

ifm electronic



Programming manual  
PC operating program  
for O2V

UK

**efector<sup>®</sup>250**

**E2V100**

**Version 2.4**

706100 / 01 10 / 2012



## Contents

1	Preliminary note	4
1.1	Symbols used	4
2	Safety instructions	4
3	System requirements	4
3.1	Software	4
3.2	Required accessories	4
4	Functions and features	4
5	Installation	4
5.1	Hardware	5
5.2	Software	5
5.2.1	Start program without installation	5
5.2.2	Install program on the hard disk	5
5.3	Factory setting	6
5.3.1	Network setting IP address range	6
5.3.2	Factory setting parameters	6
5.3.3	Verify and set the IP address of the PC	6
5.3.4	Verify and set the IP address on the unit	7
5.3.5	Adjustable parameters	7
5.3.6	Parameter setting on the unit	8
5.3.7	Display of the sensor	10
5.3.8	Lock / unlock sensor	10
6	Basic functions of the program	11
6.1	Basics on the user interface	11
6.1.1	Tool bar icons	12
6.2	Program start	12
6.3	Connect device to the operating program	13
6.3.1	Establishing a connection via bookmark entry	13
6.3.2	Establish the connection by entering the IP address	16
6.3.3	Find sensors in the network	16
6.3.4	Restore connections	17
7	Operating modes	18
7.1	Applications	18
7.1.1	Activate application mode	19
7.1.2	Help	22
7.2	General administration	23
7.2.1	Sensor identification	23
7.2.2	Export sensor configuration	23
7.2.3	Restore sensor configuration	23
7.2.4	Global settings	24
7.2.5	Network parameters	25
7.2.6	Process interface	26
7.3	Monitoring	27
7.3.1	Switching states	28
7.3.2	Models found	28
7.3.3	Switching outputs	29
7.3.4	Statistics	30
7.3.5	Data logger	30
7.4	Service	31
8	Configuring applications	32
8.1	Navigation	32
8.2	Image quality	33
8.2.1	Capture sensor image	35
8.2.2	Save or load sensor image	36
8.2.3	Setting the trigger mode	37
8.2.4	Image quality settings	37
8.3	Models	39

8.4	Segmentation	42
8.4.1	Find objects	43
8.4.2	Regions	47
8.4.3	Filters	49
8.4.4	Object list	50
8.5	Model definition	51
8.5.1	Define object characteristics	53
8.5.2	Use the entire image scene for evaluation	54
8.6	IO configuration	55
8.6.1	Real outputs	55
8.6.2	Process interface	57
8.6.3	Configure the sensor display	58
8.7	Overall function test	59
8.7.1	Switching states	59
8.7.2	Models found	60
8.7.3	Switching outputs	61
9	Application example	62
9.1	Create an application	62
9.2	Create model	63
9.3	Segmentation	64
9.4	Model definition	68
9.5	IO configuration	70
10	Additional functions	72
10.1	Select user language	72
10.2	Sensor firmware update	72
10.3	Select colours	73
10.4	Password protection	74
10.4.1	Set up password protection	74
10.4.2	Login	74
10.4.3	Logout	75
10.4.4	Remove password protection	75
11	Exit the program	75
11.1	Disconnect	75
11.2	Exit the program	75
12	Annex	76
12.1	Factory settings	76
12.2	Wiring	76
12.2.1	Process connection	76
12.2.2	Parameter setting connection	76
12.2.3	Operating modes	77
12.3	Operating and display elements	77
12.4	LED display	78

### Licences and trademarks

Microsoft®, Windows®, Windows XP®, Windows Vista® and Windows 7® are registered trademarks of Microsoft Corporation. All trademarks and company names are subject to the copyright of the respective companies.

## 1 Preliminary note

### 1.1 Symbols used

- ▶ Instruction
- > Reaction, result
- [...] Designation of pushbuttons, buttons or indications
- Cross-reference
-  Important note  
Non-compliance can result in malfunction or interference.
-  Information  
Supplementary note

## 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.

## 3 System requirements

### 3.1 Software

- Operating system Microsoft Windows XP (SP2), Vista or Windows 7
- DotNET 2.0 or higher

### 3.2 Required accessories

- Crossover cable for parameter setting connection (Ethernet), M12 connector/RJ45 connector, 4 poles, e.g. art. no.: E11898 (2 m)
- Connection cable for supply voltage and process connection, M12 socket, 8 poles, e.g. art. no. E11950 (2 m, wirable cable end)

You can find more information about the available accessories at:

[www.ifm.com](http://www.ifm.com) → data sheet search → e.g. O2V100 → Accessories

## 4 Functions and features

In conjunction with the object inspection sensor O2V10x the PC operating program provides the following options:

- Creation, administration and deletion of application-specific applications
- Real-time monitor mode for set-up

## 5 Installation

Installation and setting for operation with a fixed assigned IP address are described below (= direct connection to the PC).

This is the factory-preset operating mode of the sensor.

## 5.1 Hardware

- ▶ Connect the device to the Ethernet interface of the PC using a crossover cable.
- ▶ Supply the device via the process connection.  
Wiring → type label, data sheet O2V10x or included operating instructions
- > Green Power LED lights.
- > Green Eth LED lights for correct Ethernet connection.

## 5.2 Software

The PC operating program can be started directly from the CD or can be installed on the PC.

### 5.2.1 Start program without installation

- ▶ Insert the CD in the drive.
  - > The start menu opens.
- ▶ Select the menu item "Start efector dualis".
  - > The program starts.



If the autostart function for CD drives is deactivated and the start menu does not open automatically:

- ▶ Start the "E2V100.exe" file in the main directory of the CD with a double click.
  - > The program starts.

### 5.2.2 Install program on the hard disk

- ▶ Insert the CD in the drive.
  - > The start menu opens.
- ▶ Select the menu item "Install efector dualis" and follow the instructions of the installation routine.
  - > The program is installed.



If the autostart function for CD drives is deactivated and the start menu does not open automatically:

- ▶ Start the "E2V100.exe" file in the main directory of the CD with a double click.
  - > The start menu opens.
- ▶ Select the menu item "Install efector dualis" and follow the instructions of the installation routine.
  - > The program is installed.

### 5.3 Network settings

#### 5.3.1 Network setting IP address range

The IP address range of the device and the PC have to match.

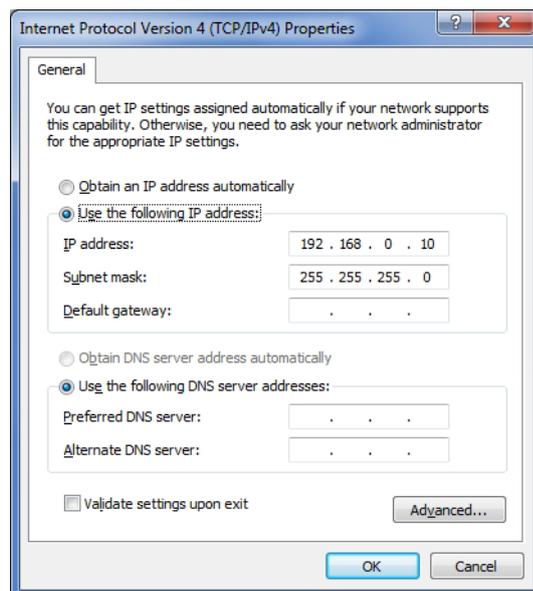
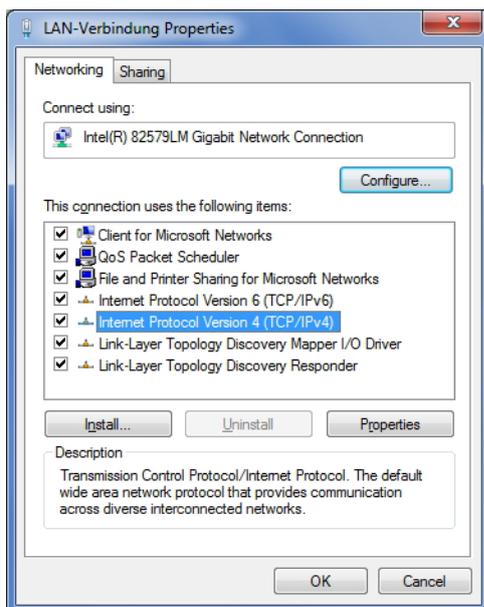
	Network address	Station address
efector dualis O2V1xx	192.168.0	59
	=	≠
PC	192.168.0	e.g. 10

#### 5.3.2 Factory setting parameters

efector dualis O2V1xx parameters	Description	Factory setting
DHCP	Dynamic Host Configuration Protocol	off
IP	IP address	192.168.0.59
nETm	Subnet mask	255.255.255.0
GWIP	Gateway address	192.168.0.201

#### 5.3.3 Verify and set the IP address of the PC

- ▶ Activate menu "Internet Protocol Properties Version 4 (TCP/IPv4)".  
The Windows menu "Internet protocol (TCP/IP) Properties" is accessible for example via:  
Start → Control Panel → Network and Sharing Center → Change adapter settings → Local Area Connection → Properties.
- ▶ Select the menu item "Use the following IP address".
- ▶ Verify and set the IP address, if necessary (here e.g. 192.168.0.10).
- ▶ Enter the subnet mask (255.255.255.0).
- ▶ Leave default gateway blank.
- ▶ Confirm the settings with [OK].



**!** Changes in the network settings of the PC require extended user rights. Contact your system administrator.

### 5.3.4 Verify and set the IP address on the unit

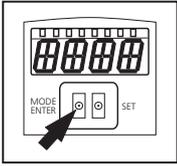
- ▶ Select the parameter "IP" (IP address) with [MODE/ENTER] and [SET].
- > The IP address is processed automatically and shown in 4 groups (A, b, C, d).
- ▶ Verify the IP address and set with [SET], if necessary.

### 5.4 Parameter setting on the unit

Set the parameter values via pushbuttons and display on the device.

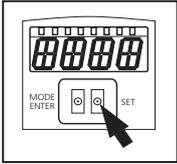
The sensor is programmed using the two buttons [Mode/Enter] and [Set].

First activate a parameter with the [Mode/Enter] button, select the required value with the [Set] button and confirm it pressing again the [Mode/Enter] button.



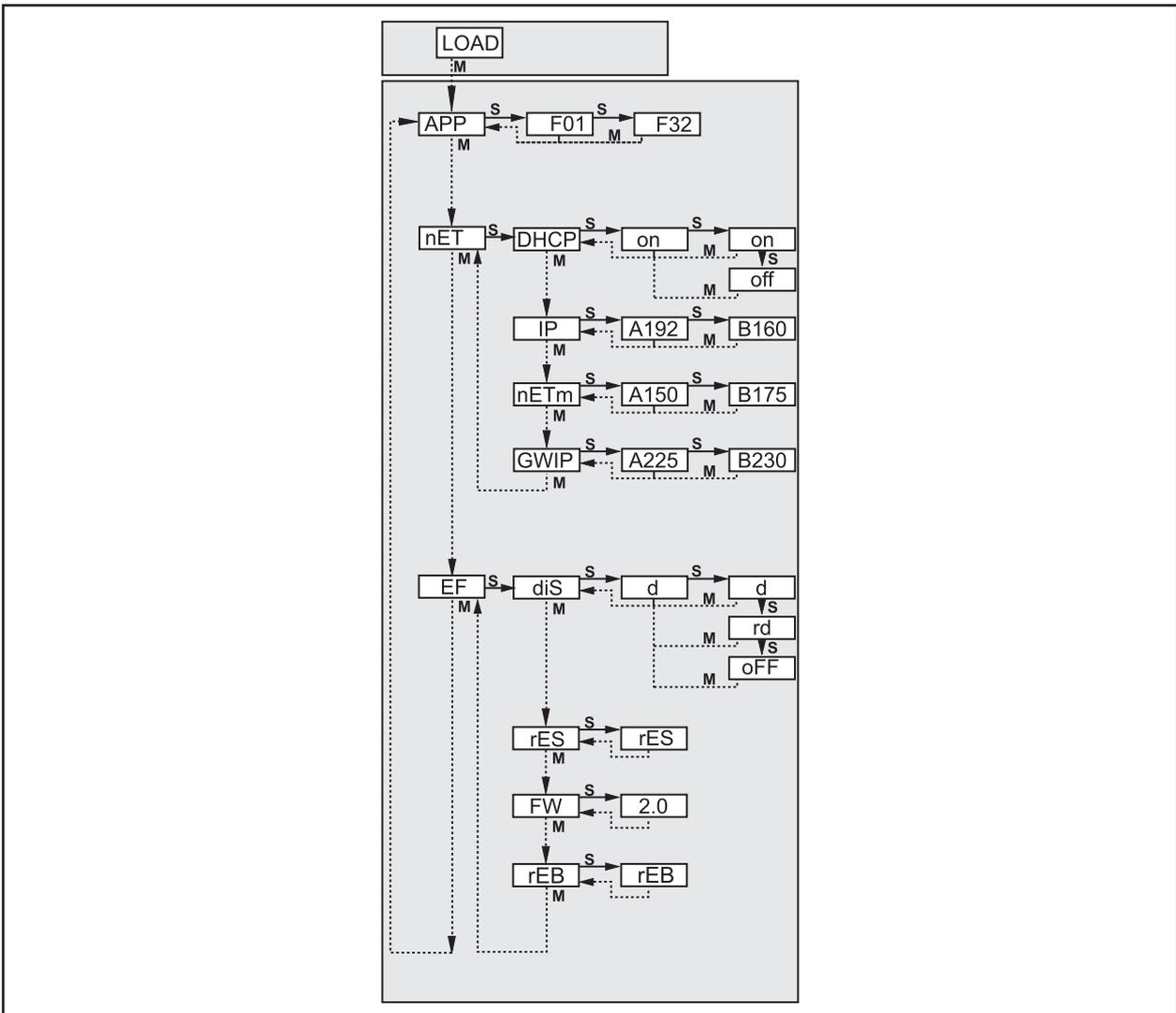
The unit changes to the parameter setting mode when you

- ▶ press [MODE/ENTER] for more than 1 s.
- > The first menu item is displayed.
- ▶ Press [MODE/ENTER] several times until the required parameter is displayed.



- ▶ Press [SET].
- ▶ The menu item is activated and the current setting is displayed.
- ▶ Keep [SET] pressed.
- > The display flashes, after 5 s with pressed SET button the display stops flashing.
- ▶ Press [SET] and change setting.
- ▶ Press [Mode/Enter].
- > The change is acknowledged and the previous menu item is shown again.

If no button is pressed for longer than 15 s, you will get to the next higher menu item or the evaluation mode.



## 5.4.1 Adjustable parameters

<i>APP</i>	<p><b>Memory location</b></p> <p>Select an application. The device can save up to 32 applications. By pressing the SET button the memory location number is incremented in the display. The current state of the memory location is visualised in the first digit of the display:</p> <p>F = memory location available  I = memory location used by an inactive application  A = memory location used by an active application  E = memory location (selected by external selection of the application)</p>
<i>nET</i>	<p><b>Network operation</b></p> <p>Here you set the parameters for network operation.</p>
<i>DHCP</i>	<p><b>Network settings via DHCP</b></p> <p>If the sensor is to get its network settings via DHCP, select the setting "on" in this menu item. With the setting "off" the fixed network settings (see next menu items) are used.  In the DHCP mode the sensor must be operated in a network with DHCP server. Otherwise it is not accessible via the operating program E2V100.</p>
<i>IP</i>	<p><b>Set IP address</b></p> <p>Here the IP address of the sensor is set. This setting is used when the sensor does not work in the DHCP mode. The input is made in the "dotted decimal notation", e.g. 192.168.0.3. Using the SET button you can select the four groups of the address. The respective group is visualised by a letter in the first digit of the display.</p>
<i>nETm</i>	<p><b>Set subnet mask</b></p> <p>Here the subnet mask of the sensor is set. This setting is used when the sensor does not work in the DHCP mode. The subnet mask must match the IP address. It is input in the same way as the IP address.</p>
<i>GWIP</i>	<p><b>Set gateway address</b></p> <p>Here the gateway address used by the sensor is set. This setting is used when the sensor does not work in the DHCP mode. It is input in the same way as the IP address.</p>
<i>EF</i>	<p><b>Access extended functions</b></p> <p>Here the extended functions of the sensor are accessed.</p>
<i>d, S</i>	<p><b>Rotate / switch off display</b></p> <p>Here you set whether a text is displayed normally (d) or rotated by 180° (rd). You also set whether the display is to be switched off (oFF) in the evaluation mode.</p>
<i>rES</i>	<p><b>Reset sensor</b></p> <p>Here you reset the sensor to the factory setting.</p>
<i>Fw</i>	<p><b>Firmware version</b></p> <p>In this menu item you can enquire about the firmware version of the sensor.</p>
<i>rEb</i>	<p><b>Reboot sensor</b></p> <p>Here you reboot the sensor without having to disconnect the power supply.</p>

## 5.5 Display of the sensor

Onli	Connection with the operating program
Parm	Parameter setting via operating program
SERp	Connection with the operating program, service report mode
ErrP	Selection of a non-existing application via switching inputs
ErrD	Critical hardware error
SC	Short circuit of one of the switching outputs
Init	Device initialisation after power-on
run	Sensor waiting for connection (no application active)
LOAd	Application is being loaded
done	Loading of application completed
MonI	Monitor mode
Lock	Pushbuttons locked
uLoc	Pushbuttons not locked
no[xx]	Application successful (number of the application)
Fail	Application not successful
rEdY	Sensor ready for trigger
FWUP	Firmware update running
DHCP nolP	No DHCP server found (display flashes alternately)
WAIT	Sensor is busy (display flashing)

## 5.6 Lock / unlock sensor

### Lock the reading or changing of sensor parameters

- ▶ Keep [Mode/Enter] and [Set] pressed simultaneously for 10 s.
- > Display changes to uLok.
- ▶ Press [Set].
- > Display changes to Lok1.
- ▶ Confirm with [Mode/Enter].
- > The sensor is locked. Parameters can neither be displayed nor changed.

### Lock changing of sensor parameters

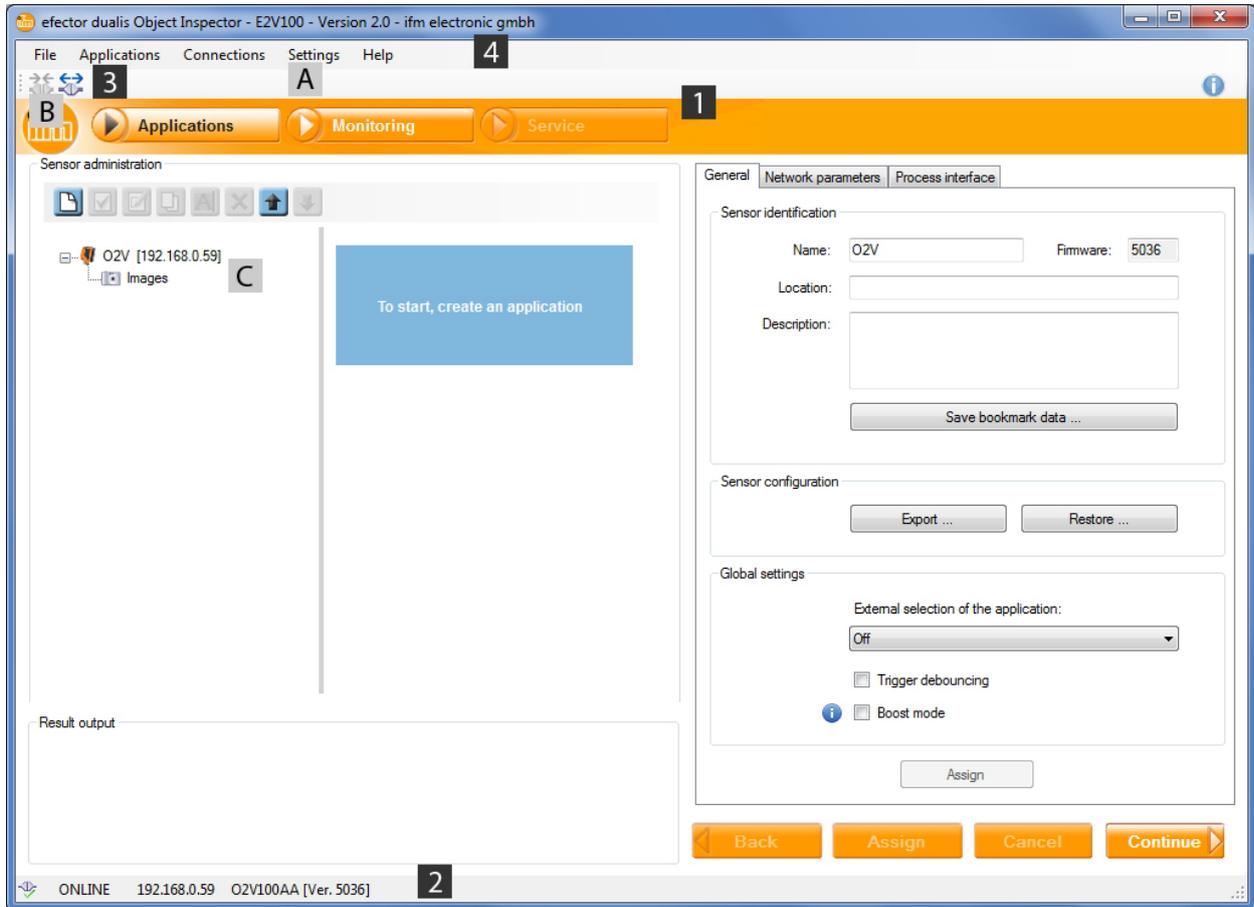
- ▶ Keep [Mode/Enter] and [Set] pressed simultaneously for 10 s.
- > Display changes to uLok.
- ▶ Press [Set] twice.
- > Display changes to Lok2.
- ▶ Confirm with [Mode/Enter].
- > The sensor is locked. Parameters are displayed but cannot be changed.

