



People Counting Analytics

App-note

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1. Introduction

This document details the configuration of counting analytics for Head Counting using the **Top-down Head Counter** and **Top-down Head Tracker** algorithms. It also covers events, databasing, reports, and the Occupancy Dashboard.

1.1 Algorithm Requirements

There are two choices of algorithm for the standard Top-Down analytics available in CathesisVision. They are the **free algorithm** (which comes standard with CathesisVision), and the **licensed algorithm** which is only made available by purchasing Analytics Suite III. The differences are listed in the table below.

Free Algorithm	Licensed Algorithm
Top-down head counter. Counting lines are single lines only.	Top-down head tracker. Counting lines may be set to single or double. A double line only counts when a person crosses both lines. This eliminates false counts that may occur when a person remains within a confined space around a line.
Line Counter and triggers are available and a line trigger must be added for counting. Line triggers may be used to set up standard CathesisVision events which will trigger when a head is counted. It is possible to select the direction to trigger, i.e., according to the arrow indicated on the line (forward), against the arrow (reverse), or both (either).	
It is possible to add overlays to the counter to indicate the count. Multiple counters can be added per line. For example, add a forward counter and a reverse counter each with their own overlay.	
Area masks are available to select and change the area that will be used by the algorithm to count heads.	

1.2 License Requirements

License	Description
CLIC license	Standard IP camera license required for each camera used for counting.
CNRP-1000	Counting and reporting base license.
CNRP-1001	Counting and reporting counter license.
CANA-3001	Analytics – Level III.

Note: There is one CNRP-1001 license required for each direction counted on a single counter. Therefore, if counting in and out, two licenses are required. If the choice is to opt for the advanced double line trigger, then an additional CANA-3001 Analytics III license will be required, per camera.

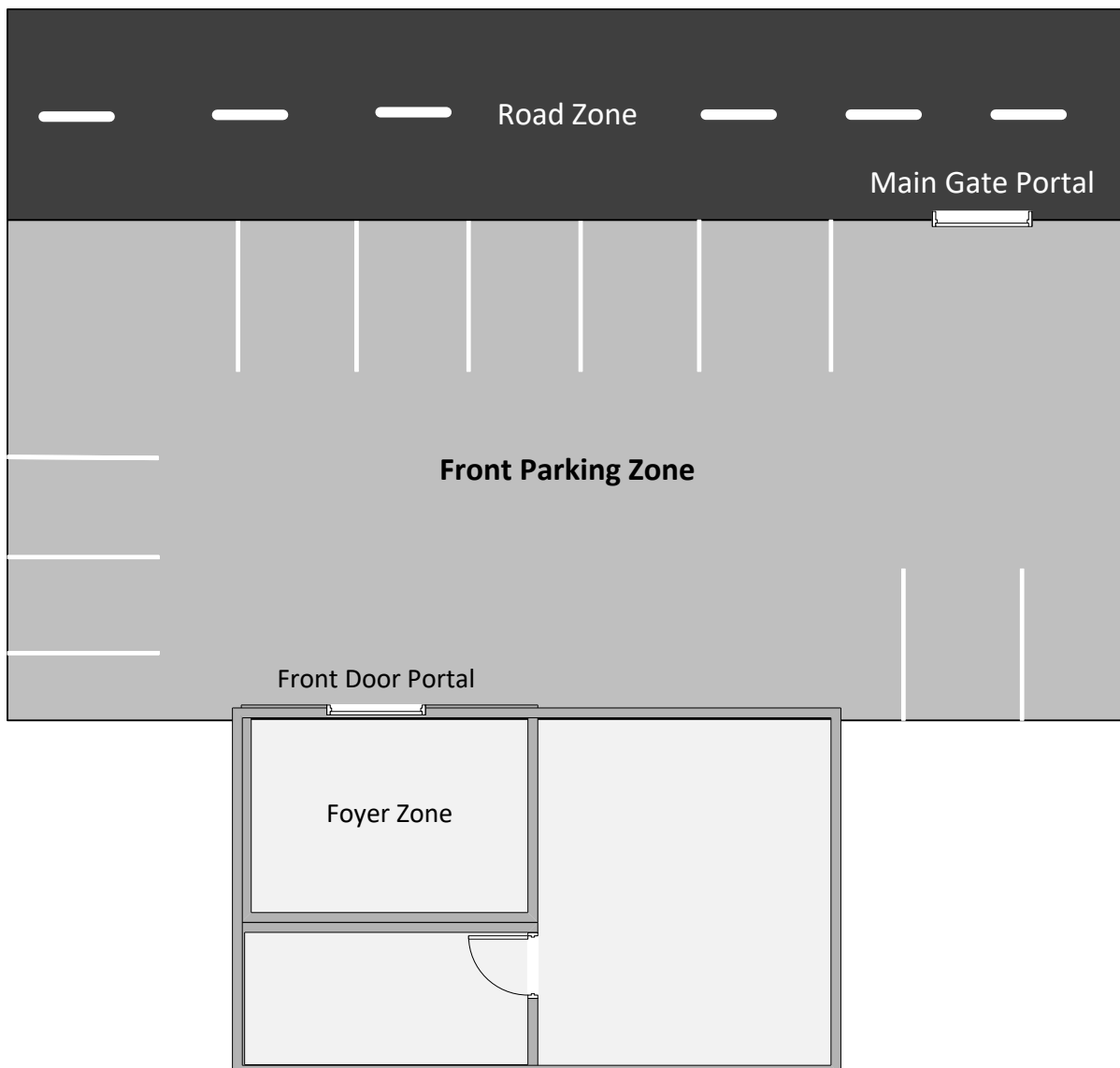
2. Concepts and Applications

This section highlights the core concepts involved in the object counting algorithm by demonstrating their application. The CathexisVision object counting algorithm works using four inter-connected concepts which inform each other. These four concepts are:

- Counters,
- Portals,
- Zones,
- Locations.

Counters are responsible for generating the actual object counts, while portals, zones and locations are the area triggers used to generate a count.

These concepts will be explained and their interconnected functions will be demonstrated by referring to the example diagram below:



Note: all the sections below refer to this example diagram.

2.1 Counters

Concept: A counter is the source of all counts and is automatically registered with the object counting system when a line counting trigger is configured on the NVR.

Example: Consider a building with a front door that has two line-counters configured over that door. One line-counter will count the people moving into the building through the door and the other line counter will count the people moving out of the building through the same door. These counters could be labeled "Front Door In" and "Front Door Out."

2.2 Portals

Concept: A portal is typically a doorway or entrance which is usually bidirectional. Counters are assigned to a portal and are given a direction so that the counting system can provide count statistics for movement across (or in/out) of that portal.

Example: To accumulate counts from the "Front Door In" and "Front Door Out" counters, the object counting system requires the counters to be assigned to a portal. That portal could be labeled "Front Door" for example.

2.3 Zones

Concept: A zone is an area that can be accessed via a portal. The object counting system is able to provide count statistics for movement from zone to zone. Zones can be designated as "Internal" or "External."

Example: Entering the "Front Door" portal from the outside could give access to a zone called "Foyer." Exiting the building via the "Front Door" portal could give access to a zone called "Front Parking." The portal would be configured with the zone "Foyer" as its "Internal Zone" and the zone "Front Parking" as its "External Zone."

Extending the example further, consider a portal called "Front Gate" that bridges the "Front Parking" and a zone called "Road."

The system is also able to provide counts for movement from one specific zone to another. For example, a single report could be generated for the last month showing:

- i. Movement from zone "Road" to "Front Parking".
- ii. Movement into zone "Front Parking" from anywhere (show counts for all movement into the "Front Parking" zone, no matter which entry portal was used).
- iii. Movement out of "Foyer" to anywhere (show counts for all movement out of the "Foyer" zone, no matter exit portal was used).

