Leuze electronic

the sensor people

LSIS 4xx*i* webConfig

Operating instructions for version 2.0

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Operator Manual

Leuze electronic

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1 General information

1.1 About the "LSIS 4xx*i* *webConfig*" program – system requirements

Leuze's ***webConfig*** is used to configure smart cameras of the **LSIS 4xx*i*** series using an operating-system-independent, web-technology-based, graphical user interface.

Through the use of HTTP as communication protocol and the client-side restriction to standard technologies (HTML, JavaScript and AJAX), which are supported by all of today's popular, modern browsers, it is possible to operate Leuze's ***webConfig*** on any Internet-enabled PC.

Notice!

*Supported browsers are **Mozilla Firefox** beginning with Version **3.0** and **Internet Explorer** beginning with version **8.0**.*

***LSIS 4xxi webConfig** is completely contained in the firmware of the **LSIS 4xxi**.*

The ***webConfig*** menus are intuitive to operate and contain both help texts as well as tooltips. The software description can be found in the download area of the Leuze electronic website:

www.leuze.com -> Download -> Identify -> Industrial image processing.

Activities in webConfig

The software offers the following possibilities for setting up the **LSIS 4xx*i***:

- Create, configure and activate various check programs
- Configure the communication interfaces
- Setting up the camera
- Configure and display of result and output logs
- Communication diagnostics
- Display of the current production data
- Management of authorized users
- Firmware updates and setting the system time

1.2 Explanation of symbols

The symbols used in this description are explained below.

Attention!
This symbol precedes text messages which must strictly be observed. Failure to comply with this information results in injuries to persons or damage to the equipment.

Notice!
This symbol indicates text passages containing important information.

↳ *This symbol asks you to carry out an action.*

The `Courier` font indicates terms contained in the software interface of **LSIS 4xx*i* *webConfig***.

1.3 Contact address

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2 First steps

First, make certain that the **LSIS 4xx*i*** was correctly mounted and connected. Information on this topic can be found in chapters "Installation and mounting" and "Electrical connection" of the technical description **LSIS 4xx*i***.

Furthermore, you must ensure that the connection between PC and **LSIS 4xx*i*** was established as described in the technical description **LSIS 4xx*i*** (chapter "Commissioning and configuration").

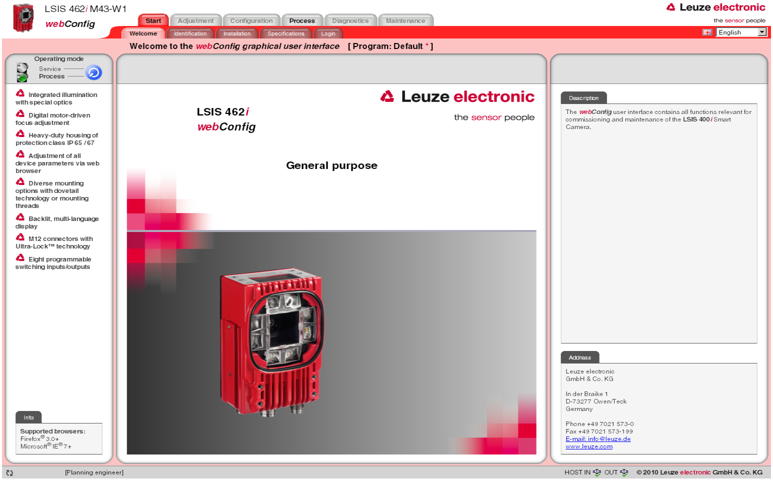
2.1 Starting the program

↳ *Start a browser on your PC and enter the address previously set by you or the address assigned by the DHCP server.*

Notice!

*The default Leuze service address for communication with smart cameras of the **LSIS 4xxi** series is **192.168.60.101**. Further information on manual or automatic address assignment via DHCP can be found in chapter "Commissioning and configuration" of the technical description **LSIS 4xxi**.*
*You can check the network address of the **LSIS 4xxi** by pressing the enter button ↵ on the display three times in sequence during normal operation of the **LSIS 4xxi**.*

If the IP address is entered correctly in the browser, the following start page appears on your PC.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Leuze electronic
the sensor people
English
Operating mode
Service
Process
LSIS 462*i*
webConfig
General purpose
Description
Info
Address
HOST IN
OUT
[Planning engineer]

Welcome to the *webConfig graphical user interface* [Program: Default *]

- Integrated illumination with special optics
- Digital motor-driven focus adjustment
- Heavy-duty housing of protection class IP 65 / 67
- Adjustment of all device parameters via web browser
- Diverse mounting options with dovetail technology or mounting threads
- Backlit, multi-language display
- M12 connectors with Ultra-Lock™ technology
- Eight programmable switching inputs/outputs

Supported browsers:
Firefox® 3.0+
Microsoft® IE® 7+

The *webConfig* user interface contains all functions relevant for commissioning and maintenance of the **LSIS 400*i*** Smart Camera.

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Figure 2.1: Start page **LSIS 4xx*i* *webConfig***

Notice!

*The **webConfig** is completely contained in the firmware of the **LSIS 4xxi**. Depending on firmware version and device model, the start page may vary from that shown above.*

2.2 Program concept: Operating modes – users – modules

Operating modes

Depending on the requirements of the work process, **LSIS 4xx*i* *webConfig*** can be used in two operating modes – "Service" and "Process".

In Process mode, running production operation is depicted: The device is controlled from the host computer, it receives control signals and yields output; Configuration via ***webConfig*** is deactivated.

The configuration, administration and diagnostic tasks necessary for designing and optimizing production operation are performed in service mode: In this mode, the device is configured via ***webConfig***. The sending and receiving of signals to and from the host computer is switched off by default in service mode (except for one trigger input and, if configured, one output for controlling an external flash).

User roles

To prevent unintended operating errors as far as possible and to facilitate user-dependent access permissions, the **LSIS 4xx*i* *webConfig*** functions with a role concept that assigns the different users a specific "role" with various hierarchically structured authorizations. By default, the program interface opens in the "Process" operating mode with the highest user authorization, "planning engineer".

Detailed information on this topic can be found in chapter 3.6.1, "User management" tab on page 85.

Work modules

The work steps necessary for a given activity are, in turn, grouped together in modules, in a single operating mask where possible. The availability of these "work modules" depends on both the authorization – the role – of the current user as well as on the selected operating mode.

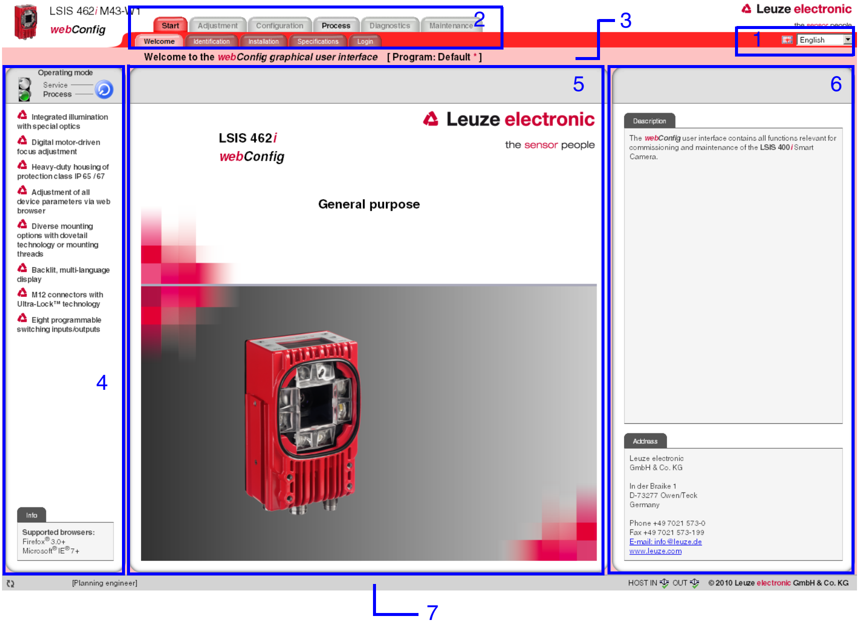
The following overview shows which modules are available in which operating mode.

Module	**Available in operating mode**
Start	Process, Service
Adjustment	Service
Configuration	Service
Process	Process, Service
Diagnostics	Service
Maintenance	Service

3 Descriptions of the user interface and menu

Information on the basic structure

The **LSIS 4xx*i* *webConfig*** program interface consists of various elements, the availability and content of which depends – on the one hand – on the user authorization, and – on the other – on the currently selected work module. On delivery, the program interface opens in the "Process" operating mode with the highest user authorization, "planning engineer". The following start window appears in this case: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webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
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English
Operating mode
Service
Process
Leuze electronic
the sensor people
LSIS 462*i*
webConfig
General purpose
Description
Address
Info
[Planning engineer]
HOST IN
OUT
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1
2
3
4
5
6
7

Welcome to the *webConfig* graphical user interface [Program: Default *]

Integrated illumination with special optics

Digital motor-driven focus adjustment

Heavy-duty housing of protection class IP 65 / 67

Adjustment of all device parameters via web browser

Diverse mounting options with dovetail technology or mounting threads

Backlit, multi-language display

M12 connectors with Ultra-Lock™ technology

Eight programmable switching inputs/outputs

Supported browsers:
Firefox® 3.0+
Microsoft® IE® 7+

The *webConfig* user interface contains all functions relevant for commissioning and maintenance of the **LSIS 400*i*** Smart Camera.

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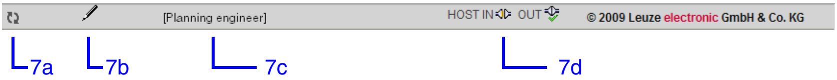
1 - Language
2 - Work module selection
3 - Title bar
4 - Menu window / selection of operating mode
5 - Main window
6 - Dialog window (variable display and input window)
7 - Status bar


[Planning engineer]
HOST IN
OUT
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7a
7b
7c
7d

Figure 3.1: **LSIS 4xx*i* *webConfig*** Start window/status bar

In general, **LSIS 4xx*i* *webConfig*** facilitates an intuitive, logical work method from top to bottom and from left to right. After setting the desired interface language in the appropriate list box **(1)**, **LSIS 4xx*i* *webConfig*** supports you with context-sensitive descriptions of the interface elements and parameters in the lower part of the dialog window **(6)**. Title- and status bars serve to provide orientation during the work process. You can see at first glance in the title bar **(3)** which check program is active. In the status bar **(7)**, the current user (authority level) **(7c)** and host connection status **(7d)** are displayed. A pencil icon **(7b)** indicates changes to the device parameters that may still need to be saved. An animated icon of rotating arrows **(7a)** visualizes the processing status of input: If the arrows rotate, the sensor is processing the input and no other actions are possible for a brief period of time.

To illustrate the meaning of the sometimes seemingly abstract parameters, the individual parameters are displayed and edited in graphic form in the main window and/or dialog window **(5** and **6)**. Some graphics in the main window can be enlarged by clicking or are mouse sensitive, which means that certain features can be accessed both via menu items and by directly clicking.

Operating mode

As already mentioned, **LSIS 4xx*i* *webConfig*** starts in the "Process" operating mode, i.e. the device is controlled from the master computer, it receives control signals and yields output. Because the configuration is deactivated via ***webConfig***, the user only has access to the "Start" and "Process" work modules depending on his respective authority level.

To control the device from ***webConfig***, you have the option of switching to the "Service" operating mode by either clicking the desired operating mode or the button displayed below. In this mode, communication with the master computer is switched off by default (exception: a trigger input and, if set up, an output for controlling an external flash) and you can access the required configuration, management and diagnostic tasks.

Further information on the dependencies of operating modes, user authority levels and work modules can be found in chapter "Program concept: Operating modes – users – modules".

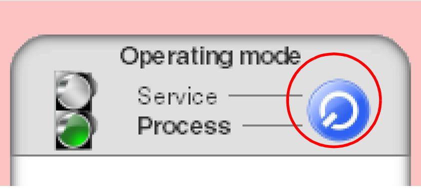


Figure 3.2: Changing the operating mode by means of a button or by selecting a menu item

Selecting the work modules

As already mentioned, the **LSIS 4xx*i* *webConfig*** user interface is divided into various main work areas, or work modules, whose functionality is, in part, grouped into individual subareas in the form of tabs.

Notice

Depending on the selected operating mode and the currently logged-in user, different pages and functions are enabled for display and editing/use.

The following modules are available:

- **Start**
  Main interface for "getting to know" the device and for logging in the current user
- **Adjustment**
  Adjust the camera and define default image acquisition parameters
- **Configuration**
  Main interface for configuring the device and the individual tasks (programs and tools); configuration of the communication interfaces and the internal image memory
- **Process**
  Display in processes operation. Currently, only statistical data
- **Diagnostics**
  Display and management of diagnostic-relevant data, such as event logs and communication diagnostics
- **Service**
  Management of authorized users, updating of firmware, creation and loading of backup files as well as setting the system time

All working modules are briefly introduced in the following. However, because operation is often self-explanatory, and ***webConfig*** provides you with context-sensitive help and descriptive texts, only the windows which make available editable parameters or special operating options are described in greater detail.

Notice!

Please note that, unless stated separately, the description which follows is from the perspective of the authority level set by default, "planning engineer".

Information on the typical workflow and the individual work steps can be found in chapter "Basic procedure – step-by-step configuration of a BLOB analysis" on page 92.

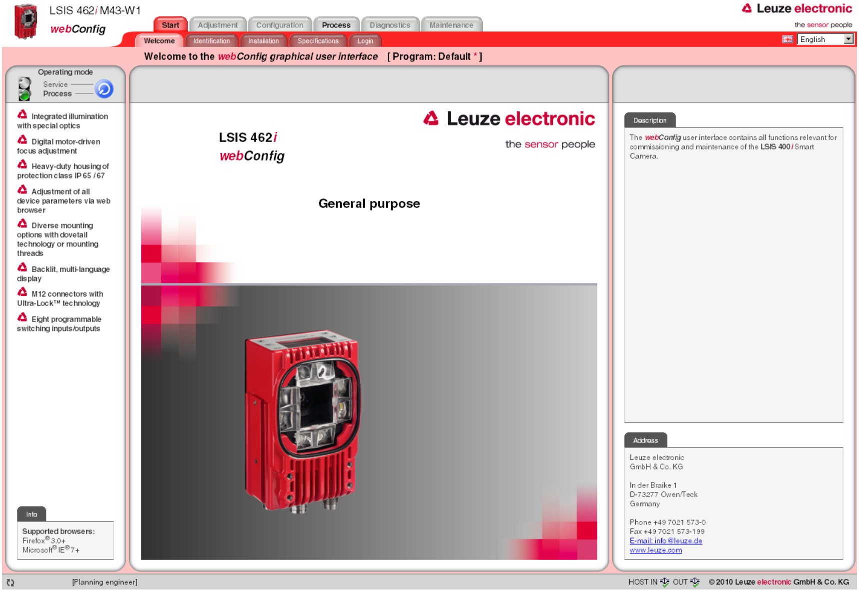
3.1 "Start" module

The "Start" module provides you with a compact description of the device. The individual aspects are summarized in the "Welcome", "Identification", "Installation" and "Specifications" tabs. In addition to these strictly informative pages, on which the user has only read access, the "Login" tab offers the possibility to login as the current user.

This is the only module that is available in both operating modes and to all users.

3.1.1 "Welcome" tab

The "Welcome" tab corresponds to the **LSIS 4xx*i* *webConfig*** start window. The main device features are presented in the left window area. In addition, you can see which browsers are supported.



LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Leuze electronic
the sensor people
English
Operating mode
Service
Process
LSIS 462*i*
webConfig
Leuze electronic
the sensor people
General purpose
Description
Address
Info
HOST IN
OUT

Welcome to the *webConfig graphical user interface* [Program: Default *]

- Integrated illumination with special optics
- Digital motor-driven focus adjustment
- Heavy-duty housing of protection class IP 65 / 67
- Adjustment of all device parameters via web browser
- Diverse mounting options with dovetail technology or mounting threads
- Backlit, multi-language display
- M12 connectors with Ultra-Lock™ technology
- Eight programmable switching inputs/outputs

Supported browsers:
Firefox® 3.0+
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The *webConfig* user interface contains all functions relevant for commissioning and maintenance of the **LSIS 400*i*** Smart Camera.

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[Planning engineer]

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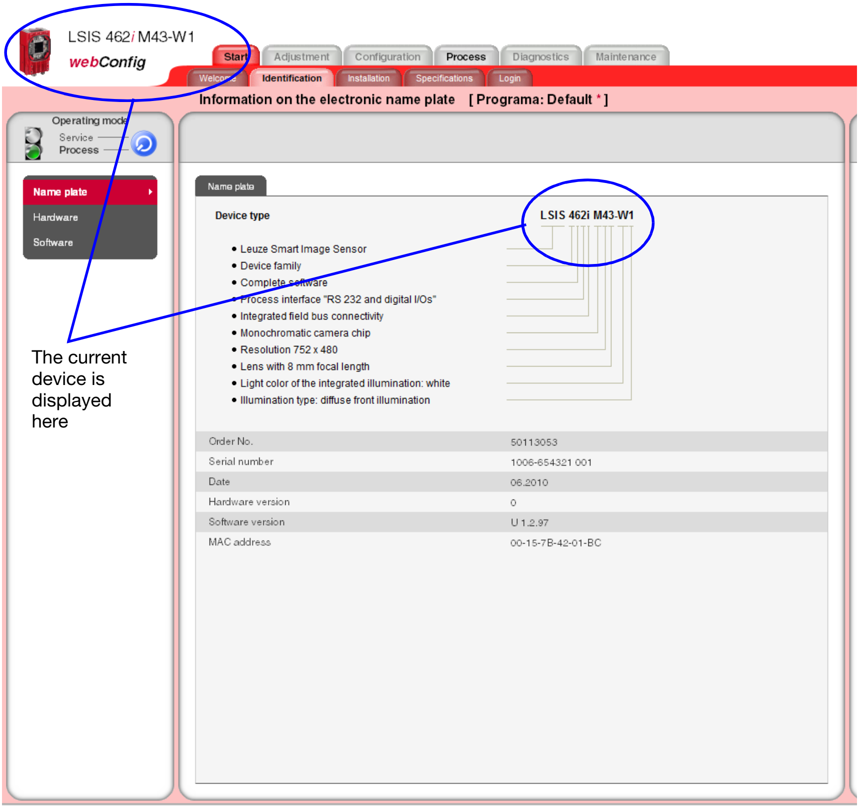
Figure 3.3: "Start" module, "Welcome" tab – device features

3.1.2 "Identification" tab

Here, you will first find an explanation of the name plate and, after selecting the appropriate menu item in the left window area, detailed release notes and information on changes to the hardware and software used in this device. In the event of problems, this may serve as important information for Leuze Support.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Operating mode
Service
Process
Name plate
Hardware
Software
Name plate

Information on the electronic name plate [Programa: Default *]

Device type: LSIS 462i M43-W1

- Leuze Smart Image Sensor
- Device family
- Complete software
- Process interface "RS 232 and digital I/Os"
- Integrated field bus connectivity
- Monochromatic camera chip
- Resolution 752 x 480
- Lens with 8 mm focal length
- Light color of the integrated illumination: white
- Illumination type: diffuse front illumination

Order No.	50113053
Serial number	1006-654321 001
Date	06.2010
Hardware version	0
Software version	U 1.2.97
MAC address	00-15-7B-42-01-BC

The current device is displayed here

Figure 3.4: "Start" module, "Identification" tab – explanation of the name plate

3.1.3 "Installation" tab

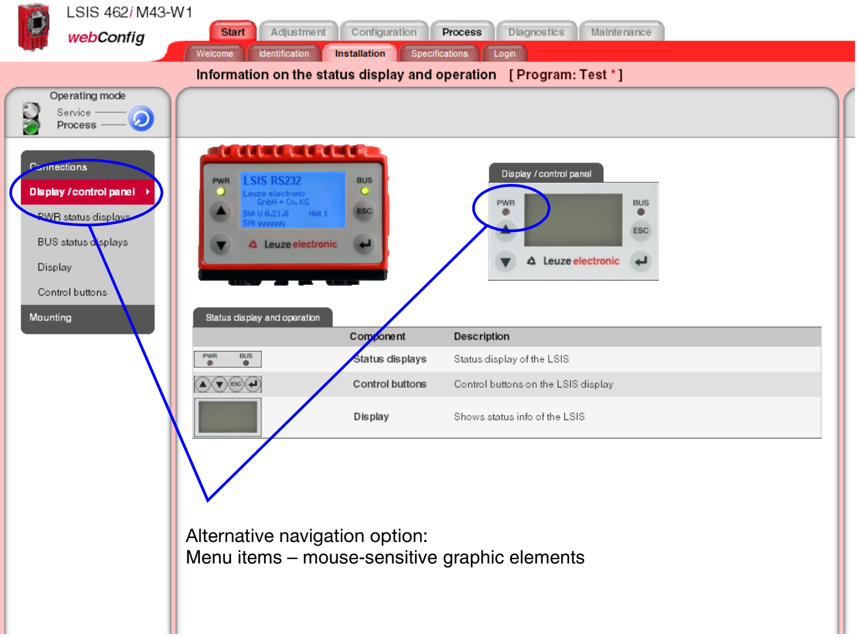
Select the appropriate menu item in the left window area to display descriptions of the device connections, mounting and display functions in the right window area.

Because the graphics contained in the overview windows are mouse sensitive, the display of the individual connections, of the status displays, of the display and of the control buttons can be activated both by selecting the respective submenu item as well as by clicking the corresponding graphic element. A magnifying glass icon identifies graphics that can be enlarged by clicking once with the mouse; clicking again reduces the image to its original size.

Notice!

Notice about the mouse-sensitive screen elements:

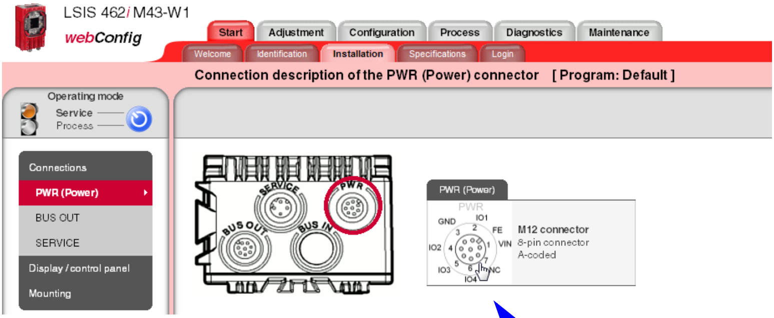
If the device is in "Service" mode, you can access the **`Connections -> PWR, -> BUS OUT and -> SERVICE`** *menus by clicking the mouse on the* ***pin assignment display*** *directly on the corresponding configuration page.*


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Information on the status display and operation [Program: Test *]
Operating mode
Service
Process
Connections
Display / control panel
PWR status displays
BUS status displays
Display
Control buttons
Mounting
PWR
BUS
LSIS RS232
Leuze electronic GmbH + Co. KG
SW: U 0.21.0 HW: 1
SN: yyyyyyy
ESC
Leuze electronic
Display / control panel
Status display and operation

Component	Description
Status displays	Status display of the LSIS
Control buttons	Control buttons on the LSIS display
Display	Shows status info of the LSIS

Alternative navigation option:
Menu items – mouse-sensitive graphic elements

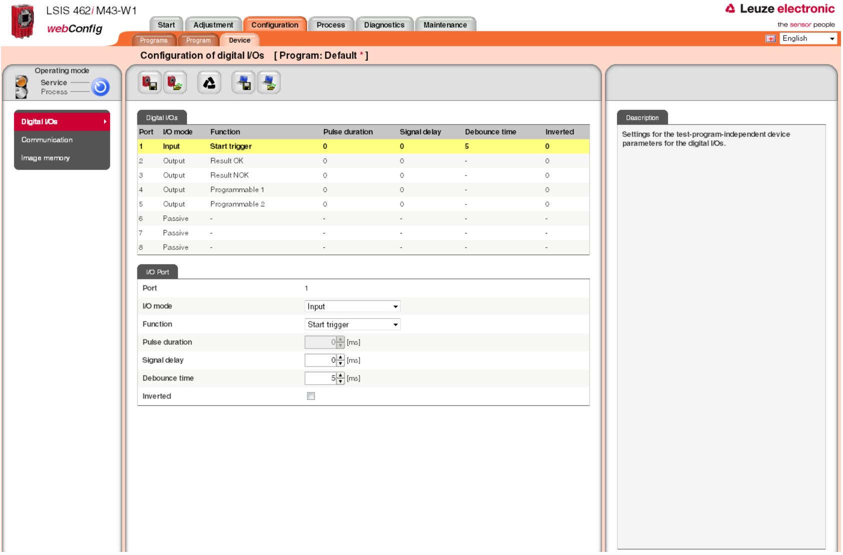
Figure 3.5: "Start" module, "Installation" tab


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Operating mode
Service
Process
Connections
PWR (Power)
BUS OUT
SERVICE
Display / control panel
Mounting
SERVICE
PWR
BUS OUT
BUS IN
PWR (Power)
PWR
GND
IO1
FE
VIN
IO2
IO3
IO4
NC
1
2
3
4
5
6
7

Connection description of the PWR (Power) connector [Program: Default]

M12 connector
8-pin connector
A-coded

Clicking on the mouse-sensitive **pin assignment display** opens the corresponding **configuration window**


LSIS 462i M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Operating mode
Service
Process
Digital I/Os
Communication
Image memory
Digital I/Os
I/O Port
Description

Configuration of digital I/Os [Program: Default *]

Port	I/O mode	Function	Pulse duration	Signal delay	Debounce time	Inverted
1	Input	Start trigger	0	0	5	0
2	Output	Result OK	0	0	-	0
3	Output	Result NOK	0	0	-	0
4	Output	Programmable 1	0	0	-	0
5	Output	Programmable 2	0	0	-	0
6	Passive	-	-	-	-	-
7	Passive	-	-	-	-	-
8	Passive	-	-	-	-	-

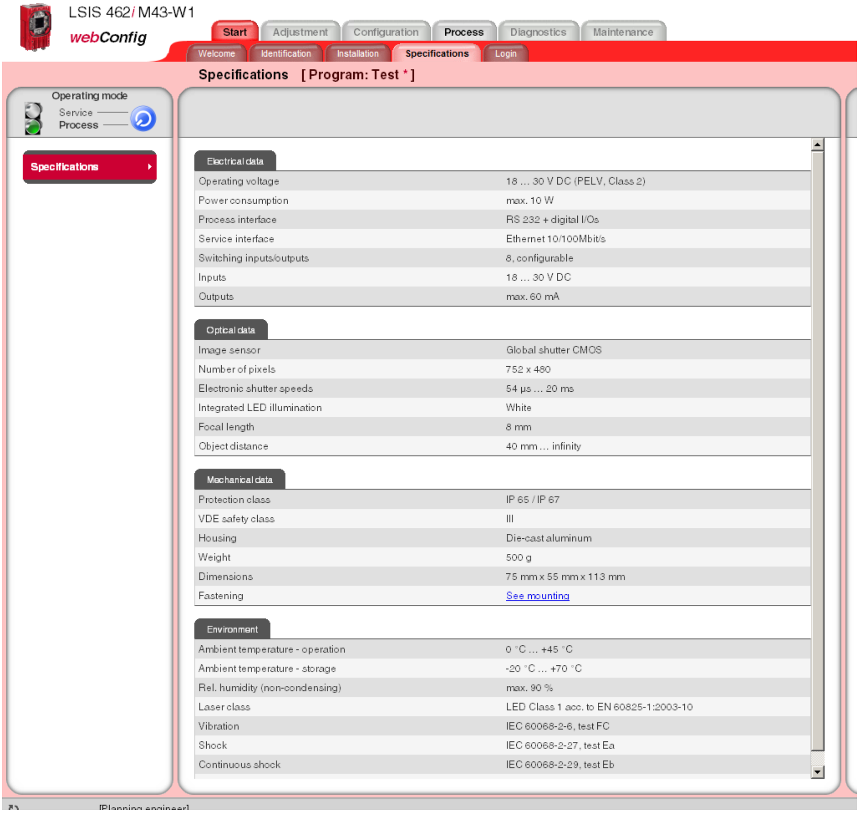
Port: 1
I/O mode: Input
Function: Start trigger
Pulse duration: 0 [ms]
Signal delay: 0 [ms]
Debounce time: 5 [ms]
Inverted: ☐

Settings for the test-program-independent device parameters for the digital I/Os.

Figure 3.6: Use mouse-sensitive graphic elements

3.1.4 "Specifications" tab

The mechanical, electrical and optical device data are displayed here in tabular form. For a device of one of the **LSIS 422*i*** and **LSIS 462*i*** (with code reading) series, the available code types and the respective, underlying standards are listed here as well.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Operating mode
Service
Process
Specifications
[Planning engineer]

Specifications [Program: Test *]

Electrical data	
Operating voltage	18 ... 30 V DC (PELV, Class 2)
Power consumption	max. 10 W
Process interface	RS 232 + digital I/Os
Service interface	Ethernet 10/100Mbit/s
Switching inputs/outputs	8, configurable
Inputs	18 ... 30 V DC
Outputs	max. 60 mA

Optical data	
Image sensor	Global shutter CMOS
Number of pixels	752 x 480
Electronic shutter speeds	54 µs ... 20 ms
Integrated LED illumination	White
Focal length	8 mm
Object distance	40 mm ... infinity

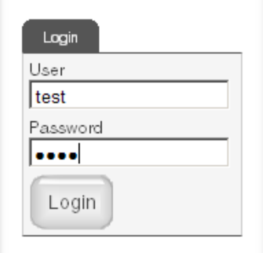
Mechanical data	
Protection class	IP 65 / IP 67
VDE safety class	III
Housing	Die-cast aluminum
Weight	500 g
Dimensions	75 mm x 55 mm x 113 mm
Fastening	See mounting

Environment	
Ambient temperature - operation	0 °C ... +45 °C
Ambient temperature - storage	-20 °C ... +70 °C
Rel. humidity (non-condensing)	max. 90 %
Laser class	LED Class 1 acc. to EN 60825-1:2003-10
Vibration	IEC 60068-2-6, test FC
Shock	IEC 60068-2-27, test Ea
Continuous shock	IEC 60068-2-29, test Eb

Figure 3.7: "Start" module, "Specifications" tab

3.1.5 "Login" tab

The "Login" tab is used to log in the respective user.



User
test

Password
••••

Figure 3.8: "Start" module, "Login" tab

Notice!

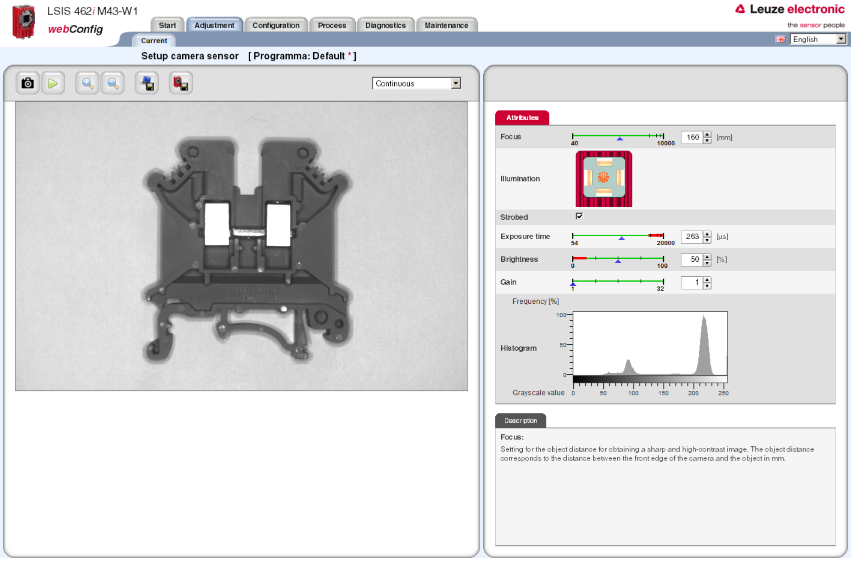
Only a user who has already been created *can log in. Management of the user data, i.e. the creation and deletion of users as well as the assignment of passwords and authorizations, occurs in the "Maintenance" module, see description ""User management" tab" on page 85.*

3.2 "Adjustment" module

Using the displayed current image, you can align the camera without needing to configure a check program, e.g., during the first installation. The image acquisition parameters used in this process are only temporary, but can be saved as a preset for all future check programs.

Notice!

Please note that these settings do not overwrite the camera settings already saved in existing check programs.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Current
Leuze electronic
the sensor people
Attributes
Illumination
Frequency [%]
100
50
0
Histogram
Grayscale value
0
50
100
150
200
250
Description

English

Setup camera sensor [Programma: Default *]

Continuous

Focus 40 10000 160 [mm]

Strobed ☑

Exposure time 54 20000 263 [µs]

Brightness 0 100 50 [%]

Gain 1 32 1

Focus:

Setting for the object distance for obtaining a sharp and high-contrast image. The object distance corresponds to the distance between the front edge of the camera and the object in mm.

Figure 3.9: User interface of the "Adjustment" module

In the left window area you see a live image and can select the desired camera operating mode from a list box. The parameters necessary for image acquisition are made available to you in the right window area. In the lower area, you can find context-sensitive information on the parameters and the various operational controls.

3.2.1 "Current" tab

Buttons

Pressing this button triggers the acquisition of a single image, taking into account the operating mode of the camera. After the button has been pressed, the web browser waits for the image to be transmitted. During the waiting time, ***webConfig*** cannot be operated, i.e. any further entries are ignored and/or not accepted.

In the "Continuous" camera operating mode, the waiting time can be ignored, since the image is displayed within just a few hundred milliseconds. In the "Triggered" camera operating mode, this is undefined, since the arrival of a trigger signal is not guaranteed. To again enable operation via ***webConfig***, a timeout elapses in the web browser. If no image is supplied within 5 seconds after the image is requested, ***webConfig*** interrupts the waiting time and is again available to the user.

Pressing this button switches the live mode of the **LSIS 4xx*i*** on and off. In live mode, the images are continuously captured, taking into account the operating mode of the camera. Depending on the performance level of the connected PC, up to 3 images are updated in the web browser per second.

In the "Continuous" camera operating mode, a request is issued for a new image as soon as the acquisition of the previous image has concluded. In the "Triggered" camera operating mode, a request for a new image is likewise immediately issued provided the acquisition of the previous image has concluded. But, because, image acquisition is dependent on the arrival of a trigger signal, a timeout of 5 seconds must elapse first. If a request for image acquisition is not answered within 5 seconds, ***webConfig*** interrupts the current image acquisition and starts the next one.

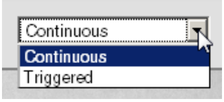
Pressing this button enlarges the view of the current image.

Pressing this button reduces the view of the current image.

Pressing this button saves the current image on the PC that is connected to the **LSIS 4xx*i***. This function is not available in live mode!

After pressing this button, all image acquisition parameters set in the "Attribute" section are **permanently** saved in the flash memory of the **LSIS 4xx*i*** as default settings. These settings are used as default values for image acquisition from this point on when creating new check programs.

Operational control: "Camera operating mode" list box for selecting the camera operating mode



These two options select the camera operating mode and determine the time at which an image acquisition is performed.

In the "**Continuous**" camera operating mode, an image is recorded immediately after the corresponding button is pressed or after an image acquisition parameter is changed; the image is then displayed in the browser. This can be helpful if, for example, an object is manually placed in front of the camera and no trigger signal is available for image acquisition.

In the "**Triggered"** camera operating mode, image acquisition and the display in the web browser are process-controlled with the rising edge of a trigger signal via a digital trigger input. Prerequisite for this operating mode is that a digital input of the **LSIS 4xx*i*** be defined as a trigger input. Information on this topic can be found in chapter 3.3.3.

The following parameters and operational controls are available in the right window area:

"Attributes" parameter group

Parameter	Explanation
Focus	Setting for the object distance for obtaining a sharp and high-contrast image. The object distance corresponds to the distance between the front edge of the camera and the object in mm.
Illumination	Four illumination quadrants that can be individually switched on and off. For example, to reduce reflections in the image, specific, individual quadrants can be switched off. When using external illumination, all four quadrants can be deactivated here.
Strobed	Switch between strobed light and continuous light. For continuous light, the maximum light power is reduced to keep from shortening the life expectancy of the LEDs. Please observe the following **dependencies** between the **"Strobed", "Exposure time" and "Brightness"** image acquisition parameters:

	Strobed operation "Strobed" option active	**Continuous light operation** "Strobed" option not active
Exposure time	Max. 8ms, dependent on the set brightness	Freely adjustable from 54µs to 20ms
Brightness	Min. 15% Max. dependent on the set exposure time	"Brightness" regulaor deactivated

Parameter	Explanation
Exposure time	In continuous light operation, the exposure time can be set freely between 54 µs and 20 ms; in strobed operation, the adjustable exposure time is based on the "Brightness" value and can be set to max. 8 ms. For moving objects, keep as small as possible in order to obtain a sharp image. The values for the exposure time and brightness are coupled to one another in order to always enable the maximum possible current through the integrated LED illumination and, thus, the maximum light yield.
Brightness	Setting for the brightness of the integrated illumination; between 0% and 100%. In continuous light operation, the "Brightness" regulator is deactivated; in strobed operation, the min. value of the regulator is 15%, the max. value is dependent on the set exposure time. As a rule, the maximum brightness is used. This keeps the exposure time as short as possible. The values for the exposure time and brightness are coupled to one another in order to always enable the maximum possible current through the integrated LED illumination and, thus, the maximum light yield.
Gain	Setting for the gain; between 1 and 32. This can be used to further increase the brightness of the image. In addition to the brightness, the noise in the image is also greatly increased, however. Therefore, this setting should only be changed if the possibilities of the "Brightness" and "Exposure time" parameters are exhausted. This option is recommended for fast processes if the image is too dark due to a very short exposure time.