### Unlock the sensor

- ▶ Keep [Mode/Enter] and [Set] pressed simultaneously for 10 s.
- > Display indicates Lok1 or Lok2.
- ▶ Press [Set] several times, if necessary, until uLok is displayed.
- ▶ Confirm with [Mode/Enter].
- > The sensor is unlocked, display changes to "run".

## 6 Basic functions of the program

### 6.1 Basics on the user interface



UK

Pos.	Operating elements	Contents
1	Mode selection	<ul style="list-style-type: none"> <li>• Applications Create, edit, delete etc. applications</li> <li>• Monitor Display or visualisation                             <ul style="list-style-type: none"> <li>– of the grey-scale image</li> <li>– of the found models</li> <li>– of the status of the switching outputs</li> </ul> </li> <li>• Evaluation of the statistics</li> <li>• Service – Evaluation report and diagnosis</li> </ul>
2	Status bar	<ul style="list-style-type: none"> <li>• Network status of the device (OFFLINE/ONLINE)</li> <li>• Connection name</li> <li>• Article number/production status of the device/firmware of the connected device</li> <li>• Active application</li> </ul>
3	Tool bar	Buttons "Connect to a sensor", "Disconnect the existing sensor" and "Help" Commands that cannot be selected are displayed in grey.
4	Menu bar	Sub-menus with program function
A/B/C	Ways of selection	Identical commands can be selected in different ways (depending on the program function). A = selection via pulldown menu in the menu bar B = selection via button C = selection via context menu (click with right mouse button)

### 6.1.1 Tool bar icons

Symbol	Function
	Connect sensor.
	Disconnect sensor.
	Help

### 6.2 Program start

- ▶ Start the PC operating program.
- > The splash screen displays the program designation and the article number for approx. 5 seconds. When the program is started for the first time, the welcome screen is displayed showing the different connection options.

If the welcome screen should not be displayed any more, remove the tick at "Display with the next start".



## 6.3 Connect device to the operating program

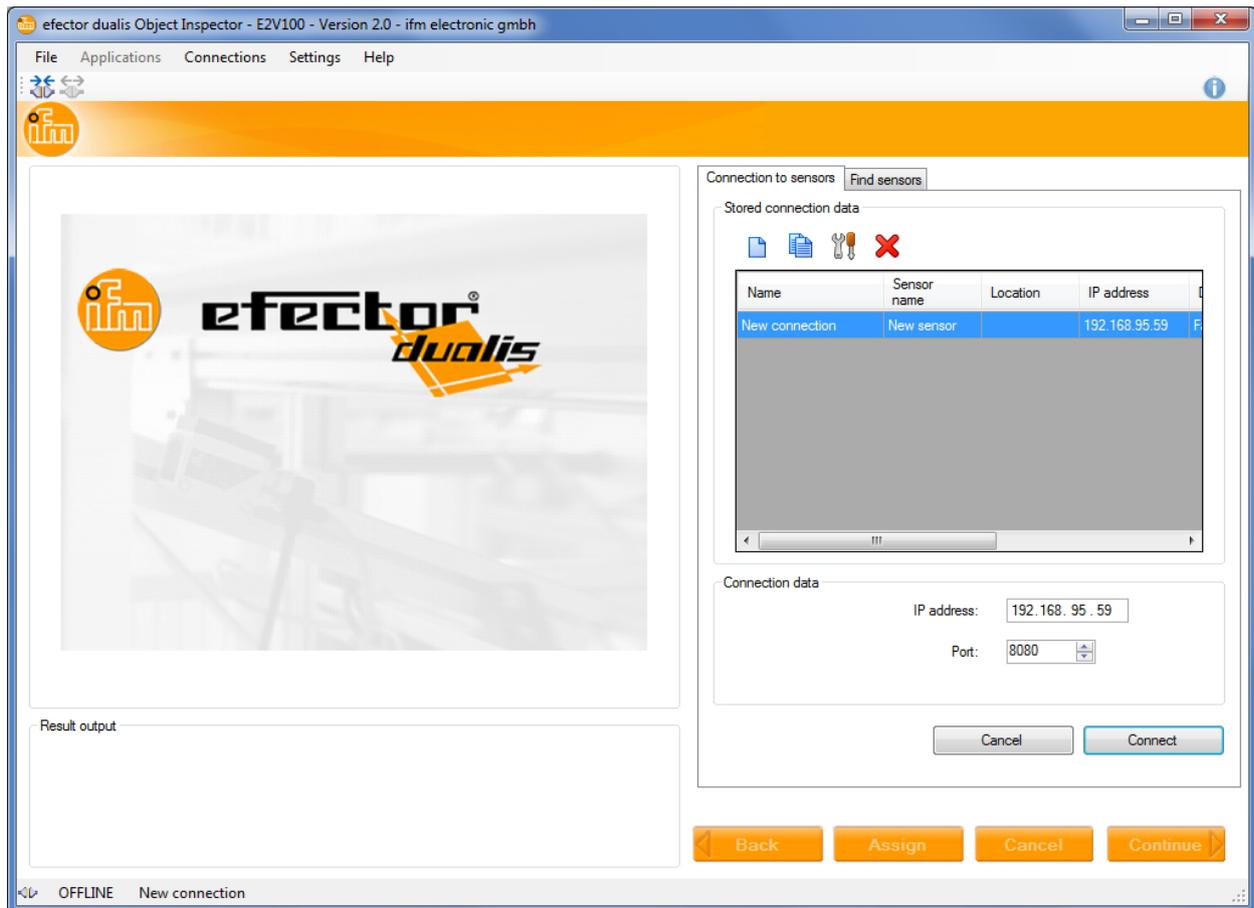
The connection options can be activated via the welcome screen or the menu bar.

Alternative 1: Welcome screen

- ▶ Select [Connect to a sensor ...] in the welcome screen.
- > User interface changes to the connection options.

Alternative 2: Menu bar

- ▶ Select [Connections] → [Sensors ...] in the menu bar.
- > User interface changes to the connection options.



There are several options to establish a connection to a sensor.

### 6.3.1 Establishing a connection via bookmark entry

A bookmark entry with the factory settings of the device is saved at "Stored connection data". (If this is not the case or if the settings of the sensor are not the factory settings, continue with 6.3.2 or 6.3.3.)

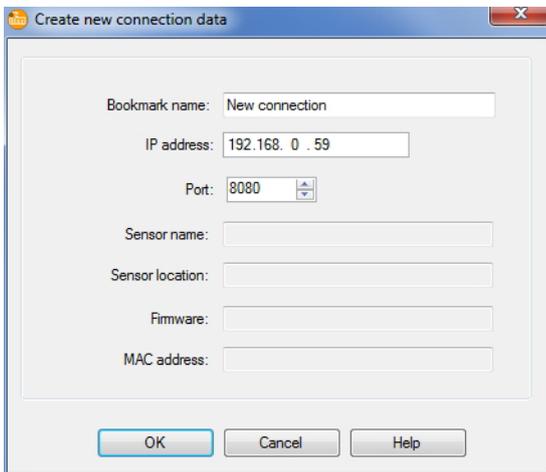
- ▶ Single-click on the bookmark entry "New connection" and click on [Connect].  
Alternatively: Double-click on the entry.
- > The status of the sensor changes from OFFLINE → ONLINE.
  - If no active application is saved in the unit, the operating program changes to the application mode.
  - If an active application is saved in the unit, the operating program changes to the monitor mode.  
After a trigger pulse the screen displays the current capture of the device.

More bookmark entries can be stored or processed in the connection settings. The following functions are available at "Stored connection data":

Symbol	Function
	Create new connection data.
	Copy connection data.
	Edit connection data.
	Delete connection data.

**Create new bookmark entry:**

- ▶ Click on the button  to create a new bookmark entry.
- > The dialogue window "Create new connection data" opens.



- ▶ Enter the name of the bookmark entry at "Bookmark name".
- ▶ Enter IP address and port.
-  Sensor-specific information such as device name, location, firmware and MAC address can be saved together with the connection data during sensor set-up at a later point of time.
- ▶ Acknowledge with [OK].
- > The new bookmark entry is displayed in the list.

**Copy bookmark entry:**

Available bookmark entries can be duplicated as a template for a new connection.

- ▶ Mark the bookmark entry to be copied in the list.
- ▶ Click on the button  .
- > The dialogue window "Copy connection data" opens. The fields are preset with the connection settings of the marked entry.

- ▶ Edit the required settings and acknowledge with [OK].
- > The new bookmark entry is displayed in the list.

### Edit bookmark entry:

IP address and port number of a bookmark entry can be changed subsequently.

- ▶ Mark the bookmark entry to be edited in the list.
- ▶ Click on the button .
- > The dialogue window "Edit connection data" opens.

- ▶ Edit the required settings and acknowledge with [OK].
- > The new settings are applied to the selected entry.

### Delete bookmark entry:

- ▶ Mark the required bookmark entry in the list.
- ▶ Click on the button .
- ▶ Acknowledge the safety query with [OK].
- > The selected entry is removed from the list.

### 6.3.2 Establish the connection by entering the IP address

If the network settings of the sensor are known, the connection can be established by entering the IP address and the port number.

- ▶ Activate connection options (→ 6.3).

- ▶ Enter IP address and port number at "Connection data".
- ▶ Click on the button [Connect].
- > The status of the sensor changes from OFFLINE → ONLINE.
  - If no active application is saved in the unit, the operating program changes to the application mode.
  - If an active application is saved in the unit, the operating program changes to the monitor mode. After a trigger pulse the screen displays the current capture of the device.



If a connection cannot be established with the entered connection data, the operating program provides a respective error message.

### 6.3.3 Find sensors in the network

Alternatively to entering the IP address the operating program can also find sensors in the network.

- ▶ Activate connection settings (→ 6.3).
- ▶ Select the tab "Find sensors".  
Alternatively: Select "Find sensors within a network ..." in the welcome screen.

- ▶ Enter the address range of the network (default setting: 192.168.0.0) at "Search zone" and the subnet mask (default setting: 255.255.255.0).
- ▶ Click on [Start sensor detection].
- > All sensors found are listed at "Detected sensors".

- ▶ Select the required sensor from the list.

Optional: A bookmark entry for the connection can be created via the button [Add connection data].

- ▶ Click on the button [Connect].

> The status of the sensor changes from OFFLINE → ONLINE.

- If no active application is saved in the unit, the operating program changes to the application mode.
- If an active application is saved in the unit, the operating program changes to the monitor mode.  
After a trigger pulse the screen displays the current capture of the device.

### 6.3.4 Restore connections

Connections once established can be quickly restored via links in the operating program.

#### Welcome screen

The created bookmark entries are listed in the welcome screen at the item "Restore a connection ...".

- ▶ Click on the required bookmark entry to restore the connection.

#### Tool bar

The last successful connection can be quickly restored via the tool bar.

- ▶ Click on the button  (→ 6.1.1)  
Alternatively, select [Connections] → [Connect].

## 7 Operating modes

The device differentiates between the operating modes "Applications", "Monitoring" and "Service". To select an operating mode the sensor must be connected with the operating program.



### 7.1 Applications

A new test program is configured in the operating mode "Applications". The device can save up to 32 test programs (applications).

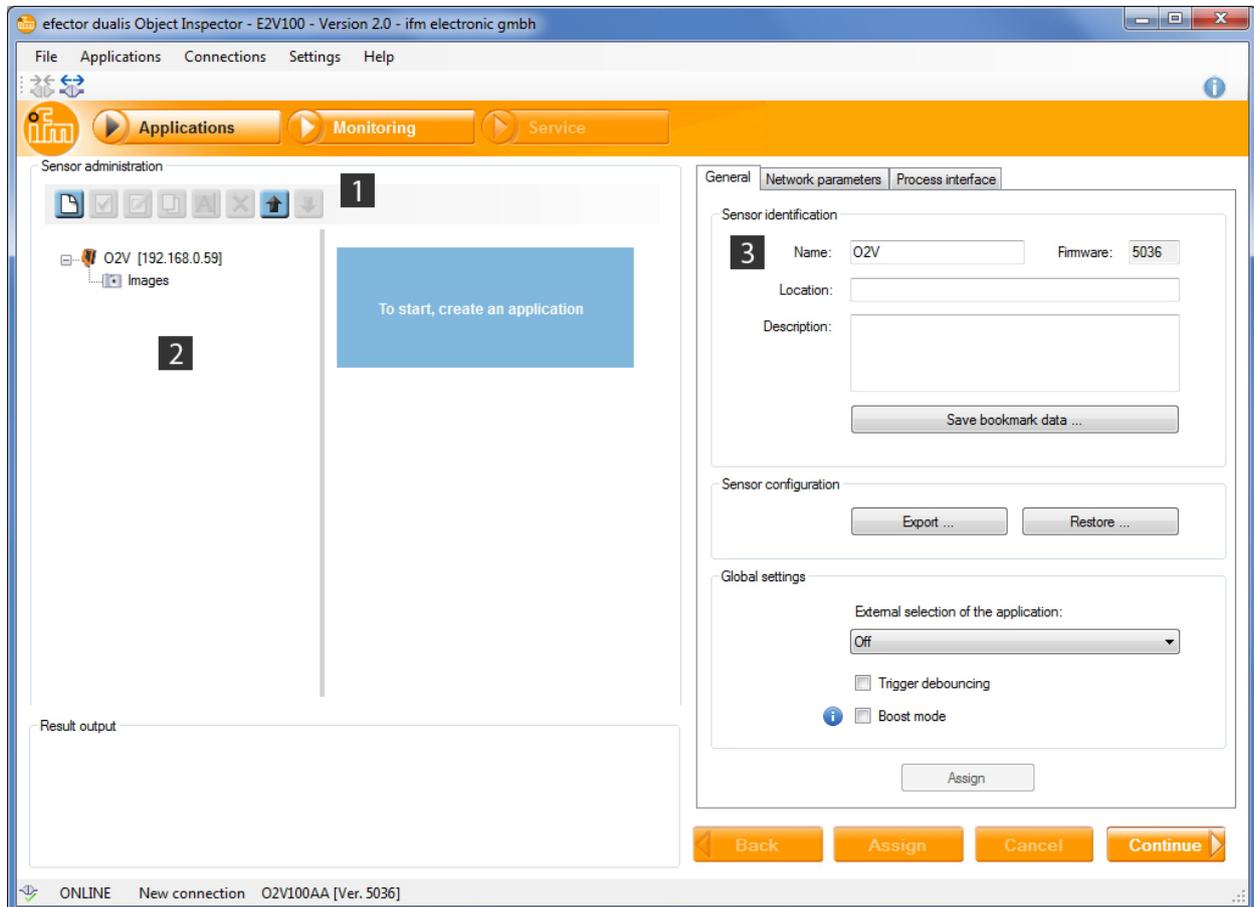
When creating an application the user is guided via a predefined navigation. The following settings and indications are polled and defined step by step:

1. Image quality
2. Create models
3. Segmentation
4. Model definition
5. IO configuration
6. Overall function test

## 7.1.1 Activate application mode

- ▶ Click on [Applications] in the navigation bar.
- > The overview for the application administration is displayed.

Applications can be created and edited in the application administration. Furthermore this overview contains functions to configure the sensor, the network parameters and the process interface.

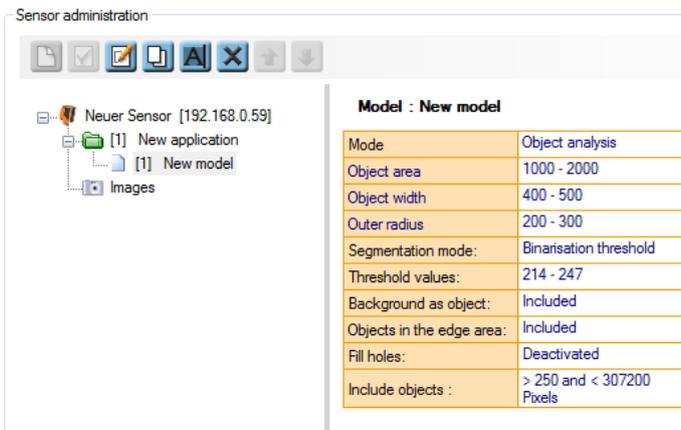


Pos.	Element	Function
1	Administer applications	New, activate, edit, rename, etc.
2	Application directory	Overview, structure and selection of the applications.
3	General administration	<ul style="list-style-type: none"> <li>– Device-specific information</li> <li>– Info about the firmware version</li> <li>– Export / restore sensor configuration</li> <li>– Configuration of the external selection of the application</li> <li>– Trigger input debouncing (on/off)</li> <li>– Boost mode</li> </ul>
	Network parameters	Possible basic settings of the performance and network parameters of the device. <ul style="list-style-type: none"> <li>– DHCP (on/off)</li> <li>– IP address, subnet mask, gateway</li> <li>– Port</li> <li>– Speed and duplex mode</li> </ul>
	Process interface	Configuration of the process interface <ul style="list-style-type: none"> <li>– TCP/IP, EthernetIP</li> <li>– Protocol version</li> <li>– Configuration parameters TCP/IP, Ethernet IP</li> </ul>

**Buttons in the section "Sensor Administration"**

Symbol	Function
	Generates a new application
	Activates the selected application
	Opens the selected application for editing
	Generates a copy of the selected application
	Renames or relocates the selected application
	Deletes the selected application
	Uploads an application from an external data medium to the sensor
	Downloads an application from the sensor to an external data medium

**Application directory**

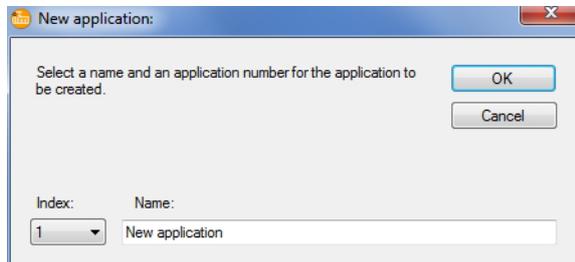


The connected sensor and the saved applications are listed in the application directory. Maximum 32 applications can be saved in every sensor, each application can contain up to 24 models. (→ Chapter 8.3 Models)

Next to the application directory detailed information about the selected application or model is shown.

### Create new application

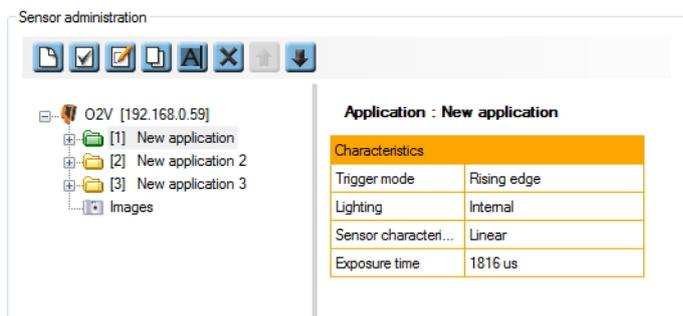
- ▶ Select the sensor in the directory structure by clicking once.
- ▶ Click on the button  or [Continue].
- > The dialogue window "New application" is displayed.



- ▶ Assign an index and a name for the new application.
- ▶ Acknowledge with [OK].
- > The new application is created.
- > The user interface changes to the first application step "Image quality" (→ chapter 8.2).

### Define active application

If there is more than one application on the sensor, the active application has to be defined first. This selection is made via the directory structure.



- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- > The colour of the activated folder changes from yellow to green and vice versa.

### Edit existing application

- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- > The user interface changes to the first application step "Image quality" (→ chapter 8.2).

### Duplicate existing application

- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Enter new name and new index in the new window "Duplicate application".
- ▶ Acknowledge with [OK].

### **Rename an existing application**

- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Enter new name and / or new index in the new window "Rename / relocate application".
- ▶ Acknowledge with [OK]

### **Delete existing application**

- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Acknowledge the safety query in the new window with [yes].
- > The application is deleted.

## Upload an application to the sensor

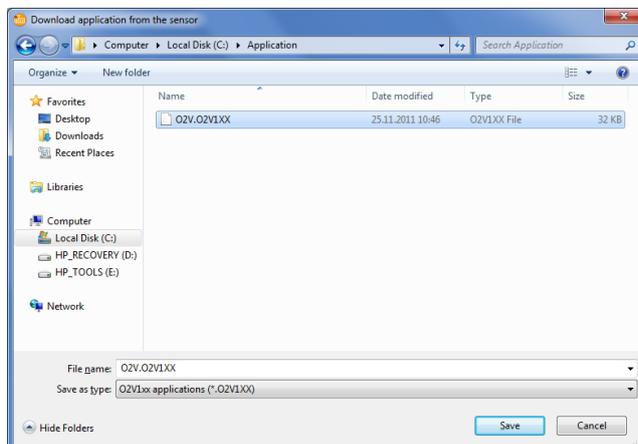
- ▶ Select the sensor in the directory structure by clicking once.
- ▶ Click on the button . Alternatively: selection via the context menu (right mouse button)
- ▶ Select the file on the storage medium and click on [Open].



