Leuze electronic

the sensor people

LSIS 400*i* *webConfig*

Software Description – Firmware Version 1.1

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Operator Manual

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1 General information ... 3
1.1 About the "**LSIS 400*i webConfig***" program – system requirements ... 3
1.2 Explanation of symbols ... 4
1.3 Contact address ... 4

2 First steps ... 5
2.1 Starting the program ... 5
2.2 Program concept: operating modes – users – modules ... 6

3 Descriptions of the user interface and menu ... 7
3.1 "Start" module ... 10
3.1.1 "Welcome" tab ... 10
3.1.2 "Identification" tab ... 11
3.1.3 "Installation" tab ... 12
3.1.4 "Specifications" tab ... 13
3.1.5 "Login" tab ... 13
3.2 "Adjustment" module ... 14
3.2.1 "Current" tab ... 15
3.3 "Configuration" module ... 18
3.3.1 "Programs" tab ... 18
3.3.2 "Program" tab ... 21
3.3.2.1 Tool-type-independent buttons and operational controls ... 22
3.3.2.2 Tool list ... 24
3.3.2.3 Display for the "Image acquisition" tool type ... 26
3.3.2.4 Display of the "blob" tool type ... 28
3.3.2.5 Display of the "output" tool type ... 37
3.3.3 "Device" tab ... 43
3.3.3.1 "Digital I/Os" menu ... 44
3.3.3.2 "Communication -> RS 232" menu ... 47
3.3.3.3 "Communication -> Service - Ethernet" menu ... 48
3.3.3.4 "Communication -> Process - Ethernet" menu ... 49
3.3.3.5 "Image memory" menu ... 54
3.4 "Process" module ... 56
3.5 "Diagnostics" module ... 57
3.5.1 "Events" tab ... 58
3.5.2 "Device" tab ... 59
3.5.2.1 "Log file" menu ... 60
3.5.2.2 "Digital I/Os" menu ... 61
3.6 "Maintenance" module ... 62
3.6.1 "User management" tab ... 62
3.6.1.1 "User management" menu ... 63
3.6.1.2 "Role descriptions" menu ... 64
3.6.2 "System" tab ... 65
3.6.2.1 "Backup/Restore" menu ... 65
3.6.2.2 "Firmware reload" menu ... 67

3.6.2.3 "System clock" menu 68

4 Working with LSIS 400*i webConfig* 69

4.1 Basic procedure – step-by-step configuration of a blob analysis 69
4.1.1 Setting the parameters for image acquisition 71
4.1.2 Selecting or creating a new check program 72
4.1.3 Defining regions of interest (ROI) within the field of view (FOV) 73
4.1.4 Segmentation of the image 74
4.1.5 Evaluating object attributes 75
4.1.6 Configuring digital inputs/outputs 77
4.2 Tips and tricks 78
4.2.1 Camera alignment and setup in the case of reflective objects 78
4.2.2 Using filters in the blob analysis 79
4.2.2.1 "Erosion" binary filter 79
4.2.2.2 "Dilatation" binary filter 79
4.2.2.3 "Open" binary filter 80
4.2.2.4 "Close" binary filter 80

1 General information

1.1 About the "LSIS 400*i* *webConfig*" program – system requirements

Leuze's ***webConfig*** is used to configure smart cameras of the **LSIS 400*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 **7.0**.*
LSIS 400*i* webConfig** *is completely contained in the firmware of the **LSIS 400*i.*

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.

Activities in webConfig

The software offers the following possibilities for setting up the **LSIS 400*i***:

- Create, configure and activate various check programs
- Configure the communication interfaces
- Set up and align the camera
- Display and manage diagnostic-relevant data, such as event logs and communication diagnostics, through the definition of output logs
- 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 can result in injuries to personnel 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 400*i* *webConfig***.

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2 First steps

First, make certain that the **LSIS 400*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 400*i***.

Furthermore, you must ensure that the connection between PC and **LSIS 400*i*** was established as described in the technical description **LSIS 400*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 400*i*** 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 400*i***.*

You can check the network address of the **LSIS 400*i*** by pressing the enter button ⏎ on the display three times in sequence during normal operation of the **LSIS 400*i***.

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

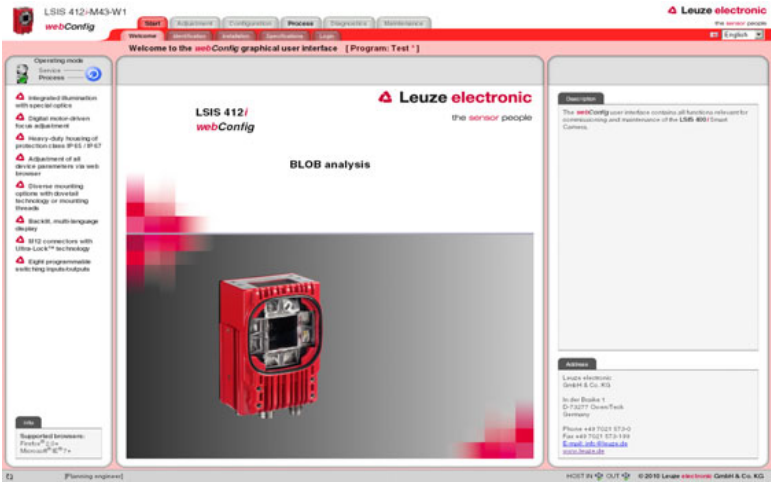


Figure 2.1: Start page **LSIS 400*i* *webConfig***

Notice!

*The **webConfig** is completely contained in the firmware of the **LSIS 400*i***. Depending on firmware version, the start page may vary from that shown above.*

2.2 Program concept: operating modes – users – modules

Operating modes

Depending to the requirements of the work process, **LSIS 400*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 main computer, it receives control signal and returns output; configuration via webConfig is deactivated.

The configuration, management and diagnostic tasks required for setting up and optimizing production operation are accessed in service operation: thus, the device is controlled from within ***webConfig***; the sending and receiving of signals from and to the master computer is switched off by default (except for a trigger input and, if configured, an output for controlling an external flash).

User roles

To prevent unintended operating errors as far as possible and to facilitate user-dependent access permissions, **LSIS 400*i* *webConfig*** functions with a role concept that assigns the different users a specific "role" with various hierarchically structured authorizations. By default, the user interface of the program opens in the "Process" operating mode with the highest user authorization, "planning engineer".

Detailed information on this topic can be found in ""User management" tab" on page 62.

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.

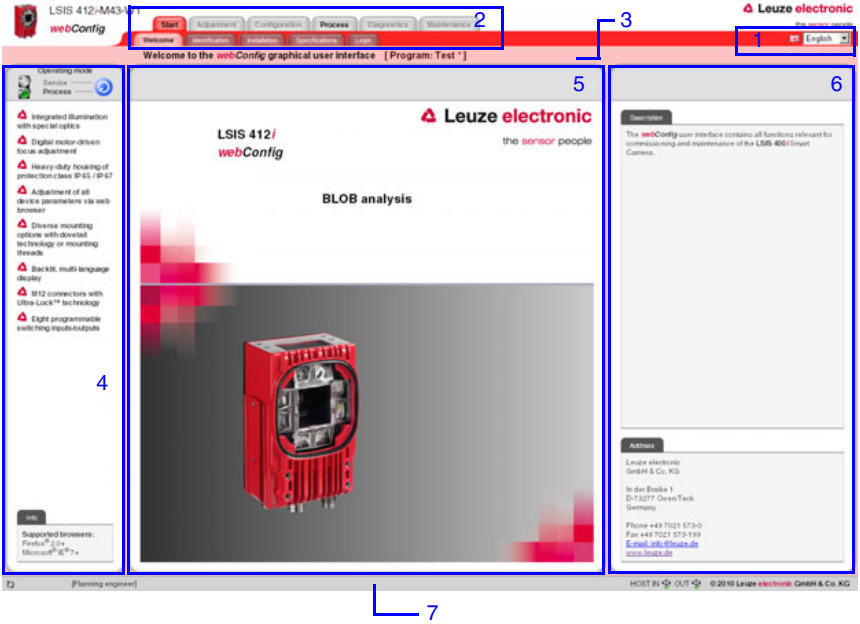
The following overview shows which modules are available in which operating mode.

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 400*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. By default, the program interface opens in the "Process" operating mode with the highest user authorization, "Planning engineer". The following start window appears in this case:



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

Figure 3.1: **LSIS 400*i* *webConfig*** Start window/status bar

In general, **LSIS 400*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 400*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. At first glance in the title bar **(3)** , for example, you see 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 with rotating arrows **(7a)** visualizes the program status: if the arrows are turning, the program is working and no further actions are possible for a brief period.

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 400*i* *webConfig*** starts in the "Process" operating mode, i.e. the device is controlled from the master computer, it receives control signals and returns 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".

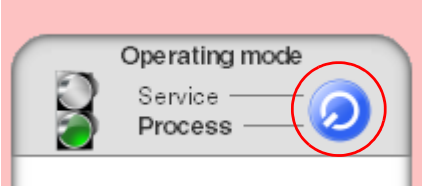


Figure 3.2: Changing the operating mode

Selecting the work modules

As already mentioned, the **LSIS 400*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 or 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 69.

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 400*i* *webConfig*** start window. The main device features are presented in the left window area. In addition, you can see which browsers are supported.

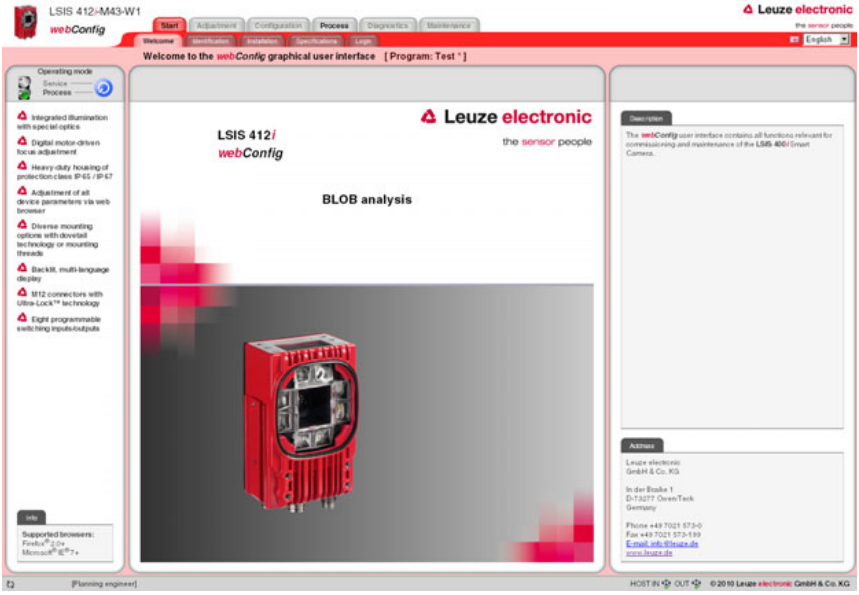


Figure 3.3: "Start" module, "Welcome" tab – device features

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, information about the hardware and software used in this device.

