

Software manual  
Object recognition sensor  
**O2D5xx**  
Version 2.4.9

**GB**

11408812 / 00 07 / 2021

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# 1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at [www.ifm.com](http://www.ifm.com).

## 1.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	Important note Non-compliance may result in malfunction or interference.
	Information Supplementary note

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## 2 Safety instructions

Please read the operating instructions prior to set-up of the device. The device must be suitable for the application without any restrictions.

If the operating instructions or the technical data are not adhered to, personal injury and damage to property can occur.

### 3 Intended use

The software manual describes the functions of the software ifmVisionAssistant:

- recognising the device in the local subnet,
- configuring the device,
- collecting, storing and evaluating data,
- installing and monitoring applications on the device.

As soon as an application has been installed on the device, the device can be operated without the ifmVisionAssistant.

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## 5 Installation

### 5.1 System requirements

#### Software

The following software is required for operation:

- Operating system: Windows 10 (32/64 bits)
- Software ifmVisionAssistant: 2.4.9 or higher
- Firmware of the device: 1.22.8766 or higher



#### Other versions

- ▷ Other versions of the software or firmware may contain changed or new functions which are not described in this software manual.

#### Hardware

The following hardware is required for operation:

- Hard disk: min. 1 GB free memory space
- Monitor: Resolution of min. 1024x768 pixels, 32-bit colour depth

#### Accessories

- Cables for the network connection (Ethernet) for setting the parameters:
  - E11898 (2 m, M12 plug/RJ45 plug, 4 poles)
  - E12283 (5 m, M12 plug/RJ45 plug, 4 poles)
  - E12204 (10 m, M12 plug/RJ45 plug, 4 poles)
  - E12205 (20 m, M12 plug/RJ45 plug, 4 poles)
- Connection cables for supply voltage and process connection, 8 poles, A-coded:
  - E11950 (2 m, M12 socket, 8 poles, A-coded, open cable end)
  - E11807 (5 m, M12 socket, 8 poles, A-coded, open cable end)
  - E11311 (10 m, M12 socket, 8 poles, A-coded, open cable end)
- Connection cables for supply voltage and process connection, 5 poles, L-coded:
  - E12641 (2 m, M12 socket, 5 poles, L-coded, open cable end)
  - E12642 (5 m, M12 socket, 5 poles, L-coded, open cable end)
  - E12643 (10 m, M12 socket, 5 poles, L-coded, open cable end)
- Power supply 24 V, 0.9 A
- Mounting set for the device (clamp mounting) E2D500



- ▷ Further information about the accessories: [www.ifm.com](http://www.ifm.com)

### 5.2 Hardware



- ▷ Detailed information about installation and electrical connection of the hardware can be found in the operating instructions of the device.


## 5.3 Software

Installing the ifmVisionAssistant:

- ▶ Download the ifmVisionAssistant from the website: [www.ifm.com](http://www.ifm.com)
- ▶ Copy the zip file to a directory on the PC and unzip.
- ▷ The ifmVisionAssistant is installed and can be started via the file „ifmVisionAssistant.exe“.



ifmVisionAssistant does not start

- ▷ If the ifmVisionAssistant does not appear within 5-10 seconds after starting:
  - ▶ Check the system requirements. (→ System requirements  9)
  - ▶ Check the unzipped zip file for completeness.

### 5.3.1 Uninstall

Uninstalling the ifmVisionAssistant:

- ▶ Delete the installation folder of the ifmVisionAssistant.
- ▷ The ifmVisionAssistant is uninstalled.



▷ Existing settings and log files are not deleted.

Deleting the settings and log files:

- ▶ Delete the following directory: „%AppData%\ifm electronic\ifmVisionAssistant“

## 6 Getting started

The chapter “First steps” explains the first steps with the device and the ifmVisionAssistant software.

### Connecting the device

Installation and electrical connection are described in the operating instructions of the device.

### Using the ifmVisionAssistant

- ▶ Install and start the ifmVisionAssistant software. (→ Software [10](#))
- ▶ Click the button [Find device] on the start page. (→ Start page [14](#))
- ▶ Connect the device by clicking.
- ▷ For new devices: No applications are stored on the device. Once the device is connected, the area “Application” is displayed.
- ▷ For already configured devices: Applications are stored on the device. Once the device is connected, the area “Monitor” is displayed. (→ Monitor [20](#))

### ifmVisionAssistant: area “Monitor”

In the area “Monitor”, the active application is displayed. In the trigger mode “Continuous”, the received data of the device is displayed in a live image.



### ifmVisionAssistant: area “Application”

An application sets the device for a specific application. Up to 32 applications can be stored on the device.

An application contains the following settings:

- Image settings and settings for image recording: Images and trigger (→ Images & trigger [26](#))
- Detection of contours and analysis of areas: Models (→ Models [35](#))
- Sequence of the processing of images and models: Flow (→ Flow [55](#))
- Output logic for data transfer to an external controller: Logic (→ Logic [57](#))
- Configuration of the output via the interfaces: Interfaces (→ Interfaces [71](#))
- Collection of statistical data: Test (→ Test [75](#))

### Detecting one or several objects with the device

- ▶ Click the button [Application]:  .
- ▷ The area “Application” indicates the applications stored on the device. (→ Application [23](#))
- ▶ Click the button [Add new application]:  .
- ▶ Click the [Presence control] or [User-defined mode] button.
- ▷ The [Presence control] wizard guides you through adding an application in several steps. The application is then activated and the area “Monitor” is displayed.
- ▷ The button [User-defined mode] allows individual configurations.

The device is ready for operation and executes the active application.

## 7 Command line parameters

The command line parameters influence the start of the ifmVisionAssistant. The parameters are entered after the exe file. Several parameters can be appended to one another, separated by a space.

### Command line parameters via prompt

Starting the ifmVisionAssistant via the prompt:

- ▶ In the prompt, enter the command line parameters after "ifmVisionAssistant.exe" separated by a space.
- ▷ Example: "ifmVisionAssistant.exe -log"

### Command line parameters via Windows

Starting the ifmVisionAssistant with command line parameters via Windows:

- ▶ Click on the [ifmVisionAssistant] link on the right.
- ▶ Click [Properties] in the submenu.
- ▶ Click the tab [Shortcut].
- ▶ Click the field [Target] and move the cursor to the end of the line.
- ▶ Enter a space followed by the command line parameter.
- ▶ Click [OK].

### Available command line parameters

The following command line parameters are available:

Command line parameter	Description
-disableclosebtn	Disables the button for closing the ifmVisionAssistant.
-log	Creates a log file for a detailed fault analysis. The log file is saved in the following folder: "%APPDATA%\ifm electronic\ifmVisionAssistant\logs"
-autoconnect filename.xml	Automatically establishes the connection to a device. The file "filename.xml" must contain the following XML code: <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;sensor&gt; &lt;sensorType&gt;O2D5xx&lt;/sensorType&gt; &lt;addressType&gt;IP&lt;/addressType&gt; &lt;name&gt;My sensor&lt;/name&gt; &lt;address&gt; &lt;ip&gt;192.168.0.69&lt;/ip&gt; &lt;pcic_port&gt;50010&lt;/pcic_port&gt; &lt;web_port&gt;80&lt;/web_port&gt; &lt;mac&gt;00:02:01:21:b9:ee&lt;/mac&gt; &lt;/address&gt; &lt;/sensor&gt;</pre> <ul style="list-style-type: none"> <li>▶ Adjust the information in the XML file: IP address, ports, etc.</li> </ul>

Command line parameter	Description
<code>-geometry [screen]:[width]x[height]+[x]+[y]</code>	<p>Sets the window size and position of the ifmVisionAssistant (incl. window frame). The minimum window size is 1024x768 pixels.</p> <p>Example:</p> <pre><code>-geometry 1:1380x768+0+0</code></pre> <p>The window is placed on screen 1 (screen=1). The window size incl. Windows window frame is set to 1380x768 (width = 1380 and height = 768). The window is positioned at the top left (x=0 and y=0). When negative values are entered for the window position x and y, the opposite corner is used as zero point. Example:</p> <p>“+0+0” window at the top left “-0+0” window at the top right “+0-0” window at the bottom left “-0-0” window at the bottom right</p>
<code>-frameless</code>	Starts the ifmVisionAssistant without the native window frame.

### Kiosk mode

In kiosk mode, the Windows window frame is hidden and the ifmVisionAssistant cannot be closed. The mode is particularly suited for trade fairs and demonstrations.

Using the kiosk mode:

- Use the following command line parameters one after the other:

```
ifmVisionAssistant.exe -disableclosebtn -frameless
```



The ifmVisionAssistant can be closed by pressing “Ctrl+F4”.

## 8 Start page

The start page contains the basic functions of the ifmVisionAssistant.

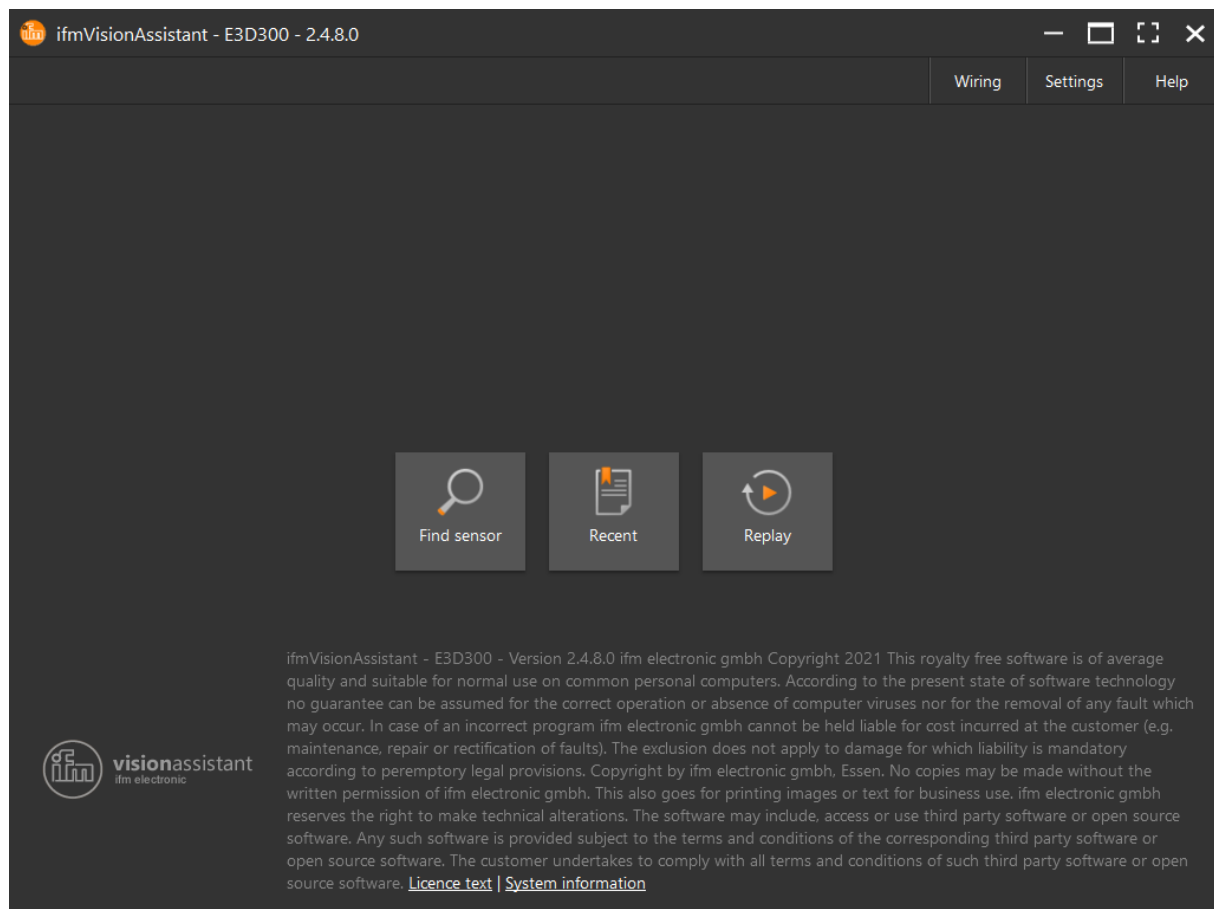


Fig. 1: Start page

Symbol	Name	Description
	Zoom out	Reduces the size of the window.
	Zoom in	Enlarges the window.
	Full screen	Displays the window in full screen.
	Exit	Closes the software.

Tab. 1: Title bar






▶ With the F11 key, you can switch between full screen and window view.

Name	Description
Device status	<p>Displays information about the hardware and firmware of the connected device. For the function [Device status], the device must be connected.</p> <p>The information can be saved in a text file for diagnostics by the support team.</p> <ul style="list-style-type: none"> <li>▶ Click the [Device status] tab.</li> <li>▶ Click the [Show device details] button.</li> <li>▶ Click the [Save] button.</li> </ul>

Name	Description
Wiring	Displays information on wiring and connection aids.
Settings	Sets the language and colour of the user interface.
Help	Displays the documentation and contact information of the support.

Tab. 2: Menu bar

Button	Name	Description
	Find sensor	Searches for connected devices and displays them in a list. (→ Connecting a new device □ 15) For this function, the device must be connected.
	Recent	Displays devices that have already been used before in a list. (→ Connecting a device that has already been used □ 16) For this function, the device must be connected.
	Replay	Plays back a saved image capture. (→ Playing back image captures □ 16)

Tab. 3: Buttons


## 8.1 Connecting a new device

This function searches for a new device and displays it in a list. The device can then be connected.

### Preparations

- ▶ Connect the device to the voltage supply.
- ▶ Connect the device to a PC via Ethernet.

### Connecting a new device

- ▶ Click the button [Find sensor]: 
- ▷ The ifmVisionAssistant searches for connected devices. A list shows the devices found and their settings.
- ▶ Select a found device.
- ▷ The connection to the device will be established.



#### Connection problems

- ▷ If the device is not found:
  - ▶ Check the connections and the operating status of the device.
  - ▶ Connect the device to the PC directly via Ethernet without network devices (e.g. router).
  - ▶ Connect the device manually. (→ Connecting the device manually □ 15)
- ▷ The IP addresses of the device and the PC must be in the same subnet.




#### Messages in the ifmVisionAssistant

- ▷ With the key combination Ctrl+C, the text of a message is copied to the clipboard.

### 8.1.1 Connecting the device manually

A device can be connected manually by entering the IP address.

- ▶ Click the button [Find sensor]: 
- ▶ Click the message [Click to connect manually].
- ▷ The window “Manual connection” is displayed.
- ▶ Select [O2D5xx manual connection] in the list.
- ▶ Enter the IP address of the device.
- ▷ The default IP address is “192.168.0.69”.
- ▶ Click on the button [Connection].




#### Connection problems

- ▷ The IP addresses of the device and the PC must be in the same subnet.






## 8.2 Connecting a device that has already been used

This function displays devices that have already been used before in a list.

- ▶ Click the button [Recent]: 
- ▷ The window “Recent” is displayed.
- ▶ Select a device from the list.
- ▷ The device is connected and can now be used.


## 8.3 Playing back image captures

The function [Replay] plays back a saved image capture. The function contains the following operating elements:

Operating element	Name	Description
	Previous image	Jumps to the previous image.
	Replay	Starts the replay.
	Next image	Jumps to the next image.
	Pause	Pauses the replay.
	Progress bar	Indicates the current position of the replay.
[Open other file]	Open other file	Opens another image capture.

Tab. 4: Operating elements

### Playing back image captures

- ▶ Click the button [Replay]: 
- ▷ A window for opening an image capture is displayed. The image captures are saved in the following folder by default: %appdata%\ifm\_electronic\ifmVisionAssistant\capture
- ▶ Select an image capture.



- ▶ Click the button [Open].
- ▷ The image capture is displayed.

### 8.3.1 Converting an image capture

This function converts an image capture into another output format. The image capture is converted via the following operating elements.

Operating element	Type	Description
[Output format]	List	Sets the output format (see table below).
[Output file path]	Output field	Displays the set output file.
[...]	Button	Sets the output directory or the output file.
[Output range]	List	Sets the output range (see table below).
[Convert]	Button	Starts converting the image capture.

Tab. 5: Operating elements



- ▷ Depending on the output format set, some operating elements are not displayed.

#### Output format

Output format	Description
[HDF5 ifm streams (*.h5)]	Flexible data container
[Data capture files (*.dat)]	Proprietary format

Tab. 6: Output format

#### Data format

Data format	Description
[ASCII]	Sets the data format to "ASCII".
[Binary little endian]	Sets the data format to "Binary little endian".
[Binary big endian]	Sets the data format to "Binary big endian".

Tab. 7: Data format

#### Output range

Output range	Description
Whole file	Converts the whole image capture.
From the current position to the end of the file	Converts from the current position of the progress bar to the end of the image capture.
From start to current position	Converts from the start of the image capture to the current position of the progress bar.
Only the next image	Converts the next image of the image capture, viewed from the current position of the progress bar.

Tab. 8: Output range

## 9 Structure of the user interface

The user interface is divided into the following areas:

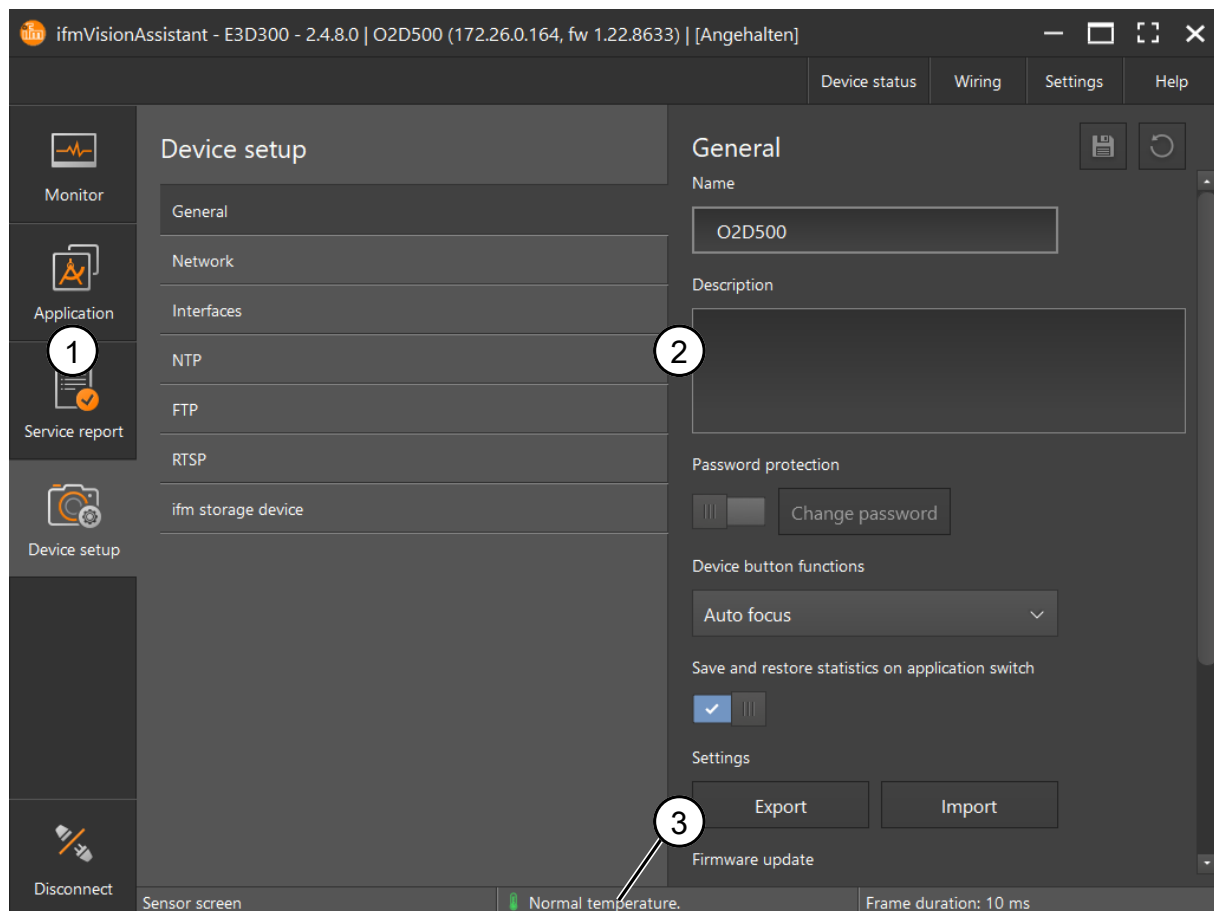







Fig. 2: User interface

1 Navigation bar  
3 Status bar

2 Main area

### Navigation bar

The buttons in the navigation bar are used to switch between the areas of the ifmVisionAssistant.

Button	Name	Description
	Monitor	Displays the received data of the device. (→ Monitor <input type="checkbox"/> 20)
	Application	Displays the applications.
	Service report	Displays an evaluation of the device.
	Device setup	Displays the device configuration. The device and network are set in the device configuration.
	Disconnect	Disconnects the connection to the device.

### Main area

The function selected with the navigation bar is displayed in the main area.

### Status bar

The status bar shows current information about the device:

- the current window name, e.g. “Sensor window”

- the temperature of the device
- processing time of an image, e.g. "80 ms"



The frame duration is the running time of the signal from the trigger input to the process interface.

## 10 Monitor

In the area “Monitor”, the active application is displayed. In the trigger mode “Continuous”, the received data of the device is displayed in a live image.

The device is in the operating mode.