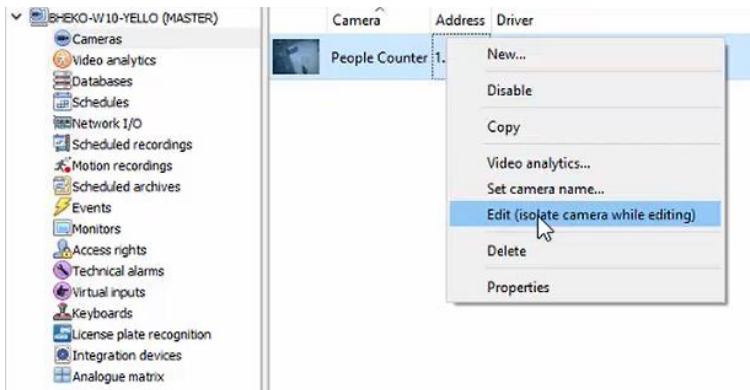
2.4 Locations

Locations allow a number of zones to be grouped together. Zones are assigned to locations and the object counting system can provide movement counts into and out of a location. The object counting system provides a count into a location by summing all movement counts to the zones assigned to that location.

3. Enable and Add Video Analytics

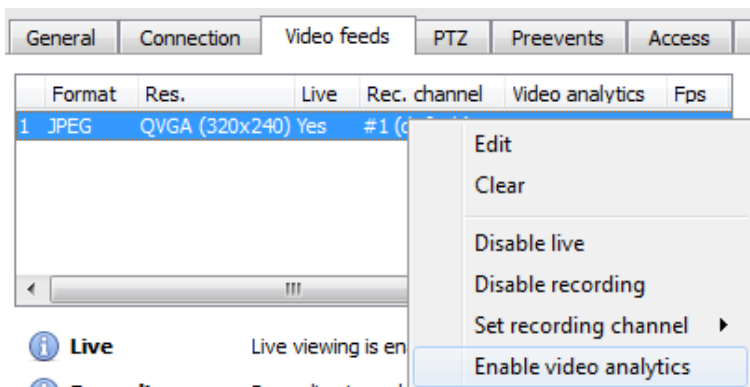
3.1 Cameras Panel

After a camera has been added (see the *CathexisVision Setup Manual*), video analytics must be enabled on it. This may be done by either editing the camera or enabling video analytics during the camera addition process.



In the **Cameras Panel**, right-click on the camera. In the drop-down menu that appears, click **Edit**.

A **Camera settings** window will appear. Click on the **Video Feeds** tab.



In **Video feeds**, right-click on the feed for which analytics will be enabled.

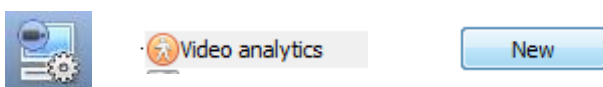
Click **Enable video analytics**.

Click **OK**.

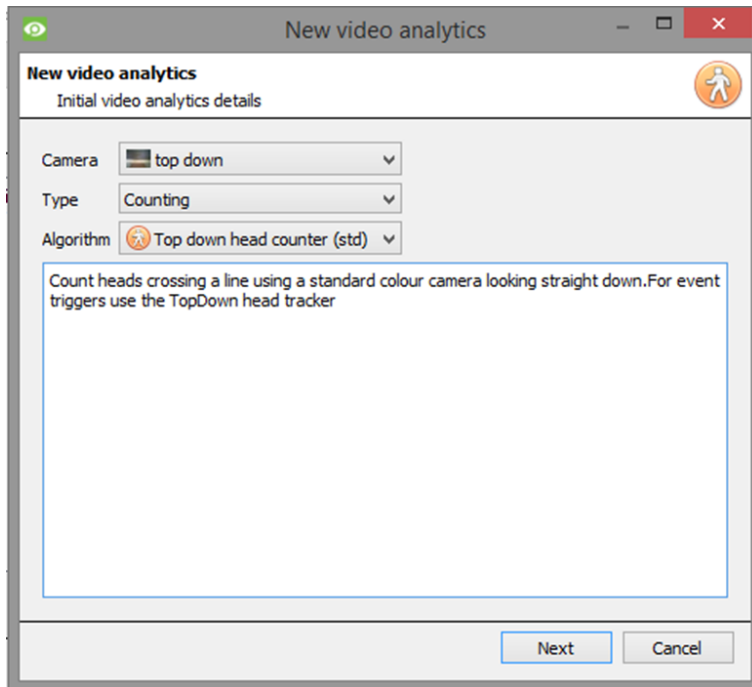
3.2 Adding Video Analytics

Please ensure that a license is available for Analytics III to use the licensed algorithms. Alternatively, the free Top-Down Head Counter can be utilised.

Navigate to **Configure Servers / Video Analytics**. Click **New**.



3.2.1 Free Algorithm (Top-Down Head Counter – std)



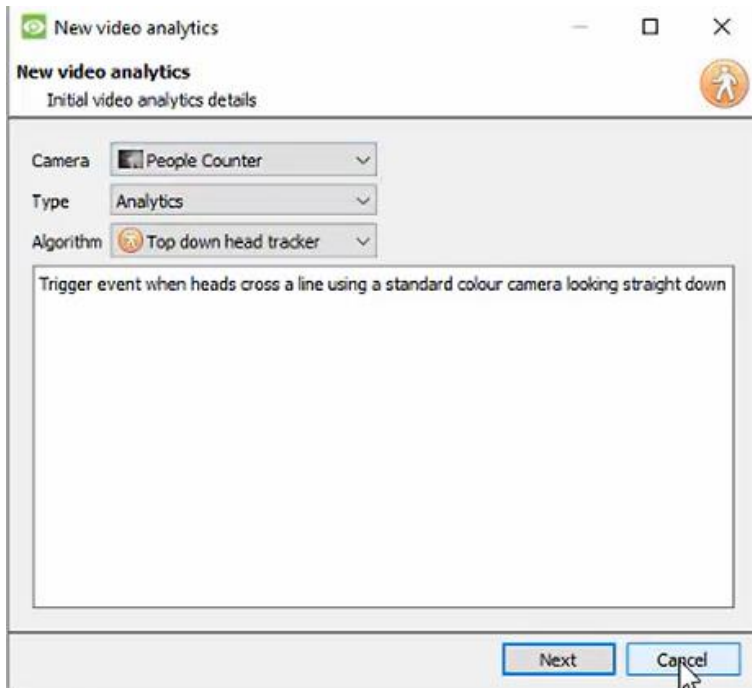
Select the Camera that requires analytics.

Select the Type of video analytics.

Select the algorithm.

Click **Next**.

3.2.2 Licensed Algorithm (Top-down Head Tracker)



Select the **Camera** that requires analytics.

Select the Type of video analytics. For people counting, select **Analytics**.

Select the Algorithm License Required for: **Top-down head tracker**

Click **Next**.


4. Configuring Top-Down Head Counter Video Analytics

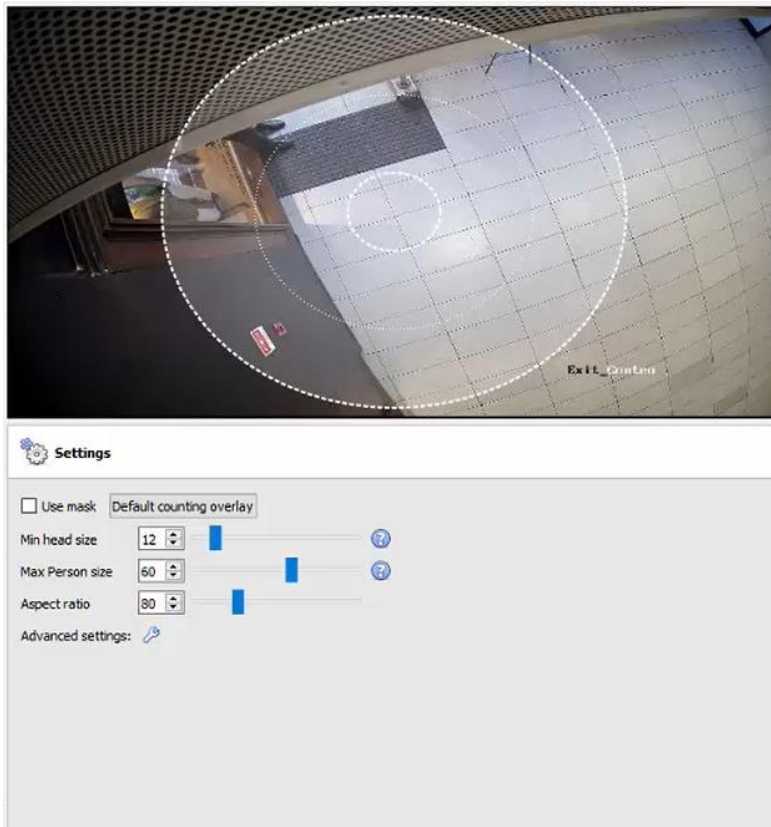
The configuration of video analytics basic interface is the same for both the free and licensed, Top-down Head Counter and Tracker. For more information on video analytics, please consult the main **CathesisVision Setup Manual**.