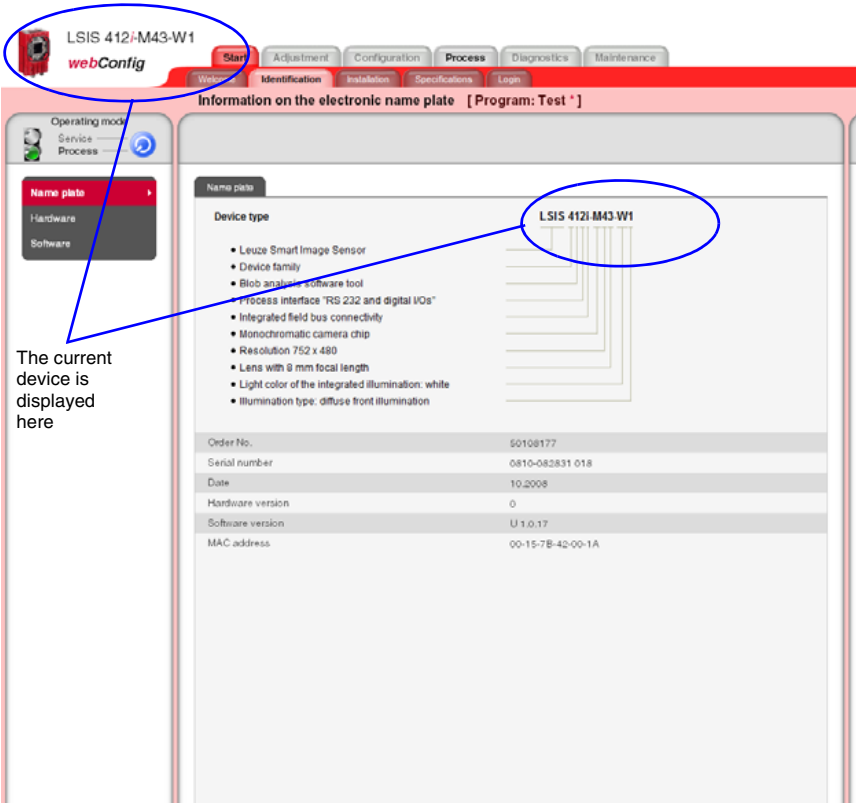


Figure 3.4: "Start" module, "Identification" tab – explanation of the name plate

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.

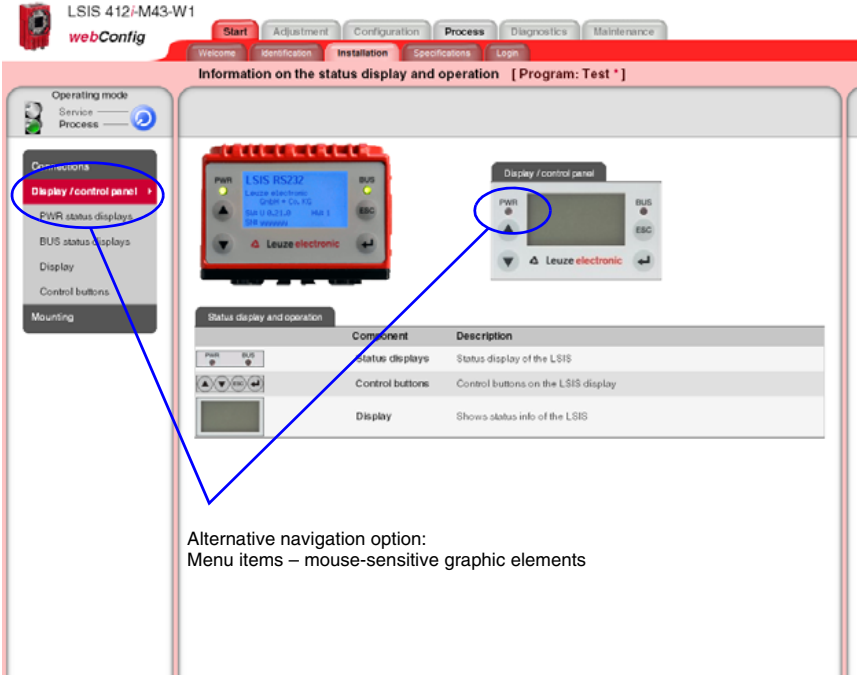


Figure 3.5: "Start" module, "Installation" tab

3.1.4 "Specifications" tab

The mechanical, electrical and optical device data are displayed here in tabular form.

Figure 3.6: "Start" module, "Specifications" tab

3.1.5 "Login" tab

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

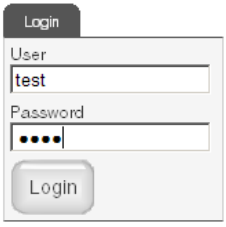


Figure 3.7: "Start" module, "Login" tab

Notice!

Only a user who has already been created can log in here. 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 62.

3.2 "Adjustment" module

Here, you can change the default settings of the image acquisition parameters for **new** check programs and change image acquisition parameters on a test basis.

Notice!

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

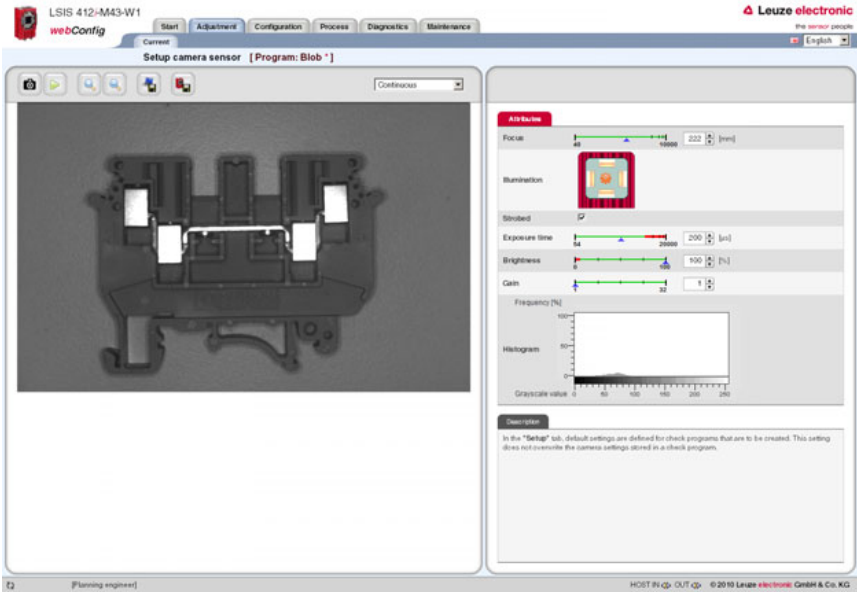


Figure 3.8: User interface of the "Adjustment" module

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 400*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.

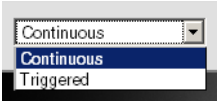
Pressing this button enlarges the view of the current image.

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 400*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 400*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



You have two options here for selecting the camera operating mode and, thus, for determining 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 400*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.

Parameter	Explanation
Exposure time	Setting for the exposure time; between 54 µs and 20 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%. 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, only use if the possibilities offered by the"Brightness" and "Exposure time" parameters have been 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 grey values in an image. The histogram of an image is used to make a statement on the grey 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.

3.3 "Configuration" module

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

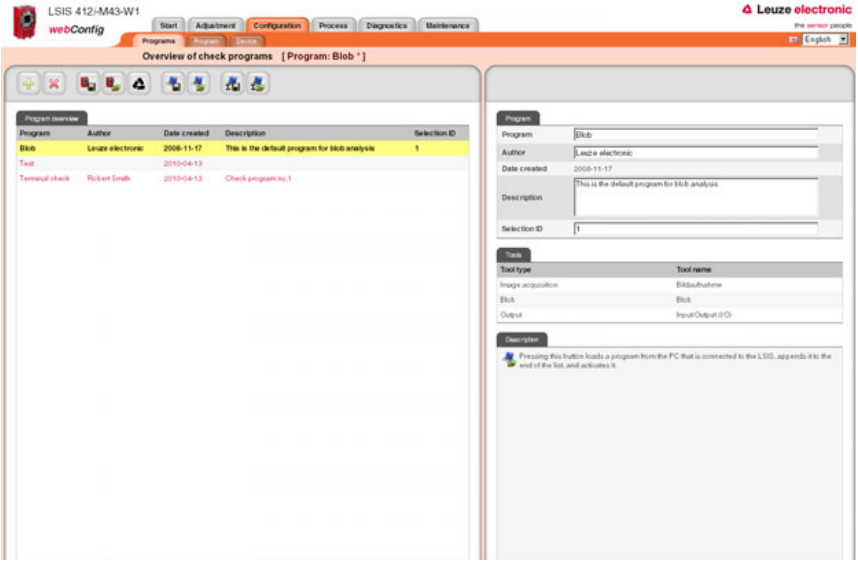


Figure 3.9: User interface of the "Configuration" module

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.

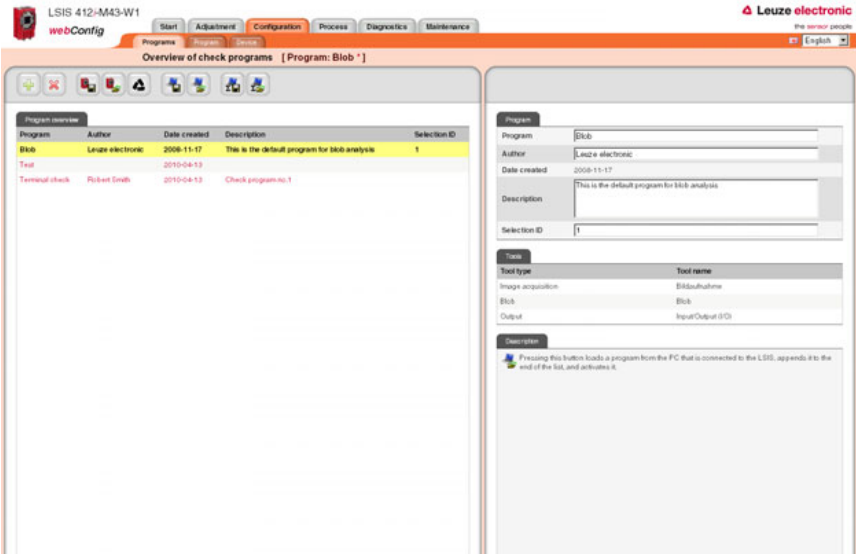


Figure 3.10:"Configuration" module, "Programs" tab

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 400*i***.

Pressing this button discards all changes by reloading the check programs saved in the flash memory of the **LSIS 400*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 400*i***.

Pressing this button loads a single program from the PC that is connected to the **LSIS 400*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.

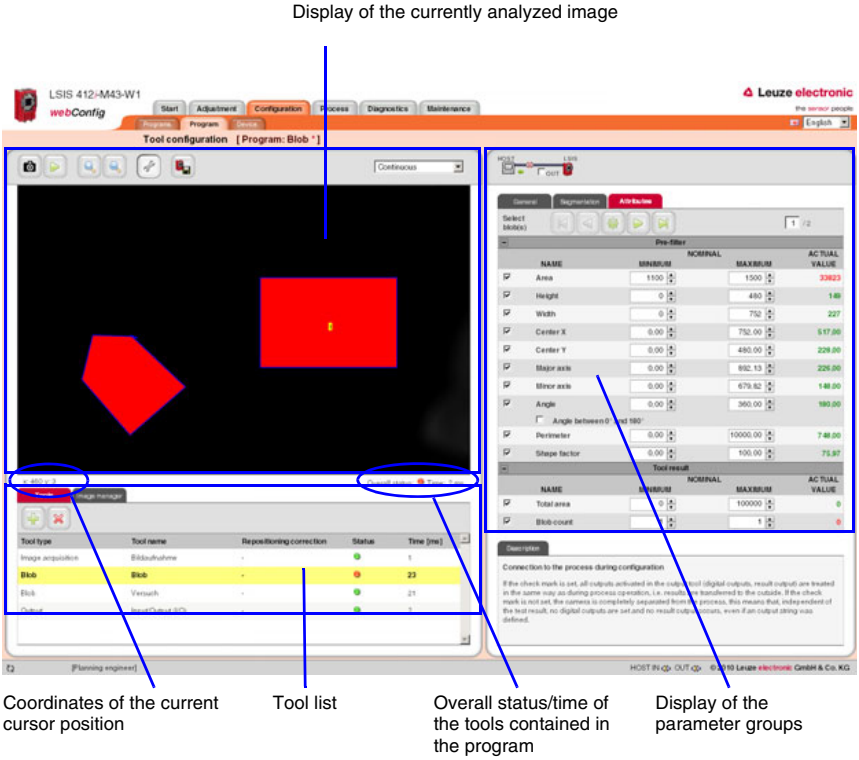


Figure 3.11:Three-part structure of the "Program" tab

The display in this window is primarily dependent on which tool type is selected in the lower area: "Image acquisition", "Blob" or "Output". 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 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 400*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.

