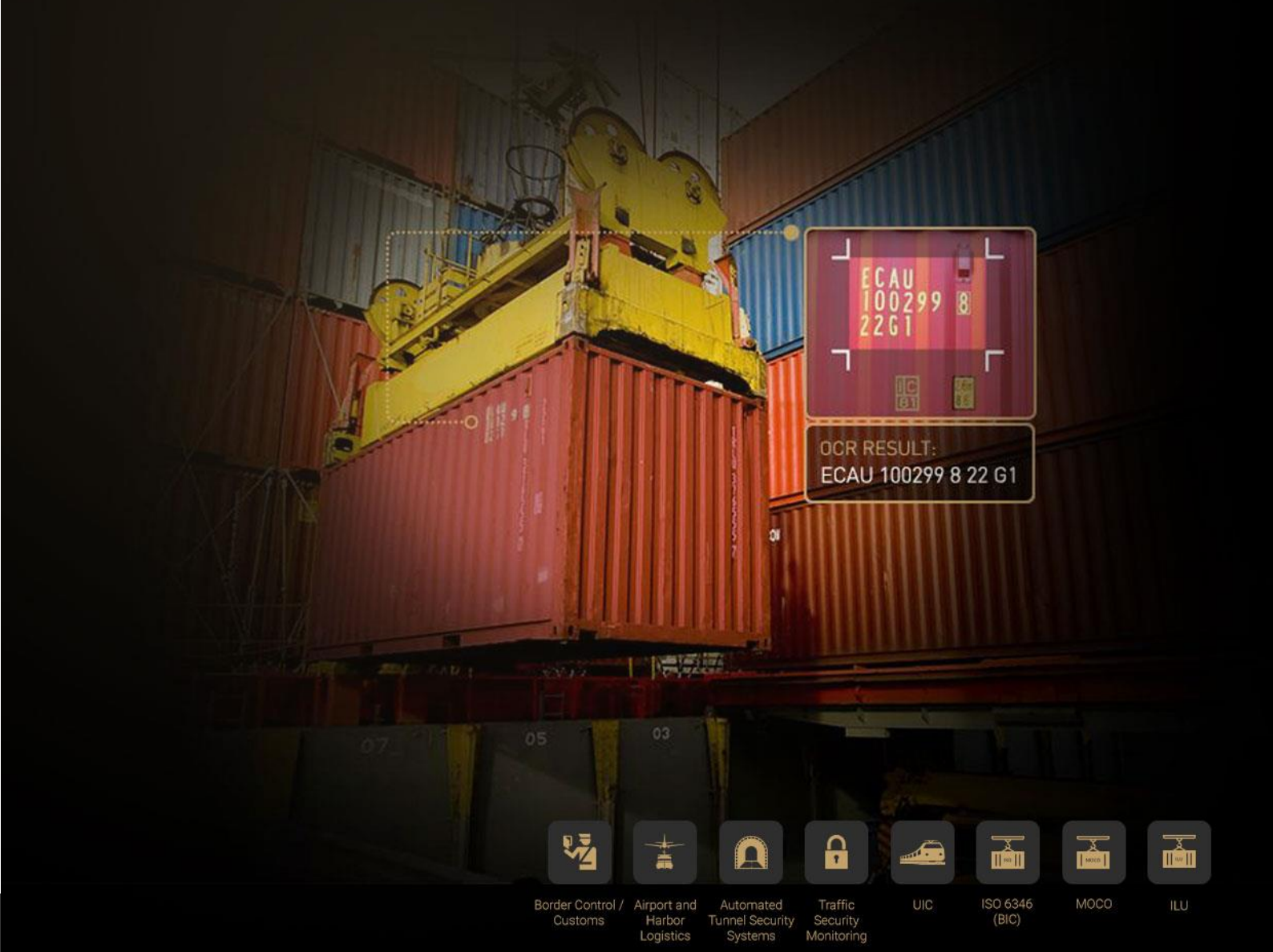
ADAPTIVE RECOGNITION

AUTOMATIC INDUSTRIAL CODE RECOGNITION SOFTWARE

Reference Manual

The Carmen® AICR engine



REFERENCE MANUAL OF THE CMOCR SOFTWARE MODULE

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This document describes the properties (user parameters) of the CARMEN® software and the cmOcr *engine handler* software module.

LIST OF THE PROPERTIES AND THEIR IMPORTANCE

PROPERTIES OF THE CMOCR ENGINES		IMPORTANCE
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POSSIBLE VALUES OF CMOCR ENGINE PROPERTIES

NAME (in alphabetical order)	POSSIBLE VALUES	DEFAULT VALUE
checksum_check	{0,1}	1
contrast_min	[0..255]	engine dependent
datafile	character string	n/a
filterlongcodes	{0,1}	0
isocode	{0,1}	1
posfreq	character string	empty string
posfreqhalflife	[0..1048576]	0
posfreqhistxs	[2..64]	16
posfreqhistys	[2..64]	16
posfreqweight	[0..100]	50
ROI	polygon(s)	empty
ROU	polygon(s)	empty
size	positive integers	engine dependent
size_max	positive integers	engine dependent
size_min	positive integers	engine dependent
slant	integer numbers	engine dependent
slope	integer numbers	engine dependent
slope_max	integer numbers	engine dependent
slope_min	integer numbers	engine dependent
timeout	non-negative integers	engine dependent
timeout_wall	non-negative integers	0
xtoyres	positive integers	100

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DESCRIPTION OF THE PROPERTIES OF THE CMOCR ENGINES

1. DATAFILE

NAME OF THE ENGINE'S DATA FILE

This property specifies the knowledge file (.dat) used by the engine. By default, the name of the datafile corresponds to the name of the engine.

For example, the cmocr-aar-7.3.2.93_21Q4 engine's datafile is *cmocr-2.93-aar.dat* . The role of this property is to query the name of the datafile after initialization and to include this information in the application's log.

Possible values:	character string
Default value:	varies with each engine release; default property value can be queried by the `GetProperty()` function
Suggested value:	leave the default value

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PROPERTIES RELATED TO PROCESSING TIME

1. TIMEOUT

1.1. TIMEOUT

CPU TIME LIMIT

Sets the maximum working time for the CPU in milliseconds in which the module tries to find industrial codes.

You can always give the module sufficient time by using this timeout. However, this could result in longer runtimes if the system is busy.

The interval starts when cm_findfirstcontainercode() is called.

At the end of this period, the engine tries to finish searching for new codes and any additional call of cm_findnextcontainercode() will result no codes found. Zero timeout value means no time limit.