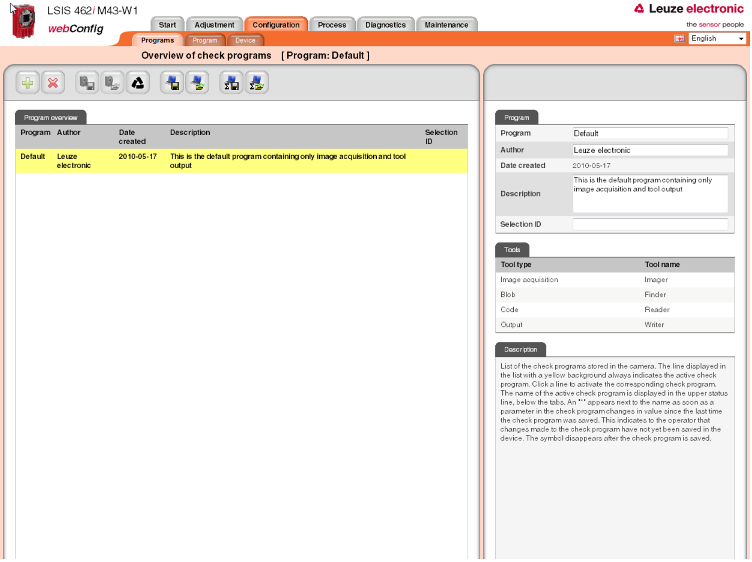
"Histogram" operational control

The histogram is displayed for assessing the displayed image. In digital image processing, a histogram is understood to be the statistical frequency of individual gray values in an image. The display of the relative frequency of a gray value in the histogram is dynamic; the 100% value is defined by the most frequently occurring gray value of the current image.

The histogram of an image is used to make a statement on the gray values that are present in the image and on the amount of contrast and on the brightness of the image and simplifies the correct setting of the thresholds for reliable segmentation of the object that is to be inspected.

3.3 "Configuration" module

The "Configuration" module serves as the main interface for configuring the device and the individual tasks (programs and tools) and for configuring the communication interfaces. The parameters required for this purpose are made available in the "Programs", "Program" and "Device" tabs.



Overview of check programs [Program: Default]

Program	Author	Date created	Description	Selection ID
Default	Leuze electronic	2010-05-17	This is the default program containing only image acquisition and tool output	

Program	Default
Author	Leuze electronic
Date created	2010-05-17
Description	This is the default program containing only image acquisition and tool output
Selection ID	

Tool type	Tool name
Image acquisition	Imager
Blob	Finder
Code	Reader
Output	Writer

List of the check programs stored in the camera. The line displayed in the list with a yellow background always indicates the active check program. Click a line to activate the corresponding check program. The name of the active check program is displayed in the upper status line, below the tabs. An "*" appears next to the name as soon as a parameter in the check program changes in value since the last time the check program was saved. This indicates to the operator that changes made to the check program have not yet been saved in the device. The symbol disappears after the check program is saved.

Figure 3.10: User interface of the "Configuration" module

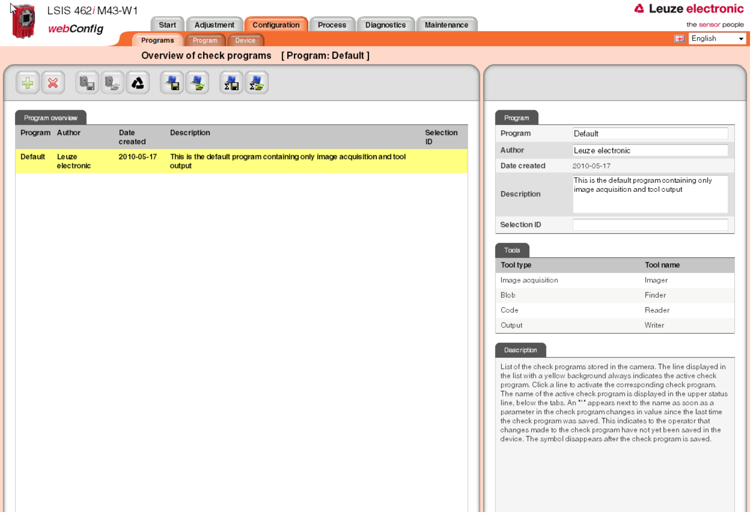
3.3.1 "Programs" tab

This tab is used for managing check programs. In the left part of the window, you will find a list of the check programs that have been saved in the camera – whereby the currently active check program is displayed with a yellow background. The name of the active check program is also displayed in the title bar below the tab name.

Click a line to activate the corresponding check program. As soon as a parameter of the check program is changed after the last time that it was saved, or if a different check program in the list was set to active by means of a mouse click, a "*" appears next to the name. This indicates to the operator that changes made to the check program have not yet been saved in the device. The symbol disappears after the check program is saved.

Various operational controls can be used to create and delete and save and load check programs. But they can also be used to name and add a description or store a selection ID for implementing an automatic change of check programs via the master computer.

Also visible in the lower part of the right window are the image processing tools contained in the active program.



Overview of check programs [Program: Default]

Program	Author	Date created	Description	Selection ID
Default	Leuze electronic	2010-05-17	This is the default program containing only image acquisition and tool output	

Program	Default
Author	Leuze electronic
Date created	2010-05-17
Description	This is the default program containing only image acquisition and tool output
Selection ID	

Tool type	Tool name
Image acquisition	Imager
Blob	Finder
Code	Reader
Output	Writer

List of the check programs stored in the camera. The line displayed in the list with a yellow background always indicates the active check program. Click a line to activate the corresponding check program. The name of the active check program is displayed in the upper status line, below the tabs. An "*" appears next to the name as soon as a parameter in the check program changes in value since the last time the check program was saved. This indicates to the operator that changes made to the check program have not yet been saved in the device. The symbol disappears after the check program is saved.

Figure 3.11: "Configuration" module, "Programs" tab

Buttons

The button bar contains the following elements:

Pressing this button creates a new check program at the end of the list and then activates it.

Pressing this button deletes the active check program.

After pressing this button, all check programs are permanently saved in the flash memory of the **LSIS 4xx*i***.

Pressing this button discards all changes by reloading the check programs saved in the flash memory of the **LSIS 4xx*i***.

Pressing this button discards all changes and loads the default programs present on delivery.

Pressing this button saves the current check program on the PC that is connected to the **LSIS 4xx*i***.

Pressing this button loads a single program from the PC that is connected to the **LSIS 4xx*i*** appends it to the end of the list, and activates it.

Pressing this button saves all programs on a PC.

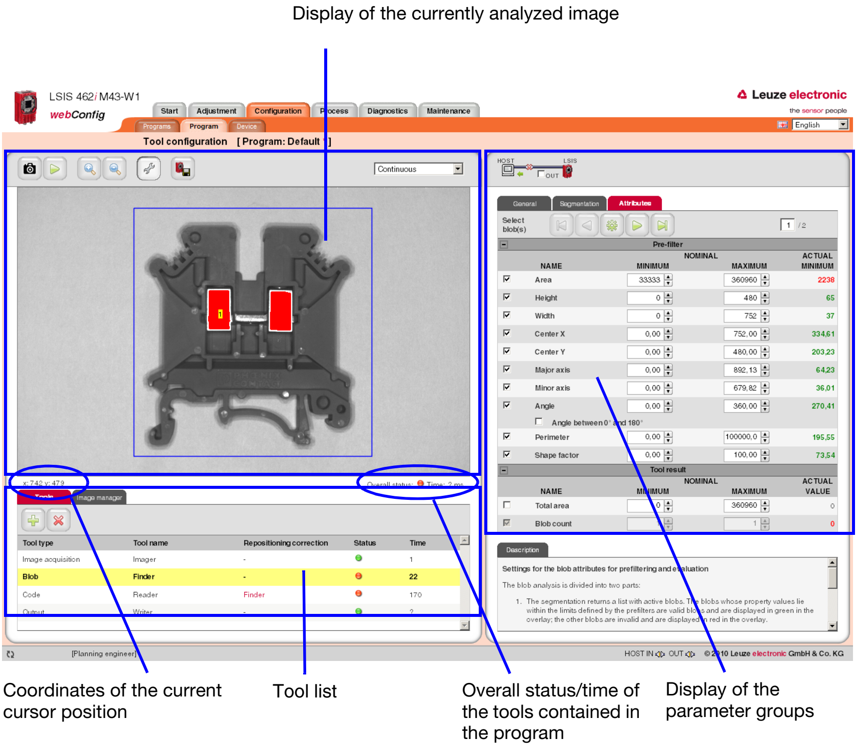
Pressing this button loads multiple programs from a file on a PC on which the file was previously saved. The current program list is overwritten.

"Program" parameter group

Parameter	Explanation
Program	Optional entry of the check program name. Can be changed at a later point in time.
Author	Optional entry of the author. Can be changed at a later point in time.
Date created	Display of the date on which the check program was created. Cannot be changed.
Description	Optional description of the tool. Can be changed at a later point in time.
Selection ID	Optional entry of the selection ID. Can be changed at a later point in time. The selection ID can be used to trigger an automatic change of check program via digital inputs. A plausibility check prevents the same number from being entered multiple times.

3.3.2 "Program" tab

In accordance with its key role in the configuration process, numerous functions for configuring the current check program are available in this window. The window consists of three main areas, which offer selection-dependent operational controls.


Display of the currently analyzed image
LSIS 462i M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Tool configuration [Program: Default]
Continuous
HOST
LSIS
OUT
General
Segmentation
Attributes
Select blob(s)
1 / 2
Tools
Image manager
[Planning engineer]
HOST IN OUT
© 2010 Leuze electronic GmbH & Co. KG
Coordinates of the current cursor position
Tool list
Overall status/time of the tools contained in the program
Display of the parameter groups

x: 742 y: 479

Overall status: ● Time: 2 ms

Pre-filter

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL MINIMUM
☑	Area	33333	360960	2238
☑	Height	0	480	65
☑	Width	0	752	37
☑	Center X	0,00	752,00	334,61
☑	Center Y	0,00	480,00	203,23
☑	Major axis	0,00	892,13	64,23
☑	Minor axis	0,00	679,82	36,01
☑	Angle	0,00	360,00	270,41
☐	Angle between 0° and 180°			
☑	Perimeter	0,00	100000,0	195,55
☑	Shape factor	0,00	100,00	73,54

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☐	Total area	0	360960	0
☑	Blob count	1	1	0

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	Imager	-	●	1
Blob	**Finder**	**-**	●	**22**
Code	Reader	Finder	●	170
Output	Writer	-	●	2

Description

Settings for the blob attributes for prefiltering and evaluation

The blob analysis is divided into two parts:

1. The segmentation returns a list with active blobs. The blobs whose property values lie within the limits defined by the prefilters are valid blobs and are displayed in green in the overlay; the other blobs are invalid and are displayed in red in the overlay.

Figure 3.12: Three-part structure of the "Program" tab

The display in this window is primarily dependent on which tool type is selected in the lower left area – "Image acquisition", "BLOB" ,"Output" or, for **LSIS 422*i*** or **LSIS 462*i***, "CODE". The parameters of the active tool are displayed in the right window area. Independent of this, there are, however, several buttons and operational controls that are available for all tool types.

3.3.2.1 *Tool-type-independent buttons and operational controls*

Buttons

The button bar in the left part of the window area contains the following elements:

📷 Pressing this button triggers the acquisition of a single image, taking into account the operating mode of the camera. After the button has been pressed, the web browser waits for the image to be transmitted. During the waiting time, ***webConfig*** cannot be operated, i.e. any further entries are ignored and/or not accepted.

In the "Continuous" camera operating mode, the waiting time can be ignored, since the image is displayed within just a few hundred milliseconds. In the "Triggered" camera operating mode, this is undefined, since the arrival of a trigger signal is not guaranteed. To again enable operation via ***webConfig***, a timeout elapses in the web browser. If no image is supplied within 5 seconds after the image is requested, ***webConfig*** interrupts the waiting time and is again available to the user.

▷ Pressing this button switches the live mode of the **LSIS 4xx*i*** on and off. In live mode, the images are continuously captured, taking into account the operating mode of the camera. Depending on the performance level of the connected PC, up to 3 images are updated in the web browser per second.

In the "Continuous" camera operating mode, a request is issued for a new image as soon as the acquisition of the previous image has concluded. In the "Triggered" camera operating mode, a request for a new image is likewise immediately issued provided the acquisition of the previous image has concluded. But, because, image acquisition is dependent on the arrival of a trigger signal, a timeout of 5 seconds must elapse first. If a request for image acquisition is not answered within 5 seconds, ***webConfig*** interrupts the current image acquisition and starts the next one.

🔍 Pressing this button enlarges the view of the current image.

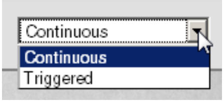
🔍 Pressing this button reduces the view of the current image.

🔧 This is a toggle button. Pressing the button switches the display of a tool-overlay image on and off, provided the active tool makes available an overlay image.

💾 Save changes in device

As soon as a parameter in the check program is changed, a "*" appears next to the name of the active check program (displayed in the upper status bar below the tab). This indicates to the operator that changes made to the check program have not yet been saved in the device. After clicking this button, all changes are permanently saved in the flash memory of the **LSIS 4xx*i***. Afterward, this symbol disappears.

"Camera operating mode" list box *for selecting the camera operating mode*



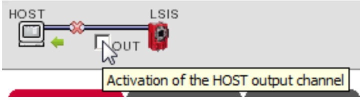
Use these two options to select the camera operating mode and to determine the time at which an image acquisition is performed.

In the "**Continuous**" camera operating mode, an image is recorded immediately after the corresponding button is pressed or after an image acquisition parameter is changed; the image is then displayed in the browser.

In the "**Triggered"** camera operating mode, an image is recorded with the rising edge of a trigger signal via a digital trigger input; the image is then displayed in the web browser. Prerequisite for this operating mode is that a digital input of the **LSIS 4xx*i*** be defined as a trigger input.

The following operational controls are available in the right window area:

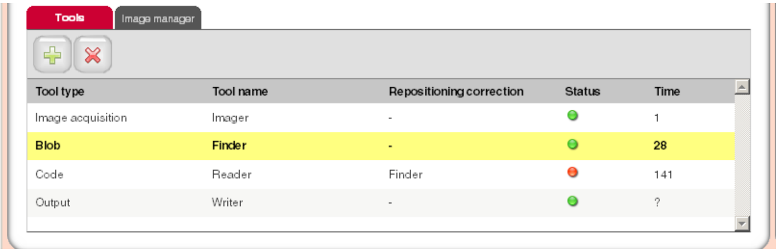
"Process coupling" check box *for connecting to the process during configuration*



If the check box is selected, all outputs (digital outputs, event output, …) activated in the output tool are handled as in process operation, i.e. results are transferred to the outside. In addition, the calculated time appears below the image display and in the tool list. If the check box is not activated, the camera is completely separated from the process, i.e. regardless of the test result, no digital outputs are set and no result output and time calculation occurs, even if an output string was defined.

3.3.2.2 *Tool list*

Here, you will find a list of the tools contained in the current check program. The active tool has a yellow background. Click a line to activate the corresponding tool.



Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	Imager	-	🟢	1
Blob	**Finder**	**-**	🟢	**28**
Code	Reader	Finder	🔴	141
Output	Writer	-	🟢	?

Figure 3.13: Tool list

The following operational controls are available in this window area:

"Tools" tab

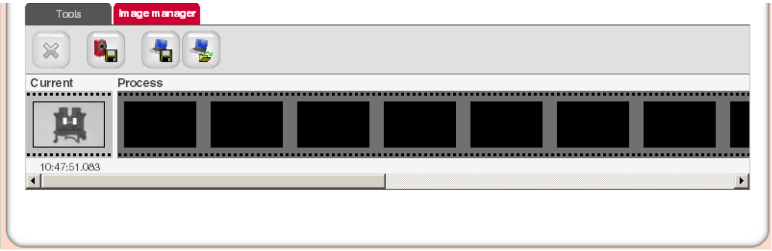
Display of the image processing tools contained in the active check program with specification of name, reference, duration and, above all, the status. Here, a green status LED indicates OK; a red LED, on the other hand, indicates a status of NOK. If the states of all tools contained in the program are OK, the overall status, shown below the image display, is also OK. For tool type output, the time is only displayed here if process coupling is activated, see page 25.

Buttons

✚ Pressing this button creates a new tool and then activates it.

✖ Pressing the button deletes the active tool.

"Image manager" tab



Displayed in the film strip are the current image and a maximum of 14 process and reference images. Each image is labeled with a time stamp that uniquely identifies it.

Process images are displayed with a green or red frame, depending on whether they resulted in a good or bad test result at the time they were taken. Fault images are saved automatically by default. This allows an error to be found quickly, e.g., after adjusting the ROI. With the aid of the fault images, "pseudo errors" can be analyzed and the check parameters adjusted accordingly.

The reference images are permanently saved in the flash memory of the **LSIS 4xx*i***. In order to store a new reference image, there must be at least one free space available in the memory range that is configured for reference images, see chapter 3.3.3.5 ""Image memory" menu".

Buttons

Pressing this button deletes the active image from the image manager.

Pressing this button permanently saves the active image in the flash memory of the **LSIS 4xx*i***.

This action is only possible if there is still at least one free memory place available for reference images.

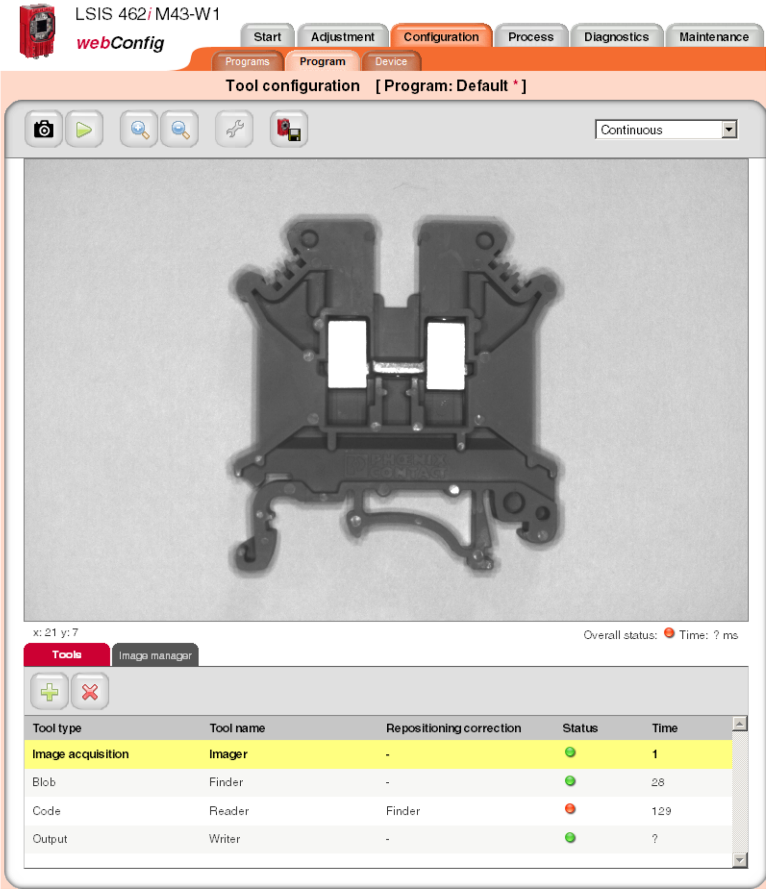
Pressing this button saves the active image on a PC that is connected to the **LSIS 4xx*i***.

Pressing this button loads an image from a PC that is connected to the **LSIS 4xx*i*** as the current image.

The active check program is immediately executed on the loaded image and the results displayed in the current view.

3.3.2.3 *Display for the "Image acquisition" tool type*

The current gray-value image is displayed in the image display.



LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Tools
Image manager

Tool configuration [Program: Default *]

Continuous

x: 21 y: 7

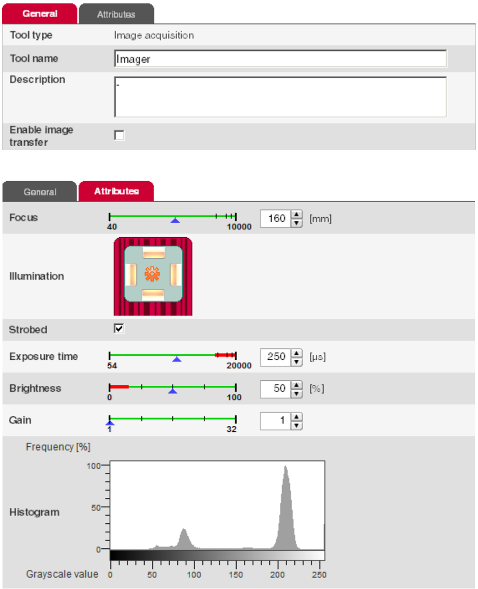
Overall status: 🔴 Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	Imager	-	🟢	1
Blob	Finder	-	🟢	28
Code	Reader	Finder	🔴	129
Output	Writer	-	🟢	?

Figure 3.14: "Image acquisition" image display

Parameters for image acquisition

The "General" and "Attributes" tabs, described in chapter ""Adjustment" module" on page 16", are available at the right for image acquisition. Please note, however, that unlike editing the image parameters in the "Adjustment" module, all settings made here apply only to the current program!



Tool type: Image acquisition
Tool name: Imager
Description:
Enable image transfer ☐

Focus: 40 – 10000: 160 [mm]
Strobed ☑
Exposure time: 54 – 20000: 250 [µs]
Brightness: 0 – 100: 50 [%]
Gain: 1 – 32: 1

Figure 3.15: Image acquisition parameters

In addition, the "General" tab offers another operational control.

"Enable image transfer" check box

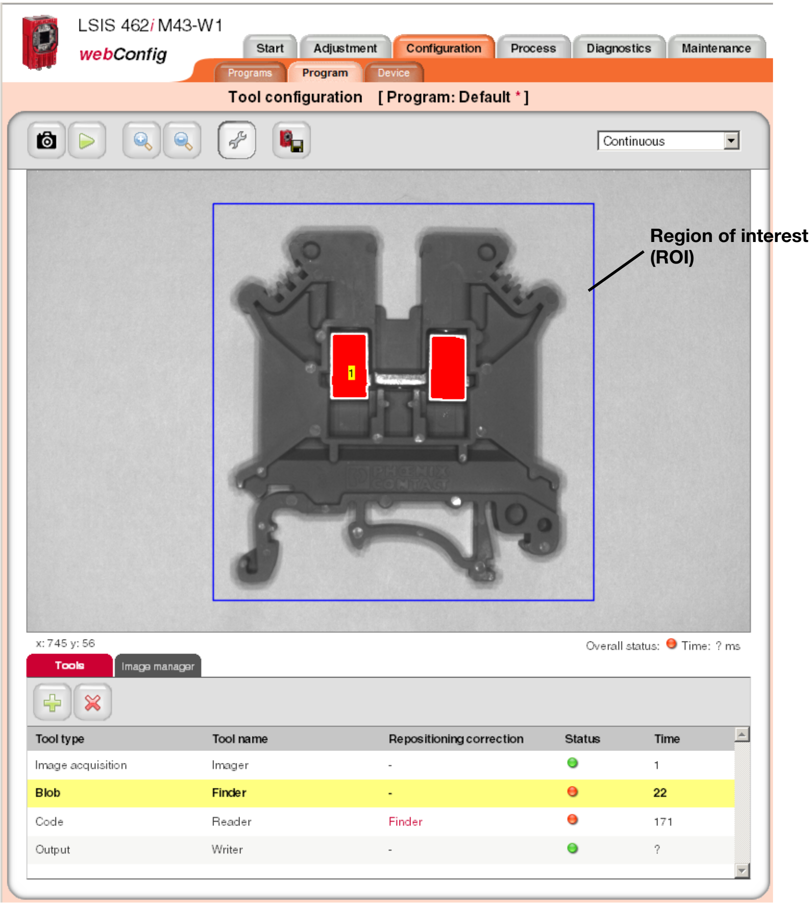
If this option is selective, the current image is prepared for output on the Ethernet interface. This requires computing time and, thus, lengthens the cycle time of a test. The port via which the image request of an external control is read and the recorded image is also transferred is defined in the configuration of the Ethernet process interface, see chapter 3.3.3 ""Device" tab", section ""Communication -> Process - Ethernet" menu" on page 73.

Notice!

*Please observe the following **dependencies** between the **"Strobed", "Exposure time" and "Brightness"** image acquisition parameters:*
*In **continuous light operation** ("Strobed" option not active), the exposure time can be freely set between 54µs and 20ms; the "Brightness" regulator is deactivated.*
*In **strobed operation** ("Strobed" option active), the adjustable exposure time is based on the "Brightness" value and can be set to max. 8ms. The min. value for brightness is 15%; the max. value is dependent on the set exposure time.*

3.3.2.4 *Display of the "BLOB" tool type*

With the BLOB tool, a red/green-colored overlay, which can be switched on and off and which represents the result of the segmentation/binarization, is placed over the gray-value image.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Tool configuration [Program: Default *]
Continuous
Region of interest (ROI)
1
x: 745 y: 56
Overall status: Time: ? ms
Tools
Image manager

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	Imager	-	🟢	1
Blob	Finder	-	🔴	22
Code	Reader	Finder	🔴	171
Output	Writer	-	🟢	?

Figure 3.16: "BLOB" image display

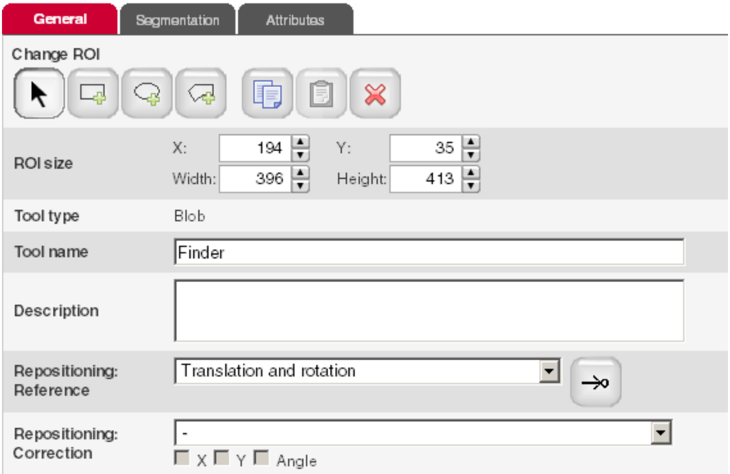
All parameters necessary for BLOB analysis are contained in the "General", "Segmentation" and "Attributes" tabs. Workflow takes place logically from left to right:

1. Defining regions of interest (ROI)
2. Segment image
3. Evaluate BLOB attributes

If the calculation of the centroid (Center X, Center Y) or the size of the circumscribing rectangle (Height, Width) was activated under the BLOB properties ("Attributes" parameter group, see page 36), the BLOB number of the active BLOB is displayed on the image at the location of the centroid.

BLOB tool: "General" parameter group

Located here are various tools for defining regions of interest and general settings of the BLOB tool.



ROI size	X: 194 Y: 35 Width: 396 Height: 413
Tool type	Blob
Tool name	Finder
Description	
Repositioning: Reference	Translation and rotation
Repositioning: Correction	- ☐ X ☐ Y ☐ Angle

Figure 3.17: General parameters of the BLOB tool

Regions of interest (ROIs) can be used for excluding interfering elements in the image (e.g., an adjacent component that should not be detected, or reflections). This reduces the evaluation time, as the entire image no longer needs to be considered.
For a composite ROI consisting of multiple, overlapping regions of interest, the set-theoretic union of the contained pixels is evaluated.

Notice!

If no region of interest is defined, the complete image is defined as the region of interest. When using repositioning (see following table), an offset rectangle can then be displayed as region of interest, even if no region of interest was initially defined.

Notice!

When using regions of interest (ROIs), the histogram displayed under "Segmentation" refers only to the actually evaluated pixels, i.e. all points that are located within a region of interest.

For further information on working with ROIs, see chapter 4.1 "Basic procedure – step-by-step configuration of a BLOB analysis".

Parameter	Explanation
Change ROI	Tools for restricting the ROI. The following elements are available: **Select ROI** Pressing this button puts the mouse in selection mode, i.e. the mouse can be used to select, and thus activate, a ROI. The activated ROI can be moved and its dimensions changed. The selection mode is the default mode. **Add rectangular ROI** Pressing this button puts the mouse in the mode for drawing rectangular ROIs. The user clicks the mouse on the image to set a starting point and then, while holding down the mouse button, pulls the mouse to create a rectangle. Upon release of the mouse button, the rectangle is accepted. The program then automatically switches to the selection mode to allow the user to make changes to the drawn rectangle. This means that in order to draw another ROI, either this or another button must again be clicked. A drawn rectangle extends the current, existing ROI. **Add elliptical ROI** Pressing this button puts the mouse in the mode for drawing elliptical ROIs. The user clicks the mouse on the image to set a starting point and then, while holding down the mouse button, pulls the mouse to create an ellipse. Upon release of the mouse button, the ellipse is accepted. The program then automatically switches to the selection mode to allow the user to make changes to the drawn ellipse. This means that in order to draw another ROI, either this or another button must again be clicked. A drawn ellipse extends the current, existing ROI. **Add polygonal ROI** Pressing this button puts the mouse in the mode for drawing polygonal ROIs. The user clicks the mouse on the image to create a starting point. He then clicks another image point to set the next vertex. Subsequent mouse clicks on the image set further vertices, thereby continuing the polygon. Drawing of the polygon is completed when the user again clicks the first point of the polygon. The program then automatically switches to the selection mode to allow the user to make changes to the drawn polygon. This means that in order to draw another ROI, either this or another button must again be clicked. A drawn polygon extends the current, existing ROI. **Copy ROI** Pressing this button saves the currently selected ROI. **Paste ROI** The most recently saved ROI is inserted in the active tool. **Delete ROI** Pressing this button deletes the activated ROI.
ROI size	Display of the x/y coordinates as well as the height and width of the current ROI. The origin (x=0, y=0) is the upper left corner of the image. The values of the x-coordinates increase to the right; the values of the y-coordinates increase downward. Values "x" and "y" describe the coordinates of the upper left corner of the ROI closest to the origin. For elliptical or polygonal ROIs, the circumscribing rectangle is used as a basis. Width and height define the dimensions of a rectangle that encloses the selected ROI.
Tool type	Display of the tool type. Cannot be changed.
Tool name	Optional entry of the tool name. Can be changed at a later point in time.
Description	Optional description of the tool. Can be changed at a later point in time.

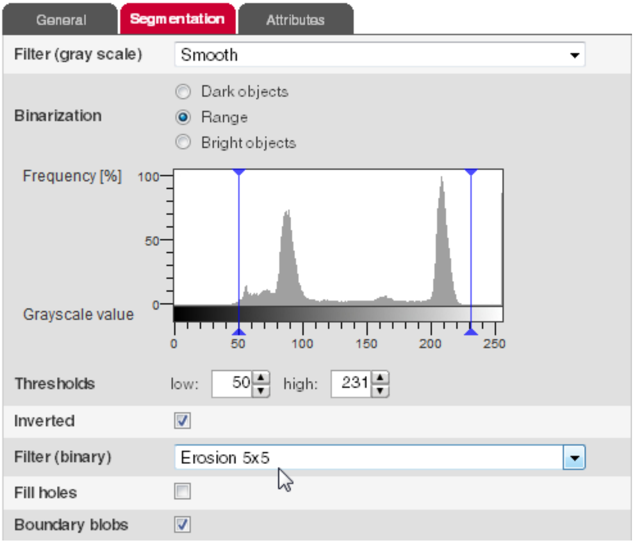
Parameter	Explanation
Repositioning: Reference 1)	Defined in this field is whether the current tool provides correction values for a repositioning of ROIs in subsequent tools. The following modes exist: `Off`: Determination of correction values deactivated. `Translation`: Determination of correction values for horizontal and vertical repositioning (x, y). This can be performed on the basis of **one or more** found BLOBs. Press the "Teach" button ⊸ to teach the center of mass of the BLOB that is valid at this point in time. In subsequent image analyses, the centers of mass of the valid BLOBs that exist at the given point in time are calculated, compared to the reference coordinates, and the repositioning values ascertained for the translation. Subsequent BLOB tools can access these values. Without a taught-in reference position, the tool result in this mode is NOK (red LED in the tool list) and a red exclamation mark appears in the "Reference" column of the tool list. `Move and rotate`: Determination of corrective values for horizontal, vertical and rotational repositioning. This can only be performed on the basis of **exactly one** found BLOB, since only in this case is a unique angle assignment possible. Thus, the prerequisite is the number "min=1" and "max=1" in the "Attribute" tab and the presence of exactly one valid BLOB. Press the "Teach" button ⊸ to teach the center of mass and the angular position of this BLOB. In subsequent image analyses, the center of mass and the angular position of the valid BLOB that then exists is calculated, compared to the taught reference values, and the repositioning values ascertained for translation and rotation. Subsequent BLOB tools can access these values. Without a taught-in reference position, the tool result in this mode is NOK (red LED in the tool list) and a red exclamation mark appears in the "Reference" column of the tool list.
Repositioning: Correction 1)	Defined in this field is whether the ROIs of the current tool should be repositioned using the correction values of a previous tool. In the dropdown box in this field, it is possible to reference a previous tool that provides correction values. Select the "X", "Y" and "Angle" check boxes to define how the ROIs of the tool are to be repositioned: X=horizontal, Y=vertical, Angle=rotational. If the tool being used for referencing provides no or insufficient corrective values, the tool result in this mode is NOK (red LED in the toolbar) and the name of the referenced tool is displayed in red in the toolbar.

1) ***Information on using repositioning:***
Repositioning is possible for BLOB or code tools. The following *conditions* must be fulfilled for repositioning:

1. In the tool used for repositioning, the minimum number of results to be found (BLOBs or codes) must be set to 1; if angle tracking is to be performed as well, the maximum number must also be 1, as unique orientation cannot otherwise be ascertained. Angle tracking is only useful if the corresponding result has a clear orientation (no circles - here, the angle is, in effect, undefined)!
2. In the same tool, "Repositioning: Reference" must be set and the "Teach" button then pressed. Each time one of this tool's parameters is changed or the camera is mechanically realigned, it is recommended that the repositioning reference be re-taught.
3. For the tool that is repositioned (also of type BLOB or code), the respective tool that offers the repositioning must be selected under "Repositioning correction". Repositioning can occur in the X or Y direction (default: X and Y). Repositioning by angle can be selected if this is offered by the projected tool (see 1.).

BLOB tool: "Segmentation" parameter group

The settings for segmenting the image are made on this tab.



Filter (gray scale) Smooth

Binarization
○ Dark objects
● Range
○ Bright objects

Thresholds low: 50 high: 231

Inverted ☑

Filter (binary) Erosion 5x5

Fill holes ☐

Boundary blobs ☑

Figure 3.18: Segmentation parameters of the BLOB tool

Notice!

When using regions of interest (ROIs), the histogram refers only to the actually evaluated pixels, i.e. all points that are located within a region of interest.

Parameter	**Explanation**
Filter (gray scale)	The dropdown box enables the use of a filter on the recorded gray-value image. If the original image is noisy, a smoothing filter can be applied to the gray-value image prior to segmentation. Notice: The original is also always displayed for filtered images.
Binarization	This option assists in the preselection process to specify whether the system is to search for dark or light objects. To reduce operating errors, the respective left or right segmentation limit cannot be changed in these cases. The threshold values for the binarization of the gray-value image can be preset as follows: Dark objects: Black to medium gray, gray values from 0 to 100, lower threshold fixed Range: Dark gray to light gray, gray values from 50 to 200 Light objects: Medium gray to white, gray values from 150 to 255, upper threshold fixed Unfixed threshold values can be changed as desired.
Histogram	The histogram is displayed for assessing the displayed image. In digital image processing, a histogram is understood to be the statistical frequency of individual gray values in an image. The histogram of an image is used to make a statement on the gray values that are present in the image and on the amount of contrast and on the brightness of the image and simplifies the setting of the thresholds for reliable segmentation of the object that is to be inspected.

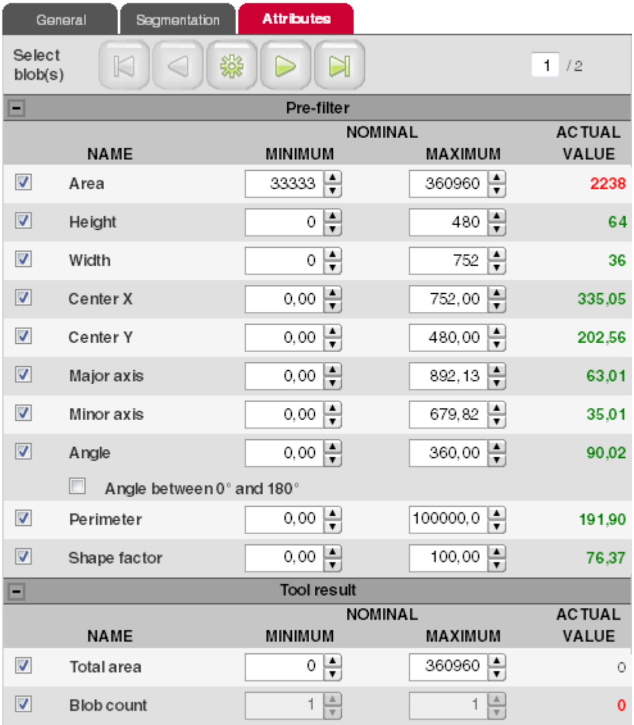
Parameter	Explanation
Thresholds	The two thresholds for the binarization of the gray-value image can be defined via the two regulators in the histogram or by directly entering the values. Pixels with gray values within the defined range are active and are displayed in the overlay in green or red.
Inverted	Select the check box to invert the binarization specified by the thresholds. This means that active pixels become inactive and vice versa.
Filter (binary)	The dropdown box enables the use of a binary filter on the generated overlay. **Erosion**: This is used to enlarge dark structures in the image and thereby eliminate bright, interfering pixels. **Dilatation**: This is used to enlarge bright structures in the image and thereby eliminate dark, interfering pixels. **Open**: Erosion is performed followed by dilation. This results in the closure of gaps in dark objects without changing the object size. **Close**: Dilation is performed followed by erosion. This results in the closure of gaps in bright objects without changing the object size. **Comment:** When displaying binarized objects in the image, "bright structures" and "bright objects" always refer to the active pixels displayed in color (red or green) in the image; "dark structures" or "dark objects" always refer to the remaining image area.
Fill holes	The parameter specifies that holes in the localized BLOBs are to be filled automatically.
Boundary BLOBs	The parameter specifies whether or not localized BLOBs that touch the edge of a ROI are taken into account. The option is active by default.

BLOB tool: "Attributes" parameter group

Here, the desired objects are separated from the undesired objects in the image and the criteria for the tool result are defined.

Notice!

Note that the processing time is extended as the number of attributes that must be checked increases. Furthermore, the processing time increases considerably as the number of found BLOBs increases. The evaluation time also increases if at least one of the three attributes "Major axis", "Minor axis" and "Angle" was activated!