- ▶ Assign the name of the new application.
- > The application is downloaded to the device and can be seen in the directory structure.

## Download an application from the sensor

- ▶ Single-click on the name / number of the application in the directory structure.
- ▶ Click on the button . Alternatively: selection via the context menu (right mouse button)
- ▶ Define location on the storage medium and assign a file name (file extension .O2V1xx).



- ▶ Acknowledge with [Save].

## 7.1.2 Help

The operating program has a by-topic help function.

- ▶ To open the help function click on the button  in the tool bar.
- > The program displays information about the current setting options in a new window.

## 7.2 General administration

The application administration provides other general configuration options for the connected sensor. The tab "General" allows the following settings and functions:

- entering information about the sensor identification (name, location, description)
- exporting and restoring the sensor configuration
- global (user-independent) settings for external selection of the application and trigger debouncing

### 7.2.1 Sensor identification

- ▶ Enter sensor name, location and description according to the application.

Sensor identification

Name:  Firmware:

Location:

Description:

Field	Function
Name	Any application-specific device name
Location	Location description (e.g. belt 3)
Description	e.g. application description
Firmware	Firmware version of the device (cannot be changed)

- ▶ Transfer the entries to the device with [Assign].
- ▶ Transfer all network data, sensor names and location designations for connection to the sensor to the PC and save with [Save bookmark data].
- > A new bookmark entry is created in the connection settings.

### 7.2.2 Export sensor configuration

The operating program provides the option to save a sensor configuration as a file.

- ▶ Click on [Export ...] in the section "Sensor configuration".
- > A new window "Archive sensor configuration data" opens.

Archive sensor configuration data

Storage options

Global device settings

Network settings

Applications

Images

- ▶ Select required storage options and acknowledge with [OK].
- ▶ Assign a file name in the save dialogue and acknowledge with [Save].

### 7.2.3 Restore sensor configuration

- ▶ Click on [Restore ...] in the section "Sensor configuration".
- ▶ Select the required file and acknowledge with [Open].

## 7.2.4 Global settings

Further application-independent options are available in the section "Global settings".

### External selection of the application

Here the selection of the active application can be configured via the switching inputs of the sensor. The following settings are possible:

Selection	Function
Off	External selection of the application deactivated
Static via switching inputs	Allows switching between the first four applications saved on the sensor. Pins 7 and 8 of the process interface are used as inputs. Pin 7 is the least significant bit (LSB), pin 8 is the most significant bit (MSB). Possible switching operations: pin 7: 0, pin 8: 0 -> application on memory location 1 active pin 7: 1, pin 8: 0 -> application on memory location 2 active pin 7: 0, pin 8: 1 -> application on memory location 3 active pin 7: 1, pin 8: 1 -> application on memory location 4 active
Pulse-controlled via switching input	Pulse-controlled selection of the active application, switching input 2 used as pulse input
Pulse-controlled via trigger input	Pulse-controlled selection of the active application, trigger input used as pulse input

For further information about the external selection of the application we refer you to the operating instructions of the sensor:

[www.ifm.com](http://www.ifm.com) → data sheet search → e.g. O2V100 → Operating instructions

### Trigger debouncing

The function "Trigger debouncing" prevents that several pulses occurring shortly after each other cause a trigger process on the device (mechanical trigger switch). With "On" a stable pulse has to be on the input for at least 3 ms so that it is recognised as a trigger pulse. Shorter pulses are ignored.

### Boost mode

In the boost mode the transfer of sensor images to the PC is deactivated. The evaluation times in the monitor mode can thus be considerably reduced (→ Chapter 7.3).

### 7.2.5 Network parameters

The tab "Network parameters" allows the network-specific settings of the sensor.

- ▶ Enter, check and change, if necessary, network parameters.

Field	Function
Obtain an IP address automatically (DHCP)	In the DHCP mode the input fields for the IP address, the mask and the gateway are blocked. The device is assigned an address by the DHCP server.
IP address	Currently assigned IP address of the device
Subnet mask	Standard setting subnet mask
Gateway	Default gateway address
MAC address	MAC address of the device (cannot be changed)
Communication port	Port number for parameter setting
Port for image transmission	Port number for the transmission of images
Speed and duplex mode	Selectable: 10 / 100 Mbits/s, full / half-duplex, automatic recognition (standard setting)

- ▶ Transfer network parameters to the device with [Assign].



Network parameters are applied only after a new start of the device.

## 7.2.6 Process interface

The tab "Process interface" allows the selection of the used process data protocol and its configuration. The device supports the TCP/IP and Ethernet/IP protocols.

General | Network parameters | Process interface

Process interface: TCP/IP

Protocol version: V 2.0

EtherNet/IP

Size of the consuming assembly: 450 bytes

Apply segmentation

Control bytes:

Reply

Decoding

Status

Index	Offset	Length

Size of the producing assembly: bytes

TCP/IP

Port: 50010

Assign

### TCP/IP

- ▶ Select the entry TCP/IP in the "Process interface" list.
- ▶ Select the required protocol version.
- ▶ Adapt the port number in the section "TCP/IP", if necessary.
- ▶ Transfer the settings to the device via [Assign].

### Ethernet/IP

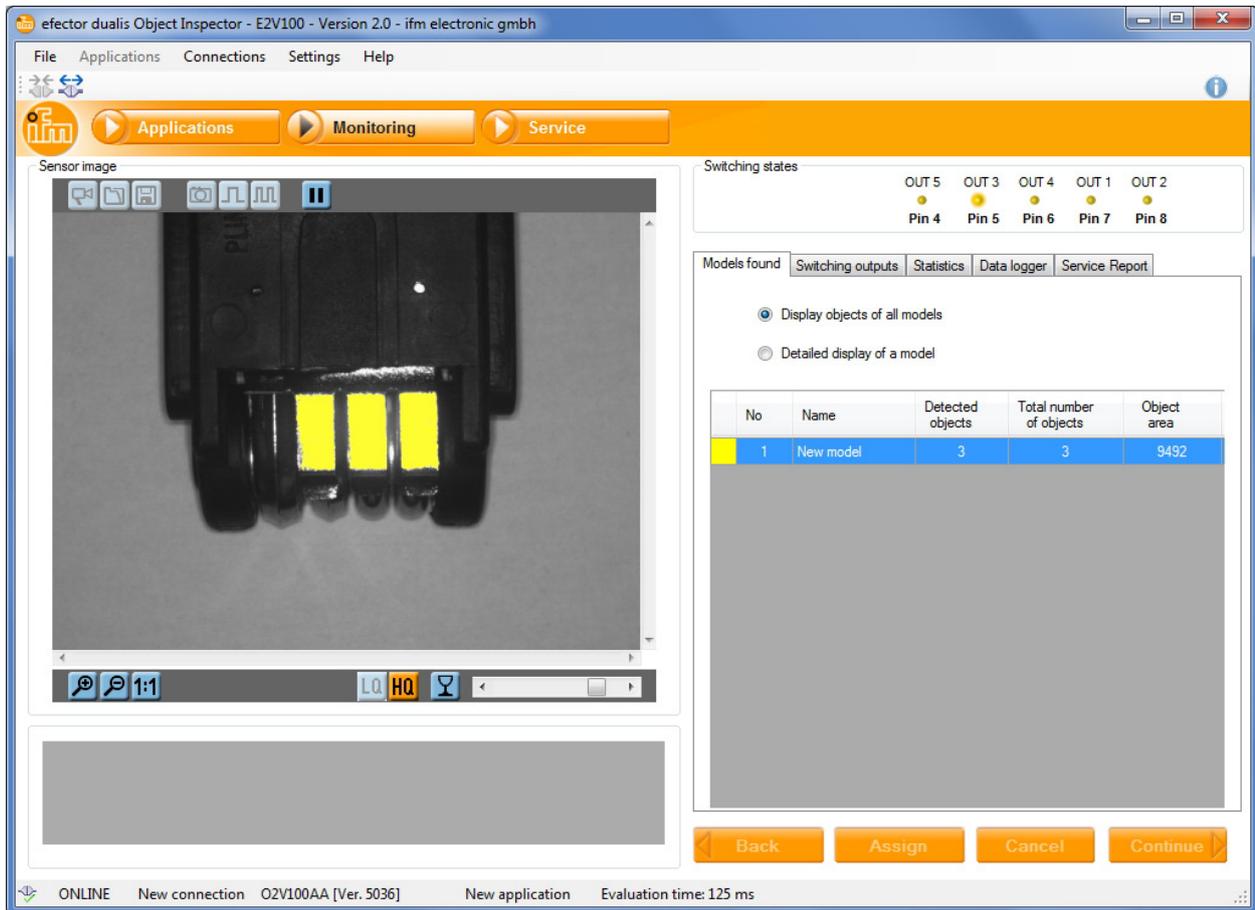
- ▶ Select the entry Ethernet/IP in the "Process interface" list.
- ▶ Select the required protocol version.
- ▶ Adapt the settings in the section "Ethernet/IP", if necessary.
- ▶ Transfer the settings to the device via [Assign].

## 7.3 Monitoring

After power-on and connection to the PC the device changes to the monitoring mode when an active application is saved. Here you can observe the device working. It is in the evaluation mode.



The evaluation time can vary considerably in monitoring mode due to the image transmission. Observing the application can lead to doubling the expected evaluation time. Use the boost mode to deactivate image transmission and to accelerate evaluation (→ Chapter 7.2.4).



The status line informs about

- Network status of the device (OFFLINE/ONLINE)
- Connection name
- Article number/production status of the device/firmware of the connected device
- Active application
- Evaluation time



### 7.3.1 Switching states

The current state of the switching outputs is graphically represented in the section "Switching states".



- LED lights yellow: output switched
- LED does not light: output not switched

### 7.3.2 Models found

The tab "Models found" shows information about the objects recognised by the sensor.

No	Name	Detected objects	Total number of objects	Object area
1	New model	3	3	9492

- ▶ Select "Display objects of all models" in the option field.
- > The table shows the active application for each model:
  - Model colour
  - Model number
  - Model name
  - Number of the detected objects matching the model (depending on the model definition → Chapter 8.5)
  - Total number of found objects (depending on the segmentation settings of the model → Chapter 8.4)
  - Total area of the found objects

In the sensor image the objects matching a model are highlighted in colour. The colour corresponds to that of the respective model.

Besides this general overview the program allows the detailed evaluation of individual models.

- ▶ Select "Detailed display of a model" in the option field.
- ▶ Select the required model in the table.
- > In the section "Result output" an identification number (ID) and the object characteristics are displayed for each found object (→ Chapter 8.4 Model definition).

Sensor image

Result output for model 1 (New model)

ID	Object area	Object height	Object width	Rectangularity
1	3273	85	42	97
2	3328	84	42	96
3	3125	83	42	92

Objects matching the selected model are displayed in green, all other objects in blue. Test criteria not passed are marked in red in the list.

### 7.3.3 Switching outputs

Real outputs

IO	Pin	Switching status	Output logic
5	4	Off	-
3	5	Off	Ready for trigger
4	6	Off	1 x [New model]
1	7	Off	-
2	8	Off	-

Outputs via process interface

IO	Switching status	Output logic
6	Off	-
7	Off	-
8	Off	-
9	Off	-
10	Off	-
11	Off	-
--	--	--

cht\_u2.jpg      ange

The tab "Switching outputs" informs about switching status and output logic of the sensor outputs. The upper section shows the 5 real switching outputs, the lower section the outputs via the process interface.

The display shows:

- number of the output
- pin connection (for real outputs)
- switching status
- configuration of the output logic

### 7.3.4 Statistics

The tab "Statistics" shows information about the number of the evaluated images.

Field	Function
Total	total number of evaluations
Switched	number of successful evaluations
Not switched:	number of failed evaluations

- ▶ Click on the button [Stop] / [Continue] to interrupt or continue with the statistics logging.
- ▶ Click on the button [Reset] to reset the counter to zero.

### 7.3.5 Data logger

Evaluation results can be logged and stored in a freely selectable directory via the tab "Data logger".

- ▶ Select the number of the required results from the list.
- ▶ Click on the button  to start logging.
- ▶ Click on the button  to stop logging.

## 7.4 Service

This mode is used for diagnosis. The sensor stops the active application and all determined results. The current sensor image and all objects are displayed in the image field.

In addition you can open and save reports, make statistical evaluations as well as display the last images of good or bad readings from the sensor.

The screenshot displays the 'Service' mode of the 'efector dualis Object Inspector' software. The main window is titled 'efector dualis Object Inspector - E2V100 - Version 2.0 - ifm electronic gmbh'. The interface includes a menu bar (File, Applications, Connections, Settings, Help) and a toolbar with 'Applications', 'Monitoring', and 'Service' buttons. The 'Service' mode is active, showing a 'Sensor image' of a component with three colored regions (blue, purple, green). Below the image is a table of object detection results:

ID	Object area	Object height	Object width	Rectangularity
1	3273	85	42	97
2	3329	84	42	96
3	3120	83	42	91

To the right of the sensor image, there is a 'Switching states' section with indicators for OUT 5, OUT 3, OUT 4, OUT 1, and OUT 2, corresponding to Pin 4, Pin 5, Pin 6, Pin 7, and Pin 8. Below this is a 'Service Report' section with a table of evaluation results:

Evaluation	Time	Display	Pin 4/5/6/7/8
1	25.11.2011 14:56:12.947	PASS	00100
2	25.11.2011 15:02:14.248	PASS	00100
3	25.11.2011 15:02:15.490	PASS	00100
4	25.11.2011 15:02:16.490	PASS	00100
5	25.11.2011 15:02:17.302	PASS	00100
6	25.11.2011 15:02:18.388	FAIL	00000
7	25.11.2011 15:02:19.383	PASS	00100
8	25.11.2011 15:02:22.070	PASS	00100

Below the evaluation table is a 'Create reports' section with radio buttons for 'Selected evaluation', 'Service report', and 'Analysis file'. At the bottom of the window, there are buttons for 'Back', 'Assign', 'Cancel', and 'Continue'. The status bar at the bottom shows 'ONLINE', 'New connection', 'O2V100AA [Ver. 5036]', 'New application', and 'Evaluation time: 108 ms'.

For the last few evaluations the list in the section "Service report" indicates:

- time and date of the evaluation
- the text in the sensor display
- the state of the switching outputs

- ▶ Click on the button  to save service reports.
- ▶ Click on the button  to load service reports.

## 8 Configuring applications

This chapter describes the general parameter settings in the application.

An example of a complete parameter setting is illustrated in chapter 9.

### 8.1 Navigation

When a new application has been created or an existing one has been edited, the user interface automatically changes to the first application step "Image quality".

There are two possibilities to navigate through the process of parameter setting:

- with the navigation buttons Back, Cancel and Continue



- jump to the required screen with the module buttons



The settings of the modules "3: Segmentation" and "4: Model definition" differ from model to model. The respective module switches are therefore greyed out until at least one model has been created and selected.

#### Load application and return to the application administration.

- ▶ Select all module buttons one after the other, acknowledge with [Continue].  
Alternatively: Click on the button [Cancel] in the selected module.
- ▶ Acknowledge the safety query "Do you want to save the changes?" with [yes].
- > The operating software returns to the application administration.

#### Save application and continue with parameter setting.

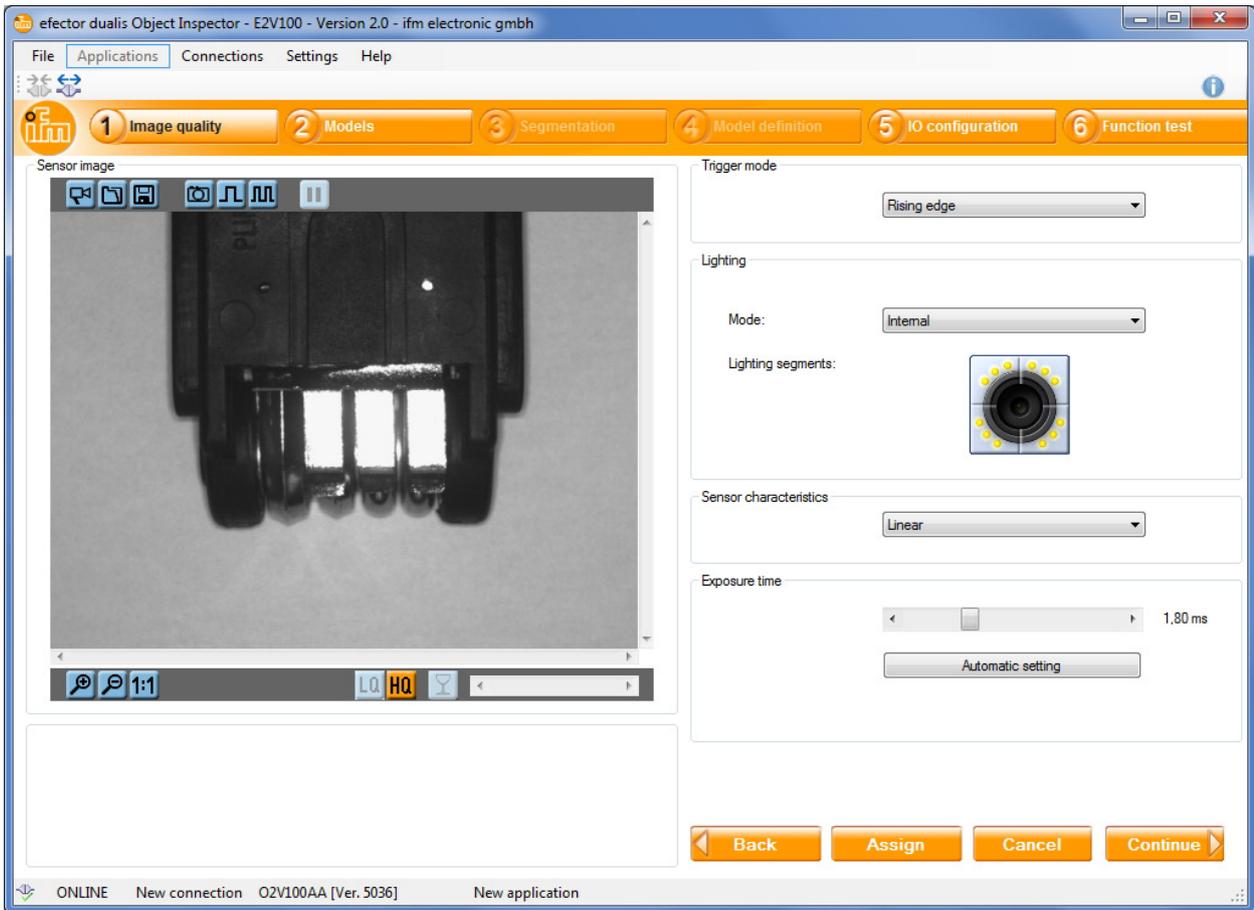
- ▶ Click on the button [Assign] in the selected module.
- > The new settings are assigned.

#### Cancelling parameter setting.

- ▶ Click on the button [Cancel].
- ▶ Acknowledge the safety query:  
select [yes] to save the changes made  
select [no] to reject the changes made
- > The operating software returns to the application administration.  
If [Cancel] is selected, the operating program returns to parameter setting.

## 8.2 Image quality

In this module you set the parameters for optimum image capture.



### Buttons in the section "Sensor image"

Symbol	Function
	Activate and deactivate live image transmission
	Load the image file to the sensor for evaluation
	Save the image file on the sensor or as a file
	Capture a new single image
	Capture a new single image with the next trigger pulse
	Capture a new single image with each trigger pulse
	Stop / continue result display in the operating program
	Increase image section

Symbol	Function
	Decrease image section
	Restore original size of the image section
	Select low quality for live image transmission
	Select high quality for live image transmission
	Show / hide object marking in the sensor image

 Buttons that do not have any function in the currently selected module or display mode are greyed out.

### 8.2.1 Capture sensor image

The device has two display modes to indicate the sensor image:

- live image transmission
- single image capture

► Click on the button  to switch between the two display modes.

#### Live image transmission

When an application is opened for parameter setting, the live image transmission is activated. In this mode the device continuously captures an image of the object to be recognised. Changes to the object or to the image quality settings are displayed in the sensor image of the operating program.

There are two quality levels for live image transmission. With the setting "High Quality" the image displayed is richer in details, however, the display speed decreases.

- Click on the button  to select the low quality level.
- Click on the button  to select the high quality level.

Quality	Function
Low quality (LQ)	<ul style="list-style-type: none"> <li>– image size transmitted: 320 x 240 pixels</li> <li>– high image repetition rate</li> <li>– reduced image definition</li> </ul>
High quality (HQ)	<ul style="list-style-type: none"> <li>– image size transmitted: 640 x 480 pixels</li> <li>– high image definition</li> <li>– reduced image repetition rate</li> </ul>

During the live image capture the buttons for loading and saving an image, for single image capture and the trigger functions are deactivated.

