Software manual

ifm Vision Assistant for 3D sensor

UK

O3D300
O3D302
O3D310
O3D312

7391232 / 00 06/2018

Contents

UK

1 Preliminary note

This document describes the following tasks with the 3D sensor of the O3D3xx product family and the ifm Vision Assistant software:

- Set the parameters of the sensor (in the following referred to as "device")
- Set up the applications with the ifm Vision Assistant
- Set up the applications with the ifm Vision Assistant

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

1.1 Symbols used

► Instructions

> Reaction, result

[…] Designation of keys and buttons

"…" Name of display text

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note

1.2 Safety instructions

Please read the operating instructions prior to set-up of the device. Ensure that the device is suitable for your application without any restrictions.

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

1.3 Further documents

- Short instructions
- Operating instructions

The documents can be downloaded at:

www.ifm.com

1.4 Open source information

This product can contain Free Software or Open Source Software from various software developers which is subject to the following licenses: General Public License version 1, version 2 and version 3 (General Public License version 3 in conjunction with the GNU Compiler Collection Runtime Library Exception version 3.1), Lesser General Public License version 2.1, Lesser General Public License version 3, Berkeley Software Distribution ("This product includes software developed by the University of California, Berkeley and its contributors"), The Academic Free License version 2.1. For the components subject to the General Public License in their respective versions the following applies:

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation. If version 1 applies to the software: either version 1 of the License or (at your option) any later version; if version 2 (or 2.1) applies to the software: either version 2 (or 2.1) of the License or (at your option) any later version; if version 3 applies to the software: either version 3 of the License or (at your option) any later version. The following disclaimer of the software developers applies to the software components that are subject to the General Public License or the Lesser General Public License in their respective versions: The Free Software is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License and the GNU Lesser General Public License for more details.

The responsibility of ifm electronic gmbh for ifm products, in the case of product-specific software, remains unaffected by the above disclaimer. Please note that the firmware for the ifm products is in some cases provided free of charge. The price of the ifm products has then to be paid for the respective device itself (hardware) and not for the firmware. For the latest information on the license agreement for your product please visit www.ifm.com

For binaries that are licensed under any version of the GNU General Public License (GPL) or the GNU LGPL you may obtain the complete corresponding source code of the GPL software from us by sending a written request to: opensource@ifm.com or to ifm electronic gmbh Friedrichstraße 1, 45128 Essen, Germany.

We charge €30 for each request. Please write “source for product Y” in the memo line of your payment. Your request should include (i) the name of the covered binary, (ii) the name and the version number of the ifm product, (iii) your name and (iv) your return address.

This offer is valid to anyone in receipt of this information.

This offer is valid for at least three years (from the date you received the GLP/LGPL covered code).

2 System requirements

2.1 Software

Operating system

- Windows 7 (32/64 bits), Windows 8.1 (32/64 bits), Windows 10 (32/64 bits)

Application software

- ifm Vision Assistant 1.8.23

Other versions of the ifm Vision Assistant may contain changed or new functions which are not described in this software manual.

2.2 Hardware and accessories

Hardware

- Sensor of the O3D3xx family
- PC with x86 or x64 type processor
- Screen: min. 1024 x 768 pixels, 32-bit colour depth

Accessories

- Jumper for network connection (Ethernet) for parameter setting, M12 connector/RJ45 connector, 4 poles, e.g. art. no.: E11898 (2 m) or E12283 (5 m)
- Cable for voltage supply and process connection, M12 socket, e.g. art.no. E11950 (8 poles 2 m, open cable end). This cable is used to connect the O3D3xx sensor to the voltage supply.
- Power supply 24 V, 1.6 A, peak current min. 2.4 A
- Mounting set (with clamp) for the camera, e.g. art. no. E3D301

More information about available accessories is given at www.ifm.com.

3 Installation

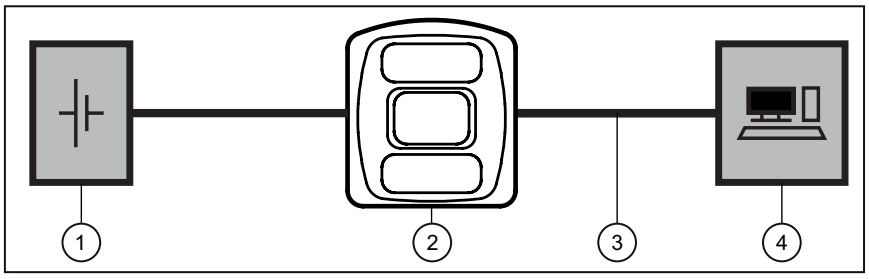
3.1 Hardware

The core colours of 8-pin sockets are not standardised.

► Observe the wiring of the device and the sockets → Data sheet.

► Connect device to the voltage supply.

► Connect device to the Ethernet interface of the PC using the network cable.



1: 24 V power supply
2: Device
3: Ethernet cable
4: PC

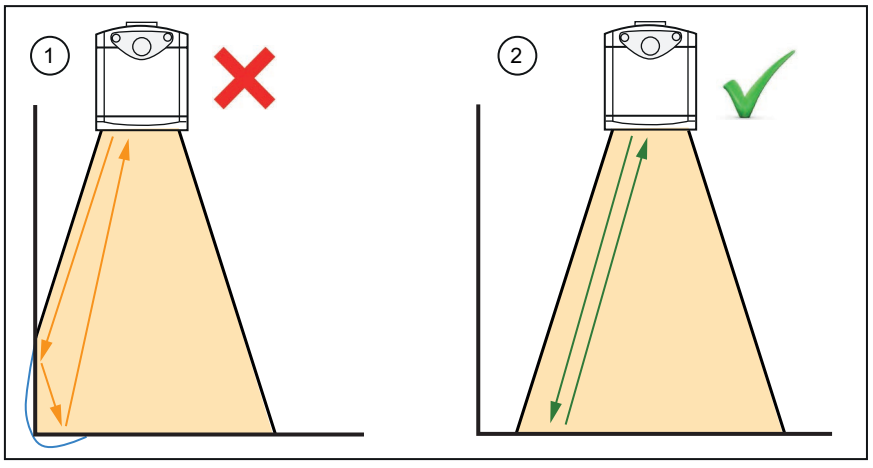
Further information about the electrical connection and the correct pin connection → Short instructions or operating instructions.

3.1.1 Measures to prevent multiple reflections

When the following objects are measured, multiple reflections may occur:

- Very shiny surfaces
- Inner walls of hollow bodies (e.g. boxes)
- Surfaces at short distances to the device (e.g. walls)

Multiple reflections increase the time of flight of the light, thus making the distance to the device seem longer.



1: Multiple reflections from a nearby surface
The apparent distance is displayed in blue.
2: Correct installation

► Install the device at a sufficient distance to surfaces.

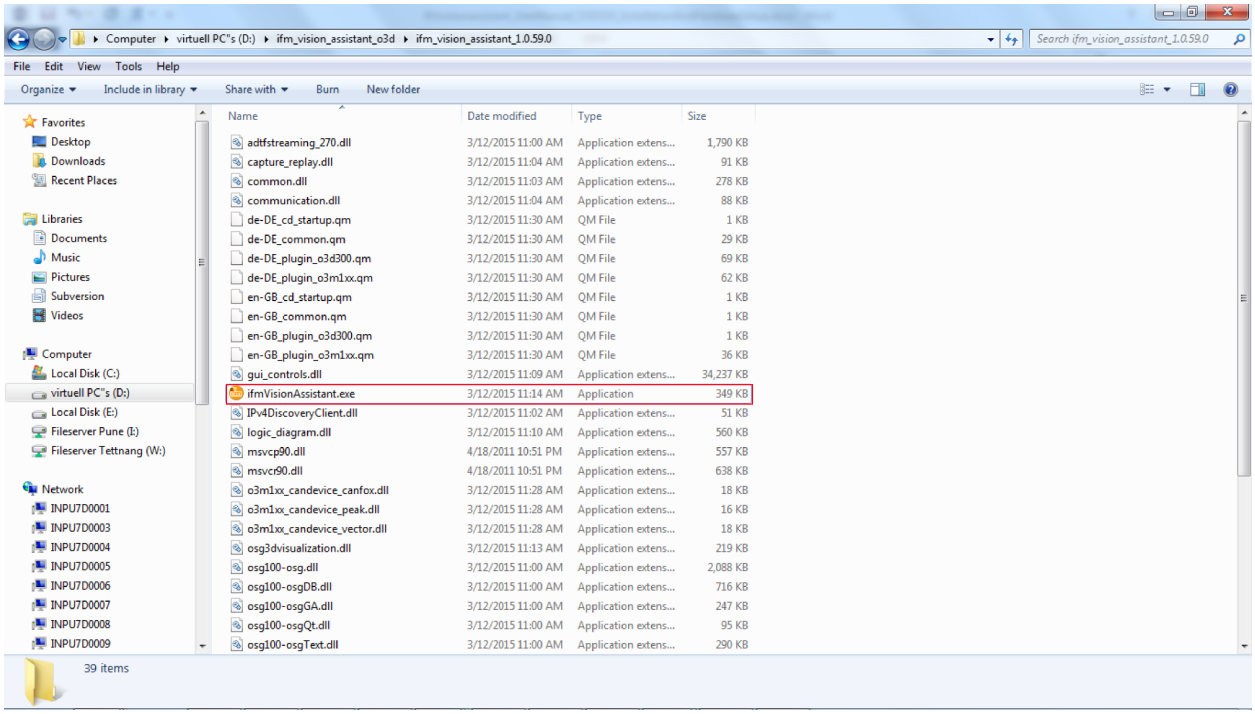
► Do not place the device on a flat surface (e.g. a table to demonstrate the device).

3.2 Software (ifm Vision Assistant)

► Insert the data carrier with the ifm Vision Assistant software.
Alternatively: Download the ifm Vision Assistant software from the ifm website: www.ifm.com

► Copy the zip file "ifmVisionAssistant" to an appropriate directory on the PC and unzip.

► Start the "ifmVisionAssistant" application file.



> The start screen of the ifm Vision Assistant opens.

► If the start screen does not appear after 5–10 seconds, check if the software requirements are met and all files are properly unzipped.

3.2.1 Command line parameters

Starting the ifm Vision Assistant can be influenced with command line parameters.

Use command line parameters when starting the ifm Vision Assistant via the prompt:

► Enter parameter after "ifmVisionAssistant.exe" and separate it by a space.

> Example: "ifmVisionAssistant.exe -log"

Use command line parameters when starting the ifm Vision Assistant via the graphic user interface Windows:

► Right-click the shortcut of the [ifm Vision Assistant].

► Click [Properties] in the submenu.

► Click the tab [Shortcut].

► Click the field [Target] and move the cursor to the end of the line.

► Enter space followed by the command line parameter.

► Click the button [OK].

The following command line parameters are available:

Command line parameter	Description
`-disableclosebtn`	Deactivates the button [Close] on the start screen.
`-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 connects to a device. The file "`filename.xml`" must contain the following XML code:
	`<?xml version="1.0" encoding="UTF-8"?>`
	`<sensor>`
	`  <sensorType>O3D3xx</sensorType>`
	`  <addressType>IP</addressType>`
	`  <name>My sensor</name>`
	`  <address>`
	`  <ip>192.168.0.69</ip>`
	`  <pcic_port>50010</pcic_port>`
	`  <web_port>80</web_port>`
	`  <mac>00:02:01:21:b9:ee</mac>`
	`  </address>`
	`</sensor>`

`-geometry [screen]:[width]x[height]+[x]+[y]`	Sets the window size and position of the ifm Vision Assistant (incl. window frame). The minimum window size is 1024x768 pixels. Example: "`-geometry 1:1380x768+0+0`" The window is placed on screen 1 (`screen=1`). The window size including the 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: "`+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
`-frameless`	Starts the ifm Vision Assistant without the native window frame.

4 Start screen

On the start screen, the basic functions of the ifm Vision Assistant can be selected.

Basic functions of the start screen:

Symbol	Name	Function	Device must be connected
	Find sensor	Connection to the newly connected device. Searches for connected devices and displays a selection list of the devices found (→ „4.1 Find device“).	Yes
	Recent	Connection to a device which was already connected before and may already be configured. Opens a selection list of the devices which were already connected before (→ „4.2 Recent“).	Yes
	Replay	Plays back recorded sequences (→ „4.3 Replay“).	No
	Wiring	Display of the wiring of the voltage supply. The display is used to simplify the connection during set-up (→ „4.4 Wiring“).	No
	Settings	Language and image mode setting of the user interface (→ „4.5 Settings“).	No
	Close	Closes the ifm Vision assistant.	No

4.1 Find device

With this function, it is possible to search for connected devices or to connect manually to a connected device.

► Ensure that the device and the PC are ready for operation and that there is an Ethernet connection.

> Without Ethernet connection, the functions of the device cannot be accessed.

The following ports must be open (if necessary, adapt the firewall settings):

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

4.1.1 Direct search

► Click  .

> The ifm Vision Assistant searches for connected devices via Ethernet.

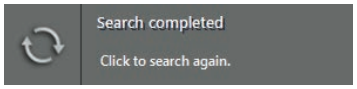
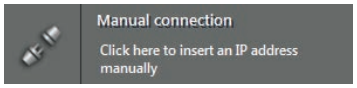
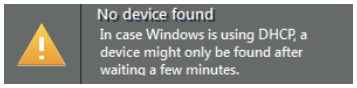
> All devices found are shown in a selection list.

► Click the button of the device found to connect.

► If the ifm Vision Assistant does not find a device automatically:

- Check if the device is correctly connected and ready for operation and click [Search completed] to start a new search.
- Directly connect the device to the PC without any additional network devices (e.g. router).
- Click [Manual connection] and enter the IP address manually (→ „4.1.2 Manual connection“).

Messages after the direct search:

Message	Description
	Starts a new search.
	Enables to enter the IP address manually (→ „4.1.2 Manual connection“).
	Displays information such as IP address and name of the device. Connects the device and continues according to the application data (→ „4.1.3 Options after connection“).
	If the IP address is retrieved automatically (via DHCP), it may take 1–2 minutes for the device to be connected and ready for operation.

With the key combination Ctrl+C the text of a message is copied to the clipboard. This works with all messages displayed in the ifm Vision Assistant.

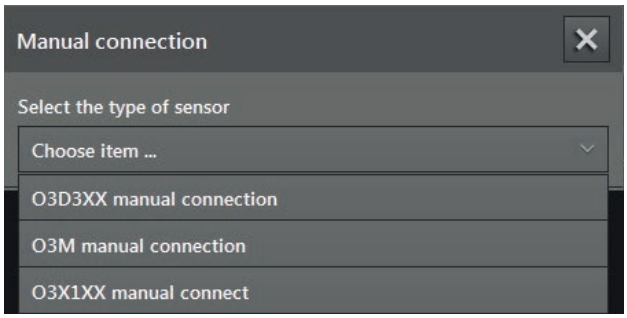
4.1.2 Manual connection

If the ifm Vision Assistant does not automatically connect to the device, the IP address can be entered manually via the button [Manual connection].

► Click  .

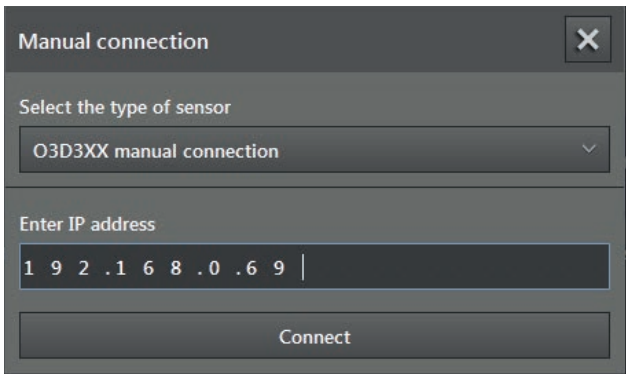
► Click [Manual connection].

> The window "Manual connection" opens:



► Select "O3D3XX manual connection".

► Enter the IP address of the device (default: 192.168.0.69).



► Click [Connect].

UK

- The IP addresses of the device and PC with ifm Vision Assistant must be in the same subnet.
- If the IP address is to remain unchanged as device address the device must be rebooted after set-up (→ „11.1.7 Reboot device“).

4.1.3 Options after connection

If connection to the device was successful, the ifm Vision Assistant continues with one of the following options depending on the state of the device:

State	Option
No application available	Edit window opens (→ „9 Application management“).
Active application available	Monitoring window opens (→ „7 Monitoring window“).
At least one application is available, but no application is active	Application management opens (→ „9 Application management“).
Error	Error message is displayed.

Initial configuration - no applications available

There are no applications on a new device. This is also so after a firmware update, reset to factory settings or manual deletion of all applications.

The ifm Vision Assistant automatically opens the set-up wizard to create a new application. The set-up wizard guides the user through the entire configuration process step by step (→ „6 Set-up wizard“). Alternatively the user defined mode can be started (→ „8 User defined mode“).

► To load applications from a file close the set-up wizard.

► Import application (→ „9.4 Import application“).

The set-up wizard also starts if a new application is added manually or an existing application is edited.

Active application available

If an application for the device is available and activated, the ifm Vision Assistant starts with the monitoring window (→ „7 Monitoring window“). To change parameters, the application must be stopped.

Inactive application available

If applications are available on the device but none is activated, the ifm Vision Assistant starts with the application management (→ „9 Application management“). The application management also opens if, for example, the application activated last was deleted.

4.2 Recent

This function opens a selection list of the devices already connected before.

► Click .

► Ensure that the corresponding device is connected to the PC via Ethernet or available in the network.

► Click the device in the selection list.

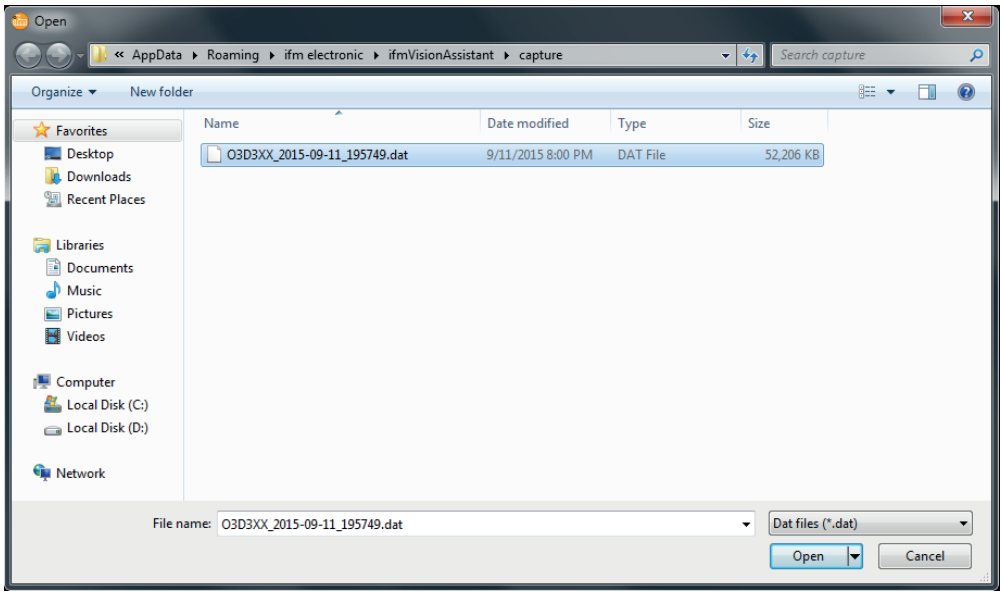
> The ifm Vision Assistant connects to the device (→ „4.1.3 Options after connection“).

4.3 Replay

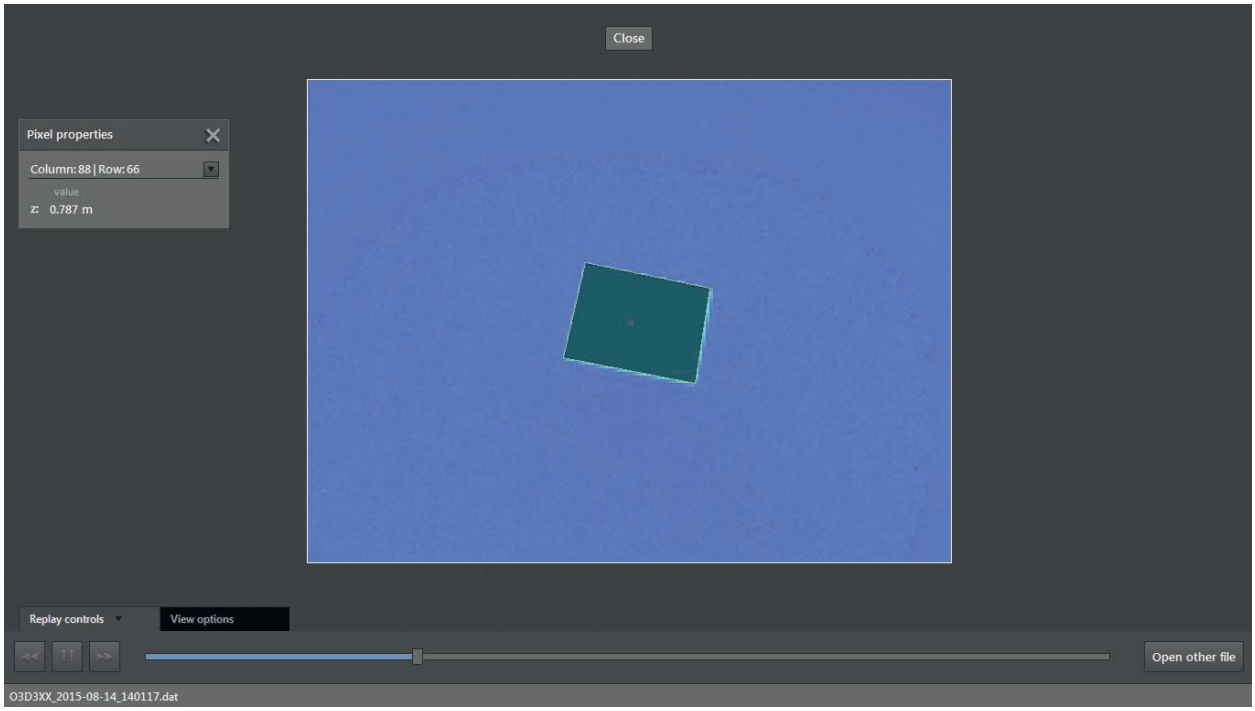
With this function, data recorded before can be viewed (→ „7 Monitoring window“). A connection to a device is not necessary.

► Click  .

► Select the requested file (*.dat) and click [Open].



> The playback screen appears.



Options on the playback screen:

Tab	Option / button	Description
Replay options	pause	Stops playback.
	previous	Stops playback and shows the previous image.
	next	Stops playback and shows the next image.
	start	Continues playback.
	Progress bar	Indicates the current position in the recording. By clicking a position in the progress bar playback continues at the corresponding image.
	Open other file	Opens a window to select another file.
View options	–	→ „7.2 View options“
–	Close	Closes the playback screen and opens the start screen.

► Click [Close] to return to the start screen.

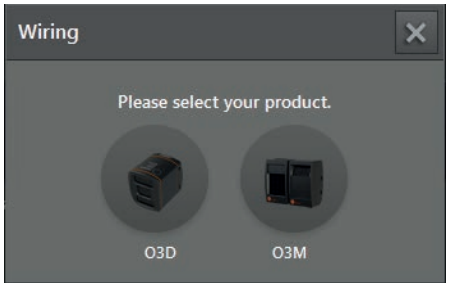
4.4 Wiring

This function allows correct wiring of the voltage supply of the 8-pole connector.

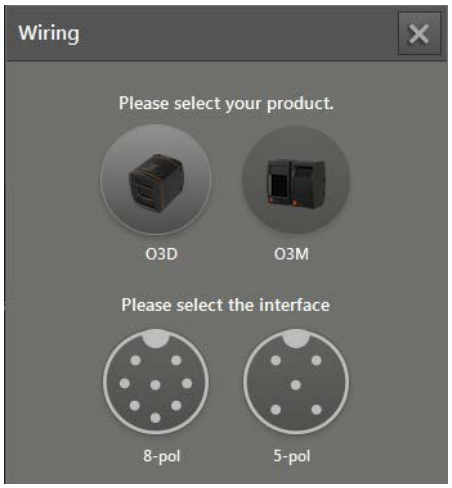
► Click  .

► Select article [O3D].

> Only necessary if a new device has been selected.



► Select interface type [8-pole] (only necessary if a new device has been selected).



► Click the selection field [Article no.] and select a cable from the selection list.

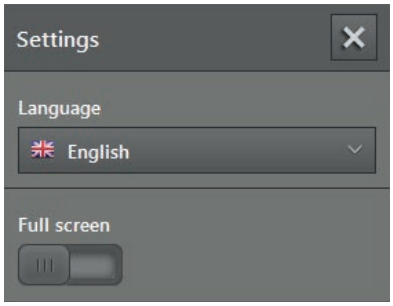
> The wiring of the voltage supply of the selected cable is displayed.

4.5 Settings

You can use this function to change the language and to switch between full screen and window view.

► Click .

> The window "Settings" is displayed.



Options in the window Settings:

Field	Option	Description
Select language	English	Selection of the available languages. "English" is set by default.
	German	
	etc.	
Activate full screen	on	Switches between full screen (on) and window view (off). Full screen is set by default.
	off	

With the F11 key, you can switch between full screen and window view at any time.

4.6 Close

► Click to close the ifm Vision Assistant.

5 Structure of the user interface

The screen of the ifm Vision Assistant has the following areas:

- Navigation bar:
  The requested option is selected in the navigation bar on the left
  (→ „5.1 Navigation bar“).
- Main area:
  The main area shows the selected option or application.
- Status bar:
  The status bar at the bottom of the screen shows the status information of the device.

1: Navigation bar
2: Main area
3: Status bar

5.1 Navigation bar

The navigation bar on the left features the following options:

Button	Name	Description
	Monitor	Opens a 2D or 3D view and shows the current device data (→ „7 Monitoring window“).
	Applications	Opens an overview of the applications (→ „9 Application management“). Manage and configure applications.
	Service report	Opens the service report (→ „10 Service report“). Create an evaluation of the device.
	Device setup	Opens the device setup (→ „11 Device setup“). For device settings that are independent of the applications.
	Device information	Shows basic information (e.g. hardware firmware, device status) (→ „12 Device information“).
	Settings	Opens the window "Settings" (→ „4.5 Settings“).
	Disconnect	Disconnects the ifm Vision Assistant from the device. The ifm Vision Assistant returns to the start screen.

5.2 Status bar

The status bar at the bottom of the screen gives the following information:

- Shows the window name which is currently open, e.g. "monitoring window"
- Temperature information of the device, e.g. "temperature normal"
- Name and IP address of the device, e.g. "new sensor (192.168.0.69)"
- Firmware version of the device, e.g. "1.6.2114"
- Name or status of the current application, e.g. "test application" or "stopped"
- Image processing time of the device, e.g. "232 ms"

5.3 Main area

While the device is operated, the main area shows the monitoring window (→ „7 Monitoring window“). When the device is set up, the main area shows the corresponding screen pages.

6 Set-up wizard

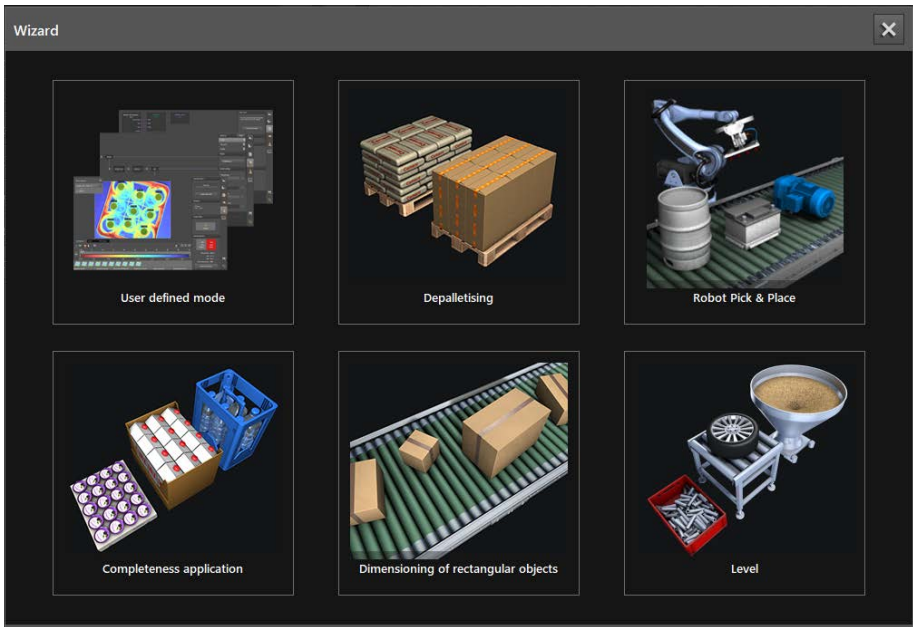
The set-up wizard helps with setting up typical applications. The set-up applications can then be processed in the user defined mode (→ „8 User defined mode“).

The set-up wizard starts in the following cases:

- A device without saved application is connected.
- A new application is added.
- An existing application is edited.

The following applications are available in the set-up wizard:

- Depalletising
- Robot Pick & Place
- Completeness monitoring
- Object dimensioning
- Level



► Click the application to be set up.

> The step-by-step configuration of the selected application starts.

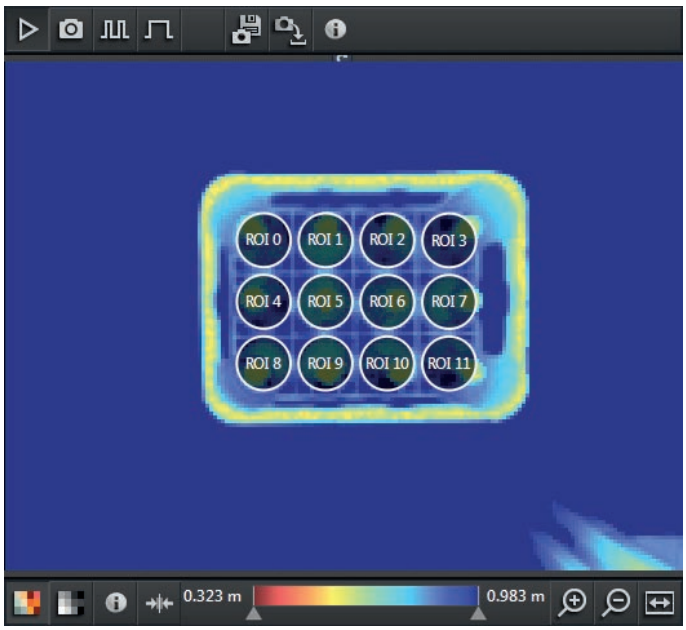
The user defined mode can be activated via the [User defined mode] button (→ „8 User defined mode“).

Basic functions of the set-up wizard:

Button	Function
Start	Starts the configuration of the selected application.
Next	Continue with the next step. The button is locked if a required configuration has not yet been finished.
Back	Return to the previous step. From step 1 you return to the start screen of the set-up wizard.
Finished	Completes the last step of the configuration and saves the set parameters in the device.

6.1 Live image display of the set-up wizard

During the configuration the set-up wizard displays live images.



In the menu bar "Image capture" the following options can be set:

Button	Option	Description
	Live image	The image is continuously updated irrespective of the set trigger source of the application.
	Force trigger	The image is updated once by means of the selection irrespective of the set trigger source.
	React to trigger	The image is updated with each trigger signal of the selected trigger source.
	Wait for trigger	With the next trigger signal of the selected trigger source the image is updated once.
	Save image	The current live image is saved.
	Load image	The live image is loaded from a file.

In the menu bar under the image the view options can be set. The view options for the live images are identical with the view options of the monitoring window (→ „7 Monitoring window“).

6.2 Depalletising

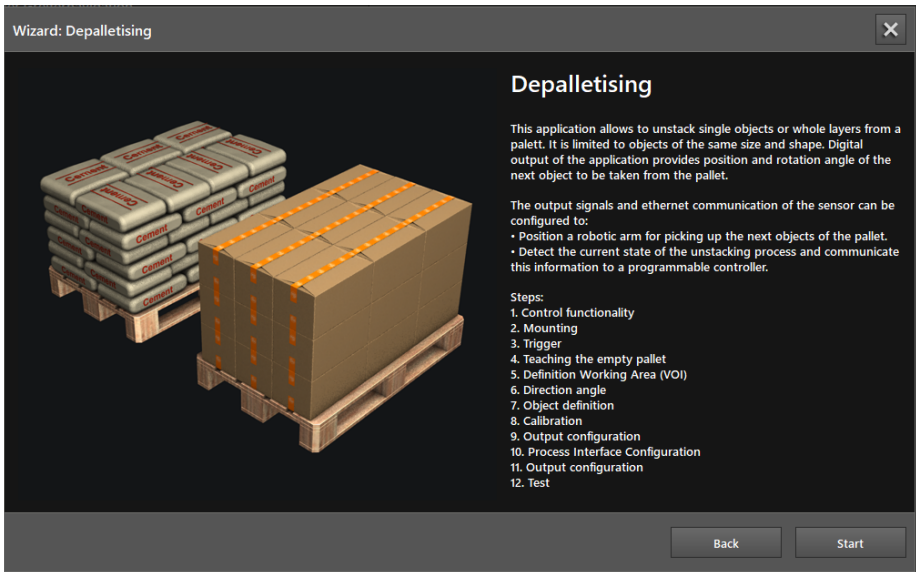
This application allows removal of individual objects or a complete layer from a pallet. The application can detect slip sheets.

The output logic and process data of the device can be used for the following applications:

- Position robot arm to grip the next object from the pallet.
- Detect current status of depalletising and transfer the information to a programmable controller.

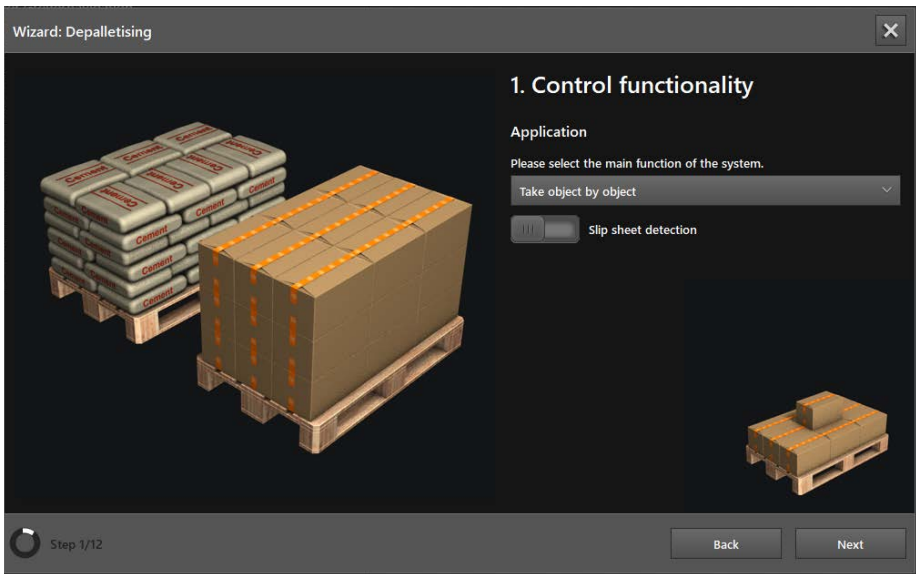
The application can only recognise objects and layers of the same size and shape.

6.2.1 Set up depalletising



► Click [Start] to start the configuration of the application.

Step 1: Control functionality



► Select the function:

Function	Description
Take object by object	Detect removal of individual objects from a pallet.
Take full layer	Detect the removal of complete layers from a pallet.

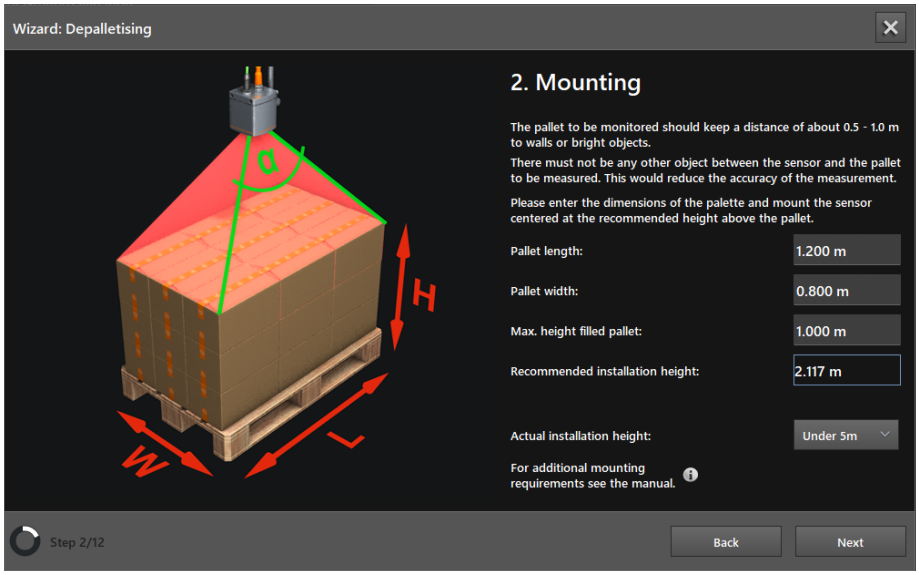
► Set the [Slip sheet detection] button:

- If there are no slip sheets between the objects or layers, set the button to "off".
- If there are slip sheets between the objects or layers, set the button to "on".

► Click [Next].

UK

Step 2: Mounting



The optimum installation height of the device is recommended in the "Mounting" window.

► Enter the length of the pallet ("L") in the input field [Pallet length].

► Enter the width of the pallet ("W") in the input field [Pallet width].

► Enter the maximum height of the filled pallet ("H") in the input field [Max. height filled pallet].

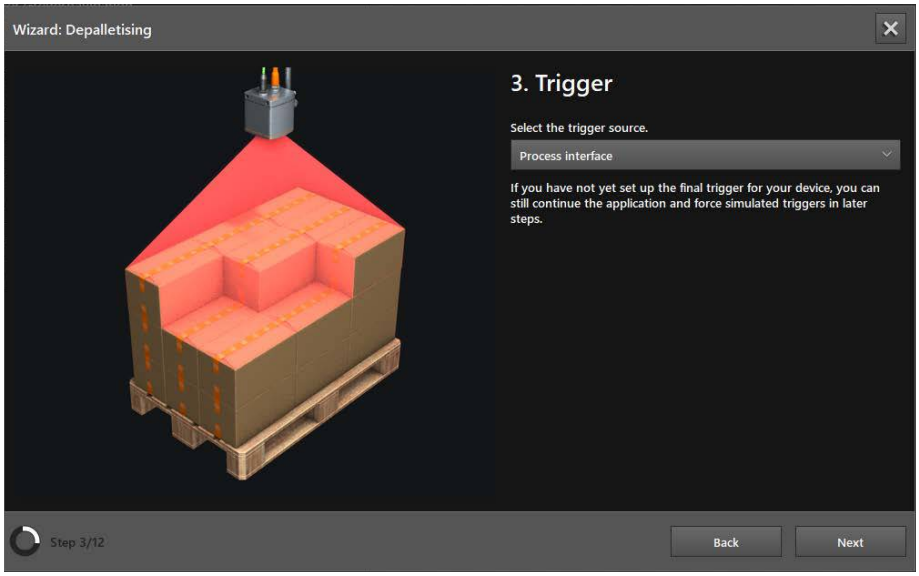
> The recommended installation height of the device is displayed in the field [Recommended installation height].

► Select the approximate distance between the device and the floor from the list [Actual installation height].

> The setting [Actual installation height] influences the frequency mode and thus the unambiguous range.

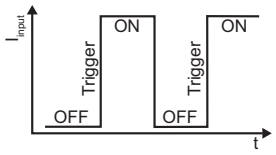
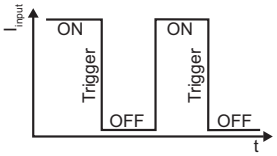
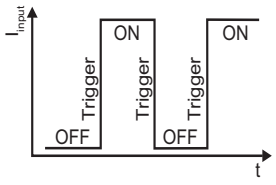
► Click [Next].

Step 3: Trigger



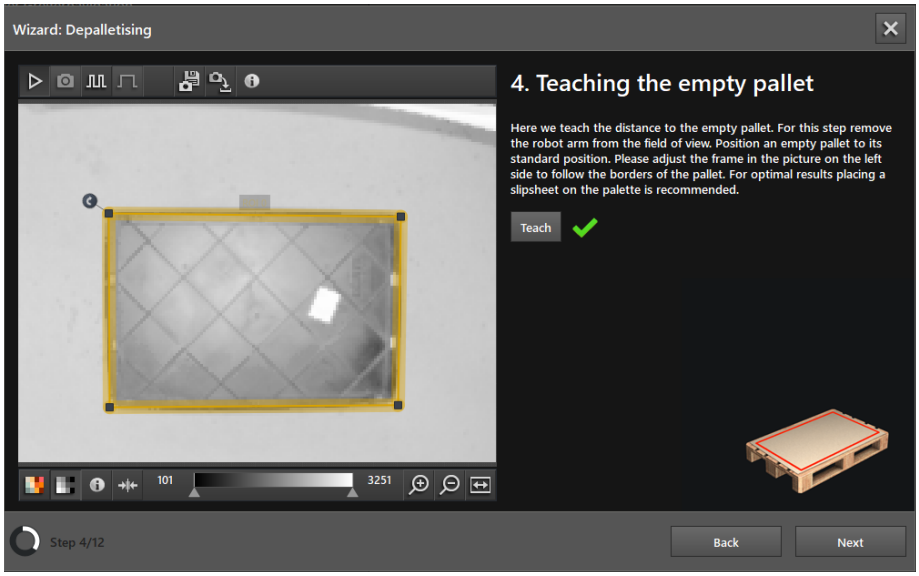
The trigger for the image capture is set in the "Trigger" window.

► Select trigger source.

Select	Description	
Continuous	The device continuously takes images. This option is mainly used for tests.	
Process interface	The device is triggered via the process interface of the connected controller (e.g. PLC / PC).	
Positive edge	The device is triggered by a hardware via the rising edge of an input signal.	
Negative edge	The device is triggered by the hardware via the falling edge of an input signal.	
Positive and negative edge	The device is triggered by a hardware via the rising and falling edge of an input signal.	

► Click [Next].

Step 4: Teaching the empty pallet



The reference level is taught in the "Teaching the empty pallet" window. The surface of the empty pallet is defined to be the reference plane.

► Position the empty pallet in the standard position under the device.

> If you use a slip sheet, the teaching process of the empty pallet is improved.

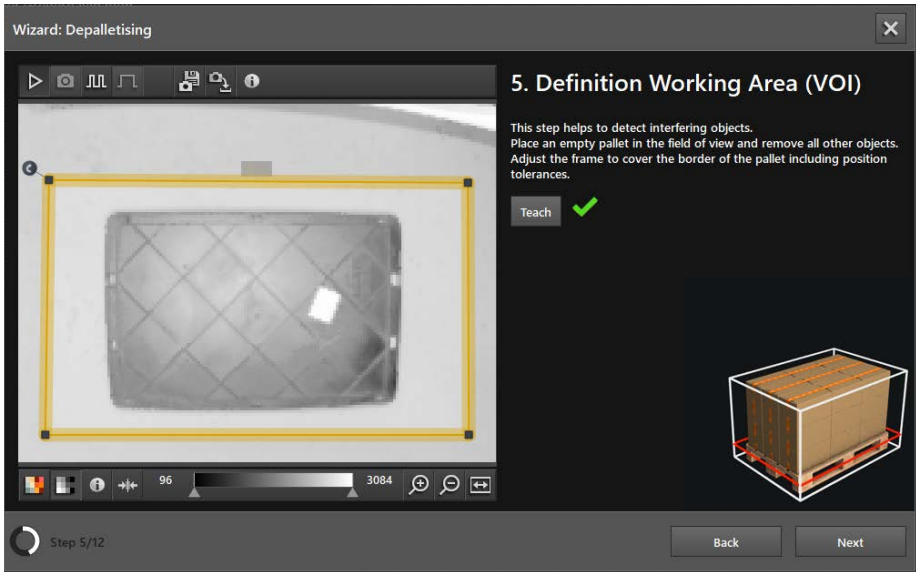
► Move the frame to the border of the pallet.

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

Step 5: Definition Working Area (VOI)



The working area is set in the "Definition Working area (VOI)" window. The working area defines the area in which the pallet is to be detected.

► Remove moving objects from the field of view.

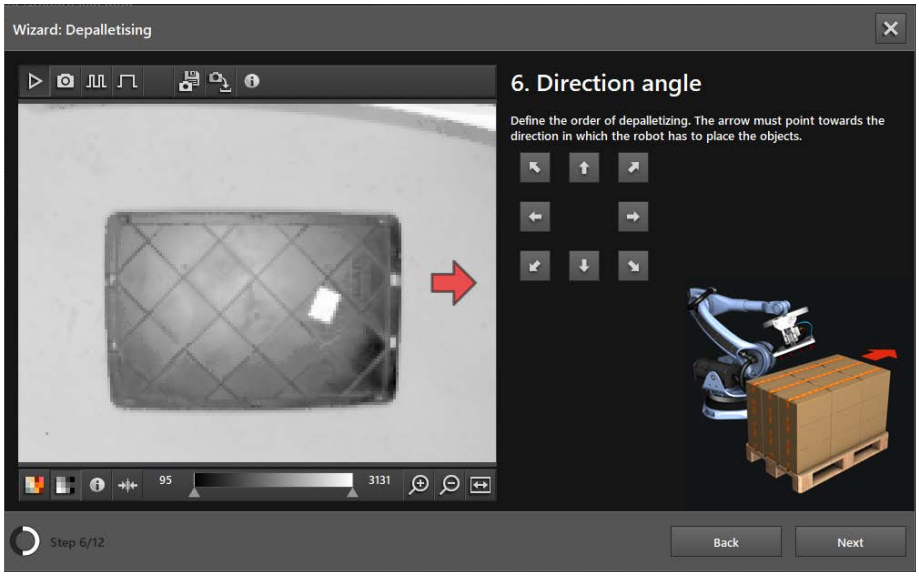
► Use the frame to set the working area.

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

Step 6: Direction angle



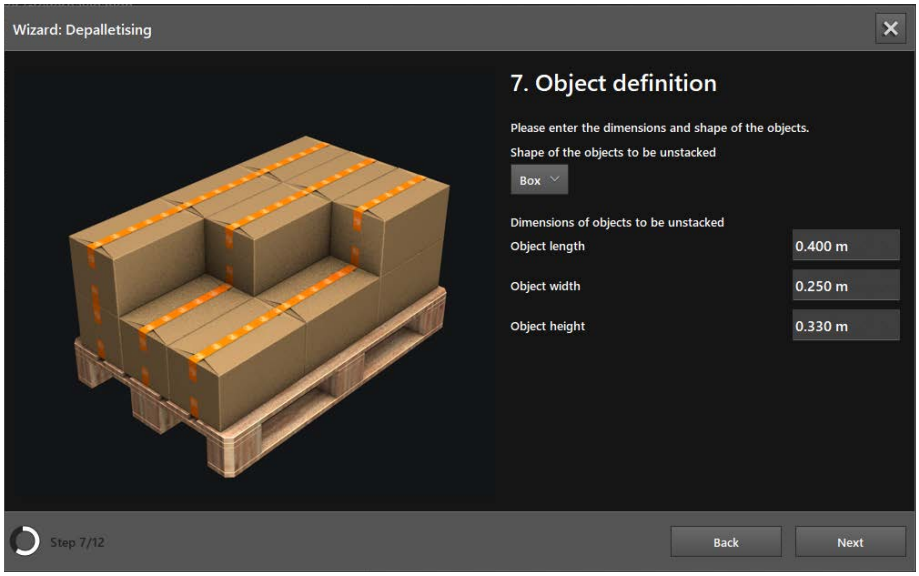
The direction in which the robot unstacks the objects (depalletising direction) is defined in the "Direction angle" window.

► Click the button marked with the corresponding direction arrow.

> In the live image the direction in which the robot removes the objects is shown by a red arrow.

► Click [Next].

Step 7: Object definition



The dimensions and shapes of the objects are set in the "Object definition" window.

► Set the object shape in the list: box or bag.

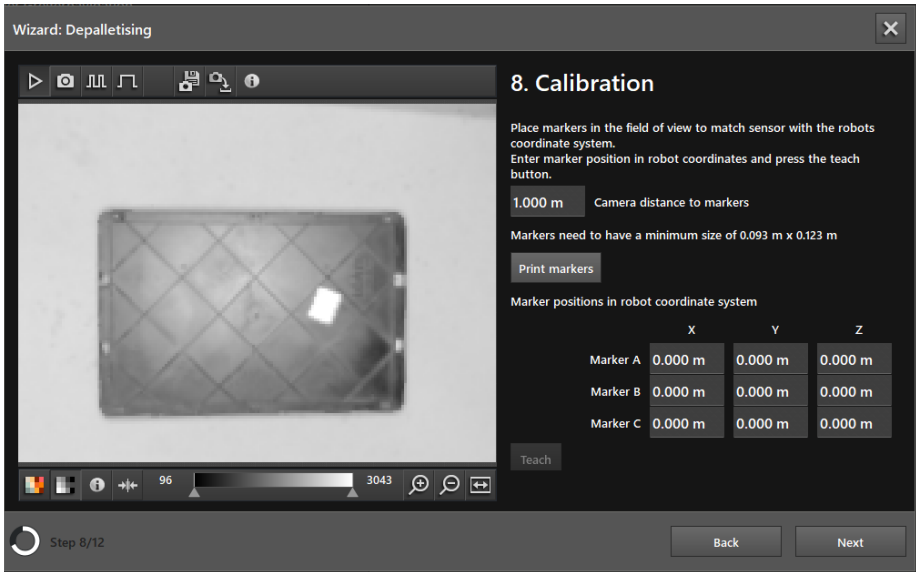
► Enter the length of the object in the input field [Object length].

► Enter the object width in the input field [Object width].

► Enter the object height in the input field [Object height].

► Click [Next].

Step 8: Calibration



The coordinate system of the device is combined with the coordinate system of the robot in the "Calibration" window.

"Step 8: Calibration" is optional. If the combination of the coordinate systems is not necessary, the step can be skipped by clicking [Next].

► Enter the distance between the device and the reference plane in the input field [Camera distance to markers].

> The surface of the empty pallet is defined to be the reference plane. The minimum size of the marker is calculated using the distance to the reference plane.

► Click the [Print markers] button.

> The minimum size of the markers is shown above the [Print markers] button.

► Distribute the printed markers in the field of view of the device.

> The markers must be completely visible and may be rotated about their Z axis. Each marker has a reference point which is shown in the live image by a cross and the corresponding letters.

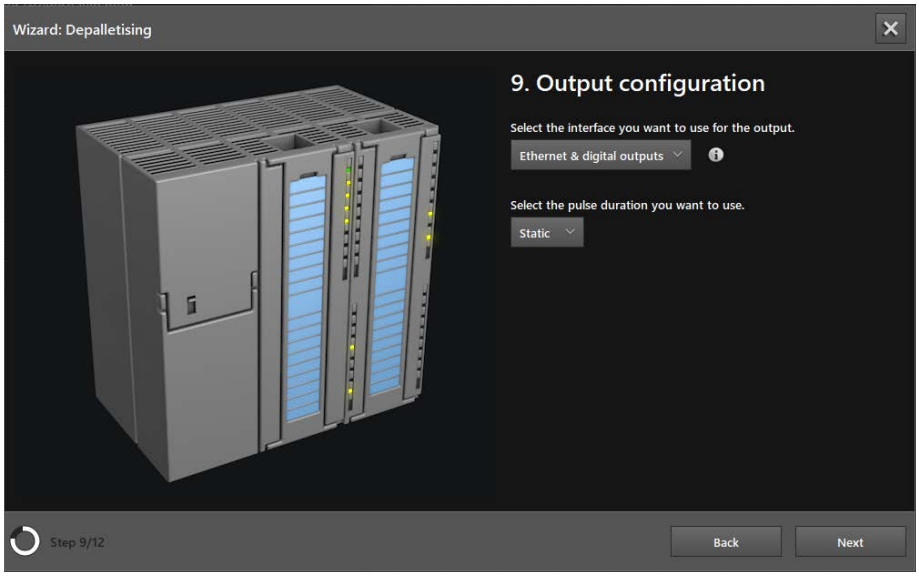
► Define the position of the reference points in the coordinate system of the robot and enter it in the [Marker A], [Marker B] and [Marker C] input fields.

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

Step 9: Output configuration



► In the list of the output interface select:

Output interface	Description
Ethernet	The measurement results regarding size, position, alignment, etc. are transmitted via the process interface. The process interface is set up in the next step. The digital outputs are deactivated.
Digital outputs	The measurement results are compared with reference values. The logical values determined from these results control the digital output signals. No measurement results are transmitted via the process interface.
Ethernet & digital outputs	Both outputs are used at the same time.

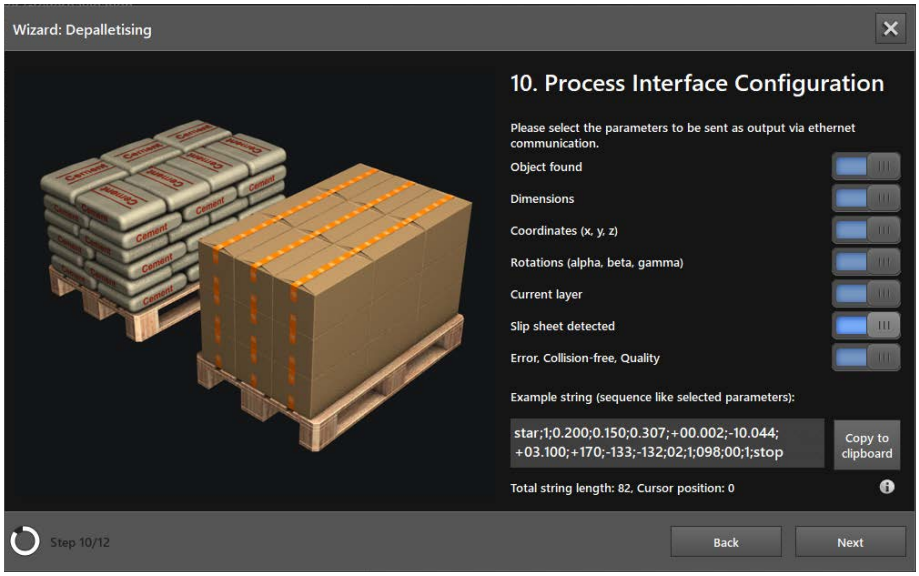
► Select the duration of the output pulse in the list [Pulsdauer wählen].

Pulse duration	Description
Static	Static output pulse
Pulsed	Value in ms (range 10…2500 ms in steps of 10 ms)

The pulse duration can only be set for digital outputs.

► Click [Next].

Step 10: Process Interface Configuration



The output is set via the process interface in the "Process Interface Configuration" window.

"Step 10: Process Interface Configuration" is skipped if "Digital outputs" is set as output interface (→ Step 9).

► Use the buttons to select the parameters to be provided via the process interface.

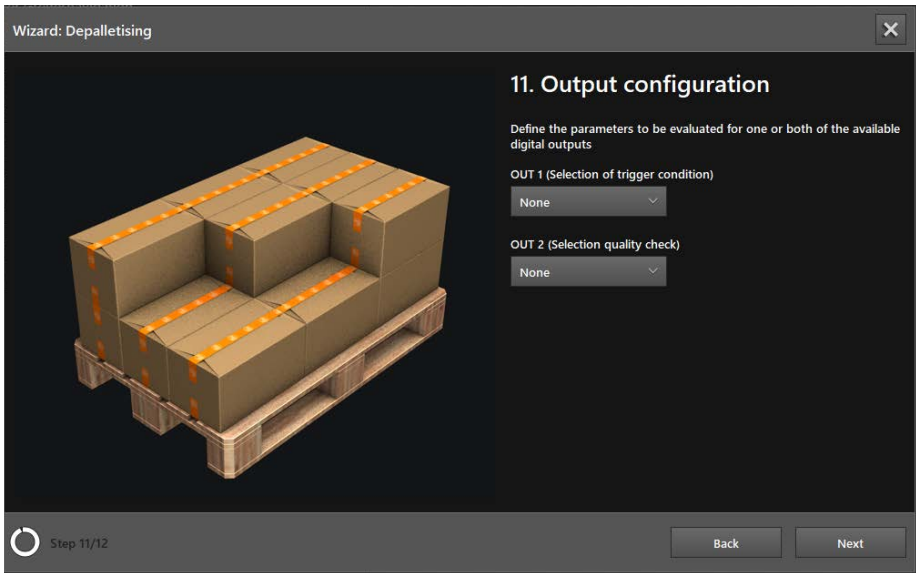
Parameters	Description
Object found	0 = no object found 1 = object found
Dimensions	Width, height and length of the object in m
Coordinates (x, y, z)	Coordinates of the centre of the object surface in m (user's coordinate system)
Rotation (alpha, beta, gamma)	Rotation about the axes of the recognised object (user's coordinate system)
Current layer	Current pallet layer, starting with "0". An empty layer is marked with "0".
Slip sheet detected	0 = no slip sheet detected 1 = slip sheet detected
Error, Collision-free, Quality	Error: 0 = no error 1 = undefined error 2 = unexpected object detected Collision-free depalletising: 0: no 1: yes Quality of object recognition between 0 and 100. The value "100" stands for best possible quality.

The icon opens a help text for the process interface.

In the example output the set output is displayed via the process interface. The example output can be copied to the Windows clipboard.

► Click [Next].

Step 11: Output configuration



The output is set via the digital outputs in the "Output configuration" window.

"Step 11: Output configuration" is skipped if "Ethernet" is set as output interface (→ Step 9).

Set output OUT1

Output OUT1 can be used as a trigger for an external controller.

► Select the trigger in the list "OUT 1 (Selection of trigger condition)".

Parameters	Description
None	Output OUT1 inactive
Object found	0 = no object found 1 = object found
Current Pallet Layer	Current pallet layer, starting with "0". An empty layer is marked with "0".

Set output OUT2

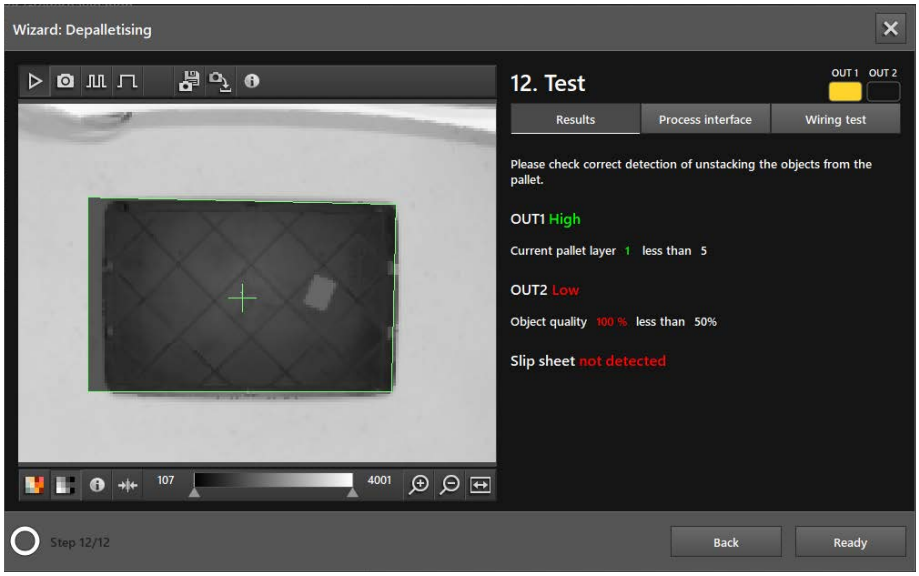
Output OUT2 can be used to check the quality.

► Select the trigger in the list "OUT 2 (Selection quality check)".

Parameters	Description
None	Output OUT 2 inactive
Error	Possible errors: ● Empty pallet ● Unknown ● No object size ● No matching object ● Data invalid ● Invalid reference teach ● Invalid VOI teach
Slip Sheet Detected	0 = no slip sheet detected 1 = slip sheet detected
Object Quality	Quality of object recognition between 0 and 100. The value "100" stands for best possible quality.

► Click [Next].

Step 12: Test



The functions of the application are tested in the "Test" window:

- Logical output signals of the digital outputs
- Output of the process interface
- Wiring

On the left the live image with the detected pallet is shown. On the top right the status LEDs of the outputs are shown. If an output is active, the status LED is continuously on.