Pre-filter

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑	Area	33333	360960	2238
☑	Height	0	480	64
☑	Width	0	752	36
☑	Center X	0,00	752,00	335,05
☑	Center Y	0,00	480,00	202,56
☑	Major axis	0,00	892,13	63,01
☑	Minor axis	0,00	679,82	35,01
☑	Angle	0,00	360,00	90,02
	☐ Angle between 0° and 180°			
☑	Perimeter	0,00	100000,0	191,90
☑	Shape factor	0,00	100,00	76,37

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑	Total area	0	360960	0
☑	Blob count	1	1	0

Figure 3.19: Setting the BLOB attributes

The BLOB analysis is divided into the "Prefilter" and "Tool result" areas. These can be opened and closed by clicking the "-" icon:

1. The segmentation yields a list with active BLOBs. The BLOBs whose complete properties lie within the borders defined by the prefilter (= actual value in the prefilter list marked in green) are valid BLOBs and are displayed in green in the overlay; the other, invalid BLOBs in the overlay are displayed in red (see figure 3.16 on page 30).

2. A second analysis is performed for the valid BLOBs. If, depending on activation, the number of BLOBs in the list and/or the total area of these BLOBs lies within the specified borders, the analysis of the tool yields the result OK, otherwise NOK. The actual values of these criteria are also marked in color in the result list (green = actual value within the defined min/max range, red = actual value outside of the defined min/max range).

Buttons

The button bar contains the following elements:

⏮	Click this button to get to the first BLOB in the list of localized BLOBs.
◁	Click this button to get back to the previous BLOB. Once the start of the BLOB list is reached, focus remains on the first BLOB.
✲	Click this button to change to the overall view.
▷	Click this button to get to the next BLOB. Once the end of the BLOB list is reached, focus remains on the last BLOB.
⏭	Click this button to get to the last BLOB in the list of localized BLOBs.

Parameter	Explanation
Area	Min: 0 Max: 360960 Prefilter according to BLOB size (in pixels): Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Height	Min: 0 Max: 480 Prefilter according to height (in pixels) of the smallest rectangle that encloses the BLOB with sides parallel to the horizontal and vertical image border. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Width	Min: 0 Max: 752 Prefilter according to width (in pixels) of the smallest rectangle that encloses the BLOB with sides parallel to the horizontal and vertical image border. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Center X	Min: 0.00 Max: 752.00 Prefilter according to the X-coordinate of the BLOB's area centroid. Coordinate origin is the upper left corner of the image. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Center Y	Min: 0.00 Max: 480.00 Prefilter according to the Y-coordinate of the BLOB's area centroid. Coordinate origin is the upper left corner of the image. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

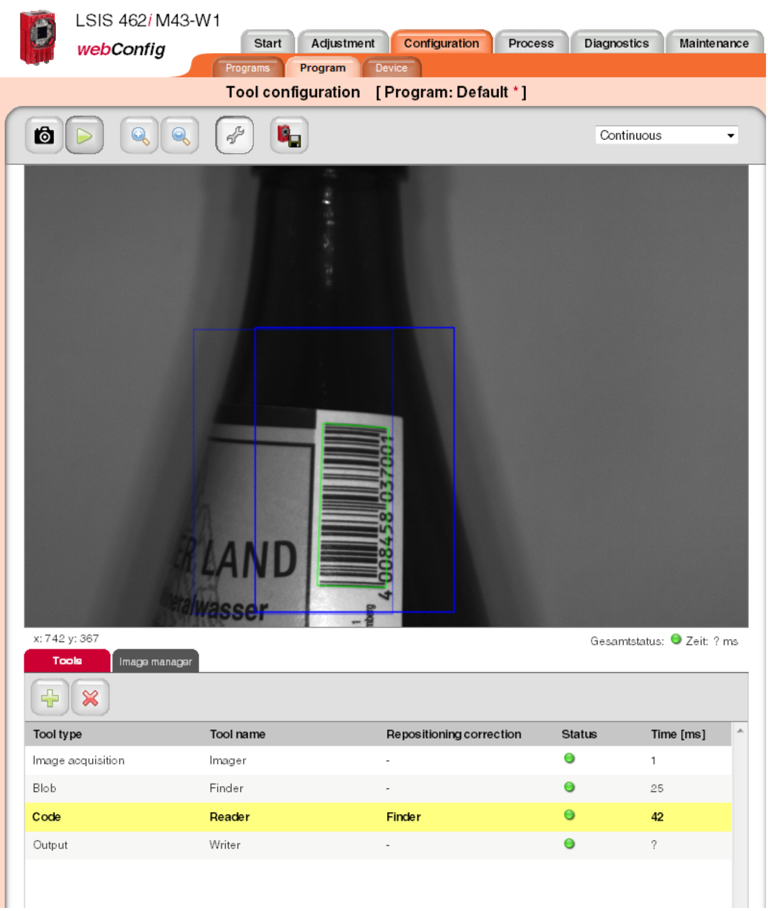
Parameter	Explanation
Major axis [1]	Min: 0.00 Max: 892.13 Prefilter according to the length (in pixels) of the major axis, i.e. the length of the smallest rotated rectangle that encloses the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Minor axis [1]	Min: 0.00 Max: 679.82 Prefilter according to the length (in pixels) of the minor axis, i.e. the height of the smallest rotated rectangle that encloses the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Angle [1]	Min: 0.00 Max: 360.00 Prefilter according to the angle of the mass centroid axis of the BLOB (0° … 360°, pointing to the "heavy" side of the BLOB, relative to the X-axis). Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Angle between 0° and 180°	Function for the support of symmetric objects. If this function is active, the same angle is displayed for two objects whose position differs by one half turn (180°). For symmetric objects, the same angle is, thus, understandably always displayed. The function limits the input for MINIMUM and MAXIMUM of the angle to a maximum value of 180°.
Perimeter	Min: 0.00 Max: 10000.00 Prefilter according to the length (in pixels) of the outer contour line of the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.
Shape factor	Min: 0.00 Max: 100.00 Prefilter according to the shape factor. This is the ratio between the area and the perimeter of the BLOB, normalized to values between 0 and 100. The shape factor classifies the geometric shape of the BLOB: "100" represents a perfect circle, "0" a perfect line. The formula is (4π * area/perimeter^2) * 100. Only BLOBs in the region between MINIMUM and MAXIMUM are valid and are displayed in the overlay in green.
Total area	Min: 0 Max: 360960 Total area of all valid BLOBs of a tool. Only if the total area is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).
BLOB count	Min: 0 Max: 10000 Number of valid BLOBs of a tool. Only if the number is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).

1) The evaluation of one or more of the three marked attributes can considerably increase the evaluation time for each found BLOB.

For further information on the evaluation of the BLOB attributes, see chapter 4.1 "Basic procedure – step-by-step configuration of a BLOB analysis".

3.3.2.5 *Display of the "Code" tool type*

The current gray-value image is displayed in the image display.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Tool configuration [Program: Default *]
Continuous
ER LAND
eralwasser
4 008458 037001
Tools
Image manager

x: 742 y: 367

Gesamtstatus: ● Zeit: ? ms

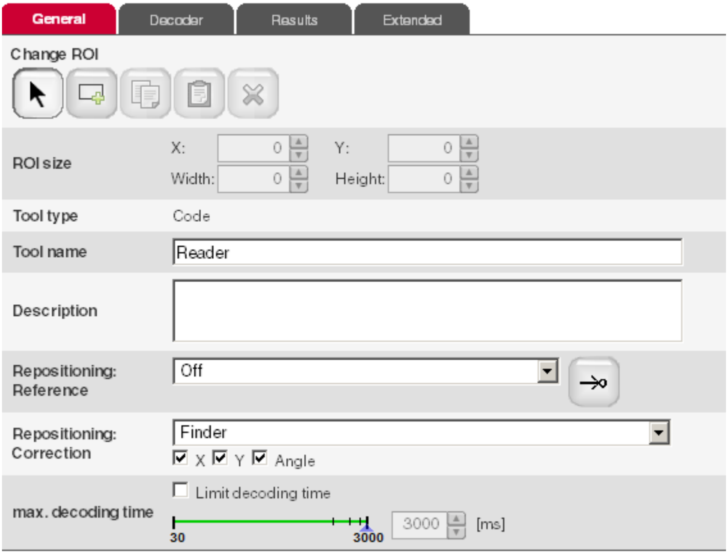
Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	25
Code	**Reader**	**Finder**	●	**42**
Output	Writer	-	●	?

Figure 3.20: "Code" image display

The settings necessary for configuring code reading are made in the "General", "Decoder", "Results" and "Extended" tabs.

Code tool: "General" parameter group

Located here are general settings of the code tool; these are already familiar to you from BLOB analysis.



ROI size X: 0 Y: 0
Width: 0 Height: 0

Tool type: Code

Tool name: Reader

Description:

Repositioning: Reference: Off

Repositioning: Correction: Finder
☑ X ☑ Y ☑ Angle

max. decoding time: ☐ Limit decoding time
30 3000 3000 [ms]

Figure 3.21: General parameters of the code tool

Notice!

In firmware version 2.0, only a rectangular region of interest is permissible for the code tool.

Parameter	Explanation
Change ROI	Tools for restricting the ROI. The following elements are available: **Select ROI** Pressing this button puts the mouse in selection mode, i.e. the mouse can be used to select, and thus activate, a ROI. The activated ROI can be moved and its dimensions changed. The selection mode is the default mode. **Add rectangular ROI** Pressing this button puts the mouse in the mode for drawing rectangular ROIs. The user clicks the mouse on the image to set a starting point and then, while holding down the mouse button, pulls the mouse to create a rectangle. Upon release of the mouse button, the rectangle is accepted. The program then automatically switches to the selection mode to allow the user to make changes to the drawn rectangle. This means that in order to draw another ROI, either this or another button must again be clicked. A drawn rectangle extends the current, existing ROI. **Copy ROI** Pressing this button saves the currently selected ROI. **Paste ROI** The most recently saved ROI is inserted in the active tool. **Delete ROI** Pressing this button deletes the activated ROI.
ROI size	Display of the x/y coordinates as well as the height and width of the current ROI. The origin (x=0, y=0) is the upper left corner of the image. The values of the x-coordinates increase to the right; the values of the y-coordinates increase downward. Values "x" and "y" describe the coordinates of the upper left corner of the ROI closest to the origin. For elliptical or polygonal ROIs, the circumscribing rectangle is used as a basis. Width and height define the dimensions of a rectangle that encloses the selected ROI.
Tool type	Display of the tool type. Cannot be changed.
Tool name	Optional entry of the tool name. Can be changed at a later point in time.
Description	Optional description of the tool. Can be changed at a later point in time.

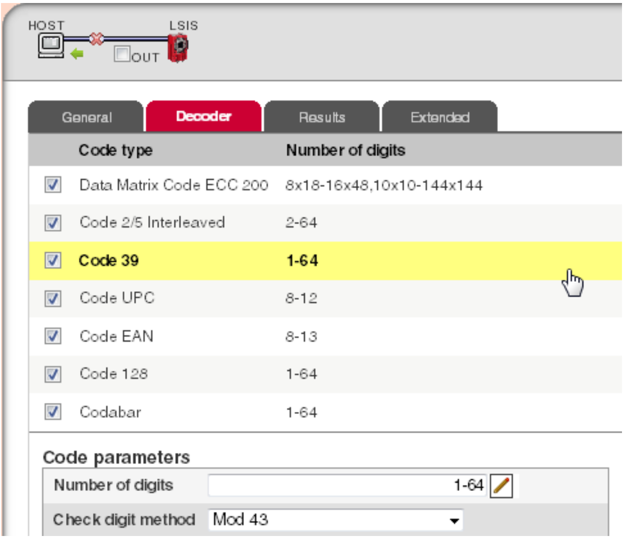
Parameter	Explanation
Repositioning: Reference 1)	Defined in this field is whether the current tool provides correction values for a repositioning of ROIs in subsequent tools. The following modes exist: `Off`: Determination of correction values deactivated `Translation`: Determination of correction values for horizontal and vertical repositioning (x, y). This can be performed on the basis of **one or more** found BLOBs. Press the "Teach" button → to teach the center of mass of the BLOB that is valid at this point in time. In subsequent image analyses, the centers of mass of the valid BLOBs that exist at the given point in time are calculated, compared to the reference coordinates, and the repositioning values ascertained for the translation. Subsequent BLOB tools can access these values. Without a taught-in reference position, the tool result in this mode is NOK (red LED in the tool list) and a red exclamation mark appears in the "Reference" column of the tool list. `Move and rotate`: Determination of corrective values for horizontal, vertical and rotational repositioning. This can only be performed on the basis of **exactly one** found BLOB, since only in this case is a unique angle assignment possible. Thus, the prerequisite is the number "min=1" and "max=1" in the "Attribute" tab and the presence of exactly one valid BLOB. Press the "Teach" button → to teach the center of mass and the angular position of this BLOB. In subsequent image analyses, the center of mass and the angular position of the valid BLOB that then exists is calculated, compared to the taught reference values, and the repositioning values ascertained for translation and rotation. Subsequent BLOB tools can access these values. Without a taught-in reference position, the tool result in this mode is NOK (red LED in the tool list) and a red exclamation mark appears in the "Reference" column of the tool list.
Repositioning: Correction 1)	Defined in this field is whether the ROIs of the current tool should be repositioned using the correction values of a previous tool. In the dropdown box in this field, it is possible to reference a previous tool that provides correction values. By marking fields "x", "y" and "angle", one defines how the ROIs of the tool are to be repositioned: x=horizontal, y=vertical, angle=rotational) If the tool that is used as a reference does not make available any or only insufficient correction values, the tool result in this mode is NOK (red LED in the tool list) and the name of the referenced tool is displayed in red in the "Repositioning reference" column of the tool list.
max. decoding time	Min: 30 ms Max: 3000 ms The maximum time for decoding the code; after this time, decoding is terminated.

1) ***Information on using repositioning:***
Repositioning is possible for BLOB or code tools. The following conditions must be fulfilled for repositioning:

1. *In the tool used for repositioning, the minimum number of results to be found (BLOBs or codes) must be set to 1; if angle tracking is to be performed as well, the maximum number must also be 1, as unique orientation cannot otherwise be ascertained. Angle tracking is only useful if the corresponding result has a clear orientation (no circles - here, the angle is, in effect, undefined)!*
2. *In the same tool, "Repositioning: reference" must be set and the "Teach" button then pressed. Each time one of this tool's parameters is changed or the camera is mechanically realigned, it is recommended that the repositioning reference be re-taught.*
3. *For the tool that is repositioned (also of type BLOB or code), the respective tool that offers the repositioning must be selected under "Repositioning correction". Repositioning can occur in the X or Y direction (default: X and Y). Repositioning by angle can be selected if this is offered by the projected tool (see 1.).*

Code tool: "Decoder" parameter group

You have the option here of restricting reading to certain code types by activating only the respective, required codes. Deactivating irrelevant codes reduces the execution time of the tool.



	Code type	Number of digits
☑	Data Matrix Code ECC 200	8x18-16x48,10x10-144x144
☑	Code 2/5 Interleaved	2-64
☑	**Code 39**	**1-64**
☑	Code UPC	8-12
☑	Code EAN	8-13
☑	Code 128	1-64
☑	Codabar	1-64

Code parameters

Number of digits: 1-64

Check digit method: Mod 43

Figure 3.22: Code parameters of the code tool

Parameter	Explanation
"Code type" area	
Data Matrix Code ECC 200	Is part of the group of 2D codes (two-dimensional codes) and is made up of dots (so-called cells). Camera-based systems (objective, camera and corresponding decoder and evaluation unit) are generally used for reading, as conventional reading methods fail here. The advantage of this matrix code is in the information density, which is approximately 15-times higher than possible with simple barcodes. The Data Matrix code can be read omnidirectionally and supports the representation of a variety of different character and typesets. It is used primarily in various areas of production for traceability and in the pharmaceutical industry. There are different development levels of the Data Matrix code (ECC 0 through ECC 200); all have a horizontal and a vertical boundary line (orientation lines). Depending on the size, up to 2334 ASCII characters (seven bit), 1558 extended ASCII characters (eight bit) or 3116 digits can be encoded. The information-carrying area of the Data Matrix code (square area in the middle) is called the data region. This is framed by the so-called finder pattern, which has an L-shape, and an alternating pattern. This is used for orienting the reader device. The Data Matrix code is AIM standardized and is specified in standard ISO/IEC 16022. Damaged or unprinted cells can be calculated and corrected with the Reed - Solomon error algorithm. This allows even bad codes to be decoded.

Parameter	Explanation
Code 2/5 Interleaved 1234	Numeric barcode (characters 0 – 9) consisting of two wide and three narrow bars and spaces, giving the code the name "2/5". "Interleaved" refers to the overlapping representation of the characters. The ratio of narrow to wide bars (or spaces) is 1:2 to 1:3. Restriction: If the narrow element has a width of less than 0.5 mm, the following applies: narrow element : wide element = 1 : 2.25 (to maximum 1 : 3). The code always consists of one start character, an even number of digits (pairs of digits), as well as a stop character. The first digit is represented by five bars, the second digit by the spaces in between the bars. The last space is limited by the first bar of the next pair of digits or the stop character. To encode various digits with five elements, exactly two wide and three narrow modules are used per digit. The Code 2/5 Interleaved has a high information density. With a module width of 0.3 mm, for example, only 2.7 mm is required for each represented digit. The disadvantages of this barcode are, on the one hand, the small number of data characters (only numeric data) and, on the other hand, a lower tolerance (± 10%), which is due to the information-carrying spaces. The exact code specifications can be found in standard EN 801. The number of data characters is arbitrary (depends on the maximum scanning width), but is always even (pairs of digits). The optional check digit is calculated according to modulo 10 with weighting 3; weighting begins at the right.
Code 39 1234	Alphanumeric code that supports the representation of digits 0 to 9, the 26 letters (no umlauts) and a total of seven special characters. Each character consists of nine elements (five bars and four spaces). Three of the elements are wide and six are narrow, with the exception of the representation of the special characters. The ratio for Code 39 is 1 : 2 to 1 : 3 (narrow element : wide element). If the narrow element has a width of less than 0.5 mm, the ratio: 1 : 2.25 to maximum 1 : 3 applies. At just ± 10%, Code 39 has a low tolerance as well as a relatively low information density: At a module width of 0.3 mm and a ratio of 1 : 3, one digit requires 4.8 mm of space. Code 39 takes its name from both its character set (originally 39 characters, now 43 characters) as well as from its structure—the characters are formed from three wide and six narrow elements which are made of up five bars and four spaces (5 + 4 = 9). The exact specifications for Code 39 can be found in ANSI MH10.8-1983, section 4.4, and in standard EN 800. Depending on how the used decoder is programmed, the + – . / % characters may have a control-character function. The number of data characters is arbitrary; depending on the scanning width, a maximum of 20 is recommended. The recommended size is a height of at least 20 mm or 25% of the width. Optionally, Code 39 can also be used without a check digit. This applies only for very specific application cases, however. The check digit is calculated according to modulo 43; the calculated number is again assigned a character from the Code 39 character set according to the reference number, e.g.: Data digits (example): 12ABCXY Sum of the reference numbers: 1+2+10+11+12+33+34 = 103 Modulo 43: 138 / 43 = 2, remainder 17 Check digit: "H" = reference number for 17

Parameter	**Explanation**
Code UPC 0 12345 67890 5 UPC-A 0 123456 5 UPC-E	**Code UPC-A**: Universal Product Code; an American, machine-readable, self-checking product number code (barcode) which is compatible with the European EAN code. A distinction is made between UPC A and UPC E, both of which can only represent numeric characters (digits 0 to 9). Version A has 12-digits and is very similar to the EAN-13 code; version E corresponds to the EAN-8 code. The bars and spaces can be 1, 2, 3 or 4 modules wide. A character always consists of seven modules. In addition to this are two edge characters and one delimiter. The check digit for the UPC code can be calculated as follows (modulo 10, weighting 3/1): Example: Sequence of data digits: 14084589938 Sum of digits at the "odd places", beginning from left: 1 + 0 + 4 + 8+ 9 + 8 = 30 Multiply by 3: 30 × 3 = 90 Sum of the "odd places": 4 + 8 + 5 + 9 + 3 = 29 Addition: 90 + 29 = 119 Subtraction from the next-higher Multiples of 10: 120 – 119 = 1 Check digit: 1 **Code UPC-E**: Abbreviated version of UPC-A for applications with little space. The UPC-E check sum is, however, calculated somewhat differently: UPC-E check digits are calculated with the aid of an expansion that is based on the sixth digit. Example: Example data: 123456 Expand to 10 digits using the table. Because the UPC-E example code ends with a 6, the digits 0000 are inserted in front of the sixth digit (insertion position 6) to expand the code to 10 digits: 1234500006 A zero is to be placed in front of the resulting 10-digit code, the number system character: 01234500006 The check digit of the resulting 11-digit code is calculated using the UPC-A procedure. The data to be printed are a number with eight digits consisting of the number system character, the original UPC-E code with six digits and the check digit: 01234565

Parameter	**Explanation**
Code EAN 4 002343 009005 EAN 13 4015 1595 EAN 8	**Code EAN 13:** European Article Numbering; name of a barcode family which exists in a wide number of versions. With regard to structure, the EAN code is compatible with the American UPC code. The exact code specifications can be found in standard EN 799. EAN 13 takes its name from the maximum number of digits that can be represented with this code. Specification: Numeric code, digits 0...9 can be represented. Each character consists of eleven elements; all bars and spaces carry information. Only 13 characters can be displayed together. Standardized sizes are SC0 through SC9 and Nominal SC2, whereby, in practical use, the code height is often reduced. The clear text line is not intended for machine detection. The EAN 13 code is used across Europe in standardized form in (self-service) product packages, based on the UPC specification. The first two digits carry the national ID (for example, "04" represents Germany, "08" Italy and "03" France); the next five digits specify the company ID within the country, the remaining five digits represent a part no. within the company or manufacturer. The last digit is a check digit. The advantage is the high information density with standardized sizes. The disadvantage is the requirement of very small tolerances. The EAN 13 symbology is divided to two halves of six digits each. These are separated from one another by a delimiter. The 13th digit (first character from left) is not encoded separately in the barcode field, but is instead encrypted within the six characters of the left half of the symbol. In practical use, common sizes are between SC0 and SC3. **Code EAN 8:** Barcode with a specification similar to EAN 13, though only eight digits can be represented together. Like the EAN 13, standardized sizes exist for this code as well (SC0...SC9). The height of this code is not typically shortened, however. EAN 8 is preferred whenever it is not deemed necessary to use the larger EAN 13 on the packages. The meaning of the characters is identical. To achieve the lower number of eight characters, successive zeros are, however, omitted. The EAN 8 symbology is divided to two halves of four digits each. There is a delimiter between the two halves. Advantage is the high information density with standardized sizes and check digit; disadvantage is the requirement of very small tolerances.

Parameter	Explanation
Code 128 A123	Code 128 is a universal, alphanumeric barcode that can represent the entire ASCII character set without character combinations. This is, of course, not directly possible; one must, therefore, distinguish between three character sets: Code A, Code B and Code C. These can be selected depending on the area of application. The character sets can also be mixed, however. There are separate codes for switching between the three character sets. Each character in Code 128 consists of a total of eleven modules that are divided into three bars and three spaces. The bars always consist of an even number (even parity) of modules and the spaces always consist of odd number of modules. The stop character is an exception here and consists of 13 modules (eleven modules and one guard bar with two modules). While Code 128 can use the entire ASCII character set and has a high information density, it has a low error tolerance. The number of data characters is arbitrary, but does, of course, depend on the maximum scanning width. The recommended size for the barcode is a height of at least 6.0 mm or 15% of the barcode length. The symbology is generally: Quiet zone, Code B start character, data characters, check character, stop character, quiet zone. The exact code specifications can be found in standard EN 799. The sum of the modules is always 11, with the exception of the start/stop character (13). Example: Character A: 1+1+1+3+2+3=11 Character B: 1+3+1+3+2+1=11, etc. Code 128 supports multiple reading. As a result, it is possible to encode strings of data characters as barcodes that exceed the maximum scanning width. This method can generally be switched on and off in the scanner. The check digit for Code 128 is calculated according to modulo 103; weighting begins with 1 and is increased by 1 with each character (from left to right). The character used as a check digit is the calculated checksum that corresponds to the associated reference number. Example check digit calculation: Data digits: 123ABC Sum of the reference numbers: 104+1×17+2×18+3×19+4×33+5×34+6+35=726 Modulo 103: 726 / 103 = 7, remainder 5 Characters of reference number 5: % **Code 128 B:** Barcode, which, unlike Code 128, is always started with the "Code B" start character. It is also possible to switch to Code C, though entered digits are not automatically converted to the respective characters. The check digit is calculated in the same way as described for Code 128. **Code 128 C:** Barcode that contains only digits (0 to 9), but which has a higher information density. In the character set, the entered digit pairs correspond to the numbers from 0 to 99 (reference number). Each of these pairs of numbers is coded with a character. The check digit is calculated according to modulo 103; weighting begins with 1 and is increased by 1 with each pair of digits (from left to right). The character used as a check digit is the calculated check number that corresponds to the associated reference number. Character set C of Code 128 allows shorter barcode symbols to be used in certain cases in which several numeric characters follow in sequence. Symbology: Quiet zone, start code C, data digits, check character, stop character, quiet zone. Example Code 128 C: Data digits: 123456 Sum of the reference numbers: 105 + 1×12 + 2×34 + 3×56 = 353 Modulo 103: 353 / 103 = 3, remainder 44 Characters of reference number 44: L

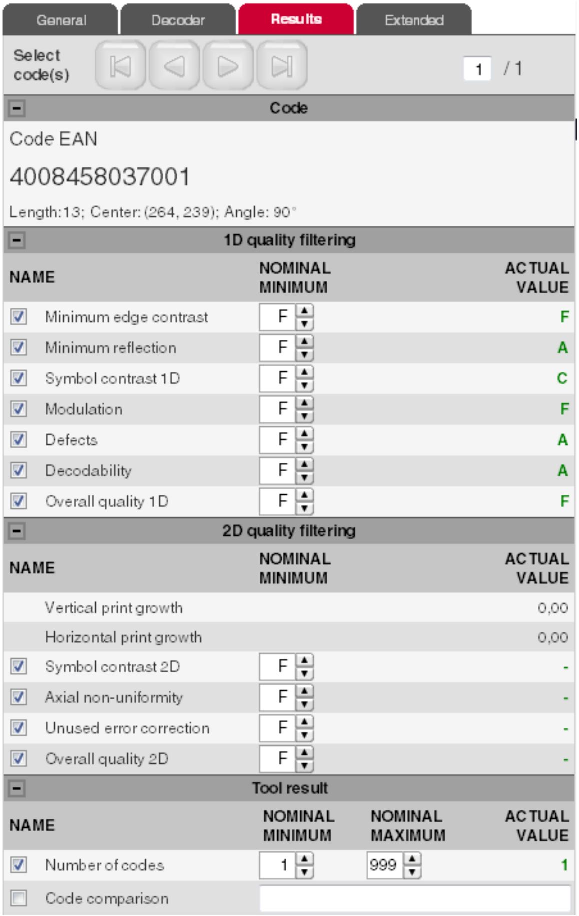
Parameter	Explanation
Codabar 1234	Numeric barcode with six additional special characters. This can be used to represent the following characters: 0 1 2 3 4 5 6 7 8 9 – $: / . + Each character consists of seven elements (bars/spaces). Either two or three wide elements and four or five narrow elements are used to represent the code. The spaces between the characters contain no information. Codabar has a low information density. With a module width of 0.3 mm and a ratio of 1 : 3, for example, 5.5 mm / digit is required. The main areas of use for Codabar are medicinal/clinical applications and photo labs, as well as libraries. It is frequently used to label stored blood. The exact code specifications can be found in standard EN 798(?). Symbology: Quiet zone, start character, data digits, check digit, stop character, quiet zone. The check digit is calculated according to modulo 16; the calculated number is assigned a character from the reference table. Example Codabar: Data digits: 1234 Start and stop, each: A Complete character string: A1234A Reference numbers: 16 1 2 3 4 16 Sum of the reference numbers: 42 Modulo 16: 42 / 16 = 2, remainder 10 Subtracted from 16: 16 – 10 = 6 Check digit for reference number 6: 6 Thus, the entire character string is: A12346A, whereby start/stop characters and check digit do not appear in the clear text line.
"Code parameters" area	
Number of digits	Number of digits in the codes that are to be decoded.
Check digit method	Configuration of the check digit method used to compute the check digit.
Check digit transm.	Selection of the check digit output enables the output of the check digit together with the data characters.
Conversion method for Code 39	Configuration of the conversion method to be applied for Code 39. The "Standard" method stands for the usual Code 39 conversion. The "ASCII" method uses the entire ASCII character set. It extends the usual Code 39 character set. "Standard/ASCII" permits a mixed conversion according to the Standard and ASCII methods.
Conversion UPC-E to UPC-A	Activation of conversion of a UPC-E code to a UPC-A code.
Output EAN 128 header	With Code 128, the output of the EAN 128 header can be activated or deactivated.

Code tool: "Results" parameter group

This parameter group is similar in function to that of the "Attributes" group for BLOB analysis. Here, the desired objects are separated from the undesired objects in the image and the criteria for the tool result are defined.

Notice!

Note that the processing time is extended as the number of attributes that must be checked increases.



Code

Code EAN

4008458037001

Length:13; Center: (264, 239); Angle: 90°

1D quality filtering

	NAME	NOMINAL MINIMUM	ACTUAL VALUE
☑	Minimum edge contrast	F	F
☑	Minimum reflection	F	A
☑	Symbol contrast 1D	F	C
☑	Modulation	F	F
☑	Defects	F	A
☑	Decodability	F	A
☑	Overall quality 1D	F	F

2D quality filtering

	NAME	NOMINAL MINIMUM	ACTUAL VALUE
	Vertical print growth		0,00
	Horizontal print growth		0,00
☑	Symbol contrast 2D	F	-
☑	Axial non-uniformity	F	-
☑	Unused error correction	F	-
☑	Overall quality 2D	F	-

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑	Number of codes	1	999	1
☐	Code comparison			

Figure 3.23: Setting the code attributes

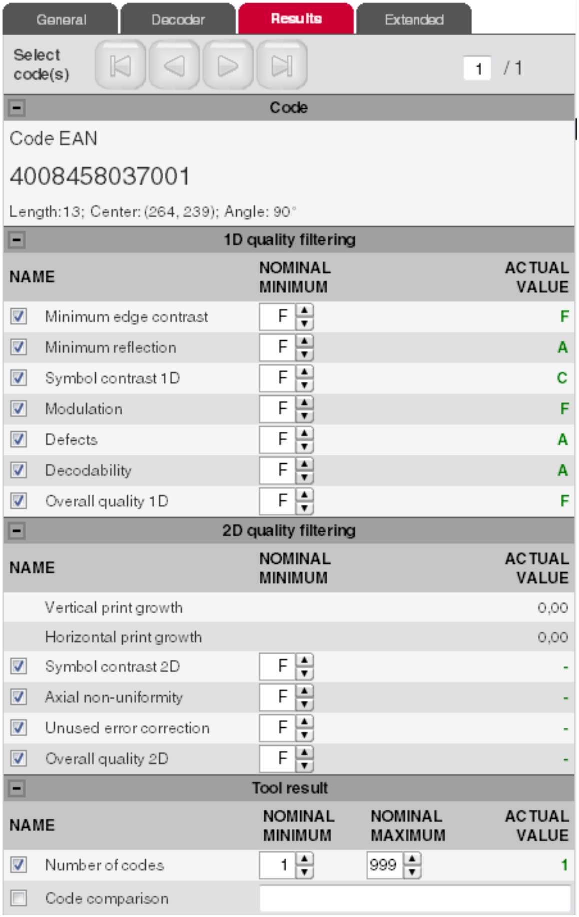
Code analysis is divided into the "Code", "Quality filtering 1D/2D" and "Tool results"areas; these can be opened by clicking on the "-" icon:

1. The "Code" area is used for displaying the current code.
2. The code reading yields a list with active codes. The codes whose properties lie within the borders defined by the quality filter (= actual value in the quality filter list marked in green) are valid codes and are displayed in green in the overlay; the other, invalid codes in the overlay are displayed in red.
3. A second analysis is performed for the valid codes. If, depending on activation, the number of codes in the list and/or the comparison result of these codes lies within the specified borders, the analysis of the tool yields the result OK, otherwise NOK. The actual value of the number of codes is also marked in color in the result list (green = actual value within the defined min/max range, red = actual value outside of the defined min/max range).

Buttons

The button bar contains the following elements:

⏮	Click this button to get to the first code in the list of localized codes.
◁	Click this button to get back to the previous code. Once the start of the codes is reached, focus remains on the first code.
✲	Click this button to change to the overall view.
▷	Click this button to get to the next code. Once the end of the codes is reached, focus remains on the last code.
⏭	Click this button to get to the last code in the list of localized codes.



1 / 1

Code

Code EAN

4008458037001

Length:13; Center: (264, 239); Angle: 90°

1D quality filtering

	NAME	NOMINAL MINIMUM	ACTUAL VALUE
☑	Minimum edge contrast	F	F
☑	Minimum reflection	F	A
☑	Symbol contrast 1D	F	C
☑	Modulation	F	F
☑	Defects	F	A
☑	Decodability	F	A
☑	Overall quality 1D	F	F

2D quality filtering

	NAME	NOMINAL MINIMUM	ACTUAL VALUE
	Vertical print growth		0,00
	Horizontal print growth		0,00
☑	Symbol contrast 2D	F	-
☑	Axial non-uniformity	F	-
☑	Unused error correction	F	-
☑	Overall quality 2D	F	-

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑	Number of codes	1	999	1
☐	Code comparison			

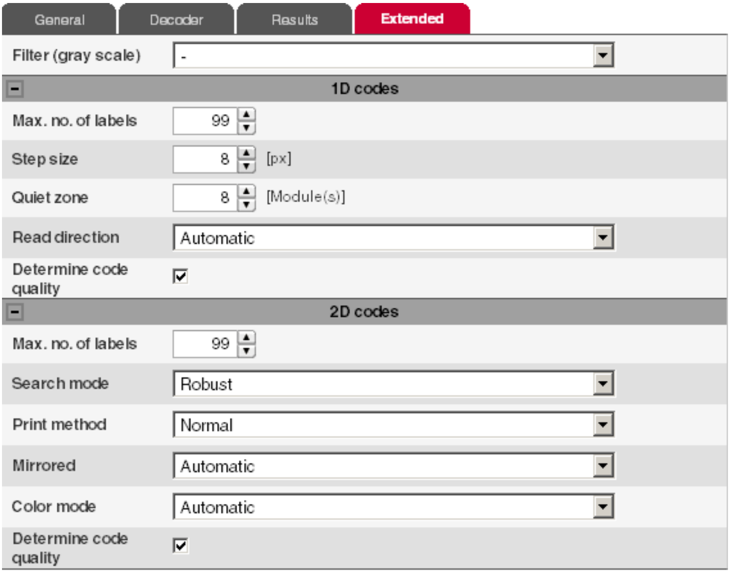
Figure 3.24: Results of the code tool

Parameter	Explanation
1D quality filtering	
Minimum edge contrast	The minimum edge contrast (also called adjacency contrast) is the difference between R_s and R_b of adjacent elements including light zones. The lowest value of an adjacency contrast of a scan reflection profile is the minimum adjacency contrast. $EC = R_s - R_b$
Minimum reflection	Minimum reflection (R_{min}) is the lowest reflection value in the reflection profile. R_{min} should not be greater than 0.5 R_{max}. This parameter shall ensure that R_{min} is not too high and guarantees that an adequate distance exists between background and bar reflection, especially for high values of R_{max}.
Symbol contrast 1D	The symbol contrast is the difference between the highest and the lowest reflection value in a scan reflection profile. $SC = R_{max} - R_{min}$ The value is divided into classes.
Modulation	The modulation is the ratio of minimum edge contrast to symbol contrast, whereby the edge contrast is the difference between the space reflectance and the bar reflectance of adjacent elements. $MOD = EC_{min} / SC$ The value is divided into classes.
Defects	Defects are irregularities within elements or light zones. They are measured as irregularities of the element reflection. An irregular element reflection within a given element or light zone is the difference between the reflection of the global maximum and the reflection of the global minimum. If an element consists of a single maximum or a single minimum, its irregular reflection is equal to zero. The highest value of an irregular element reflection of a scan reflection profile is the maximum irregularity of an element reflection. The degree of a defect is expressed as the ratio of maximum irregularity of an element reflection (ERNmax) to the symbol contrast. $Defects = ERN_{max} / SC$ The value is divided into classes.
Decodability	The decodability of a barcode symbol is a measure of its print accuracy relative to the corresponding reference decoding algorithm. Normally, barcode readers achieve better results with symbols having a higher decodability level than with symbols having a lower decodability. The relevant rules for the nominal measurements of each barcode symbology are specified in the respective symbology specifications. The reference decoding algorithm provides adequate leeway for errors in the printing and reading process through the definition of one or more reference threshold values, which are used when making decisions regarding the element width or other measurements. The value is divided into classes.
Overall quality 1D	The individual results are summarized and classified here. The overall quality corresponds to the poorest ascertained individual quality.
2D quality filtering	
Vertical print growth	The vertical print growth is the percentage deviation from the nominal dimension of the cells. The measurement value is ascertained with the vertical timing cells. A positive value represents enlarged cells; a negative value represents reduced cells.
Horizontal print growth	The horizontal print growth is the percentage deviation from the nominal dimension of the cells. The measurement value is ascertained with the horizontal timing cells. A positive value represents enlarged cells; a negative value represents reduced cells.
Symbol contrast 2D	The symbol contrast is the difference between the highest and the lowest reflection value in a gray-value image. $SC = R_{max} - R_{min}$ The value is divided into classes.

Parameter	Explanation
Axial non-uniformity	Axial non-uniformity provides information on possible horizontal or vertical distortion of the code; it is divided into classes.
Unused error correction	The Data Matrix code includes error correction that can correct errors in individual modules. The sum of the corrected errors is subtracted from the maximum possible number of errors and is then classified as "unused error correction".
Overall quality 2D	The individual results are summarized and classified here. The overall quality corresponds to the poorest ascertained individual quality.
Tool result	
Number of codes	Min: 0 Max: 999 Number of valid codes of a tool. Only if the number is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).
Code comparison	Input field for a comparison with the code contents. Please be certain to enter the code contents exactly.

Code tool: "Extended" parameter group

Located here are further settings for the code tool.