#### Single image capture (manual)

In this mode the device captures a single image of the object to be recognised at the push of a button. Changes to the object or the image quality settings are displayed in the operating program after another capture has been triggered.

- Click on the button  to change from the live image mode to the single image capture.
- Capture a single image with .
- > The operating program indicates the new capture at "Sensor image".

### Single image capture (external trigger)

Instead of the operating software the selected trigger input can be used alternatively to capture a new image.



The mode "Single image capture (external trigger)" is useful when the parameters of moving objects are to be set.

Option 1: Capture a new image with the next trigger pulse

▶ Click on the button .

> The device captures a new image with the next trigger pulse, other trigger pulses are ignored.

Option 2: Capture a new image with each trigger pulse

▶ Click on the button .

> The device captures a new image with the next and subsequent trigger pulses.

Each new image overwrites the previous image. Images once captured can therefore be saved on the sensor or in an external file for later use.

### Zoom function

Use the buttons and to increase or decrease the size of an area of the image in the two display modes.

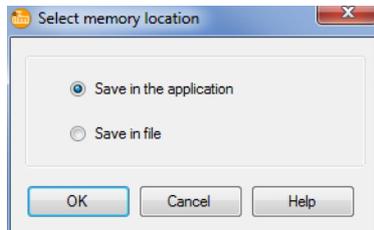
The button restores the image to its original size.

## 8.2.2 Save or load sensor image

Sensor images can only be saved or loaded in the mode "Single image capture".

### Save sensor image:

- ▶ Capture new single image.
- ▶ Click on the button .
- > The dialogue window "Select memory location" opens.



Option 1: Save image on the sensor.

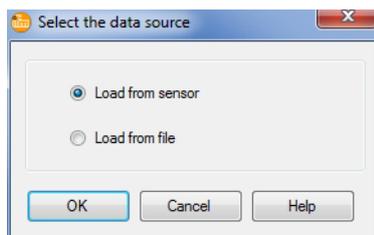
- ▶ Select "Save in the application" in the option field, acknowledge with [OK].
- ▶ Enter the name of the image to be saved, acknowledge with [OK].
- > The image is stored in the internal memory of the sensor.

Option 2: Save image in external file.

- ▶ Select "Save in file" in the option field, acknowledge with [OK].
- ▶ Indicate path and file name for the image to be saved, acknowledge with [Save].
- > The image is stored in the selected file.

### Load sensor image:

- ▶ Click on the button .
- > The dialogue window "Select the data source" opens.



Option 1: Load image from sensor.

- ▶ Select "Load from sensor" in the option field, acknowledge with [OK].
- ▶ Select the required image from the list, acknowledge with [OK].
- > The image is loaded from the sensor and displayed in the section "Sensor image".

Option 2: Load image from external file.

- ▶ Select "Load from file" in the option field, acknowledge with [OK].
- ▶ Indicate path and file name for the required image, acknowledge with [OK].
- > The image is loaded from the sensor and displayed in the section "Sensor image".



The sensor processes grey-scale images of size 640x480 pixels.

### 8.2.3 Setting the trigger mode

In this section you select the trigger type.

- ▶ Select trigger type in the list.

Trigger mode

Rising edge ▼

The following trigger types are available:

Trigger	Function
Off	Trigger deactivated, image capture is only possible via the operating program
Rising edge	The device captures a new image with rising edge on the trigger input
Falling edge	The device captures a new image with falling edge on the trigger input
Process interface	The device captures a new image via the process interface at respective command (→ O2V operating instructions → Chapter 12 process interface)
Continuous	The device continuously captures images and evaluates them. The processing speed is limited by the exposure and evaluation times.

### 8.2.4 Image quality settings

To achieve optimum image quality, please adhere to the notes on the installation location (→ Chapter 5.3) and the operating distance (→ Chapter 11.1) in the operating instructions of the sensor. You will find them on the web at:

[www.ifm.com](http://www.ifm.com) → data sheet search → e.g. O2V100 → Operating instructions

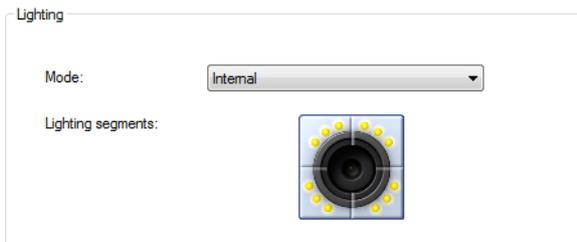
#### Image definition

- ▶ Install the sensor so that the required object is displayed.
- ▶ Optimise the image definition (focus) via the setting screw on the back of the device.

#### Lighting

To illuminate the object to be recognised, there are the following options:

Trigger	Function
Internal	The object to be recognised is illuminated by the integrated LEDs
External	External lighting can be controlled via the trigger output
Internal and external	Combined method of LED lighting and external lighting
Off	Internal LED lighting and background illumination are deactivated. Permanent lighting is used for image capture.



The internal LED lighting of the sensor is divided into four segments. By deactivating individual segments unwanted reflections on the object to be recognised can be avoided.

- ▶ For activation / deactivation click on the required lighting segment.

### Sensor characteristics



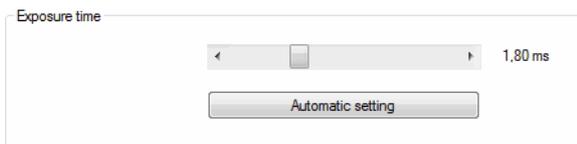
The default setting for the sensor characteristics is "Linear". This setting is suited for most objects to be recognised.

- ▶ Select "Linear" from the list.

The setting "Logarithmic" is available for strongly reflective objects to be recognised. It prevents irradiation of the sensor image.

- ▶ Select "Logarithmic" from the list.

### Exposure time



The exposure time is preset automatically. The current value is indicated in microseconds or milliseconds in the parameter field.

Option 1: Manual setting of exposure time

- ▶ Move the slider bar with the mouse pointer.

Option 2: Automatic setting of exposure time

- ▶ [Automatic setting].

> The sensor redetermines and sets the exposure time.



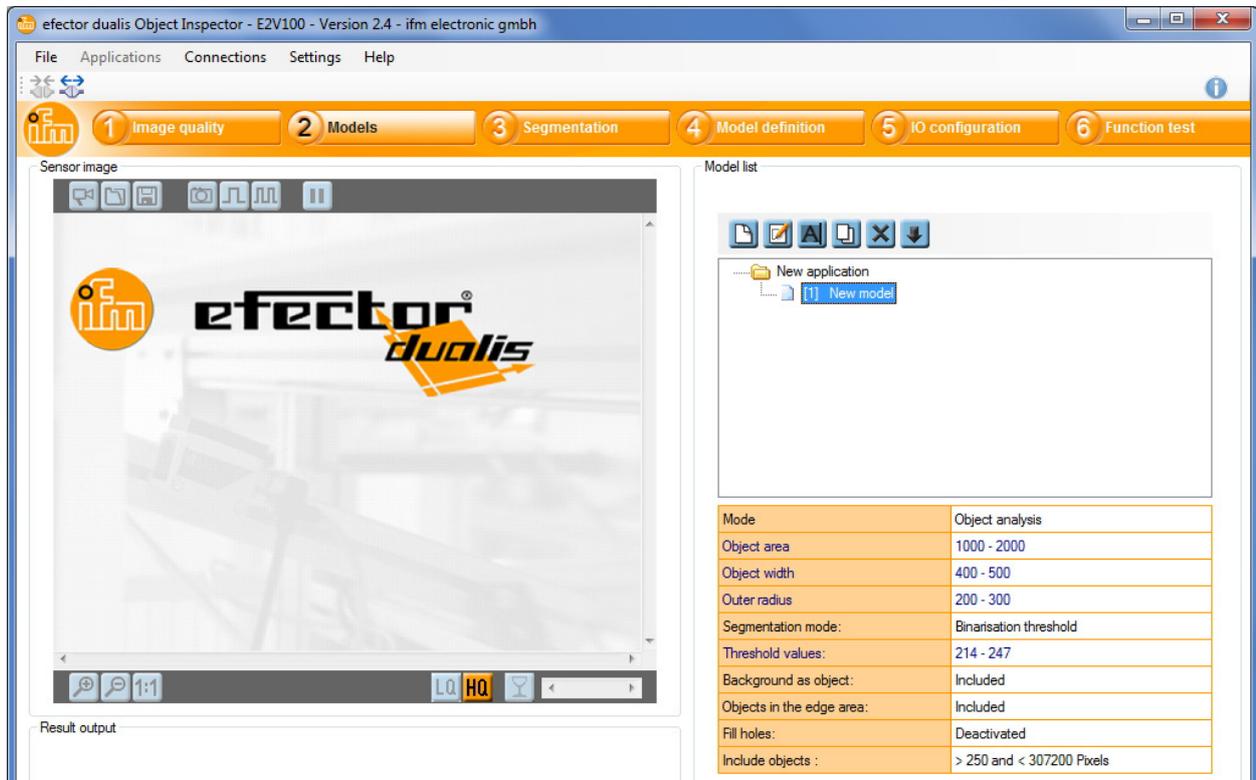
The automatically determined exposure time is not always the optimum setting; it is, however, useful as reference. The exposure time should be selected so that there is a maximum contrast between the detail to be verified and the background.

- ▶ If the sensor image is sharp and all parameters are set to your requirements, click on [Continue].

> Change to the parameter setting module "Models".

### 8.3 Models

In this module you create new models or edit existing ones. Each application can contain up to 24 models.



A module comprises

- specifications about the image zones to be evaluated (→ Chapter 8.4 Segmentation)
- object properties according to which an object to be recognised is evaluated to be "good" or "faulty" (→ Chapter 8.5 Model definition).

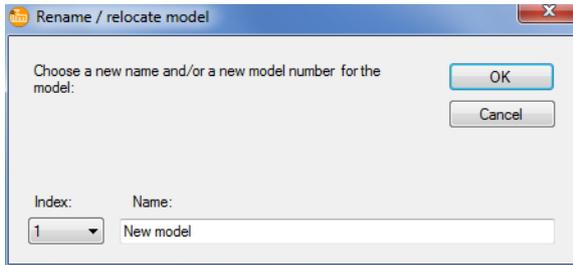
The operating program displays a list of the created models on the right. Detailed information about the selected model is given below the list of models.

#### Button in the section "Model list"

Symbol	Function
	Creates a new model
	Opens the selected model for editing
	Renames or relocates the selected model
	Makes a copy of the selected model
	Deletes the selected model
	Imports a model definition from another application or from a file

## Create a new model

After changing from the parameter setting module "Image quality" to the module "Models" a new model is created automatically.



- ▶ Assign an index and a name for the new model.
- ▶ Acknowledge with [OK].
- > A new model is created.
- > The user interface changes to the next application step "Segmentation".

If you need more models, for example to verify several different objects in an image scene, you can return to the module "Models" at any time.

- ▶ Click on the button  to create more models.

## Edit existing model

- ▶ Single-click on the name / number of the model in the model list.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- > The user interface changes to the next application step "Segmentation".

## Rename existing model

- ▶ Single-click on the name / number of the model in the model list.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Enter new name and/or new index in the new window "Rename / relocate model".
- ▶ Acknowledge with [OK].

## Duplicate existing model

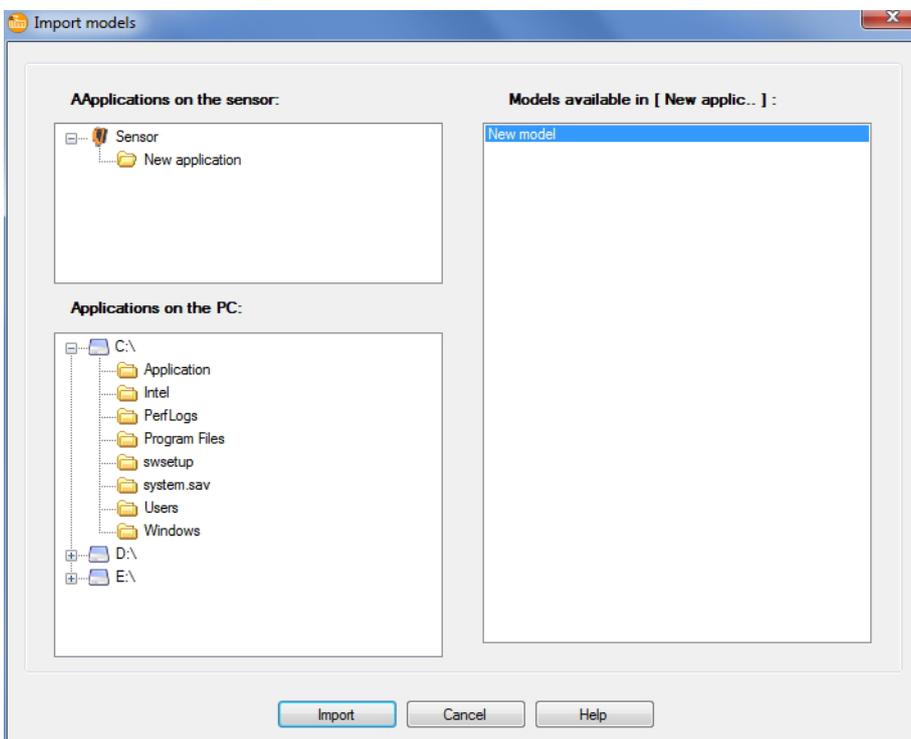
- ▶ Single-click on the name / number of the model in the model list.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Enter new name and new index in the new window "Copy model".
- ▶ Acknowledge with [OK].

### Delete existing model

- ▶ Single-click on the name / number of the model in the model list.
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Acknowledge the safety query in the new window with [yes].
- > Model is deleted.

### Import model from another application or file.

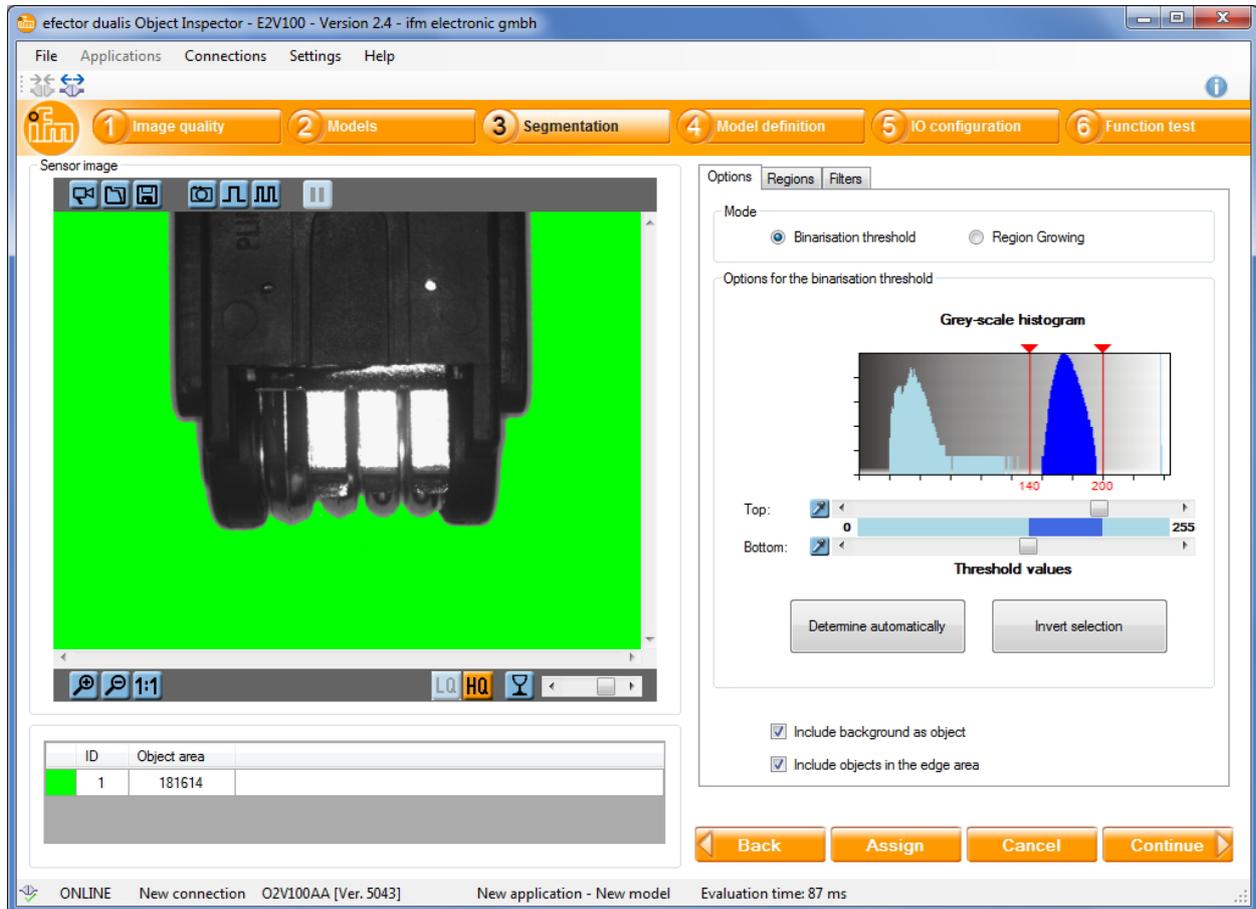
- ▶ Click on the button  .  
Alternatively: selection via the context menu (right mouse button)
- ▶ Select required application on the sensor or PC.
- > The available models are displayed in the list on the right.



- ▶ Select model and acknowledge with [Import].
- ▶ Assign an index and a name for the new model.
- > The model is imported to the device and can be seen in the model list.

## 8.4 Segmentation

In the parameter setting module "Segmentation" you define which objects in the image should be evaluated. For this purpose the program separates the image scene into several areas on the basis of the differences in luminosity.



The operating program shows the sensor image captured last on the left, the options for object selection on the right. The objects found are listed below the sensor image.

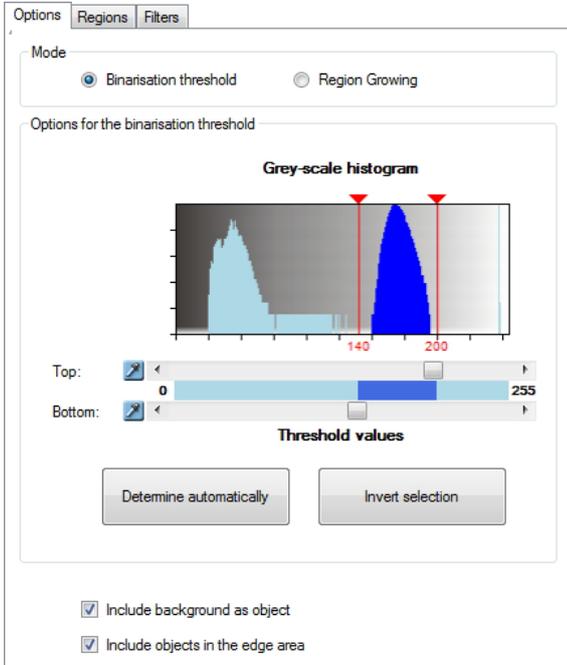
### 8.4.1 Find objects

To evaluate an object, the program must differentiate between the object to be recognised and the background. It uses the difference in brightness created in the module "Image quality".

There are two ways to distinguish the required object from the background.

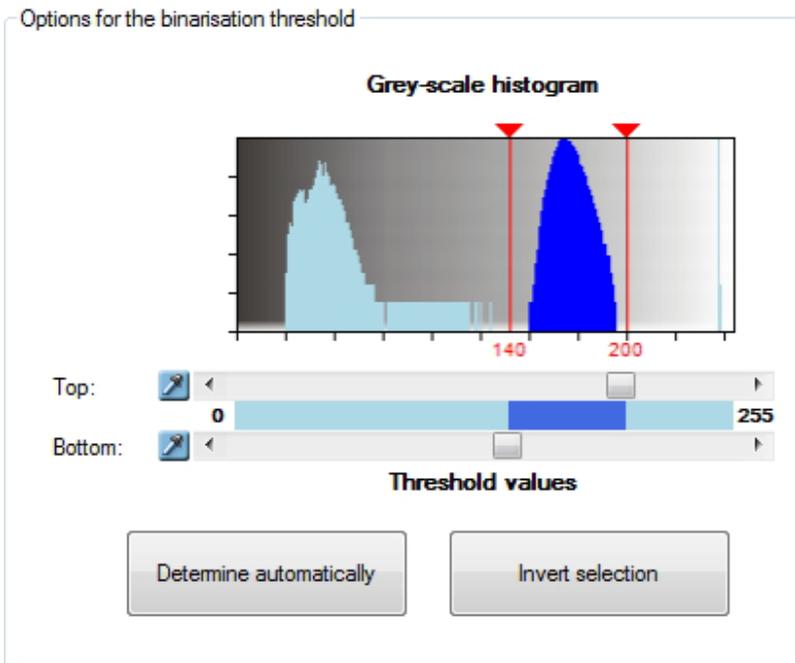
#### 1. Binarisation threshold

- ▶ Click on the tab "Options".
- ▶ Select the option "Binarisation threshold" in the section "Mode".