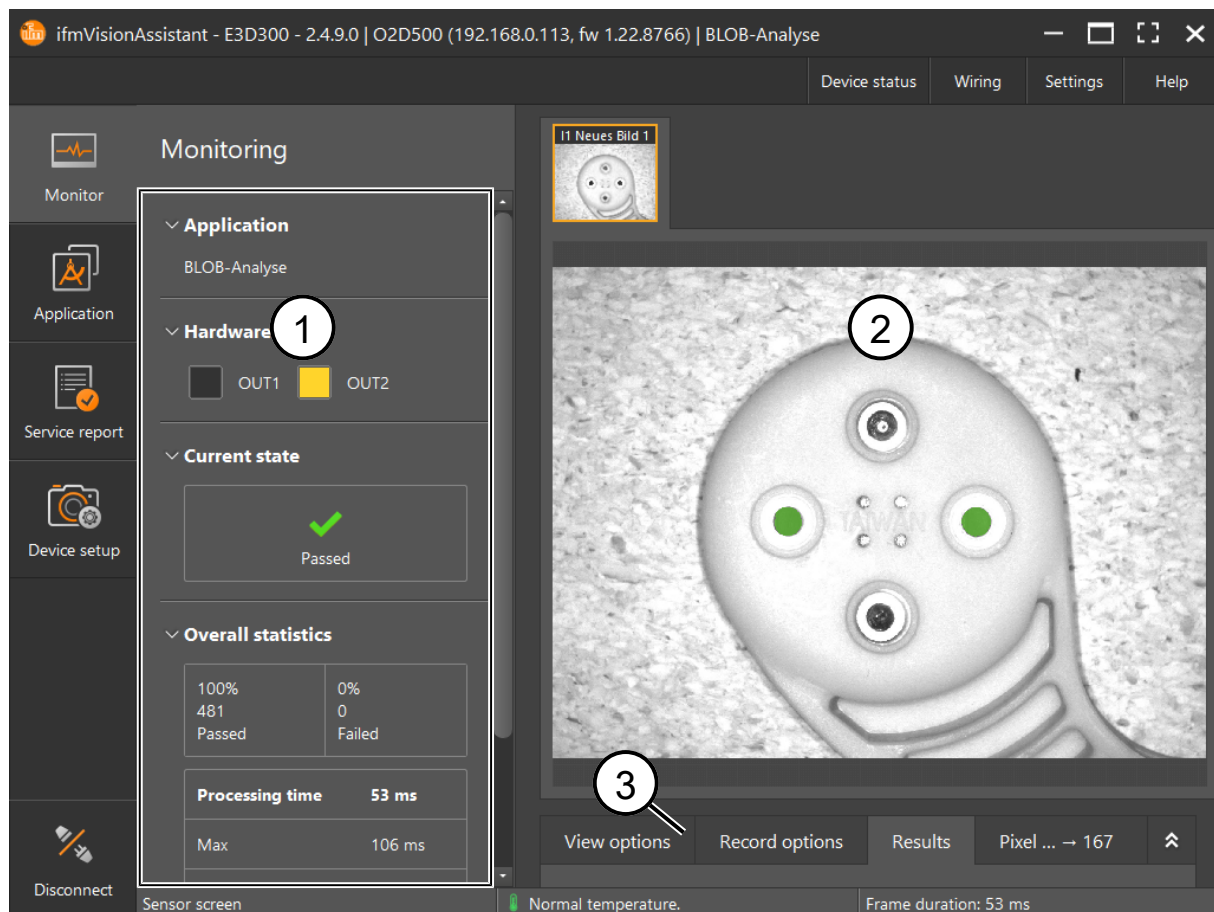


Fig. 3: Area “Monitor”

1 Status indicators  
3 Tabs

2 Live image

### Status indicators

The “status indications” show the states of the digital outputs and the statistics on the active application.

- “Application”: Indicates the name of the active application.
- “Hardware”: Shows the status of the digital outputs. If a signal is present, the yellow LED is on.
- “Current state”: Shows the current state of the application.
- “Overall statistics”: Shows the recorded values of all models of the active application and the number of total measurements. The values “Passed” and “Failed” are incremented via a counter. The ratio of the two values is indicated in per cent.
- “Processing time”: Displays the current, maximum and minimum evaluation time.
- [Reset All Statistics]: This button resets the overall statistics.

### Live image

The “live image” displays the current image of the vision sensor.







Only in the trigger mode “Continuous”, the live image is continuously updated. In the other trigger modes, an update of the live image must first be triggered.

### Tabs



The area “Monitor” contains the following tabs:

Tab	Description
[View Options]	Sets the displayed image area of the live image.
[Record options]	Records the data from the device and the results of the application in a video or image.
[Results]	Displays the results of the models. The results can be restricted to certain models or images.
[Pixels]	Displays details of pixels and grey scales of the live image.



The tab [View options] contains the following operating elements:



Operating element	Name	Description
	Zoom out	Reduces the image area of the live image. The zoom level can also be changed using the mouse wheel.
	Undo zoom	Resets the image area of the live image to the standard size.
	Zoom in	Enlarges the image area of the live image. The zoom level can also be changed using the mouse wheel.
	Show all ROIs of all models	Displays the search zones (ROIs) of all models in the live image.
	Overlay application reference image	Displays the reference image in the live image. The button [Overlay application reference image] is displayed as soon as a reference image has been saved. (→ Reference image  31) The slider adjusts the transparency of the reference image. The colour field to the right of the slider sets the colour of the reference image.

The tab [Record options] contains the following operating elements:




Operating element	Name	Description
	Save current image as JPEG	Saves the current live image as a JPEG file.
[Duration]	Duration	Sets the duration of the image capture. Approx. 250 MB/minute are required. If the duration is set to [Continuous], the image capture is limited by the free memory capacity of the data carrier.
	Start/Stop	Starts or stops the image capture. The image capture is saved in a file with the extension “*.h5” or “*.dat”.
- / 02:00	Image capture time	Shows the duration of the current image capture and the maximum capture time.

The [Results] tab contains the following operating elements:

Operating element	Name	Description
	Filter table by selected image	Filters the table according to the selected image.
	Filter table by selected model	Filters the table according to the selected model.

Operating element	Name	Description
	BLOB result table	Displays the results of the BLOB analysis.
	Contour result table	Displays the results of the contour verification.
[Show ROI group results]	Show ROI group results	Shows the results of the ROI groups in the table.

The [Pixels] tab contains the following operating elements:

Operating element	Name	Description
	Line	Draws a line in the live image. Displayed measured values of the line: “Line”: Start/end coordinates [px] “Angle”: angle [°] “Length”: length [px] “Grey scale”: mean/min/max value of grey levels
	Rectangle	Draws a rectangle in the live image. Displayed measured values of the rectangle: “Rect”: coordinate of the upper left corner [px] and width/height [px] “Area”: area [px <sup>2</sup> ] “Grey scale”: mean/min/max value of grey levels
	Circle	Draws a circle in the live image. Displayed measured values of the circle: “Circle”: coordinate of the circle centre [px] and radius [px] “Area”: area [px <sup>2</sup> ] “Grey scale”: mean/min/max value of grey levels

## 11 Application

The area “Application” manages the applications of the connected device. An application contains application-specific settings.

An application contains the following settings:

- Image settings and settings for image recording: Images and trigger (→ Images & trigger [📄 26](#))
- Detection of contours and analysis of areas: Models (→ Models [📄 35](#))
- Sequence of the processing of images and models: Flow (→ Flow [📄 55](#))
- Output logic for data transfer to an external controller: Logic (→ Logic [📄 57](#))
- Configuration of the output via the interfaces: Interfaces (→ Interfaces [📄 71](#))
- Collection of statistical data: Test (→ Test [📄 75](#))

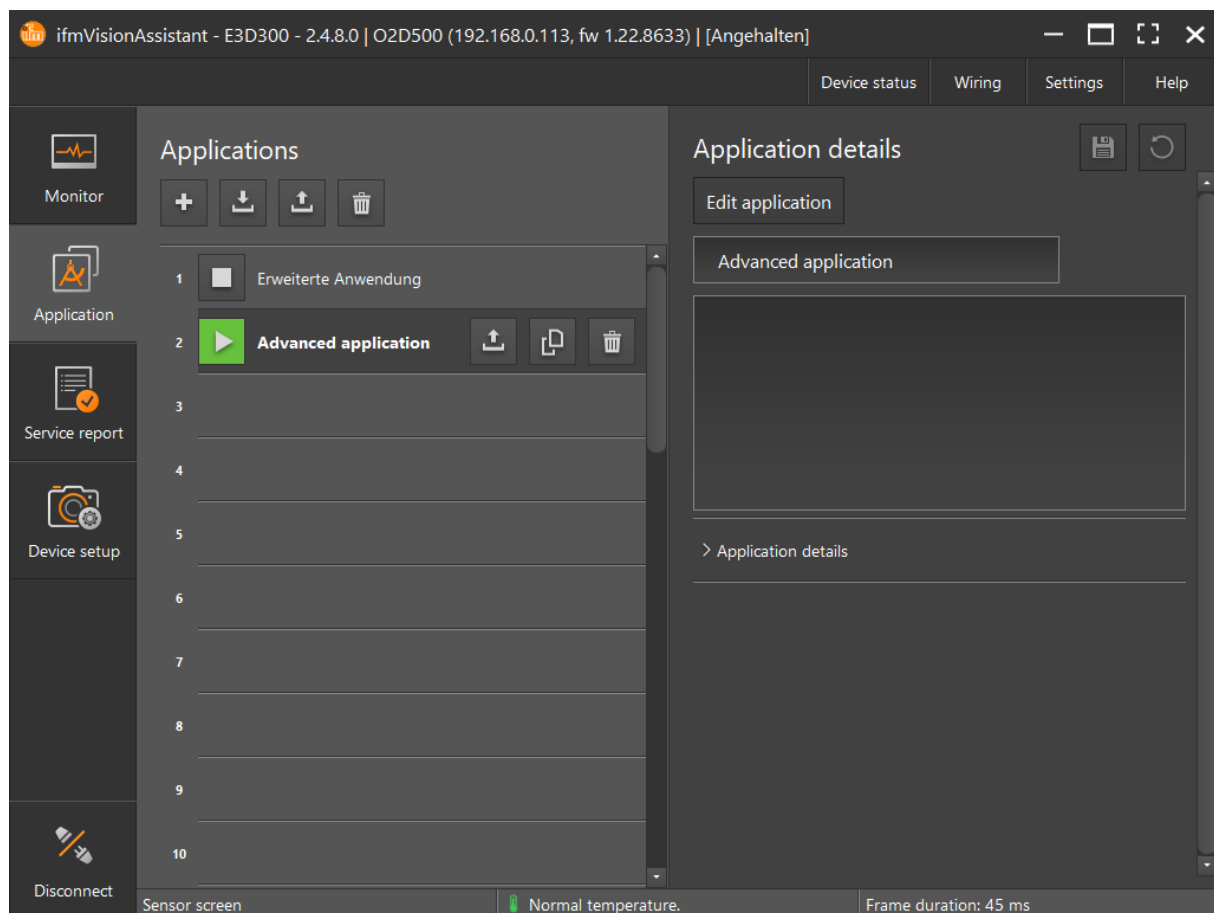











Fig. 4: Area “Application”



A maximum of 32 applications can be managed.

The area “application” contains the following operating elements:

Operating element	Name	Description
	Add new application	Displays several buttons that can be used to add a new application: [User-defined mode]: Starts the user-defined mode. All settings are displayed. The mode is intended for advanced users. [Wizard]: The wizard guides you through creating an application for a specific task in several steps.
	Import application	Imports one or more applications from a file with the extension "*.o2d5xxapp".
	Export all applications	Exports one or more applications to a file with the extension "*.o2d5xxapp".
	Delete all applications from the device without backup	Deletes all applications irrevocably after confirmation.
	Activate	Displays the active application.
	Activate	Activates the selected application.
	Duplicate	Duplicates the selected application. The duplicate can be used for tests, for example.
	Save	Saves the changed application details.
	Discard unsaved changes	Discards the changed application details and restores the status saved last.
[Edit application]	Edit application	Edits the application-specific settings of the selected application in the "user-defined mode". If the application was created with the wizard "Presence control", the wizard opens.
[Edit without wizard]	Edit without wizard	Edits the selected application in the "user-defined mode". All settings are displayed. The button is only displayed for applications that have been added with the wizard "Presence control".
[Application name]	Application name	Sets the name of the selected application.
[Application description]	Application description	Sets a description for the selected application.
[Application details]	Application details	Displays details of the selected application.

### Edit application

The application is set in the area "Edit application". An application contains application-specific settings.



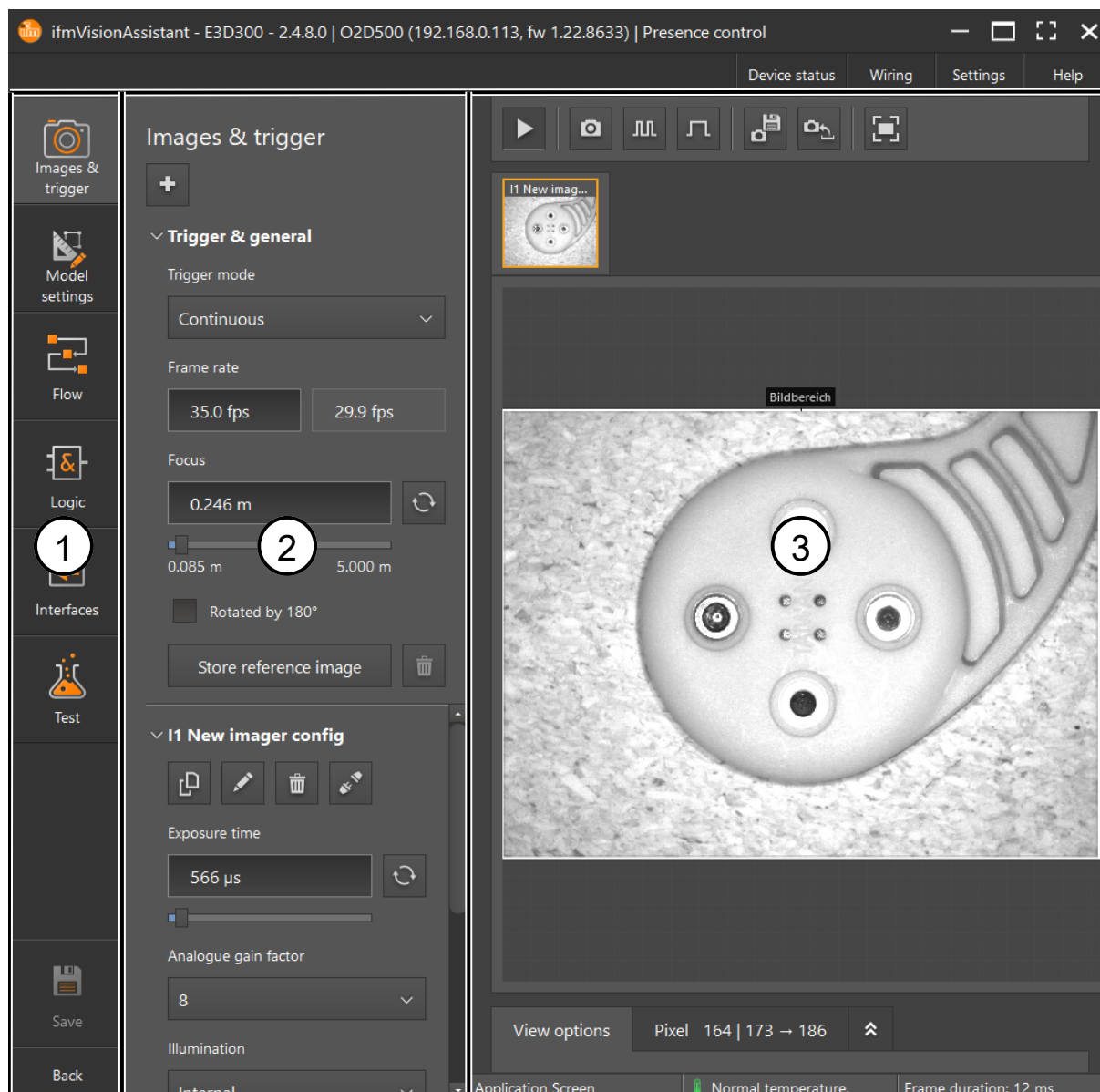


Fig. 5: Area “Edit application”

- 1 Navigation bar
- 3 Main area




2 Settings




The area “Edit application” can be accessed in two ways:

- by adding a new application,
- by editing the selected application.

**Navigation bar**

The buttons in the navigation bar are used to switch between functions.

Function	Name	Description
	Images & trigger	Sets the image and trigger settings of the application. (→ Images & trigger □ 26)
	Models	Sets the search of objects. (→ Models □ 35)
	Flow	Sets the evaluation order of the images and models. (→ Flow □ 55)










Function	Name	Description
	Logic	Sets the output logic. (→ Logic <a href="#">□ 57</a> ) The model and pin events are assigned to the outputs in the output logic.
	Interfaces	Sets the data packages which are sent via the interface. (→ Interfaces <a href="#">□ 71</a> )
	Test	Displays statistics and states of the connected device. (→ Test <a href="#">□ 75</a> )

## Settings

The selected function is set in the settings.

## Main area

In the main area, the found objects are displayed in the live image. The live image contains the following operating elements:

Operating element	Name	Description
	Live image	Continuously refreshes the live image independently of the set trigger source and frame rate.
	Force trigger	Refreshes the live image once independently of the set trigger source.
	React to all triggers	Refreshes the live image on each trigger signal.
	Wait for a trigger	Refreshes the live image once on the next trigger signal.
	Save snapshot	Saves the current live image in a file. If several images exist, all are saved in a file. The file has the extension “.o2d5xx-img”.
	Load snapshot	Loads the live image from a file. The loaded file is displayed instead of the live image. The file has the extension “.o2d5xximg”.  If a file contains several images, there may be an error message when the live image is loaded. Before loading the live image, add the number of images in the ifmVisionAssistant. (→ Add new image <a href="#">□ 30</a> )
	Activate models	Activates the models. Objects are detected with the models.
	Create region of interest (ROI)	Opens the menu for creating a search zone (ROI: Region of Interest). (→ Creating a region of interest (ROI) <a href="#">□ 53</a> ) Objects are detected in the ROI.
	Create region of disinterest (ROD)	Opens the menu for creating an exclusion zone (ROD: Region of Disinterest). (→ Creating a region of disinterest (ROD) <a href="#">□ 54</a> ) No objects are detected in the exclusion zone.



Some buttons are only visible in certain areas of the ifmVisionAssistant.

## 11.1 Images & trigger

The function “Images & trigger” sets the image capture of the device and the triggers.

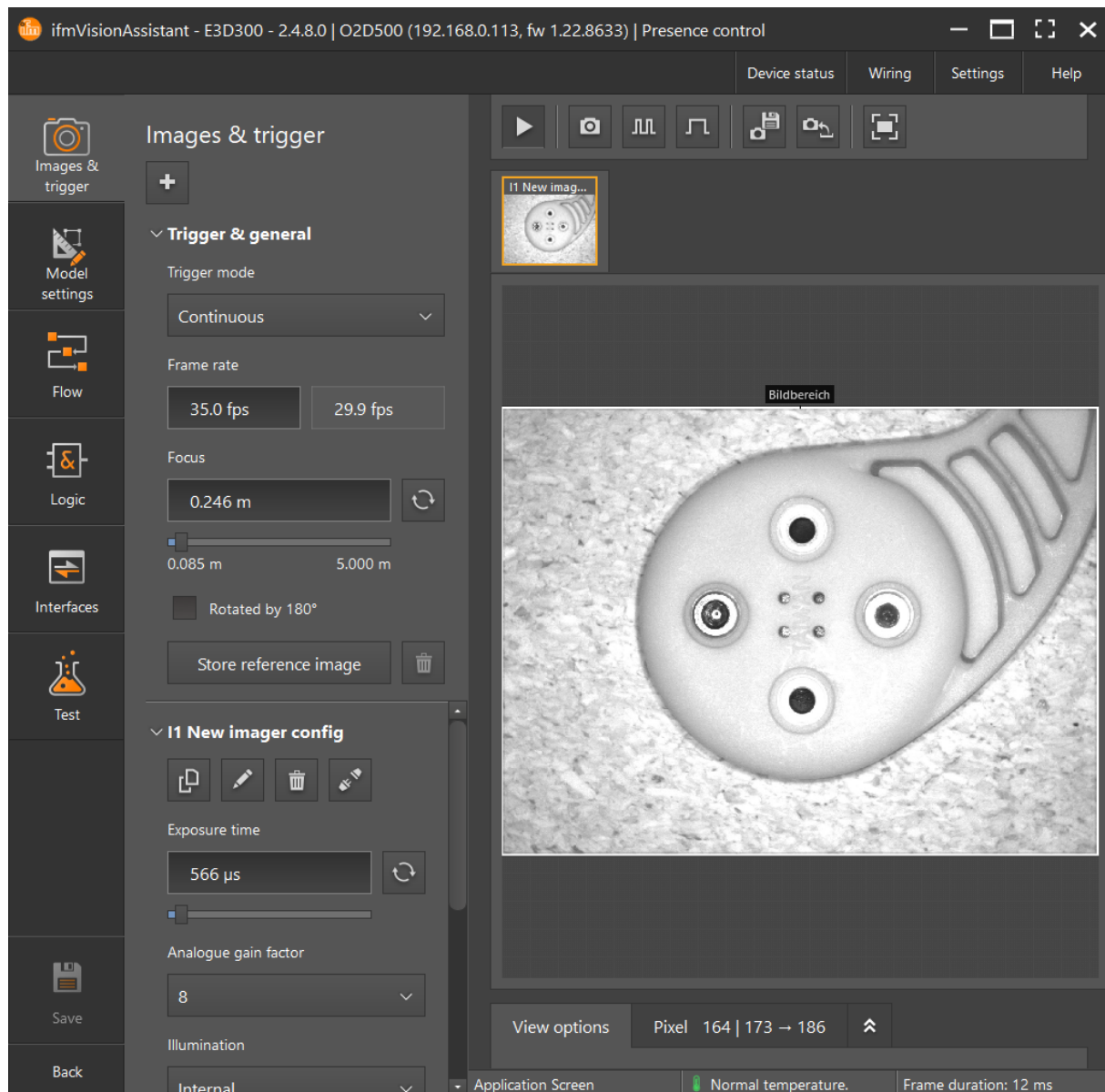


Fig. 6: Function “Images &amp; trigger”



To detect objects, models have to be added. (→ Models [35](#))

The function “Images & trigger” contains the following operating elements:



Operating element	Type	Description
	Button	Adds a new image. (→ Add new image <a href="#">30</a> )

### Trigger & general

In the area “Trigger & general”, the trigger mode, the frame rate and the focus are set.