This section will detail configuring a Top-Down head count for both the free and licensed video analytics.

4.1 Free Algorithm (Top-down Head Counter – std)

4.1.1 Settings Panel

 **Settings** In the left panel of the configuring video analytics window, select **Settings**. This will bring up the following options underneath the camera image.



Check **Use mask** to use a mask (in red) to apply the algorithm over a specific area.

Click **Default counting overlay** to configure the way the head count number will appear as an overlay on the camera image.

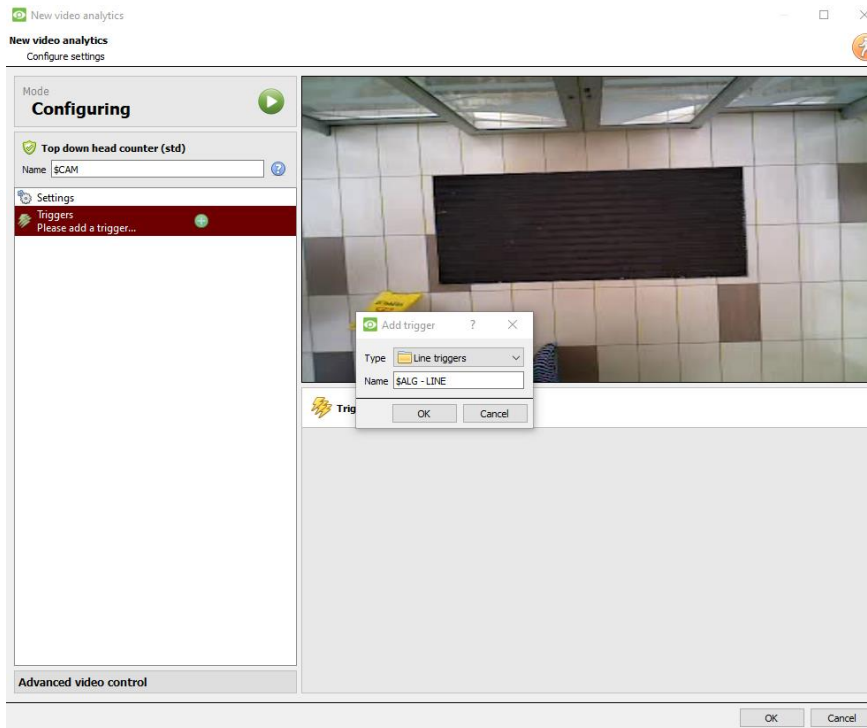
Set the **Min head size** to eliminate counting of heads which are smaller than the inner circle.

Set the **Max person size** value to split objects that are bigger than one person.

Change the Head **Aspect Ratio** to resemble the head shapes on the feed.

4.1.2 Triggers Panel

In the **Triggers** panel, at least one trigger must be added.



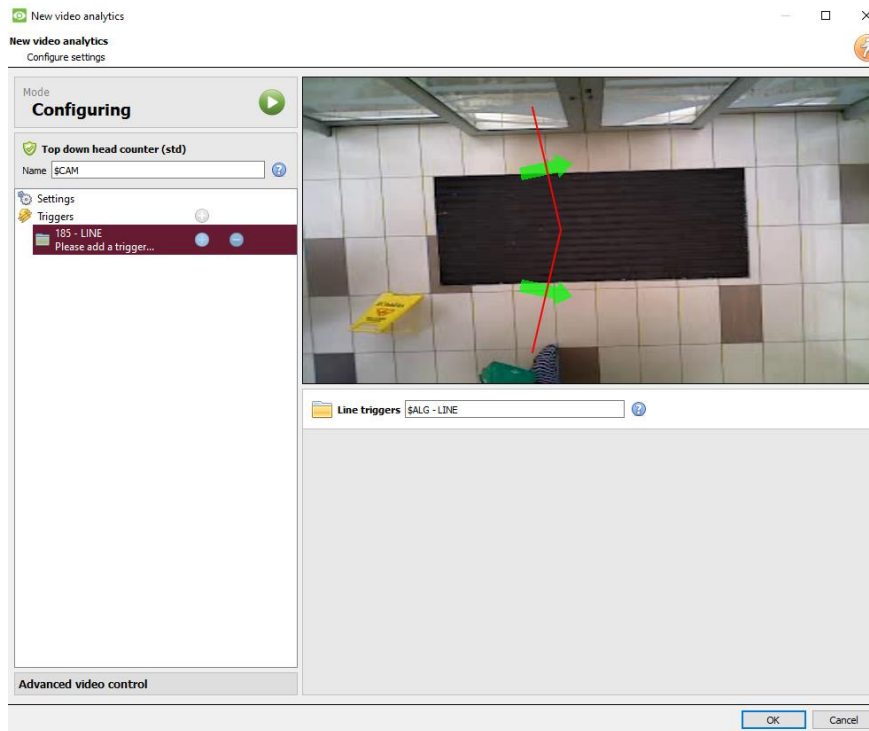
Click the **plus icon** to add a line trigger.

Add a **Name**, or leave it as the default name.

Click **OK**.

The line will now be added to the camera image.

4.1.2.1 Define the counting line



Define the line so that it covers the area where counting people crossing it is required.

Add nodes: CTRL-click the red line.

Remove nodes: Double-click on the node to be removed.

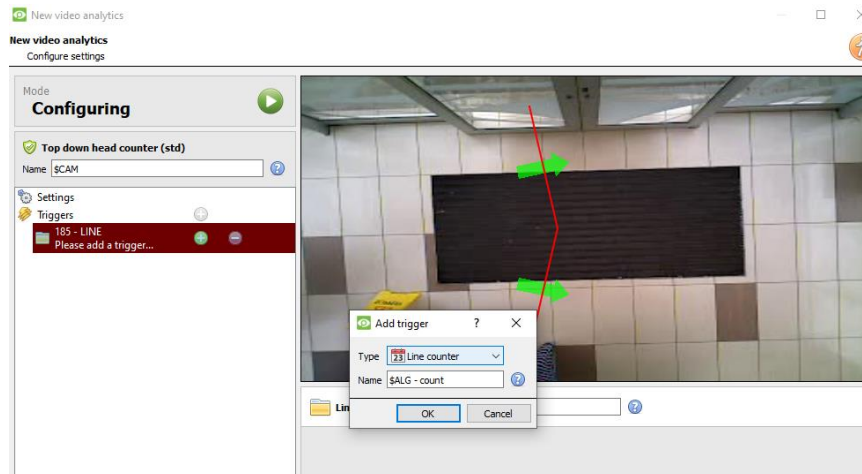
Move the line: Click anywhere on the red line to the desired position.

Angle the line: Click on a node and drag it to the desired position.



4.1.2.2 Add a Line Counter

Adding a line counter will allow heads to be counted as they cross the line.



Select the newly added Line trigger.

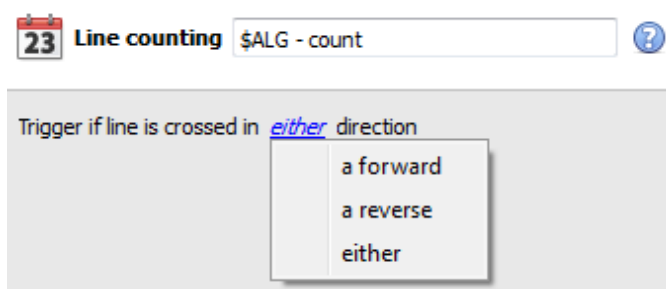
Click the plus icon to add a line counter.

Click OK.

Note: Multiple line counters may be added.

Define Direction to Trigger a Count

Once added, the direction to trigger a count can be defined. The default direction is set to **Either**. Select the trigger in the left panel, and options will appear underneath the camera image.



Forward will trigger counts if people cross the line in the same direction as the arrow.

Reverse will trigger counts if people cross the line in the opposite direction as the arrow.

Either will trigger counts if people cross in either direction. **Note:** This trigger is only applicable if the user wishes to have one counter to count the total traffic in and out of an entrance.