In this mode you define an upper and a lower threshold value for the brightness of the required objects. Each image zone whose brightness is between these two thresholds is seen as an object.

To facilitate the selection of the zones the program indicates the brightness distribution of the sensor image as a grey-scale histogram.

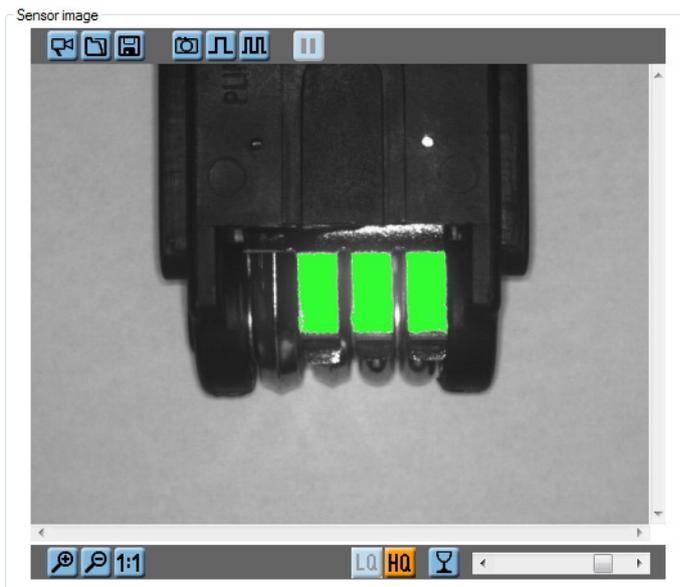


The histogram represents the frequency of the grey-scale values in the image in 256 shades, starting on the left with black (value 0) up to white (value 255) on the utmost right.

A high-contrast image shows an accumulation of dark and light pixels in the histogram. These peaks can be used as reference for determining the threshold values.

Take the following steps to define the required brightness zone.

- ▶ Set the upper threshold value with the slider bar "Top".
- ▶ Set the lower threshold value with the slider bar "Bottom".
- > The selected zones are shown in green in the sensor image.
- ▶ Correct setting until the required objects are marked in green.



Alternative 1: Determine threshold values automatically

- ▶ Click on the button [Determine automatically].
- > The determined zones are shown in green in the sensor image.
- ▶ Correct setting until only the required objects are marked in green.

Alternative 2: Select the threshold values directly in the sensor image

- ▶ Click on the eyedropper symbol  next to the respective slider bar.
- ▶ Click on the zone of the required brightness in the sensor image.
- > The selected zones are shown in green in the sensor image.
- ▶ Correct setting until only the required objects are marked in green.



In all views the grey-scale value of the pixel indicated by the mouse pointer is shown in the status bar.



The transparency degree of the object view can be set via the slider bar.

A single-click on the button  activates and deactivates the object markings.

The button [Invert selection] inverts the current selection, the upper and lower threshold values are exchanged.

In addition it can be defined via the selection fields if the background or objects in the edge area should be considered for the evaluation.

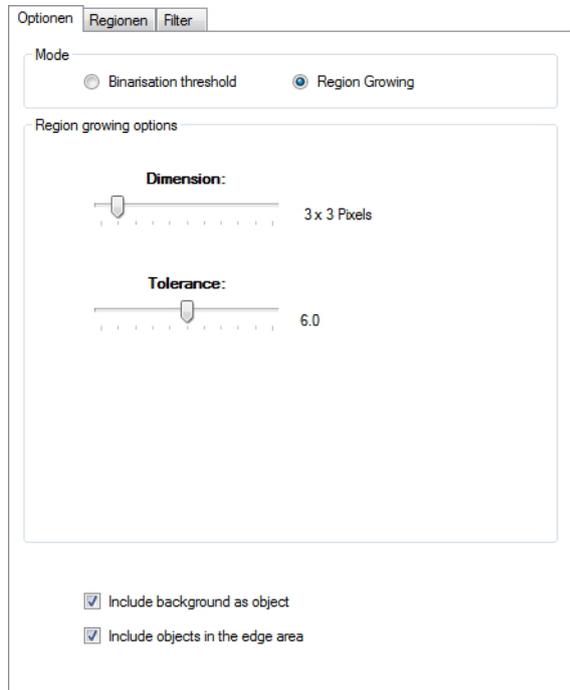
- Include background as object
- Include objects in the edge area



If the objects cannot be isolated as required via the threshold values, you may have to adapt the lighting settings or use the mode "Region growing".

## 2. Region growing

- ▶ Click on the tab "Options".
- ▶ Select the option "Region growing" in the section "Mode".



As opposed to the "Binarisation threshold" the mode "Region growing" does not use any absolute grey-scale values for the segmentation of the image scene. Instead the function evaluates differences in luminosity between neighbouring image zones. All coherent areas having a similar brightness are considered for the same object. "Region growing" is therefore also suited for the segmentation of scenes with changing light conditions.

By means of the slider bar "Dimension" you can set rough or fine evaluation of the image zones. Lower values allow finer distinctions; they increase the evaluation time, however.

Example value 3x3: The evaluation is made for blocks of the size 3x3 pixels.

The slider bar "Tolerance" defines by how many brightness levels a neighbouring image zone may differ to be considered to belong to the same object.

Example value 6: If neighbouring blocks differ by 6 brightness levels or less, the program includes them to the same object.



To better highlight objects in the centre of the image, the selection field "Include background as object" should be deactivated.

## 8.4.2 Regions

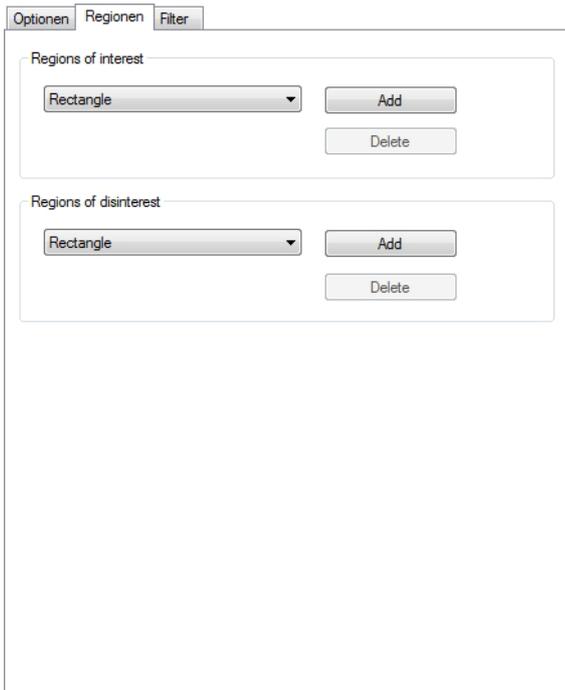
You can limit the evaluation manually to certain image zones via the tab "Regions". You can also exclude areas that are not important for the evaluation. Thus interference is reduced and evaluation accelerated.



If you use regions in "Binarisation threshold" mode, the histogram only considers the brightness values of the selected image zones.

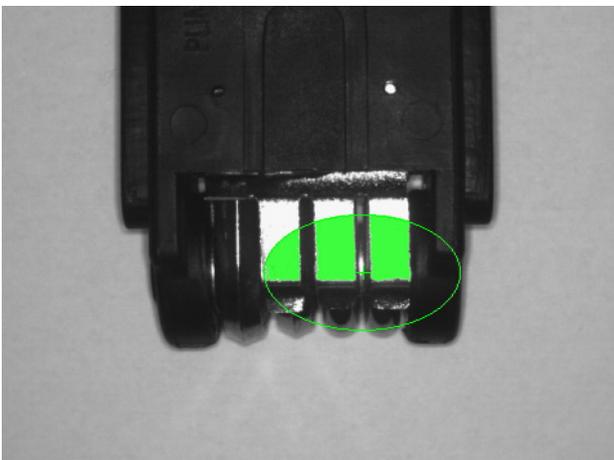


Please note that the object to be recognised must be precisely positioned for a small evaluation region.



### Add region

- ▶ Select either "Rectangle" or "Ellipse" from the list in the section "Regions of interest".
- ▶ Click on [Add].
- > The cursor changes to a cross hair in the image zone.
- ▶ Drag the required region in the sensor image to the required size.
- > The program only considers objects in the selected zone.



**Exclude region**

- ▶ Select either "Rectangle" or "Ellipse" from the list in the section "Regions of disinterest".
- ▶ Click on [Add].
- > The cursor changes to a cross hair in the image zone.
- ▶ Drag the required region in the sensor image to the required size.
- > The program ignores objects in the selected area.

The size of the region can be changed subsequently by clicking and dragging the frame accordingly. By shifting the centre, the position can also be adapted.

You can add several regions of interest or disinterest. The two functions can also be combined, for example to exclude details in a certain region from the evaluation.

**Remove regions of interest or disinterest**

- ▶ Click on the centre of the required region in the sensor image.
- ▶ Click on the button [Delete].

### 8.4.3 Filters

To improve distinction between object to be recognised and background, several filters are available.

#### Include objects

Via the function "Include objects" it is possible to exclude especially small or large objects from the evaluation. Interference or undesired reflections can be suppressed. This filter is automatically active when a new model is created.

The object area is indicated as the number of pixels that make up the object.

- ▶ Enter the area of the smallest required object in the number field on the left.
  - ▶ Enter the area of the largest required object in the field on the right.
  - ▶ Click on [Assign].
- > Objects whose size is outside the indicated area are ignored for the evaluation.

#### Fill holes

In evenly bright objects there may be individual bright or dark pixels, for example due to rough material surfaces or image interference. These "holes" in the object are automatically filled with the function "Fill holes".

The size of the holes to be filled can be either indicated absolutely as number of pixels or relative to the object surface in percent.

- ▶ Select absolute or relative indication via the option field.
  - ▶ Enter the size of the largest area to be filled in the number field.
  - ▶ Click on [Assign].
- > Holes that are smaller than the indicated value are filled.

## Preprocessing filter

In complex image scenes preprocessing of the sensor image can improve the evaluation result. Four different preprocessing filters can be selected.

Filters	Function
Enlarge dark areas	enlarges dark areas in the sensor image suited to link dark objects or to separate light objects
Enlarge light areas	enlarges light areas in the sensor image suited to link light objects or to separate dark objects
Median	reduces image noise suited for noisy image scenes with only few details
Mean value	reduces image noise suited for weakly noisy, detailed image scenes

- ▶ Select the required filter from the list in the section "Preprocessing".
- ▶ Select the application radius in the adjoining list.
- > The program automatically applies the filter to the image scene.



You can combine up to three different preprocessing filters. Please note that the evaluation time increases with each selected filter.

### 8.4.4 Object list

When the image zones have been selected, the program displays a list of the found objects at "Result output". For each object an identification number and also the size of the object area are indicated.

Result output

ID	Object area
1	3265
2	3185
3	3342

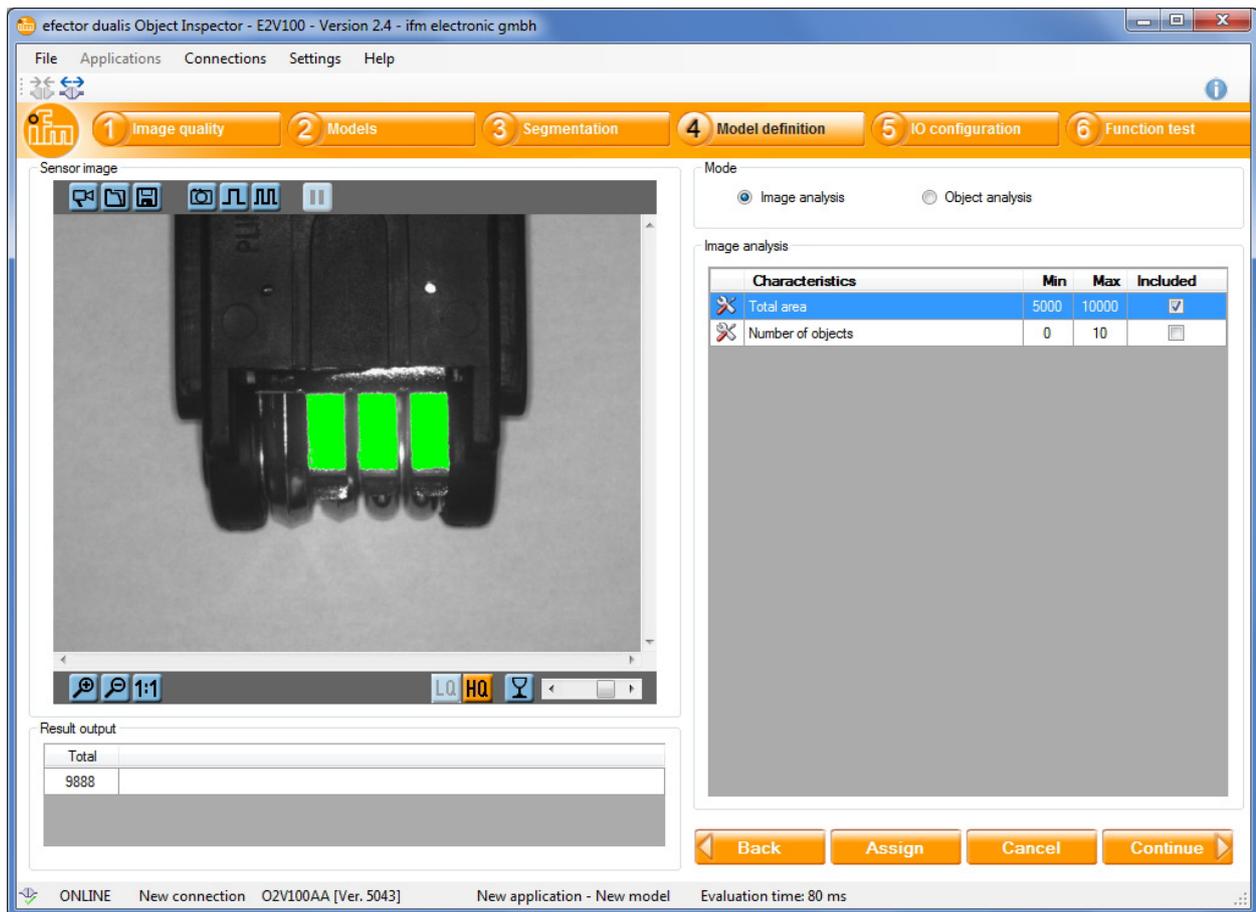
By clicking on a list entry the respective object is marked in red in the sensor image. Alternatively, the object can be clicked on in the sensor image to select the respective list entry.

## 8.5 Model definition

In each module you define the criteria according to which an object to be recognised is evaluated as good or faulty. The basis for the evaluation are object characteristics such size, orientation or grey-scale value. You indicate a minimum and maximum value for each required criterion. All objects whose characteristics are between these two values are recognised as good.

The following two evaluation modes are available:

- Image analysis: evaluation of the whole image (→ 8.5.1)
- Object analysis: evaluation of individual objects (→ 8.5.2)



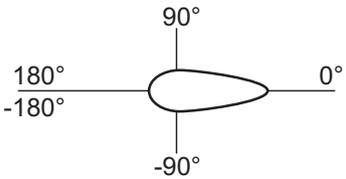
Abhängig vom gewählten Modus können die folgenden Eigenschaften ausgewertet werden:

### Image analysis mode

Object characteristics	Description
Total area	Total area of all objects Value range (1...307200)
Number of objects	Total number of all detected objects Value range (0...10000)

### Object analysis mode

Object characteristics	Description
Object area	Surface of the object in number of pixels Value range (1...307200)
Horizontal centre of gravity	Horizontal coordinate of the object's centre of gravity, measured from the left image border Application example: position determination or limitation Value range (1...640)

Object characteristics	Description	
Vertical centre of gravity	Vertical coordinate of the object's centre of gravity, measured from the top image border Application example: position determination or limitation Value range (1...480)	
Object height	Height of the smallest rectangle completely enclosing the object and whose sides are parallel to the image borders Value range (1...480)	
Object width	Width of the smallest rectangle completely enclosing the object and whose sides are parallel to the image borders Value range (1...640)	
Roundness	Degree of roundness of the object; describes the similarity to a perfect circle. A circle has the value 100; deviating objects have smaller values. Value range (1...100 %)	
Compactness	Degree of compactness of the object Empty regions have the value 0. Circular objects have the value 1. Long, narrow objects have average values. Entwined objects or objects with holes have high values. Value range (0...2750)	
Rectangularity	Degree of rectangularity of the object; describes the similarity to a perfect rectangle. A rectangle has the value 100; deviating objects have smaller values. Value range (1...100)	
Outer radius	The radius of the smallest circle completely enclosing the object Value range (1...480)	
Inner radius	The radius of the largest circle completely fitting inside the object Value range (1...480)	
Inner width	Width of the biggest rectangle completely fitting inside the object and whose sides are parallel to the image borders. Value range (1...640)	
Inner height	Height of the biggest rectangle completely fitting inside the object and whose sides are parallel to the image borders. Value range (1...480)	
Number of holes	Number of holes in the object Value range (1...2000)	
Orientation	Orientation of the object in degrees Value range (-180°...180°) A pointer-shaped object goes through the orientations anticlockwise: -180°...-90°...0°...90°...180°	 <p>Example: Orientation 0°</p>
Minimum grey-scale value	Smallest permissible grey-scale value of the object Value range (0...255)	
Maximum grey-scale value	Largest permissible grey-scale value of the object Value range (0...255)	
Average grey-scale value	Average grey-scale value of the object Value range (0...255)	
Grey-scale value deviation	Standard deviation of the grey-scale value of the object Describes the homogeneity of the object. The value is low for the evenly grey objects and high for irregular surfaces or grey-scale gradient. Value range (0...2250)	

Select suitable characteristics from this list to differentiate a good part from a faulty part.



The evaluation time increases with every selected criterion. Activate only as many object characteristics as necessary.

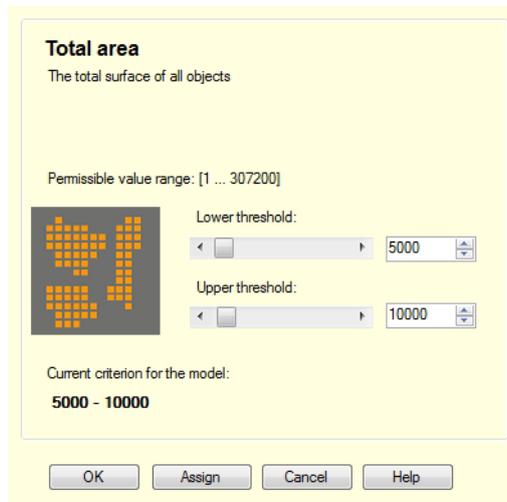
### 8.5.1 Image analysis

In "Image analysis" mode the program evaluates the global characteristics of the whole image, including the total area and the number of all detected objects.

This mode is suited, for example, for level applications or counting tasks.

Image analysis			
Characteristics	Min	Max	Included
 Total area	50000	150000	<input checked="" type="checkbox"/>
 Number of objects	0	10	<input type="checkbox"/>

- ▶ In the "Mode" section select the option "Image analysis".
- ▶ Click on the button  next to the requested characteristic.
- > The dialogue window for the configuration opens.



The configuration window displays the input options, the permissible value range, the current value range and a brief description of the selected object characteristic.

- ▶ Define the lower and upper threshold values via the slider bars or the input fields.
- ▶ Acknowledge with [OK].
- ▶ Follow these steps for all required characteristics.

You activate or deactivate individual object characteristics via the selection fields in the column "Included". Please note that the evaluation time increases with each selected test criterion.

## 8.5.2 Object analysis

In "Object analysis" mode the program evaluates the characteristics of individual objects.

Object analysis		Min	Max	Included
	Object area	1	307200	<input checked="" type="checkbox"/>
	Hor. centre of gravity	200	400	<input type="checkbox"/>
	Ver. centre of gravity	200	400	<input type="checkbox"/>
	Object height	85	90	<input type="checkbox"/>
	Object width	400	500	<input type="checkbox"/>
	Roundness	75	100	<input type="checkbox"/>
	Compactness	1500	2750	<input type="checkbox"/>
	Rectangularity	95	100	<input type="checkbox"/>
	Outer radius	200	300	<input type="checkbox"/>
	Inner radius	100	400	<input type="checkbox"/>
	Inner width	100	400	<input type="checkbox"/>
	Inner height	100	400	<input type="checkbox"/>
	Number of holes	5	100	<input type="checkbox"/>
	Orientation	-10	10	<input type="checkbox"/>
	Min. grey-scale value	200	255	<input type="checkbox"/>
	Max. grey-scale value	200	255	<input type="checkbox"/>
	Average grey-scale value	200	255	<input type="checkbox"/>
	Grey-scale value deviation	0	1000	<input type="checkbox"/>

- ▶ In the "Mode" section select the option "Object analysis".
- ▶ Click on the button next to the required entry.
- > The dialogue window for the configuration opens.

**Object area**  
The object surface

Permissible value range: [1 ... 307200]



Lower threshold:

Upper threshold:

Current criterion for included objects:  
**3000 - 3500**

The configuration window displays the input options, the permissible value range, the current value range and a brief description of the selected object characteristic.