The area contains the following operating elements:






Operating element	Type	Description
[Trigger mode]	List	Sets the trigger mode. (→ Trigger mode <a href="#">30</a> ) A trigger is an electronic signal that is sent to the device for image capture.

Operating element	Type	Description
[Trigger delay]	Input field	Sets a time delay between the received trigger signal and the image capture in [ms].
[Enable burst trigger]	Checkbox / input field	Activates the burst trigger. The input field is used to set how often the application is triggered. For example, an application with 3 set images and burst trigger="10" records a total of 30 images. After the image capture, the images are evaluated. The first image rated as "pass" is output. Other images rated as "pass" are discarded. The burst trigger is particularly suitable for dynamic applications.
[Trigger gate logic]	List	Sets the logic of the trigger modes [Gated...]: [High active]: As long as the trigger is on "High", images are captured with a fixed frame rate. The device stops capturing images on "Low". [Low active]: As long as the trigger is on "Low", images are captured with a fixed frame rate. The device stops capturing images on "High".
[Only one result per trigger gate]	List	Sets the handling of found objects in the [Gated...] trigger modes: [Off]: All recorded images are output. [Relaxed]: The trigger mode [Continuous] is active. If the gate is active and an object is found: The gate is immediately terminated and the result is output. If no object is found: The gate is terminated externally by a controller or a hardware trigger after a certain time. If an image is taken at the time of termination, the image will still be evaluated. [Strict]: The trigger mode [Continuous] is active. If the gate is active and an object is found: The gate is immediately terminated and the result is output. If no object is found: The gate is terminated externally by a controller or a hardware trigger after a certain time. If an image is taken at the time of termination, the image will not be evaluated.
[Frame rate]	Input field	Sets the frame rate to be achieved. (→ Frame rate □ 31) The setting is only available for certain trigger modes.
[Focus]	Input field	Sets the focus. (→ Focus □ 31)
	Button	Automatically optimises the focus.
[Rotated by 180°]	Checkbox	Rotates the live image by 180°.
[Store reference image]	Button	Saves the current live image as a reference image. (→ Reference image □ 31)
	Button	Deletes the saved reference image.

### I1 New image 1

In the area "I1 New image 1", the recorded image of the device is set. The name of the image "I1 New image 1" can vary.

The area contains the following operating elements:

Operating element	Type	Description
	Button	Copies the image and changes to the new image.
	Button	Renames the image.
	Button	Deletes the image.
	Button	Deactivates the image.
[Exposure time]	Input field	Sets the exposure time. (→ Exposure time □ 32)
	Button	Automatically sets the exposure time.
[Analogue gain factor]	List	Sets the amplification factor of the analogue signal. (→ Analogue gain factor □ 32)
[Illumination]	List	Activates the internal and external illumination. (→ Illumination □ 32)
[Internal segments]	Button	Sets the internal illumination of the device. (→ Illumination of internal segments □ 32) When the internal illumination is active, individual segments are deactivated or activated by clicking in the graphic.
[Filter type]	List	Sets the filter for the image. (→ Filter type □ 33)
[Filter strength]	List	Sets the intensity of the selected filter type. (→ Filter strength □ 33)
[Invert image]	Checkbox	Inverts the brightness values of the image. (→ Invert image □ 33)

### Image quality check

The image quality check is set in the area “Image quality check”. (→ Image quality check □ 34)

The area contains the following operating elements:

Operating element	Type	Description
[Enabled]	Checkbox	Activates the image quality check.
[Reset statistics]	Button	Resets the statistics.
[Sharpness]	Graphical representation	Shows the current measuring range (orange line).
[Teach]	Button	Sets the current measuring range as the permitted value range.
[Mean brightness]	Graphical representation	Shows the current measuring range (orange line).
[Teach]	Button	Sets the current measuring range as the permitted value range.
[Underexposed area]	Graphical representation	Shows the current measuring range (orange line).
[Teach]	Button	Sets the current measuring range as the permitted value range.
[Overexposed area]	Graphical representation	Shows the current measuring range (orange line).
[Teach]	Button	Sets the current measuring range as the permitted value range.

### 11.1.1 Add new image

The button [Add new image] adds a new image. The following settings are saved in an “image”:

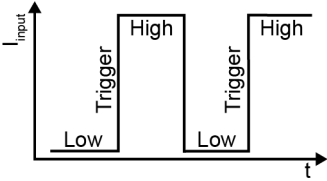
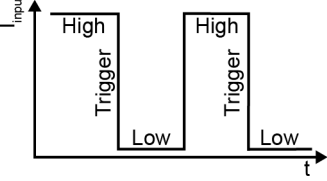
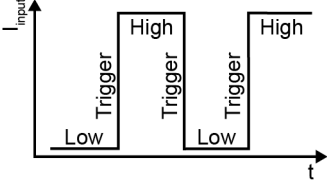
- exposure time
- analogue gain
- illumination
- filter
- image quality check

Up to 5 images with their own settings can be used in parallel. Several images ensure detection with different

- qualities,
- surfaces,
- lighting conditions over a certain period of time, e.g. days, years, etc.

### 11.1.2 Trigger mode

The list [Trigger mode] contains the following trigger modes:

Trigger mode	Description
[Continuous]	The device continuously captures images. The maximum achievable frame rate depends on the exposure mode, exposure time and evaluation time. This mode is usually used for tests.
[Process interface]	The device is triggered via the process interface (e.g. by a PLC).
[Positive edge]	The device is triggered via the rising edge of an input signal. 
[Negative edge]	The device is triggered via the falling edge of an input signal. 
[Both edges]	The device is triggered via the rising and falling edge of an input signal. 
[Gated HW]	If [Trigger gate logic] is set to [High active]: The device starts continuous image capture with a rising edge. As long as the trigger is on “High”, images are captured with a fixed frame rate. The device stops capturing images on “Low”. With [Trigger gate logic] set to [Low active], the behaviour reverses.

Trigger mode	Description
[Gated PCIC]	<p>The device starts continuous image capture with the g command of the process interface:</p> <pre>1234L000000008 1234g1</pre> <p>Images are captured with a fixed frame rate. The device stops capturing images with the following g command:</p> <pre>1234L000000008 1234g0</pre> <p>The sending of commands is described in the "Programmer's Guide": <a href="http://www.ifm.com">www.ifm.com</a></p>
[Gated time-based]	<p>During the rising and falling edge (gate), images are captured with a fixed frame rate. The gate duration is set in the [Gate duration] input field.</p>



### 11.1.3 Frame rate

The input field [Frame rate] defines a maximum frame rate for the device.

Set the frame rate:

- ▶ Enter the frame rate in the input field [Frame rate] and confirm with [Enter].



The frame rate only influences the trigger modes [Continuous] and [Gated...].

Depending on which additional settings are active, the requested frame rate will not be reached.


### 11.1.4 Focus

The input field [Focus] sets the distance in metres [m] between the lens and the object to be detected. The optimum focus has been reached when the object in the live image is sharply displayed and is detected by the device.




The set focus is used for all images. The focus cannot be set separately for each image.

The focus can be set in 3 ways:


- via the input field,
- via the slider,
- automatically via the button 



In the input field [Focus], the button  appears if the focus has been optimised automatically. A click on the button shows the focus levels found by the automatic focus.



The focus of the device depends on the LED colour.

- ▶ Readjust the focus after changing the LED colour. (→ Focus  31)

### 11.1.5 Reference image

The button [Store reference image] saves the current live image as a reference image. The reference image is used as an overlay in the area "Monitor".

The reference image is used to help align the device. For example:

- if the orientation of the device has changed and the original position is to be restored.
- if the device is replaced and the new device is to be aligned in the same way.

### 11.1.6 Exposure time

The input field [Exposure time] sets the period in “ $\mu\text{s}$ ” for the image capture.

The exposure time can be set in 3 ways:

- via the input field,
- via the slider below the input field,
- automatically via the button [Optimise].

### 11.1.7 Analogue gain factor

The list [Analogue gain factor] sets the gain factor of the analogue signal. The analogue gain factor reacts linearly to the exposure time. Therefore, half of the exposure time can be used with double analogue gain factor. Especially dynamic applications benefit from the short exposure times.



The analogue gain factor slightly increases the image noise.

### 11.1.8 Illumination

The list [Illumination] sets the internal and external illumination. The following illuminations are available:

Illumination	Description
[None]	Deactivates the internal and external illumination.
[Internal]	Activates the internal illumination of the device. The graphic below the list [Illumination] shows the status of the internal illumination. When internal illumination is active, individual segments are deactivated and activated by clicking in the graphic. (→ Illumination of internal segments <a href="#">32</a> )
[External]	Activates the external illumination. The external illumination unit is connected to switching output OUT5 of the device. In addition, the external illumination has to be activated. The illumination unit is active as long as the switching output is in the “high” state. The external illumination and output OUT5 are only available for 8-pole devices.
[Both]	Activates the internal and external illumination.

### 11.1.9 Illumination of internal segments

The function “Illumination internal segments” sets the internal illumination of the device.

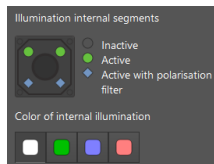


Fig. 7: Illumination of internal segments

The list [Illumination] activates the internal illumination. (→ Illumination [32](#))

When the internal illumination is active, individual segments can be activated or deactivated by clicking in the graphic [Illumination internal segments].



The polarisation filters and the [Colour of internal illumination] buttons are only available for the “RGB-W” units O2D50x and O2D51x.

The infrared units O2D52x and O2D53x lack the polarisation filter and the different LED colours.



### Colour of internal illumination

The [Colour of internal illumination] buttons are used to set the LED colour of the internal illumination.

- ▶ Depending on the colour of the object, set an opposing LED colour.
- ▷ Opposing means that the wavelength of the LED colour is as far away as possible from the wavelength of the object. This ensures a high image contrast.

The following LED-colours are available:

[white]

[green]

[blue]

[red]



The focus of the device depends on the LED colour.

- ▶ Readjust the focus after changing the LED colour. (→ Focus 31)



The focus setting always applies to the application. This means that all images in the application use the same focus setting.

- ▷ If different LED colours are used:
  - ▶ create a separate application for each LED colour or
  - ▶ set a focus that provides an acceptable result for all images.

#### 11.1.10 Filter type

The list [Filter type] sets filters for the image with which the representation is optimised. The following filters available:

Filter type	Description
[No filter]	Deactivates the filter.
[Erosion]	Enlarges dark pixel groups and decreases light pixel gaps.
[Dilatation]	Enlarges light pixel groups and decreases dark pixel gaps.
[Median]	Reduces noise and noise pixels.

#### 11.1.11 Filter strength

The list [Filter strength] sets the intensity of the selected filter type. The following filter intensities are available:

Filter strength	Description
[1 (weak)]	Uses a weak intensity for the selected filter type (preset).
[2]	...
[3]	...
[4]	...
[5 (strong)]	Uses a strong intensity for the selected filter type.

#### 11.1.12 Invert image

The checkbox [Invert Image] inverts the brightness values of the selected image: black/white becomes white/black.

### 11.1.13 Image quality check

The checkbox [Enabled] activates the image quality check. The image quality check checks whether the measured values received from the vision sensor of the device are within the permitted value range. The following measured values are recorded:

- sharpness
- mean brightness
- underexposed area (all pixels with grey value < 10)
- overexposed area (all pixels with grey value > 245)

If a measured value is outside the permitted value range, this can be signalled via the process interface.

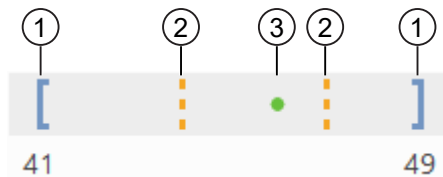


Fig. 8: Image quality check

1 Permitted value range  
3 Current measured value

2 Measuring range

#### Permitted value range

The permitted value range is indicated by the blue square brackets. The brackets can be moved within the graphic using the mouse. If the measured value (green dot) is outside the permitted value range (blue brackets), this is indicated by an exclamation mark: . In addition, this can be signalled via the process interface. For this, the process interface must be configured accordingly via the function "Interface". (→ Interfaces 71)

#### Measuring range

The measuring range is indicated by the orange dashed lines. The lines mark the min/max values of the taught measured values. The lines overlap if the measured value has not yet changed.

The [Reset statistics] button discards the taught measuring range.

The [Teach] button adopts the measuring range (orange dashed lines) as the default for the permitted value range (blue square brackets).

#### Current measured value

The current measured value is indicated by the green dot. The measuring range is indicated by the orange dashed lines.

#### Operating elements

The area "Image quality check" contains the following operating elements:

Operating element	Type	Description
[Enabled]	Checkbox	Activates the image quality check. The image quality check checks the image quality of the entire image.
[Reset statistics]	Button	Resets the statistics.
[Sharpness]	Blue square brackets	Shows the current measuring range (orange line), the measured value (green dot) and the permitted value range (blue brackets). The blue brackets can be moved within the graphic.
[Teach]	Button	Sets the current measuring range as the permitted value range.

Operating element	Type	Description
[Mean brightness]	Blue square brackets	Shows the current measuring range (orange line), the measured value (green dot) and the permitted value range (blue brackets). The blue brackets can be moved within the graphic.
[Teach]	Button	Sets the current measuring range as the permitted value range.
[Underexposed area]	Blue square brackets	Shows the current measuring range (orange line), the measured value (green dot) and the permitted value range (blue brackets). The blue brackets can be moved within the graphic.
[Teach]	Button	Sets the current measuring range as the permitted value range.
[Overexposed area]	Blue square brackets	Shows the current measuring range (orange line), the measured value (green dot) and the permitted value range (blue brackets). The blue brackets can be moved within the graphic.
[Teach]	Button	Sets the current measuring range as the permitted value range.

## 11.2 Models

The function “Models” sets the objects to be detected. A model has to be added to detect an object. A model is the taught “good” condition of one or several objects. Up to 10 models can be added.

The device uses incident light or backlight to detect the image of an object, and compares it with the taught objects of the added models. Depending on the degree of conformity a model is considered found.

The following types of models are distinguished:

- “BLOB analysis”: The number, structure and brightness of the pixels of an object is analysed. BLOB analysis is particularly suited for applications with objects that vary in shape, size or colour.
- “Contour detection”: The contours of an object are analysed. Contour detection is particularly suited for applications with repetitive object shapes.
- “Contour anchor”: The contour anchor is used to trace the search zone of another model. The position and orientation are taken into account.

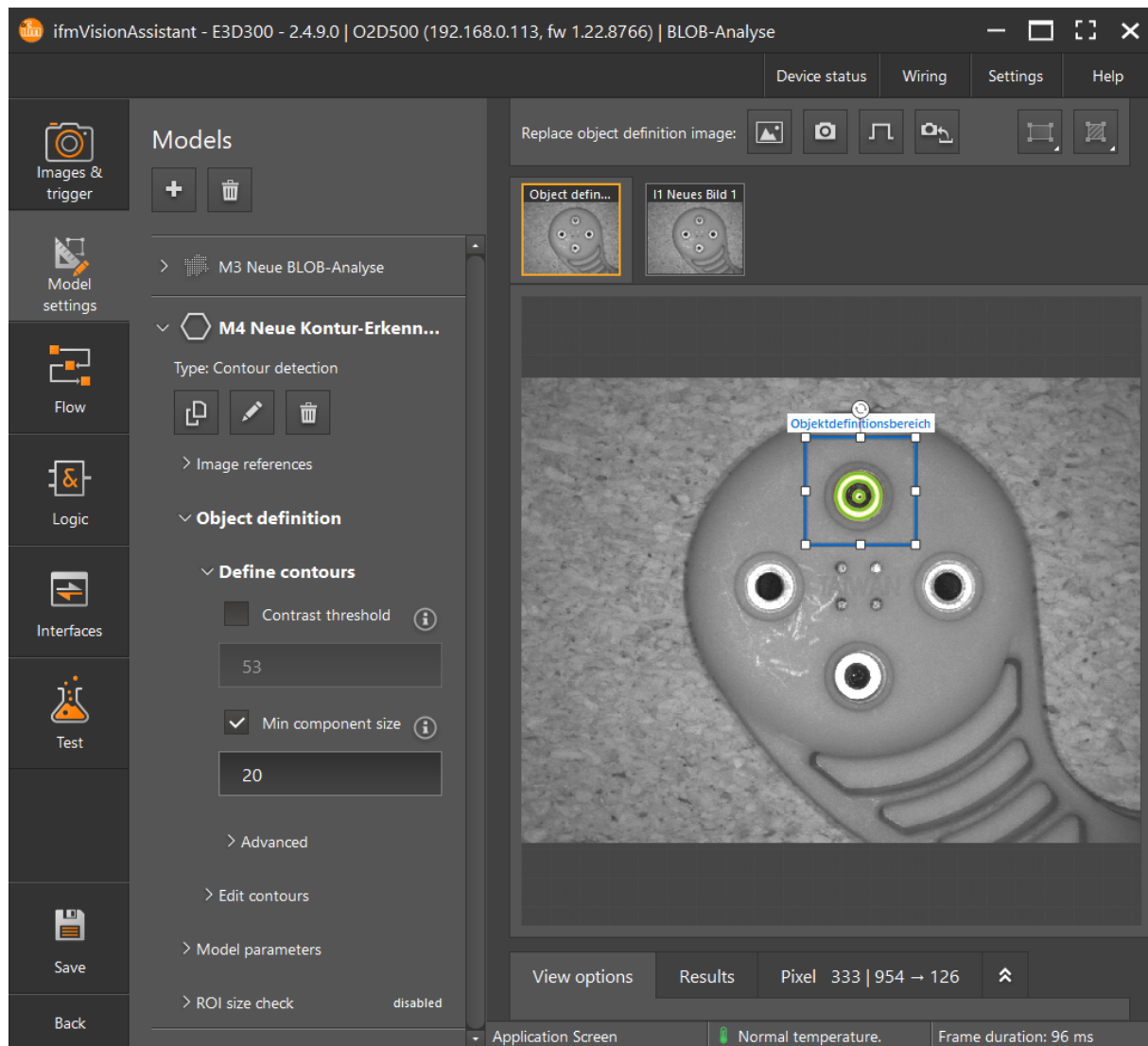








Fig. 9: Function “Models”

The function “Models” contains the following operating elements:


Operating element	Name	Description
	Create new model	Adds a new model. (→ Add new model  36)
	Delete all models	Deletes all models irrevocably.

The following operating elements differ depending on the selected model:

- BLOB analysis model (→  37)
- Contour detection model (→  45)
- Contour anchor model (→  53)

### 11.2.1 Add new model

The button [Add new model] adds a new model. A model has to be added to detect an object. The settings for object detection are saved in the model.

 Up to 10 models can be added per application.

After clicking the button [Create new model], the following buttons are displayed:

Button	Description
[BLOB analysis]	Creates a model that detects objects through BLOB analysis. (→ BLOB analysis model □ 37) The number, structure and brightness of the pixels of an object is analysed. BLOB analysis is particularly suited for applications with objects that vary in shape, size or colour.
[Contour detection]	Creates a model that recognises objects through contour detection. (→ Contour detection model □ 45) The contours of an object are analysed. Contour detection is particularly suited for applications with repetitive object shapes.
[Contour anchor]	Adds the “Contour anchor” to the BLOB analysis and contour detection models. (→ Contour anchor model □ 53) The search zone of an object is traced. The model “Contour anchor” can only be created once.

### 11.2.2 BLOB analysis model




The BLOB analysis analyses the number, structure and brightness of the pixels of an object.

First, the pixels to be analysed are selected in the grey-scale histogram. The selection is then further refined with the object properties:

- geometry
- circular
- rectangular
- grey scales
- etc.

BLOB analysis is particularly suited for applications with objects that vary in shape, size or colour.

The model contains the following operating elements:

Operating element	Name	Description
	Copy model	Copies the model and changes to the new model.
	Rename model	Renames the model.
	Delete model	Deletes all models irrevocably.

#### Image references





The area “Image references” contains the following operating elements:

Operating element	Type	Description
[11 New image 1]	Checkbox	Assigns the selected images to the model. A new image is added via “Images & trigger”. (→ Add new image □ 30) Up to 5 images can be added. The 5 images are assigned to the model as “11” to “15”.