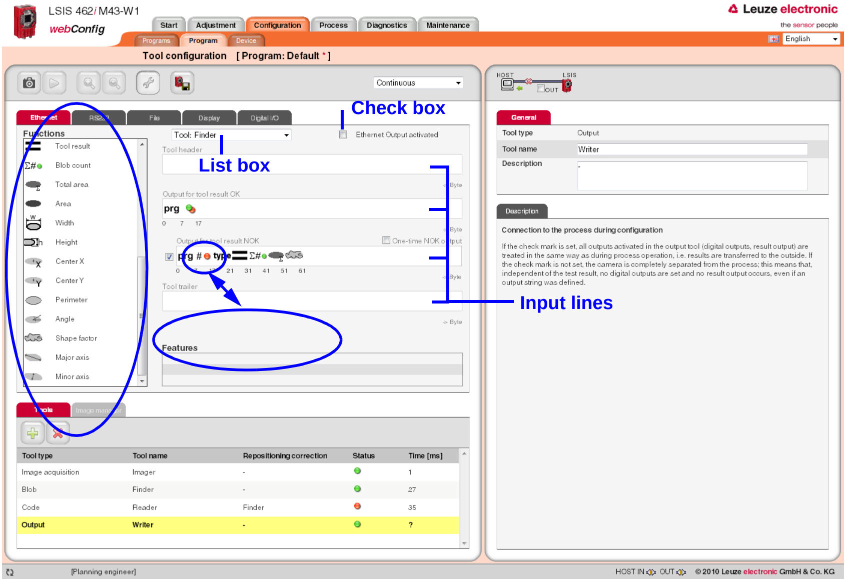
Filter (gray scale)	-
1D codes	
Max. no. of labels	99
Step size	8 [px]
Quiet zone	8 [Module(s)]
Read direction	Automatic
Determine code quality	☑
2D codes	
Max. no. of labels	99
Search mode	Robust
Print method	Normal
Mirrored	Automatic
Color mode	Automatic
Determine code quality	☑

Figure 3.25: Extended settings of the code tool

Parameter	**Explanation**
1D codes	
Filter (gray scale)	The dropdown box enables the use of a filter on the recorded gray-value image.
Max. no. of labels	Data type: UINT16 Min: 0 Max: 99 Default: 99 Defines the maximum number of barcodes that are decoded in a tool.
Step size	Specifies the step size from one decoding line to the next. This value is specified in pixels.
Quiet zone	Defines the size of the quiet zone before the start character and after the stop character in modulus width. The module thickness is the dimension of the narrow/narrowest element (bar or space) in the barcode. A common value when printing the barcode is 10-times the module thickness.
Read direction	Here, you can preset the read direction of the barcode.
Determine code quality	Activation of the code quality for barcodes. The values appear in the Results tab. The values can also be transferred via the interfaces (see Output tool).
2D codes	
Max. no. of labels	Data type: UINT16 Min: 0 Max: 99 Default: 99 The maximum number of 2D codes that are decoded in a tool.
Search mode	Here, you can preset whether the search mode for decoding the 2D codes is to be "fast" or "robust". The "fast" search mode is recommended for decoding high-contrast and large 2D codes. If the 2D codes are low contrast or small, the "robust" search mode should be selected.
Print method	Here, the type of 2D code that is to be decoded can be preset. For 2D codes with square cells, the "normal" setting is recommended. If the cells only appear as dots, the "dot matrix" setting is recommended. This is the case, for example, if the codes are applied with a dot-peen marking device or an inkjet printing system.
Mirrored	Here, you can preset whether the 2D code is printed normally or mirrored. If both are to be detected, select "automatic".
Color mode	Here, you can preset whether the background is white and the dots are black (normal) or if the background is black and the dots are white (inverted). If both can occur, automatic can be selected.
Determine code quality	Activation of the code quality for barcodes. The values appear in the Results tab. The values can also be transferred via the interfaces (see Output tool).

3.3.2.6 *Display of the "Output" tool type*

In addition to the already-listed, tool-type-independent buttons and operational controls, you will find for the "Output" tool in the left window area five tabs for configuring the program-specific output data via various media and interfaces. These are the "Ethernet", "RS 232", "File", "Display" and "Digital I/O" tabs. In the right part of the window, you can optionally enter a name and a description.


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
Ethernet
RS232
File
Display
Digital I/O
Functions
Tool result
Blob count
Total area
Area
Width
Height
Center X
Center Y
Perimeter
Angle
Shape factor
Major axis
Minor axis
Check box
List box
Input lines
Tool header
Output for tool result OK
Output for tool result NOK
One-time NOK output
Tool trailer
Byte
Features
Tools
Image manager
General
Description
HOST IN
OUT
© 2010 Leuze electronic GmbH & Co. KG

Tool configuration [Program: Default *]

Tool: Finder

☐ Ethernet Output activated

prg

☑ prg # type

[Planning engineer]

Tool type: Output

Tool name: Writer

Description: -

Connection to the process during configuration

If the check mark is set, all outputs activated in the output tool (digital outputs, result output) are treated in the same way as during process operation, i.e. results are transferred to the outside. If the check mark is not set, the camera is completely separated from the process; this means that, independent of the test result, no digital outputs are set and no result output occurs, even if an output string was defined.

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	27
Code	Reader	Finder	●	35
Output	**Writer**	**-**	●	**?**

Figure 3.26: Window for configuring the output

" ... Output activated" check box

Only if the respective option is selected is the data output via the corresponding interface, the device display or to a text file. Furthermore, it is possible to assign tool results to programmable digital outputs.

"Structure of the output data" list box

In general, the output is divided into a **header**, into the **output data of the individual tools** of the current check program and into a **trailer**. Here, you can select which part you would like to edit. Delimiters between the individual pieces of data and the use of separate lines increase the "readability" of the output data. If you selected the `BLOB tool` entry here, you will have much more extensive selection and input options in the steps that follow.

List of functions / input lines

Displayed in the left window area is a list of "output functions" with which you can define (independent of output type) what is to be output and in what order. The desired elements can be inserted into and removed from the input lines provided for this purpose at the right by means of drag & drop. Information on the individual elements (date, time etc.) and other possibilities for the specification are available as usual in the right part of the window. Considerably more functions are available for the description of the individual tools than for a header or trailer.

With regard to the input lines of the BLOB or the code tool:

- Parameters entered in the "Tool header" and "Tool trailer" lines are output once.
- Parameters entered in the "Output for tool result ..." lines are output in a dynamically created list.
- These input lines are passed through once for each valid BLOB or each read code. As a result, a table with various parameters for multiple BLOBs or codes can be created. In the case of "Tool result not OK", this list can be reduced by means of the "One-time NOK output" option to exactly one pass to e.g., create a single text output in the event of an NOK case.

Notice!

Please note that the loop is executed for each result (i.e. each BLOB in the BLOB tool, each code in the code tool). If no result is returned, i.e. not a single BLOB or single code was found, the loop is not executed and no output is carried out.

The list of output functions contains the following elements:

General functions

🕒	Time: Time of the check-program evaluation in fixed format, "hh:mm:ss".
31	Date: Date of the check-program evaluation in fixed format, "YYYY-MM-DD".
text	Text: Freely definable text.
!%	Special characters: Output of a single, unprintable character.
prg	Program: Optional entry of the check program name. Can be changed at a later point in time.
●	Global result: Global result (OK/not OK) of the active check program.
#●	Number of good parts: Total number of good parts produced since the last reset (program change).
#●	Number of bad parts: Total number of bad parts produced since the last reset (program change).

BLOB-tool-specific functions

tool	Tool name: Optional input of the tool name. Can be changed at a later point in time.
type	Tool type: Display of the tool type. Cannot be changed.
=	Tool result: Display of the tool result (OK/not OK).
Σ#●	BLOB count: Number of valid BLOBs of a tool. Only if the number is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).

Total area: Total area of all valid BLOBs of a tool. Only if the total area is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).

Area: Prefilter according to BLOB size (in pixels):
Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Width: Prefilter according to width (in pixels) of the smallest rectangle that encloses the BLOB with sides parallel to the horizontal and vertical image border. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Height: Prefilter according to height (in pixels) of the smallest rectangle that encloses the BLOB with sides parallel to the horizontal and vertical image border. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Center X: Prefilter according to the X-coordinate of the BLOB's area centroid. Coordinate origin is the upper left corner of the image. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Center Y: Prefilter according to the Y-coordinate of the BLOB's area centroid. Coordinate origin is the upper left corner of the image. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Perimeter: Prefilter according to the length (in pixels) of the outer contour line of the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Angle: Prefilter according to the angle of the mass centroid axis of the BLOB (0° ... 360°, pointing to the "heavy" side of the BLOB), relative to the X-axis. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Shape factor: Prefilter according to the shape factor. This is the ratio between the area and the perimeter of the BLOB, normalized to values between 0 and 100. The shape factor classifies the geometric shape of the BLOB:
"100" represents a perfect circle, "0" a perfect line. The formula is $(4\pi * \text{area} / \text{perimeter}^2) * 100$. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Major axis: Prefilter according to the length (in pixels) of the major axis, i.e. the length of the smallest rotated rectangle that encloses the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Minor axis: Prefilter according to the length (in pixels) of the minor axis, i.e. the height of the smallest rotated rectangle that encloses the BLOB. Only BLOBs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Code-tool-specific functions

Number of codes:

Min: 0

Max: 999

Number of valid codes of a tool. Only if the number is in the range between MINIMUM and MAXIMUM is the tool result OK (green LED in the tool list).

Code type:

0: No code
1: Code 2/5 interleaved
2: Code 39
6: Code UPC
7: Code EAN
8: Code 128
11: Codabar
32: Datamatrix ECC 200

The code type may include other values between "0" and "64" if they are supported by the firmware.

Center X:

Min: 0.00

Max: 752.00

X-coordinate of the center point of the code. Coordinate origin is the upper left corner of the image.

Center X:

Min: 0.00

Max: 752.00

X-coordinate of the center point of the code. Coordinate origin is the upper left corner of the image.

Angle:

Min: 0.00

Max: 360.00

Angular position of the code (in read direction), relative to the X-axis.

Code length:

Number of digits in the read code.

Code content:

All decoded characters of the read code.

MEC Minimum edge contrast:

The minimum edge contrast (also called adjacency contrast) is the difference between R_s and R_b of adjacent elements including light zones. The lowest value of an adjacency contrast of a scan reflection profile is the minimum adjacency contrast.

$EC = R_s - R_b$

MR Minimum reflection:

Minimum reflection (Rmin) is the lowest reflection value in the reflection profile. R_{min} should not be greater than 0.5 R_{max}. This parameter shall ensure that R_{min} is not too high and guarantees that an adequate distance exists between background and bar reflection, especially for high values of R_{max}.

SC Symbol contrast 1D:

The symbol contrast is the difference between the highest and the lowest reflection value in a scan reflection profile.

$SC = R_{max} - R_{min}$

The value is divided into classes.

MO Modulation:

The modulation is the ratio of minimum edge contrast to symbol contrast, whereby the edge contrast is the difference between the space reflectance and the bar reflectance of adjacent elements.

$MOD = EC_{min} / SC$

The value is divided into classes.

DEF Defects:

Defects are irregularities within elements or light zones. They are measured as irregularities of the element reflection.

An irregular element reflection within a given element or light zone is the difference between the reflection of the global maximum and the reflection of the global minimum. If an element consists of a single maximum or a single minimum, its irregular reflection is equal to zero. The highest value of an irregular element reflection of a scan reflection profile is the maximum irregularity of an element reflection. The degree of a defect is expressed as the ratio of maximum irregularity of an element reflection (ERN_{max}) to the symbol contrast.

$Defects = ERN_{max} / SC$

The value is divided into classes.

DEC Decodability:

The decodability of a barcode symbol is a measure of its print accuracy relative to the corresponding reference decoding algorithm. Normally, barcode readers achieve better results with symbols having a higher decodability level than with symbols having a lower decodability.

The relevant rules for the nominal measurements of each barcode symbology are specified in the respective symbology specifications. The reference decoding algorithm provides adequate leeway for errors in the printing and reading process through the definition of one or more reference threshold values, which are used when making decisions regarding the element width or other measurements.

The value is divided into classes.

ΣQ Overall quality 1D:

The individual results are summarized and classified here. The overall quality corresponds to the poorest ascertained individual quality.

SC Symbol contrast 2D:

The symbol contrast is the difference between the highest and the lowest reflection value in a gray-value image.

$SC = R_{max} - R_{min}$

The value is divided into classes.

AN Axial non-uniformity:

Axial non-uniformity provides information on possible horizontal or vertical distortion of the code; it is divided into classes.

UEC Unused error correction:

The Data Matrix code includes error correction that can correct errors in individual modules. The sum of the corrected errors is subtracted from the maximum possible number of errors and is then classified as "unused error correction".

PGH Horizontal print growth:

The horizontal print growth is the percentage deviation from the nominal dimension of the cells. The measurement value is ascertained with the horizontal timing cells. A positive value represents enlarged cells; a negative value represents reduced cells.

Vertical print growth:

The vertical print growth is the percentage deviation from the nominal dimension of the cells. The measurement value is ascertained with the vertical timing cells. A positive value represents enlarged cells; a negative value represents reduced cells.

Overall quality 2D:

The individual results are summarized and classified here. The overall quality corresponds to the poorest ascertained individual quality.

Code comparison result:

The code comparison result is a value that states whether the code comparison was successful or not.

Features

In this area, you can define options such as length, alignment, fill character, etc. for the function element currently active in the input line. In this way, you achieve better structuring of the output data.

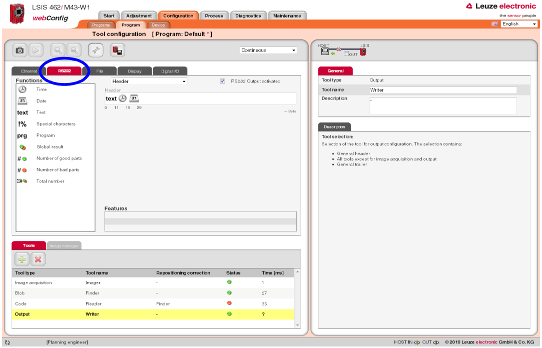
Configuring process-data output

The procedure for configuring process-data output via Ethernet or RS 232 interface, to a text file, or even on the device display is, in principle, always the same. Following the window structure, work through the operational controls from top to bottom and from left to right.

- Activate output (select check box)
- Define the part that is to be edited (header, tools, trailer)
- Add/remove output functions to/from the input line by means of drag&drop
- Specify element options, such as length, alignment, fill character, etc., in the lower part of the Features area
- If necessary, permanently save the settings in the flash memory of the **LSIS 4xx*i*** with the button

Notice!

Notice about deleting icons:
Particularly when working with lower-performance PCs, the following visual acknowledgement assists when deleting elements in the output fields by means of drag&drop: If an icon is clicked on and pulled out of the output field, the output field briefly has a red border. This indicates that the delete function has been activated. If the icon is then "dropped" outside of the field, the delete operation is concluded and the corresponding element is removed from the respective line.



LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Ethernet
RS232
File
Display
Digital I/O
Continuous
Header
Functions
Time
Date
Text
Special characters
Program
Global result
Number of good parts
Number of bad parts
Total number
Features
Tools
Image manager
HOST
LSIS
OUT
English
[Planning engineer]
HOST IN OUT
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Tool configuration [Program: Default *]

☑ RS232 Output activated

General

Tool type: Output

Tool name: Writer

Description: -

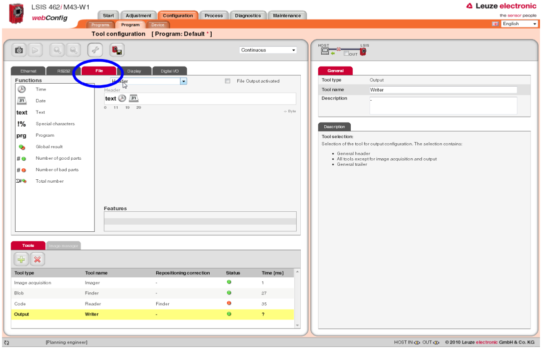
Tool selection:

Selection of the tool for output configuration. The selection contains:

- General header
- All tools except for image acquisition and output
- General trailer

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	27
Code	Reader	Finder	●	35
Output	Writer	-	●	?

Configuring **RS 232** output



LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Ethernet
RS232
File
Display
Digital I/O
Continuous
Header
Functions
Time
Date
Text
Special characters
Program
Global result
Number of good parts
Number of bad parts
Total number
Features
Tools
Image manager
HOST
LSIS
OUT
English
[Planning engineer]
HOST IN OUT
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Tool configuration [Program: Default *]

☐ File Output activated

General

Tool type: Output

Tool name: Writer

Description: -

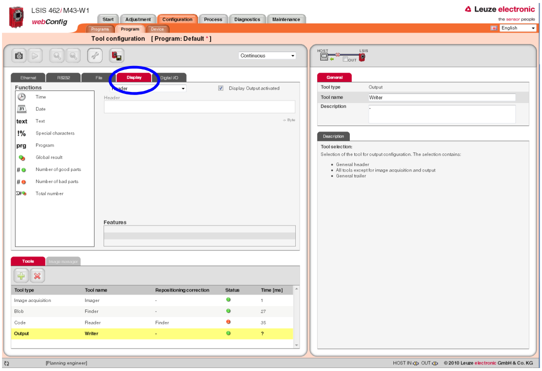
Tool selection:

Selection of the tool for output configuration. The selection contains:

- General header
- All tools except for image acquisition and output
- General trailer

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	27
Code	Reader	Finder	●	35
Output	Writer	-	●	?

Configuring **file** output



LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Ethernet
RS232
File
Display
Digital I/O
Continuous
Header
Functions
Time
Date
Text
Special characters
Program
Global result
Number of good parts
Number of bad parts
Total number
Features
Tools
Image manager
HOST
LSIS
OUT
English
[Planning engineer]
HOST IN OUT
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Tool configuration [Program: Default *]

☑ Display Output activated

General

Tool type: Output

Tool name: Writer

Description: -

Tool selection:

Selection of the tool for output configuration. The selection contains:

- General header
- All tools except for image acquisition and output
- General trailer

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	27
Code	Reader	Finder	●	35
Output	Writer	-	●	?

Configuring **display** output

Note that the area available on the display for output is very limited.
The output data of a new input line overwrites that of the previous input line.

Figure 3.27: Configuring process-data output

General information on outputting to RS 232, Ethernet, file and display

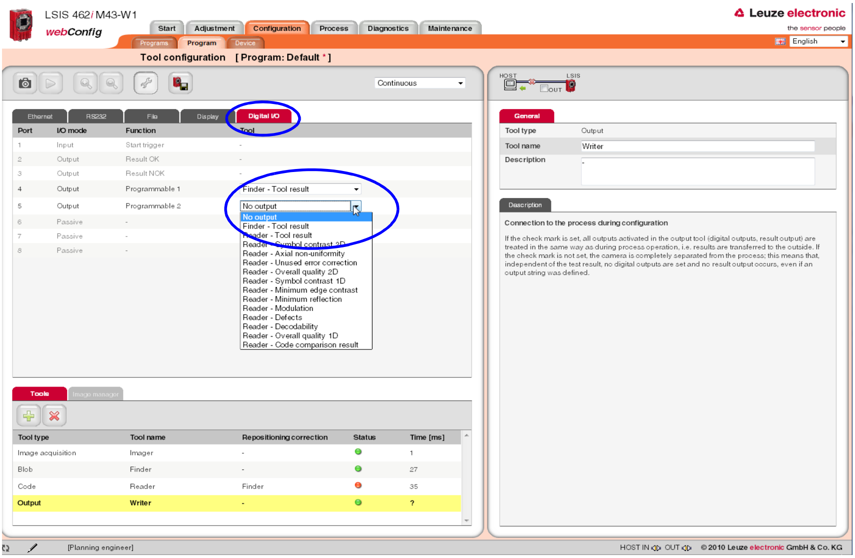
A leading delimiter (";") is always output between any two configured output elements; this delimiter is not taken into account in the tabs displayed here.

Configuring programmable outputs

If you would like to activate the control in the event of specific tool results, you have the option in the "*Digital I/0*" tab of assigning program-specific tool results to programmable outputs. To do this, for the programmable outputs you need only to select program-specific tool results from the list box.

Notice!

Available here are only programmable outputs that were previously configured under "Configuration - Device - Digital I/Os" (standard setting = none)!


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
Ethernet
RS232
File
Display
Digital I/O
HOST
LSIS
OUT
General
Description
Tools
Image manager
No output
Finder - Tool result
Reader - Tool result
Reader - Symbol contrast 2D
Reader - Axial non-uniformity
Reader - Unused error correction
Reader - Overall quality 2D
Reader - Symbol contrast 1D
Reader - Minimum edge contrast
Reader - Minimum reflection
Reader - Modulation
Reader - Defects
Reader - Decodability
Reader - Overall quality 1D
Reader - Code comparison result
HOST IN
OUT
© 2010 Leuze electronic GmbH & Co. KG

Tool configuration [Program: Default *]

Port	I/O mode	Function	Tool
1	Input	Start trigger	-
2	Output	Result OK	-
3	Output	Result NOK	-
4	Output	Programmable 1	Finder - Tool result
5	Output	Programmable 2	No output
6	Passive	-	
7	Passive	-	
8	Passive	-	

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	Imager	-	●	1
Blob	Finder	-	●	27
Code	Reader	Finder	●	35
Output	**Writer**	**-**	●	**?**

[Planning engineer]

Tool type	Output
Tool name	Writer
Description	-

Connection to the process during configuration

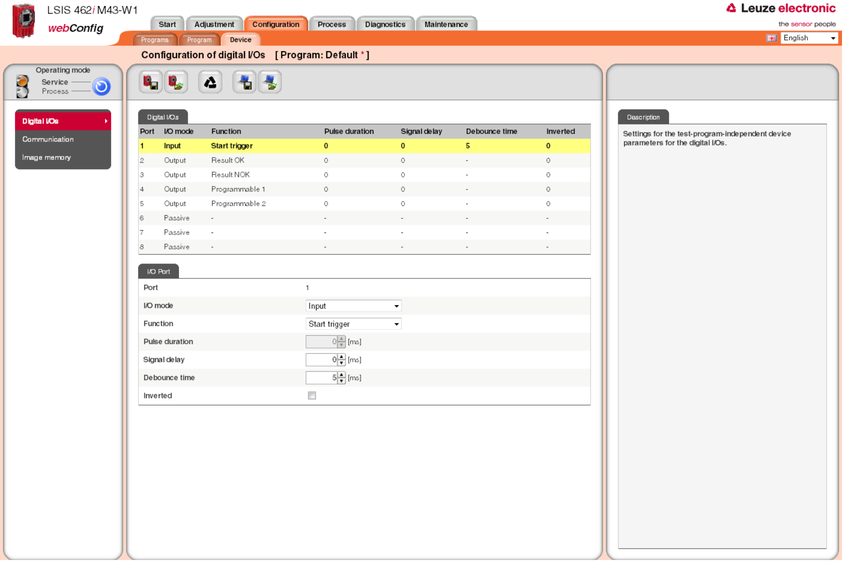
If the check mark is set, all outputs activated in the output tool (digital outputs, result output) are treated in the same way as during process operation, i.e. results are transferred to the outside. If the check mark is not set, the camera is completely separated from the process; this means that, independent of the test result, no digital outputs are set and no result output occurs, even if an output string was defined.

Figure 3.28: Configuring programmable outputs

3.3.3 "Device" tab

This window makes available the device parameters used throughout the check program. Select the respective menu in the left window area to activate the corresponding input window in the middle area. You can then define the settings for the existing digital inputs and outputs, the communication between device and master computer, and the necessary image memory.

The parameters for serial communication, such as baud rate, data mode and handshake, are defined in the "Communication -> RS 232" menu. The IP address, subnet mask and gateway are configured in the "Communication -> Service - Ethernet" menu: Here, you will find the parameters for the Ethernet service interface. The parameters for process data transfer to an external host system via Ethernet can be found in the "Communication -> Process - Ethernet" menu. Defined here, for example, is whether the **LSIS 4xx*i*** performs the server or the client function during TCP/IP communication of if communication occurs via UDP.


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Operating mode
Service
Process
Digital I/Os
Communication
Image memory
Digital I/Os
I/O Port
Description

Configuration of digital I/Os [Program: Default *]

Port	I/O mode	Function	Pulse duration	Signal delay	Debounce time	Inverted
1	Input	Start trigger	0	0	5	0
2	Output	Result OK	0	0	-	0
3	Output	Result NOK	0	0	-	0
4	Output	Programmable 1	0	0	-	0
5	Output	Programmable 2	0	0	-	0
6	Passive	-	-	-	-	-
7	Passive	-	-	-	-	-
8	Passive	-	-	-	-	-

Port	1
I/O mode	Input
Function	Start trigger
Pulse duration	0 [ms]
Signal delay	0 [ms]
Debounce time	5 [ms]
Inverted	☐

Settings for the test-program-independent device parameters for the digital I/Os.

Figure 3.29: "Configuration" module, "Device" tab

Buttons

The button bar contains the following elements:

After pressing this button, all changes to the parameters are saved in the flash memory of the **LSIS 4xx*i***.

Pressing this button discards all changes by reloading the device parameters saved in the flash memory of the **LSIS 4xx*i***.

Pressing this button resets the device parameter to the original state.

After pressing this button, the parameters from the flash memory are made available for download.

Pressing this button loads device data from the PC to the **LSIS 4xx*i*** flash memory.

3.3.3.1 "Digital I/Os" menu

The parameters of the digital inputs and outputs are set here. In the top part of the middle window, all eight digital I/Os are displayed in a list. The associated parameters are set in the bottom part of the window with the aid of list boxes, input fields and check boxes. A pencil icon in the status bar alerts you of any unsaved changes to the device parameters.

"I/O Port" parameter group

Parameter	Explanation
Port	Number of the selected digital input/output.
I/O mode	Possible functions of the digital ports: **Passive** **Input** **Output**

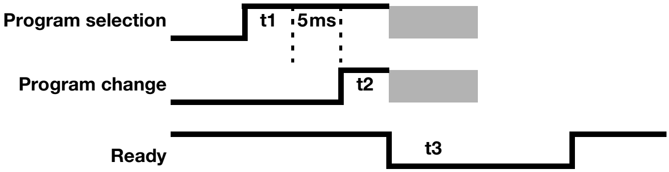
Parameter	Explanation
Function	Notice! *Further important details on the following functions are provided at the end of this table for the sake of clarity.*
	Possible functions for inputs: **Trigger** Trigger input for image acquisition **Program selection, bit n** External check-program preselection Can only be set in logical order (1, 2, 3, …) Can only be reset in logical order (…, 3, 2, 1) **Program change** Acceptance bit for program changeover Can only be selected if at least one program selection bit is present. The "program change" signal causes the check program encoded by the check-program bit to be loaded at the earliest possible time. If the signal is set during a running test, this test is allowed to run to completion and be evaluated in the normal way. The system then immediately switches to the new check program. In this context, the debounce times assigned to the input signals are to be observed. For further information, see chapter "Additional information on the functions of the digital I/Os".
	Possible functions for outputs: Notice! *Available here are only programmable outputs that were previously configured under "Configuration - Device - Digital I/Os" (standard setting = none)!* **Result OK/NOK** Overall result (AND-link of the results of the individual tools) **Ready** Ready for testing, trigger can be processed. The following applies during process operation: If a trigger signal is received while a check program is being processed, i.e. while the device is not ready for testing, a "Lost trigger" warning is entered in the diagnostic log **Programmable** Output is used by image processing tools **External flash** Trigger pulse for external flash module (pulse duration corresponds to shutter speed) **Device error** Signals an error at the device
	Possible functions for passive ports: digital port has no function.
Pulse duration [ms]	Only possible for the "**Result OK/NOK**" and "**Programmable**" functions). Only values between 0 and 2500 can be entered. If a value that is too large is entered, "2500" is displayed. The value represents the pulse length of the output, "0" means "static" and allows the output to remain pending until the next trigger.
Signal delay [ms]	Only possible for the "**Trigger**", "**Ready**", "**Result OK/NOK**" and "**Programmable**" functions). With "**Trigger**": Delayed image acquisition after the rising edge of the trigger pulse. The trigger pulse must be applied for at least the duration of the signal delay. For output signals: Start-up delay of the output signal. Only values between 0 and 2500 can be entered. If a value that is too large is entered, "2500" is displayed.
Debounce time [ms]	Only possible for "**Trigger**", "**Program selection**" and "**Program change**". Minimum pulse length of an input signal; shorter pulses (interference due to nearby electromagnetic oscillations) are ignored. Only values between 0 and 100 can be entered. If a value that is too large is entered, "100" is displayed.
Inverted	For **outputs**: Signal is inverted For **trigger**: Input responds to falling edge

Additional information on the functions of the digital I/Os

Program change - debounce times

- In the simplest case (debounce times = 0), the signals for "program selection" should be applied for at least 5ms before the "program change" signal is set.
- If the debounce times of the input signals are not equal to 0, the "Program selection" signal is activated no sooner than after the set debounce time t1 + 5ms has elapsed, i.e. the "Program change" signal cannot be set before this time. However, this, too, is not active until after debounce time t2 has elapsed.
  Thus, the minimum pulse length of the program selection signals = 5ms + t1 + t2.

While the new check program is being loaded, an inactive "ready" indicates that no trigger signals can be processed.



t1/t2 = debounce time
t3 = loading time of a new check program

Max. number of externally selectable programs: 64 (via 6 bit).

A certain input function (trigger, program selection bit x, program change) may only be assigned to one port at a time.

Notice on automatically changing check programs via digital inputs:

In the "Configuration-> Programs" tab, the check programs are first created and assigned a selection ID. At least two programs must be created with an individual selection ID (0 and 1). With n bits, 2^n *different states can be represented. For example, with two bits,* $2^2 = 4$ *different check programs can be addressed – specifically: 00 (0), 01 (1), 10 (2) and 11 (3).*

In the "Configuration-> Device" tab, the digital inputs for the program-selection bits and for the program change are defined.

Save the configuration in the **LSIS 4xx*i*** and switch to Process mode.

Following program selection via the corresponding program-selection bits, the "program change" input must be activated.

The program changeover now occurs. Depending on the focus setting range, program changeover may take a few seconds. The new check program, with all illumination and analysis settings, is loaded and the motor-driven focus moves to the check-program-specific position.

For the following reasons, the automatic check program change is intended only for lot changes, and not constantly during the process:

- The stepping motor for moving the objective is designed for max. 10,000 movement cycles
- On every tenth movement operation, the stepping motor also travels via a reference position for synchronization. During the process, this would result in a considerably longer change time (several seconds) on every tenth program change.
  Comment: A movement cycle consists of two movement operations. It follows that a reference movement consists of one cycle, and a normal movement to a new focus position consists of a half cycle.

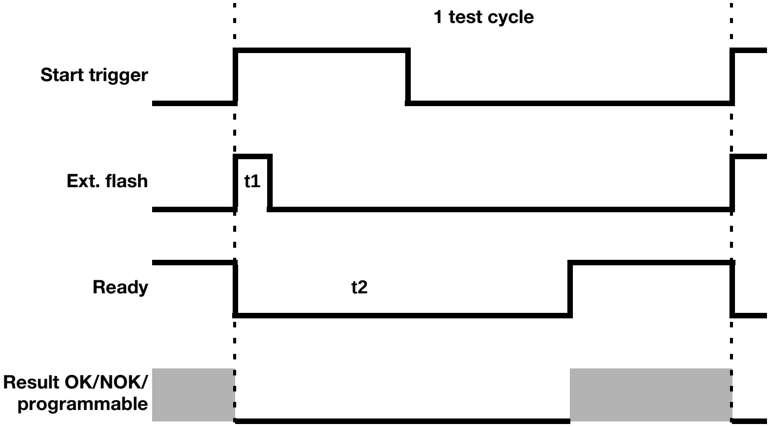
Dependencies and time behavior of the inputs / outputs

For the sake of clarity, the individual signal curves for "signal delay = 0" and "pulse duration = static" are displayed.

For "signal delay not equal to 0", the trigger signal triggers image acquisition with a corresponding delay / sets the affected outputs with a corresponding delay.

For "pulse duration not equal to static", the corresponding outputs are reset after the corresponding time.

The "Device error" output remains pending statically.



t1 = shutter time
t2 = execution time of check program

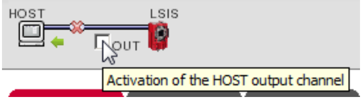
Notice!

As an alternative to the digital trigger input, the RS 232 or Ethernet interface can also be used for triggering or changing the check program in the "Process" operating mode.
For ***triggering****, the "+" character must be sent to the* ***LSIS 4xxi*** *via RS 232 or the defined Ethernet process interface.*

*To **change the check program**, the "GAI=xxx" command is sent to the **LSIS 4xxi** via the RS 232 or the defined Ethernet process interface. Here, "xxx" stands for the selection ID of the check program in the program list.*
After successfully changing to a different check program, the device sends the "GS=00" character string as confirmation. A value not equal to "00" signals an error.

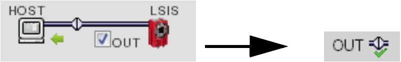
Notice!

***Effects of the "Process coupling"** check box*



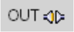
With respect to the digital outputs and the RS 232 and Ethernet communication, deactivating this check box has the same effect as mechanically disconnecting the plug:

- If the check box is active (check set), the outputs function in the same way as during process operation.



Display in the status line

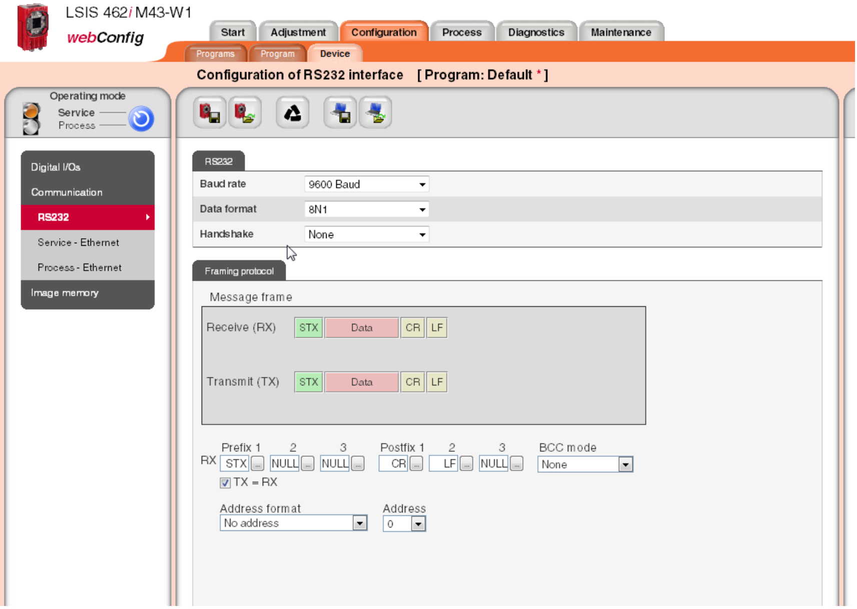
- If the check box is passive (no check set), the outputs are deactivated (0V) and the RS 232 or Ethernet output suppressed.
  Exception: The "tunneled" output for controlling an external flash is always active.



Display in the status line

3.3.3.2 "Communication -> RS 232" menu

The RS 232 interface is configured in this window.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Operating mode
Service
Process
Digital I/Os
Communication
RS232
Service - Ethernet
Process - Ethernet
Image memory
RS232
Framing protocol
Message frame
STX
Data
CR
LF

Configuration of RS232 interface [Program: Default *]

Baud rate: 9600 Baud
Data format: 8N1
Handshake: None

Receive (RX): STX Data CR LF
Transmit (TX): STX Data CR LF

RX Prefix 1: STX, 2: NULL, 3: NULL; Postfix 1: CR, 2: LF, 3: NULL; BCC mode: None
☑ TX = RX
Address format: No address
Address: 0

Figure 3.30: "Configuration" module, "Device" tab – "RS 232" communication

"RS 232" parameter group

Parameter	Explanation
Baud rate	Selection of the serial communication baud rate. The baud rate specifies the speed of the data transmission. It must be identical on transmitter and receiver side in order to enable communication.
Data format	Selection of the serial communication data mode. This is specified with the number of data bits, parity and number of stop bits. For example, "8N1" means 8 data bits, no parity, 1 stop bit.
Handshake	Selection of the serial communication handshake.

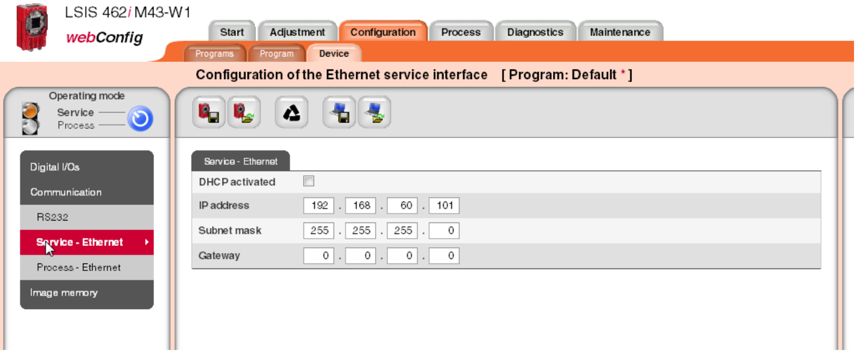
"*Framing protocol*" parameter group

The framing protocol is a character-based protocol for the transmission of 7-bit ASCII characters. It groups the characters to be transmitted into a datablock and frames the block with control characters. Various block checking methods are optionally available for protecting the integrity of the data.

Parameter	Explanation
Prefix 1	Minimum: 0 Maximum: 127 Default: 2 Data type: UINT 8
Prefix 2	Minimum: 0 Maximum: 127 Default: 0 Data type: UINT 8
Prefix 2	Minimum: 0 Maximum: 127 Default: 0 Data type: UINT 8
Postfix 1	Minimum: 0 Maximum: 127 Default: 13 Data type: UINT 8
Postfix 2	Minimum: 0 Maximum: 127 Default: 10 Data type: UINT 8
Postfix 3	Minimum: 0 Maximum: 127 Default: 0 Data type: UINT 8
BCC mode	Minimum: none Maximum: BCC mode 11 Default: none Data type: UINT 8 Computation algorithm for the receive check characters of the respective interface. In order to detect transmission errors, it is possible to add a check character to the message. The check character is computed from the data in a message. A transmission error can be detected by the receiver recomputing the same computation and comparing its check character with the check character received.
Address format	Minimum: no address Maximum: auto. address Default: no address Data type: UINT 8 Address format of the address of the serial interface. The address identifies the receiver or transmitter of a message. In this context, all participants have different addresses.
Address	Minimum: 0 Maximum: 32 Default: 0 Data type: UINT 8 The address identifies a single device within a network. The device can be addressed in the framing protocol via this address.