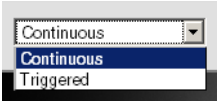
Pressing this button reduces the view of the current image.

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, an "*" 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 400*i***. Afterward, this symbol disappears.

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



You have two options here for selecting the camera operating mode and, thus, for determining 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 400*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.

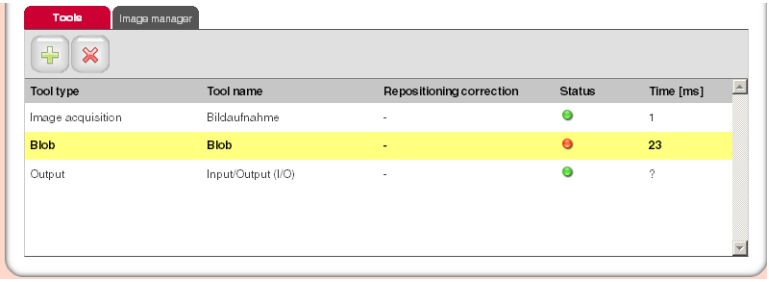


Figure 3.12:Tool list

The following operational controls are available in this window area:

"Tools" tab

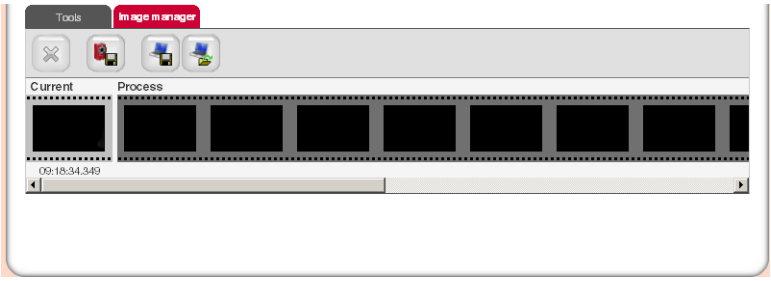
Display of the image processing tools contained in the active check program with specification of name, reference, duration and, above all, the status. Here, a green status LED indicates OK; a red LED, on the other hand, indicates a status of NOK. If the states of all tools contained in the program are 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 23.

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 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 400*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 400*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 400*i***.

Pressing this button loads an image from a PC that is connected to the **LSIS 400*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 grey-value image is displayed in the image display.

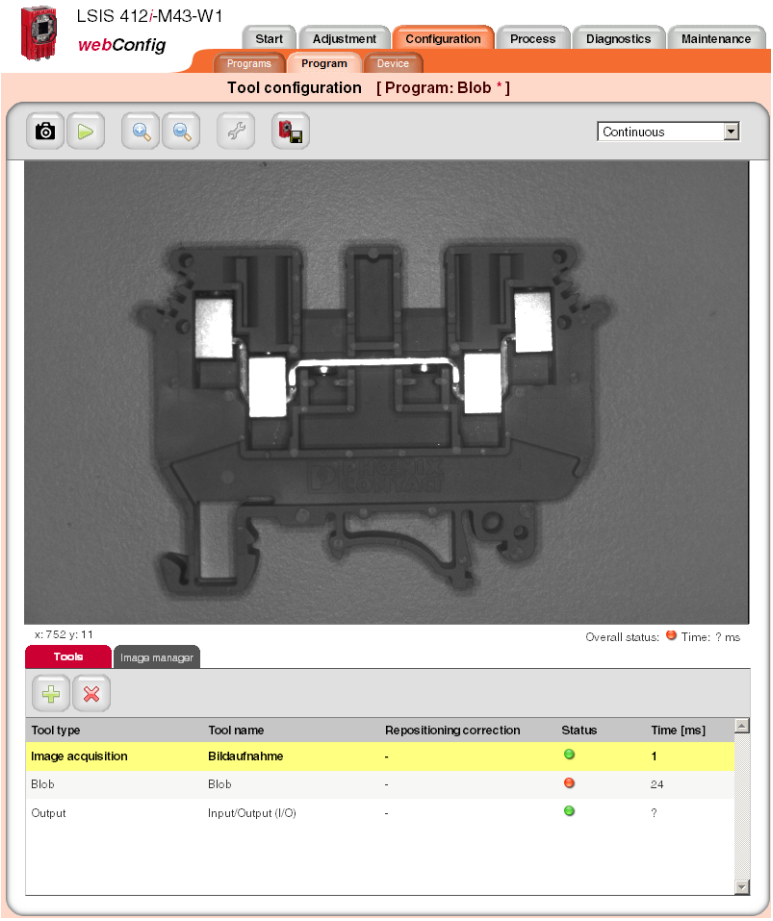


Figure 3.13:"Image acquisition" image display

Parameters for image acquisition

The "General" and "Attributes" tabs, described in chapter ""Adjustment" module" on page 14", 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!

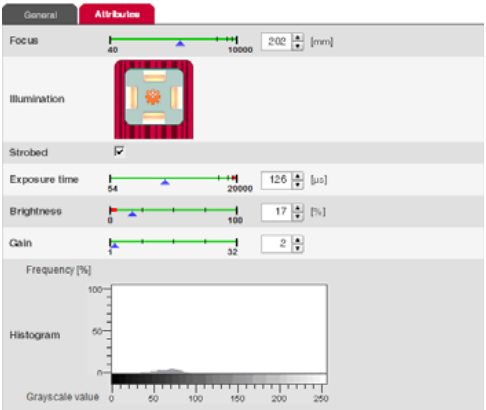


Figure 3.14:Image acquisition parameters

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

"Enable image transfer" check box

If this option is selected, 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 49.

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 grey-value image.

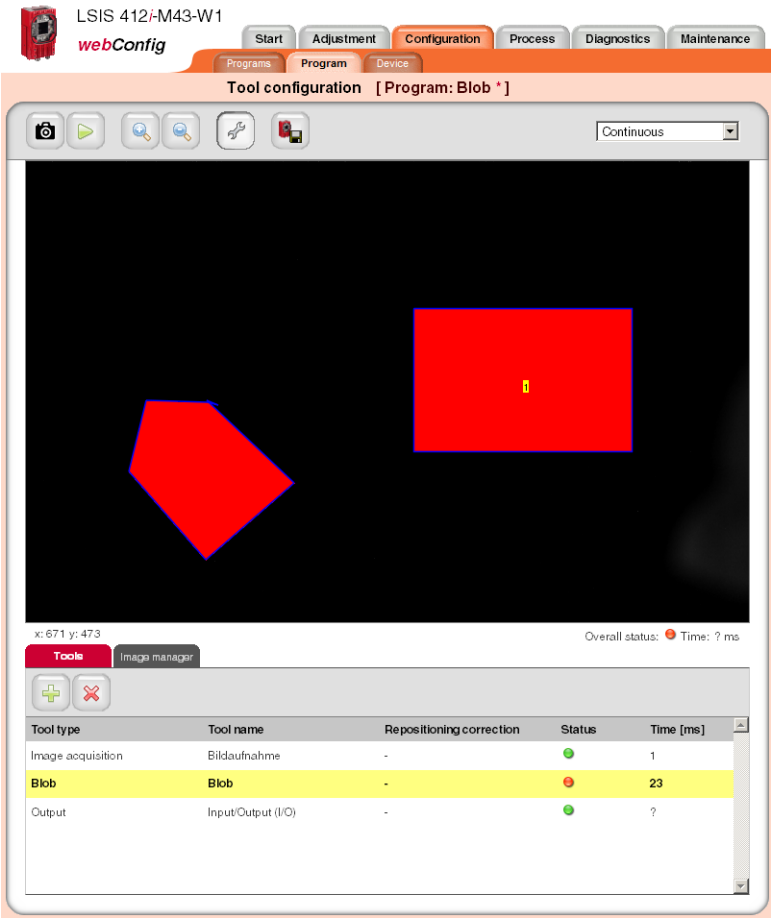


Figure 3.15:"Blob" image display

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 34), the blob number of the active blob is displayed on the image at the location of the centroid.

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

Blob tool: "General" parameter group

Located here are general settings for the blob tool.

Figure 3.16:General parameters of the blob 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. **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.

Parameter	Explanation
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.
Repositioning: Reference	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	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.

Blob tool: "Segmentation" parameter group

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

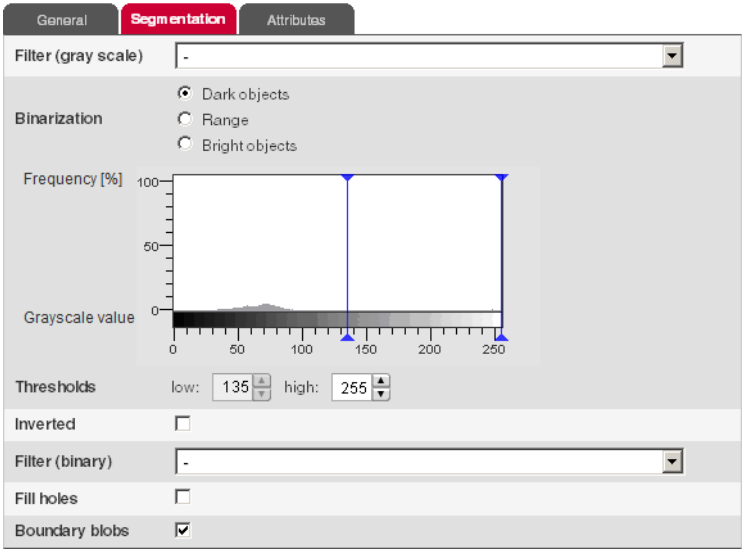


Figure 3.17:Segmentation parameters of the blob tool

Parameter	Explanation
Filter (grey scale)	The dropdown box enables the use of a filter on the recorded grey-value image. If the original image is noisy, a smoothing filter can be applied to the grey-value image prior to segmentation.
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 grey-value image can be preset as follows: Dark objects: 0 - 100, lower threshold fixed Range: 50 - 200 Light objects: 150 - 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 grey values in an image. The histogram of an image is used to make a statement on the grey 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 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.
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. In general, the selection and limitation of the values requires a certain amount of experience.