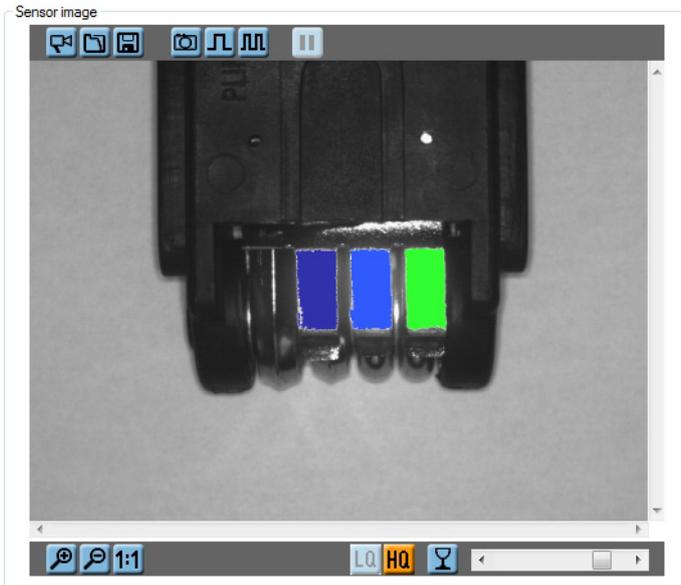
- ▶ Define the lower and upper threshold values via the slider bars or the input fields.
- ▶ Acknowledge with [OK].
- ▶ Follow these steps for all required characteristics.

You activate or deactivate individual object characteristics via the selection fields in the column "Included". Please note that the evaluation time increases with each selected test criterion.

### 8.5.3 Object list

Active characteristics and their current value are displayed in the object list below the sensor image. Objects meeting the selected criteria are marked in green, deviating objects in blue.

Test criteria not passed are marked in red in the list.



Result output

ID	Object area	Object height	Object width	Rectangularity
1	3265	85	42	97
2	3185	84	42	92
3	3342	84	42	96

Using the mouse you can point to individual table entries to show the current minimum and maximum values of an object characteristic.

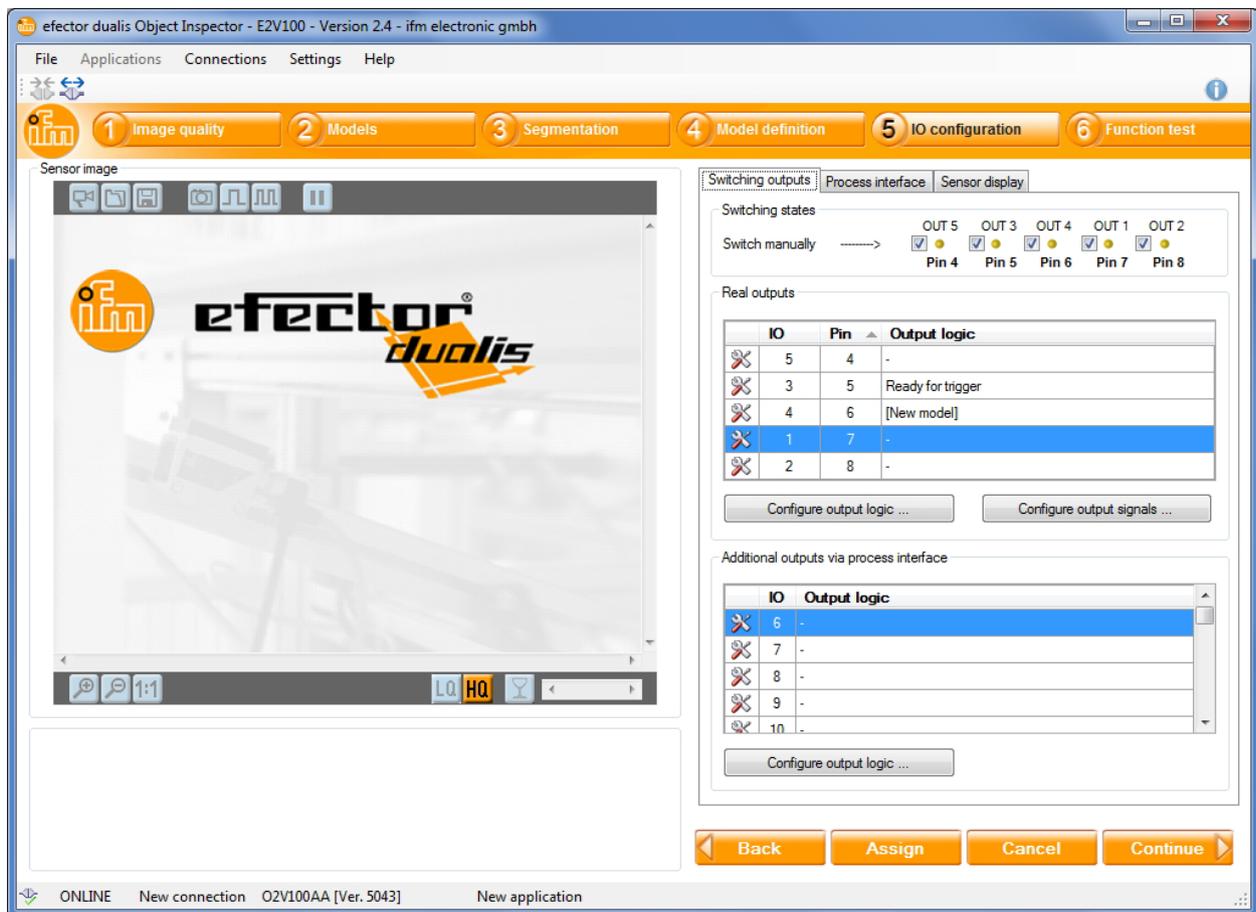


Sensible settings can be determined by evaluating good and bad parts by trial and error.

If you have made the settings matching your application, model creation is complete. Configuration of the process interface follows in the next section of parameter setting.  
 (→ Chapter 8.6 IO configuration)

## 8.6 IO configuration

In this module you configure the switching outputs and define which information is transferred via the process interface.



UK

### 8.6.1 Real outputs

The real sensor outputs have the default parameters.

I/O	Pin	Factory setting
5	4	- (may be blocked when an external illumination is used)
3	5	Ready for trigger
4	6	Evaluation result
1	7	-
2	8	-

The following paragraph describes how you adapt the output configuration.

► Click on  next to the required output.

Alternative: Mark the output and click on [Configure output logic].

► Select the required output mode.

The following modes are available:

- Ready for trigger
- Model combination
- Evaluation completed
- Ext. selection of the applications completed

- Number of objects

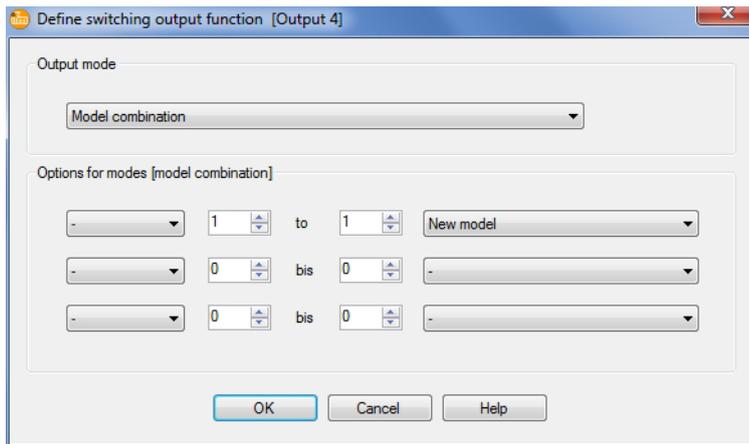
▶ Acknowledge with [OK].

In addition the type of output signal can be adapted.

- ▶ Select [Configure output signals...].
- ▶ Select "Static" or "Pulsed"; adapt the pulse length, if necessary.
- ▶ Acknowledge with [OK].

### Model combination

More options are available in the output mode "Model combination".



Here you define

- which models are to be included in the evaluation
- how often a model should be present in an evaluated image

Several models or versions of a model can be combined via the AND or OR functions.

In addition model versions can be excluded via a NOT function.

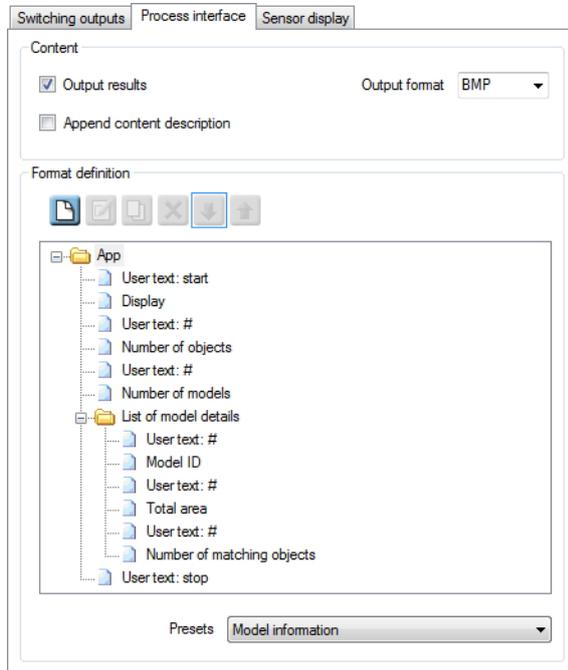
- ▶ Select the required model in the list on the right.
- ▶ Define via the input fields how often (minimum and maximum values) a model may occur.
- ▶ Where needed select "AND" or "OR" from the list on the left to link several model versions.
- ▶ Where needed select "NOT" from the list on the left to reverse the output logic.

Up to three different models can be combined for the evaluation.

## 8.6.2 Process interface

Besides the real outputs the sensor also has an Ethernet interface for TCP/IP and Ethernet/IP connections. If required, up to 32 further inputs or outputs can be addressed. The configuration is made in the same way as for the real outputs.

Several presets are available for the transmission of the evaluation result.



- ▶ Change to the tab "Process interface".
- ▶ Activate "Output results" to switch on the result output.
- ▶ Select the required options.

If the selection field "Append content description" is activated, each element of the result message is preceded by a clear label. So the output can be interpreted without further additional information.

In addition, the evaluated image can be transferred from the sensor (→ see below Activate image output). Available output formats are BMP, RAW, JPG and PNG.

You can find further information about the elements of the result message in the operating instructions of the sensor:

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. O2V100 → Operating instructions

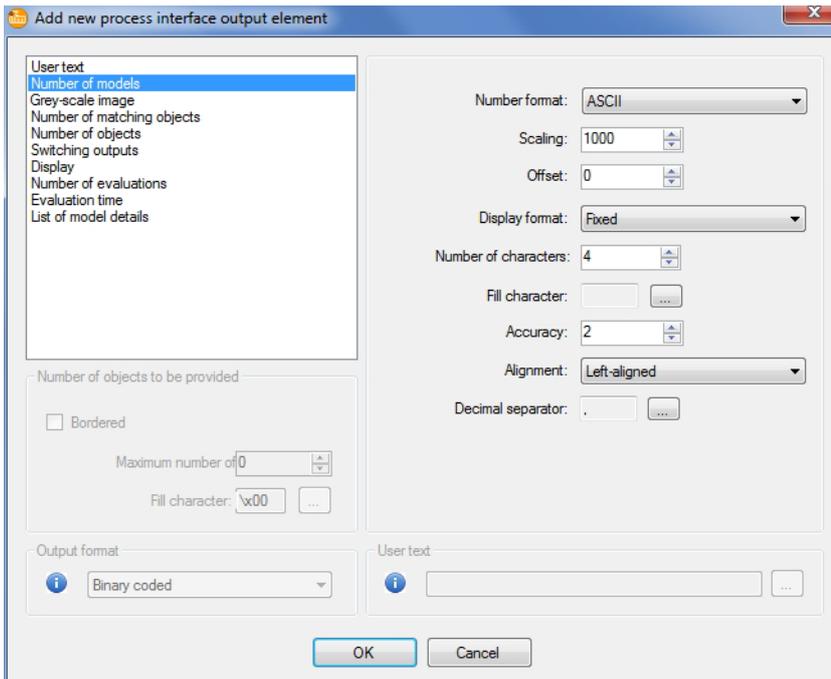
## User-defined result output

The elements of the result message can be configured individually.

- ▶ Select the entry "user-defined" in the "Presets" list.

Add element:

- ▶ Select the entry that will follow the new element.
- ▶ Click on the button .
- > The window "Add new process interface output element" opens:



- ▶ Define the requested settings for the output element.
- ▶ Acknowledge with [OK].
- > The new element is added.

Edit element:

- ▶ Select the requested element.
- ▶ Click on the button .
- > The edit window opens.
- ▶ Define the requested settings for the output element.
- ▶ Acknowledge with [OK].

**Copy element:**

- ▶ Select the requested element
- ▶ Click on the button .
- > A copy of the element is added.

**Delete element:**

- ▶ Select the requested element
- ▶ Click on the button .
- > The element is deleted.

**Move element:**

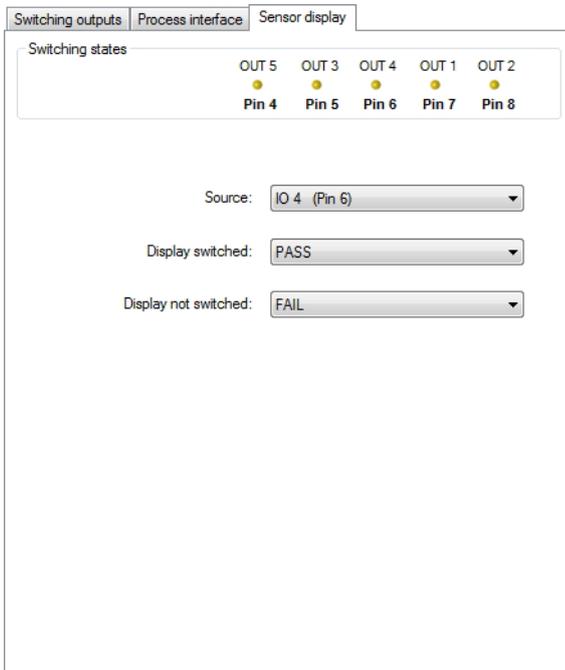
- ▶ Select the requested element
- ▶ Click on the button  or  to move the element up or down.

**Activate image output**

- ▶ Click on the button .
- > The window "Add new process interface output element" opens.
- ▶ Select the entry "grey-scale value" in the list.
- ▶ Acknowledge with [OK].
- > The element "grey-scale value" is added at the end of the format definition.

### 8.6.3 Configure the sensor display

During the evaluation mode different information can be displayed on the sensor.



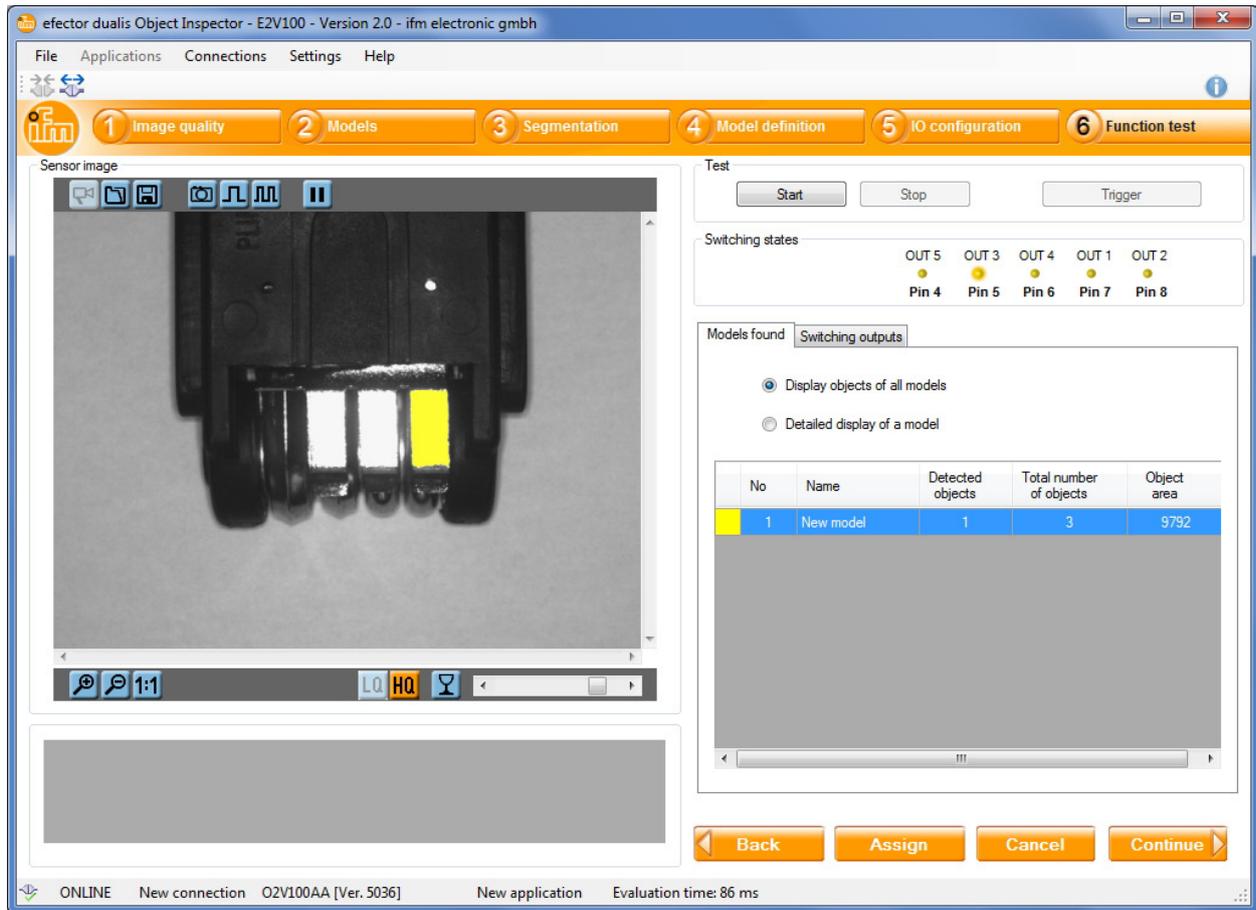
- ▶ Select the tab "Sensor display".
- ▶ Select the required switching output at "Source".
- ▶ Then select the required display for switched or not switched state.

The following options are available:

- Display OFF
- Firmware version
- Active application
- Total number of objects
- Number of all detected objects
- Display "OK"
- Display "PASS"
- Display "N.OK"
- Display "FAIL"

## 8.7 Overall function test

This final step tests all settings of the new configuration.



- ▶ Click on [Start] in the section "Test".
- ▶ Click on [Release trigger] if "continuous trigger" or "external trigger" was not selected before.
- > The device performs a complete test on the basis of the previous settings.

 Not every result is transferred in the mode "continuous trigger". There may be fluctuations in the evaluation time caused by the transmission of the image, like in the monitor mode.

### 8.7.1 Switching states

The current state of the switching outputs is graphically represented in the section "Switching states".

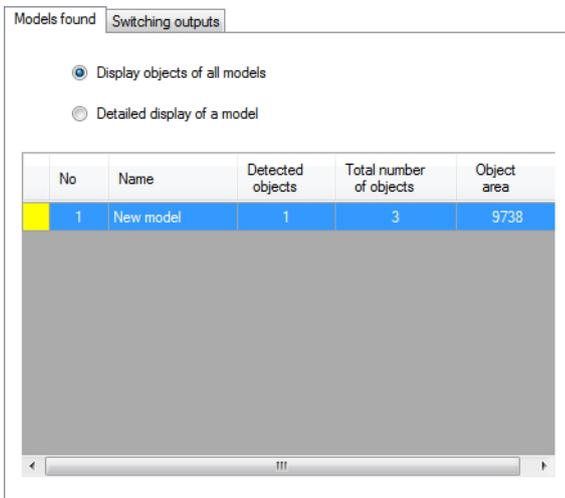


- LED lights yellow: output switched
- LED does not light: output not switched

UK

## 8.7.2 Models found

The tab "Models found" shows information about the objects recognised by the sensor.



- ▶ Select "Display objects of all models" in the option field.
- > The table shows the active application for each model:
  - Model colour
  - Model number
  - Model name
  - Number of the detected objects matching the model depending on the model definition (→ Chapter 8.5)
  - Total number of found objects depending on the segmentation settings of the model (→ Chapter 8.4)
  - Total area of the found objects

In the sensor image the objects matching a model are highlighted in colour. The colour corresponds to that of the respective model.

Besides this general overview the program allows the detailed evaluation of individual models.

- ▶ Select "Detailed display of a model" in the option field.
- ▶ Select the required model in the table.
- > In the section "Result output" an identification number (ID) and the object characteristics are displayed for each found object (→ Chapter 8.5 Model definition).

Result output for model 1 (New model)

ID	Object area	Object height	Object width	Rectangularity	
1	3265	85	42	97	
2	3185	84	42	92	
3	3342	84	42	96	

Objects matching the selected model are displayed in green, all other objects in blue. Test criteria not passed are marked in red in the list.

