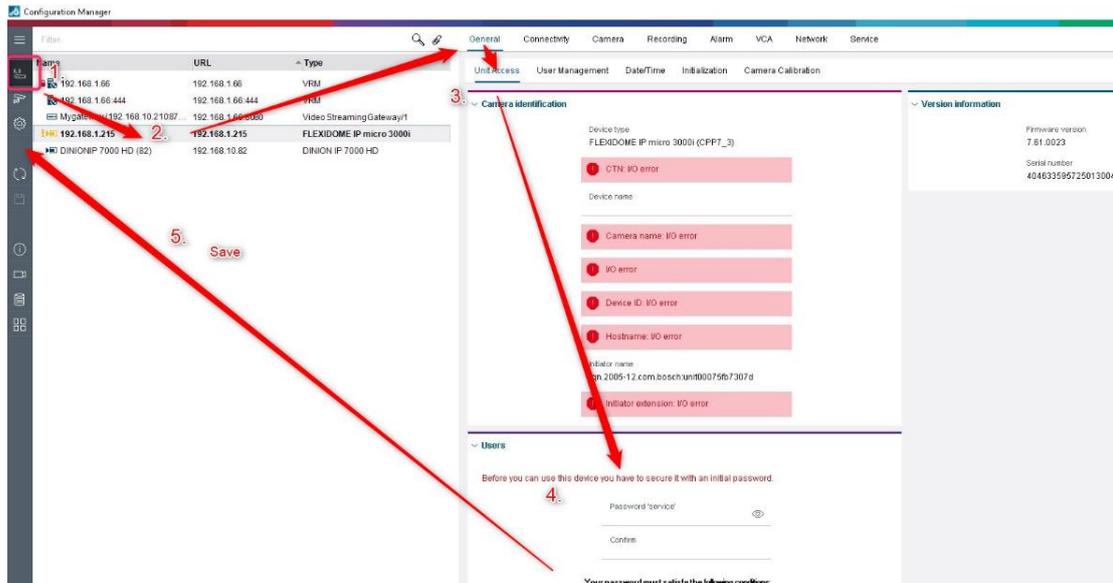


The Firmware Version must be 7.61.0023 or later, if not go to Appendix C.2 to upgrade FW first.

Find your listed camera and follow steps 1 to 5 to set an initial password for user “service” in your camera.

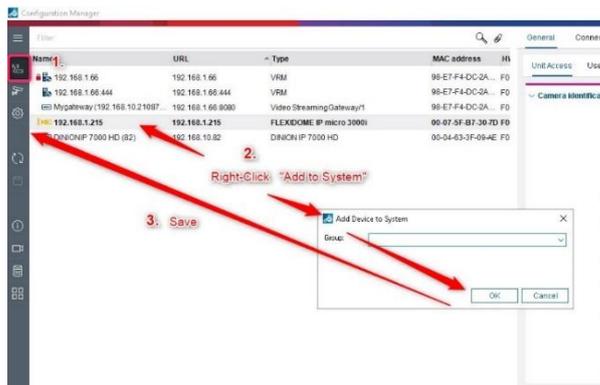
General note:

After each change of settings using Configuration Manager, please do not forget to save your changes in the left hand menu bar.