By setting the timeout value before the cm_ findnextcontainercode() call, the timing will be restarted and the evaluation lasts till the newly specified time interval.

Example:

If the value of the timeout is set to 500

The cm_findfirstcontainercode() returns successfully after 200 ms. In this case after additional cm_findnextcontainercode() call 300 ms would be available. However, if the timeout is set to 500 after cm_findfirstcontainercode(), then 500ms would be available for further cm_findnextcontainercode() calls.

Possible values:	non-negative integers
Default value:	varies with each regional engine; default property value can be queried by the `GetProperty`() function
Suggested value:	around 1000 – on servers and desktop computers 5000 – on slower computers with less than 2GHz CPU clock speed

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1.2. TIMEOUT_WALL

REAL TIME LIMIT

Sets the length of the time interval in milliseconds in which the module tries to find industrial codes.

You can ensure that the module won't run much longer than the desired time by using this timeout_wall property. However, the results could possibly be worse if the system is busy and the timeout_wall is set too low.

The interval starts when cm_findfirstcontainercode() is called.

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At the end of this period, the engine tries to finish searching for new codes and any additional call of cm_findnextcontainercode() will result no codes found. Zero timeout_wall value means no walltime limit.

By setting the timeout_wall value before the cm_findnextcontainercode() call, the timing will be restarted and the evaluation lasts till the newly specified time interval.

Example:

If the value of the timeout_wall is set to 500

The cm_findfirstcontainercode() returns successfully after 200 ms. In this case after additional cm_findnextcontainercode() call 300 ms would be available. However, if the timeout_wall is set to 500 after cm_findfirstcontainercode(), then 500ms would be available for further cm_findnextcontainercode() calls.

Possible values: non-negative integers

Default value: 0

Suggested value: equal or greater values than the value set for timeout

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USAGE

It is possible to use the timeout and the timeout_wall parameters together or just one or the other. If either timeout is reached, the engine tries to finish searching for new codes and any additional call of cm_findnextcontainercode() will result no codes found. If both parameters are used, the timeout value should always be smaller than the timeout_wall value or equal to it. Otherwise it has no effect.

It can happen that in case of a busy processor the AICR process takes a long time (2-4 seconds) even if the timeout is set to 1000 ms, because during this 2-4 seconds CARMEN can only use the processor for around 1000 ms.

In either case, if Carmen® has found an industrial code close to the set timeout/timeout_wall limit, the process will be finished as quickly as possible. So, if you are setting the timeout_wall property to 1000 ms the AICR process cannot take much longer than 1000 ms, but if you are setting only the timeout property 1000 ms the AICR process could take up to 2000-4000 ms depending on the CPU usage.

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PROPERTIES RELATED TO THE GEOMETRY OF CODES

1. SIZE

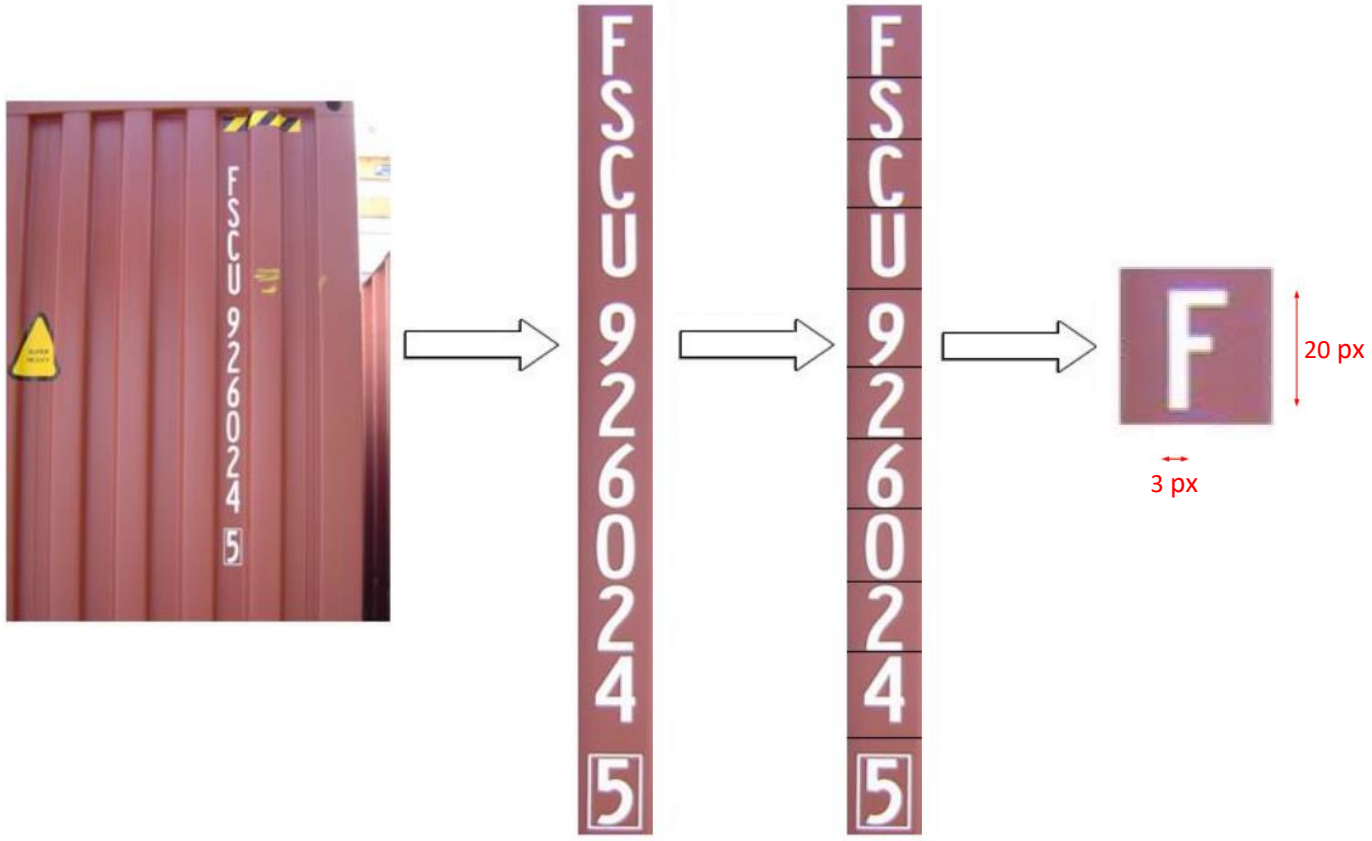
AVERAGE HEIGHT OF THE CHARACTERS

The average height of the characters of the code in the image in pixels.