Note:

- If multiple counters have been added, define the trigger directions for each counter.
- A counter trigger should only be defined with *either* direction if the user wishes to have a single report which combines the total in- and outbound traffic. In this case, only a single license is required.
- A CNRP-1001 license is required for each direction being counted. In order to count in both directions, the user needs to add a dedicated forward counter trigger and a dedicated reverse counter trigger in the video analytics setup. The user therefore needs *two* licenses if counting both inbound and outbound traffic (as compared to a combined total traffic count, explained above).

4.1.2.3 Configure Overlays

This is applicable to the line counting trigger.

Overlay

Check the **Overlays** box for the head count of each line counter to be indicated on the camera image.



Click the settings icon to bring up the configure overlay dialogue window, below.

Check box to **Use default settings**.

Choose the **Style** of the count overlay.

Set **Text** to appear before the count number.

Select **Text size** and **colour**.

Select **Background colour** of the overlay.

Set the **Opacity of the background** colour.

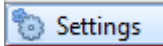
Decide when to **Reset counters**.

Click  when finished.

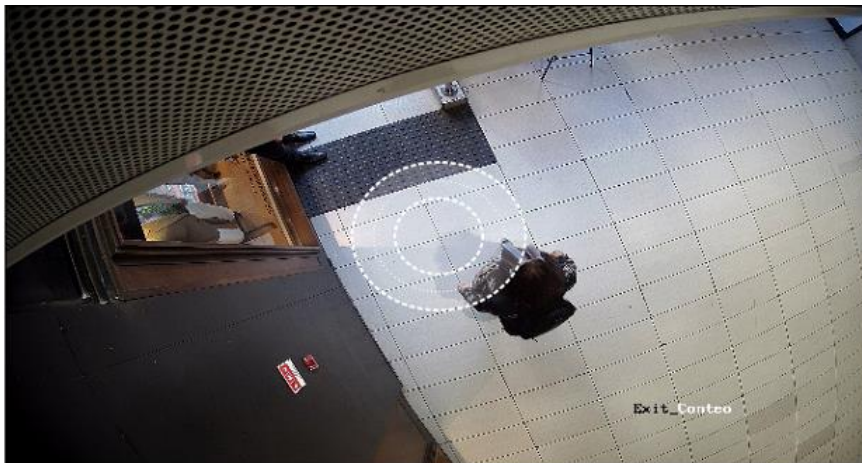
4.2 Licensed Algorithm (Top-down Head Tracker)

It is necessary to purchase and license the Analytics III suite in order to use this algorithm. Please also consult the license requirements at the beginning of this document for details on the specific licenses required.

4.2.1 Settings Panel



In the left panel of the configuring video analytics window, select **Settings**. This will bring up the following options underneath the camera image.



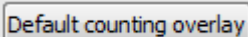
Check **Use mask** to use a mask (in red) to apply the algorithm over a specific area.

Click **Default counting overlay** to configure the way the head count number will appear as an overlay on the camera image.

Set the **Min head size** to eliminate counting of heads which are smaller than the inner circle.

Set the **Max person size** value to split objects that are bigger than one person.

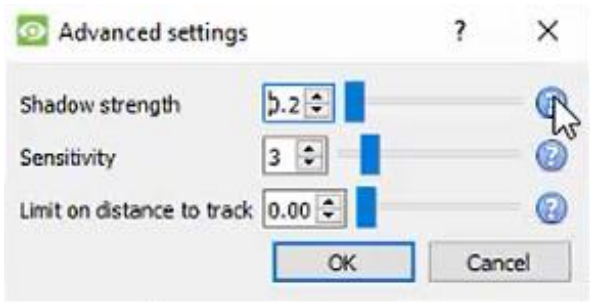
Change the **Aspect Ratio** to in order to better fir the Min Head Size and Max Person size overlays to the moving objects.



Default Counting Overlay: Click to allow the visual display of tracking on the live and recorded data. This is useful to identify whether a head crossed a line, and how many times this occurred. These counts are also overlaid on the recorded footage. This setup allows re-setting the head counter on an hourly or daily basis.



Click on the **spanner icon** to access Advanced settings.



Shadow strength: Shadows will be multiplied by this value, making them weaker or stronger. This reduces false detection of shadows as objects.

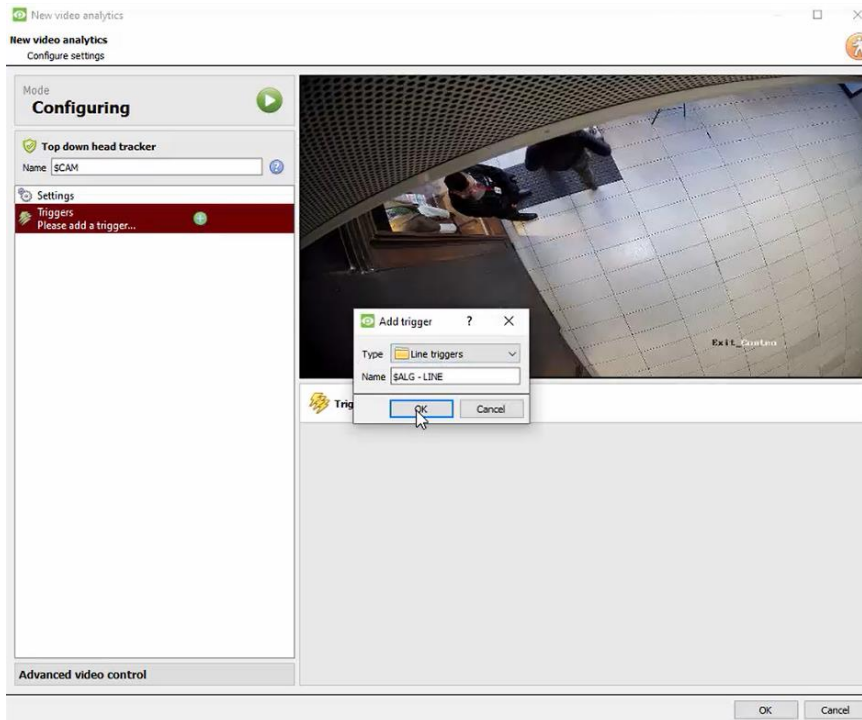
Sensitivity: the lower the sensitivity, the easier objects will be detected.

Limit on distance to track: maximum distance to track between heads (heads in consecutive frames will not be tracked and matched as the same head if they are at a distance greater than this limit).

4.2.2 Triggers Panel

4.2.2.1 Add a Counting Line

Add at least one counting line.



Click the plus icon to add a counting line.

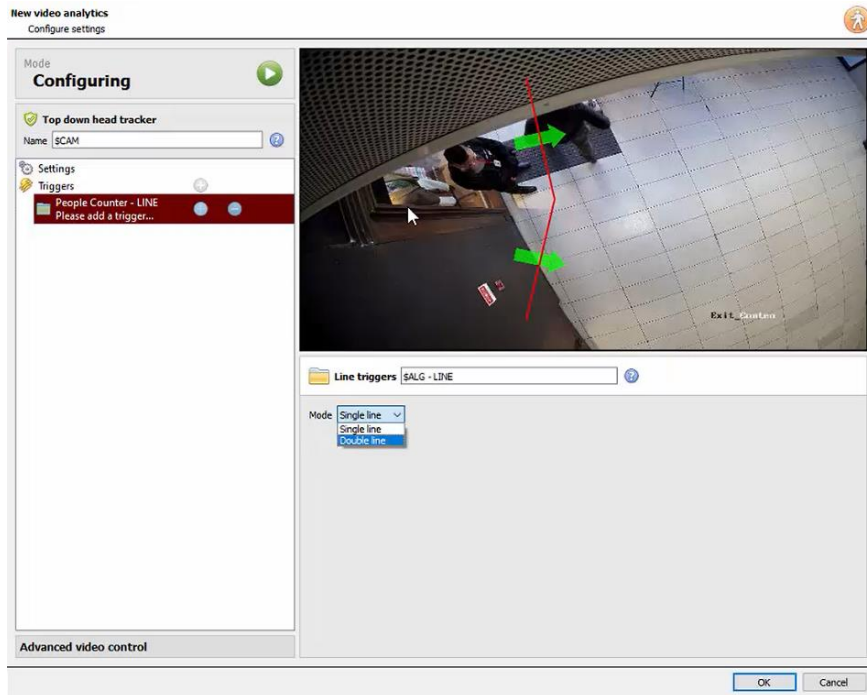
Select **Line Triggers**.