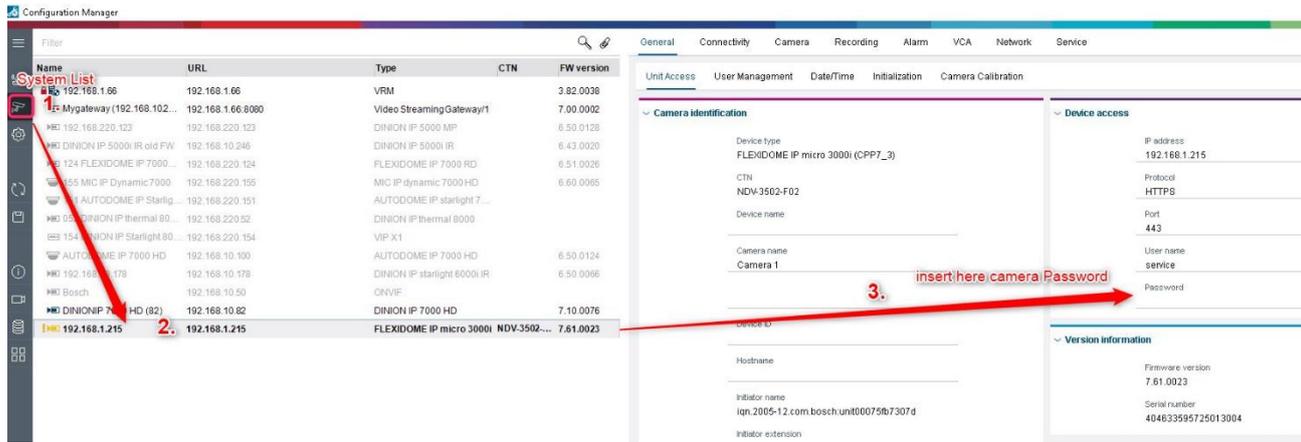


2.1.2 Adding your PeopleCount camera to “System” and authentication for Configuration Manager

Please follow these steps to add the camera to the system in order to program the correct settings later:

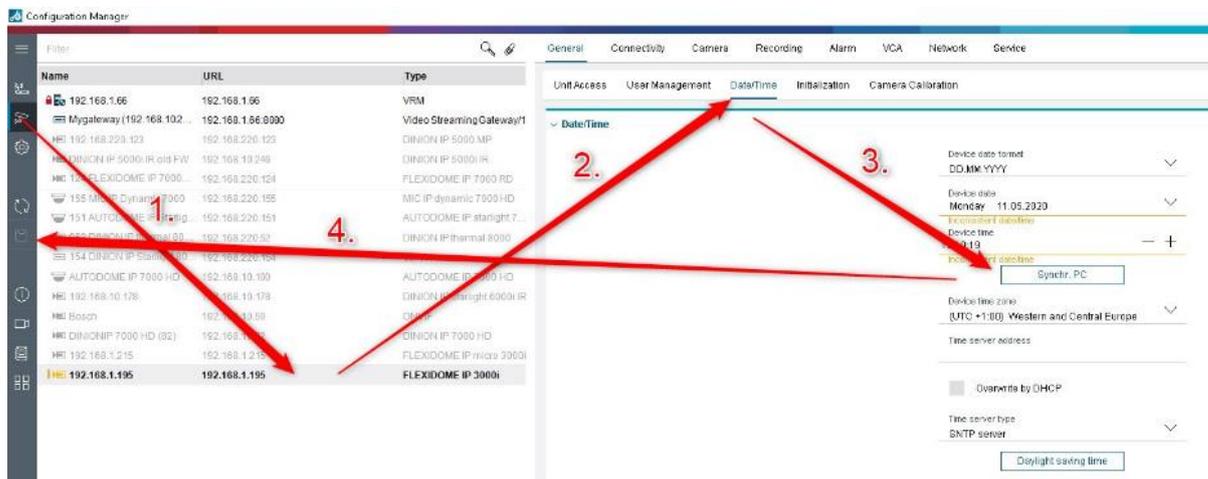


Insert the camera password here to authenticate the Configuration Manager to program the camera:



Press save in left menu bar.

Please set or synchronize the camera time to your PC like this:

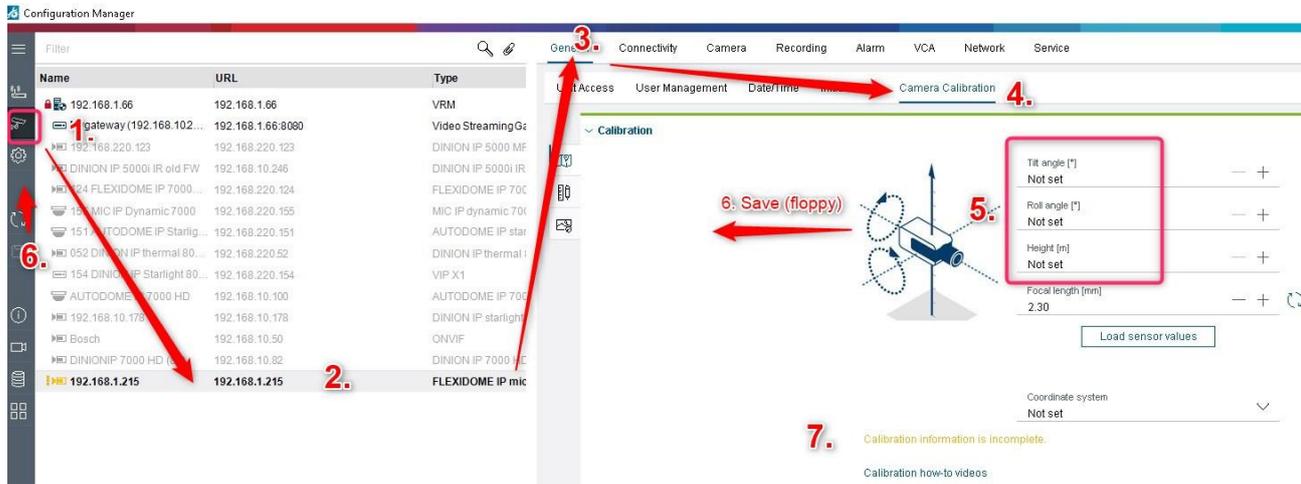


At this point you are ready to prepare the camera for the PeopleCount solution.

2.1.3 Setting the PeopleCount camera's height, tilt angle

In order to calibrate the camera for the best counting performance, some local camera elements such as height etc. need to be inserted in the camera calibration page.

Please add the values (to your best knowledge) in the following steps.



To confirm the successful calibration of the camera, the message shown in position 7 in the picture above will disappear.

2.1.4 Copying the file “Bosch camera AlarmTaskScript.txt“ to the camera

The function of this script is to convert line crossing events from the Video Analytics algorithms into HTTP messages and to send these events to the Philips Android app over IP for up / down counting purpose.

The script is a plain text file that will be compiled in the camera to send the events to the display. It looks like this:

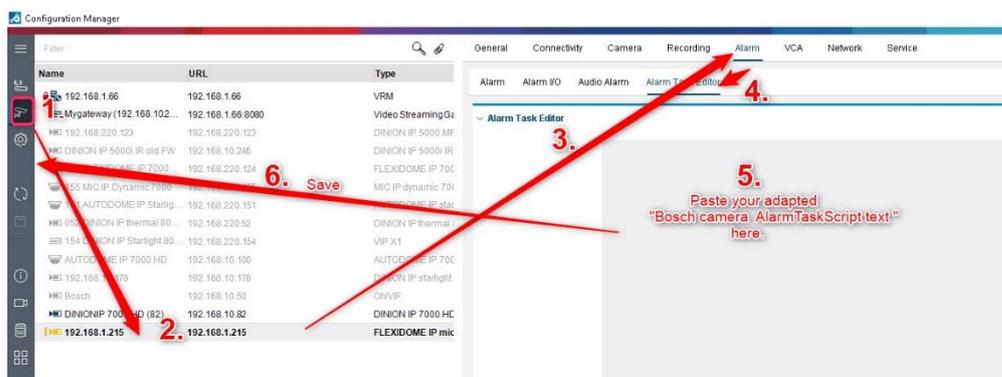
```
//Alarm Taks Script
//Define an http entry event message to be sent to the Philips Monitor. Please change to below IP number to match the Philips Monitor IP number
HttpCommand sendHttpIn:={ Command("add") SSL(false) Port(7888)IP("192.168.1.179") Name("add")};

//Define an http exit event message to be sent to the Philips Monitor. Please change to below IP number to match the Philips Monitor IP number
HttpCommand sendHttpOut:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.179") Name("minus")};

//Send and entry Event triggered via IVA Rule 1
if(VCARule(1,1)) then sendHttpIn;

//Send and exit Event triggered via IVA Rule 2
if(VCARule(1,2)) then sendHttpOut;
```

Before you can use it, please edit the above IP address in the txt file to the Philips display IP address (yellow highlight). **Please consult the display for the IP address via its remote control menu INFO-7-7.** After saving the changed script, you can copy and paste the entire script here:



Note: if errors are reported after saving, then you have to check the script for syntax errors.