Possible values: positive integers (between 15 and 300)

Default value: varies with each engine release; default property value can be queried by the `GetProperty`() function

Suggested value: [30..80] (between 30 and 80), depending on the character heights in the input images



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2. SIZE_MAX

MAXIMUM HEIGHT OF CHARACTERS

The maximum height of the characters of the code in the image in pixels.

Possible values: positive integers (between the actual size value and 300)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value

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3. SIZE_MIN

MINIMUM HEIGHT OF THE CHARACTERS

The minimum height of the characters of the code in the image in pixels.

Possible values: positive integers (between 15 and the actual size value)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value

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Note

size_min ≤ size ≤ size_max

So, the size value has to be equal to or greater than size_min and equal to or less than size_max otherwise the engine returns no data.

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4. SLANT

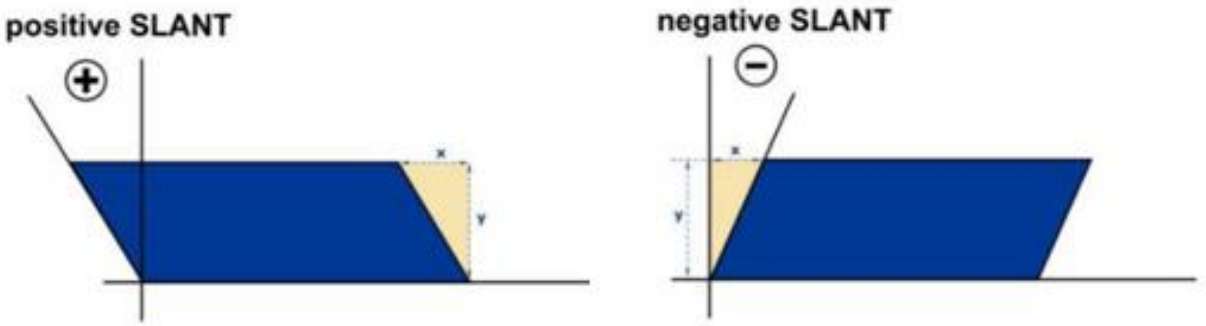
AVERAGE SLANT OF THE CODE

The average slant of the characters of the code in the image. This value is represented in percent (%) and it is positive if the vertical axis of the characters slants to the left viewing from bottom to top.

Possible values: integer numbers (between -100 and 100)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value



$$\text{Slant} = \frac{x}{y} \cdot 100$$

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5. SLOPE

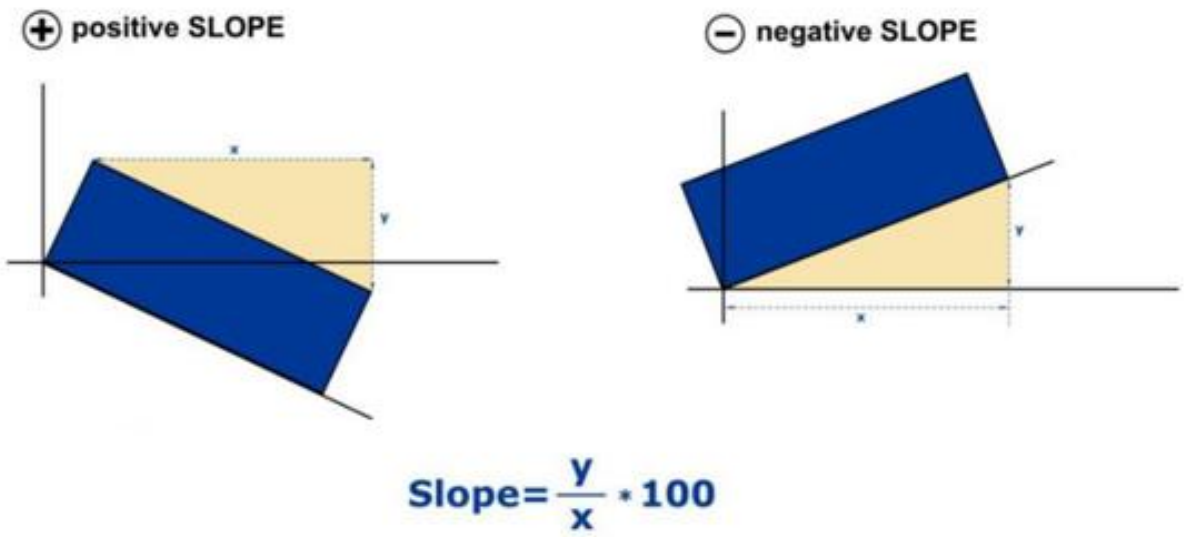
AVERAGE SLOPE OF THE CODE

The average slope of the characters of the code in the image. This value is represented in percent (%) and it is positive if the horizontal axis of the code slopes downwards viewing from left to right.

Possible values: integer numbers (between -100 and 100)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value



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6. SLOPE_MAX

MAXIMUM SLOPE OF THE CODE

The maximum slope of the characters of the code in the image. This value is represented in percent (%) and it is positive if the horizontal axis of the code slopes downwards viewing from left to right.

Possible values: integer numbers (between the actual slope value and 100)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value

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7. SLOPE_MIN

MINIMUM SLOPE OF THE CODE

The minimum slope of the characters of the code in the image. This value is represented in percent (%) and it is positive if the horizontal axis of the code slopes downwards viewing from left to right.

Possible values: integer numbers (between -100 and the actual slope value)

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value

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Note

slope_min ≤ slope ≤ slope_max

So, the slope value has to be equal to or greater than slope_min and equal to or less than slope_max otherwise the engine returns no data.

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8. XTOYRES

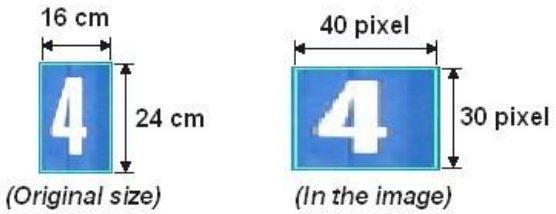
THE RATIO OF HORIZONTAL AND VERTICAL DIMENSIONS OF CODES

X to Y resolution – only for analog input!

The ratio of the horizontal and vertical resolutions of the frame of the character area. This value is represented in percent (%). The horizontal resolution is the ratio of the width of the character frame in the image and the real width of the character. The vertical resolution is the ratio of the height of the character frame in the image and the real height of the character.