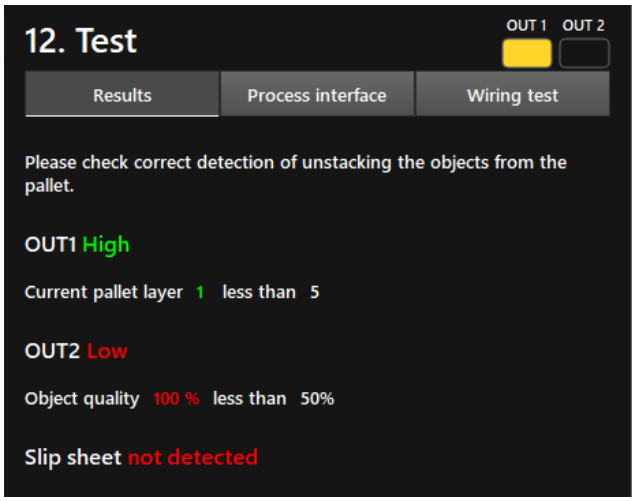
The LEDs for OUT1 and OUT2 shown in the ifm Vision Assistant are identical with the LEDs on the device.

With the buttons below the LEDs it is possible to switch between the following windows:

- Results
- Process interface
- Wiring test

"Results" window

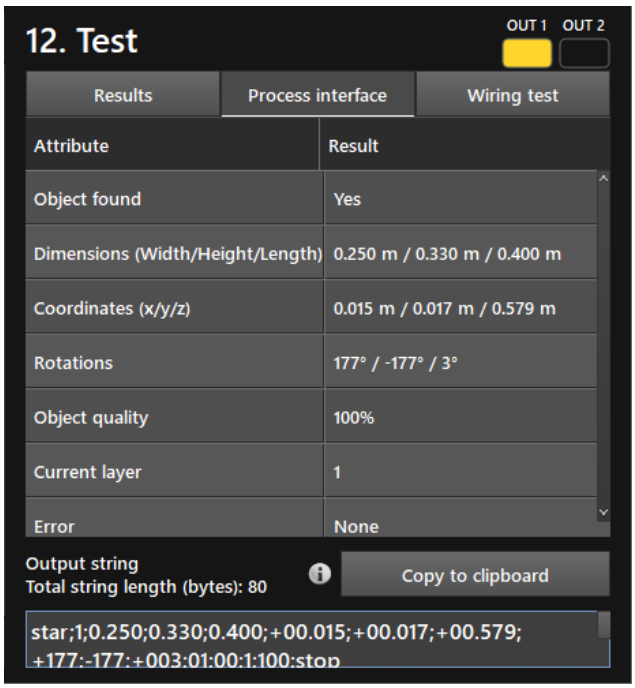
The "Results" window shows the output of the digital outputs and the measurement results, the comparison logic and its results.



► Test results with different objects.

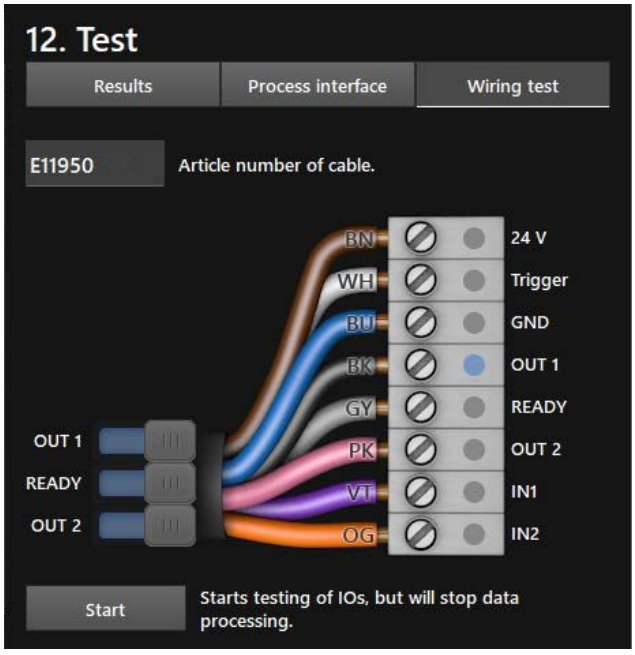
"Process interface" window

The "Process interface" window shows the measurement results of the parameters configured for the output. The output string transmitted by the device via the process interface is shown below the table. The output string can be copied to the Windows clipboard.



Wiring test

In the "Wiring test" window the wiring of the device to the control unit can be tested. The test is carried out in real time and shows the output and input signals at the wires. In the simulation mode, the digital outputs can be manually controlled to test the connection to an external control unit irrespective of the application.



► Click on the input field [Article number of cable] and select the cable from the list or enter the article number.

> The wiring and pin configuration of the selected cable is shown.

► Click [Start] to start the simulation mode.

► Click [OUT 1] to switch the signal at "OUT 1" on or off.

► Click [Ready] to switch the signal at "READY" on or off (ready for next trigger).

► Click [OUT 2] to switch the signal at "OUT 2" on or off.

► If the inputs are used, test the input signals at input 1 and input 2.

The inputs can for example be used for application switching.

► Click [Stop] to stop the simulation mode.

6.2.2 Activate depalletising

► If all settings are made, click [Ready] to save the application.

> The device activates and starts the application.

> The monitoring window opens.

6.2.3 Transmit process values via EtherNet/IP

The device can transmit the process values to a PLC via the EtherNet/IP fieldbus.

Only one fieldbus can be active at a time. The fieldbus is adjustable (→ software manual).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant.
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

1;0.200;0.150;0.307;+00.002;-10.044;+03.100;+170;-133;-132;02;1;098;00;1

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Duplicated command word	• Bit 0.5 indicates a successful trigger command.
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0000 2#0000_0011	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9	1 0	Binary Binary	1		Object found	0 = no object found 1 = object found
10 11	200 0	Decimal Decimal	200	mm	Width	The broadest dimension of the object surface.
12 13	150 0	Decimal Decimal	150	mm	Height	The object height relative to the base plate.

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
14 15	307 0	Decimal Decimal	307	mm	Length	The longest dimension of the object surface.
16 17	2 0	Decimal Decimal	+2		Centre point X	The X coordinate of the centre point of the object surface (in the user's coordinate system).
18 19	10044 0	Decimal Decimal	-10044		Centre point Y	The Y coordinate of the centre point of the object surface (in the user's coordinate system).
20 21	3100 0	Decimal Decimal	+3100		Centre point Z	The Z coordinate of the centre point of the object surface (in the user's coordinate system).
22 23	170 0	Decimal Decimal	+170		Rotation X	Rotation about the X axis of the detected object (in the user's coordinate system)
24 25	-133 0	Decimal Decimal	-133		Rotation Y	Rotation about the Y axis of the detected object (in the user's coordinate system).
26 27	-132 0	Decimal Decimal	-132		Rotation Z	Rotation about the Z axis of the detected object (in the user's coordinate system).
28 29	02 0	Decimal Decimal	02		Current layer	Current pallet layer, starting with "0". An empty layer is marked with "0".
30 31	1 0	Binary Binary	1		Slip sheet	There is a slip sheet on a pallet layer: 0 = no slip sheet detected 1 = slip sheet detected
32 33	098 0	Decimal Decimal	098		Error	Error:0 = no error 1 = undefined error 2 = unexpected object detected
34 35	00 0	Binary Binary	00		Collison-free	Collision-free depalletising: 0: no 1: yes
36 37	1 0	Decimal Decimal	1		Quality	Quality of object recognition between 0 and 100. The value "100" stands for best possible quality.

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Duplicated command word is displayed
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.2.4 Transmit process values via PROFINET

The device can transmit the process values to a PLC via the PROFINET fieldbus.

Only one fieldbus can be active at a time. The fieldbus is adjustable (→ software manual).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant.
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

1;0.200;0.150;0.307;+00.002;-10.044;+03.100;+170;-133;-132;02;1;098;00;1

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Duplicated command word	• Bit 0.5 indicates a successful trigger command.
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0000 2#0000_0011	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9	1 0	Binary Binary	1		Object found	0 = no object found 1 = object found
10 11	200 0	Decimal Decimal	200	mm	Width	The broadest dimension of the object surface.
12 13	150 0	Decimal Decimal	150	mm	Height	The object height relative to the base plate.
14 15	307 0	Decimal Decimal	307	mm	Length	The longest dimension of the object surface.
16 17	2 0	Decimal Decimal	+2		Centre point X	The X coordinate of the centre point of the object surface (in the user's coordinate system).
18 19	10044 0	Decimal Decimal	-10044		Centre point Y	The Y coordinate of the centre point of the object surface (in the user's coordinate system).
20 21	3100 0	Decimal Decimal	+3100		Centre point Z	The Z coordinate of the centre point of the object surface (in the user's coordinate system).
22 23	170 0	Decimal Decimal	+170		Rotation X	Rotation about the X axis of the recognised object (in the user's coordinate system)

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
24 25	-133 0	Decimal Decimal	-133		Rotation Y	Rotation about the Y axis of the recognised object (in the user's coordinate system).
26 27	-132 0	Decimal Decimal	-132		Rotation Z	Rotation about the Z axis of the recognised object (in the user's coordinate system).
28 29	02 0	Decimal Decimal	02		Current plane	Current pallet layer, starting with "0". An empty layer is marked with "0".
30 31	1 0	Binary Binary	1		Slip sheet	There is a slip sheet on a pallet layer: 0 = no slip sheet recognised 1 = slip sheet recognised
32 33	098 0	Decimal Decimal	098		Error	Error: 0 = no error 1 = undefined error 2 = unexpected object detected
34 35	00 0	Binary Binary	00		Collision-free	Collision-free depalletising: 0: no 1: yes
36 37	1 0	Decimal Decimal	1		Quality	Quality of object recognition between 0 and 100. The value "100" stands for best possible quality.

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Duplicated command word is displayed
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.2.5 Transmit process values via TCP/IP

The device can transmit the process values to a PLC via the TCP/IP protocol. In the ifm Vision Assistant the process values are displayed as output string as shown below:

```
star;1;0.200;0.150;0.307;+00.002;-10.044;
+03.100;+170;-133;-132;02;1;098;00;1;stop
```

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Semicolons ";" in the output string are not transmitted.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows (data type: ASCII):

star;1;0.200;0.150;0.307;+00.002;-10.044;+03.100;+170;-133;-132;02;1;098;00;1;stop

Process value	Unit	Description
star		Start string
1		1 = no object found 0 = object found
0.200		Width
0.150		Height
0.307		Length
+00.002		Centre point X
-10.044		Centre point Y
+03.100		Centre point Z
+170		Rotation X
-133		Rotation Y
-132		Rotation Z
02		Current layer
1		0 = no slip sheet detected 1 = slip sheet detected
098		Error
00		0 = no collision-free depalletising 1 = collision-free depalletising
1		Quality of object recognition (0 to 100).
stop		Stop string

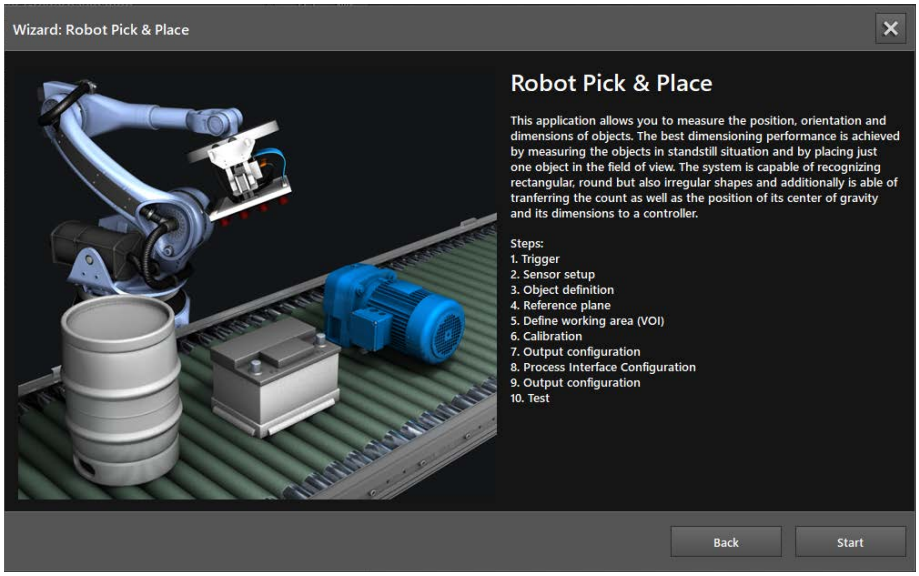
6.3 Robot Pick & Place

This application measures the following object properties:

- Position (centre of gravity)
- Alignment
- Dimensioning
- Shapes (rectangular, circular, irregular)
- Number of objects

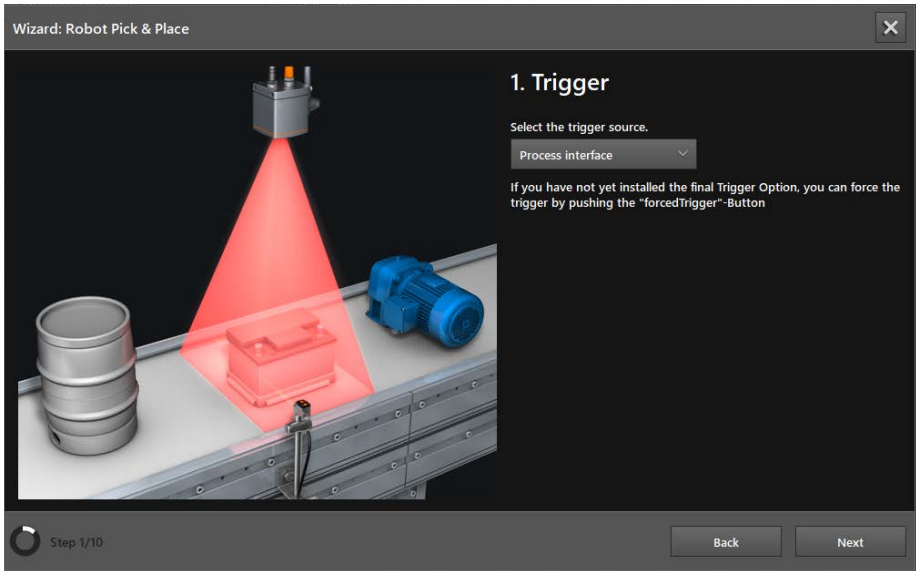
The best result is obtained with stationary objects.

6.3.1 Set up robot pick & place



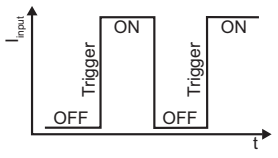
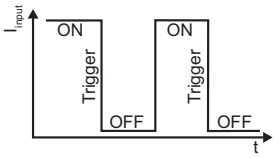
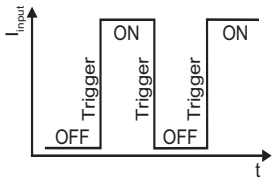
► Click [Start] to start the configuration of the application.

Step 1: Trigger



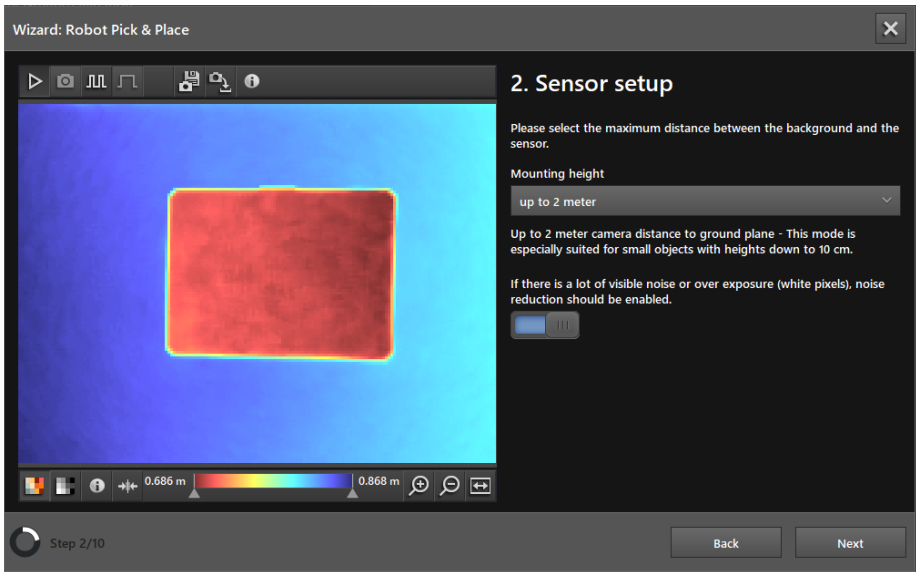
The trigger for the image capture is set in the "Trigger" window.

► Select trigger source.

Select	Description	
Continuous	The device continuously takes images. This option is mainly used for tests.	
Process interface	The device is triggered via the process interface of the connected controller (e.g. PLC / PC).	
Positive edge	The device is triggered by a hardware via the rising edge of an input signal.	
Negative edge	The device is triggered by the hardware via the falling edge of an input signal.	
Positive and negative edge	The device is triggered by the hardware via the rising and falling edge of an input signal.	

► Click [Next].

Step 2: Sensor setup



The distance between the device and the background (reference plane) of the objects are set in the "Sensor setup" window.

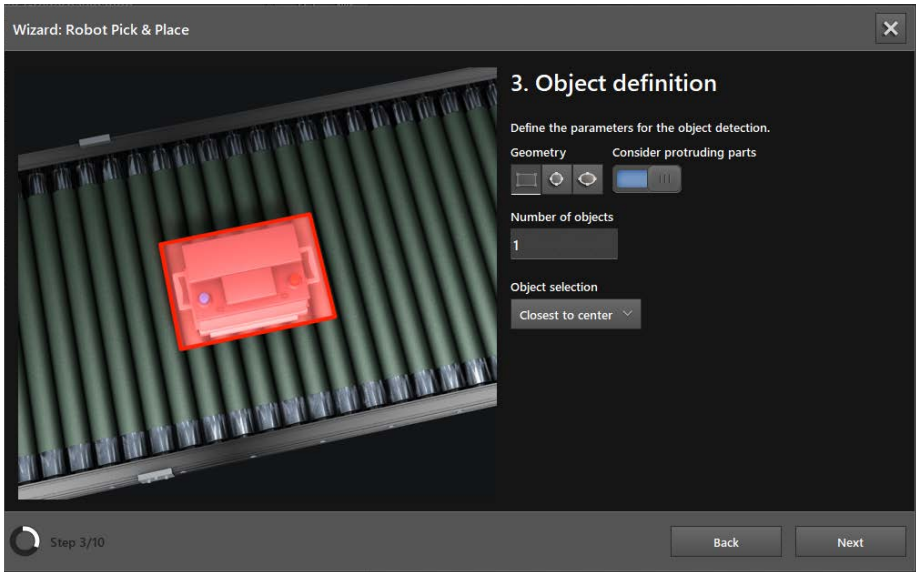
► In the list [Mounting height] set the distance between the device and the background.

► Set the [Noise reduction] button:

- If the live image is not noisy or overexposed (white pixels), set the button to "off".
- If the live image is noisy or overexposed (white pixels), set the button to "on".

► Click [Next].

Step 3: Object definition



The shape, number and selection of the objects are set in the "Object definition" window.

► Use the [Geometry] button to select a shape (rectangular, circular or elliptic).

► Set the [Consider protruding parts] button:

- If the object does not have any protruding parts, set the button to "off".
- If the object has protruding parts (e.g. handholds) which should not be considered, set the button to "on".

► Enter the expected number of objects in the input field [Number of objects].

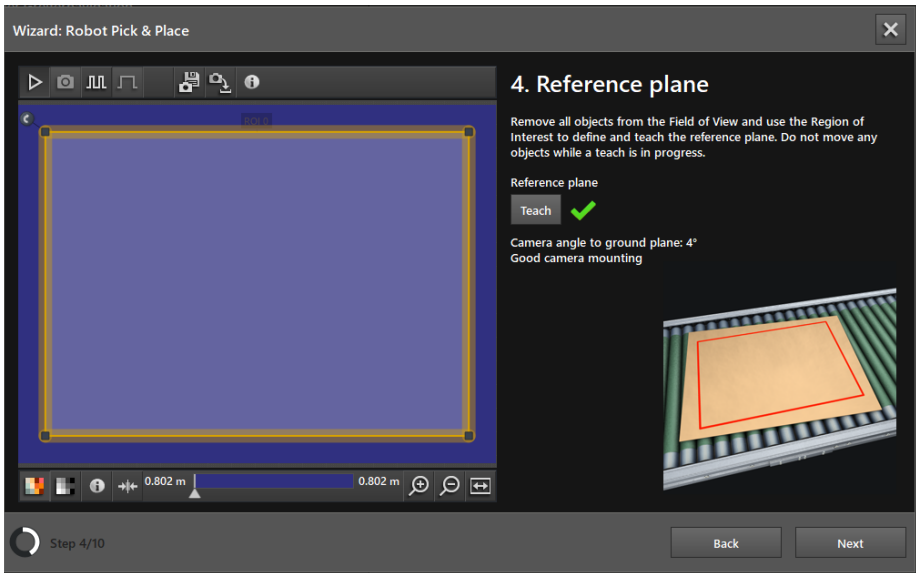
A maximum of 10 objects is possible.

► Select the preferred type of object in the list [Object selection].

> The object type is selected as soon as several objects are simultaneously in the field of view of the device and a value of ">1" is set in the input field [Number of objects].

► Click [Next].

Step 4: Reference plane



The reference plane is taught in the "Reference plane" window. The base plate of the objects is defined to be the reference plane (e.g. conveyor belt).

► Remove all objects from the field of view.

► Use the frame to set the reference plane.

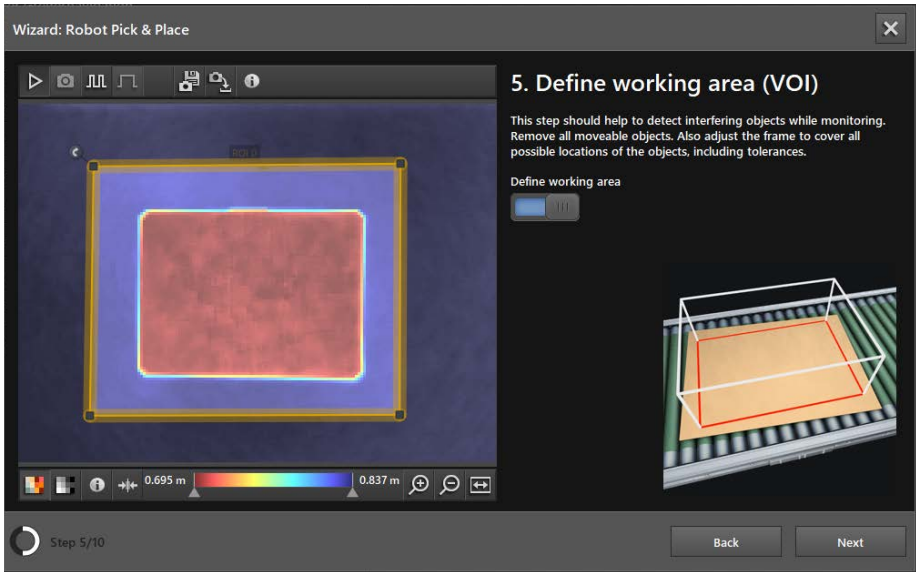
► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

UK

Step 5: Define working area (VOI)



The working area is set in the "Define working area (VOI)" window. The working area defines the area in which the object is to be detected.

► Set the [Define working area (VOI)] button to "on".

> If the button is set to "off", the working area is not considered.

► Remove moving objects from the field of view.

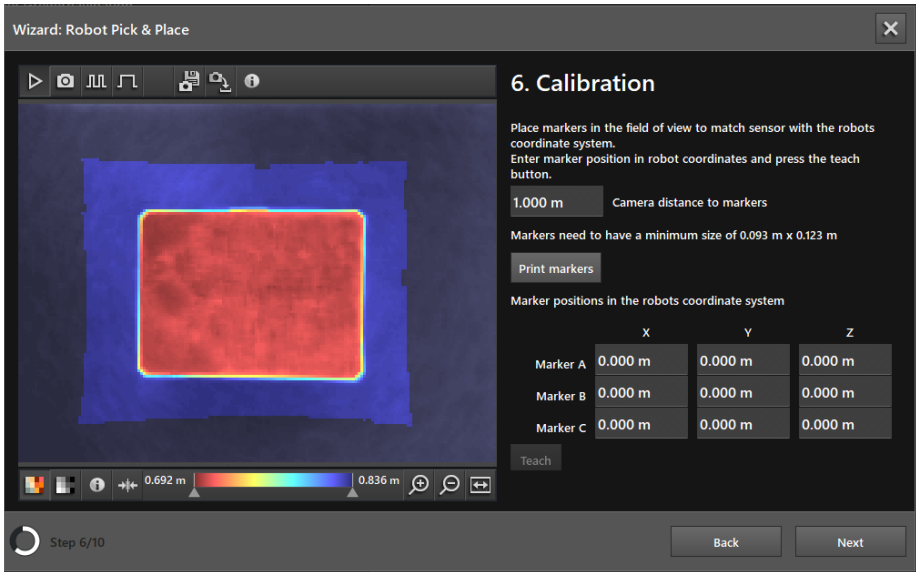
► Use the frame to set the working area.

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

Step 6: Calibration



The coordinate system of the device is combined with the coordinate system of the robot in the "Calibration" window.

"Step 6: Calibration" is optional. If the combination of the coordinate systems is not necessary, the step can be skipped by clicking [Next].

► Enter the distance between the device and the reference plane in the input field [Camera distance to markers].

> The minimum size of the marker is calculated using the distance to the reference plane.

► Click the [Print markers] button.

> The minimum size of the markers is shown above the [Print markers] button.

► Distribute the printed markers in the field of view of the device.

> The markers must be completely visible and may be rotated about their Z axis. Each marker has a reference point which is shown in the live image by a cross and the corresponding letters.

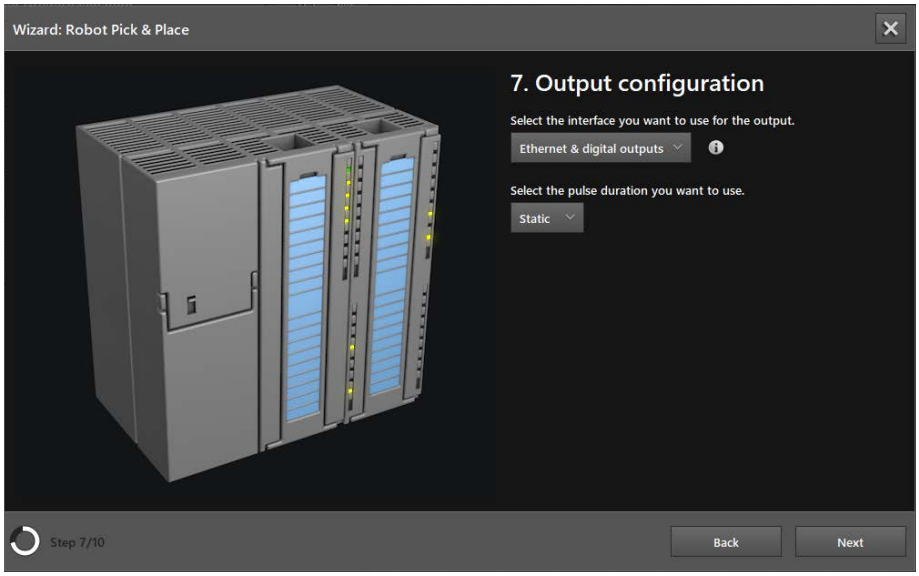
► Define the position of the reference points in the coordinate system of the robot and enter it in the [Marker A], [Marker B] and [Marker C] input fields.

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button. The icon shows the description of the transformation parameters.

► Click [Next].

Step 7: Output configuration



► In the list of the output interface select:

Output interface	Description
Ethernet	The measurement results regarding size, position, alignment, etc. are transmitted via the process interface. The process interface is set up in the next step. The digital outputs are deactivated.
Digital outputs	The measurement results are compared with reference values. The logical values determined from these results control the digital output signals. No measurement results are transmitted via the process interface.
Ethernet & digital outputs	Both outputs are used at the same time.

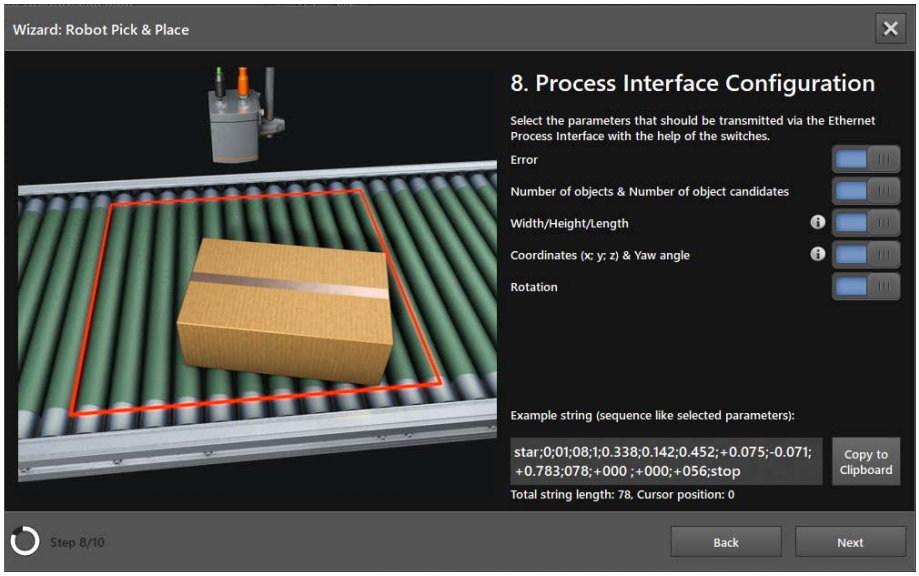
► Select the duration of the output pulse in the list [Pulsdauer wählen].

Pulse duration	Description
Static	Static output pulse
Pulsed	Value in ms (range 10…2500 ms in steps of 10 ms)

The pulse duration can only be set for digital outputs.

► Click [Next].

Step 8: Process Interface Configuration



The output is set via the process interface in the "Process Interface Configuration" window.

"Step 8: "Process Interface Configuration" is skipped if "Digital outputs" is set as output interface (→ Step 7).

► Use the buttons to select the parameters to be provided via the process interface.

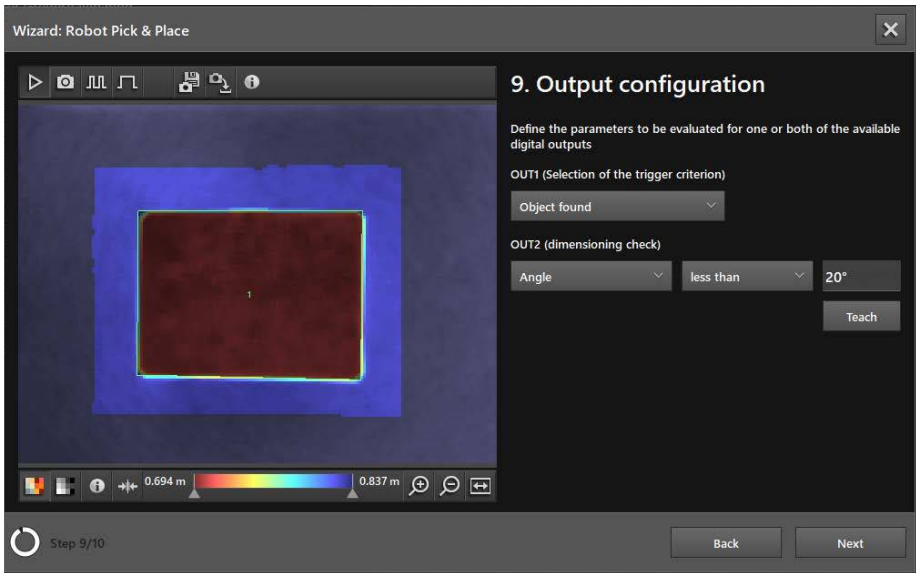
Parameters	Description
Error	Error:0 = no error 1 = undefined error 2 = no object found
Number of objects & Number of object candidates	Number of found objects Number of found and checked object candidates
Width/Height/Length	Width: The broadest dimension of the object surface. Height: The object height relative to the base plate. Length: The longest dimension of the object surface.
Coordinates (x; y; z) & Yaw angle	Coordinates of the centre of the object surface in m (user's coordinate system) The angle of rotation is between the x axis (world coordinate system) and the vector along the "length" of the object (yaw angle).
Rotation	Rotation about the axes of the recognised object (user's coordinate system)

The icon opens a help text for the process interface.

In the example output the set output is displayed via the process interface. The example output can be copied to the Windows clipboard.

► Click [Next].

Step 9: Output configuration



The output is set via the digital outputs in the "Output configuration" window.

"Step 9: Output configuration" is skipped if "Ethernet" is set as output interface (→ Step 7).

Set output OUT1

Output OUT1 can be used as a trigger for an external controller.

► Select trigger in the list "OUT1 (Selection of the trigger criterion).

Parameters	Description
None	OUT1 inactive
Object found	0 = no object found 1 = object found
Number of objects	Number of found objects
Number of object candidates	Number of found and checked object candidates

Set output OUT2

Output OUT2 can be used to check the object dimensions.

► Select trigger in the list "OUT2 (dimensioning check)".

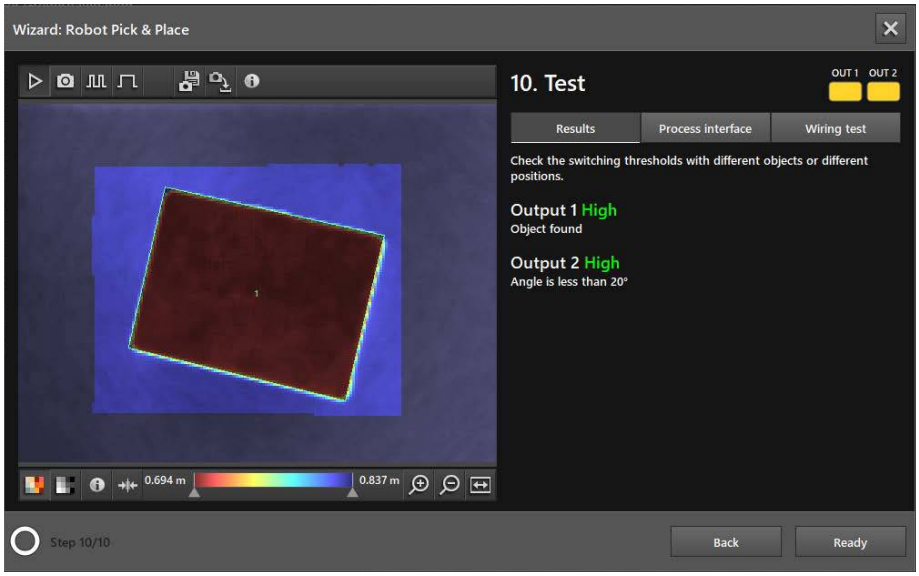
Parameters	Description
None	Output OUT2 inactive
Error	Error: 0 = no error 1 = undefined error 2 = no object found
Width	The broadest dimension of the object surface.
Height	The object height relative to the base plate.
Length	The longest dimension of the object surface.
Angle	The angle of rotation is between the x axis (world coordinate system) and the vector along the "length" of the object (yaw angle).

► Click [Teach].

> A successful teach process is indicated by a green tick next to the button.

► Click [Next].

Step 10: Test



The functions of the application are tested in the "Test" window:

- Logical output signals of the digital outputs
- Output of the process interface
- Wiring

On the left the live image with the detected pallet is shown. On the top right the status LEDs of the outputs are shown. If an output is active, the status LED is continuously on.

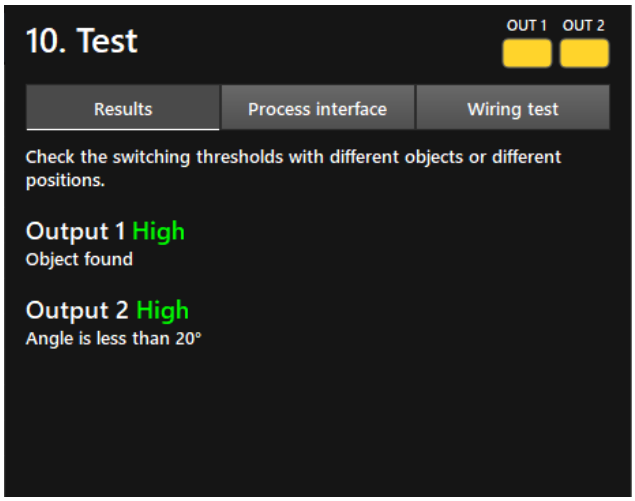
The LEDs for OUT1 and OUT2 shown in the ifm Vision Assistant are identical with the LEDs on the device.

With the buttons below the LEDs it is possible to switch between the following windows:

- Results
- Process interface
- Wiring test

"Results" window

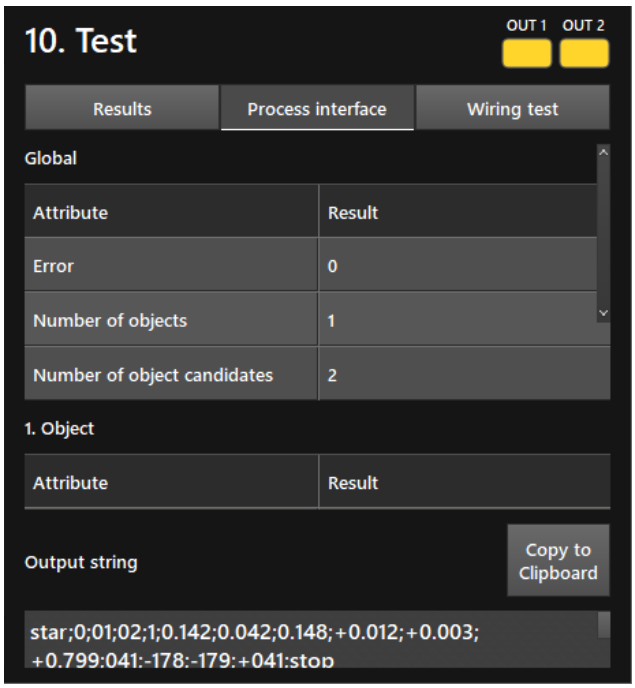
The "Results" window shows the output of the digital outputs and the measurement results, the comparison logic and its results.



► Test results with different objects.

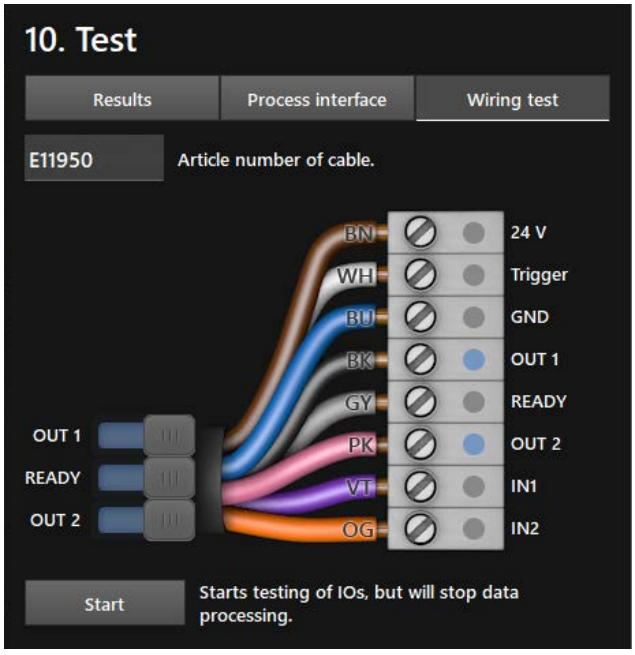
"Process interface" window

The "Process interface" window shows the measurement results of the parameters configured for the output. The output string transmitted by the device via the process interface is shown below the table. The output string can be copied to the Windows clipboard.



Wiring test

In the "Wiring test" window the wiring of the device to the control unit can be tested. The test is carried out in real time and shows the output and input signals at the wires. In the simulation mode, the digital outputs can be manually controlled to test the connection to an external control unit irrespective of the application.



► Click on the input field [Article number of cable] and select the cable from the list or enter the article number.

> The wiring and pin configuration of the selected cable is shown.

► Click [Start] to start the simulation mode.

► Click [OUT 1] to switch the signal at "OUT 1" on or off.

► Click [Ready] to switch the signal at "READY" on or off (ready for next trigger).

► Click [OUT 2] to switch the signal at "OUT 2" on or off.

► If the inputs are used, test the input signals at input 1 and input 2.

The inputs can for example be used for application switching.

► Click [Stop] to stop the simulation mode.

6.3.2 Activate robot pick & place

► If all settings are made, click [Ready] to save the application.

> The device activates and starts the application.

> The monitoring window opens.

6.3.3 Transmit process values via EtherNet/IP

The device can transmit the process values to a PLC via the EtherNet/IP fieldbus.

Only one fieldbus can be active at a time. The fieldbus is adjustable (→ software manual).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant.
- Bytes 14 to 35 are repeated for each object set under "Number of objects" (maximum 10 repetitions) (→ „6.3.1 Set up robot pick & place“).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

0;01;08;1;0.338;0.142;0.452;+0.075;-0.071;+0.783;078;+000;+000;+056

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Duplicated command word	• Bit 0.5 indicates a successful trigger command.
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0000 2#0000_0011	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9	0 0	Decimal Decimal	0		Error	Error: 0 = no error 1 = undefined error 2 = no object found
10 11	1 0	Decimal Decimal	01		Number of objects	Number of found objects

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
12 13	8 0	Decimal Decimal	08		Number of object candidates	Number of found and checked object candidates
14 15	1 0	Binary Binary	1		Object found	0 = no object found 1 = object found
16 17	338 0	Decimal Decimal	338	mm	Width	The broadest dimension of the object surface.
18 19	142 0	Decimal Decimal	142	mm	Height	The object height relative to the base plate.
20 21	452 0	Decimal Decimal	452	mm	Length	The longest dimension of the object surface.
22 23	75 0	Decimal Decimal	75		Centre point X	The X coordinate of the centre point of the object surface (in the user's coordinate system).
24 25	-71 0	Decimal Decimal	-71		Centre point Y	The Y coordinate of the centre point of the object surface (in the user's coordinate system).
26 27	783 0	Decimal Decimal	783		Centre point Z	The Z coordinate of the centre point of the object surface (in the user's coordinate system).
28 29	78 0	Decimal Decimal	078		Yaw angle	The yaw angle is between the x axis (world coordinate system) and the vector along the "length" of the object.
30 31	0 0	Decimal Decimal	+000		Rotation X	Rotation about the X axis of the recognised object (in the user's coordinate system)
32 33	0 0	Decimal Decimal	+000		Rotation Y	Rotation about the Y axis of the recognised object (in the user's coordinate system).
34 35	56 0	Decimal Decimal	+056		Rotation Z	Rotation about the Z axis of the recognised object (in the user's coordinate system).

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Duplicated command word is displayed
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.3.4 Transmit process values via PROFINET

The device can transmit the process values to a PLC via the PROFINET fieldbus.

Only one fieldbus can be active at a time. The fieldbus is adjustable (→ software manual).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant.
- Bytes 14 to 35 are repeated for each object set under "Number of objects" (maximum 10 repetitions) (→ „6.3.1 Set up robot pick & place“).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

0;01;08;1;0.338;0.142;0.452;+0.075;-0.071;+0.783;078;+000;+000;+056

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Duplicated command word	• Bit 0.5 indicates a successful trigger command.
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0000 2#0000_0011	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9	0 0	Decimal Decimal	0		Error	Error: 0 = no error 1 = undefined error 2 = no object found
10 11	1 0	Decimal Decimal	01		Number of objects	Number of found objects
12 13	8 0	Decimal Decimal	08		Number of object candidates	Number of found and checked object candidates
14 15	1 0	Binary Binary	1		Object found	0 = no object found 1 = object found
16 17	338 0	Decimal Decimal	338	mm	Width	The broadest dimension of the object surface.
18 19	142 0	Decimal Decimal	142	mm	Height	The object height relative to the base plate.
20 21	452 0	Decimal Decimal	452	mm	Length	The longest dimension of the object surface.
22 23	75 0	Decimal Decimal	75		Centre point X	The X coordinate of the centre point of the object surface (in the user's coordinate system).
24 25	-71 0	Decimal Decimal	-71		Centre point Y	The Y coordinate of the centre point of the object surface (in the user's coordinate system).

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
26 27	783 0	Decimal Decimal	783		Centre point Z	The Z coordinate of the centre point of the object surface (in the user's coordinate system).
28 29	78 0	Decimal Decimal	078		Yaw angle	The yaw angle is between the x axis (world coordinate system) and the vector along the "length" of the object.
30 31	0 0	Decimal Decimal	+000		Rotation X	Rotation about the X axis of the recognised object (in the user's coordinate system)
32 33	0 0	Decimal Decimal	+000		Rotation Y	Rotation about the Y axis of the recognised object (in the user's coordinate system).
34 35	56 0	Decimal Decimal	+056		Rotation Z	Rotation about the Z axis of the recognised object (in the user's coordinate system).

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Duplicated command word is displayed
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.3.5 Transmit process values via TCP/IP

The device can transmit the process values to a PLC via the TCP/IP protocol. In the ifm Vision Assistant the process values are displayed as output string as shown below:

```
star;0;01;08;1;0.338;0.142;0.452;+0.075;-0.071;
+0.783;078;+000 ;+000;+056;stop
```

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Semicolons ";" in the output string are not transmitted.
- The process values "Object found" to "Rotation Z" are repeated for each object set under "Number of objects" (maximum 10 repetitions) (→ „6.3.1 Set up robot pick & place“).
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows (data type: ASCII):

star;0;01;08;1;0.338;0.142;0.452;+0.075;-0.071;+0.783;078;+000;+000;+056;stop

Process value	Unit	Description
star		Start string
0		Error
01		Number of objects
08		Number of object candidates
1		1 = no object found 0 = object found
0.338	mm	Width
0.142	mm	Height
0.452	mm	Length
+0.075		Centre point X
-0.071		Centre point Y
+0.783		Centre point Z
078		Yaw angle
+000		Rotation X
+000		Rotation Y
+056		Rotation Z
stop		Stop string

6.4 Completeness monitoring

This application checks the completeness of evenly filled containers. It can be checked if objects are missing (underfill) and/or if too many objects are present (overfill).

The objects in the container have to be arranged in a rectangular grid. The maximum per lateral edge is 16 objects for a total of maximum 64 objects.

For each object a ROI (region of interest) is defined. In each ROI a level is measured and compared with limits.

Level measured in the ROIs	Result
Within the defined parameters	Object correct - container completely filled
Below the minimum limit	Underfill, output 1 switches
Above the maximum limit	Overfill, output 2 switches

The process interface provides the measured values of the individual ROIs (overfill or underfill "good"/"invalid").

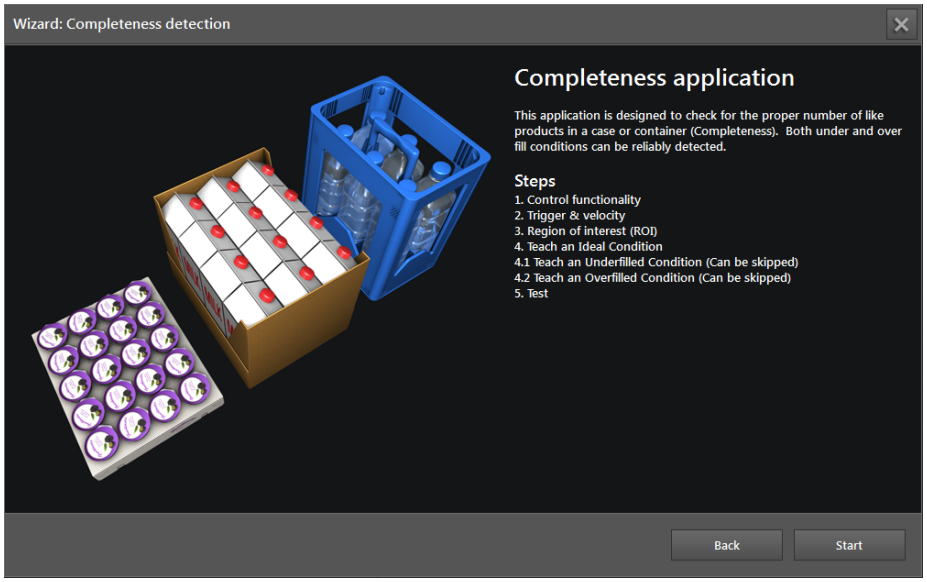
Object requirements for a reliable detection:

- Minimum height of static objects (velocity ≤ 0.2 m/s): 2.5 cm
- Minimum height of moving objects (velocity > 0.2 m/s): 4.5 cm
- Surface with diffuse reflections
- Shiny surface: Avoid direct reflection back to the device

To verify different multipack shapes a separate application must be created for each multipack. The active application can be selected according to the expected multipack.

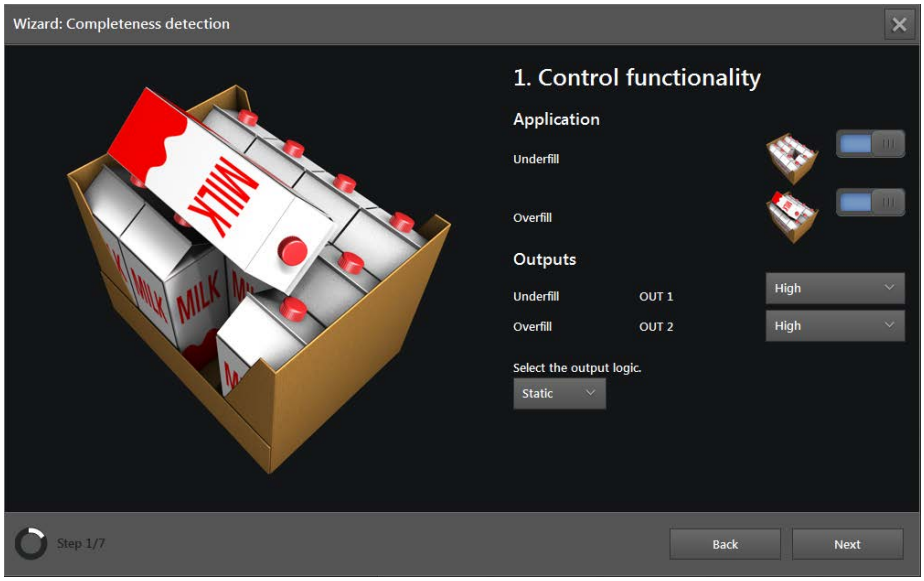
Fully transparent or reflective surfaces cannot be measured reliably.

6.4.1 Set up completeness monitoring



► Click [Start] to start the configuration of the application.

Step 1: Control functionality



► Set the button for underfill (missing objects) to "on" or "off" depending on the application.

► Set the button for overfill (too many objects) to "on" or "off" depending on the application.

> At least one of these two options must be activated.

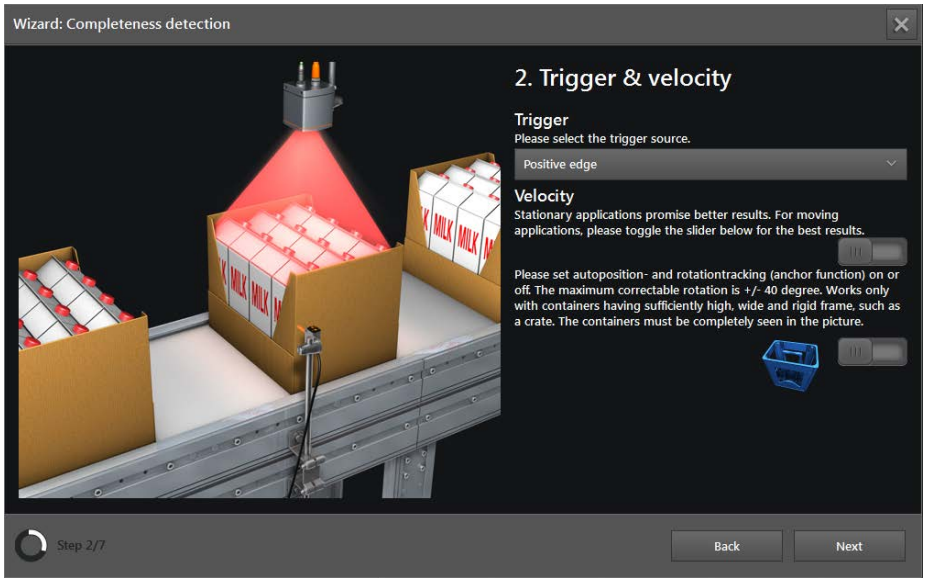
Messages regarding underfill are always provided on output 1.
Messages regarding overfill are always provided on output 2.

► Select the output logic:

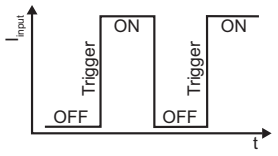
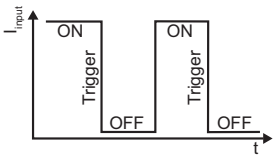
Type of output logic	Description
Static	If underfill or overfill was measured, the corresponding output is set to logical one (high) and retains this value until the next measurement.
Pulsed	If underfill or overfill was measured, the corresponding output is set to logical one (high) for the set pulse duration and then returns to logical zero (low). It is necessary to indicate the pulse frequency in ms (range 10...2500 ms in steps of 10 ms).

► Click [Next].

Step 2: Trigger & velocity



► Select trigger source.

Selection	Description	
Continuous	The device continuously takes images. This option is mainly used for tests.	
Process interface	The device is triggered via the process interface of the connected controller (e.g. PLC / PC).	
Positive edge	The device is triggered by the hardware via the rising edge of an input signal.	
Negative edge	The device is triggered by the hardware via the falling edge of an input signal.	

► Set the button [Velocity]:

- To measure static objects set the button to "off". The object must be at standstill for min. 100 ms.
- To measure moving objects set the button to "on". In this case the switching thresholds for underfill and overfill are automatically defined in the good state. The switching thresholds can be adapted subsequently in the last step of the wizard (→ „8.7 Test operations“).

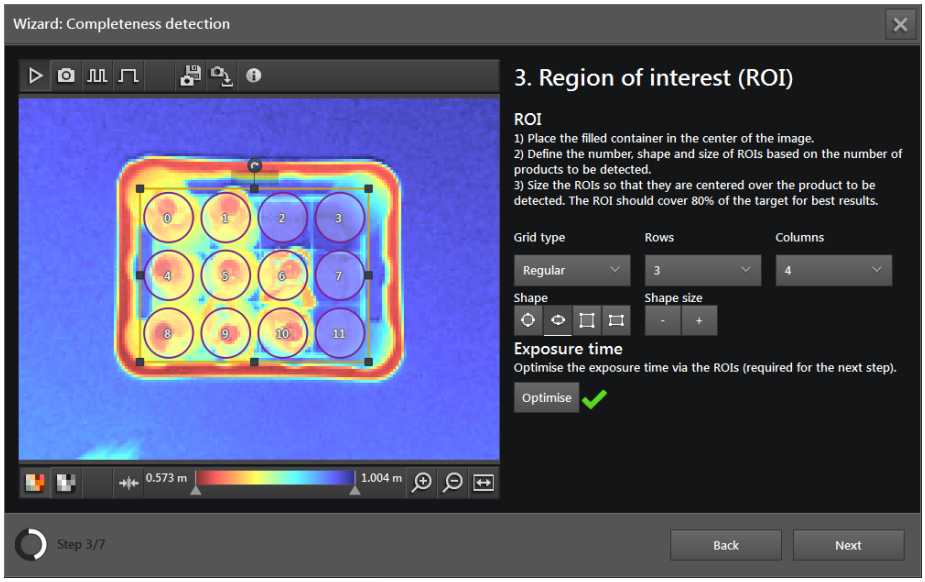
► Set the button for anchor function to "on" or "off" (automatic anchor tracking of containers).

- If the anchor function is switched off, the container always has to be at the same position in the same orientation so that the application works correctly.
  If the anchor function is switched on, the orientation of the container is determined and the positions of the ROIs are adapted to the position of the objects. Therefore, the evaluation times are longer. To ensure reliable detection of the objects, a sufficient number of container contours must be visible.
- If the anchor function is switched on, the evaluation time may be longer.
- The anchor function must be set again if the ROIs change.

► Click [Next].

> The exposure time for the current scene is automatically optimised.

Step 3: Region of interest (ROI)



The window "Region of interest (ROI)" shows live images to set the number, shape and size of the ROIs. Then the exposure time can be optimised.

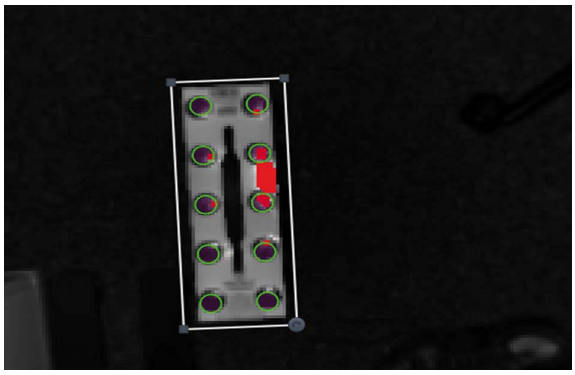
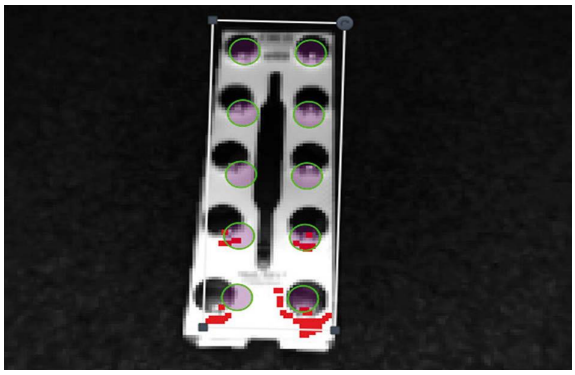
► If not selected, set the option [Live image] (→ „6.1 Live image display of the set-up wizard“).

► Place a correctly filled container in the centre under the device and meet the following conditions by changing the position of the container and / or of the device:

- The container is fully in the image and all corners are visible.
- The distance to the device is between 0.3 m and 5 m.
- No object in the image section (including the background) is farther than 5 m away from the device.

An inclined view distorts the object grid and makes it more difficult to detect the objects in the ROIs.

► Align the device as vertically as possible to the container.

Vertical	Inclined (distorted)
	

► In case of shiny surfaces (e.g. polished metal, products wrapped in foil):
Avoid direct reflections of the internal light by slightly tilting the device.

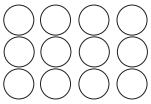
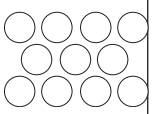
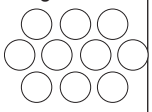
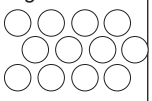
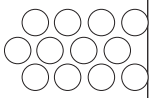
► Set view options so that the ROIs can be easily set
(→ „7.2 View options“).

It depends on the shape and the reflectivity of the containers and objects whether a distance image or an amplitude image (brightness) is better suited for display.

- Amplitude image: Container and objects with high-contrast reflectivity values in the infrared range
- Distance image: Characteristic shapes of the container and the objects (e.g. crate with bottles)

► After the view options have been changed click  to optimise the image.

► Set ROIs.

Setting of the ROIs	Option	Description
Grid type 	Regular 	The centres of the ROIs are arranged directly on top of and next to each other.
	Honeycomb...	With the grid types "Honeycomb..." the centres of the ROIs are one line above or below the gaps of the ROIs of the neighbouring line. This results in a hexagonal structure or honeycomb structure of the ROIs with the following differences:
	Honeycomb Shorter 	The lines with an even range number (2nd line, 4th line, ...) are one ROI shorter than the lines with an odd range number (1st line, 3rd line, ...). For multi-ROIs with an even number of lines the grid type "Honeycomb Shorter" is identical with the grid type "Honeycomb Longer" after a rotation of 180°.
	Honeycomb Longer 	The lines with an odd range number (1st line, 3rd line, ...) are one ROI shorter than the lines with an even range number (2nd line, 4th line, ...). For multi-ROIs with an odd number of lines the grid type "Honeycomb Shorter" is identical with the grid type "Honeycomb Longer" after a rotation of 180°.
	Honeycomb Right 	The number of ROIs in each line is identical. The ROIs in the lines with an even range number (2nd line, 4th line, ...) are shifted to the right as against the ROIs in the lines with an odd range number (1st line, 3rd line,...). For multi-ROIs with an odd number of lines the grid type "Honeycomb Right" is identical with the grid type "Honeycomb Left" after a rotation of 180°.
	Honeycomb Left 	The number of ROIs in each line is identical. The ROIs in the lines with an even range number (2nd line, 4th line, ...) are shifted to the left as against the ROIs in the lines with an odd range number (1st line, 3rd line,...). For multi-ROIs with an odd number of lines the grid type "Honeycomb Left" is identical with the grid type "Honeycomb Right" after a rotation of 180°.
	Manual	The ROIs are arranged manually.
Lines		Select the number of lines of a multi-ROI: 1…64 (lines x columns ≤ 64)
Columns		Select the number of columns of a multi-ROI: 1…64 (lines x columns ≤ 64)
Square		Select the shape that is best suited for the shape of the objects.
Rectangle		
Circle		
Ellipse		
Shape size	[–]	Decreases the ROIs
	[+]	Increases the ROIs

► Adapt the number of ROIs to the number of objects in the container.