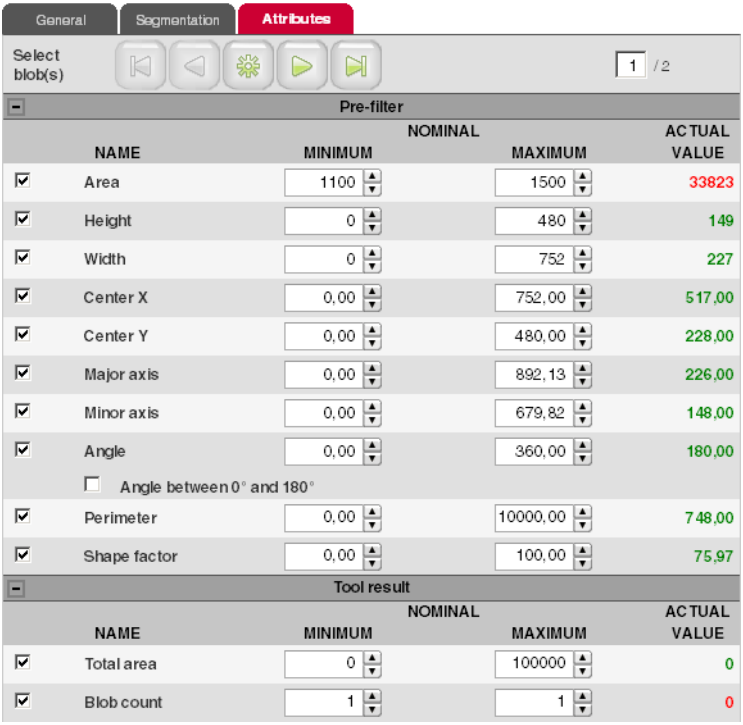


Figure 3.18:Setting the blob attributes

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 returns a list with active blobs. The blobs whose 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.

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 returns 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 mark the first blob in the list of localized blobs.

Click this blob 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 blob 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	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	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	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/perimeter²) * 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).

3.3.2.5 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.

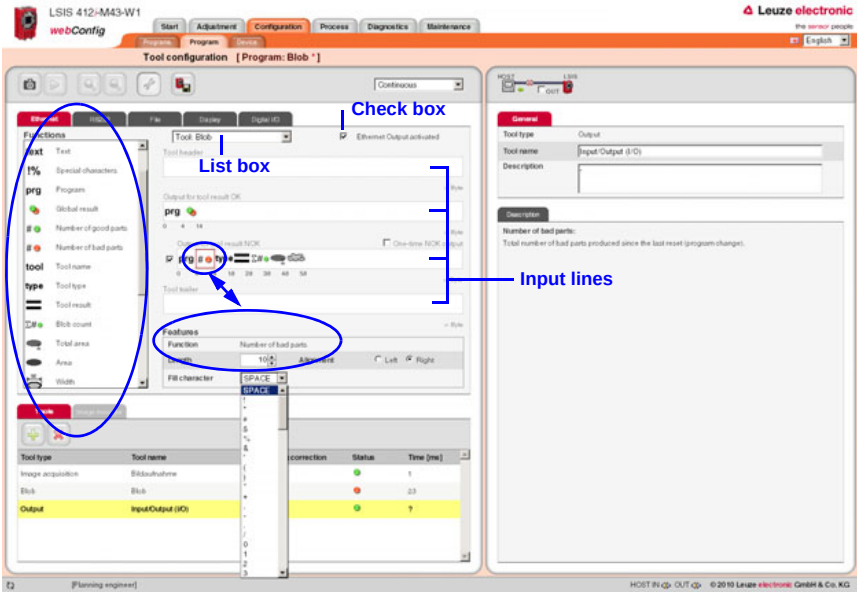


Figure 3.19:Window for configuring the output

" … 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 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. As a result, a table with various parameters for multiple blobs 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.

The list of output functions contains the following elements:

General functions

	Time: Time of the check-program evaluation in fixed format, "hh:mm:ss".
	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).
Σ	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? * area / perimeter2) * 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.

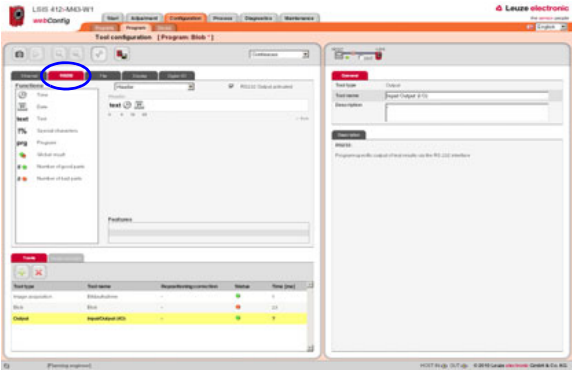
Features

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.

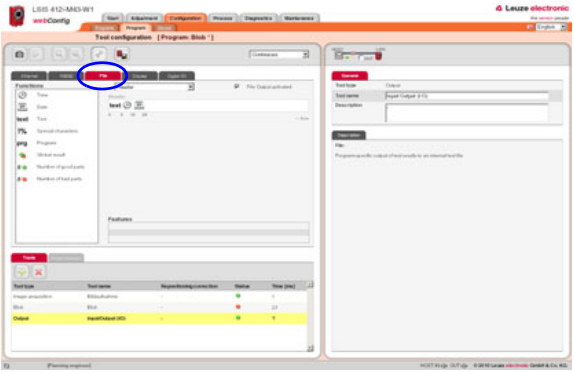
Configuring process-data output

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.

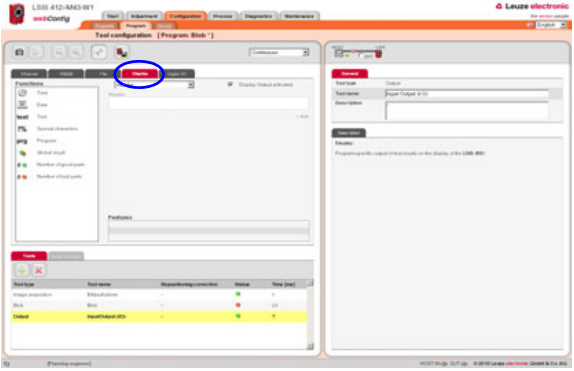
- Activate output (select check box)
- Define the part that is to be edited (header, tools, trailer)
- Add/remove output functions to/from the input line by means of drag&drop
- Specify element options, such as length, alignment, fill character, etc., in the lower part of the Features area
- If necessary, permanently save the settings in the flash memory of the **LSIS 400*i*** with the button



Configuring **RS 232** output



Configuring **file** output



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 3.1: Configuring process-data output

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.

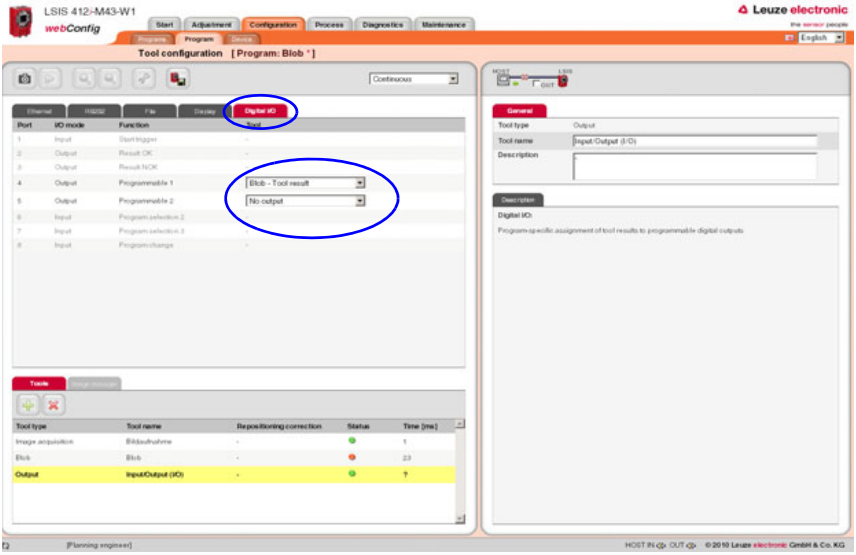


Figure 3.2: Configuring programmable outputs

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 400*i*** performs the server or the client function during TCP/IP communication of if communication occurs via UDP.

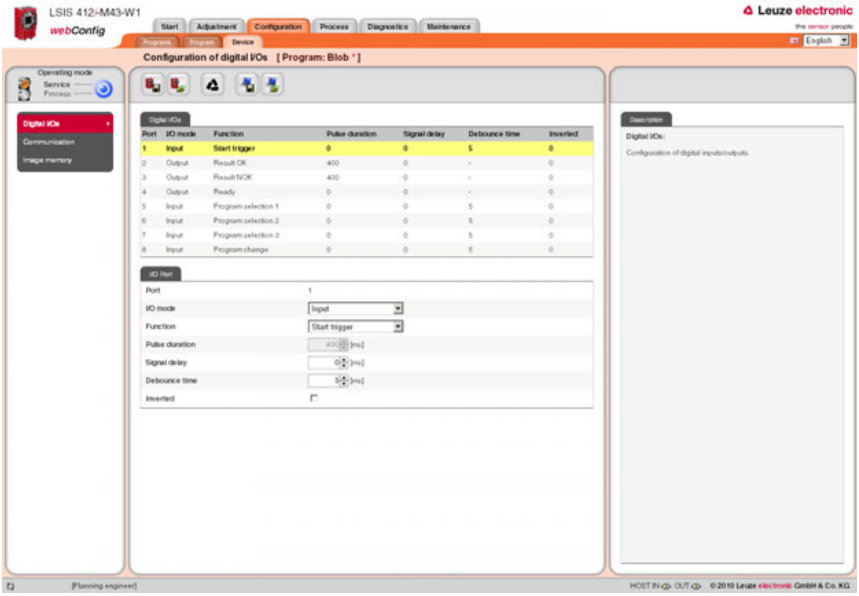


Figure 3.20:"Configuration" module, "Device" tab

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 400*i***.

Pressing this button discards all changes by reloading the device parameters saved in the flash memory of the **LSIS 400*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 400*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	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. 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:** 1. 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). 2. In the "Configuration-> Device" tab, the digital inputs for the program-selection bits and for the program change are defined. 3. Save the configuration in the **LSIS 400*i*** and switch to Process mode. 4. Following program selection via the corresponding program-selection bits, the "**program change**" input must be activated. 5. 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.
	Possible functions for *outputs*: **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.

Parameter	Explanation
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

Notice!

*As an alternative to the digital trigger input, the RS 232 or Ethernet interface can also be used for triggering in the "Process" operating mode. For this purpose, the "+" character must be sent to the **LSIS 400i** via RS 232 or the defined Ethernet process interface.*

3.3.3.2 "Communication -> RS 232" menu

The RS 232 interface is configured in this window.

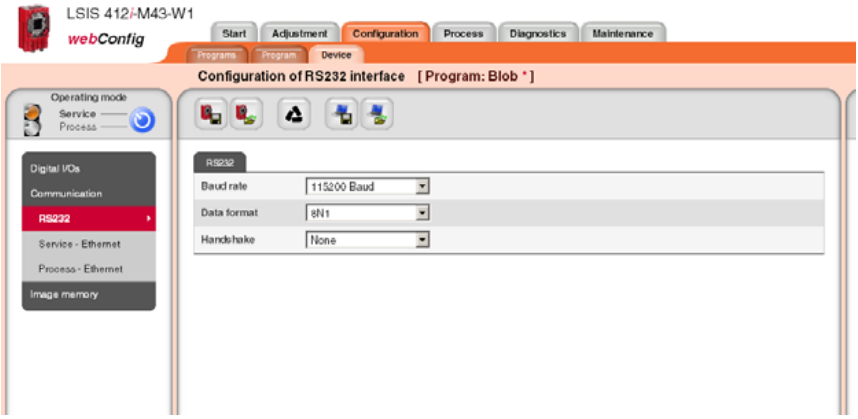


Figure 3.21:"Configuration" module, "Device" tab – "RS 232" communication

"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.