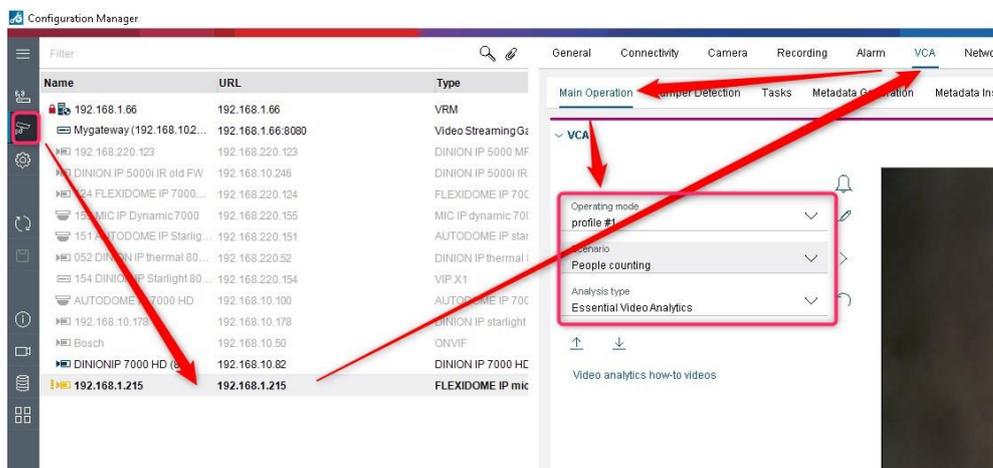
2.1.5 Copying the file “Bosch camera VCAScript.txt” to the camera

This file contains all the information for a single door camera to detect incoming and outgoing people via that door area. The file content will store a Video Analytics line concept into your camera called “PeopleCount”. It will provide an entry line and an exit line in the video scene straight away, which only needs relocation via the mouse to match the local shop floor entry / exit situation.

Note: For other scenarios for example 1 camera registering entry traffic and another 1 camera registering exit traffic but both cameras reporting to a single display or any other variants, please consult **appendix B** after reading the basics below.

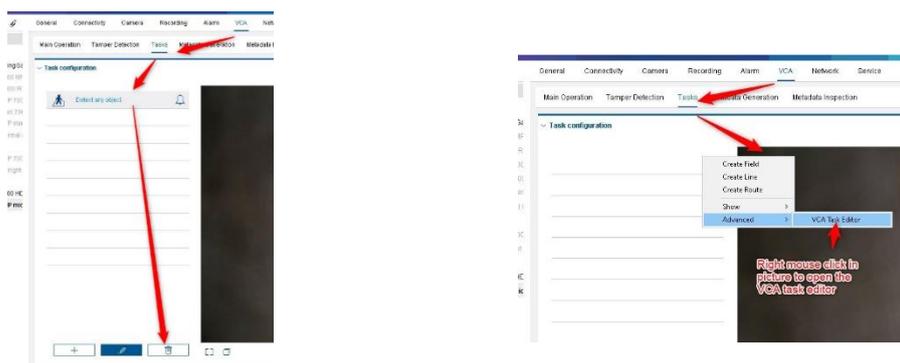
As mentioned, this script will automatically setup two detection lines in the middle of the screen. Each line has an arrow in the middle to indicate the detection direction (entry or exit). The script will report line crossing events as rule events to the Alarm Task engine to be forwarded to the Philips display app.

Before we can copy the script file to the camera, first prepare the Video Content Analysis (VCA) settings as follows:



Please also save again in the left hand menu.