If the original height of a character is (Ys) 24 cm and the width is (Xs) 16 cm but in the image the height of the character is (Ysi) 30 pixels and the width is (Xsi) 40 pixels, then

$$xtoyres = 100 \cdot \frac{\frac{Xsi}{Ysi}}{\frac{Xs}{Ys}} = 100 \cdot \frac{\frac{40}{30}}{\frac{16}{24}} = 200$$



Note

If you have regular digital camera that does not change the ratio of the width and the height of the objects, simply use 100.

This property has a role only if there is significant distortion in the dimensions of the objects, for example in case of half-frames taken by analog cameras.

Possible values: positive integers

Default value: 100

Suggested value: 100

(Zero value setting of *xtoyres* means automatic re-setting of *xtoyres* to 100.)

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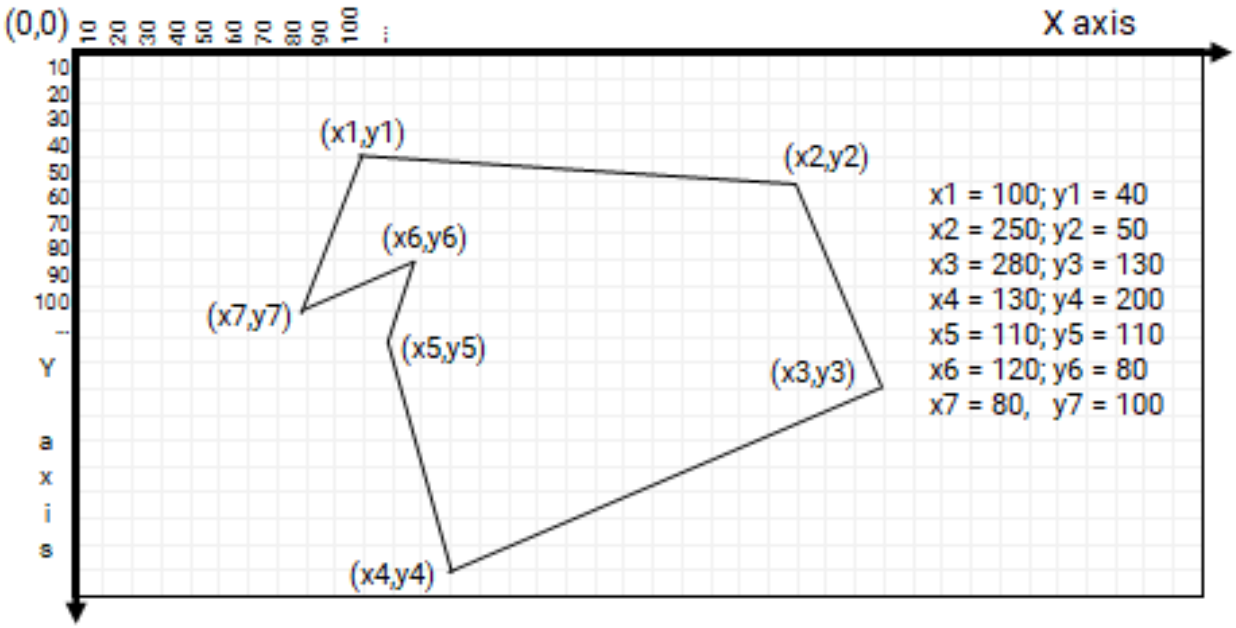
PROPERTIES RELATED TO THE POSITION OF INDUSTRIAL CODES IN INPUT IMAGES

How to define a polygon

For the below properties we are using polygons as follows:

One Polygon is: P = $x_1,y_1; x_2,y_2; x_3,y_3; \ldots; x_i,y_i; \ldots; x_n,y_n$

Where (x_i,y_i) means one point on a picture in axis parallel coordinate system. The origo (0,0) is the top left corner. On the X axis the values are increasing rightwards, on the Y axis the values are increasing downwards. You have to set the polygon points clockwise.



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1. ROI/ROU

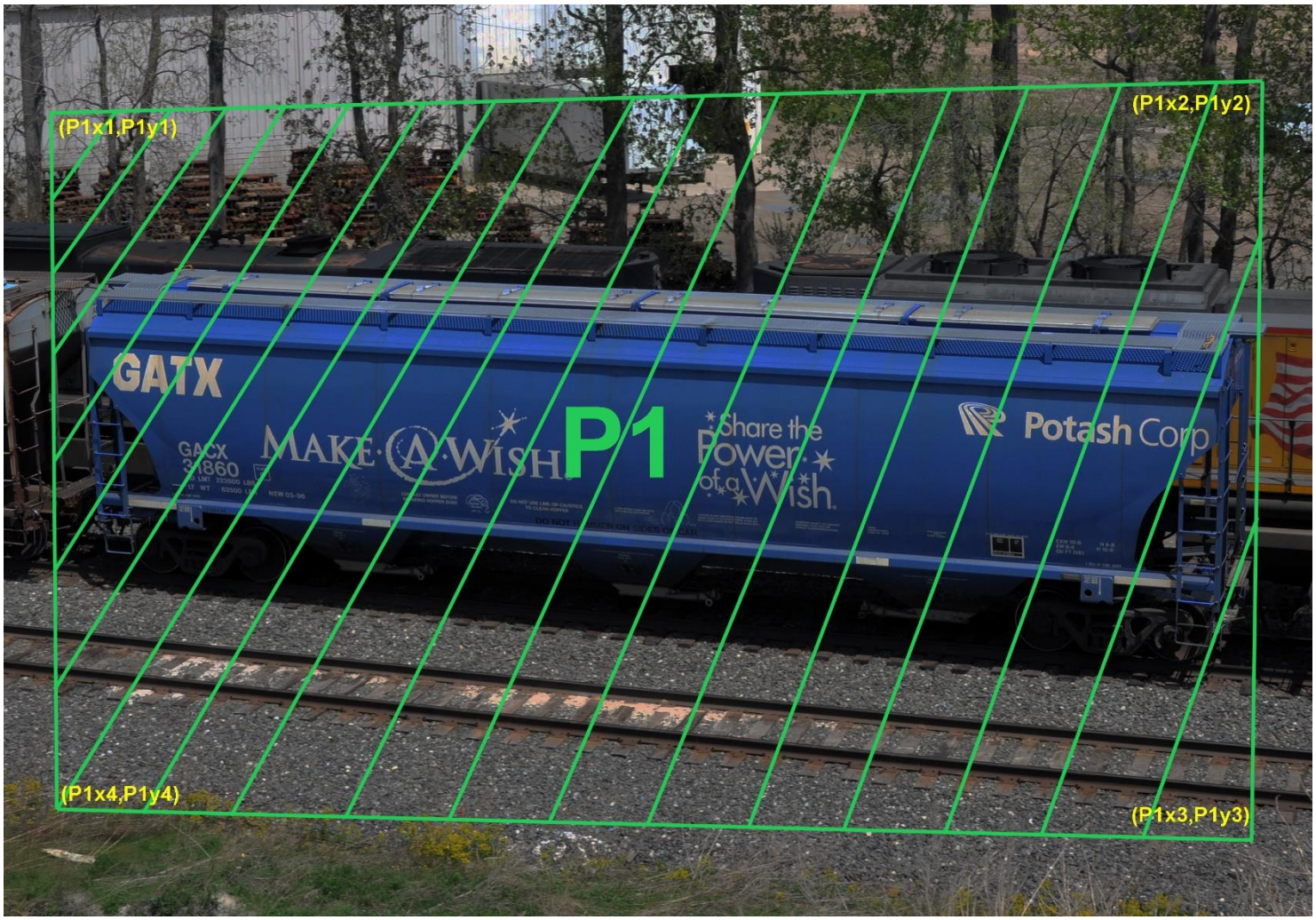
REGION OF INTEREST / REGION OF UNINTEREST
(available from version 7.3.11.189)