3.3.3.3 "Communication -> Service - Ethernet" menu

The Ethernet service interface can be set here.

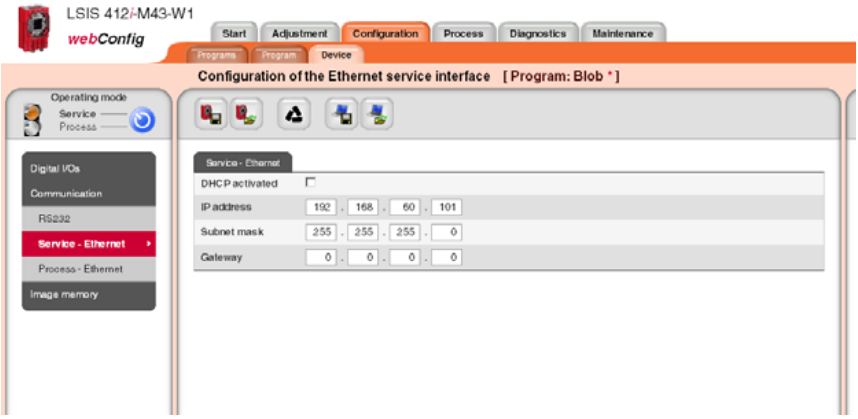


Figure 3.22:"Configuration" module, "Device" tab – "Service - Ethernet" communication

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 400*i*** performs the server or the client function during TCP/IP communication of if communication occurs via UDP.

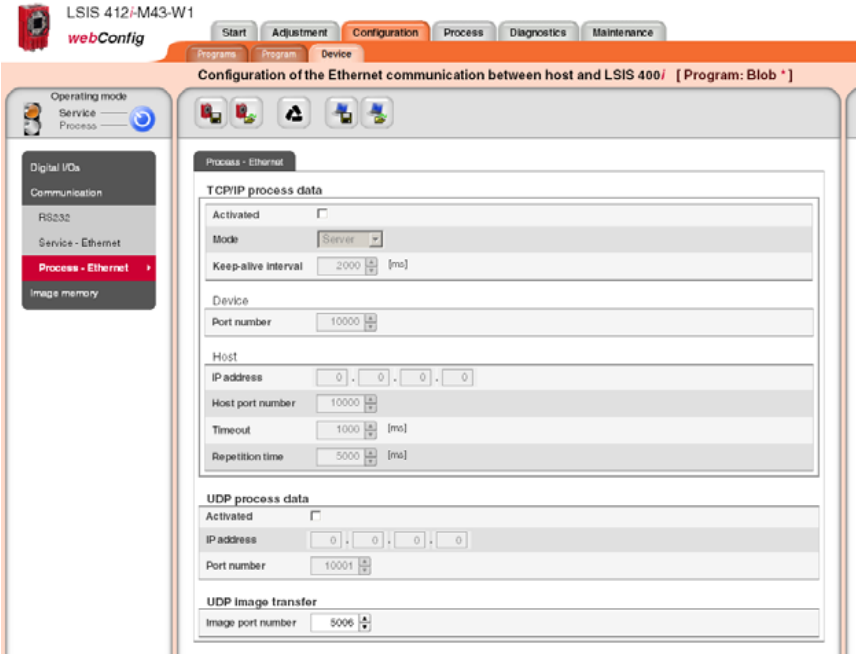


Figure 3.23:"Configuration" module, "Device" tab – "Process - Ethernet" communication

"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 400*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 400*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 400*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 Host mode - 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 400*i*** actively establishes the connection to the primary host system (PC / PLC as server). The **LSIS 400*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 400*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 Host mode - 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.

Parameter	Explanation
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 400*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 400*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 27) 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.

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.

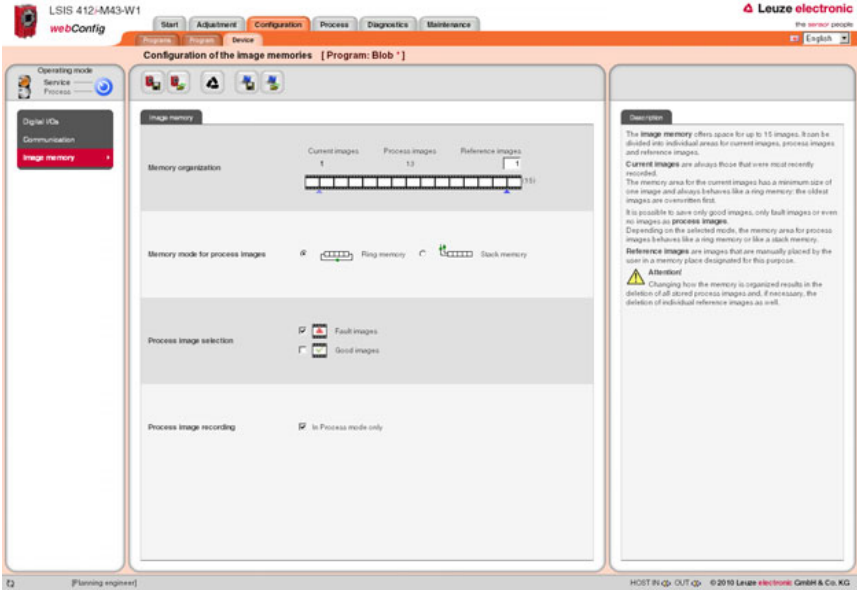


Figure 3.24:"Configuration" module, "Device" tab – Image memory

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 permanently saved 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.

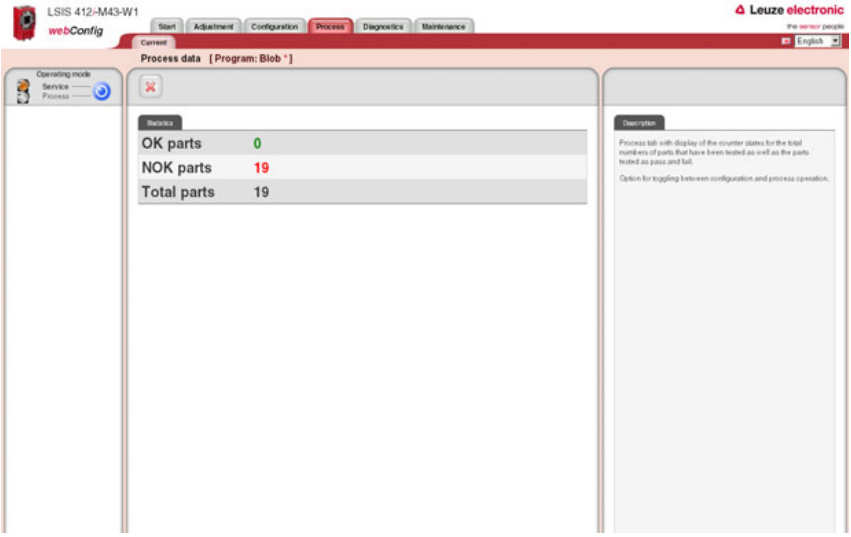


Figure 3.25:User interface of the "Process" module

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 21et seq.

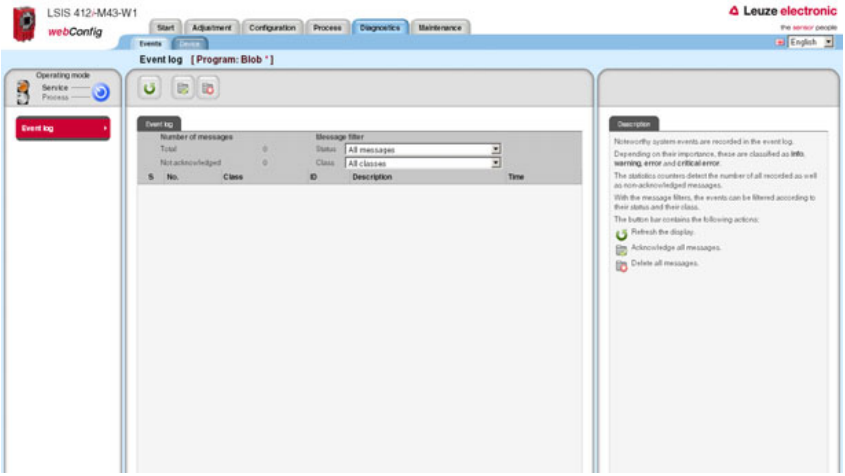


Figure 3.26:User interface of the "Diagnostics" module

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

3.5.1 "Events" tab

ПРОМЭЛЕКТРОНИКА / sales@prom-elec.com

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.

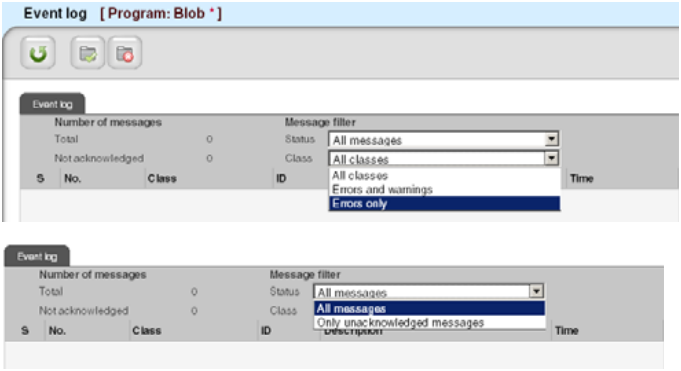


Figure 3.27:Event selection according to status and class

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, see page 21 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.*

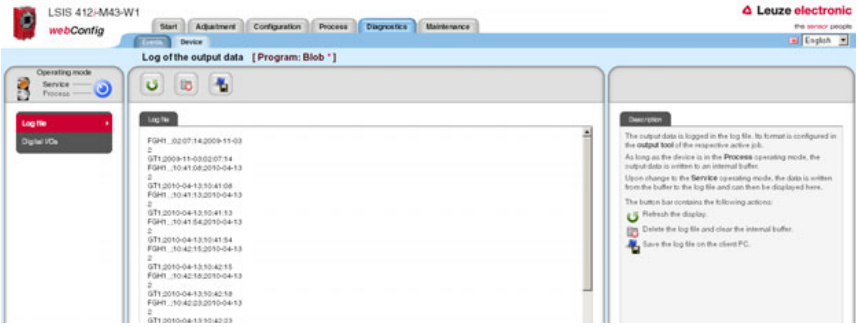


Figure 3.28:"Diagnostics" module, "Device" tab

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.