Next delete the default rule "Detect any object" or any other rule and open the VCA editor with the right mouse:



The VCA Task Script for a PeopleCount setup with 1 camera and 1 display looks like this:

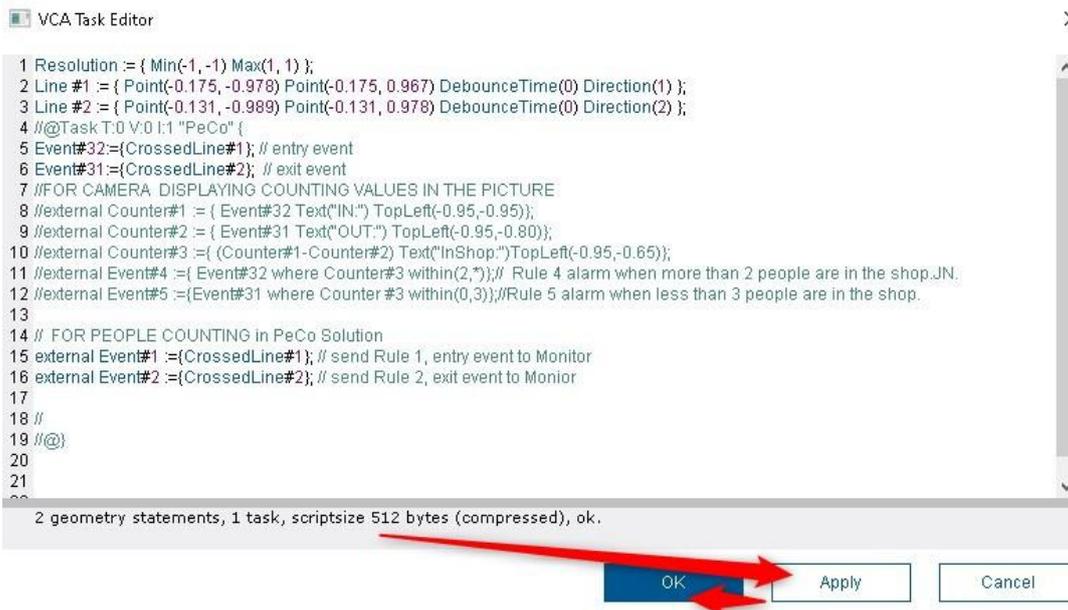
```

Bosch camera VCATaskScript.txt - Notepad
File Edit Format View Help
Resolution := { Min(-1, -1) Max(1, 1) };
Line #1 := { Point(-0.175, -0.978) Point(-0.175, 0.967) DebounceTime(0) Direction(1) };
Line #2 := { Point(-0.131, -0.989) Point(-0.131, 0.978) DebounceTime(0) Direction(2) };
//@Task T:0 V:0 I:1 "PeCo" {
Event#32:={CrossedLine#1}; // entry event
Event#31:={CrossedLine#2}; // exit event
//FOR CAMERA DISPLAYING COUNTING VALUES IN THE PICTURE
//external Counter#1 := { Event#32 Text("IN:") TopLeft(-0.95,-0.95)};
//external Counter#2 := { Event#31 Text("OUT:") TopLeft(-0.95,-0.80)};
//external Counter#3 :=( Counter#1-Counter#2) Text("InShop:")TopLeft(-0.95,-0.65)};
//external Event#4 :=( Event#32 where Counter#3 within(2,*));// Rule 4 alarm when more than 2 people are in the shop.JN.
//external Event#5 :=(Event#31 where Counter #3 within(0,3));//Rule 5 alarm when less than 3 people are in the shop.

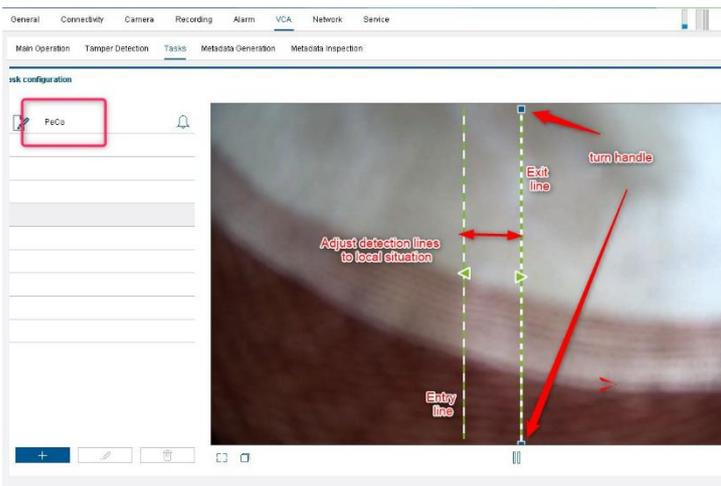
// FOR PEOPLE COUNTING in PeCo Solution
external Event#1 :=(CrossedLine#1); // send Rule 1, entry event to Monitor
external Event#2 :=(CrossedLine#2); // send Rule 2, exit event to Monitor

//
//@}
    
```