► Adapt the size and shape of the ROIs to the objects in the container.

► Set the outer frame so that the ROIs are well positioned on the objects:
  - To scale the frame: Click the border mark and move while holding the mouse button down.
  - To rotate the frame: Click the rotate icon and move while holding the mouse button down.

A good initial value for the configuration is a coverage of the objects of 80 % by the ROIs. Only the ROIs are used for the measurements, the frame serves as a positioning help.

> Each ROI is represented by a frame.

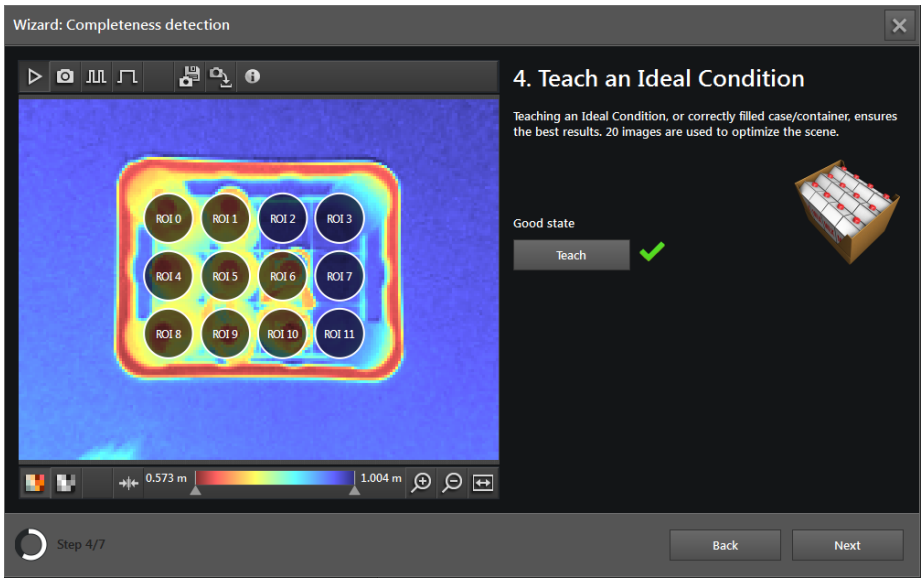
► If the ROIs are adapted to the objects, click [Optimise].

> The exposure time for the objects in the ROIs is automatically optimised.
Even after optimisation of the exposure times invalid pixels or strong image noise may occur in the background. This has no effect on the measurement.

► Click [Next].

During the following steps of the teach process the objects must not move, otherwise the application cannot function correctly. This is also so if the anchor function was activated. The anchor function only works if the teach process for the good and bad states is completed.

Step 4: Teach an ideal condition
In this step the device measures reference values for a correctly filled container.



► Click [Teach].

> [Next] is deactivated until the teach process has been successfully completed.

> The current scene is recognised as full state. Depending on the setting "Velocity" (→ Step 2: Trigger & velocity) the switching thresholds for underfill and overfill are determined.

> If the automatic rotation tracking (anchor function) was activated, contours (edges) that mark the border of the container are searched for in an area around the ROIs. With the contours found a multipack model is created whose quality is then assessed. If the quality of the multipack model is not sufficient to reliably detect the multipack in the image, an error message is displayed in the live image.

If the teach process is not successful:

Cause	Solution
The object has moved.	► Return to step 3 and set the ROIs again. ► Avoid object movement: – If the anchor function is switched off: Ensure that the objects are at the same image position for each frame. This can be achieved with the hardware trigger. – If the application is switched on: Check if the anchor function can reliably determine the objects that were moved.
The anchor function is on and the characteristics of the container or the objects are not sufficient to reliably determine position and orientation.	► Return to step 2 and switch off the anchor function.
In the ROIs too many pixels are overexposed due to direct reflection.	► Reduce overexposure by slightly tilting the device. ► Return to step 3 and click [Optimise] to set the ROIs again.
In the ROIs too many pixels are overexposed due to too bright objects.	► Ensure that the exposure time was optimised in step 3. ► If optimisation of the exposure time does not improve the situation, increase the device distance.
In the ROIs too many pixels are underexposed.	► Ensure that the exposure time was optimised in step 3. ► If optimisation of the exposure time does not improve the situation, reduce the device distance.

When you return to step 3 and change the settings (ROIs, exposure, movement of the object or the device), the teach process has to be repeated. Otherwise the application will not function correctly.

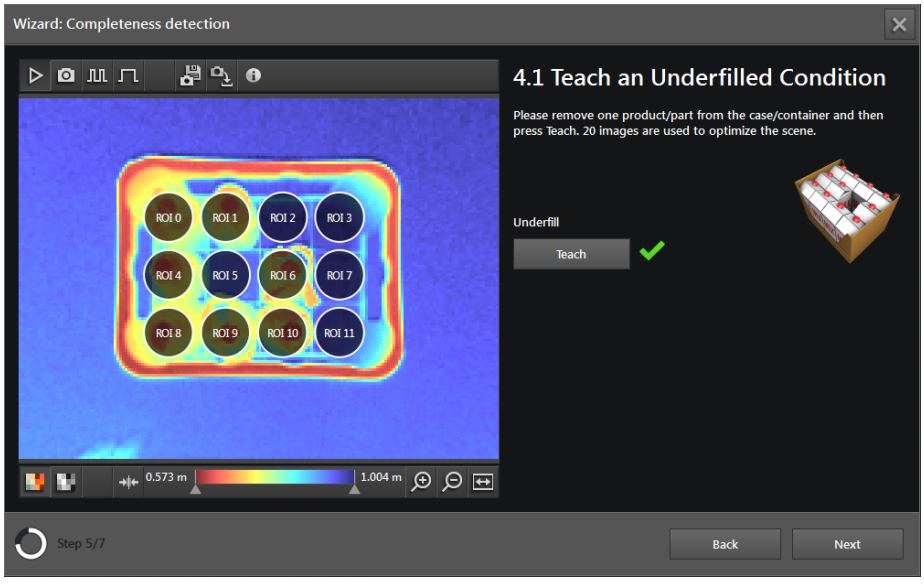
► After the problem has been solved, click [Teach] again.

► Click [Next].

Step 4.1: Teach underfill

If the detection of underfill was not switched on in step 1, the wizard will skip this step.

During the teach process a limit for underfill is determined. The limit for underfill can be adapted subsequently in the last step of the wizard (→ Step 5: Test).



► Remove one object from the container and click [Teach].

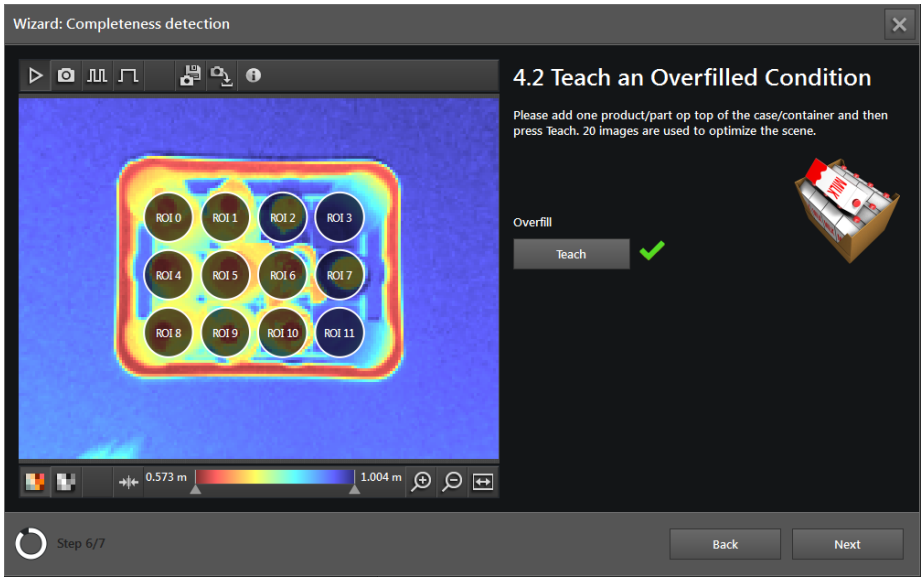
> If no object was removed or the difference between full and empty state is too small, the teach process will fail.

► Click [Next].

Step 4.2: Teach overfill

If the detection of overfill was not switched on in step 1, the wizard will skip this step.

During the teach process a limit for overfill is determined. The limit for overfill can be adapted subsequently in the last step of the wizard (→ Step 5: Test).



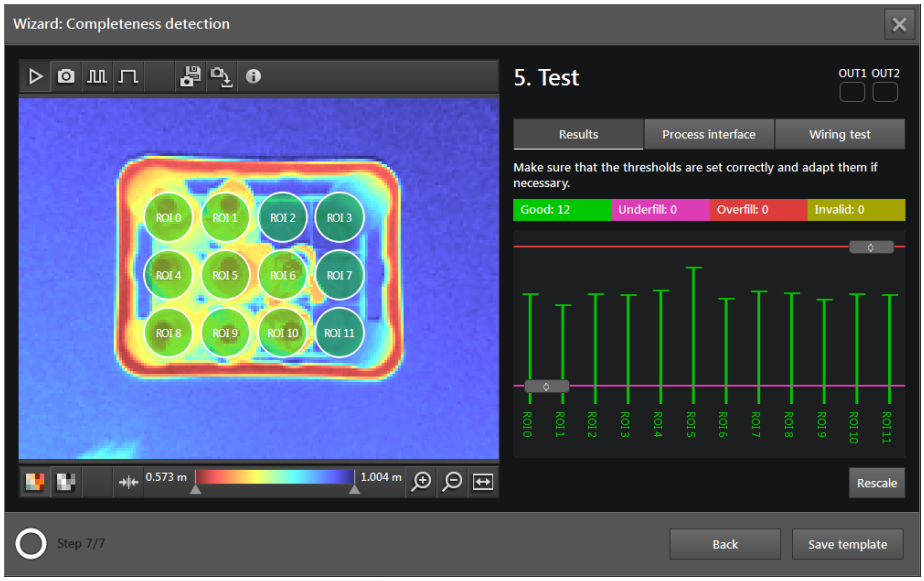
► Add an object to the correctly filled container and click [Teach].

> If no object was added or the difference between full and empty state is too small, the teach process will fail.

► Click [Next].

Step 5: Test
In the final step, the functions of the application are tested:

- Device limits (e.g. underfill, overfill)
- Output signals at the outputs
- Wiring



On the left side, the device image with the ROIs and the measurement results are shown.

Colour	Description
Green	OK
Red	Underfill
Pink	Overfill
Olive green	Invalid
Yellow	Selected

The status LEDs of the outputs are shown at the top right.

- LED OUT1 yellow on: Underfill was measured and output 1 is active.
- LED OUT2 yellow on: Overfill was measured and output 2 is active.
- If an output is active, the LED is continuously on. The setting to a pulse or [Static] in step 1 has no effect on this.

The LEDs for OUT1 and OUT2 shown on the screen are identical with the LEDs on the device.

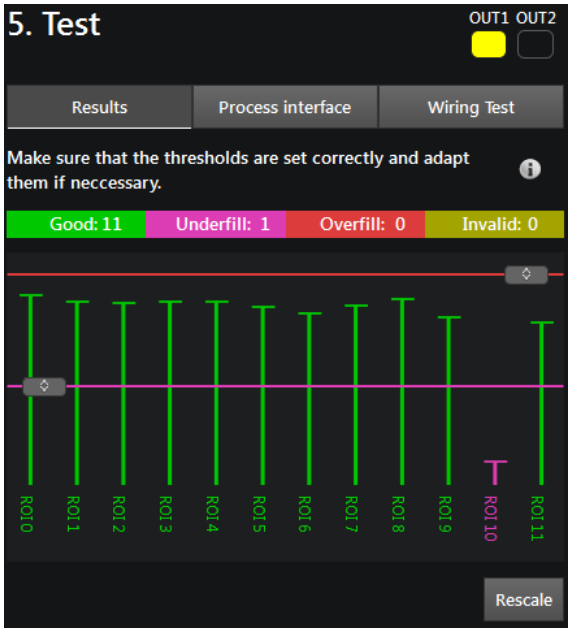
With the buttons under the LEDs it is possible to switch between the following screens:

- Results
- Process interface
- Wiring test

Results
The window "Results" shows the measurement results in a bar graph. If it is not possible to display all results at the same time, a horizontal scroll bar is displayed. The numbers and colour codes of the ROIs in the image and in the bar graph are identical. If a ROI or a line is marked by clicking, the corresponding line is shown in dark yellow.

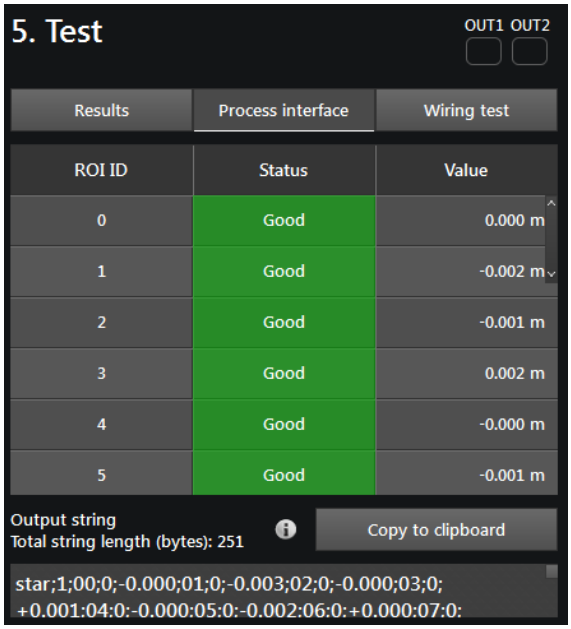
If underfill or overfill is actively detected, a coloured line marks the corresponding limit:

- Red (upper line): Overfill
- Pink (lower line): Underfill

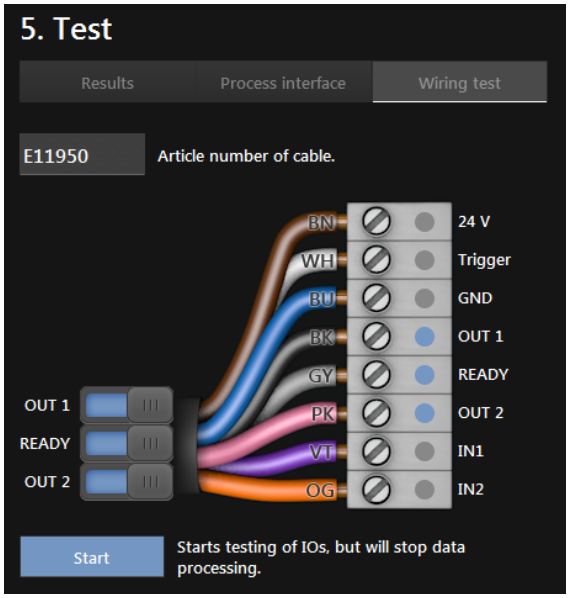


► Test application by removing or adding objects.
► If the test is not satisfactory, optimise settings, such as:
  – Adapt limits by vertically shifting the coloured lines.
  – Return to step 3 to set the ROIs again and to repeat the teach process in step 4.
► If the anchor function has been activated, test it by moving and rotating the container.

Process interface
The window "Process interface" displays a table with the status of the ROIs and the process values (→ „6.2.3 Transmit process values via EtherNet/IP“). The output string transmitted by the device via the process interface is shown below the table. The output string can be copied to the Windows clipboard.



Wiring test
The wiring of the device to the control unit can be tested via the window "Wiring test". The test is carried out in real time and shows the output and input signals at the corresponding wires. In the simulation mode, the digital outputs can be manually controlled to test the connection to an external control unit irrespective of the application.



► Click the field [Article number of cable] and select the cable from the list or enter the article number.
> The wiring and pin configuration of the selected cable is shown.
► Click [Start] to start the simulation mode.
► Click [OUT 1] to switch the signal at "OUT 1" on or off.
► Click [Ready] to switch the signal at "READY" on or off (ready for next trigger).
► Click [OUT 2] to switch the signal at "OUT 2" on or off.
► If the inputs are used, test the input signals at input 1 and input 2.

The inputs can for example be used for application switching.

► Click [Stop] to stop the simulation mode.

6.4.2 Activate completeness monitoring

► If all settings are made, click [End] to save the application.

> The device activates and starts the application.

> The monitoring window opens. Under the tab "Results" a bar graph is shown which is used to control the values of the active application (→ „7.6.3 Display of the model results of completeness monitoring“).

6.4.3 Transmit process values via EtherNet/IP

The device can transmit the process values to a PLC via the EtherNet/IP fieldbus. The process values are displayed in the ifm Vision Assistant as output string as shown below:

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

star;0;00;0;+0.000;01;7;-0.068;02;6;+0.013;03;0;+0.001;stop

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0000_0000 2#0010_0000	Binary Binary	1.5		Command word displayed backwards	• Bit 1.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Decimal Decimal			Synchronous / asynchronous message identification	
4 5	30 0	Decimal Decimal	30		Message counter	• The device has received 30 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	0 0	Decimal Decimal			Reserved	
8 9 10 11	s t a r	ASCII ASCII ASCII ASCII	star		Start string	

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
12 13	0 0	Decimal Decimal	0		Status of all ROIs (0 = bad, 1 = good)	Shows the status of the completeness monitoring
14 15	0 0	Decimal Decimal	0		ROI ID	With activated anchor tracking bytes 14 and 15 are used. 0 = anchor is not tracked 1 = anchor is tracked All the following data is shifted by 2 bytes; i.e. the 1st ROI ID starts with bytes 16 and 17.
16 17	0 0	Decimal Decimal	0		ROI status	ROI status: 0 = good 1 = reference plane not set 2 = teach process failed 3 = reference plane invalid 4 = no valid pixels 5 = reference plane contains no valid pixels 6 = overfill 7 = underfill
18 19	0 0	Decimal Decimal	0	mm	ROI value	
20 21	1 0	Decimal Decimal	1		ROI ID	
22 23	7 0	Decimal Decimal	7		ROI status	
24 25	-67 -1	Decimal Decimal	-67	mm	ROI value	
26 27	2 0	Decimal Decimal	2		ROI ID	
28 29	6 0	Decimal Decimal	6		ROI status	
30 31	14 0	Decimal Decimal	14	mm	ROI value	
32 33	3 0	Decimal Decimal	3		ROI ID	
34 35	0 0	Decimal Decimal	0		ROI status	
36 37	0 0	Decimal Decimal	0	mm	ROI value	
38 39 40 41	s t o p	ASCII ASCII ASCII ASCII	stop		Stop string	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.4.4 Transmit process values via PROFINET

The device can transmit the process values to a PLC via the PROFINET fieldbus. The process values are displayed in the ifm Vision Assistant as output string as shown below:

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

star;0;00;0;+0.000;01;7;-0.068;02;6;+0.013;03;0;+0.001;stop

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Command word displayed backwards	• Bit 0.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Decimal Decimal			Synchronous / asynchronous message identification	
4 5	0 30	Decimal Decimal	30		Message counter	• The device has received 30 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	0 0	Decimal Decimal			Reserved	
8 9 10 11	s t a r	ASCII ASCII ASCII ASCII	star		Start string	
12 13	0 0	Decimal Decimal	0		Status of all ROIs (0 = bad, 1 = good)	Shows the status of the completeness monitoring
14 15	0 0	Decimal Decimal	0		ROI ID	With activated anchor tracking bytes 14 and 15 are used. 0 = anchor is not tracked 1 = anchor is tracked All the following data is shifted by 2 bytes; i.e. the 1st ROI ID starts with bytes 16 and 17.

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
16 17	0 0	Decimal Decimal	0		ROI status	ROI status: 0 = good 1 = reference plane not set 2 = teach process failed 3 = reference plane invalid 4 = no valid pixels 5 = reference plane contains no valid pixels 6 = overfill 7 = underfill
18 19	0 0	Decimal Decimal	0	mm	ROI value	
20 21	0 1	Decimal Decimal	1		ROI ID	
22 23	0 7	Decimal Decimal	7		ROI status	
24 25	-1 -67	Decimal Decimal	-67	mm	ROI value	
26 27	0 2	Decimal Decimal	2		ROI ID	
28 29	0 6	Decimal Decimal	6		ROI status	
30 31	0 14	Decimal Decimal	14	mm	ROI value	
32 33	0 3	Decimal Decimal	3		ROI ID	
34 35	0 0	Decimal Decimal	0		ROI status	
36 37	0 0	Decimal Decimal	0	mm	ROI value	
38 39 40 41	s t o p	ASCII ASCII ASCII ASCII	stop		Stop string	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.4.5 Transmit process values via TCP/IP

The device can transmit the process values to a PLC via the TCP/IP protocol. The process values are displayed in the ifm Vision Assistant as output string as shown below:

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

The output string is as follows (data type: ASCII):

star;0;00;0;+0.000;01;7;-0.068;02;6;+0.013;03;0;+0.001;stop

Process value	Unit	Description
star		Start string
0		Status of all ROIs (0 = bad, 1 = good)
00		ROI ID
0		ROI status
+0.000	m	ROI value
01		ROI ID
7		ROI status
-0.068	m	ROI value
02		ROI ID
6		ROI status
+0.013	m	ROI value
03		ROI ID
0		ROI status
+0.001	m	ROI value
stop		Stop string

ROI status:
0 = good
1 = reference plane not set
2 = teach process failed
3 = reference plane invalid
4 = no valid pixels
5 = reference plane contains no valid pixels
6 = overfill
7 = underfill

6.5 Dimensioning of rectangular objects

This application measures the position, orientation and size of rectangular, box-shaped objects. Quality parameters can be used to detect open flaps or a deviation from the box shape.

Object requirements for a reliable detection:

- The object is stationary
- The object is fully in the image and has sufficient distance to the image borders
- There are no other objects in the field of view (other boxes)
- If there are other objects in the field of view:
  - Minimum distance between the objects: 3 pixels
  - Background is visible between the objects

If there is more than one object in the field of view, the object closest to the image centre is measured.

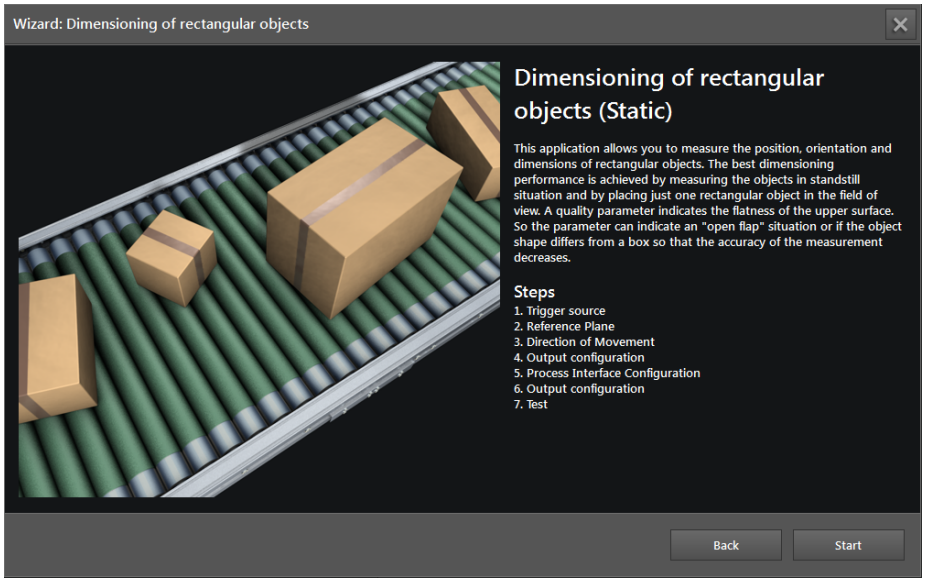
Requirements for the installation of the device to achieve good measurement results:

- Install the device as vertically as possible over the measuring range so that the object is measured from above.

If the device is inclined, accuracy is reduced. In case of an inclination over 45°, the application will not work.

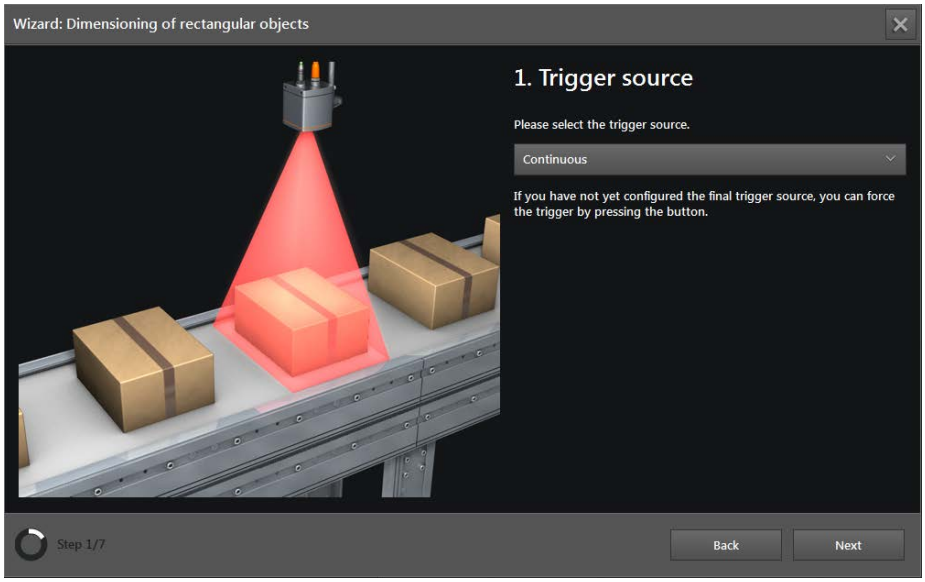
- Install the device at a distance so that the complete objects to be measured are in the field of view of the device and there is still some space to the outer edge on all sides.
- Measuring distance for most applications: 1 to 2 metres
- Nothing in the field of view, including the background, may be farther than 5 m away from the device (radially).

6.5.1 Set up object dimensioning

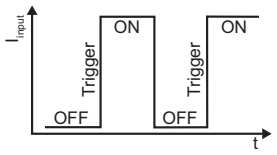
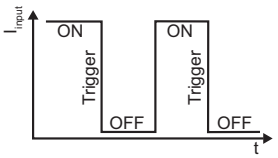


► Click [Start] to start the configuration of the application.

Step 1: Trigger source

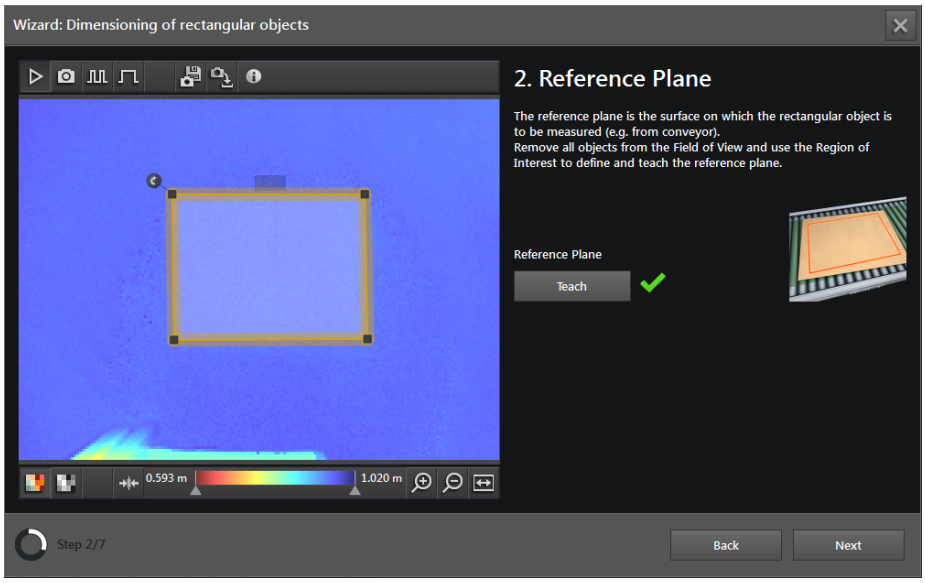


► Select trigger source.

Selection	Description	
Continuous	The device continuously takes images. This option is mainly used for tests.	
Process interface	The device is triggered via the process interface of the connected controller (e.g. PLC / PC).	
Positive edge	The device is triggered by the hardware via the rising edge of an input signal.	
Negative edge	The device is triggered by the hardware via the falling edge of an input signal.	

► Click [Next].

Step 2: Reference plane
In this step the reference plane is set on which the objects to be measured are placed. This is necessary for correct measurement results to determine the object dimensions.



The window displays live images so that the reference plane can be configured.

► If not selected, set option [Live image] (→ „6.1 Live image display of the set-up wizard“).

► Make sure that there are no objects to be measured in the field of view (blank scene).

► Make sure that the reference plane is flat and reflective.

- If a measurement is to be made on a roller conveyor or the like: Place a sheet of hard paper or thin cardboard in the measuring range to create a flat surface.
- If a measurement is to be made on a black surface: Place a white sheet of paper in the measuring range.

► Set the frame of the ROI

- Shift the frame of the ROI so that the ROI is in the flat part of the reference plane.
- Select the ROI as large as possible.
- Leave some space to all surrounding objects (e.g. to the sides).
- To create additional corners: Click the limiting lines of the frame and drag the frame while holding the mouse button down.

The ROI is only a section of the correct reference plane and determines the quality of the teach process. The actual measuring range always corresponds to the whole field of view of the device.

► Click [Teach].

If the teach process was not successful:

Problem	Solution
The reference plane in the ROI is not flat.	► Place a sheet of hard paper or thin cardboard on the reference plane.
Other objects are nearby or in the ROI.	► Remove objects or increase distance between the ROIs and the objects.
The ROI is too small.	► Ensure that the ROI can be increased: – Remove objects nearby the ROIs. – Increase the surface of the reference plane by adding more sheets of paper or the like. – Shift ROI. – Mount the device at another location.

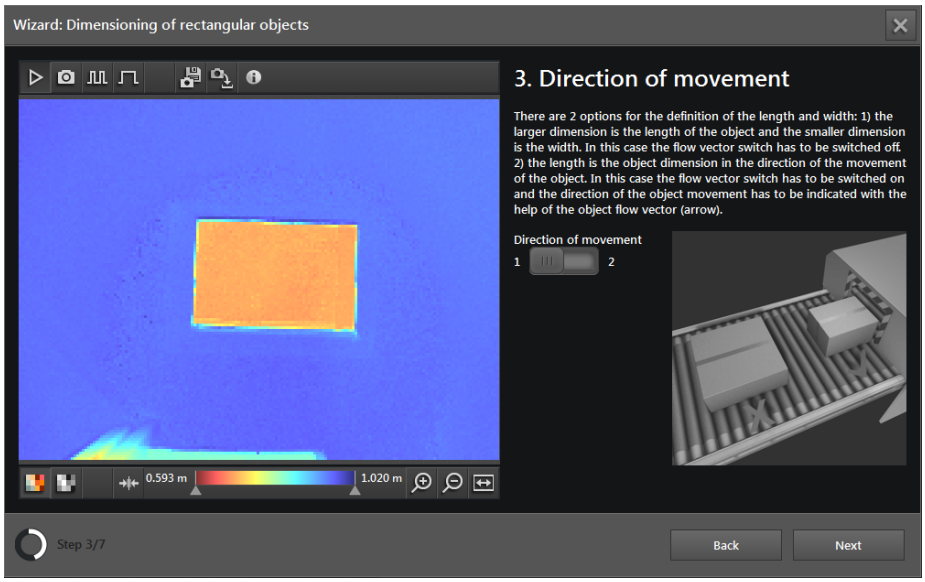
Problem	Solution
There are too many saturated, underexposed or invalid pixels in the region of interest.	► Place a white sheet of paper on the reference plane.
There is too much interference in the image of the reference plane (reflection too weak).	
The device is inclined by more than 45 °.	► Reduce the inclination of the device. ► Mount the device at another location.
Objects moved in the field of view of the device during the teach process.	► Avoid movements in the field of view of the device.

After a successful teach process the internal coordinate system of the device aligns to the reference plane. This ensures that the measurement points on the reference plane are displayed in an even colour.

► After the problem has been solved, click [Teach] again.

► Click [Next].

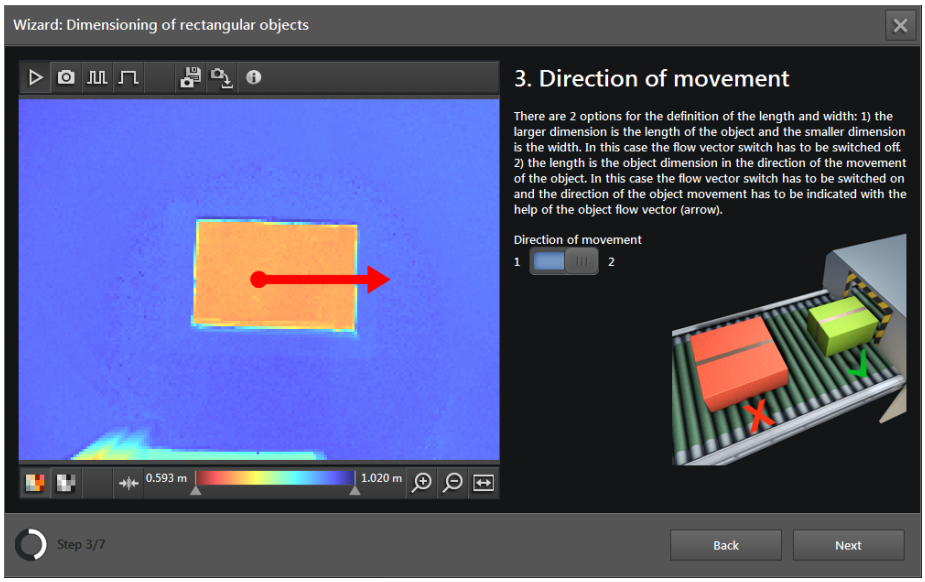
Step 3: Direction of movement
In this step you define which side of the object is considered as length and which side as width. The height is the distance between the highest point of the object against the reference plane.



► Set [Direction of movement]:

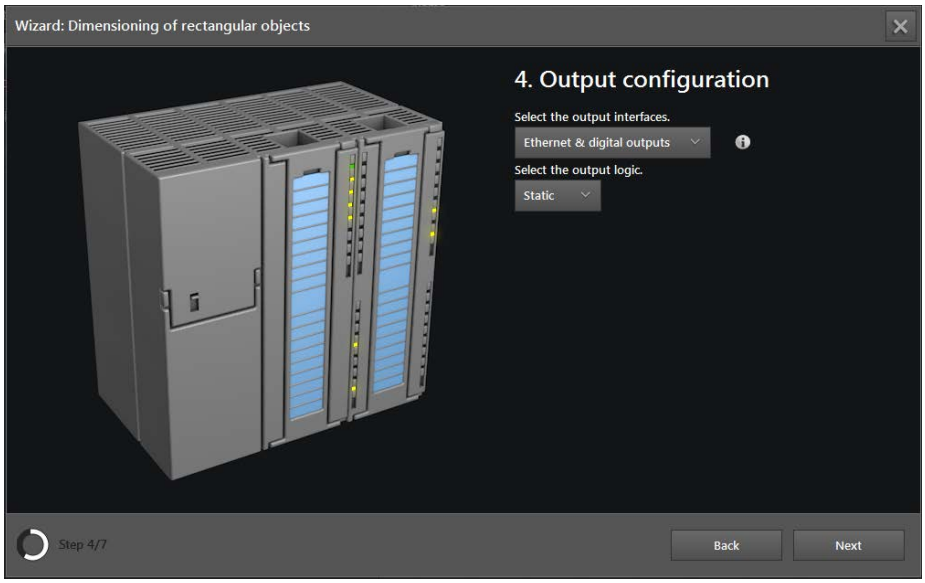
- Direction of movement ""off" (1): Irrespective of the orientation of the object the longer side is the length, the shorter side the width.
- Direction of movement "on" (2): The side along the direction of movement is the length. The side vertical to it is the width. The direction of movement is indicated by a red arrow.

► Turn the red arrow in the direction of movement of the objects in the image.



► Click [Next].

Step 4: Output configuration



► Select output interface.

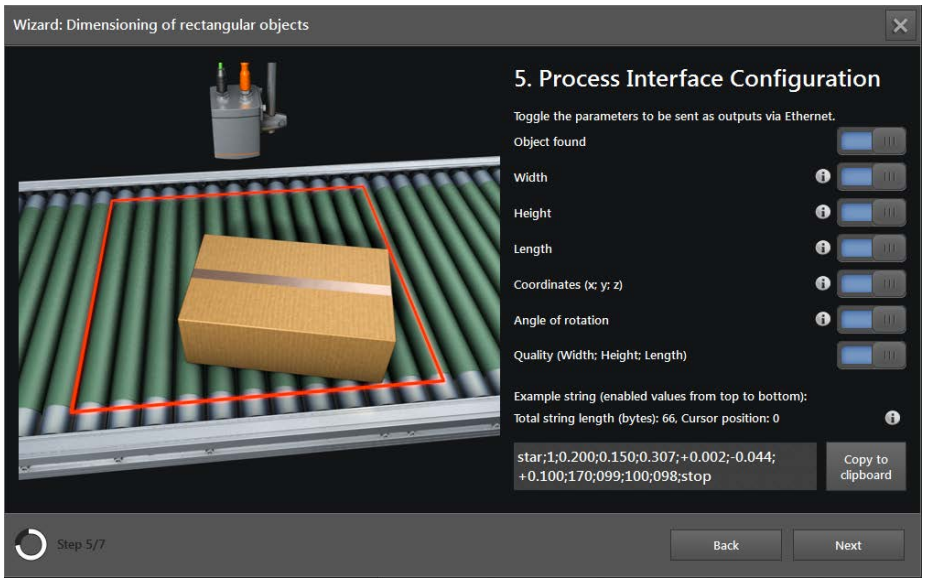
Option	Description
Ethernet	The measurement results regarding size, position, alignment, etc. are transmitted via the process interface. The process interface is set up in the next step. The digital outputs are off.
Digital outputs	The measurement results are compared with reference values. The logical values determined from these results control the digital output signals. No measurement results are transmitted via the process interface.
Ethernet & digital outputs	Both outputs are used at the same time.

► If the digital outputs are on, select duration of the output pulse: [Static] or value in ms (range 10…2500 ms in steps of 10 ms).

► Click [Next].

Step 5: Process interface

If the digital outputs are switched on (→ Step 4), the wizard will skip this step.



► Select via the buttons which parameters are to be transmitted via the process interface (Ethernet).

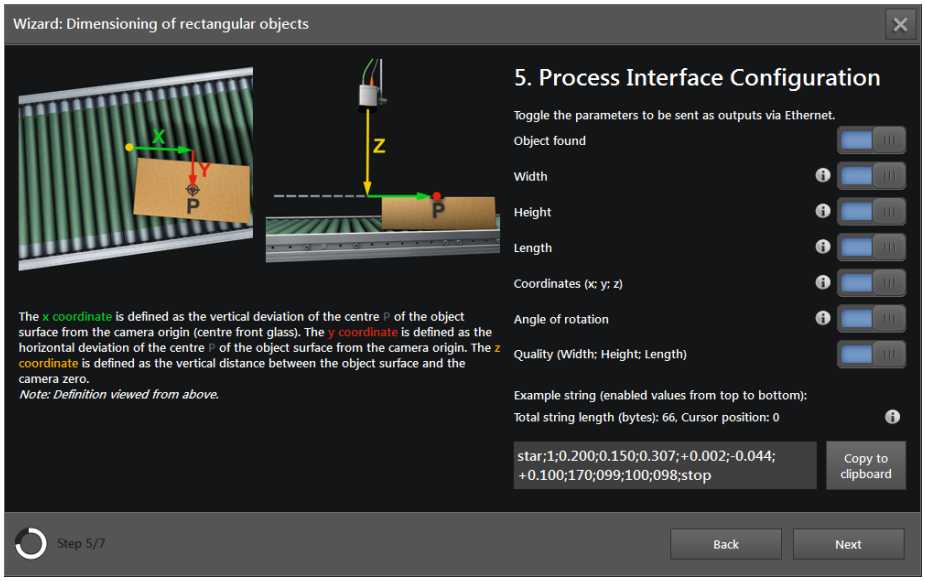
Parameters	Definition
Object found	1 = yes (object found) 0 = no (no object found)
Width	Width of the object in m
Height	Height of the object in m
Length	Length of the object in m
Coordinates (x, y, z)	Coordinates of the centre of the object in m
Angle of rotation	Angle between the X axis and the side defined as length in degrees
Quality (width, height, length)	Quality of the values for width, height and length of the object on a scale from 0 to 100 (0 = bad, 100 = good) The value for the height indicates how flat the surface is.The values for length and width indicate how straight the edges are.

The definition of the parameters "length" and "width" depends on the setting of the direction of movement (→ Step 3).

With a click on the button next to the requested parameter the definition of the parameter is displayed.

The button at the bottom right opens a help text regarding the process interface.

Example: Definition of the parameter "coordinates (x, y, z)"

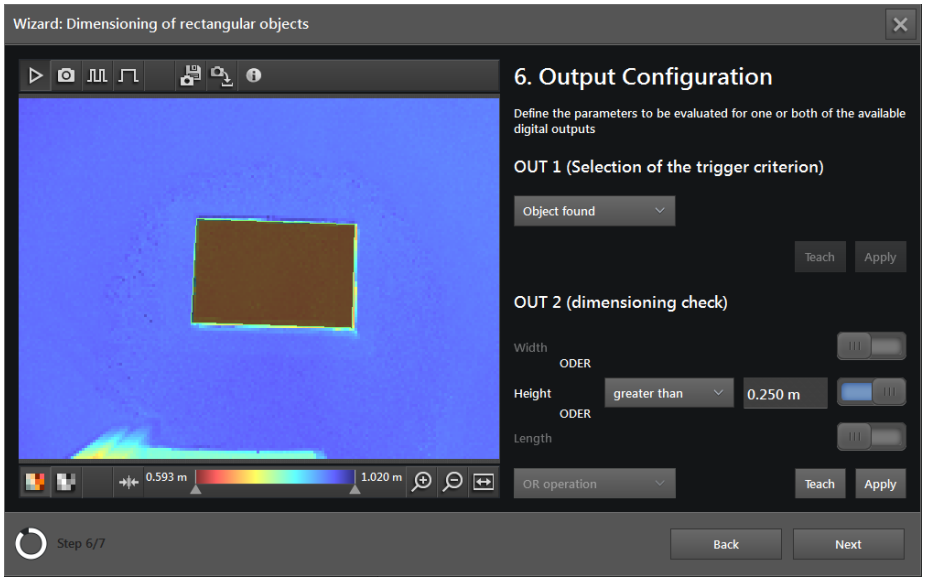


Under the parameters the currently determined output string of the device is displayed as an example. The output string can be copied to the Windows clipboard.

► Click [Next].

Step 6: Output configuration of the digital outputs

If only the process interface (Ethernet) is switched on (→ Step 4), the wizard will skip this step.



Configure output 1:

Output 1 can be used as a trigger for an external controller

► Select switch criterion for output 1.

Parameter	Definition
None	Output inactive
Object found	1 = yes (object found) 0 = no (no object found)
Width	The measured value is compared with the set limit. Possible conditions for the comparison: "less than" "greater than" Logical value provided: 1 = yes (condition met) 0 = no (condition not met)
Height	
Length	
Position X	
Position Y	
Position Z	
Angle of rotation	
Quality width	
Quality height	
Quality length	

► Set the following for a parameter with limit:

- Set the comparison condition to "less than" or "greater than".
- Enter a limit.
- As an alternative place an object as a reference under the device and click [Teach] to use the measured value of the object as limit.
- Click [Apply] to save the settings.

The ifm Vision Assistant calculates the actually used limits as follows:

- With "greater than": limit = measured value + 0.01 m
- With "less than": limit = measured value - 0.01 m

Configure output 2:

Via output 2 a value for checking the size of the object can be provided. For the value provided the measurement results of length, width and height can be combined by means of the logical operator AND or OR.

► Set the buttons of the requested dimensions to "on".

► For each selected dimension set the comparison condition to "less than" or "greater than".

► Enter a limit for each selected dimension.

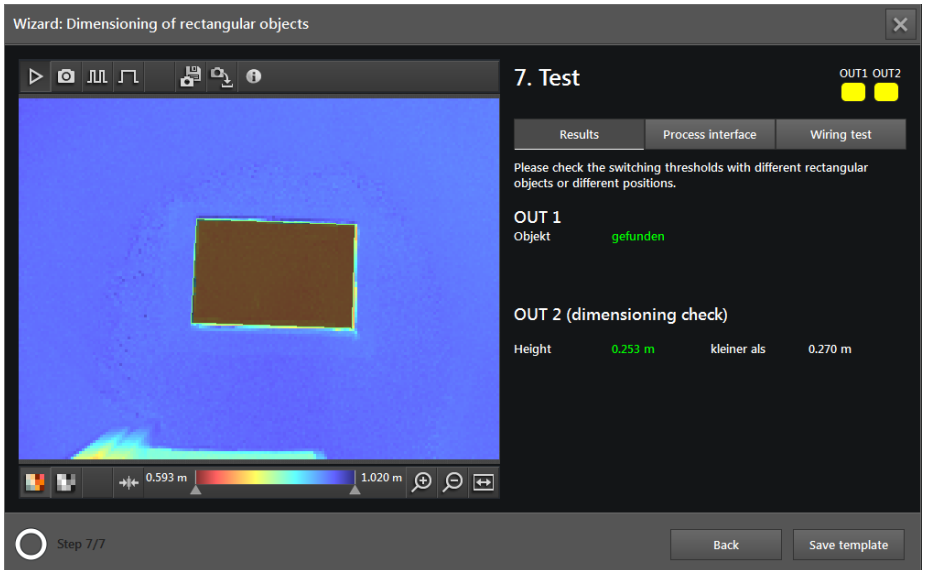
► As an alternative place an object as a reference under the device and click [Teach] to use the measured value of the object as limit.

► Set if the results are to be combined by means of the logical operator AND or OR.

► Click [Next].

Step 7: Test
In the final step the functions of the application are tested:

- Logical output signals of the digital outputs
- Output of the process interface
- Wiring



The device image and the object found are displayed on the left.

At the top right the status LEDs of the outputs are shown.

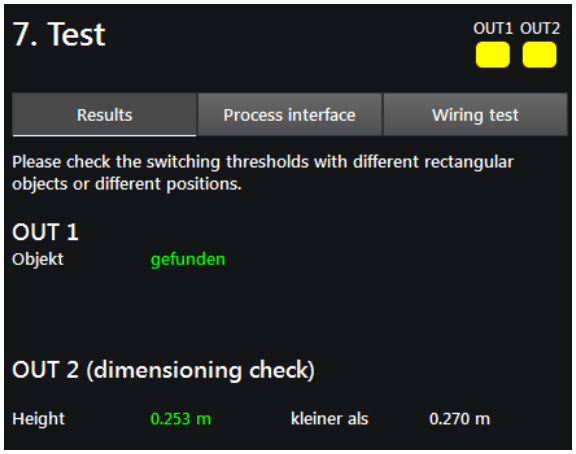
- If an output is active, the LED is continuously on. The setting to a pulse or [Static] in step 4 has no effect on this.

The LEDs for OUT1 and OUT2 shown on the screen are identical with the LEDs on the device.

With the buttons under the LEDs it is possible to switch between the following screens:

- Results
- Process interface
- Wiring test

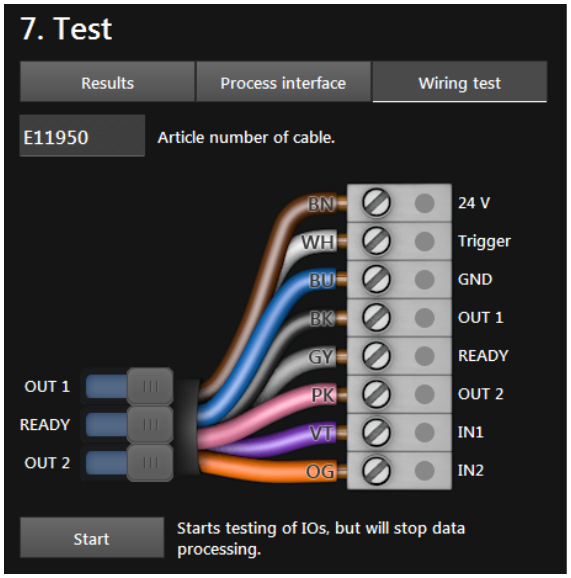
Results
The window "Results" shows the result of the digital outputs as well as the measurement results, the set comparison logic and its results.



► Test output with different objects, if necessary.

Process interface
The window "Process interface" shows the measurement results of the parameters configured for the transmission in step 5 (→ „6.3.3 Transmit process values via EtherNet/IP“). The output string transmitted by the device via the process interface is shown below the table. The output string can be copied to the Windows clipboard.

Wiring test
In the window "Wiring test" the wiring of the device to the control unit can be tested. The test is carried out in real time and shows the output and input signals at the corresponding wires. In the simulation mode, the digital outputs can be manually controlled to test the connection to an external control unit irrespective of the application.



► Click the field [Article number of cable] and select the cable from the list or enter the article number.

> The wiring and pin configuration of the selected cable is shown.

► Click [Start] to start the simulation mode.

► Click [OUT 1] to switch the signal at "OUT 1" on or off.

► Click [Ready] to switch the signal at "READY" on or off (ready for next trigger).

► Click [OUT 2] to switch the signal at "OUT 2" on or off.

► If the inputs are used, test the input signals at input 1 and input 2.

The inputs can for example be used for application switching.

► Click [Stop] to stop the simulation mode.

6.5.2 Activate object dimensioning

► If all settings are made, click [End] to save the application.

> The device activates and starts the application.

> The monitoring window opens. Under the tab "Results" a table with all values of the object found is displayed (→ „7.6.4 Display of the model results of object dimensioning“).

6.5.3 Transmit process values via EtherNet/IP

The device can transmit the process values to a PLC via the EtherNet/IP fieldbus. The process values are displayed in the ifm Vision Assistant as output string as shown below:

```
star;1;0.200;0.150;0.307;+0.002;-0.044;
+0.100;170;099;100;098;stop
```

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- The output string can be set. The process values to be transmitted can be set in the ifm Vision Assistant.
- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

star;1;0.104;0.088;0.109;+0.021;-0.011;+0.389;158;097;094;097;stop

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0000_0000 2#0010_0000	Binary Binary	1.5		Command word displayed backwards	• Bit 1.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0011 2#0000_0000	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9 10 11	s t a r	ASCII ASCII ASCII ASCII	star		Start string	
12 13	2#0000_0001 2#0000_0000	Binary Binary	1		Result bit	0 = no box found 1 = box found
14 15	104 0	Decimal Decimal	104	mm	Width	
16 17	88 0	Decimal Decimal	88	mm	Height	
18 19	108 0	Decimal Decimal	109	mm	Length	
20 21	21 0	Decimal Decimal	21		x coordinate	
22 23	-11 -1	Decimal Decimal	-11		y coordinate	
24 25	-124 1	Decimal Decimal	389		z coordinate	
26 27	-98 0	Decimal Decimal	158		Degree of rotation	
28 29	97 0	Decimal Decimal	97		Quality width	
30 31	93 0	Decimal Decimal	94		Quality height	
32 33	97 0	Decimal Decimal	97		Quality length	
34 35 36 37	s t o p	ASCII ASCII ASCII ASCII	stop		Stop string	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.5.4 Transmit process values via PROFINET

The device can transmit the process values to a PLC via the PROFINET fieldbus. In the ifm Vision Assistant the process values are displayed as output string as shown below:

```
star;1;0.200;0.150;0.307;+0.002;-0.044;
+0.100;170;099;100;098;stop
```

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- The output string can be set. The process values to be transmitted can be set in the ifm Vision Assistant.
- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

star;1;0.104;0.088;0.109;+0.021;-0.011;+0.389;158;097;094;097;stop

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Command word displayed backwards	• Bit 0.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Binary Binary			Synchronous / asynchronous message identification	
4 5	2#0000_0000 2#0000_0011	Binary Binary	3		Message counter	• The device has received 3 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	2#0000_0000 2#0000_0000	Binary Binary			Reserved	
8 9 10 11	s t a r	ASCII ASCII ASCII ASCII	star		Start string	
12 13	2#0000_0000 2#0000_0001	Binary Binary	1		Result bit	0 = no box found 1 = box found
14 15	0 104	Decimal Decimal	104	mm	Width	
16 17	0 88	Decimal Decimal	88	mm	Height	
18 19	0 109	Decimal Decimal	109	mm	Length	
20 21	0 21	Decimal Decimal	21		x coordinate	
22 23	-1 -11	Decimal Decimal	-11		y coordinate	
24 25	1 -124	Decimal Decimal	389		z coordinate	
26 27	0 -98	Decimal Decimal	158		Degree of rotation	
28 29	0 97	Decimal Decimal	97		Quality width	
30 31	0 94	Decimal Decimal	94		Quality height	
32 33	0 97	Decimal Decimal	97		Quality length	
34 35 36 37	s t o p	ASCII ASCII ASCII ASCII	stop		Stop string	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.5.5 Transmit process values via TCP/IP

The device can transmit the process values to a PLC via the TCP/IP protocol. The process values to be transmitted can be selected in the ifm Vision Assistant. In the ifm Vision Assistant the process values are displayed as output string as shown below:

```
star;1;0.200;0.150;0.307;+0.002;-0.044;
+0.100;170;099;100;098;stop
```

In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Semicolons ";" in the output string are not transmitted.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows (data type: ASCII):

star;1;0.104;0.088;0.109;+0.021;-0.011;+0.389;158;097;094;097;stop

Process value	Unit	Description
star		Start string
1		Object found
0.104	m	Width
0.088	m	Height
0.109	m	Length
+0.021		x coordinate
-0.011		y coordinate
+0.389		z coordinate
158		Degree of rotation
097		Quality width
094		Quality height
097		Quality length
stop		Stop string

6.6 Level measurement

The "level measurement" application configures the device to measure levels in containers.

Level requirements for accurate detection:

- Surface with diffuse reflections
- Shiny surface: Avoid direct reflection back to the device

Fully transparent or reflective surfaces cannot be measured reliably.

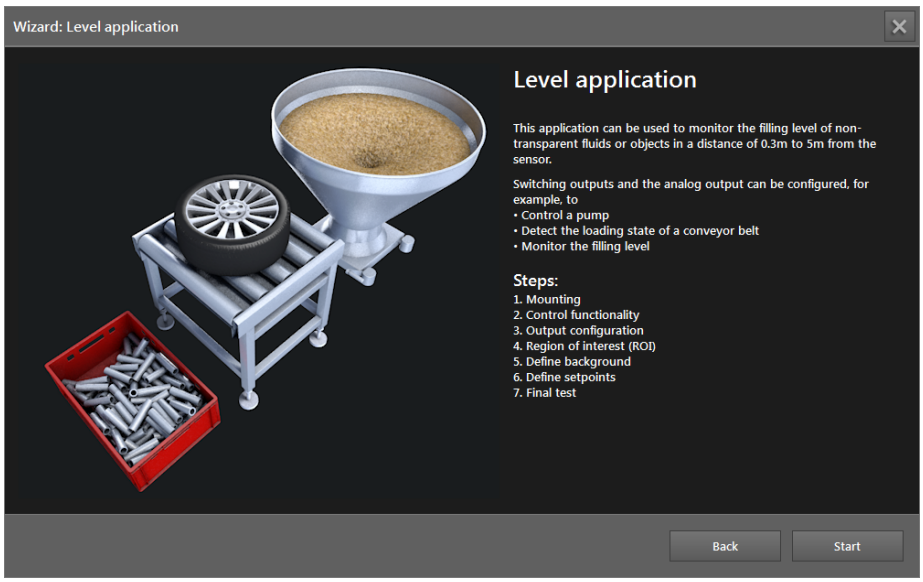
Requirements for the installation of the device to achieve good measurement results:

- Mount the device as vertically as possible over the measuring zone so that the object is measured from above.

If the device is inclined, accuracy is reduced. In case of an inclination over 45°, the application will not work.

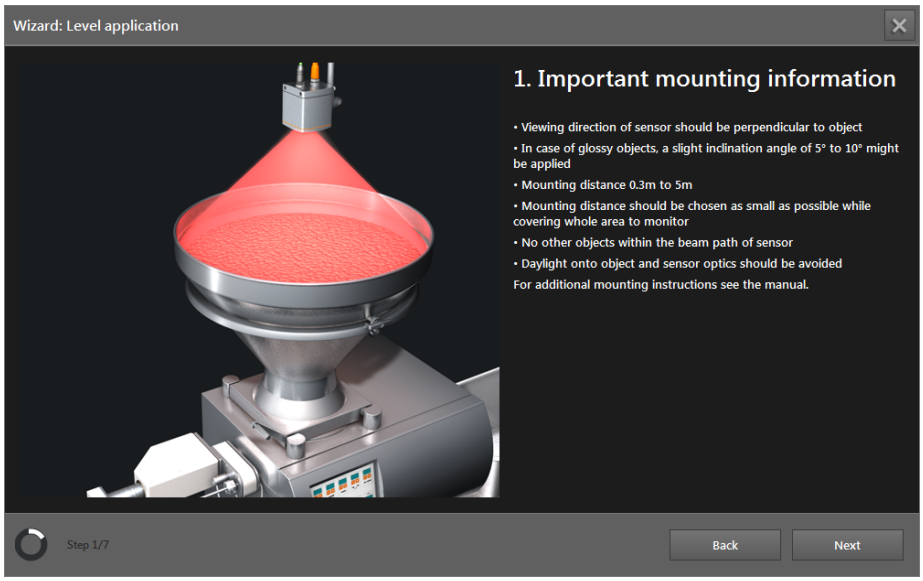
- Install the device at a distance so that the complete objects to be measured are in the field of view of the device and there is still some space to the outer edge on all sides.
- Measuring distance for most applications: 1 to 2 metres
- Nothing in the field of view, including the background, may be farther than 5 m away from the device (radially).

6.6.1 Set up level measurement



► Click [Start] to start the configuration of the application.

Step 1: Important mounting information

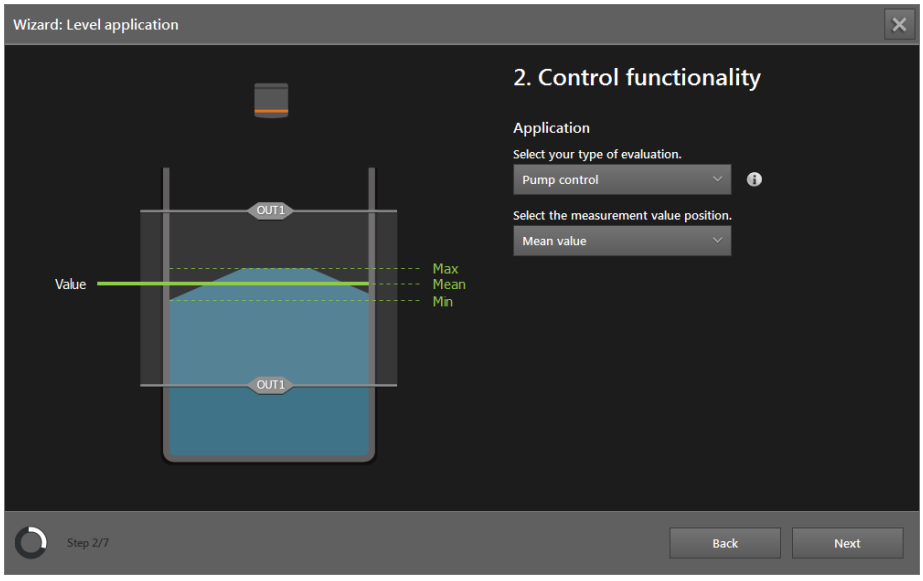


Observe the mounting information of the sensor.