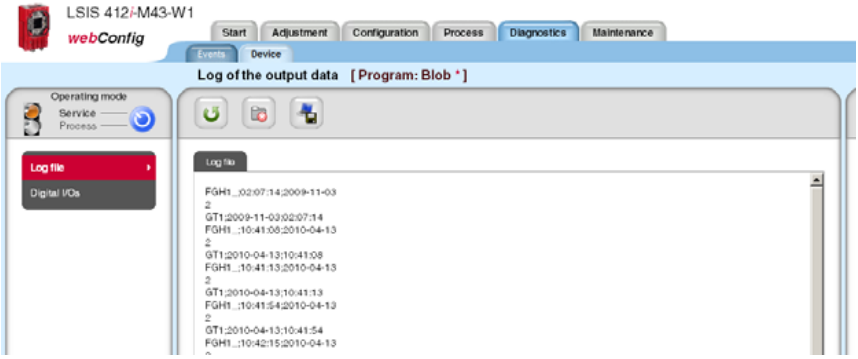


Figure 3.29:Display of the output data in the log file

3.5.2.2 "Digital I/Os" menu

The "Set/Reset" button is used to permanently set the output or to reset it: **`Set`** forces the output to "1", **`Reset`** forces the output to "0"

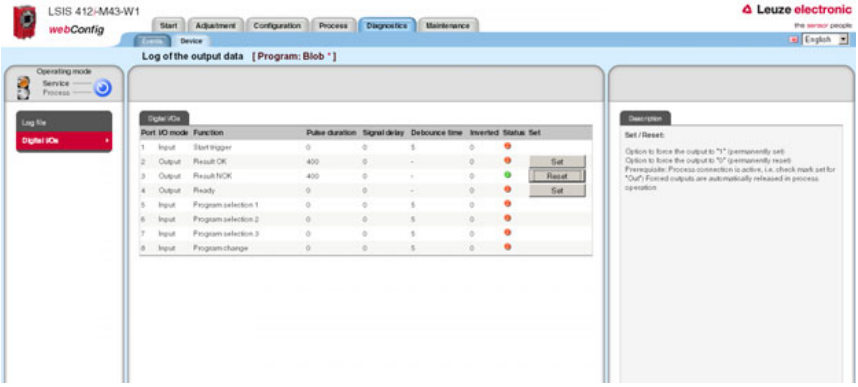


Figure 3.30:"Diagnostics" module, "Device" tab - Digital I/Os

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.

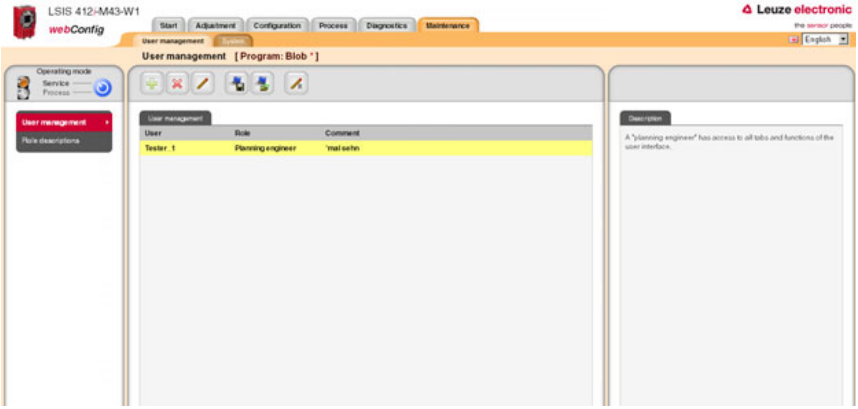


Figure 3.31:User interface of the "Maintenance" module

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.

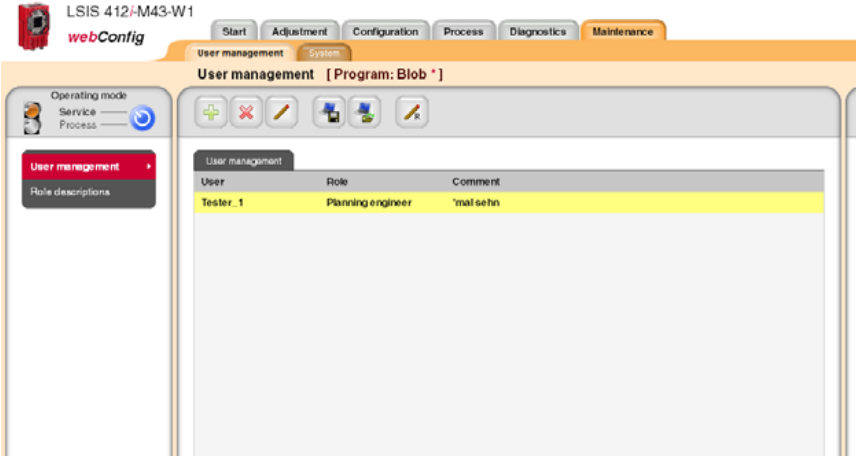


Figure 3.32:"Maintenance" module, "User management" tab

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.

Figure 3.33: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 400*i***.

This button can be used to import the user file from the PC that is connected to the **LSIS 400*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.

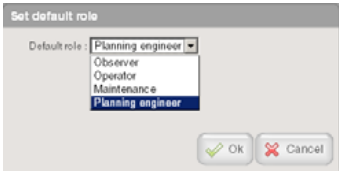


Figure 3.34:User management – set default role

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 400*i* *webConfig*** and the assigned authorizations. This window is for information purposes only and cannot be edited.

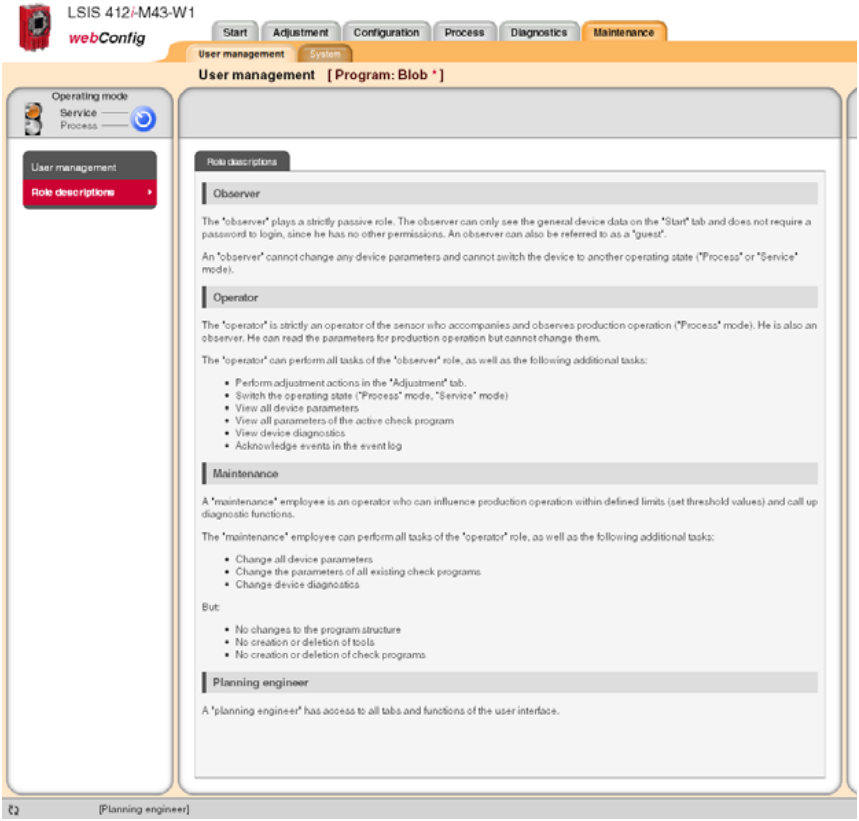


Figure 3.35:"Role descriptions" user interface

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.

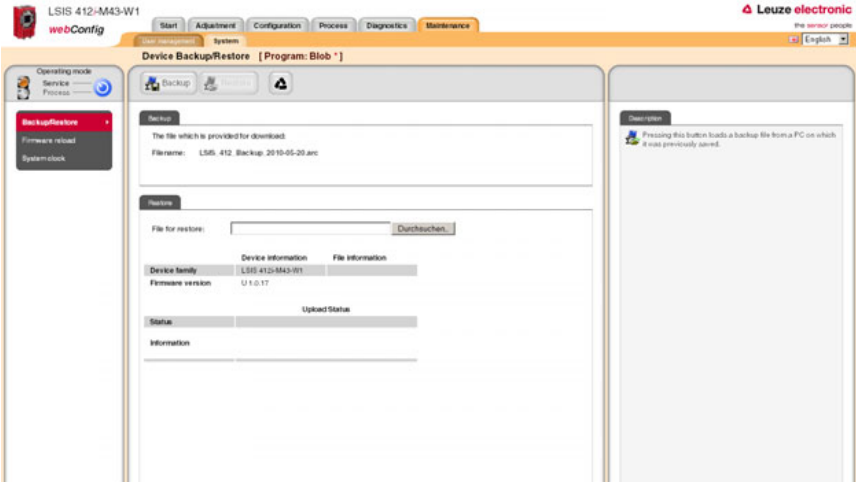


Figure 3.36:"Maintenance" module, "System" tab

3.6.2.1 "Backup/Restore" menu

Three different parameter categories are saved in the **LSIS 400*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.

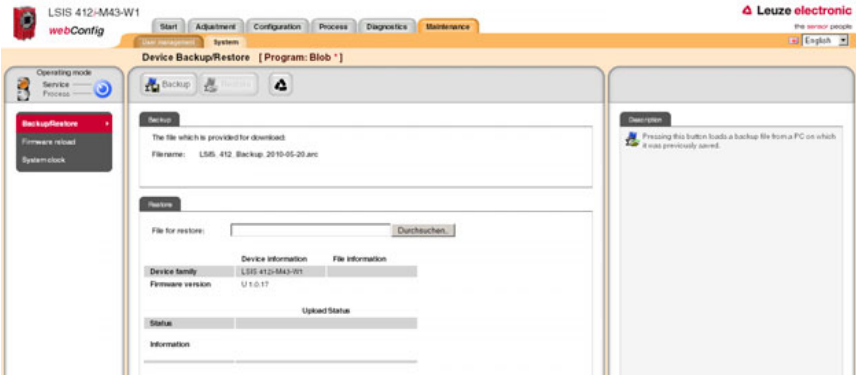


Figure 3.37:"Backup/Restore" user interface

Buttons

The button bar contains the following elements:

Pressing this button creates a device backup on a PC.

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.

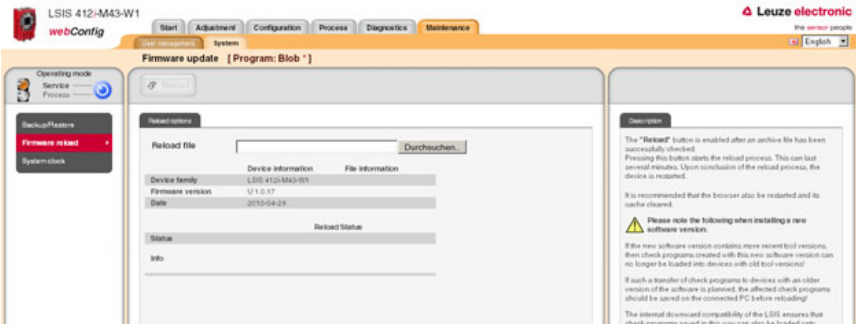


Figure 3.38:"Firmware reload" user interface

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 400i** 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:

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.