#### Object definition

In the “Object definition” area, an area to be searched for within the ROI is configured. After expanding the “Object definition” section, the [Object definition area] is displayed in the live image. (→ Object definition area of a BLOB □ 40)


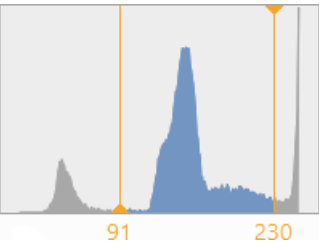



The area contains the following operating elements above the live image:

Operating element	Type	Description
	Button	Uses the last image as object definition image.
	Button	Triggers an update of the object definition image.
	Button	Uses the set trigger to update the object definition image. (→ Trigger mode $\square$ 30)
	Button	Loads an image and uses it as object definition image.

### Define BLOBs

Under “Object definition” → “Define BLOBs”, you can define what is to be recognised as an object.

The area contains the following operating elements:

Operating element	Type	Description
[Grey-scale histogram]	Button	Segments the grey levels displayed in the histogram. The selected segment is highlighted in blue in the histogram.
	List	Displays the recognised segments in a list. The selected segment is highlighted in blue in the histogram.
	Slider	Displays the grey-scale histogram. Sets the segment with the vertical orange lines in the histogram.
	Slider	Sets the segment in the histogram.
[Min]	Input field	Sets the lower limit of the segment (darkest colour).
	Button	Changes the mouse pointer to a pipette for selecting a pixel in the live image. The grey level of the pixel sets the lower limit of the segment (darkest colour).
[Max]	Input field	Sets the upper limit of the segment (brightest colour).
	Button	Changes the mouse pointer to a pipette for selecting a pixel in the live image. The grey level of the pixel sets the upper limit of the segment (brightest colour).
[Invert segmentation]	Checkbox	Inverts the lower and upper limit of the segment. Particularly bright or dark areas are thus more easily recognisable.

### Edit BLOBs

In the area “Object definition” → “Edit BLOBs”, the permissible area, the handling of holes and filters are configured.

The area contains the following operating elements:

Operating element	Type	Description
[Include objects]	Checkbox	Detects objects the area of which lies within a certain range. This is particularly useful for excluding very small or large objects.

Operating element	Type	Description
[Min]	Input field	Sets the minimum area of the objects to be detected.
[Max]	Input field	Sets the maximum area of the objects to be detected.
[Fill holes]	Checkbox / input field	Fills holes in objects. Holes appear as bright or dark pixels in evenly bright objects. Reasons for this can be rough material surfaces or image interference. The size of the holes to be filled is indicated absolutely as number of pixels.
[Morphology type]	List	Sets the object filter: [None]: Uses no filter. [Opening]: Removes objects that are smaller than the [Morphology radius]. For example, narrow connections between 2 objects are removed. [Closing]: Fills holes in objects that are smaller than the [Morphology radius]. [Erosion]: Decreases objects at their border by the [Morphology radius]. This affects all objects that are larger than the [Morphology radius]. [Dilation]: Enlarges objects at their border by the [Morphology radius]. This fills holes that are smaller than the [Morphology radius].
[Morphology radius]	Input field	Sets the radius used for [Morphology type] in pixels.
[Sort objects]	List	Sets the sorting of the objects in the "Results" tab below the live image in the "Interfaces" function. <ul style="list-style-type: none"> <li>• (→ Monitor □ 20)</li> <li>• (→ Interfaces □ 71)</li> </ul>

### Model parameters

In the "Model parameters" area, the search zone, the exclusion zone and the permissible number of objects are set.



The area contains the following operating elements:

Operating element	Type	Description
[Search zone ROI]	Button	Sets the search zone (region of interest: ROI). (→ Creating a region of interest (ROI) □ 53)
[Exclusion zone (ROD)]	Button	Sets the exclusion zone (ROD: Region of Disinterest). (→ Creating a region of disinterest (ROD) □ 54)
[Anchor tracking]	Checkbox	Activates anchor tracking. (→ Anchor tracking □ 40) Anchor tracking allows detection of objects despite changes in position and rotation.
[Number of objects per ROI - Min]	Input field	Sets the minimum number of objects per ROI. (→ Number of objects per ROI □ 41) The setting affects the pass/fail status of the overall statistics. (→ Test □ 75)
[Number of objects per ROI - Max]	Input field	Sets the maximum number of objects per ROI. (→ Number of objects per ROI □ 41) The setting affects the pass/fail status of the overall statistics. (→ Test □ 75)

## Object properties

In the area “Model parameters” → “Object properties”, restrictions for object recognition can be configured.

The area contains the following operating elements:

Operating element	Type	Description
	Button	Adds object properties to the model. (→ Object properties □ 41) The object properties help to further limit the recognition of an object.
	Button	Deletes all object properties. The object properties are irrevocably deleted.

## ROI size check

In the “ROI size check” area, a warning can be activated for objects that move out of the ROI.

The area contains the following operating elements:

Operating element	Type	Description
[Enabled]	Checkbox	Warns if the object moves further out of the ROI with each trigger. (→ ROI size check □ 45)
[Threshold ROI warning]	Input field	Sets the warning threshold.
[Threshold distance to mean position]	Input field	Sets a distance to the mean position of the objects.
[Threshold movement score]	Input field	Sets a threshold for the movement score of the objects.

### 11.2.2.1 Anchor tracking

Anchor tracking allows detection of objects despite changes in position and rotation. Anchor tracking is taught automatically.



Before it can be used, the “Anchor contour” model must be added.



Depending on the number and size of the objects, the evaluation time of the device can increase if anchor tracking is active.

### 11.2.2.2 Object definition area of a BLOB

After expanding the “Object definition” section, the [Object definition area] is displayed in the live image.



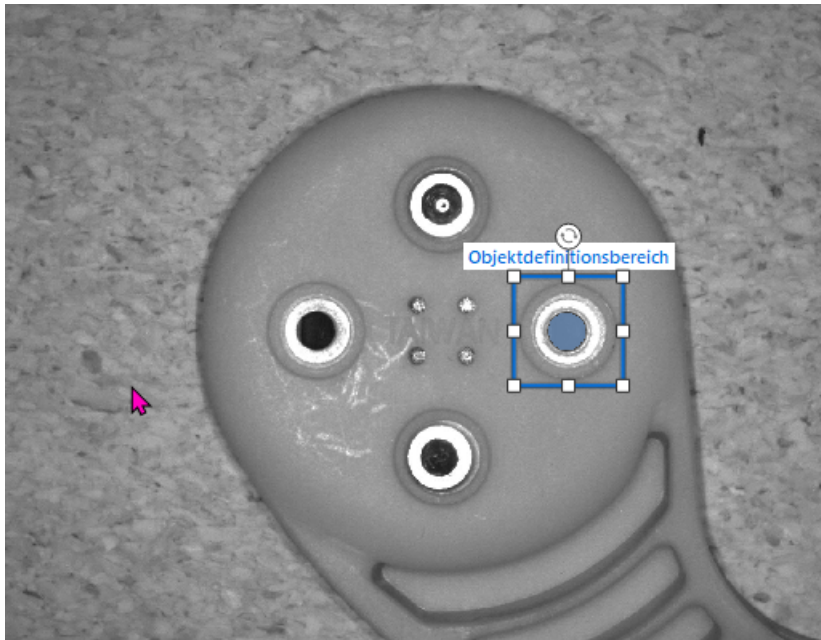


Fig. 10: Object definition area

In the object definition area, an area to be searched for within the ROI is set. This area can be detected several times within the ROI, such as solder joints of the same shape and size.


Setting an object definition area:

- ▶ Using the mouse pointer, place the object definition area in the live image as close as possible around the object.
- ▷ The object is automatically detected within the object definition area and highlighted in colour.

### 11.2.2.3 Number of objects per ROI

The input fields [Number of objects per ROI] set the number of objects to be detected per ROI.



If more or fewer objects are found, the model is considered “failed” in the overall statistics. (→ Test  75)

#### Example

With the settings input field [Min] = “1” and input field [Max] = “3”, 1 to 3 objects per ROI are recognised.


- If 1 ROI exists: 1 to 3 objects are searched for within the ROI.
- If 2 ungrouped ROIs exist: 1 to 3 objects are searched for in each ROI.
- If 1 ROI group of 2 ROIs exists: 1 to 3 objects are searched for in the ROI group.





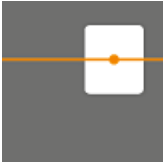
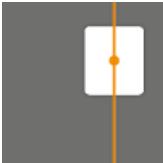



A large number of objects to be detected increases the evaluation time of the device.








### 11.2.2.4 Object properties






The object properties help to further limit the recognition of an object. If an object meets the settings, it can be processed further.

After clicking the  [Add object properties] button, the following menu is displayed:

Object property	Description
[Geometry]	




Object property	Description
<ul style="list-style-type: none"> <li>[Object area]</li> </ul>	<p>The object area is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Object areas in ROI]</li> </ul>	<p>The total area of all objects in the ROI is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Position X]</li> </ul>	<p>The object's centre of gravity on the X-axis is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Position Y]</li> </ul>	<p>The object's centre of gravity on the Y-axis is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Object height]</li> </ul>	<p>The height of the smallest rectangle completely enclosing the object and whose sides are parallel to the image borders is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Object width]</li> </ul>	<p>The width of the smallest rectangle completely enclosing the object and whose sides are parallel to the image borders is in the [Min] to [Max] range.</p> 
[Circular]	
<ul style="list-style-type: none"> <li>[Roundness]</li> </ul>	<p>The roundness of the object is in the [Min] to [Max] range. A perfect circle has the value "100".</p> 

Object property	Description
<ul style="list-style-type: none"> <li>[Outer radius]</li> </ul>	<p>The radius of the smallest circle completely enclosing the object is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Inner radius]</li> </ul>	<p>The radius of the largest circle completely fitting inside the object is in the [Min] to [Max] range.</p> 
[Rectangular]	
<ul style="list-style-type: none"> <li>[Rectangularity]</li> </ul>	<p>The rectangularity of the object is in the [Min] to [Max] range. A perfect rectangle has the value "100".</p> 
<ul style="list-style-type: none"> <li>[Inner width]</li> </ul>	<p>The width of the biggest rectangle completely fitting inside the object and whose sides are parallel to the image borders is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Inner height]</li> </ul>	<p>The height of the biggest rectangle completely fitting inside the object and whose sides are parallel to the image borders is in the [Min] to [Max] range.</p> 
[Grey scales]	
<ul style="list-style-type: none"> <li>[Min. grey-scale value]</li> </ul>	<p>The smallest grey-scale value is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Max. grey-scale value]</li> </ul>	<p>The largest grey-scale value is in the [Min] to [Max] range.</p> 

Object property	Description
<ul style="list-style-type: none"> <li>[Average grey-scale value]</li> </ul>	<p>The average grey-scale value is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Grey-scale value deviation]</li> </ul>	<p>The standard deviation (homogeneity) is in the [Min] to [Max] range. The value is low for the evenly grey objects and high for irregular surfaces or grey-scale gradients.</p> 
[Other]	
<ul style="list-style-type: none"> <li>[Compactness]</li> </ul>	<p>The compactness of the object in the [Min] to [Max] range. Empty regions have the value "0"; circular objects have the value "1". Long, narrow objects have average values. Entwined objects or objects with holes have high values.</p> 
<ul style="list-style-type: none"> <li>[Number of holes]</li> </ul>	<p>The number of holes in the object is in the [Min] to [Max] range.</p> 
<ul style="list-style-type: none"> <li>[Orientation]</li> </ul>	<p>The orientation of the object in degrees in the [Min] to [Max] range.</p> 

By selecting the checkboxes, the respective object properties are activated.

An activated object property has the following operating elements:

Operating element	Type	Description
	Button	Deletes the object property irrevocably.
	Button	Displays the description of the object property.
Min	Input field	Sets the minimum value of the object property.
Max	Input field	Sets the maximum value of the object property.
	Slider	Sets the minimum and maximum values of the object property by moving the sliders.

### 11.2.2.5 ROI size check

The checkbox [Enabled] activates the function “ROI size check”. The function provides a warning if an object moves to the edge of the defined ROI.

The function can be used as a predictive maintenance tool. The results of the function are forwarded to a controller if desired.

The function “ROI size check” contains the following input fields:

Input field	Description
[Threshold ROI warning]	If the distance of at least one object to the ROI falls below the set value, a warning is issued. If an object is found, the warning area is displayed in colour in the live image.
[Threshold distance to mean position]	A mean value is formed from N detected objects and stored as the mean position ( $N_{max} = 100$ , where N = number of detected objects). If the distance of a detected object is greater than the set value, a warning is issued. The mean value is reset if an object is not detected successfully. The last N positions are displayed in the form of a “track” in the live image.
[Threshold movement score]	If an object continues to move in the same direction in consecutive images, the probability that it will continue to move in that direction increases. If the probability exceeds the set value, a warning is issued.

#### Example

Objects to be detected move on a belt. If the belt speed or the position of the objects does not match the trigger rate of the device exactly, the objects will move out of the ROI. If the object is outside the ROI, it will not be detected. The function “ROI size check” warns against this.




### 11.2.3 Contour detection model

The contour detection analyses the contours of an object.

First, the contour of a good part is taught. The contour detection checks the match degree between the taught contour and the contours of the objects. Additional quality characteristics can be defined for the check.

Contour detection is particularly suited for applications with repetitive object shapes.

The model contains the following operating elements:

Operating element	Name	Description
	Copy model	Copies the model and changes to the new model.
	Rename model	Renames the model.
	Delete model	Deletes all models irrevocably.

#### Image references

The area “Image references” contains the following operating elements:





Operating element	Type	Description
[11 New image 1]	Checkbox	Assigns the selected images to the model. A new image is added via “Images & trigger”. (→ Add new image <input type="checkbox"/> 30) Up to 5 images can be added. The 5 images are assigned to the model as “11” to “15”.

## Object definition

In the “Object definition” section, contours are taught based on an object definition image.

After expanding the “Object definition” section, the [Object definition area] is displayed in the live image. (→ Object definition area of a contour [□ 52](#))

The area contains the following operating elements above the live image:

Operating element	Type	Description
	Button	Uses the last image as object definition image.
	Button	Triggers an update of the object definition image.
	Button	Uses the set trigger to update the object definition image. (→ Trigger mode <a href="#">□ 30</a> )
	Button	Loads an image and uses it as object definition image.

## Define contours

Under “Object definition” → “Define contours” you can define what is to be recognised as a contour.

The area contains the following operating elements:

Operating element	Type	Description
[Contrast threshold]	Checkbox / input field	Sets the lower contrast threshold for defining the contours.
[Min. contour length]	Checkbox / input field	Sets the minimum contour length. Smaller contours are ignored.

## Advanced

Under “Object definition” → “Define contours” → “Advanced”, advanced settings are made.



▶ **The “Advanced” section contains settings that are not required for typical configurations.**

▶ Only change the settings if you fully understand the consequences of your actions.






The area contains the following operating elements:

Operating element	Type	Description
[Pregeneration]	List	Saves the object at specified angles in the working memory. As a result, the object rotated around its own axis is detected. The evaluation time of the device is increased. [Pregeneration]: Activates the pregeneration. [No pregeneration]: Deactivates the pregeneration.
[Point reduction]	List	Reduces the number of contour points used. [Automatic]: Automatically reduces the contour points. [None]: Does not reduce contour points. [Point reduction low]: Reduces low number of contour points. [Point reduction medium]: Reduces medium number of contour points. [Point reduction high]: Reduces high number of contour points.

## Edit contours

In the area “Object definition” → “Edit contours”, the contours are directly edited in the live image using the mouse pointer.


The area contains the following operating elements:

Operating element	Type	Description
	Button	Draws an additional contour in the live image. The mouse pointer is displayed as a cross-hair.
	Button	Restores parts of the deleted contour. The deleted contour is shown as a blue line. A mouse click restores the contour inside the circle. The size of the circle can be set via [Tool size].
	Button	Deletes parts of the contour. A mouse click deletes the contour inside the circle. The deleted contour is shown as a blue line. The size of the circle can be set via [Tool size].
	Button	Deletes the complete contour. A mouse click deletes the selected contour. The deleted contour is shown as a blue line. The size of the circle can be set via [Tool size].
	Button	Restores the deleted contour. The deleted contour is shown as a blue line. A mouse click restores the selected contour. The size of the circle can be set via [Tool size].
[Tool size]	Input field / slider	Sets the size of the circle.

## Used contours

In the area “Object definition” → “Edit contours” → “Used contours” the used contours are displayed. The used contours are shown in green in the live image.

The area contains the following operating elements:


Operating element	Type	Description
[111 point contour]	Text field	Displays the point number “111” of the selected contour. The selected contour is displayed in orange. The contour is selected by moving the mouse pointer over the text field.
	Button	Deletes the selected contour. The deleted contour is moved to the “Unused contours” area.

## Unused contours

In the area “Object definition” → “Edit contours” → “Unused contours” the unused contours are displayed. The used contours are shown in blue in the live image.

The area contains the following operating elements:



Operating element	Type	Description
[111 point contour]	Text field	Displays the point number “111” of the selected contour. The selected contour is displayed in orange. The contour is selected by moving the mouse pointer over the text field.

Operating element	Type	Description
	Button	Restores the deleted contour. The restored contour is moved to the "Unused contours" area.

### Reference point

In the area "Object definition" → "Edit contours" → "Reference point", the zero point of the objects is set. The object coordinates indicated in the ifmVisionAssistant refer to the zero point. Example: in the [Results] tab, "Position X" and "Position Y". (→ Monitor □ 20)

The area contains the following operating elements:

Operating element	Type	Description
	Button	Moves the zero point to a new position using the mouse pointer.
	Button	Restores the original position.


### Model parameters

In the "Model parameters" section, the defined contour is configured further so that it can be found in an application.

The area contains the following operating elements:

Operating element	Type	Description
[Search zone ROI]	Button	Sets the search zone (region of interest: ROI). (→ Creating a region of interest (ROI) □ 53)
[Exclusion zone (ROD)]	Button	Sets the exclusion zone (ROD: Region of Disinterest). (→ Creating a region of disinterest (ROD) □ 54)
[Anchor tracking]	Checkbox	Activates anchor tracking. (→ Anchor tracking □ 40) Anchor tracking allows detection of objects despite changes in position and rotation.
[Number of objects per ROI]	Input field	Sets the permissible number of objects per ROI. (→ Number of objects per ROI □ 50) The setting affects the pass/fail status of the overall statistics. (→ Test □ 75)
[Tolerance width]	Input field	Sets the tolerance width of the contour detection. A contour within the tolerance width is detected.
[Maximum orientation]	Input fields	Sets the maximum orientation. Objects are detected within the area.
[Min. score]	Input field / slider	Sets the minimum score for the evaluation. The contour must reach the score to be detected. The theoretical value of "1" is not achieved in practice.
[Analysis mode]	Checkbox	Activates the analysis mode. If the analysis mode is activated, objects that do not reach the [Min. score] are also displayed. The setting is only intended for problem analysis. The evaluation time of the device will increase considerably.



Operating element	Type	Description
[Max overlap]	Input field / slider	<p>Sets the maximum overlap of contours. The contours of 2 objects can overlap by the set value.</p> <p>Example: 2 square-shaped objects are located next to each other and the contours overlap (red line).</p>  <p>With the value "0.25" (1/4 of the object, i.e. one side) 2 objects are detected.</p>

### Advanced

Under "Object definition" → "Define contours" → "Advanced", advanced settings are made.



▶ **The "Advanced" section contains settings that are not required for typical configurations.**

▶ Only change the settings if you fully understand the consequences of your actions.

The area contains the following operating elements:

Operating element	Type	Description
[Timeout]	Checkbox / input field	<p>Sets a timeout for object detection. When the time has elapsed, the detection is terminated.</p>
[Contrast min]	Input field	<p>Sets a minimum contrast for the current image.</p> <p>In areas with small grey-scale differences, no analysis is performed (min. contrast &lt; 10). In areas with higher contrast, the system looks for the defined contours. The search algorithm can for example quickly exclude homogeneous backgrounds (consistently white or black) and only search in high-contrast areas.</p>
[Orientation steps]	Checkbox / input field	<p>Sets the orientation steps in [°] for the [Maximum orientation]. The search for a rotating object is performed in the set steps.</p> <p>Small values increase the evaluation time of the device.</p>
[Subpixel]	List	<p>Activates the sub-pixels. The sub-pixels form a mean value from the neighbouring pixels. The sub-pixels can reduce jitter in the live image and improve the accuracy of the orientation.</p> <p>[None]: Deactivates the sub-pixels. The setting is only recommended if a very short evaluation time of the device is required.</p> <p>[Interpolation]: Uses linear interpolation for the mean value derived from 2 neighbouring pixels.</p> <p>[Least squares]: Determines a function (usually a straight line) for a number of pixels that best summarises the pixels.</p> <p>[Least squares high]: Determines a function, as in [Least squares], with high precision.</p> <p>[Least squares very high]: Determines a function, as in [Least squares], with very high precision.</p>

Operating element	Type	Description
[Yaw]	Input field / slider	Accelerates the search for contours with a high value. The accelerated search is less accurate than the slow search. A high value can influence the [Min. score], as the [Min. score] may then be outside the defined limits.
[Levels]	Checkbox / input field	Sets the resolution levels at which contours are searched for. (→ Pyramid levels □ 50) With only 1 level, the search is performed in the original image of the device, which significantly increases the evaluation time. Each additional level reduces the resolution and thus the evaluation time.
[Lowest level]	Input field	The lowest pyramid level sets up to which level the images are to be analysed. (→ Pyramid levels □ 50)
[Position limits]	Input fields	Limits the area in which contours are detected.

### ROI size check

In the “ROI size check” area, a warning can be activated for objects that move out of the ROI.