Copy and paste the entire VCATaskScript.txt content to the editor field and press **APPLY** then **OK**.



After pressing OK, the picture will show the entry and exit lines as overlays on the video.



Note:

- ▶ The left line is called “Entry line” and has a **fixed arrow indication to the left**. Crossing this line will send an ADD count (+1) to the display. (Entry line in the script is **CrossedLine#1**)
- ▶ The right line is called “Exit line” and has a **fixed arrow indication to the right**. Crossing this line will send a MINUS count (-1) to the display. (Exit line in the script is **CrossedLine#2**)

The last step is to position both lines according to the local shop floor for detection of entry and exit traffic. You can use the mouse to drag / rotate the Entry line and Exit line. Make sure the lines stay close to the center so the camera has enough time to detect approaching persons.

Caution:

If you rotate lines (with handles) in order to match the detection direction with the flow of people as seen by the camera, the line will still generate its designated count command (ADD or MINUS) So make sure you do not swap the lines called Entry and Exit because the display app will count in reverse.

To finish please press save

If you have programmed the Philips display correctly according to **appendix A** then all should work now.

Congratulations, your PeopleCount installation is ready to go.

Note: (for comprehensive Video Analytics tuning by an expert)

It is difficult for cameras to discriminate between shopping trolleys and people. It is therefore recommended that the so called "3D people tracking" should only be used in applications where there are **no trolleys**. Please seek assistance if needed.

3 Test and see the integration at work

3.1 Test setup

Please follow the USB content instructions in **chapter 1.4** as well as the Philips display setup mentioned in **appendix A** for the boot sequence settings.

To test the installation, you can test walk and use the display remote control to see count changes when pressing the “INFO” button on the remote control. Count values will appear in the center of the bottom line.

You can also temporarily observe the camera line crossings turning RED in the cameras video to verify counting events. For real time counter overlay in the camera picture itself, you have to temporarily remove the following // in the red box in the VCA Script and then press save.

After some seconds the counters will appear in the left top of the camera video.

```
Resolution := { Min(-1, -1) Max(1, 1) };
Line #1 := { Point(-0.175, -0.978) Point(-0.175, 0.967) DebounceTime(0) Direction(1) };
Line #2 := { Point(-0.131, -0.989) Point(-0.131, 0.978) DebounceTime(0) Direction(2) };
//@Task T:0 V:0 I:1 "PeCo" {
Event#32:={CrossedLine#1}; // entry event
Event#31:={CrossedLine#2}; // exit event
//FOR CAMERA DISPLAYING COUNTING VALUES IN THE PICTURE
//external Counter#1 := { Event#32 Text("IN:") TopLeft(-0.95,-0.95)};
//external Counter#2 := { Event#31 Text("OUT:") TopLeft(-0.95,-0.80)};
//external Counter#3 := { (Counter#1-Counter#2) Text("InShop:")TopLeft(-0.95,-0.65)};
//external Event#4 := { Event#32 where Counter#3 within(2,*)}; // Rule 4 alarm when more than 2 people are in the shop.JN.
//external Event#5 := {Event#31 where Counter #3 within(0,3)}; //Rule 5 alarm when less than 3 people are in the shop.

// FOR PEOPLE COUNTING in PeCo Solution
external Event#1 := {CrossedLine#1}; // send Rule 1, entry event to Monitor
external Event#2 := {CrossedLine#2}; // send Rule 2, exit event to Monitor

//
//@}
```

If counting events are registered during a walk test but not forwarded to the display, check the connection to the display and make sure that you have inserted the correct display IP setting in the ATSL script mentioned in chapter 2.1.4. (See also **appendix C.1** on network hints)

Please note that all overlaid counters can only be reset to zero which automatically happens at any save action in the Configuration Manager. It has no effect on the display app.