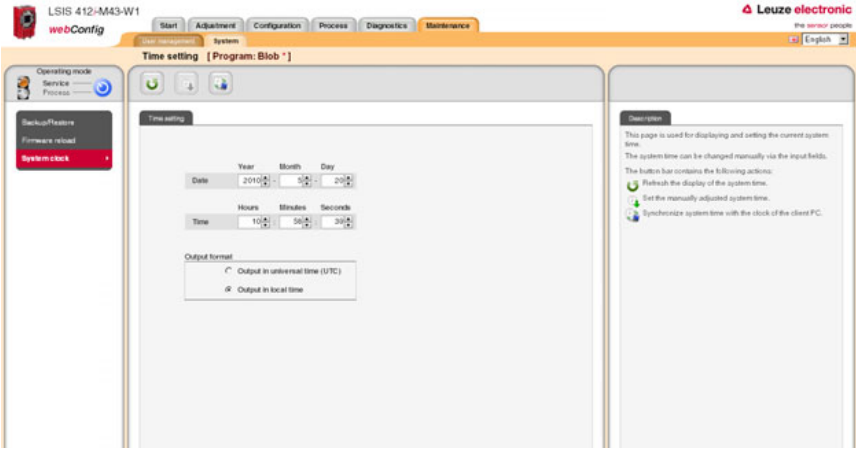


Figure 3.39:"System clock" user interface

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 400*i* *webConfig*

This chapter explains the configuration of the **LSIS 400*i*** using a sample application. 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

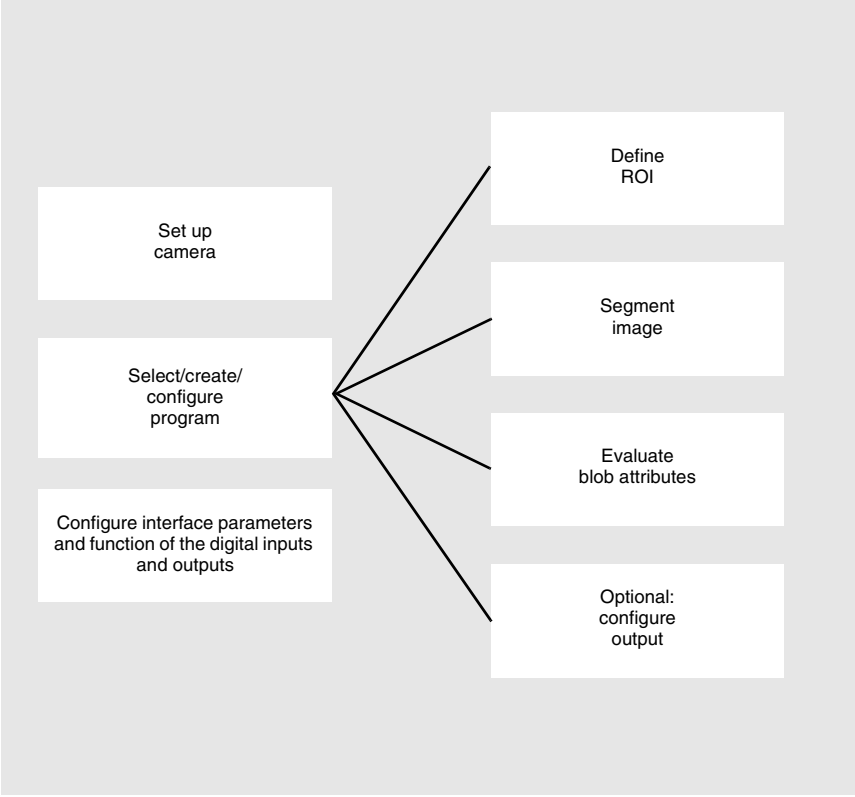


Figure 4.1: Schematic illustration of the blob analysis

After switching on the device, LSIS 400i webConfig starts in Process mode.

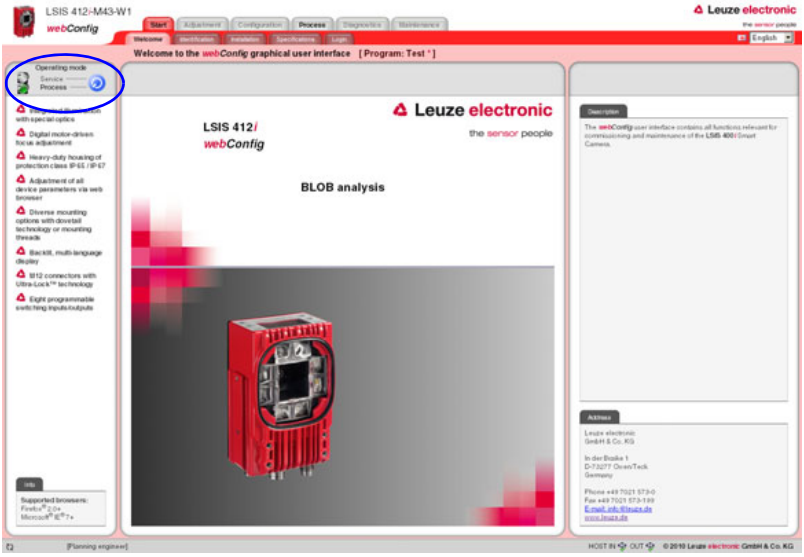


Figure 4.2: Program start in Process mode

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.*

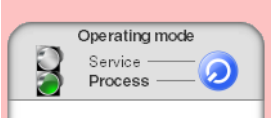


Figure 4.3: Changing the operating mode

You can now select the tabs which were initially disabled.

↳ *Activate the "Configuration" work module.*

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 for all subsequently created programs.

- *Activate the "Adjustment" work module if you would like to change the default settings* for all new programs.
  If you would instead like to change the settings for only an individual program, you can do this in the "Program" tab of the "Configuration" work module. Here, you must then select the "Image Acquisition" tool type in the "Tools" area to make the corresponding settings.
- *Make the desired settings in the "Attributes" parameter group.*
- *To permanently save the image acquisition parameters in the flash memory of the* ***LSIS 400i*** *as default settings, press the* *button.*

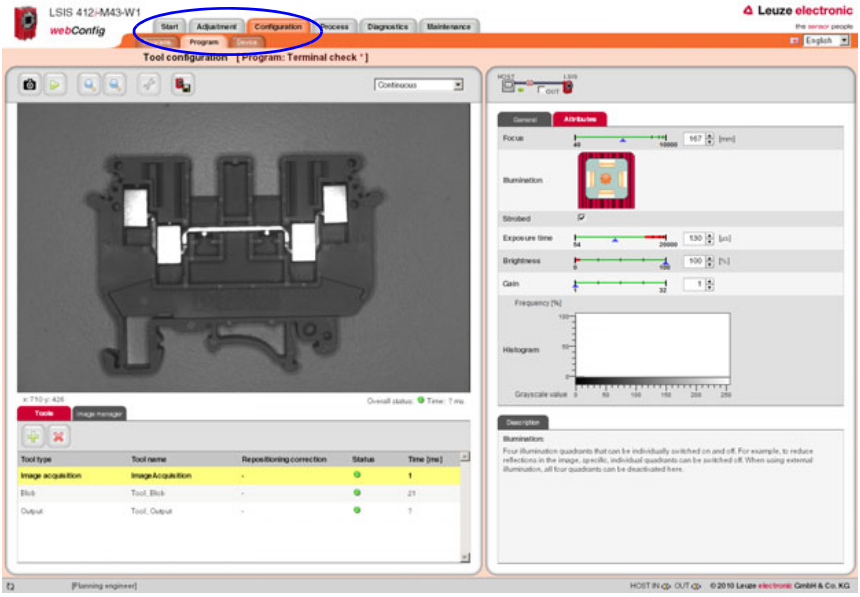


Figure 4.5: Setting the image acquisition parameters

4.1.2 Selecting or creating a new check program

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

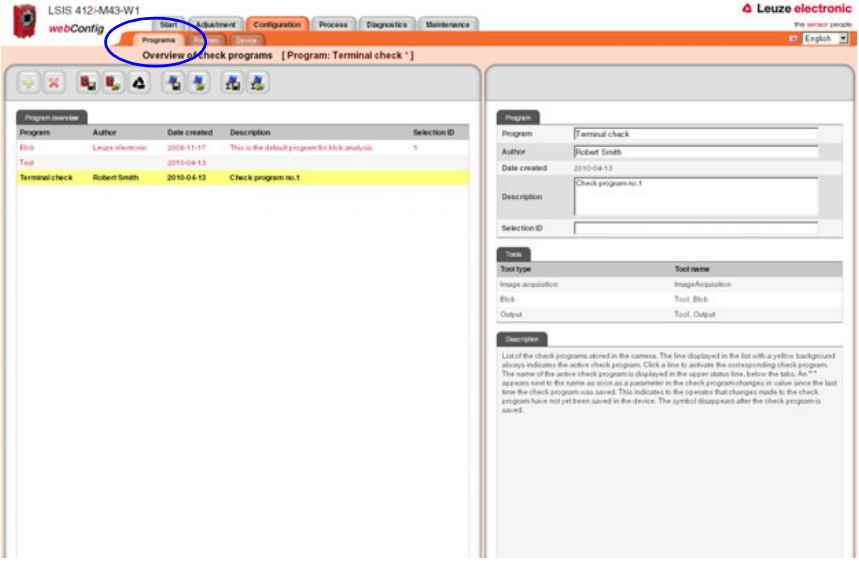


Figure 4.6: Selecting or creating a new check program

↳ *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.*

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.*

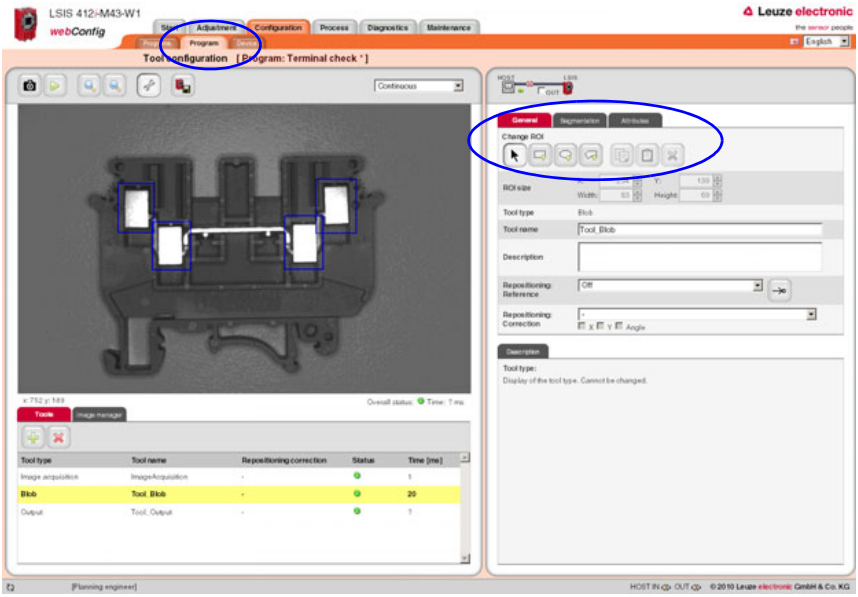


Figure 4.7: Defining the ROI

↳ *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.*

4.1.4 Segmentation of the image

↳ *Switch to the "Segmentation" tab.*

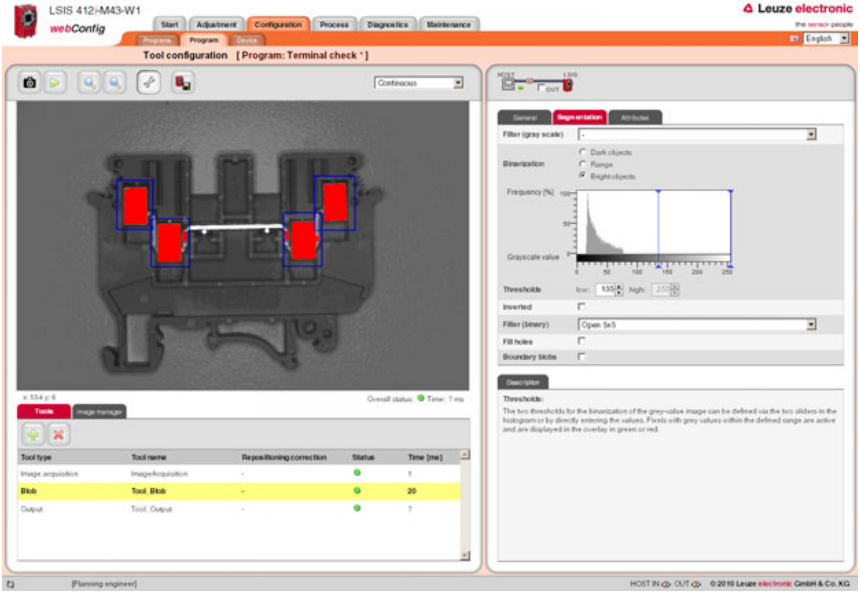


Figure 4.8: Segmentation of the image

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 pull 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 4.2.*
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.*