1.1. ROI

REGION OF INTEREST

Please check how to define a polygon at the beginning of this section.
You can set with this property, the polygon(s) where CARMEN® should search for the industrial codes (IC).
Usage:

- P: CARMEN® will search the IC inside the polygon (delete the previous ROI settings)
- P1 + P2 + … + Pn: set more polygons at the same time (delete the previous ROI settings)
- +P: add one more polygon to the existing ones, it will NOT delete the previous settings



- *del*: delete the previous ROI settings

This parameter can be set, get, its values saved into gxsd.dat, and it's readable from there.
If you set ROI only then CARMEN® will search the IC only inside the ROI.

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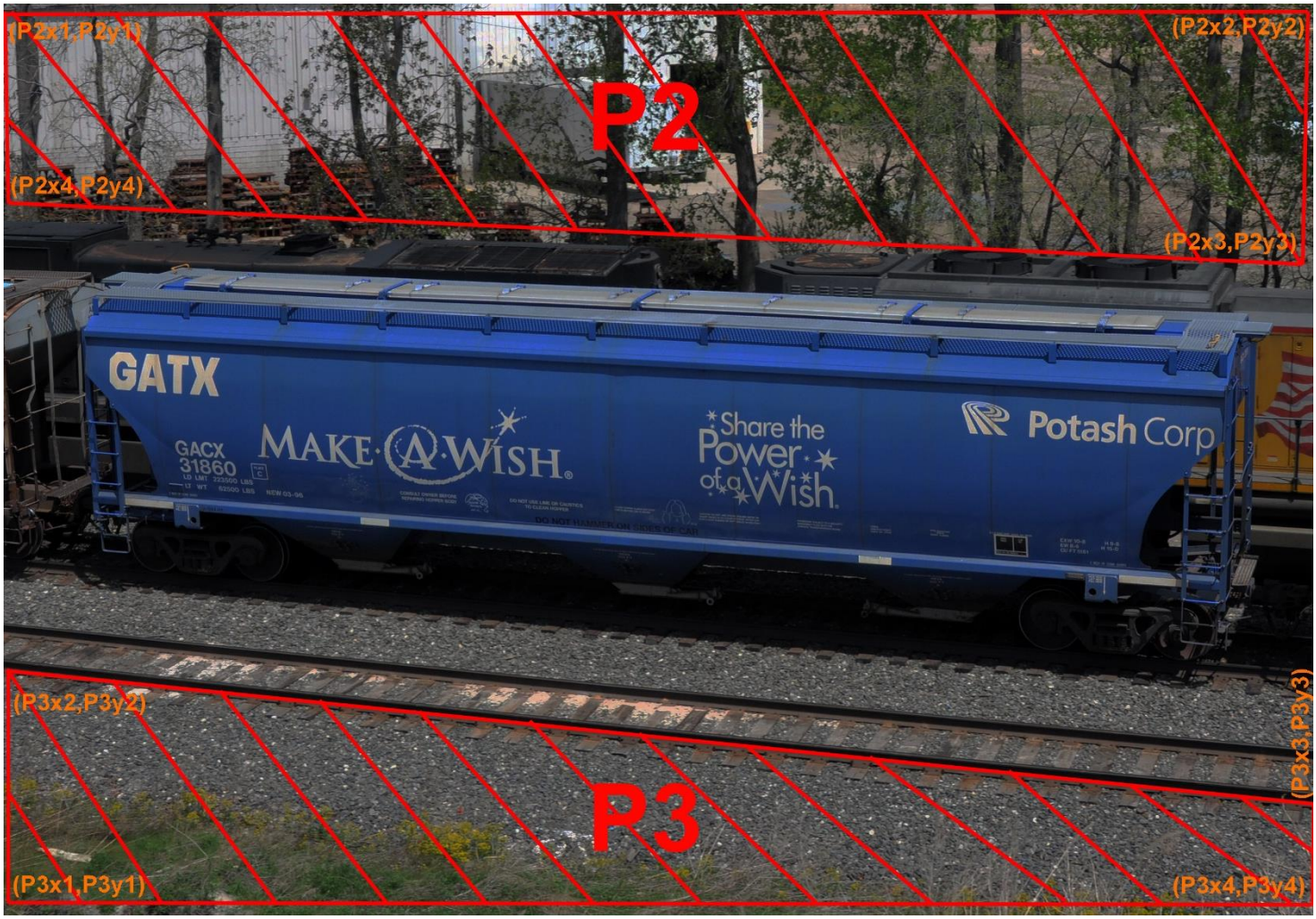
1.2. ROU

REGION OF UNINTEREST

Please check how to define a polygon at the beginning of this section.
You can set with this property the polygon(s) where CARMEN® shouldn't search for the industrial codes.

Usage:

- P: CARMEN® will NOT search the IC inside the polygon
- P1 + P2 + … + Pn: set more polygons at the same time (delete the previous ROU settings)
- +P: add one more polygon to the existing ones, it will NOT delete the previous settings
- *del*: delete the previous ROU settings



This parameter can be set, get, its values saved into gxsd.dat, and it's readable from there.
If you set ROU only then CARMEN® will search IC outside ROU.