### 8.7.3 Switching outputs

Models found		Switching outputs		
Real outputs				
IO	Pin	Switching status	Output logic	
5	4	Off	-	
3	5	Off	Ready for trigger	
4	6	Off	[New model]	
1	7	Off	-	
2	8	Off	-	
Additional outputs via process interface				
IO	Switching status		Output logic	
6	Off		-	
7	Off		-	
8	Off		-	
9	Off		-	
10	Off		-	

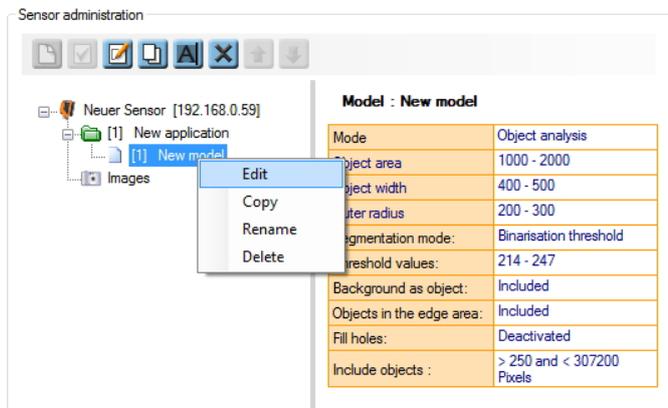
The tab "Switching outputs" informs about switching status and output logic of the sensor outputs. The upper section shows the 5 real switching outputs, the lower section the outputs via the process interface.

The display shows:

- number of the output
- pin connection (for real outputs)
- switching status
- configuration of the output logic

## 8.8 Change parameter setting

Via the application management window you can quickly access all settings of the saved applications and models.



### Edit application

- ▶ Select the requested application in the application directory.
- ▶ Click on [Continue].
- > The application opens for editing.

### Edit model

- ▶ Select the requested model in the application directory.
- ▶ Click on [Continue].
- > The model opens for editing.

### Create new model

- ▶ Select the requested application in the application directory.
- ▶ Click on the button .
- > The window to enter a new model name opens.



Alternatively, you can use the context menu to create or edit applications and models.

## 9 Application example

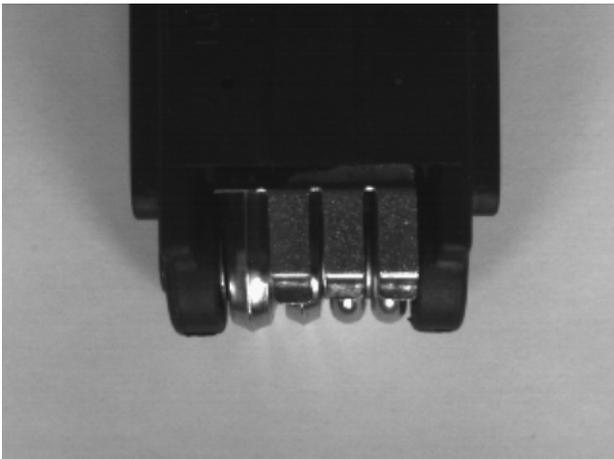
In the following application example metal clips are to be detected for presence in a tool.



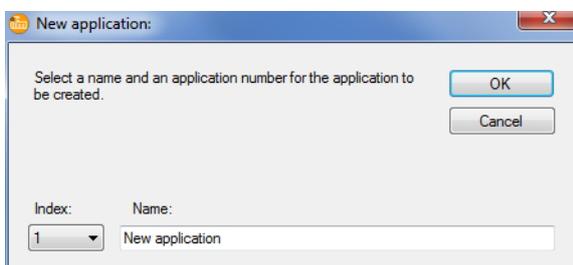
UK

### 9.1 Create an application

- ▶ Place the sensor opposite the object to be recognised.



- ▶ Start the operating program and connect with the sensor.
- ▶ Create a new application.

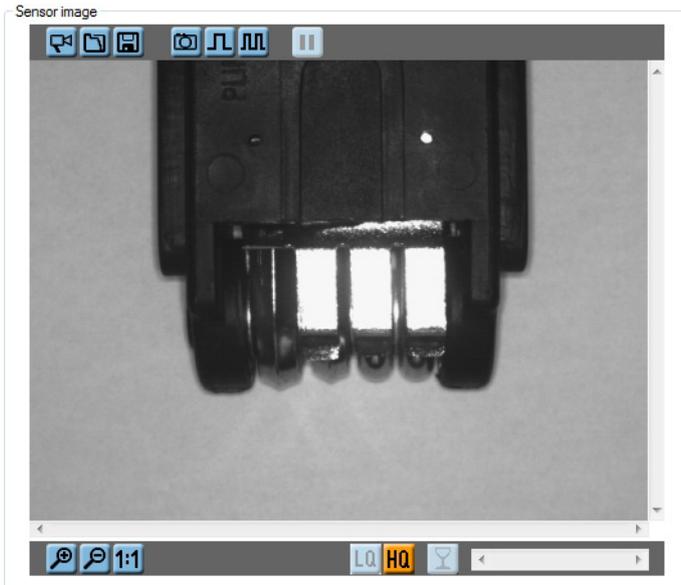


- > The operating program changes to the first parameter setting module "Image quality".

The object to be recognised contains three metal clips next to each other when correctly manufactured. These clips are seen in the sensor image as grey rectangles.

For optimum object detection a high contrast between the metal clips and the background has to be created in the module "Image quality". Since the clips reflect the light more intensively than the surrounding plastics, lighting from the front (direct object detection) is suited here.

- ▶ Select the lighting mode "Internal" and the sensor characteristic "Linear".
- ▶ Adapt the exposure time so that there is a maximum contrast between the metal clips and the background.



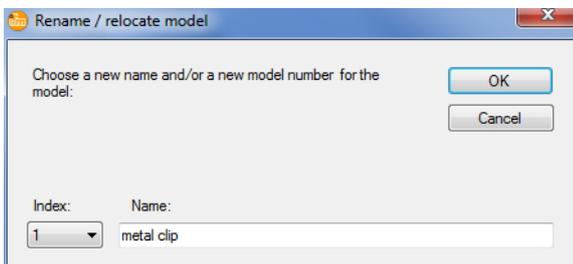
The reflecting clips stand out from the background as light rectangles.

- ▶ Acknowledge with [Continue].
- > The operating program changes to the parameter setting module "Models".

## 9.2 Create model

After changing to the parameter setting module "Models", the dialogue window "Create new model" opens automatically.

- ▶ Define model name and index.



- ▶ Acknowledge with [OK].
- > The operating program changes automatically to the next parameter setting module "Segmentation".



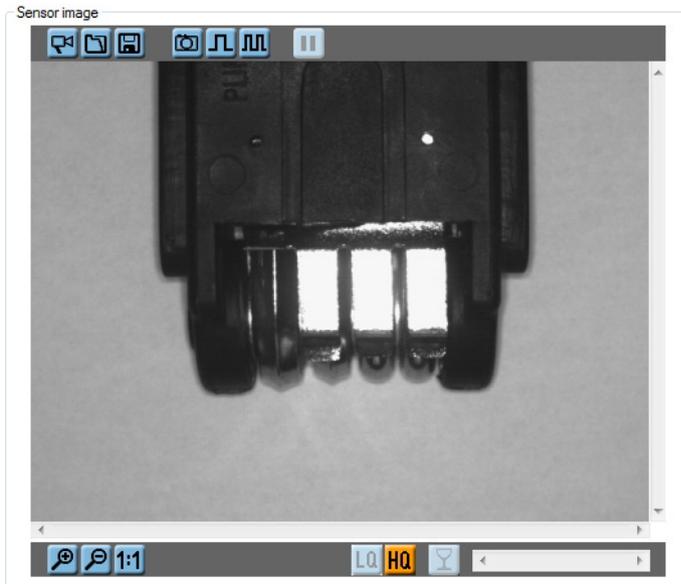
One single module is sufficient to verify several identical objects in an image scene for presence.

### 9.3 Segmentation

After changing to the parameter setting module "Segmentation", the mode "Binarisation threshold" is pre-set. This mode is used in this example to distinguish the objects to be recognised.

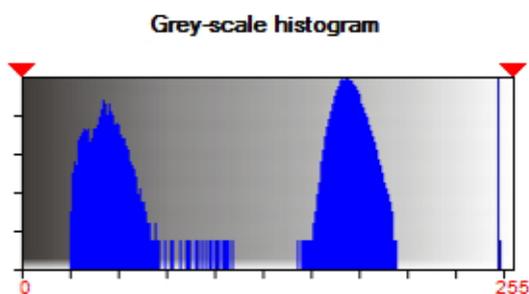
#### Distinguish objects to be recognised

The lighting of the image scene was selected so that the metal clips stand out against the dark background as light rectangles.



This difference in brightness allows the program to recognise and distinguish the clips as separate objects. To do so the user has to tell the program which brightness zone belongs to the object to be recognised.

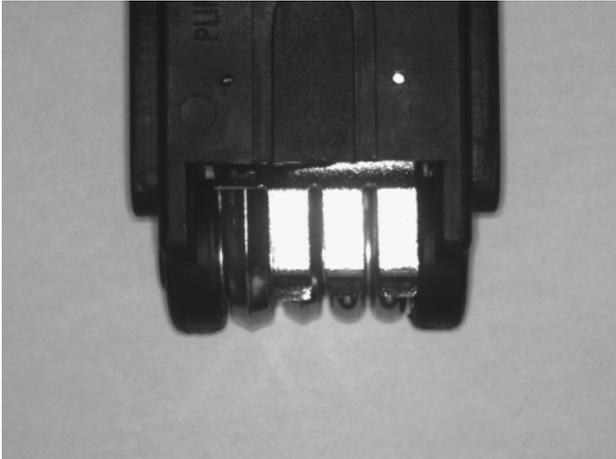
The grey-scale histogram facilitates this assignment.



The graphic shows 3 peaks of pixels of a certain brightness:

- dark grey with the brightness values 20-70
- medium grey with the brightness values 150-200
- very light grey with the brightness values 246-248

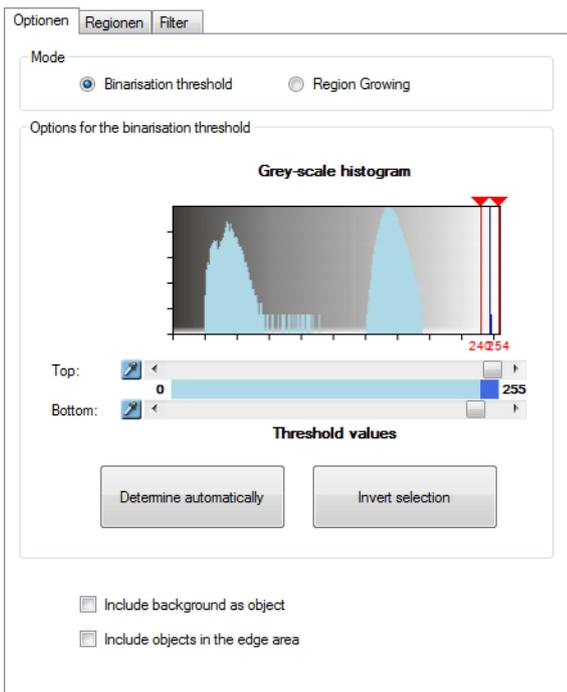
In comparison with the sensor image the respective image zones can be found.



Dark grey corresponds to the tool body, light grey to the background and very light grey to the metal clips.

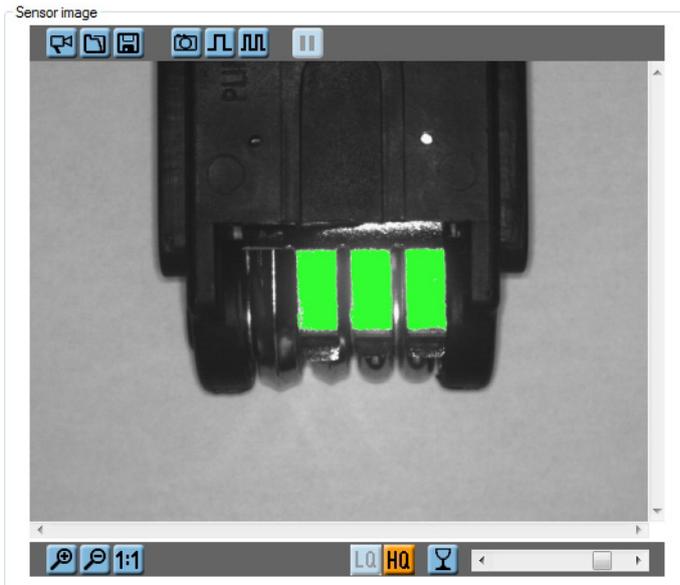
### Defining threshold values

To define the metal clips as the object to be recognised the upper and lower threshold values have to be set in the histogram. The required brightness zone is, as determined above, the very light grey with values between 246 and 248. To detect this zone the lower threshold value is set to 240, the lower one to 254 (allowing for a tolerance).



Since the background and objects in the edge section shall not be included, both selection fields can be deactivated.

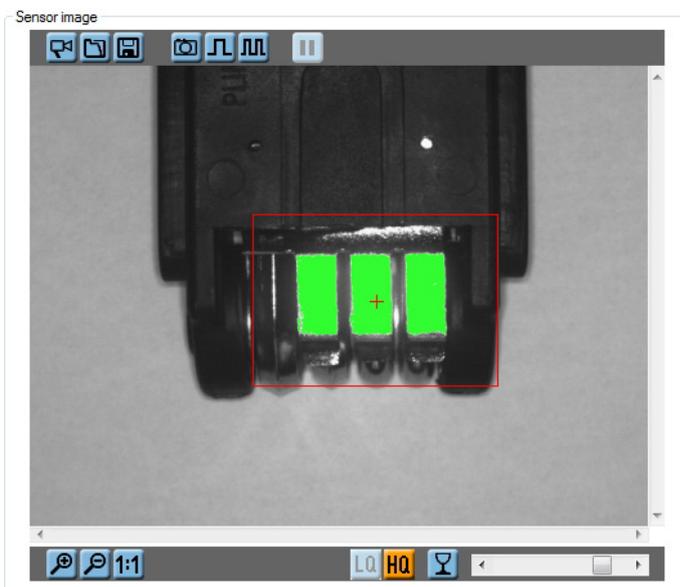
When the threshold values have been set, the metal clips are now marked in colour as objects in the sensor image.



### Defining evaluation region

To limit evaluation to the zones around the metal clips an evaluation region is added.

- ▶ Select tab "Regions".
  - ▶ Select "Regions of interest" and then "Rectangle" from the list.
  - ▶ Click on [Add] and drag the frame to the required size in the sensor image.
- > Then the program only evaluates objects in this region.



### Setting the filter

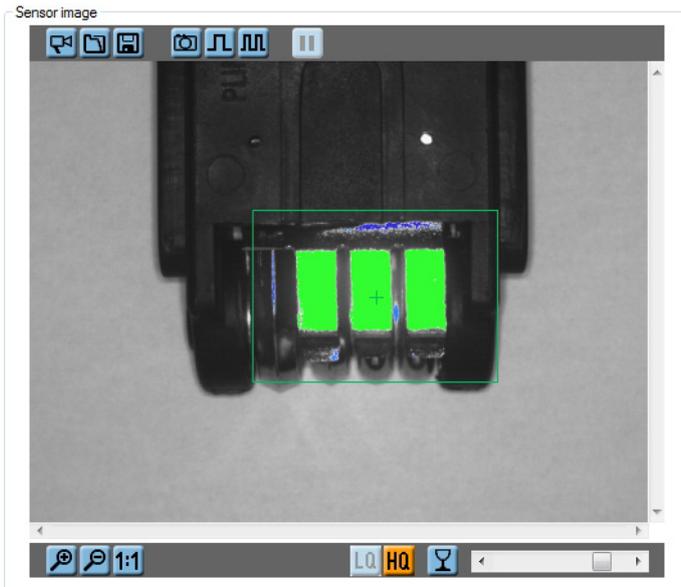
To improve the evaluation result the filters "Include objects" and "Fill holes" should be used for the image scene.

The function "Include objects" is automatically active for a new model.

Without "Include objects" the number of the found objects in the application example increases from 3 to more than 30 entries.

Result output

ID	Object area
25	2
26	1
27	1
28	2
29	4
30	42
31	1
32	2
33	1



To exclude undesired miniature objects from the evaluation the filter should remain active.

- ▶ Change to the tab "Filters".
  - ▶ If not active, activate selection field "Include objects".
  - ▶ Enter "2000" as lower limit.
  - ▶ Click on [Assign].
- > Objects of an area of < 2000 pixels are suppressed.

Include objects

> 2000 and < 307200 Pixels

Fill holes

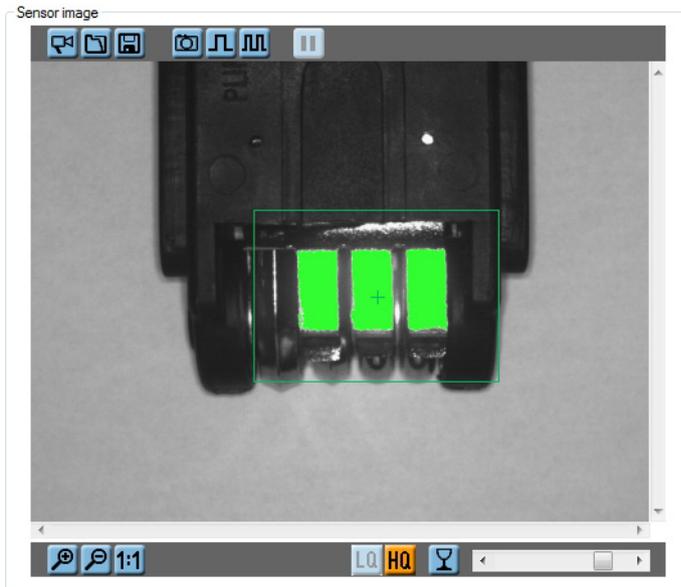
< 50 Pixels

< 0 %

Assign

In addition the filter "Fill holes" is activated to exclude small holes in the objects.

- ▶ Activate the selection field "Fill holes".
  - ▶ Select the setting "Pixels" via the option field.
  - ▶ Enter "50" in the number field.
  - ▶ Click on [Assign].
- > The program fills all holes with a surface of < 50 pixels.



With the filter settings segmentation is completed.

- ▶ Click on [Continue] to change to the next module "Model definition".

## 9.4 Model definition

Now that the metal clips have been indicated as objects to be recognised in the module "Segmentation", the criteria for the evaluation are now to be defined.

The characteristic "Rectangularity" is suited for rectangular objects such as clips. In addition the object area is to be evaluated.

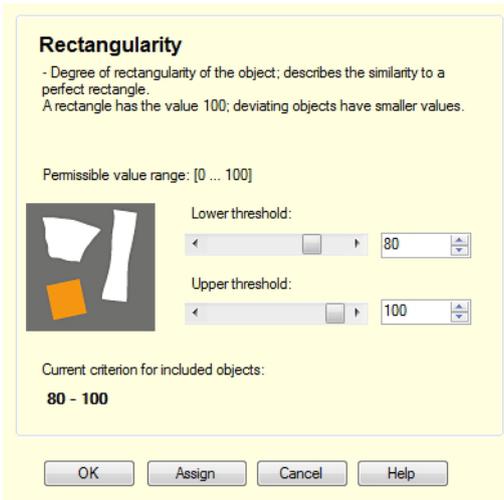
- ▶ Activate the object characteristic "Rectangularity" in the column "Included".
- > The value for "Rectangularity" is displayed in the object list next to each object.

Result output

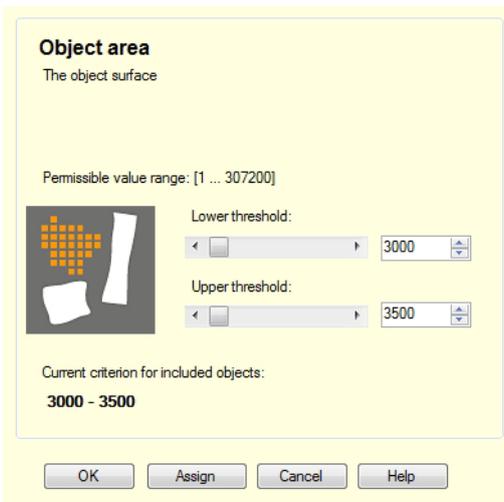
ID	Rectangularity
1	97
2	92
3	96

The value for the metal clips is between 90 and 100, this is the target value for the subsequent evaluation.