3.3.3.3 "Communication -> Service - Ethernet" menu

The Ethernet service interface can be set here.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Operating mode
Service
Process
Digital I/Os
Communication
RS232
Service - Ethernet
Process - Ethernet
Image memory
Service - Ethernet

Configuration of the Ethernet service interface [Program: Default *]

DHCP activated ☐
IP address 192 . 168 . 60 . 101
Subnet mask 255 . 255 . 255 . 0
Gateway 0 . 0 . 0 . 0

Figure 3.31: "Configuration" module, "Device" tab – "Service - Ethernet" communication

Notice!

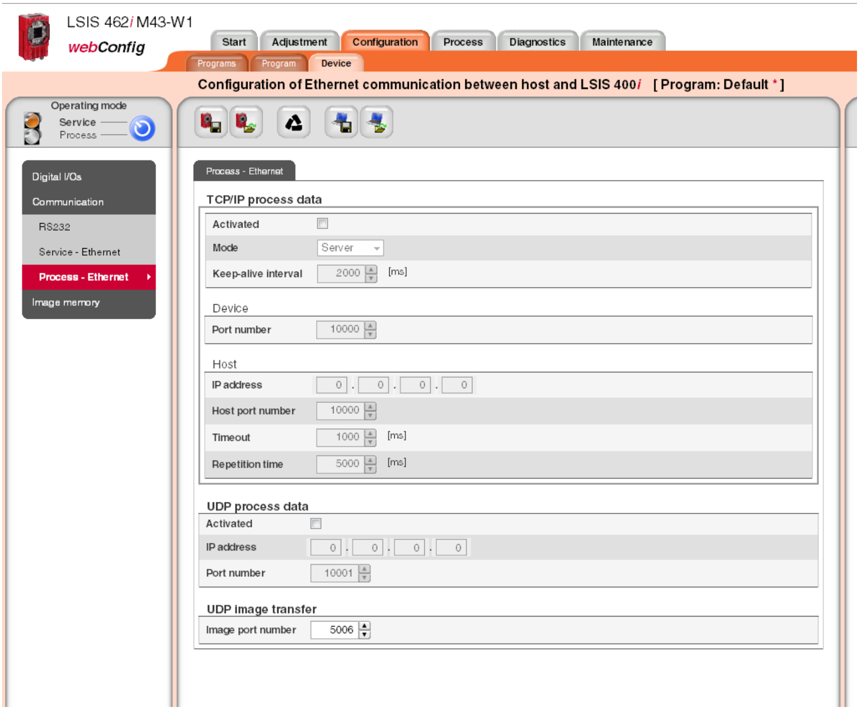
Upon changing the IP address, it is necessary to save the settings and restart the device in order to work effectively with the new address.
After restarting the device, it can then only be reached via the new address.

"Service - Ethernet" parameter group

Parameter	Explanation
DHCP activated	If set, TCP/IP parameters are determined by a DHCP server.
IP address	The IP address is used as a unique address for the device in an IP network. It consists of a 32 bit value that is subdivided into four 8 bit values each. These can each have a value of 0 to 255.
Subnet mask	The subnet mask is used to identify the subnet part of the IP address. It has the same length as the IP address (32 bits), and, in binary form, must consist of a sequence of 1-bits followed by 0-bits. It is normally entered in the same format as an IP address - four numbers, each from 0 to 255.
Gateway	The gateway address identifies a particular device in an IP (sub-)net that acts as a gateway to other (sub-)nets. The address is only required when communication across network boundaries is necessary.

3.3.3.4 *"Communication -> Process - Ethernet" menu*

In this window, you will find parameters for process data transfer via Ethernet. Defined here, for example, is whether the **LSIS 4xx*i*** performs the server or the client function during TCP/IP communication of if communication occurs via UDP.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Operating mode
Service
Process
Digital I/Os
Communication
RS232
Service - Ethernet
Process - Ethernet
Image memory
Process - Ethernet

Configuration of Ethernet communication between host and LSIS 400*i* [Program: Default *]

TCP/IP process data

Activated ☐

Mode: Server

Keep-alive interval: 2000 [ms]

Device

Port number: 10000

Host

IP address: 0 . 0 . 0 . 0

Host port number: 10000

Timeout: 1000 [ms]

Repetition time: 5000 [ms]

UDP process data

Activated ☐

IP address: 0 . 0 . 0 . 0

Port number: 10001

UDP image transfer

Image port number: 5006

Figure 3.32: "Configuration" module, "Device" tab – "Process - Ethernet" communication

"Process - Ethernet-> TCP/IP process data transfer" parameter group - LSIS in server mode (default)

In TCP server mode, the primary host system (PC / PLC) actively establishes the connection and the connected **LSIS 4xx*i*** waits for the connection to be made. The TCP/IP stack must be informed by the user as to the local port of the **LSIS 4xx*i*** (port number) on which connection requests from a client application (host system) are to be received. If a connection request and connection setup are pending from the primary host system (PC / PLC as client), the **LSIS 4xx*i*** (server mode) accepts the connection,enabling the sending and reception of data.

Parameter	Explanation
TCP/IP process data	
Activated	Data type: BOOL Default: false Host TCP/IP communication activated.
Mode	TCP/IP mode: Data type: ENUM Min: server Max: client Default: server Mode of the host TCP/IP communication.
Keep-alive interval	Keep-alive interval: Data type: UINT16 Min: 0 [ms] Max: 65535 [ms] Default: 2000 [ms] In order for the device to determine whether the connection to the host still exists, keep-alive messages, which are answered by the host, can be cyclically transmitted. This parameter defines the time interval [ms] in which the keep-alive messages are transmitted. A value of 0 deactivates the transmission of keep-alive messages.
Device	
Port number	Port number: Data type: UINT16 Min: 0 Max: 65535 Default: 10000 The LSIS400i is waiting for connections from the host at this port number. The corresponding IP address is set under the 'Service - Ethernet' menu item.

"Process - Ethernet-> TCP/IP process data transfer" parameter group - LSIS in client mode

In TCP client mode, the **LSIS 4xx*i*** actively establishes the connection to the primary host system (PC / PLC as server). The **LSIS 4xx*i*** requires from the user the IP address of the server (host system) and the port number on which the server (host system) accepts a connection. In this case, the **LSIS 4xx*i*** determines when and with whom a connection is established!

Parameter	Explanation
TCP/IP process data	
Activated	Data type: BOOL Default: false Host TCP/IP communication activated.
Mode	TCP/IP mode: Data type: ENUM Min: server Max: client Default: server Mode of the host TCP/IP communication.
Keep-alive interval	Keep-alive interval: Data type: UINT16 Min: 0 [ms] Max: 65535 [ms] Default: 2000 [ms] In order for the device to determine whether the connection to the host still exists, keep-alive messages, which are answered by the host, can be cyclically transmitted. This parameter defines the time interval [ms] in which the keep-alive messages are transmitted. A value of 0 deactivates the transmission of keep-alive messages.
Host	
IP address	Host IP address for LSIS400i connection to the host in client mode.
Host port number	Host port number: Data type: UINT16 Min: 0 Max: 65535 Default: 10000 Host port number for LSIS400i connection to the host in client mode.
Timeout	Timeout: Data type: UINT16 Min: 100 Max: 60000 Default: 1000 After this time passes, the LSIS400i terminates its attempt to establish a connection to the host.
Repetition time	Repetition time: Data type: UINT16 Min: 100 Max: 60000 Default: 5000 If a connection cannot be established to the host, the device waits this amount of time before the next attempt.

"Process - Ethernet-> UDP process data transfer" parameter group

Communication via UDP

The **LSIS 4xx*i*** requires from the user the IP address and the port number of the communication partner. In the same way, the host system (PC / PLC) now also requires the set IP address of the **LSIS 4xx*i*** and the selected port number. By means of these parameter assignments, a socket is created via which the data can be sent and received.

Parameter	Explanation
UDP process data	
Activated	Activated: Data type: BOOL Default: false Host UDP communication activated.
IP address	Host IP address for UDP communication.
Port number	Port number: Data type: UINT16 Min: 0 Max: 65535 Default: 10001 Host port number for UDP communication.

"Process - Ethernet-> UDP image transfer" parameter group

Parameter	Explanation
UDP image transfer	
Image port number	Image port number: Data type: UINT16 Min: 0 Max: 65535 Default: 5006 The image port number specifies via which port an image request from an external control is read and the recorded image is transferred. Upon request from a PLC or PC, the "get img" command then transfers the last recorded image via Ethernet (UDP). Prerequisite for this is that the "Enable image transfer" option be selected for the image acquisition tool (see section ""Enable image transfer" check box" on page 29). The corresponding IP address is set under the 'Service - Ethernet' menu item.

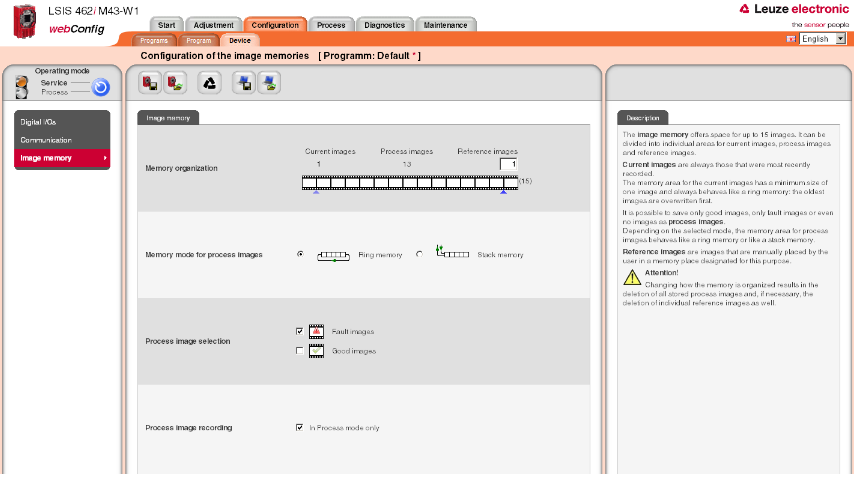
3.3.3.5 "Image memory" menu

The internal image memory is used for quickly logging process images (fault images/good images) as well as permanently saving reference images. You can configure the image memory by first organizing the memory and then defining the storage mode, selection and recording for the process images.

Notice!

Process images are stored in RAM memory and are deleted if power is lost. Reference images are stored in non-volatile FLASH memory and are retained if power is lost.

Process images are automatically created according to the settings made here – reference images, on the other hand, are only stored if requested by the user in the "Image manager" tab in the "Configuration - program" area (see page 26).


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Operating mode
Service
Process
Digital I/Os
Communication
Image memory
Image memory
Description

Configuration of the image memories [Programm: Default *]

Memory organization: Current images 1, Process images 13, Reference images 1 (15)

Memory mode for process images: ● Ring memory ○ Stack memory

Process image selection: ☑ Fault images ☐ Good images

Process image recording: ☑ In Process mode only

The **image memory** offers space for up to 15 images. It can be divided into individual areas for current images, process images and reference images.

Current images are always those that were most recently recorded.
The memory area for the current images has a minimum size of one image and always behaves like a ring memory: the oldest images are overwritten first.

It is possible to save only good images, only fault images or even no images as **process images**.
Depending on the selected mode, the memory area for process images behaves like a ring memory or like a stack memory.

Reference images are images that are manually placed by the user in a memory place designated for this purpose.

Attention!
Changing how the memory is organized results in the deletion of all stored process images and, if necessary, the deletion of individual reference images as well.

Figure 3.33: "Configuration" module, "Device" tab – Image memory

Notice!

Changing how the memory is organized results in the deletion of all saved process images and, if necessary, the deletion of individual reference images as well.

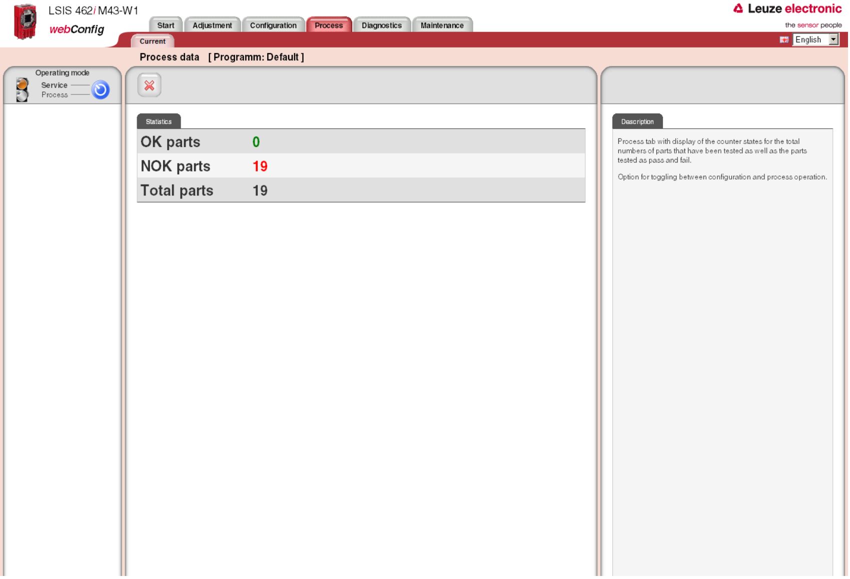
"*Image memory*" *parameter group*

Parameter	**Explanation**
Memory organization	Displayed in the film strip are a current image and 14 process and reference images. Each image is labeled with a time stamp that uniquely identifies it. Process images are displayed with a green or red frame, depending on whether they resulted in a good or bad test result at the time they were taken. The reference images are stored permanently in the flash memory of the LSIS. In order to store a new reference image, there must be at least one free space available in the memory range that is configured for reference images. **Attention!** Changing how the memory is organized results in the deletion of all stored process images and, if necessary, the deletion of individual reference images as well.
Memory mode for process images	Select from the following options: **Ring memory** – the oldest images are overwritten first. I.e. this option is used for evaluating the most recently recorded images. **Stack memory** – only the last image is updated. This is used for evaluating the first recorded images.
Process image selection	The following options are made available by selecting the check boxes: Only **Good images**, only **Fault images**, **all** or **none**.
Process image recording	Here, you can select whether recording of the process images occurs only in Process mode or in Configuration mode as well.

3.4 "Process" module

In the "Process data" window, current production operation is depicted with a display of the counter states for the total number of parts that have been tested as well as the parts tested as OK and NOK. Please note that the data may be displayed with a time delay depending on the current processing speed and the type of data being displayed.

With the appropriate authority level, you have the option here of selecting between Process and Service mode by clicking the respective term or the button in the left area. In addition, you can set the counter to zero.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Leuze electronic
the sensor people
Current
English
Process data [Programm: Default]
Operating mode
Service
Process
Statistics
Description

Statistics	
OK parts	0
NOK parts	19
Total parts	19

Process tab with display of the counter states for the total numbers of parts that have been tested as well as the parts tested as pass and fail.

Option for toggling between configuration and process operation.

Figure 3.34: User interface of the "Process" module

The button bar contains the following element:

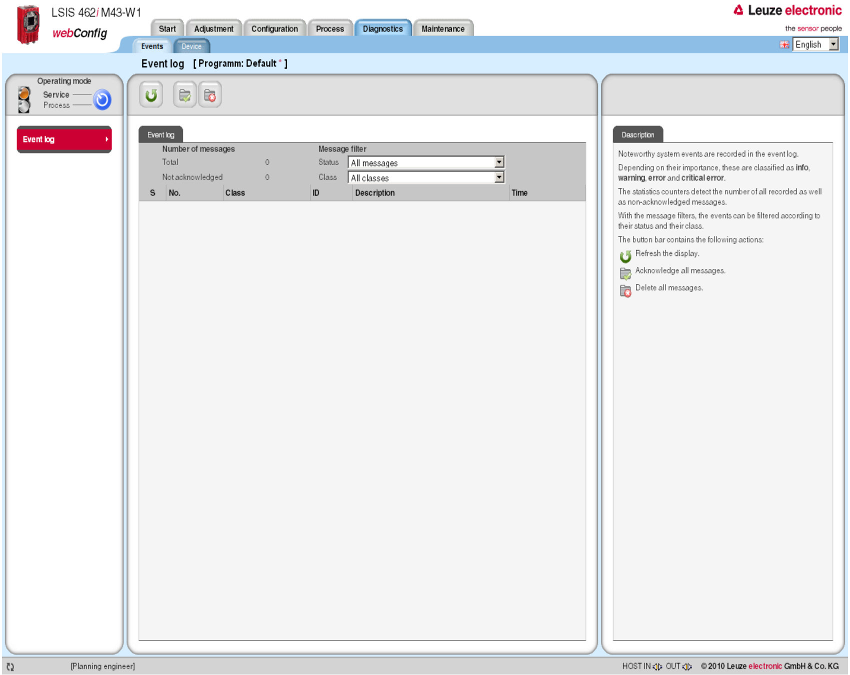
☒ Pressing this button resets the values.

3.5 "Diagnostics" module

The "Diagnostics" module is used for logging events and output data.

Noteworthy system events are recorded in an event log. Depending on their importance, these are classified as warning, error or info. Errors result in a red PWR-LED; in addition, an assigned output is set. The output data is recorded in a log file, the format of which was configured previously in the output tool of the check programs, see page 23et seq.

Preliminary information on the respective error message can be found in the right window area.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Leuze electronic
the sensor people
English
Events
Device
Operating mode
Service
Process
Event log
Description
[Planning engineer]
HOST IN
OUT
©2010 Leuze electronic GmbH & Co. KG

Event log [Programm: Default *]

Event log

Number of messages
Total 0
Not acknowledged 0

Message filter
Status: All messages
Class: All classes

S	No.	Class	ID	Description	Time

Noteworthy system events are recorded in the event log.

Depending on their importance, these are classified as **info**, **warning**, **error** and **critical error**.

The statistics counters detect the number of all recorded as well as non-acknowledged messages.

With the message filters, the events can be filtered according to their status and their class.

The button bar contains the following actions:

- Refresh the display.
- Acknowledge all messages.
- Delete all messages.

Figure 3.35: User interface of the "Diagnostics" module

Logs are displayed and configured in the "Events" and "Device" tabs.

3.5.1 "Events" tab

The event log is displayed in this window. The number of all recorded as well as non-acknowledged messages is recorded in a statistics counter.

Notice!

Please note that the error memory only contains 25 entries; the total number is, however, counted until the next reset.

To select events according to their status and their class, select the required message filter from a list box.

Notice!

By default, only warnings and errors are displayed, not information.

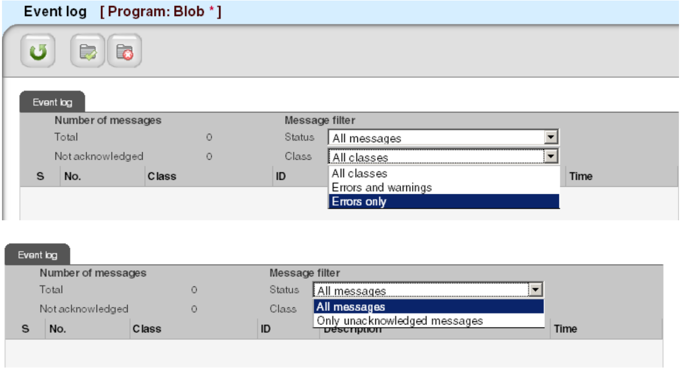

Event log [Program: Blob *]
Event log
Number of messages
Total 0
Not acknowledged 0
Message filter
Status All messages
Class All classes
S
No.
Class
ID
Description
Time
All classes
Errors and warnings
Errors only
All messages
Only unacknowledged messages

Figure 3.36: Event selection according to status and class

Use the corresponding buttons to update the display, acknowledge messages and – provided you have the necessary authorization – also delete messages.

Buttons

The button bar contains the following elements:

Refresh the display.

Acknowledge all messages.

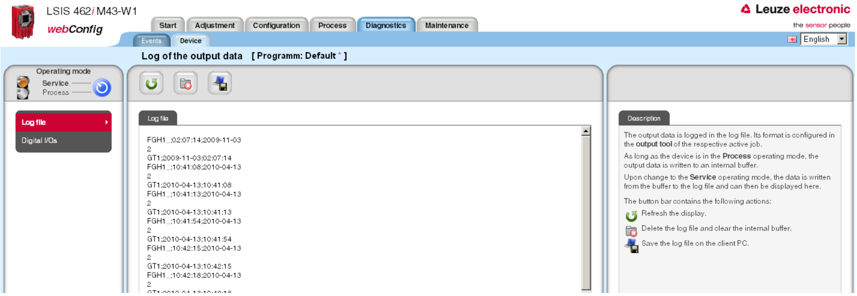
Delete all messages.

3.5.2 "Device" tab

The log of the output data is displayed in the "Device" tab. The display corresponds to the settings made previously in the output tool of the check programs for file output, see page 23 et seq.

Notice!

As long as the device is in the ***Process*** *operating mode, the output data is written to an internal buffer. Only upon changing to the* ***Service*** *operating mode are the data written from the buffer to the log file. The data can then be displayed here.*


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Leuze electronic
the sensor people
Events
Device
English
Operating mode
Service
Process
Log file
Digital I/Os
Log file
Description

Log of the output data [Programm: Default *]

```
FGH1_;02:07:14;2009-11-03
2
GT1;2009-11-03;02:07:14
FGH1_;10:41:08;2010-04-13
2
GT1;2010-04-13;10:41:08
FGH1_;10:41:13;2010-04-13
2
GT1;2010-04-13;10:41:13
FGH1_;10:41:54;2010-04-13
2
GT1;2010-04-13;10:41:54
FGH1_;10:42:15;2010-04-13
2
GT1;2010-04-13;10:42:15
FGH1_;10:42:18;2010-04-13
2
```

The output data is logged in the log file. Its format is configured in the **output tool** of the respective active job.

As long as the device is in the **Process** operating mode, the output data is written to an internal buffer.

Upon change to the **Service** operating mode, the data is written from the buffer to the log file and can then be displayed here.

The button bar contains the following actions:

- Refresh the display.
- Delete the log file and clear the internal buffer.
- Save the log file on the client PC.

Figure 3.37: "Diagnostics" module, "Device" tab

3.5.2.1 "Log file" menu

The output data is logged in the log file. As long as the device is in the Process operating mode, the output data is written to an internal buffer. Upon change to the Service operating mode, the data is written from the buffer to the log file and can then be displayed here. The maximum size of the log file is 500 kB.

Notice!

The format of the log file is configured in the output tool of the check programs.

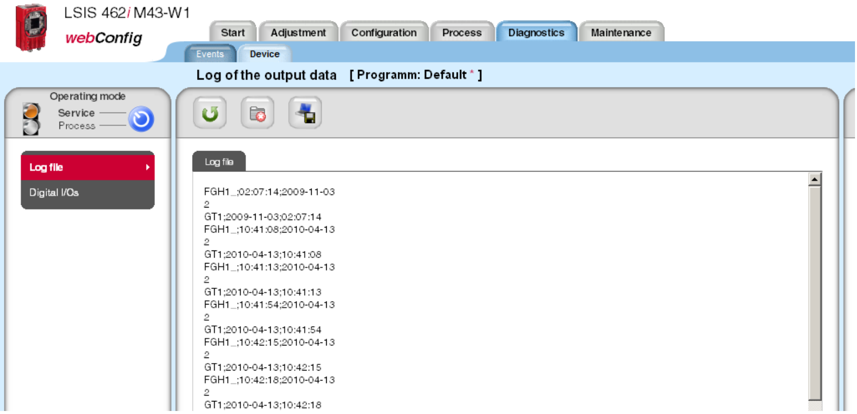
Buttons

The button bar contains the following elements:

Refresh the display.

Delete the log file and clear the internal buffer.

Save the log file on the client PC.

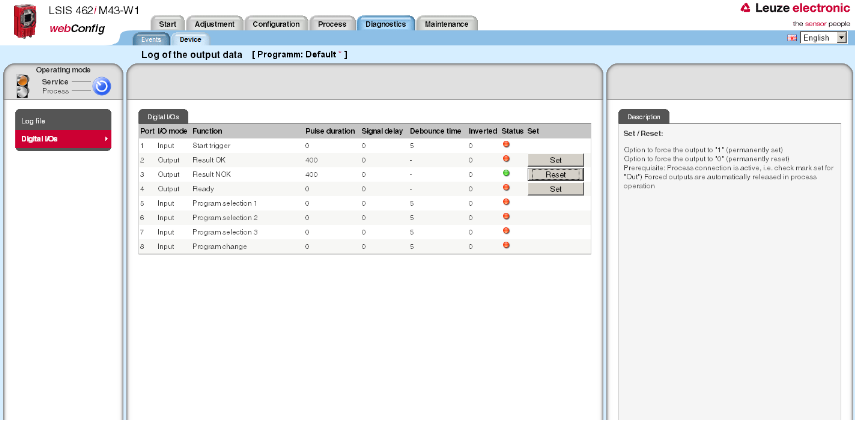

LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Events
Device
Log of the output data [Programm: Default *]
Operating mode
Service
Process
Log file
Digital I/Os
Log file

```
FGH1_;02:07:14;2009-11-03
2
GT1;2009-11-03;02:07:14
FGH1_;10:41:08;2010-04-13
2
GT1;2010-04-13;10:41:08
FGH1_;10:41:13;2010-04-13
2
GT1;2010-04-13;10:41:13
FGH1_;10:41:54;2010-04-13
2
GT1;2010-04-13;10:41:54
FGH1_;10:42:15;2010-04-13
2
GT1;2010-04-13;10:42:15
FGH1_;10:42:18;2010-04-13
2
GT1;2010-04-13;10:42:18
```

Figure 3.38: Display of the output data in the log file

3.5.2.2 "Digital I/Os" menu

The "Set/reset" button is used to assign a level state to the output: **`Set`** assigns the output the so-called high level, i.e. a logical one signal is output. **`Reset`** assigns the output the so-called low-level, i.e. a logical zero signal is output.


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Events
Device
English
Operating mode
Service
Process
Log file
Digital I/Os
Description

Log of the output data [Programm: Default *]

Digital I/Os

Port	I/O mode	Function	Pulse duration	Signal delay	Debounce time	Inverted	Status	Set
1	Input	Start trigger	0	0	5	0	●	
2	Output	Result OK	400	0	-	0	●	Set
3	Output	Result NOK	400	0	-	0	●	Reset
4	Output	Ready	0	0	-	0	●	Set
5	Input	Program selection 1	0	0	5	0	●	
6	Input	Program selection 2	0	0	5	0	●	
7	Input	Program selection 3	0	0	5	0	●	
8	Input	Program change	0	0	5	0	●	

Set / Reset:

Option to force the output to '1' (permanently set)
Option to force the output to '0' (permanently reset)
Prerequisite: Process connection is active, i.e. check mark set for 'Out') Forced outputs are automatically released in process operation

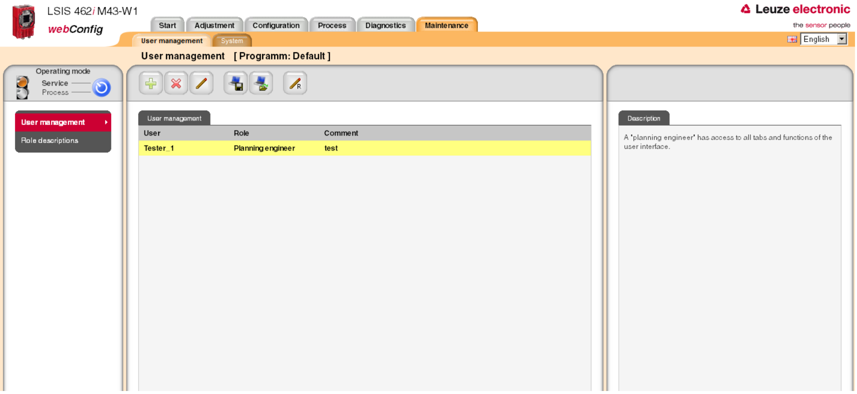
Figure 3.39: "Diagnostics" module, "Device" tab - Digital I/Os

The status of the inputs is displayed in the "Status" column:

Orange LED:	no voltage present
Green LED:	voltage present

3.6 "Maintenance" module

Depending on authority level, the "User management" and "System" tabs are available in the "Maintenance" module.


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
English
User management [Programm: Default]
Operating mode
Service
Process
User management
Role descriptions
User management
Description

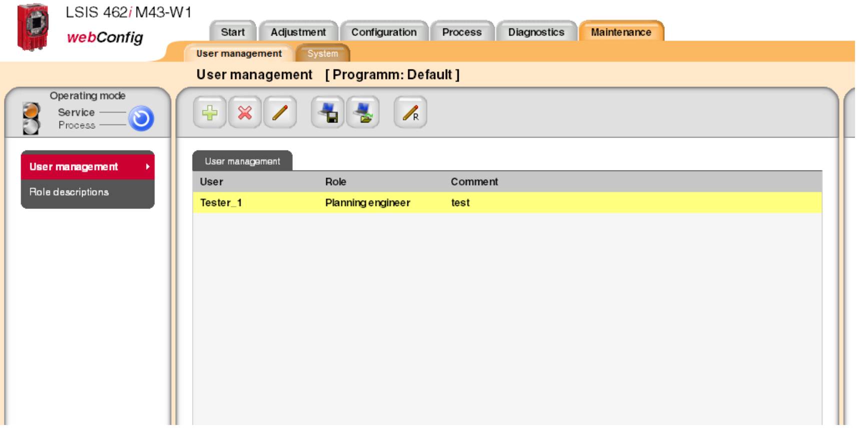
User	Role	Comment
Tester_1	Planning engineer	test

A "planning engineer" has access to all tabs and functions of the user interface.

Figure 3.40: User interface of the "Maintenance" module

3.6.1 "User management" tab

The "User management" tab first offers you a list of the created users and their respective "role". Using the appropriate buttons and taking into account your own authority level, you can create new users or delete existing users here. In addition, password definitions can be changed and user data can be imported and exported. Information on the required authority levels can be found in the descriptions of the respective buttons given below.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
User management [Programm: Default]
Operating mode
Service
Process
User management
Role descriptions
User management

User	Role	Comment
Tester_1	Planning engineer	test

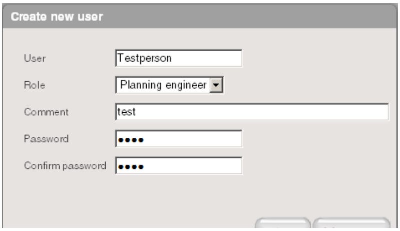
Figure 3.41: "Maintenance" module, "User management" tab

3.6.1.1 "User management" menu

Buttons

The button bar contains the following elements:

This button can be used to create a new user; properties include role, password and description. This button is only available in the "planning engineer" authority level.



User Testperson
Role Planning engineer
Comment test
Password ••••
Confirm password ••••

Figure 3.42:User management – enter user data

The selected user is deleted using this button. This button is only available in the "planning engineer" authority level.

With this button, a user can change the password and the description of his own user entry. A "planning engineer" can also change the user data of other users.

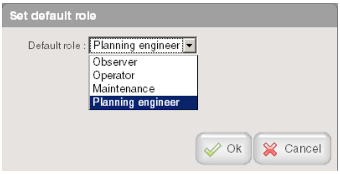
This button can be used to export the user file to the PC that is connected to the **LSIS 4xx*i***.

This button can be used to import the user file from the PC that is connected to the **LSIS 4xx*i***.

Set here is the default role assigned to a user who is not logged in. This role is preset to "planning engineer".

If various password-protected authority levels are to be used, a "planning engineer" can be assigned a default role here with corresponding, lower level.

This function is only available if a user with the "planning engineer" authority level exists. It would not otherwise be possible to again change a once-changed default roll with fewer rights than a "planning engineer" or to create new users!

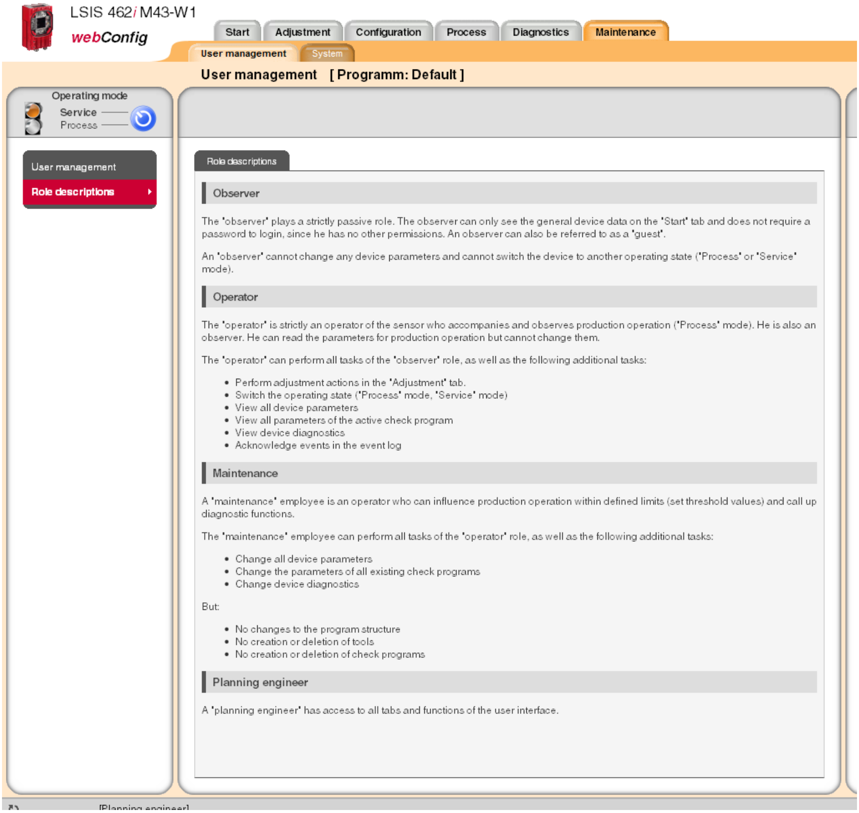


Default role : Planning engineer

Figure 3.43:User management – set default role

3.6.1.2 "Role descriptions" menu

Click the "Role descriptions" menu item to display a detailed description of the "roles" that can be used in **LSIS 4xx*i* *webConfig*** and the assigned authorizations. This window is for information purposes only and cannot be edited.


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
User management [Programm: Default]
Operating mode
Service
Process
User management
Role descriptions
Role descriptions

Observer

The 'observer' plays a strictly passive role. The observer can only see the general device data on the 'Start' tab and does not require a password to login, since he has no other permissions. An observer can also be referred to as a 'guest'.

An 'observer' cannot change any device parameters and cannot switch the device to another operating state ('Process' or 'Service' mode).

Operator

The 'operator' is strictly an operator of the sensor who accompanies and observes production operation ('Process' mode). He is also an observer. He can read the parameters for production operation but cannot change them.

The 'operator' can perform all tasks of the 'observer' role, as well as the following additional tasks:

- Perform adjustment actions in the 'Adjustment' tab.
- Switch the operating state ('Process' mode, 'Service' mode)
- View all device parameters
- View all parameters of the active check program
- View device diagnostics
- Acknowledge events in the event log

Maintenance

A 'maintenance' employee is an operator who can influence production operation within defined limits (set threshold values) and call up diagnostic functions.

The 'maintenance' employee can perform all tasks of the 'operator' role, as well as the following additional tasks:

- Change all device parameters
- Change the parameters of all existing check programs
- Change device diagnostics

But:

- No changes to the program structure
- No creation or deletion of tools
- No creation or deletion of check programs

Planning engineer

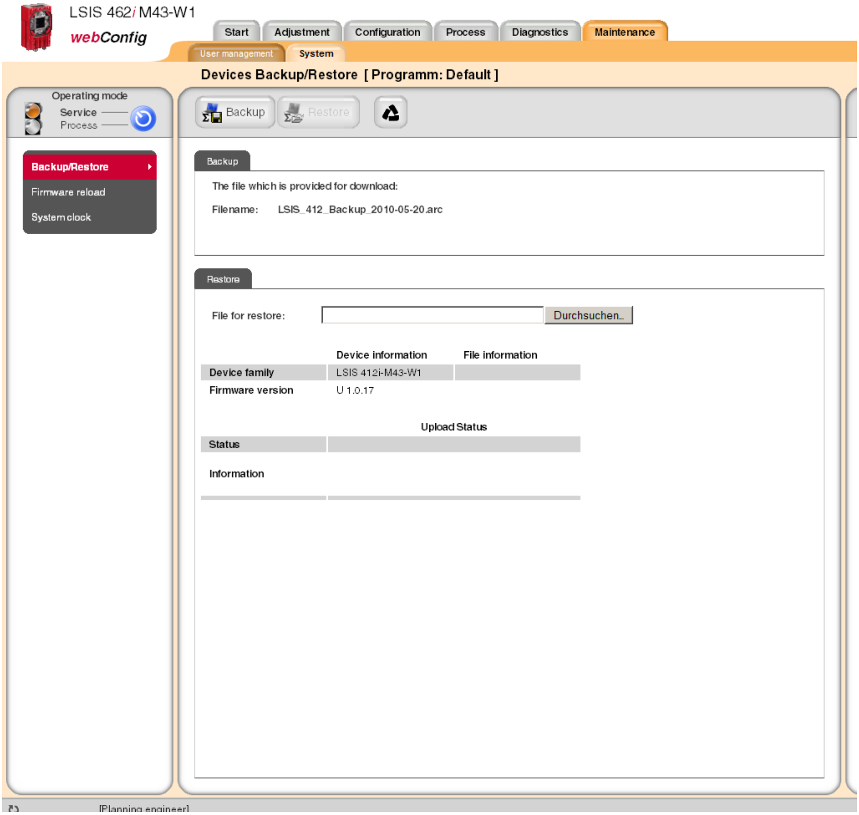
A 'planning engineer' has access to all tabs and functions of the user interface.

[Planning engineer]

Figure 3.44: "Role descriptions" user interface

3.6.2 "System" tab

The "System" tab groups together functions for system maintenance, such as saving or restoring various device or program states, updating the firmware or setting the system time.