The area contains the following operating elements:

Operating element	Type	Description
[Enabled]	Checkbox	Warns if the object moves further out of the ROI with each trigger. (→ ROI size check □ 45)
[Threshold ROI warning]	Input field	Sets the warning threshold.
[Threshold distance to mean position]	Input field	Sets a distance to the mean position of the objects.
[Threshold movement score]	Input field	Sets a threshold for the movement score of the objects.

#### 11.2.3.1 Number of objects per ROI

The input field [Number of objects per ROI] sets the number of objects to be detected per ROI.



If more or fewer objects are found, the model is considered “failed” in the overall statistics. (→ Test □ 75)

#### Example

With the setting “3”, 3 objects per ROI are recognised.

- If 1 ROI exists: 3 objects are searched for within the ROI.
- If 2 ungrouped ROIs exist: 3 objects are searched for in each ROI.
- If 1 ROI group of 2 ROIs exists: 3 objects are searched for in the ROI group.



A large number of objects to be detected increases the evaluation time of the device.

#### 11.2.3.2 Pyramid levels

The pyramid method is used in industrial image processing to shorten the evaluation time needed for image analysis. The resolution of the original image is decreased. The resolution can be reduced multiple times, resulting in several “levels” that are visually represented as a pyramid. Each level is  $\frac{1}{4}$  the size of the previous one, thus reducing the evaluation time.

Subsequently, the defined contours are first searched for in the low resolution images. After the contours have been detected, a cross-check is performed on the high-resolution image. The procedure leads to significantly shorter evaluation times with consistently high accuracy.

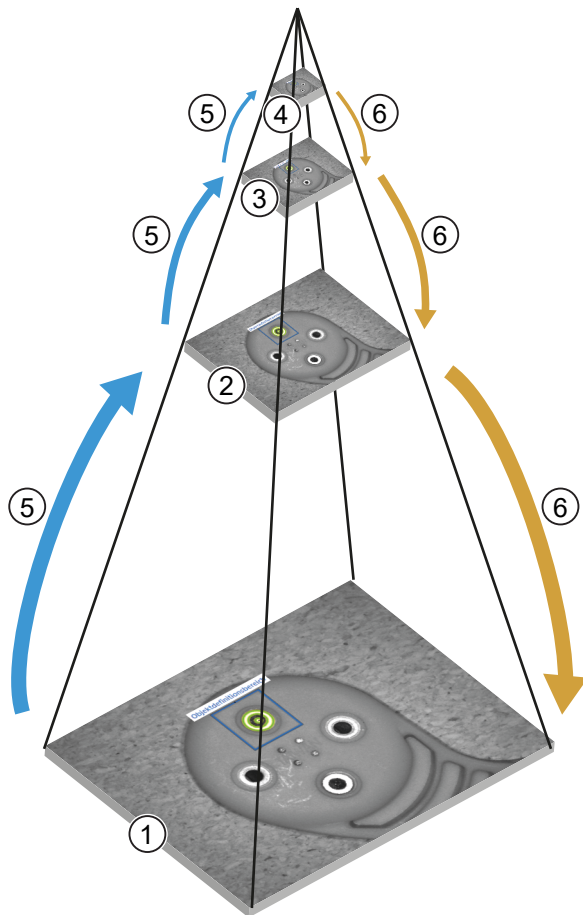


Fig. 11: Pyramid levels

- |   |                                |
|---|--------------------------------|
| 1 Level 1 image (high resolution image) | 2 Level 2 image                |
| 3 Level 3 image                         | 4 Level 4 image                |
| 5 Reduce resolution to $\frac{1}{4}$    | 6 Detect contours in the image |

First the resolution of the original image is reduced by the set number of [Levels]. Then, starting with the smallest image, a search for contours is performed. If all contours are found in the smallest image, the following (larger) image is used for verification.

For typical applications, the setting [Levels] = "4" is sufficient, which corresponds to a level 4 image with  $\frac{1}{64}$  the size of the original resolution. A high resolution is only required to detect very small structures.

### Lowest pyramid level

The lowest pyramid level sets up to which level the images are to be analysed. For example, with the value "2", the 1st level (the image in the original resolution) is not used for analyses.

### 11.2.3.3 ROI size check

The checkbox [Enabled] activates the function "ROI size check". The function provides a warning if an object moves to the edge of the defined ROI.

The function can be used as a predictive maintenance tool. The results of the function are forwarded to a controller if desired.

The function "ROI size check" contains the following input fields:

Input field	Description
[Threshold ROI warning]	If the distance of at least one object to the ROI falls below the set value, a warning is issued. If an object is found, the warning area is displayed in colour in the live image.

Input field	Description
[Threshold distance to mean position]	<p>A mean value is formed from N detected objects and stored as the mean position (<math>N_{max} = 100</math>, where N = number of detected objects). If the distance of a detected object is greater than the set value, a warning is issued.</p> <p>The mean value is reset if an object is not detected successfully. The last N positions are displayed in the form of a "track" in the live image.</p>
[Threshold movement score]	<p>If an object continues to move in the same direction in consecutive images, the probability that it will continue to move in that direction increases. If the probability exceeds the set value, a warning is issued.</p>

### Example

Objects to be detected move on a belt. If the belt speed or the position of the objects does not match the trigger rate of the device exactly, the objects will move out of the ROI. If the object is outside the ROI, it will not be detected. The function "ROI size check" warns against this.

#### 11.2.3.4 Object definition area of a contour

After expanding the "Object definition" section, the [Object definition area] is displayed in the live image.

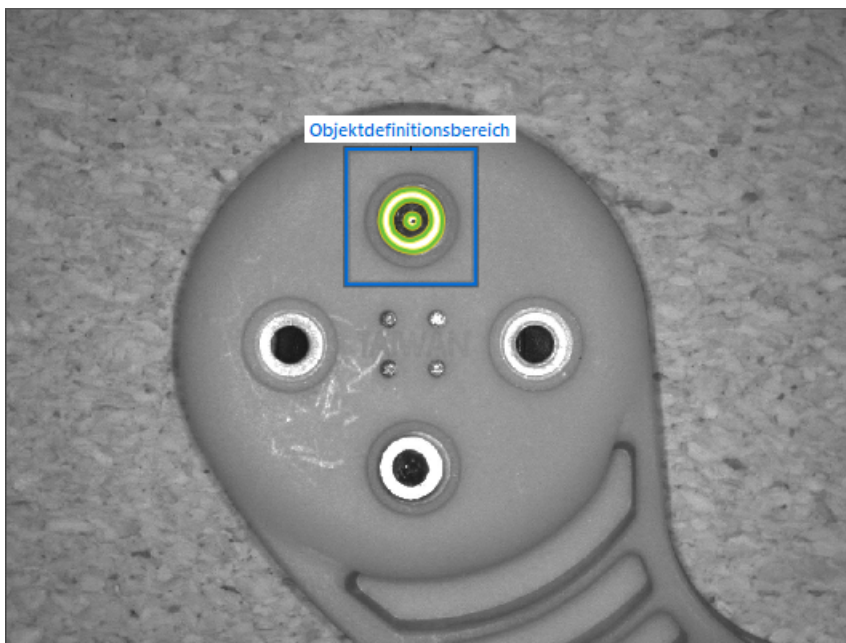


Fig. 12: Object definition area

In the "Object definition" section, contours are taught based on an object definition image. By setting an object definition image, the contours are determined automatically. The contours can then be adjusted manually.

The contour taught in the object definition image is also referred to as the "reference contour" or "good part".

This area can be detected several times within the ROI (e.g. orientation of screw heads).

Setting an object definition area:

- ▶ Using the mouse pointer, place the object definition area in the live image as close as possible around the object.
- ▷ The object is automatically detected within the object definition area and highlighted in colour.

### 11.2.4 Contour anchor model

The “Contour anchor” model can be used to trace the search zone of another model. The position and orientation are taken into account. This means that objects do not have to have same position and orientation for the application to work correctly.

The “Contour anchor” model is linked to the already created “BLOB analysis” and “Contour detection” models. It then traces the search zone (ROI). Objects are searched for in the search zone.

Only one model of the type “Contour anchor” can be created.



To ensure reliable object detection, the contour anchor must only be visible once in the image.



The function increases the evaluation time of the device.

The operating elements of the “Contour anchor” model are identical to those of the “Contour detection” model. (→ Contour detection model [□ 45](#)) The only difference: The “Contour detection” model can detect several contours; the “Contour anchor” model can only detect one contour.

### 11.2.5 Creating a region of interest (ROI)

Within the search zone (ROI: Region of Interest), the device looks for accomplishable conditions, such as recognising contours. With default setting and when a new model is added, an ROI covering the entire live image is automatically created. Up to 64 ROIs can be created per model.



The operating elements for creating a ROI are only displayed in the model settings.





Creating a ROI:

► Select a model.

▷ If no model exists, one must be added. (→ Add new model [□ 36](#))

► Click the button [Search zone (ROI)]: 

▷ A list with the following buttons is displayed:

Button	Function	Description
	Create rectangle ROI	Creates a rectangular ROI.
	Create ellipse ROI	Creates an elliptical ROI.
	Create polygon ROI	Creates an ROI with any desired number of points. To create the ROI, click on the first point after setting the last point.
	Create multi-ROI	Creates a multi-ROI containing several individual ROIs of the same shape and size. The contained ROIs can be adjusted in shape, grid type, number and size.







► Select an ROI shape from the list.

► Create the region of interest in the live image by clicking and dragging using the mouse.

► Click and drag to move the region of interest.

#### Setting the region of interest

The following buttons are used to set the region of interest:

Button	Function	Description
	Change the size and shape of the region of interest	Click on the small squares to change the size and shape of the region of interest.
	Rotate region of interest	Click and drag the button to rotate the region of interest.
	Group regions of interest	Groups several regions of interest. Several regions of interest are selected while pressing the Shift key.
	Edit region of interest	Edits the selected region of interest. The ROIs contained in a multi-ROI can be adjusted in shape, grid type, number and size.
	Copy region of interest	Copies the selected region of interest.
	Delete region of interest	Deletes the selected region of interest.



If a region of interest cannot be selected:

- ▶ Click on the name of the region of interest.


### 11.2.6 Creating a region of disinterest (ROD)

Within the region of disinterest (ROD), the device does not search for accomplishable conditions, such as detecting contours. Up to 64 regions of disinterest can be created per model.






The operating elements for creating a region of disinterest are only displayed in the model settings.

Creating a region of disinterest:

- ▶ Select a model.
- ▷ If no model exists, one must be added. (→ Add new model  36)

- ▶ Click the button [Exclusion zone (ROD)]: 





- ▶ A list with the following buttons is displayed:

Button	Function	Description
	Create rectangle ROD	Creates a rectangular ROD.
	Create ellipse ROD	Creates an elliptical ROD.
	Create polygon ROD	Creates an ROD with any desired number of points. To create the ROD, click on the first point after setting the last point.

- ▶ Select an ROD shape from the list.
- ▶ Create the region of disinterest in the live image by clicking and dragging using the mouse.
- ▶ Click and drag to move the region of disinterest.

#### Setting the region of disinterest

The following buttons are used to set the region of disinterest:

Button	Function	Description
	Change the size and shape of the region of disinterest	Click on the small squares to change the size and shape of the region of disinterest.
	Rotate region of disinterest	Click and drag the button to rotate the region of disinterest.
	Copy region of disinterest	Copies the selected region of disinterest.
	Delete region of disinterest	Deletes the selected region of disinterest.



If a region of disinterest cannot be selected:

- ▶ Click on the name of the region of disinterest.

### 11.3 Flow

The function “Flow” displays the images and models available in a flow chart. In just a few steps

- the evaluation order of the images and models is set,
- images are activated/deactivated,
- timeouts for models are set.

In addition, the capture times of images and evaluation times of the models are displayed.

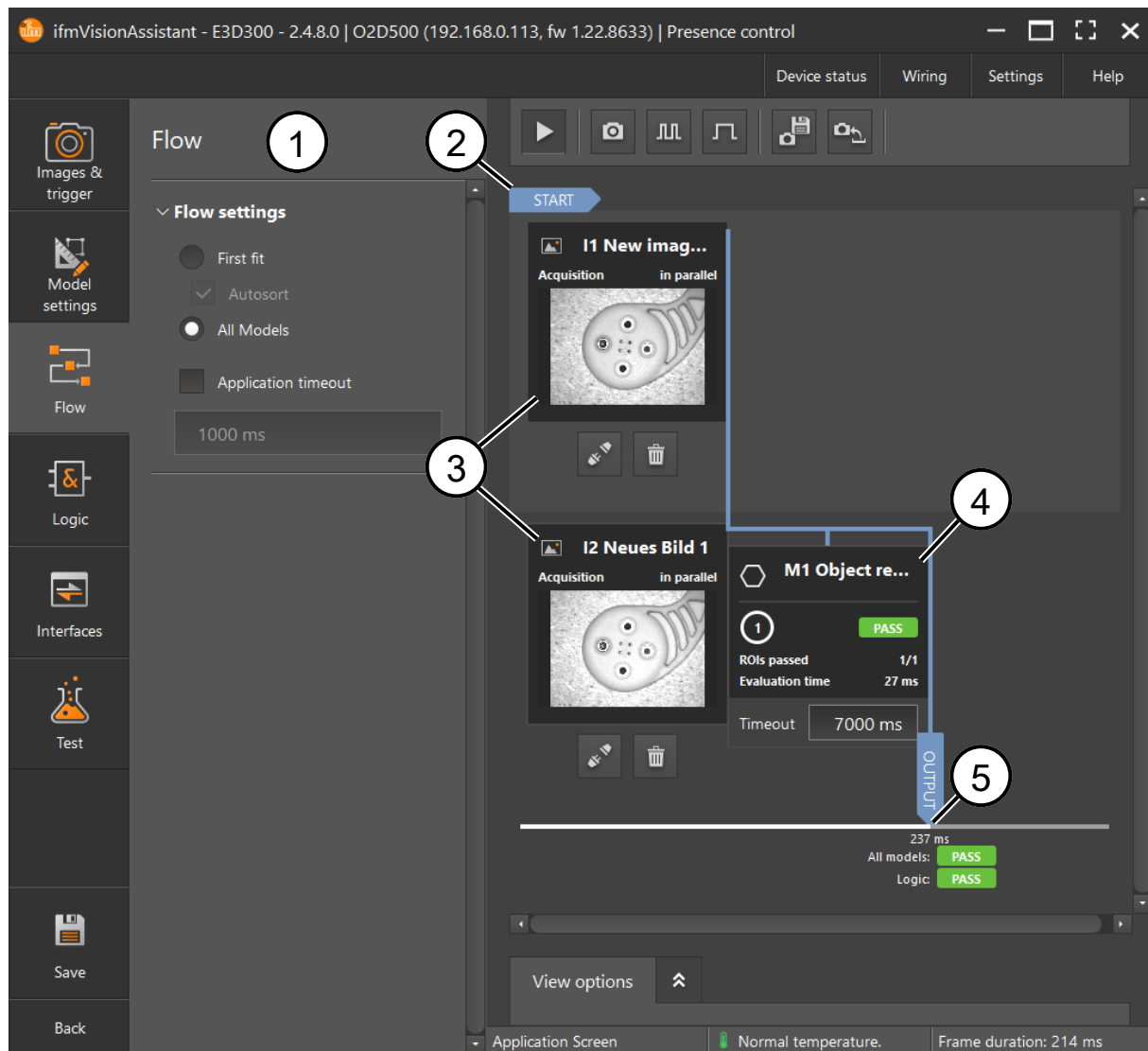


Fig. 13: Function "Flow"

- |                         |                           |
|-------------------------|---------------------------|
| 1 Flow settings         | 2 Start of the flow chart |
| 3 Images                | 4 Model                   |
| 5 End of the flow chart |                           |

### Flow settings

The flow settings are used to set the processing order of the images and models.

The flow settings contain the following settings:

Flow settings	Type	Description
[First fit]	Option field	Runs the models in the processing order. The flow is stopped as soon as a model successfully completes the search task. The models following in the flow chart are not executed.
[Autosort]	Checkbox	Runs the model first that successfully fulfilled an ROI in the previous pass.
[All Models]	Option field	Runs all models. The total evaluation time increases.
[Application timeout]	Checkbox	Sets a timeout for the application. If the evaluation time of the application exceeds the timeout, the evaluation is stopped.



## Flow chart

The flow chart starts with the image underneath “START” (2). (→ Images & trigger □ 26) The active models (4) are connected with the blue line. (→ Models □ 35) Disabled models are greyed out and encircled with a dashed line.

The flow chart ends with “OUTPUT” (5). The total evaluation time is displayed underneath “OUTPUT”.



**Double-clicking on an image or a model links directly to the respective settings.**

The following properties are displayed within an image (3):

- image name
- current image of the vision sensor
- capture time (corresponds to the exposure and image read-out time of the image)

Within a model (4) the following properties are displayed:

- model name
- model type
- status of the model (ROI fulfilled)
- number of fulfilled ROIs / number of ROIs
- evaluation time (influenced by the settings of the model) (→ Models □ 35)
- timeout (→ Models □ 35)

## Setting images

The following functions are used to set images:

Function	Button	Description
Change position	-	Press the mouse button and move the image to the new position.
Activate/deactivate		Activates the selected image.
Delete		Deletes the selected image from the device's system.

## Setting models

The following functions are used to set a model:

Function	Button	Description
Change position	-	Press the mouse button and move the model to the new position.
Image references		Connects the model to an available image.
Delete		Deletes the selected model from the device's system.
Timeout	-	Sets a timeout for the model. If the evaluation time of the model exceeds the timeout, the evaluation is stopped.

## 11.4 Logic

The function “Logic” creates an output logic by means of logic blocks. In addition to binary signals, numbers and strings are also processed. The model and pin data is assigned to the outputs in the output logic. Then the data is transferred to a controller (PLC/PC) via the outputs.

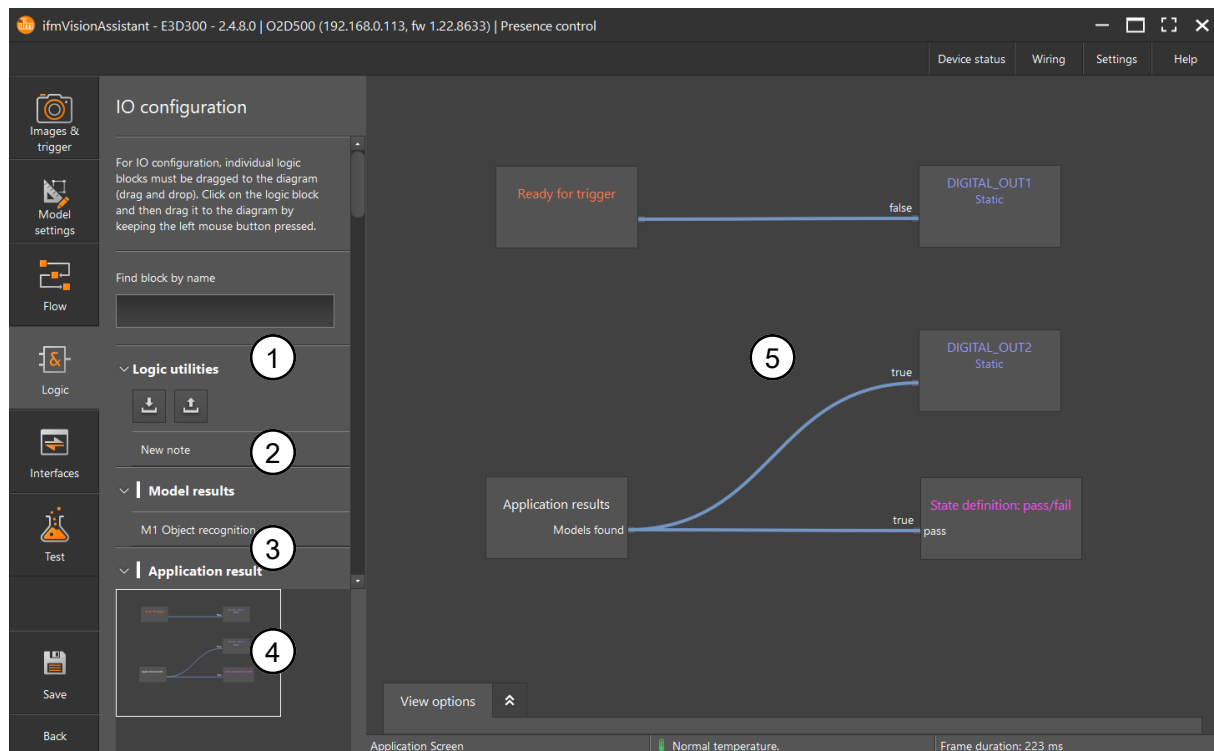


Fig. 14: Function “Logic”

- |                      |                   |
|----------------------|-------------------|
| 1 Find block by name | 2 Logic utilities |
| 3 Logic blocks       | 4 Overview area   |
| 5 Chart              |                   |

### Find block by name

Find logic blocks quickly by entering their name in the search field.

### Logic utilities

The “Logic utilities” import and export an output logic. (→ Logic utilities [59](#)) The export saves the output logic and makes it interchangeable with other devices.

### Logic blocks

The logic blocks are used to create an output logic in the diagram. (→ Logic block [59](#)) The logic blocks are placed in the diagram by clicking and dragging using the mouse:

- ▶ Click the logic block and keep the mouse button pressed.
- ▶ Drag the logic block into the diagram and release the mouse button.
- ▷ The logic block is placed.