For more information please refer to the operating instructions.

► Click [Next].

Step 2: Control functionality



► Select evaluation.

Selection	Description
Threshold switch	The level is evaluated within the switching thresholds SP1 and SP2.
Double threshold switch	Two areas are defined with the switching thresholds SP1 and SP2 (a total of 4 switching thresholds). The level is evaluated within the areas.
Pump control	The minimum level is defined with switching threshold SP1. As long as the measured value is below this level, the pump remains switched on and the filling process continues. The maximum level is defined with switching threshold SP2. If the measured value exceeds this level, the pump is switched off and the filling process stops.
Analogue	The current level is directly provided as a current / voltage signal via an analogue output. The switching threshold SP1 is defined as 4 mA / 0 V and SP2 as 20 mA / 10 V.

► Select measurement task.

Selection	Description
Mean value	The mean value of all measured values in the ROI is compared with the switching thresholds.
Minimum	The minimum measured value in the ROI is compared with the switching thresholds.
Maximum	The maximum measured value in the ROI is compared with the switching thresholds.

► Select mode.

> The mode can only be selected if the type of evaluation is "analogue".

Selection	Description
Voltage	The current level is directly provided as a voltage signal via an analogue output. The switching thresholds are defined as 0 V and 10 V.
Current	The current measured level is directly provided as a current signal via an analogue output. The switching thresholds are defined as 4 mA and 20 mA. The analogue output must be used with a load (load resistor).

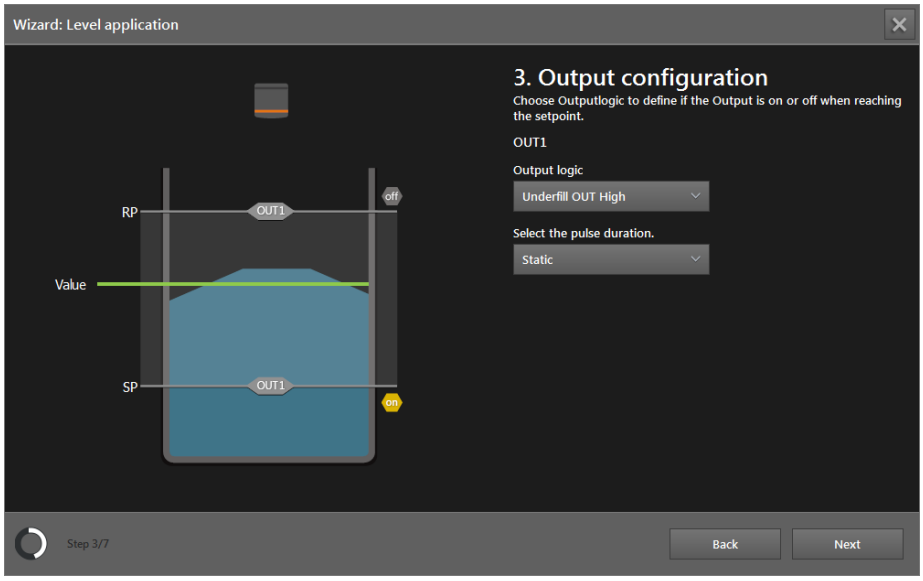
► Select direction.

> The direction can only be selected with the evaluation "analogue".

Selection	Description
Rising	The switching threshold SP1 is defined as 4 mA / 0 V and SP2 as 20 mA / 10 V.
Falling	The switching threshold SP1 is defined as 20 mA / 10 V and SP2 as 4 mA / 0 V.

► Click [Next].

Step 3: Output configuration



► Invert output function.

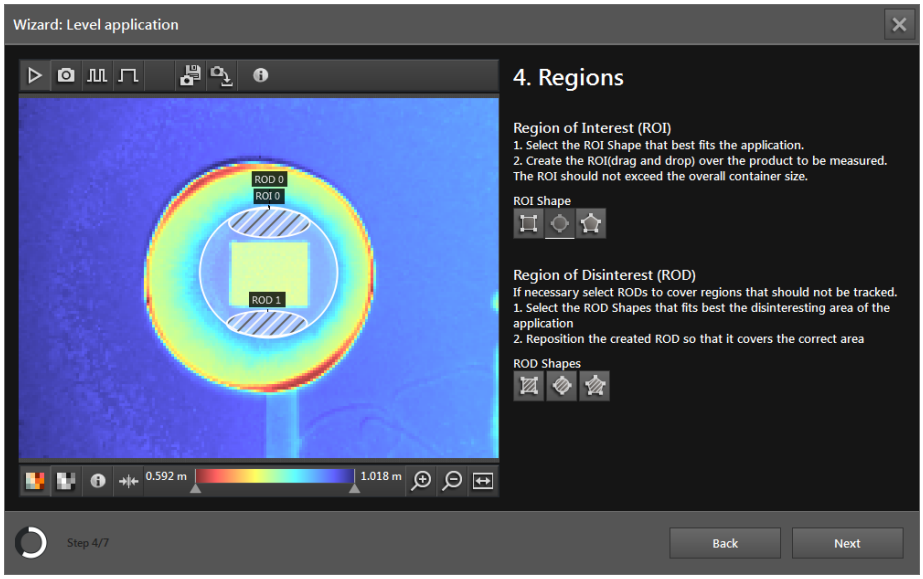
Selection	Description
Underfill switched	The output value corresponds to an NO contact (normally open). The threshold values correspond to the switching values of the hysteresis.
Overfill switched	The output value corresponds to an NC contact (normally closed). The threshold values correspond to the switching values of the hysteresis.

► Select pulse duration.

Selection	Description
Pulsed	If a level outside the switching threshold is measured, the corresponding output is switched to logical one (high) for the set pulse duration and then switches back to logical zero (low). It is necessary to specify the pulse duration in ms (range 10...2500 ms in steps of 10 ms).
Static	If a level outside the switching threshold is measured, the corresponding output is set to logical one (high) and remains at this value until the next measurement.

► Click [Next].

Step 4: Regions



The window "Regions" displays live images to set the number, shape and size of the ROI (region of interest) and the RODs (region of desinterest).

► If not selected, set the option [Live image] (→ "6.1 Live image display of the set-up wizard").

► Place a container in the middle under the device and meet the following conditions by changing the position of the container and / or the device:

- The container is fully in the image and all corners are visible.
- The distance to the device is between 0.3 m and 5 m.
- No object in the image section (including the background) is farther than 5 m away from the device.

An inclined view distorts the object grid and makes it more difficult to detect the objects in the ROI.

► Align the device as vertically as possible to the container.

► In case of shiny surfaces (e.g. polished metal, products wrapped in foil):
Avoid direct reflections of the internal light by slightly tilting the device.

► Set view options so that the ROI can be easily set
(→ „7.2 View options“).

It depends on the shape and the reflectivity of the containers and objects whether a distance image or an amplitude image (brightness) is better suited for display.

- Amplitude image: Container and objects with high-contrast reflectivity values in the infrared range
- Distance image: Characteristic shapes of the container and the objects (e.g. crate with bottles)

► Click  after the view options have been changed to optimise the image.

► Select the ROI shape that suits the application best.

► Create the ROI above the container to be measured.

> The ROI should not exceed the size of the container.

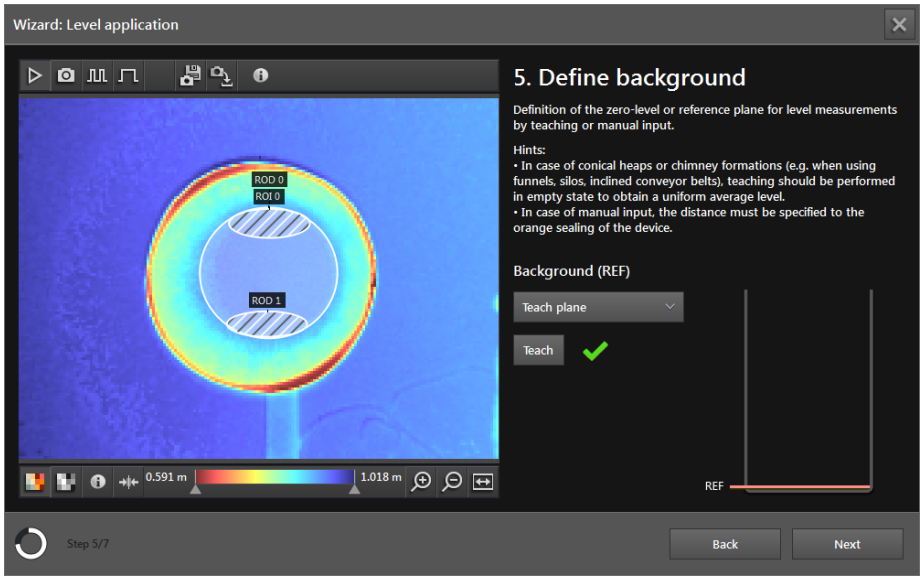
If necessary, the RODs (region of desinterest) can be used to define areas which are not to be evaluated.

► Select the ROD shape best suited for the area which is not to be evaluated.

► Change the size and the position of the ROD so that it covers the requested area.

► Click [Next].

Step 5: Define background



The window "Define background" determines the reference or zero plane of the level measurement. It can either be set (use an average value from 20 measurements on an empty container) or entered manually.

Teach background

► Select "Teach plane" in the menu.

► Click the button [Teach].

> A successful teach process of the background is indicated by a green tick.

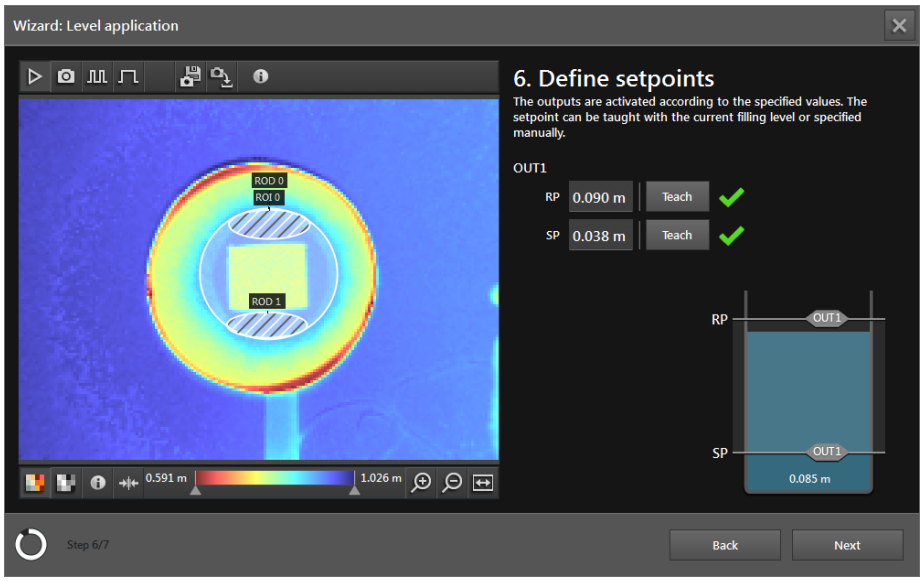
Enter background manually

► Select "Manual input" in the menu.

► In the field enter the height of the background in metres.

► Click [Next].

Step 6: Define setpoints



The outputs are switched according to the definition of the setpoints Each setpoint can either be entered manually or set with an appropriate quantity of the product in the container.

Enter setpoints manually

► Enter the setpoint values in the fields.

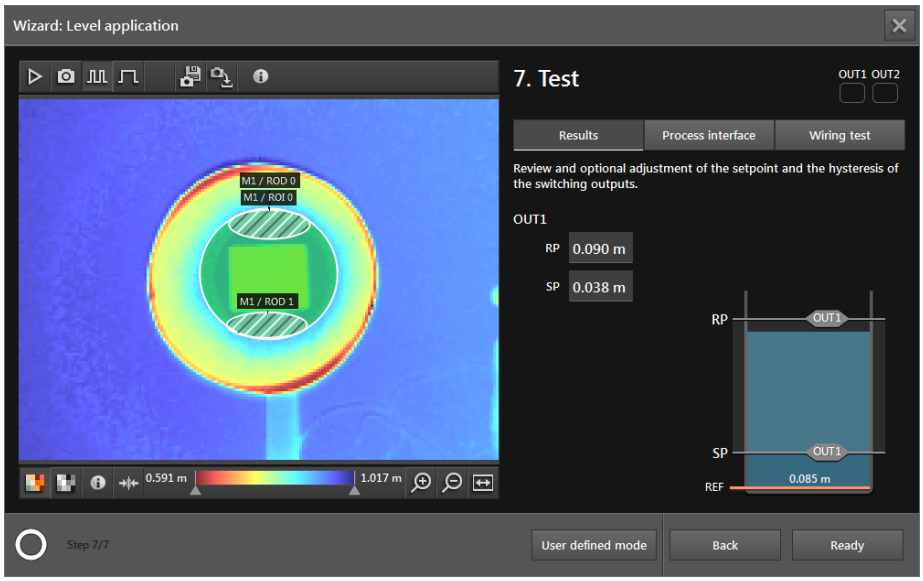
Teach setpoints

► Fill the container up to the corresponding setpoint.

► Click the button [Teach] of the respective setpoint.

► Click [Next].

Step 7: Test



In the final step the functions of the application are tested:

- Device limits (e.g. underfill, overfill)
- Output signals at the outputs
- Wiring

On the left the device image with the ROI and the measurement results are shown.

Colour	Description
Green	OK
Red	Overfill
Pink	Underfill
Olive green	Invalid
Yellow	Selected

At the top right the status LEDs of the outputs are shown.

- LED OUT1 yellow on: Underfill was measured and output 1 is active. LED OUT1 switches off as soon as overfill is measured.
- LED OUT2 yellow on: For the double threshold switch underfill was measured and output 2 is active. LED OUT2 switches off as soon as overfill is measured.
- If an output is active, the LED is continuously on. The setting to a pulse or [Static] in step 1 has no effect on this.

The LEDs for OUT1 and OUT2 shown on the screen are identical with the LEDs on the device.

With the buttons under the LEDs it is possible to switch between the following screens:

- Results
- Process interface
- Wiring test

Results

In the window "Results" the accuracy of the setpoints can be verified.

► Test the application by raising or lowering the level.

► If the test is not satisfactory, optimise settings such as:

– Go back to step 6 to adapt the setpoints.

– Go back to step 4 to set the ROI and the RODs again to redefine the background as described in step 5.

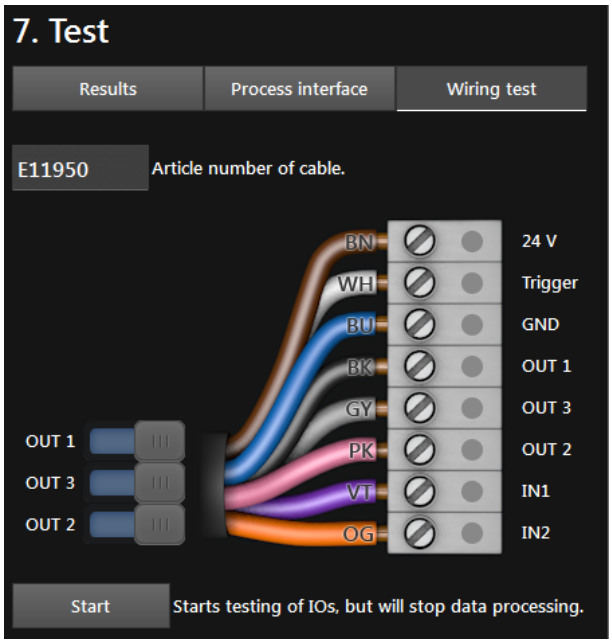
► If the anchor function has been activated, test it by moving and rotating the container.

Process interface

The window "Process interface" shows a table with the status of the ROI, the RODs and the process values. The output string transmitted by the device via the process interface is shown below the table. The output string can be copied to the Windows clipboard.

Wiring test

In the window "Wiring test" the wiring of the device to the control unit can be tested. The test is carried out in real time and shows the output and input signals at the corresponding wires. In the simulation mode, the digital outputs can be manually controlled to test the connection to an external control unit irrespective of the application.



► Click the field [Article number of cable] and select the cable from the list or enter the article number.

> The wiring and pin configuration of the selected cable is shown.

► Click [Start] to start the simulation mode.

► Click [OUT 1] to switch the signal at "OUT 1" on or off.

► Click [OUT 2] to switch the signal at "OUT 2" on or off.

► Click [OUT 3] to switch the signal at "OUT 3" on or off.

► If the inputs are used, test the input signals at input 1 and input 2.

The inputs can for example be used for application switching.

► Click [Stop] to stop the simulation mode.

6.6.2 Activate level measurement

► If all settings are made, click [End] to save the application.

> The device activates and starts the application.

> The monitoring window opens. Under the tab "Results" a bar graph is shown which is used to control the values of the active application (→ „7.6.3 Display of the model results of completeness monitoring“).

6.6.3 Transmit process values via EtherNet/IP

The device can transmit the process values to a PLC via the EtherNet/IP fieldbus. In the ifm Vision Assistant the process values are displayed as output string as shown below:

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

0070

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0000_0000 2#0010_0000	Binary Binary	1.5		Command word displayed backwards	Bit 1.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Decimal Decimal			Synchronous / asynchronous message identification	
4 5	30 0	Decimal Decimal	30		Message counter	• The device has received 30 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	0 0	Decimal Decimal			Reserved	
8 9	0 0	Decimal Decimal	0		Status of all ROIs (0 = bad, 1 = good)	Shows the status of the level measurement
10 11	0 0	Decimal Decimal	0		ROI ID	ROI status: 0 = good 6 = overfill 7 = underfill
12 13	7 0	Decimal Decimal	7		ROI status	
14 15	0 0	Decimal Decimal	0	mm	ROI value	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.6.4 Transmit process values via PROFINET

The device can transmit the process values to a PLC via the PROFINET fieldbus. In the ifm Vision Assistant the process values are displayed as output string as shown below:

Only one fieldbus can be active at a time. The fieldbus can be set (→ „11.3 Interfaces“).

The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Bytes 0 to 7 are part of the output string. They are not displayed in the ifm Vision Assistant (see screenshot above).
- Semicolons ";" in the output string are not transmitted.
- Float values are converted into 16-bit integers before the transmission.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows:

0070

Byte no.	Data	Encoding	Process value	Unit	Description	Comment
0 1	2#0010_0000 2#0000_0000	Binary Binary	0.5		Command word displayed backwards	Bit 0.5 indicates a successful trigger command
2 3	2#0000_0000 2#0000_0000	Decimal Decimal			Synchronous / asynchronous message identification	
4 5	0 30	Decimal Decimal	30		Message counter	• The device has received 30 messages. • Increments by 1 with each action (trigger, message sent etc.).
6 7	0 0	Decimal Decimal			Reserved	
8 9	0 0	Decimal Decimal	0		Status of all ROIs (0 = bad, 1 = good)	Shows the status of the level measurement

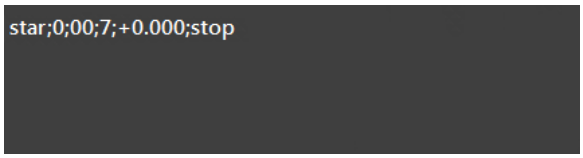
Byte no.	Data	Encoding	Process value	Unit	Description	Comment
10 11	0 0	Decimal Decimal	0		ROI ID	ROI status: 0 = good 6 = overfill 7 = underfill
12 13	0 7	Decimal Decimal	7		ROI status	
14 15	0 0	Decimal Decimal	0	mm	ROI value	

The incorrect execution of a command leads to the following status:

- Error bit = 1
- Command word is displayed backwards
- Asynchronous message bit = 0
- Asynchronous message identification = 0
- Message counter increments by 1

6.6.5 Transmit process values via TCP/IP

The device can transmit the process values to a PLC via the TCP/IP protocol. In the ifm Vision Assistant the process values are displayed as output string as shown below:



In the output string the process values are separated by a semicolon. The output string is transmitted to a PLC in the displayed sequence.

Observe the following notes to transmit the output string to a PLC:

- Semicolons ";" in the output string are not transmitted.
- All numerical values are converted into 16-bit integers before the transmission.

The output string is as follows (data type: ASCII):

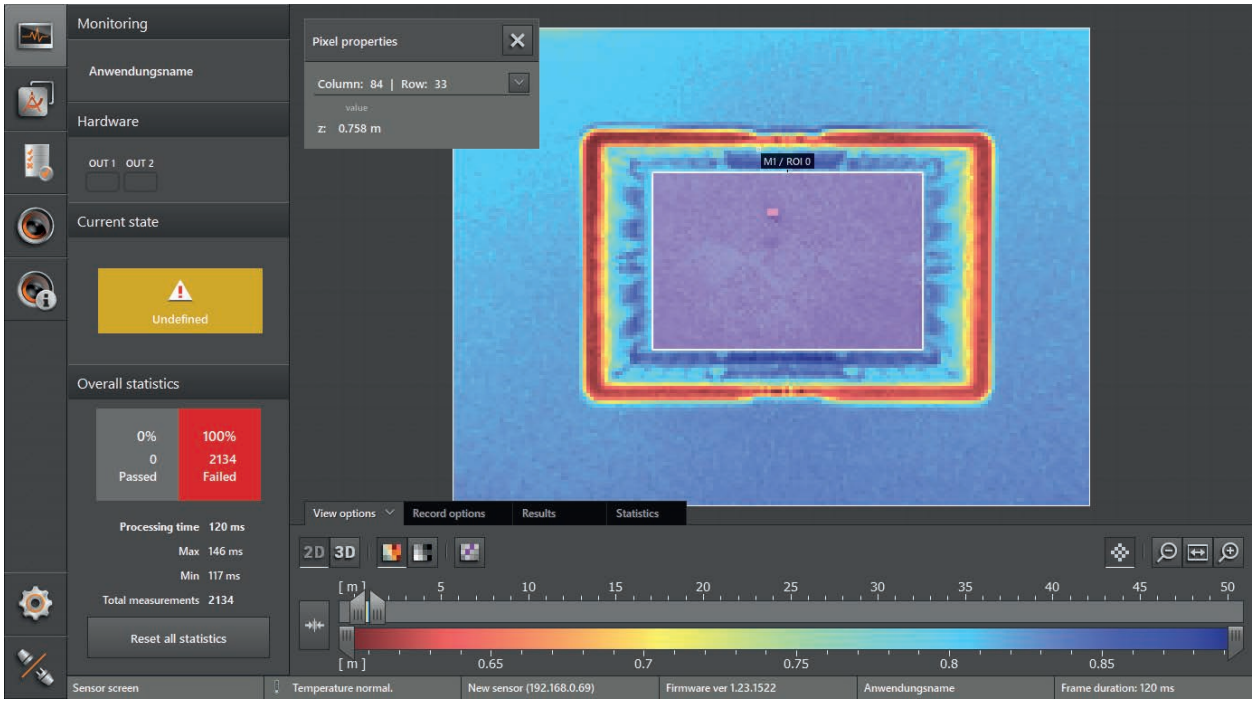
star;0;00;7;+0.000;stop

Process value	Unit	Description	
star		Start string	
0		Status of all ROIs (0 = bad, 1 = good)	
00 7 +0.000	 m	ROI ID ROI status ROI value	ROI status: 0 = good 6 = overfill 7 = underfill
stop		Stop string	

7 Monitoring window

The software will continue with the monitoring screen if a connection to the device is established and an active application is available. The device runs in the operating mode. In the monitoring window, the active application can be monitored but not interrupted or changed.

► Click  .



The following tabs are under the live image of the device:

- [View options] (→ „7.2 View options“)
- [Record options] (→ „7.5 Record options“)
- [Results] (→ „7.6 Results“)
- [Statistics] (→ „7.7 Statistics“)

7.1 Status indication

The status of the digital outputs and the statistics for the active application are displayed on the left of the monitoring window:

- Monitoring: The active application is displayed.
- Hardware: The status LED (OUT1, OUT2) is yellow on if there is a signal at the respective digital output.
- Current state: The current state of the device is indicated.
- Overall statistics
  - The statistically recorded values of all models of the active application are displayed. Via a counter the values "good / passed (green)" and "over SP2 / overfill (red) are counted. The ratio of the two values is indicated in per cent and highlighted in colour.
  - The evaluation time indicates the average, max. and min. time of the measurements.
  - The button "Reset all statistics" resets the overall statistics.

    Depending on the application an additional logic block "State definition: Pass/Fail" is necessary in the logic diagram so that the value "good / passed (green)" is counted in the overall statistics (→ „8.5 Create output logic“).

7.2 View options

► Click 2D or 3D to select the requested view.

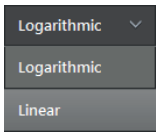
Button	Name	Description
2D	2D view	The central view shows the device data as a 2D visualisation (→ „7.3 2D view“).
3D	3D view	The central view shows the device data as a 3D visualisation (→ „7.4 3D view“).

The figures in the following chapters are examples. Depending on objects and individual settings, the representation may differ significantly.

7.3 2D view

► Click 2D to display the 2D view.

► Set 2D view.
The following setting options are available in the tab "View options":

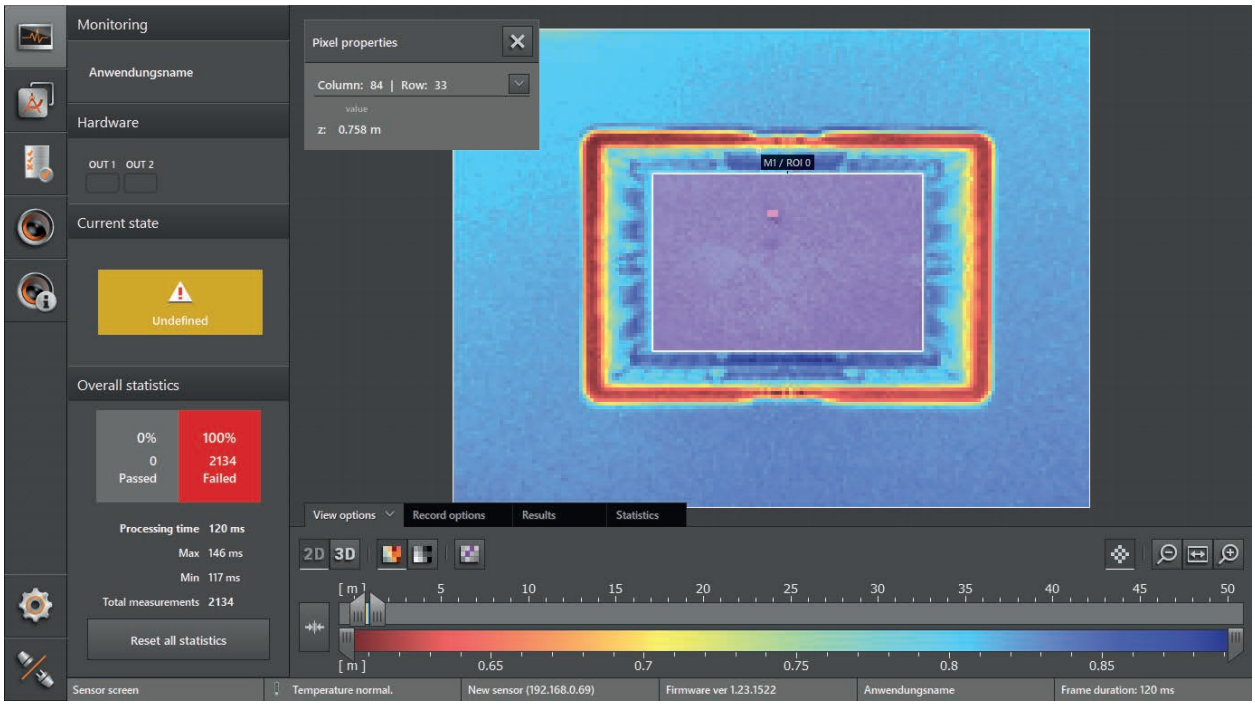
Button	Name	Description
	Distance image	Displays the pixels in the 2D view in relation to the distance values in colour.
	Amplitude image	Displays the pixels in the 2D view in relation to the amplitude values in shades of grey (brightness).
	Logarithmic	Displays the amplitude values of the 2D view in logarithmic shades of grey (only available for the amplitude image).
	Linear	Displays the amplitude values of the 2D view in linear shades of grey (only available for the amplitude image). The "linear" view is particularly helpful to set up the image.
	Show invalid pixels	If the function is active, invalid pixels are shown in "pink". If the function is deactivated, invalid pixels are shown in "black" in the distance image and in "blue" in the amplitude image.
	Pixel properties	Shows the window for the pixel properties.
	Zoom out	The 2D view is zoomed out.
	Zoom reset	Resets the image zoom to the default view.
	Zoom in	The 2D view is zoomed in.
	Rescale	Automatically sets the colour range to a suitable area. The settings of the slider bars are rejected.

The settings of the view (e.g. [Logarithmic] or [Linear]) only change the calculation and type of display. The application itself is not affected.

UK

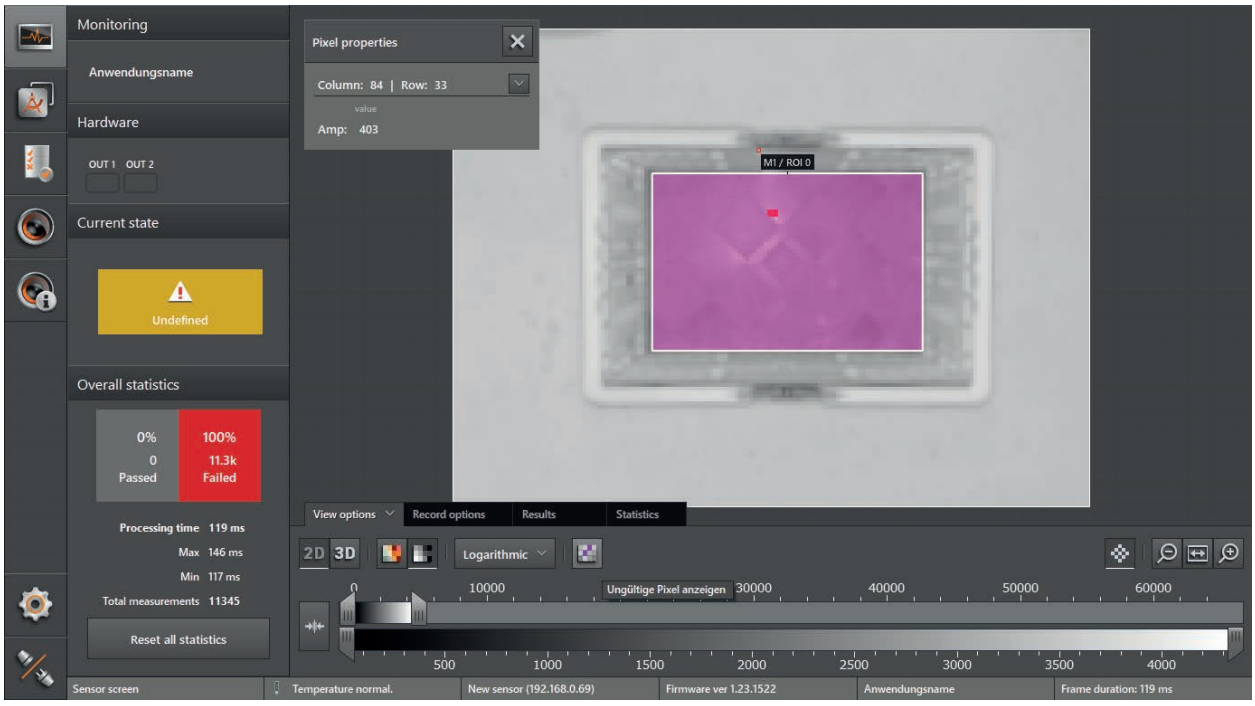
7.3.1 Distance image

► Click  to display the distance image.



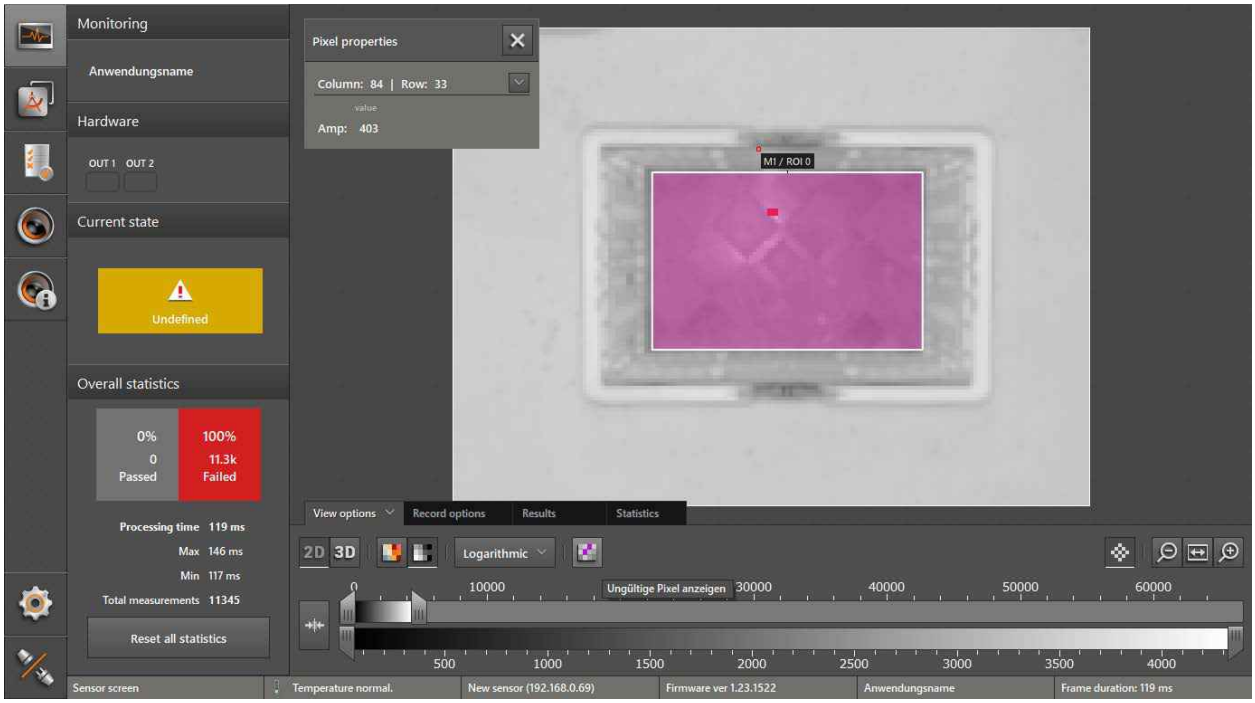
7.3.2 Amplitude image

► Click  to display the amplitude image.

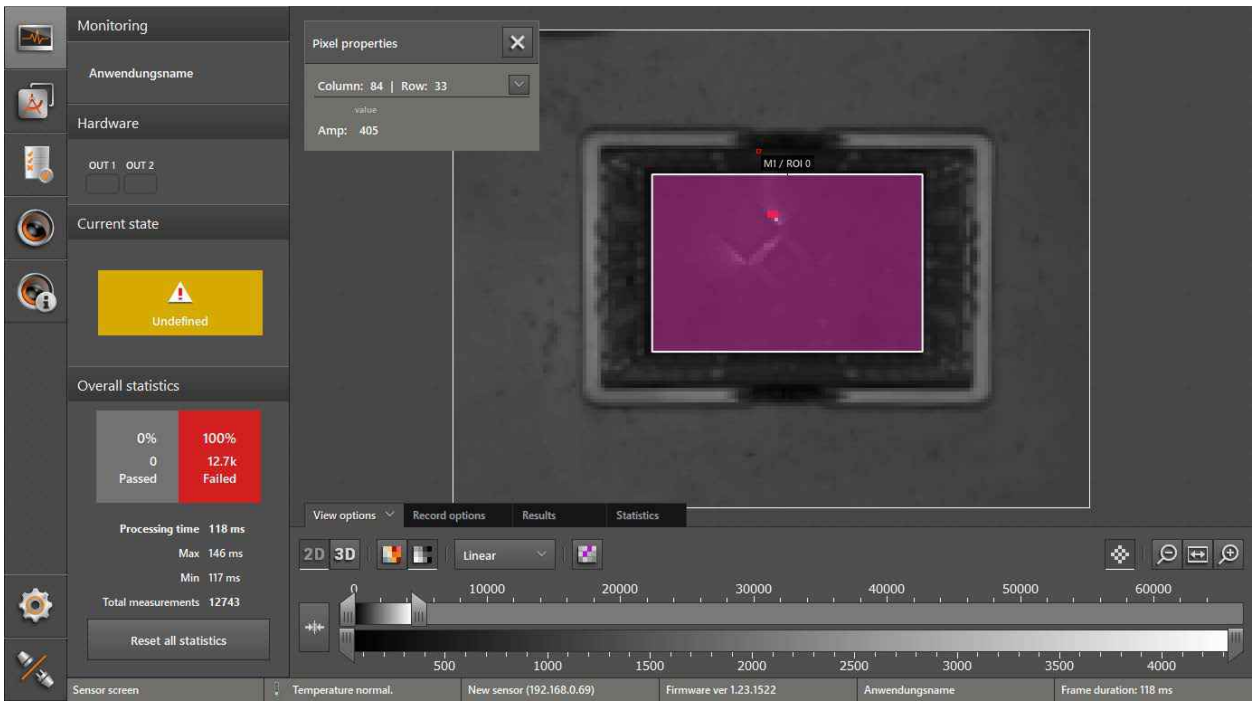


► Select the requested view via [Logarithmic] or [Linear].

Logarithmic view:



Linear view:

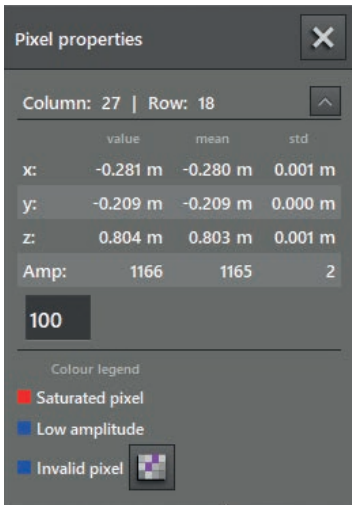


7.3.3 Pixel properties

In the 2D view the "pixel properties" display information about the selected pixel:

Field	Description
Column | Row	Indicates the number of columns and lines of a specific pixel.
x	x coordinate of the selected pixel: current measured value, mean value and deviation in metres.
y	y coordinate of the selected pixel: current measured value, mean value and deviation in metres.
z	z coordinate of the selected pixel: current measured value, mean value and deviation in metres.
Amp	Amplitude of the selected pixel.
Standard deviation	Via the numerical value the device determines the standard deviation of the selected pixel (preset value: 100).
Colour legend distance image	White: saturated pixels.
	Black: low amplitude.
	Pink: invalid pixel. If the"Show invalid pixels" button is deactivated, the invalid pixels are displayed in black.
Colour legend amplitude image	Red: saturated pixels.
	Blue: low amplitude.
	Pink: invalid pixel. If the "Show invalid pixels" button is activated, the invalid pixels are displayed in "blue".

► Click  to open the "Pixel properties" window.



Show pixel properties:

► Click the pixel in the 2D view.

> Position and z coordinate of the pixel are indicated in metres.

► Click  to open extended information.

► Click  to close extended information.

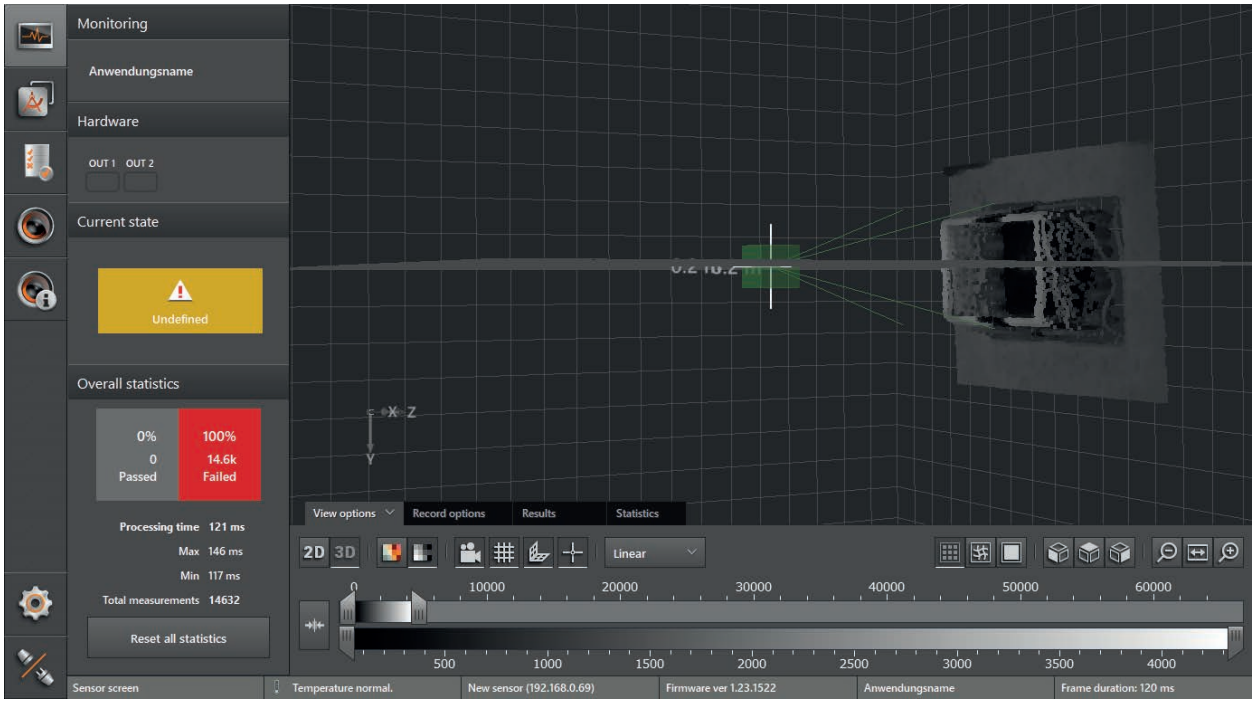
Invalid pixels

The invalid pixels are displayed with the button  in "pink".

If the function is deactivated, invalid pixels are shown in "black" in the distance image and in "blue" in the amplitude image.

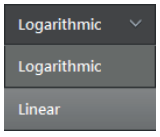
The display of invalid pixels is deactivated by default.

7.4 3D view



► Click 3D to show the 3D view.

► Set 3D view.
The following setting options are available in the tab "View options":

Button	Name	Description
	Distance image	Displays the pixels in the 3D view in relation to the distance values in colour.
	Amplitude image	Displays the pixels in the 3D view in relation to the amplitude values in shades of grey (brightness).
	Device position	Shows and hides the device position and angle of view in the 3D view.
	Grid	Shows and hides the plane grid (xz plane) in the 3D view.
	Background grid	Shows and hides a spatial grid (xy plane and yz plane) in the 3D view.
	Origin	Shows and hides the origin of the coordinate system in the 3D view.
	Logarithmic	Displays the amplitude values of the 3D view in logarithmic shades of grey (only for the amplitude image).
	Linear	Displays the amplitude values of the 3D view in linear shades of grey (only for the amplitude image).
	Points	Shows the data as a point cloud.
	Mesh	Shows the data as a mesh.
	Surface model	Shows the ascending gradients as colours.

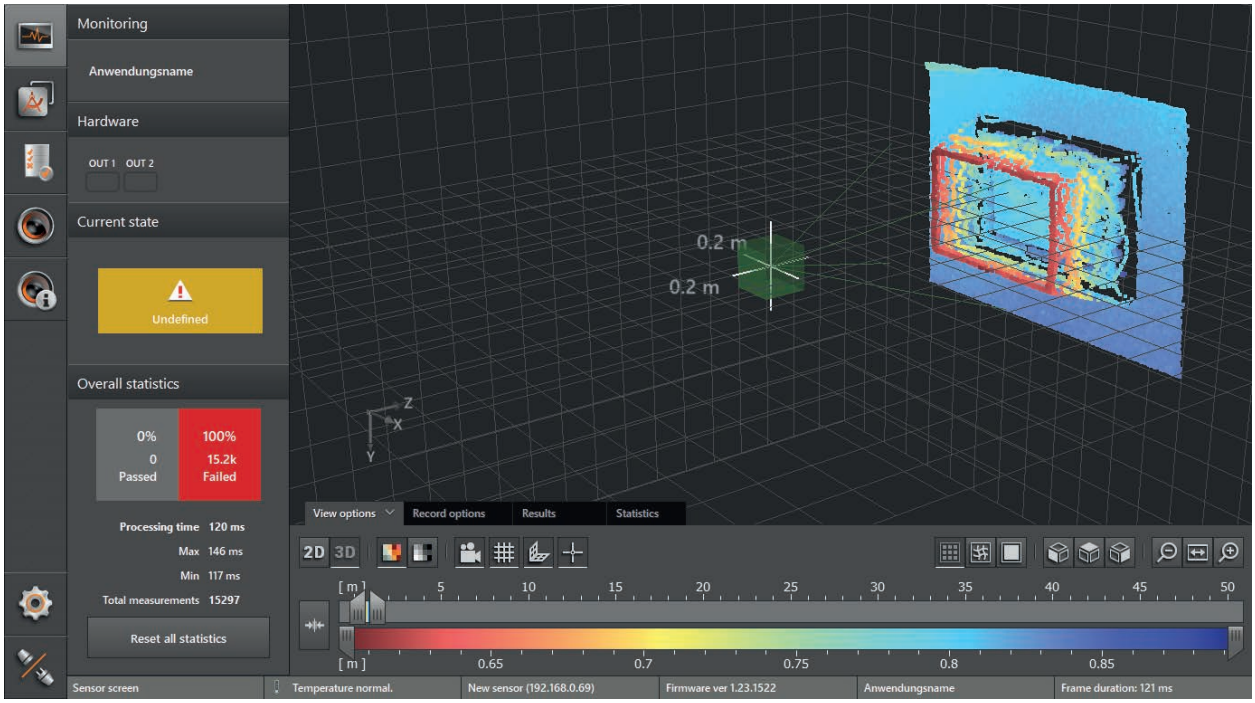
Button	Name	Description
	Rear view	Rotates the 3D view to the xy plane.
	Top view	Rotates the 3D view to the xz plane.
	Side view	Rotates the 3D view to the yz plane.
	Zoom out	The 3D view is zoomed out.
	Zoom reset	Resets the image zoom to the default view.
	Zoom in	The 3D view is zoomed in.

UK

The settings of the view (e.g. logarithmic or linear) only change the calculation and type of display. The application itself is not affected.

7.4.1 Distance image

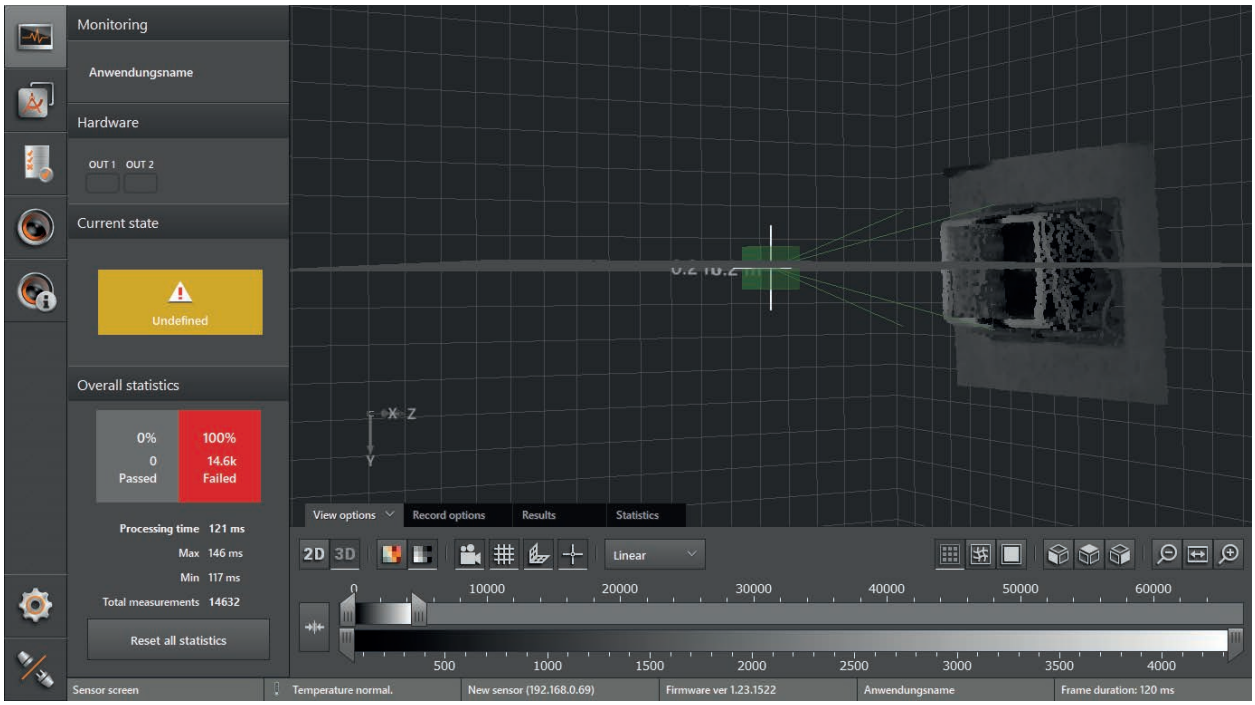
► Click  to display the distance image.



Representation in the 3D image	Description
Pixel position	Space coordinate of the pixel (x, y, z coordinates).
Pixel colour	Distance (z coordinate). The colour shade depends on the measured distance of the pixel and the setting of the colour scale (→ „7.4.5 Slider bar“).
Red	Value of the z coordinate ≤ minimum of the set colour scale.
Blue	Value of the z coordinate ≥ maximum of the set colour scale.

7.4.2 Amplitude image

► Click  to display the amplitude image.



► Select the requested view via [Logarithmic] or [Linear].

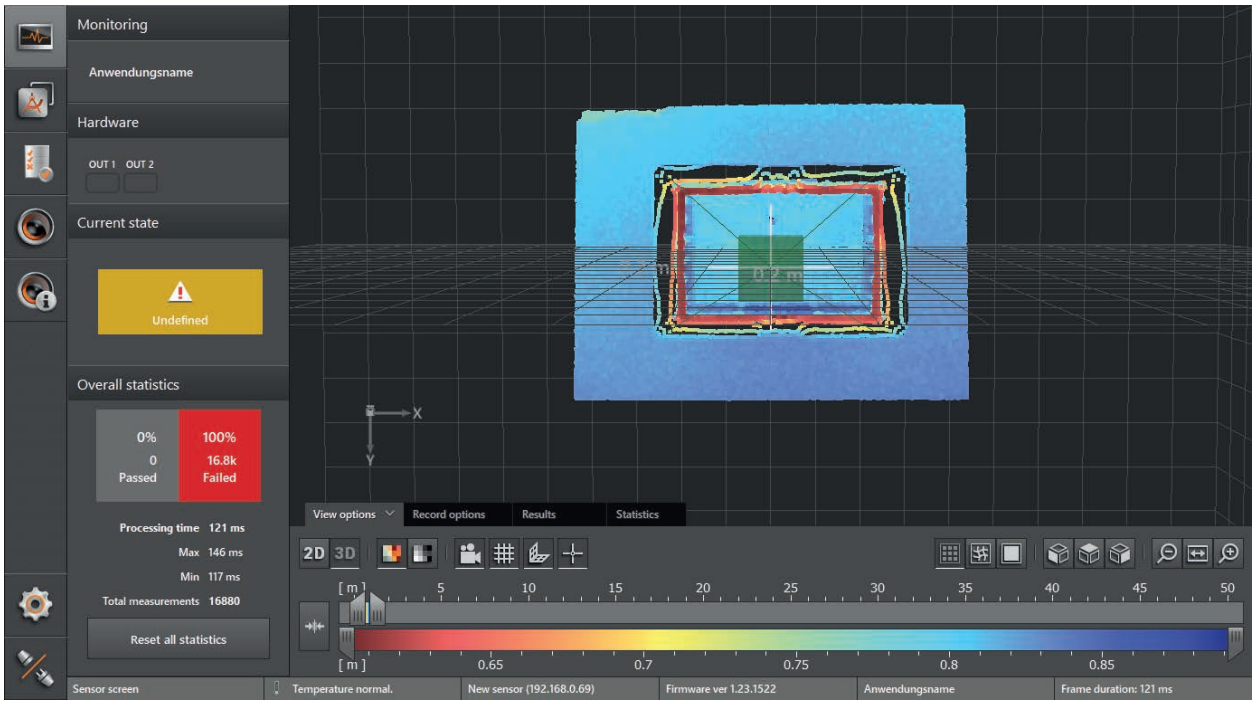
Representation in the 3D image	Description
Pixel position	Space coordinate of the pixel (x, y, z coordinates).
Pixel colour (grey scale)	Amplitude value. The brightness follows the measured amplitude and the setting of the grey scale linearly or logarithmically (→ „7.4.5 Slider bar“).
Black	Amplitude value ≤ minimum of the set scale.
White	Amplitude value ≥ maximum of the set scale.

7.4.3 Views in the coordinate system

The 3D view can be rotated to a preset view in the coordinate system.

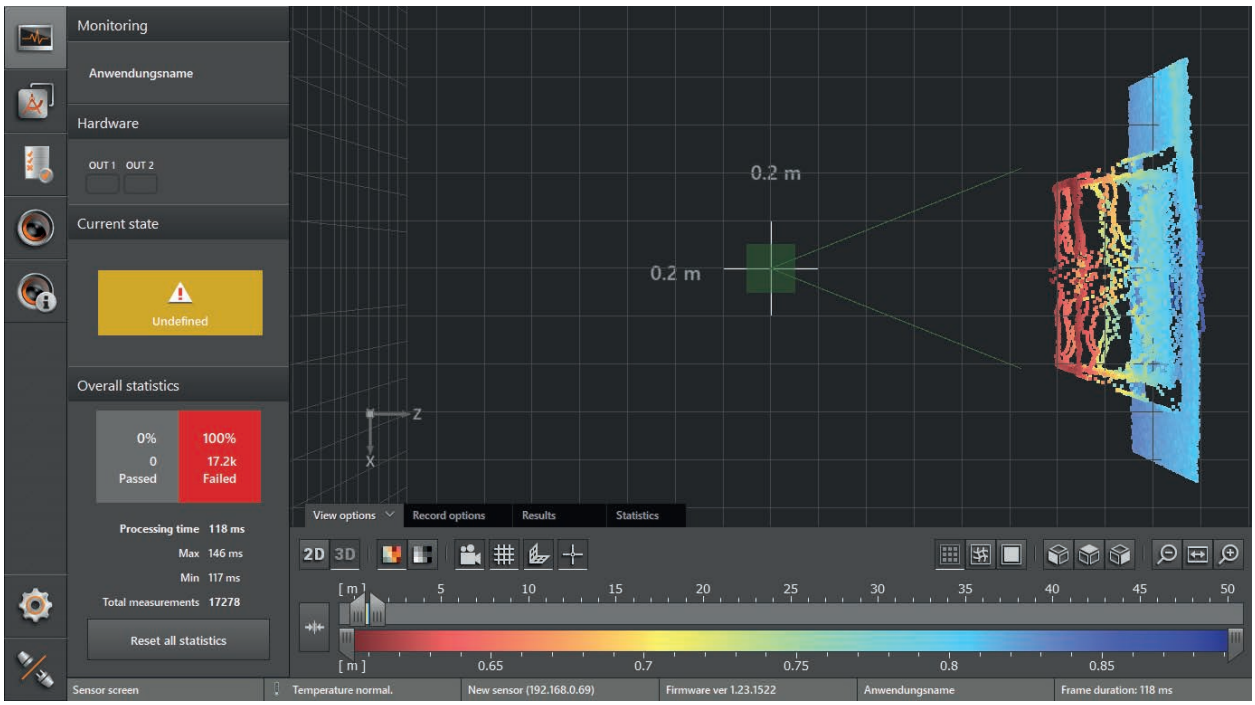
► Click  to show the rear view.

> The object is displayed on the xy plane.



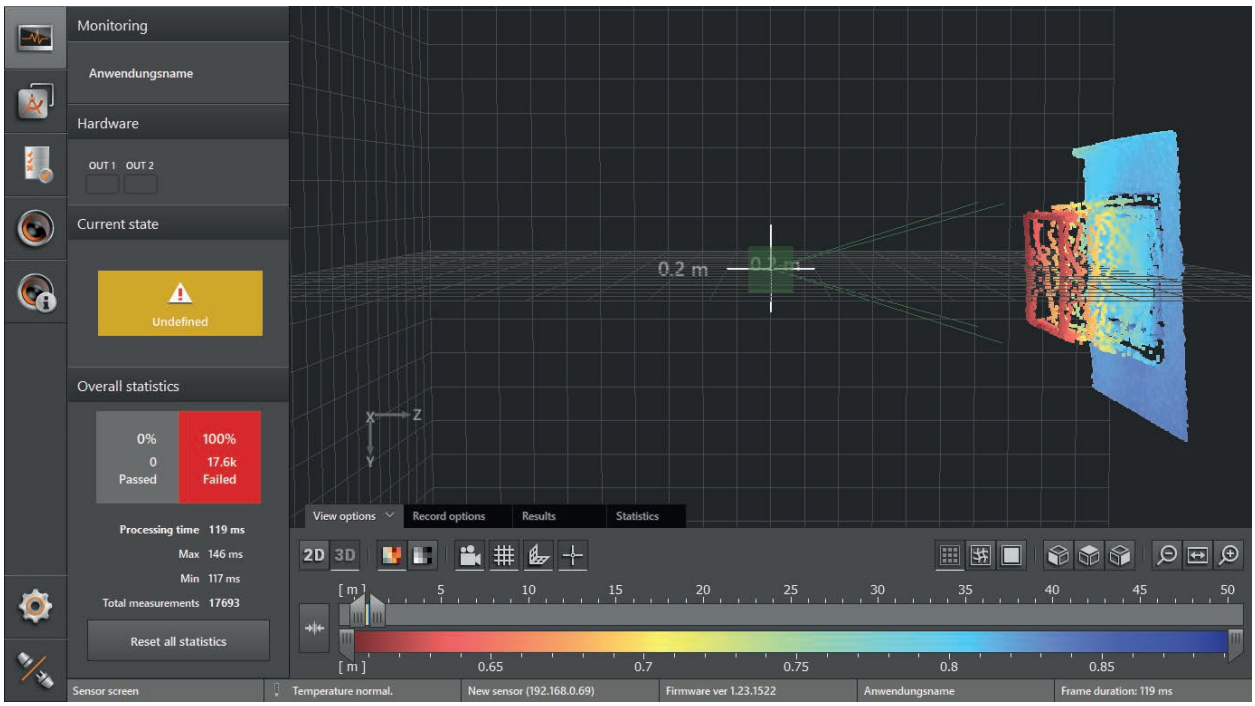
► Click  to show the top view.

> The object is displayed on the xz plane.



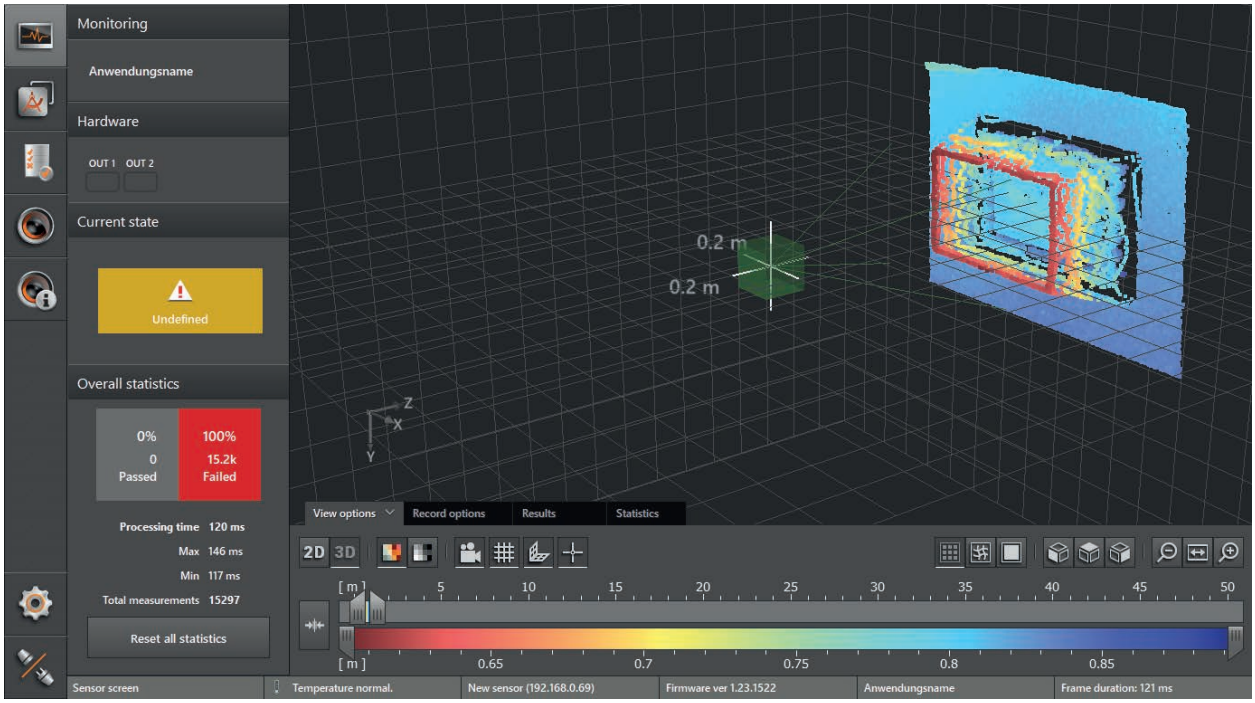
► Click  to show the side view.