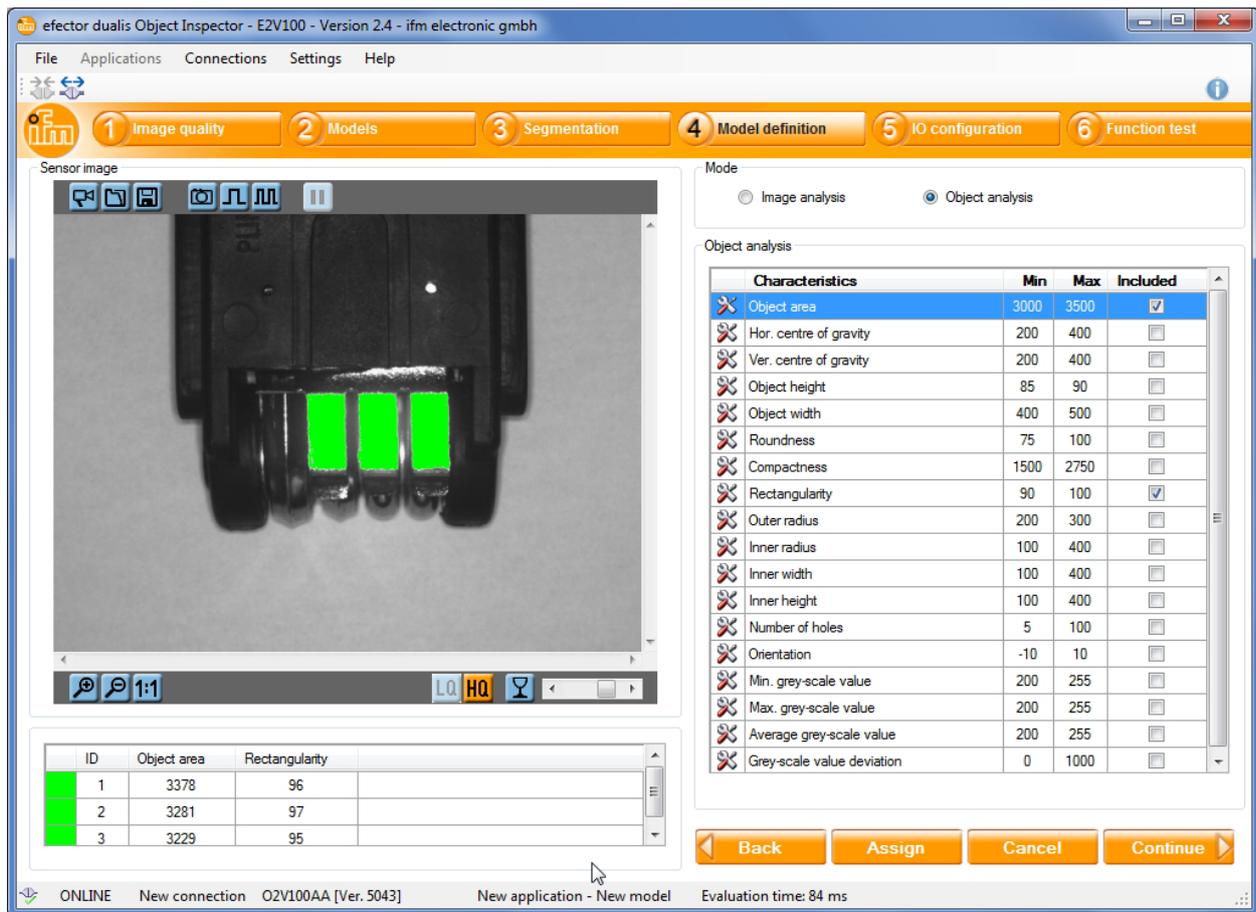
- ▶ Click on the button  next to the entry "Rectangularity".
- ▶ Enter the minimum and maximum values including the tolerance in the configuration window.



- ▶ Acknowledge with [OK].
  - ▶ Activate the characteristic "Object area" in the column "Included".
  - > In addition the value for the "Object area" is displayed next to each object in the object list.
- The area of the individual metal clips is between 3100 and 3400 pixels.
- ▶ Click on the button  next to the entry "Object area".
  - ▶ Enter the minimum and maximum values including the tolerance in the configuration window.



- ▶ Acknowledge with [OK].
- The sensor recognises objects meeting the indicated target values as valid.



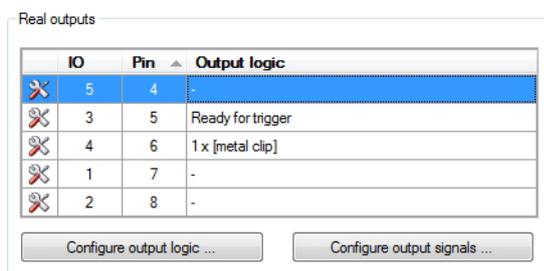
Now only the information of how many of these objects are contained in an image to be analysed is missing for the overall evaluation. This setting is made in the next parameter setting module "IO configuration".

- Click on [Continue] to change to the module "IO configuration".

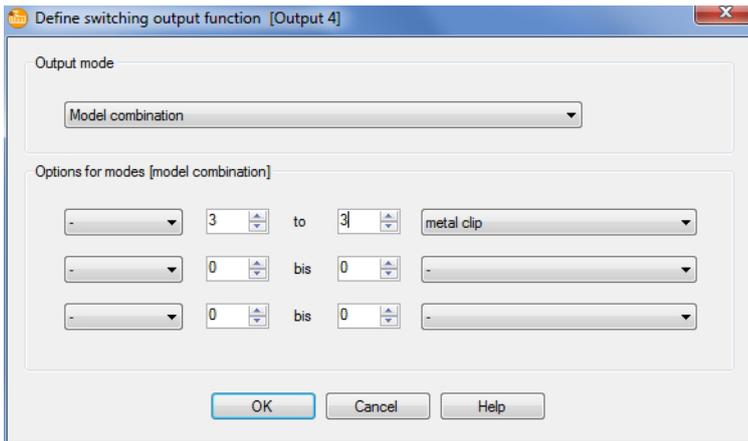
## 9.5 IO configuration

To complete parameter setting the required model combination must be assigned to a switching output.

- Change to the tab "Switching outputs".
- Select IO 4 in the list.



- Click on [Configure output logic].
- Select "Model combination" in the output mode.



- ▶ Select the required model in the list on the right.

The correctly manufactured object to be recognised contains 3 metal clips; consequently the model should be found exactly 3 times.

- ▶ Enter "3" as minimum and maximum value in the input fields.
- ▶ Acknowledge with [OK].

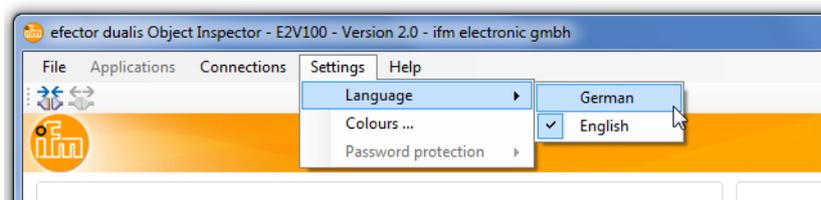
The sensor can now recognise a good part in the evaluation mode on the basis of the entered information according to the following pattern:

- differentiate image contents with the set brightness value as objects (segmentation)
- compare object characteristics "Rectangularity" and "Object area" (model definition)
- verify number of found models (IO configuration)

## 10 Additional functions

### 10.1 Select user language

- ▶ Disconnect the sensor.
- ▶ Select [Settings] → [Language] → [German], [English] .... in the menu bar.

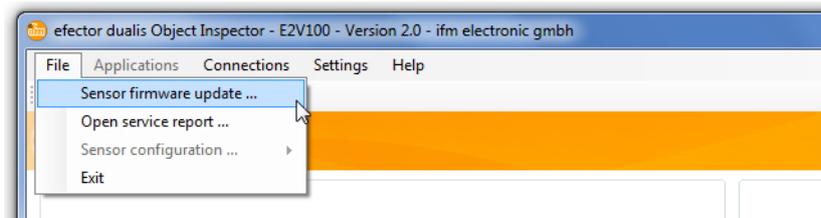


- > The program changes to the selected language.

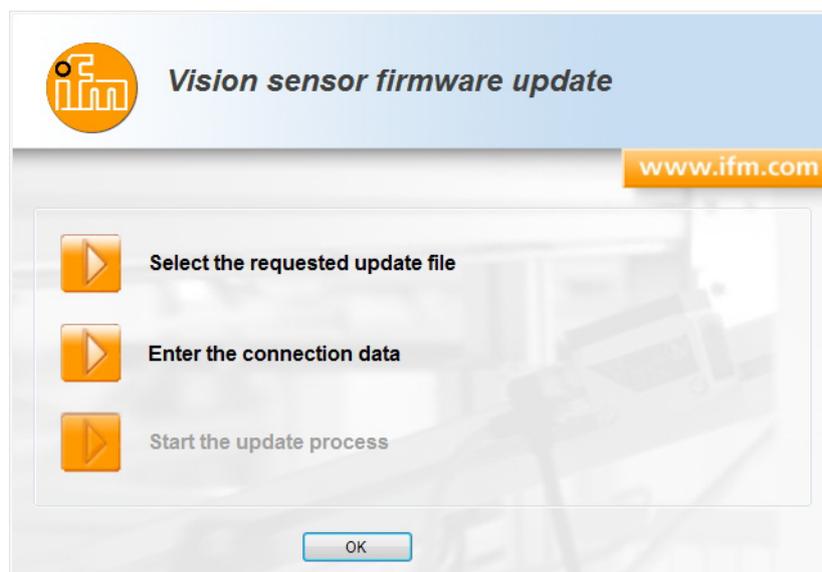
### 10.2 Sensor firmware update

The update consists of a file with the extension .swu.

- ▶ Save file in a directory of your choice.
- ▶ Disconnect the sensor.
- ▶ Select [File] → [Update sensor firmware] in the menu bar.



- > The window "Vision sensor firmware update" opens.



- ▶ Select the update file.
- ▶ Enter the connection data.
- ▶ Start the update process.
- > The data is transferred to the sensor.
- > Display FWuP.

This process will take a while. After successful transmission you receive a message. Then the sensor will automatically make a reset. After initialisation you can connect to the sensor as usual.



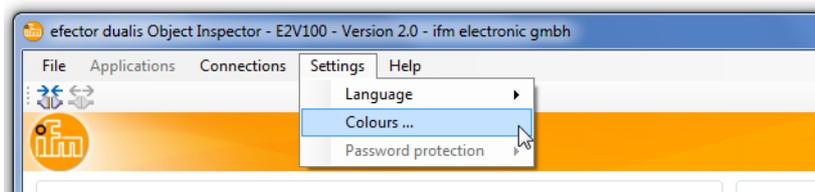
Do not interrupt the power supply to the sensor during the update process; otherwise this could result in loss of data and functionality of the sensor.



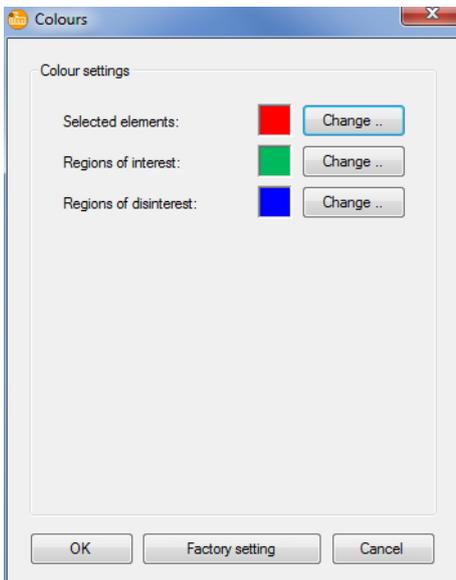
During the update of the firmware, BIOS is also updated at irregular intervals. The sensor display will then remain dark for some seconds.

### 10.3 Select colours

- ▶ Select [Settings] → [Colours] in the menu bar.



- ▶ Change the colour settings individually in the new window.



- ▶ Confirm all selected settings with [OK] or reject the changes and restore the factory setting via [Factory setting].

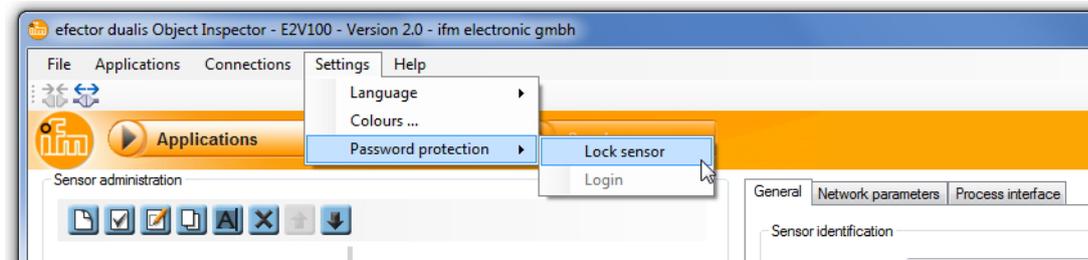
## 10.4 Password protection

### 10.4.1 Set up password protection



The password protection is only enabled in the operating mode "Applications".

- ▶ Select [Settings] → [Password Protection] → [Lock sensor] in the menu bar.



- ▶ Assign a password in the new window and confirm once more.



The password must have a minimum length of 6 characters. The following characters are allowed: 0-9, a-z, A-Z, -, \_, , #, \$, \*, +, ,, , ..

- ▶ Acknowledge with [OK].
- > The sensor is locked.



The password also protects against changes via the 2-button menu.

- > Display LoK1.

### 10.4.2 Login

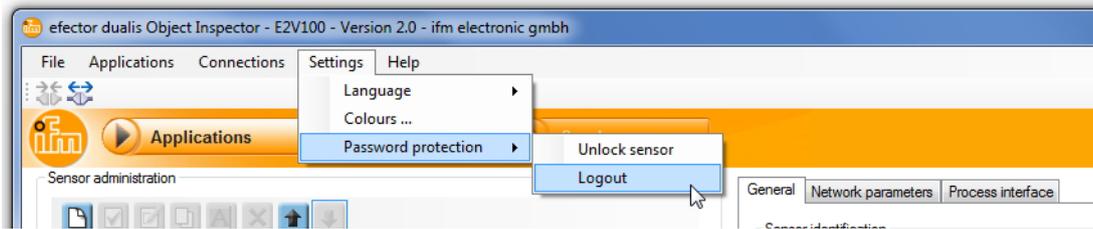
With activated protection function the user gets to the monitor mode after connection to the sensor. With the change to the application mode a dialogue window to enter the required password is displayed.



- ▶ Enter password and acknowledge with [OK].
- ▶ As an alternative, select [Settings] → [Password Protection] → [Login].
- ▶ Enter password and acknowledge with [OK].
- > When changing to the individual modules (monitoring, applications, service report) it is not necessary to enter the password again.

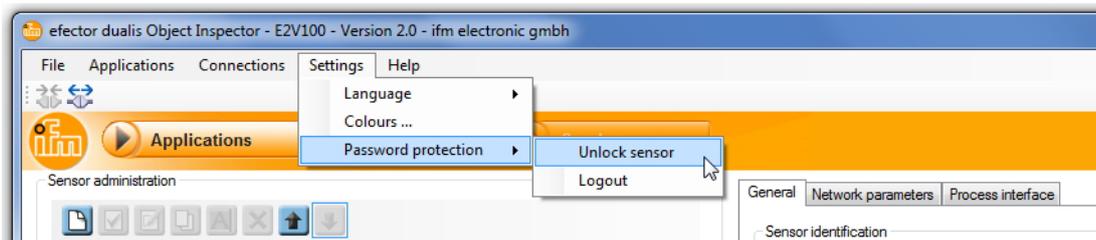
### 10.4.3 Logout

- ▶ To log out, select [Settings] → [Password Protection] → [Logout].



### 10.4.4 Remove password protection

- ▶ Select [Settings] → [Password Protection] → [Unlock sensor] in the menu bar.



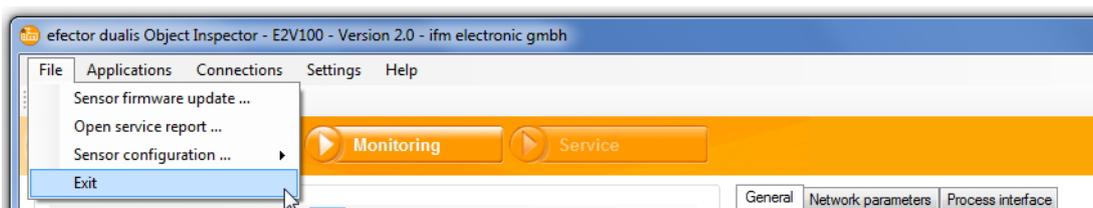
- ▶ Acknowledge with [OK].
- > The password protection is removed.

## 11 Exit the program

### 11.1 Disconnect

- ▶ Select [Connections] → [Disconnect] in the menu bar.  
Alternatively: Click on the disconnect symbol in the tool bar → .
- ▶ Acknowledge with [OK].
- > The device is disconnected from the program.

### 11.2 Exit the program



- ▶ Select [File] → [Exit] in the menu bar.

## 12 Annex

After installation, electrical connection and parameter setting, check whether the sensor operates correctly. Align the sensor to the object to be detected.

### 12.1 Factory settings

Parameters	Factory setting
Device name	New sensor
Device location	New location
DHCP	not active
IP address	192.168.0.59
Subnet mask	255.255.255.0
Gateway	192,168,000,201
IP communication port	8080
UDP live image port	50002
Application selection via switching inputs	not active
Trigger debouncing	not active
Process interface mode	TCP/IP
Process interface version	2
Process interface TCP/IP port	50010
Saved applications	none
Application settings	none
Saved images	none

### 12.2 Wiring

Process connection: M12 connector, 8-pole	Parameter setting connection: M12 connector, 4-pole, D-coding
 <ul style="list-style-type: none"> <li>1: U+</li> <li>2: trigger input</li> <li>3: 0 V</li> <li>4: switching output 5 / trigger output</li> <li>5: switching output 3 / ready</li> <li>6: switching output 4 / OUT</li> <li>7: switching output 1 / input 1</li> <li>8: switching output 2 / input 2</li> </ul>	 <ul style="list-style-type: none"> <li>1: TD+</li> <li>2: RD+</li> <li>3: TD-</li> <li>4: RD-</li> <li>S: screen</li> </ul>

#### 12.2.1 Process connection

Connect the supply voltage (24 V DC) to the M12 process connection (wiring → chapter 13.2 or type label on the sensor).



If you use an external trigger source (e.g. a diffuse reflection sensor), connect the trigger signal to the trigger input of the sensor. If you use external illumination, it must be controlled via the trigger output of the sensor.

Depending on the device setting, one of four configuration files saved in the sensor can be selected via two switching inputs. Information about the test result is provided via switching outputs.

#### 12.2.2 Parameter setting connection

Connect the 4-pole M12 socket for Ethernet connection (E11898) to the parameter setting connection of the sensor. An existing connection is signalled via an LED (Eth) on the device.

### 12.2.3 Operating modes

#### Evaluation mode (normal operating mode)

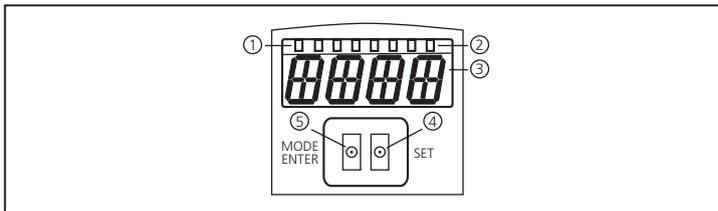
After power-on the device is in the evaluation mode. If an active application is saved on the device, it carries out its monitoring function and generates output signals according to the set parameters. The display indicates the current evaluation result, the yellow LEDs signal the switching status of the outputs or inputs.

#### Operation via operating program E2V100

Setting the parameter values via the operating program

An existing connection to the operating program is signalled via the green LED "Con". Depending on the application mode "OnLi" (online), "Parm" (Parameterisation), "Moni" (Monitor), "SErv" (service report) or "Edit" (Processing an application) is displayed. The buttons on the device are disabled.

### 12.3 Operating and display elements



1	3 x LED green	Active LED Power (ready for operation display) Eth (Ethernet connection status) Con (connection status to the operating program (software))
2	4 x LED yellow	Indication of the switching status; lights when the corresponding input or output is switched. LED 1 status indication switching output 1 / switching input 1 LED 2 status indication switching output 2 / switching input 2 LED 3 status indication switching output 3 LED 4 status indication switching output 4
3	4-digit alphanumeric display	Indication of the evaluation results, parameters, parameter values, warnings and error messages.
4	Programming button "Set"	Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly)
5	Programming button Mode / Enter	Selection of the parameters and acknowledgement of the parameter values

## 12.4 LED display

- LED green Power: ready for operation display
  - lights: ready for operation
  - flashes (20 Hz): device fault
  - flashes (2 Hz): no application on the device
- LED green Eth: Ethernet connection status
  - lights: connection available
  - flashes: data traffic
- LED green Con: connection status to operating program
  - lights: connection available
- LED yellow 1: switching status indication
  - off: switching input 1 / switching output 1 not switched
  - on: switching input 1 / switching output 1 switched
  - flashes (20 Hz): short circuit switching output 1
- LED yellow 2: switching status indication
  - off: switching input 2 / switching output 2 not switched
  - on: switching input 2 / switching output 2 switched
  - flashes (20 Hz): short circuit switching output 2
- LED yellow 3: switching status indication
  - off: switching output 3 not switched
  - on: switching output 3 switched
  - flashes (20 Hz): short circuit switching output 3
- LED yellow 4: switching status indication
  - off: switching output 4 not switched
  - on: switching output 4 switched
  - flashes (20 Hz): short circuit switching output