After your tests, please add the removed slashes (//) back in the above VCA Script and then save.

Then overlaid real-time camera counters will disappear.

4 Appendix A. Programming the Philips display

4.1 Please follow the configuration steps and the app setup for the Philips display

Note:

A webpage will be available as soon as possible to download all software as well as Philips documentation.

- ▶ For the time being, please retrieve the entire solution software here:
<https://partner.ipp.boschsecurity.com/cloud/index.php/s/9BhifAbLig7rH7l>
- ▶ For the time being, please retrieve the Philips installation manual here:
<https://partner.ipp.boschsecurity.com/cloud/index.php/s/hXpbu0BKOVXCrla>
- ▶ For the time being, please find this Bosch PeopleCount application note here:
<https://partner.ipp.boschsecurity.com/cloud/index.php/s/ZvWcsj7plCDfaFh>

5 Appendix B. Additional variable PeopleCount setups

5.1 Expanding PeopleCount cameras and displays to match any large project concept

As a Bosch camera can detect entry and exit moves via line crossing events and forward this event over IP to Philips displays, many combinations of collecting cameras as well as forwarding their data to Philips displays are possible.

Examples:

- ▶ Large stores with wide doors: 2 dedicated cameras to collect entry data and 2 dedicated cameras to collect exit data
- ▶ Many surveillance points in shopping malls: Bosch camera to send entry / exit traffic data to multiple displays at the same time
- ▶ Various shop islands in a large shopping mall with private counting but all to central monitoring center.

Note: Currently the tested maximum devices to combine in any setup is 80 cameras and 20 displays.

5.2 Alarm Task Script routing all counting events

The Alarm Task script in each camera can be programmed to distribute its entry / exit events to any Philips display in the network. Each camera will produce a Video Analytics rule 1 event for entry line crossings (VCARule(1,1)) and a Video Analytics rule 2 event for exit line crossings (VCARule(1,2)). In the IF statements a rule validation will send an HTTP to a dedicated display.

This allows the installer to route any event to any display by editing the script code.

Here is the principle code of the standard camera sending both entry and exit events to the same display:

```
//Define an http entry event message to be sent to the Philips display. Please change to below IP address to match the Philips display IP address
HttpCommand sendHttpIn:={ Command("add") SSL(false) Port(7888)IP("192.168.1.179") Name("add"); //this will send an ADD command to the display 179

//Define an http exit event message to be sent to the Philips display. Please change to below IP address to match the Philips display IP address
HttpCommand sendHttpOut:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.179") Name("minus"); //this will send an MINUS command to display 179

//Send and entry Event triggered via IVA Rule 1
if(VCARule(1,1)) then sendHttpIn;

//Send and exit Event triggered via IVA Rule 2
if(VCARule(1,2)) then sendHttpOut;
```

5.3 One PeopleCount camera to send counts to 2 (or multiple) Philips displays

The blue lines in this camera could look like this:

```
HttpCommand sendHttpIn179:={ Command("add") SSL(false) Port(7888)IP("192.168.1.179") Name("add"); //this will send an ADD command to the display179
HttpCommand sendHttpIn200:={ Command("add") SSL(false) Port(7888)IP("192.168.1.200") Name("add"); //this will send an ADD command to the display200

HttpCommand sendHttpOut179:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.179") Name("minus"); //this will send an MINUS command to the display 179
HttpCommand sendHttpOut200:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.200") Name("minus"); //this will send an MINUS command to the display 200

//Send and entry Event triggered via IVA Rule 1
if(VCARule(1,1)) then sendHttpIn179,sendHttpIn200;

//Send and exit Event triggered via IVA Rule 2
if(VCARule(1,2)) then sendHttpOut179,sendHttpOut200;
```

5.4 Multiple PeopleCount cameras to send counts to one Philips display

Camera 1.