At the edge of each logic block, there is at least one contact area via which the logic blocks are connected. (→ Logic block [59](#))

### Overview area

The overview area displays a reduced overview of the main area. The white frame is shifted using the mouse. By this, the logic blocks outside the visible area can be displayed.



### Chart

The output logic is created in the diagram. (→ Output logic [60](#)) The pin events and the outputs are displayed as logic blocks with different designations and font colours. The logic blocks are connected by connecting lines. The connecting lines represent the data flow between the logic blocks. Next to the inputs of the logic blocks, the current state of the input is displayed.

## 11.4.1 Logic utilities

The “Logic utilities” import and export the output logic. The export saves the output logic and makes it interchangeable with other devices.

The function “Logic utilities” contains the following operating elements:




Operating element	Name	Description
	Import logic	Imports the output logic from a file with the extension “.o2xlgc”.
	Export the whole logic	Exports the output logic to a file with the extension “.o2xlgc”.

## 11.4.2 Logic block

### Editing a logic block

Logic blocks can be edited in two ways. The available functions are displayed as buttons for the selected logic block.

The following buttons are used to edit a logic block:

Function	Button	Description
Duplicate		Creates a duplicate of the selected logic block.
Delete		Deletes the selected logic block.
Set		Sets the selected logic block.

### Connecting logic blocks

The contact areas at the border connect the logic blocks.

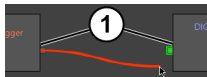


Fig. 15: Contact areas with connecting line

1 Contact areas

Connecting a logic block:

- ▶ Click the contact area at the right border of a logic block and keep the mouse button pressed.
- ▷ The contact areas of the outputs are at the right border.
- ▶ Drag the connecting line to a free contact area on the left border of a logic block and release the mouse button.
- ▷ The contact areas of the inputs are at the left border.



During connection, the compatibility of the logic block is verified. For example, a numeric output cannot be connected to a Boolean input.

During connection, the units of measurement of the logic blocks are not verified.

Deleting a connecting line:

- ▶ Click the connecting line.




- ▶ Click on the button [Delete]: 

- ▷ The connecting line is deleted.

### Selecting several logic blocks

By holding down the Ctrl key and clicking with the left mouse button, several logic blocks are selected. The selected logic blocks can then be exported as a bundle, duplicated or deleted.

The selected logic blocks are highlighted with a frame. The following operating elements are displayed below the frame:

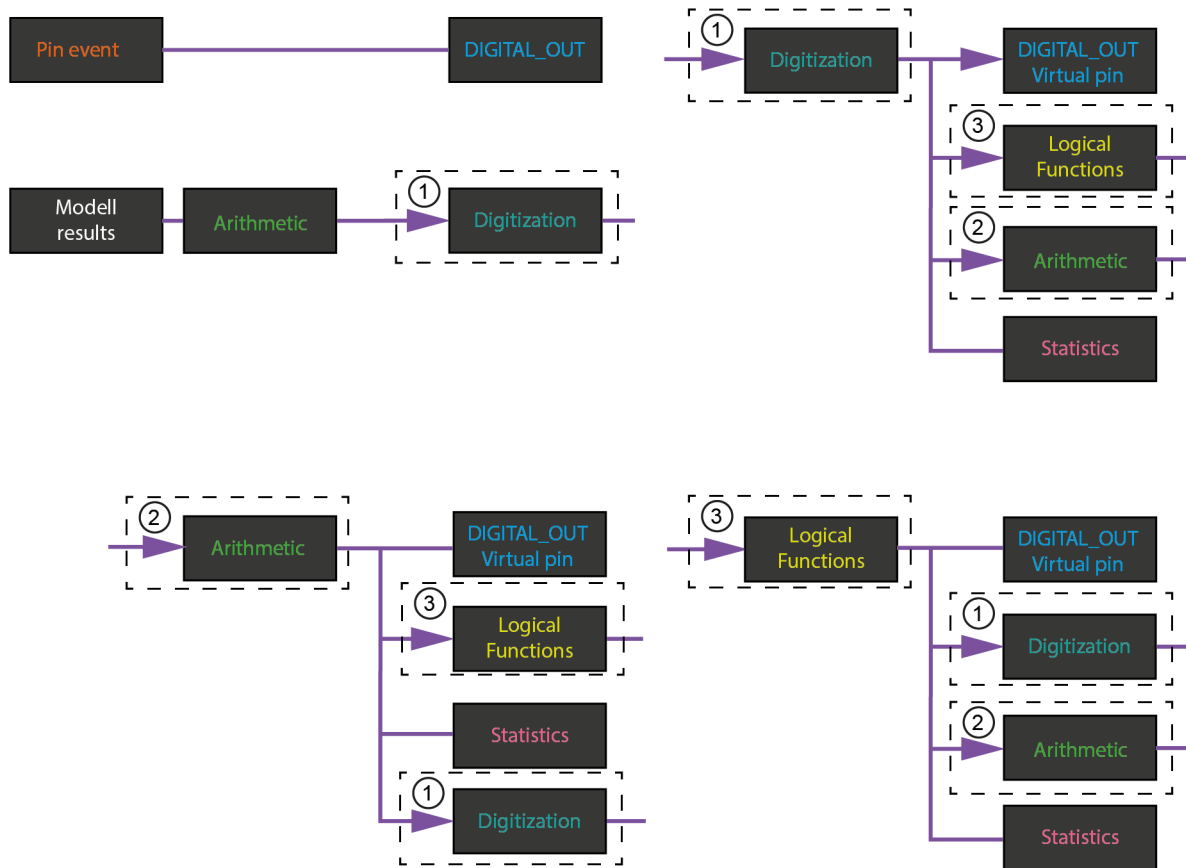
Operating element	Name	Description
	Duplicate	Duplicates the selected logic blocks. Some logic blocks may only be present once in the output logic and therefore cannot be duplicated.
	Export	Exports the selected logic blocks to a file with the extension ".o2xlgc".
	Delete	Deletes the selected logic blocks.

### 11.4.3 Output logic

The output logic is created in the diagram. The model and pin data is assigned to the outputs in the output logic. The following rules apply for creating an output logic:

- The pin events are provided as Boolean numbers (1 = true, 0 = false) and assigned to digital outputs.
- The model results are numerical values and are processed as follows:
  - use of operators,
  - digitalisation by comparison with other results or values,
  - transfer of digitalised numerical values by applying arithmetic operators and logic functions,
  - output of a Boolean value via a digital output or a virtual pin.

The following figure shows an overview of the configuration options in the output logic. The numbers identify the connection between the logic blocks.



GB

Fig. 16: Output logic

### 11.4.4 Logic block “Add note”

The logic block “Add note” inserts notes into the diagram. The notes contain any text and behave like a sticky note.

The following functions are used to set the logic block:

Function	Button	Description
Edit text	-	Clicking within the note displays a cursor that is used to add and edit text.

### 11.4.5 Logic blocks “Model results”

In the area “Model results”, the created models are listed as a logic blocks. (→ Models □ 35) The logic blocks provide the properties of the detected objects at the outputs.

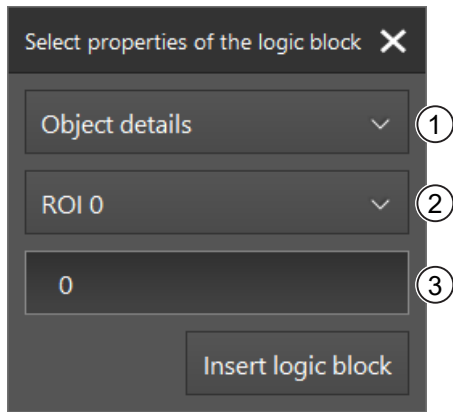


Fig. 17: Properties of the logic block

- 1 Function  
3 Object index

2 ROI group

### Logic block model “Contour detection” / “Contour anchor”

After placing a logic block of the model type “Contour detection” or “Contour anchor”, the properties are displayed:

List	Description
[Function] (1)	Sets the function of the logic block: [Object properties]: Provides the object properties at the outputs. [ROI result]: Provides the status of a specific ROI group at the outputs. [Model overview]: Provides the status of all ROI groups and the decoding status at the outputs.
[ROI group] (2)	Sets the ROI group.
[Object index] (3)	Sets an object index. For access to a specific object, the number of objects per ROI group must be set to a value “>=0”.

### Logic block model “BLOB analysis”

After placing a logic block of the model type “BLOB analysis”, the properties are displayed:

List	Description
[Function] (1)	Sets the function of the logic block: [Geometry]: geometric properties of the object. [Circular]: circularity of the object [0..100]. A perfect circle has the value “100”. [Rectangular]: Rectangularity of the object [0..100]. A perfect rectangle has the value “100”. [Grey scales]: Grey scales of the object. [Other]: Other properties of the object. [ROI result]: The status of a certain ROI group. [Model overview]: The status of all ROI groups, the number of model objects and the total area model.
[ROI group] (2)	Sets the ROI group.
[Object index] (3)	Sets an object index. For access to a specific object, the number of objects per ROI group must be set to a value “>=0”.

### Outputs of logic block with [Object properties] function

With the function [Object properties], the logic block provides the following outputs:

Output	Number format	Description
[Position X]	Numerical	Position of the object on the X axis

Output	Number format	Description
[Position Y]	Numerical	Position of the object on the Y axis
[Orientation]	Numerical	Orientation of the object
[Score]	Numerical	Evaluation of the object

### Outputs of logic block with [Geometry] function

With the function [Geometry], the logic block provides the following outputs:

Output	Number format	Description
[Valid object area]	Bool	Valid object area
[Object area]	Numerical	Total object area covered
[Valid position X]	Bool	Valid position X from the reference point
[Position X]	Numerical	Position X from the position reference
[Valid position Y]	Bool	Valid position Y from the position reference
[Position Y]	Numerical	Position Y from the position reference
[Valid object height]	Bool	Valid object height
[Object height]	Numerical	Object height
[Valid object width]	Bool	Valid object width
[Object width]	Numerical	Object width

### Outputs of logic block with [Circular] function

With the function [Circular], the logic block provides the following outputs:

Output	Number format	Description
[Valid roundness]	Bool	Valid roundness
[Roundness]	Numerical	Roundness
[Valid outer radius]	Bool	Valid outer radius
[Outer radius]	Numerical	Outer radius
[Valid inner radius]	Bool	Valid inner radius
[Inner radius]	Numerical	Inner radius

### Outputs of logic block with [Rectangular] function

With the function [Rectangular], the logic block provides the following outputs:

Output	Number format	Description
[Valid rectangularity]	Bool	Valid rectangularity
[Rectangularity]	Numerical	Rectangularity
[Valid inner width]	Bool	Valid inner width
[Inner width]	Numerical	Inner width
[Valid inner height]	Bool	Valid inner height
[Inner height]	Numerical	Inner height

### Outputs of logic block with [Grey scales] function

With the function [Grey scales], the logic block provides the following outputs:

Output	Number format	Description
[Valid min. grey value]	Bool	Valid minimum grey-scale value
[Min. grey-scale value]	Numerical	Minimum grey-scale value
[Valid max. grey-scale value]	Bool	Valid maximum grey-scale value
[Max. grey-scale value]	Numerical	Maximum grey-scale value

Output	Number format	Description
[Valid grey value deviation]	Bool	Valid grey value deviation
[Grey-scale value deviation]	Numerical	Grey value deviation
[Valid average grey value]	Bool	Valid average grey-scale value
[Average grey value]	Numerical	Average grey-scale value

### Outputs of logic block with [Other] function

With the function [Other], the logic block provides the following outputs:

Output	Number format	Description
[Valid compactness]	Bool	Valid compactness
[Compactness]	Numerical	Compactness
[Valid number of holes]	Bool	Valid number of holes
[Number of holes]	Numerical	Number of holes
[Valid orientation]	Bool	Valid orientation
[Orientation]	Numerical	Orientation

### Outputs of logic block with [ROI result] function

With the function [ROI result], the logic block provides the following outputs:

Output	Number format	Description
[ROI passed]	Bool	State of an ROI
[Number of objects]	Numerical	Number of found objects
[Total area]	Numerical	Total area size

### Outputs of logic block with [Model overview] function

With the function [Model overview], the logic block provides the following outputs:

Output	Number format	Description
[All ROIs passed]	Bool	State of the ROI groups
[Number of model objects]	Numerical	Number of model objects
[Total area model]	Numerical	Total area model

## 11.4.6 Logic blocks “Application result”

The “Application result” logic blocks show the status of the models contained in the application.

The logic block “Application results” provides the following outputs:

Output	Number format	Description
[Models found]	Bool	State of the models contained in the application: - “All models found” or - “Not all models found”

The “Image quality” logic block provides the results of the image quality check at the outputs:

Output	Number format	Description
[Sharpness warning]	Bool	Image sharpness warning
[Sharpness]	Numerical	Image sharpness
[Brightness warning]	Bool	Value range for brightness has been left
[Brightness]	Numerical	Image brightness
[Underexposure warning]	Bool	Value range for underexposed image has been left



Output	Number format	Description
[Underexposure]	Numerical	Underexposed image
[Overexposure warning]	Bool	Value range for overexposed image has been left
[Overexposure]	Numerical	Overexposed image

The “Anchor result” logic block provides the results of the “Contour anchor” model at the outputs: (→ Contour anchor model [53](#))

Output	Number format	Description
[valid]	Bool	Model recognised.
[rotation]	Numerical	Rotation of the traced object.
[translation column]	Numerical	Translation on the X-axis
[translation row]	Numerical	Translation on the Y-axis

### 11.4.7 Logic blocks “Arithmetic”

The following logic blocks are provided in the area “Arithmetic”:

Logic block	Number format on the input	Number format on the output	Description
[DIFF]	Numerical	Numerical	The signals on the inputs are subtracted. The two outputs provide the result with different signs.
[ADD]	Numerical	Numerical	The signals on the inputs are added.
[COUNT]	Bool	Numerical	The signals on the inputs are added. The Boolean values at the input are treated as numerical values.
[Min/max value]	Numerical	Numerical	The minimum and maximum values are determined on the basis of the signals on the inputs.
[Fixed value]	–	Numerical	A floating point number is set as a fixed value. The fixed value is provided and can be used for the logic blocks “DIFF” and “ADD” (for example to set an offset).
[Distance between points]	Numerical	Numerical	The distance is output between: - objects - position reference of BLOBs and contours

### 11.4.8 Logic blocks “Digitalisation”

The following logic blocks are provided in the area “Digitalisation”:

Logic block	Number format on the input	Number format on the output	Description
[Comparator]	Numerical	Bool	The signals on the inputs are compared to each other. Signals on the outputs: "1": The relation displayed in the output name applies. "0": The relation displayed in the output name does not apply.

### 11.4.9 Logic blocks "Logical functions"

The area "Logical functions" contains the following logic blocks:

Logic block	Number format at the input	Number format at the output	Description
[AND]	bool	bool	The signals at the inputs are compared to each other. Signals at the output: "1": All signals at the inputs are "1". "0": Minimum one signal at the inputs is "0".
[OR]	bool	bool	The signals at the inputs are compared to each other. Signals at the output: "1": Minimum one signal at the inputs is "1". "0": All signals at the inputs are "0".
[NOT]	bool	bool	The signal at the input is inverted. Signals at the output: "1": The signal at the input is "0". "0": The signal at the input is "1".

### 11.4.10 Logic blocks "Output"

The following logic blocks are provided in the area "Output":

Logic block	Number format on the input	Description
[Output string]	Alphanumerical	Saves the received string. The logic block [Output string] is available up to 10x. The content of the logic blocks is retrieved via the process interface. (→ Interfaces □ 71)
[Binary output]	Byte array	Saves the received binary data. The logic block [Binary output] is available up to 10x. The byte array has a maximum size of 256 bytes. The content of the logic blocks is retrieved via the process interface. (→ Interfaces □ 71)
[DIGITAL_OUT1]	Bool	The digital output is switched with or without limited pulse duration. The digital outputs have the following settings: "Static": The digital output is switched without limited pulse duration (recommended setting). "Pulsed": The digital output is switched with a limited pulse duration (>= 10 ms).
[DIGITAL_OUT2]	Bool	

Logic block	Number format on the input	Description
[Virtual pins bytes 1-8]	Bool	The virtual pins are memory areas to transfer the data from the logic area to an interface.  A virtual pin consists of an 8-bit order. The 8 virtual pins are arranged in sequence to maximum 64 Boolean values and provided via an interface. (→ Interfaces 71) Non-assigned virtual pins provide a Boolean "0".

### 11.4.11 Logic blocks "Pin events"

The following logic blocks are provided in the area "Pin events":

Logic block	Number format on the output	Description
[Ready for trigger]	Bool	The device is ready for trigger to capture a new image.
[Error]	Bool	The device has found an error.
[Image acquisition finished]	Bool	The device has finished the image acquisition.
[Process interface]	Bool	The digital output is switched to "High" or "Low" via the process interface with the "o" command.

### 11.4.12 Logic block "Statistics"

The following logic block is provided in the area "Statistics":

Logic block	Number format at the input	Description
[State definition: pass/fail]	bool	The result of an application is provided: "1": The application was successfully executed. "0": The application was not successfully executed.  The result is written in the service report and is available for statistical calculations.

### 11.4.13 Logic blocks "Converter"

The following logic blocks are provided in the area "Converter":

Logic block	Number format on the input	Number format on the output	Description
[String to number]	Alphanumerical	Numerical	Converts the alphanumeric data at the input to numeric data at the output.
[Number to string]	Numerical	Alphanumerical	Converts the numeric data at the input to alphanumeric data at the output.
[Binary to string]	byte array	Alphanumerical	Converts the binary data at the input to alphanumeric data at the output.
[String to binary]	Alphanumerical	byte array	Converts the alphanumeric data at the input to binary data at the output.
[Number to binary]	Numerical	byte array	Converts the numeric data at the input to binary data at the output.

Logic block	Number format on the input	Number format on the output	Description
[Bool to string]	Bool	Alphanumerical	Converts the Boolean data at the input to alphanumeric data at the output.
[Bool to binary]	Bool	byte array	Converts the Boolean data at the input to binary data at the output.

#### 11.4.14 Logic blocks “String operations”

The following logic blocks are provided in the area “String operations”:

Logic block	Number format on the input	Number format on the output	Description
[Fixed string]	-	Alphanumerical	Provides an adjustable character string which is used for operations with character strings.
[PCIP input string]	-	Alphanumerical	Provides an adjustable character string (ID “00” to “09”) which is transferred to a controller for operations. The character string can be changed during the runtime with the “J Command” (see separate document Programmers Guide).
[Equal strings]	Alphanumerical	Bool	Compares the character string on both inputs in view of identical content: “a==b” = “1”: The character strings are identical. “a!=b” = “1”: The character strings are not identical.
[Match regex]	Alphanumerical	Alphanumerical	Applies a regular expression (regex) to the character string on the input. If an expression is found, the output [Match pattern] provides a Boolean “1”. The found expression is provided at output [Output string].
[Match pattern]	Alphanumerical	Bool	Searches a pattern in the input string. Wildcards such as “*” and “?” are accepted for the pattern (example: “* png”). Contains the input string of the pattern, is provided on the output of a Boolean “1”.
[Split by delimiter]	Alphanumerical	Alphanumerical	Searches the delimiter in the character string. The character string is split at the positions of the delimiter. The split string of characters is provided one after the other on the 7 outputs without the delimiter.  If the character string is split in more than 7 segments at the input, the segments >7 are provided at the outputs.
[Split string at position]	character string: alphanumeric, position: Numerical	Alphanumerical	Splits a character string at a certain position. The split character string is provided on the outputs.

Logic block	Number format on the input	Number format on the output	Description
[Concatenate]	Alphanumeric	Alphanumeric	Concatenates up to 7 character strings, optionally with a delimiter. The character string and the optional delimiter are provided via the logic blocks "Fixed string", for example.
[Selection]	Bool / alphanumeric	Alphanumeric	If there is a Boolean "0" on the input "Switch (0/1)" the character string is provided on the input "Option 0". If there is a Boolean "1" at the input "Switch (0/1)", the character string is provided at the input "Option 1".
[Find first wildcard match]	Alphanumeric	Bool	Compares the data at the inputs

### 11.4.15 Logic blocks "Binary operations"

The following logic blocks are provided in the area "Binary operations":

Logic block	Number format at the input	Number format at the output	Description
[Fixed binary data]	-	byte array	Provides adjustable binary data which is used for operations with binary data.
[Binary data input]	-	byte array	Provides adjustable binary data (ID "00" to "09") which is transferred to a controller for operations. The binary data can be changed during the runtime with the "J Command" (see separate document Programmers Guide).
[Equal bytes]	byte array	bool	Compares the binary data at the inputs in view of identical content: "a==b" = "1": The binary data is identical. "a!=b" = "1": The binary data is not identical.
[Split binary by delimiter]	byte array	byte array	Searches the delimiter in the binary data. The binary data is split at the positions of the delimiter. The split binary data is provided one after the other at the 7 outputs without the delimiter. If the binary data is split in more than 7 segments at the input, the segments >7 are provided at the outputs.
[Split binary at position]	byte array	byte array	Splits the binary data at a certain position. The split binary data is provided at the outputs.
[Concatenate binaries]	byte array	byte array	Concatenates up to 7 binary data, optionally with a delimiter. The binary data and the optional delimiter are provided via the logic blocks "Fixed binary data", for example.

Logic block	Number format at the input	Number format at the output	Description
[Select binary]	byte array	byte array	<p>If there is a Boolean "0" at the input "Switch (0/1)", the binary data is provided at the input "Option 0".</p> <p>If there is a Boolean "1" at the input "Switch (0/1)", the character string is provided at the input "Option 1".</p>

### 11.4.16 Example 1 - Compare distance values

The X and Y positions of two models are compared.