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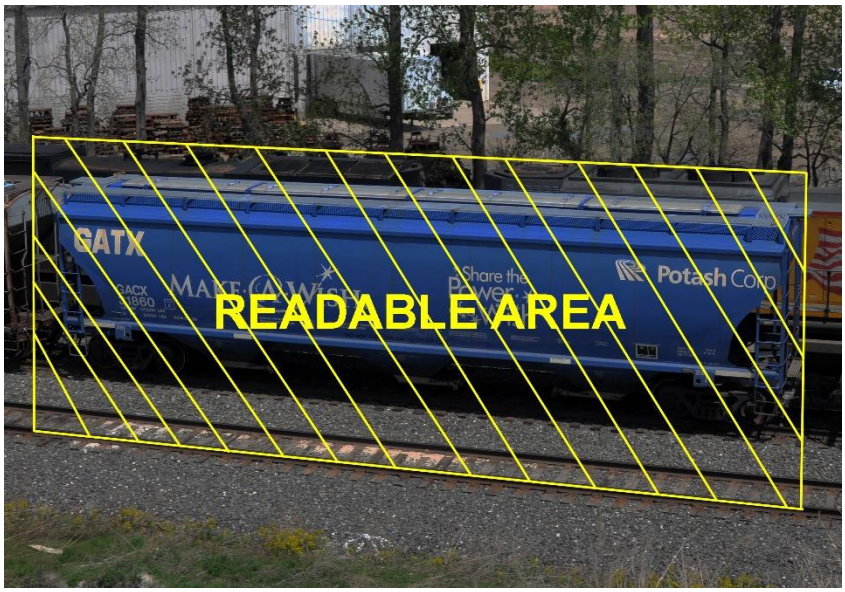
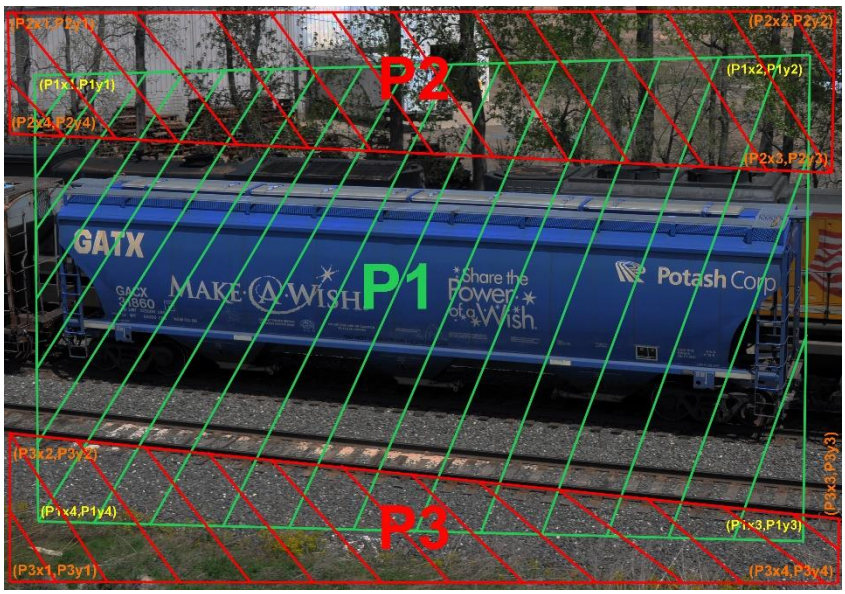
If you set ROI and ROU as well then CARMEN® will search IC only inside ROI where there is no ROU, so ROU is the stronger condition.





Note

If you set posfreq as a polygon then it will delete the ROI and ROU and overwrite the ROI with the posfreq polygon.

Note

We strongly suggest not to use the posfreq and the ROI/ROU parameters simultaneously to avoid future difficulties.

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2. POSFREQ

POSITION FREQUENCY

By using the position frequency, certain areas can be specified for the AICR engine, which are more superior to the others.

With the following parameters, the AICR algorithm can be set to search for industrial codes on specific parts of the image. Moreover, some parts can be differentiated according to probability of the industrial code occurrence. The essence of the method is that the image is divided into equal zones and each zone is provided with a weight.

The correct value assignment of the weight increases the effectiveness of the searching process. Giving a larger weight of the appointed zone increases the probability of finding the coe and decreases the code reading time.

The weight assignment is possible in three ways:

- by *uniform distribution*: the weight of each zone will be the same positive number,
- *defining zones*: zones can be defined by the user,
- *defining a polygon*: the polygon should contain all the codes to be read.

The weights may be calculated in a self-adaptive way, as well. In this case, the engine calculates the weights by itself based on the incoming images: each found code increases the weight of that zone which contains the code.

The property contains a string of characters. It consists of numbers separated by ',' and ';', where ',' separates the numbers and the ';' stands for the line wrap.

If the string is empty, it initializes the grid with uniform distribution (the weight of each zone will be the same positive number). If there are exactly two numbers and at least three number pairs (two columns and three rows), the string defines a polygon. Otherwise, it defines zones, where the given numbers represent the starting weights of each zone.

The data is invalid if the rows are not the same length or if there are less than two columns, or less than three rows.

Zero-weight zones are omitted from the search for industrial codes. However, the engine will provide results even for codes partially located in a zero-weight zone, if the other parts of the industrial code can be found in a non-zero weight zone.

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For example:

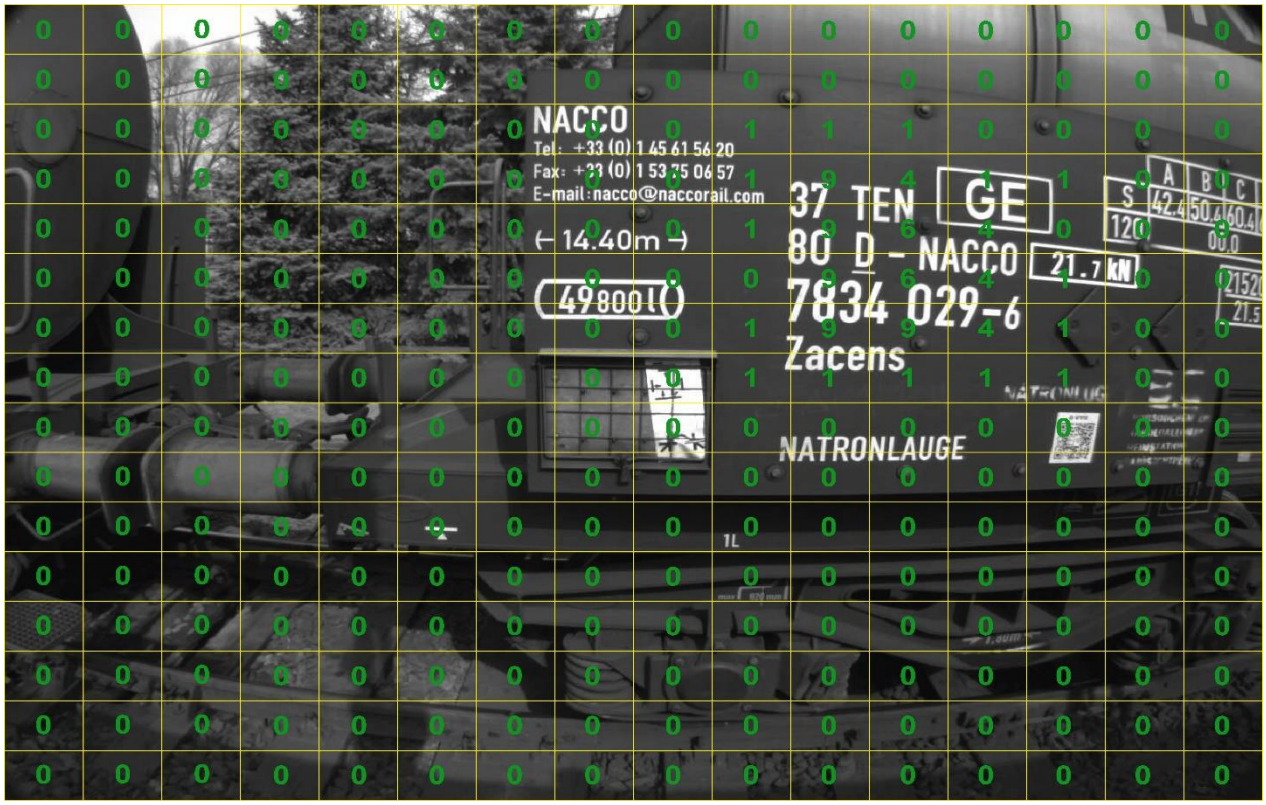
Defining zones:

<posfreq value="1,1,1;4,9,4;1,1,1"/>

The image is divided into 3×3 zone with the given starting weights.

1	1	1
4	9	4
1	1	1

Please check the following sample image, which indicates superior areas in the centre of the image:



Defining a polygon:
<posfreq value="426,111;865,92;900,562;354,593">

Note

The order of the coordinates has to be set clockwise (see below). A polygon is designated in the centre of the image, on the score of which the algorithm produces the zones (posfreqhistxs*posfreqhistys is the number of zones, 16*16 by default) in such a way that the starting weight of the zones – contained by the polygon – will be maximal. The weight of the zones intersected by the polygon will be lower in proportion to the intersection. Finally, the weight of the outer (untouched by the polygon) zones will be 0. It does not return any character from the zones with 0 weight.

Example for a polygon posfreq setting:

Possible usage of posfreq polygon

(points are represented in pixel coordinates on the 16x16 default grid)

Possible values:	character string
Default value:	“” (empty string)
Suggested value:	leave the default value

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3. POSFREQHALFLIFE

LEVEL OF WEIGHT ADAPTATION

If its value is 0, the weights will not be adapted (it does not learn from the previous cases). It will use the original settings all the time.

Otherwise, after 'posfreqhalflife' number of evaluations, the starting information will be half lapsed and the new information will be half freshened.

Half-life: after the evaluation of so many images, the total weight of the histogram will be twice as much.

Possible values: [0..1048576]

Default value: 0

Suggested value: 0

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4. POSFREQHISTXS

HORIZONTAL RESOLUTION FOR DEFINING POSITION FREQUENCY

In case of setting a polygon or zones, the number of columns can be set by this property.

Possible values: [2..64]

Default value: 16

Suggested value: 16

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5. POSFREQHISTYS

VERTICAL RESOLUTION FOR DEFINING POSITION FREQUENCY

In case of setting a polygon or zones, the number of rows can be set by this property.

Possible values: [2..64]

Default value: 16

Suggested value: 16

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6. POSFREQWEIGHT

WEIGHT FOR THE POSITION OF THE INDUSTRIAL CODES

This parameter defines the extent the system has to take into account the position of the industrial codes.

If this parameter is 0, the system does not distinguish between the non-0 weight zones. In this case, the searching does not exploit the distribution of the position of industrial codes.

If this parameter is 100, the system tries to exploit maximally the distribution of the position of industrial codes.

Possible values: [0..100]

Default value: 50

Suggested value: 50

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PROPERTIES RELATED TO IMAGE QUALITY

1. CONTRAST_MIN

MINIMUM CONTRAST DIFFERENCE

The minimum difference between the grayscale value of the industrial code characters and its background.

> **Note**
>
> No result will be returned where the grayscale contrast is smaller than the specified value.

Possible values: [0..255]

Default value: varies with each engine release; default property value can be queried by the `GetProperty()` function

Suggested value: leave the default value

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PROPERTIES RELATED CODE TYPE

1. CHECKSUM_CHECK

RUNTIME CHECK OF THE CHECKSUM
(available in ILU, ISO, ISOILU and UIC engines)

Is runtime checksum validation enabled? If it's value is set to 1, a runtime checksum validation is enabled, therefore the codes which aren't valid don't even get into the possible tips. If it is set to 0 the runtime validation is disabled.

Possible values: {0,1}

Default value: 1

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2. FILTERLONGCODES

LONG CODE FILTERING
(available in ACCR_USA, ILU, ISO and ISOILU engines)

If there is no industrial code on an image but there is other kind of text on it then the engine may return with false (industrial) codes. The FilterLongCodes option helps to reduce the occurrence of these false codes, increases runtime length (approx 5%), and worsens the recognition of container codes on pictures having a container code (approx 0.5%). If this option is set to 1 then filtering is enabled. (If set to 0, filtering is disabled) Default value: 1.

Possible values: {0,1}

Default value: 0

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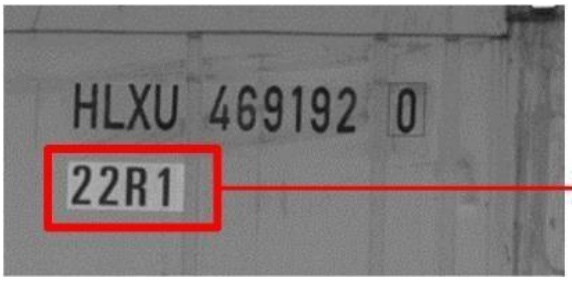
3. ISOCODE

ISO CODE RECOGNITION
(available in ISO and ISOILU engines)



This is the last 4 digit of an ISO code

With this property the user can set if the engine searches for the last four digits of the entire ISO code as well (1) or not (0).