> The object is displayed on the yz plane.

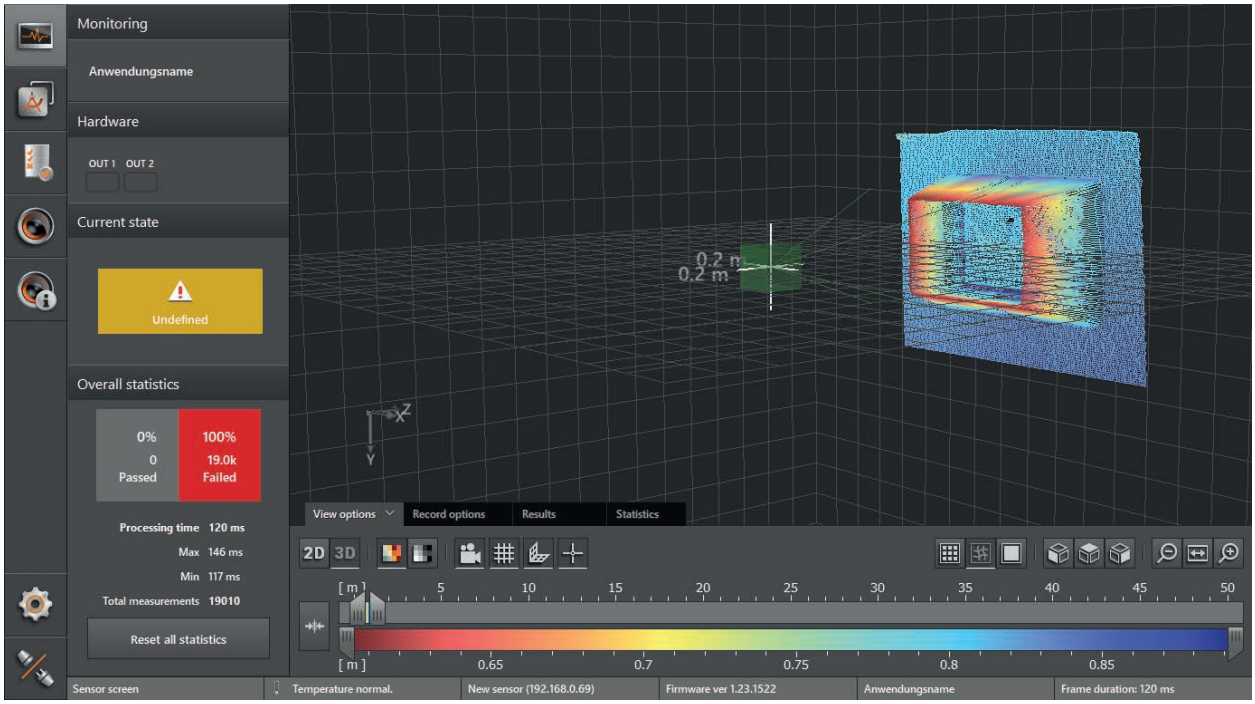


7.4.4 Type of display

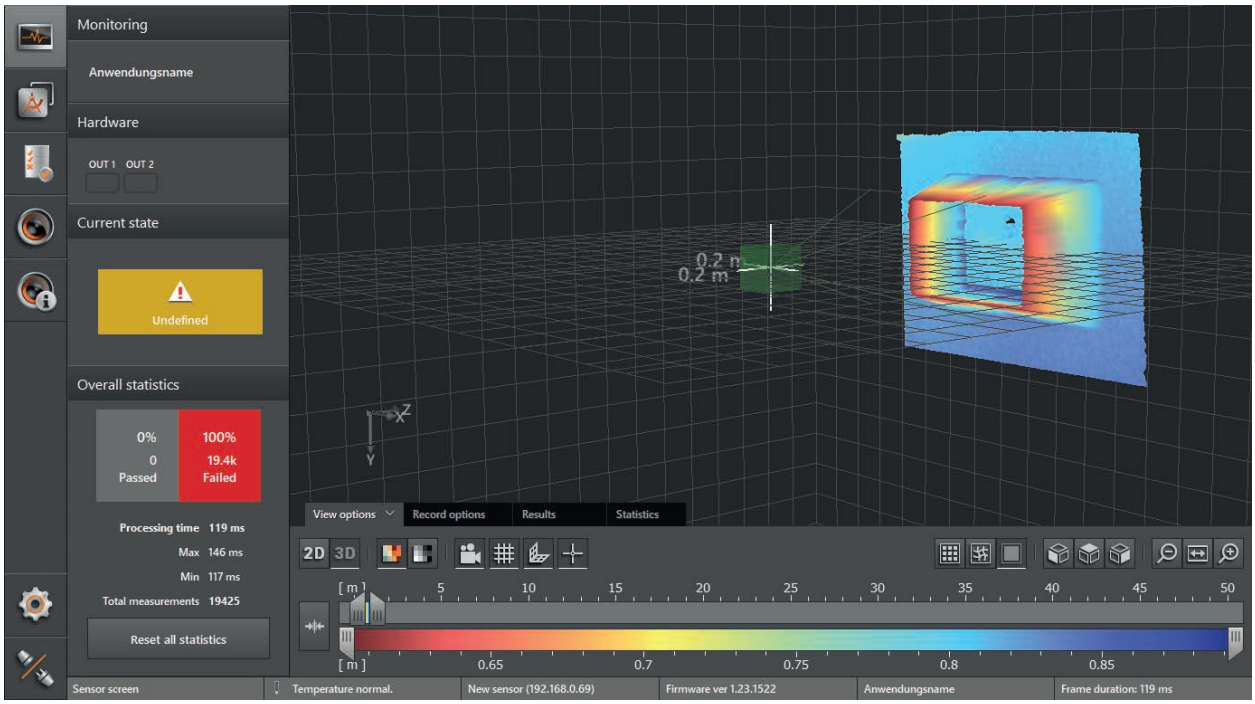
► Click  to show the 3D view as a point cloud.



► Click  to show the 3D view as a mesh.



► Click  to show the ascending gradients in the 3D view as a surface model.



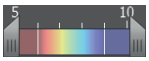
UK

7.4.5 Slider bar

With the slider bar the colour range of the display can be set manually. The results of the application are not changed.

- Distance image: measuring range in metres (from-to)
- Amplitude image: measuring range in amplitudes (from-to)

Set colour range

Operating element		Description
Automatic range selection		The button automatically sets the colour range to an appropriate range. The settings of the slider bars are rejected.
Upper slider bar		With the upper slider bar the colour range for the distance or amplitude image is roughly set.
Lower slider bar		With the lower slider bar the set colour range is fine-adjusted.
Colour range		The set colour range can be shifted using the left mouse button without changing the size of the range. The vertical white lines within the colour range indicate the colour range that is fine-adjusted with the lower slider bar.

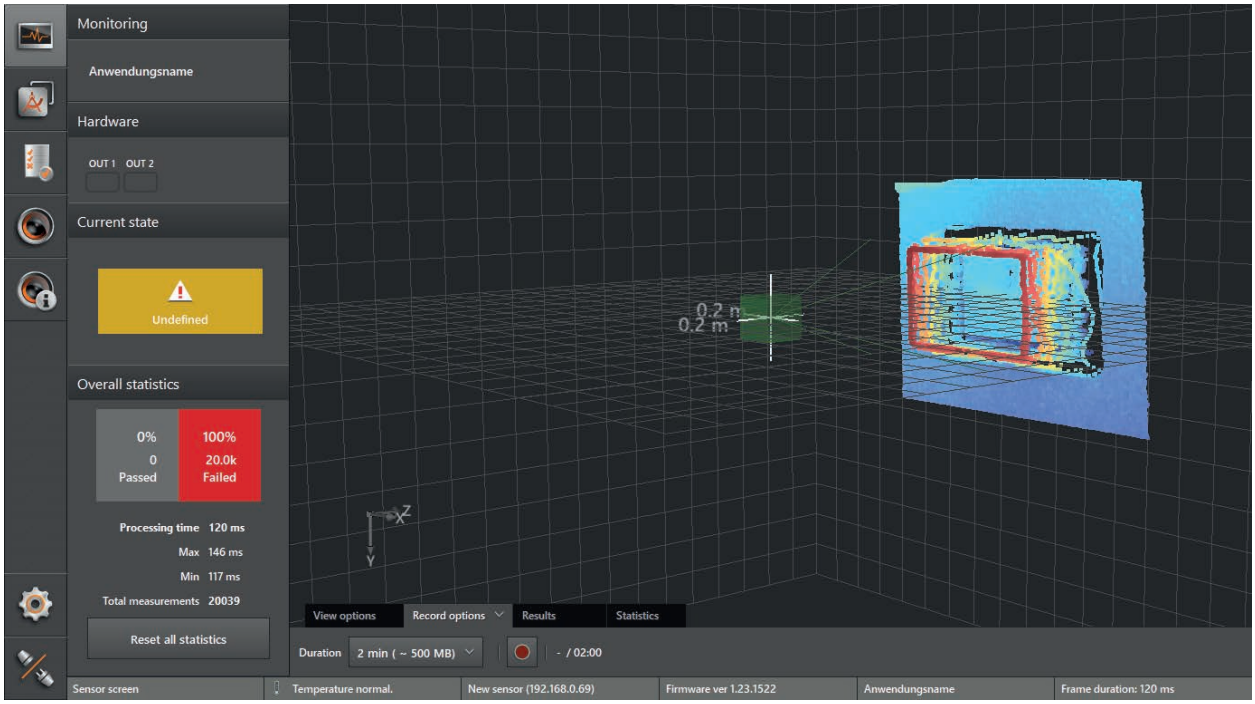
► Set the upper slider bar to the requested colour range.

► Set the lower slider bar for fine-adjustment of the colour range.

> The scale of the lower slider bar corresponds to the colour range set above.

7.5 Record options

With this function the device image can be recorded.



► Select the duration of the recording in the tab "Record options" (1, 2, 4, 8 minutes or infinite; required space: approx. 250 MB per minute).

► Click ● to start a recording.

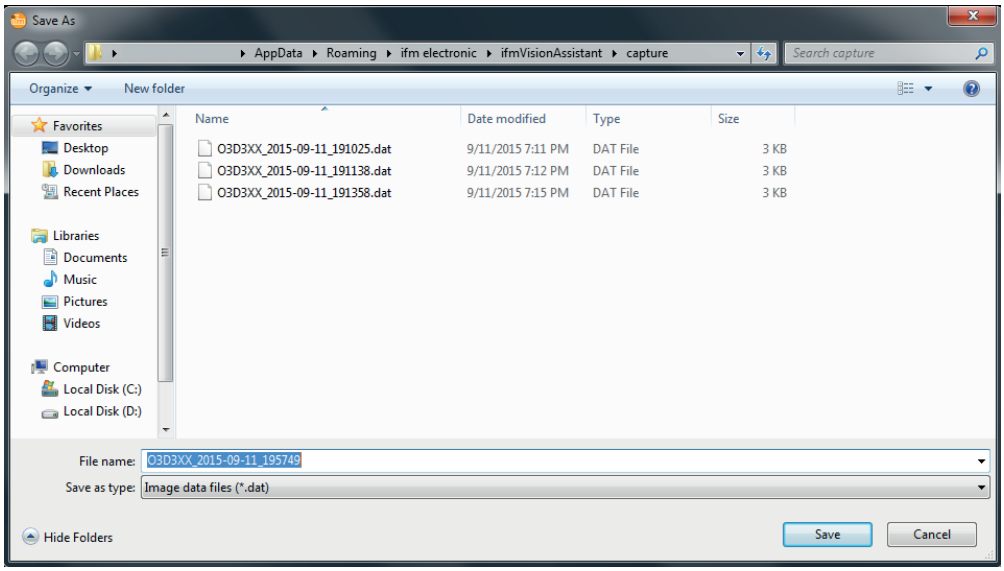
> The window "Save as" is opened using a default folder path and default file name:

- Default folder path: "…\ifm electronic\ifmVisionAssistant\capture" (exact path depends on the Windows version and settings)
- Default file name: "O3D3XX_yyyy-mm-dd_hhmmss.dat"

The file name consists of the characters "O3D3XX" with date and time stamp being appended to it.

Example: The file "O3D3XX_2015-04-15_144726.dat" was recorded on 15 April 2015 at 14:47:26 h.

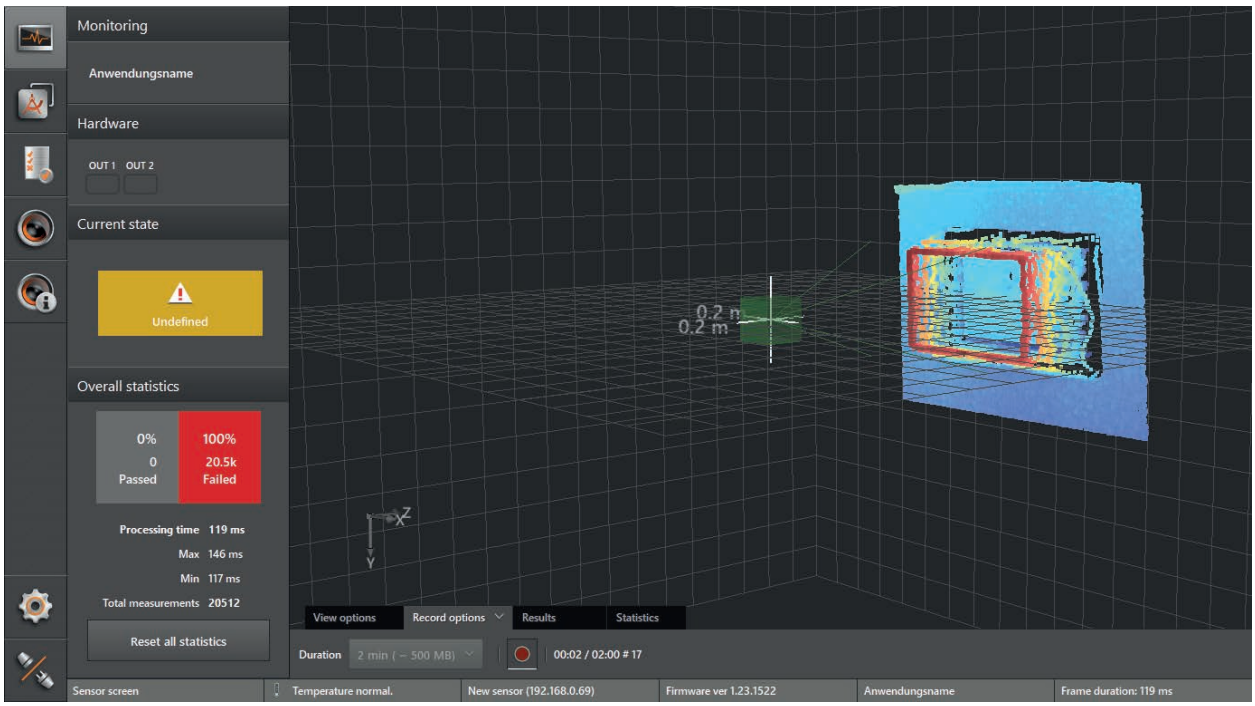
> All measured and process data is recorded (e.g. recognised objects and results of the applications).



► Click [Save].

> The recording starts and the recorded time is displayed next to the ● button.
Example: 1 minute and 5 seconds of the set 2 minutes are displayed as 01:05/02:00.

> The recording ends automatically as soon as the set recording time is reached.



► Click ● again to manually stop the recording before the set recording time has elapsed.

> The sequence is saved and can be played back using the [Replay] option on the start screen.

7.6 Results

The results indicate a summary of the features of an application. The display of the results depends on the type of application.

7.6.1 Display of the model results of depalletising

A table with all features of the object found is displayed under the tab "Results" in the monitoring window:

Object found	Dimensions	Center point	Rotation	Object quality	Current layer	Slip sheet	Error	Collision-free
Yes	0.240 m / 0.200 m / 0.320 m	-0.001 m / 0.028 m / 0.564 m	-0° / 1° / -4°	100%	1	No	None	Yes

The following properties of the recognised object are displayed:

- Object found
- Dimensions of the object (width, height and length)
- x, y and z coordinates of the centre point of the object surface
- Rotation of the object about the x, y and z axis
- Quality of object recognition between 0 and 100. The value "100" stands for best possible quality.
- The current layer on which the recognised object is.
- Slip sheet on the pallet layer recognised.
- Error detected
- Collision-free depalletising possible

7.6.2 Display of the model results of robot pick & place

A table with all properties of the objects found is displayed under the tab "Results" in the monitoring window:

Error			Number of objects			Number of object candidates	
0			2			3	
Id	Object Found	Length	Width	Height	Coordinates (x/y/z)	Angle	Rotation (x/y/z)
1	Yes	0.202 m	0.200 m	0.141 m	-0.123 m / 0.048 m / 0.689 m	176°	-0° / 2° / -4°
2	Yes	0.190 m	0.177 m	0.115 m	0.145 m / -0.008 m / 0.715 m	173°	-0° / 2° / -7°

The following properties of each recognised object are displayed in a table row:

- ID of the object
- Object Found
- Length, width and height of the object
- x, y and z coordinates of the centre point of the object surface
- Yaw angle of the object
- Rotation of the object about the x, y and z axis

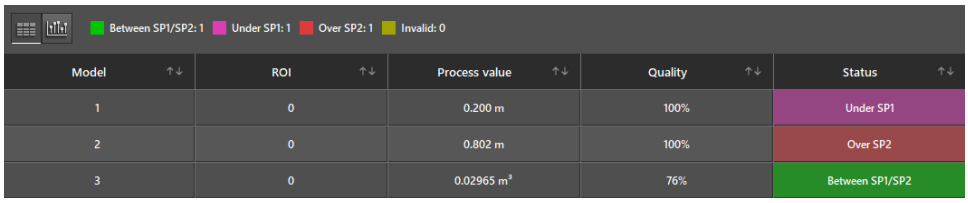
7.6.3 Display of the model results of completeness monitoring

A bar graph is displayed under the tab "Results" in the monitoring window:

The process values of the individual ROIs are indicated as vertical lines in the bar graph. The line colour shows the status of the ROIs. The switching thresholds are represented by horizontal lines.

- Pink: switching threshold SP1
- Red: switching threshold SP2

The icons  and  are used to switch between the bar graph and a table of the results.



Model	ROI	Process value	Quality	Status
1	0	0.200 m	100%	Under SP1
2	0	0.802 m	100%	Over SP2
3	0	0.02965 m³	76%	Between SP1/SP2

For every ROI the features "process value", "quality" and "status" are indicated in a table line. With a click on the cell in the table head the table lines are sorted in rising or falling order.

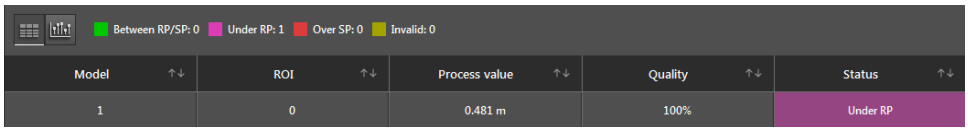
7.6.4 Display of the model results of object dimensioning

A table with all properties of the object found is displayed under the tab "Results" in the monitoring window:

Object found	Length	Width	Height	Quality	Position	Angle
Yes	0.195 m	0.156 m	0.491 m	84% / 74% / 52%	-0.017 m / 0.041 m / 0.454 m	177°

7.6.5 Display of the model results of level

A table with all properties of the object found is displayed under the tab "Results" in the monitoring window:



Model	ROI	Process value	Quality	Status
1	0	0.481 m	100%	Under RP

7.6.6 Display of the model results in the user defined mode

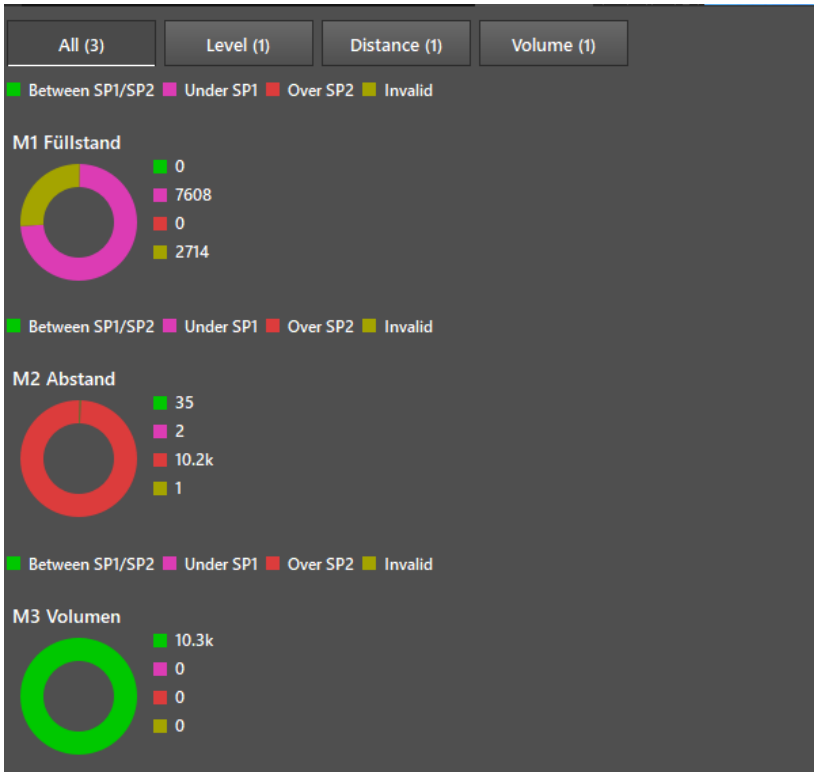
In the user defined mode the model results can be displayed with the respective icons as bar graph and in a table as is the case for completeness monitoring (→ „7.6.3 Display of the model results of completeness monitoring“).

When the monitoring window is selected, the table is displayed first.

7.7 Statistics

In the statistics statistically recorded values are indicated for every ROI. The statistics are grouped according to the created models.

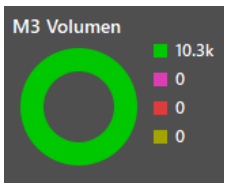
The ROIs are sorted according to the respective models. The [All] button displays statistics for all ROIs at the same time. If the model "Distance" is created, only the related ROIs are displayed via the [Abstand] (distance) button. The same goes for the models "Füllstand" (level) and " Volumen" (volume).



For every ROI the following values are statistically recorded:

- Between SP1/SP2 (green)
- Under SP1 (pink)
- Over SP2 (red)
- Invalid (yellow)

The values are displayed via a counter and graphically represented in a ring chart. Within the ring chart the statistically recorded values are indicated as a percentage of the whole.



For completeness monitoring a value is statistically recorded as "Between SP1/SP2" (green) if one of the corresponding ROIs signals "Between SP1/SP2" (green).

This applies to all values. A value is, for example, statistically recorded as "Over SP2" (red) if one of the related ROIs signals "Over SP2" (red).

7.8 Quit monitoring window

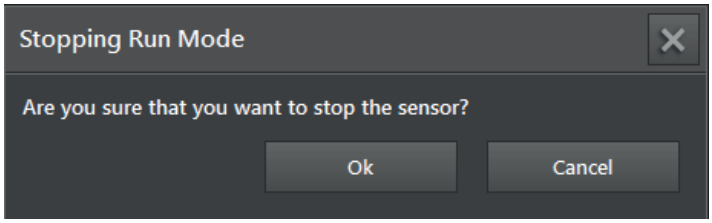
The monitoring window can be quit as follows:

- Open another option: switches to the selected option, for example, to manage and change settings or applications of the device. An active application is stopped. This can be protected by a password (→ „11.1.2 Password protection“).
- Disconnect the device: The ifm Vision Assistant is disconnected from the device. The active application is not interrupted and continues.

Switch to another option

► Click the button of the requested option.

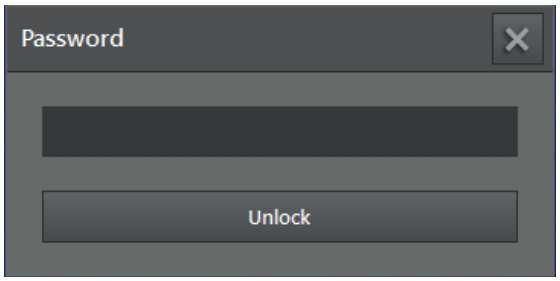
> The window "Stopping Run Mode" appears.



► Click [OK].

> If the password protection has been activated, the ifm Vision Assistant asks for the password.

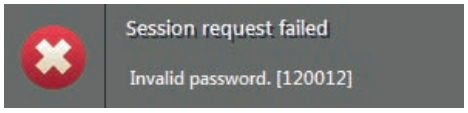
If the device is protected by a password, the icon next to the buttons , and indicates the lock.



► Enter password and click [Unlock].

> The ifm Vision Assistant stops the active application and switches to the selected option.

> Entering a wrong password triggers an error message and the ifm Vision Assistant returns to the monitoring window.



Disconnect device

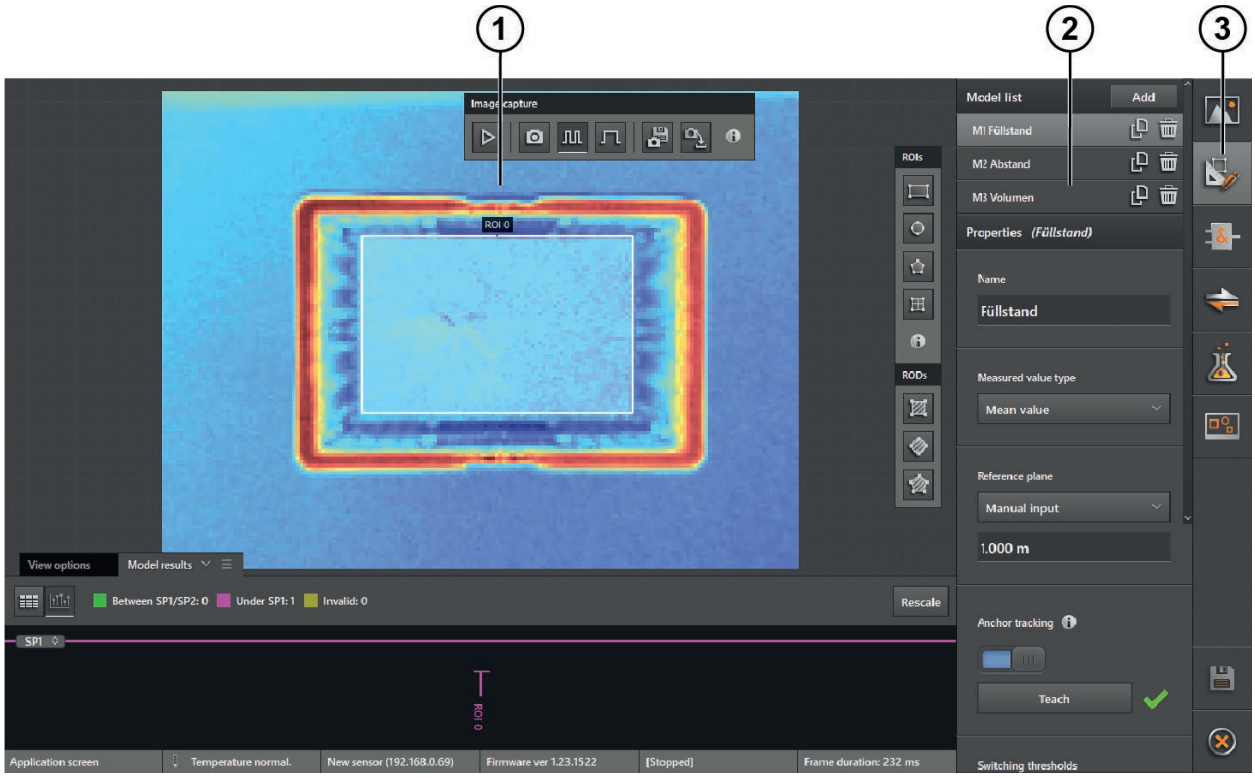
► Click .

> The device is disconnected.

> The ifm Vision Assistant returns to the start screen.

8 User defined mode

In the user defined mode models for level and distance monitoring can be defined. The output of the measurement results can be assigned to different interfaces.



1: Live image display
2: Settings
3: Menu of the user defined mode

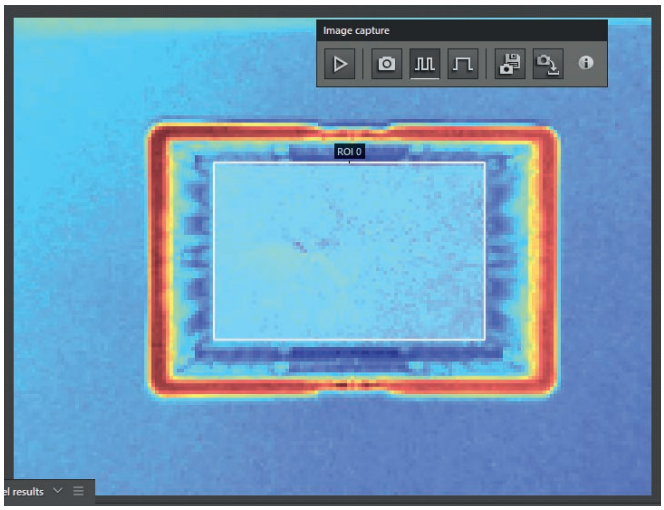
8.1 Activate user defined mode

The user defined mode is activated as follows:

Requirement	Action
A device without saved application is connected.	The set-up wizard starts automatically with the first connection to the device (→ „6 Set-up wizard“). ► Click [User defined mode] on the start screen of the set-up wizard. > A new application named "level/distance application" is created and the edit application window opens.
A new application is added.	► Add a new application in the application management (→ „9 Application management“). > The set-up wizard starts (→ „6 Set-up wizard“). ► Click [User defined mode] on the start screen of the set-up wizard. > A new application named "level/distance application" is created and the edit application window opens.
An application created in the user defined mode is edited.	► Select application in the application management and start editing (→ „9 Application management“). ► The edit application window opens in the user defined mode.

8.2 Live image display in the user defined mode

The edit application window displays live images during editing.



In the menu bar "Image capture" the following options can be set:

Button	Option	Description
	Live image	The image is continuously updated irrespective of the set trigger source.
	Force trigger	The image is updated once by means of the selection irrespective of the set trigger source.
	React to trigger	The image is updated with each trigger signal of the selected trigger source.
	Wait for trigger	With the next trigger signal of the selected trigger source the image is updated once.
	Save image	The current live image is saved.
	Load image	The live image is loaded from a file.

8.2.1 Save image

► Click .

> The window "Save as" for saving the image opens.

► Enter requested file name.

► Click [Save].

> The saved data has the extension "*.o3d3xximg".

8.2.2 Load image

► Click .

> The window "Open" for loading the image opens.

► Select the file to be loaded (*.o3d3xximg) and click [Open].

> As soon as loading has been finished the loaded image is displayed instead of the live image.

> With the option [Live image] in the menu bar "Image capture" you can switch to the live image.

If the file format of the loaded image does not correspond to the default format (*.o3d3xximg) an error message is displayed.

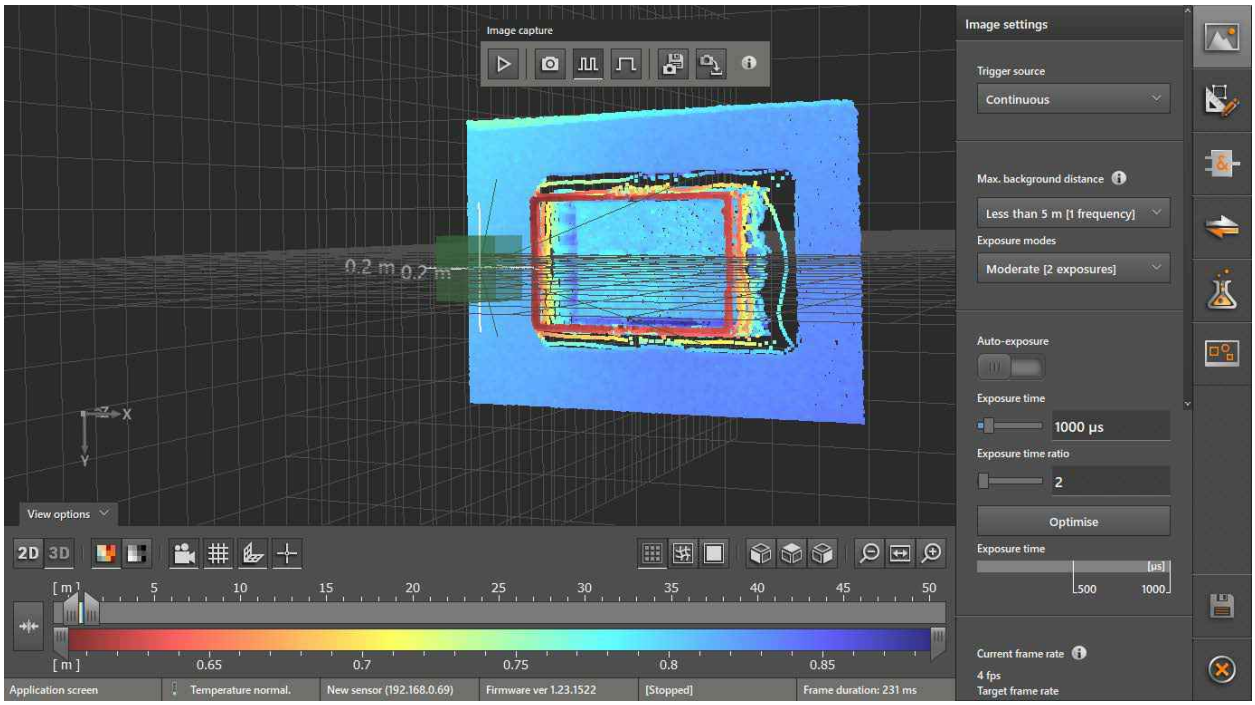
8.2.3 Set live image view

In the menu bar under the image the view options can be set. The view options for the live images are identical with the view options of the monitoring window (→ „7.2 View options“).

8.3 Image settings

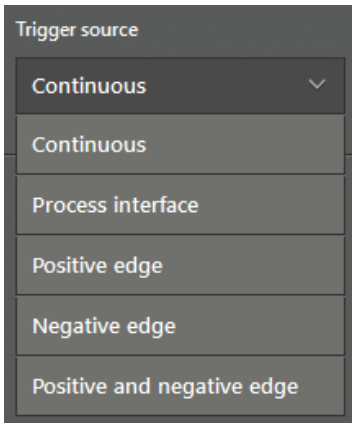
► Click  .

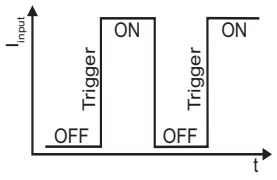
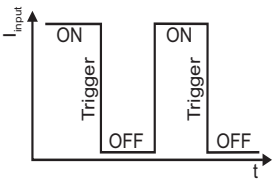
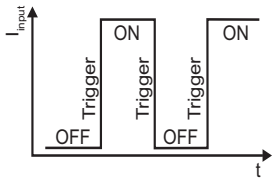
> The window "Image settings" appears.



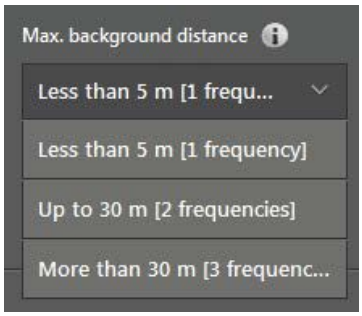
On most screens not all image settings are displayed. Further image settings can be accessed via the scroll bar on the right edge of the window "Image settings".

8.3.1 Set trigger source



Option	Description	
Continuous	The device continuously takes pictures. This option is mainly used for tests. When this option is selected, the current frame rate is displayed in fps (frames per second) in the window "Image settings". The frame rate can be changed in the input field "Target frame rate". The max. possible frame rate depends on the exposure mode and exposure time.	
Process interface	The device is triggered via the process interface (e.g. PLC).	
Positive edge	The device is triggered by the hardware via the rising edge of an input signal.	
Negative edge	The device is triggered by the hardware via the falling edge of an input signal.	
Positive and negative edge	The device is triggered by the hardware via the rising and falling edge of an input signal.	

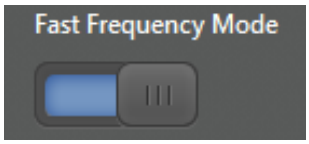
8.3.2 Set max. background distance



Option	Description
Less than 5 m [1 frequency]	The measurement of objects with a maximum distance of about 5 m is unambiguous. Objects farther away are represented in a wrong size and shape as if they were at a distance of up to about 5 m (see explanation below).
Up to 30 m [2 frequencies]	The measurement of objects up to about 30 m is possible. Due to the measurement with an additional low frequency the unambiguous range can be extended (see explanation below). With decreasing frequency noise increases and repeatability decreases. Therefore several measurements and longer measuring times are needed.
More than 30 m [3 frequencies]	Objects up to about 30 m are measured with 2 frequencies. An image is generated from this measurement. The third frequency detects measurable pixels between approx. 30 and 200 m (e.g. background reflections). To suppress ambiguity these pixels are deleted from the generated image and identified as invalid pixels. The result of the measurement is an image of objects up to a distance of approx. 30 m with increased unambiguity. With decreasing frequency noise increases and repeatability decreases. Therefore several measurements and longer measuring times are needed. Because of the limited illumination intensity of the device objects can only be measured up to a distance of only 30 m.

8.3.3 Fast Frequency Mode

From a distance of 30 m [2 frequencies] the "Fast Frequency Mode" can be activated. The mode accelerates the processing of the frames.



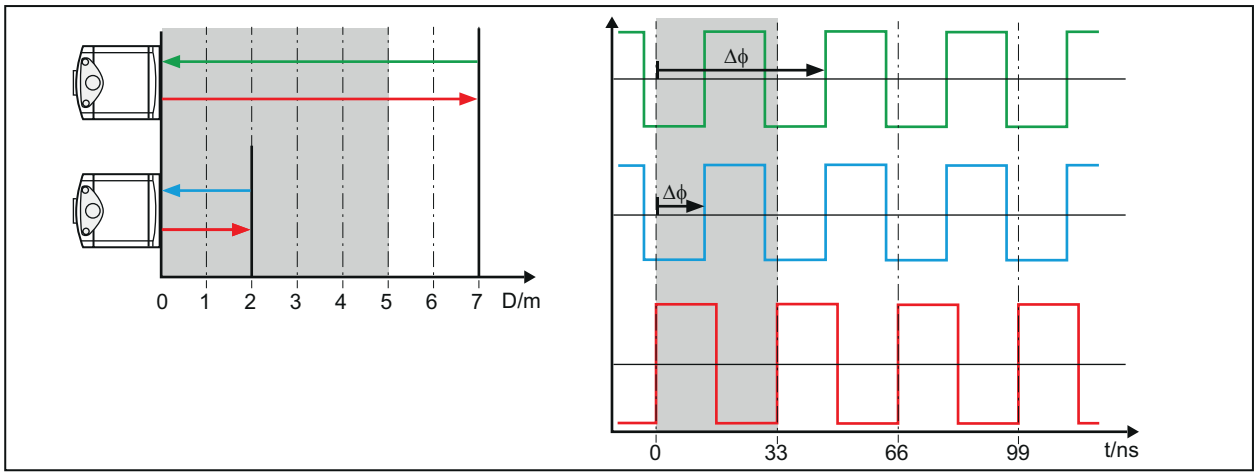
The "Fast Frequency Mode" is only available for a continuous trigger source.

Explanation of the unambiguity of the measuring range

To measure objects, the device transmits a modulated light signal and detects the light reflected from the objects. The distance of the objects is determined from the time of flight of the transmitted and reflected light.

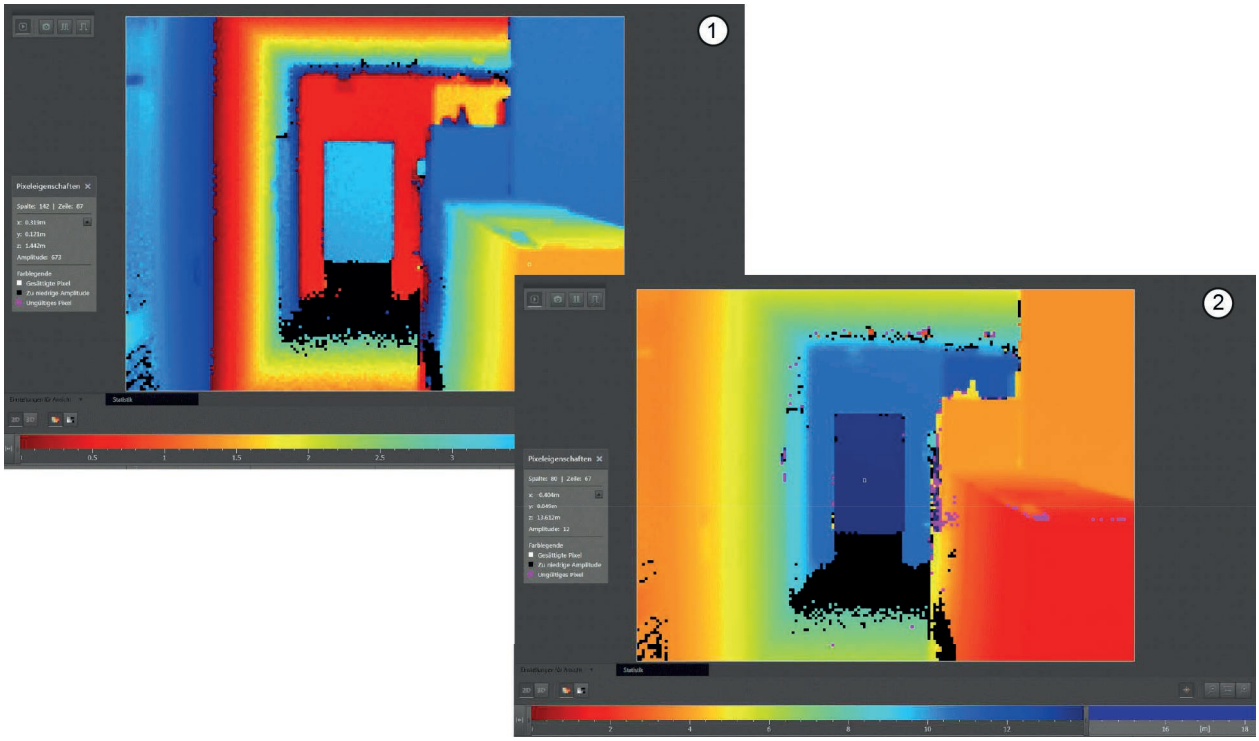
Whereas the modulation frequency is not changed by the reflection, the phases of the transmitted and the detected light are shifted to each other depending on the distance of the reflected point.

Phase shifts which are a multiple of the wave length are not differentiated. Therefore distances greater than half the wave length cannot be measured unambiguously. With a modulation frequency of 30 MHz, half the wavelength is 5 m.



Example

The following figure shows two captures of the same scene with different distance settings.



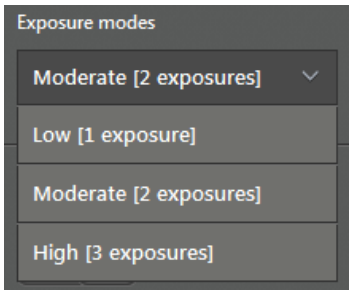
1: Max. background distance less than 5 m [1 frequency]: Colours are repeated for distant objects
2: Maximum background distance up to 30 m [2 frequencies]: Colours can be clearly assigned to different distances

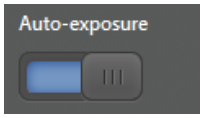
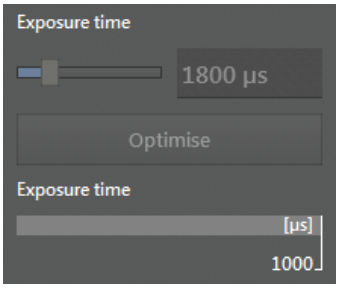
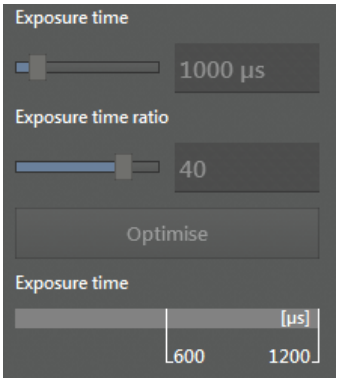
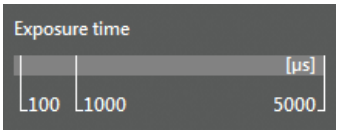
8.3.4 Set exposure mode

In the 3D view the scene dynamics may be too high for a single exposure. This particularly applies to the following areas:

- Areas with many different reflectivities (e.g. black, white, shiny)
- Areas with many different distances to the device

In this case the image quality can be increased by two or three exposures with different exposure times. This increases the evaluation time and the sensitivity to movements in the scene.



Option	Description	Display/settings
Auto-exposure	Automatic adaptation of the exposure time during the image capture. The exposure time is calculated between the frames by the device. Auto-exposure is only available for the trigger source continuous. After auto-exposure has been switched on the settings of the exposure time are suppressed.	
Low [1 exposure]	Exposure mode for scenes with low dynamics. The exposure time is indicated in µs. The value can be changed with the slider bar or entered in the display window. With a click on the button [Optimise] the device captures several images and calculates the optimum exposure time for the current scene.	
Moderate [2 exposures]	Exposure mode for scenes with high dynamics. The exposure times are indicated in µs. • The value of the longer exposure time can be changed with the slider bar or entered in the display window. • The value of the shorter exposure time is set as a ratio of the longer exposure time. The ratio can be changed with the slider bar or entered in the display window. With a click on the button [Optimise] the device captures several images and calculates the optimum exposure times for the current scene.	
High [3 exposures]	Exposure mode for scenes with very high dynamics. The exposure times are indicated in µs. Default values cannot be changed manually or automatically. This exposure mode cannot be combined with the distance option "More than 30 m" (→ „8.3.2 Set max. background distance“).	

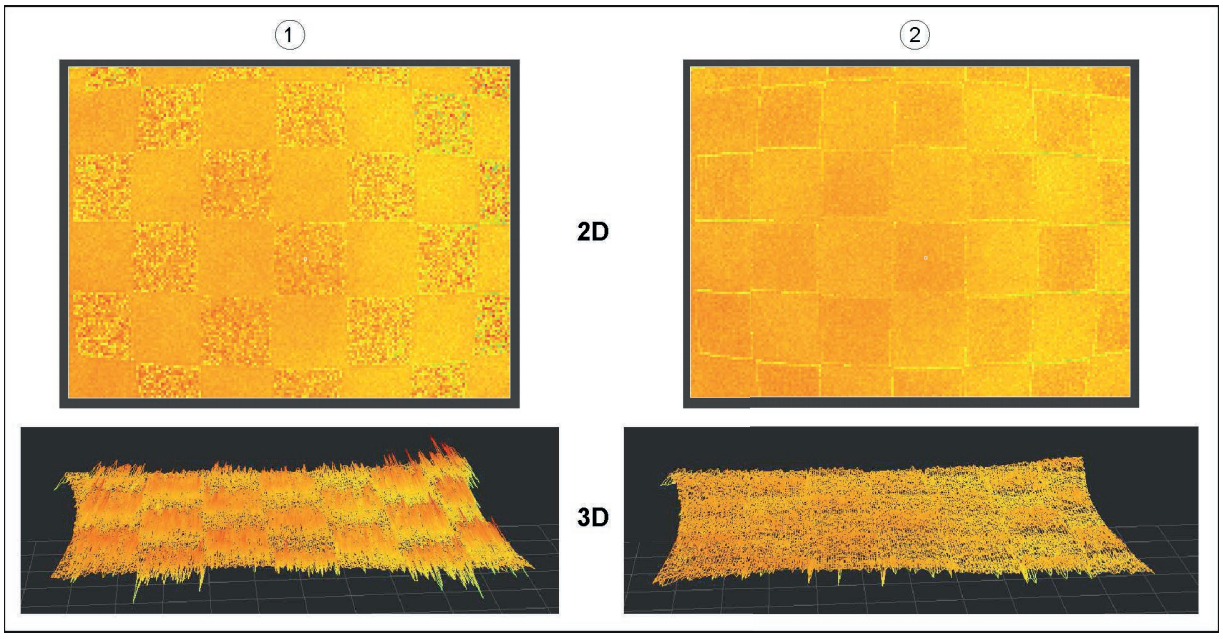
With the automatic optimisation the exposure times are set to the current scene (total device image less a frame). The scene must not change during optimisation. This avoids saturation and measurement noise is minimised. So the application is more immune to interference.

Even after optimisation of the exposure times invalid pixels or much image noise may occur. This may have the following cause:

- The pixels are outside the optimisation area (e.g. in the frame of the device image).
- The pixels represent shiny objects.
- The pixels represent dark objects whose difference to the brightest objects is too great. In this case this may be improved by increasing the number of exposure times.

Example

The following figure shows the 2D and 3D captures of a chessboard section at a distance of 60 cm with different exposure modes.



1: An exposure time of 500 µs, white surfaces almost saturated, black surfaces noisy
2: Two exposure times of 500 µs and 3500 µs, white and black surfaces slightly noisy

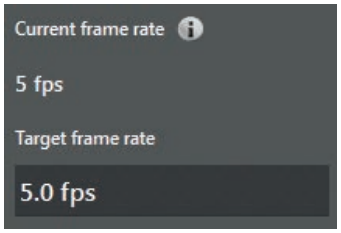
8.3.5 Set target frame rate

A frame rate can be defined for the device which it tries to reach.

The maximum target frame rate is 30 fps.

Set target frame rate

► Enter target frame rate in the field.



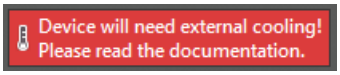
> The current frame rate is displayed above the target frame rate.

Depending on the settings activated, the target frame rate cannot be reached by the device. The following settings have an effect on the target frame rate:

- Max. background distance (→ „8.3.2 Set max. background distance“)
- Exposure mode, exposure time, auto-exposure (→ „8.3.4 Set exposure mode“)

- Fast frequency mode (→ „8.3.2 Set max. background distance“)
- Filters (→ „8.3.6 Apply filter“)
- Image processing

Observe the notes on device cooling in the operating instructions when the following note is displayed:

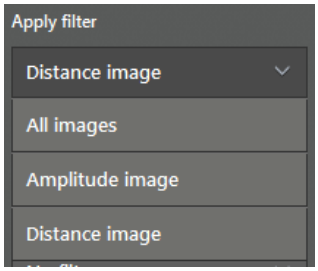


UK

8.3.6 Apply filter

Filters can be applied to optimise the frame rate.

► In the selection list "Apply filter" select the type of image to which the filters are to be applied:



Option	Description
All images	The filters are applied to the distance image and the amplitude image.
Amplitude image	The filters are only applied to the amplitude image.
Distance image	The filters are only applied to the distance image.

► Select spatial filter:

Option	Description	Characteristics
Median filter	Each pixel is replaced by the median of the neighbouring pixels.	• Good edge preservation • Moderate evaluation time
Mean filter	Every signal value is replaced by the mean value calculated with the signal values of the neighbouring pixels.	• Bad edge preservation • Short evaluation time
Bilateral filter	The intensity of a pixel is replaced by the weighted mean value of the intensities of neighbouring pixels.	• Excellent edge preservation • Very long evaluation time

► Select matrix size.

> The matrix size determines the window around the pixel to be calculated. The pixels in this window are used for calculation.

► Select time filter:

Option	Description
Exponential filter	A weighted mean value across successive images is calculated. Newer images have more weight than older images. This filter can only be applied to the trigger source "continuous".

8.3.7 Clip 3D data

By clipping the 3D data the data which is to be used for further calculation can be limited. If the 3D data is clipped, only the data within the min./max. values are used for further calculation. The data outside the min./max. values is rejected.

If the button "Clipping box on 3D data" is active, a min. value and a max. value can be defined for each of the three coordinate axes.

Clip 3D data

► Set button "Clipping box on 3D data" to "on".

> The fields for the 3D data to be clipped are shown.

► Enter min./max. values for the three coordinate axes.

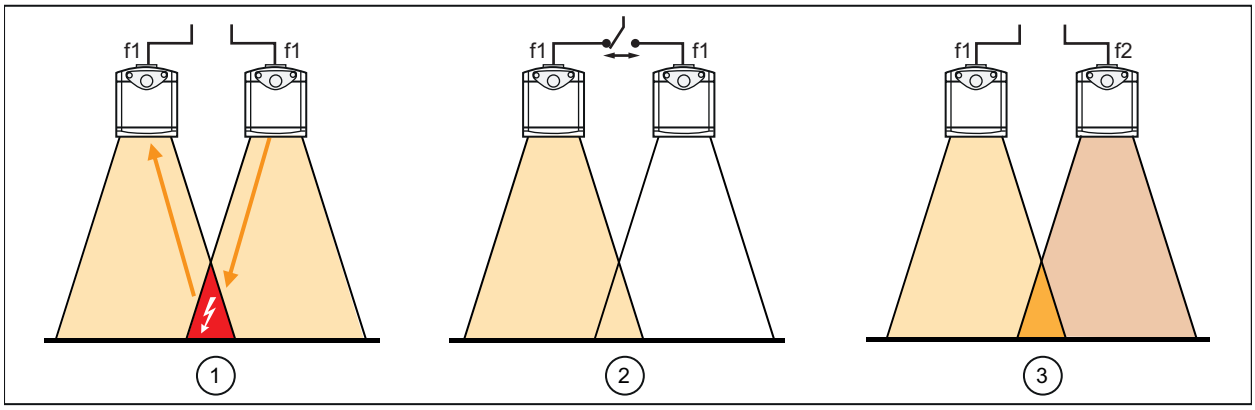
The data clipped is differently displayed in the views:

- In the 3D view the data within the field is suppressed.
- In the 2D view the data within the field is displayed in pink.

A coordinate system can be transformed via XML-RPC. The 3D data clipped is applied to the transformation.

8.3.8 Operate several devices

The devices may interfere with each other if they are not optically separated from each other.



1: Mutual interference of the devices when operated simultaneously with a frequency f1
2: Prevention of interference when operated with a frequency f1 by cascading the trigger signals
3: Prevention of interference when operated with different frequencies f1 and f2

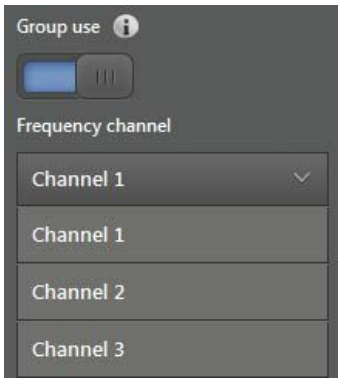
Interference can be prevented with the following measures:

Measure	Description
Cascading the trigger signals	The trigger signals are set so that the devices are triggered at different points in time (→ „8.5 Create output logic“ and operating instructions). This is the preferred measure to prevent interference.
Operation via different frequency channels	The devices are triggered via different frequency channels. 3 frequency channels can be selected. This measure is not possible for the option "more than 30 m" because 3 frequency channels are already used for this option. 2 of the 3 frequency channels are used for the option "up to 30 m". Therefore the devices must use one frequency channel together.

Set group use

► Set button "Group use" to "on".

> The selection list "frequency channel" is displayed.



► Select frequency channel for the device.

8.4 Define models

The models are used to define the features to assess the level of objects (e.g. level of a bulk material). A model consists of the following features:

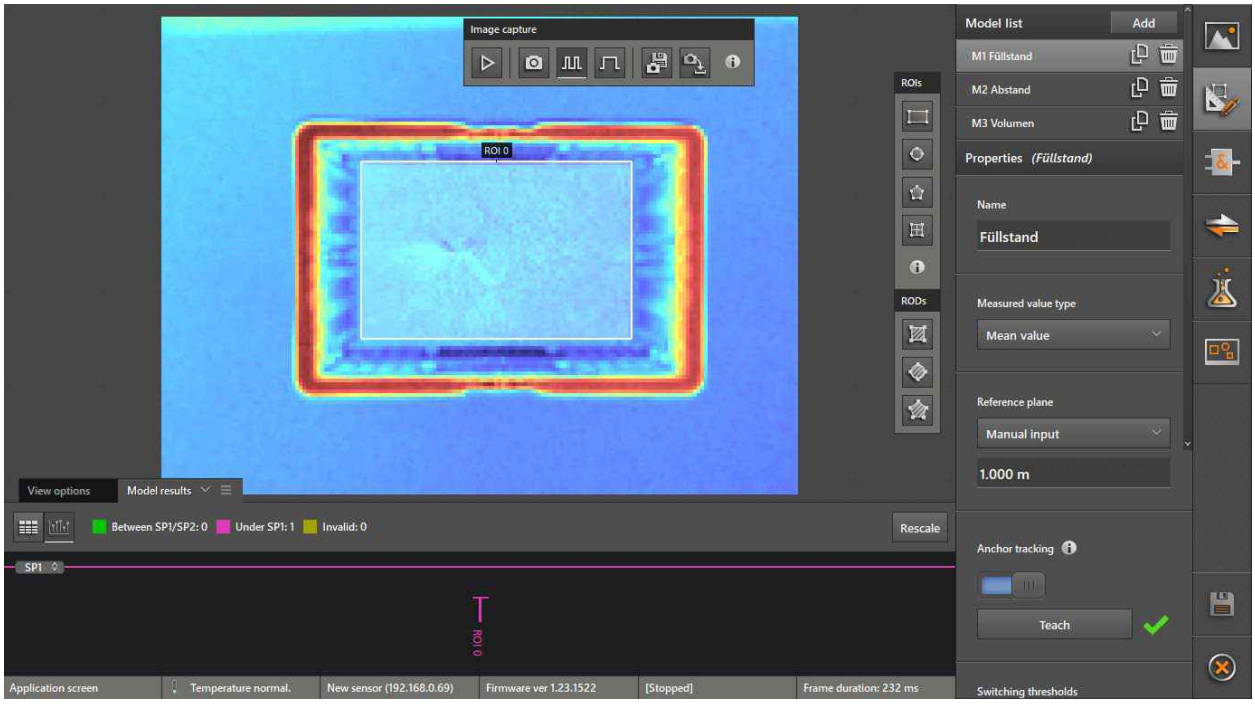
Feature	Description
Model type	The model type determines the technology used to measure the level.
ROI	At least one ROI identifies the area to which the measurement refers.
Process value	The process value defines the value (maximum, minimum, mean value) of the measured data used for the comparison with the switching thresholds.
Switching thresholds	With the switching thresholds values for the evaluation of the measurement results are defined (e.g. switch filling system with a connected controller).

The model features can be transmitted to a connected controller via the device interfaces. Changes of a model may require changes in the output logic and / or in the interface definitions.

► After every change of a model check if the output logic and / or interface definition must be adapted (→ „8.5 Create output logic“ and „8.6 Configure interface“).

► Click  .