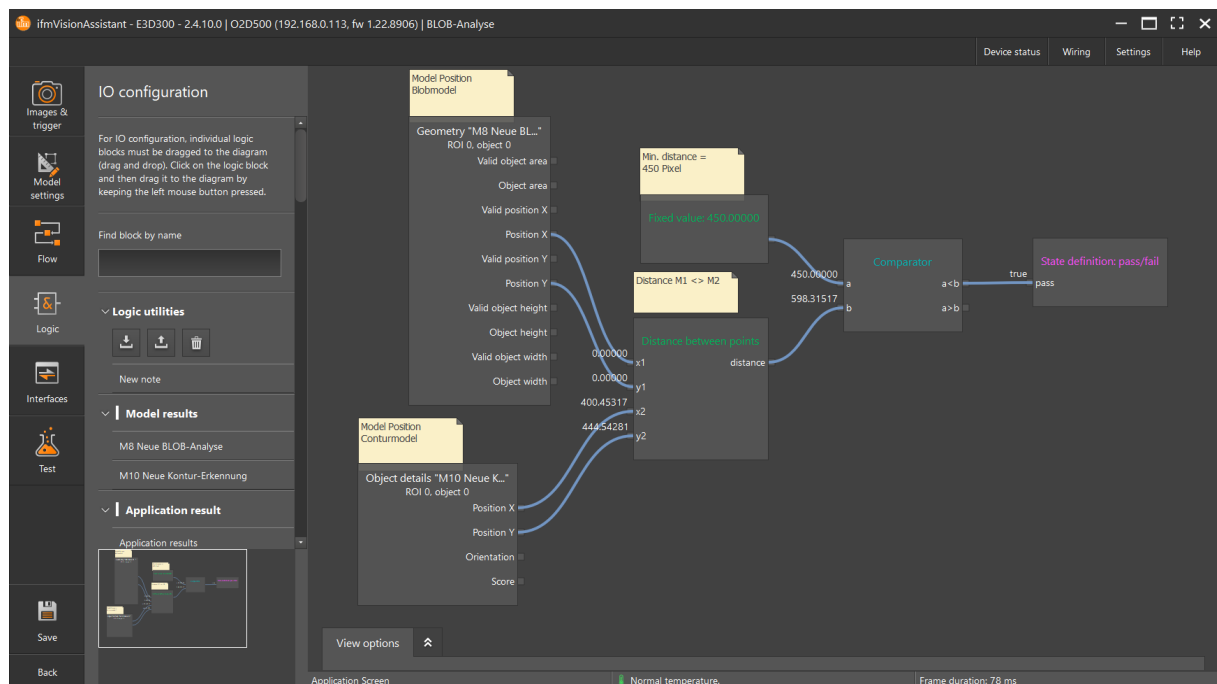


Fig. 18: Example 1 - Compare distance values

If the distance is above "450 pixels", the signal "High" is output.

### 11.4.17 Example 2 - Counter and comparator

Adds up the ROI results of the models and outputs them as a binary value.

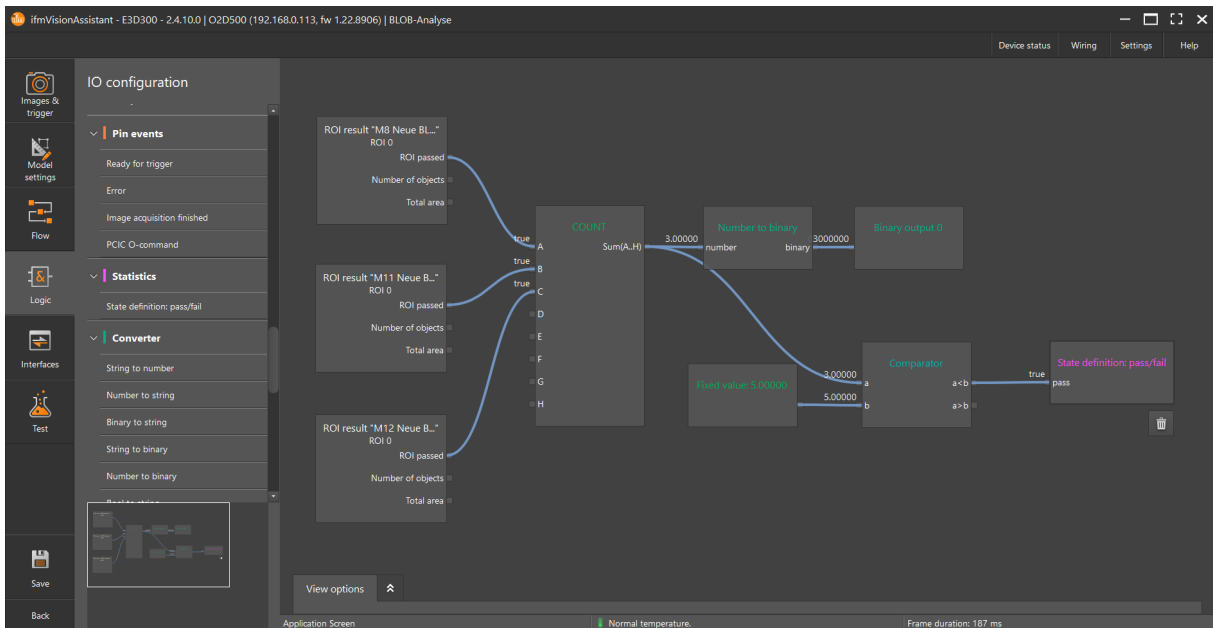


Fig. 19: Example 2 - Counter and comparator

In addition, the sum of the ROI results is compared with a constant and recorded statistically if there are less than 5 ROI results.

### 11.4.18 Example 3 - Converter

The number of found objects of a model is converted into a string and output.

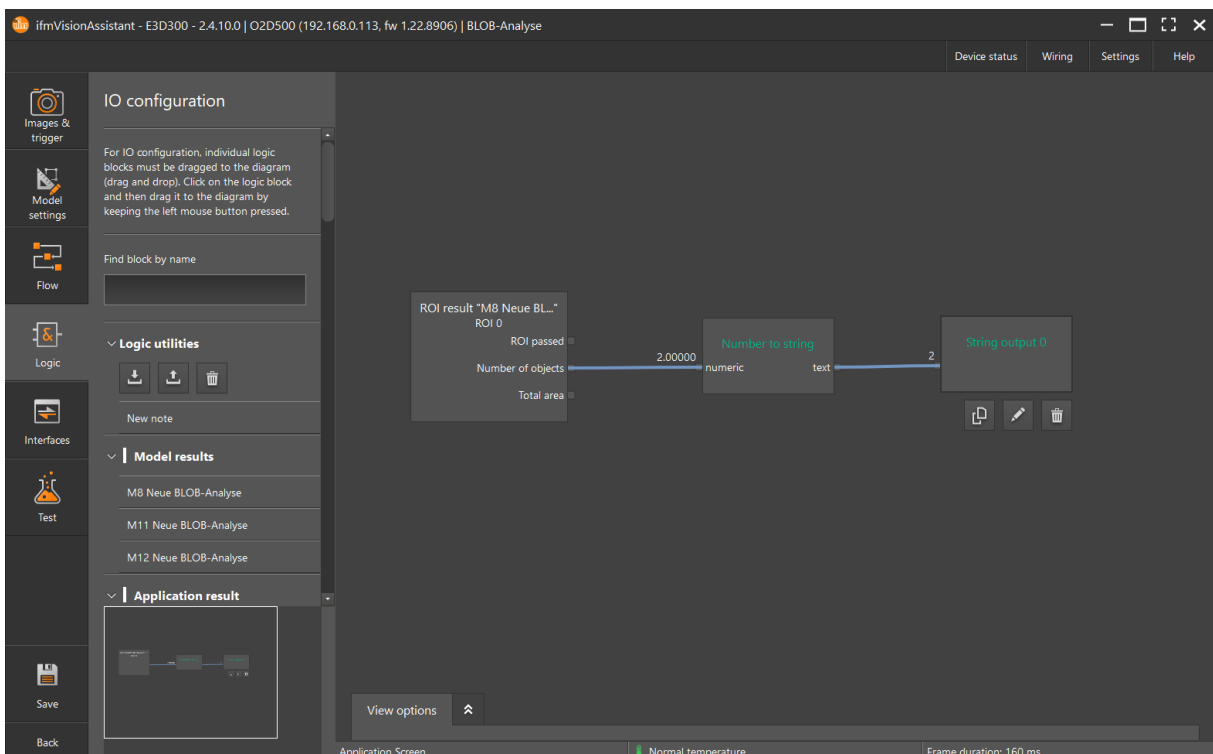


Fig. 20: Example 3 - Converter

## 11.5 Interfaces

The function “Interfaces” sets the interfaces of the selected application. Data packages are defined which are sent via the interface.

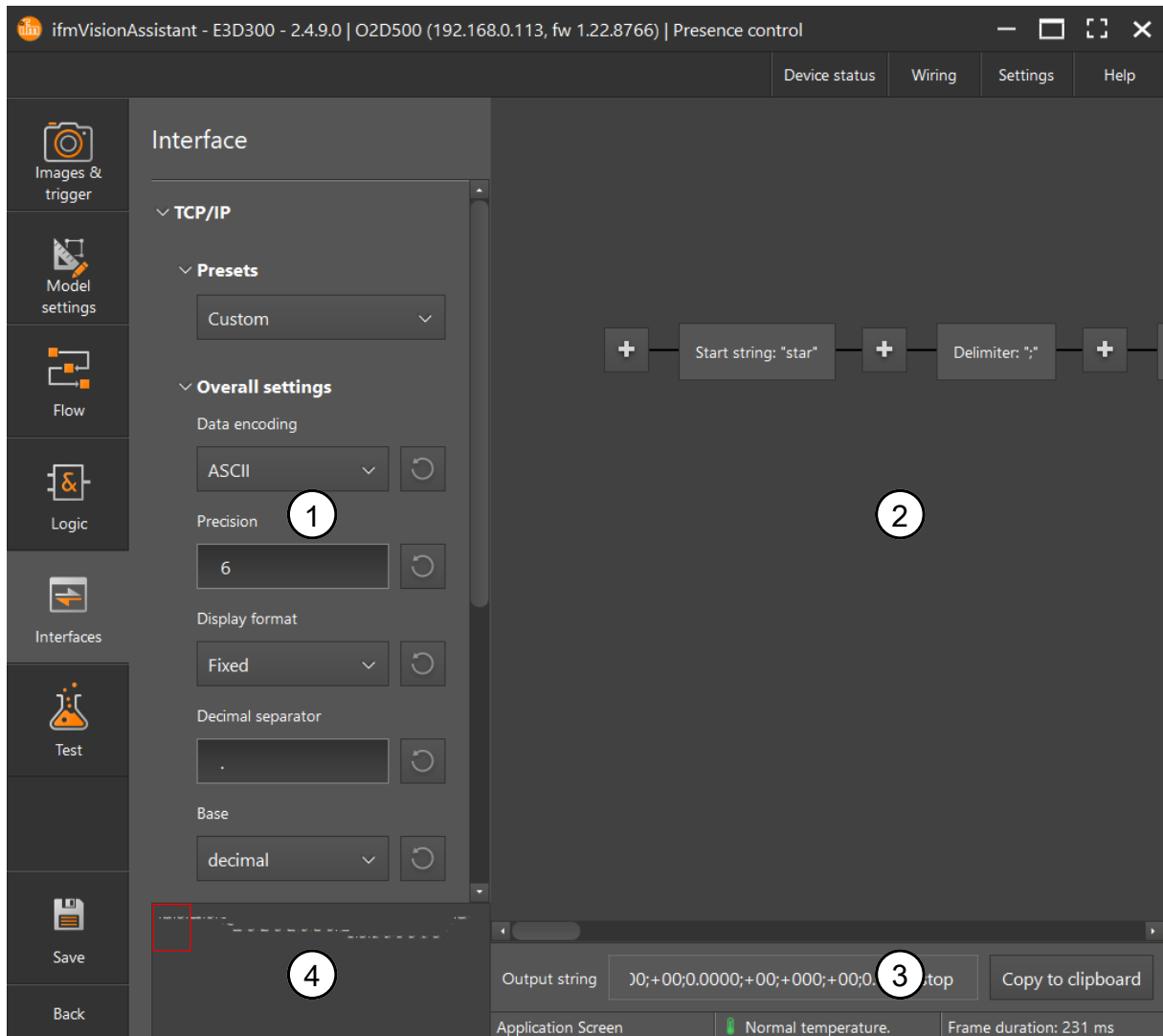


Fig. 21: Function “Interfaces”

- 1 Presets and overall settings
- 3 Output string

- 2 Main area
- 4 Overview area

**Presets**

The area “Settings” contains the following operating elements:

Operating element	Name	Description
	Default value	Resets the setting to the default setting.
[Presets]	List	Sets sets of preset data packages. The sets are directly used or adapted. An adapted set is saved as preset “Custom”.

**Overall settings**

The area “Overall settings” contains the following operating elements:

Operating element	Name	Description
	Default value	Resets the setting to the default setting.
[Data encoding]	List	Sets the data encoding: [ASCII] [Binary]








Operating element	Name	Description
[Precision]	Input field	Sets the number of decimal places.
[Display format]	List	Sets the display format: [fixed]: fixed-point number [scientific]: exponential
[Decimal separator]	Input field	Sets the decimal separator. The decimal separator is a 7-bit character (e.g. ".").
[Base]	List	Sets the output format: [Binary]: Base 2 [octal]: Base 8 [decimal]: Base 10 [hex]: Base 16
[Width]	Input field	Sets the minimum total length of the value.
[Numeric fill]	List	Sets the values of non-used bits: [on]: Each non-used bit is assigned a Boolean "0" and positive values are preceded by a plus sign. [off]: Bits which are not used remain blank.
[Fill]	Input field	Sets the fill character.
[Alignment]	List	Sets the alignment of the value within the defined bit width: [Left] [Right]
[Byte order]	List	Sets the byte order: [little endian]: least significant byte of binary data at the first position or at the lowest memory address. [big endian]: most significant byte of binary data at the first position or at the lowest memory address. [Network byte order]: byte order specified by the network protocol. [Bus-depending order]: byte order specified by the fieldbus.

### Main area

The data packages of the interface are set in the main area. The data packages are displayed as rectangles. The data blocks are connected via dashed connecting lines. The data is sent from left to right in the order of the data blocks.

The "main area" contains the following operating elements:

Operating element	Name	Description
	Add data package	Adds a data package at the position. (→ Insert data package  74)
	Set data package	Sets the selected data package.
	Delete data package	Deletes the selected data package.
	Show/hide loops	Shows or hides the loop of the data package [Models]. The data package [Models] consists of several data packages which are connected via loops. Depending on the ROIs contained, this loop is passed through several times.

## Output string

“Output string” is a character string which is changed with the data packages in the main area. Depending on the selected data encoding in the area “Settings”, “Output string” is displayed as ASCII or Bool code.

The area “Output string” contains the following operating elements:

Name	Type	Description
[Copy to clipboard]	Button	Copies the “Output string” to the clipboard.



“Output string” cannot be set directly. “Output string” is set via the data packages in the main area.

## Overview area

The overview area displays a reduced overview of the main area. The red frame is shifted using the mouse. By this, the data packages outside the visible area can be displayed.

### 11.5.1 Insert data package

A data package is inserted in the main area with the [+] button. After clicking [+], a list opens. The data package is set with the elements in the list.



The content of the list is variable and depends on the position of the data package in the “Output string”.

### “General” data packages

The area “General” contains the following data packages:

Data package	Description
[Start string]	Adjustable character string for starting a data transfer.
[End string]	Adjustable character string for ending a data transfer.
[User-driven input]	Adjustable character string within data transfer.
[Index of active application]	Index of the active application
[Application decoding time [ms]]	Evaluation time of the application in [ms]

### “Logic layer” data packages

The area “Logic layer” contains the following data packages:

Data package	Description
[Reading result (pass/fail)]	Reading result of the logic block “State definition: pass/fail”.
[Number of bytes in output string 0-9]	Size in bytes of the content of the logic block “Output string”.
[Output string 0-9]	Content of the logic block “Output string”.
[Digital output]	Bit order with the values at the digital outputs.
[Virtual output]	8-byte order with the values at the inputs of the virtual pins.

### “Application results” data packages

The area “Application results” contains the following data packages:

Data package	Description
[Anchor model ID]	ID of the anchor model.
[Anchor result]	The result of the object tracing.
[Number of images]	Number of the images defined for the application.
[Images]	The captured images are provided as JPEG one after the other.

Data package	Description
[ModelsSize]	Number of the models created for the application.
[Models]	<p>The data of the defined models is provided one after the other. The data package is displayed as a program loop. The content of the program loop also consists of data packages which can be selected separately:</p> <p>[Model ID]: The "Model ID" consists of a consecutive ID (0-999) in the order in which the models were defined. After 999 IDs have been assigned in an application, the IDs of deleted models are assigned again.</p> <p>[Model ID]: unique ID of the model.</p> <p>[Numeric model type]: numeric model type.</p> <p>[Model decoding status]: decoding status of the model. (-&gt; Logic blocks "Model results" □ 61)</p> <p>[Model Pass/Fail]: state definition pass/fail.</p> <p>[Number of ROI results]: number of ROI groups in the model. (-&gt; Logic blocks "Model results" □ 61)</p> <p>[ROI results]: results of the ROI groups.</p> <p>[String model type]: model type as string.</p> <p>[Model name]: name of the model.</p> <p>[User-driven input]: adjustable character string.</p> <p>[Delimiter]: delimiter to split data packages.</p>
Data package	Description
[Delimiter]	Delimiter to split data packages.

## 11.6 Test

The function "Test" records statistical data on the selected application. During the test, the current states of the device are displayed.

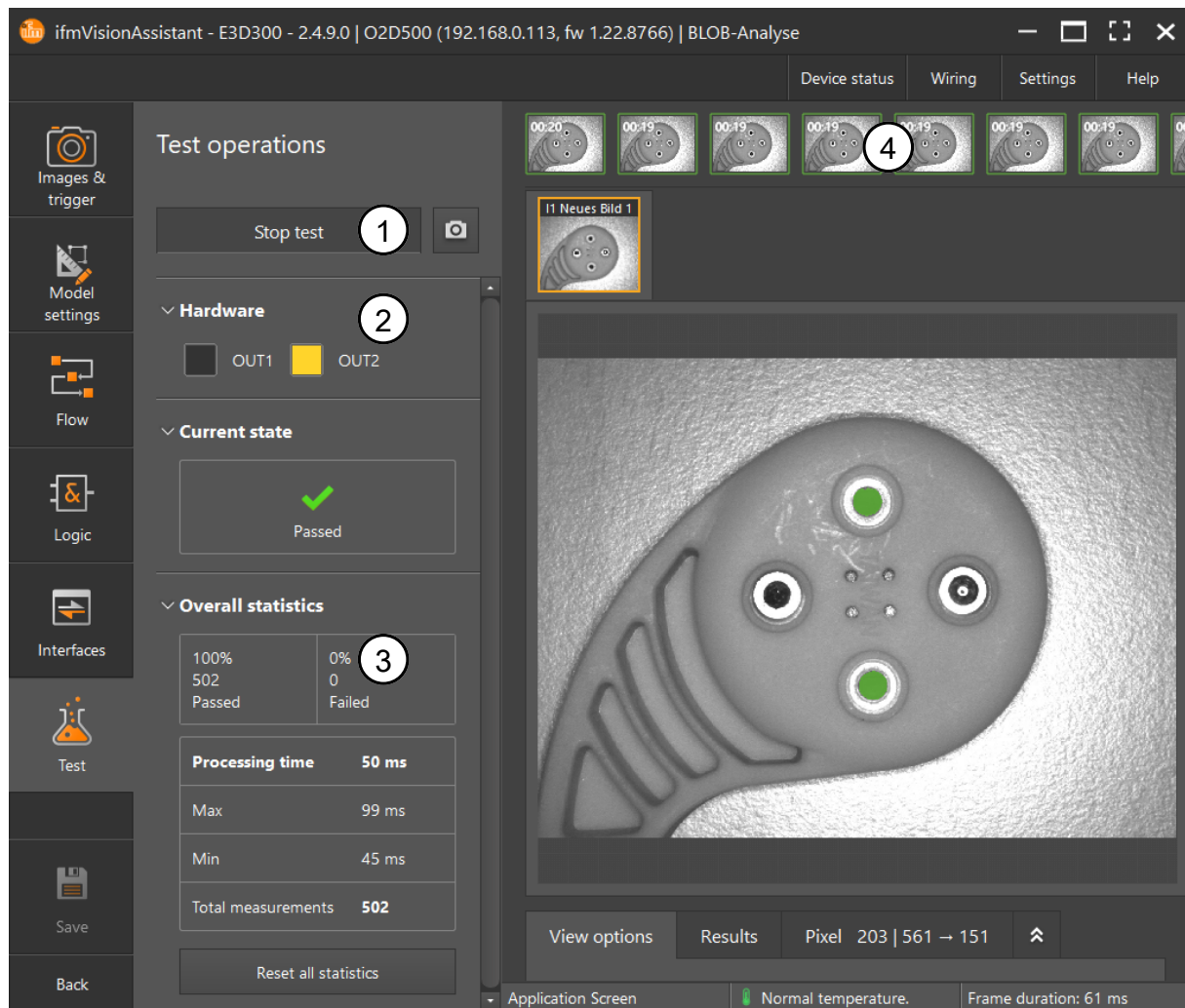



Fig. 22: Function "Test"

1 Buttons to control the test  
3 Overall statistics

2 State of the digital outputs  
4 Test images

The function "Test" contains the following operating elements:

Operating element	Type	Description
[Start test]	Button	Starts the test according to the setting "Trigger mode". (→ Trigger mode <input type="checkbox"/> 30)
[Stop test]	Button	Stops the test.
	Button	Forces a trigger manually.
[Reset all statistics]	Button	Resets all statistics.