Possible values: {0,1}

Default value: 1

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APPENDICES

CONFIDENCE LEVEL CALCULATION

$$\text{maxconf} + \frac{(100 - \text{maxconf})*(k-1)}{k}$$

Where:

- k stands for the number of images, where the SAME result was read
- "maxconf" = highest confidence of the image series where the confidence level of one image equals the minimum confidence of the characters on the actual image

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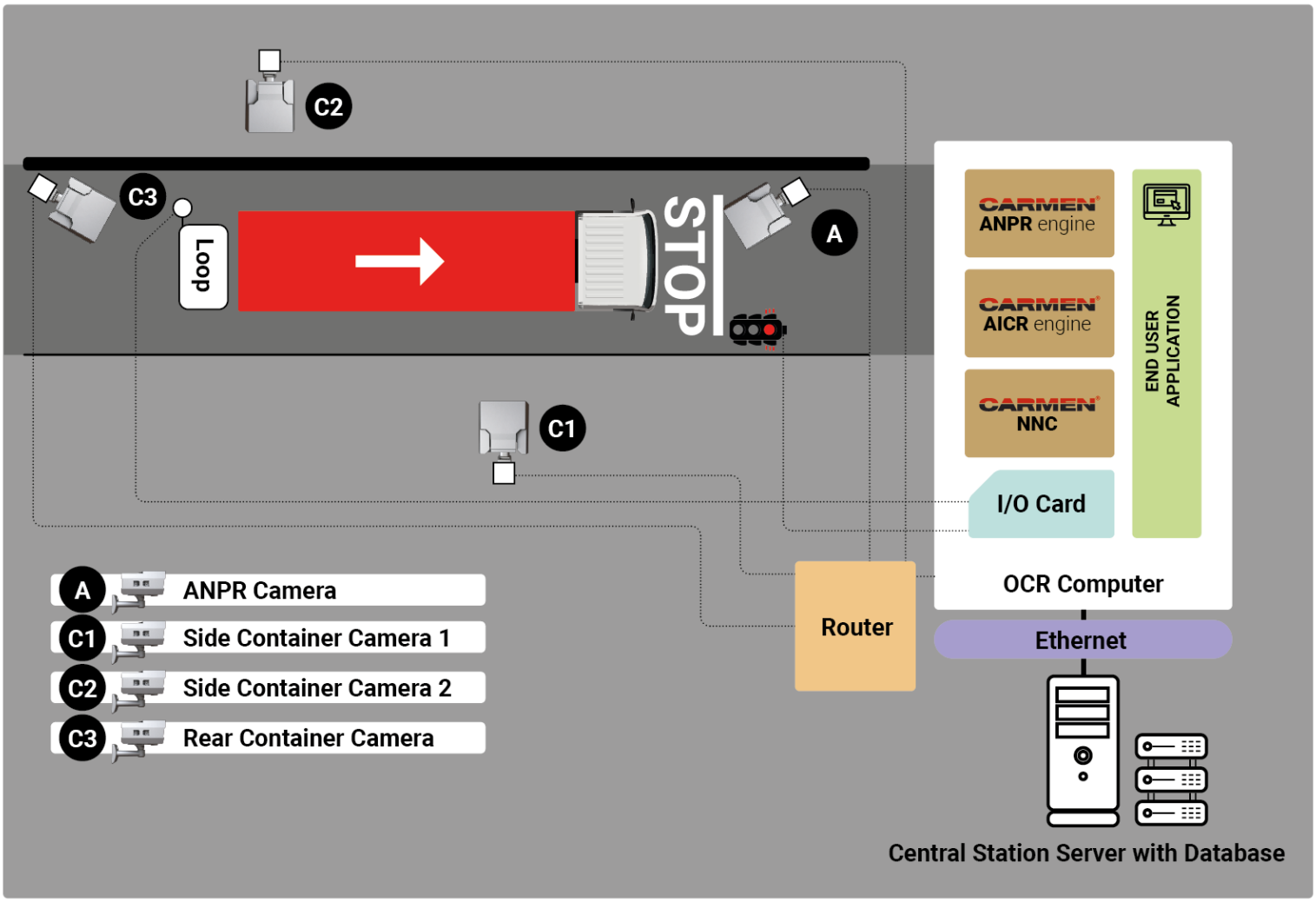
SAMPLE INSTALLATION

TRUCK LANE



In the above image, a sample application can be seen for AICR purposes. In many cases the container codes are damaged, therefore we suggest to capture multiple images from different sides of the container and handle them together as an image sequence. Three container cameras are recommended to reach the most precise reading results. To provide optimal conditions for taking an image, we suggest using two external white LED illuminator devices. With the help of an additional ANPR camera, the truck, carrying the container, can be identified.

To reduce consumption of the computer resources we suggest using external triggering to capture images only if the container code and the industrial code are in a good position.

The inductive loop (other triggering possibilities: laser sensor, microwave sensor, magnetic sensor or infrared barrier) serves as a sensor, which indicates the arrival of the vehicle.

As the vehicle stops at the "STOP" sign, all cameras identify the container code and the industrial code of the truck. For more information, feel free to contact our Sales Team on one of the following possibilities.

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SENDINFO@ARH.HU
WWW.ADAPTIVERECOGNITION.COM

CONTACT INFORMATION

Headquarters:
Adaptive Recognition, Hungary Inc.
Alkotás utca 41 HU-
1123 Budapest Hungary
Phone: +36 1 201 9650
Fax: +36 1 201 9651
Web: adaptiverecognition.com

Service Address:
Adaptive Recognition, Hungary Inc.
Ipari Park HRSZ1113/1 HU
2074 Perbál Hungary
Phone: +36 1 2019650
E-mail: rmarequest@adaptiverecognition.com

Adaptive Recognition Technical Support System (ATSS) is designed to provide you with the fastest and most proficient assistance to get you back to business quickly.
For further technical information about our products, please visit our official website.

Information regarding hardware, software, manuals, and FAQ are easily accessible for customers who previously registered to enter the dedicated ATSS site. Besides offering assistance, the site is also designed to provide maximum protection while managing your business information and the technical solutions utilized.

New User
If this is your first online support request, please create an account by clicking on this link.

Returning User
All registered ATSS customers receive a personal access link via email. If you previously received a confirmation message from ATSS, it contains the embedded link that allows you to enter the support site securely.

If you need assistance with login or registration, please contact atsshelp@adaptiverecognition.com.