> In addition to the live image the model list and the model results are displayed:

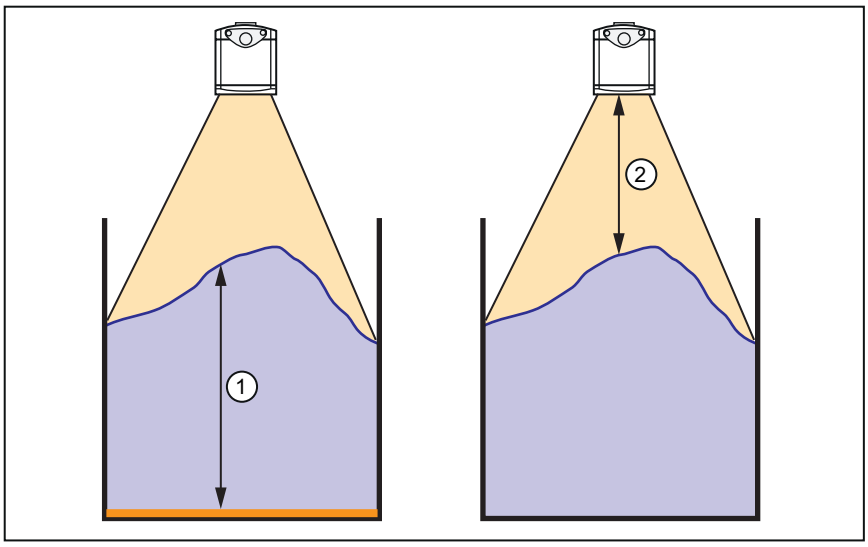


8.4.1 Define model type

► Click [Add] in the model list.

► Select model type:

Model type	Description
Level	Measurement of the level of an object surface against a reference plane
Distance	Measurement of the distance of an object surface to the device
Volume	Measurement of the volume of an object surface against a reference plane



1: Distance between object surface and reference plane for the model types "level" and "volume"
2: Distance between object surface and device for the model type "distance"

> A window to select the level model opens:

► Select level model.

> Depending on the selected model type the meaning of the level models is as follows.

Model type "level"	Model type "distance"	Model type "volume"
With the switching threshold SP1 the minimum vertical distance of an object surface to a reference plane is defined. If the measured value is below this distance, the object is considered underfilled.	With the switching threshold SP1 the maximum vertical distance of an object surface to the device is defined. If the measured value is below this distance, the object is considered underfilled.	
• With the switching threshold SP1 the minimum vertical distance of an object surface to a reference plane is defined. If the measured value is below this level, the object is considered underfilled. • With the switching threshold SP2 the maximum vertical distance of an object surface to a reference plane is defined. If the measured value is above this distance, the object is considered overfilled.	• With the switching threshold SP1 the minimum vertical distance of an object surface to the device is defined. If the measured value is below this level, the object is considered overfilled. • With the switching threshold SP2 the maximum vertical distance of an object surface to the device is defined. If the measured value is above this distance, the object is considered underfilled.	• With the switching threshold SP1 the minimum volume of an object surface to a reference plane is defined. If the measured value is below this volume, the object is considered underfilled. • With the switching threshold SP2 the maximum volume of an object surface to a reference plane is defined. If the measured value is above this volume, the object is considered overfilled.
• With the switching threshold SP1 the minimum vertical distance of an object surface to a reference plane is defined. As long as the measured value is below this distance, the pump remains switched on and the filling process continues. • With the switching threshold SP2 the maximum vertical distance of an object surface to a reference plane is defined. If the measured value exceeds this distance, the pump is switched off and the filling process stops.	• With the switching threshold SP1 the minimum vertical distance of an object surface to the device is defined. If the measured value is below this distance, the pump is switched off and the filling process stops. • With the switching threshold SP2 the maximum vertical distance of an object surface to the device is defined. As long as the measured value is below this distance, the pump remains switched on and the filling process continues.	

Model type "level"	Model type "distance"	Model type "volume"
An optimum vertical distance to a reference plane is defined with the target value SPM. The maximum vertical deviations from this target value upward and downward are defined with the hysteresis. On this basis the switching thresholds SP1 (lower maximum deviation from the target value) and SP2 (upper maximum deviation from the target value) are calculated.	An optimum vertical distance to the device is defined with the target value SPM. The maximum vertical deviations from this target value upward and downward are defined with the hysteresis. On this basis the switching thresholds SP1 (upper maximum deviation from the target value) and SP2 (lower maximum deviation from the target value) are calculated.	

> After selection of the level model the related model features and their default values are displayed.

► Enter a model name in the field "Name".

> In the output logic the model is displayed under this name (→ „8.5 Create output logic“).

► Enter switching value(s) of the selected model type and of the selected level model in metres.

8.4.2 Define reference plane (only for model type "level")

The reference plane must be determined for the model type "level". The level at every point results from the difference of the reference value and the distance value measured at this point.

The reference plane can be determined manually or automatically:

Method	Procedure
Manual	► Select the item "Manual input" in the drop-down menu "Reference plane". ► Enter the distance between the device and the reference plane in metres. ● Advantage: If small changes of the plane occur during operation they are "averaged out". ● Disadvantage: In particular asymmetric uneven and inclined planes lead to incorrect measurements.
Automatic	► Ensure that there are no objects in the requested area and the reference plane can be seen in the live image. ► Select the item "Teach plane" in the drop-down menu "Reference plane". > The device measures the distance for every point and determines these measured values as reference plane. > The successful determination of the reference plane is indicated by a green tick. If changes have occurred the reference plan can be redetermined with [Teach]. ● Advantage: Uneven or inclined planes can be used as reference plane. ● Disadvantage: Changes regarding unevenness as well as changes of inclination and rotation of inclined planes lead to incorrect measurements.

8.4.3 Define and edit ROIs

With the selection of the level model (→ „8.4.1 Define model type“) a rectangular ROI is automatically displayed in the live image.

A total of up to 64 ROIs can be defined.

With multi-ROIs every ROI contained is taken into account. Example: In addition to a multi-ROI with 48 ROIs another 16 ROIs can be defined.

► Select the shape of the ROI in the window "ROIs":

Shape	Name	Description
	Rectangle	Rectangular surface with variable length and width.
	Ellipse	Ellipsoidal surface with variable length and width.
	Polygon	Polygon with corner points that can be freely positioned. The corner point set last must match the corner point set first so that a closed surface results. If the connecting lines cross the resulting partial surface is excluded from the ROI.
	Multi-ROI	Rectangular ROI matrix with variable length and width. The ROI matrix contains individual ROIs of the same shape and size.

- Except the polygon the ROIs are added to the live image by clicking and dragging while holding the mouse button down.
- Click the corner points of the polygon to position them in the live image.

► Adapt ROI to the object to be measured:

Adaptation	Procedure
Change size and shape	► Click ROI. ► Click ■ and drag to the requested position while holding the mouse button down.
Shift ROI	► Click ROI. ► Drag ROI to the requested position while holding the mouse button down.
Rotate ROI	► Click ROI. ► Click and drag in the requested direction. > The ROI rotates around the centre point of the surface.
Adapt multi-ROI 	► Click ROI. ► Click the pen symbol at the bottom of the ROI matrix. > A window for setting the multi-ROI opens. – Shape: Defines the shape of the individual ROIs. The ROIs of a multi-ROI always have the same shape. – Grid type: Defines the geometrical arrangement of the ROIs in the multi-ROI (→ "Step 3: Region of interest (ROI)" on page 26). – Number of columns / lines: Defines the number of columns / lines of the ROIs in the multi-ROI. The number of ROIs in a multi-ROI is limited to 64. – Shape size: The individual ROIs within the multi-ROI are scaled with [+] and [–]. The preset scaling factor is applied to all ROIs and in both spatial axes. Upward scaling is limited by the size of the ROI matrix. ► To change the ROI dimensions in different spatial axes: Click the border mark of the ROI matrix and, while holding the mouse button down, drag it to the position where the ROIs are displayed with the requested scaling.
Group ROIs	► Click several ROIs with the mouse while holding the shift key down. ► Click .
Copy ROI	► Click ROI. ► Click .
Delete ROI	► Click ROI. ► Click .

8.4.4 Define and edit RODs

A total of up to 64 RODs can be defined.

► Select the shape of the ROD in the window "RODs":

Shape	Name	Description
	Rectangle	Rectangular surface with variable length and width.
	Ellipse	Ellipsoidal surface with variable length and width.
	Polygon	Polygon with corner points that can be freely positioned. The corner point set last must match the corner point set first so that a closed surface results. If the connecting lines cross the resulting partial area is excluded from the ROD.

- Except the polygon the RODs are added to the live image by clicking and dragging while holding the mouse button down.
- Click the corner points of the polygon to position them in the live image.

► Adapt ROD to the object to be measured:

Adaptation	Procedure
Change size and shape	► Click ROD. ► Click ■ and drag to the requested position while holding the mouse button down.
Shift ROD	► Click ROD. ► Drag ROD to the requested position while holding the mouse button down.
Rotate ROD	► Click ROD. ► Click and drag in the requested direction. > The ROD rotates around the centre point of the area.
Copy ROD	► Click ROD. ► Click .
Delete ROD	► Click ROD. ► Click .

8.4.5 Activate anchor tracking

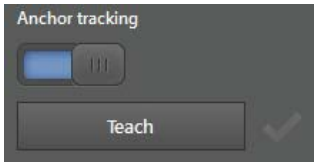
Anchor tracking allows detection of objects with variable position and rotation. The option is activated when a model is created.

Anchor tracking works reliably if the depth contrast of the areas outside the ROIs and rectangular objects is sufficient. This is typically the case with beverage crates or similar containers.

Activate anchor tracking

► Set the button "Anchor tracking" to "on".

> Anchor tracking must be set. After it has been switched on anchor tracking is automatically set.



> A successful teach process is indicated by a green tick. With the button "Teach" anchor tracking can be set again.

If the ROIs are changed, anchor tracking must be set again.

If the teach process fails, the following measures may lead to success:

- Change installation position and orientation of the device. Ideally, the device is aligned vertically to the object.

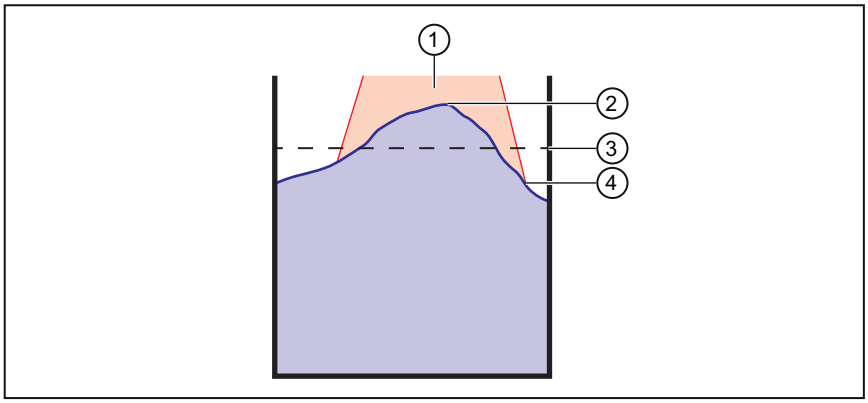
- Set the exposure time so that the areas around the ROIs provide valid measured values.

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

8.4.6 Define ROI distance value

The ROI distance value is the process value which is compared with the switching thresholds. To calculate the process value from the measured data 3 methods are available:

Method	Process value calculation
Minimum	Minimum measured value in the ROI
Maximum	Maximum measured value in the ROI
Mean value	Mean value across all measured values in the ROI



1: ROI
2: Maximum
3: Mean value
4: Minimum

8.4.7 Define threshold values

Depending on the selected model type and the selected level model (→ „8.4.1 Define model type“) the input windows and a graphical representation of the threshold values are indicated in the model list.

Threshold value	Description
SP1	This threshold value is the lower value for both model types. For the model type "level" it defines the lower threshold. For the model type "distance" it defines the upper threshold.
SP2	This threshold value is the higher value for both model types. For the model type "level" it defines the upper threshold. For the model type "distance" it defines the lower threshold. This threshold value is not available for the level model "underfill".
SPM	This mean threshold value must be defined for the level model "threshold switch". In addition, the distance of the threshold value d must be indicated. The threshold values are calculated as follows: ● SP1 = SPM – d ● SP2 = SPM + d

8.4.8 Model results

The model results can be shown in a window under the live image.

The status of the ROIs (good, underfill, overfill, invalid) is displayed in coloured fields. There the number of ROIs to which the properties apply are indicated.

The icons  and  are used to switch between a numerical and a graphical representation (→ „7.6 Results“).

8.5 Create output logic

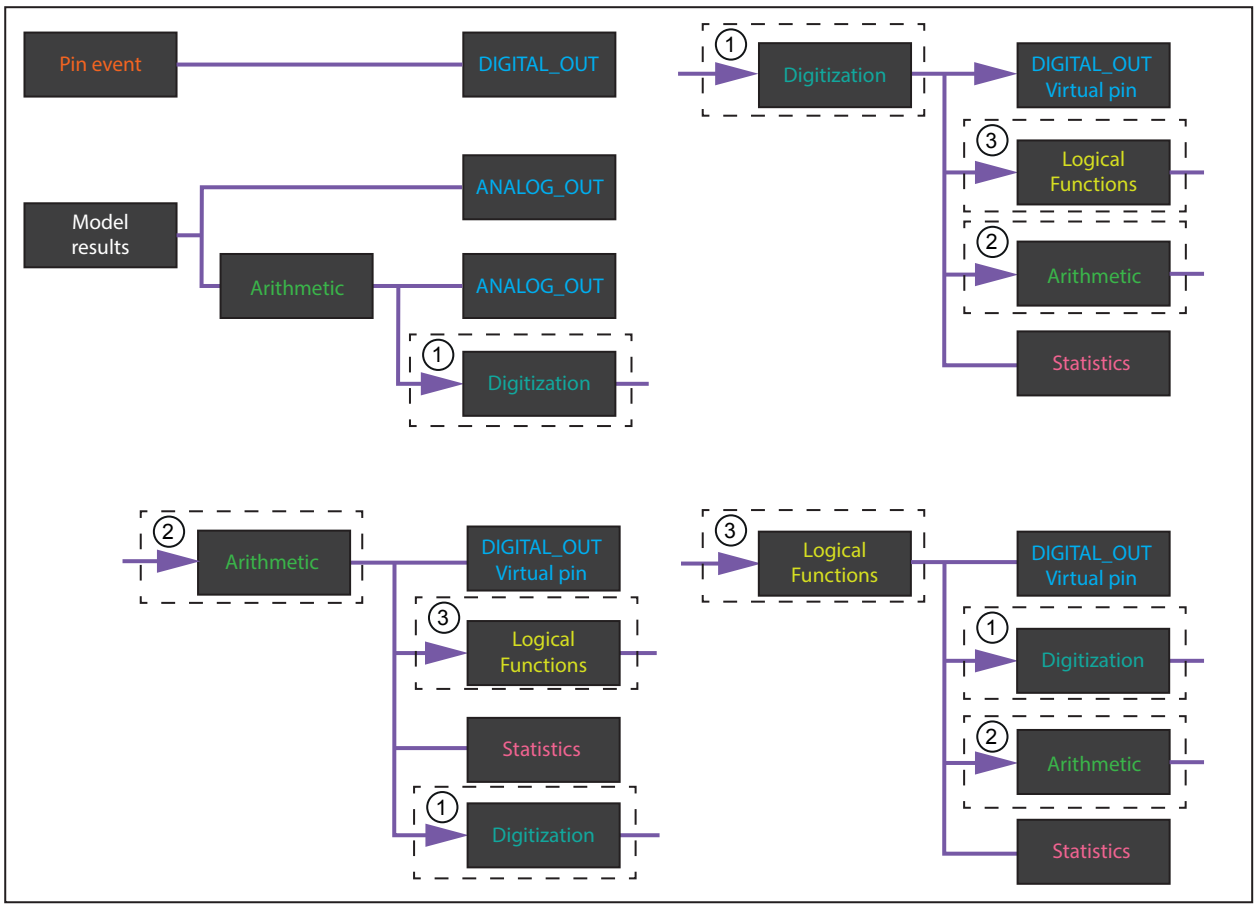
On the screen "Logic" model results and pin events can be assigned to the available device outputs to provide the data to a connected controller (PLC / PC).

8.5.1 General creation rules

The creation of the output logic is based on the following rules:

- Pin events are provided as binary numbers (1 = true, 0 = false) and can only be assigned to digital outputs.
- Model results are numerical values and can be processed as follows:
  - Direct output via an analogue output
  - Use of arithmetic operators and then output via an analogue output
  - Digitalisation by comparison with other results or values
  - Further processing of digitalised values by using arithmetic operators and / or logical operations
  - Output of a binary value via a digital output or a virtual pin

The following figure shows an overview of the configuration options in the output logic. Because of the numerous combination options the logic circuits are divided into blocks. Identical numbers show the connections between the blocks.

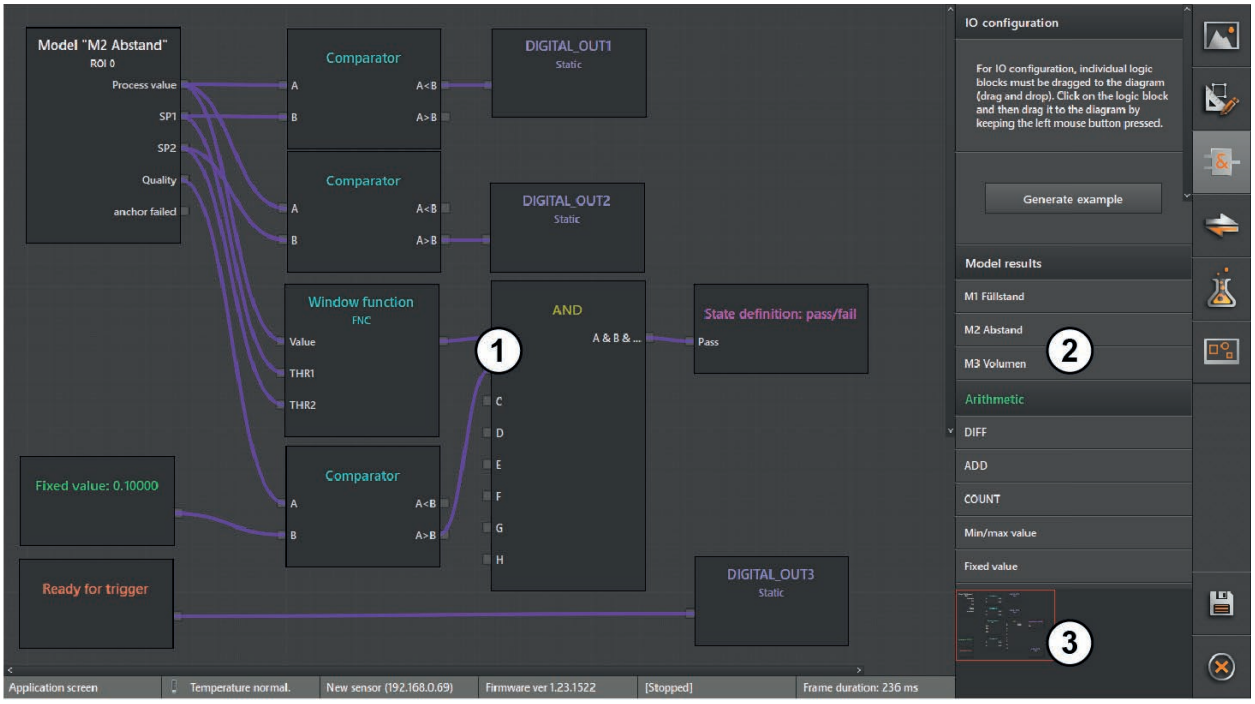


8.5.2 Place logic blocks and assign signals

► Click  .

> The "Logic" screen is displayed.

If no logic is stored on the device, the "Generate example" window is displayed. With the settings in the "Generate example" window an example logic is created for the existing models and ROIs.



1: Main area
2: Selection area
3: Overview area

Window area	Description
Main area	In the main area the assignment of the pin events to the outputs is displayed. The pin events and the outputs are displayed as logic blocks in different font colour. Lines between these logic blocks represent the assignment. If the elements in the main area go beyond the visible area, this area can be shifted using the scroll bar at the edge of the main area.
Selection area	All pin events and outputs are listed in the selection area.
Overview area	In the bottom right corner of the main area a reduced main area is displayed for a better overview. If the elements in the main area go beyond the visible area, this area can be shifted by dragging the red frame with the mouse.

The following functions can be executed on the start screen "Logic":

Generate example

This function is used to help users who have no or only little experience with the creation of output logics.

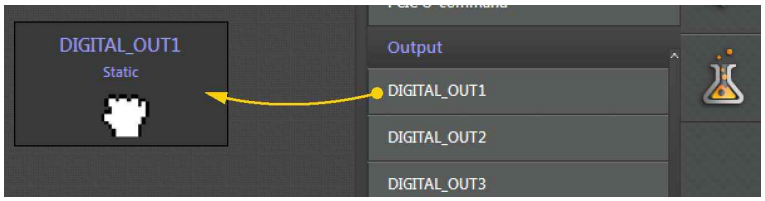
► Click [Generate example].

> An output logic suitable for the models defined is created as an example. The region of interest (ROI) can be selected.

Place new logic block in the main area

► Click entry in the selection area and hold the mouse button down.

► Hold the mouse button down to drag the entry to the main area and release the mouse button at the requested position (drag and drop).



> The respective logic block is displayed at the target position.

> At the edge of the logic block at least one pin is displayed which is used for the assignment.

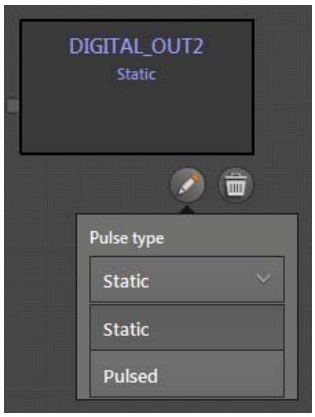
> A logic block can be shifted to any position in the main area via drag and drop.

The device has a limited number of outputs. An error message is indicated when you try to place more logic blocks than outputs are available.

Set logic block

For logic blocks which allow settings a pen is indicated at the bottom right corner of the marked logic block.

► Click logic block.



► Click pen.

> A window with the settings opens.

Delete logic block

► Click logic block.

> In the bottom right corner of the logic block a bin is displayed.

► Click bin.

> The logic block and the connection, if any, to another logic block are deleted.

Assign signals

► Set the mouse pointer to the output pin at the right edge of the logic block.

► Hold the mouse button down to drag the mouse pointer out of the output pin.

> Free input pins that can be assigned the signal on the output pin are displayed in green.

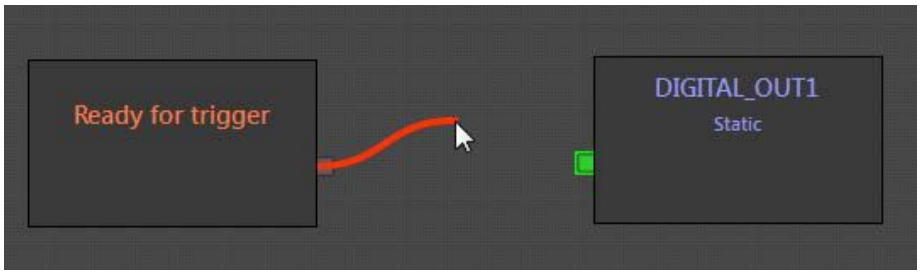
– Every input pin can only be assigned one signal.

– An output signal can be assigned to several input pins.

The ifm Vision Assistant checks the compatibility of the signal types. It is, for example, not possible to directly compare or combine numerical and binary values. The units of measurement are not checked. It would, for example, be possible to add the numerical values "process value" (unit: m) and "quality" (unit: %).

► For the assignment of the signals take into account the respective units of measurement.

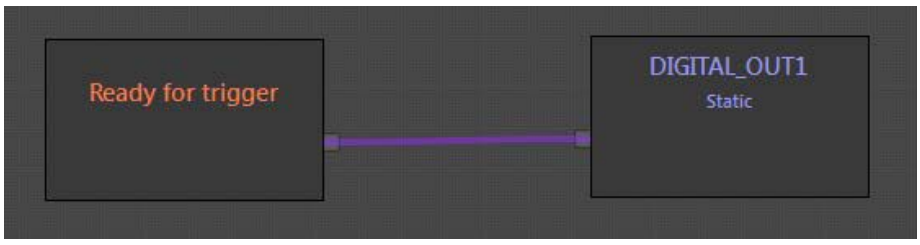
> A red line is displayed between the pin event box and the mouse pointer.



► Move the mouse pointer to the green pin of the requested logic block.

► If the connecting line between output signal and input signal is displayed in green, release the mouse button.

> A successful assignment is represented by a purple line.

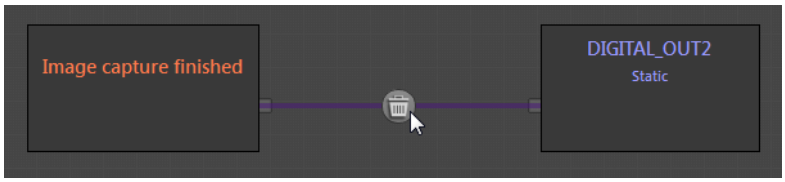


> When the logic blocks are shifted in the main area, the connecting lines follow.

Delete assignment

► Click the connecting line of the assignment to be deleted.

> A bin is shown.



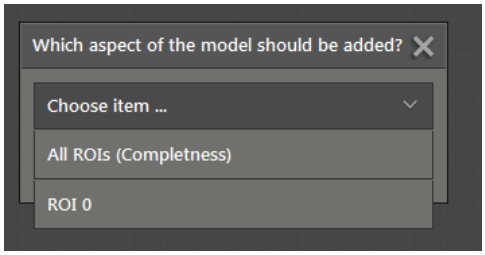
► Click bin.

8.5.3 Description of the logic blocks

Model results

The models defined on the screen "Models" can be selected on the screen "Logic".

The following window appears when the logic block is placed on the screen "Logic":



Option	Output signals	Code	Description
Model "volume"	All regions of interest (ROIs) good	Binary	● 1: The quality of the measured values in all ROIs is "good". ● 0: The quality of the measured value in at least one ROI is not "good".
	Number Under SP1	Numerical	Number of ROIs where the process value is lower (level measurement) or higher (distance measurement) than the lower threshold value.
	Number Over SP2	Numerical	Number of ROIs where the process value is higher (level measurement) or lower (distance measurement) than the higher threshold value.
	Number of good regions of interest (ROIs)	Numerical	Number of ROIs with measured values of the quality "good".
	Number of invalid regions of interest (ROIs)	Numerical	Number of ROIs with measured values that are "invalid".
	Min. value	Numerical	Minimum measured value
	Max. value	Numerical	Maximum measured value
Result of a ROI	Process value	Numerical	→ „8.4.6 Define ROI distance value“.
	SP1	numerical	● Level measurement: lower threshold value in metres ● Distance measurement: upper threshold value in metres
	SP2	Numerical	● Level measurement: upper threshold value in metres ● Distance measurement: lower threshold value in metres
	Quality	Numerical	Quality of the measured values in the ROI on a scale from 0 % (bad) to 100 % (good).
	Anchor tracking failed	Binary	● 1: Anchor tracking failed ● 0: Anchor tracking successful

For both options the model can be changed via the pen symbol. For the option "Result of a ROI" it is also possible to switch to another ROI (if any).

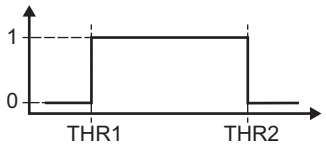
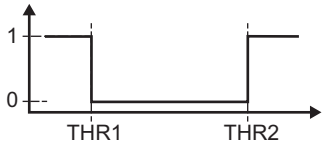
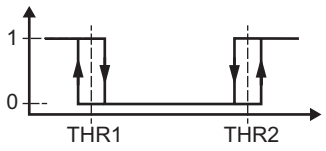
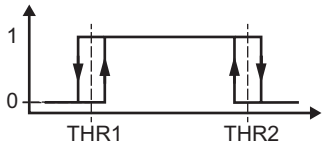
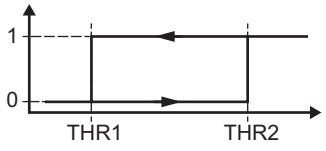
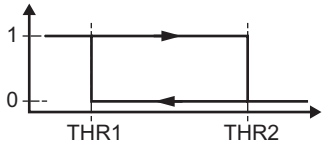
Arithmetic

The following arithmetic functions can be applied to the values:

Function	Code at input	Code at output	Description
DIFF	Numerical	Numerical	Subtracts the signals applied to the two inputs. The selection of the output defines the sign.
ADD	Numerical	Numerical	Adds the signals applied to the two inputs.
COUNT	Binary	Numerical	Adds the signals applied to the inputs. For the addition the binary values 1 and 0 are treated as numerical values.
Min max value	Numerical	Numerical	Defines the min. and max. value of the input signals.
Fixed value	–	Numerical	Enables to enter a floating point number which can be used for the arithmetic functions "DIFF" and "ADD" (e.g. to set an offset).

Digitalisation

The numerical values applied can be compared with the digitalisation functions. The output value is binary.

Function	Description	Output value
Window function FNC	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NC contact (normally closed): ● Output value = 0 if value < THR1 ● Output value = 0 if value > THR2 ● Output value = 1 if value ≥ THR1 AND value ≤ THR2	
Window function FNO	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NO contact (normally open): ● Output value = 0 if value < THR1 ● Output value = 0 if value > THR2 ● Output value = 1 if value ≥ THR1 AND value ≤ THR2	
Window function FNCh	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NC contact (normally closed). Switching at the threshold values is delayed (switching hysteresis): ● Output value = 0 if value < (THR1 – 0.5 • hysteresis) ● Output value = 0 if value > (THR2 + 0.5 • hysteresis) ● Output value = 1 if value ≥ (THR1 + 0.5 • hysteresis) AND value ≤ (THR2 – 0.5 • hysteresis) ● The output value remains unchanged in the hysteresis ranges. ● Hysteresis = 0.05 • (THR2 – THR1) ● Hysteresis = 2 mm if 0.05 • (THR2 – THR1) ≤ 2 mm	
Window function FNOh	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NO contact (normally open). Switching at the threshold values is delayed (switching hysteresis): ● Output value = 1 if value < (THR1 – 0.5 • hysteresis) ● Output value = 1 if value > (THR2 + 0.5 • hysteresis) ● Output value = 0 if value ≥ (THR1 + 0.5 • hysteresis) AND value ≤ (THR2 – 0.5 • hysteresis) ● The output value remains unchanged in the hysteresis ranges. ● Hysteresis = 0.05 • (THR2 – THR1) ● Hysteresis = 2 mm if 0.05 • (THR2 – THR1) ≤ 2 mm	
Hysteresis HNC	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NC contact (normally closed). The threshold values correspond to the switching values of the hysteresis: ● Output value = 0 if value < THR1 ● Output value = 1 if value > THR2 ● The output value remains unchanged in the hysteresis range (THR1 ≤ value ≤ THR2).	
Hysteresis HNO	The input value (value) is compared with 2 threshold values (THR1, THR2). The output value corresponds to an NO contact (normally open). The threshold values correspond to the switching values of the hysteresis: ● Output value = 1 if value < THR1 ● Output value = 0 if value > THR2 ● The output value remains unchanged in the hysteresis range (THR1 ≤ value ≤ THR2).	
Comparator	Two input values (A, B) are compared. ● Output value = 1 if the relation indicated at the output applies ● Output value = 0 if the relation indicated at the output does not apply	

Logical operations

The logical operations can only be applied to binary values.

Operation	Description
AND	● Output value = 1 if all input values = 1 ● Output value = 0 if at least one input value = 0
OR	● Output value = 1 if at least one input value = 1 ● Output value = 0 if all input values = 0
NOT	The output value is the inverted input value: ● Output value = 1 if input value = 0 ● Output value = 0 if input value = 1

Every logical operation can have max. 64 inputs. Results of a logical operation cannot be assigned to the input of a previous logical operation level.

Pin events

Pin event	Description
Ready for trigger	The device is ready for being triggered and capturing a new image.
Error	The device has found an error.
Evaluation finished	The device finished the image capture and the calculation of the image data. The image data is available for sending via Ethernet.
Image capture finished (cascading)	The device finished the image capture. This signal can be used for cascading the trigger signals when several devices are operated (→ „8.3.8 Operate several devices“).
Process interface	The status of the digital output can be switched to "high" or to "low" with the command "o" via the process interface.

Output

The output values can be assigned to different outputs irrespective of their coding (binary, numerical).

Output	Code at input	Settings	Description
DIGITAL_OUT1/2/3	Binary	Static	The output is switched without time limit (recommended setting).
		Pulsed	The output is switched with a limited signal duration. The signal duration can be set in ms. The minimum value is 10 ms.
ANALOG_OUT ANALOG_OUT_DYN	Numerical	Mode	The output value can be provided as current signal (I) between 4 and 20 mA or as voltage signal (U) between 0 and 10 V.
		Direction	The output signal rises (rising, ↑) or falls (falling, ↓) with the output value.
		Start point	The lowest or highest output value depending on the selected direction: ● Rising direction: Start point of the output value corresponds to 0 V or 4 mA ● Falling direction: Start point of the output value corresponds to 24 V or 20 mA For the output via ANALOG_OUT_DYN a dynamic start point can be applied to the respective input.
		End point	The lowest or highest output value depending on the selected direction: ● Rising direction: End point of the output value corresponds to 24 V or 20 mA ● Falling direction: End point of the output value corresponds to 0 V or 4 mA For the output via ANALOG_OUT_DYN a dynamic end point can be applied to the respective input.
Virtual pins byte1–8	Binary	–	A virtual pin can be provided as part of a datagram via TCP/IP, EtherNet/IP or PROFINET (→ „8.6 Configure interface“). The virtual pin consists of an 8-bit order. In the datagram the 8 virtual pins are arranged in sequence. So maximum 64 binary values can be transmitted via the Ethernet interface with the virtual pins. A binary 0 is provided for the inputs of the virtual pins which are not used.

Statistics (Pass/Fail)

A binary value can be defined as a decision criterion that an event is evaluated as success (1) or failure (0).

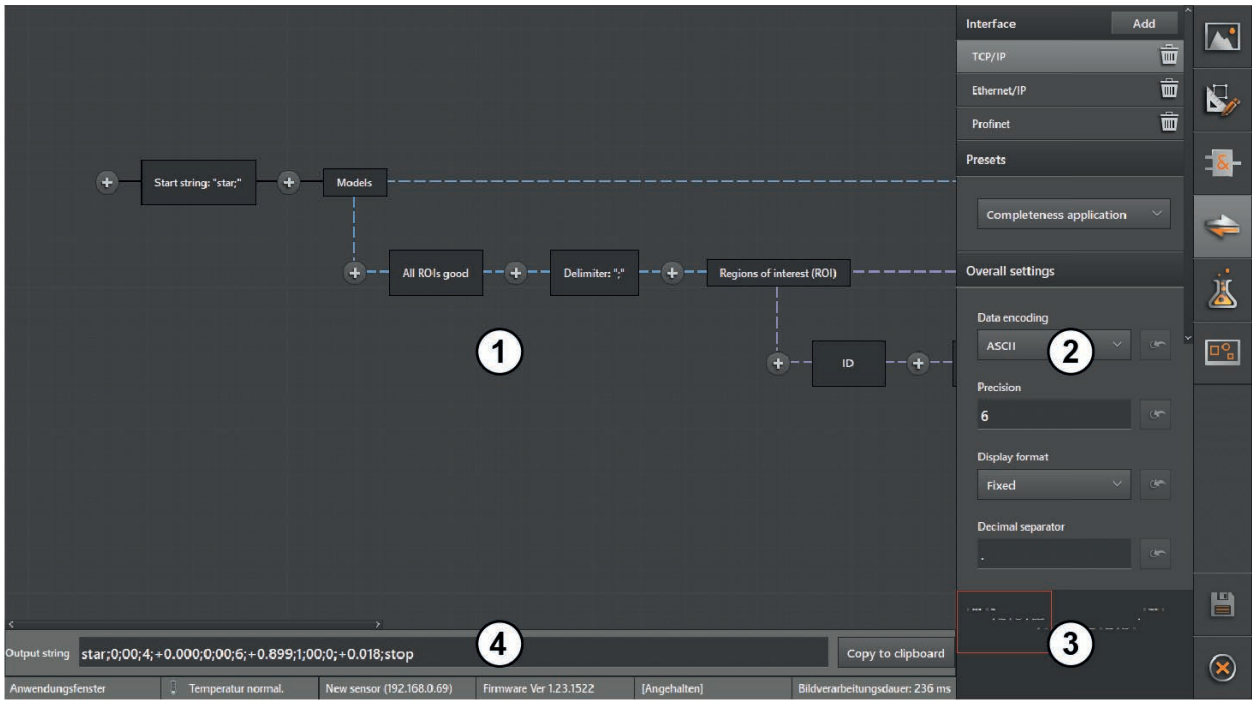
The results are written to the service report and are available for statistical calculations.

8.6 Configure interface

The data packages which are transmitted via the Ethernet interface can be defined on the screen "Interface".

► Click  .

> The screen "Interface" appears.



1: Main area
2: Setting range
3: Overview area
4: Output string

Window area	Description
Main area	In the main area the data blocks of a data package are displayed as boxes. The data is sent from left to right in the order of the data blocks.If the elements in the main area go beyond the visible area, this area can be shifted using the scroll bar at the edge of the main area.
Setting range	The setting area consists of the following subareas: ● Interfaces: The interfaces can be configured for the network protocols TCP/IP, EtherNet/IP and PROFINET. All settings refer to the selected network protocol. ● Preset data packages: The ifm Vision Assistant contains preset data packages that can be applied or used as templates for user-defined settings. If a preset data package is changed it becomes a user-defined data package. The preset data package remains in its initial state. The data package changed last is available as user-defined data package. ● General output format: The general output format refers to all data packages created (see section below).
Overview area	In the bottom right corner of the main area a reduced main area is displayed for a better overview. If the elements in the main area go beyond the visible area, this area can be shifted by dragging the red frame with the mouse.
Output string	● The output string indicates the character string which is integrated into the datagram. Depending on the overall setting "Data encoding" in the setting area the output string is displayed in ASCII code or binary code. ● With the button [Copy to clipboard] the output string can be copied to the clipboard.

Set general output format

The general output format of the numerical values can be set using the overall settings. The diagnostic data can be assigned individual output formats which may differ from the general output format (→ „Set data block“).

► Click [Overall settings] in the setting area.

Setting	Description
Data encoding	Format for data encoding: ASCII or binary.
Accuracy	Number of decimal places.
Display format	● Fixed: fixed-point number ● Scientific: exponential notation
Decimal separator	7-bit character (e.g. ".") as a separator of decimal numbers.
Basis	Output format: ● 2: binary ● 8: octal ● 10: decimal ● 16: hexadecimal
Width	Minimum total length of the value. If the value exceeds this width it is not shortened.
Numeric fill	● On: Every bit position which is not used by the value is filled with a binary 0 and positive values are preceded by a plus sign. ● Off: Bit positions which are not used by the value remain blank.
Fill	Fill character
Alignment	Right or left alignment of the value within the defined bit width.
Byte order	● little endian: least significant byte of a binary value at the first position or at the lowest memory address. ● big endian: most significant byte of a binary value at the first position or at the lowest memory address. ● Network byte order: byte order defined by the network protocol. ● Fieldbus-dependent: byte order defined by the fieldbus.

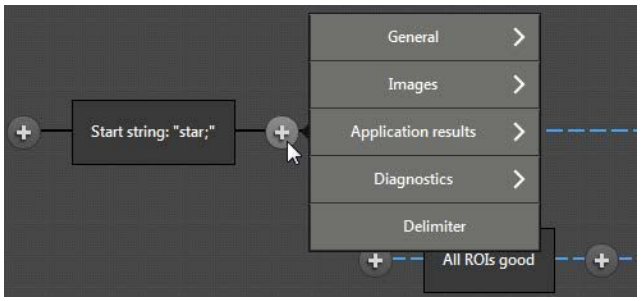
With the button [Default value] the setting can be reset to your default value.

More information about the settings → Operating instructions.

Add data block

A data block can be added at the start, at the end or between two existing data blocks.

► Click the plus sign where the data block is to be added.



> A selection list is displayed where the data blocks are grouped as follows:

Group	Data block	Description
General	Start string	Indicates the start of the data package.
	End string	Indicates the end of the data package.
	User-driven input	Allows writing of free text in the data package.
	Unit vector matrix e1/ e2/e3	Adds a unit vector matrix to the respective axis in the Cartesian coordinate system (x, y, z) to project a radial distance
	Conversion to world coordinate system	Conversion of the current coordinates to the world coordinate system.
	Index of active application	Indicates the index of the active application.
images	X/Y/Z image	Cartesian x, y z, coordinates of the pixels.
	Normalised amplitude image	Image of the amplitude values of the light reflected from the object. The amplitude values are normalised to the exposure time.
	Radial distance image	Image of the distance values determined through the time of flight.
	Pixel status indication	Display of the status (e.g. invalid, saturated) for each pixel.
	Amplitude image	Image of the measured amplitude values of the light reflected from the object.
Application results	Models	The data of all models defined for the application is transmitted one after the other. The data block is displayed as a program loop. The content of the program loop also consists of data blocks which can be selected separately. ● ID: The IDs consist of a consecutive number (0-999) in the order in which the models are defined. After 999 IDs have been assigned in an application the IDs of deleted models are assigned again. ● Regions of interest (ROI): The data of all ROIs defined for the model is transmitted one after the other. The data block is displayed as a program loop. The content of the program loop also consists of data blocks which can be selected separately. – ID: The IDs consist of a consecutive number (0-999) in the order in which the ROIs are defined. After 999 IDs have been assigned in a model the IDs of deleted ROIs are assigned again. – Quality: quality of the measured values in the ROI in %. – Process value: process value of the ROI (→ „8.4.6 Define ROI distance value“). – Status: status of the ROI as character string. – User-driven input: allows writing of free text in the data package. – Separator: delimiter to separate data blocks ● Number of regions of interest (ROIs) in the model ● User-driven input: Allows writing of free text in the data package. ● Separator: delimiter to separate data blocks
	Number of models	Number of the models defined for the application.
	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.
Diagnostics	Temperature front end	Temperature of the image converter PCB.
	Temp illu	Temperature of the device illumination.
	Evaluation time	Time to calculate the image data.
	Frame rate	Actual frame rate.
	Diagnostic data	→ Operating instructions.
Separator	–	Delimiter to separate data blocks

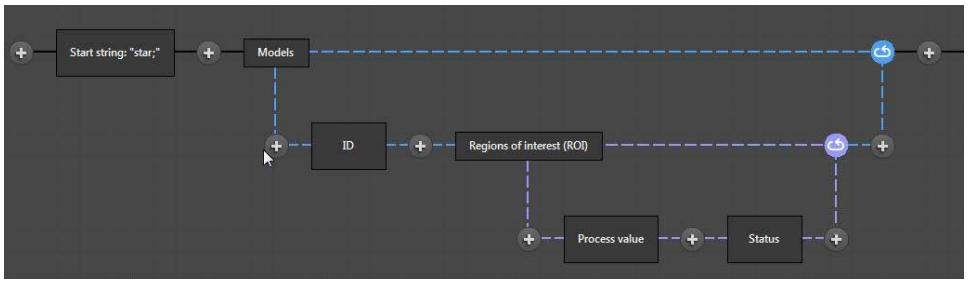
The parser configuration for complex data blocks is time-intensive and prone to errors.

► Keep data packages as simple and short as possible.

Show and hide loops

The data blocks "Models" and "Regions of interest (ROI)" are combined into sequences of data blocks from individual data blocks. If more than one model and / or more than one ROI is defined for the application, these sequences of data blocks are transmitted one after the other.

On the screen "Interface" these data blocks are displayed as a program loop. The following illustration shows an example.



The program loop can be shown or hidden by clicking the data block.

Set data block

► Click box.

> If the settings of the data block can be changed, a pen is indicated in the bottom right corner of the box.

► Click pen.

> The settings of the data block are indicated in a selection list:

Group	Data blocks that can be changed	Options
General	Start string	Input of a character string which marks the start of the data package.
	End string	Input of a character string which marks the end of the data package.
	User-driven input	Input of a character string for application-specific purposes.

<table>
<tr><th>Group</th><th>Data blocks that can be changed</th><th>Options</th></tr>
<tr><td rowspan="2">Application results</td><td>Models:
● ID
● Regions of interest (ROI):
– ID
– Status
– Quality
● Number of regions of interest</td><td rowspan="6">The following output formats can be individually set for every data block of these groups:
● Data type: signed integer, unsigned integer or floating point number of different bit lengths.
● Data encoding: format for data encoding (ASCII or binary).
● Scale: factor for scaling the measured value.
● Offset: amount added to the measured value.
● Precision: number of decimal places (only with floating point numbers).
● Display format: fixed point number (fixed) or exponential notation (scientific).
● Decimal separator: 7-bit character (e.g. ".") to separate decimal numbers (only with floating point numbers).
● Basis: output format binary, octal, decimal or hexadecimal (only with integers).
● Width: If the value exceeds this width it is not shortened.
● Numeric fill: Every bit position which is not used by the value is filled with a binary 0 (on) or remains blank (off).
● Fill: fill character.
● Alignment: right or left alignment of the value within the defined bit width.</td></tr>
<tr><td>Number of models</td></tr>
<tr><td rowspan="4">Diagnostics</td><td>Temperature front end</td></tr>
<tr><td>Temp illu</td></tr>
<tr><td>Evaluation time</td></tr>
<tr><td>Frame rate</td></tr>
<tr><td>Separator</td><td>–</td><td>Delimiter to separate data blocks</td></tr>
</table>

Delete data block

► Click box.

> In the bottom right corner of the box a bin is indicated.

► Click bin.

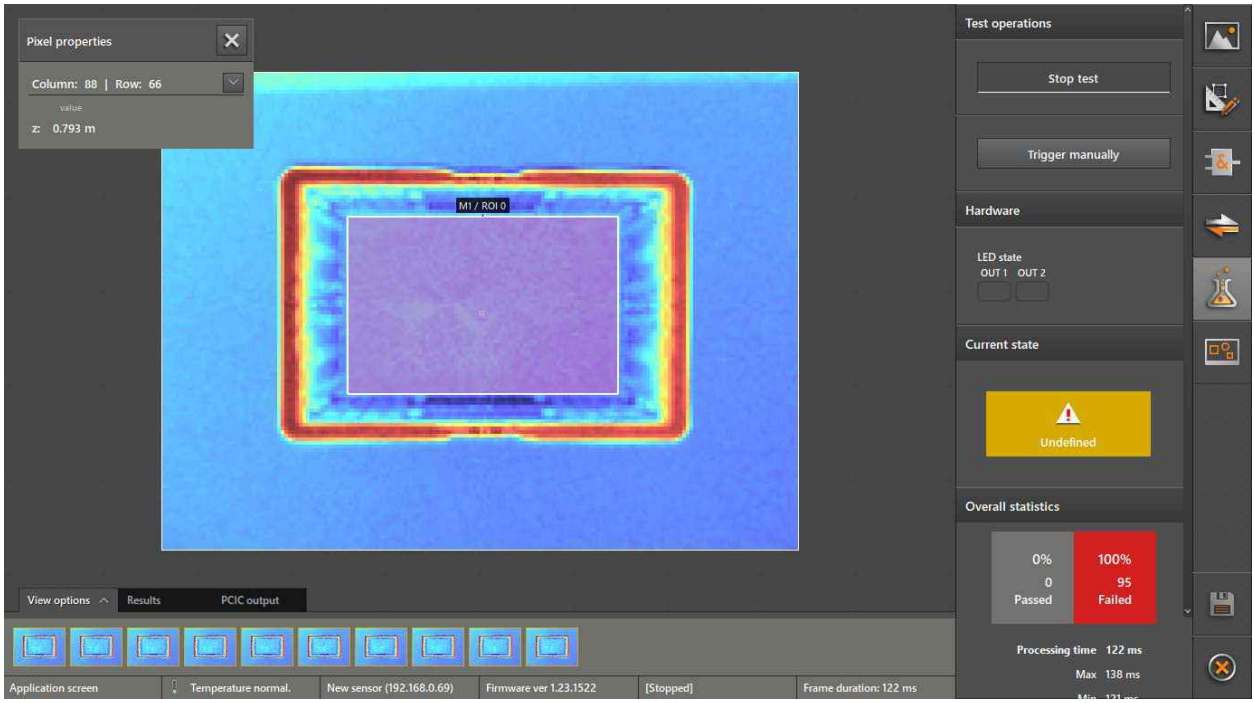
> The data block is deleted.

8.7 Test operations

The application can be tested on the screen "Test operations".

Start test

► Click  .



> The live image can be set under the tab "View options" (→ "7.2 View options").

► Click [Start test] in the field "Test operations".

> The device starts the image capture according to the setting of the trigger source.

> If no continuous image capture is set the capture of a test image can be triggered with [Trigger manually].

> The last 10 test images are displayed in miniature view in the bar under the live image in chronological order from left (old) to right (new).

> The states of the status LEDs (OUT1, OUT2) and the model statistics are also saved for every test image.

> The output string can be shown under the tab "PCIC output" in ASCII format. The output string can be copied to the Windows clipboard.

View test images

► Click [Stop test].

► Click the requested test image in the bar.

> The miniature view of the selected test image is displayed with a frame.

> The following test results are displayed:

- The selected test image is displayed instead of the live image.
- The related states (status LEDs, model statistics) are displayed (→ „7.2 View options“).
- The model results for the selected test image can be displayed under the tab "Results" (→ „7.6 Results“).

> By clicking the test image several times it is possible to switch back and forth between the test image and the test image captured last.

8.8 Program example application

The following example is to illustrate the necessary steps to create a typical application in the user defined mode.

Description of the example application

A box (e.g. on a conveyor) is filled with objects. The application is to execute the following functions:

- The current average level is provided at the analogue output so that a controller can react to changes of the level.
- A digital output is to switch if the average level is between two defined switching thresholds.
- A second digital output is to switch if the maximum level is exceeded.

Requirements

- The device is correctly installed (→ „3 Installation“).
- The connection to the device is established (→ „4.1 Find device“).

Create application

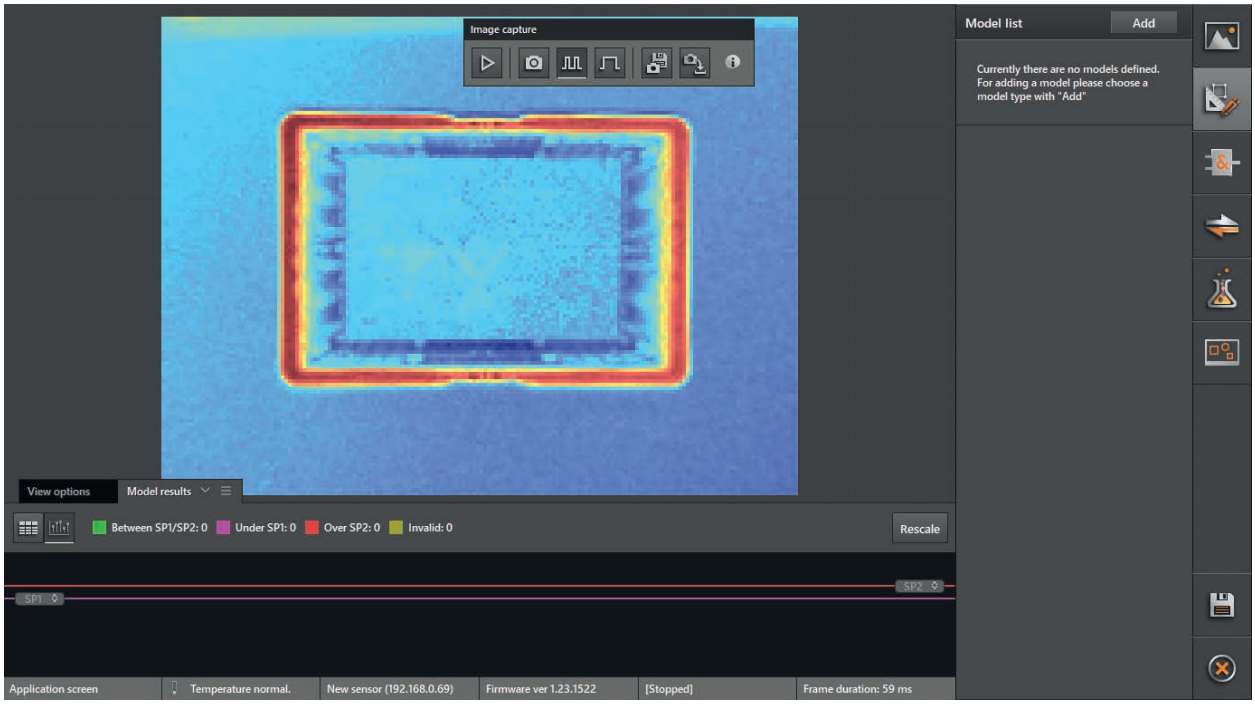
► Start user defined mode (→ „8 User defined mode“).

► Create new application (→ „9.3 Add new application“).

> The configuration of the new application is started (→ „9.2 Edit application“).

Set image

► Place an empty box under the device.



► Select image settings (→ „8.3 Image settings“):

  – Trigger source: continuous
  – Max. background distance: less than 5 m [1 frequency]
  – Exposure modes: moderate [2 exposures]
  – Filter: no filter

► Click "Image capture" in the menu bar to activate the continuous live image display.

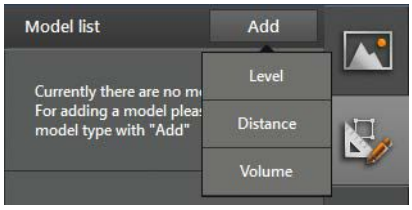
► If necessary, adapt view options to the current scene (→ „7.2 View options“).

► Click [Optimise] to optimise the exposure time.

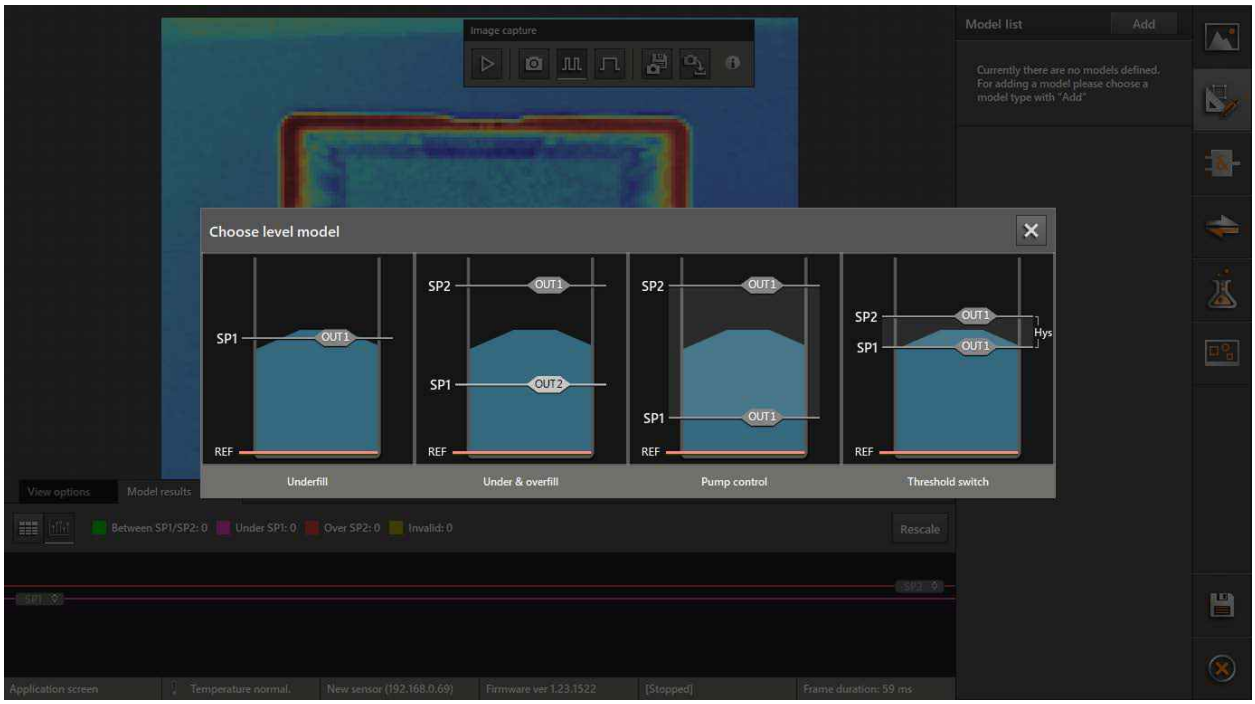
Create model "Level in the box"

► Click  .

► Click [Add] in the model list and select "level".

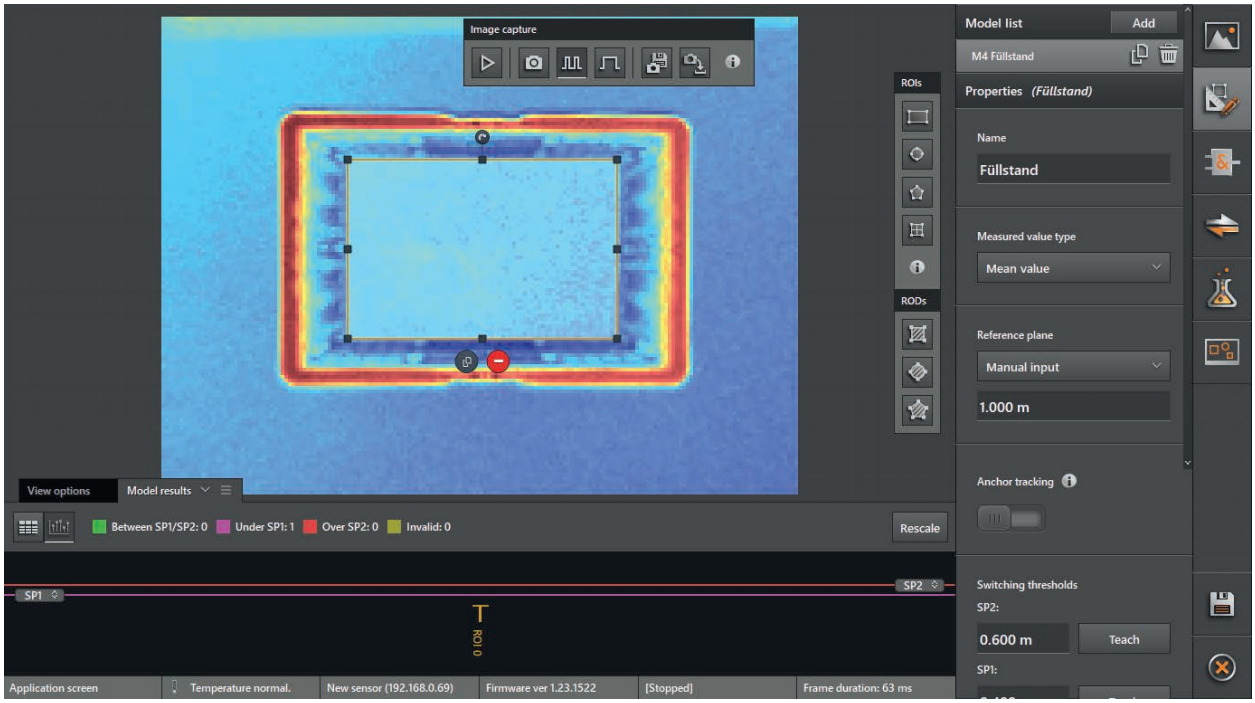


► Select level model "underfill & overfill".



> The new model is set up with a ROI (ROI 0) that is placed automatically.