Give the trigger a name, or leave it as the default.

Click **OK**.

The line will now be added to the camera image.

Choose Line Mode



Select the relevant line trigger in the Configuring Panel.

Define its line **Mode** underneath the camera image.

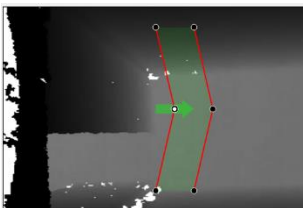
Single line will add a single line. People crossing this line will be counted.

Double line will add a double line. People will only be counted if they cross both lines in the direction configured for the trigger.

Tip: add a double line to eliminate false counts which may occur when a person remains within a confined space around a line.

4.2.2.2 Define the Counting Line

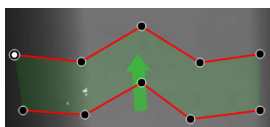
Note: This section will detail the definition of a **Double line**.



Define the line so that it covers the area in which to count people crossing.

Add nodes: Ctrl-click the red line.

Remove nodes: Double-click on the node to be removed.



Move the Line: Click anywhere on the red line to drag the counting line around.

Angle the Line: Click on a node and drag it to the desired position.


4.2.2.3 Add a Trigger or Counter

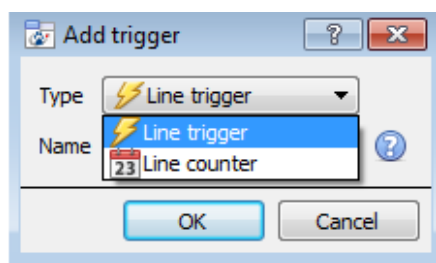
Add a trigger

Adding a trigger to the counting line can be used to create a CathexisVision event when the line is crossed.



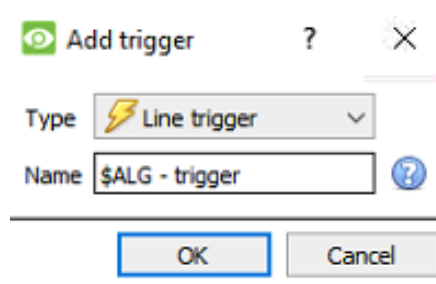
Select the **People Counter – LINE**.

 Click the **plus icon**.



Select **Line trigger**.

Click **OK**.



Give the Trigger a name, or leave it as the default.

Click **OK**.

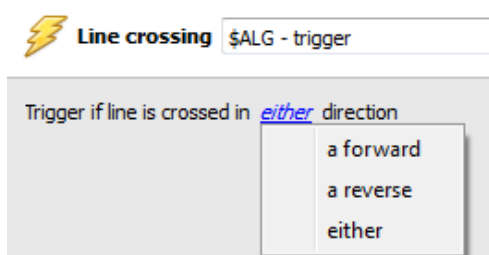
Note: It is possible to add multiple Triggers to a line.

Define Direction of Trigger

Once added, define which directions will trigger a count. The default direction is set to **Either**. Select the trigger in the left pane, and options will appear underneath the camera image.

Note: a **CNRP-1001 license** is required for each direction being counted. Two **CNRP-1001 licenses** are required if using both *in* and *out* triggers.

Click on the blue hyperlink.



Forward will trigger events if people cross the line in the same direction of the arrow.

Reverse will trigger events if people cross the line in the opposite direction of the arrow.

Either will trigger events if people cross in either direction.



Set the **Hold trigger** time to extend the event by this amount after the trigger has terminated.

Note: if multiple triggers have been added, define the trigger directions for each trigger.

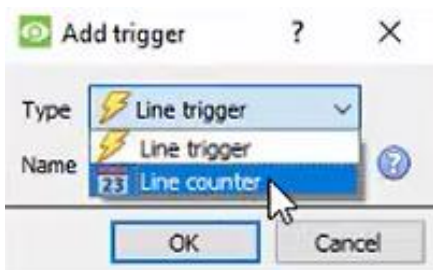
Add a Counter

Adding a line counter causes the count value to increase when the line is crossed.

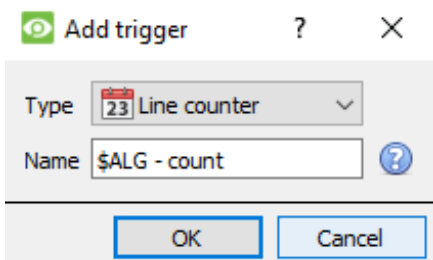


Select the **People Counter – LINE**.

Click the **plus icon**.



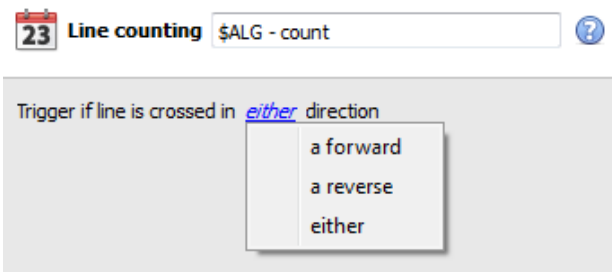
Select **Line counter**.



Give the Counter a name, or leave it as the default.

Click **OK**.

Note: It is possible to add multiple counters to a line.



Once added, **define which directions** will trigger a count. The default direction is set to *Either*. Select the counter in the left panel, and options will appear underneath the camera image.

Forward will trigger counts if people cross the line in the same direction of the arrow.


Reverse will trigger counts if people cross the line in the opposite direction of the arrow.

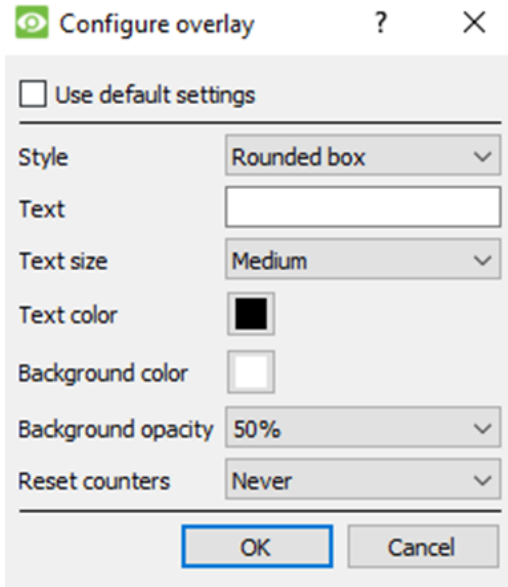
Either will trigger counts if people cross in either direction.

Note: Licenses are required for each direction being counted. Please consult the License Requirements section at the beginning of this document for details.

Configure Line Counting Overlays

Overlay Check the **Overlays** box for the overlays of the selected counter to be displayed on the camera image.

 Click the spanner icon to bring up the count overlay settings dialogue.



Check box to **Use default settings**.

Choose the **Style** of the count overlay.

Set **Text** to appear before the count number.

Select **Text size** and **colour**.

Select **Background colour** of the overlay.

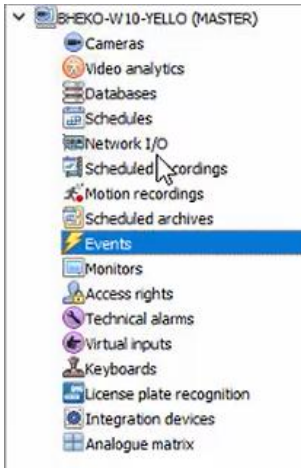
Set the **Opacity of the background** colour.

Decide when to **Reset counters**.

Click **OK** when finished.