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
Operating mode
Service
Process
Backup/Restore
Firmware reload
System clock
Backup
Restore
Backup
Restore
Durchsuchen...
[Planning engineer]

Devices Backup/Restore [Programm: Default]

The file which is provided for download:

Filename: LSIS_412_Backup_2010-05-20.arc

File for restore:

	Device information	File information
Device family	LSIS 412i-M43-W1	
Firmware version	U 1.0.17	

	Upload Status
Status	
Information	

Figure 3.45: "Maintenance" module, "System" tab

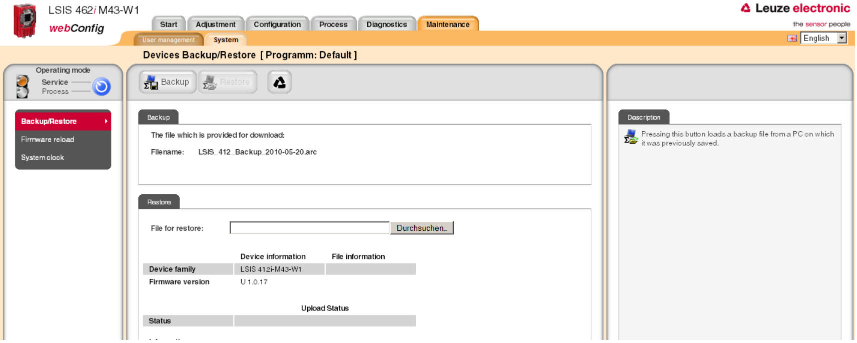
3.6.2.1 "Backup/Restore" menu

Three different parameter categories are saved in the **LSIS 4xx*i***:

- Program parameters (all check programs with all tool parameters)
- Device parameters (all check-program-independent device settings)
- User parameters (all defined user roles including passwords)

Use the appropriate buttons to save each of these categories on the PC or to load them into the device.

The "Backup/Restore" option, on the other hand, can be used to **completely backup of all parameters** to the PC or to restore the entire device configuration by reading a restore file from the PC.


LSIS 462i M43-W1
webConfig
Leuze electronic
the sensor people
English
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
Operating mode
Service
Process
Backup
Restore
Backup/Restore
Firmware reload
System clock
Backup
Restore
Durchsuchen...
Description

Devices Backup/Restore [Programm: Default]

The file which is provided for download:

Filename: LSIS_412_Backup_2010-05-20.arc

File for restore:

	Device information	File information
Device family	LSIS 412i-M43-W1	
Firmware version	U 1.0.17	

	Upload Status
Status	

Pressing this button loads a backup file from a PC on which it was previously saved.

Figure 3.46: "Backup/Restore" user interface

Buttons

The button bar contains the following elements:

Backup
Pressing this button creates a device backup on a PC.

Restore
The button is enabled after an archive file has been successfully checked.

Pressing this button starts the restore process. This can last several minutes. Upon conclusion of the restore process, the device is restarted. It is recommended that the browser also be restarted and its cache cleared.

Notice:
When loading a backup, please note:

The backup version may contain other interface parameters, such as the IP address!

Pressing this button resets the device to the factory settings.
The TCP/IP connection parameters are not changed! The device retains its IP address.

3.6.2.2 "Firmware reload" menu

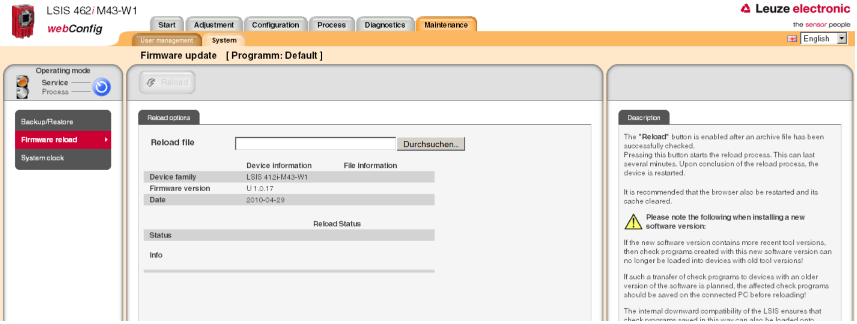
The "Firmware reload" menu provides information on the currently used firmware and allows the planning engineer to load new firmware versions, thereby keeping device functionality up to date.

Notice!

The reload procedure briefly requires a relatively large portion of the flash memory in order to extract the files.
If the flash memory in the device is mostly filled with user data, the reload procedure may, under certain circumstances, terminate! In this case, delete reference images and/or check programs in the "Configuration" area.
The following rule of thumb applies: The memory space of three reference images or three medium-size check programs is sufficient for safely performing the reload procedure.
If you must delete reference images and/or check programs for the reload procedure that are actually still needed, you should first export them.

Attention!

A complete export with firmware version 2.0 does not save any reference images.



Firmware update [Programm: Default]

Reload file

	Device information	File information
Device family	LSIS 412i-M43-W1	
Firmware version	U 1.0.17	
Date	2010-04-29	

Reload Status

Status

Info

The **"Reload"** button is enabled after an archive file has been successfully checked.
Pressing this button starts the reload process. This can last several minutes. Upon conclusion of the reload process, the device is restarted.

It is recommended that the browser also be restarted and its cache cleared.

Please note the following when installing a new software version:

If the new software version contains more recent tool versions, then check programs created with this new software version can no longer be loaded into devices with old tool versions!

If such a transfer of check programs to devices with an older version of the software is planned, the affected check programs should be saved on the connected PC before reloading!

The internal downward compatibility of the LSIS ensures that check programs saved in this way can also be loaded onto

Figure 3.47: "Firmware reload" user interface

Notice!

The following must absolutely be observed when installing a new firmware version:
if the new firmware contains more recent tool versions, check programs created with this new firmware can no longer be loaded into devices with older firmware!
If such a transfer of check programs to devices with an older firmware is planned, the affected check programs should be saved on the connected PC before reloading!
The internal backward compatibility of the ***LSIS 4xxi*** *ensures that check programs saved in this way can also be loaded into devices with a more recent firmware.*

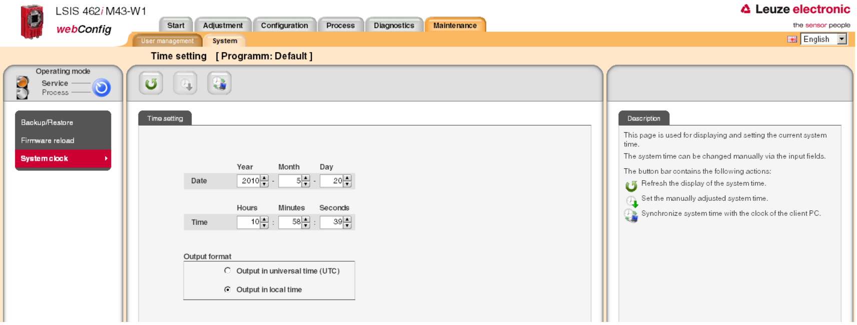
Buttons

The button bar contains the following action:

Reload	The **`Reload`** button is enabled after an archive file has been successfully checked. Pressing this button starts the reload process. This can last several minutes. Upon conclusion of the reload process, the device is restarted. It is recommended that the browser also be restarted and its cache cleared.

3.6.2.3 "System clock" menu

This page is used for displaying and setting the current system time. The system time can be changed manually via the input fields. In addition, by selecting the appropriate check box, you can specify whether the output is to be in local time or in universal time.


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
User management
System
English
Operating mode
Service
Process
Backup/Restore
Firmware reload
System clock
Time setting
Description

Time setting [Programm: Default]

Date: Year 2010 - Month 5 - Day 20

Time: Hours 10 : Minutes 58 : Seconds 39

Output format
○ Output in universal time (UTC)
● Output in local time

This page is used for displaying and setting the current system time.
The system time can be changed manually via the input fields.
The button bar contains the following actions:
Refresh the display of the system time.
Set the manually adjusted system time.
Synchronize system time with the clock of the client PC.

Figure 3.48: "System clock" user interface

Notice!

The set date and set time are battery buffered and are retained even if power is lost.

Buttons

The button bar contains the following elements:

Refresh the display of the system time.

Set the manually adjusted system time.

Synchronize system time with the clock of the client PC.

4 Working with LSIS 4xx*i* ***webConfig***

This chapter explains the configuration of the **LSIS 4xx*i*** using sample applications. The following points should be observed when using ***webConfig*** for the setup process:

- Configure at least one check program and activate it.
- Set up one of the 8 I/Os as a trigger input for the check program. Make certain that this input is correctly connected.
- If you use the RS 232 or Ethernet interface to communicate with the process control, you must configure the transmission parameters of the corresponding interface in the device parameters as well as the data to be output in the data output tool of the respective check program.

4.1 Basic procedure – step-by-step configuration of a BLOB analysis

In the following, we will explain the procedure, using as an example an electronic component to be inspected for the presence of four metal contact surfaces.

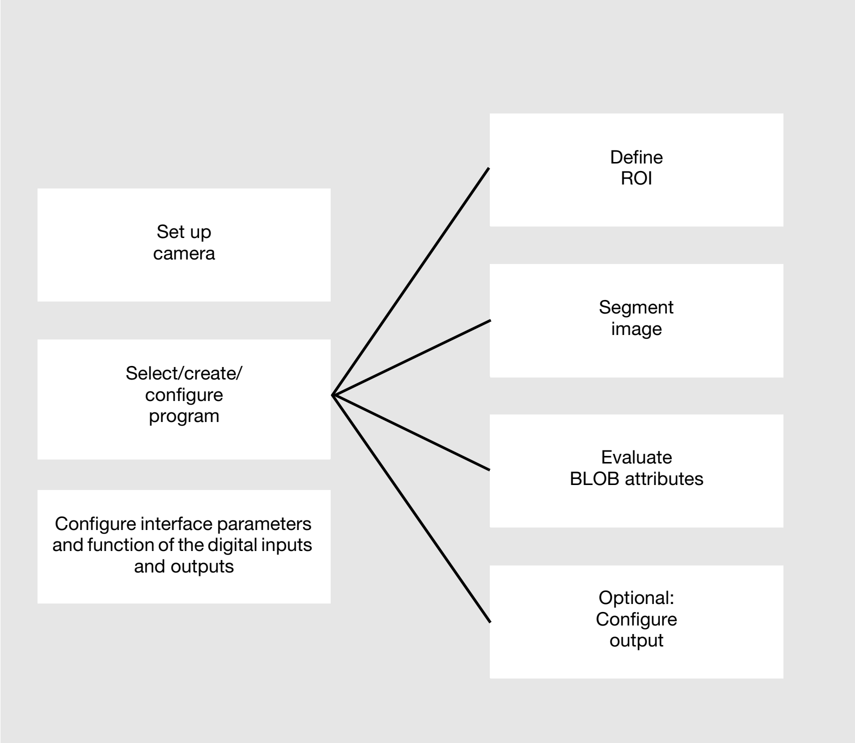
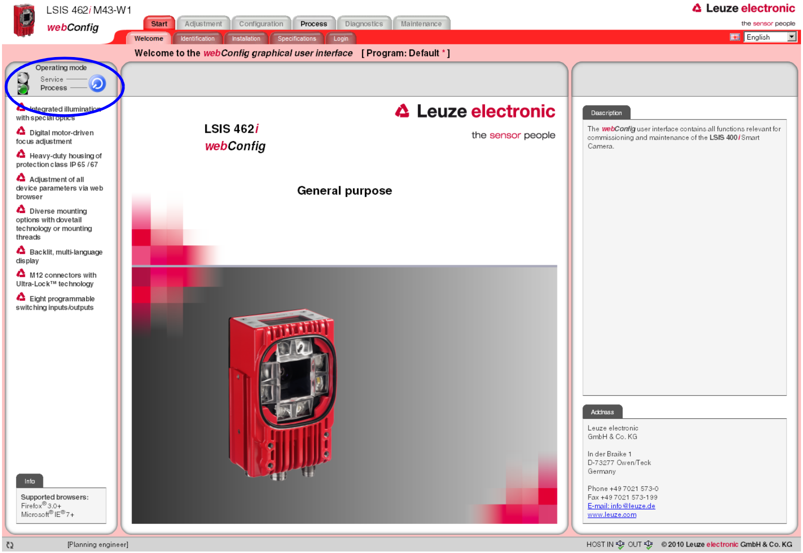

Set up camera
Select/create/ configure program
Configure interface parameters and function of the digital inputs and outputs
Define ROI
Segment image
Evaluate BLOB attributes
Optional: Configure output

Figure 4.1: Schematic illustration of the BLOB analysis

After switching on the device, **LSIS 4xx*i*** ***webConfig*** starts in Process mode.


LSIS 462*i* M43-W1
*web*Config
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Leuze electronic
the sensor people
English
Operating mode
Service
Process
LSIS 462*i*
*web*Config
Leuze electronic
the sensor people
General purpose
Description
Address
Info
[Planning engineer]
HOST IN
OUT

Welcome to the *web*Config graphical user interface [Program: Default *]

- Integrated illumination with special optics
- Digital motor-driven focus adjustment
- Heavy-duty housing of protection class IP 65 / 67
- Adjustment of all device parameters via web browser
- Diverse mounting options with dovetail technology or mounting threads
- Backlit, multi-language display
- M12 connectors with Ultra-Lock™ technology
- Eight programmable switching inputs/outputs

Supported browsers:
Firefox® 3.0+
Microsoft® IE® 7+

The *web*Config user interface contains all functions relevant for commissioning and maintenance of the **LSIS 400*i*** Smart Camera.

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www.leuze.com

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Figure 4.2: Program start in Process mode

In order to access the configuration, management and diagnostic tasks, which are necessary for performing the configuration, you must first switch to Service mode.

↳ *First, select the "Service" operating mode by clicking the* **`Service`** *menu item or the corresponding* 🔄 *button.*

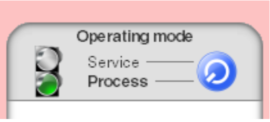
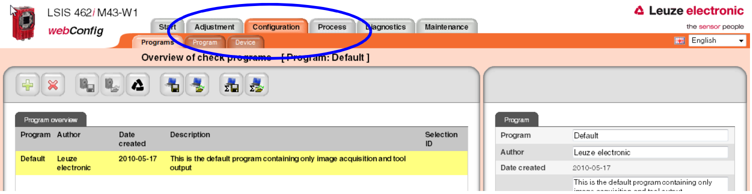

Operating mode
Service
Process

Figure 4.3: Changing the operating mode

You can now select the tabs which were initially disabled.

↳ *Activate the "Configuration" work module.*


LSIS 462*i* M43-W1
*web*Config
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Program overview
Program

Overview of check programs [Program: Default]

Program	Author	Date created	Description	Selection ID
Default	Leuze electronic	2010-05-17	This is the default program containing only image acquisition and tool output	

Program	Default
Author	Leuze electronic
Date created	2010-05-17
	This is the default program containing only

Figure 4.4: "Configuration" work module

4.1.1 Setting the parameters for image acquisition

The image acquisition parameters are usually set just once during commissioning. Once the optimum image acquisition parameters, such as focus setting and exposure time, have been set, they can be saved as default values in the camera. They then apply as an editable preset for subsequently created programs.

↳ *Activate the "Adjustment" work module if you would like to change the default settings* for new programs.

If you would only like to change the settings for a single program, proceed as follows:

↳ *Activate the "Program" tab in the "Configuration" work module.*

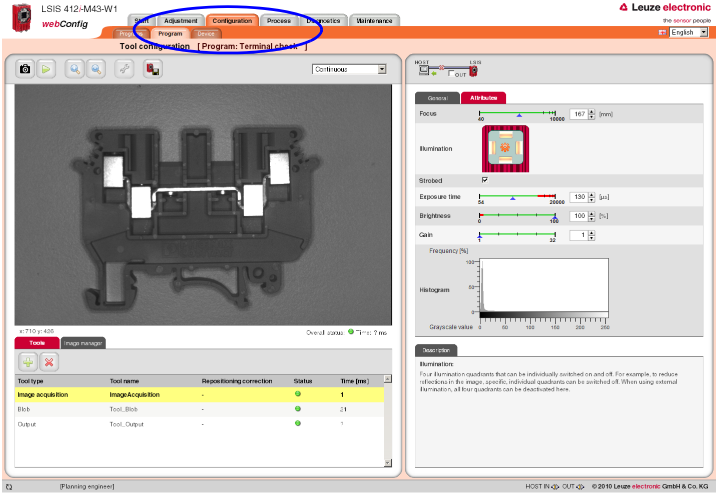
↳ *Select the "Image Acquisition" tool type in the "Tools" area to make the corresponding settings.*

↳ *Make the desired settings in the "Attributes" parameter group.*

Save your settings as follows:

↳ *If you are in the "Program" tab in the "Configuration" work module, save the image acquisition parameters* ***for the current program*** *by pressing the button.*

↳ *If you are in the "Adjustment" work module, save the image acquisition parameters permanently in the flash memory of the* ***LSIS 4xxi*** *as default settings by pressing the button.*


LSIS 412i-M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
HOST
LSIS
OUT
General
Attributes
Tools
Image manager
Description
HOST IN
OUT
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Tool configuration [Program: Terminal check]

Continuous

x: 710 y: 426

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	21
Output	Tool_Output	-	●	?

Focus: 167 [mm] (40 – 10000)

Strobed: ☑

Exposure time: 130 [µs] (54 – 20000)

Brightness: 100 [%] (0 – 100)

Gain: 1 (1 – 32)

Histogram: Frequency [%] 0, 50, 100; Grayscale value 0, 50, 100, 150, 200, 250

Illumination:

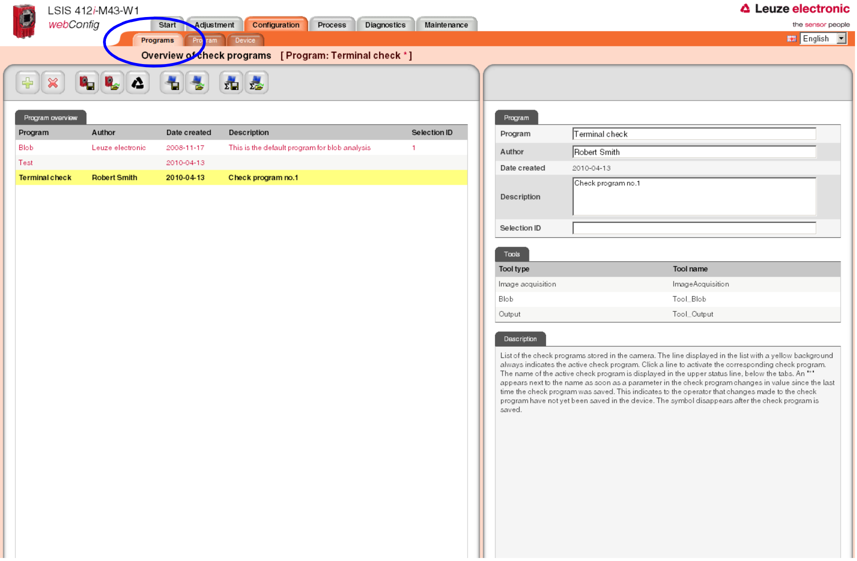
Four illumination quadrants that can be individually switched on and off. For example, to reduce reflections in the image, specific, individual quadrants can be switched off. When using external illumination, all four quadrants can be deactivated here.

[Planning engineer]

Figure 4.5: Setting the image acquisition parameters

4.1.2 Selecting or creating a new check program

↳ *In the "Configuration" work module, switch to the "Programs" tab.*


LSIS 412*i*-M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Program overview
Program
Tools
Description

Overview of check programs [Program: Terminal check *]

Program	Author	Date created	Description	Selection ID
Blob	Leuze electronic	2008-11-17	This is the default program for blob analysis	1
Test		2010-04-13		
Terminal check	Robert Smith	2010-04-13	Check program no.1	

Program: Terminal check
Author: Robert Smith
Date created: 2010-04-13
Description: Check program no.1
Selection ID:

Tool type	Tool name
Image acquisition	ImageAcquisition
Blob	Tool_Blob
Output	Tool_Output

List of the check programs stored in the camera. The line displayed in the list with a yellow background always indicates the active check program. Click a line to activate the corresponding check program. The name of the active check program is displayed in the upper status line, below the tabs. An "*" appears next to the name as soon as a parameter in the check program changes in value since the last time the check program was saved. This indicates to the operator that changes made to the check program have not yet been saved in the device. The symbol disappears after the check program is saved.

Figure 4.6: Selecting or creating a new check program

↳ *Click the line of the desired program to activate it*

or

↳ *use the ✚ button to create a new check program, to append it to the list and to activate it.*

↳ *Make the desired entries in the "Program" parameter group in the right window area. You may optionally store e.g., explanatory text for the respective program here.*

Notice!

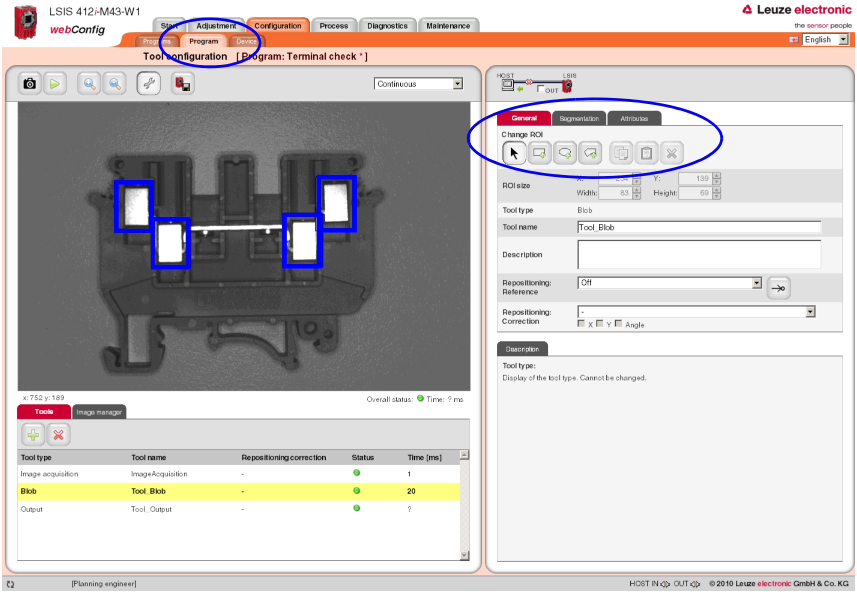
For each device variant, a new check program is preset with the appropriate tools:

Tool	LSIS 412*i*	LSIS 422*i*	LSIS 462*i*
Image acquisition	x	x	x
BLOB	x	–	x
CODE	–	x	x
Output	x	x	x

4.1.3 Defining regions of interest (ROI) within the field of view (FOV)

By defining ROIs (areas framed in blue), it is possible to restrict the analysis to individual parts of the image. If no ROIs are defined, the entire image is analyzed.

↳ *Switch to the "Program" tab.*


LSIS 412i-M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
General
Segmentation
Attributes
Change ROI
Tools
Image manager
Description
HOST IN OUT

Tool configuration [Program: Terminal check *]

ROI size X: 234 Y: 139 Width: 83 Height: 69

Tool type: Blob

Tool name: Tool_Blob

Description:

Repositioning: Reference: Off

Repositioning: Correction: - ☐ X ☐ Y ☐ Angle

Tool type:
Display of the tool type. Cannot be changed.

x: 752 y: 189

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	ImageAcquisition	-	●	1
Blob	**Tool_Blob**	**-**	●	**20**
Output	Tool_Output	-	●	?

[Planning engineer]

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Figure 4.7: Defining the ROI

↳ *If the desired BLOB tool is not already active (= yellow background), click the appropriate line in the tool selection area.*

At the right, you will now see the "General", "Segmentation" and "Attributes" tabs.

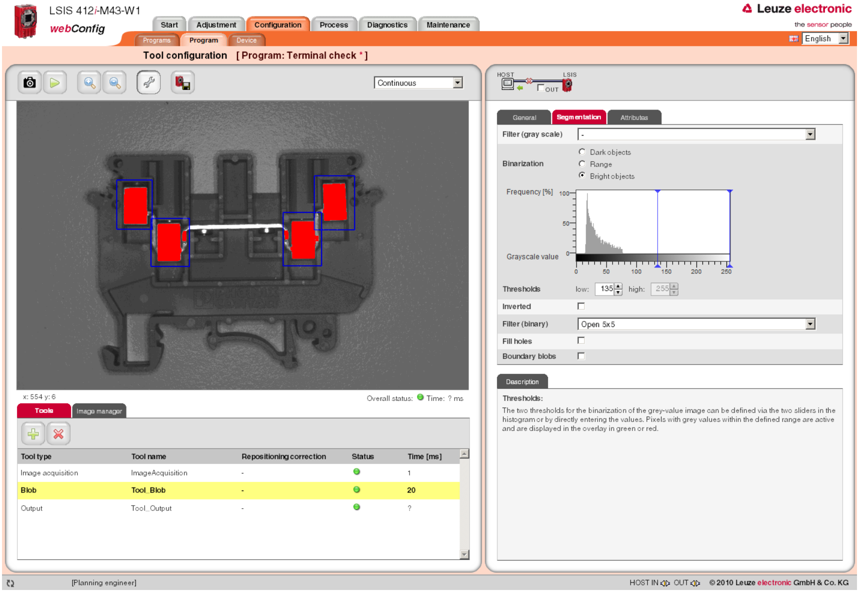
↳ *Use the buttons in the "General" tab to sensibly limit the ROI and thereby optimize the processing speed.*

Notice!

It is, in principle, beneficial to position the ROIs as small and as precisely as possible in order to obtain fewer faults and a fast evaluation. In doing so, note that this is only possible for very precisely positioned parts or if there is a need for additional repositioning!

4.1.4 Segmentation of the image

↳ *Switch to the "Segmentation" tab.*


LSIS 412i-M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
General
Segmentation
Attributes
Frequency [%]
100
50
0
Grayscale value
0
50
100
150
200
250
Tools
Image manager
Description
HOST IN
OUT
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Tool configuration [Program: Terminal check *]

Filter (gray scale): -

Binarization: ○ Dark objects ○ Range ● Bright objects

Thresholds: low: 135 high: 255

Inverted: ☐

Filter (binary): Open 5x5

Fill holes: ☐

Boundary blobs: ☐

Thresholds:

The two thresholds for the binarization of the grey-value image can be defined via the two sliders in the histogram or by directly entering the values. Pixels with grey values within the defined range are active and are displayed in the overlay in green or red.

x: 554 y: 6

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	ImageAcquisition	-	●	1
Blob	**Tool_Blob**	**-**	●	**20**
Output	Tool_Output	-	●	?

[Planning engineer]

Figure 4.8: Segmentation of the image

In the "Segmentation " tab, the segmentation threshold is set so that the bright metal parts are separated from the dark background. The goal is to display the metal bodies that are to be inspected as large objects that are separated from the background. Any interfering, narrow "bridges", caused by thin metal connections, can be eliminated with the aid of an "open" binary filter.

↳ *In this example, use the default option of "Bright objects" for the binarization and move the left slider of the histogram to a value that clearly separates the bright metal bodies from the background.*

or

↳ *For the* **`Thresholds`** *parameter, make manual entries in order to display the desired brightness range.*

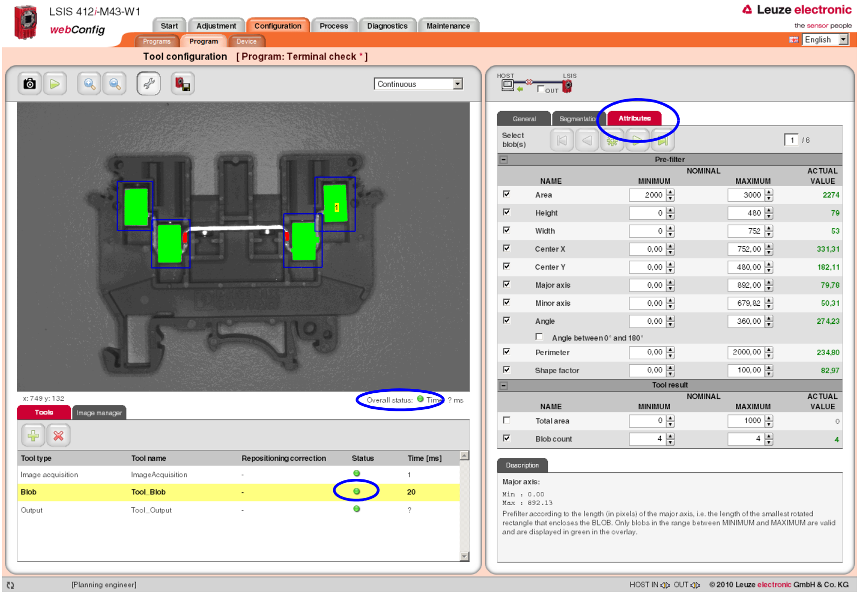
↳ *Activate the options and filters that are appropriate for your task, see chapter 4.4.*
In the example above, the "open" binary filter ensures that interfering BLOBs caused by the thin metal connectors are removed.

↳ *If necessary, activate the* **`Boundary BLOBs`** *option to ensure that BLOBs that touch the edge of the ROI are displayed as well.*

4.1.5 Evaluating object attributes

After segmentation, the criteria for the detected objects (BLOBs) must now be set.

↳ *Switch to the "Attributes" tab.*


LSIS 412*i*-M43-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
General
Segmentatio
Attributes
Select blob(s)
Tools
Image manager
Description
[Planning engineer]
HOST IN
OUT
© 2010 Leuze electronic GmbH & Co. KG

Tool configuration [Program: Terminal check *]

x: 749 y: 132

Overall status: ● Time ? ms

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	ImageAcquisition	-	●	1
Blob	**Tool_Blob**	**-**	●	**20**
Output	Tool_Output	-	●	?

1 / 6

Pre-filter

	NAME	NOMINAL MINIMUM	MAXIMUM	ACTUAL VALUE
☑	Area	2000	3000	2274
☑	Height	0	480	79
☑	Width	0	752	53
☑	Center X	0,00	752,00	331,31
☑	Center Y	0,00	480,00	182,11
☑	Major axis	0,00	892,00	79,78
☑	Minor axis	0,00	679,82	50,31
☑	Angle	0,00	360,00	274,23
	☐ Angle between 0° and 180°			
☑	Perimeter	0,00	2000,00	234,80
☑	Shape factor	0,00	100,00	82,97

Tool result

	NAME	NOMINAL MINIMUM	MAXIMUM	ACTUAL VALUE
☐	Total area	0	1000	0
☑	Blob count	4	4	4

Major axis:

```
Min : 0.00
Max : 892.13
```

Prefilter according to the length (in pixels) of the major axis, i.e. the length of the smallest rotated rectangle that encloses the BLOB. Only blobs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Figure 4.9: Evaluating object attributes: Part OK

In the above example, six BLOBs were detected in the four ROIs. For each of these BLOBs, the permissible minimum or maximum size (area) of the valid objects is now defined in the "Area" prefilter. As a result, minor interference and reflections are filtered out (displayed in red), and only the four large metal bodies to be inspected are retained as valid objects (displayed in green).

↳ *Activate the required attributes for all BLOBs in the Prefilter area by setting the appropriate check marks and entering the minimum and maximum values.*

↳ *In doing so, use the buttons or click on the image to change to the next BLOB.*

Notice!

Note that the processing time increases with the number of attributes that are to be inspected and with the number of found BLOBs. The calculation of the "major axis", "minor axis" and "angle" attributes is particularly time intensive, whereby it makes no difference if one or all three are calculated!

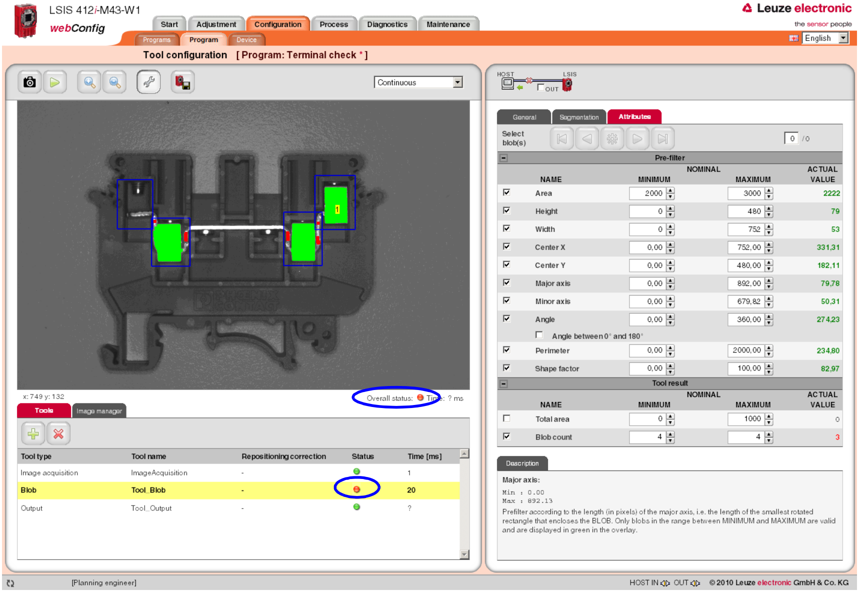
Depending on the ascertained actual values, shown in the right column, the objects classified as good are shown in green in the overlay of the image display and the objects classified as bad are shown in red.

In the lower part, the entire area and/or the number of found BLOBs are used to define when the tool is to report an "OK" result, i.e. when a checked part is to be evaluated as good or bad. Only if these criteria are satisfied does the analysis return the result OK and does a green status LED appear in the tool list.

↳ *In the lower area, define how large the total area must be or how many BLOBs must be present.*
In the above example: Only parts that have exactly four BLOBs are to be classified as good.

In the event of a faulty part - in this example, one of the metal bodies to be checked is missing - too few valid (displayed in green) objects are found:

The tool reports an "NOK" result - indicated by the red LED in the corresponding line of the tool list.


LSIS 412i-M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
x: 749 y: 132
Overall status: Time: ? ms
Tools
Image manager
HOST
LSIS
OUT
General
Segmentation
Attributes
Select blob(s)
0 /0
Description
[Planning engineer]
HOST IN OUT
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Tool configuration [Program: Terminal check *]

Tool type	Tool name	Repositioning correction	Status	Time [ms]
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	20
Output	Tool_Output	-	●	?

Pre-filter

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑	Area	2000	3000	2222
☑	Height	0	480	79
☑	Width	0	752	53
☑	Center X	0,00	752,00	331,31
☑	Center Y	0,00	480,00	182,11
☑	Major axis	0,00	892,00	79,78
☑	Minor axis	0,00	679,82	50,31
☑	Angle	0,00	360,00	274,23
	☐ Angle between 0° and 180°			
☑	Perimeter	0,00	2000,00	234,80
☑	Shape factor	0,00	100,00	82,97

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☐	Total area	0	1000	0
☑	Blob count	4	4	3

Major axis:

```
Min : 0.00
Max : 892.13
```

Prefilter according to the length (in pixels) of the major axis, i.e. the length of the smallest rotated rectangle that encloses the BLOB. Only blobs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Figure 4.10: Evaluating the BLOB attributes: Part faulty

4.1.6 Configuring digital inputs/outputs

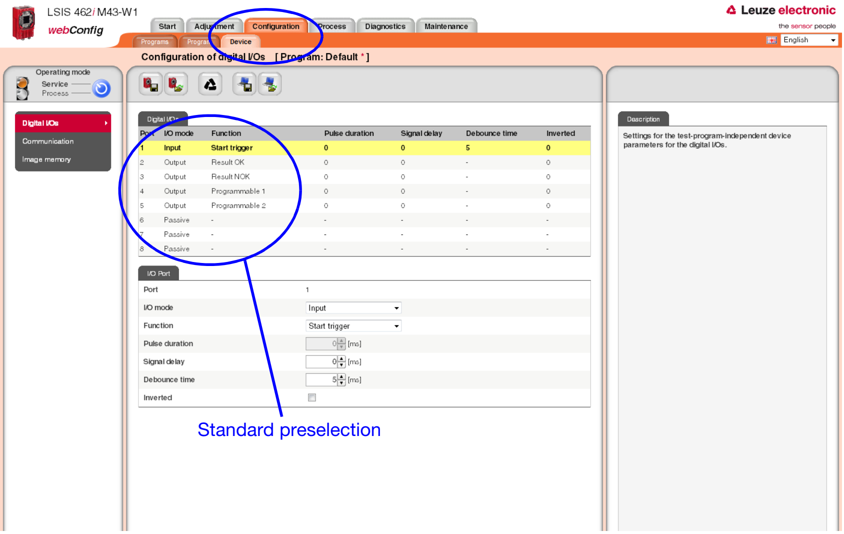
The interface parameters and function of the digital inputs and outputs are usually configured only once during commissioning, since the settings are saved as device parameters and apply for all check programs. Important device parameters include, for example, the digital interface signals to the primary control: The trigger input, inputs for automatic program selection and device outputs.

↳ *Switch to the "Device" tab in the "Configuration" work module to configure the digital I/Os.*

Defining the function of the digital inputs and outputs

↳ *In the upper part of the tab ("Digital I/Os"), activate the given I/O that is to be set up. In the lower part of the tab ("I/O Port"), make the desired changes by selecting the required options from the list box and making your entries.*

↳ *Save your entries in the flash memory of the* ***LSIS 4xxi*** *by pressing the* 🖫 *button.*


LSIS 462*i* M43-W1
*web*Config
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Operating mode
Service
Process
Digital I/Os
Communication
Image memory
Digital I/Os
I/O Port
Description

Configuration of digital I/Os [Program: Default *]

Port	I/O mode	Function	Pulse duration	Signal delay	Debounce time	Inverted
1	Input	Start trigger	0	0	5	0
2	Output	Result OK	0	0	-	0
3	Output	Result NOK	0	0	-	0
4	Output	Programmable 1	0	0	-	0
5	Output	Programmable 2	0	0	-	0
6	Passive	-	-	-	-	-
7	Passive	-	-	-	-	-
8	Passive	-	-	-	-	-

Port	1
I/O mode	Input
Function	Start trigger
Pulse duration	0 [ms]
Signal delay	0 [ms]
Debounce time	5 [ms]
Inverted	☐

Settings for the test-program-independent device parameters for the digital I/Os.