### Overall statistics

The overall statistics include the following data:

- number of detected and non-detected objects
- evaluation time of the test images
- number of the total measurements

### Test images

Image capture generates test images while the test is active. The test images are chronologically sorted. The most current test image is on the very left.

Additional information is saved with each test image:

- status of the digital outputs OUT1 and OUT2
- overall statistics
- capture time as from test start in minutes:seconds

By clicking on a test image, it is displayed enlarged in the area “Live image”. The states of the digital outputs and the overall statistics are displayed at the time the test image is captured.



Clicking the reduced test image several times switches between the selected test image and the last recorded test image.

## 12 Service report

The area “Service report” creates an evaluation of the last 17 pass and fail images with information on the software and hardware of the device (34 images in total). The service report can be exported for support requests.

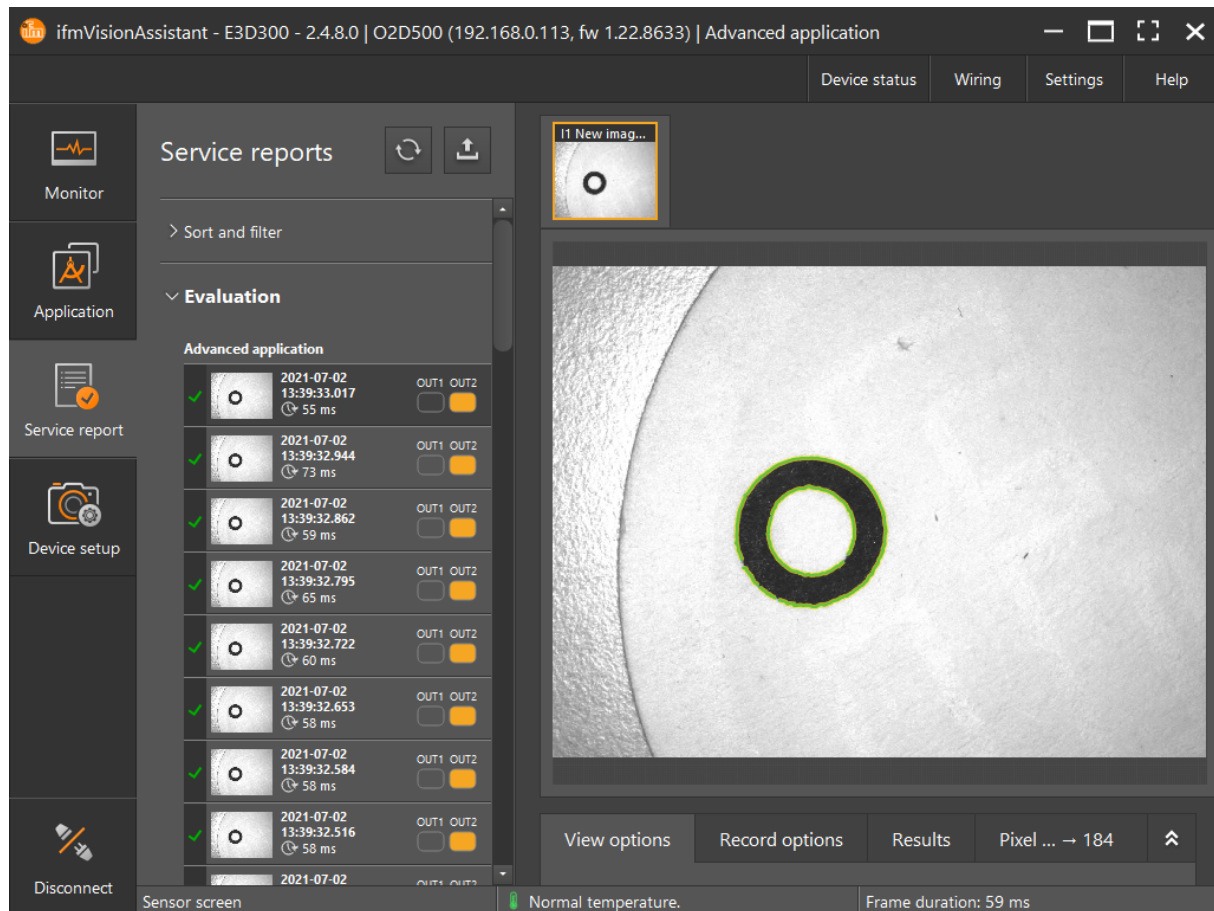




Fig. 23: Area “Service report”

The area “Service report” contains the following operating elements:

Operating element	Name	Description
	Reload	Reloads the evaluation of the service report. Reloading may take up to 1 min.
	Export	Exports the evaluation of the service report to a folder.

Area “Sort and filter”:

Name	Type	Description
[Sort by]	List	Sorts the evaluation according to the following characteristics: [Newest first]: The most recent measurements are displayed first. [Failed -> passed]: Failed measurements are displayed first. [Passed -> failed]: Passed measurements are displayed first. [OUT1 -> OUT2]: Output 1 is displayed before output 2. [OUT2 -> OUT1]: Output 2 is displayed before output 1. [Application name]: The measurements are sorted alphabetically by the name of the application. [Duration long -> short]: The longest measurement is displayed first. [Duration short -> long]: The shortest measurement is displayed first.
[Filter status failed]	Checkbox	Filters the measurements with the status "Failed" if the checkbox is deactivated.
[Filter status passed]	Checkbox	Filters the measurements with the status "Passed" if the checkbox is deactivated.
[Filter OUT1 active]	Checkbox	Filters the measurements with active output 1 if the checkbox is deactivated.
[Filter OUT1 inactive]	Checkbox	Filters the measurements with inactive output 1 if the checkbox is deactivated.
[Filter OUT2 active]	Checkbox	Filters the measurements with active output 2 if the checkbox is deactivated.
[Filter OUT2 inactive]	Checkbox	Filters the measurements with inactive output 2 if the checkbox is deactivated.



The evaluation is not filtered by default.

## 13 Device setup

The device and the networks used are set in the area “Device setup”.

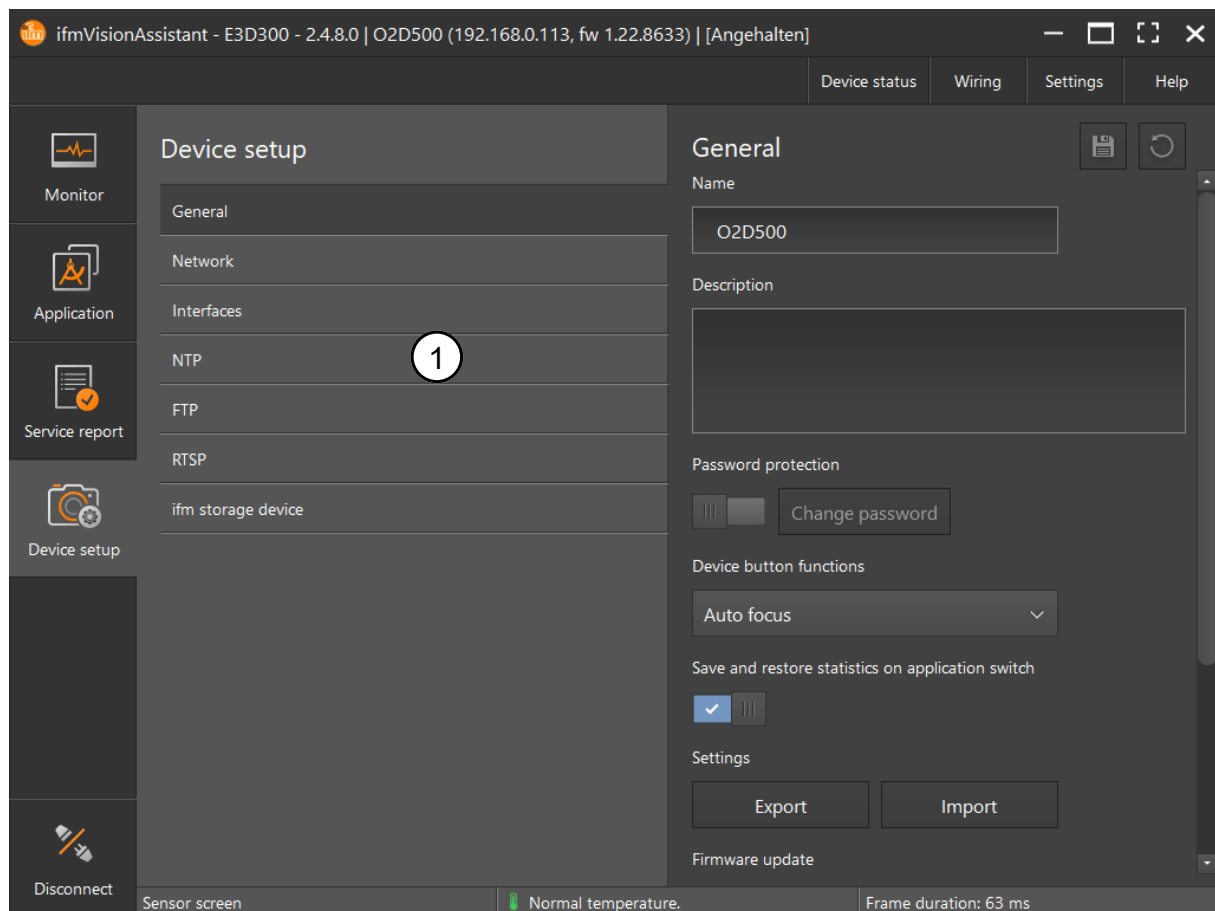


Fig. 24: Area “Device setup”

1 List


The area “Device setup” contains the following list items:

Item	Description
[General]	Sets the device, updates the firmware and imports/exports the settings. (→ General □ 80)
[Network]	Sets the Ethernet interface. (→ Network □ 81)
[Interfaces]	Sets the process and fieldbus interfaces. (→ Interfaces □ 82)
[NTP]	Synchronises the time of the device. (→ NTP □ 83)
[FTP]	Sets the connection to an FTP server. (→ FTP □ 84)
[RTSP]	Sets the real-time streaming protocol. (→ RTSP □ 85)
[ifm storage device]	Sets the ifm storage device. (→ ifm storage device □ 86)


### 13.1 General

The item [General] sets the device, updates the firmware and imports/exports the settings.

The item [General] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.





Operating element	Type	Description
	Button	Resets the changed settings.
[Name]	Input field	Sets the name of the device.
[Description]	Input field	Sets a description for the device.
[Password protection]	Switch	Activates the password protection. Password protection activates write protection for the following areas: - "Application" - "Device setup" - multi-function key on the device The password unlocks the areas. The area "Monitor" can always be accessed, regardless of password protection.
[Change password]	Button	Changes the password. If the password is lost, contact the manufacturer's support with the serial number of the device.
[Device button functions]	List	Sets the device button: [Disabled]: deactivate the device button. [Autofocus]: Activate the autofocus by pressing the device button.
[Save and restore statistics on application switch]	Switch	Saves the statistics of an application before switching to another application. If there are already statistics saved for an application, they are restored.
[Export]	Button	Exports the settings of the device to a file.
[Import]	Button	Imports the settings of the device from a file. The settings and applications on the device are overwritten when importing.
[Update]	Button	Updates the firmware of the device. The current firmware version is shown next to the button. In order for the firmware to update successfully, a static IP address is assigned to the device beforehand. (→ Assigning a static IP address □ 88)
[Reset]	Button	Restores the factory settings and deletes all settings and applications.
[Reboot]	Button	Reboots the device.

## 13.2 Network

The item [Network] sets the Ethernet interface.

The item [Network] contains the following operating elements:



Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.

Operating element	Type	Description
[DHCP]	Switch	Activates the automatic assignment of the network settings (DHCP). With activated DHCP, the input fields [IP address], [Subnet mask] and [Gateway] are not available.
[IP address]	Input field	Changes the IP address of the device (default value: "192.168.0.69"). The device must be rebooted if the process interface is used after a change of the IP address. If TCP/IP is used as process interface, it is not necessary to reboot the device.
[Connected via ...]	Output field	Displays the current connection type and IP address.
[Subnet mask]	Input field	Sets the subnet mask of the device (default value: "255.255.255.0").
[Gateway]	Input field	Sets the gateway of the device (default value: "192.168.0.201").
MAC address	Output field	Displays the MAC address of the device.

### 13.3 Interfaces

The item [Interfaces] sets the process interfaces. In addition, a wiring test can be carried out.

The item [Interface] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.
[Process interface version]	List	Sets the version of the process interface protocol. The default setting is "V3".
[TCP/IP Port for PCIC]	Input field	Sets the TCP/IP port for the data of the process interface with a socket connection (default value: "50010").
[PCIC TCP/IP scheme auto update]	Switch	Activates the corresponding PCIC data output (see operating instructions) when the active application is changed. If the switch is deactivated, the PCIC data output of the previous application remains active when the active application is changed (see operating instructions). Only if the connection to the device is separated, will the PCIC data output change.
[Active fieldbus]	List	Sets the fieldbus for the communication with connected controllers. The setting has an effect on all applications.
[Profinet device name]	Input field	Sets the device name with active "PROFINET" fieldbus.
[Web interface GSDML file URL]	Button	Downloads the GSDML file from the device. The GSDML file is used to prepare a controller for PROFINET.

Operating element	Type	Description
[Output logic]	List	Sets the output logic of the digital outputs of the device: [PNP]: switches positive potential to the output. [NPN]: switches ground to the output.
[IO debouncing]	Switch	Activates the debouncing of the trigger. Then a signal has to be present for at least 4 ms to be detected as trigger signal. Shorter signals are ignored.
[External illumination]	List	Reserves the digital output OUT5 for the external illumination (see operating instructions): [Disabled]: The external illumination is not used and is deactivated. [Using OUT5]: The digital output OUT5 is reserved for the external illumination. Output OUT5 is no longer available as a logic block. The external illumination and output OUT5 are only available for 8-pole devices.
[OUT 1]	Switch	Switches the digital output OUT1. The wiring test must be active.
[OUT 2]	Switch	Switches the digital output OUT2. The wiring test must be active. Output OUT2 is only available for 8-pole devices.
[Start]	Button	Starts the wiring test to test the digital outputs. During the wiring test, the applications are disabled.

## 13.4 NTP

The item [NTP] synchronises the time of the device. The clock is synchronised via the Network Time Protocol (NTP).








In the event of connection problems, activate port “123” in the firewall.



The clock is not buffered by a battery. If the current supply fails, the clock is reset.

The item [NTP] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.
[Activate NTP]	Switch	Activates the Network Time Protocol.
[NTP server IP]	Input field	Sets the IP address of the server. The date and the time are synchronised with the server. Several servers can be set. Besides the IP address, the status of the server is displayed: [green field]: The server responds. [red field]: The server does not respond. [grey field]: So far no request has been sent to the server.

Operating element	Type	Description
	Button	Checks the IP address of the server.
	Button	Deletes the IP address of the server. The button is only displayed after checking an IP address.
	Button	Adds a server. The button is only displayed after checking an IP address.
[Synchronisation time]	Input field	Sets the waiting time of the NTP server when the device is restarted. During the waiting time the device is not accessible for the ifmVisionAssistant.
[Current time set on device]	Output field	Displays the time currently used in the device.

## 13.5 FTP

The item [FTP] sets the connection to an FTP server. The device sends current images and configurations to the FTP server if certain events occur.








FTP transfers data such as user name and password unencrypted. The data can be read and manipulated by third parties.

- ▶ Do not use the user name and the password of the FTP server for other services.
- ▶ Restrict the visibility of the FTP server to the local network.
- ▶ Do not use the function [FTP] if the FTP server is visible on the internet.



In the event of connection problems, activate ports “20” and “21” in the firewall.

The item [FTP] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.
	Button	Adds a server.
[Status of the FTP server]	Output field	Displays the status of the server via a coloured field: [green field]: The server responds. [red field]: The server does not respond. [grey field]: So far no request has been sent to the server.
	Button	Renames the server.
	Button	Deletes the IP address of the server.
[Activate]	Checkbox	Activates the client of the device.

Area “Connection”

Operating element	Type	Description
[Server IP] [Port]	Input field	Sets the IP address and the port of the FTP server (default value of the port: "21").
[User] [Password]	Input field	Sets the user name and the password of the FTP server if authentication is required.

## Area "Folders"

Operating element	Type	Description
[Push decoding results]	Checkbox	Activates the transfer of decoding results to the FTP server.
[Path]	Input field	Sets the path to transfer the decoding results.
[Push image data]	Checkbox	Activates the transfer of the image data to the FTP server.
[Path]	Input field	Sets the path to transfer the image data.
[Push device and application configuration data]	Checkbox	Activates the transfer of device and application data to the FTP server.
[Path]	Input field	Sets the path to transfer the device and application data.

## Area "Configuration"

Operating element	Type	Description
[Passive mode]	Checkbox	Activates the passive mode. The passive mode reduces connection problems in context with a firewall.
[Keep alive]	Checkbox	Activates the keep-alive function. Depending on the configuration, the connection is quickly stopped on the server side. With the keep-alive function, the connection remains active.
[Warranty of data transfer]	Checkbox	Activates the warranty of data transfer. It is ensured that all data is transferred. If the data is not transferred fast enough, it is possible that - image capture is delayed, - the frame rate is reduced.
[Result types that should be pushed]	List	Sets the result type which is transferred to the FTP server: [Only fail results] [Only pass results] [All results]


## 13.6 RTSP


The item [RTSP] controls the transfer of the live image as video data stream. The stream can be replayed with a client software (video player with RTSP support).

As soon as the item [RTSP] is active and the following conditions apply, the live image of the device is transmitted:



- an application is active, (→ Application □ 23)
- at least one model has been added. (→ Add new model □ 36)

Together with the live image, the ROIs are transmitted, depending on the model set. (→ Models □ 35)  
The live image can be retrieved via the displayed URL.

 The function increases the evaluation time of the device.

 In the event of connection problems, activate port “554” in the firewall.


The item [RTSP] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.
[Activate RTSP]	Switch	Activates the Real-Time Streaming Protocol.
[Frame rate]	Slider / input field	Sets the transferred images per second. High values lead to smoother image transitions and require more band width in the network.
[Image quality]	Slider / input field	Sets the quality of the images. High values increase the image quality, reduce the compression and increase the required bandwidth. Small values reduce the image quality, increase the compression and reduce the required bandwidth.
[Port]	Output field	Displays the preset port.
[RTSP stream url:]	Output field	Displays the URL set for retrieving the RTSP. Clicking on the URL opens the URL in a compatible video player. Right-click to copy the URL to the clipboard.



## 13.7 ifm storage device

The item [ifm storage device] sets the ifm storage device of the device. The ifm storage device is located behind a service lid in the device (see operating instructions). The configuration of the device and error images are saved on the ifm mass storage device. The stored content can be accessed via a web interface.

If the device fails due to a defect, the configuration is saved on the ifm storage device and can be quickly transferred to a replacement device (see operating instructions).

 The ifm mass storage device must not be inserted in a PC, notebook etc.  
▶ Only use the ifm mass storage device with the devices O2D5xx.

The item [ifm storage device] contains the following operating elements:

Operating element	Type	Description
	Button	Saves the settings on the device.
	Button	Resets the changed settings.
[Enable failed image storage]	Checkbox	Activates saving of images to the ifm mass storage device in case of an error.
[Enable configuration change storage]	Checkbox	Activates saving of configurations on the ifm mass storage device.

Operating element	Type	Description
[Format storage]	Button	Formats the ifm mass storage device. Formatting cannot be reversed. All data on the ifm mass storage device is deleted.
[Import config]	Button	Imports the configuration saved last on the ifm mass storage device. After clicking the button, the configurations for the import are selected: [General settings] [Network] [Application settings] The currently used configuration is overwritten by the import.
[Status]	Output field	Displays information on the ifm storage device.
[Web interface URL]	Output field	Displays the URL to the web interface of the ifm storage device. A click on the URL shows the content of the ifm storage device in the web browser.

## 14 Appendix

### 14.1 Assigning a static IP address

Below you find a description of how to assign a static IP address to the PC. A static IP address is necessary if

- the assignment of a dynamic IP address is not possible due to the network configuration,
- the firmware of the device is to be updated.



The details of the network settings in this document describe the procedure for PCs with the operating system Windows 10. Changing network settings in a PC requires administrator rights. The following ports must be enabled in the firewall:

- UDP: 3321
- TCP/HTTP: 80 and 8080
- TCP: 50010

Assigning a static IP address:

- ▶ Open the [Network and Sharing Centre] in Windows.
- ▶ Click the name of the local network.
- ▷ The window [Ethernet Status] opens.
- ▶ Click the button [Properties].
- ▷ The window [Ethernet Properties] opens.
- ▶ Activate the checkbox [Internet Protocol Version 4 (TCP/IPv4)].
- ▶ Click the button [Properties].
- ▷ The window [Internet Protocol Version 4 (TCP/IPv4) Properties] opens.
- ▶ Activate the option field [Use the following IP address].
- ▶ Set “192.168.0.1” for the IP address.
- ▶ Set “255.255.255.0” for the subnet mask.
- ▶ Set “192.168.0.201” for the default gateway.
- ▶ Click the button [OK].



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