5. Events

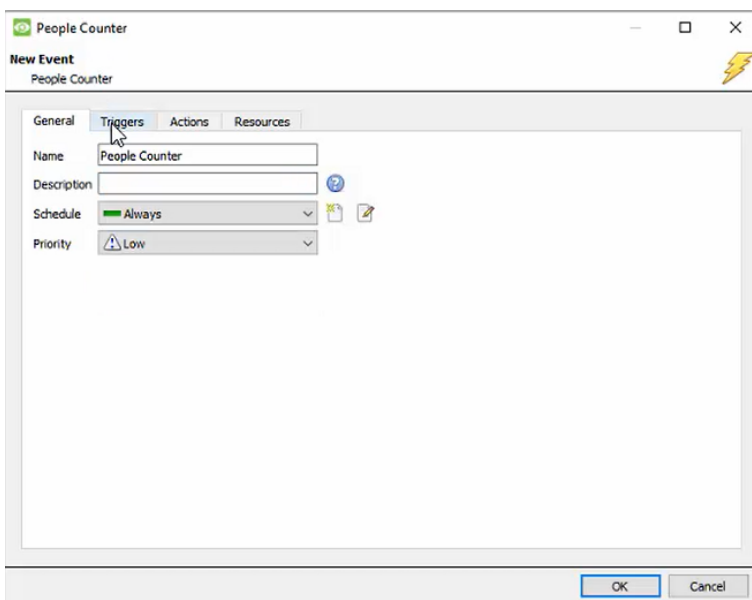
If the user wishes to create an event whenever the line is triggered, a **Line trigger** will need to be added to the **People Counter - LINE** algorithm. Then, an Event will need to be configured.



In the site list, click on **Events**.

In the Events tab, click **New**. The **New Event** window will appear.

5.1 Event tab: General

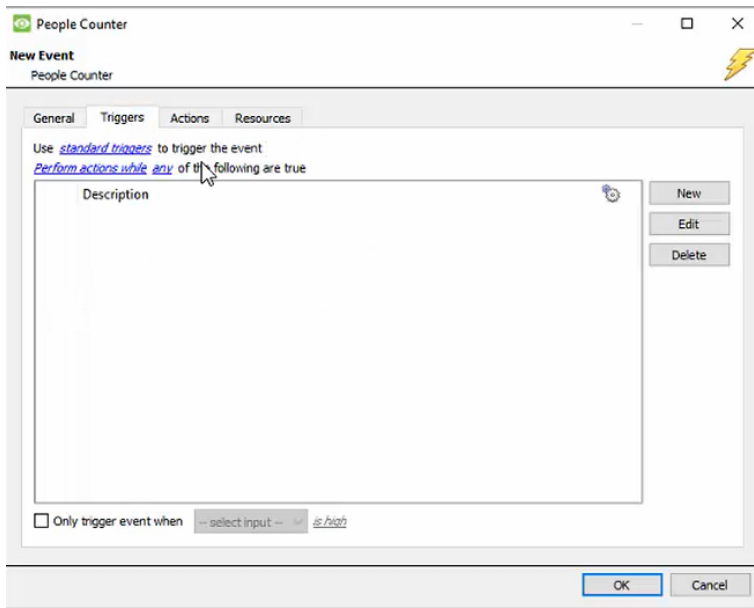


In the General tab of the New Event window, give the event a descriptive **name**.

Select a **Schedule**.

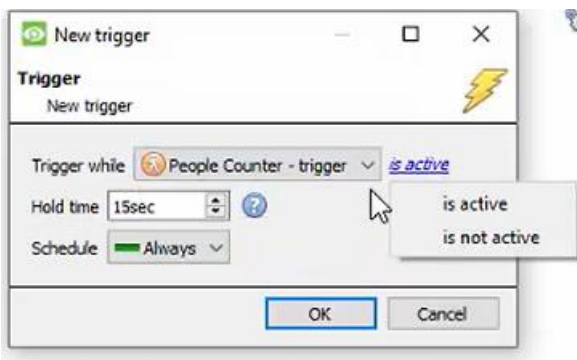
Choose the event **priority**.

5.2 Event tab: Triggers



Click **New** to add a trigger to the event.

A **New trigger** window will appear.



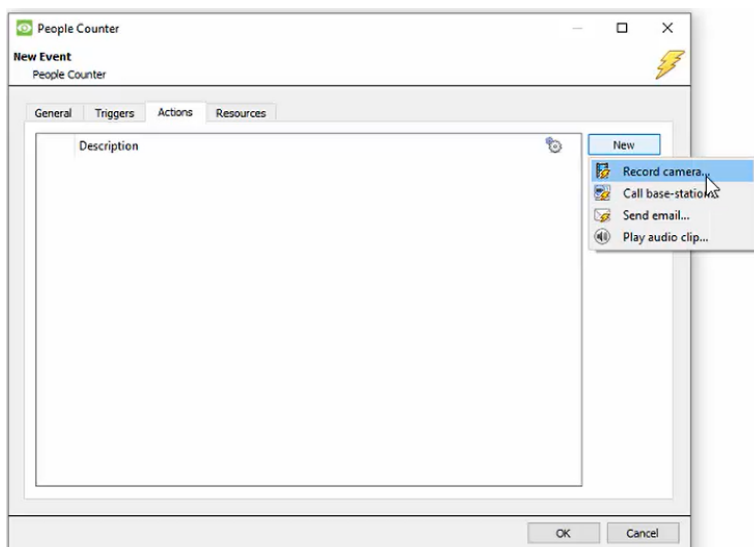
Trigger while: select **People Counter – trigger**.

Choose **is active**.

Hold time: the event is extended for this duration after the trigger has terminated.

Click **OK**.

5.3 Event tab: Actions



In the **Actions** tab of the **New Event** window, click **New**.

Choose an action. The options are **Record camera**, **Call base-station**, **Send email**, or **Play audio clip**.

If an integration is set up, the user also has the option to control the integration.

Click **OK** to save the settings.

6. Testing Video Analytics

After the algorithm is set up, the user can test how the algorithm runs before adding it to a camera.



In the configuration window, click the **play icon** to switch to **Running**.



To adjust settings, click the **gear icon** to switch back to **Configuration**.

New video analytics
Configure settings

Mode
Running

Overlays

- Heads
- Debug
- Track
- People Counter - LINE

Time

Time	Event
23 2020-12-18 08:30:21.851	People Counter - count 1
23 2020-12-18 08:30:19.901	People Counter - count 1

Advanced video control

Events Graphs Advanced

OK Cancel

Checking **Heads** will capture the head in red, and indicate the size, measured in pixels.

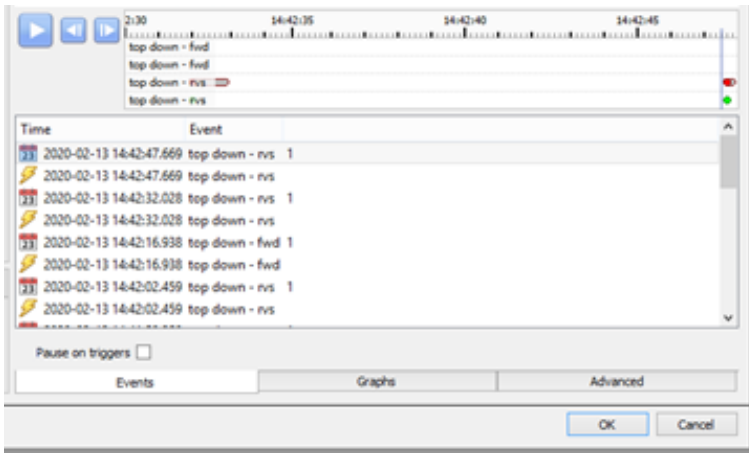
Checking **Debug** will display the head capture size circles set up in the configuration stage.

Checking **Track** will track the movement of the heads across the camera image with a line.

Checking **People Counter - LINE** will display it.

6.1 Events Panel

Counts and triggers which have been set up will appear in the **Events Panel**.



To view an event on the timeline and in the camera image, **pause the video**. From there, either select the event entry, or click on the event icon in the playback timeline.

6.1.1 Event icons

The triggers and counts set up in the previous section will be displayed on the playback timeline at the time of the count.



This is the trigger icon. The length of the icon will change depending on the trigger hold time setup during configuration phase. I.e., this trigger is set to hold for 1000ms, but if set to hold for 300ms it would look like this:



This is the count icon. It will appear only to denote that a head has been counted.

6.2 Graphs Panel

The graphs panel is not used by this algorithm. For information on creating graphs and reports, please see the [Reports Section](#).