AlarmTask Script text:

```
HttpCommand sendHttpIn:={ Command("add") SSL(false) Port(7888)IP("192.168.1.179") Name("add"); //this will send an ADD command to the display
HttpCommand sendHttpOut:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.179") Name("minus"); //this will send an MINUS command
//Send and entry Event triggered via IVA Rule 1
if(VCARule(1,1)) then sendHttpIn;

//Send and exit Event triggered via IVA Rule 2
if(VCARule(1,2)) then sendHttpOut;
```

Camera 2.

Alarm Task Script text:

```
HttpCommand sendHttpIn:={ Command("add") SSL(false) Port(7888)IP("192.168.1.179") Name("add"); //this will send an ADD command to the display
HttpCommand sendHttpOut:={ Command("minus") SSL(false) Port(7888)IP("192.168.1.179") Name("minus"); //this will send an MINUS command
//Send and entry Event triggered via IVA Rule 1
if(VCARule(1,1)) then sendHttpIn;

//Send and exit Event triggered via IVA Rule 2
if(VCARule(1,2)) then sendHttpOut;
```

Camera X:

Alarm Task Script text

Etc.

5.5 Multiple PeopleCount cameras sending counts to multiple Philips displays

This is a combination of the chapter 5.3 and 5.4 examples.

This above applied concept of routing line crossing events by PeopleCount cameras allows enormous flexibility in setting up almost any routing scenario needed for large scale coverage for people counting.

6 Appendix C. Good to know

6.1 Router and DHCP

The PeopleCount solution Power over Ethernet (PoE) router can be a basic PoE router or a PoE router in an existing network. The PoE part is needed to power the camera. Of course also a normal router with PoE injector between router and camera will work.

Since the camera communicates to the display on a fixed IP address basis (via the Alarm Task script mentioned in chapter 2.1.4), the DHCP Server must be set to providing a so called “permanent lease IP address”. See router instructions.

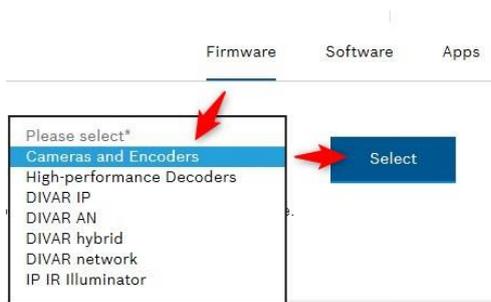
If instead of a PoE router a PoE switch is used without a DHCP server, then the installer should provide a fixed IP address during installation manually to both camera and display. (Via network settings in camera and display)

Please check their IP address availability, both camera and display should be assigned a unique IP address in the network and should be “pingable”.

6.2 Upgrading FW using Configuration Manager

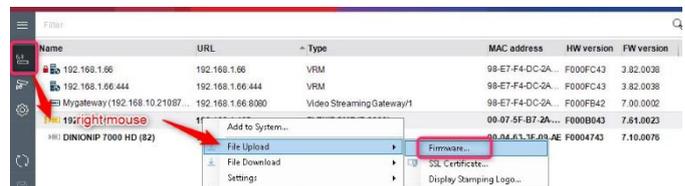
If you need to upgrade the cameras FW then download it from the Bosch Download Store to your laptop

<https://downloadstore.boschsecurity.com>



Choose the latest FW available and the correct CPP platform for your camera type. For 3000i camera this is CPP7.3

Now use the CM to upload the new firmware:



6.3 Hints to optimise Line Crossed detections

If under poor or challenging conditions, EVA cameras detection rates cannot fulfil expectations, it is recommended to use the Bosch IVA camera technology instead. IVA technology cameras are specifically designed for such conditions.

7 History

VERSION	DATE	AUTHOR	DESCRIPTION
V 1.2	May 2020	Jan Noten (BT-SC/MKI) Eindhoven The Netherlands	First version for distribution

8 Disclaimer

Bosch cannot not accept any liability on the implementation or use of scripts mentioned in this document. Your activity in developing products that interface with Bosch products is at your own risk and responsibility regarding fitness for use, completeness, faultlessness, or any claims of third parties which may arise based on such further development.



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