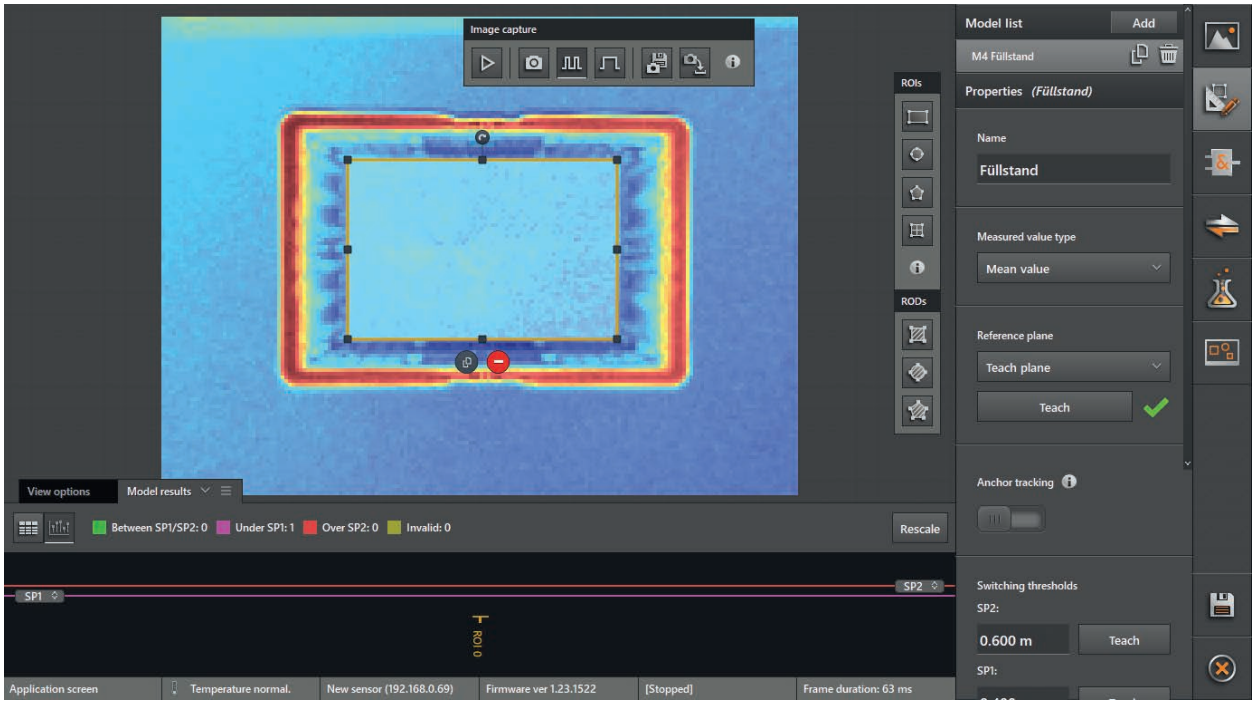
► Set the shape of ROI 0 so that the bottom of the box is covered.



► Select the option "Teach plane" in the field "Reference plane".

► Click [Teach].

> The surface in ROI 0 is set as reference plane.



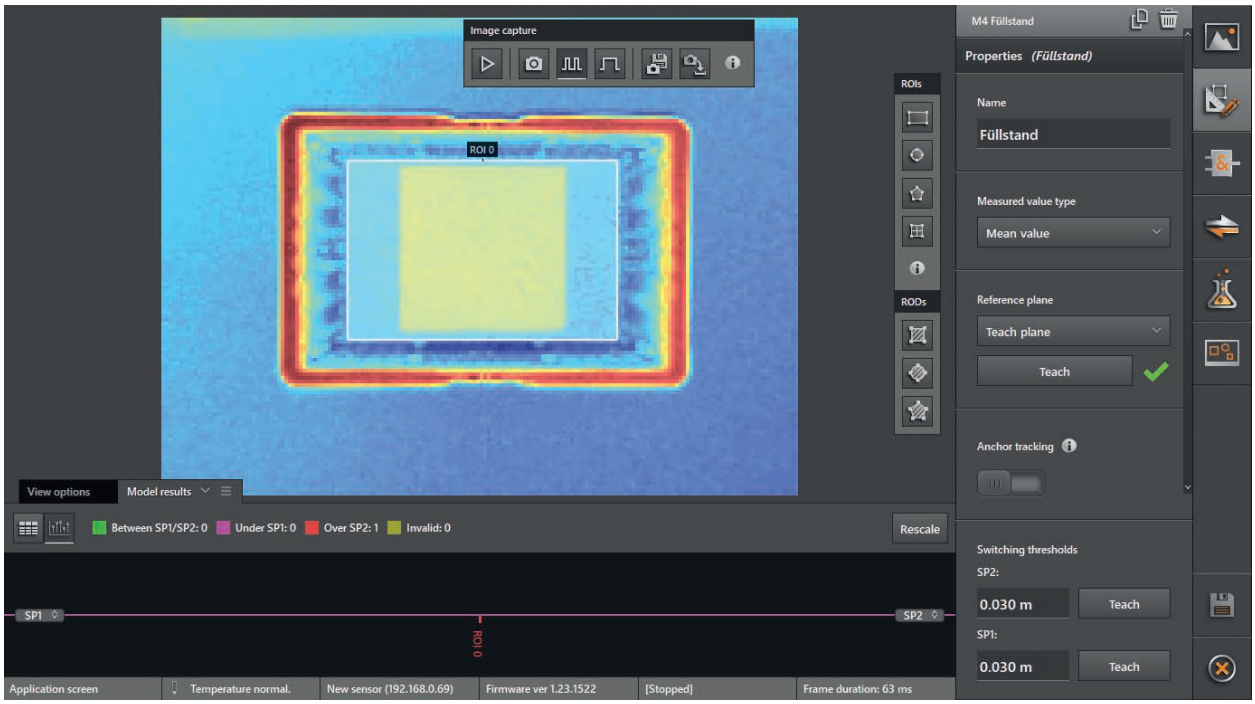
► Select the option "Mean value" in the field "Measured value type".

► If the live mode is no longer active: Click ▶ in the menu bar "Image capture" to activate the continuous live image display.

► Put the first object in the box.

► If this reduces the quality: Optimise exposure time again.

► Read the process value in the model results.



> In the example the process value is 0.092 m.

► Subtract a tolerance from the process value and enter the calculated value as switching threshold SP1.

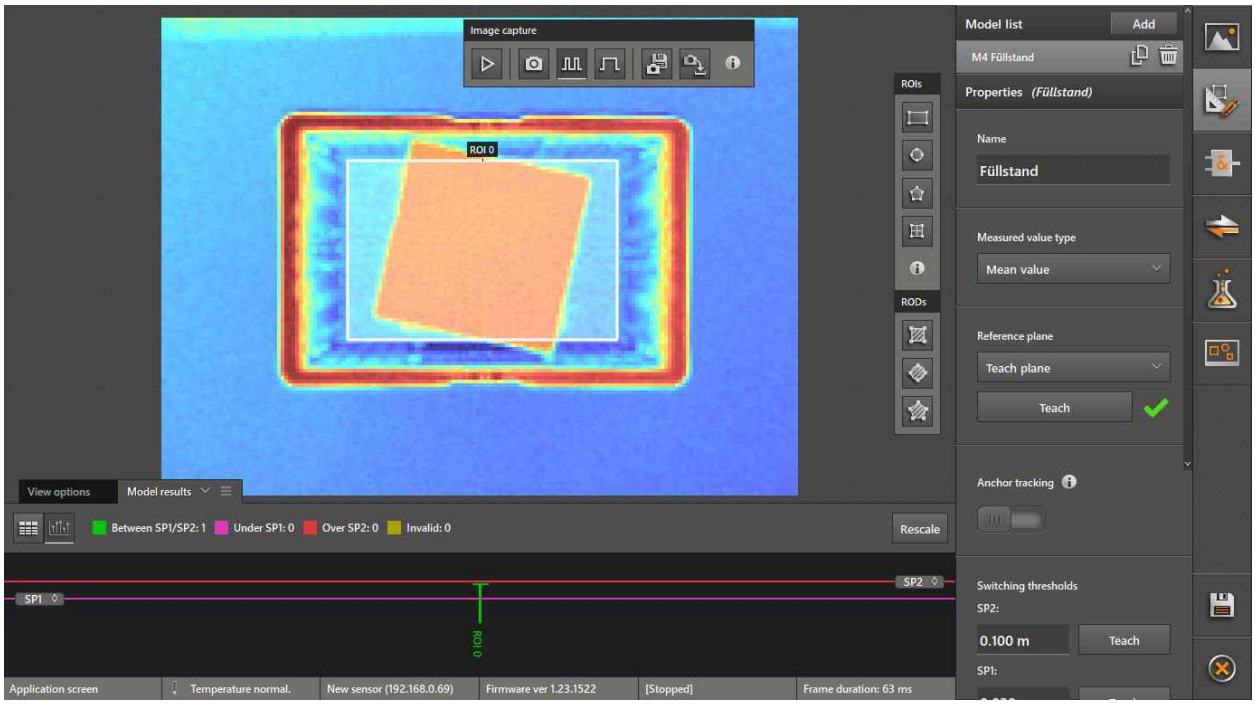
> In the example the switching threshold is 0.09 m. The switching threshold SP2 is automatically set to the value of SP1 because this value must at least be just as high.

► If the live mode is no longer active: Click ▶ in the menu bar "Image capture" to activate the continuous live image display.

► Put the second object in the box.

► If this reduces the quality: Optimise exposure time again.

► Read the process value in the model results.

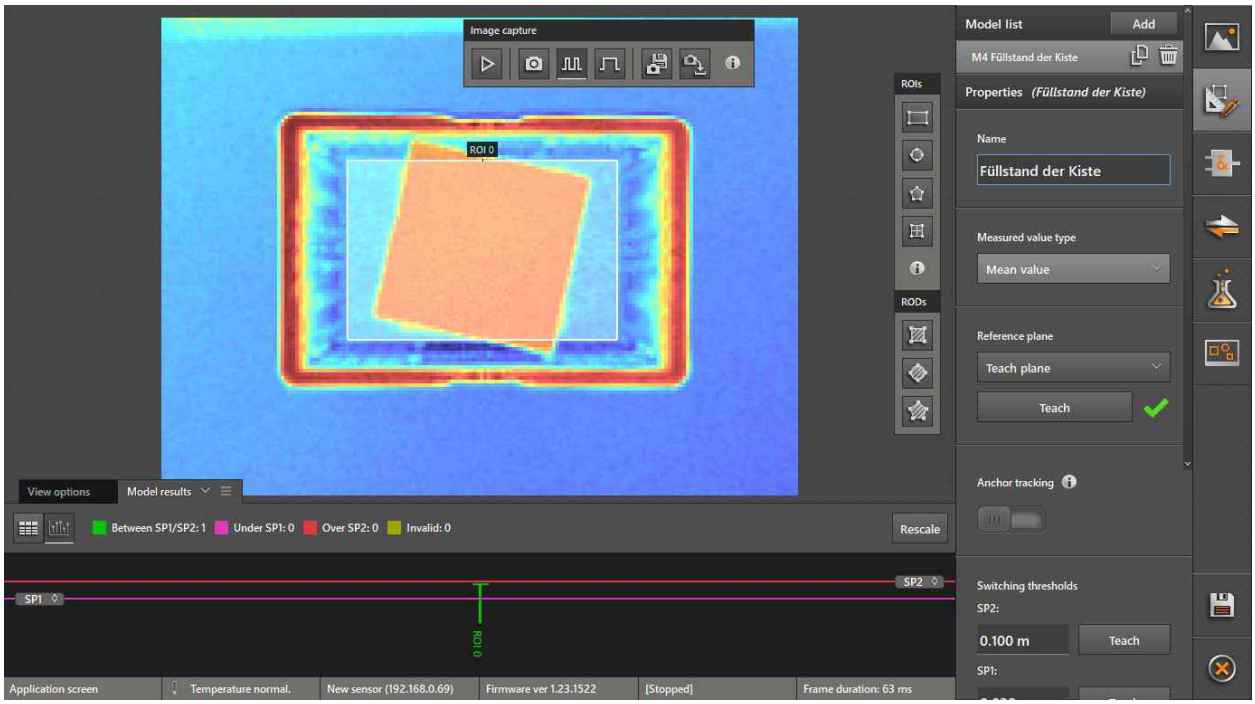


> In the example the process value is 0.138 m.

► Subtract a tolerance from the process value and enter the calculated value as switching threshold SP2.

> In the example the switching threshold is 0.135 m.

► Enter the model name "Level in the box".



Create the model "Highest level value"

► Remove all objects from the box.

► Click [Add] in the model list and select "level".

► Select level model "underfill".

> The new model is set up with a ROI (ROI 0) that is placed automatically.

► Set the shape of ROI 0 so that the bottom of the box is covered.

► Select the option "Teach plane" in the field "Reference plane".

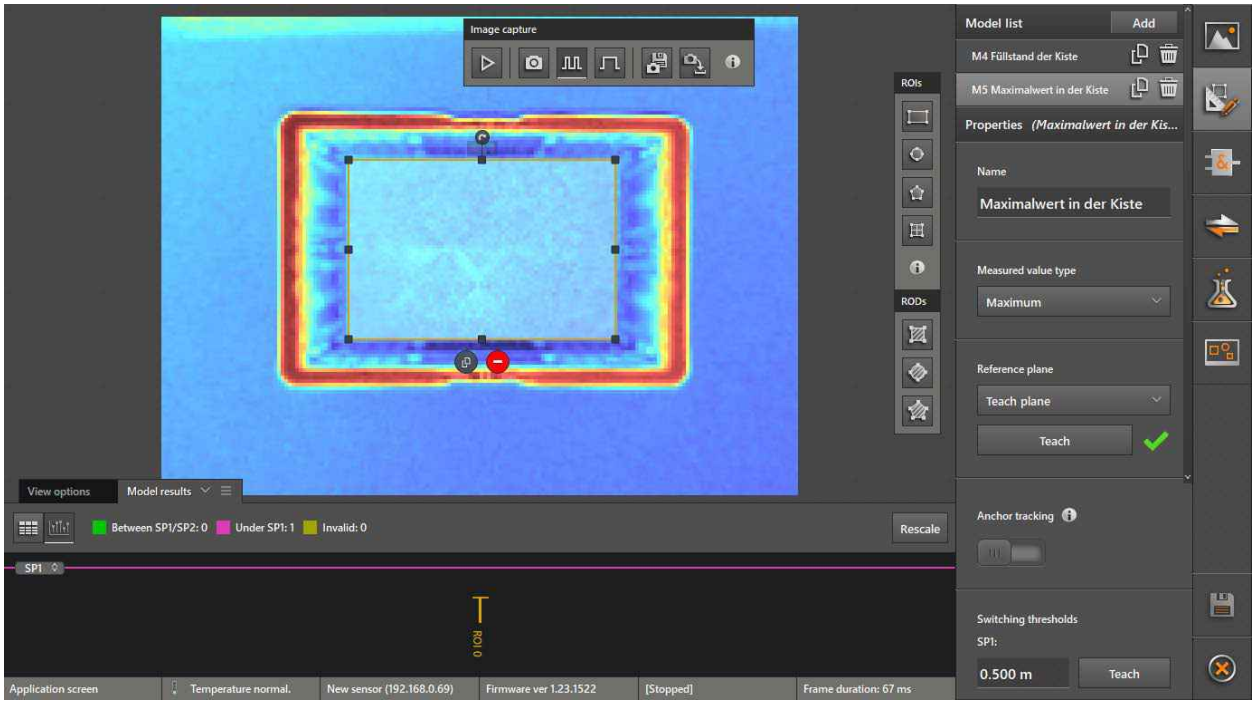
► Click [Teach].

> The surface in ROI 0 is set as reference plane.

► Select the option "Maximum" in the field "Measured value type".

► Enter the model name "Maximum value in the box".

► Click [Save].



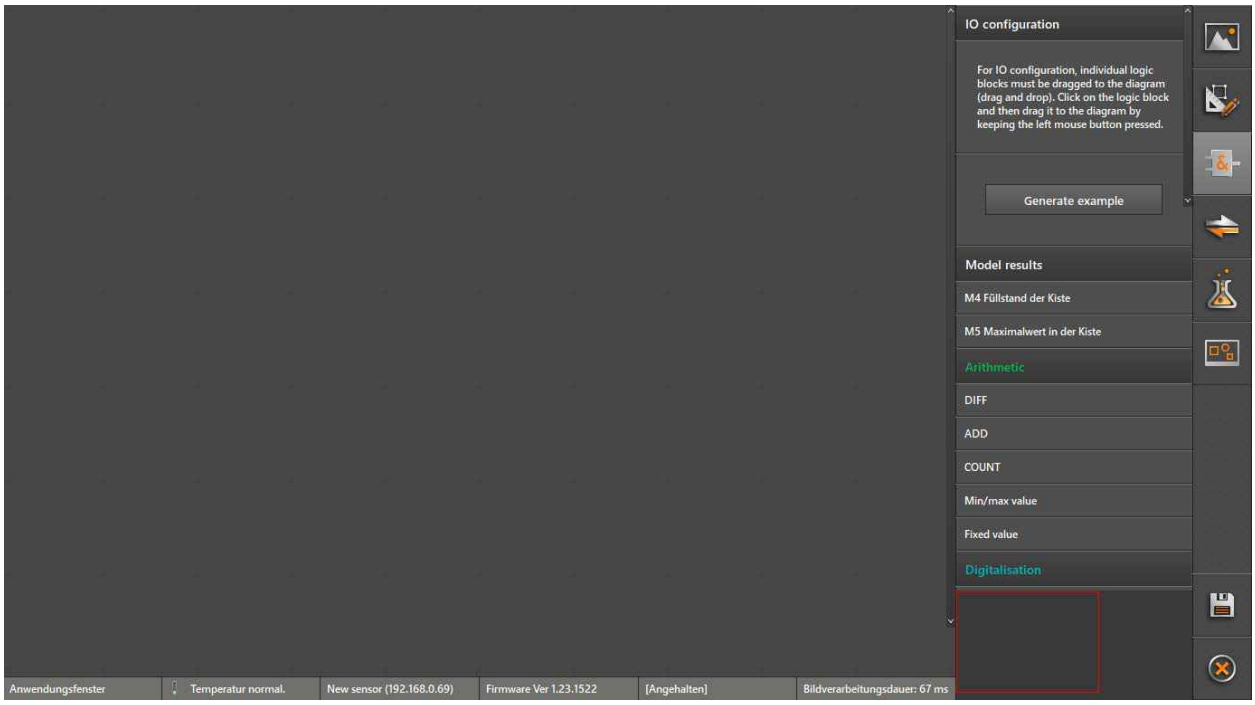
For this example application the value of the switching threshold is not relevant and can remain set to the default value.

Prepare workspace for output logic

► Click  .

> The screen "Logic" appears.

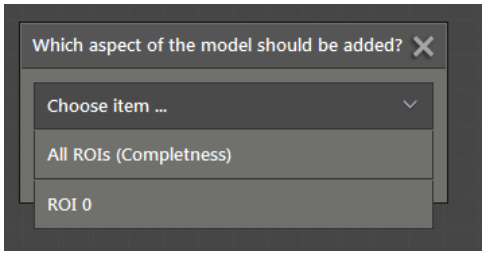
► Delete all displayed boxes from the workspace (→ „8.5.2 Place logic blocks and assign signals“).



Provide process value "Level in the box" at the analogue output

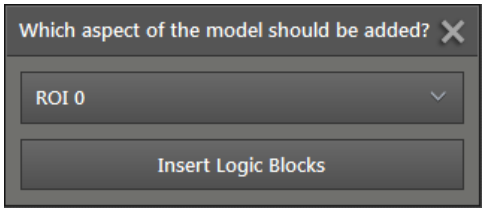
► Click the model "Level in the box" in the field "Model results" and drag to the workspace while holding the mouse button down.

> After the mouse button has been released the following window opens:



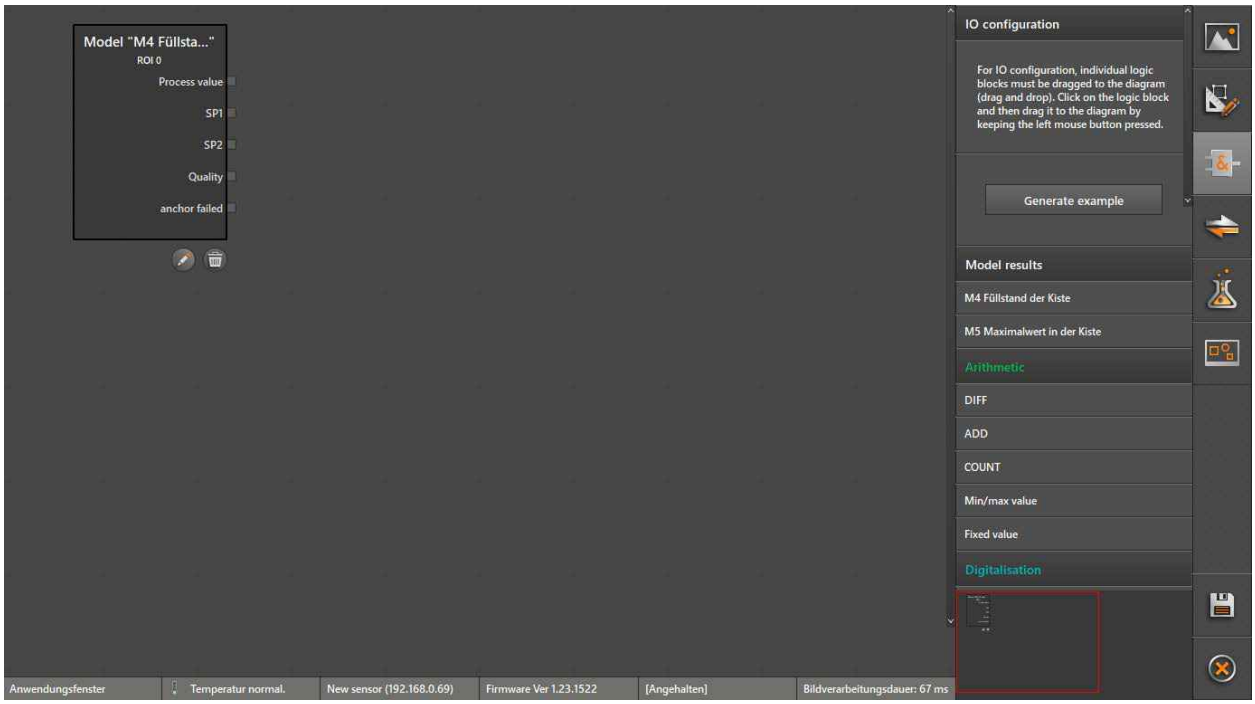
► Select the option [ROI 0] in the displayed window.

> The following window opens:



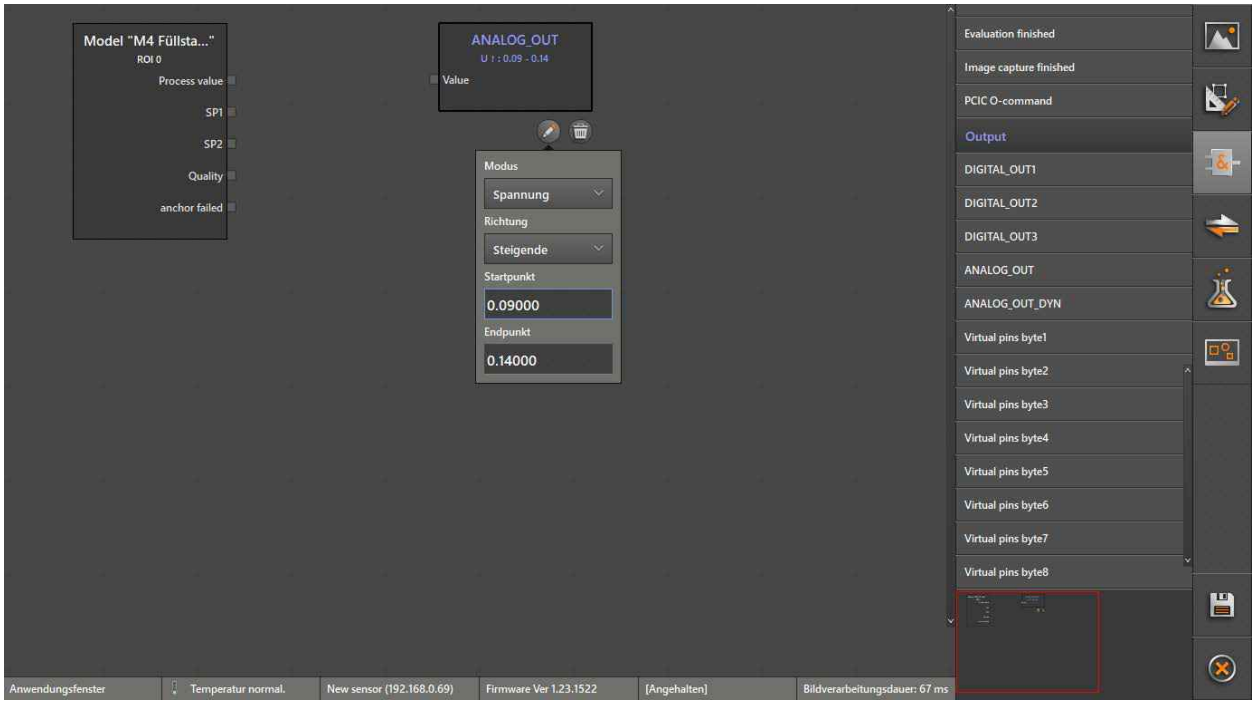
► Select [Insert Logic Blocks] in the window displayed.

> The model box "Level in the box" is displayed.



► Click the analogue output "ANALOG_OUT" in the field "Output" and drag to the workspace while holding the mouse button down.

► Adapt settings for the analogue output.



> In the example the voltage is set within the range 0.09-0.14. The output current increases as the input value increases.

► Assign the process value of the model box "Level in the box" to the input value of the analogue output "ANALOG_OUT" (→ „8.5.2 Place logic blocks and assign signals“).

If the process value "Level in the box" is between the switching thresholds SP1 and SP2, switch digital output 1

► Place the digital output "DIGITAL_OUT2", two "comparators" and the logical operator "AND" in the workspace.

► Assign the process value of the model box "Level in the box" to input A of the two "comparators".

► Assign the switching threshold SP1 of the model box "Level in the box" to input B of the first "comparator".

► Assign the switching threshold SP2 of the model box "Level in the box" to input B of the second "comparator".

► Combine output "A>B" of the first "comparator" with an input of the logical operator "AND".

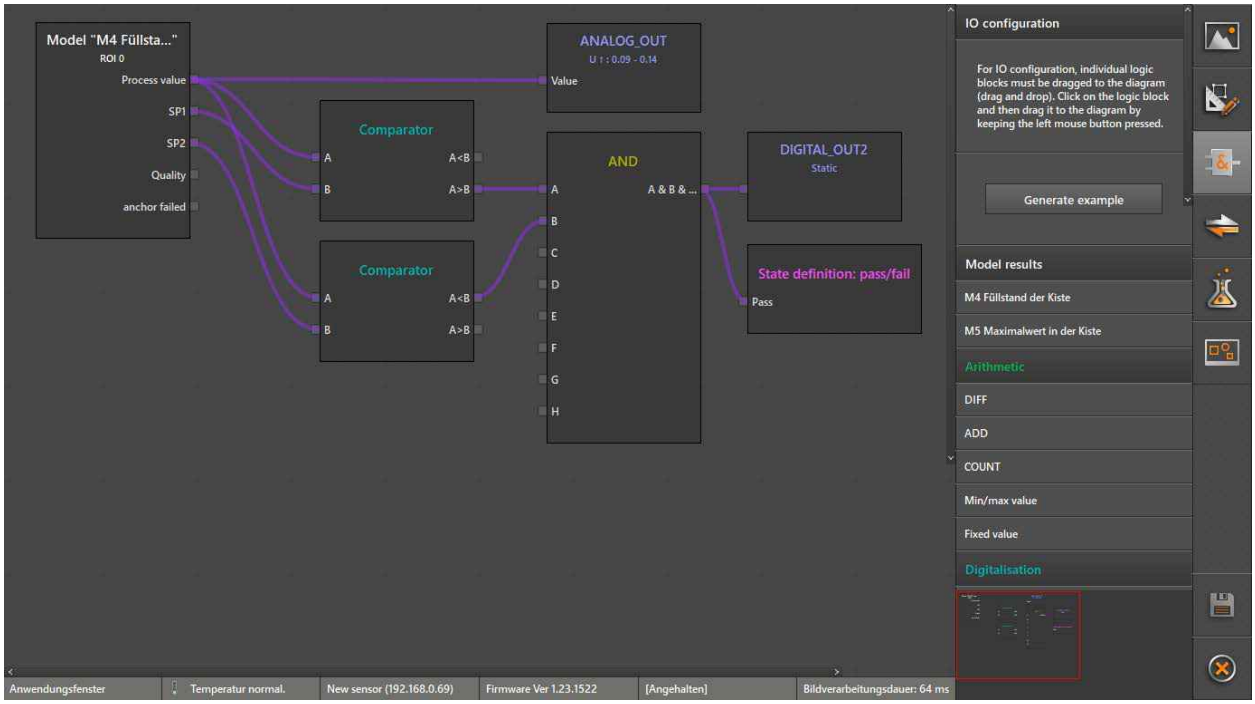
► Combine output "A<B" of the second "comparator" with an input of the logical operator "AND".

► Combine the output of the logical operator "AND" with the input of the digital output "DIGITAL_OUT2".

► Place the status definition in the workspace.

► Combine the output of the logical operator "AND" with the input of the status definition.

The additional logic block "State definition: pass/fail" is needed so that the value "good / passed (green) is counted in the overall statistics (→ „8.5 Create output logic“).

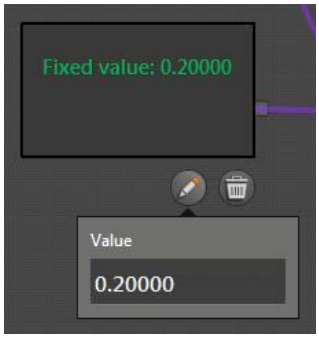


> This logic is used to verify if the process value is greater than the lower switching threshold SP1 and less than the upper switching threshold SP2. If both conditions apply at the same time, the digital output is switched.

If the process value "Maximum value in the box" is above the maximum level (e.g. edge of the box) switch the digital output 2

► Place the model "Maximum value in the box" (result of a region of interest (ROI)), the digital output "DIGITAL_OUT3", a "comparator" and the arithmetic function "fixed value" in the workspace.

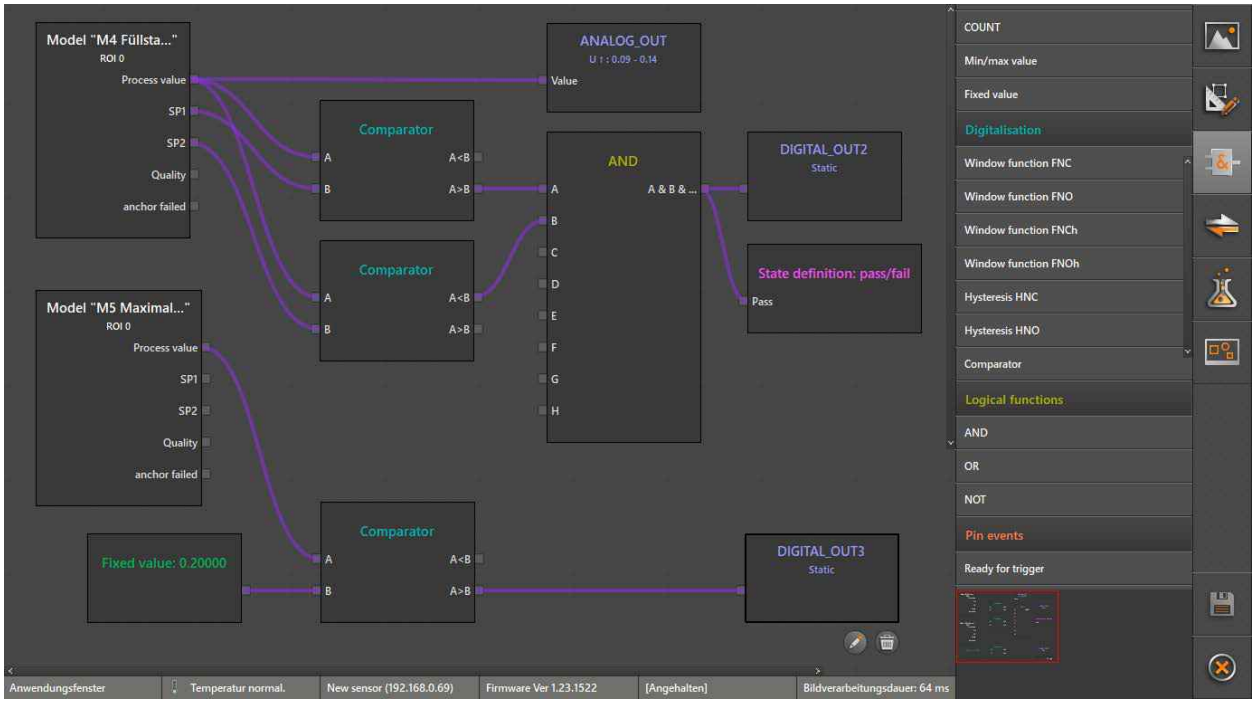
► Set the arithmetic function "fixed value" to maximum level.



► Assign the process value of the model box "Maximum value in the box" to input A of the "comparator".

► Assign the fixed value to input B of the "comparator".

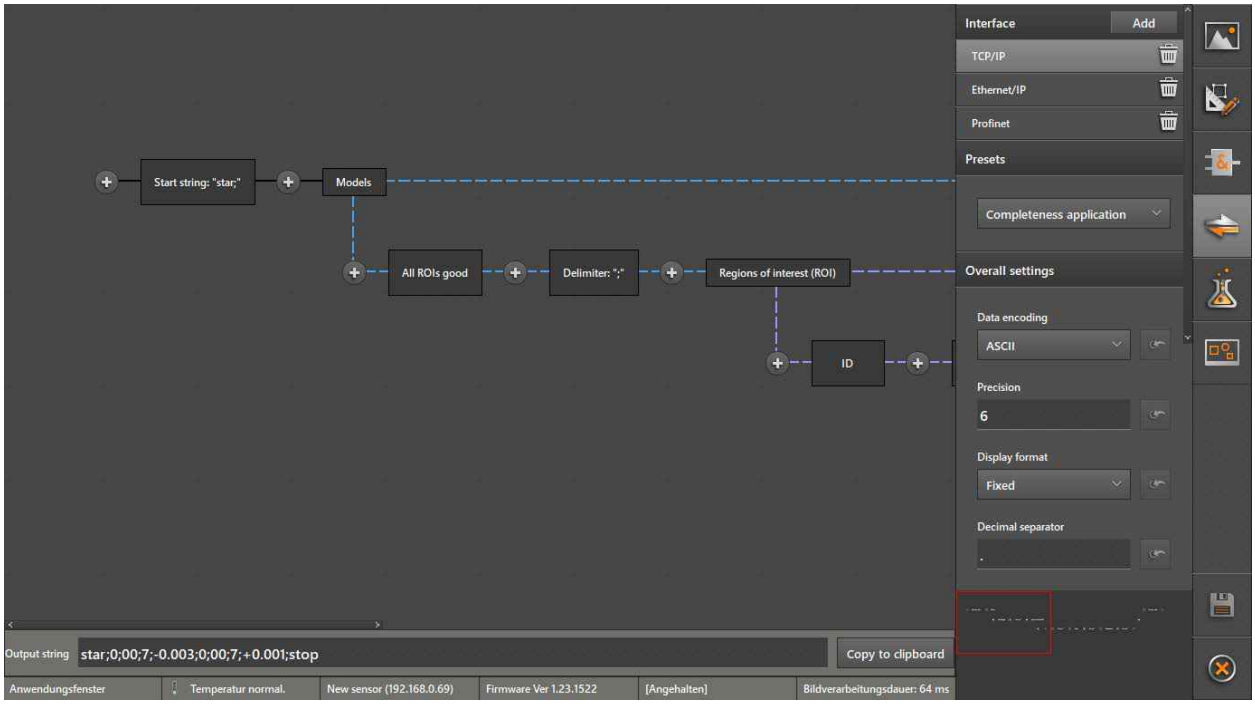
► Combine output "A>B" of the "comparator" with the input of the digital output "DIGITAL_OUT3".



> This logic is used to verify if the process value is greater than the fixed value. If this condition applies, the digital output is switched.

Configure interface

► Apply presets of the interface configuration (→ „8.6 Configure interface“).



Carry out test operations

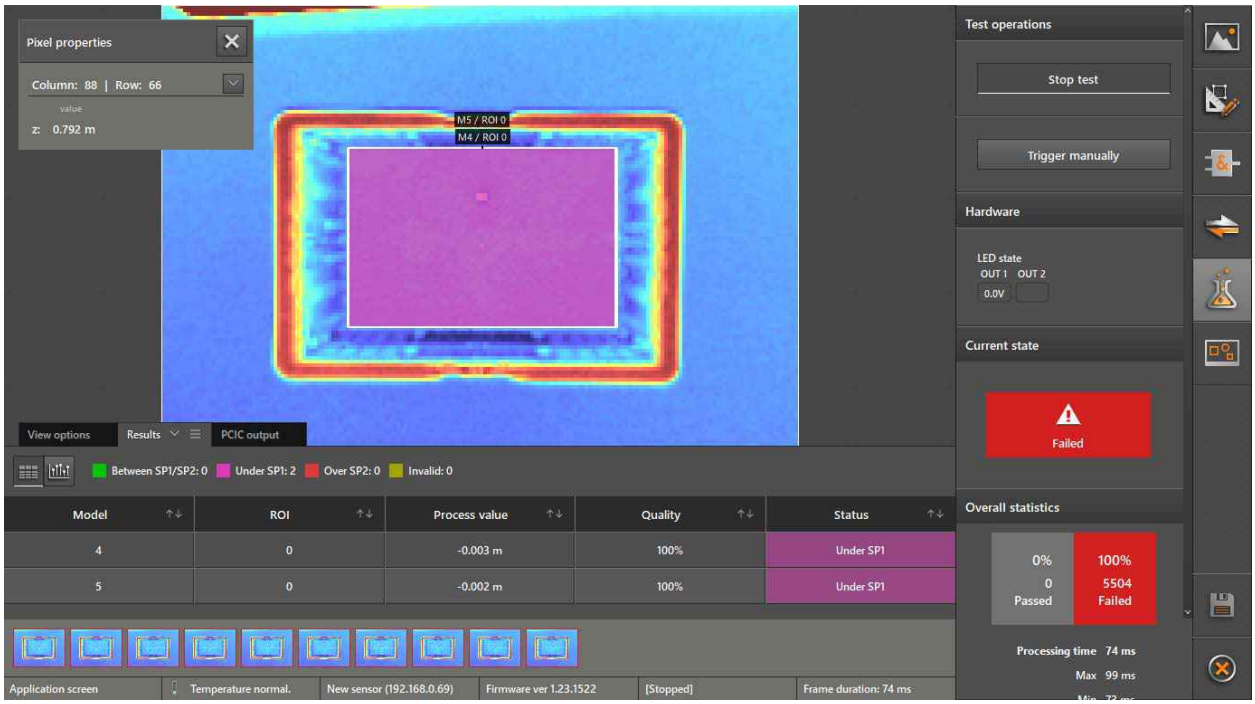
► Click  .

► Ensure that the following conditions are met with an empty box:

– Both status LEDs (OUT1, OUT2) are off.

– The indicated values for the switching thresholds correspond to the settings for both models.

– For both models "underfill" is indicated.



► Put the first object in the box.

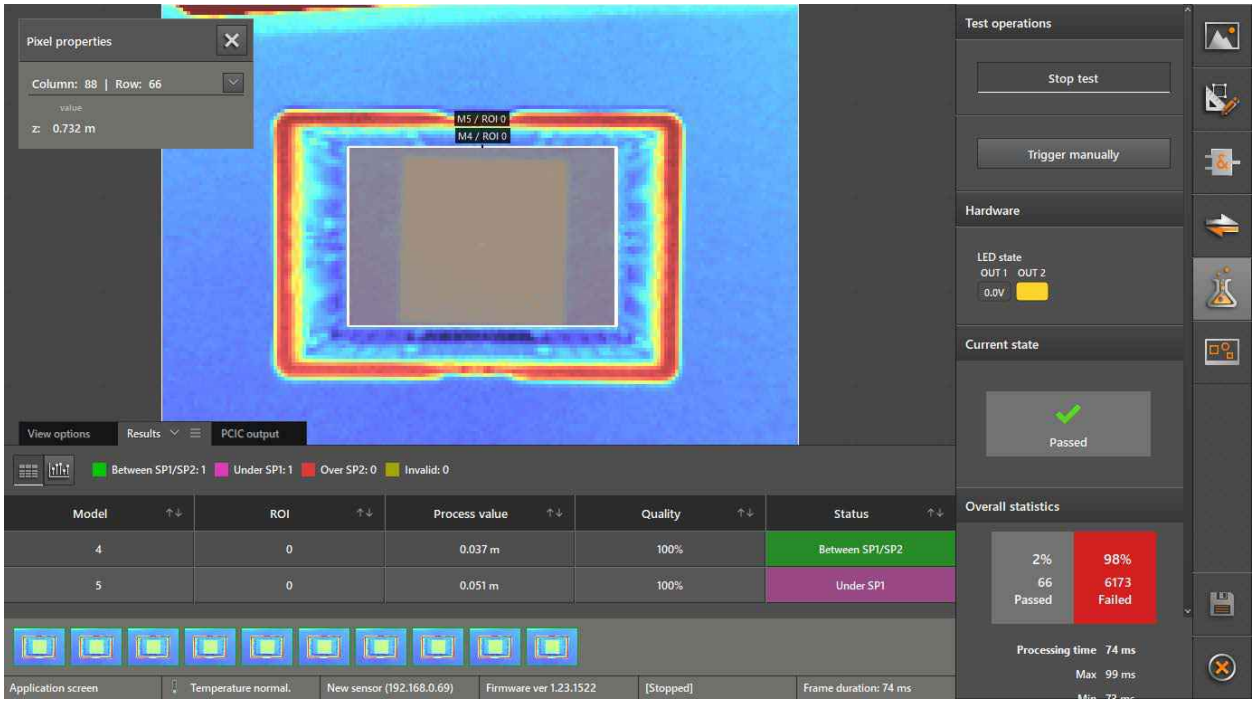
► Ensure that the following conditions are met:

– The status LED "OUT2" is on.

– For the model "Level in the box" a "good" quality is indicated because the level is between SP1 and SP2.

– For the model "Maximum value in the box" "underfill" is still indicated because the level is not above the maximum level.

– Current is provided at the analogue output (is not displayed by the ifm Vision Assistant).



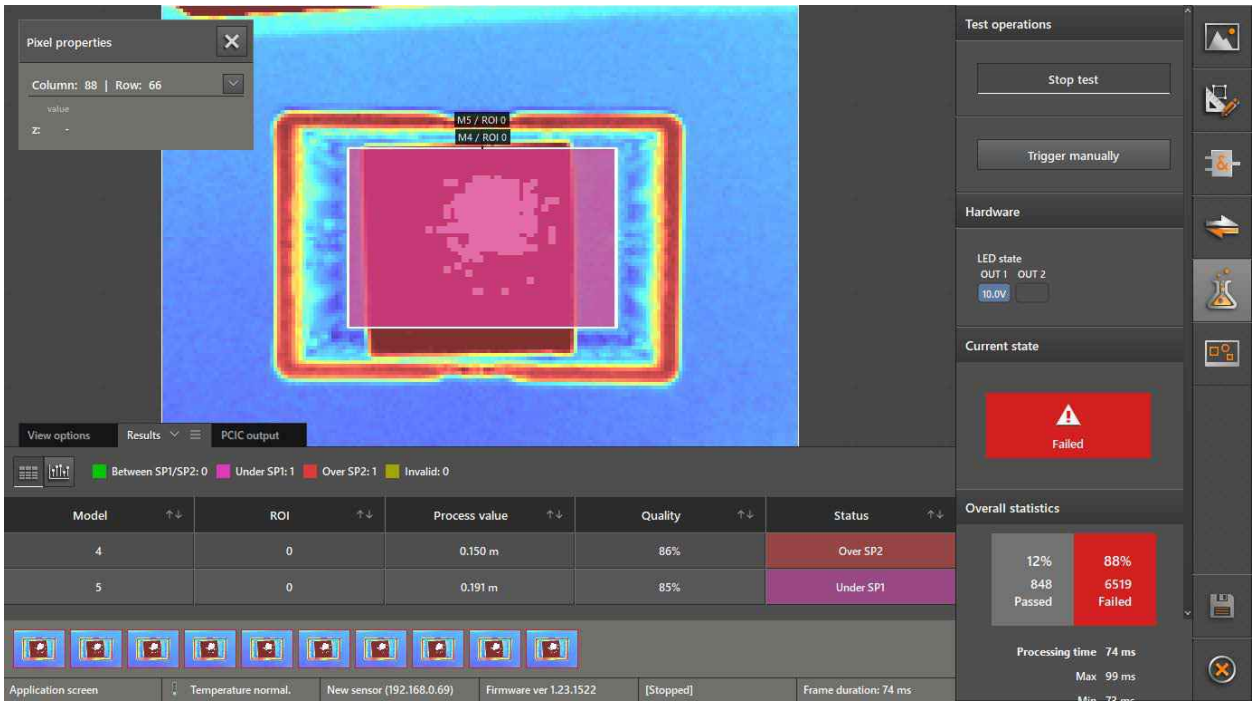
► Put the second object in the box.

► Ensure that the following conditions are met:

– The status LED "OUT2" is off.

– For the model "Level in the box" "overfill" is indicated because the level is above the switching threshold SP2.

– For the model "Maximum value in the box" "underfill" is still indicated because the level is not above the maximum level.



► Put another object in the box whose highest point is above the maximum level.

► Ensure that the digital output 3 provides the binary value "1" (24 V) (is not displayed by the ifm Vision Assistant).

Correct settings and save application

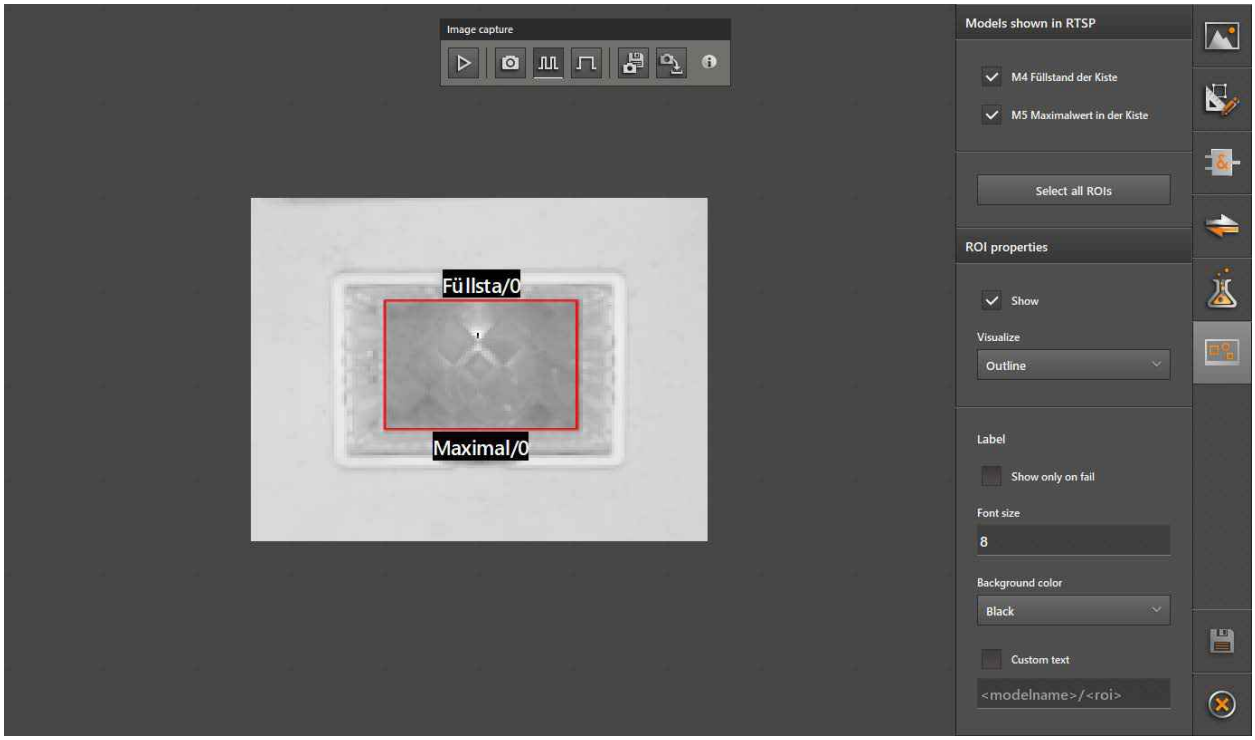
► If one of the conditions to pass the test is not met, change the previous settings and carry out the test again.

► If all conditions to pass the test are met, save the application.

► Enter an appropriate name and, if necessary, a short description of the application in the application management.

8.9 Set RTSP

In the "RTSP" screen the displays transferred with the real-time streaming protocol are set (→ „11.5 RTSP“).

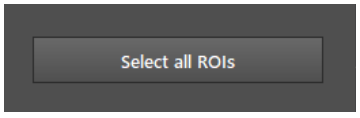


Using the mouse wheel the 2D amplitude image can be zoomed in and out.

Models shown in RTSP

Created models can be shown in the 2D amplitude image. The RTSP then transfers the 2D amplitude image with the shown models.

Activate the checkboxes before the model names and deactivate the display of the models in the 2D amplitude image.

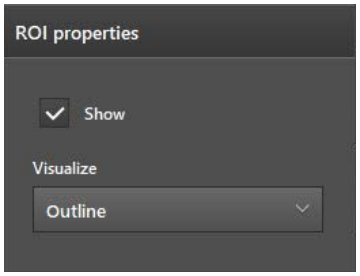


The [Select all ROIs] button selects the ROIs of the activated models.

ROI properties

The display of the ROIs can be set.

Before the adaptation of the settings click the [Select all ROIs] button in "ROI properties"

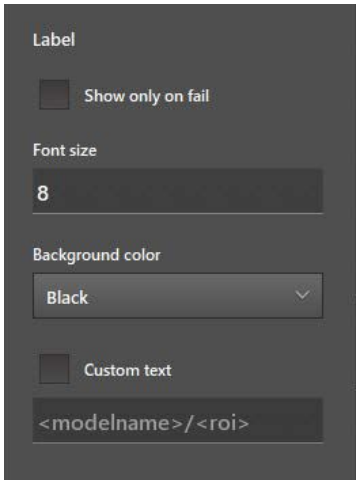


The checkbox [Visualize] activates the display of the ROIs in the 2D amplitude image.

The [Visualize] list sets the display of the ROIs:

Setting	Description
Outline	The ROIs are shown with a border in colour.
Fill	The ROIs are highlighted in colour.
Symbol	The ROIs are shown with a symbol in the centre of the ROIs.

Labelling



The checkbox [Show only on fail] links labelling of the ROIs with their state. If the checkbox is activated, labelling of the ROIs is only shown if the state is "failed".

In the input field [Font size] the font size of labelling is set.

The [Background color] list sets the background colour of labelling:

Setting	Description
Passed / Failed	The background colour is linked with the state of the ROIs. The states "passed" and "failed" are shown in different background colours.
Black	The background colour is set to "black".
None	The background colour is deactivated.

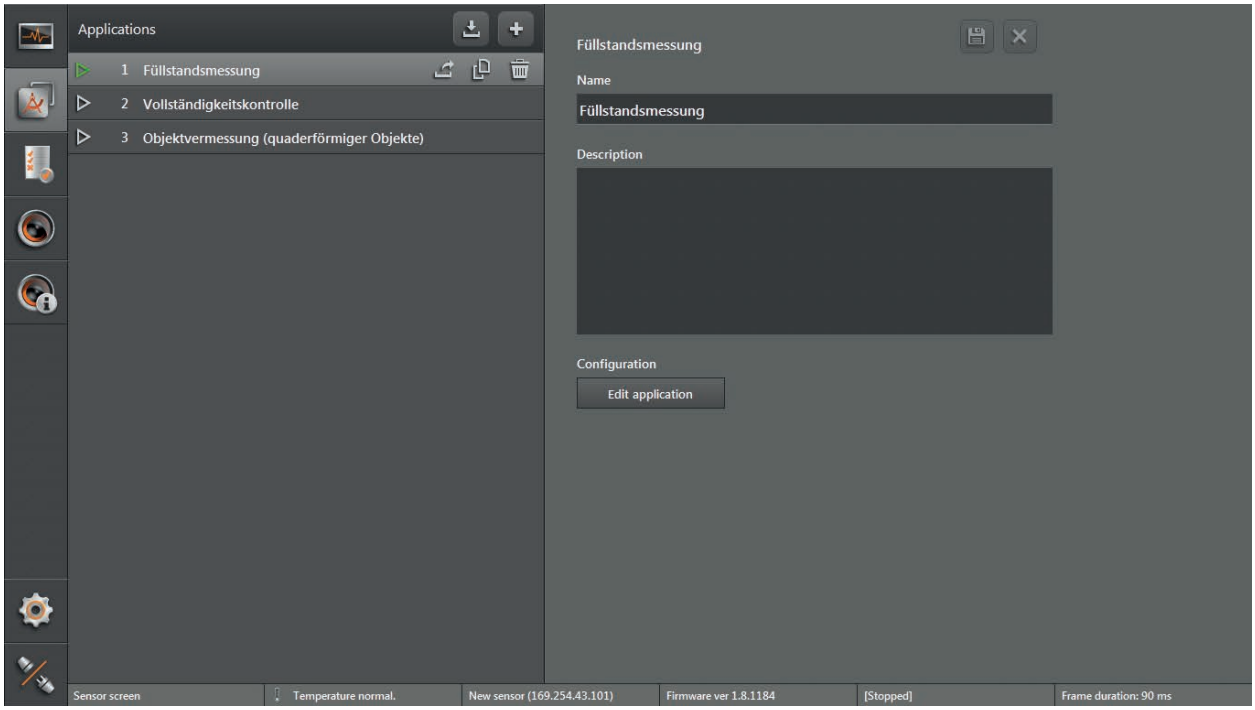
The checkbox [Custom text] activates the user-defined labelling. Then the labelling of the ROIs can be adapted. As a standard, the labelling is set to "<modelname>/<roi>".

9 Application management

In the application management the applications of the connected device are displayed and managed.

► Click  to open the application management.

When you switch from the monitoring window to the application management confirm that the evaluation (operating mode) of the device is stopped.



Functions:

Button	Name	Description
	Import application	Opens a window to import an application from a file.
	Add new application	Opens a window to create or add a new application.
	Export	Opens a window to export the application.
	Duplicate	Makes a copy of the application.
	Delete	Deletes the application.
	Save	Saves the changes entered in the application.
	Cancel	Rejects the changes made.

Maximum 32 applications can be saved.

9.1 Activate application

► Click the arrow next to the requested application to activate it.

> The arrow is displayed in green.

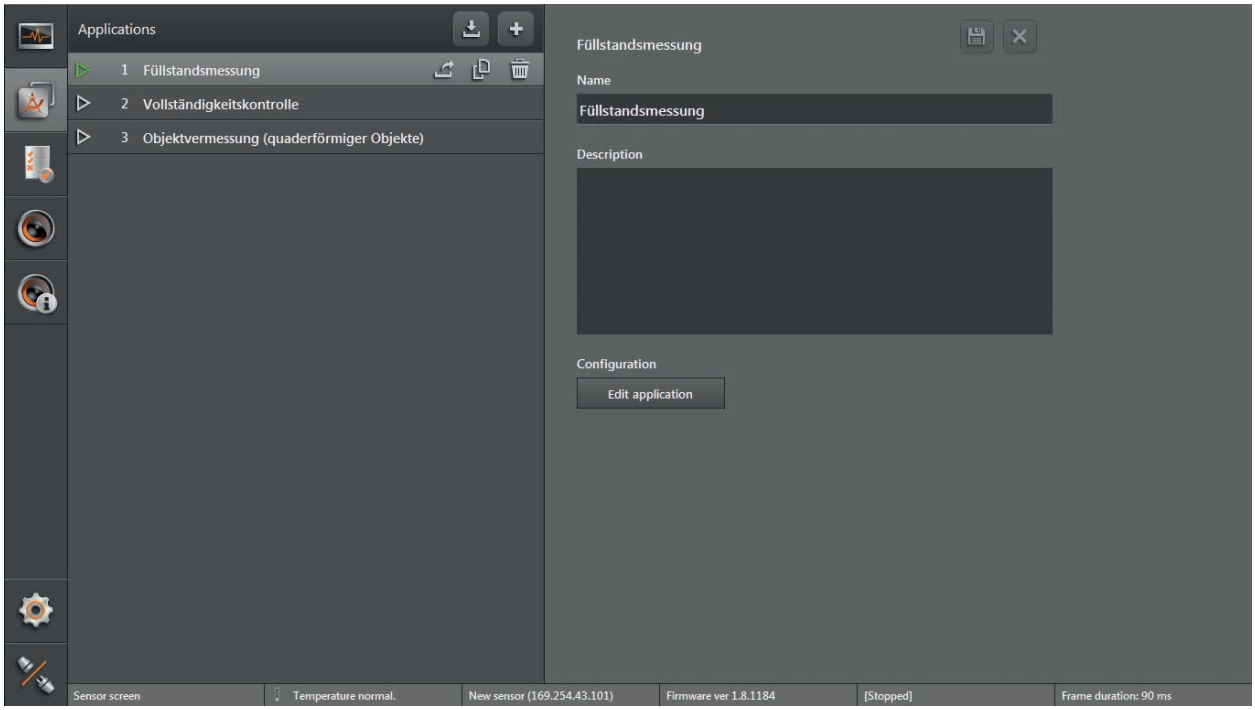
If the active application is deleted, another application is not automatically activated.

9.2 Edit application

The name and description of an application can be freely edited later on without changing the parameters and settings of the application.

► Click application.

> The selected application is highlighted in light grey.



► If requested, make changes in the input fields "Name" and "Description".

► Click to save the changes.

► Click [Edit application].

> The result depends on how the application was created:

– The application was created via the set-up wizard:The set-up wizard opens (→ „6 Set-up wizard“). The type of application cannot be changed (completeness monitoring or object dimensioning). To change the type of application the application must be deleted and recreated.If an application is edited, the values from the settings previously saved apply. Individual steps may be skipped where appropriate.

– The application was created in the user defined mode:The edit application window opens (→ „8 User defined mode“).

9.3 Add new application

► Click to create a new application.

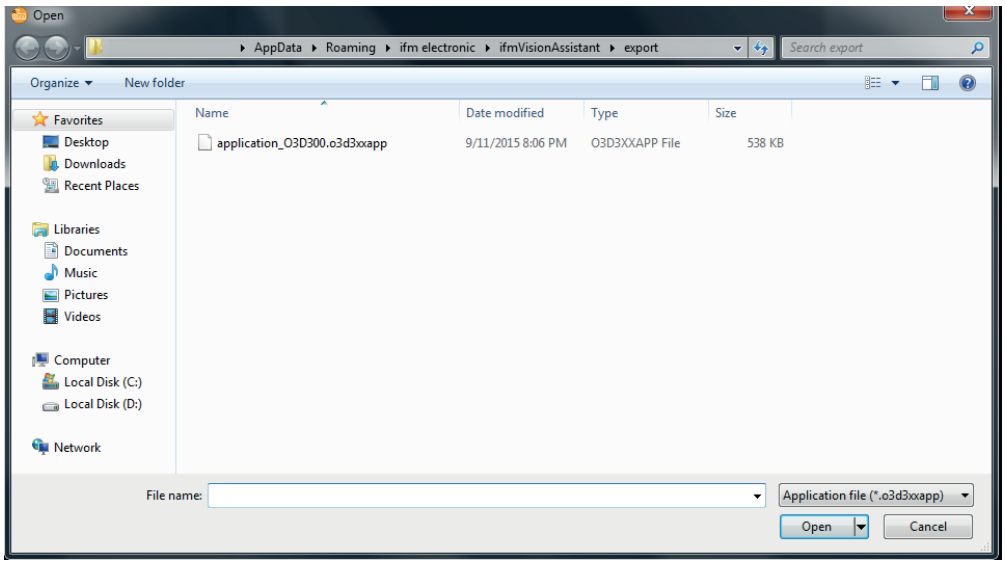
> The set-up wizard opens (→ „6 Set-up wizard“).
When a new application is created the default parameters apply.

> If the user defined mode is active, the application can be created in the edit application window (→ „8 User defined mode“).

9.4 Import application

► Click .

> The window "Open" to import the application is displayed.



► Select the file to be imported (*.o3d3xxapp) and click [Open].

> As soon as the import is finished the application is indicated in the application list.

If the file format of the imported application does not correspond to the default format (*.o3d3xxapp) an error message is displayed.