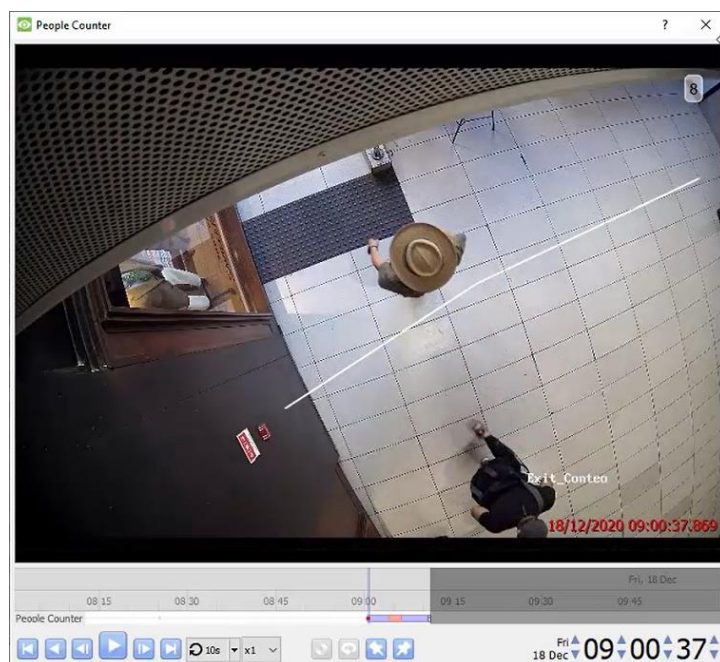
7. Database

If an Event action has been set to **Record camera**, this footage can be reviewed in the Database.

Time	Event
30/11/2020 04:50:24	Q1635 timer
30/11/2020 04:55:24	Q1635 timer
30/11/2020 05:00:24	Q1635 timer
30/11/2020 05:05:24	Q1635 timer
30/11/2020 05:10:24	Q1635 timer
30/11/2020 05:15:24	Q1635 timer
30/11/2020 05:20:24	Q1635 timer
30/11/2020 05:25:24	Q1635 timer
30/11/2020 05:30:24	Q1635 timer
30/11/2020 05:35:24	Q1635 timer
30/11/2020 05:40:24	Q1635 timer
30/11/2020 05:45:24	Q1635 timer
30/11/2020 05:50:24	Q1635 timer
30/11/2020 05:55:24	Q1635 timer
30/11/2020 06:00:24	Q1635 timer
30/11/2020 06:05:24	Q1635 timer
30/11/2020 06:10:24	Q1635 timer
30/11/2020 06:15:24	Q1635 timer
30/11/2020 06:20:24	Q1635 timer
30/11/2020 06:25:24	Q1635 timer
30/11/2020 06:30:24	Q1635 timer
30/11/2020 06:35:24	Q1635 timer
30/11/2020 06:40:24	Q1635 timer
30/11/2020 06:45:24	Q1635 timer
30/11/2020 06:50:24	Q1635 timer
30/11/2020 06:55:24	Q1635 timer
30/11/2020 07:00:24	Q1635 timer
30/11/2020 07:05:24	Q1635 timer
30/11/2020 07:10:24	Q1635 timer
30/11/2020 07:15:24	Q1635 timer
30/11/2020 07:20:24	Q1635 timer
30/11/2020 07:25:24	Q1635 timer
30/11/2020 07:30:24	Q1635 timer
30/11/2020 07:35:24	Q1635 timer
30/11/2020 07:40:24	Q1635 timer
30/11/2020 07:45:24	Q1635 timer
30/11/2020 07:50:24	Q1635 timer
30/11/2020 07:55:24	Q1635 timer
30/11/2020 08:00:24	Q1635 timer
30/11/2020 08:05:24	Q1635 timer
30/11/2020 08:10:24	Q1635 timer
30/11/2020 08:10:27	Q1635 timer
18/12/2020 09:00:34	People Counter timer
18/12/2020 09:03:12	People Counter timer

5fc0ce1f-6000-43cc-bd7f-6d8e8933a095

Double-click an entry to view the associated footage.



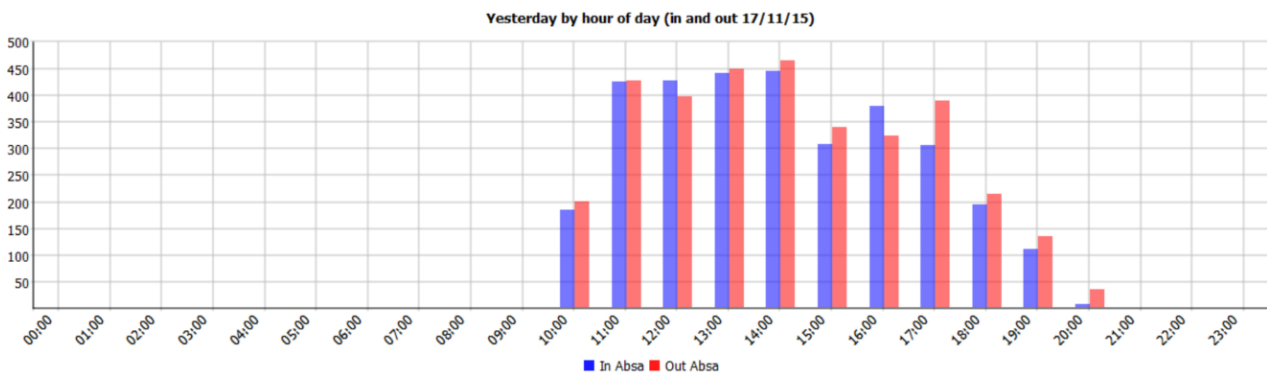
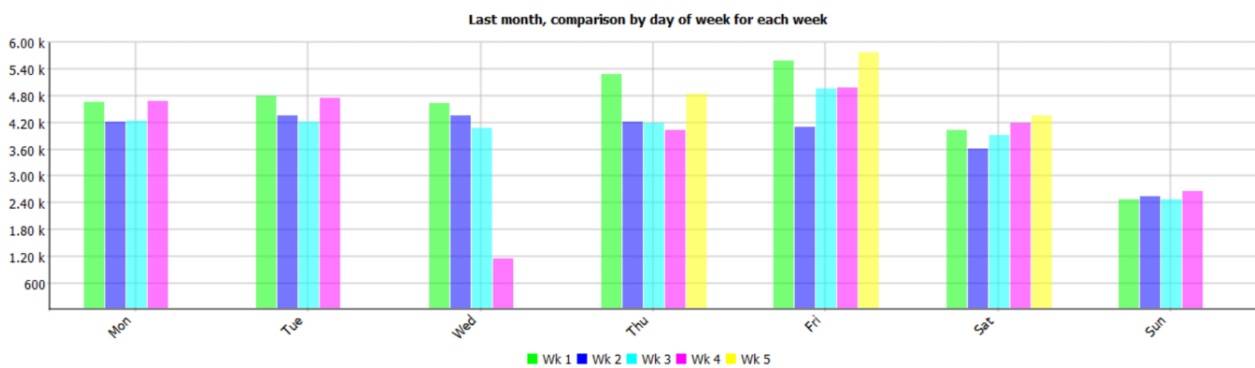
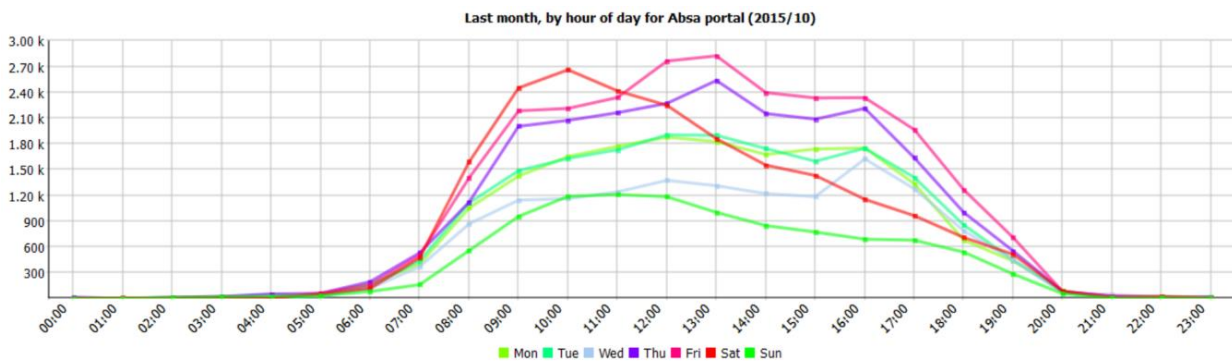
Press the **play** icon to play the footage.