Standard preselection

Figure 4.11: Configuration of the digital inputs and outputs

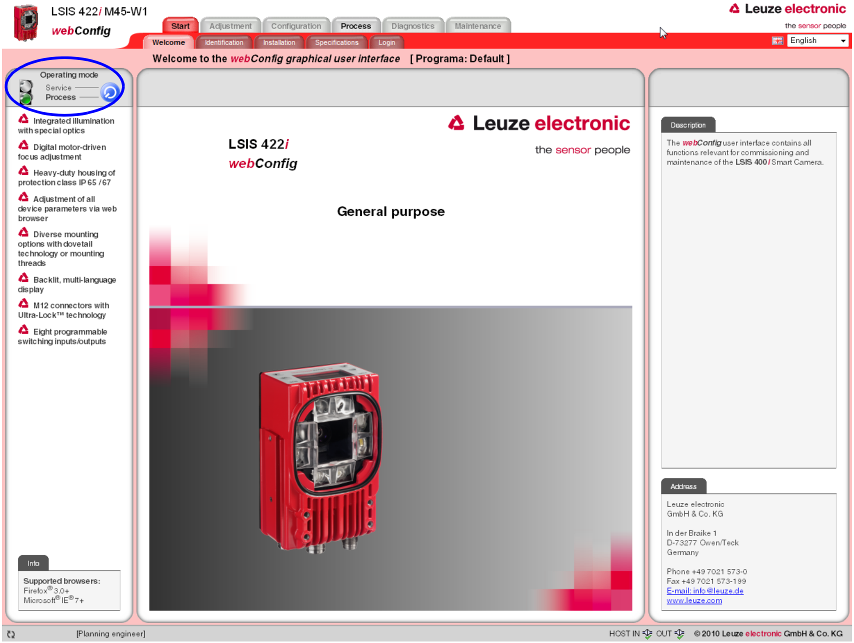
4.2 Basic procedure – step-by-step configuration of code reading

Provided in the following is an application description for a code reading using an **LSIS 422*i*** M4x-W1 as an example.

Notice!

*The configuration of the code tool for devices of the **LSIS 462i** series is performed in an analogous manner.*

After switching on the device, **LSIS 4xx*i* *webConfig*** starts in Process mode.


LSIS 422*i* M45-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Welcome
Identification
Installation
Specifications
Login
Leuze electronic
the sensor people
English
Operating mode
Service
Process
Leuze electronic
the sensor people
LSIS 422*i*
webConfig
Description
Address
Info
[Planning engineer]
HOST IN
OUT

Welcome to the *webConfig graphical user interface* [Programa: Default]

General purpose

Integrated illumination with special optics

Digital motor-driven focus adjustment

Heavy-duty housing of protection class IP 65 / 67

Adjustment of all device parameters via web browser

Diverse mounting options with dovetail technology or mounting threads

Backlit, multi-language display

M12 connectors with Ultra-Lock™ technology

Eight programmable switching inputs/outputs

Supported browsers:
Firefox® 3.0+
Microsoft® IE® 7+

The *webConfig* user interface contains all functions relevant for commissioning and maintenance of the **LSIS 400*i*** Smart Camera.

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GmbH & Co. KG

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Germany

Phone +49 7021 573-0
Fax +49 7021 573-199
E-mail: info@leuze.de
www.leuze.com

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Figure 4.12: Program start in Process mode

In order to access the configuration, management and diagnostic tasks, which are necessary for performing the configuration, you must first switch to Service mode.

↳ *First, select the "Service" operating mode by clicking the* **`Service`** *menu item or the corresponding* ⟳ *button.*

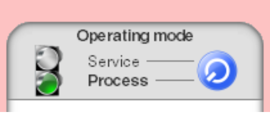

Operating mode
Service
Process

Figure 4.13: Changing the operating mode

You can now select the tabs which were initially disabled.

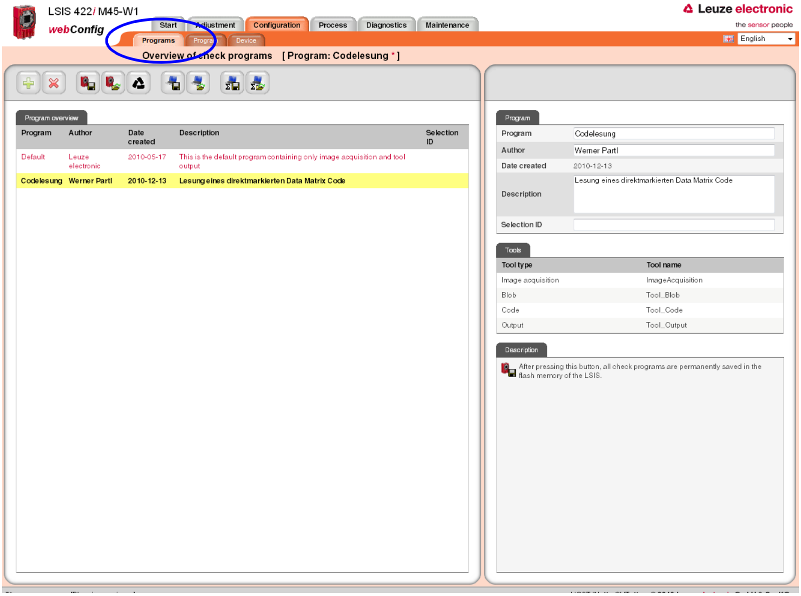
↳ *Activate the "Configuration" work module.*

4.2.1 Create new check program

↳ *In the "Configuration" work module, switch to the "Programs" tab.*

↳ *Use the + button to create a new check program and to append it to the existing program list.*

↳ *Make the desired entries in the "Program" parameter group in the right window area. You may optionally store e.g., explanatory text for the respective program here.*


LSIS 422*i* M45-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Progra
Device
Leuze electronic
the sensor people
English
Program overview
Program
Tools
Description

Overview of check programs [Program: Codelesung *]

Program	Author	Date created	Description	Selection ID
Default	Leuze electronic	2010-05-17	This is the default program containing only image acquisition and tool output	
Codelesung	Werner Partl	2010-12-13	Lesung eines direktmarkierten Data Matrix Code	

Program	Codelesung
Author	Werner Partl
Date created	2010-12-13
Description	Lesung eines direktmarkierten Data Matrix Code
Selection ID	

Tool type	Tool name
Image acquisition	ImageAcquisition
Blob	Tool_Blob
Code	Tool_Code
Output	Tool_Output

After pressing this button, all check programs are permanently saved in the flash memory of the LSIS.

Figure 4.14: Create new check program

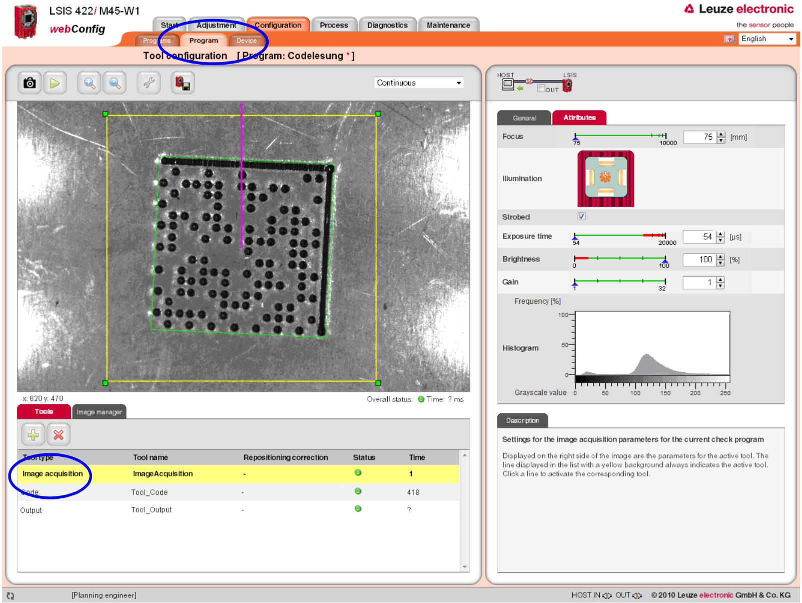
In the "Program" tab, the newly created check program can now be edited and extended.

4.2.2 Setting the parameters for image acquisition

↳ *In the "Configuration" work module, switch to the "Program" tab.*

↳ *Click on the first tool in the tool list (-> image acquisition).*

The corresponding configuration masks open on the right side.


LSIS 422i M45-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
HOST
LSIS
OUT
General
Attributes
Frequency [%]
100
50
0
Grayscale value
0
50
100
150
200
250
Tools
Image manager
Description
HOST IN
OUT
© 2010 Leuze electronic GmbH & Co. KG

Tool configuration [Program: Codelesung *]

Focus: 75 [mm] (75 – 10000)

Illumination

Strobed: ☑

Exposure time: 54 [µs] (54 – 20000)

Brightness: 100 [%] (0 – 100)

Gain: 1 (1 – 32)

Histogram

x: 620 y: 470

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Code	Tool_Code	-	●	418
Output	Tool_Output	-	●	?

Settings for the image acquisition parameters for the current check program

Displayed on the right side of the image are the parameters for the active tool. The line displayed in the list with a yellow background always indicates the active tool. Click a line to activate the corresponding tool.

[Planning engineer]

Figure 4.15: Image acquisition parameters

↳ *In the "Attributes" parameter group, set the parameters relevant for image acquisition, such as focus setting and exposure time.*

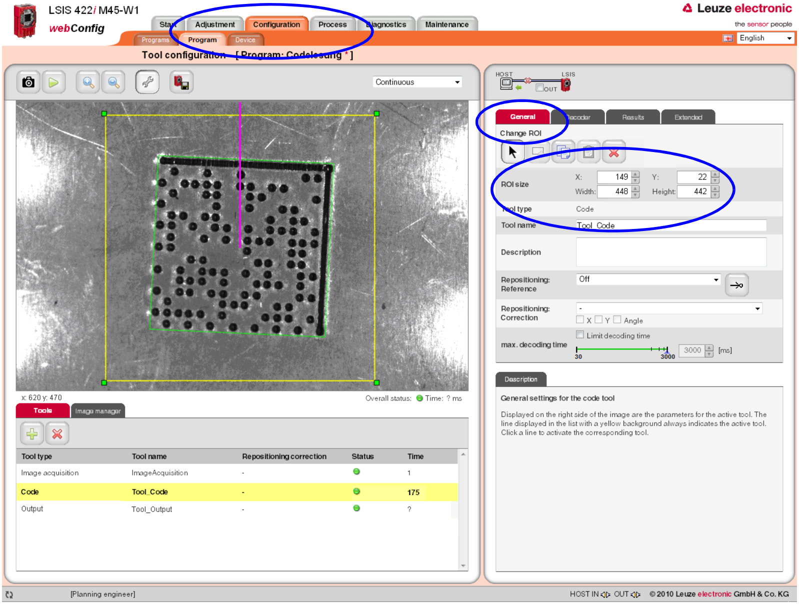
4.2.3 Setting the parameters for code reading

↳ *Activate the second tool in the tool list (->Code).*

The configuration masks associated with this tool open on the right side.

↳ *In the "General" parameter group, define a region of interest around the area in which the code to be read must be located in order to reduce the execution time of the tool.*

If no ROI is defined, the entire image is analyzed.


LSIS 422*i* M45-W1
webConfig
Leuze electronic
the sensor people
English
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Continuous
HOST
LSIS
OUT
General
Decoder
Results
Extended
Change ROI
Tools
Image manager
Description

Tool configuration [Program: Codelesung *]

ROI size: X: 149, Y: 22, Width: 448, Height: 442

Tool type: Code

Tool name: Tool_Code

Description:

Repositioning: Reference: Off

Repositioning: Correction: -
☐ X ☐ Y ☐ Angle

max. decoding time: ☐ Limit decoding time
30 – 3000, 3000 [ms]

x: 620 y: 470

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Code	Tool_Code	-	●	175
Output	Tool_Output	-	●	?

General settings for the code tool

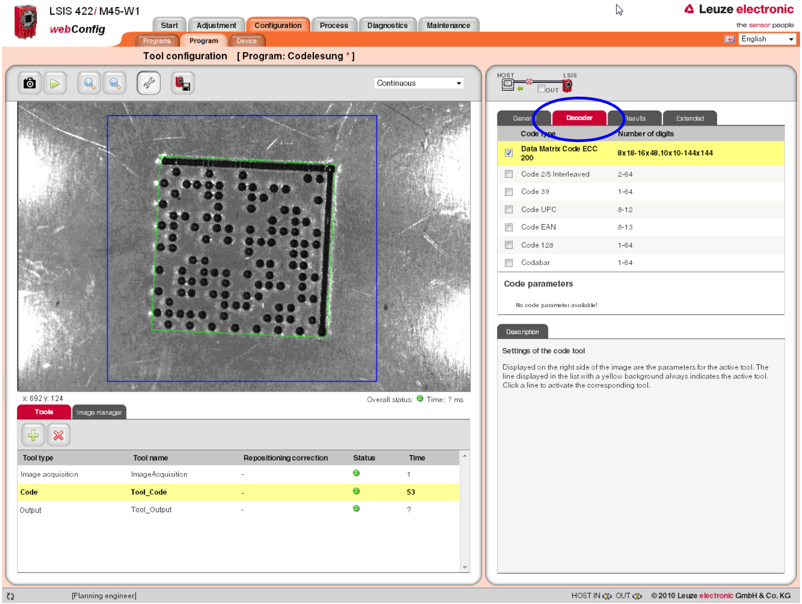
Displayed on the right side of the image are the parameters for the active tool. The line displayed in the list with a yellow background always indicates the active tool. Click a line to activate the corresponding tool.

[Planning engineer]   HOST IN   OUT   © 2010 Leuze electronic GmbH & Co. KG

Figure 4.16: Defining the ROI

↳ *Switch to the "Decoder" parameter group.*

↳ *Deactivate the unneeded codes in order to reduce the execution time of the tool or to restrict reading to certain code types.*


LSIS 422*i* M45-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
HOST
LSIS
OUT
General
Decoder
Results
Extended
Tools
Image manager
Description
HOST IN OUT

Tool configuration [Program: Codelesung *]

	Code type	Number of digits
☑	**Data Matrix Code ECC 200**	**8x18-16x48,10x10-144x144**
☐	Code 2/5 Interleaved	2-64
☐	Code 39	1-64
☐	Code UPC	8-12
☐	Code EAN	8-13
☐	Code 128	1-64
☐	Codabar	1-64

Code parameters

No code parameter available!

Settings of the code tool

Displayed on the right side of the image are the parameters for the active tool. The line displayed in the list with a yellow background always indicates the active tool. Click a line to activate the corresponding tool.

x: 692 y: 124

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Code	**Tool_Code**	-	●	**53**
Output	Tool_Output	-	●	?

[Planning engineer]

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Figure 4.17: "Decoder" parameter group – deactivating unneeded codes

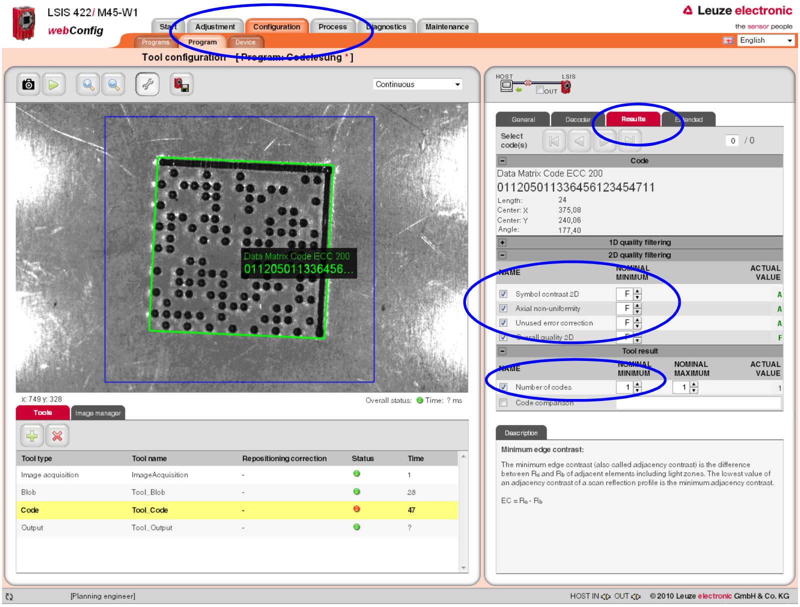
In this example, the deactivation of all 1D barcodes results in a considerable reduction of the execution time (in the same way, deactivation of the 2D Data Matrix code leads to a considerable reduction if only a 1D barcode is being searched for).

↳ *Change to the "Results" parameter group to view details on the read codes in the image or region of interest.*

Various "OK criteria" can also optionally be defined here for the tool result – with respect to the quality parameters of the read code, the number of codes to be found or with respect to a code comparison.

In the current example, exactly one code is to be found with arbitrary quality parameters (= F).

↳ *Set the corresponding options, as shown in the figure.*


LSIS 422*i* M45-W1
webConfig
Leuze electronic
the sensor people
English
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Continuous
HOST
LSIS
OUT
General
Decoder
Results
Extended
Select code(s)
Tools
Image manager
Description
HOST IN
OUT
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Tool configuration [Program: Codelesung *]

Data Matrix Code ECC 200
0112050113364561...

0 / 0

Code

Data Matrix Code ECC 200
011205011336456123454711

Length: 24
Center: X 375,08
Center: Y 240,06
Angle: 177,40

1D quality filtering

2D quality filtering

NAME	NOMINAL MINIMUM	ACTUAL VALUE
☑ Symbol contrast 2D	F	A
☑ Axial non-uniformity	F	A
☑ Unused error correction	F	A
☑ Overall quality 2D	F	F

Tool result

NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑ Number of codes	1	1	1
☐ Code comparison			

x: 749 y: 328

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	**Tool_Code**	**-**	●	**47**
Output	Tool_Output	-	●	?

Minimum edge contrast:

The minimum edge contrast (also called adjacency contrast) is the difference between R_s and R_b of adjacent elements including light zones. The lowest value of an adjacency contrast of a scan reflection profile is the minimum adjacency contrast.

$EC = R_s - R_b$

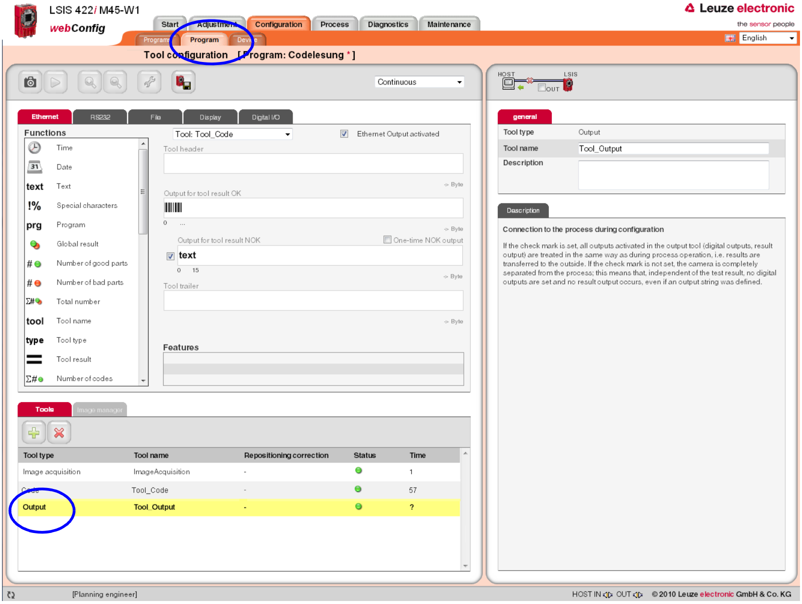
[Planning engineer]

Figure 4.18: "Results" parameter group – use quality filter and number to define tool result

4.2.4 Optional: Configuring process data output

↳ *In the "Program" tab of the Configuration module, switch to the "Output" tool type to configure an output sequence.*

This sequence is output following processing of the check program, e.g., via the Ethernet process interface.


LSIS 422i M45-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Program
Program
Device
English
Tool configuration [Program: Codelesung *]
HOST
LSIS
OUT
Ethernet
RS232
File
Display
Digital I/O
Functions
Time
Date
Text
Special characters
Program
Global result
Number of good parts
Number of bad parts
Total number
Tool name
Tool type
Tool result
Number of codes
Tool header
Byte
Output for tool result OK
Output for tool result NOK
Tool trailer
Features
general
Description
Tools
Image manager
[Planning engineer]
HOST IN
OUT
© 2010 Leuze electronic GmbH & Co. KG

Continuous

Tool: Tool_Code

☑ Ethernet Output activated

☐ One-time NOK output

☑ text

Tool type: Output

Tool name: Tool_Output

Description:

Connection to the process during configuration

If the check mark is set, all outputs activated in the output tool (digital outputs, result output) are treated in the same way as during process operation, i.e. results are transferred to the outside. If the check mark is not set, the camera is completely separated from the process; this means that, independent of the test result, no digital outputs are set and no result output occurs, even if an output string was defined.

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Code	Tool_Code	-	●	57
Output	Tool_Output	-	●	?

Figure 4.19: Window for configuring the output

Displayed in the left area is a list of the available "output functions". Information on the individual elements (date, time etc.) and other possibilities for the specification are available as usual in the right part of the window.

Configuring the Ethernet output

↳ *Activate the* `Ethernet output activated` *check box.*

↳ *In the list box, first define whether you would like to configure the header, the code tool or the trailer.*

↳ *Insert the desired elements from the function list in the input line provided for this purpose at the right by means of drag & drop.*

↳ *Specify element options, such as length, alignment, fill character, etc., in the lower part of the Features area.*

Delimiters between the individual pieces of data and the use of separate lines increase the "readability" of the output data.

In the current example, the code contents are output in the case of an OK; for an NOK (no code detected), a freely definable text "no code found!" is output.

Activation of the "Host LSIS" check box in the upper right causes the otherwise not displayed tool execution time to be calculated and displayed for the data output.

Notice!

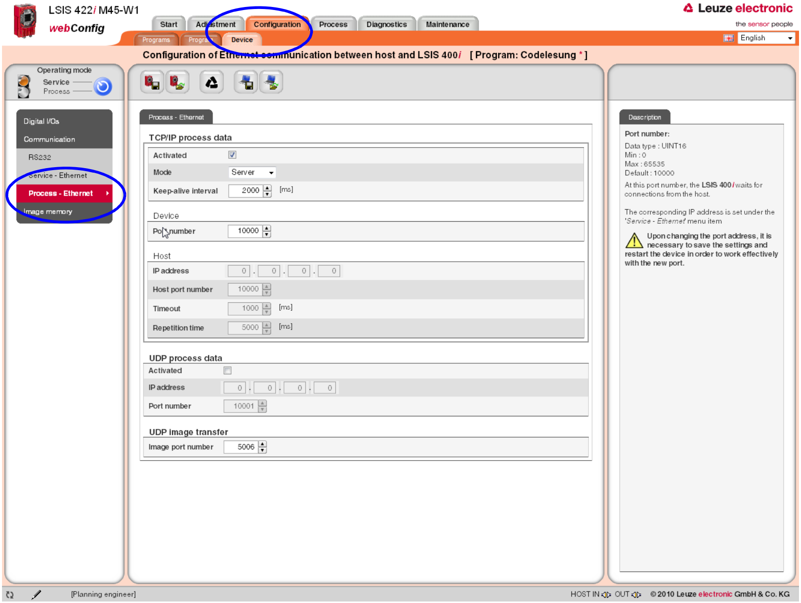
The transmission time of the output data depends largely on the speed of the connection, particularly if many objects are found for which an output is configured.
For example, the standard setting for RS 232 transmission is set to 9600 baud for compatibility reasons, even though 115200 baud is, in principle, possible.

4.2.5 Optional:
Configuring cross-program device settings for process-data transmission

↳ *In the "Configuration" work module, switch to the "Device" tab.*

↳ *In the "Process - Ethernet" submenu, specify the parameters for Ethernet communication with the primary control that is to receive the process data.*

In the current example, a TCP/IP connection is established with the LSIS as server.


LSIS 422i M45-W1
webConfig
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Operating mode
Service
Process
Digital I/Os
Communication
RS232
Service - Ethernet
Process - Ethernet
Image memory
Process - Ethernet
Description
[Planning engineer]
HOST IN
OUT
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Configuration of Ethernet communication between host and LSIS 400i [Program: Codelesung *]

TCP/IP process data

Activated	☑	
Mode	Server	
Keep-alive interval	2000	[ms]

Device

Port number	10000

Host

IP address	0 . 0 . 0 . 0	
Host port number	10000	
Timeout	1000	[ms]
Repetition time	5000	[ms]

UDP process data

Activated	☐
IP address	0 . 0 . 0 . 0
Port number	10001

UDP image transfer

Image port number	5006

Port number:

Data type : UINT16
Min : 0
Max : 65535
Default : 10000

At this port number, the **LSIS 400*i*** waits for connections from the host.

The corresponding IP address is set under the '*Service - Ethernet*' menu item

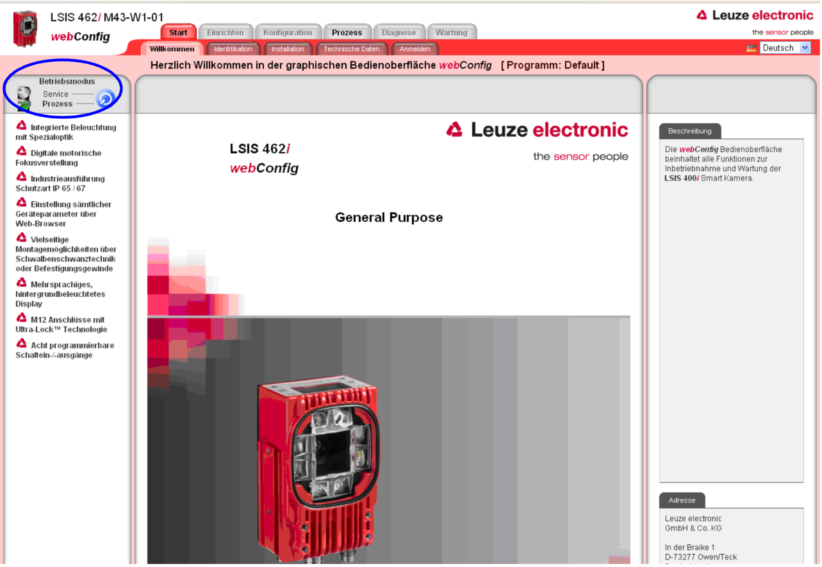
⚠ **Upon changing the port address, it is necessary to save the settings and restart the device in order to work effectively with the new port.**

Figure 4.20: Defining Ethernet communication with the primary control

4.3 Basic procedure – step-by-step configuration of a combined BLOB analysis and code reading

Provided in the following is an application description for a combined BLOB analysis and code reading using an LSIS 462 M4x-W1 as an example.

After switching on the device, **LSIS 4xx*i* *webConfig*** starts in Process mode.


LSIS 462i M43-W1-01
webConfig
Start
Einrichten
Konfiguration
Prozess
Diagnose
Wartung
Willkommen
Identifikation
Installation
Technische Daten
Anmelden
Leuze electronic
the sensor people
Deutsch
Betriebsmodus
Service
Prozess
LSIS 462i
webConfig
General Purpose
Beschreibung
Adresse

Herzlich Willkommen in der graphischen Bedienoberfläche *webConfig* [Programm: Default]

- Integrierte Beleuchtung mit Spezialoptik
- Digitale motorische Fokusverstellung
- Industrieausführung Schutzart IP 65 / 67
- Einstellung sämtlicher Geräteparameter über Web-Browser
- Vielseitige Montagemöglichkeiten über Schwalbenschwanztechnik oder Befestigungsgewinde
- Mehrsprachiges, hintergrundbeleuchtetes Display
- M12 Anschlüsse mit Ultra-Lock™ Technologie
- Acht programmierbare Schaltein-/-ausgänge

Die ***webConfig*** Bedienoberfläche beinhaltet alle Funktionen zur Inbetriebnahme und Wartung der **LSIS 400*i*** Smart Kamera.

Leuze electronic
GmbH & Co. KG

In der Braike 1
D-73277 Owen/Teck

Figure 4.21: Program start in Process mode

In order to access the configuration, management and diagnostic tasks, which are necessary for performing the configuration, you must first switch to Service mode.

↳ *First, select the "Service" operating mode by clicking the* **`Service`** *menu item or the corresponding* ⟳ *button.*

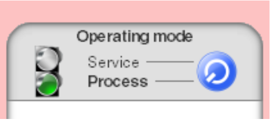

Operating mode
Service
Process

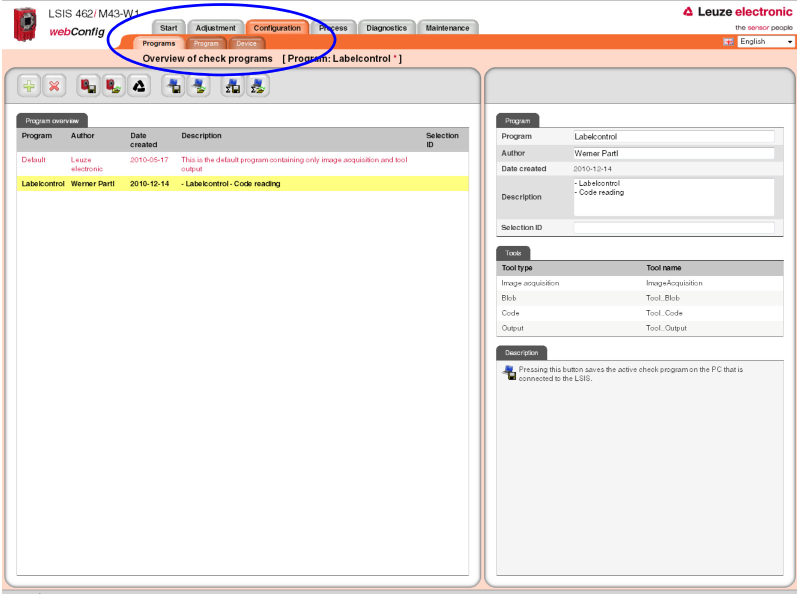
Figure 4.22: Changing the operating mode

You can now select the tabs which were initially disabled.

↳ *Activate the "Configuration" work module.*

4.3.1 Create new check program

- *In the "Configuration" work module, switch to the "Programs" tab.*
- *Use the ✚ button to create a new check program and to append it to the existing program list.*
- *Make the desired entries in the "Program" parameter group in the right window area. You may optionally store e.g., explanatory text for the respective program here.*


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Program overview
Program
Tools
Description

Overview of check programs [Program: Labelcontrol *]

Program	Author	Date created	Description	Selection ID
Default	Leuze electronic	2010-05-17	This is the default program containing only image acquisition and tool output	
Labelcontrol	Werner Partl	2010-12-14	- Labelcontrol - Code reading	

Program	Labelcontrol
Author	Werner Partl
Date created	2010-12-14
Description	- Labelcontrol - Code reading
Selection ID	

Tool type	Tool name
Image acquisition	ImageAcquisition
Blob	Tool_Blob
Code	Tool_Code
Output	Tool_Output

Pressing this button saves the active check program on the PC that is connected to the LSIS.

Figure 4.23: Create new check program

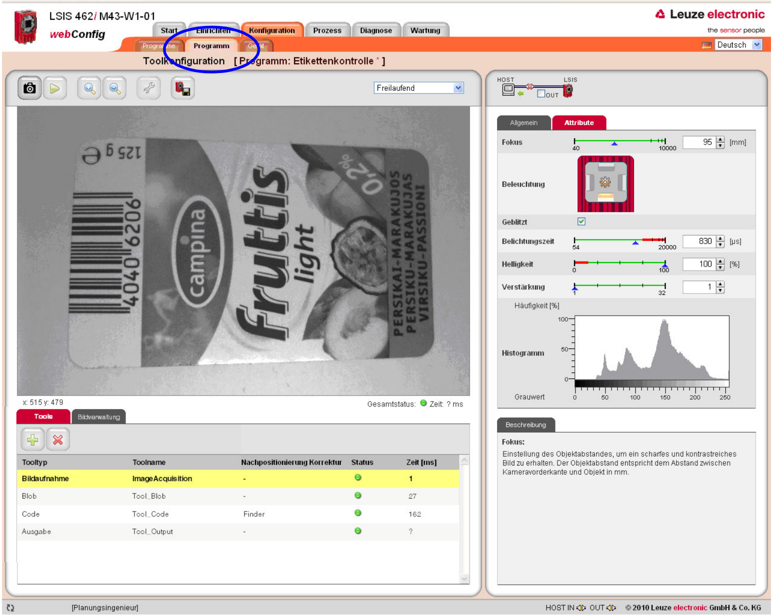
In the "Program" tab, the newly created check program can now be edited and extended.

4.3.2 Setting the parameters for image acquisition

↳ *In the "Configuration" work module, switch to the "Program" tab.*

↳ *Click on the first tool in the tool list (-> image acquisition).*

The corresponding configuration masks open on the right side.


LSIS 462i M43-W1-01
webConfig
Start
Einrichten
Konfiguration
Prozess
Diagnose
Wartung
Programme
Programm
Gerät
Leuze electronic
the sensor people
Deutsch
Toolkonfiguration [Programm: Etikettenkontrolle *]
Freilaufend
HOST
OUT
LSIS
Allgemein
Attribute
Tools
Bildverwaltung
Beschreibung
Häufigkeit [%]
Grauwert
[Planungsingenieur]
HOST IN
OUT
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x: 515 y: 479

Gesamtstatus: ● Zeit: ? ms

Tooltyp	Toolname	Nachpositionierung Korrektur	Status	Zeit [ms]
Bildaufnahme	**ImageAcquisition**	**-**	●	**1**
Blob	Tool_Blob	-	●	27
Code	Tool_Code	Finder	●	162
Ausgabe	Tool_Output	-	●	?

Fokus 40 – 10000: 95 [mm]

Beleuchtung

Geblitzt ☑

Belichtungszeit 54 – 20000: 830 [µs]

Helligkeit 0 – 100: 100 [%]

Verstärkung 1 – 32: 1

Histogramm

Fokus:

Einstellung des Objektabstandes, um ein scharfes und kontrastreiches Bild zu erhalten. Der Objektabstand entspricht dem Abstand zwischen Kameravorderkante und Objekt in mm.

Figure 4.24: Image acquisition parameters

↳ *In the "Attributes" parameter group, set the parameters relevant for image acquisition, such as focus setting and exposure time.*

4.3.3 Tool for editing BLOB analysis

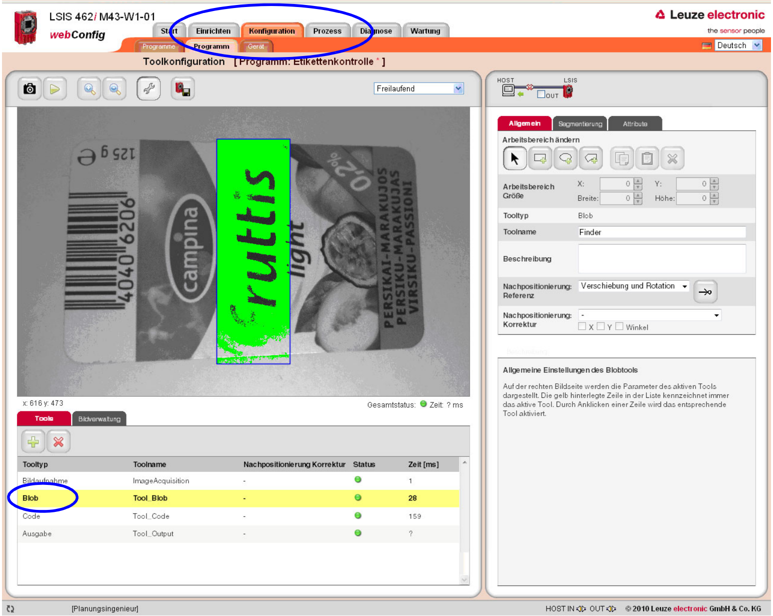
➪ *In the tool list, activate the "BLOB" tool.*

The configuration masks associated with this tool open on the right side.

Defining ROIs

➪ *In the "General" parameter group, define the regions of interest (areas framed in blue) to restrict the evaluation to individual areas of the image.*

If no ROIs are defined, the entire image is analyzed.


LSIS 462i M43-W1-01
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Start
Einrichten
Konfiguration
Prozess
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Wartung
Programme
Programm
Gerät
Leuze electronic
the sensor people
Deutsch
Toolkonfiguration [Programm: Etikettenkontrolle *]
Freilaufend
HOST
LSIS
OUT
Allgemein
Segmentierung
Attribute
Arbeitsbereich ändern
Tools
Bildverwaltung
[Planungsingenieur]
HOST IN
OUT
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x: 616 y: 473

Gesamtstatus: ● Zeit: ? ms

Tooltyp	Toolname	Nachpositionierung Korrektur	Status	Zeit [ms]
Bildaufnahme	ImageAcquisition	-	●	1
Blob	**Tool_Blob**	**-**	●	**28**
Code	Tool_Code	-	●	159
Ausgabe	Tool_Output	-	●	?

Arbeitsbereich Größe: X: 0 Y: 0 Breite: 0 Höhe: 0

Tooltyp: Blob

Toolname: Finder

Beschreibung:

Nachpositionierung: Referenz: Verschiebung und Rotation

Nachpositionierung: Korrektur: - ☐ X ☐ Y ☐ Winkel

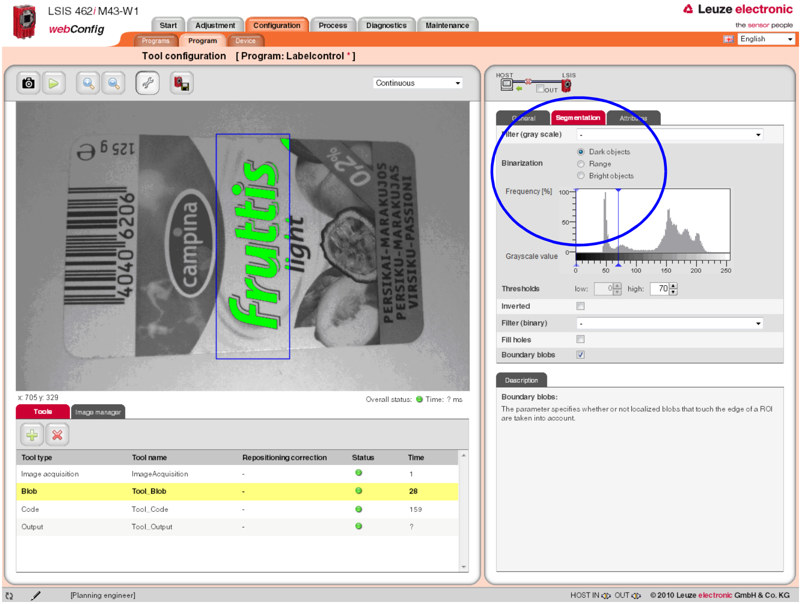
Allgemeine Einstellungen des Blobtools

Auf der rechten Bildseite werden die Parameter des aktiven Tools dargestellt. Die gelb hinterlegte Zeile in der Liste kennzeichnet immer das aktive Tool. Durch Anklicken einer Zeile wird das entsprechende Tool aktiviert.