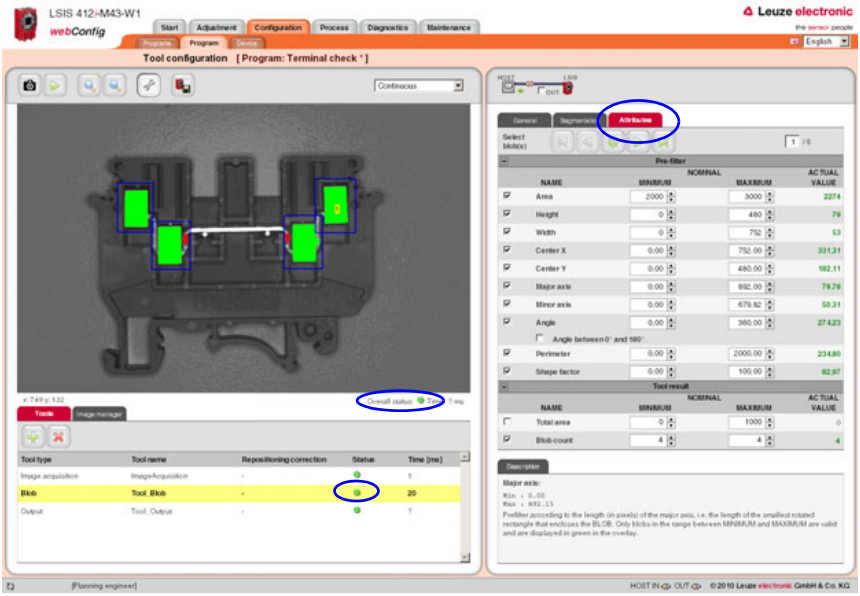


Figure 4.9: Evaluating object attributes: part OK

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.*

↳ *Use the buttons to advance 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. In general, the selection and restriction of the values requires a certain amount of experience.

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.

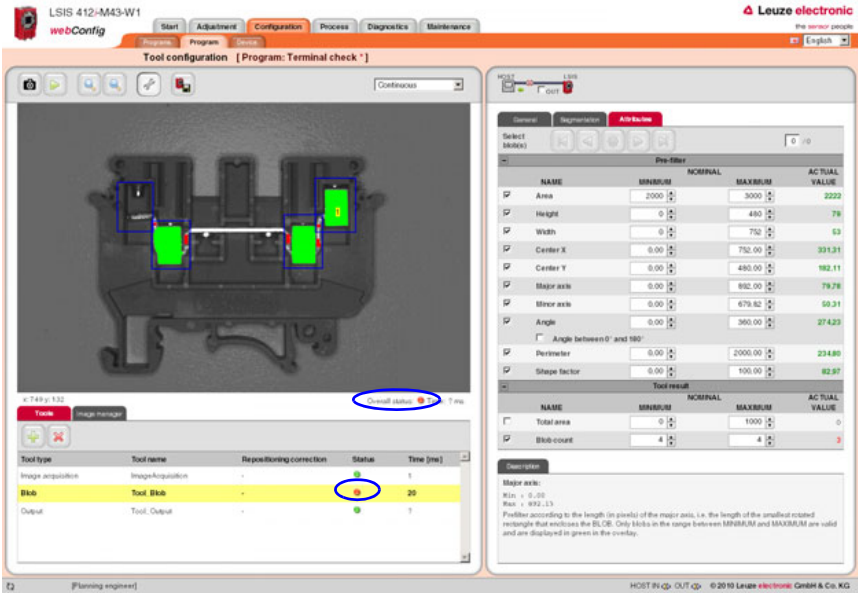


Figure 4.10:Evaluating the blob attributes: part faulty

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 400i** by pressing the button.*

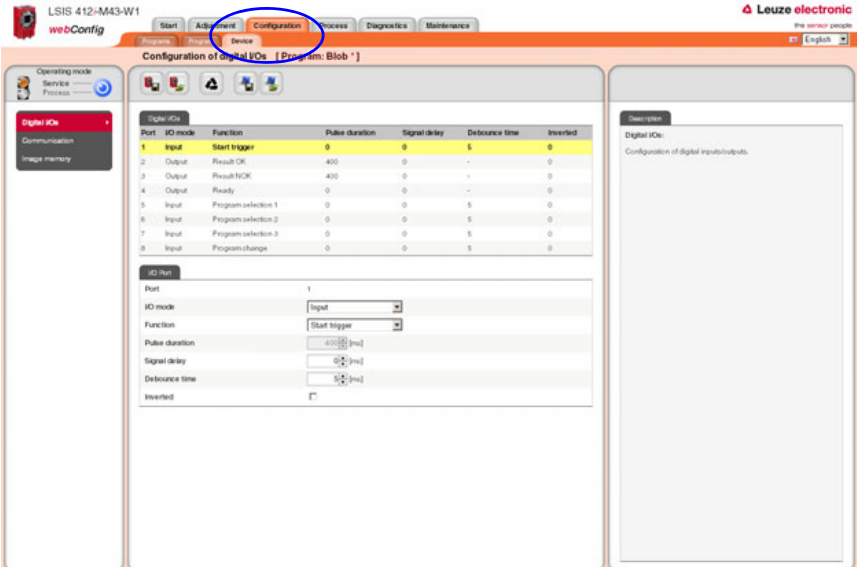


Figure 4.11:Configuration of the digital inputs and outputs

4.2 Tips and tricks

4.2.1 Camera alignment and setup in the case of reflective objects

To avoid interfering reflections in the grey-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. This is illustrated in the following images.

Figure 4.12:Vertical camera alignment – maximum reflections

Figure 4.13:Inclined camera alignment with all four illumination quadrants active – better, but reflections still visible in one quadrant

Figure 4.14:Inclined camera alignment with only three illumination quadrants active (reflected quadrant is off) – nearly all reflections in the image are suppressed

4.2.2 Using filters in the blob analysis

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

- Erosion
- Dilatation
- Open
- Close

4.2.2.1 "Erosion" binary filter

Enlarge dark structures, eliminate bright interfering pixels

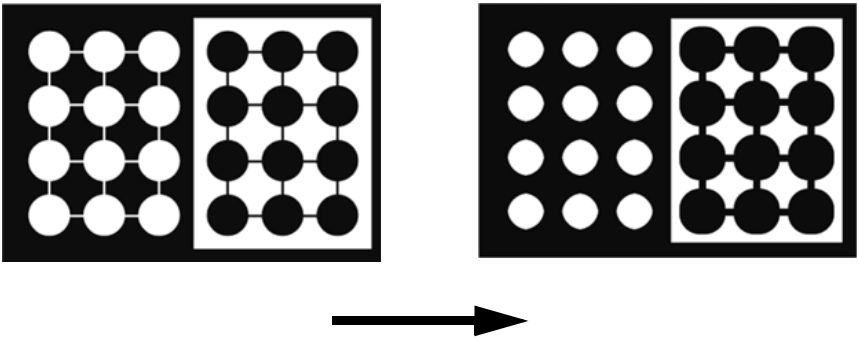


Figure 4.15:Original/processed image

4.2.2.2 "Dilatation" binary filter

Enlarge bright structures, eliminate dark interfering pixels

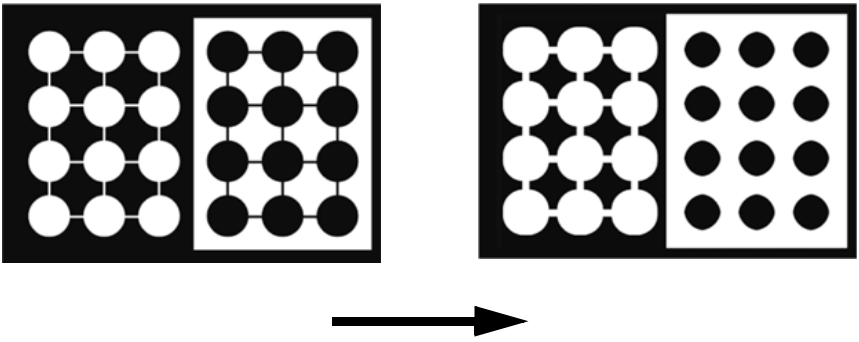


Figure 4.16:Original/processed image

4.2.2.3 "Open" binary filter

Close gaps in dark objects without changing the object size

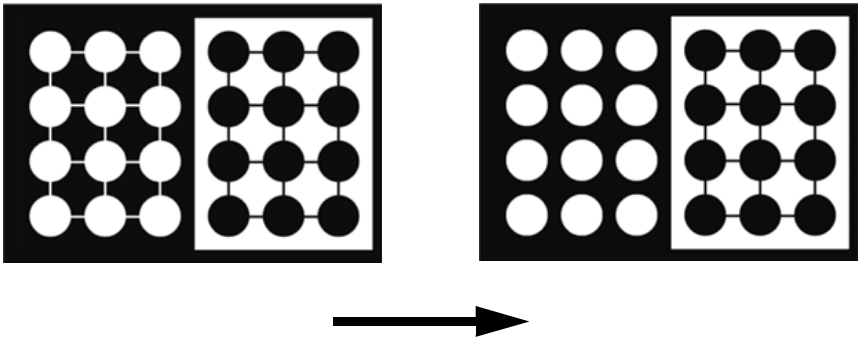


Figure 4.17:Original/processed image

4.2.2.4 "Close" binary filter

Close gaps in bright objects without changing the object size

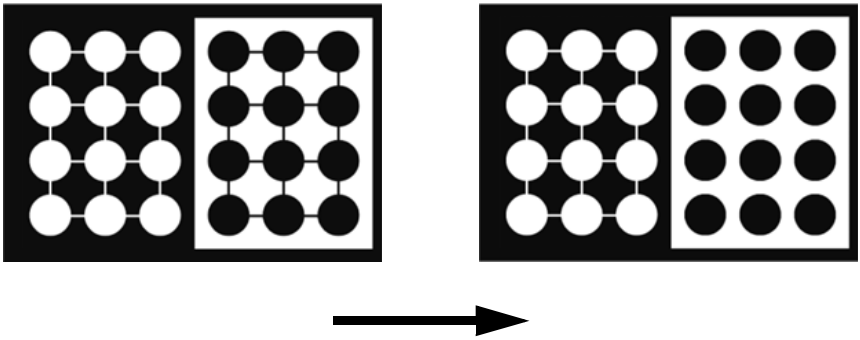


Figure 4.18:Original/processed image