8. Reports

Currently, counting reports are generated by Cathesis and supplied to the client. In order to generate a report of counts over a specific time period, please contact support@cat.co.za with specific reporting requirements.

8.1 Report Examples

Below are some examples of the kind of reports that can be generated for the user:



Yesterday by hour of day (in and out 17/11/15)		
When	In Absa	Out Absa
00:00	0	0
01:00	0	0
02:00	0	0
03:00	0	0
04:00	0	0
05:00	0	0
06:00	0	0
07:00	0	0
08:00	0	0
09:00	0	0
10:00	190	206
11:00	430	431
12:00	432	402
13:00	445	454
14:00	450	470
15:00	313	344
16:00	384	328
17:00	311	393
18:00	199	219
19:00	116	139
20:00	12	41
21:00	0	0
22:00	0	0
23:00	0	0
Total	3.28 k	3.42 k

9. Occupancy Dashboard

The object counter server has an occupancy dashboard, which automatically updates its charts every five minutes. This allows users to stay updated on changes in occupancy.

9.1 View the dashboard

Connect to the master NVR: <http://masternvr.ip:30092/occupancy>

9.1.1 Requirements

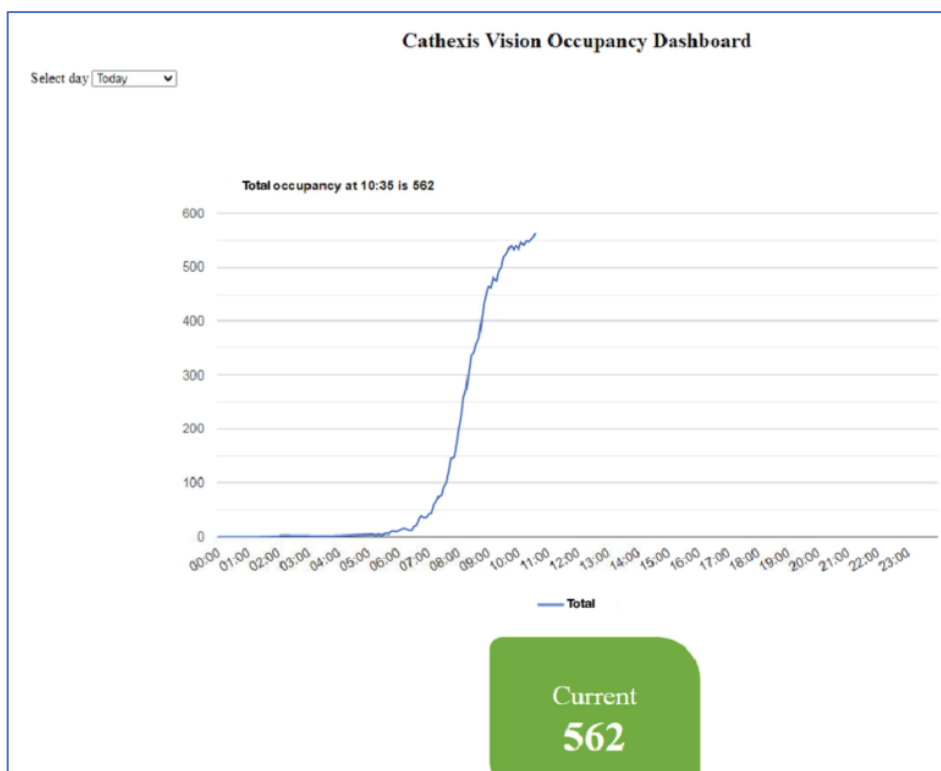
- The viewing PC requires internet access to render the Google charts used by the dashboard.
- The dashboard requires a site login.

9.2 Using the dashboard

The dashboard shows occupancy by day of every configured **location** and **zone**.

- The user can choose any day in the preceding 10 days.
- Occupancy assumes that the **location** and **zones** are empty at midnight.

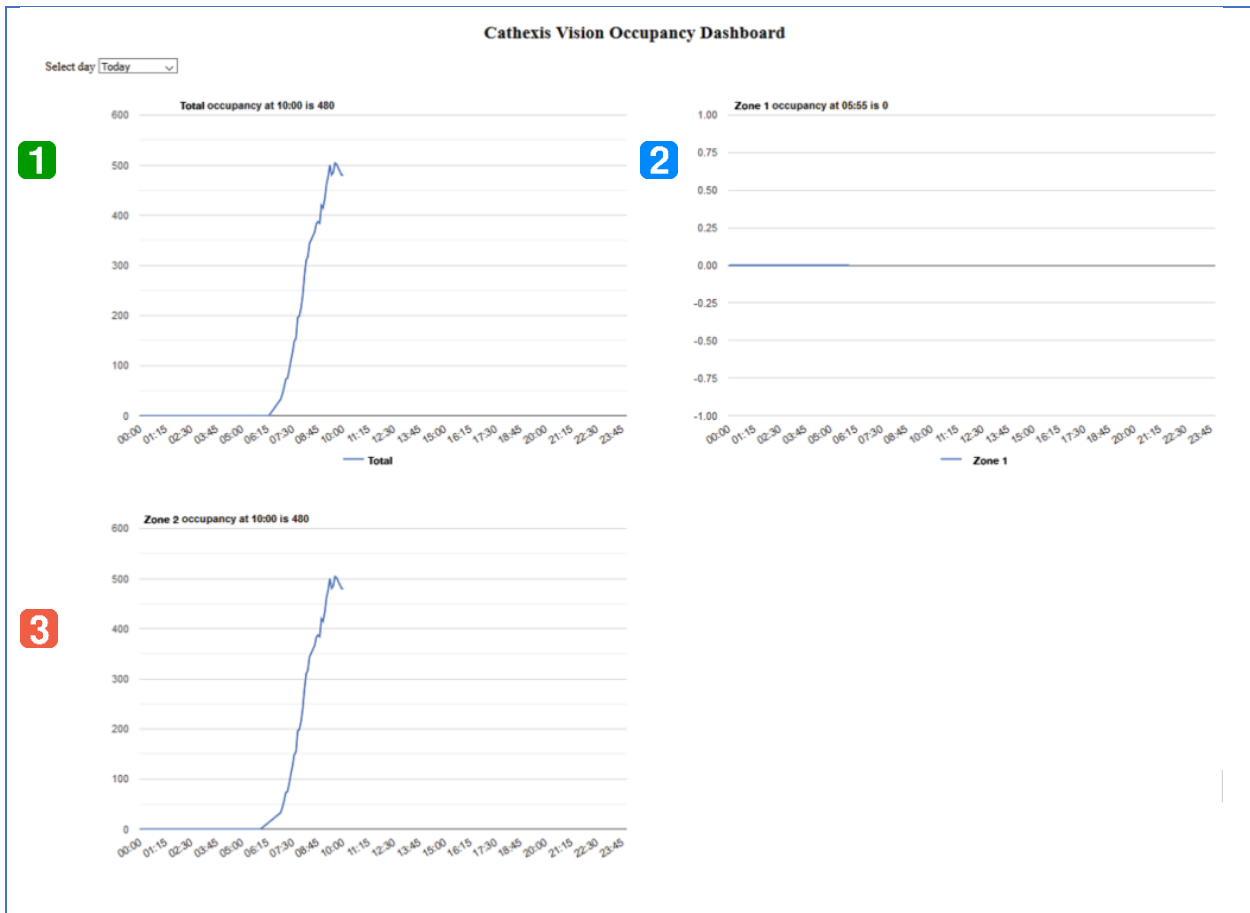
9.3 Viewing the dashboard



The CathexisVision 2021 occupancy dashboard displays a green counter underneath the occupancy graph.

It indicates the total number of people. It is updated on the web browser every 5 minutes.

9.3.1 Zone occupancy



1 The top-left graph shows total occupancy.

2 Zone 1 occupancy

3 Zone 2 occupancy

The user can define zones. These could be applied in an area with two entrances, for example.

10. Conclusion

This app-note was designed to deal specifically with people-counting analytics.

For further information about the CathesisVision software, please consult the **CathesisVision Setup Manual**: <http://cathesisvideo.com>

For support, contact support@cat.co.za

USEFUL LINKS

To view **tutorial videos** on CathesisVision setup, visit <https://cathesisvideo.com/resources/videos>

Find answers to Cathesis **Frequently Asked Questions**: <https://cathesis.crisp.help/en/?1557129162258>