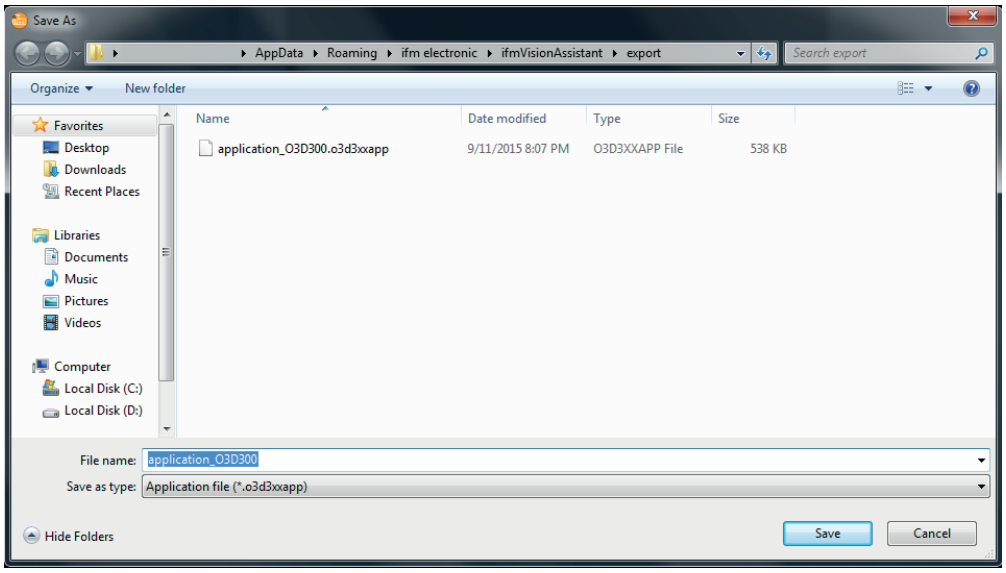
9.5 Export application

► Click application to be exported.

> The selected application is highlighted in light grey.

► Click .

> To export the application the window "Save As" is displayed.



► Select requested folder and name file.

► Click [Save]

> The saved application file has the extension "*.o3d3xxapp".

9.6 Duplicate applications

Applications can be duplicated to create, for example, an application where only the parameters need to be changed.

► Click the application to be duplicated.

> The selected application is highlighted in light grey.

► Click  .

> A copy of the application is added at the end of the application list.

9.7 Sort application list

The order of the applications can be changed in the application list via drag and drop.

► Click application and hold the mouse button down.

> The application is marked in colour.

► Hold the mouse button down to shift the application to the new position.

► Release mouse button.

> The applications are numbered in the new order.

By sorting the application list new IDs are assigned to the applications. The IDs are used for the external triggering via the process interface.

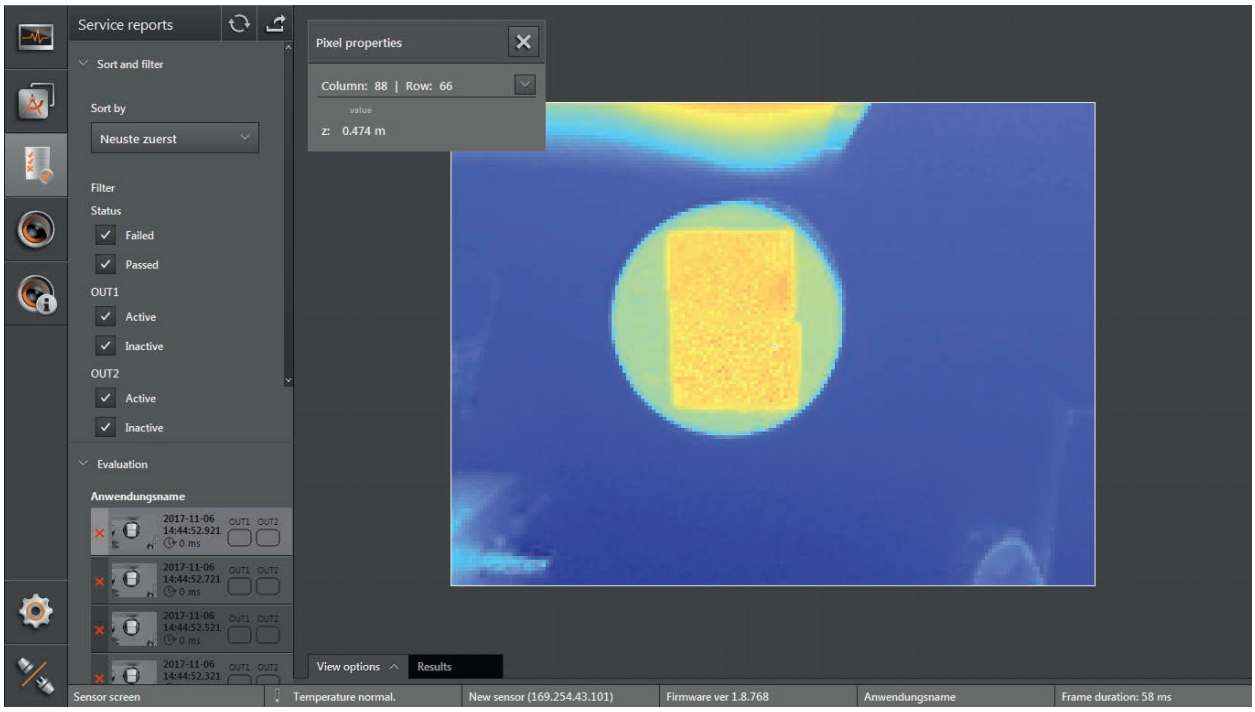
► Adapt external triggering to the new IDs.

10 Service report

The function service report makes an evaluation with information about software and hardware of the device. The service report can be exported for support requests.

► Click .

The screen "Service reports" is displayed.



10.1 Reload

The evaluation of the service report can be reloaded.

► Click .

The download of the new evaluation from the device may take up to 1 minute.

10.2 Export

The evaluation of the service report can be exported.

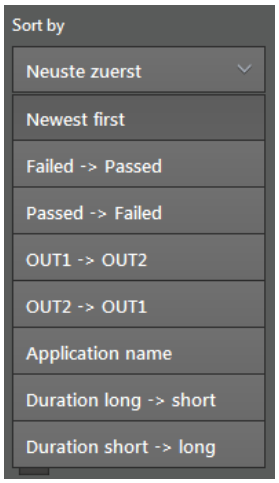
► Click .

► Select folder to save the evaluation.

UK

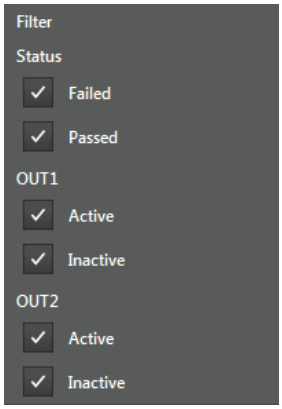
10.3 Sorting

The evaluation of the service report can be sorted. The list "Sort by" contains the following menu items:

List	Menu item	Description
	[Newest first]	Sorts by the newest measurements: The newest messages are displayed first.
	[Failed -> Passed]	Sorts by the status of the measurements: Failed messages are displayed first.
	[Passed -> Failed]	Sorts by the status of the measurements: Passed measurements are displayed first.
	[OUT1 -> OUT2]	Sorts by the status of the outputs: Output 1 is displayed before output 2.
	[OUT2 -> OUT1]	Sorts by the status of the outputs: Output 2 is displayed before output 1.
	[Application name]	Sorts by the name of the application: The measurements are sorted alphabetically by the name of the application.
	[Duration long -> short]	Sorts by the duration of the measurement: The longest measurement is displayed first.
	[Duration short -> long]	Sorts by the duration of the measurement: The shortest measurement is displayed first.

10.4 Filter

The evaluation of the service report can be filtered. The evaluation is filtered by deactivating the corresponding option fields.

Area	Option field	Description
	Status [Failed]	If the option field is deactivated: Measurements with the status "Failed" are filtered.
	Status [Passed]	If the option field is deactivated: Measurements with the status "Passed" are filtered.
	OUT1 [Active]	If the option field is deactivated: Measurements with activated output 1 are filtered.
	OUT1 [Inactive]	If the option field is deactivated: Measurements with inactive output 1 are filtered.
	OUT2 [Active]	If the option field is deactivated: Measurements with activated output 2 are filtered.
	OUT2 [Inactive]	If the option field is deactivated: Measurements with inactive output 2 are filtered.

The evaluation is not filtered by default.

11 Device setup

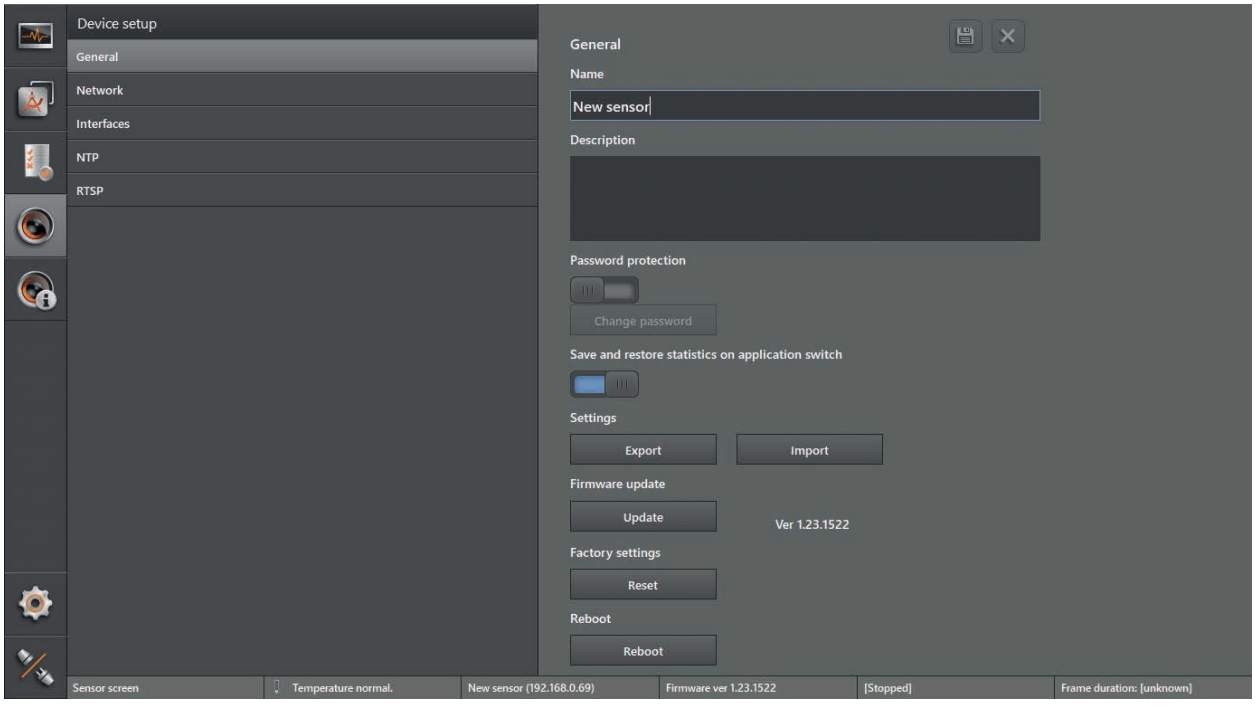
For the device setup the setting options are as follows:

- General:
  - Enter name and description of the device
  - Password protection on / off
  - Import and export settings
  - Carry out firmware update
  - Reset to factory settings
- Network
  - Set network protocol and network address
- Interfaces
  - Set process interface
- NTP
  - Set real-time clock
- RTSP
  - Set Real Time Streaming Protocol

UK

► Click  .

> The "Device setup" screen is displayed.



11.1 General

Basic functions and options of the device are set in the window [General].

► Click [General] to switch to the window "General".

Functions

Field	Button	Description
Name	–	Editable field to enter a device name
Description	–	Editable field for additional device information
Password protection	 on  off	Switches the password protection on or off.
	Input field	Editable field to enter a password
Save and restore statistics on application switch	 on  off	If the function is switched on, the statistics of an application are saved before switching to another application. If there are statistics saved for an application, they are restored.
Settings	[Export]	Makes a copy of the settings and applications on the PC.
	[Import]	Saves a copy of the settings and applications that are on the PC to the device.
Firmware update	[Update]	Installs a firmware update. The current firmware version is shown next to the button.
Factory settings	[Reset]	Restores the factory settings and deletes all current settings and applications.
Reboot device	[Reboot]	Reboots the device.
Save		Saves the changes made on the device.
Cancel		Rejects the changes made.

11.1.1 Name and description

The name and the description of the device can be freely edited.

► Click input field.

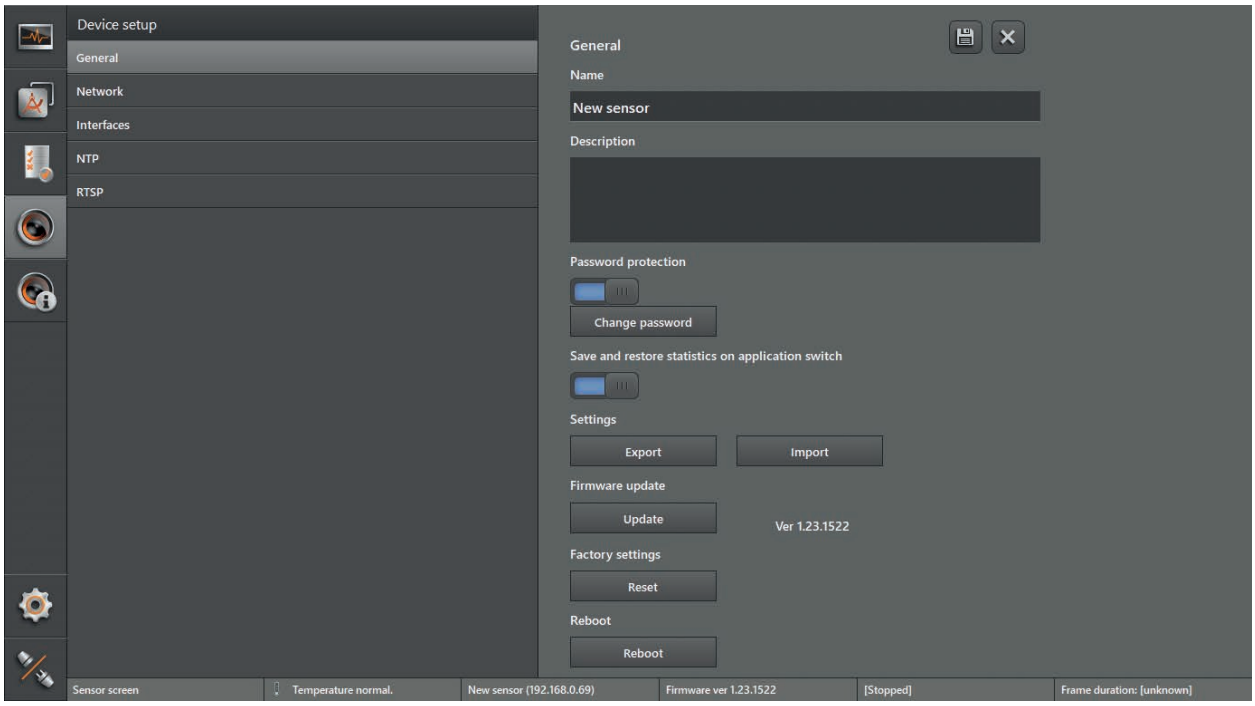
► Enter requested text.

► Click  to save the changes.

11.1.2 Password protection

When the password protection is active, the "Applications", "Device setup" and "Device info" screens are locked and only accessible after the password has been entered. Without entering the password, only the monitoring window opens.

► Activate password protection.



► Enter password in the input field.

► Click to save the changes.

> The changes are saved on the device.

11.1.3 Firmware update

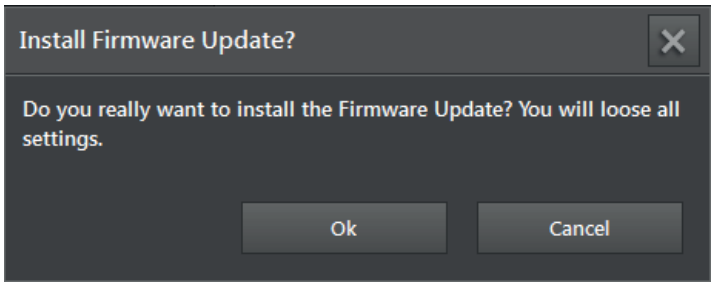
The current firmware is on the supplied data carrier or can be downloaded from the internet if needed: www.ifm.com

The firmware update will delete all settings and applications.

► If necessary, export the existing settings beforehand.

► Click [Update] to update the firmware.

> A safety query is displayed.



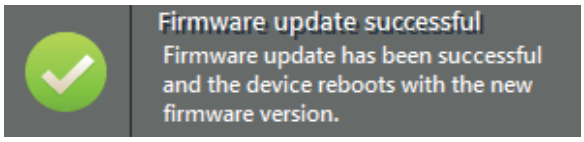
► Click [OK].

> The window "Open" appears.

► Select requested firmware file (*.swu).

► Click [Open].

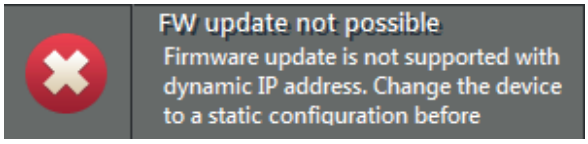
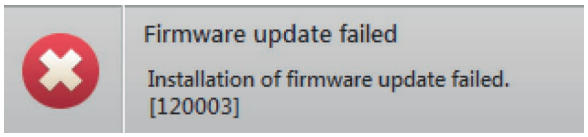
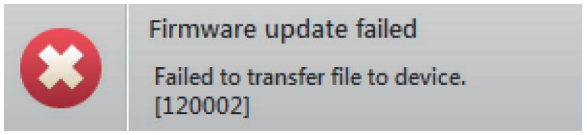
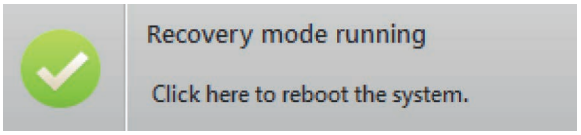
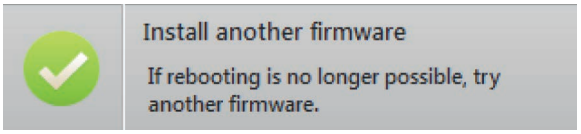
> A message indicates that the firmware update has been successful.



> The ifm Vision Assistant connects to the device.

After the update the default application is available on the device. With this application the ifm Vision Assistant switches to the monitoring window.

Failed firmware update

Problem	Solution
Error message:  The device is set to a temporary address or to DHCP.	► Change network settings of the device to a static IP address. > After saving the settings the ifm Vision Assistant tries to connect automatically.
Error message:  – or –  – or –  	► Click  on the start screen and connect device. ► Click message. > The following messages are displayed:   ► Click the message "Install another firmware". ► Install another firmware.

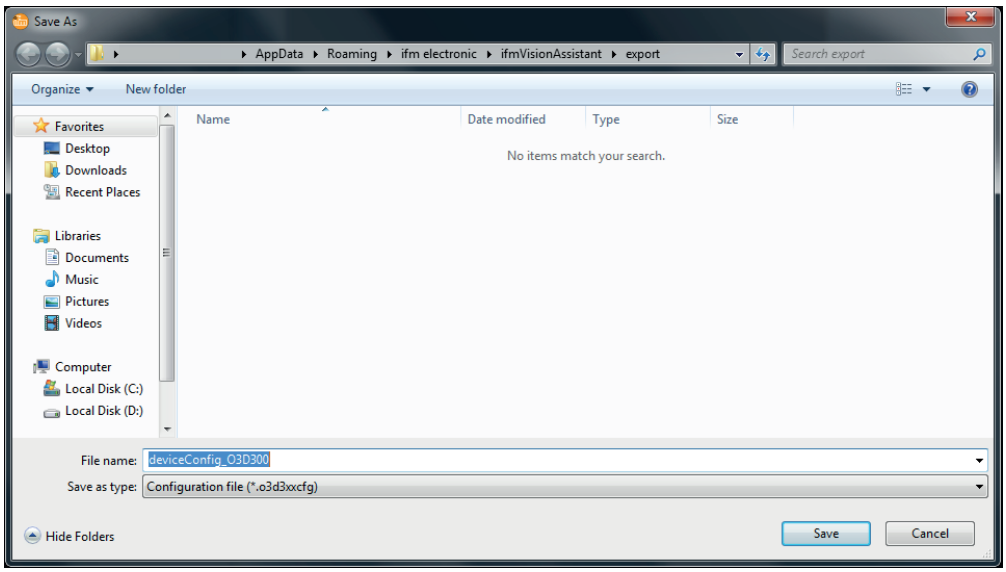
With the key combination Ctrl+C the text of a message is copied to the clipboard. This works with all messages displayed in the ifm Vision Assistant.

11.1.4 Export settings

With the function "Export" all settings and applications are exported from the device to the PC.

► Click [Export] to start the export of the settings.

> The window "Save As" appears.



► Enter name and click [Save].

> The settings are saved in a file with the extension .o3d3xxcfg.

11.1.5 Import settings

Settings and applications can be imported separately or together. The following options are available:

- General (name, description etc.)
- Network settings
- Applications

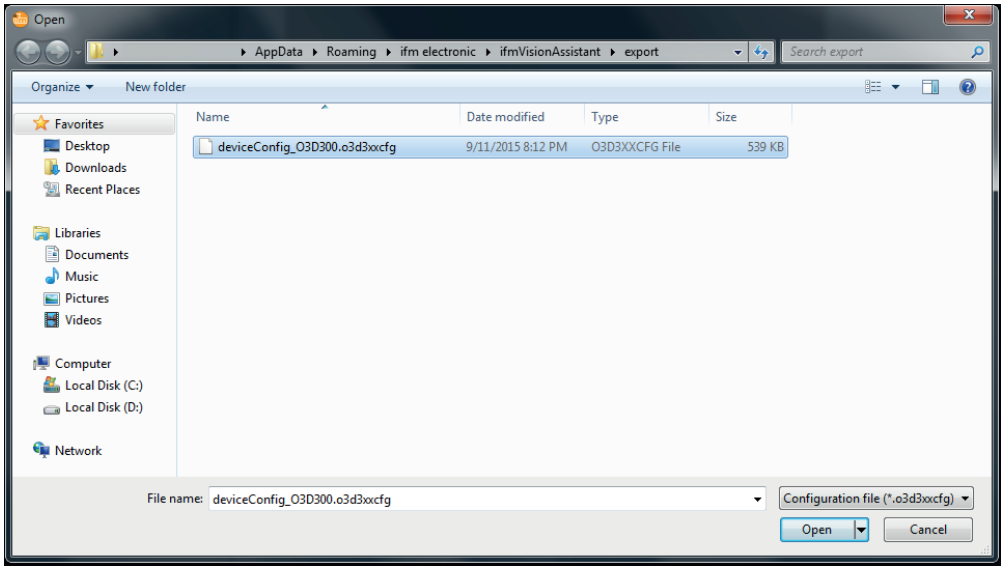
Existing settings and applications are overwritten during the import.

► If necessary, export the existing settings beforehand.

► Click [Import] to start the import of the settings.

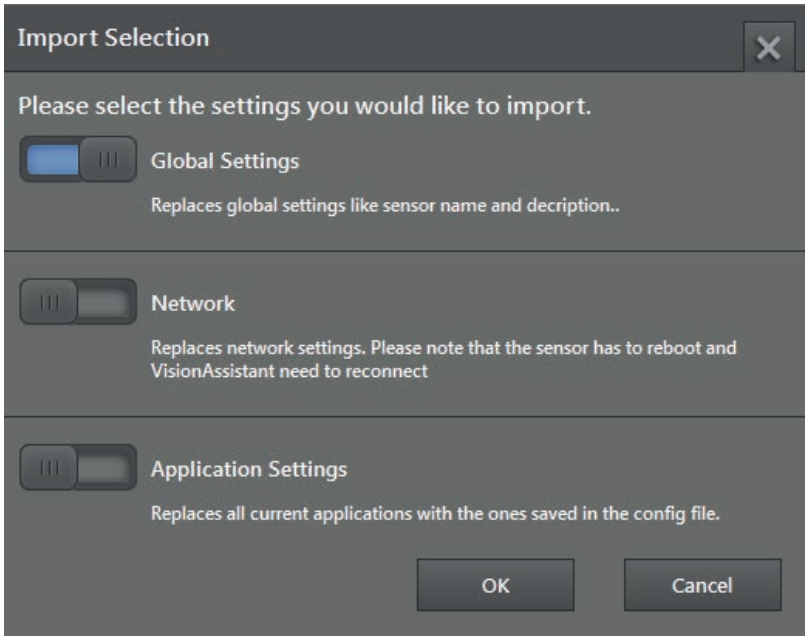
UK

> The window "Open" appears.



► Select the requested file with the extension .o3d3xxcfg and click [Open].

> The window "Import Selection" appears.



► Set the button of the settings to be imported to "on" (global settings, network and / or application settings).

► Click [OK].

> The selected settings are imported.

11.1.6 Factory settings

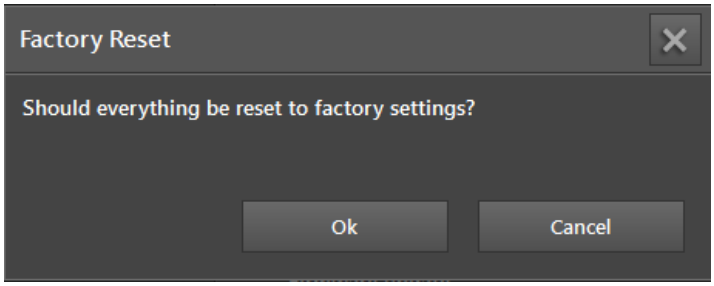
To delete all data on the device (setup, applications, etc.) the device can be reset to factory settings. The firmware version is not reset.

Existing settings and applications are deleted when the device is reset to factory settings.

► If necessary, export the existing settings beforehand.

► Click [Reset].

> A safety query is displayed.



► Click [OK].

> All settings are reset.

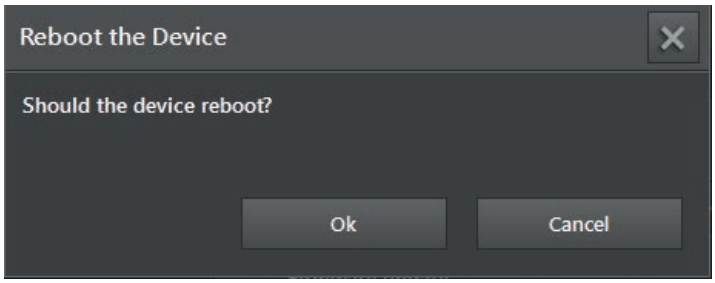
> The device setup is closed and the start screen appears.

11.1.7 Reboot device

The device must be rebooted if the EtherNet/IP or PROFINET interface is used after a change of the IP address. If TCP/IP is used, it is not necessary to reboot the device.

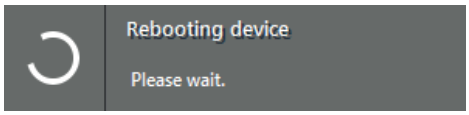
► Click [Reboot].

> A safety query is displayed.

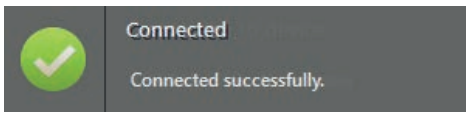


► Click [OK].

> The device reboots.



> The ifm Vision Assistant connects to the device.



> If an application is active, the ifm Vision Assistant continues with the monitoring window. If no application is active, the ifm Vision Assistant switches to the edit window.

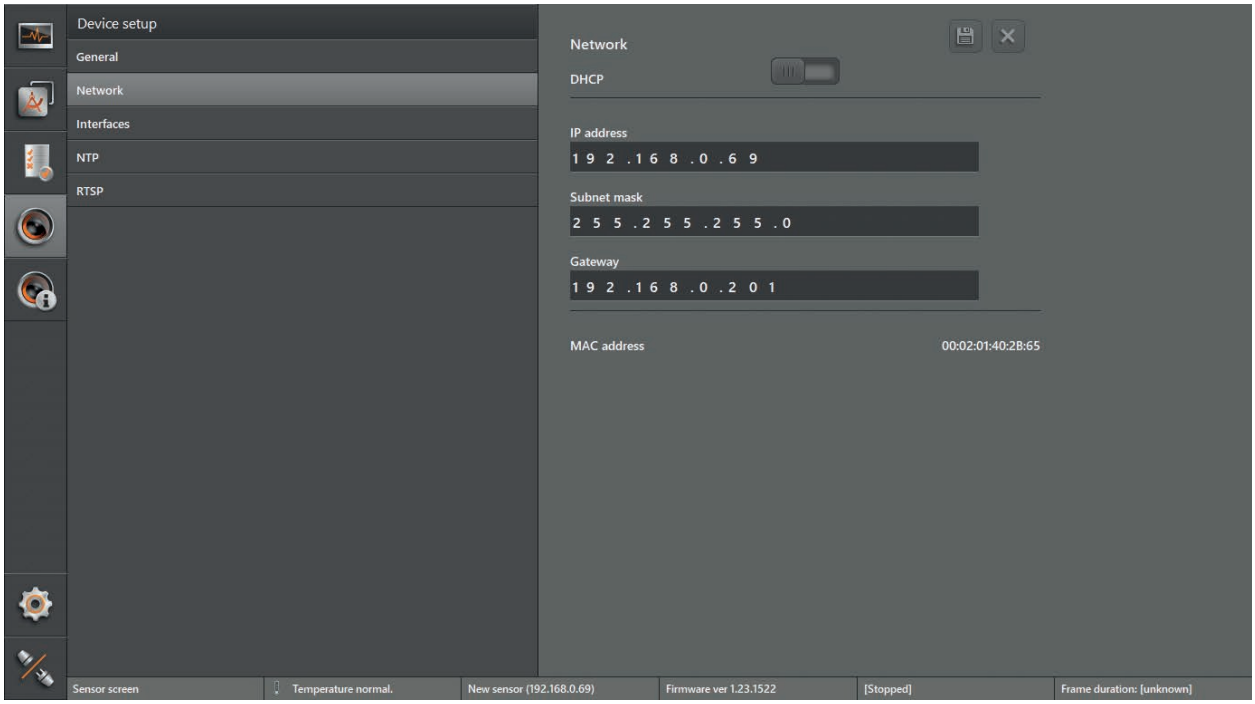
► If connecting to the device fails, search for the device via on the start screen or connect it manually.

11.2 Network

The network settings of the device are set in the window [Network]. If a new device is connected and the ifm Vision Assistant automatically finds the device, the default network data has already been entered.

► Click [Network].

> The network settings are displayed in the window "Network".



► Set button "DHCP" to "on" to activate DHCP (default: "off").

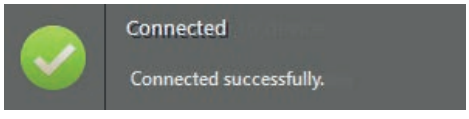
► Enter network settings in the input fields.
Default settings:

- IP address: 192.168.0.69
- Subnet mask: 255.255.255.0
- Gateway: 192.168.0.201

► Click to save the changes.

> The changes are saved on the device.

> The ifm Vision Assistant connects to the device.



> If an application is active, the ifm Vision Assistant continues with the monitoring window. If no application is active, the ifm Vision Assistant switches to the edit window.

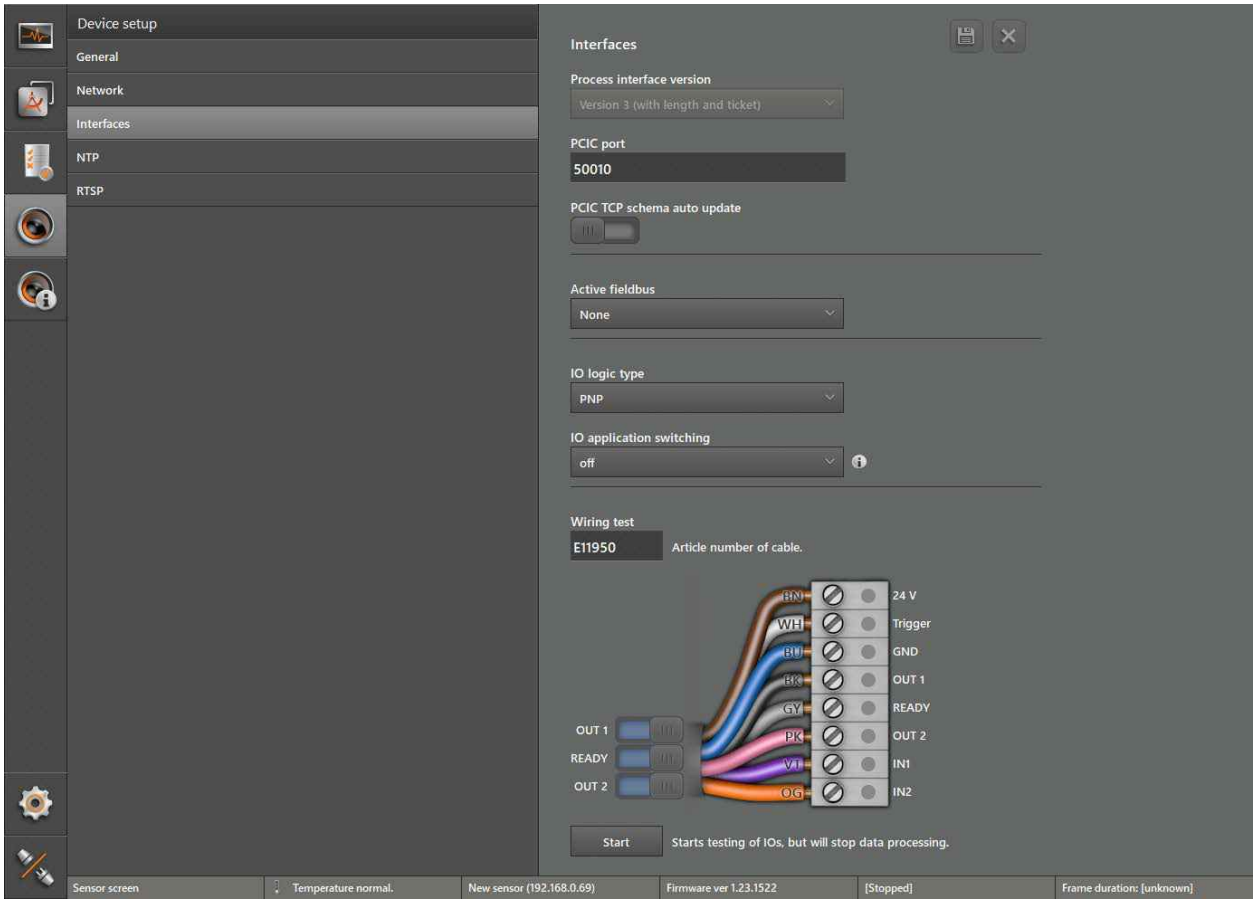
► If connecting to the device fails, search for the device via on the start screen or connect it manually.

11.3 Interfaces

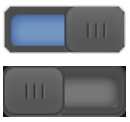
In the [Interfaces] window the fieldbus and the output logic of the device are set.

► Click [Interfaces].

> The settings of the process interface are shown in the "Interfaces" window.



Depending on the interface not all options are available.

Field	Button	Description
Process interface version	Version X	Set version of the process interface protocol.
PCIC port	50010	Set PCIC port for the data of the process interface with a socket connection. In the event of connection problems activate the port in the firewall.
PCIC TCP schema auto update	 on off (standard)	Switch "PCIC TCP schema auto update" on or off. If "PCIC TCP schema auto update" is off, the PCIC data output of the previous application remains active, when the active application is changed (→ Operating instructions). Only if the connection to the device is separated will the PCIC data output change. If "PCIC TCP schema auto update" is on, the corresponding PCIC data output is activated, when the active application is changed (→ Operating instructions).
Active fieldbus	[None] [EtherNet/IP] [PROFINET]	Set fieldbus for the communication with connected controllers. Only one fieldbus can be active at a time. The setting has an effect on all applications.

Field	Button	Description
PROFINET device name	–	Set device name with active PROFINET fieldbus. The field is only displayed if PROFINET is set as an active fieldbus.
Output logic	[PNP] [NPN]	Set output logic for the signals of the digital outputs of the device: ● PNP: switches positive potential to the output ● NPN: switches ground to the output
Application switching via inputs	[deactivated] [static] [pulsed] [pulsed via trigger input] [static only input 1]	Set external application switching via the digital inputs.

The external application switching is described in the operating instructions.

► Click to save the changes.

> The changes are saved on the device.

Wiring test of the inputs and outputs

The wiring of the different connectors is not standardised. With the wiring test the correct wiring of the 8-pole connector can be displayed and tested.

During the wiring test the outputs are not available for applications.

► Click [Start] to start the wiring test.

► Click [OUT 1] to switch the signal at "OUT 1" on or off.

► Click [Ready] to switch the signal at "READY" on or off (ready for next trigger).

► Click [OUT 2] to switch the signal at "OUT 2" on or off.

► If the inputs are used, test the input signals at input 1 and input 2.

► Click [Stop] to stop the wiring test.

> The outputs are again available for applications.

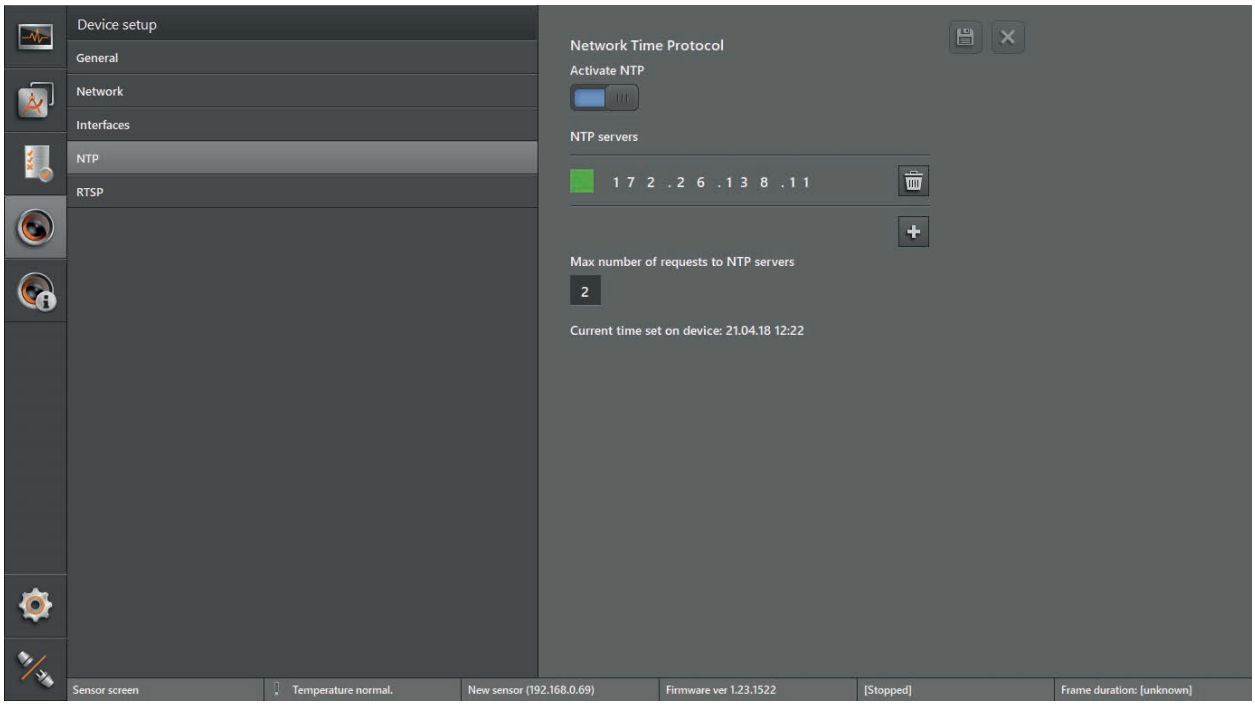
11.4 NTP

In the window [NTP] the real-time clock of the device is set.

A real-time clock which can be synchronised via NTP (Network Time Protocol) is integrated in the device. If several devices are used, it is ensured via NTP that the real-time clocks of the devices are synchronous.

► Click [NTP].

> The NTP settings are indicated in the window "NTP".



Field	Button	Description
Activate NTP	on off (by default)	Switch NTP on or off. When NTP is on, the device gets the date and time from the network.
NTP servers	green	The set NTP server replied to the last request.
NTP servers	red	The set NTP server did not reply to the last request.
NTP servers	grey	So far no request has been sent to the set NTP server.
NTP servers	IP address	IP address of the set NTP server.
Add server		Adds the NTP server.
Delete		Deletes the NTP server.
Max. number of requests	Input field	Set maximum number of requests. If the NTP server does not reply within the set number of requests, the NTP server will be ignored in future.
Current time set on device	Date and time	Display of the date and time saved last in the device.
Save		Saves the network settings.
Cancel		Rejects the network settings.

11.5 RTSP

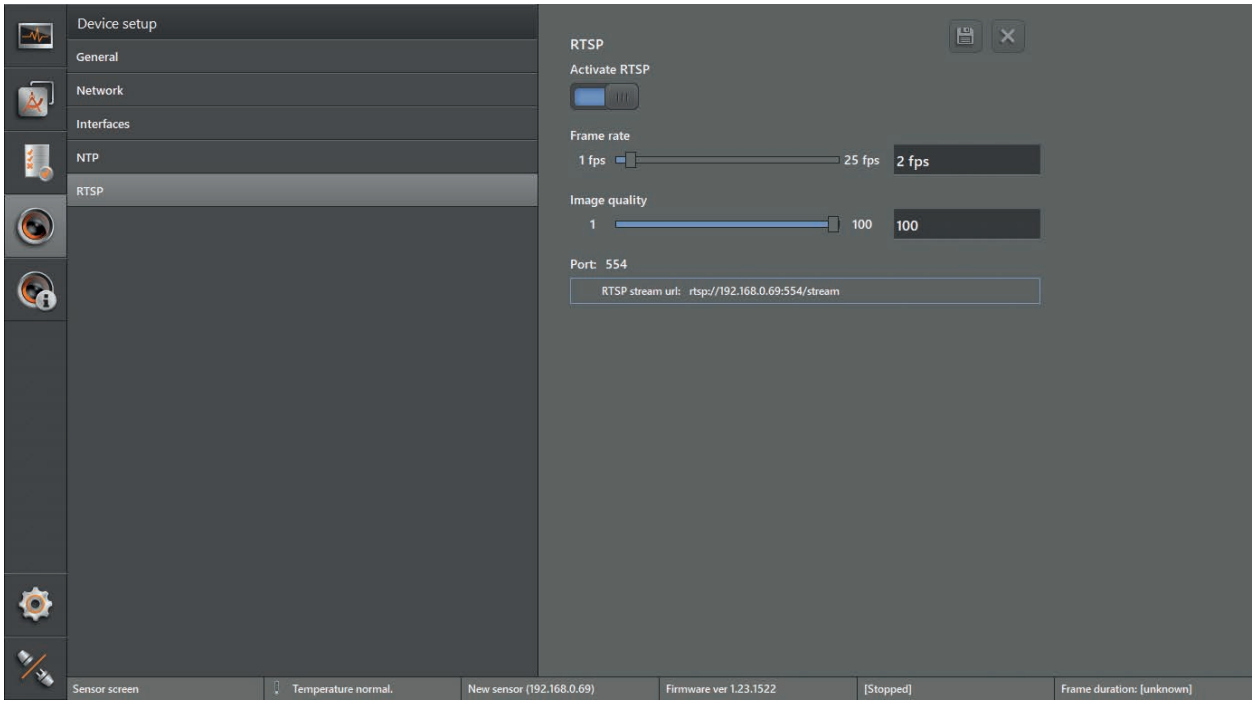
The Real Time Streaming Protocol is set in the [RTSP] window.

The network protocol RTSP controls the transfer of video data as stream. The stream can be replayed with a client software (video player with RTSP support].

Once the network protocol RTSP is active, the 2D amplitude image (logarithmic) of the device is transferred and it can be retrieved via the displayed URL. Depending on the model used ROIs are additionally drawn in the 2D amplitude image (→ „8.4 Define models“).

► Click [RTSP].

> The RTSP settings are shown in the "RTSP" window.



Field	Element	Description
Activate RTSP	on off (standard)	Switch RTSP on or off If RTSP is on, the 2D amplitude image (logarithmic) of the device is transferred. If RTSP is activated, the speed and the evaluation time of the device are reduced.
Frame rate	1 fps 25 fps	Sets the images per second (fps). A high value leads to smoother image transitions and requires more band width in the network.
Image quality	1 100	Sets the quality of the images. A higher value means a higher image quality, low compression and requires a higher band width. A lower value means a lower image quality, high compression and requires a lower band width.
Port	554	Port "554" is preset. In the event of connection problems activate the port in the firewall.
RTSP stream url	RTSP stream url	The URL "RTSP stream url" makes it possible to replay the stream with a suitable client software (video player with RTSP support). The URL can be marked and copied.
Save		Saves the settings.
Cancel		Rejects the settings.

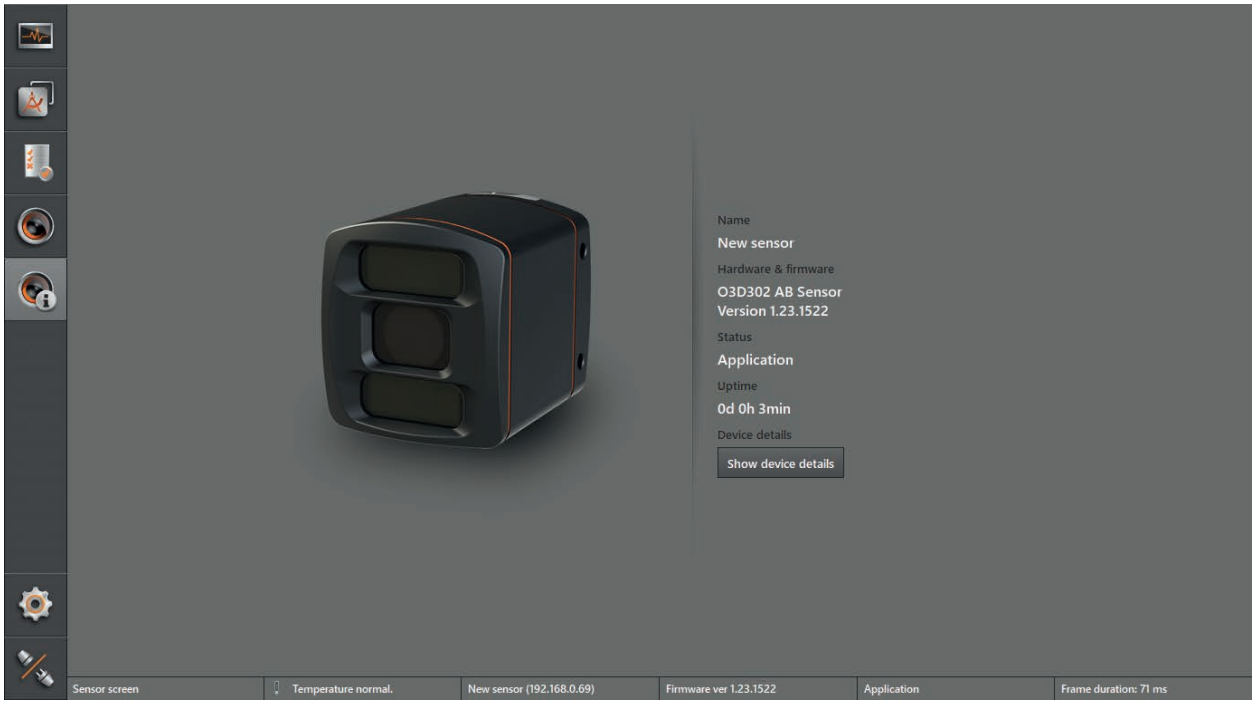
For transferring the video data to the network the following conditions have to be met:

- one application is active (→ „9.1 Activate application“),
- at least one model is defined (→ „8.4 Define models“).

12 Device information

► Click .

> An image of the device and basic information are displayed.



Field	Description
Name	Name of the device; example: "New sensor". The name of the device can be edited (→ „11.1.1 Name and description“).
Hardware & Firmware	Hardware and firmware version of the device.
Status	Current status of the device.
Uptime	Uninterrupted runtime of the device. Time format: ##d (days) ##h (hours) ##min (minutes).
Device details	Display of hardware and software details of the device (→ „12.1 Show device details“).

12.1 Show device details

For the diagnostics by support people detailed information about the device hardware and software used can be displayed. The information is saved in a text file.

► Click [Show device details].

> The device details are displayed.

► Click [Save].

> The window "Save As" appears.

► Enter name and click [Save].

> The settings are saved in a file with the extension .txt.

13 Appendix

13.1 Network settings

The details of the network settings in this document describe the procedure for PCs with the operating system Windows 7.

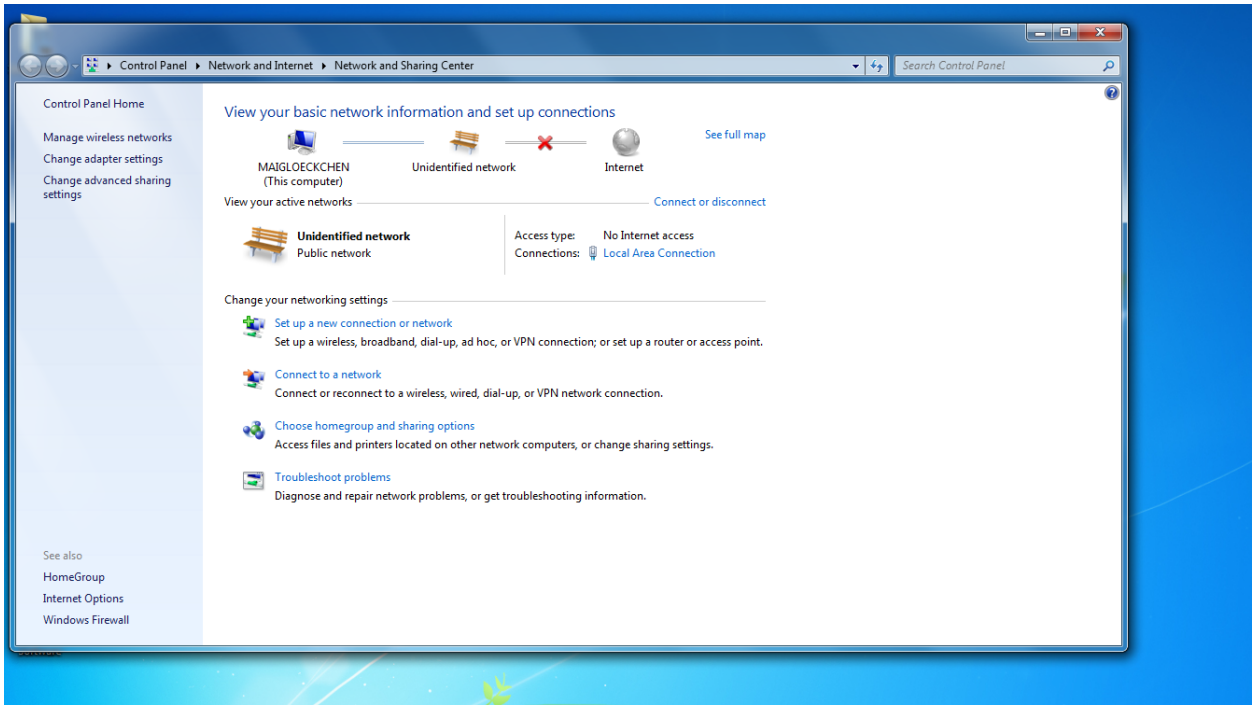
Changing network settings in a PC requires administrator rights.

The following ports must be open (if necessary, adapt the firewall settings):

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

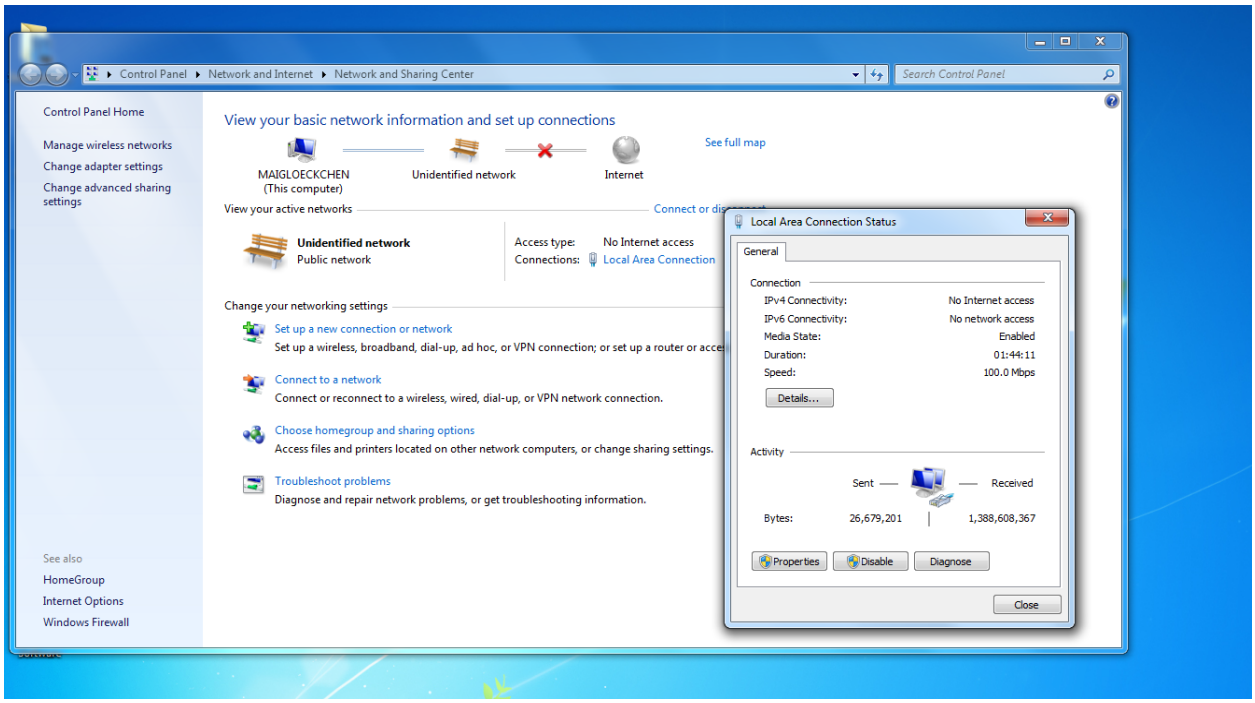
UK

► Open [Network and Sharing Center].



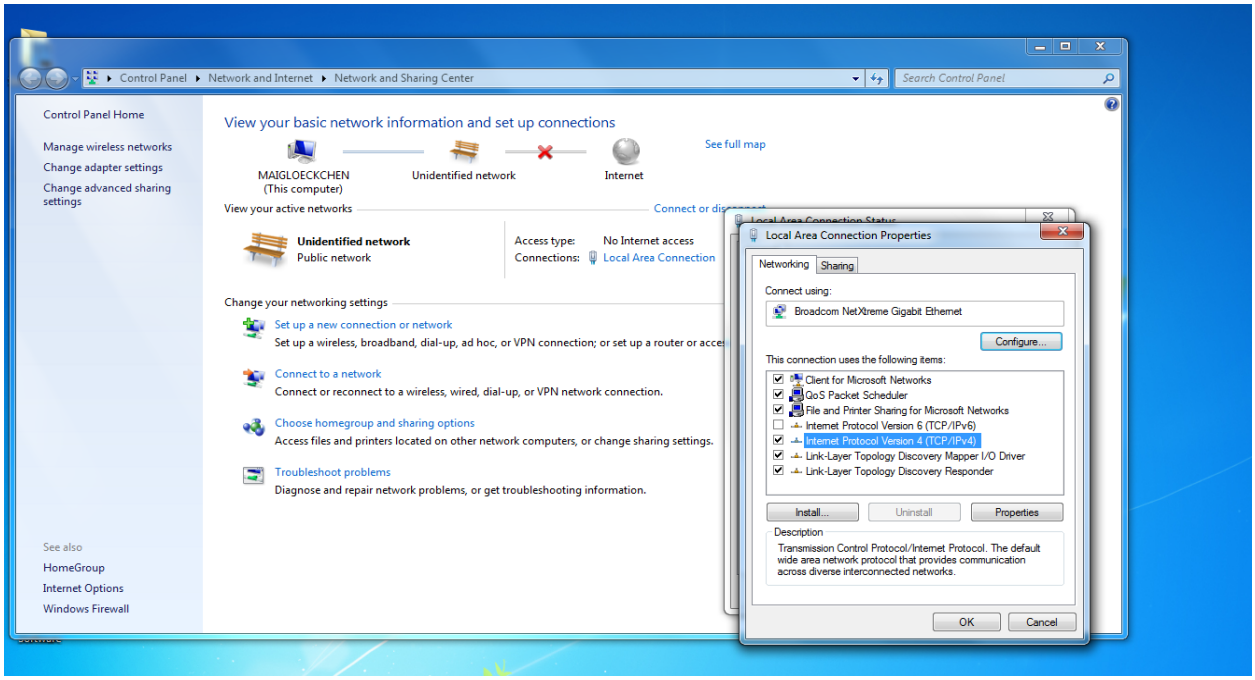
► Click the name of the local network next to [Connection].

> The window "Local Area Connection Status" of the local network opens.



► Click [Properties].

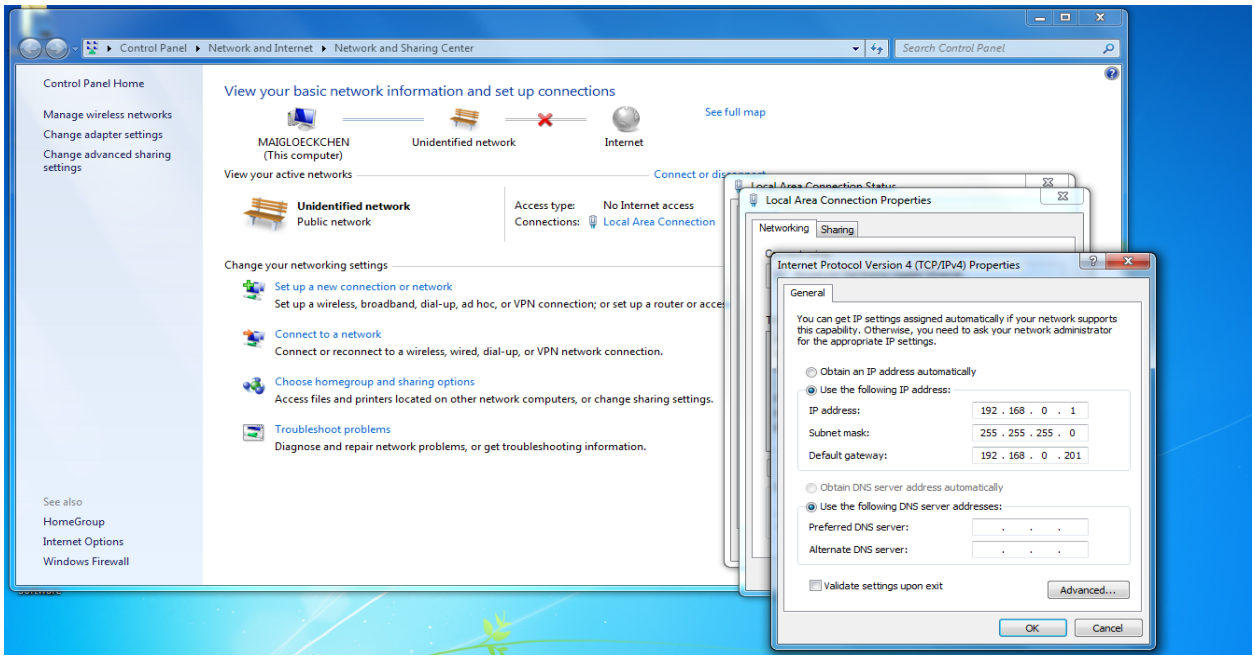
> The window "Local Area Connection Properties" of the local network opens.



► Select [Internet Protocol Version 4 (TCP/IPv4)].

► Click [Properties].

> The window "Internet Protocol Version 4 (TCP/IPv4) Properties" opens.



► Select the option [Use the following IP address:].

► Set the following default values:

- IP address: 192.168.0.1
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.0.201

► Click [OK].

13.2 Glossary

Active application

The application set to "active" in the device: This application is running when the device is ready for operation.

Amplitude

Refers to the reflectivity of the objects in the infrared range: The device provides a greyscale representation of the measurement result - the higher the reflection, the lighter the shade of grey.

Anchor function

The anchor function enables the detection of the object's position and orientation, for example in the completeness monitoring. This enables to compensate for a rotation of the object up to 40°.

Application switching

The application switching can be triggered via the process interface or via the digital inputs.

Operating mode

Active mode by default if an active application is available on the device. The active application is in the process of being executed.

User defined mode

Mode to configure and set the device and the applications: no application is executed.

Pixel

Individual data point in a 2D/3D image.

Process interface

Interface for external hardware: Data can be transmitted by or received from a PLC, for example, via the process interface.