Figure 4.25: Defining the region of interest for the BLOB analysis

Segmentation of the image

↳ *Switch to the "Segmentation" tab.*


LSIS 462*i* M43-W1
webConfig
Leuze electronic
the sensor people
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Configuration
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Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
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Segmentation
Attributes
Tools
Image manager
Description
HOST IN
OUT
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Tool configuration [Program: Labelcontrol *]

Filter (gray scale): -

Binarization: ● Dark objects ○ Range ○ Bright objects

Frequency [%] / Grayscale value

Thresholds low: 0 high: 70

Inverted ☐

Filter (binary): -

Fill holes ☐

Boundary blobs ☑

Boundary blobs:
The parameter specifies whether or not localized blobs that touch the edge of a ROI are taken into account.

x: 705 y: 329

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	Tool_Code	-	●	159
Output	Tool_Output	-	●	?

[Planning engineer]

Figure 4.26: Segmentation of the image

In the "Segmentation" tab, select the "Dark objects" option to make a rough presetting of a suitable segmentation threshold for dark objects in the image. The objective is to cleanly separate dark letters from the light background, e.g., to use the presence of one or more defined objects (here: letters) to detect the correct label or label side.

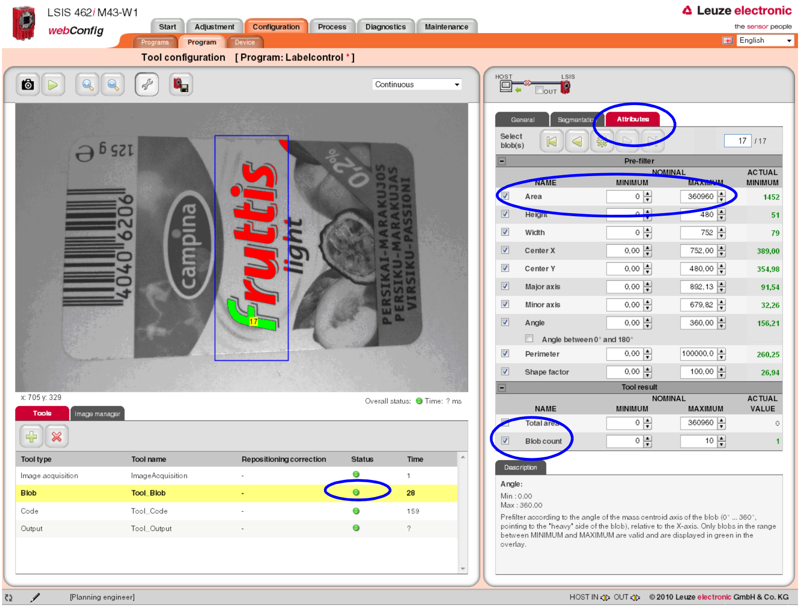
↳ *In this example, use the default option of "Dark objects".*

↳ *To make* fine adjustments, use the sliding upper threshold in the histogram.

4.3.4 Evaluating object attributes

After segmentation, the criteria for the detected objects (BLOBs) must now be set.

↳ *Switch to the "Attributes" tab.*


LSIS 462*i* M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
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English
Continuous
HOST
LSIS
OUT
General
Segmentation
Attributes
Tools
Image manager
Description
17
[Planning engineer]
HOST IN OUT
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Tool configuration [Program: Labelcontrol *]

x: 705 y: 329

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	Tool_Code	-	●	159
Output	Tool_Output	-	●	?

Select blob(s) 17 / 17

Pre-filter

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL MINIMUM
☑	Area	0	360960	1452
☑	Height	0	480	51
☑	Width	0	752	79
☑	Center X	0,00	752,00	389,00
☑	Center Y	0,00	480,00	354,98
☑	Major axis	0,00	892,13	91,54
☑	Minor axis	0,00	679,82	32,26
☑	Angle	0,00	360,00	156,21
	☐ Angle between 0° and 180°			
☑	Perimeter	0,00	100000,0	260,25
☑	Shape factor	0,00	100,00	26,94

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☐	Total area	0	360960	0
☑	Blob count	0	10	1

Angle:
Min : 0.00
Max : 360.00
Prefilter according to the angle of the mass centroid axis of the blob (0° ... 360°, pointing to the "heavy" side of the blob), relative to the X-axis. Only blobs in the range between MINIMUM and MAXIMUM are valid and are displayed in green in the overlay.

Figure 4.27: Evaluating object attributes

To detect the correct label type or the correct label side, a characteristic character is searched for, in this example, the letter "f".

↳ *For this purpose, a permissible minimum and maximum size (area) is defined in the "Area" prefilter of the "Attributes" tool tab. This area is oriented to displayed area of the character being searched for, the letter "f".*

As a result, all objects are filtered out whose area does not correspond to that of the object being searched for.

Notice!

If the "Area" attribute is not sufficient for clearly identifying the "f" because there are other objects with similar or even identical areas in the evaluation range, it would be necessary to include other attributes, such as "circumference", "shape factor", ... to distinguish the character.

In this way, all other dark objects are filtered out (displayed in red), and only the searched-for "f" remains as a valid object (displayed in green).

↳ *In the bottom line, define that the tool should report an "OK" result if exactly one object (BLOB number minimum = maximum = 1) is found.*

The corresponding line ("BLOB" tool type) of the tool list now has a green LED.

4.3.5 Setting the parameters for code reading

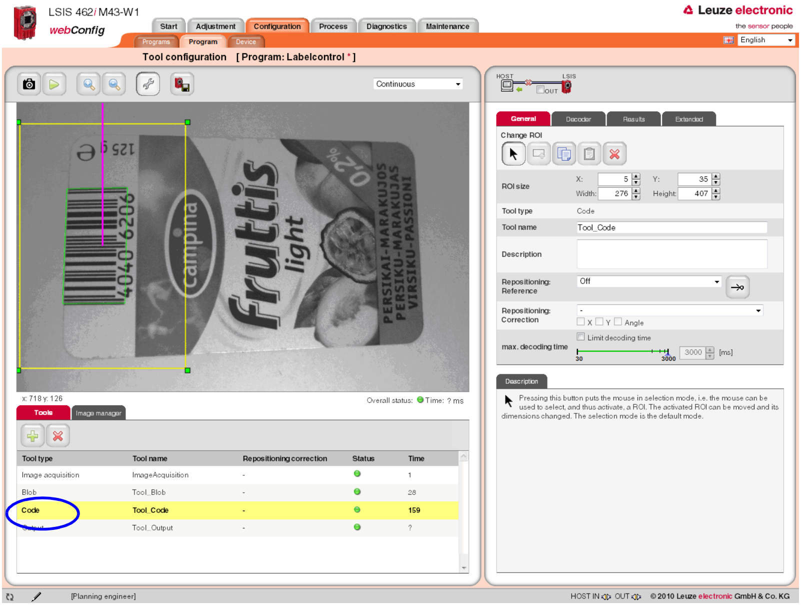
↳ *In the tool list, activate the "Code" tool.*

The configuration masks associated with this tool open on the right side.

Defining the ROI

↳ *In the "General" parameter group, define a region of interest around the area in which the code to be read must be located in order to reduce the execution time of the tool.*

If no ROI is defined, the entire image is analyzed.


LSIS 462*i* M43-W1
*web*Config
Leuze electronic
the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
General
Decoder
Results
Extended
Change ROI
Description
Tools
Image manager
[Planning engineer]
HOST IN
OUT
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Tool configuration [Program: Labelcontrol *]

ROI size: X: 5 Y: 35 Width: 276 Height: 407

Tool type: Code

Tool name: Tool_Code

Description:

Repositioning: Reference: Off

Repositioning: Correction: -
☐ X ☐ Y ☐ Angle

max. decoding time: ☐ Limit decoding time
30 3000 3000 [ms]

Pressing this button puts the mouse in selection mode, i.e. the mouse can be used to select, and thus activate, a ROI. The activated ROI can be moved and its dimensions changed. The selection mode is the default mode.

x: 718 y: 126

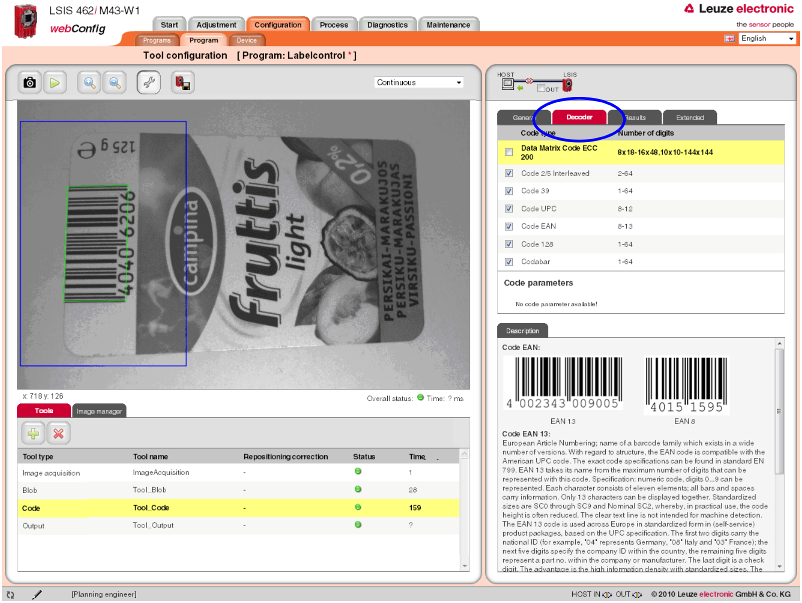
Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	**Tool_Code**	**-**	●	**159**
Output	Tool_Output	-	●	?

Figure 4.28: Defining the ROI

Deactivating any unneeded codes

- ↳ *Switch to the "Decoder" parameter group.*
- ↳ *Deactivate the unneeded codes in order to reduce the execution time of the tool or to restrict reading to certain code types.*


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
HOST
LSIS
OUT
General
Decoder
Results
Extended
Tools
Image manager
Description
EAN 13
EAN 8
HOST IN
OUT

Tool configuration [Program: Labelcontrol *]

x: 718 y: 126

Overall status: ● Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	**Tool_Code**	**-**	●	**159**
Output	Tool_Output	-	●	?

	Code type	Number of digits
☐	**Data Matrix Code ECC 200**	**8x18-16x48,10x10-144x144**
☑	Code 2/5 Interleaved	2-64
☑	Code 39	1-64
☑	Code UPC	8-12
☑	Code EAN	8-13
☑	Code 128	1-64
☑	Codabar	1-64

Code parameters

No code parameter available!

Code EAN:

Code EAN 13:
European Article Numbering; name of a barcode family which exists in a wide number of versions. With regard to structure, the EAN code is compatible with the American UPC code. The exact code specifications can be found in standard EN 799. EAN 13 takes its name from the maximum number of digits that can be represented with this code. Specification: numeric code, digits 0...9 can be represented. Each character consists of eleven elements; all bars and spaces carry information. Only 13 characters can be displayed together. Standardized sizes are SC0 through SC9 and Nominal SC2, whereby, in practical use, the code height is often reduced. The clear text line is not intended for machine detection. The EAN 13 code is used across Europe in standardized form in (self-service) product packages, based on the UPC specification. The first two digits carry the national ID (for example, '04' represents Germany, '08' Italy and '03' France); the next five digits specify the company ID within the country, the remaining five digits represent a part no. within the company or manufacturer. The last digit is a check digit. The advantage is the high information density with standardized sizes. The

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Figure 4.29: "Decoder" parameter group – deactivating unneeded codes

In this example, the deactivation of the 2D Data Matrix code results in a considerable reduction of the execution time (in the same way, deactivation of all 1D barcodes leads to a considerable reduction if only a Data Matrix code is being searched for).

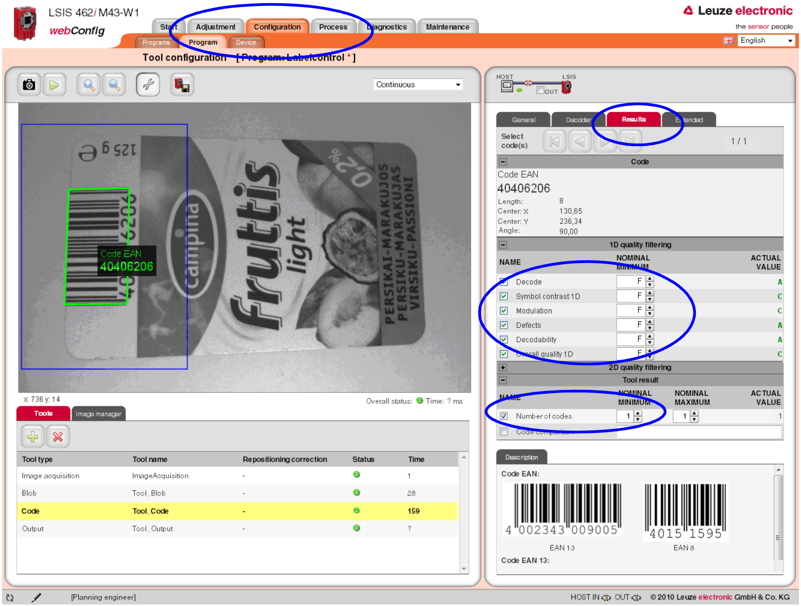
Defining the quality filter and number of codes to be found

↳ *Change to the "Results" parameter group to view details on the read codes in the image or region of interest.*

Various "OK criteria" can also optionally be defined here for the tool result – with respect to the quality parameters of the read code, the number of codes to be found or with respect to a code comparison.

In the current example, exactly one code is to be found with arbitrary quality parameters (= F).

↳ *Set the corresponding options, as shown in the figure.*


LSIS 462i M43-W1
webConfig
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
Leuze electronic
the sensor people
English
Continuous
Code EAN
40406206
HOST
LSIS
OUT
General
Decoder
Results
Extended
Select code(s)
1 / 1
Description
Code EAN:
EAN 13
EAN 8
Code EAN 13:
HOST IN
OUT
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Tool configuration [Program: Labelcontrol *]

Code

Code EAN

40406206

Length:	8
Center: X	130,65
Center: Y	236,34
Angle:	90,00

1D quality filtering

NAME	NOMINAL MINIMUM	ACTUAL VALUE
☑ Decode	F	A
☑ Symbol contrast 1D	F	C
☑ Modulation	F	C
☑ Defects	F	A
☑ Decodability	F	A
☑ Overall quality 1D	F	C

2D quality filtering

Tool result

NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☑ Number of codes	1	1	1
☐ Code comparison			

x: 736 y: 14

Overall status: ● Time: ? ms

Tools | Image manager

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	28
Code	**Tool_Code**	**-**	●	**159**
Output	Tool_Output	-	●	?

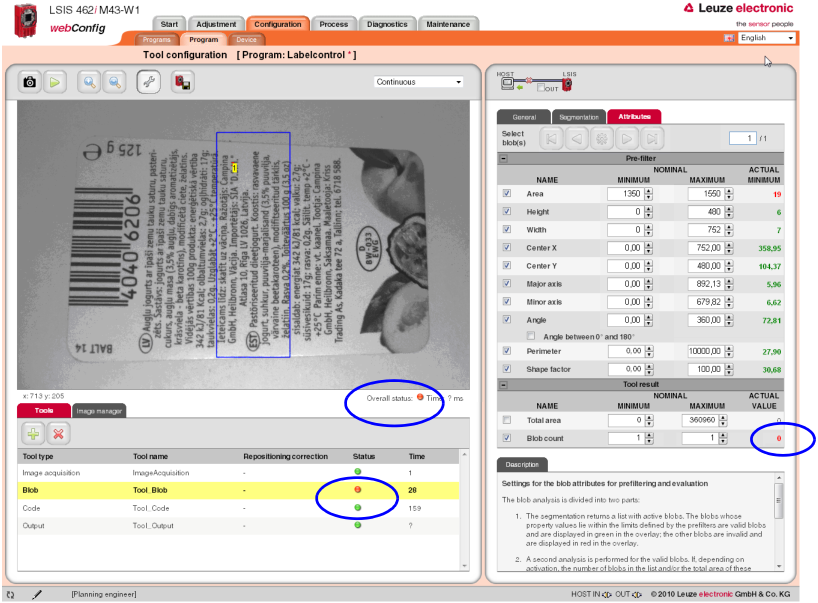
[Planning engineer]

Figure 4.30: "Results" parameter group – use quality filter and number to define tool result

Example for code reading with combined BLOB analysis in which the object attributes do not correspond to the criteria

The inspection with an "incorrect" label that does contain the searched-for letter "f" shows that the code is read (green status LED in the "Code" line), but the BLOB analysis fails (red status LED in the "BLOB" line).

As soon as a tool in the tool list yields an NOK result (red status LED), the global result is NOK as well (red "global result" status LED below the camera image).


LSIS 462i M43-W1
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the sensor people
Start
Adjustment
Configuration
Process
Diagnostics
Maintenance
Programs
Program
Device
English
Continuous
HOST
LSIS
OUT
General
Segmentation
Attributes
Select blob(s)
Tools
Image manager
Description
HOST IN
OUT
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Tool configuration [Program: Labelcontrol *]

x: 713 y: 205

Overall status: 🔴 Time: ? ms

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	🟢	1
Blob	**Tool_Blob**	**-**	🔴	**28**
Code	Tool_Code	-	🟢	159
Output	Tool_Output	-	🟢	?

[Planning engineer]

Select blob(s): 1 / 1

Pre-filter

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL MINIMUM
☑	Area	1350	1550	19
☑	Height	0	480	6
☑	Width	0	752	7
☑	Center X	0,00	752,00	358,95
☑	Center Y	0,00	480,00	104,37
☑	Major axis	0,00	892,13	5,96
☑	Minor axis	0,00	679,82	6,62
☑	Angle	0,00	360,00	72,81
	☐ Angle between 0° and 180°			
☑	Perimeter	0,00	10000,00	27,90
☑	Shape factor	0,00	100,00	30,68

Tool result

	NAME	NOMINAL MINIMUM	NOMINAL MAXIMUM	ACTUAL VALUE
☐	Total area	0	360960	0
☑	Blob count	1	1	0

Settings for the blob attributes for prefiltering and evaluation

The blob analysis is divided into two parts:

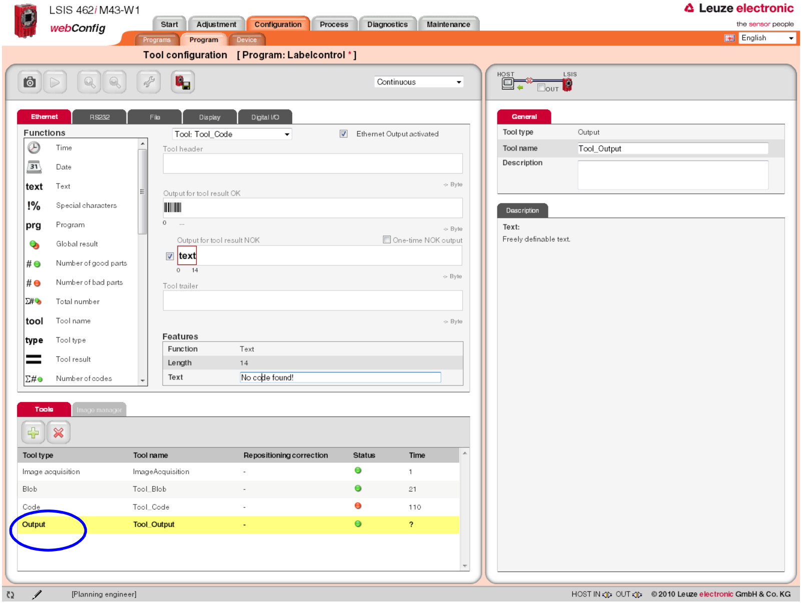
1. The segmentation returns a list with active blobs. The blobs whose property values lie within the limits defined by the prefilters are valid blobs and are displayed in green in the overlay; the other blobs are invalid and are displayed in red in the overlay.
2. A second analysis is performed for the valid blobs. If, depending on activation, the number of blobs in the list and/or the total area of these

Figure 4.31: Evaluating object attributes

4.3.6 Optional: Configuring process data output

↳ *In the "Program" tab of the Configuration module, switch to the "Output" tool type to configure an output sequence.*

This sequence is output following processing of the check program, e.g., via the Ethernet process interface.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Programs
Program
Device
English
HOST
LSIS
OUT
Ethernet
RS232
File
Display
Digital I/O
General
Description
Functions
Time
Date
text Text
!% Special characters
prg Program
Global result
Number of good parts
Number of bad parts
Total number
tool Tool name
type Tool type
Tool result
Number of codes
-> Byte
Tools
Image manager
HOST IN
OUT

Tool configuration [Program: Labelcontrol *]

Continuous

Tool: Tool_Code

☑ Ethernet Output activated

Tool header

Output for tool result OK

Output for tool result NOK

☐ One-time NOK output

☑ text

Tool trailer

Features

Function	Text
Length	14
Text	No code found!

Tool type	Tool name	Repositioning correction	Status	Time
Image acquisition	ImageAcquisition	-	●	1
Blob	Tool_Blob	-	●	21
Code	Tool_Code	-	●	110
Output	**Tool_Output**	-	●	?

Tool type	Output
Tool name	Tool_Output
Description	

Text:
Freely definable text.

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Figure 4.32: Window for configuring the output

Displayed in the left area is a list of the available "output functions". Information on the individual elements (date, time etc.) and other possibilities for the specification are available as usual in the right part of the window.

Configuring the Ethernet output

↳ *Activate the* `Ethernet output activated` *check box.*

↳ *In the list box, first define whether you would like to configure the header, the code tool or the trailer.*

↳ *Insert the desired elements from the function list in the input line provided for this purpose at the right by means of drag & drop.*

↳ *Specify element options, such as length, alignment, fill character, etc., in the lower part of the Features area.*

Delimiters between the individual pieces of data and the use of separate lines increase the "readability" of the output data.

In the current example, the code contents are output in the case of an OK; for an NOK (no code detected), a freely definable text "no code found!" is output.

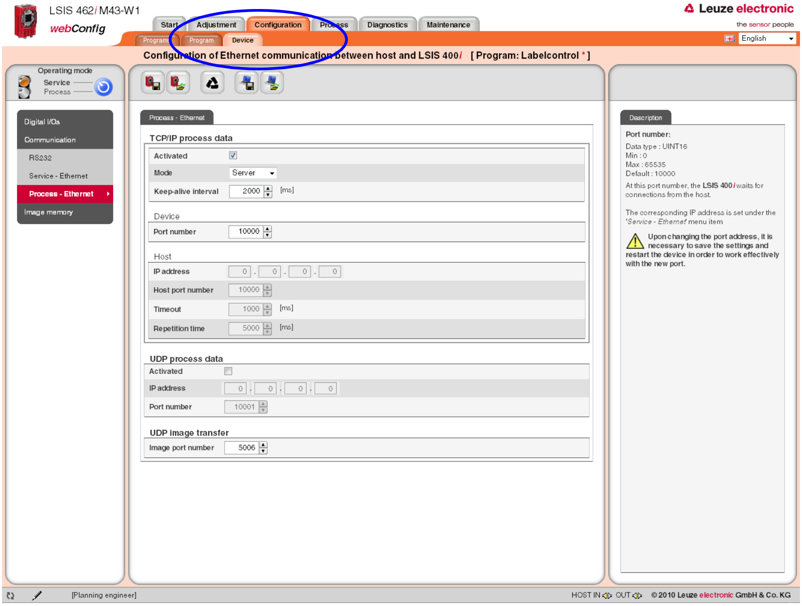
Activation of the "Host LSIS" check box in the upper right causes the otherwise undisplayed tool execution time to be calculated and displayed for the data output.

4.3.7 Optional: Configuring cross-program device settings for process-data transmission

↳ *In the "Configuration" work module, switch to the "Device" tab.*

↳ *In the "Process - Ethernet" submenu, specify the parameters for Ethernet communication with the primary control that is to receive the process data.*

In the current example, a TCP/IP connection is established with the LSIS as server.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Programs
Program
Device
English
Operating mode
Service
Process
Digital I/Os
Communication
RS232
Service - Ethernet
Process - Ethernet
Image memory
Process - Ethernet
Description
[Planning engineer]
HOST IN
OUT
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Configuration of Ethernet communication between host and LSIS 400*i* [Program: Labelcontrol *]

TCP/IP process data

Activated	☑
Mode	Server
Keep-alive interval	2000 [ms]

Device

Port number	10000

Host

IP address	0 . 0 . 0 . 0
Host port number	10000
Timeout	1000 [ms]
Repetition time	5000 [ms]

UDP process data

Activated	☐
IP address	0 . 0 . 0 . 0
Port number	10001

UDP image transfer

Image port number	5006

Port number:
Data type : UINT16
Min : 0
Max : 65535
Default : 10000

At this port number, the **LSIS 400*i*** waits for connections from the host.

The corresponding IP address is set under the '*Service - Ethernet*' menu item

⚠ **Upon changing the port address, it is necessary to save the settings and restart the device in order to work effectively with the new port.**

Figure 4.33: Defining Ethernet communication with the primary control

4.4 Tips and tricks

4.4.1 Camera alignment and setup in the case of reflective objects

To avoid interfering reflections in the gray-value image during image acquisition on highly reflective objects, such as crown caps, it is recommended that the camera be mounted at a slight incline and with adjusted illumination focus according to object size and object distance. This is illustrated in the following images.

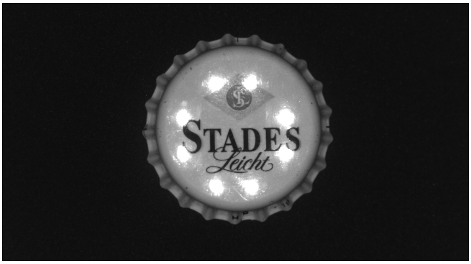

Figure 4.34: Vertical camera alignment - maximum reflections

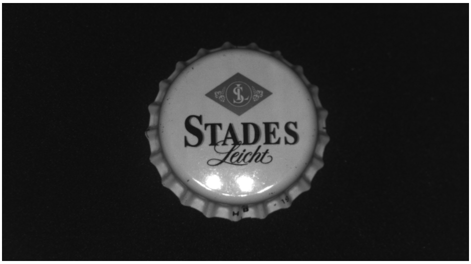

Figure 4.35: Inclined camera alignment with all four illumination quadrants active - better, but reflections still visible in one quadrant

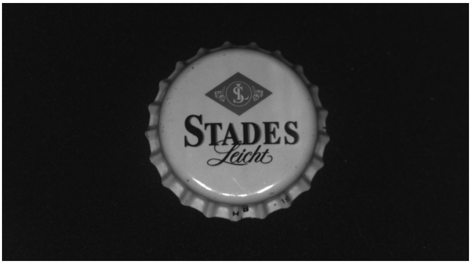

Figure 4.36: Inclined camera alignment with only three illumination quadrants active (reflected quadrant is off) - nearly all reflections in the image are suppressed

4.4.2 Using filters in the BLOB analysis

The following morphological filters can be applied to the binary image created following segmentation:

- Erosion
- Dilatation
- Open
- Close

Notice!

When speaking of "bright" in the context of binary filters, the active pixels displayed in color in the image overlay are always meant.
When speaking of "dark" in the context of binary filters, the remaining area of the image is always meant.

4.4.2.1 "Erosion" binary filter

Enlarge dark structures, eliminate bright interfering pixels

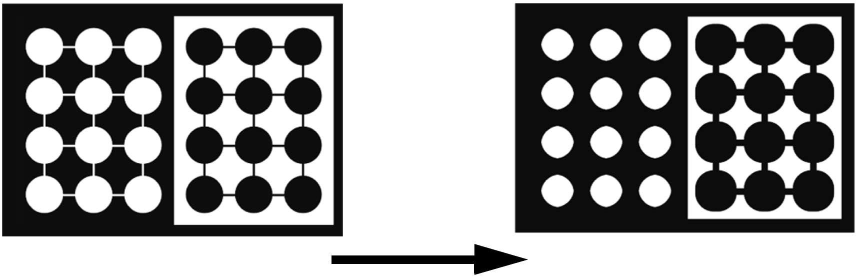

Figure 4.37: Original/processed image

4.4.2.2 "Dilatation" binary filter

Enlarge bright structures, eliminate dark interfering pixels

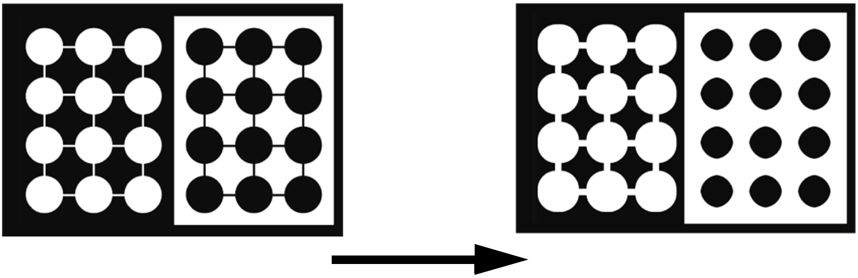

Figure 4.38: Original/processed image

4.4.2.3 "Open" binary filter

Close gaps in dark objects without changing the object size

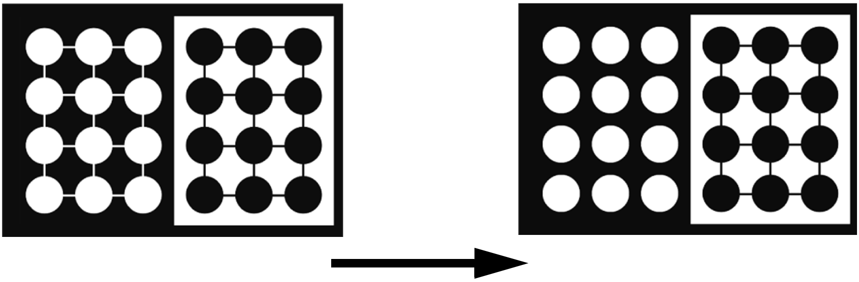

Figure 4.39: Original/processed image

4.4.2.4 "Close" binary filter

Close gaps in bright objects without changing the object size

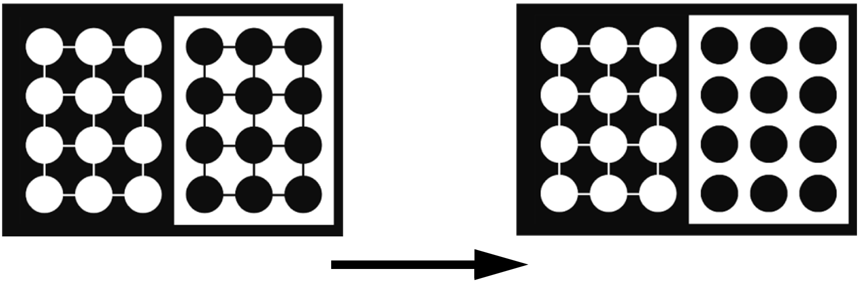

Figure 4.40: Original/processed image

4.4.3 Illumination

Decisive for image processing is the highlighting of characteristic features of the object to be inspected.

Problems could arise as the result of:

- Shadows
- Reflections
- Too much light
- Too little light
- Reflective surfaces
- Poor contrast

Various **lighting techniques** can be used:

- Rear illumination
- Front illumination
- Bright field illumination
- Dark field illumination
- Telecentric illumination
- Diffuse light source
- Continuous illumination
- Pulsed illumination (flash)
- Light color (red, IR, UV, ...)

Rear illumination

Illumination type where the object is located between the camera and the light source.

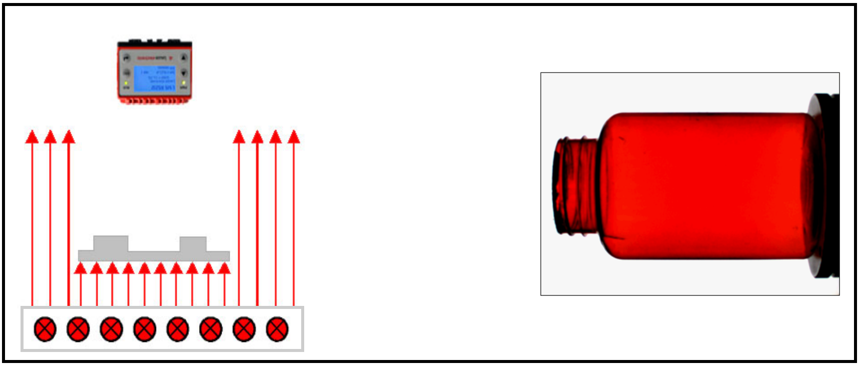

Figure 4.41: Rear illumination

Notice!

This can be used to create silhouettes with sharp edges and very good contrast for contour inspections.

Front illumination

Illumination type where the camera and the light source are located in front of the object.

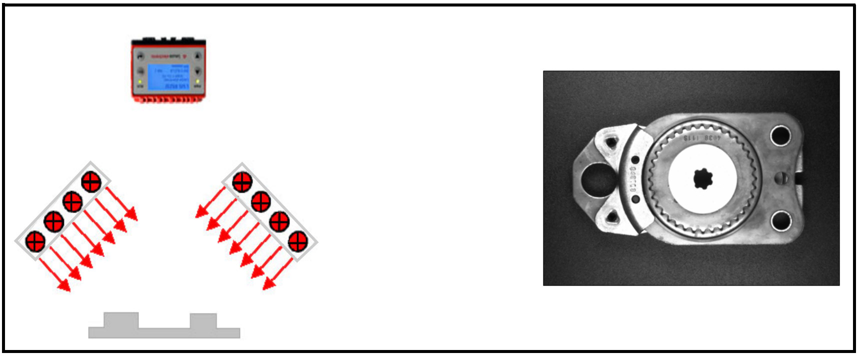

Figure 4.42: Front illumination

Notice!

Diffuse (scattering) objects are always visible, glossy objects only at an appropriate angle relative to the objective.

Bright field

Illumination type in which the camera detects the light directly reflected by the object surface.

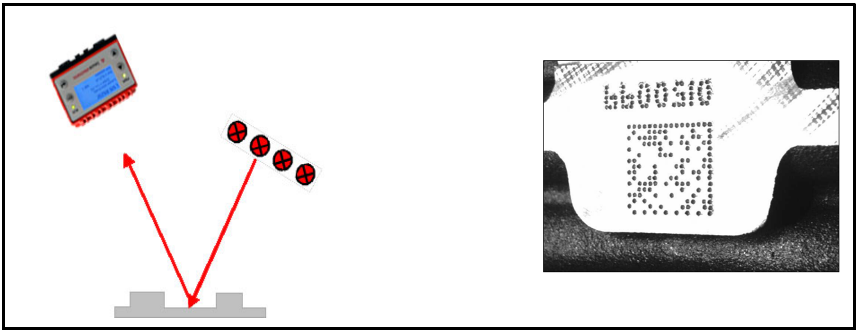

Figure 4.43: Bright field

Notice!

The reflecting surfaces appear bright, while the scattering surfaces appear dark. Gloss is possible!

Dark field

Illumination type where the camera detects the light spread by the object surface (scratches, indentations).

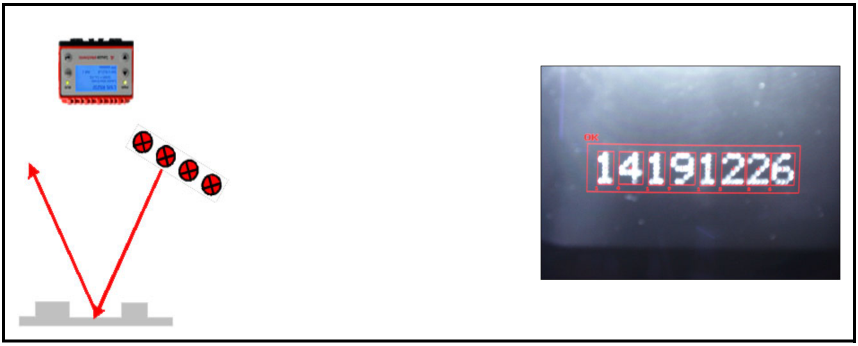

Figure 4.44: Dark field

Notice!

The scattering surfaces appear bright, while the reflecting surfaces appear dark.

Directed illumination

Illumination type where the incident light has a narrow angular distribution. Ideal case: Telecentric illumination (parallel light).

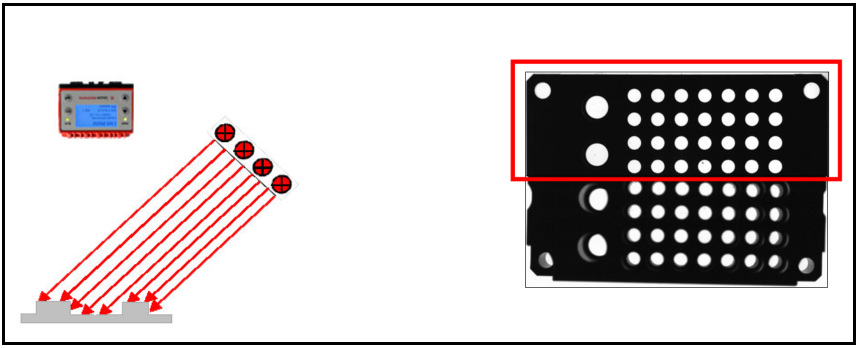

Figure 4.45: Directed illumination

Notice!

Yieldss very strong edge contrast and emphasizes object surface structures.

Diffuse illumination

Homogeneous illumination of a half-space from all directions (primarily for reflective/glossy objects).

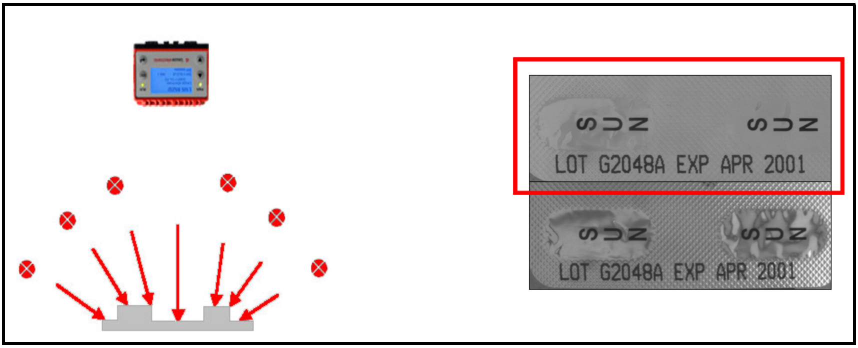
LOT G2048A EXP APR 2001
LOT G2048A EXP APR 2001

Figure 4.46: Diffuse illumination

Notice!

With homogeneous rear illumination, dark objects appear smaller (lighter edges as a result of diffused light).

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